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Function boxes of the HEAVAC package

English Edition 26/745 E3

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Notes

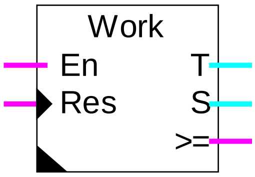
1. HVC-General

Table of contents

1.1 Hours Run Meter

Family:	**HVC-General**	
Name:	**Hours run meter**	
Macro name:	_HeaCtw	(Former [_HeaCth])
Dialogue:	Dialogue Fbox, see below.	

Fbox:



Short description

This function is provided for counting the working time and the number of switch-on. The counters can be set manually or automatically to 0. They can also be adjusted manually.

Inputs

En	Enable	Activates the time meter. Each start will also be counted.
Res	Reset	Sets the time and the starts counters to 0.

Outputs

T	Time	Value of the time meter.
S	Starts	Value of the starts counter.
>=	Warning	Target run time OR number of starts exceeded.

Parameters

Reset Heavac	Masking option for the Reset signal of the HVC-Init function		
- Masked	Reset is masked		
- Activated	Reset is activated		
Unit of time	Option for time counting unit		
- Day/100	Counting in	Days with resolution of	1/100
- Hour/100		Hours	1/100
- Minute/100		Minutes	1/100
- Day /10		Days	1/10
- Hour /10		Hours	1/10
- Minute/10		Minutes	1/10

- Day	Days
- Hour	Hours
- Minute	Minutes
Running time	Displays the running time (d)
Signalling	Target run time before activating the output (d)
Backup	Running time at last reset
Number of switch	Displays the number of switch-on (d)
Signalling	Number of switch-on before activating the output (d)
Backup	Number of switch-on at last reset
Manual / Reset	Button for manual reset (d)

(d) Accessible parameter from terminal by using the dialogue auxiliary Fbox. See below.

Description of the function

When the En signal is activated, the output T gives a cumulative Run Time. The S output is incremented for each start.

The selected time base is Minute / Hours / Days with resolution of 1/1, 1/10 or 1/100th.

The parameters, the display of the counter and the numeric output will always be shown without decimal point, E.g. 1234 for 12.34 Hours.

If either the S or T signals reach their selected 'targets' the output >= fires. This signal can be used for servicing pumps, ventilators, etc.

When the input Reset is activated:

- the output >= is switched off
- the contents of the counters are copied in the Backup registers
- the counters are set to 0

It allows to check afterwards when the last revision has been acknowledged.

A Reset from the HVC-Init function (at system start) has the same effect as the above Reset.

See also HVC Init, Subfunction Reset

An option allows to mask the reset function of HVC-Init Fbox. With this option the value are protected in case of power failure.

Dialogue

A dialogue function with the same name is available in the family HVC-Dialogue-HVC.

Option resolution	The resolution must match the option of the Fbox 'Hours Run Meter'.
- 1/1	For options Hours, Minutes and Seconds
- 1/10	For options Hours/10, Minutes/10 and Seconds/10
- 1/100	For options Hours/100, Minutes/100 and Seconds/100

Option Dialogue

- Hours	Only hours (Minutes or Seconds) are displayed
- Hours+Start	Hours (Minutes or Seconds) and number of starts are displayed
- Adjust+Reset	A Reset of the values is also possible on terminal

See also: Family HVC-Dialogue HVC
HVC-Dialogue, Overview

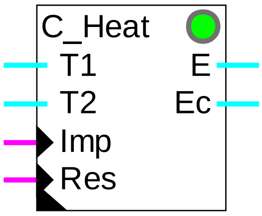
1.2 Heat Meter

Family: **HVC-General**

Name: **Heat meter**

Macro name: _HeaChea

Fbox:



Short description

The heat is calculated from the difference between the flow and return temperatures T1-T2 and the pulses of a flowmeter. The energy can be corrected by a correction factor. The counter can be reset manually or automatically.

Inputs

T1	Temp. 1	Flow Temperature
T2	Temp. 2	Return Temperature
Imp	Impulse	Input for pulses from a flowmeter
Res	Reset	Reset of the counter

Outputs

E	Energy	Value of the energy
Ec	Energy corrected	Value of the energy corrected by a correction factor

Parameters

Reset Heavac	Masking the general reset of HVC-Init function.
- Masked	The reset is masked
- Activated	The reset is activated
Null range	Limited value for null range. In this range, energy is not counted.
Energy factor [J/Kg/K]	Energy factor of the energy transport medium. Water = 4183 J/Kg/K.
Flow factor [Kg/imp]	Weight of counting pulses [Kg].
Reduction factor	Reduction factor of the measured energy for the value of output 'E'.

Correction factor	Factor for calculating values to be corrected at output 'Ec'.
Difference T1-T2 [°C]	Display of the difference between flow temperature and return temperature.
Measured energy	Measured energy after reduction. Value at output 'E'.
Remainder	Remainder after reduction.
Corrected energy	Measured energy after correction factor. Value at output 'Ec'.
Reset and backup	Button for manual reset and display of counter value at last reset.

Description of the function

Inputs T1 and T2 receive the flow and return temperatures of the heating fluid. If the difference is in the null zone, the energy counting is not activated. Normally, T1 is higher than T2. If the reverse happens, the LED turns red and the energy is not added up.

Input Imp is provided for the reception of measuring pulses from a flowmeter. The quantity of fluid, in kg, flowing between 2 measuring pulses is entered as a parameter in the adjust window.

Any adjustment for a different medium of energy transport is made by adapting the energy factor parameter.

Measurement can be set with an adjustable reduction factor. This produces a very large measurement range. The reduction factor is selectable between 1 and 2,000,000,000. The resultant counting or measuring capacity is therefore $4 * 10^{18}$. The remainder after reduction is stored and included in calculation of the next measurement. This remainder can be viewed in the adjust window. It can be used for converting the energy in another unit. Example:

Conversion in Wh:	factor = 3'600
Conversion in kWh:	factor = 3'600'000

If various influences on counting or measuring necessitate the correction of the energy calculation, it is possible to insert a correction factor in the adjust window.

The values for calculated energy and energy after correction are represented at outputs 'E' and 'Ec' respectively.

The reset signal zeroes the meter and the remainder. The value in the meter is copied to backup memory and is saved until the next reset.

The system reset of the HVC-Init function has the same effect as the 'Res' signal of this function. To avoid losing the contents of the counter after a power down, the system reset can be masked by an option.

See HVC-Init, Subfunction Reset

When the installation starts up, the values present are checked for plausibility:

- positive values
- remainder < reduction factor

See also Energy Pulse Counter

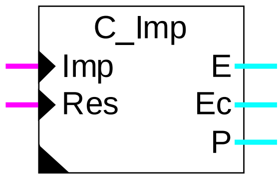
1.3 Energy Pulse Counter

Family: **HVC-General**

Name: **Pulse counter**

Macro name: _HeaCimp2 Old name: _HeaCimp

Fbox:



Short description

The Energy Pulse Counter is provided for measurement of energy via a pulsing digital signal. The counter memory can be set to 0 manually or automatically.

Inputs

Imp	Impulse	Input of energy pulses
Res	Reset	Reset of the counter

Outputs

E	Energy	Value of the energy
Ec	Corrected Energy	Value of the energy corrected by a correction factor
P	Power	Evaluation of the power from pulses. This output remains at 0 if the function is not activated in the adjust window.

Parameters

Reset Heavac	Masking the reset signal of the HVC -Init function
- Masked	The reset is masked
- Activated	The reset is activated
Energy factor	Energy to be counted through pulses on the input 'Imp'.
Reduction factor	Reduction factor of the measured energy for the value at output 'E'.
Correction factor	Factor for calculating values to be corrected at output 'Ec'.
Measured energy	Display of the measured energy after reduction. Value at output 'E'.
Remainder	Remainder after reduction.
Corrected energy	Measured energy after correction factor. Value at output 'Ec'.
Reset and backup	Button for manual reset and display of counter value at last reset.

-----[Evaluation of the power]-----

Evaluation time	Time interval between each new power evaluation. The parameter 'Not used' allows to deactivate the function.
Power at 1 Hz	Basic value for the calculation of the power. The value must correspond to the power which produces a pulse frequence of 1 Hz.

Description of the function

The quantity of energy represented by one pulse is given by the energy factor.

Counting is reduced with an adjustable factor. This produces a very large counting capacity. The reduction factor is selectable between 1 and 2,000,000,000. The counting capacity therefore amounts to $4 * 10^{18}$. The remainder after reduction is stored and taken into account for the next measuring pulse. This remainder can be viewed in the adjust window.

When the counted energy must be corrected as to take into account various situations, it is possible to introduce a correction factor.

The content of the energy meter and the corrected value are copied to outputs 'E' and 'Ec' respectively.

The signal at input 'Res' (reset) zeroes the meter and the remainder. When there is a reset, the value in the meter is copied to backup memory where it remains until the next reset.

The system reset of the HVC-Init function has the same effect as the 'Res' signal of this function. To avoid losing the contents of the counter after a power down, the reset can be masked by an option.

See HVC-Init, Sub-fucntion Reset

When the installation starts up, the values present are checked for plausibility:

- positive values
- remainder < reduction factor

Evaluation of the power

This function must be activated in the adjust window. The Fbox has 2 calculation modes which are activated automatically.

Frequence mode:

In this mode, the power is evaluated at regular time intervals according to the selected parameter. If the pulse number per interval is lower than 3, the function switches in period mode.

Period mode:
In this mode, the power is evaluated according the time between pulses. If the time between pulses becomes lower than 1/3 of the adjusted time, the Fbox switches to frequence mode.

Cette valeur de la puissance ne peut pas être précise ni régulière. Le temps de 60 sec permet une calculation moins rapide mais plus correcte et plus stable.

Application typique

La sortie P est typiquement prévue pour fournir un signal de puissance à la Fbox de Délestage.

See also Heat Meter

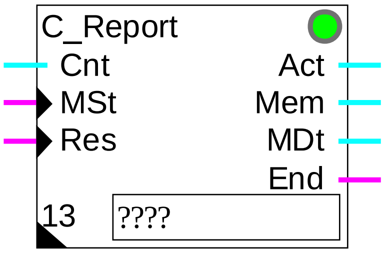
1.4 Monthly Report

Family: **HVC-General**

Name: **Monthly report**

Macro-Name: _HeaCmr

Fbox:



Short description

This function allows to automatically report every month an energy counter or an hours run meter. The 12 last reports are always available. The report may be continu (without reset to 0), yearly (one reset every year), or monthly. In addition to that, a storage may be done anytime.

Inputs

Cnt	Counter	Counter value
MSt	Mem Store	Order for immediate storage
Res	Reset	Order for reset of all reports

Outputs

Act	Actual	Actual value of the actual report
Mem	Memory	Value of intermediate report
Mdt	Mem, date	Date of intermediate report in format JJJJMMDD
End	End	Signal for the end of report according to the following parameter.

Fbox Fields

13	13 Register	Basic address of 13 following registers. The first register is the reference and allows to calculate the value of the actual report. The registers 1 to 12 contain the reports of the last 12 months. Address+1 for January, address+2 for February...address+12 for December

Parameters

Reset Heavac	Masking option for the Reset signal of the function HVC-Init.
- Masked	The Reset is masked

- Activated	The Reset is activated
Report value	Option for the calculation of the report value
- Continue	The reported value is continue. No reset.
- Yearly	The reported value is continue over one year. The reset is done at the end of the month selected below.
- Monthly	The values are monthly values (difference begin and end of month).
End of report	Option for the switching signal End of report (output 'End').
- January...	The end of report is signalled for the end of the selected month
- December	
- Monthly	The signal for the end of report is activated at the end of each month.
After memorized	Option for the restart of the report after memorized.
- Continue	The report continues normally
- Restart	The report restarts with 0.
-----[Report control]-----	
Report	Changeover button and display of the above mentioned report (January..December).
Report value	Value of the report of the month selected above.
-----[Manual memorize and clear]-----	
Actual report	Button for manual reset and display of the actual report.
Memorize	Button for manual storage and display of intermediate report.
Report value	Button for manual clearing of the monthly report selected above.
All reports	Button for manual clearing of all reports.

Description

This function allows to automatically report every month an energy counter or an hours run meter.The counting function must be placed before the report function. The counting value must be connected to the input Cnt.

The value at input Cnt is compared with a reference value for defining the value of the actual report. This value is permanently available at output Act. If the report is done without reset, this value corresponds to the input signal Cnt (reference=0).

The reports values are stored at the end of each month in a different register. For each month a register is available. At the end of the month, the new value replaces the old, which is one year old. In this way, the rports of the last 12 months are available. These values are located in the 12 registers following the basic address indicated in field '13' of the Fbox.

These 13 registers must be programmed with an absolute address (numeric value). It allows to keep the reference value and all reports when the program is modified. The first of these 13 registers contain the above described reference value.

The value of the reports can be calculated in different ways depending on the selected option. With the option 'Continue', the rported values are corresponding to the signal at input Cnt. The reports are not automatically set to 0.

With the option 'Yearly', the values are set to 0 every year. This is done in adapting the reference value. The setting to 0 is done at the end of the month selected by the 'Signal end of report'. The counting function, which is before, must not be set to 0.

With the option 'Monthly', the reports start at 0 each month. In this case it is corresponding to the difference between the begin and the end of the month. This is done in adapting the reference value at the end of each month.

The binary signal at the end of the report gives one cycle pulse at the end of the selected month. It gives one pulse each month with the option 'Monthly'. It allows for example to make a automatic reset of the counting function. It may also give a signal to the supervisor as to read the report of the last 12 months.

An additional memory is available for an intermediate report. This report is started by the binary input 'Mem' or the button 'Memorize'. When the input switches to 1 or the button is pressed:

- the actual value of the report is stored. It is available at output 'Mem'.
- The date is stored. It is available at output 'Mdt' in format JJJJMMDD.
- If the option 'Restart' is selected, the report restart with value 0. The next monthly report will contain the partial value counted from the intermediate report date up to the end of the month.

The intermediate report is useful when the room user changes during the month. A single pulse on input 'Mem' allows to store the value. It can be read later.

Caution ! It is important to avoid multiple successive pulses. In this case the values will be lost in the reports. It can be locked for example through a delay of some hours or by a Flip-Flop that has to be enable by another signal.

The input 'Res' and the reset button allow to reset the values to 0. It is not necessary for the functioning but can be used for checking the report made since the last reading (and set to 0) of the values.

In the adjust window, a button allow to display successively all reported values. Each value can be cleared individually.

An additional button allow to re-initialize manually the actual report. The reference value is then adapted to the actual counting value.

The Reset signal of the function HVC-Init can be masked as to avoid the set to 0 when the PCD is restarted. The function must be initialized at least once by the input 'Res' or by the Reset button.

The counter provides usually ascending progressive values. If not, the reports follow the variations as far as the value does not go below the reference value. In this case, the reference value is adapted in order to avoid negative value in a report.

This case may arise if the counter placed before is set to 0 not at the same time as the report function.

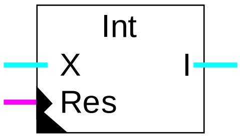
1.5 Integrator

Family: **HVC-General**

Name: **Integrator**

Macro name: _HeaInt

Fbox:



Short description

Integration of a numeric signal. The time base and the scaling factor are adjustable. The integration memory can be zeroed manually or automatically.

Inputs

X	Input X	Input value to be integrated (e.g. power)
Res	Reset	Reset of the integrator

Output

I	Integration	Content of the integration memory (eg energy)

Parameters

Reset Heavac	Masking the reset signal of the HVC initialization function
- Masked	The reset is masked
- Activated	The reset is activated
Unit of time	Selection option for the integration time interval.
- Hours	
- Minutes	
- Seconds	
- Sec./10	
Integration interval	Value of integration interval depending on the selected unit.
Reduction factor	Reduction factor of the integrated value for the output 'E'.
Integration	Display of integrated value
Integration remainder	Remainder after reduction by the scaling factor
Reset and backup	Button for manual reset and display of counter value at last reset.

<u>Description of the function</u>
The input signal is integrated in memory at regular intervalls. The time base is defined by a time unit and time interval. The integration is done once over the defined time period.

The integration memory state, divided by a scaling factor, is then copied to the output, I.

A reset signal sets the integration memory and remainder to 0. The the actual integration value is backed up and remains available up to the next reset.

The value of the integrator is reduced by an adjustable factor. This makes it possible to have a very large integration capacity. The reduction factor can be defined between 1 and 2'000'000'000. The maximum integration capacity is therefore $4 * 10^{18}$.

The remainder after reduction is stored and recalled at the next integration. It can be viewed in the adjust window.

When the Reset Heavac signal is activated, it has the same effect as the function's Res signal. To avoid losing the contents of the counter after a power down, the system reset can be masked with an option.

When the installation is started up, all memory is checked for containing coherent values:

- positive values
- remainder < reduction factor

1.6 Conversion

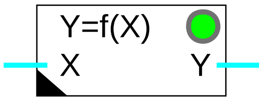
Family: **HVC-General**

Name: **Conversion**

Macro name: _HeaConv

Dialogue: Dialogue Fbox, see below.

Fbox:



Short description

Linear conversion of a numeric value. The characteristic line is defined by two points (x1, y1) and (x2, y2).

Input

X	Input X	Input value to scale

Output

Y	Output Y	Scaled value output

Parameters

Error, Acknowledge	Error acknowledge button
Point X1	Reference value X of point 1 (d)
Point Y1	Output value Y at point 1 (d)
Point X2	Reference value X of point 2 (d)
Point Y2	Output value Y at point 2 (d)

(d) Accessible parameter from terminal by using the dialogue auxiliary Fbox. See below.

Description of the function

The input value undergoes a linear conversion according to the line defined by the points x1, y1 and x2, y2. The converted value is then sent to the output. All x and y values are adjustable.

If the points x1 and x2 are equal (i.e. a vertical line), the LED turns red and the maximum gradient (y2-y1)/1 applies.

Diagram with positive gradient

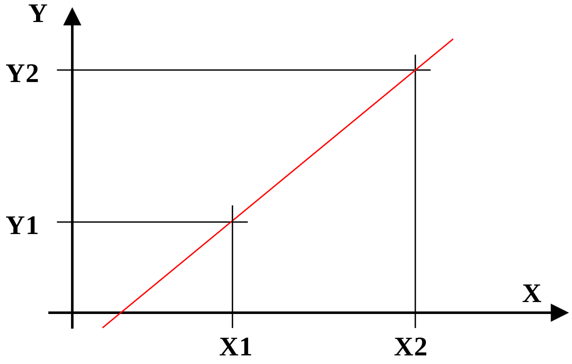
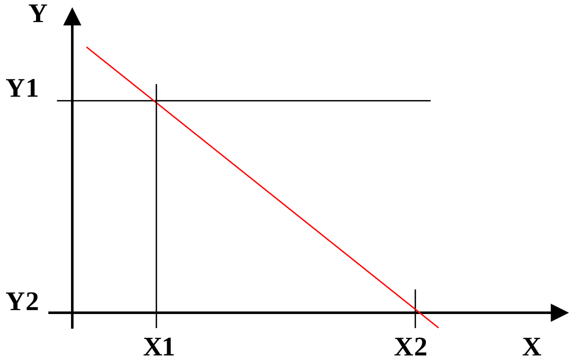


Diagram with negative gradient



Dialogue

A dialogue function with the same name is available in the family HVC-Dialogue-HVC.

See also: Family HVC-Dialogue HVC
HVC-Dialogue, Overview

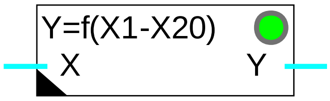
1.7 Conversion 20 points

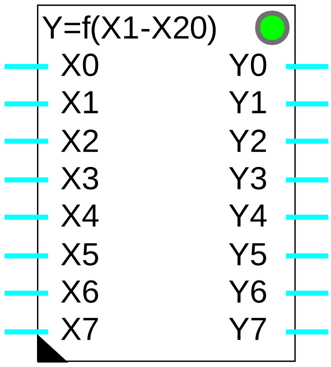
Family: **HVC-General**

Name: **Conversion 20 points**

Macro name: _HeaConv28 Old name: _HeaConv20

Fbox:





Short description

Linear conversion of a numeric value. The characteristic line is defined by 20 points (x1, y1) upto (x20, y20). The X reference points must be given in crescending order. The Y points however, can be given in any order. See following use of groups. The function is stretchable from 1 to 8 signals. All signals are converted with the same characteristic.

Info version

From version 2.0.30 Beta, this Fbox has 8 inputs and outputs (instead of 4).

Inputs

X0..X7	Inputs X	Input value to scale

Outputs

Y0..Y7	Outputs Y	Scaled value output

Parameters

Error	Error acknowledge button
Point X1	Reference value X of point 1
Point Y1	Output value Y of point 1
...	
Point X20	Reference value X of point 20
Point Y20	Output value Y of point 20

Description

The input value is converted according to the line segments defined by the points (x1, y1) to (x20, y20). The converted value is transmitted to output Y. The reference points X are adjustable offline. The points Y, however, are adjustable online.

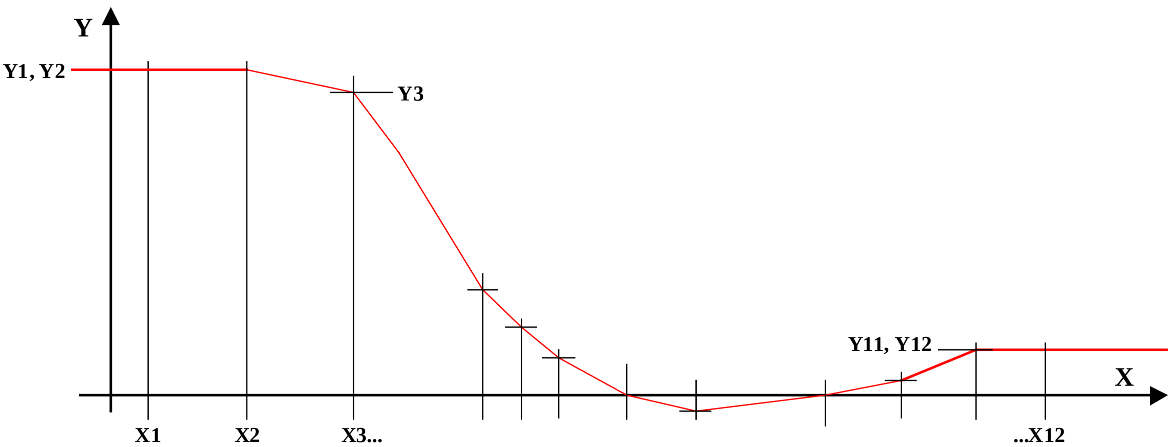
The parameters are organized in 5 groups od 4 each. Depending on the number of necessary points, the use of these groups allows to optimize the memory space as well as the CPU load. The definition of the number of groups used is defined by the number of reference points X. If the first point X of a group is lower than the prvious one, the points of this group are ignored. For example, the default values define the use of 8 points only (X9 < X8). Within the used groups, the X points must always be given in crescending order.

The parameters must be given in 2 steps. The reference points X have to be selected offline before the program compilation. They must be close one to the other if the line is strongly not-linear. They can be far one to the other in the linear parts. The Y values for each reference point can be adjusted accurately online. All X and Y points are adjustable in the positive and negative ranges.

Outside the defined segments, the points of the last segment remains applicable. For example, the points x1-y1 and x2-y2 are applied to the values lower than x1. As to limit the output value outside of the defined segments, it is recommended to define the last two Y points at the same level. This can be important when the input signal is not limited and may differ (Example: defective temperature sensor). See following diagram.

If two successive points are equal égaux (vertical line), the LED turns red and the maximal gradient is applied (for ex. (Y2-Y1)/1). After correction of the parameters, the LED can be acknowledged by the button in the adjust window.

Example of diagram



If Y1 is equal to Y2, the characteristic is flat, the output Y is always equal to Y1 and Y2 for all X values lower than X2. The same remark is valid for Y11, Y12 and X12.

Reference

See also: Linear conversion

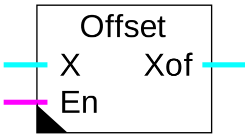
1.8 Conditional Offset

Family: **HVC-General**

Name: **Conditional offset**

Macro name: _HeaOfst

Fbox:



Short description

Offset of a numeric value conditioned by digital signal.

Inputs

X	Input X	Numeric input signal
En	Enable	Condition for the offset activation

Output

Xof	X Offset	Numeric value with conditional offset

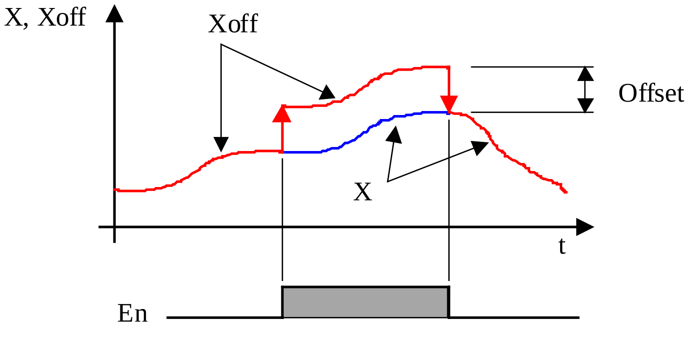
Parameter

Offset	Offset value applied to input signal.

Description of the function

When enabled'En' = 1, the output, Xof, takes the form of the input, X, plus the offset value defined in the adjust window. When En is low, X is transferred directly to Xof.

Diagram



See also:

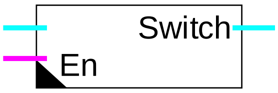
Numeric Switch

1.9 Numeric Switch

Family: **HVC-General**

Name: **Numeric switch**

Macro name: _HeaSw1

Fbox: 

Short description

The numeric value is switched by a digital signal.

Inputs

	Input	Numeric value
En	Enable	Activation of the switch

Output

	Output	Numeric value switched between input and the preset fix value

Parameter

Off value	Fix output value for En=0.

Description of the function

When the switch is on, the input signal is switched through to the output. When the switch is off, a fix value is switched through to the output.

See also:

Conditional offset

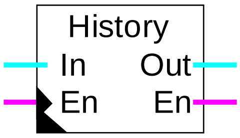
1.10 History

Family: **HVC-General**

Name: **History**

Macro name: _HeaSto

Fbox:



Short description

Memorizing of a numeric signal history. The memorizing of one value is enabled by an external digital signal. The last 10 values are memorized. The functions may be used multiple time as to save n times 10 values.

Inputs

In	Input	Numeric value to be memorized
En	Enable	Activation signal for the memorizing

Outputs

Out	Output	Value output for cascade
En	Enable	Enable output for cascade

Parameters

Signal reset	Masking the reset signal of the HVC-Init function.
- Masked	The reset is masked
- Activated	The reset is activated
-----[Buffer, positions 1..10]-----	
Position 1	Displays the buffer value at position 1.
...	
Position 10	Displays the buffer value at position 10.
-----[Manual functions]-----	
Storing counter	Counting the number of values loaded in the buffer.
Manual, Load	Button for manual storing of one value in the buffer.
Output	Displays the last buffer output value. This value is also present on Output "Out'.
Manual, Delete	Deletes the last stored value and shifts the other values.
Last deleted	Display of the last deleted value.

Description of the function

A positive edge on the En input = 1, stores the actual numeric value on the input In in a register buffer and the buffer is shifted one place.

The last (oldest) value in the buffer is copied to Out and the output En is pulsed (this allows further History blocks to be cascaded for logging more than ten positions 10, 20, 30....

As an example, with temperature monitoring at hourly intervals, the En signal will be activated by a blinker with a half-on, half-off cycle (Tv = 18000).

To avoid losing stored values during a reset, this signal can be masked with an option.

See also HVC-Init, Subfunction Reset

The load and delete buttons enable values to be read and deleted manually. This case does not handle any cascading functions.

This function is provided for monitoring an installation with a supervisor or modem. The absolute addressing must be used for accessing the internal registers. See Fupla description.

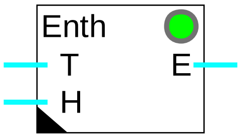
1.11 Enthalpy

Family: **HVC-General**

Name: **Enthalpy**

Macro name: _HeaEnth

Fbox:



Short description

This function calculates the atmospheric enthalpy.

Inputs

T	Temperature	Temperature measurement [°C]
H	Humidity	Relative humidity measurement [%]

Output

E	Enthalpy	Calculated enthalpy value [J/kg]

Parameters

Enthalpy dry air [kJ/kg]	Calculation of the dry air enthalpy.
Enthalpy water [kJ/kg]	Calculation of the water enthalpy.
Error, Acknowledge	Error acknowledge button.

Description of the function

Calculates the atmospheric enthalpy. Temperature and humidity must be given to inputs T and H. Both are displayed on-line in the adjust window.

If, as the result of an error, the humidity value is negative or greater than 100%, the LED turns red and may be acknowledged via the button.

The enthalpy calculation corresponds to the Mollier diagram. The pression reference is 98 kPa or 980 mbar or 735 mmHg. It corresponds to an altitude of 300m.

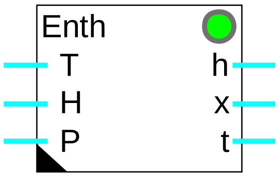
1.12 Enthalpy h-x-t

Family: **HVC-General**

Name: **Enthalpy h-x-t**

Macro name: _HeaEnth2

Fbox:



Short description

This function calculates the atmospheric enthalpy, the absolute humidity and the dew-point of air. The temperature, the humidity and the relative pressure are to be given on the inputs.

Inputs

T	Temperature	Temperature measurement [°C]
H	Humidity	Relative humidity measurement [%]
P	Pressure	Pressure measurement [mbar]

Outputs

E	Enthalpy	Calculated enthalpy value [J/kg]
x	Absolute humidity	Calculated absolute humidity [g/kg]
t	Dew-point	Calculated dew-point [°C]

Parameters

Enthalpy dry air [kJ/kg]	Calculation of the dry air enthalpy.
Enthalpy water [kJ/kg]	Calculation of the water enthalpy.
Saturation pressure [mBar]	Calculation of the saturation pressure.
Vapor pressure [mBar]	Calculation of the vapor pressure.

Description

The function calculates the enthalpy, the absolute humidity and the dew-point of air. The temperature, the humidity and the relative pressure are to be given on the inputs. The 2 parts, dry air enthalpy and water enthalpy are displayed individually in th adjust window. The vapor pressure and saturation pressure are also displayed. All values for inputs and outputs have a resolution of 1/10.

The calculations are valid for temperatures from 0.0 to 50.0 °C. If the temperature goes out of this range, the LED turns red. If the value of the humidity is 0.0% calculations are impossible. In this case, the value is replaced by 0.1% and the LED turns red. If the value of the humidity is negative or higher than 100.0 %, the limit value is taken and the LED turns red. In all 3 cases, the LED comes back to green as soon as the values are in their correct range.

The calculation is done according to Mollier diagram.

If the pressure is not measured, it can be introduced as a constant according to the following table.

Altitude over sea level	Pressure	Constant value
0 m	1013 mBar	10130
300 m	980 mBar	9800
400 m	966 mBar	9660
600 m	943 mBar	9430
800 m	921 mBar	9210
1000 m	899 mBar	8990
1500 m	842 mBar	8420
2000 m	795 mBar	7950

Reference

Enthalpy

1.13 Manual Override Numeric

Family: **HVC-General**

Name: **Override numeric**

Macro name: _HeaMani2

Fbox: 

Short description

This function performs the manual forcing of a numeric value.

Input

Input	Automatic numeric signal

Output

Output	Numeric value of input or manual value

Parameters

Manual value	Output value in manual mode.
Mode, Change	Switch button and display of the actual mode.

Description of the function

This function is necessary for any numeric signal requiring the possibility of override using Fupla.

Manual override takes place in 2 stages:

- definition of manual value
- activation of manual override

When override is active, the LED turns red.

Possible applications:

- override analogue outputs to test peripheral devices
- override a setpoint when an outside temperature sensor is not working.

Caution: to avoid windup problems with any controllers, their internal manual modes must be used.

1.14 Motor-Generalities

This description is valid for all motor controls. Individual descriptions contain only particularities or modifications compared to this general description. Depending on the selected function, only some signals or parameters are available.

Short description

The function controls the speed changes from low to high and reverse. It monitors the possible errors of the contactors and the thermal protection. A general monitoring (feedback) is available for the supervision of the mechanical devices.

Four motor control functions are available:

- Motor, 1 Speed
- Motor, 2 Speed
- Motor, 1 Speed + Acknowledge
- Motor, 2 Speed + Acknowledge

Key:

1 =	V1 =	Low speed
2 =	V2 =	High speed

Inputs

V1	Start speed 1	Starts speed 1 only
V2	Start speed 2	Starts speed 1 and 2
c1	Contactor signal 1	Signal from auxiliary contact for speed 1 1=contactor closed, 0=contactor open
c2	Contactor signal 2	Signal from auxiliary contact for speed 2 1=contactor closed, 0=contactor open
fb	Feedback	Signal from pressure detector (ventilator) or other motor monitoring.
t1	Thermal monitoring 1	Signal from thermal package for speed 1 1=thermal monitor not OK, 0= thermal monitor OK, 1=faulty
t2	Thermal monitoring 2	Signal from (thermal package) for speed 2 1=thermal monitor not OK, 0= thermal monitor OK, 1=faulty
Qit	Acknowledge	Acknowledge of errors

Outputs

M1	Drive speed 1	Control of contactor speed 1

M2	Drive speed 2	Control of contactor speed 2
Err	Error	General digital signal for error detection
Err	Error code	Numeric code of detected error
Erc	Contactor error	General digital signal for contactor error detection
Erf	Feedback error	Digital signal for error detection of feedback monitoring
Ert	Thermal error	General digital signal for error detection of thermal monitoring

LED

The LED turns to red if an error has been detected. It takes the same state as the digital output Err.

Err = 1, LED = red

Err = 0, LED = green

Parameters

-----[Delay times[sec]]-----

Start Delay speed V1	Delay time of the motor control before starting low speed.
Delay, speed, V1-V2	Delay time for changeover from low speed to high speed.
Delay V2-Stop-V1	Delay time for direct changeover from high to low speed.
Contact delay	Delay time for signal of low speed and high speed contactors.
Feedback delay	Delay time for feedback signal from low speed start.
Comment	Contact and Feedback delays must be smaller than the V1-V2 speed delay.

-----[Functional control]-----

Status	Display of the actual command status. See following status list.
Timer [sec]	Display of the actual time delay.
Error	Display of error code. See following error code list.
Error / Acknowledge	Acknowledge button for errors

Status indication:

Stop	V1 and V2 are at 0 or an error has been detected. M1 and M2 are at 0.
Start	Awaiting start delay. M1 and M2 are still at 0.
Relay?	Awaiting signal c1 for motor 1 speed.
Speed V1 !	Awaiting signal c1 for motor 2 speed.
Feedback ?	Awaiting feedback signal.
Running	Signals c1 and feedback are OK. Normal running state for 1 speed motor.
Speed V1 OK	Signals c1 and feedback are OK. Normal running state in low speed for 2 speed motor. Awaiting command V2 or delay V2-V1.

Speed V2 !	Awaiting signal c2.
Speed V2 OK	Signals c2 and feedback are OK. Normal running state in high speed.

Error codes:

Output Err	Display	Description
0	OK	No error detected
11	Thermo 1 !	The thermal monitoring signal V1 shows an error after the delay Contacts
12	Thermo 2 !	The thermal monitoring signal V2 shows an error after the delay Contacts
21	Speed V1 !	The contactor signal V1 shows an error after the delay Contacts
22	Speed V2 !	The contactor signal V2 shows an error after the delay Contacts
31	Feedback !	The feedback signal shows an error after the delay feedback

For motor speed only the following codes are available:

0	OK	No error detected
11	Thermo 1 !	The thermal monitoring signal V1 shows an error after the delay Contacts
21	Speed V1 !	The contactor signal V1 shows an error after the delay Contacts
31	Feedback !	The feedback signal shows an error after the delay feedback

Functional description

The controls of the 1-speed motors are started by the activation of the input V1.

The controls of the 2-speed motors can only be started in low speed through input V1. The input V2 can be activated later on for shifting to high speed.

They may also be started directly through input V2. In this case the whole starting sequence V1-V2 will be done automatically.

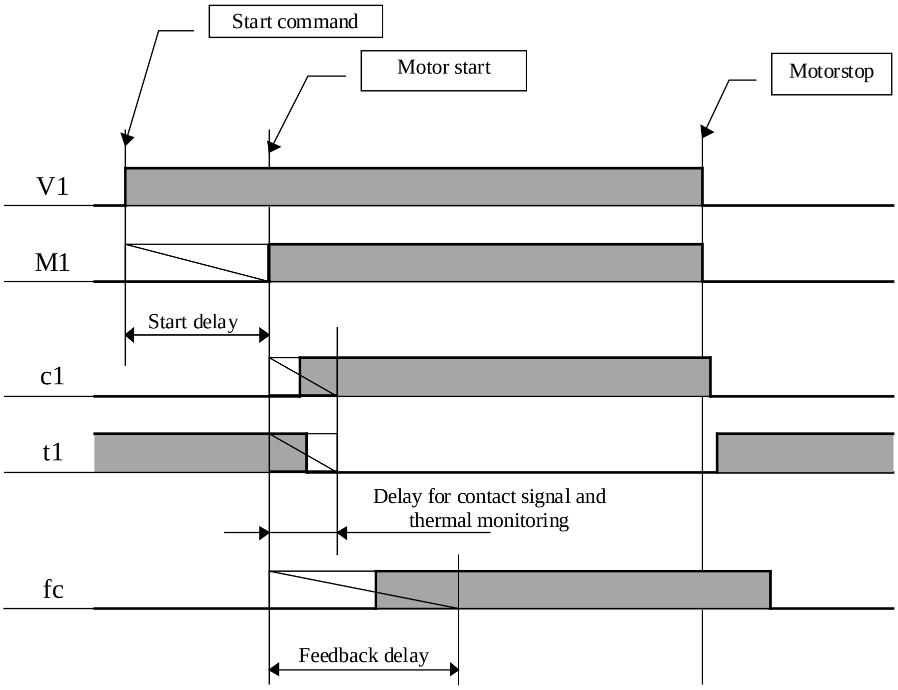
Fonctioning in low speed and 1-speed motors

When the input V1 is activated, the following sequence is executed:

- The timer is started for the time 'Delay Start'.
- After this delay, the output M1, for the control of the motor is activated
- The timer is restarted for the time 'Delay contact'.
- After this delay, the contactor signal 1 (1 = OK) and the 2 thermals monitoring(0 = OK) must be present on the inputs c1, t1 and t2.
- The timer is restarted for the remaining time 'Delay feedback'.
- After this delay, the feedback signal must be present on the input fb.

When the input V1 is deactivated, the output M1 is switched back and the sequence must be started up from beginning.

Diagram



Comment

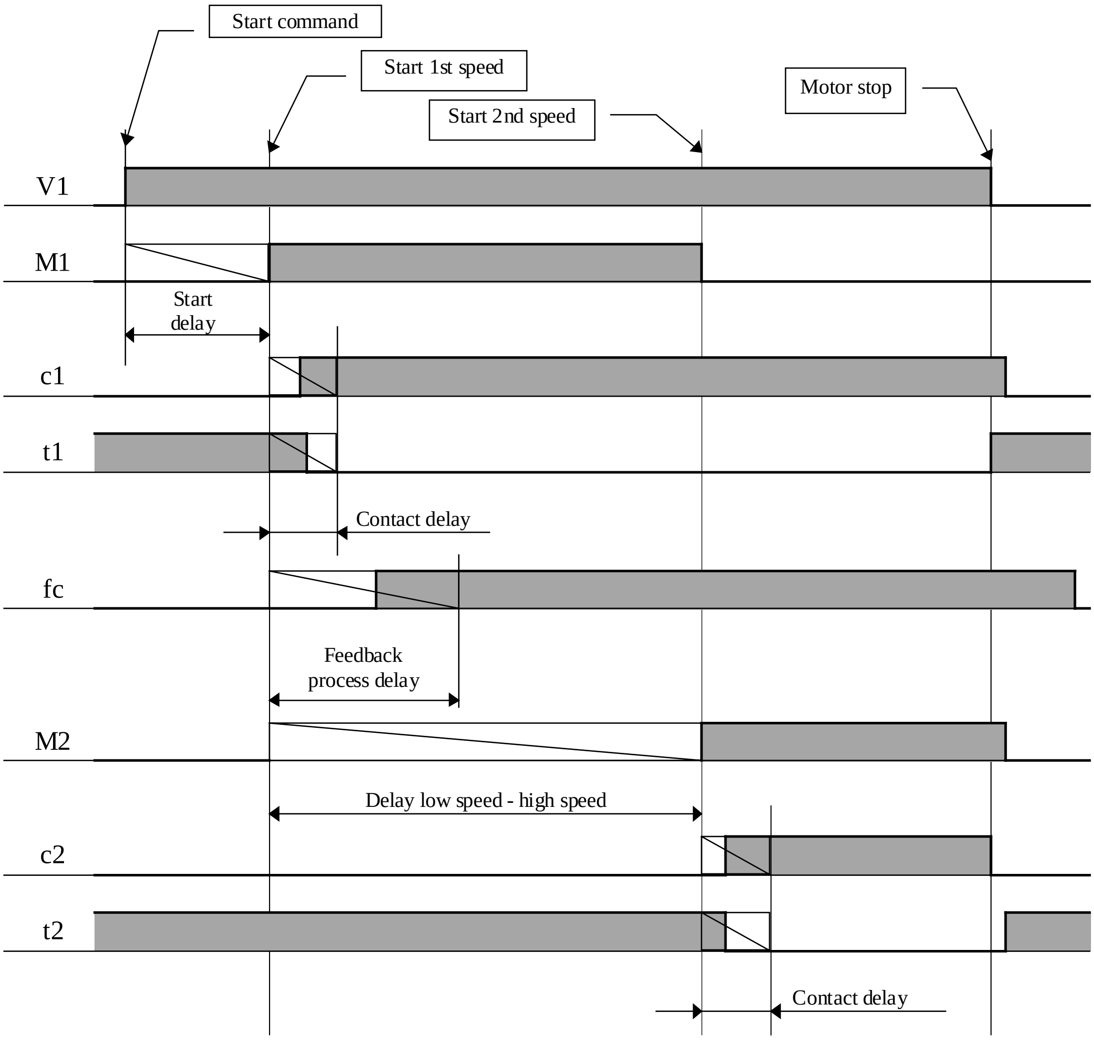
If the mechanical feedback signal is unstable (air flow unstability), a 'Off delay' function (Fbox from basic Fupla library) must be added on the 'fb' signal.

Operation at high speed

After the low speed sequence described above, the following sequence is to be executed:

- The timer is restarted for the time 'Delay V1-V2'.
- After that time, the M2 output is switched ON and the M1 is switched OFF.
- The timer is started for the contact delay.
- After that time, the monitoring signal of contactor 2 must be present at input c2.
- The signal at c1 is no longer necessary.

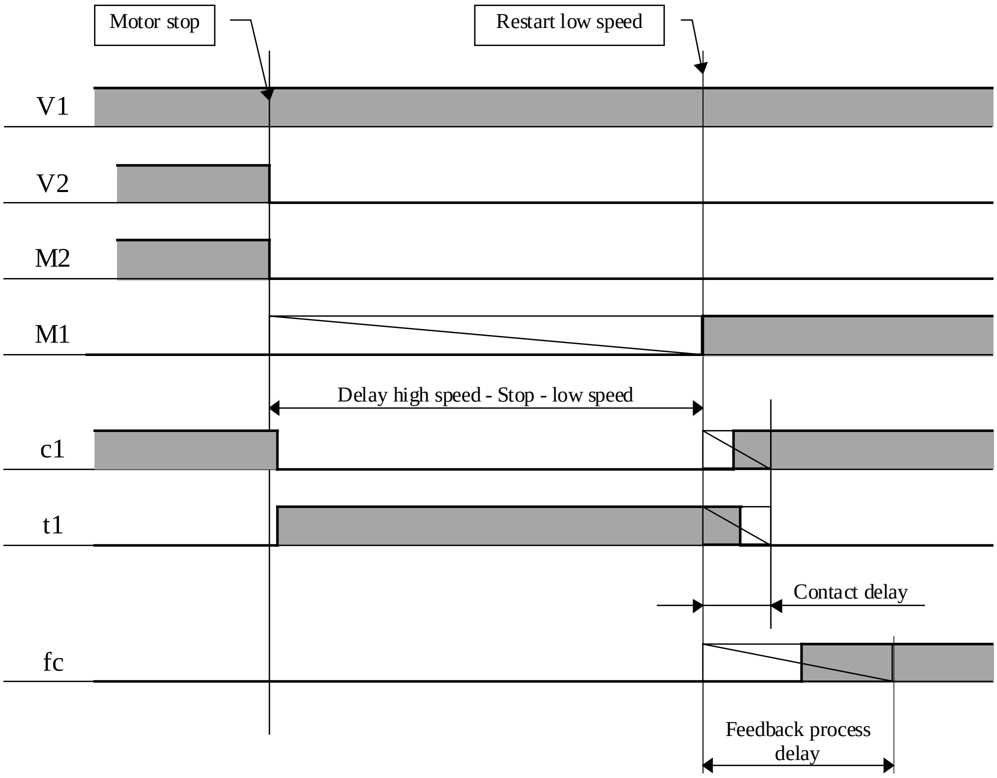
Diagram



Switching from high speed to low speed

If the speed changes from high to low without switching off signal V1, a low speed sequence is started up again with the delay 'V2 - Stop - V1'.

Diagram



However, if both signals V1 and V2 are switched off before restarting in low speed, the sequence is restarted including Start delay.

Errors handling

If either of these signals is not active from the moment at which it is monitored, the motor control shows an error. The error is handled as follows:

- The M1 output is switched off.
- The LED turns red.
- The binary output Err is set to 1.
- The error code is present at output Err numeric.
- The adjust window shows the type of error.
- The Erc output is set if the error is due to the contact.
- The Erf output is set if the error is due to the feedback.
- The Ert output is set if the error is due to the thermal monitor.

Comment: In versions lower than $135, the signals t1 and t2 had to be OK before start up. From version $135 these signals have the same delay as c1 and c2.

Error acknowledge

For controls with acknowledge signals, the error must be acknowledged through an impulse at input Qit.

If the input V1 or V2 is remaining at 1, the start sequence is launched automatically. The error outputs are deactivated and the error code is cleared (set to 0 = OK) as soon as the acknowledge is given.

For controls without acknowledge signals, the control inputs V1 and V2 must be switched off. The error is acknowledged automatically during the next start up. The error outputs are deactivated as soon as the inputs V1 and V2 are switched off. However, the status remains visible until the next start up.

Operation without monitoring signal

The monitoring signals of contactors, thermal monitors and feedback that are not used must be connected to a constant binary signal set to 1. Empty Fupla input field for example.

These unused signals may not be connected to the V1 and V2 motor control . This shows generally an error when the motor is swithched off.

Typical applications

These Fbox are used for all control of 1 and 2 speed motors.

The Start delay may be used for a ventilation start delay when waiting on the climatisation mixing valves.

The feedback signal is mainly used for monitoring a mechanical equipment (belt and other mechanical devices) by means of differential pressure such as in the ventilation equipment.

The Err binary output may be connected at an alarm monitoring function. In this way, the acknowledge of the motor Control may be different than the acknowledge of the alarm.

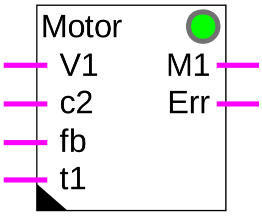
1.15 Motor, 1 Speed

Family: **HVC-General**

Name: **Motor 1 speed**

Macro name: _HeaMot

Fbox:



Short description

Control of a single speed motor with feedback and thermal monitoring.

See also the general description for the motor controls:

Motor-Generalities

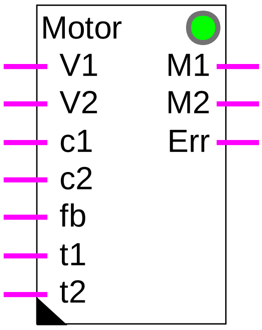
1.16 Motor, 2 Speed

Family: **HVC-General**

Name: **Motor 2 speed**

Macro name: _HeaMot2

Fbox:



Short description

Control of a 2-speed motor with feedback and thermal monitoring.

See also the general description for the motor controls:

Motor-Generalities

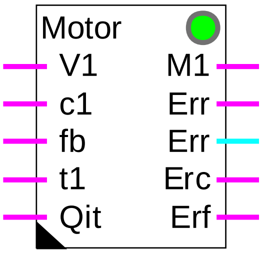
1.17 Motor, 1 Speed+Acknowledge

Family: **HVC-General**

Name: **Motor 1 speed+Ack**

Macro name: _HeaMotlq

Fbox:



Short description

Control of a single speed motor with feedback and thermal monitoring. An input allows to acknowledge the error and to restart the motor.

See also the general description for the motor controls:

Motor-Generalities

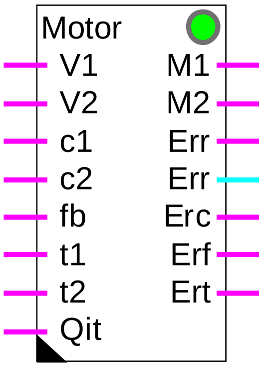
1.18 Motor, 2 Speed+Acknowledge

Family: **HVC-General**

Name: **Motor 2 speed+Ack**

Macro name: _HeaMot2q

Fbox:



Short description

Control of a 2-speed motor with feedback and thermal monitoring. An input allows to acknowledge the error and to restart the motor.

See also the general description for the motor controls:

Motor-Generalities

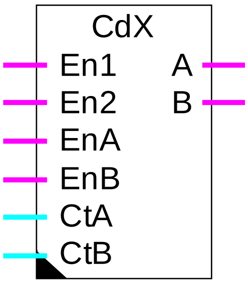
1.19 Redundant Command

Family: **HVC-General**

Name: **Redundant command**

Macro name: [_heaCdX2]

Fbox:



Short description

Redundant command for 2 pumps with automatic priority changeover depending on the run hours.

Inputs

En1	Enable 1	Command for switch-on of the priority pump
En2	Enable 2	Command for switch-on of the non-priority pump
EnA	Enable A	Autorization of running for pump A
EnB	Enable B	Autorization of running for pump B
CtA	Counter A	Run hours counter for pump A
CtB	Counter B	Run hours counter for pump B

Outputs

A	Command A	Command signal for pump A
B	Command B	Command signal for pump B

Parameters

Tolerance		Tolerance of the difference between the run hours before forcing a priority changeover. This parameter must be introduced without taking into account the counting resolution. Example: For a counting in 1/100 hours, 15.00 hours is represented by 1500.
Difference		Actual difference between the running hours of pump A and B
Priority		Display of the actual priority
	- Direct	Direct priority, the pump A has priority

- Inverted   Inverted priority the pump B has priority

Description

At initialization, the command is in direct priority if the 2 inputs EnA and EnB are at 1. The input En1 activates the output A and the input En2 activates the output B.

However, in inverted priority the input En1 activates the output B and the input En2 activates the output A.

The priority can be inverted (or set to direct again) in the following 3 cases:

Breakdown:

The priority is immediately inverted if the input 'EnA' switches to 0. It means that output 'A' cannot be used. The switch-on of one pump activates directly the output 'B'. In the other way, the priority is immediately set to 'Direct' if the input 'EnB' switches to 0.

Balance of run hours:

The priority is inverted if the value of input 'CtA' (running time of pump A) overrun the value of input 'CtB' (running time of pump B). However, this changeover occurs not immediately but only when a pump is switched on or off by the inputs 'En1' and 'En2'. In the other way, the priority is set back to 'Direct' if the running time of pump B overrun the running time of A. In this way, the running time are automatically balanced.

Important difference of run hours:

The priority is immediately inverted if the run hours (inputs 'CtA' and 'CtB') becomes bigger than the adjusted tolerance. This mechanism allows to balance the run hours even if no pump are switched on or off during a long period.

Typical applications

The Fbox has been provided for the redundant command of 2 pumps. It can be also used for other devices having a similar functioning.

For example: Ventilators

Burners

Lighting

Electrical heating

For a use without measurement ans without balance of the run hours, inputs 'CtA' and 'CtB' can be connected to a constant value=0.

More complex functions can be realized with the controller sequence functions:

Sequence, Master Burner

Sequence, 1-4 Levels

Sequence, 2 Points

References:

Hours Run Meter

Burner cascade 2*2

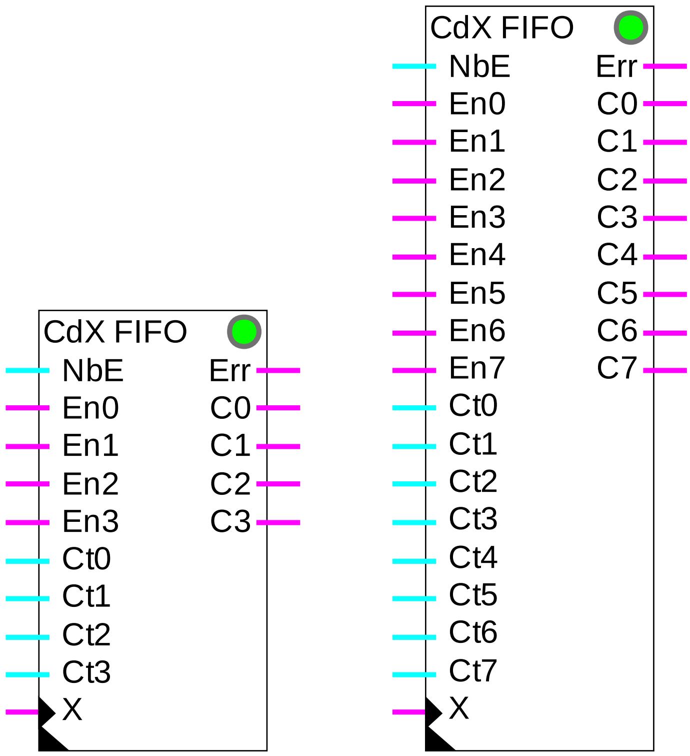
1.20 Redundant Command FIFO

Family: **HVC-General**

Name: **Redundant command FIFO**

Macro name: [_heaCdX8]

Fbox:



Short description

Redundant command for 2 to 8 pumps with automatic priority changeover depending on the run hours. The switch-on are made on the pump having the less working hours. The switch-off are made on the first pump switched on in the FIFO buffer

Inputs

NbE	Number	Number of pumps
En0	Enable 0	Working authorization for pump 0
...		
En7	Enable 7	Working authorization for pump 7
Ct0	Counter 0	Measurement of working hours of pump 0
...		
Ct7	Counter 7	Measurement of working hours of pump 7

X	Changeover	Pump forced changeover

Outputs

Err	Error	Number of pumps not sufficient
C0	Command 0	Signal for command of pump 0
...		
7	Command 7	Signal for command of pump 7

Parameters

Buffer FIFO	Display of the successive commands in buffer. The first swtched on pump is left. Comment: a 0 as first digit will not be displayed.
Next command	Display of the next command to be switched on.

Description

The function switches on the number of outputs specified on input NbE.

Each command possesses a working authorization (En?), a counter input (Ct?) and an output signal (C?).

At each switch-on, the command of smallest value is taken into account. A command is switched on only when its authorization input is at 1. The command taken into account is put in a FIFO buffer.

At each switch-off, the first command put in the buffer is taken into account. It is then taken out of the FIFO buffer.

If the input of an authorization command that is activated is switched to 0, the corresponding output is switched off. The command is then taken out of the buffer. If another command is available, it is then switched on and put in the buffer.

The X input allows to force the command changeover in the FIFO buffer. When a pulse is given on this input, the first buffer command is executed and replaced by the next available command. This allows to invert the commands even if the request does not change for long period of time. As to insure a regular change, a pulse per day can be given on the X input.

Remark: if no command is available, a forcing of command changeover may show an error during a short time. In this case, the command which is in first position is taken out of the buffer and put in last position.

The FIFO buffer is displayed in the adjust window. It is therefore possible to check its function. Remark: 0 as first digit will not be displayed.

The 'Change' button allows to force manually the command chageover in the buffer, same as the X input.

The next command available is displayed in the adjust window.

Typical applications

The Fbox has been provided for the redundant command of 2 to 8 pumps. It can be also used for other devices having a similar functioning.

For example: Ventilators

Burners

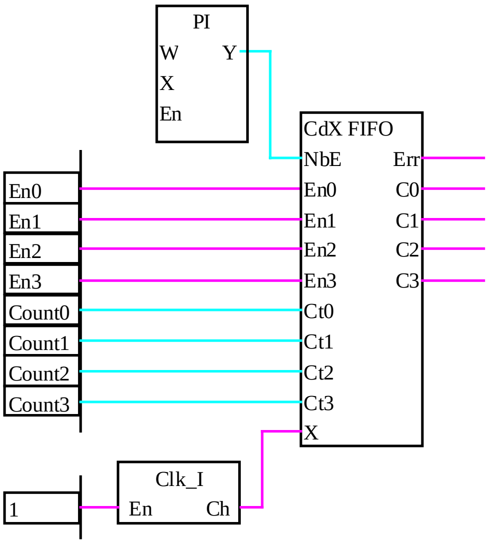
Lighting

Electrical heating

For a use without measurement ans without balance of the run hours, inputs Ct0 to Ct7 can be connected to a constant value=0.

This function can be controlled by a P or PI controller. The output value as well as the P and I parameters must be adapted to the number of pumps available.

Example:



References:

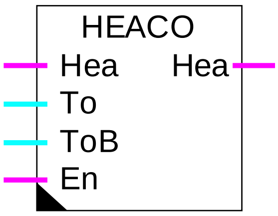
Redundant Command

Hours Run Meter

1.21 Heater On/Off

Family:	**HVC-General**
Name:	**Heater on/off**
Macro name:	_HeaCo

Fbox:



Short description

The HEACO function allows to switch the heating system on and off. The function takes into account the actual outside temperature and the building temperature which must be corrected by a filter.

Input

Hea	Heater	Control signal for the heater
To	Outside temperature	Measurement of the outside temperature
ToB	Filtered To	Filtered outside temperature
En	Enable	Activation of the on/off function

Output

Hea	Heater	Control of the heater with automatic on/off

Parameters

Threshold To	Threshold for switch-on depending on the outside temperature
Dead range To	Dead range between the switch-on and switch-off point, depending on the outside temperature
Threshold T building	Threshold for switch depending on the building temperature
Dead range T building	Dead range between the switch-on and switch-off point, depending on the building temperature

Description of the function

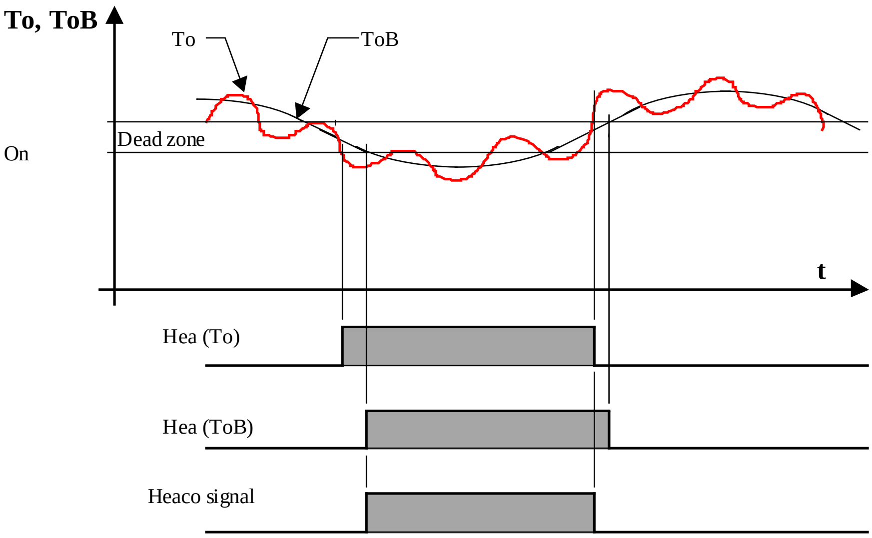
Two criteria are necessary for switching on the heating system. The outside temperature must be lower than the set threshold. The building temperature (filtered outside temperature) must be lower than the set threshold. Each one of these signals is switched off when the corresponding temperature is higher than the threshold plus the dead range. If one of the two conditions is not fulfilled, the heater is switched off.

The on/off switching is activated through the En input. If this signal is 0, the input Hea is simply copied on the output Hea.

The filtered temperature can be obtained from the Building T2 filter or a Data Log average.

A preliminary signal for switching on the heating system (Clock, Yearly for example) might be connected to the Hea binary input. The Hea output is switched on if Hea input is at 1 and the switching conditions described above are fulfilled. This output may be connected to an antifreeze function input.

Diagram



For this example, the switching on level and the dead range are the same for To and ToB.

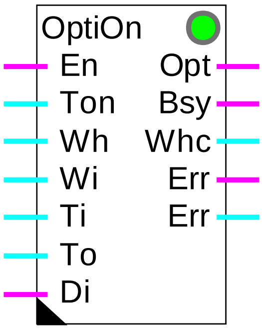
Hea output = Heaco Signal when input Hea = 1 and En = 1

Hea (To) and Hea (ToB) is only calculated internally.

1.22 Optimum Start

Family:	**HVC-General**	
Name:	**Optimum start**	(former 'Optimum A' and 'B')
Macro name:	_HeaOptiC	(former _HeaOptiA and _HeaOptiB)

Fbox:



Short description

This function calculates the time necessary for a heated or air-conditioned room to attain its setpoint temperature. The plant is switched on as late as possible in order to save as much energy as possible.

The effective time to attain the temperature is measured and the calculation factors are automatically adapted for the next sequence.

Inputs

En	Enable	Activation of the signal for Optimization *
Ton	Time On	Input signal for the delay of temperatur attainment **
Wh	Set-point	Set-point for the heater **
Wi	Set-point	Set-point for the inside temperature
Ti	Inside temperature	Measurement of inside temperature
To	Outside temperature	Measurement of outside temperature (filtered)
Di	Disable	Switches off of the parameter adjustment

Outputs

Opt	Optimization	Optimized Switching on signal
Bsy	Busy	Indication for the temperature attainment **
Whc	Corrected set-point	Temperature set-point, corrected during temperature attainment **
Err	Error	General binary error signal
Err	Error	Numeric error signal

* St has been replaced by En in the new versions. The signal St must be activated by a clock function before the time 'Advance'.

** Was not available in the old versions Optimum A and B.

<u>Parameters</u>

-----[Basic parameters]-----	
Option time	Option for temperature attainment
- Input	The delay for temperature attainment is given by the input Ton
- Parameter	The delay for temperature attainment is given by the following parameter
Target time for temperature	Absolute time [HH:MM] to achieve final temperature
Maximum advance start	Maximum advance of the start signal [HH:MM] to achieve final temperature in the specified time
Time tolerance	Tolerance [HH:MM] between the calculated and the effective time for attainment of final temperature.
Temperature tolerance	Temperature tolerance [K] for determining actual time to achieve final temperature
Correction factor Wh	Factor for correction of the heater set-point Wh [K/Hour]
Correction limit Wh	Maximum correction value of the heater set-point Wh [K]
-----[Actual optimization]-----	
T1: Time constant	Time fraction [min] for achieving the final temperature, regardless of other temperatures
T2: Time f(Ti)	Time fraction [min] for achieving the final temperature dependent on inside temperature
T3: Time f(Ti,To)	Time fraction [min] for achieving the final temperature dependent on inside and outside temperature
Ft2: Factor for T2	Factor for calculating the time f(Ti) [min/K]
Ft3: Factor for T3	Factor for calculating the time f(Ti,To) [min/K/K]
ETi: temp. difference inside	Difference of inside temperature Ti and set-point Wi taken into account during the last optimum time calculation.
ETo: temp. difference outside	Difference of outside temperature To and average of inside temperature during the last temperature attainment (Wi-Ti). Time taken into account during the last optimum time calculation.
Top: calculated optimum time	Optimum calculated time of temperature attainment for the actual or the last finished sequence.
-----[Functional control]-----	
Time remaining	Remaining time [min] before time for temperature attainment
Effective time measurement	Effective time [min] for temperature attainment measured actually or measured during the last sequence.

Delay time [sec]	Next time calculation when Time function element=0
Temp. difference	Actual temperature difference (Wi-Ti)
Status	Actual status of the function. See following list.
Error	Error code of the last detected error. See following list.
-----[Adaptation]-----	(Time in minutes)
	This section shows a copy of the parameters taken into account during the last optimization. They are useful in case of difficulties during the putting into operation.

The function may display the following status:

Stopped	The optimization is not working. The En input is at 0. This status is also displayed 1 minute before the beginning of the optimization if En remains at 1.
Wait	The optimization is active. The function is waiting for the optimum time as to switch-on the output Opt.
Temp. runs	The output Opt has been set to 1. The time for temperature attainment is running. the effective time is measured.
Active	The time for temperature attainment is over. The installation is in operation. The output Opt is at 1.
Switched off	The input Di is at 1. The optimization is deactivated. The Opt output corresponds to the En input.

The function can detect the following errors:

0	OK	No error
1	Start !	The calculated optimum time exceeds the advance of the start signal. A temperature measurement error may have caused an incorrect calculation. If not, it will be necessary to increase the advance of the start signal.
2	Early!	Temperature attainment has been completed earlier than the tolerance allows.
3	Late!	Temperature attainment has been completed later than the tolerance allows. An air-conditioning malfunction may have delayed attainment of temperature without activating the Di signal.
4	Switched off!	Optimisation has been disabled by the Di input.
5	Tolerance !	The tolerance is bigger than the calculated time for attainment of temperature. This error is not displayed if error 2 or 3 has been detected.

The errors Early! and Late! may appear if the constant time is too high or if the tolerance is too small.

In case of error detection, the Err output signal is activated until the En output is switched off or until next optimization. The numeric output Err shows an error code.

Caution !
It may be impossible to adapt parameters which differ too greatly from the ideal. The calculated time would then be outside the tolerance. Increasing the tolerance is only possible up to the value of the calculated time itself (see error 5).

Description of the function

The optimization is switched on in order to attain a temperature setpoint in the given delay. Depending on the option this delay is given at input Ton or from the parameter in the adjust window. The time calculation begins at maximum time given as parameter. This time must be sufficient to allow the temperature to stabilize under the least favourable conditions. From that moment, the function calculates the optimum time for temperature attainment and compares it with the time remaining until start-up of the plant (output Opt). The effective time is measured from start-up until the inside temperature is within the specified tolerance.

The En input activates the optimization function. If set to 0, the output remains at 0. If it remains at 1 after the first putting into service, the Opt output is reset to 0 one minute before the beginning of the maximum advance.

The input Ton is foreseen for connection to the Fbox Clock, 7 Days which can be connected to a terminal. If the delay option 'Parameter' is selected, the input Ton is not used. It must be then connected to a field having a constant=0.

During this temperature attainment time , the temperature starting set-point can be corrected upwards as to accelerate the temperature attainment. For that, the set-point coming from the heat curve, must be connected to the input 'Wh'. The corrected set-point is then given to the output 'Whc'. The applied correction is proportional to the calculated temperature attainment time. The calculation factor in K/hour is adjustable. The correction is limited by an adjustable value.

During the temperature attainment time, the output 'Bsy' is set to 1. It allows to switch on some additional devices. However, this output is not switched on if the optimization is desactivated by the input 'Di'.

The effective time must be within the specified tolerance relative to the time calculated. If this is not the case, the result is ignored for any later sequence and the function remains in an error state. If the time calculated is itself smaller than the tolerance, the function shows an error, even if the tolerance is respected. This situation may occur if either the tolerance is too big or the given time is very short. In this case the installation should be put out of service. With this error, the result will not be used for parameters adaptation. This prevents large difference (in relative term) from causing a divergence in the parameters.

Switching on input Di before attainment of the desired temperature allows optimization to be disabled and prevents parameters from being adapted when the air-conditioning has broken down or a disturbance has been detected. Output Opt is then switched on as the En input. The Di signal may also be used for permanently deactivating the optimization function.

The function is simply commissioned by giving it initial parameters estimated on the basis of an jump response or of the technical data for the air-conditioned room. The time constant allows the introduction of a dead time before start-up, plus a slow approach time to the set-point. Factor Ft2 represents the rise time relative to the difference from inside temperature at the start. Factor Ft3 can be initialised to 0 if it is not known from experience. The temperature tolerance should not be smaller than temperature fluctuations during operation. The time tolerance should not be too small, before experience is obtained regarding the accuracy of the calculation: for example, 1/3 of maximum optimum time. It should not be too large either, as this prevents the parameters from being adapted.

When the parameters are adapted, the calculation will be correct for the next start sequence under

under the same climatic conditions and with the same energy in the building.

<u>Signal To</u>

This signal must represent as well as possible the effect of the external temperature on the internal walls surface.

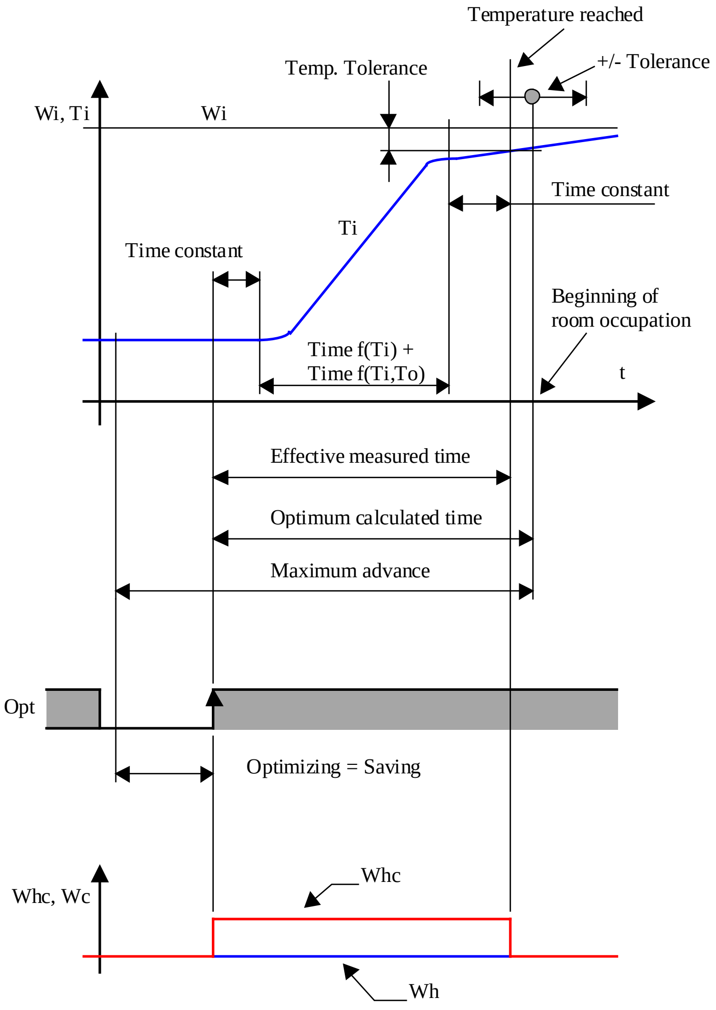
This effect is generally only applicable on the external building surface.

Value for To according to possibilities:

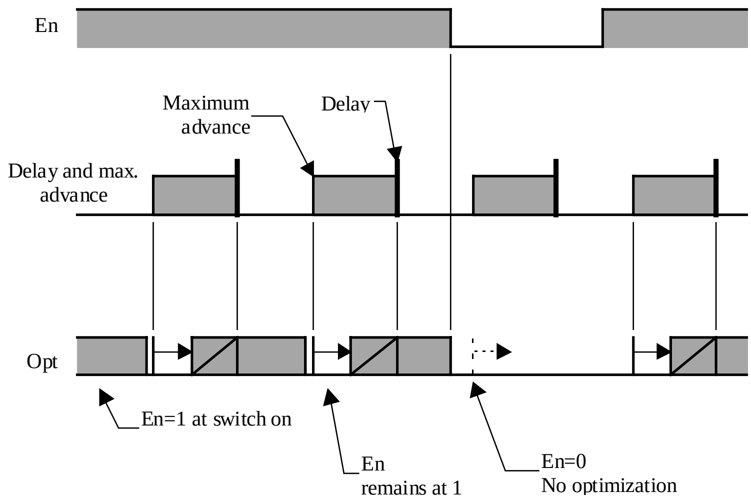
(preferred order)

- inside temperature of outside walls and windows
- filtered outside temperature with filter T2 building
- historical average of outside temperature
- outside temperature

Diagram

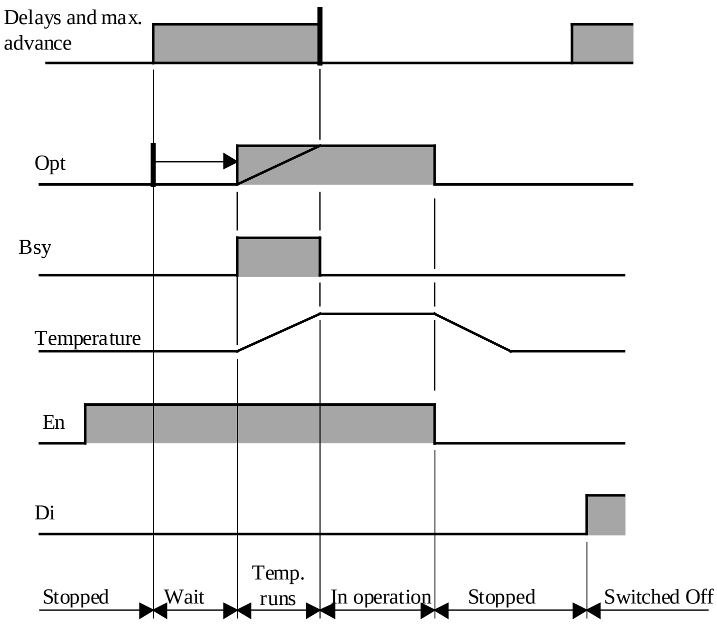

Temperature reached
+/- Tolerance
Temp. Tolerance
Wi, Ti
Wi
Time constant
Ti
Time constant
Beginning of
room occupation
Time f(Ti) +
Time f(Ti,To)
t
Effective measured time
Optimum calculated time
Maximum advance
Opt
Optimizing = Saving
Whc, Wc
Whc
Wh

Behaviour with input En



The En input activates the optimization function. If the input is at 0, the output remains at 0. If the input is at 1 after the putting into operation, the output Opt will be set to 0 one minute before the maximum advance.

Display of the status



Algorithm:

Tm = Tl + T2 + T3

Tl = constant

T2 = Ft2 * ETi

T3 = Ft3* Eti * ETo

ETi = W-Ti

ETo = (W+Ti)/2-To

where:

Tm = Calculated time to achieve final temperature

Tl = Constant proportion of Tm

T2 = Proportion of Tm f(Ti)

T3 = Proportion of Tm f(Ti,To)

Ft2 = Factor for calculation T2 in [Min/K] *

Ft3 = Factor for calculation T3 in [Min /K/K] *

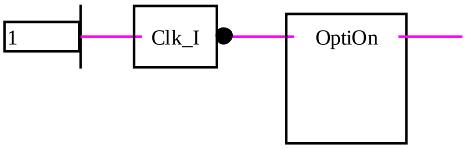
ETi = Difference from inside temperature start-up

ETo = Average difference between inside and outside temperatures

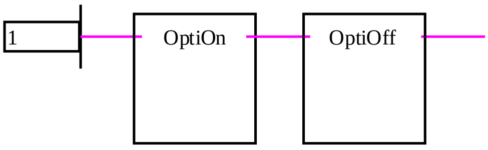
* In old versions, depending on the option Min must be replaced by HMS (Hour, Minute, Second).

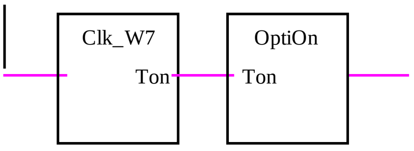
Reference

The switch-off may be done through a function Clock, Daily (0-Impulse at input En).



This function can be connected to the function Optimum Stop.





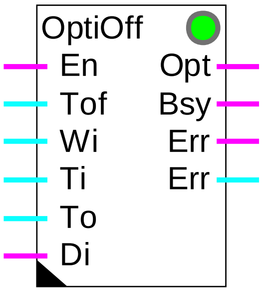
1.23 Optimum Stop

Family: **HVC-General**

Name: **Optimum stop**

Macro name: _HeaOptih

Fbox:



Short description

The function calculates the optional swtch off time of a heating plant. The room is put in a free running state before the end of occupation in order to save as much energy as possible.

The effective time of the free running sequence is measured and the calculation factors are automatically adapted for the next sequence.

Caution ! Works for a heated room only. Temperature drifts downward only.

Inputs

En	Enable	Activation signal for the optimization *
Tof	Time Off	Input signal for the delay of end of occupation **
Wi	Set-point	Set-point for the inside temperature
Ti	Inside temperature	Measurement of inside temperature
To	Outside temperature	Measurement (filtered) of outside temperature
Di	Disable	Disable the parameter adjustment

Outputs

Opt	Optimization	Optimized free run signal
Bsy	Busy	Indication of free running state sequence **
Err	Error	General binary error signal
Err	Error code	Numeric error code

* Was replaced by St in old version 'Temperature Optimum G'. The signal St must be switched on before the time 'Advance'.

Parameters

-----[Basic parameters]-----	
End of room occupation	Absolute time [HH:MM] for the end of room occupation
Maximum advance	Maximum advance of the optimum signal [HH:MM] related to the end of the room occupation.
Time tolerance	Tolerance [HH:MM] between the calculated and the effective time of the free run.
Temperature tolerance	Temperature tolerance [K] for evaluation of the free run effective time.
-----[Actual Optimization]-----	
T1: constant time	Time proportion [Min] for free run indenpendently of the temperatures.
T2: time f(Ti,To)	Time proportion [Min] for free run denpending on the inside and outside temperatures.
Ft2: Factor for T2	Factor for the time calculation f(Ti,To) [Min*K/K]
ETi: Inside temp. difference	Difference between the inside temperature Ti and the set-point Wi. The difference of the last time calculation will be considered here.
ETo: Outside temp. difference	Difference between the outside temperature To and the inside temperature average during free run time. The difference of the last time calculation will be considered here.
Top: Optimum calculated time	Optimum calculated time for the free run time. This value has been calculated during the actual or the last finished sequence.
-----[Functional control]-----	
Remaining time	Remaining time [Min] before the free run delay
Effective time measurement	Effective time [Min] measured during the actual sequence or during the last finished sequence.
Timer	Next calculation of optimum time when timer = 0
Temperature difference	Actual temperature difference (Wi-Ti)
Status	Actual status of the function. See following list.
Error	Code of the last error found. See following list.
----[Adjustment]----	(Time in minutes)
	This section shows a copy of the parameters taken into account during the last optimization. They are useful in case of difficulties during the putting into operation.

The function can display the following status:

In operation	The plant is in operation. The Opt output is at 1.

Wait	The optimization is active. The function is awaiting the optimum time for switching off the Opt output.
Free run	The Opt output has been set to 0. The free run time is running. The effective time is measured.
Stop	The plant is not in operation. The temperature is probably out of tolerance.
Disabled	The Di input is at 1. The optimization is deactivated. The Opt output corresponds directly to the En input.

The function can detect the following errors:

0	OK	No error
1	Start !	The calculated optimum time exceeds the advance of the start signal. A temperature measurement error may have caused an incorrect calculation. If not, it will be necessary to increase the advance of the start signal.
2	Early!	The free run sequence has been completed earlier than the tolerance allows.
3	Late!	The free run sequence has been completed later than the tolerance allows.
4	Disabled!	Optimisation has been disabled by the Di input.
5	Tolerance !	The tolerance is bigger than the free run caculated time. This error is not displayed if error 2 or 3 has been detected.

The errors Early! and Late! may appear if the constant time is too high or if the tolerance is too small.

In case of error detection, the Err output signal is activated until the En output is switched on. The numeric output Err shows an error code.

Caution !

It may be impossible to adapt parameters which differ too greatly from the ideal. The calculated time would then be outside the tolerance. Increasing the tolerance is only possible up to the value of the calculated time itself (see error 5).

Description of the function

The optimization is calculated in order to finish the free run sequence set in the adjust window at the end of the room occupation. The time calculation begins at maximum advance. This time must be sufficient as to allow the free run sequence to work in the most favourable conditions. From that moment, the function calculates the optimum time for the free run and compares it with the time remaining until stop of the plant (output Opt). The effective time is measured from free run until the inside temperature is out of the specified tolerance.

The En input activates the optimization function. A switch-on and switch-off of this signal every day is necessary for restarting the optimization. If the input remains at 1 or 0 after an optimization sequence the output remains at 0.

The input Tof is foreseen for connection to the Fbox Clock, 7 Days which can be connected to a terminal. If the delay option 'Parameter' is selected, the input Ton is not used. It must be then connected to a field having a constant=0.

During the free running state, the output 'Bsy' is set to 1. It allows to switch off some additional devices. However, this output is not switched on if the optimization is desactivated by the input 'Di'.

The effective time must be within the tolerance specified relative to the time calculated. If this is not the case, the result is ignored and the function remains in an error state. If the time calculated is itself smaller than the tolerance, the function shows an error, even if the tolerance is respected. This situation may occur if either the tolerance is too big or the given time is very short. With this error, the result will not be used for parameters adaptation. This prevents relatively large differences (in relative term) from causing a divergence in the parameters.

Switching on input Di during free run allows the optimization to be disabled and prevents parameters from being adapted when the heating has broken down or a disturbance has been detected. Output Opt is then switched on as the En input. The Di signal may also be used for permanently deactivating the optimization function.

The function is simply commissioned by giving it initial parameters estimated on the basis of an jump response or of the technical data for the heated room. The time constant allows the introduction of a timeout at start-up of free run. Factor Ft2 represents the free run time relative to the difference from inside temperature at the start. The temperature tolerance should not be smaller than temperature fluctuations during operation. The time tolerance should not be too small, before experience is obtained regarding the accuracy of the calculation: for example, 1/3 of maximum optimum time. It should not be too large either, as this prevents the parameters from being adapted.

When the parameters are adapted, the calculation will be correct for the next start sequence under

under the same climatic conditions and with the same energy in the building.

Signal To

This signal must represent as well as possible the effect of the external temperature on the internal walls surface.

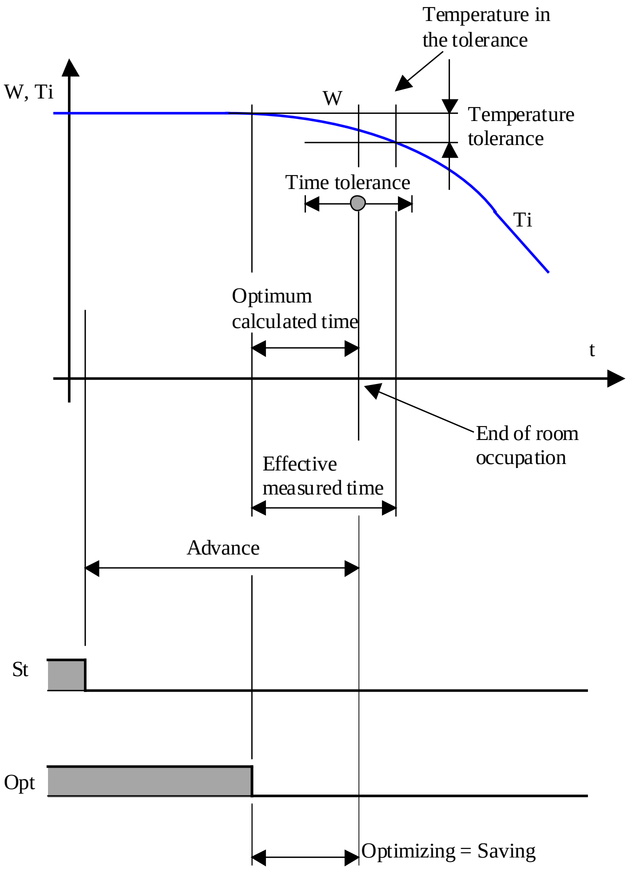
This effect is generally only applicable on the external building surface.

Value for To according to possibilities:

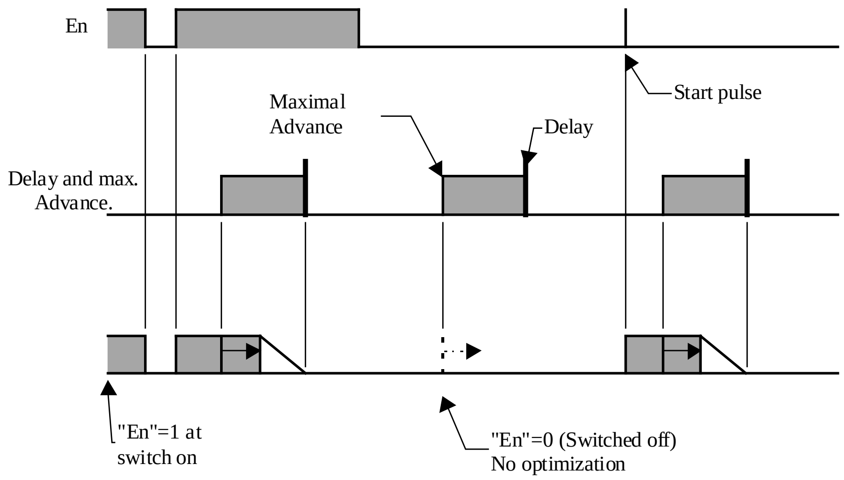
(preferred order)

- inside temperature of outside walls and windows
- filtered outside temperature with filter T2 building
- historical average of outside temperature
- outside temperature

Diagram

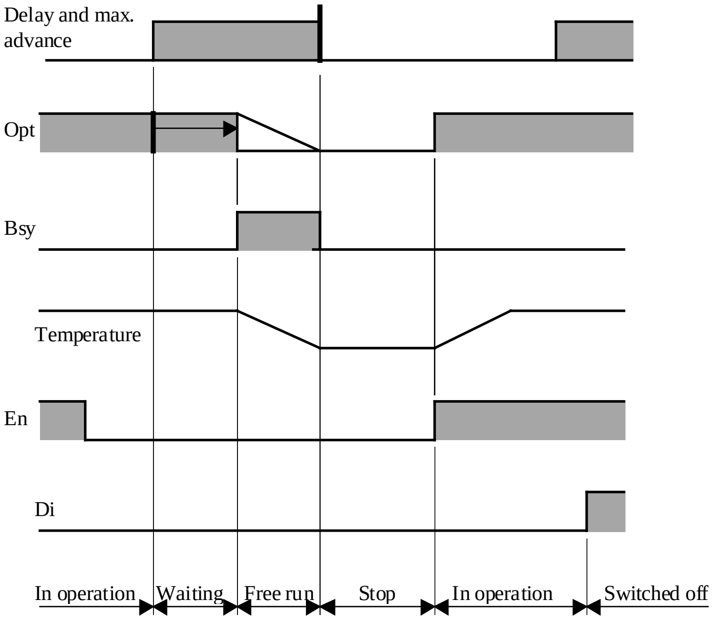


Behaviour with input En



The En input activates the optimization function. To start the optimization again it is necessary to switch the signal on and off every day. If the input remains at 1 or 0 after the optimization, the output 'Opt' remains at 0.

Status display



Algorithm:

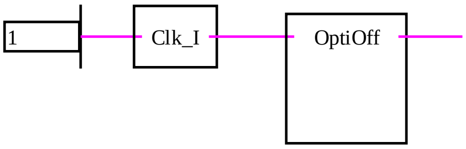
Tr	=	T1 + T2
T1	=	constant
T2	=	Ft2 * Eti / Eto
Eto	=	(Ti+Toff)/2-To
Eti	=	Ti-Toff
Toff	=	Wi-Tol

With:

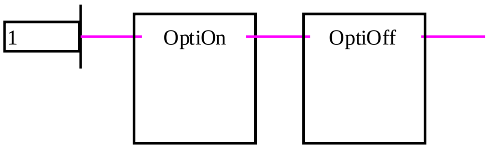
Tr	Calculated free running time
T1	Constant proportion of Tm
T2	Proportion of Tm f(Ti,To)
Tol	Tolerance of difference
Ft2	Factor for the calculation of T2 in [Min*K/K] *
Toff	Acceptable temperature at the end of free running state
Eti	Acceptable temperature decrease during free running state
Eto	Average of the difference between inside and outside la temperature

* In old versions, depending on the option, 'Min' must be replaced by HMS (Hours, Minutes, Seconds).

Reference
The switch-off may be done through a function Clock, Daily (0-Impulse at input En).



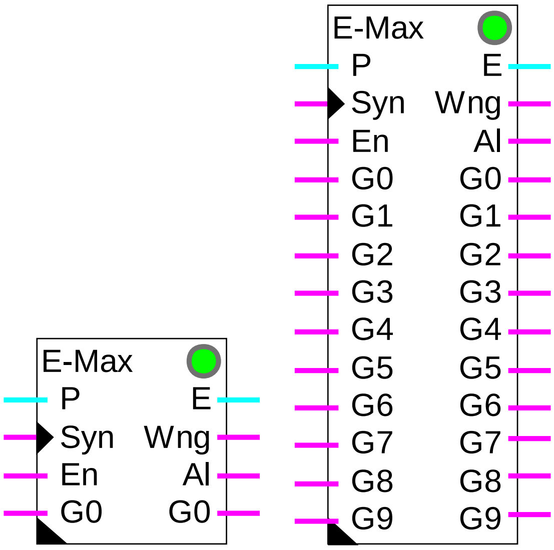
This function can be connected to the function Optimum Start.



1.24 Load Switching

Family:	**HVC-General**
Name:	**Load switching**
Macro name:	_HeaEmax

Fbox:



Short description

Peak load switching is used to monitor energy consumption over short periods. Individual load groups are switched off to avoid exceeding a maximum threshold.

Inputs

P	Power	Measurement of the actual power
Syn	Synchronization	Synchronization signal of the measuring period
En	Enable	Activation of the function
G0	Group 0	Availability of group 0
		1=the group is available for peak load switching
		0=the group is not available for peak load switching
...		
G9	Group 9	Availability of the group 9

Outputs

E	Energy	Calculated energy since the beginning of the mesuring period
Wng	Warning	Risk of exceeding of maximum consumption for the actual period

Al	Alarm	Alarm for exceeding of maximum consumption for the actual period
G0	Group 0	Peak load switching for group 0.
		0=The group must be switched off
		1=The group may be switched on again
...		
G9	Group 9	Peak load switching for group 9.

Parameters

Measurement cycle [sec]	Measuring period in which the maximum value must be respected.
Remaining time [sec]	Remaining measuring time until end of actual period.
Pause beginning of cycle [sec]	Pause time at beginning of cycle before first calculation of final consumption.
Calculation interval [sec]	Interval between each new calculation of final energy, after the pause at beginning of cycle.
Energy unit	Unit option for energy.
- kJ	Energy in Kilo-Joules
- Mj	Energy in Mega-Joules
- kWh	Energy in Kilo-Watt-Hours
Maximum energy	Maximum energy not to be exceeded during each cycle.
Actual energy	Energy calculated for the actual cycle.
Energy, last cycle	Final energy calculated at the end of the previous cycle.
Power group 0...9 [kW]	Power of the group 0 in kW. Thes values must be known as accurately as possible.

Description

The measuring period must be defined according to the energy supplier's own method. The function is synchronized with the start of measurement by means of input Syn (positive edge). Energy consumption must be measured in the installation itself. The power signal, in 1/10 kW, is sent to input P of the Fbox.

Active load groups are reported at inputs G0 to G9 via binary signals. Outputs G0 to G9 are set to 1 if permission to operate is present. When the load must be switched off, the outputs are set to 0. The power consumption for each group must be defined in the adjust window of the Fbox.

The Enable input En switches the function on or off. If En is at 0, inputs G0 to G9 are switched through to the corresponding outputs. No measurements are made and nothing is switched off.

Throughout the period of measurement, energy consumption is calculated. The power at the input E is integrated every second. The actual value of this integration is copied to output E. At the end of the period of measurement, the final value is stored in a register. This ultimate value can be viewed at any time in the adjust window. The integrator is then zeroed in preparation for the next period of measurement. If calculated energy exceeds the load limit, alarm output Al is set to 1. As soon as a period of measurement terminates within the load limit, alarm output Al is reset to 0.

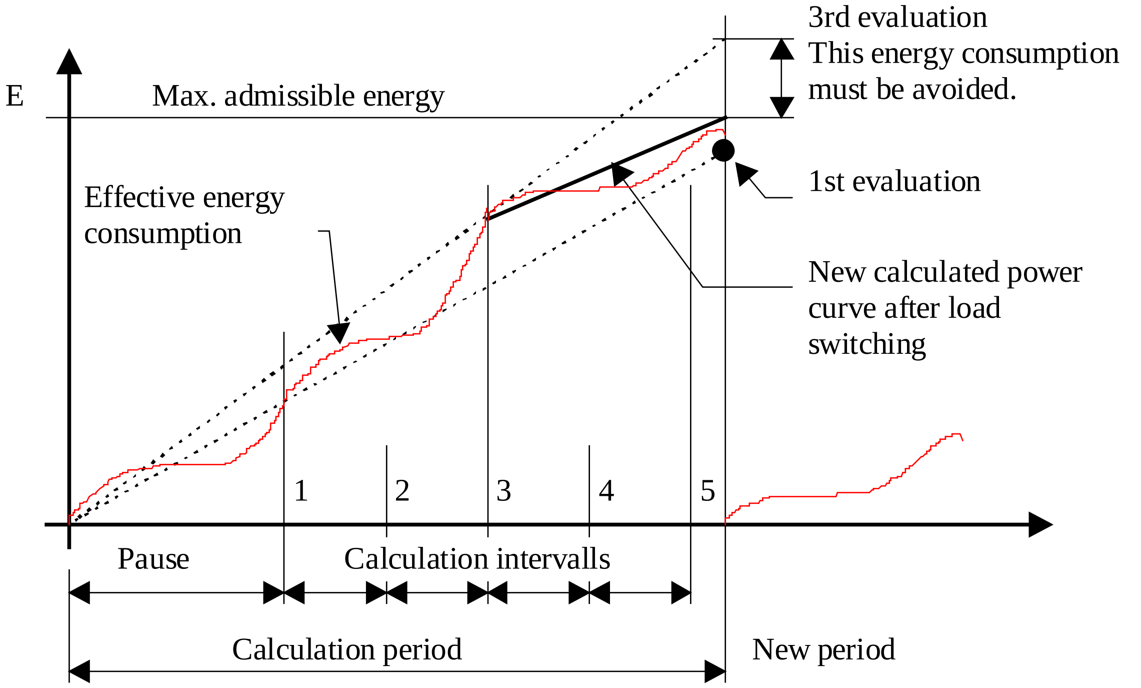
A period of measurement begins with a start delay, followed by a series of measuring intervals. Nothing is switched off or on again during the start delay. This prevents any significant errors of measurement which might arise from power fluctuations. At the end of this delay, and after each measuring interval, actual values are used to calculate probable energy consumption up to the end of the period of measurement. If there is any risk that the consumption limit will be exceeded, the load switching is activated. Starting from G0 and extending to G9, groups are successively switched off according to their capacity, where the aim is to reduce the energy consumption below the limit value. Any non-active groups (input at 0) are left out of the calculation, although they are also switched off.

If energy consumption comes close to the limit value while no group is available to be switched off, output Wng (Warning) is set to 1. This allows the prior programming of possible emergency power-off or of an alarm message. As soon as the risk of excessive consumption has been averted (by switching off or restarting) output Wng is set to 0.

If any load has been swithched off, it is not possible to effect a restart during the same period of measurement. This prevents any surge effect arising from a specification of group power which does not correspond to reality.

If calculated energy is less than the maximum, groups are switched on again. Starting from G9 and extending to G0 (reverse sequence) groups are reconnected. Any non-available groups are left out of the power calculations and are not enabled. This prevents anything from being switched on during a period of measurement which might result in exceeding the load limit. If all available groups are enabled, the non-available groups are also released.

Diagram


3rd evaluation
This energy consumption must be avoided.
E
Max. admissible energy
Effective energy consumption
1st evaluation
New calculated power curve after load switching
1
2
3
4
5
Pause
Calculation intervalls
Calculation period
New period

1.25 Manual Override Digital

Family:	**HVC-General**
Name:	**Override digital**
Macro name:	_HeaManb2

Fbox:

Short description

Manual forcing of a digital value.

Input

Man	Manual	Automatic digital signal

Output

	Output	Digital signal with manual override

Parameters

Mode, Change	Switching button and display of the actual mode.
State manual, Change	Switching button and display of the state in manual mode.

Description of the function

This function must be used on a numeric signal where online forcing must be possible.

Manual forcing takes place in 2 stages:

- definition of manual value
- activation of manual forcing

When forcing is active, the LED turns red.

Possible applications:

- forcing digital outputs for test purposes
- forcing a clock channel outside its turn-on times

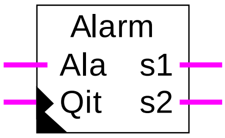
1.26 Alarm+Acknowledge

Family: **HVC-General**

Name: **Alarm**

Macro name: _HeaAlrm

Fbox:



Short description

Simple alarm function with 2 signals for acoustic and visual alarm.

Inputs

Ala	Alarm	Digital input signal
Qit	Ack.	Acknowledge

Outputs

s1	Signal 1	Acoustic alarm output
s2	Signal 2	Visual alarm output

Parameters

Blink option	Option which defines when the alarm output is blinking.
- Ala AND Qit	Blinking when alarm remains but acknowledged.
- Ala AND /Qit	Blinking when alarm remains but not acknowledged.

Description of the function

When the input signal Ala is at 1, both outputs s1 and s2 are switched on. As soon as the acknowledge is given (input Ack = 1, dynamic) signal s1 is switched off. If the alarm remains, the output s2 can takes 2 different states: switched on or flashing. Depending on the selected option in adjust window, the blinker shows:

- Alarm remains but acknowledged
- Alarms remains and not acknowledged

Diagram 1: Blinker option: Ala AND Ack.

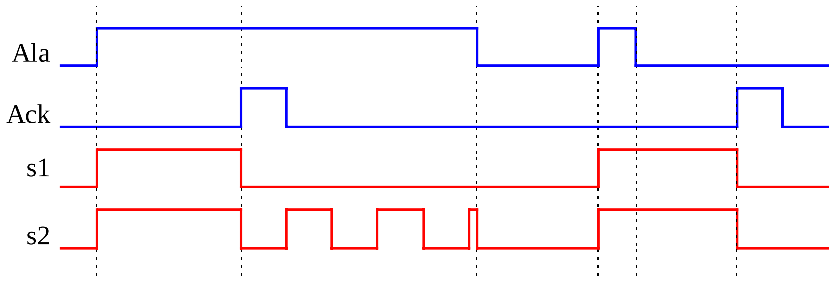
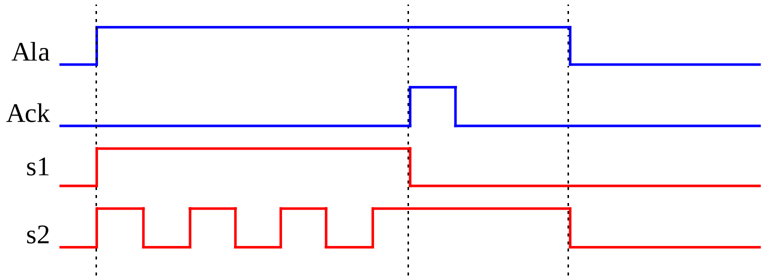


Diagram 2: Blinker option: Ala AND /Ack



The general alarm signal (HVC-Init, Subfunction Alarm) is switched on whenever such an alarm is present. The general acknowledge signal is switched on whenever that alarm has not been acknowledged.

Reference

See also:

Alarm General

Alarm+Acknowledge & Time Stamp

Alarm Inhibit 1-10 + Acknowledge

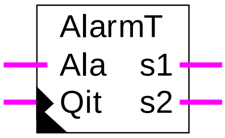
1.27 Alarm + Acknowledge & Time Stamp

Family: **HVC-General**

Name: **Alarm + time stamp**

Macro name: _HeaAlrt2

Fbox:



Short description

Simple alarm function with 2 signals for acoustic and visual alarm including date/time stamp.

Inputs

Ala	Alarm	Digital input signal
Qit	Ack.	Acknowledge

Outputs

s1	Signal 1	Acoustic alarm signal
s2	Signal 2	Visual alarm signal

Parameters

Blink option	Option which defines when the alarm output is blinking.
- Ala AND Qit	Blinking when alarm remains but acknowledged.
- Ala AND /Qit	Blinking when alarm remains but not acknowledged.
Alarm state	Display of the alarm state. See following codes.
Start date	Date of alarm outbreak.
Start time	Time of alarm outbreak.
End date	Date of alarm disappearing.
End time	Time of alarm disappearing.
Acknowledge date	Date of alarm acknowledge.
Acknowledge time	Time of alarm acknowledge.

Description of the function

When the input signal Ala is at 1, both outputs s1 and s2 are switched on. As soon as the acknowledge is given (input Ack = 1, dynamic) signal s1 is switched off. If the alarm remains, the output s2 can takes 2 different states: switched on or flashing. Depending on the selected option in adjust window, the blinker shows:

- Alarm remains but acknowledged
- Alarms remains and not acknowledged

Diagram 1: Blinker option: Ala AND Ack.

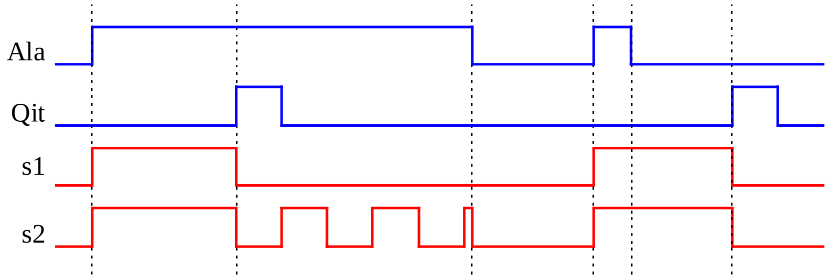
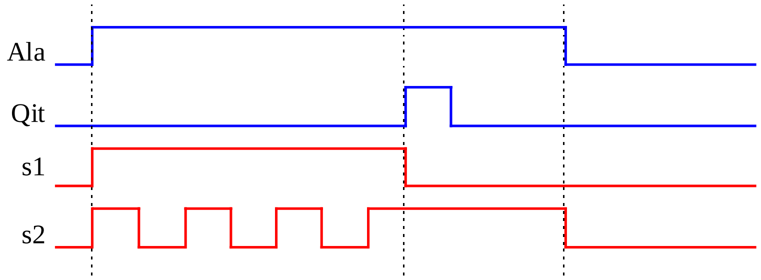


Diagram 2: Blinker option: Ala AND /Ack



Dates and times at which the alarm appeared, was cleared or was acknowledged can be viewed online in the adjust window. When a new alarm appears, the date and time registers are all zeroed.

The date/time format used is taken from the WINDOWS settings.

The following alarm states are shown online.

Code	Alarm state	Description
0	OK	no alarm
1	Cleared !	alarm cleared but not acknowledged
2	Ack'ed !	alarm acknowledged but still present
3	Alarm !	alarm present and not acknowledged

The general alarm signal (HVC-Init, Subfunction Alarm) is switched on whenever such an alarm is present. The general acknowledge signal is switched on whenever that alarm has not been acknowledged.

Reference

See also:

Alarm General

Alarm+Acknowledge

Alarm Inhibit 1-10 + Acknowledge

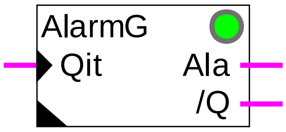
1.28 Alarm General

Family: **HVC-General**

Name: **Alarm general**

Macro name: _HeaAlrg

Fbox:



Short description

General alarm signal and general acknowledge for the whole application.

Input

Qit	Ack.	General acknowledge all alarms

Outputs

Ala	Alarm	General alarm signal for the whole application
/Q	/Ack.	General signal for not acknowledged alarms in the whole application

LED

The LED has the same state as the Ala output: 0=green, 1=red

Parameters

Alarm state	Display presence of alarms.
- OK	No alarm is present in the application.
- Alarm !	At least one alarm is present in the application.
Alarms not acknow.	Display if alarms not acknowledged.
- OK	No alarm not acknowledged in the application.
- Alarm !	At least one alarm is not acknowledged in the application.
Manual acknow.	Button for manual acknowledge of all alarms in the application.

Description of the function

The general alarm signal indicates that at least on alarm remains to be dealt within the installation. See also the descriptions of the various alarm functions. The signal '/Q' indicates, that one or more alarms have not been acknowledged. Neither of these signal requires acknowledge and they are reset after all alarms are cleared or acknowledged. Both signals can also be viewed in the adjust window.

A general acknowledge of all alarms within the installation can be made using the input Ack or via the acknowledge button in the adjust window.

See also:

Alarm+Acknowledge

Alarm+Acknowledge & Time Stamp

Alarm Inhibit 1-10 + Acknowledge

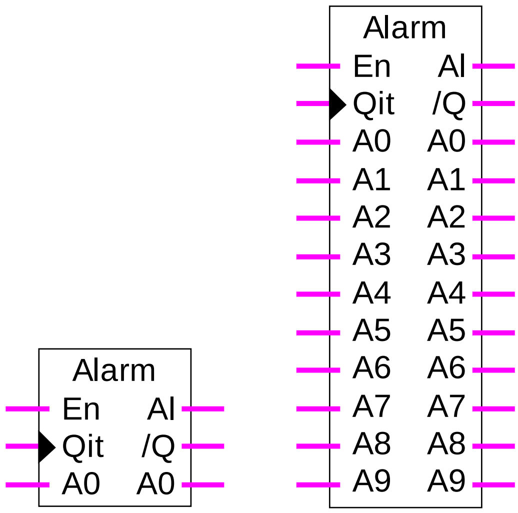
1.29 Alarm Inhibit 1-10 with Acknowledge

Family: **HVC-General**

Name: **Alarm inhibit 1-10**

Macro name: _HeaAlrme

Fbox:



Short description

Storage and acknowledge of a group of 1 to 10 alarms. A digital input allows to mask the alarm signals temporarily.

Inputs

En	Enable	Activation of alarm inputs
Qit	Acknowledge	Alarm acknowledge signal
A0	Alarm 0	Digital signal for alarm 0
...		
A9	Alarm 9	Digital signal for alarm 9

Outputs

Ala	Alarm	General alarm signal
/Q	Quittierung	General display for not acknowledged alarms in the function
A0	Alarm 0	Remaining alarm signal 0
...		
A9	Alarm 9	Remaining alarm signal 9

Description of the function

If an alarm is present at the inputA0 - A9, it is transferred to the corresponding output and stored. When the acknowledge is activated (input Ack = 1, dynamic) any alarms which are no longer present are cleared (corresponding output = 0). When the alarm group is masked (input En = 0) the alarms are not registered and all outputs are zeroed.

Output Ala indicates that at least one alarm is still present at the inputs (logical OR addition of all the alarm inputs). Output /Q indicates that at least one alarm has not yet been acknowledged (logical OR addition of all the alarm outputs). These outputs can be connected to the simple 2-signal alarm function to control an acoustic or optic signal.

The general alarm signal (HVC-Init sub-function alarm) is switched on whenever such an alarm is present. The general acknowledge signal is switched on whenever that alarm has not been acknowledged.

See also:

Alarm General

Alarm+Acknowledge

Alarm+Acknowledge & Time Stamp

1.30 Supervision 4 levels

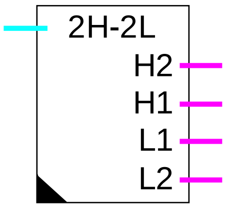
Family: **HVC-General**

Name: **Supervision 4 levels**

Macro name: _HeaSup2

Dialogue: Dialogue Fbox, see below.

Fbox:



Short description

Supervision of analogue value with two upper and two lower levels. The exceedings are shown at digital outputs.

Input

	Input	Analog value to monitor

Outputs

H2	Higher level 2	Swiched on when exceeding higher level 2
H1	Higher level 1	Swiched on when exceeding higher level 1
L1	Lower level 1	Swiched on when exceeding lower level 1
L2	Lower level 2	Swiched on when exceeding lower level 2

Parameters

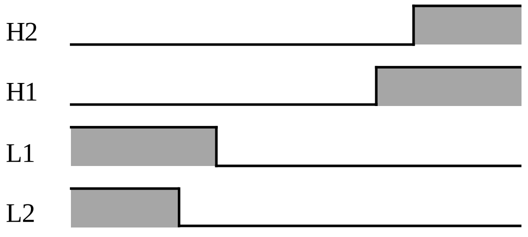
2nd upper level	Monitoring of 2nd upper level (d)
1st upper level	Monitoring of 1st upper level (d)
1st upper level	Monitoring of 1st upper level (d)
2nd upper level	Monitoring of 2nd upper level (d)

(d) Accessible parameter from terminal by using the dialogue auxiliary Fbox. See below.

Description of the function
The input value is compared with both higher alarm levels. If the input value is equal to or greater than the limit, the corresponding output is set to 1. If the input value is smaller, the output is set to 0.

Operation is similar for the 2 lower limits.

Diagram



These signals can be connected to one of the alarm functions.

Dialogue

A dialogue function with the same name is available in the family HVC-Dialogue-HVC.

See also: Family HVC-Dialogue HVC
HVC-Dialogue, Overview

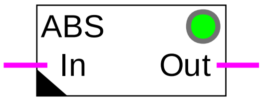
1.31 Antiblocking System for Pumps

Family: **HVC-General**

Name: **Anti-blocking pump**

Macro name: _HeaAbs

Fbox:



Short description

Function to ensure all plant is regularly run-up for correct operation when required. ABS=Pump anti-blocking system. For avoiding blocking, pumps should be run at least once every week.

Input

In	Input	Control signal for pump

Output

Out	Output	Pump control with ABS system

Parameters

Switch-on	Switch-on option of ABS function.
- Monday...Sunday	Switch-on day of ABS function.
- Switched off	The ABS function is switched off.
Switch-on [HH:MM]	Switch-on time of ABS function.
Forcing time ABS [sec]	Forcing time when ABS function is active.
ABS status	Display the state of ABS function.

Description of the function

During normal operation, the input signal In is transferred to the output Out. At a defined date and time, if the input In has not been been activated at least once in the course of the past week, the output Out is forced to 1 and the pump runs for the defined time.

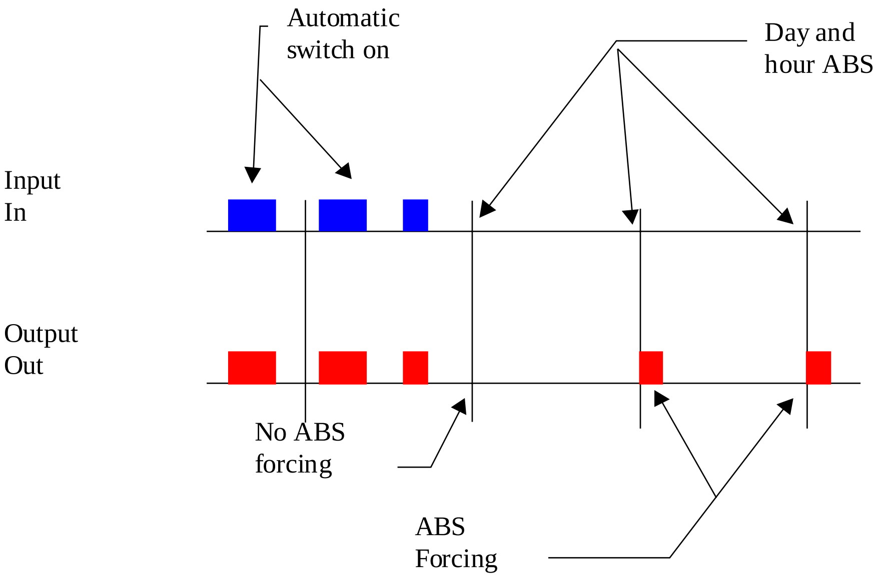
Meaning of ABS states displayed in the adjust window:

Wait Still waiting to be switched on in the actual period.

Clear	A switch-on has taken place, the ABS forcing will not occur. Force ABS ABS forcing is active. The output is forced to 1 for the preset time. During this time, the LED is red.
Off	The function is switched off. No date of operation has been given.
Clock error !	A hardware clock error has been detected on system start-up. The ABS function will probably not work correctly. In this case, the LED is permanently red.

The date/time format used has been taken from the WINDOWS settings.

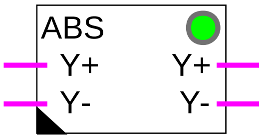
Diagram



1.32 Anti-Blocking for 3-Points Valve

Family:	**HVC-General**
Name:	**Anti-blocking 3 points**
Macro name:	_HeaAbs3

Fbox:



Short description

Function to ensure a 3-points valve to be run up regularly during the non-heating period. For avoiding blocking, the valve should be run up at least once every week.

ABS=Antiblocking system.

Input

Y+	Y Opening	Control signal for valve opening
Y-	Y Closing	Control signal for valve closing

Output

Y+	Y Opening	Control signal for valve opening with ABS safety system
Y-	Y Closing	Control signal for valve closing with ABS safety system

Parameters

Switch-on	Switch-on option of the ABS function.
- Monday...Sunday	Switch-on day of the ABS function.
- Switched off	The ABS is switched off.
Switch-on [HH:MM]	Switch-on time of the ABS function.
Min. run ABS free	Minimum running time for cancelling the ABS function.
ABS forcing time [sec]	Forcing time when ABS function is activated.
State ABS	Displays the state of the ABS function

Description of the function

If the minimal movements are not taking place during one week, the function will run up the valve according to the defined parameters. Day, hour and forcing time must be set in the adjust window.

The forcing time corresponds to the signal opening time Y+ . The closing signal Y- will then be given for same time. The adjustment should normally ensure a complete movement of the valve (Standard 120.0 Sec). However, a longer time is advised as to ensure a complete opening and closing of the valve.

Meaning of ABS states displayed in the adjust window:

Wait	Still waiting to be switched on in the actual period
Clear	Has been switched on, ABS forcing will not take place
Force ABS	The ABS forcing is active. The output is forced to 1 for the preset time. During this time, the LED is red.
Off	The function is switched off. No date of operation has been given.
Clock error !	A hardware clock error has been detected at system start-up. The ABS function will probably not work correctly. In this case the LED is permanently red.

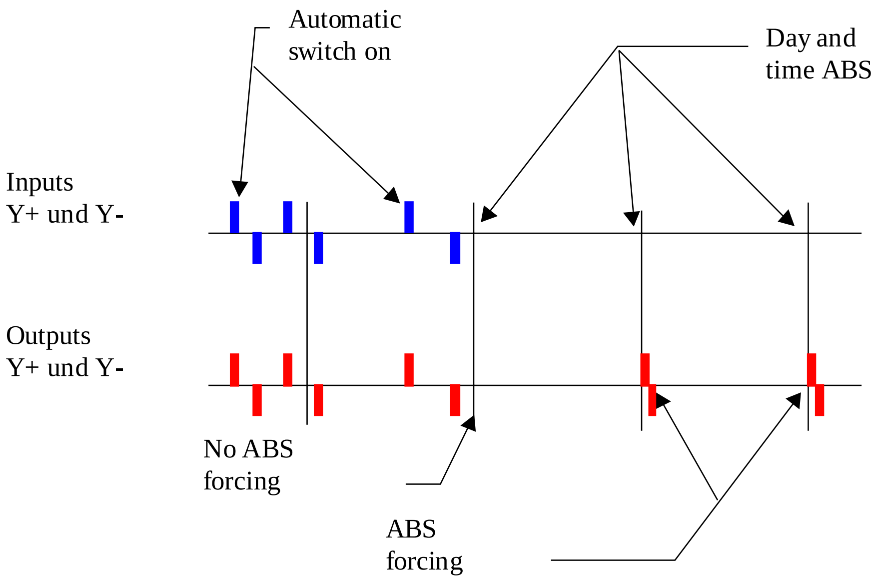
The function 3-points with reference may not be used with the present function but with the function Antiblocking for Analogue Valve.

However, this function is useful for use with the simple 3-points output function.

It is important to notice that the forcing in a regulation loop may drive to unstable regulator state. After forcing, some fluctuations may occur before the loop is stable again.

The date/time format used has been taken from the WINDOWS settings.

Diagram


Automatic
switch on
Day and
time ABS
Inputs
Y+ und Y-
Outputs
Y+ und Y-
No ABS
forcing
ABS
forcing

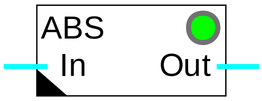
1.33 Anti-Blocking for Analogue Valve

Family: **HVC-General**

Name: **Anti-blocking analogue**

Macro name: _HeaAbsa

Fbox:



Short description

Antiblocking function for 3-points valve command. The antiblocking function commands at least once a week a minimum working time in order to avoid the valve blocking outside the working period.

Input

In	Input	Control signal of the valve

Output

Out	Output	Control of the valve with ABS safety system

Parameters

Switch-on	Switch-on option of the ABS function.
- Monday...Sunday	Switch-on day of the ABS function.
- Switched off	The ABS is switched off.
Switch-on [HH:MM]	Switch-on time of the ABS function.
Minimum ABS free	Minimum opening position in automatic mode for cancelling the ABS function.
ABS forcing level	Forcing value when ABS function is active.
ABS forcing time [sec]	Forcing time when ABS function is active.
ABS status	Display the state of ABS function.

Description of the function

If the valve does not open at least once at this level during the week, the function forces the valve according to the parameters set. These parameters are the day, the time of the forcing, the opening level and the time during which the valve must be open.

Meaning of ABS states displayed in the adjust window:

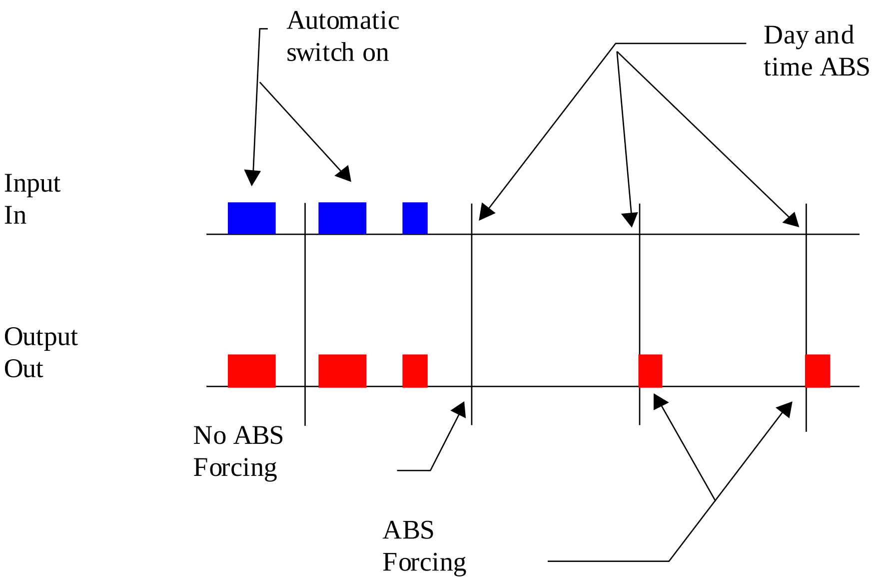
Wait	Still waiting to be switched on in the actual period.
Clear	A switch-on has taken place, the ABS forcing will not occur.
Force ABS	ABS forcing is active. The output is forced to 1 for the preset time. During this time, the LED is red.
Off	The function is switched off. No date of operation has been given.
Clock error !	A hardware clock error has been detected on system start-up. The ABS function will probably not work correctly. In this case, the LED is permanently red.

This function may be used with an analogue output as well as with the 3-points output with reference.

It is important to notice that the forcing in a regulation loop may drive to unstable regulator state. After forcing, some fluctuations may occur before the loop is stable again.

The date/time format used has been taken from the WINDOWS settings.

Diagram



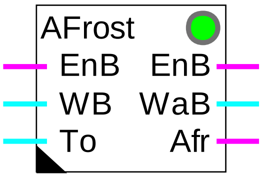
1.34 Anti-Freeze System with Outside Temperature

Family: **HVC-General**

Name: **Anti-freeze with To**

Macro name: _HeaAfo

Fbox:



Short description

The antifreeze system monitors the outside temperature and the function of the burner. It allows to control the heating plant where no inside temperature detector has been installed.

Inputs

EnB	Enable	Signal for the burner automatic running
WB	Set-point	Burner temperature set-point
To	Outside temperature	Measurement of the outside temperature

Outputs

EnB	Enable	Burner function control with antifreeze function
WaB	Set-point	Temperature set-point of the burner with antifreeze set-point
Afr	Anti-freeze	Display for freeze danger

Parameters

Antifreeze threshold [°C]	Antifreeze activation threshold
Dead range [K]	Dead range between the activation threshold and the switch-off safety level
Antifreeze set-point [°C]	Temperature set-point when antifreeze safety switched on
Correction factor [K/K]	Correction factor of WaB output calculated according to the temperature difference between outside temperature and antifreeze threshold.

Description of the function

The digital input EnB receives the burner switch-on signal (from function Clock, Yearly or HEACO). The numeric input WB receives the burner temperature set-point.

In normal function, inputs EnB and WB are copied to outputs EnB and WB. The burner is functionning and the antifreeze function is deactivated.

If the burner is switched off (Input EnB=0), the set-point (output WB) is controlled by the antifreeze function. As long as the outside temperature is higher than the threshold set in the adjust window, the set-point receives the parameter as signal.

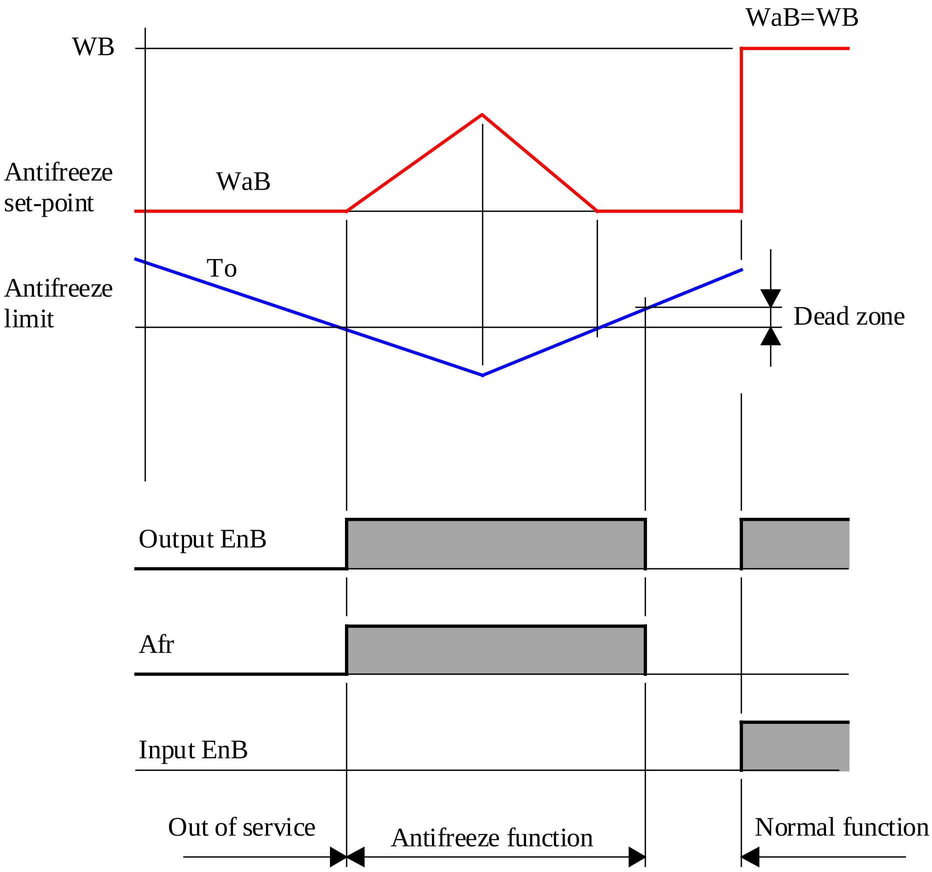
If the outside temperature exceeds the antifreeze set value, the burner is switched on by forcing the burner command (Output EnB=1). Up to this threshold, the output WB corresponds to antifreeze set-point. From this value, if the temperature goes lower again, the set-point is corrected by the defined correction factor.

The digital output Afr shows that the antifreeze system has been switched on (Afr=1). It can be used to activate other elements (Mixing pumps, mixing valve).

If the outside temperature goes higher than the threshold and the deadzone, the antifreeze system is deactivated and the output Afr reset to 0.

The LED corresponds to output state Afr : 1=Red, 0=Green.

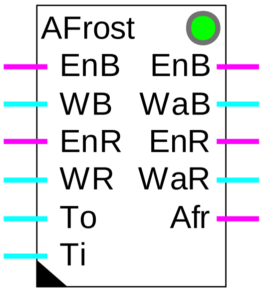
Diagram



1.35 Anti-Freeze System with Inside and Outside Temperature

Family:	**HVC-General**
Name:	**Anti-freeze with Ti+To**
Macro name:	_HeaAFIO

Fbox:



Short description

The function contains 2 antifreeze systems combined together.

The first system monitors the outside temperature To and the function of the burner EnB. It allows to build an antifreeze function for the heating plant.

The second system monitors the inside temperature Ti and the function of the regulator EnR. It allows to build an antifreeze function when an inside temperature detector is present.

Inputs

EnB	Enable	Signal for the burner automatic running
WB	Set-point	Burner temperature set-point
EnR	Enable R	Signal for the regulator automatic running
WR	Sollwert R	Regulator temperature set-point
To	Outside temperature	Measurement of the outside temperature
Ti	Innentemperatur	Measurement of the inside temperature

Outputs

EnB	Enable	Burner function control with antifreeze function
WaB	Set-point	Temperature set-point of the burner with antifreeze set-point
EnR	Enable R	Regulator function control with antifreeze function
WaR	Sollwert R	Regulator temperature set-point with antifreeze function

Afr	Anti-freeze	Display for freeze danger

Parameters

----[Antifreeze through To EnB and WaB]----

Antifreeze threshold [°C]	Antifreeze activation threshold on outside temperature
Dead range [K]	Dead range between the activation threshold and the switch-off safety level
Antifreeze set-point [°C]	Temperature set-point when antifreeze safety is switched on
Correction factor [K/K]	Correction factor of WaB output calculated according to the temperature difference between outside temperature and antifreeze threshold.
State antifreeze through To	Display of the actual antifreeze state on the outside temperature
- OK	Normal operation. No freeze danger.
- Antifreeze !	The antifreeze safety is active

----[Antifreeze through Ti for EnR and WaR]----

Antifreeze threshold Ti [°C]	Activation threshold for antifreeze safety on inside temperature
Keeping time [sec]	Time during which the antifreeze safety is kept when freeze danger has been detected.
Antifreeze set-point [°C]	Temperature set-point when antifreeze safety switched on
Correction factor [K/K]	Correction factor of WaR output calculated according to the temperature difference between outside temperature and antifreeze threshold.
State antifreeze through Ti	Display of the actual antifreeze state on the inside temperature
- OK	Normal operation. No freeze danger.
- Antifreeze !	The antifreeze safety is active

Description of the function

The first system monitors the outside temperature To and the function of the burner EnB. It allows to build an antifreeze function for the heating plant.

The digital input EnB receives the burner switch-on signal (from function Clock, Yearly or HEACO). The numeric input WB receives the burner temperature set-point.

In normal function, inputs EnB and WB are copied to outputs EnB and WB. The burner is functionning and the antifreeze function is deactivated.

If the burner is switched off (Input EnB=0), the set-point (output WB) is controlled by the antifreeze function. As long as the outside temperature is higher than the threshold set in the adjust window, the set-point receives the parameter as antifreeze set-point.

If the outside temperature goes lower than the antifreeze set value, the burner is switched on by forcing the burner command (Output EnB=1). Up to this theshold, the output WB corresponds to antifreeze set-point. From this value, if the temperature goes lower again, the set-point is corrected by the defined correction factor.

If the outside temperature goes higher than the threshold and the dead range, the antifreeze system is deactivated and the output Afr reset to 0.

The second system monitors the inside temperature Ti and the function of the regulator EnR. It allows to build an antifreeze function when an inside temperature detector is present.

The digital input EnR receives the controller switch-on signal (from function Clock, Yearly or HEACO). The numeric input WR receives the controller temperature set-point.

In normal function, inputs EnR and WR are copied to outputs EnR and WR. The controller is working and the antifreeze function is deactivated.

If the controller is switched off (Input EnR=0), the set-point (output WR) is controlled by the antifreeze function. As long as the outside temperature is higher than the threshold set in the adjust window, the set-point receives the parameter as antifreeze set-point.

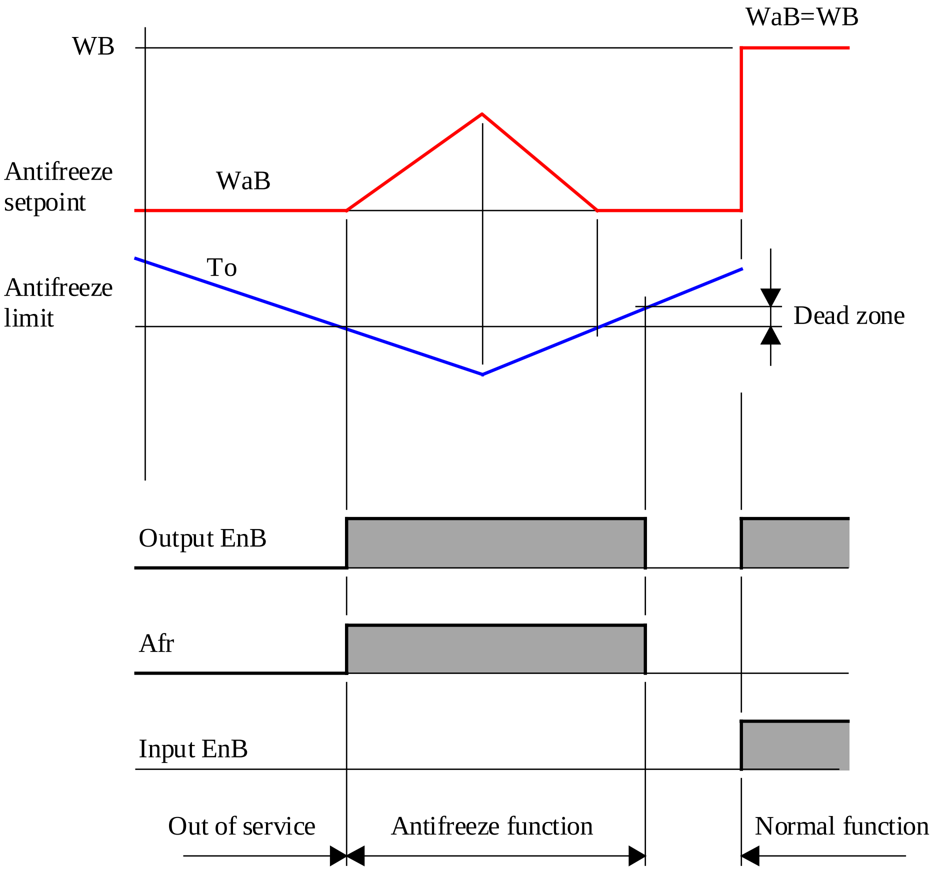
If the inside temperature goes lower than the antifreeze set value, the controller AND THE BURNER are immediately switched on by forcing the burner command (Output EnB=1). Up to this threshold, the output WB corresponds to antifreeze set-point. From this value, if the temperature goes lower again, the set-point is corrected by the the defined correction factor.

If the inside temperature goes up again above the threshold value, the antifreeze system is switched off if the keeping time is passed.

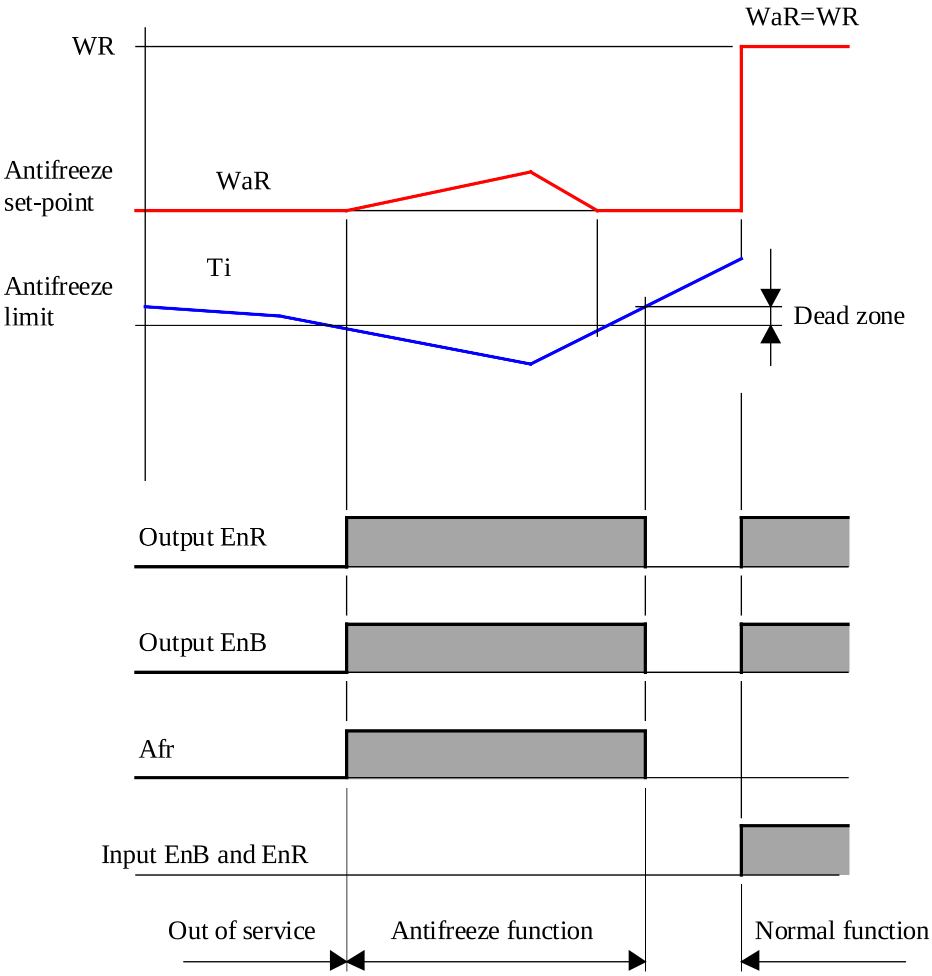
The digital output Afr shows that one of the antifreeze systems has been switched on (Afr=1). It can be used to activate other elements (Mixing pumps, mixing valve) and generate an alarm. The output Afr goes back to 0 if the 2 antifreeze systems are released or cleared.

The LED corresponds to output state Afr : 1=Red, 0=Green.

Diagram, antifreeze of burner



Diagram, antifreeze of controller with Ti



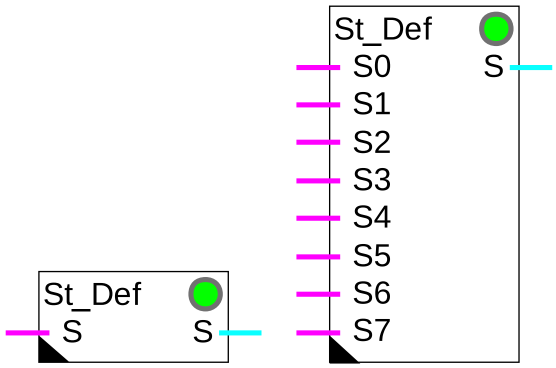
1.36 Definition of Process Status

Family: **HVC-General**

Name: **State definition**

Macro name: _HeaStatd

Fbox:



Short description

This function monitors special plant operating states. The various states are connected to individual digital inputs and monitored according to priorities. A numeric code controls the commuting function.

Inputs

S0	Fire	Fire alarm signal
S1	Smoke	Smoke extraction signal
S2	Freeze	Freezing signal
S3	Signal 3	Other danger or alarm signal
...		
S7	Signal 7	Other danger or alarm signal

Output

S	State	Process state code output. The code remains at 0 if no signal is active. The codes 1 to 8 show the presence of the signals 0 to 7.

Parameters

State		Actual state of installation detected by inputs S0 to S7.
	- Normal	Normal state. No input signal has been detected.
	- S0=Fire	The 'Fire' signal has been detected.
	- S1=Smoke	The 'Smoke' signal has been detected.

- S2=Freeze The 'Freeze' signal has been detected.
- S3...7=Fault... The Fault signal... has been detected.

S0...S7... Comments

Description of the function

Definition of special plant operating states. This function allows detection of 1 to 8 different operating states in an installation. The first 3 state signals are for fire alarm, smoke extraction and danger of freezing respectively. The remaining inputs can be used as desired for any special operating states.

Priority is in descending order from the S0 signal (fire). The signal S7 has the lowest priority. Any masking or input signal maintenance must be programmed outside this function. In the absence of any active input signal, the installation is considered to be operating normally (run or stop).

Typical applications

Ventilation systems. Forcing of mixing valve position in case of fire and smoke extraction.

Heating block. Forcing of heating valve to 100% in case of freeze danger.

Referenz

The output signal S can be used for forcing digital or numeric signals.

See:

Status for Digital Signals

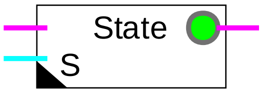
Status for Numeric Signals

1.37 Status for Digital Signals

Family: **HVC-General**

Name: **State binary**

Macro name: _HeaStatb

Fbox: 

Short description

Special operating states for binary signals. For each state, the parameter for the forcing required can be defined individually.

Inputs

	Input	Binary signal for normal operation
S	State	Process state control. The code 0 shows the normal operation. The codes 1 to 8 show the special operating states 0 to 7.

Output

Output	Binary signal for normal or special state.

The input signal (process state) is given by the state definition function. For each state, the necessary forcing can be adjusted OFFLINE. During installation normal operation (run or stop), the input signal is sent to the output.

Parameters

S0=Fire	Forcing function when the installation has detected the 'Fire' signal.
S1=Smoke	Forcing function when the installation has detected the 'Smoke' signal.
S2=Freeze	Forcing function when the installation has detected the 'Freeze' signal.
S...=Fault...	Forcing function when the installation has detected the 'Fault' signal.

Forcing option for each state:

- Free	No forcing. The signal is free.
- Forcing 1	The signal is forced to 1.
- Forcing 0	The signal is forced to 0.
- Inversion	The signal state is inverted.

State Display of the actual installation state.

Description of the function

When a special state is activated and the corresponding option is 'free', the input signal is switched through to the output.

When a special state is activated and a forcing option has been selected, the output is forced and the LED turns red.

Example: during smoke extraction, the controls of the extraction fans are switched on (forcing 1) and the inlet ventilator controls are switched off (forcing 0).

1.38 Status for Numeric Signals

Family: **HVC-General**

Name: **State numeric**

Macro name: _HeaStati

Fbox:

Short description

Special operating states for numeric signals. For each state, the parameter for the forcing required can be defined individually.

Inputs

	Input	Numeric signal for normal operation.
S	State	Process state code. The code 0 shows the normal operation. The codes 1 to 8 show the special operating states 0 to 7.

Output

Output	Signal for normal or special state.

Parameters

S0=Fire	Forcing function when the installation has detected the 'Fire' signal.
S0, parameter	Parameter for the forcing function 'Fire'
S1=Smoke	Forcing function when the installation has detected the 'Smoke' signal.
S1, parameter	Parameter for the forcing function 'Smoke'
S2=Freeze	Forcing function when the installation has detected the 'Freeze' signal.
S2, parameter	Parameter for the forcing function 'Freeze'
S...=Fault...	Forcing function when the installation has detected the 'Fault' signal.
S.., parameter	Parameter for the forcing function 'Fault'

Forcing option for each state:

- Free	No forcing. The signal is free.
- Forcing	The signal is forced to the preset value.
- Offset	The signal is increased of the preset value.
- Amplify	The signal is multiplied by the preset value.

Description of the function

Input signal *S* (operating state) is provided by the state definition function. For each state, the parameter for the forcing required can be defined individually. When the installation is in normal operation (run or stop), the input signal is switched through to the output.

When a special state is activated and the corresponding option is 'free', the input signal is switched through to the output.

When a special state is activated and a forcing option has been selected, the output is forced to the defined parameter value and the LED turns red.

The offset option adds the parameter to the input value and transfers it to the output.

The amplification option multiplies the input signal by the parameter (%) and transfers it to the output.

The signal can also be reduced by setting a parameter less than 100.0%.

Example: when there is a risk of freezing, the heating battery valves are forced to 100.0%.

To avoid averaging problems, it is advisable to deactivate any controller when its output is forced.

Notes

2. HVC-Clocks

Contents

2.1 Clocks, Generalities

The following description is valid for most functions of the HVC-Clocks family. The Fbox descriptions contain only the particularities of each Fbox or the difference compared to this general description.

General working principle of clocks Fboxes

The clocks Fboxes have an input signal 'En' and a digital output signal 'Ch'. According to its particular clock program, the Fbox switches a contact called internal channel. The output signal 'Ch' is the serial combination (logical AND) of the 'En' input and the state of the internal channel.

The state of internal channel is displayed in the adjust window (Channel state).

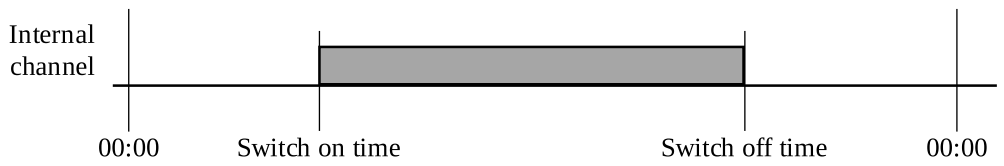
The switch-on and off time and date define the interval during which the clock is switched on.

As to realize a switch-on period (normal case), the switch-on time must be smaller than the switch-off time.

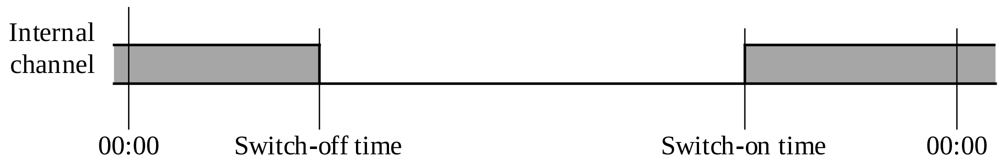
As to realize a switch-off period (Inverted function), the switch-on time must be greater than the switch-off time.

Diagram

Switch-on before switch-off time:



Switch-on after switch-off time:



Simply the term 'switching function is used in this document.

The basic functions for building standard clock program structures are as follows:

- Clock, Daily
- Clock, Weekly
- Clock, Yearly

Some switching functions, based on the same principle, have been brought together in a same Fbox as to simplify the Fupla programming:

- Clock, 7 Days
- Clock, 4 * 8 Days
- Clock, Yearly 8 programs

The following functions are used to build particular programs such as holidays, monthly switch-on periods or successive periods in the day.

- Clock, Daily pulse
- Clock, Daily programmable 1-4 channels
- Clock, Monthly
- Clock, Exceptions

Three auxiliary functions are used for reading and writing the clock data:

- Clock, Read
- Clock, Settings
- Clock, Receive

The clock functions may also be used without hardware clock when the time is given by the Master of a S-Bus network. This mechanism must be configurated in the HVC Init, subfunction Validity range.

If a clock error is detected on system start up, the LED will be red. The clock channels will probably not operate. The clock operation is tested and displayed in HVC-Init, subfunction Clock .

Input

En	Enable	Activation of the clock

Output

Ch	Clock channel	Combination of Enable signal and internal clock channel

Parameters

The typical parameters of the clock Fboxes are given hereafter. Please check the description of each Fbox for the available parameters.

Switch-on Date	Switch-on Date of channel
Switch-on Time	Switch-on Time of channel
Switch-off Date	Switch-off Date of channel
Switch-off Time	Switch-off Time of channel
Day of the week	Particular day of the week (Monday to Sunday)
	This day may be combined with other options such as:
	- permanently switched on
	- permanently switched off
Channel state	Display the state of the internal channel: on or off.

The time is given and displayed according to the Windows settings. For example HH:MM for hours and minutes. Moreover, the colon is always accepted as separator. The valid range is '00:00' to '23:59'. The switch-on and off take place when the seconds are at 00.

For deactivating the clock program and forcing its state to 0, set 00:00 as switch-on and switch-off time. Set as well the week day (Clock, Weekly) or the dates (Clock Yearly) at the same value.

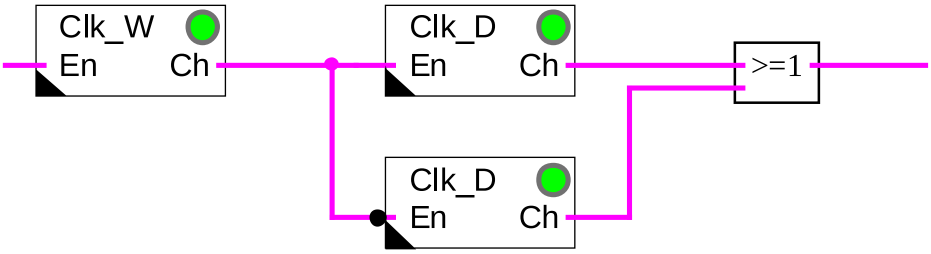
For deactivating the clock program and forcing its state to 1, set 23:59 as switch-on and switch-off time.

The days are given and displayed according to the Windows settings. For example DD.MM for day and month. Moreover, the slash is always accepted as separator. The valid range is '01/01' to '31/12'. The value 00/00 allows to deactivate the date.

An internal central flag detects automatically all days defined as holidays by the Fboxes. Some clocks are able to use automatically this central flag.

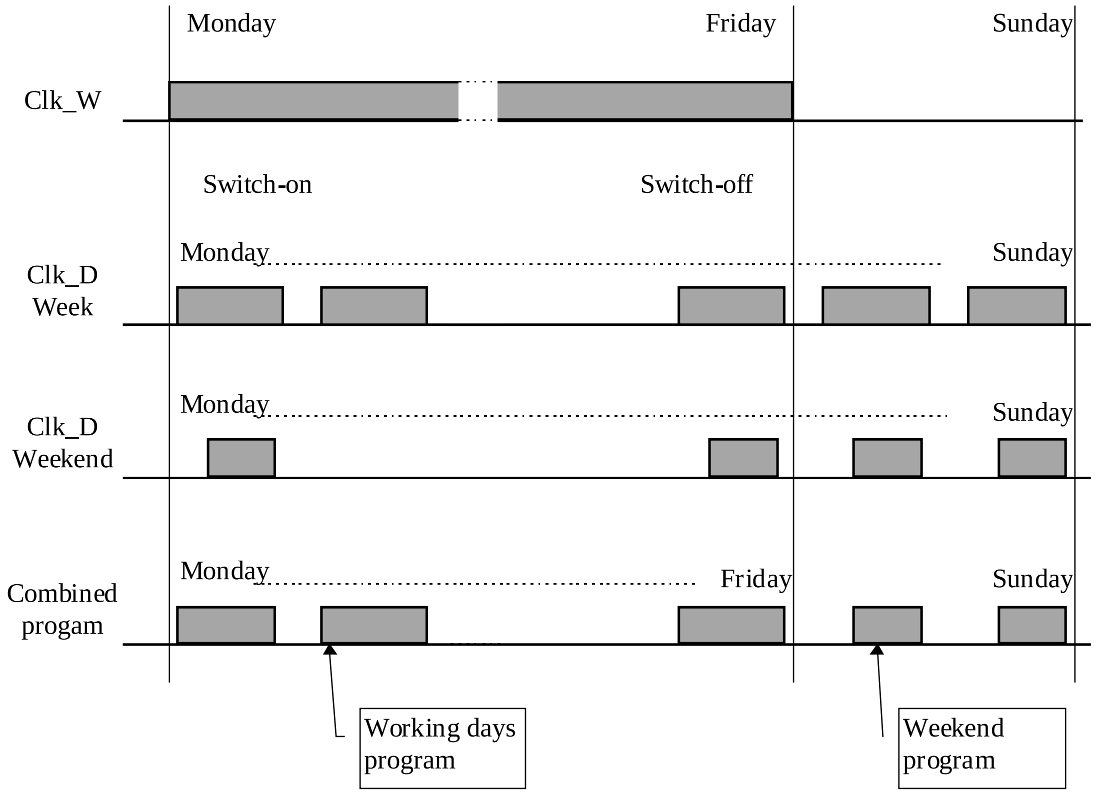
The clock Fboxes have been developed as to realize in Fupla a clock structure freely adaptable to the application.

Example: Weekly program with different switch-on and off times for working days and weekend.



A weekly clock is placed in serie with 2 daily clocks. The 'En' input of a daily clock is inverted. The 2 outputs of the daily clocks are combined with 'logical OR' Fbox.

Diagram of the program:



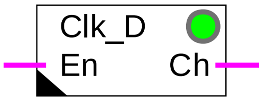
2.2 Clock, Daily

Family: **HVC-Clocks**

Name: **Clock daily**

Macro name: _HeaClkd

Dialogue: Dialogue Fbox, see below.

Fbox: 

Short description

Daily clock for 1 digital channel.

See also Clocks-Generalities.

Dialogue

A dialogue function with the same name is available in the family HVC-Dialogue-HVC. The switch-on and switch-off times are accessible from terminal.

See also: Family HVC-Dialogue HVC

HVC-Dialogue, Overview

2.3 Clock, Weekly

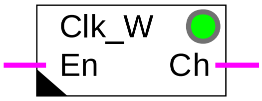
Family: **HVC-Clocks**

Name: **Clock weekly**

Macro name: _HeaClkw

Dialogue: Dialogue Fbox, see below.

Fbox:



Short description

Weekly clock for one switch-on and off.

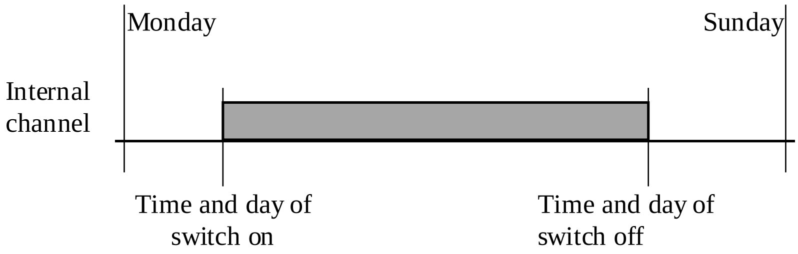
See also Clocks-Generalities.

Parameters

Switch-on	Switch-on option (d)
- Monday..Sunday	Switch-on day
- permanent	The channel is forced at On. Switch-off has priority on switch-on
Switch-on	Switch-on time (d)
Switch-off	Switch-off option (d)
- Monday..Sunday	Switch-off day
- permanent	The channel is forced at Off.
Switch-off	Switch-off time (d)
Channel state	Displays state of internal channel

(d) Accessible parameter from terminal by using the dialogue auxiliary Fbox. See below.

Diagram



Description of the function

The function has parameters defining a day of the week and time for switching on and the same for switching off. Only one switch-on and off per week is possible. If one switch-on and off per day is required, this function must be connected to a daily clock.

Typical application

The output can be linked to two daily clocks (one of which is inverted at the input) so that two programs can run: working days - weekend.

Dialogue

A dialogue function with the same name is available in the family HVC-Dialogue-HVC.

See also: Family HVC-Dialogue HVC

HVC-Dialogue, Overview

2.4 Clock, Yearly

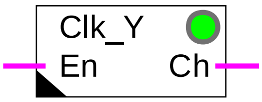
Family: **HVC-Clocks**

Name: **Clock yearly**

Macro name: _HeaClky

Dialogue: Dialogue Fbox, see below.

Fbox:



Short description

Yearly clock for one switch-on and off.

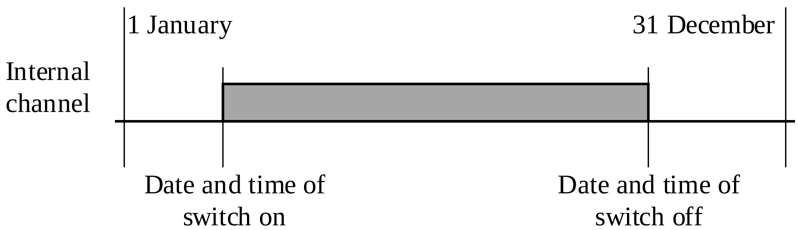
See also Clocks-Generalities.

Parameters

Switch-on	Switch-on date (d)
Switch-off	Switch-off time (d)
Switch-on	Switch-on date (d)
Switch-off	Switch-off time (d)
Channel state	Displays state of internal channel
Switching option	Switch option
- Yearly	Yearly switch-on and off
- Single	Single switch-on and off

(d) Accessible parameter from terminal by using the dialogue auxiliary Fbox. See below.

Diagram



Description of the function

The channel has parameters defining a month, day and time for switching on and the same for switching off. The function allows only one switch-on and off per year.

With the option 'Yearly', the switch-on and off will be repeated every year. However, with the option 'Single', the switch-on and off will be operated one time only. In this case, the date will be reset to 00/00 after switching. The time remains unchanged.

One switch-on and off per day may be build with the function clock daily.

For programming more than one holiday period, multiple Fboxes of this type must be placed in parallel. The Fbox 'Clock, Yearly 8 Programs' may also be used.

Typical application

The output can be linked to two weekly or daily clocks (one of which is inverted at the input) so that two programs can run: working periods - holiday periods.

The option 'Single' allows to program different holiday periods from one year to the next. New dates must be introduced every year.

The option 'Yearly' allows to program a fix period. E.g. switch-on of the heating system.

Dialogue

A dialogue function with the same name is available in the family HVC-Dialogue-HVC.

Option Dialogue

- Date	Only dates are adjustable from terminal
- Date+Time	Date and times are adjustable from terminal

See also:	HVC-Auxiliary Dialogue Fboxes
	HVC-Dialogue Overview

2.5 Clock, Daily Pulse

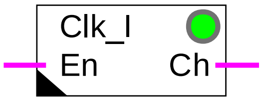
Family: **HVC-Clocks**

Name: **Clock daily pulse**

Macro name: _HeaClkI

Dialogue: Dialogue Fbox, see below.

Fbox:

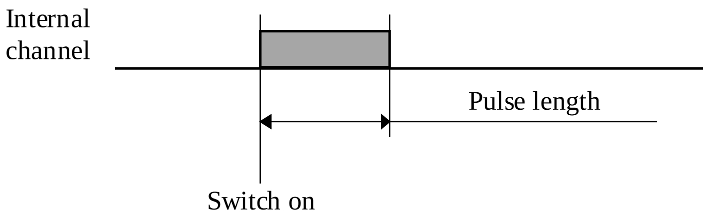


Short description

Clock with one pulse per day.

See also Clocks-Generalities.

Diagram



Description of the function

It is possible to program a switch-on time and length. Switch-on duration is selectable between 0 (no pulse) and 0.2 to 100.0 sec. If the switch-on length is 0.0, the function is deactivated.

Typical application

This function allows to start or stop an automatic process with one single pulse.

It will be used instead of the daily clock when the pulse time must be short and must be maintained when the switch-on time is modified.

Dialogue

A dialogue function with the same name is available in the family HVC-Dialogue-HVC. Switch-on and duration times are adjustable from terminal.

See also: Family HVC-Dialogue HVC
HVC-Dialogue, Overview

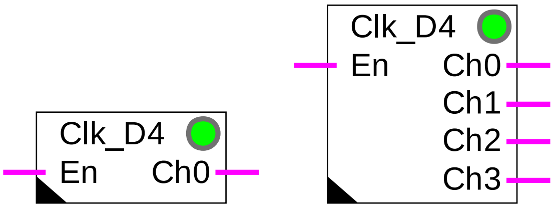
2.6 Clock, Daily 1-4

Family: **HVC-Clocks**

Name: **Clock daily 1-4**

Macro name: _HeaClkd4

Dialogue: Dialogue Fbox, see below.

Fbox: 

Short description

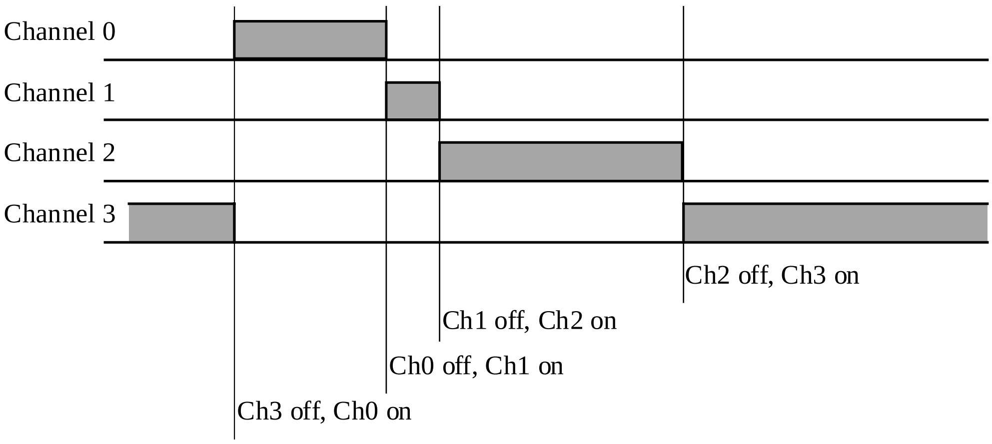
Four channels daily clock.

See also Clocks-Generalities.

Outputs

Ch0	Channel 0 output
Ch1	Channel 1 output
Ch2	Channel 2 output
Ch3	Channel 3 output

Diagram



Description of the function

From 1 to 4 channels can be defined. A switch-on time can be selected for each channel. If a channel is switched on, the preceding one is automatically switched off. Times for switching on must be entered in ascending order. Switch-on times for channels which have not been programmed are ignored.

Application example

This clock has been developed for use with the function Set-point Correction, Clock.

Dialogue

A dialogue function with the same name is available in the family HVC-Dialogue-HVC. All times are adjustable from terminal.

See also: Family HVC-Dialogue HVC

HVC-Dialogue, Overview

2.7 Clock, 7 Days

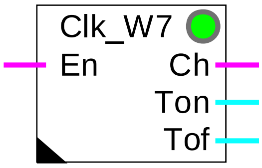
Family: **HVC-Clocks**

Name: **Clock 7 days**

Macro name: _HeaClkw7a Old Fbox (_HeaClk7)

Dialogue: Dialogue Fbox, see below.

Fbox:



Short description

Weekly clock with one switch-on and switch-off time for each day of the week.

See also Clocks-Generalities.

Outputs

Ch	Channel	
Ton	Time On	Switch-on time adjusted for the actual day. *
Tof	Time Off	Switch-off time adjusted for the actual day. *

* available from version $139 of the HVC library.

Description of the function

The clock can be programmed with one switch-on time and one switch-off time for each day of the week. It corresponds to 7 successive daily clocks with individual settings.

The actual day of the week as well as the clock state can be viewed in the adjust window.

The outputs Ton and Tof can be used by other Fboxes that need a different parameter 'Time' for each day of the week and in numeric value [HHMM]. These times can then be adjusted by a terminal.

Example:

Time for begin and end of local occupation for the functions Optimum Stop

<u>Dialogue</u>

A dialogue function with the same name is available in the family HVC-Dialogue-HVC. Switch-on and switch-off times for all days are adjustable from terminal.

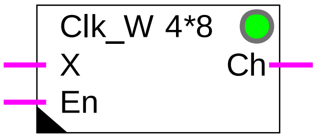
See also: Family HVC-Dialogue HVC

HVC-Dialogue, Overview

2.8 Clock, Weekly 4 Programs

Family:	**HVC-Clocks**
Name:	**Clock 4 * 8 days**
Macro name:	_HeaClkw8
Dialogue:	Dialogue Fbox, see below.

Fbox:



Short description

Weekly clock with 7 programs daily (Monday to Sunday) and one program for exception days. Exception days are defined either by a binary input or by the Fbox for exception days. Each program has 4 switch-on periods per day.

See also Clocks-Generalities.

Inputs

X	Exception Day	Activation of the program for exception days
En	Enable	Activation of the clock

Parameters

This Fbox has a great number of parameters, a button has been made for day switch. Only the switch-on and switch-off time of the selected day can be viewed and modified.

Actual day / Display	Display of the actual day and button for display of the actual day program. (d)
Channel state	Display of the internal channel state.
Automatic holidays	Option for detecting the holidays
- Yes	The general detection flag for holidays (in addition to input 'X') activates automatically the program for holidays.
- No	The holidays are not detected automatically. Only input 'X' activates this program.
-----[Period modification]-----	
Day of the week / Next	Display of the day of the week and button for switch to the next day. Monday to Sunday, Exception and cleared. (d)
Period 1 Switch-on.	Switch-on time, period 1 (d)

Period 1 Switch-off. Switch-off time, period 1 (d)

...

Period 4 Switch-off. Switch-off time., period 4 (d)

-----[For absolute address]-----

Internal registers This parameter has no meaning for the user. It allows to allocate internal registers to an absolute address range and to keep the defined values during a PCD program modification.

(d) Accessible parameter from terminal by using the dialogue auxiliary Fbox. See below.

Description

The clock has 4 switch-on periods each working day and 4 periods for exception days. It contains 4 * 8 daily clocks which are successively activated each day of the week or exception day.

The day of the week as well as the internal clock state are displayed.

If the switch buttons are not pressed during 5 minutes, the display is automatically cleared. It reduces the CPU load.

If the corresponding option is activated, the exception days are automatically detected. The exception days may be defined by one or more Fboxes Clock, Exceptions.

The Reset of the HVC-Init function initializes the daily programs every day at the time given in Offline fields. Individual times for each day can not be introduced at programming time. It must be done Online from Fupla or from the terminal.

Description for access to the internal register by supervisor.

The last parameter of the adjust window (internal registers) allows to allocate the internal registers to an absolute address range containing 33 registers.

The Switch on and Switch off times are stored in the 32 first registers as follows:

	1	**2**	**3**	**4**
Monday	R_{base}+0	R_{base}+1	R_{base}+2	R_{base}+3
Tuesday	R_{base}+4	R_{base}+5	R_{base}+6	R_{base}+7
Wednesday	R_{base}+8	R_{base}+9	R_{base}+10	R_{base}+11
Thursday	R_{base}+12	R_{base}+13	R_{base}+14	R_{base}+15
Friday	R_{base}+16	R_{base}+17	R_{base}+18	R_{base}+19
Saturday	R_{base}+20	R_{base}+21	R_{base}+22	R_{base}+23

Sunday	R_{base}+24	R_{base}+25	R_{base}+26	R_{base}+27
Holidays	R_{base}+28	R_{base}+29	R_{base}+30	R_{base}+31

The switch on and switch off times are combined in one register as follows:

Switch on time	Switch off time
Higher word 16 bits	Lower word 16 bits
Bit 16 to Bit 31	Bit 0 to Bit 15

Each time is individually stored as a decimal value on a 16 bits word. Values from 0000 to 2359 are stored for times going from 00:00 h to 23:59 h.

The two values can be found in dividing (integer division) the register value by 65536. The division result is the Switch-on time and the rest of the division is the Switch-off time.

Note that supervisor can only write all 32 bits of a register. Both Switch-on and Switch-off times must be always loaded together.

Dialogue

A dialogue function with the same name is available in the family HVC-Dialogue-HVC.

The first parameter (actual day) allows to combine this function with the corresponding dialog function.

See also: Family HVC-Dialogue HVC
HVC-Dialogue, Overview

2.9 Clock, Monthly

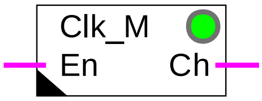
Family: **HVC-Clocks**

Name: **Clock monthly**

Macro name: _HeaClkm

Dialogue: Dialogue Fbox, see below.

Fbox:



Short description

Clock with one switching per month at a defined day of the week.

See also Clocks-Generalities.

Parameters

Switch-on	Switch-on option (d)
- Monday..Sunday	Switch-on day
- Permanent on	The channel is forced to 1.
- Permanent off	The channel is forced to 0.

Switch-on	Switch-on time (d)
Switch-off	Switch-off time (d)
Channel state	State of the internal channel

(d) Accessible parameter from terminal by using the dialogue auxiliary Fbox. See below.

Description of the function

It is possible to program a day of the week and time for switching on and for switching off. The function processes switching on and off once only on the 1st defined day of each month. E.g. Switch-on: Tuesday --> on/off every 1st Tuesday of the month. The channel will be switched on and off according to the defined time.

Typical application

This function allows to switch-on process that have to take place once per month at a given date and time, e.g. trial of fire protecting system.

Dialogue

A dialogue function with the same name is available in the family HVC-Dialogue-HVC.

See also: Family HVC-Dialogue HVC
HVC-Dialogue, Overview

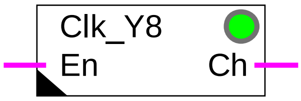
2.10 Clock, 8 Holidays

Family: **HVC-Clocks**

Name: **Clock 8 Holidays**

Macro name: _HeaClky8

Fbox:



Short description

Yearly clock with 8 successive switch-on periods. The periods can be unique or repetitive each year. The function can be defined for one switch-on for the all period or optionally one switch-on and one switch-off per day for each period.

See also Clocks-Generalities.

Parameters

Actual period	Affichage de la période actuelle selon les dates paramétrées
Channel state	Affichage de l'état du canal interne
Daily switching option	Option for day to day period
- Single	Single switch-on at beginning of period and switch-on at the end of period
- Daily	Daily switch-on and switch-on during the whole period
Yearly switching option	Option for year to year period
- Single	Single period
- Yearly	Yearly period
-----[Time]-----	
Switch-on	Switch-on time of channel
Switch-off	Switch-off time of channel
-----[Dates]-----	
Period 1...8 On	Switch-on date of channel for period 1 to 8
Period 1...8 Off	Switch-off date of channel for period 1 to 8

Description

The clock has 1 to 8 switch-on periods over a year. The switch-on and off are valid for all periods. They correspond to 8 yearly clocks activated one after the other.

With the option 'Yearly', the switch-on and off will be repeated every year. However, with the option 'Single', the switch-on and off will be operated one time only. In this case, the date will be reset to 00/00 after switching.

With the option 'Period day = Single', one single switch-on is operated every programmed period. However, with the option 'Daily', the channel is switched on every day during all periods.

To deactivate a period, set 00/00 for the 2 dates and 00:00 for the switch-on and switch-off hours.

To completely deactivate the clock and force its state to 0, set 00/00 for all dates and 00:00 for the switch-on and switch-off hours.

To completely deactivate the clock and force its state to 1, set 00/00 for all dates and 23:59 for the switch-on and switch-off hours of the first period.

Diagram for daily period = Single

Diagram for one period only.

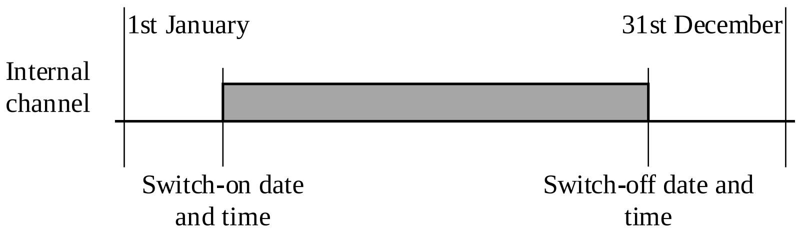
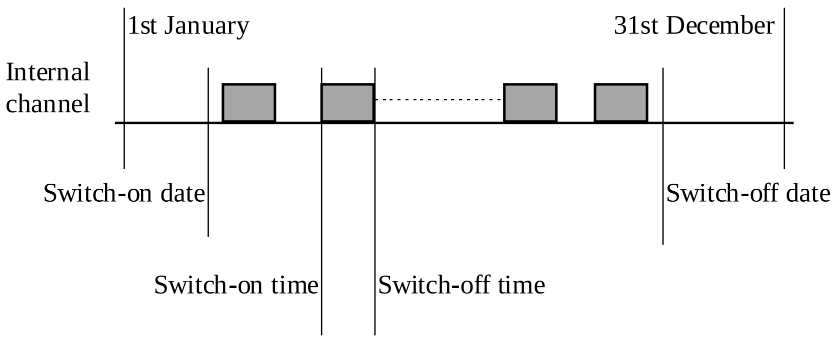


Diagram for daily period = Daily

Diagram for one period only.



2.11 Clock, Holidays

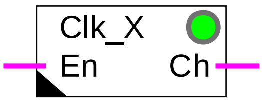
Family: **HVC-Clocks**

Name: **Clock holidays**

Macro name: _HeaClkE

Dialogue: Dialogue Fbox, see below.

Fbox:



Version info

From version HVC $135, the option 'Period: Single/Yearly' is available. Exchange the Fbox as to get this new option.

Short description

Clock for up to 12 public holidays.

See also Clocks-Generalities.

Parameters

Switch-on time	Switch-on time
Switch-off time	Switch-off time
Holiday 1..12	Date of holiday 1..12 (d)
Status of day	Display of the actual status
- Normal	The actual day is a normal day.
	The channel remains switched off.
- Holiday	The actual day has been set as holiday.
	The channel is switched on according to the settings.
Channel state	State of the internal channel
Switch option	Option for repeating the switching.
- Yearly	Yearly switch period
- Single	Single switching

(d) Accessible parameter from terminal by using the dialogue auxiliary Fbox. See below.

Description of the function

The channel has parameters defining 12 holidays, one switch-on and one switch-off time. The same times for switch-on and off apply to all 12 days

Time 00:00 and all dates 00:00 can be specified to disable the holiday and force the output to 0.

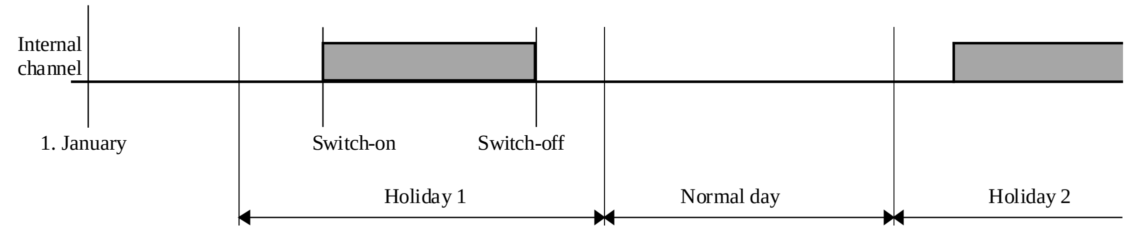
Time 23:59 and all dates 00:00 can be specified to disable the holiday and force the output to 1.

For holidays, the channel operates like a daily clock. For normal days, the channel takes the state is has at the end of the holidays. If the switch-on time is after the switch-off time, the channel is reversed the whole year.

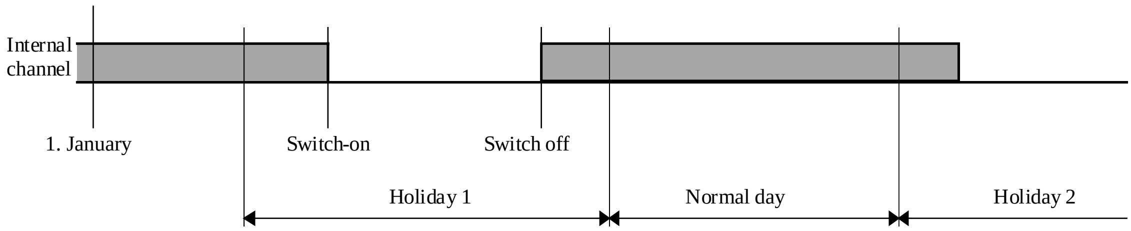
The function positions also a central flag for detection of holidays. It is used by other functions.

Diagram

Switch-on before switch-off:



Switch-on after switch-off:



Typical application

The option 'Single' allows to program public holidays which take place year after year at a different date. The new dates must be introduced every year as to set the switch-on period.

The option 'Yearly' allows to program public holidays which take place every year at fix date.

For application where the time must be different from one day to the next, multiple clocks of this type must be combined together.

This Fbox can be linked to daily clocks so that programs can run: working days - holidays. In this case the time must be set to maximum values (00:00 to 23:59) and the daily clocks must be programmed for the desired working days and holidays.

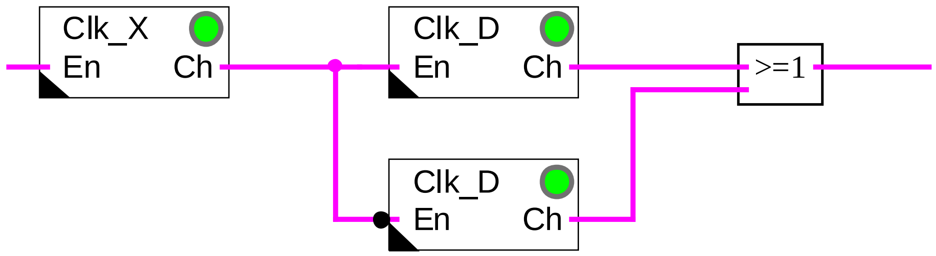
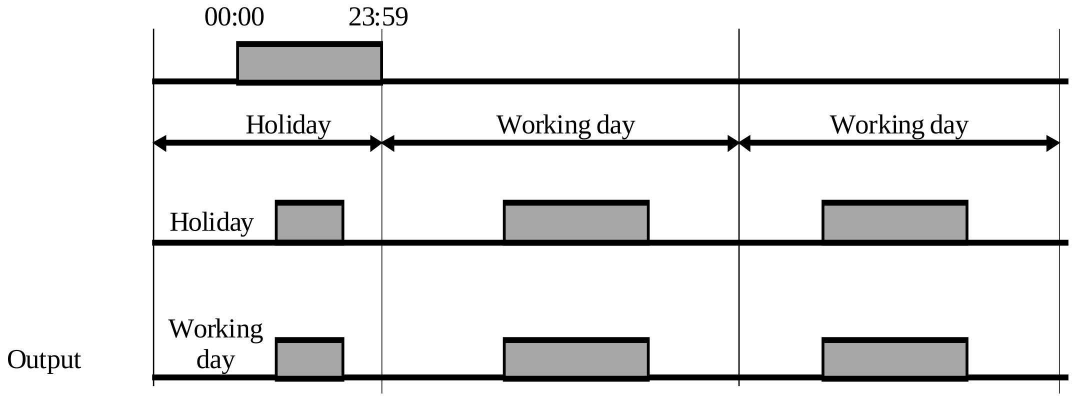


Diagram of the program:



The function may be used for programming a switch-on time at a given date every month. For example each 15th of the month, since it has 12 dates, one every month.

Dialogue

A dialogue function with the same name is available in the family HVC-Dialogue-HVC.

See also: Family HVC-Dialogue HVC

HVC-Dialogue, Overview

2.12 Clock, Write

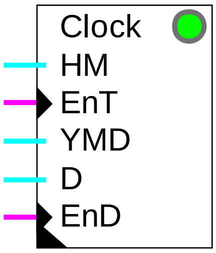
Family: **HVC-Clocks**

Name: **Clock write**

Macro name: _HeaWclk

Dialogue: Dialogue Fbox, see below.

Fbox:



Short description

This function is provided for setting the clock from an external system. The data may be provided by a master clock or by a supervisor. The settings may be done through Fupla.

Inputs

HM	Hours, Minutes	Data for the clock
EnT	Confirmation HM	Input signal for data HM (Hours, Minutes)
YMD	Year, Month, Day	Input for the date
D	Day	Input for the day of the week
EnD	Confirmation YMD	Input signal for Year, Month, Day according to data YMD and D

Parameters

Hour and minute	Inputs for time setting
Write time	Control button for time setting
Day, Month and Year	Inputs for date setting
Day of the week	Input for setting the day of the week
Write date	Input button for setting of the date and the day of the week

When the settings are made by a supervisor, the data are also copied in the PCD registers and displayed in the adjust window. It is therefore possible to check them at later time.

(d) Accessible parameter from terminal by using the dialogue auxiliary Fbox. See below.

Description of the function

Settings by a supervisor

The hours and minutes must be present at Input 'HM' before activation of the input 'EnT' (Enable Time).

The format is: HH/MM.

The seconds start at 00.

Example:	1230	for 12 hours and 30 minutes
	2248	for 22 hours and 48 minutes

The date and the day of the week must be present at inputs 'YMD' and 'D' before activation of input 'EnD' (Enable Date).

The format is YYMMDD.

Example:	961231	for 31. December 1996
	971029	for 29. January 1997

Format for the day of the week is 1 to 7 for Monday to Sunday.

The week number remains unchanged.

Example: Setting of the clock on Tuesday, 16. November 1993, 20.37h

HM= 2037 YMD = 931116 D= 2

After loading these values into the corresponding registers for the 3 inputs, activate inputs 'EnD' and 'EnT'. The clock is set at time and date indicated.

The signals 'EnD' and 'EnT' must be reset before the next clock setting.

Note that the clock settings can be madein an easier way by a telegram, which is writing directly in the PCD clock.

Synchronization by a master clock

The function can be used for synchronizing the clock with a daily synchronization pulse. For this application it is only necessary to give as a constant the synchronization time at input HM and to give pulses to the input EnT. To prevent PCD clock errors from causing a difference in the date, the synchronization time chosen must be other than 00:00.

The synchronization with a master clock can replace the automatic Summer-Winter time changeover of the HVC Init-Function.

Settings through Fupla

For settings through Fupla, the data must be first introduced in the adjust window. They are then transmitted in the PCD registers with the button 'Send all'. The time setting is finally done with the 2 buttons 'Order'.

Note that the clock setting can be made in an easier way with the PCD configurator.

Further comments

If the PCD does not have any hardware clock, the LED is red and no setting is possible.

Any attempt to load the clock with incorrect data will not be accepted and the time or date will remain unchanged.

If the clock has never been set through the PCD configurator, it may contain wrong data. In this case, it may occur that the time and date settings are impossible.

See also HVC-Init, Subfunction Clock which tests and displays the PCD clock state.

Several clock setting Fboxes may be used for combining both the synchronization with a master clock and the setting by a supervisor.

Typical applications

This Fbox is mainly used for time setting by a master clock.

It may also be used in combination with the Fbox Clock, Write of the HVC-Dialogue family for setting the clock from a terminal.

Dialogue

A dialogue function with the same name is available in the family HVC-Dialogue-HVC.

See also: Family HVC-Dialogue HVC

HVC-Dialogue, Overview

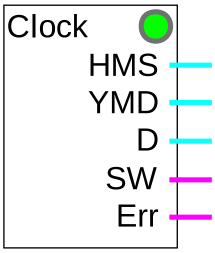
2.13 Clock, Read

Family: **HVC-Clocks**

Name: **Clock read**

Macro name: _HeaRclk

Fbox:



Short description

This function is provided for reading the clock hour, date, day of the week and display of the Summer-Winter time changeover as well as any clock error.

Outputs

HMS	Hours, Minutes, Seconds	Hours, Minutes, Seconds of the clock
YMD	Year, Month, Day	Year, Month, Day of the clock
D	Day of the week	Day of the week
SW	Summer-Winter	Time changeover. Summer=1 / Winter=0.
Err	Error	Error=1 / OK=0. Clock error detection.

Description of the function

This function allows to use freely the clock data in a PCD program. The data are read and decoded by the HVC-Init function. The reading is done once per second.

The time format is: HHMMSS

The date format is: YYMMDD

The week format is: 1 to 7 for Monday to Sunday

SW output may be used for starting specific functions when the summer time is active.

Err output shows that a clock error has been detected.

For more information about the PCD clock, see the following functions:

HVC-Init, Subfunction Clock

HVC-Init, Subfunction Summer-Winter Time

Typical application

This Fbox must be used in a S-Bus master station as to distribute the time to Slave stations having no hardware clock. Please refer to HLK-Init, Subfunction Validity Range for the procedure.

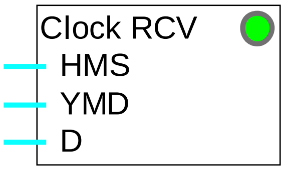
2.14 Clock, Receive

Family: **HVC-Clocks**

Name: **Clock receive**

Macro name: _HeaRcvclk

Fbox:



Short description

Reception of clock data through the S-Bus network in a slave station not equipped with a hardware clock.

Inputs

HMS	Hours-Minutes-Seconds	Data 'Hours-Minutes-Seconds' of the clock
YMD	Year-Month-Day	Data 'Year-Month-Day' of the clock
D	Day of the week	Data 'Day of the week' of the clock

Description

This Function allows to receive clock data in a PCD system which is not equipped with a hardware clock. The data are automatically copied in the internal registers of the HVC-Init function.

The LED indicates that a programmation error avoids the correct reception of data or the S-Bus is disconnected.

Please refer to HLK-Init, Subfunction Validity Range.

See also HVC-Init, Subfunction Clock for more details about the clock.

Typical application

This Fbox may only be used for time distribution to Slave stations which do not have a hardware clock.

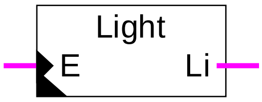
3. HVC-Electric

Contents

3.1 Lighting Control

Family:	**HVC-Electric**
Name:	**Lighting control**
Macro name:	_HeaLight

Fbox:



Short description

Standard function for lighting control with option for 2 successive pulses.

Input

E	Switch-on	Switch-on and off signal for the light

Output

Li	Lighting	Lighting Control

Parameters

2nd pulse	Option for the effect of the second pulse during timeout.
- Stop	The second pulse stops the timer and switches out the output.
- Restart	The second pulse restarts the timer and maintains the output.
Delay time [sec]	Switch-on time in seconds from 1.0 to 3600.0 (=1 hour)
Timer [sec]	Remaining time, in seconds before output is switched off.

Description of the function

When input E = 1, the output Li is switched on for the period of time defined by 'Delay time'.

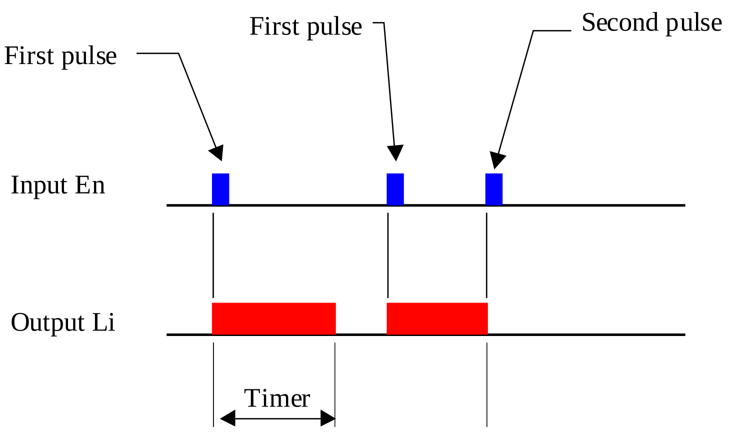
If the input is reactivated while the output is already switched on, the reaction is dependant on the choice made in '2nd pulse' in the adjust window.

Option '2nd pulse' = Stop: the output Li is switched off and the timer set to zero.

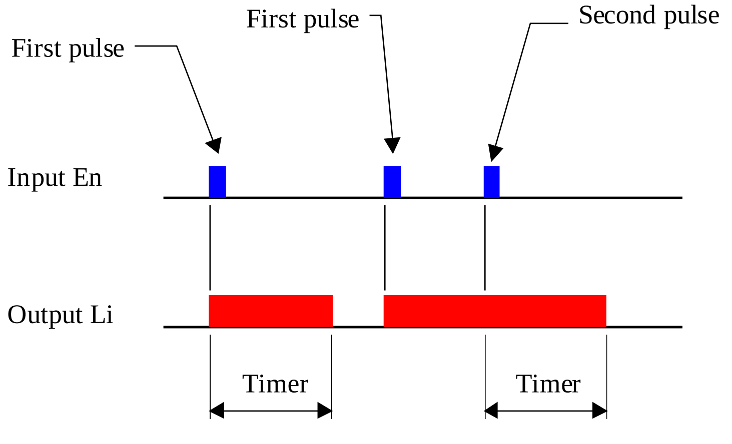
Option '2nd pulse' = Restart: the output Li remains on and the timer is reloaded.

Diagram

Option 2nd pulse = Stop



Option 2nd pulse = Restart



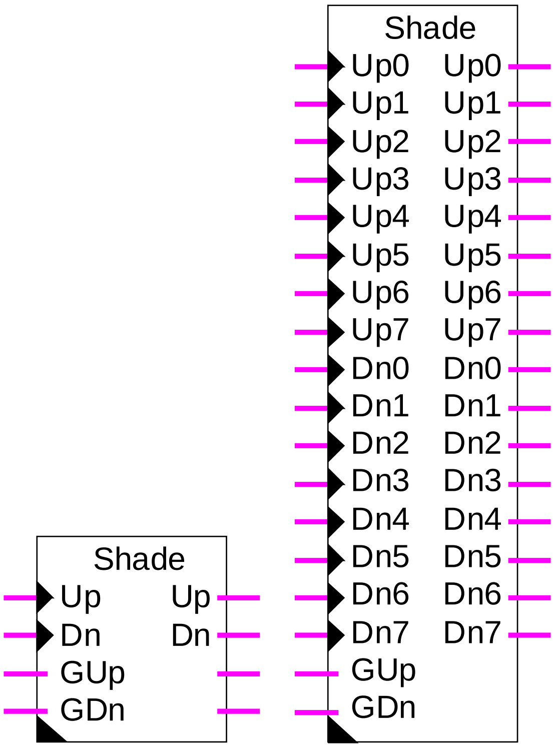
3.2 Command of shades

Family: **HVC-Electric**

Name: **Shade**

Macro name: _HeaShade

Fbox:



Short description

Standard function for shade control, 1 to 8 shades, with general command.

Input

Up0..Up7	Upward	Control signal for upward movement.
Dn0..Dn7	Downward	Control signal for downward movement.
GUp	General Up	Control signal for upward movement of all shades.
GDn	General down	Control signal for downward movement of all shades.

Output

Up0..Up7	Upward	Motor control for upward movement.
Dn0..Dn7	Downward	Motor control for downward movement.

<u>Parameter</u>

Time, positioning [sec]	Output pulse time (Up and Dn) for positioning.
Time, full movement [sec]	Stroke time for full movements.
Time, input pulse [sec]	Input pulse time to start full up and down movements.

<u>Description</u>

Inputs Up0..Up7 as well as Dn0..Dn7 are foreseen for button control. Inputs GUp and GDn, however are foreseen for control by supervisor or general signal.

When a button is shortly pressed, the output gives a pulse of adjustable length for positioning the shade.

If the button remains pressed longer as the adjusted time, the upward or downward full movement is activated. The output is then activated during the adjusted time for full movements.

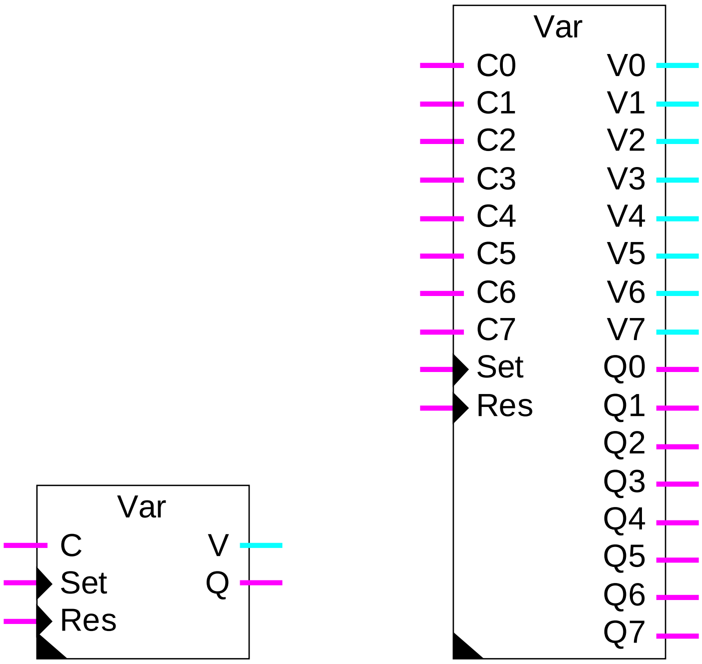
Up or Dn buttons can be pressed during up or down movements. The movement is then stopped immediately.

Inputs GUp and GDn are foreseen for a general command. With a positive edge, a complete upward or downward movement of all shade is started. These inputs can also remain activated permanently. In this case, the individual button commands are locked.

3.3 Variator Toggle

Family:	**HVC-Electric**
Name:	**Variator Toggle**
Macro name:	_HeaVar1

Fbox:



Short description

Variator for 1 to 8 values. General command for switch-on and switch-off and individual commands Up and Down through one single input.

Inputs

C0..C7	Command	Command signal En, Off, Up and Down with inversion
Set	General set	General switch-on signal for all outputs.
Res	General reset	General switch-off signal for all outputs.

Outputs

V0..V7	Value 0..7	Output value of the variator.
Q0..Q7	State 0..7	Binary auxiliary signal for switch-on or switch-off state of the variator.

Parameters

Max level Maximum output value for all variators

Min level	Minimum output value for all variators
Variation per second	Variation speed of the output signal for all variators
Initialization option	Option for the initialization value
- Initial	The variators are initialized with the initial adjusted value
- Old value	The variators are initialized with the old output value
Initial value	Initialization for the option 'Initial'
General Set command	General command for switching on all outputs.
General Reset command	General command for switching off all outputs.

Description

The input Set allows to switch-on simultaneously all variators. The input Res allows to switch-off simultaneously all variators.

The inputs C0..C7 have 4 functions. A short pulse allows to switch-on and switch-off the variator. At each successive pressing the function En and Off is inverted. A pressing longer than one second starts a variation Up or Down as long as the button remains pressed. At each successive pressing, the function Up and Down is inverted.

The output values are limited to the minimum and maximum adjusted values.

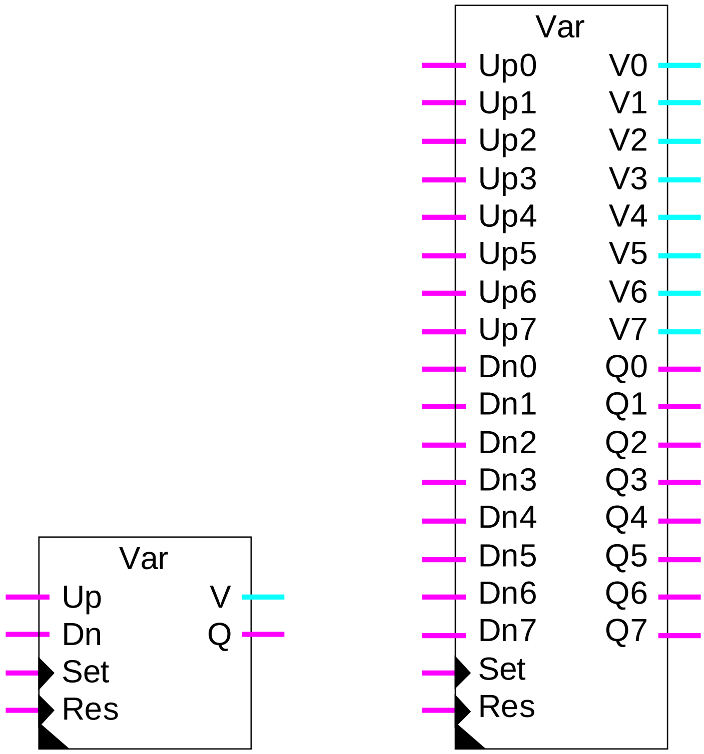
3.4 Variator Up Down

Family: **HVC-Electric**

Name: **Variator Up Down**

Macro name: _HeaVar2

Fbox:



Short description

Variator for 1 to 8 values. General command for switch-on and switch-off and individual commands Up and Down.

Inputs

Up0..Up7	Going up	Command signal for upward variation.
Dn0..Dn7	Going Down	Command signal for downward variation.
Set	General set	General switch-on signal for all outputs.
Res	Reset général	General switch-off signal for all outputs.

Outputs

V0..V7	Value 0..7	Output value of the variator.
Q0..Q7	State 0..7	Binary auxiliary signal for switch-on or switch-off state of the variator.

Parameters

Max level	Maximum output value for all variators
Min level	Minimum output value for all variators
Variation per second	Variation speed of the output signal for all variators
Initialization option	Option for the initialization value
- Initial	The variators are initialized with the initial adjusted value
- Old value	The variators are initialized with the old output value
Initial value	Initialization for the option 'Initial'
General Set command	General command for switching on all outputs.
General Reset command	General command for switching off all outputs.

Description

The input Set allows to switch-on simultaneously all variators. The input Res allows to switch-off simultaneously all variators.

The inputs Up0..Up7 have 2 functions. A short pulse allows to switch-on the variator. A pressing longer than one second starts an upward variation as long as the button remains pressed.

The output values are limited to the minimum and maximum adjusted values. The inputs Dn0..Dn7 work in a similar way for switch-off and downward variations.

The output values are limited to the minimum and maximum adjusted values.

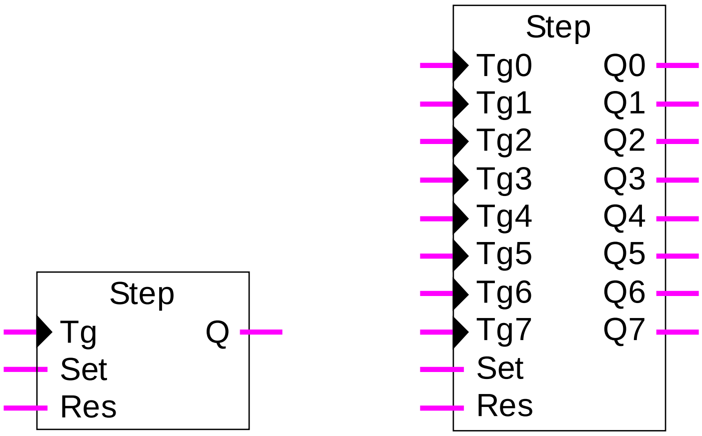
3.5 Step

Family: **HVC-Electric**

Name: **Step**

Macro name: _HeaStep

Fbox:



Short description

Step by step switch for 1 to 8 binary outputs. General commands with priority for switch-on and switch-off.

Inputs

Tg0..Tg7	Inverter	Command signal for the step by step function.
Set	General set	General signal for switching on all inputs.
Res	General reset	General signal for switching off all inputs.

Outputs

Q0..Q7	State 0..7	Binary output signal for the step by step function.

Description

The inputs Tg0..Tg7 allow to invert the output signals Q0..Q7.

The input Set allows to switch on all outputs simultaneously. The input Res allows to switch off all outputs simultaneously. These inputs are not dynamized. It allows to lock the commands individually. If the input Set is set to 1, all outputs are forced to 1. If the input is set to 1, but Set is set to 0, all outputs are forced to 1.

Reference: Step dynamized

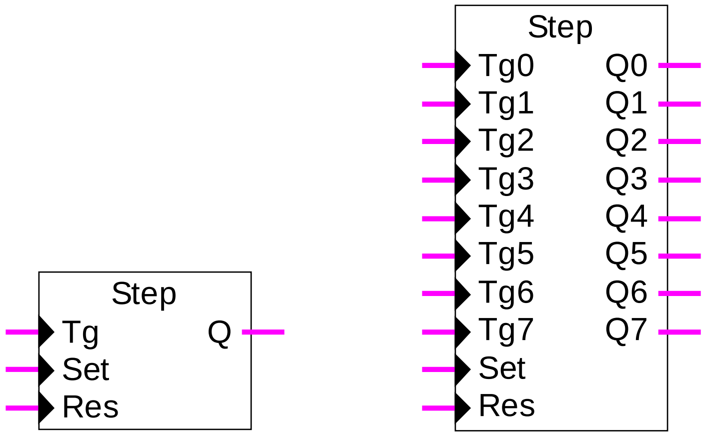
3.6 Step dynamized

Family: **HVC-Electric**

Name: **Step dynamized**

Macro name: _HeaDStep

Fbox:



Short description

Step by step switch for 1 to 8 binary outputs. General dynamized commands for switch-on and switch-off.

Inputs

Tg0..Tg7	Inverter	Command signal for the step by step function.
Set	General set	General signal for switching on all outputs.
Res	General reset	General signal for switching off all outputs.

Outputs

Q0..Q7	State 0..7	Binary output signal for the step by step function.

Description

The inputs Tg0..Tg7 allow to invert the output signals Q0..Q7.

The input Set allows to switch on all outputs simultaneously. The input Res allows to switch off all outputs simultaneously. All inputs are dynamized. It means that one input has no priority compared to the others.

Reference: Step

Notes

4. HVC-Filters

Contents

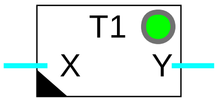
4.1 Filter T1

Family: **HVC-Filter**

Name: **Filter T1**

Macro name: _HeaT1

Fbox:



Short description

First order filter for analogue signal.

Input

X	Input X	Filter Input

Output

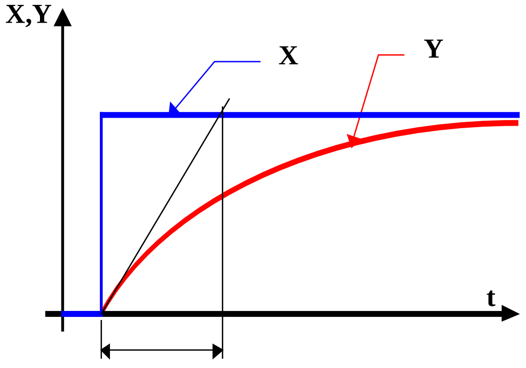
Y	Output Y	Filtered output signal

Parameter

Initialization	Initialization option
- Initial option	The filter will be initialized with the defined value
- Input	The filter will be initialized with the input value
- Old value	The filter will be initialized with the last Y value
Initial value	Value for the initialization with option 'Initial'
Time constant	Time constant of filter

Diagram

Jump response



Description of the function

The signal is applied to the X input through a 1st order filter. The signal is provided to the Y output. The function is sampled with the standard one-second signal. For time constants which exceed sampling time by a multiple greater than 5, the function is sufficiently close to the theoretical equation. If a time constant is equal to the sampling time, the filter will have no effect.

If too big values are applied to the input (more than +/- 100'000.0) an overload of capacity may occur. In this case the LED turns red. At program sart up, it will turn to green again.

Initialization

Initialization is made according to option and value selected.

During the Restart cycle (see HVC-Init, Subfunction CPU Performance) the output remains at initialization value. The filter memory is also initialized.

Algorithm:

$$Y = Yt\_1 + (X - Yt\_1) * Te / T1$$

where:

Y	= input
X	= output
Te	= sampling time
T1	= time constant of the filter
Yt_1	= previous value of Y

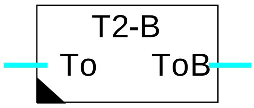
4.2 Filter T2 Building

Family: **HVC-Filter**

Name: **Filter T2 building**

Macro name: _HeaT2b

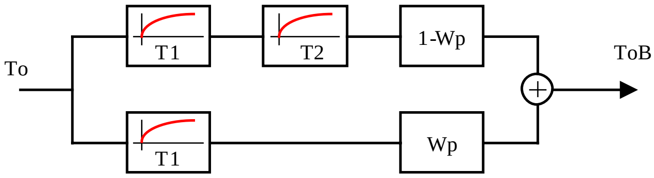
Fbox:



Short description

This function is provided for simulation of the outside temperature in a building. The walls and windows characteristic are adjustable.

Diagram



Wp = Window proportion

Input

To	Outside temperature	Measurement of outside temperature

Output

ToB	T Building	Filtered outside temperature according to building data

Parameters

Initialization	Initialization option
- Initial option	The filter will be initialized with the defined value
- Input	The filter will be initialized with the input value
- Old value	The filter will be initialized with the last Y value
Initial value	Value for the initialization with option 'Initial'

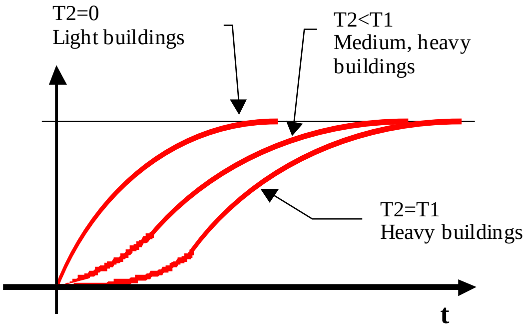
Manual initialization	Button for the manual initialization
Constant T1 Wall [H]	Time constant (in hours) of the first filter for walls
Constant T2 Wall [H]	Time constant (in hours) of the second filter for walls
Constant T1 Window [H]	Time constant (in hours) of the filter for windows
Window proportion [%]	Window proportion(in %) of the whole building face

Description of the function

This allows to simulate the effect of the outside temperature in a building.

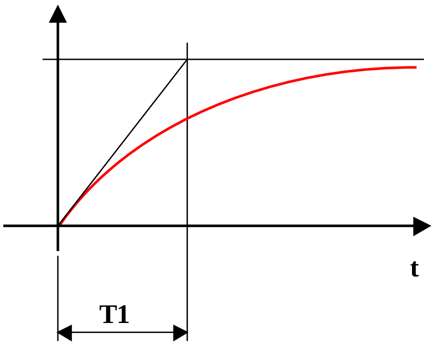
A Filter 2nd order simulates the walls characteristic. For a light construction the time constant must be low (4 to 8 hours). The constant 'T2' can be set to 0. For a heavy construction the time constants 'T1' and 'T2' can be the same (12 to 24 hours).

Diagram



A filter 1.Order corresponds the windows effect. The time constant is always low (0.1 to 1.0 hour).

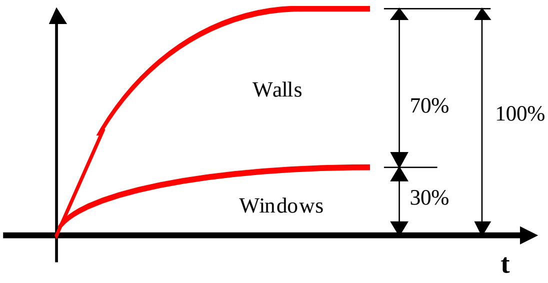
Diagram



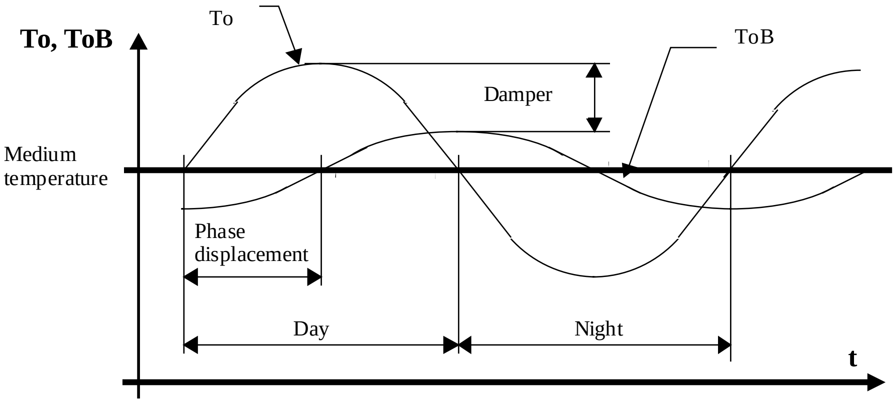
The proportion Walls-Windows is adjustable. The parameter shows the percentage of windows compare to the whole surface.

Diagram

Example Wp=30%



The daily variation of the outside temperature are damped through the filter and shifted in time.



Initialization

The filter must be initialized at system start. Depending on the situation an option is available for the filter initialization mode.

Initial	Is provided for initialization of fix selected values and is useful for tests and trials.
Input	Is provided for initialization of the filter input value (outside temperature at start). Is also useful in case of long interruption.
Old value	At start the filter remains in its previous state. This corresponds to standards. For short interruptions, the filter keeps the filtered temperature. During the first switch-on, the filter must be initialized by hand. The initialization button allows this operation.

4.3 Limit

Family: **HVC-Filter**

Name: **Limit**

Macro name: _HeaLimit

Fbox: 

Short description

Minimum and maximum limit of a numeric value.

Input

Input	Numeric input value

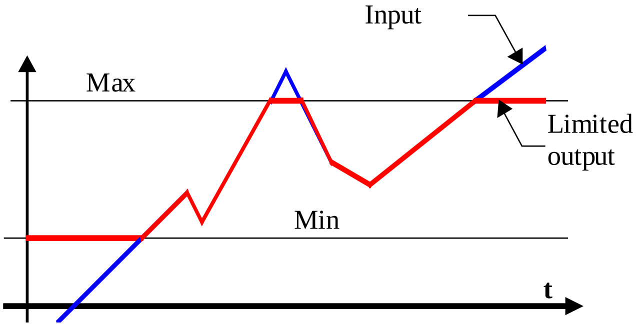
Output

Output	Limited numeric output value

Parameters

Lower limit	Value of lower limit
Upper limit	Value of upper limit

Diagram



Description of the function

If the input value is smaller than the lower limit, the output takes that limit value. If the input value is greater than the upper limit, the output takes the upper limit value. If the input value is between the upper and lower limits, the output takes the input value.

When the input value is outside these limits, the LED is red. If the values are inadmissible (lower > upper), the lower limit is used.

4.4 Ramp

Family: **HVC-Filter**

Name: **Ramp**

Macro name: _HeaRamp

Fbox:

Short description

Limitation of the positive and negative variation speed of a numeric signal.

Input

Input	Numeric input value

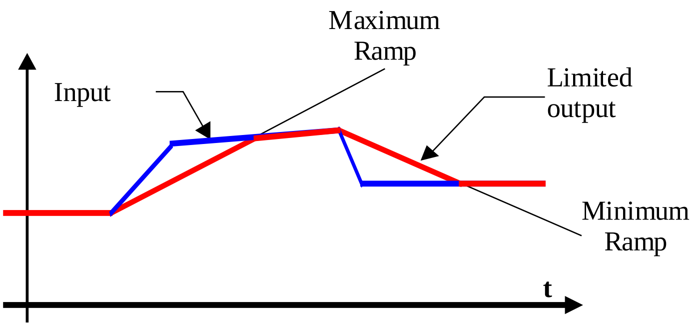
Output

Output	Limited numeric output value

Parameters

Initialization option	Option for the initialization value. See below.
- Initial	The filter is initialized with the preset initial value
- Input	The filter is initialized with the input value
- Old value	The filter is initialized with the old output value
Initial value	Initialization value for the option 'Initial'
Unit of time	Time unit for the following parameter 'Time'.
Time	Time interval for the maximum variation.
Variation	Maximum variation per defined time.

Diagram



Description of the function

When the input signal varies, the output progresses to the maximum speed defined by the parameters for time and variation.

Maximum ramp = variation / time

Variation and time can be adjusted online. A rough definition of the timebase is made offline in units (hours, minutes, seconds or 1/10 seconds). It is then adjustable online.

The incrementation interval selected depends on the unit.

Unit	Interval
Hours	1 minute
Minutes	1 sec
Seconds	1/10 sec
Seconds/10	1/10 sec

During the restart cycle (see HVC-Init, Subfunction CPU Performance) the output takes the state defined by the option and the initialization value.

When the output value is limited by the ramp, the LED turns red.

When selecting the time and its unit, it is advisable to select a high value increment as to get fine adjustment possibilities.

The initialization option 'Old value' initializes the output at the input value during a HVC initialization function reset.

Typical application

This function may be used with the function Signal jump as to generate a set-point ramp.

When selecting the time and the unit of time, it is advisable for the increment to be at a value which is large enough to allow fine adjustment.

With the initialization option 'Old value', the value is not defined at first start after loading of the program in the PCD. For this reason, the output will be initialized at the input value, if the Reset signal of the HVC initilization function is active. See HVC-Init, Subfunction Reset.

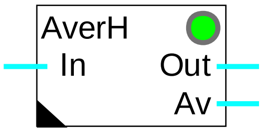
4.5 Historic Average

Family: **HVC-Filter**

Name: **Historic average**

Macro name: _HeaAvrh

Fbox:



Version info

The first version has the options '1 day' to '8 days'. Replace the Fboxes by the new ones as to get the options '2 hours' to '12 hours'

Short description

Performs the storage and average calculation of 24 measured values. The time period for the 24 measured values is adjustable between 2 hours and 8 days.

Input

In	Input	Numeric value to introduce in buffer.

Outputs

Out	Output	Last value out of the buffer.
Av	Average	Calculation of the average value (24 last measured values)

Parameters

Sampling period	Measuring periods in hours/days and total measurement per hour/day. Total = 24 measurements.
Synchronization	Hour of synchronization and sampling. From this hour, the samplings are done at above defined interval.

-----[Options and reset fonctions]-----

Reset signal	Option for masking the reset signal of the HVC-Init function
- Masked	The reset is masked
- Activated	The reset is active
Initial value	Initial value of whole buffer after a reset.
Manual reset	Manual reset button of the whole buffer.

-----[Online function]-----

Last value	Display of the last value read in the buffer.
Last value but one	Display of the last value but one read in the buffer.
Average of 24 values	Display the average of 24 values.

Description of the function

This function calculates the average of 24 values stored at regular intervals. The storage period is selected with an offline option. It also defines the number of measurements per day:

- 12 hours/2 m — 12 hours with 2 measurements per hour
- 8 hours/3 m — 8 hours with 3 measurements per hour
- 6 hours/4 m — 6 hours with 4 measurements per hour
- 4 hours/6 m — 4 hours with 6 measurements per hour
- 2 hours/12 m — 2 hours with 12 measurements per hour
- 1 day/24 m — 1 day with 24 measurements
- 2 days/12 m — 2 days with 12 measurements per day
- 3 days/8 m — 3 days with 8 measurements per day
- 4 days/6 m — 4 days with 6 measurements per day
- 6 days/4 m — 6 days with 4 measurements per day
- 8 days/3 m — 8 days with 3 measurements per day

This function requires a hardware clock. If the clock test carried out by the HVC-Init function is negative, the LED will be red and operation will be impossible.

An online parameter can be used to synchronize measurements at any time of the day. Measurements are then made at regular intervals synchronized against this time.

It is possible to avoid any loss of measurements during start-up by masking the reset of the HVC-Init (see HVC Init, Subfunction Reset). The reset button can be used to clear the buffer manually. The initialization value is then loaded into all 24 registers.

Typical application

This function can be used for temperature filtration in case of regulation monitored by outside detector.

Reference

See also Filter T2 Building .

4.6 Dead Range

Family: **HVC-Filter**

Name: **Dead range**

Macro name: _HeaDdr

Fbox: 

Short description

Application of a dead range on an numeric signal.

Input

Input	Numeric input value

Output

Output	Output value filtered by the dead range

Time diagram

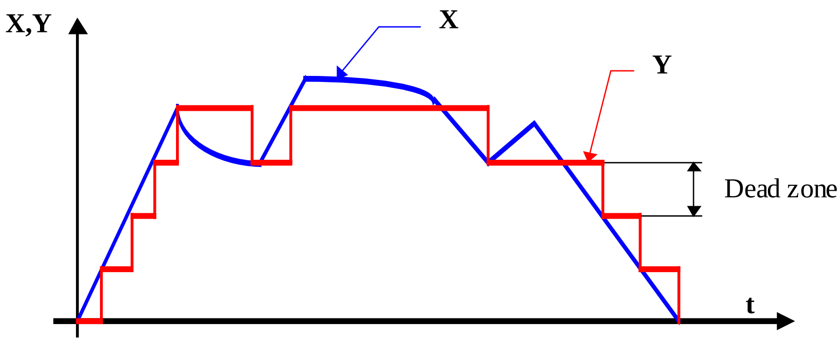
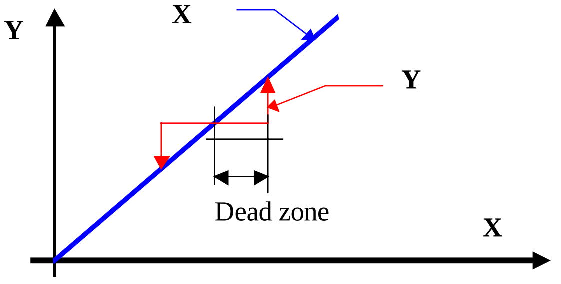


Diagram Input-Output



<u>Description of the function</u>

The dead range allows to clear little variations of the signal. The signal moves by jumps of fix values only. For as long as variations in the input signal do not exceed the dead range value, the output value remains unchanged.

As soon as any variation exceeds this dead range, the input is written to the output. The dead range then applies according to the new output value.

The signal moves by jumps. The difference of the dead range is each time compensated.

This filter decreases the regulation quality. If the dead range is too big, the regulation becomes unstable.

<u>Typical application</u>

Filter for the control of a mix valve. The dead range avoid short movement of the valve and the motor will be saved.

4.7 Null Range

Family: **HVC-Filter**

Name: **Null range**

Macro name: _HeaNulr

Fbox:

Short description

Keeps a numeric value at 0 below a minimum threshold.

Input

Input	Numeric input value

Output

Output	Output value filtered by the null range

Description of the function

If the value at the input is close to null, i.e. within the defined range, the output is set to or remains at zero. The null range operates symmetrically, i.e. both in the positive and negative ranges. If the null range is active the LED turns red.

Example of application

Energy measurement. A null range prevents energy metering when small temperature differences arise as a result of imprecise measurement.

Time diagram

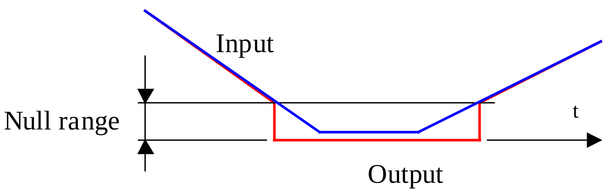
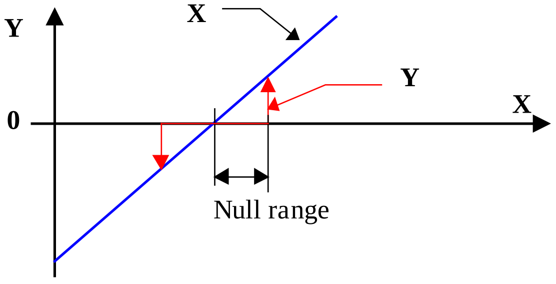


Diagram input-output



4.8 Dead and Null Range

Family: **HVC-Filter**

Name: **Dead + null range**

Macro name: _HeaDnul

Fbox:

Short description

A dead zone is applied to the analogue signal and the value is kept at 0 below a minimum threshold.

Input

Input	Numeric input value

Output

Output	Output value filtered by null and dead range.

Parameters

Dead and null range	Parameter valid for dead range and null range. The value is valid in the positive as well as negative range.

Description of the function

If signal fluctuations at the input do not exceed the dead range, the value at the output is unchanged.

If this range is exceeded, the value at the input is copied to the output. The dead range now operates on the new output value.

Moreover, if the input value approaches null in the defined range, the output is zeroed. The null range operates symmetrically, i.e. in the positive and negative ranges.

Typical application

To avoid constantly opening and closing heating valves, a controller output (P, PI or PID) is filtered with a dead range. The null range guarantees that the output is also reset when the controller is switched off, even when the dead range is ignored.

References

Null Range

Dead Range

Time diagram

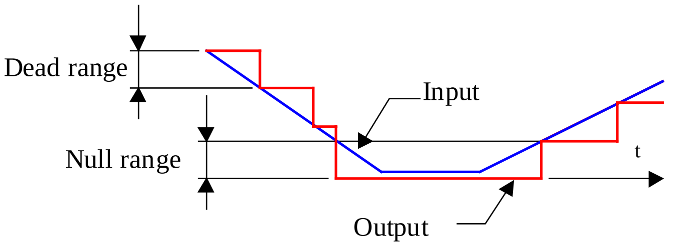
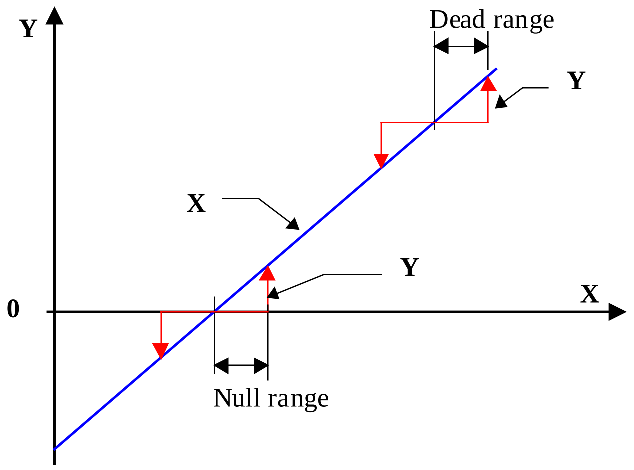


Diagram input-output



4.9 Hysteresis

Family: **HVC-Filter**

Name: **Hysteresis**

Macro name: _HeaHys

Fbox: 

Short description

Hysteresis function for analogue signal. It allows to clear signal variations when direction changes.

Input

Input	Numeric input value

Output

Output	Filtered output value

Parameters

Going high hysteresis	Value of hysteresis difference when the input signal increases
Going down hysteresis	Value of hysteresis difference when the input signal decreases

Description of the function

If the value at the input rises, the output value follows the input value with a difference (delay) which corresponds to the 'hysteresis rising' parameter.

If the value at the input falls, the output value follows the input value with a difference (delay) which corresponds to the 'hysteresis falling' parameter.

If the input value fluctuates within the range between these two values, the output value remains unchanged.

The hysteresis shows the disadvantage of a permanent difference between the input and the output signal.

Time diagram

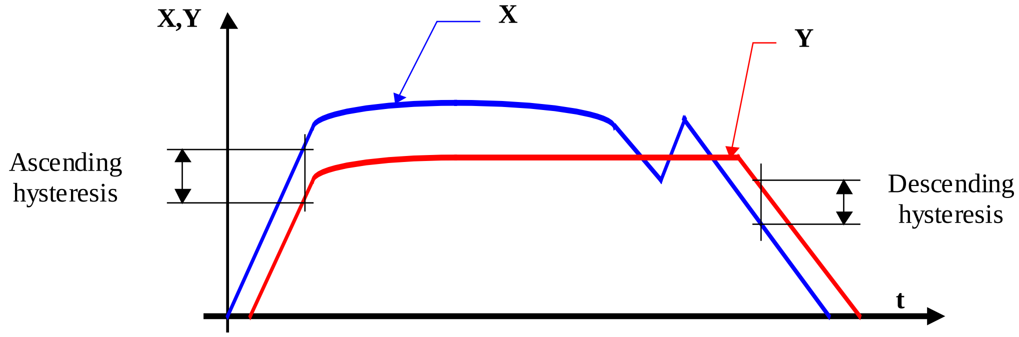
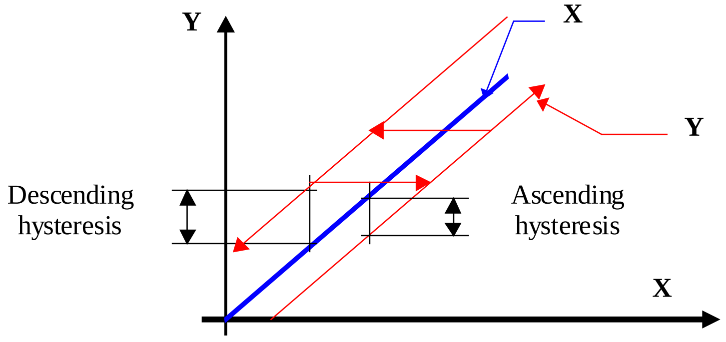


Diagram Input-Output



Typical application

Analogue input filter.

Notes

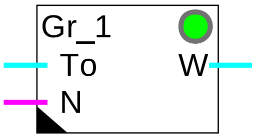
5. HVC-Set-Points

Contents

5.1 Heating Gradient 1

Family:	**HVC-Set-point**
Name:	**Heating gradient 1**
Macro name:	_HeaGr1
Dialogue:	Dialogue Fbox, see below.

Fbox:



Short description

Heat curve for day and night. Simple definition made by an offset and a gradient.

Inputs

To	Outside temperature	Measurement of outside temperature (filtered)
N	Night	Activation signal for night reduction signal

Output

W	Set-point	Calculated set-point value according to curve and night reduction

Parameters

Error, Acknowledge	Error acknowledge button.
Outside temperature	Display of outside temperature. (d)
Offset	Initial point for calculation of correction. (d)
Gradient	Gradient factor for calculation of correction. (d)
Night reduction	Constant offset in K, deducted from set-point, for the activation of the night reduction 'N'. (d)
Lower limit	Set-point lower limit.
Upper limit	Set-point higher limit.
Set-point	Display of the calculated set-point (Output W). (d)

(d) Accessible parameter from terminal by using the dialogue auxiliary Fbox. See below.

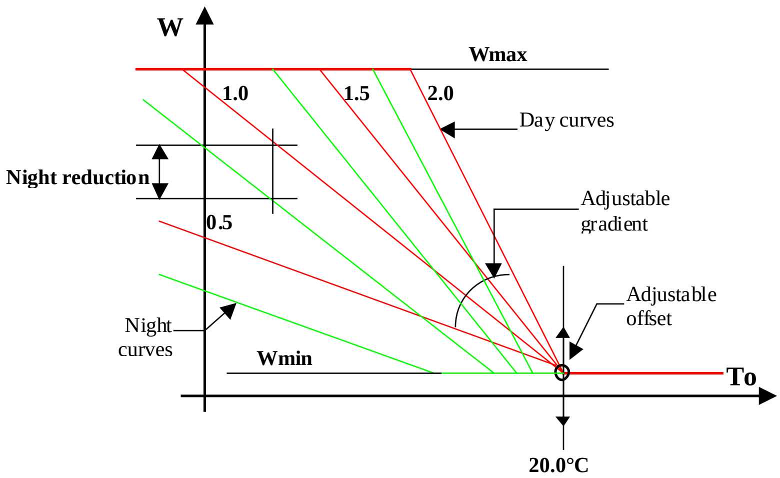
Description of the function

The heat curve is used to define a temperature set-point W as a function of the outside temperature To.

The characteristic is calculated from an adjustable offset for the outside temperature of 20°C. From this point, the correction calculated from the gradient factor is applied to the set-point value. The digital input signal N allows to switch from day curve (state 0) to night curve (state 1). The set-point is limited by minimum and maximum values.

If an unlogical value or a too big gradient is applied, a capacity overrun may occur and the LED turns red. This state can be acknowledged after correction of the parameters.

Diagram



Typical application

Flow temperature for heating depending on the outside temperature and night reduction.

Reference

The set-point calculated by this function may be corrected by various set-point correction functions .

Dialogue

A dialogue function with the same name is available in the family HVC-Dialogue-HVC.

See also: Family HVC-Dialogue HVC

HVC-Dialogue, Overview

5.2 Heating Gradient 4

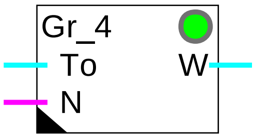
Family: **HVC-Set-point**

Name: **Heating gradient 4**

Macro name: _HeaGr4

Dialogue: Dialogue Fbox, see below.

Fbox:



Short description

Heat curve for day and night with 4 points for outside temperature and 2 times 4 set-points.

Inputs

To	Outside temperature	Measurement of the outside temperature. Usually this temperature is filtered before the heat kurve.
N	Night	Activation signal for the night reduction

Output

W	Set-point	Calculated set-point value according to 4 points curve and night reduction

Parameters

Error, Acknowledge	Error acknowledge button
Point 1	Reference point 1 of outside temperature.
Day set-point	Day set-point for reference 1. (d)
Night set-point	Night set-point for reference 1.
Point 2	Reference point 2 of outside temperature.
Day set-point	Day set-point for reference 2. (d)
Night set-point	Night set-point for reference 2.
Point 3	Reference point 3 of outside temperature.
Day set-point	Day set-point for reference 3. (d)
Night set-point	Night set-point for reference 3.
Point 4	Reference point 4 of outside temperature.
Day set-point	Day set-point for reference 4. (d)
Night set-point	Night set-point for reference 4.

Minimum set-point	Minimum set-point limit. (d)
Maximum set-point	Maximum set-point limit. (d)

(d) Accessible parameter from terminal by using the dialogue auxiliary Fbox. See below.

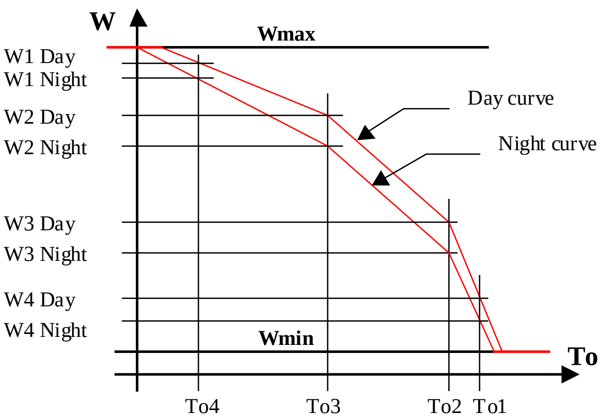
Description of the function

The heat curve with 4 points is used to define a temperature set-point, W, as a function of the outside temperature To, following a characteristic curve of 2x3 segments plus maximum and minimum limits. A night reduction signal, N (active ON), activates another similar curve for night-time operation. The same points 'To1'...'To4' are valid. The minimum and maximum limits remain active.

Important

Descending order should be used when entering points for values of To: To1 > To2 > To3 > To4. Those for set-point W are generally in ascending order. This should be upheld even if certain points are not used. Any unused points should be placed outside the normal utilization range**.**

Diagram



Typical application

Flow temperature with night reduction as a function of the outside temperature.

If two successive To points are equal (vertical line) the maximum gradient applies and the LED turns red. This state can be acknowledged after correction of the parameters.

If a very steep line has been defined, a capacity overrun may occur and the LED turns red. This state can be acknowledged after correction of the parameters.

Reference

The set-point calculated by this function may be corrected by various set-point correction functions .

Dialogue

A dialogue function with the same name is available in the family HVC-Dialogue-HVC. All day set-points are adjustable. The night reduction is adjustable for all points simultaneously.

See also: Family HVC-Dialogue HVC

HVC-Dialogue, Overview

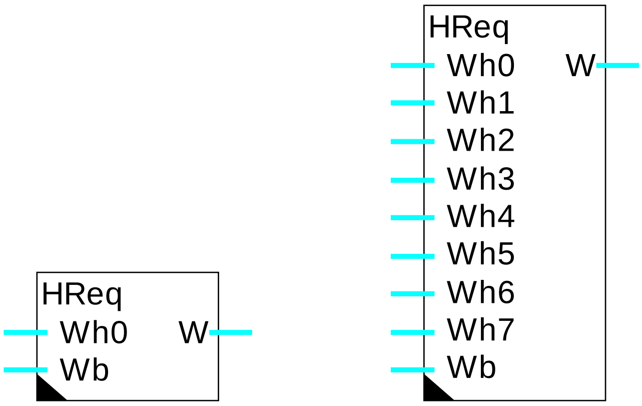
5.3 Heat Request

Family: **HVC-Set-point**

Name: **Heat Request**

Macro name: _HeaReq

Fbox:



Short description

Calculation of the temperature set-point for heat production as a function of heat request of each heating group (1 to 8) and a set-point reserve.

Inputs

Wh0	Set-point 0	Set-point of heating group 0
...		
Wh7	Set-point 7	Set-point of heating group 7
Wb	Boiler	Boiler set-point

Output

W	Set-point	Set-point corresponding to the highest request plus the set-point reserve

Parameters

Highest set-point Wh	Display of the highest flow set-point according to inputs Wh0...Wh7.
Set-point reserve	Set-point reserve between the above highest set-point and the output set-point. The reserve is not applied to the boiler request.
Minimum W	Minimum set-point limit
Maximum W	Maximum set-point limit

Description of the function

The highest set-point among inputs W0 to W7 is detected and displayed in the adjust window. This value can not be lower than 0. It is then increased with the set-point reserve. The boiler set-point Wb is then taken into account, but without set-point reserve. The highest value is limited by minimum and maximum adjustable values and reported on output W.

The set-point reserve should not be too low in order to avoid the controller working too close to the upper limit. A minimum regulation reserve of 20% is advised in stable situation. In this way the controllers work at 80% opening.

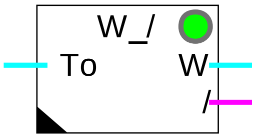
Typical application

This function is foreseen for definition of the burner optimum temperature set-point (heat production). It depends on the request from the heating groups and the boiler. These requests can be provided by various heat curves.

5.4 Set-Point Slide

Family:	**HVC-Set-point**
Name:	**Set-point slide**
Macro name:	_HeaSld2 (Old Fbox _HeaSld)
Dialogue:	Dialogue Fbox, see below.

Fbox:



Short description

Definition of the set-point for a room regulation. This function is provided for the definition of an ambient temperature set-point which slides dependant on the outside temperature.

Input

To	Outside temperature	Measurement of the outside temperature (filtered)

Outputs

W	Set-point	Offset set-point value
/	Slide	Set-point slide active

Parameters

Error, Acknowledge	Button for error acknowledge.
Set-point 1 [°C]	Basic set-point used before the slide zone. (d)
Outside temperature 1	Maximum outside temperature before temperature slide.
Set-point 2 [°C]	Set-point 2 in the slide zone as to define the slide line. (d)
Outside temperature 2	Outside temperature in the slide zone corresponding to set-point 2.
Maximum set-point [°C]	Maximum value for the set-point.
Dead range for output / [K]	Dead range between the switch-on point of output '/' and the switch-off point.

(d) Accessible parameter from terminal by using the dialogue auxiliary Fbox. See below.

Description of the function

The defined set-point, “Set-Point 1” is valid on the output until the outside temperature reaches “Outside Temperature 1”.

These 2 first values correspond to the first point of the curve. The set-point then begins to ‘slide’ up to a maximum of “Set-Point 2” as outside temperature rises to “Outside Temperature 2” where it is clamped.

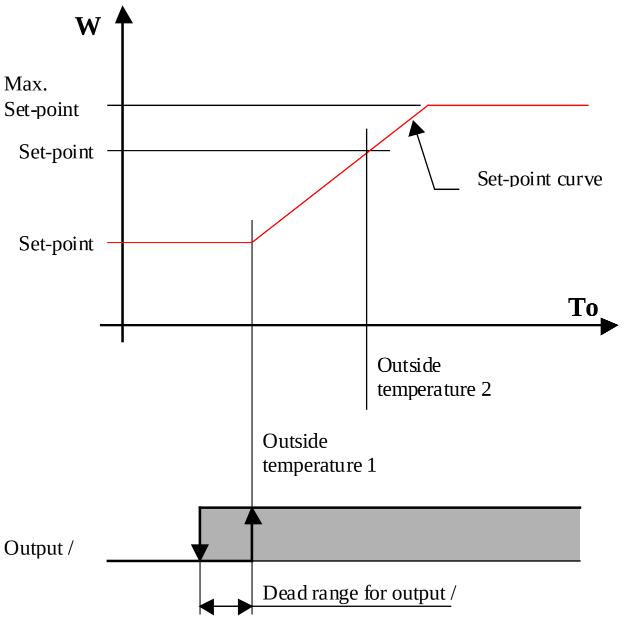
The slide is then made up to the maximum set-point which can be above or below point 2.

Set-point 2 must be higher than point 1.

If the defined gradient is too high, a capacity overrun may occur. In this case the maximum gradient applies and the LED turns red. The parameters must be adjusted and the LED can be acknowledged.

The digital output “/” is set to '1' once the outside temperature is above the slide zone. It is reset when it falls below the slide zone with an adjustable dead range. The heating system may be clamped in this zone. The function Air Mixer, Economy has an input for this signal.

Diagram



Typical application

This function is provided for the definition of an inside temperature of an air conditioned room. The slide is depending on the outside temperature. This slide allows to avoid discomfort due to high temperature differences. It saves air conditioned energy.

A temperature difference of 6°C between inside and outside is generally acceptable.

Dialogue

A dialogue function with the same name is available in the family HVC-Dialogue-HVC.

See also: Family HVC-Dialogue HVC

HVC-Dialogue, Overview

5.5 Set-Point Correction, Clock

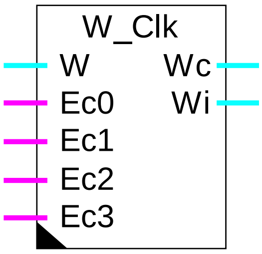
Family: **HVC-Set-point**

Name: **W / Clock** Old name**:** Fixed Shift Controller

Macro name: _HeaWcor

Dialogue: Dialogue Fbox, see below.

Fbox:



Short description

Correction of flow temperature set-point as a function of room temperature. E.g. day reduction resp. day increase. The various set-points can be switched on with clocks.

Inputs

W	Set-point	Basic set-point of flow temperature
Ec0	Enable	Binary signal for the activation of set-point 0
Ec1	Enable	Binary signal for the activation of set-point 1
Ec2	Enable	Binary signal for the activation of set-point 2
Ec3	Enable	Binary signal for the activation of set-point 3

Outputs

Wc	Set-point	Actual corrected set-point for flow temperature
Wi	Inside set-point	Display of the actual inside temperature set-point

Parameters

Reference	Set-point reference when no correction.
Factor	Multiplication factor for correction of the difference. (d)
Set-point 0	Correction of set-point 0. (d)
Set-point 1	Correction of set-point 1. (d)
Set-point 2	Correction of set-point 2. (d)
Set-point 3	Correction of set-point 3. (d)

Minimum	Minimum for corrected output.
Maximum	Maximum for corrected output.
Actual set-point	Display of the actual ambient set-point according to inputs 'Ec0' to 'Ec3'. Corresponds to output 'Wi'
Correction	Display of actual correction applied to set-point 'W'

(d) Accessible parameter from terminal by using the dialogue auxiliary Fbox. See below.

Description of the function

The flow temperature set-point (input 'W') is corrected as a function of the choice of room temperature ('Ec0' to 'Ec3') and the set-points (0...3) defined in the adjust window. This correction is achieved by comparing the chosen set-point with the reference value. The difference is multiplied by the factor obtained. This correction value (which can be viewed online) is added to the value at input 'W' and transferred to output 'Wc'. The set-point for the actual room temperature is sent to output 'Wi'.

Signals are processed in the following order: Ec0, Ec1, Ec2 and Ec3. If no signal is active, no correction is made: Wc = W.

Diagram

Diagram as a time function (Example)

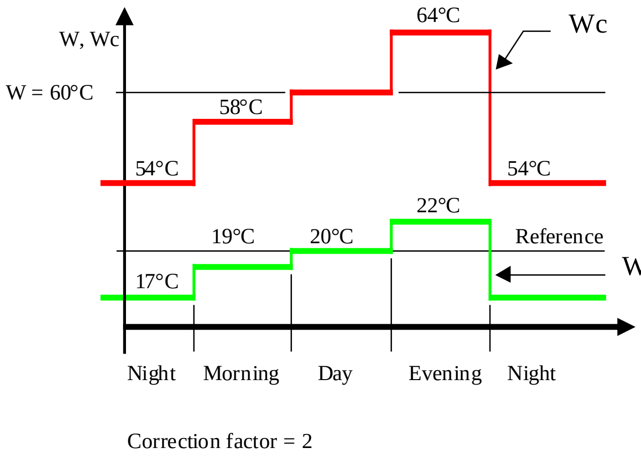
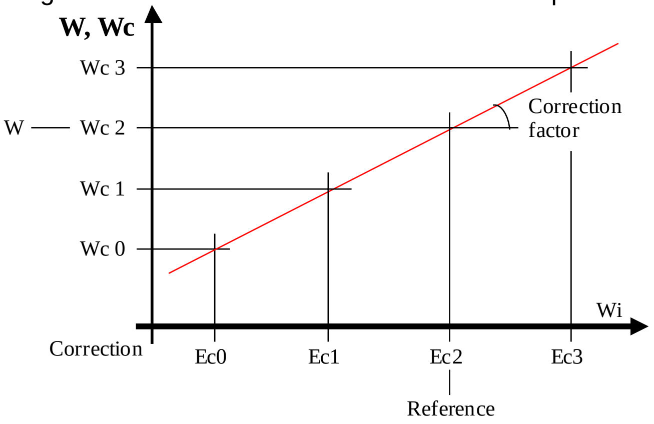


Diagram Wc as a function fo the corrected set-point Wi



Reference

This function is provided for the correction of flow temperature, dependent upon time signals from the clock for night-time, daytime or holiday reductions.

Dialogue

A dialogue function with the same name is available in the family HVC-Dialogue-HVC.

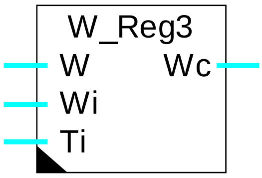
See also: Family HVC-Dialogue HVC

HVC-Dialogue, Overview

5.6 Set-Point Correction, 3-Points Controller

Family:	**HVC-Set-point**
Name:	**W / 3 points**
Macro name:	_HeaWreg5
Dialogue:	Dialogue Fbox, see below.

Fbox:



Short description

Correction of flow temperature set-point as a function of the ambient set-point and ambient temperature (room compensation). The correction is arrived at with a 3-point controller.

Inputs

W	Set-point	Basic set-point, flow temperature
Wi	Ambient set-point	Actual set-point, room temperature
Ti	Actual value	Actual value room temperature

Output

Wc	Set-point	Corrected set-point, flow temperature

Parameters

Action	Option for correction.
- Inverted	Inverted action. Standard case for heating and cooling.
- Direct	Direct action. Special case.
Offset	Offset on the Ti measured value. (d)

-----[Positive deviation, Ti > Wi]-----

Switch-on point	Switch-on point for correction by positive deviation. (d)
Dead range	Dead range for correction switch-off by positive deviation. (d)
Correction [absolute]	Correction for absolute value of W. (d)
	Indirect action: Wc = W - cor.
	Direct action: Wc = W + cor.

-----[Negative deviation, Ti < Wi]-----

Switch-on point	Switch-on point for correction by negative deviation. (d)
Dead range	Dead range for correction switch-off when difference is negative. (d)
Correction [absolute]	Correction for W as absolute value. (d)
	Indirect action: Wc = W + cor.
	Direct action: Wc = W - cor.
-----[Functional control]-----	
Ti + Offset	Display of calculation of input Ti + Offset.
Deviation	Display of actual deviation.
Correction	Display of actual correction

(d) Accessible parameter from terminal by using the dialogue auxiliary Fbox. See below.

Description of the function

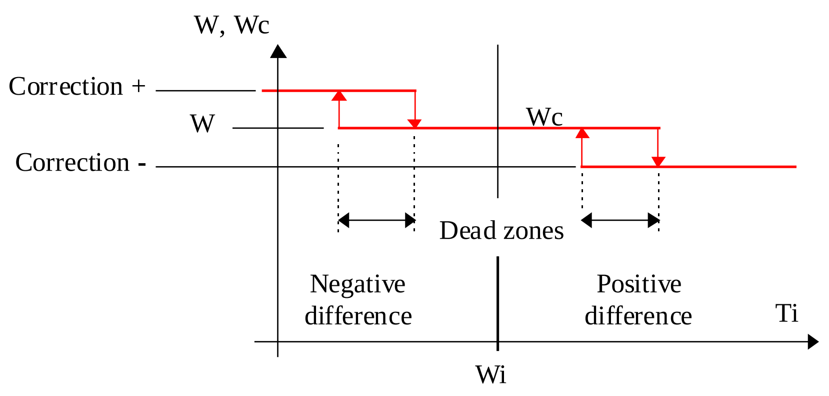
During the Restart cycle (see HVC-Init, Subfunction CPU Performance), the set-point is not corrected.

Inverted operation

If the divergence between measured temperature Ti and set-point Wi exceeds the defined parameter, a negative correction is made at the preset value for a positive difference. If this difference shrinks back and crosses the dead range, the correction is zero again. This function behaves symetrically, i.e. a negative difference produces a positive correction.

Output Wc is then equal to input W plus the correction.

Diagram



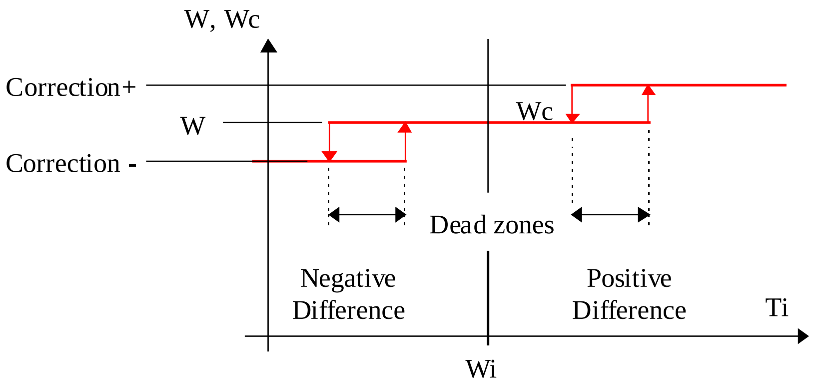
Direct operation

Special case.

Operation is identical. The function has an inverted preceding sign at the same points.

The value at output Wc is equal to the one at input W plus the correction.

Diagram



See also:

Additional Dialogue functions

Generalities about Dialogue HVC.

Dialogue

A dialogue function with the same name is available in the family HVC-Dialogue-HVC.

See also: Family HVC-Dialogue HVC

HVC-Dialogue, Overview

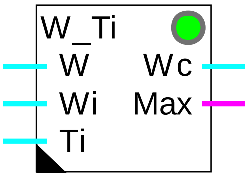
5.7 Set-Point Correction, Ambient Temperature

Family: **HVC-Set-point**

Name: **W / Ambient temperature**

Macro name: _HeaWti

Fbox:



Short description

Correction of flow temperature set-point as a function of the effective ambient temperature.

Inputs

W	Set-point	Set-point, flow temperature
Wi	Set-point inside	Actual set-point, room temperature
Ti	Room temperature	Actual value room temperature

Output

Wc	Set-point	Actual corrected set-point, flow temperature
Max	Maximum	Display exceeding of maximum difference of room temperature. Display also the deactivation of the set-point correction.

Parameters

Correction factor [K/K]	Set-point correction factor per degree of ambient temperature difference.
Maximum positive correction	Maximum positive correction.
Maximum negative correction	Maximum negative correction.
Deviation, Alarm	Temperature deviation for alarm state. In this state, the correction is no more applied.
Recovering time [sec]	Recovering time for set-point correction after alarm state.
Correction [K]	Display of the actual correction.

Description of the function

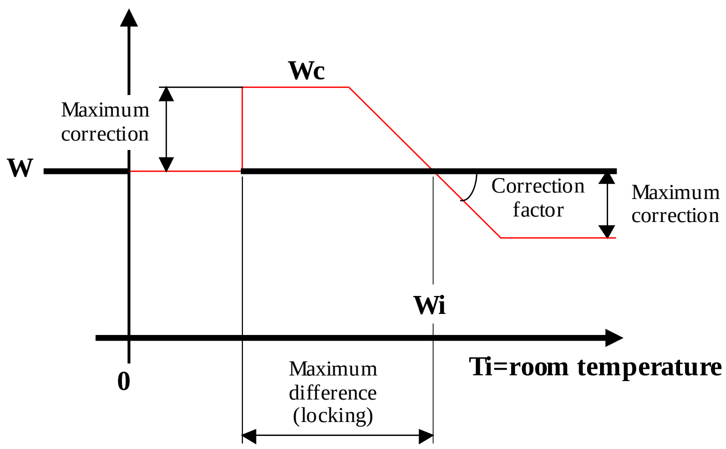
The correction is executed proportionally to the difference between the ambient set-point Wi and the measurement of Ti. This difference is multiplied by the adjustable correction factor. The correction is applied to the water flow set-point W. The corrected set-point is provided by the output Wc.

The correction is limited by adjustable maximum and minimum values.

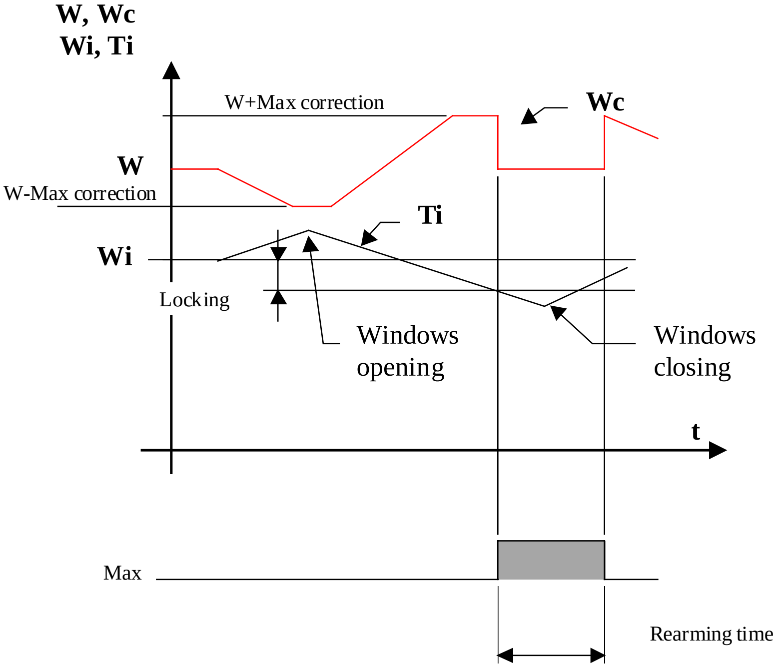
If the correction reaches the alarm threshold, it is admitted that an important disturbance occured and a set-point correction is no more needed (opened window). In this case, the correction is deactivated (correction=0, Wc=W) and the binary output Max is set to 1. The correction tries to switch-on after the adjustable rearming time. If the correction is reactivated, the binary signal Max comes back to 0.

The correction actually applied is displayed in the adjust window.

Diagram



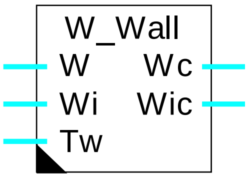
Example: Time diagram



5.8 Set-Point Correction, Wall Temperature

Family:	**HVC-Set-point**
Name:	**W / Wall temperature**
Macro name:	_HeaWwall

Fbox:



Short description

The function allows to correct the temperature set-point as a function of a measurement or a simulation of the wall surface temperature. It provides also a corrected ambient set-point.

Inputs

W	Set-point	Basic set-point of flow temperature
Wi	Ambient set-point	Actual set-point of room temperature
Tw	Wall temperature	Measurement (or simulation) of the actual wall temperature

Output

Wc	Set-point	Actual corrected set-point of flow temperature
Wic	Room temperature set-point	Actual corrected set-point of room temperature

Parameters

Correction parameters [K/K]	Set-point correction factor per degree of Wi - Tw difference.
Maximum positive correction	Maximum positive correction.
Maximum negative correction	Maximum negative correction.
Correction [K]	Display of the actual correction.

Description of the function

The function is based on the following principle: the temperature felt in a room correspond to the average between the ambient temperature and the wall surface temperature.

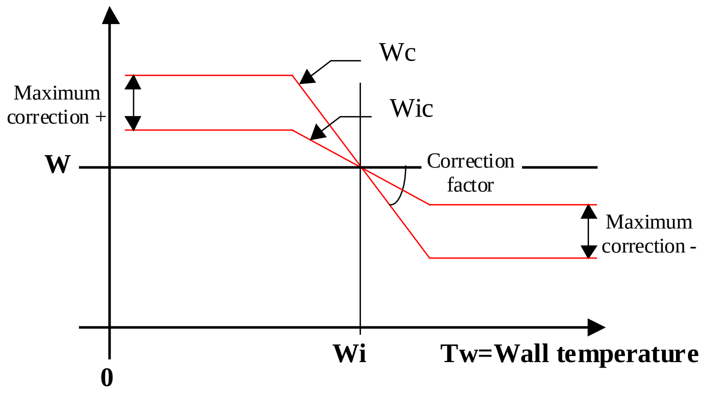
The correction of flow temperature 'W' is done proportionnally to the difference between ambient temperature 'Wi' and Wall surface temperature 'Tw'. The difference is multiplied by an adjustable correction factor. The correction is applied to the flow temperature set-point 'W'. The corrected set-point is available at output 'Wc'.

For the correction maximum and minimum values can be defined by the user.

The applied correction can always be viewed in the adjust window.

The ambient temperature set-point 'Wi' is corrected by a 1:1 ration compared to wall temperature 'Tw'. In this way, the average between wall temperature 'Tw' and corrected ambient temperature set-point 'Wic' is equal to the set-point 'Wi'.

Diagram



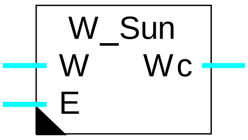
5.9 Set-Point Correction, Sun Radiation

Family: **HVC-Set-point**

Name: **W / Sun radiation**

Macro name: _HeaWsun

Fbox:



Short description

The function allows to correct the flow temperature set-point as a function of measurement of the sun radiation.

Inputs

W	Set-point	Basic set-point for flow temperature
E	Sunniness	Measurement of sun radiation

Output

Wc	Set-point	Actual corrected set-point for flow temperature.

Parameters

Correction factor [K]	Degrees to be corrected on the set-point for 100 Lux lighting (E).
Maximum correction [K]	Maximum correction. Negative correction only.
Correction [K]	Display of the actual correction.

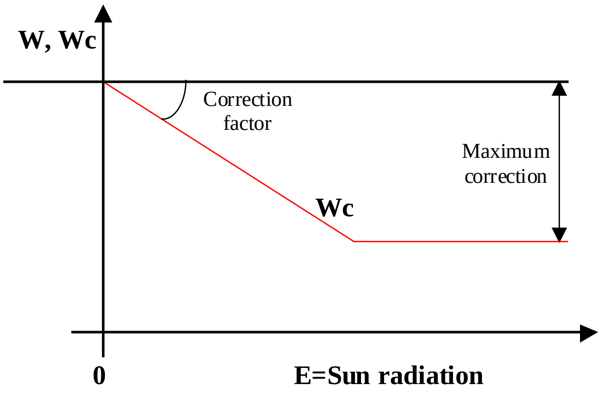
Description of the function

The correction is executed proportionally to the measurement of the sun lighting E. The signal is multiplied by the adjustable correction factor. It defines the correction for 100 Lux lighting. The correction is applied to the water flow set-point W. Only a negative correction is applied. The corrected set-point is provided by the output Wc.

The correction is limited by adjustable maximum value.

The correction actually applied is displayed in the adjust window.

<u>Diagram</u>


W, Wc
Correction
factor
Maximum
correction
Wc
0
E=Sun radiation

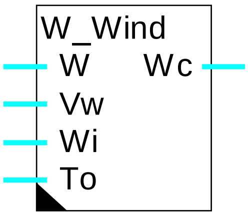
5.10 Set-Point Correction, Wind Speed

Family: **HVC-Set-point**

Name: **W / Wind**

Macro name: _HeaWwind

Fbox:



Short description

The function allows to correct the flow temperature set-point as a function of the measured wind speed.

Inputs

W	Set-point	Basic set-point of flow temperature
Vw	Wind speed	Measurement of wind speed
Wi	Ambient set-point	Basic set-point for ambient temperature
To	Outside temperature	Measurement (not filtered) of outside temperature

Output

Wc	Set-point	Actual corrected set-point for flow temperature

Parameters

Correction parameter [K]	Degrees to be corrected on set-point for a wind of 20 m/s and To -Wi différence = 5 K.
Maximum correction [K]	Maximum correction. Positive correction only
Correction [K]	Display of the actual correction.

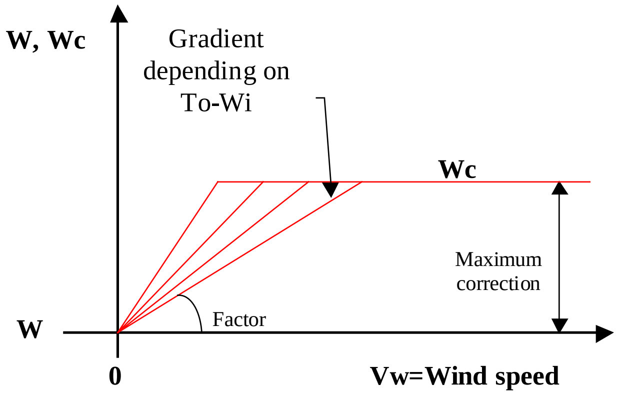
Description of the function

The correction of the flow temperature'W' is executed proportionally to the wind speed 'Vw' and the temperature difference between the ambient set-point 'Wi' and the outside temperature 'To'. These two parameters are multiplied together and by an adjustable correction factor. The factor defines the correction to apply for a wind of 20m/s and a temperature difference of 5K (100 mK/s). The correction is applied to the flow temperature set-point 'W' . Only positive correction is applied. The corrected set-point is supplied by the output 'Wc'.

The correction is limited by defined maximum value.

The correction actually applied is displayed in the adjust window.

Diagram



Notes

6. HVC-Controllers

Contents

6.1 Two Points Controller

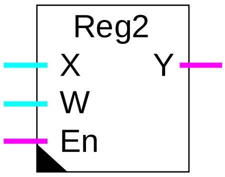
Family: **HVC-Controllers**

Name: **Controller 2 points**

Macro name: _HeaReg1 (Former _HeaReg2)

Dialogue: Dialogue Fbox, see below.

Fbox:



Short description

Two points controller: one digital output with hysteresis (Dead range).

Inputs

X	Input X	Regulating variable, e.g. measurement of actual temperature.
W	Set-point	Set-point value
En	Enable	Activation of the controller.

Output

Y	Output Y	Digital output for regulation. E.g. Heating switch-on.

Parameters

Action	Option for controller action	
	- Inverted	Inverted action. E.g. for heating
	- Direct	Direct action. E.g. for refrigeration
Initialization state		Option for initialization state.
	- Y = 0	The controller is initialized with the output Y = 0
	- Y = 1	The controller is initialized with the output Y = 1
	- Old value Y	The controller is initialized with the output in the state it was at switch-off.
Disabled state		Option for disable state (En=0).
	- Y = 0	The ouput Y is set to 0
	- Y = 1	The ouput Y is set to 1
Switch-on point		Switch-on point relative to the set-point W (d).
Switch-off point		Switch-off point relative to the set-point W (d).

Control deviation Xw	Display of the actual control deviation. Xw=X-W (d).
-----[Manual mode]-----	
Mode / Change	Display of the mode Manual / Automatic and toggle button.
Y manual / Change	Display of the manual state and toggle button.

(d) Accessible parameter from terminal by using the dialogue auxiliary Fbox. See below.

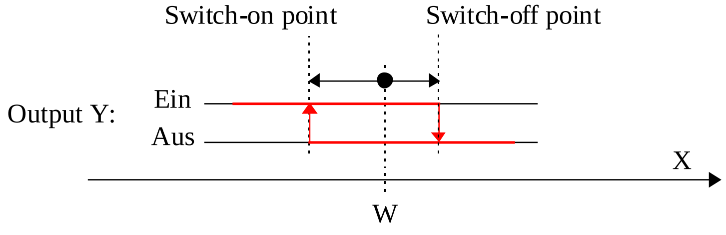
Description of the function

The Fbox supports a two-points controller: switch-on and off of a binary output. The switching points are adjustable relative to the set-point W. During the restart cycle (see HVC-Init, Subfunction CPU Performance) and at the moment when input En is activated, the output takes the state defined in the initialization option.

Operation for Action = Inverted

E.g. heating

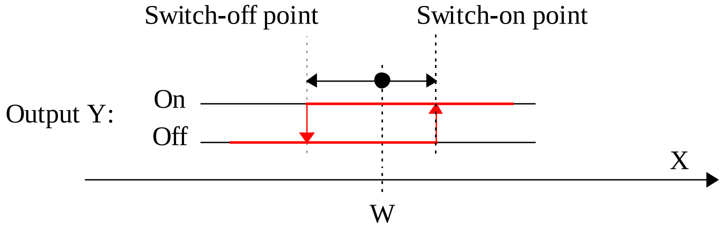
The output signal Y is switched on when controlled variable X is smaller than the set-point W plus the adjusted switch-on point. This parameter has usually a negative value. The output Y is switched off when controlled variable X is bigger than the set-point W plus the adjusted switch-off point. This parameter has usually a positive value.



Operation for Action = Direct

E.g. refrigeration

The output signal Y is switched on when controlled variable X is bigger than the set-point W plus the adjusted switch-on point. This parameter has usually a positive value. The output Y is switched off when controlled variable X is smaller than the set-point W plus the adjusted switch-off point. This parameter has usually a negative value.



If the activation signal En is at 0, the output takes the state defined in the option 'Disabled state'.

The output Y can be forced using the manual mode. For working in manual mode, switch first from automatic to manual. The controller remains then at the actual state. The output can then be switched using the button 'Y manual'. As to come back in automatic mode, switch the mode from manual to automatic.

Dialogue
A dialogue function with the same name is available in the family HVC-Dialogue-HVC.

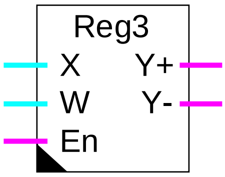
The swotch-on and switch-off points are changeable. The difference is displayed.

See also Two Points Controller, old Version.

6.2 Three Points Controller

Family:	**HVC-Controllers**	
Name:	**Controller 3 points**	
Macro name:	_HeaReg3	(Former _HeaReg5)

Fbox:



Short description

Three points controller: two digital outputs with each two switching points.

Inputs

X	Input X	Regulating variable, e.g. measurement of the actual temperature.
W	Set-point	Set-point value
En	Enable	Activation signal of controller.

Output

Y+	Y Open	Digital signal for positive regulation, e.g. opening of mixing valve.
Y-	Y Close	Digital signal for negative regulation, e.g.closing of mixing valve.

Parameters

Action	Option for the controller action	
	- Inverted	Inverted action. E.g. heating
	- Direct	Direct action. E.g. cooling
Initialization state		Option for initialization state.
	- Y+ = 1	The controller is initialized with output Y+ = 1 and Y- = 0
	- Y+- = 0	The controller is initialized with output Y+ = 0 and Y- = 0
	- Y- = 1	The controller is initialized with output Y+ = 0 and Y- = 1
	- Old Y+-	The controller is initialized with outputs in the same state as at switch-on.
Disabled state		Option for the controller state when disabled (En=0).
	- Y+ = 1	The output Y+ is set to 1 and Y- to 0
	- Y+- = 0	The output Y+ is set to 0 and Y- to 0
	- Y- = 1	The output Y+ is set to 0 and Y- to 1

Switch-on point Y+	Switch-on point for Y+ relative to the set-point W
Switch-off point Y+	Switch-off point for Y+ relative to the set-point W
Switch-off point Y-	Switch-off point for Y- relative to the set-point W
Switch-on point Y-	Switch-on point for Y- relative to the set-point W
Control deviation Xw	Display of the actual control deviation. Xw=X-W
-----[Manual mode]-----	
Mode / Change	Display of the mode Manual / Automatic and toggle button
Y+ manual / Change	Display of the manual state of Y+ and toggle button
Y- manual / Change	Display of the manual state of Y- and toggle button

Description of the function

The Fbox supports a two-points controller: switch-on and off of two binary outputs. The working principle of Y- is inverted regarding Y+. The switching points are adjustable relative to the set-point W.

The controller has three possible state:

- Y+ switched on and Y- switched off
- Y+ and Y- switched off
- Y+ switched off and Y- switched on

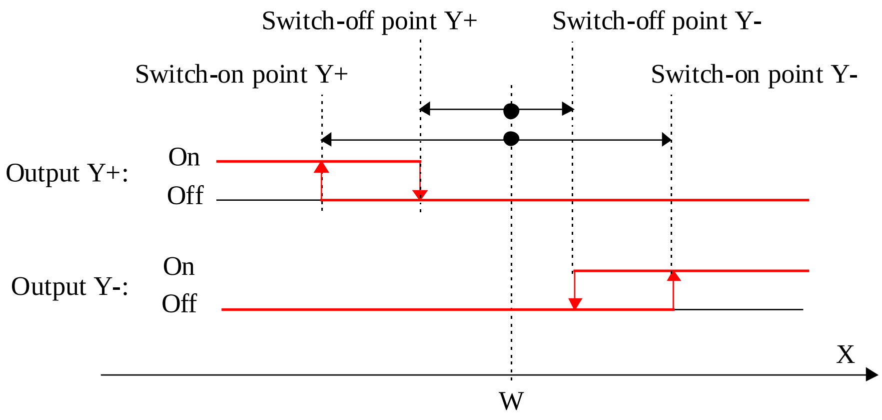
During the restart cycle (see HVC-Init, Subfunction CPU Performance) and at the moment when input En is activated, the output takes the state defined in the initialization option.

Operation for Action = Inverted

E.g. heating

The output signal Y+ is switched on when controlled variable X is smaller than the set-point W plus the adjusted switch-on point for Y+. This parameter has usually a negative value. The output Y+ is switched off when controlled variable X is bigger than the set-point W plus the adjusted switch-off point for Y+. This parameter has usually a negative value.

The output signal Y- is switched on when controlled variable X is bigger than the set-point W plus the adjusted switch-on point for Y-. This parameter has usually a positive value. The output Y- is switched off when controlled variable X is smaller than the set-point W plus the adjusted switch-off point for Y-. This parameter has usually a positive value.

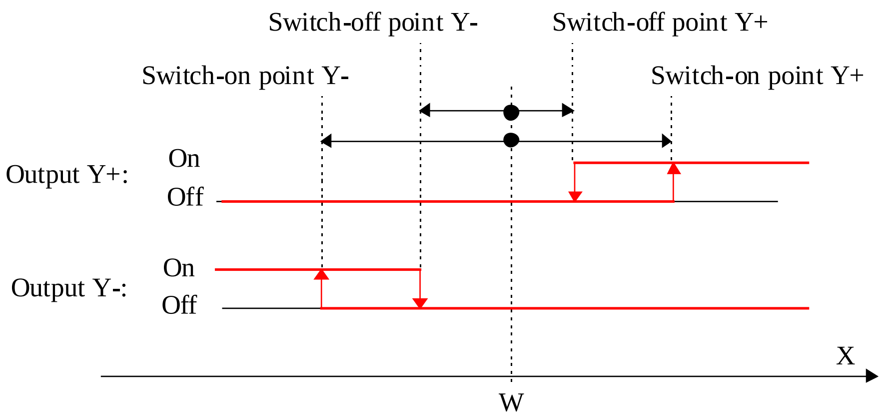


Function for action = Direct

(e.g. Cooling)

The output signal Y+ is switched on when controlled variable X is bigger than the set-point W plus the adjusted switch-on point for Y+. This parameter has usually a positive value. The output Y+ is switched off when controlled variable X is smaller than the set-point W plus the adjusted switch-off point for Y+. This parameter has usually a positive value.

The output signal Y- is switched on when controlled variable X is smaller than the set-point W plus the adjusted switch-on point for Y-. This parameter has usually a negative value. The output Y- is switched off when controlled variable X is bigger than the set-point W plus the adjusted switch-off point for Y-. This parameter has usually a negative value.



If the activation signal En is at 0, the outputs take the state defined in the option 'Disabled state'.

The outputs Y+ and Y- can be forced using the manual mode. For working in manual mode, switch first from automatic to manual. The controller remains then at the actual state. The outputs can then be switched using the buttons 'Y manual'. As to come back in automatic mode, switch the mode from manual to automatic.

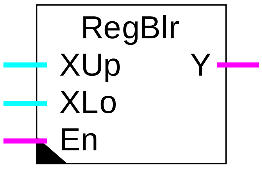
6.3 Boiler Load

Family: **HVC-Controllers**

Name: **Boiler load**

Macro name: _HeaRegB

Fbox:



Short description

Two points controller for boiler load with 2 temperature sensors.

Inputs

XUp	X up	Measurement of upper temperature for load switch-on.
XLo	X low	Measurement of lower temperature for load switch-off.
En	Enable	Activation signal of controller

Output

Y	Output Y	Binary signal for control of the load pump.

Parameters

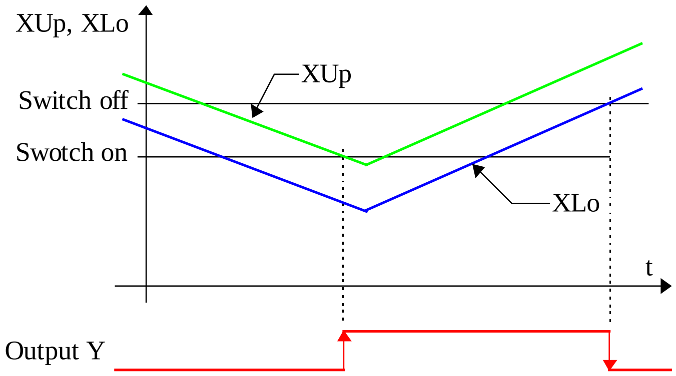
Initialization state		Option for initialization state.
	- Y = 0	The controller is initialized with output Y = 0
	- Y = 1	The controller is initialized with output Y = 1
	- Old value Y	The controller is initialized with output in the switch-off state.
Priority		Priority option when the switch-on and switch-off conditions are simultaneously fullfilled.
	- Off	The priority is given to switch-off.
	- On	The priority is given to switch-on.
Switch-on point		Temperature set-point for load switch-on.
Switch-off point		Temperature set-point for load switch-off.

Description

During the Restart cycle (See Initialization-Generalities) as well as during the first time of En input activation, the output takes the state defined in the initialization option.

The output signal is switched on when the measurement of the upper temperature becomes smaller than the switch-on point. It is switched off when the measurement of the lower temperature becomes greater than the switch-off point.

In the boiler, the temperature of the upper part is normally higher than the lower part. The switch-on and switch-off points must be adjusted accordingly. However, if the switch-on and switch-off conditions are fullfilled simultaneously, the priority is given according to the selected option.



If the activation signal En is at 0, the output is set to 0.

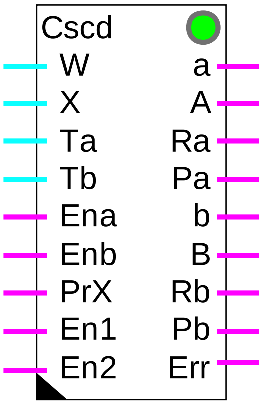
6.4 Burner cascade 2*2

Family: **HVC-Controllers**

Name: **Burner cascade 2*2**

Macro name: _HeaCsc2

Fbox:



Short description

Cascade of 2 burners, each with 2 heat settings (low and high jet). This function uses 4 x 2-point controllers to control 2 burners, each with a low and a high jet heat setting. It achieves this by taking into account each burner's enable signal, the run release signals for 1 or 2 burners, and a priority signal. Depending on temperature measurement at the burner outputs, the controllers are activated or deactivated.

When a burner is running, its pump is also activated.

Inputs

W	Set-point	Set-point, common reference for all levels.
X	Controlled variable	Measurement of actual value. Flow or return temperature.
Ta	T Burner A	Measurement of flow temperature of burner A
Tb	T Burner B	Measurement of flow temperature of burner B
Ena	Enable A	Release burner A
Enb	Enable B	Release burner B
PrX	Priority	Signal priority inversion. 0=Priority A. 1=Priority B.
En1	Enable 1	Release 1 burner only
En2	Enable 2	Release both burners

Outputs

a	Burner A, low jet	Function control burner A, low jet
A	Burner A, high jet	Function control burner A, high jet
Ra	Controller A	Activation, output controller burner A
Pa	Pump A	Activation, burner pump burner A
b	Burner B, low jet	Function control burner B, low jet
B	Burner B, high jet	Function control burner B, high jet
Rb	Controller B	Activation, output controller burner B
Pb	Pump B	Activation, burner pump burner B
Err	Error	General error display. No burner available.

LED

The LED takes the same state ass the Err output: 0=green, 1=red

Parameters

-----[Burners]-----	
Dead time LJ-HJ	Waiting time [sec] from low jet to high jet and vice versa.
Dead time 1-2	Waiting time[sec] between switching from 1 to 2 resp. from 2 to 1 burner.
Option dead time	Option for starting the above waiting time.
- Instantly	The dead time starts immediately when switching to a higher/lower stage. It works as a temporary latching of the next stage.
- On request	The dead time starts when the next stage higher/lower is required. It works like a delay of each stage switch-on.
Bypass dead time	Maximum difference from which the above dead time is ignored. The bypass is only valid when stages upwards.
Burner offset	Highest switch-off point relative to the burner set-point.
Stage 0-1	Additional difference for switching on the first burner.
Stage LJ-HJ	Additional difference for switching to high jet, 1st and 2nd burner.
Stage 1-2	Additional difference for switching from 1 to 2 burners.
-----[Controllers]-----	
Controller offset	Switching off point of controllers compared to set-point.
Controller dead range	Dead range between the switch-on and switch-off of controllers.
Hold time 2nd controller	Hold time of 2nd controller after low jet switch-off.
-----[Functional control]-----	
Temperature difference	Display of the actual setting difference.
Switch-on point,	Display of switch-on point of the next stage.
Switch-off point	Display of switch-off point of the next stage.

Timer wait [sec]	Display of waiting time for changeover to a higher or lower stage.
Timer hold [sec]	Display of waiting time for holding controller 2 after low jet switch-off.

Description of the function

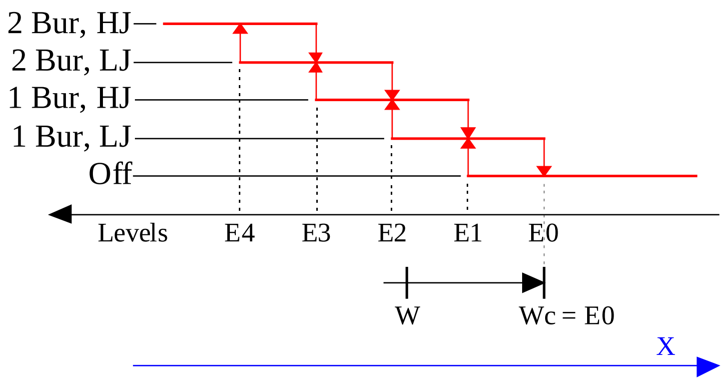
Cascade of 2 burners, each with 2 heat settings (low and high jet). This function uses 4 x 2-point controllers to control 2 burners, each with a low and a high jet heat setting.

The common reference point is set-point W which, for example, is defined by a heating gradient function. The lowest switching point (switch-off, 1 burner, low jet) is set with the parameter 'burner offset'. The spacing of subsequent points is defined with the parameters 'Stage 0-1', 'Stage Low Jet -High Jet', 'Stage 1-2' and once again 'Stage Low Jet -High Jet '.

The effective measured temperature, X, can be the flow temperature or the return temperature. Parameters for the offset and stages must be defined accordingly.

The temperature difference and the currently active commutation points (of the difference) are shown in the adjust window.

Diagram



Key:

1 Bur = 1 burner

2 Bur = 2 burner

HJ = high jet

LJ = low jet

Wc = W (setpoint) + burner offset

D0 = deviation = offset

D1 = D0 + stage 0-1

D2 = D1 + stage LJ-HJ

D3 = D2 + stage 1-2

D4 = D3 + stage LJ-HJ

Delay timers

There is a delay time which starts after any switching on or off to prevent the immediate switching of 2 successive stages. According to the parameter 'Option dead time', the delay timer is started immediately after the switching to the next step (Immediately) or only when the request for the next step comes for the first time (Request).

The delay timer can be cancelled through a bypass for the switching to a next step. This accelerates the temperature attainment of the plant when switching the set-points on 'Day'. The bypass is adjustable up to the maximum value of the deviation. The delay timer remains always active for the switch-off steps.

The operation of the delay timer can be view online in the adjust window.

Maintenance of 2nd burner

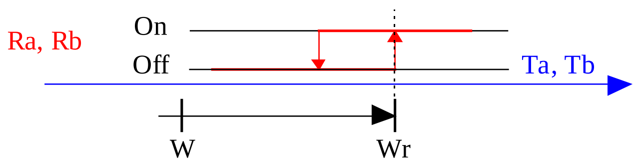
When the 2nd burner is switched off (no longer required, or authorization withdrawn), a maintenance delay timer starts up. If the burner is still not in operation when the delay timer reaches zero, its controller and pump are switched off. This avoids heating an unused burner with the heat generated by the first burner.

The operation of the delay timer can be view online in the adjust window.

Temperature maintenance, liberation of controllers

Controllers Ra and Rb are enabled as a function of output temperature at burners Ta and Tb relative to set-point W. When the burner temperature is below a minimum threshold, the controller is desactivated. This signal has to be used for burner preheating in closed loop. When a sufficient temperature is attained, the controller is liberated by the output Ra resp. Rb and the produced heat is sent to the heating system. The switch-off point is set with the parameter 'Controller offset'. The dead range defines the gap between switching on and switching off points.

Diagram:



Key:

Wr = W + controller offset = switch-on point

Pumps control

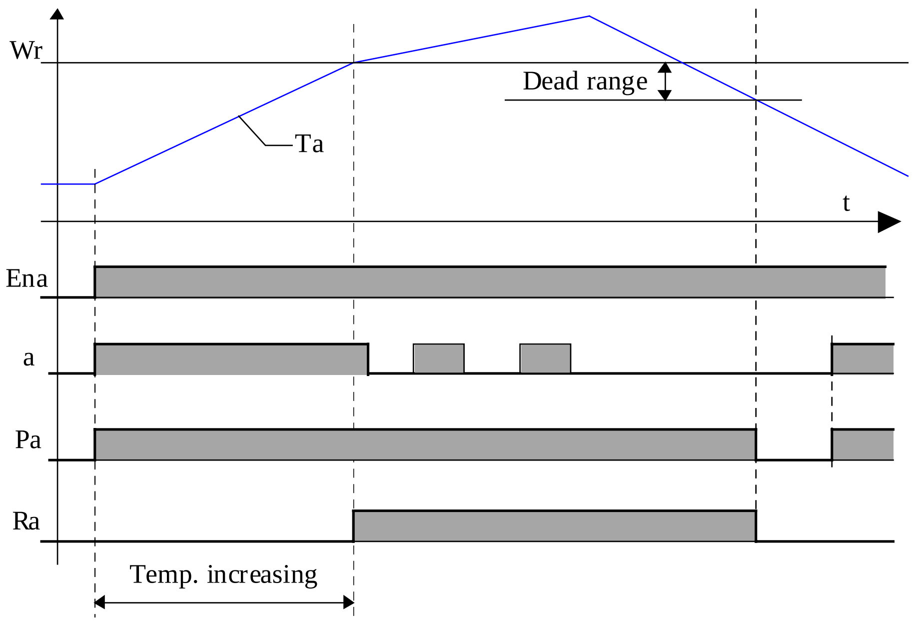
When a burner is in operation, its circulating pump is also activated by the output Pa resp. Pb. It can be also activated during the temperature attainment if at least the low jet is in operation.

In other words:

- when the burner is cold, the pump is activated if the burner is in operation
- when the burner is hot, the pump is always running

Moreover, the command of the pump of the second burner is switched off by the maintenance function described above even if the burner is hot.

Time diagram



Priorities and authorisations

In principle, burner A has priority (PrX = 0). Burner B is therefore activated with secondary priority. Input PrX allows these priorities to be reversed (PrX = 1). This inversion is taken into account when both burners are switched off completely, or when both are switched on at high jet.

This signal can be defined by comparing operating times to achieve equal use of both burners. For installations where the burners have differing capacities, priorities can be defined as a function of energy requirement. For example: low outside temperature -> priority to the more powerful burner.

2 Bur, HJ	=	a,A,b and B switched on
2 Bur, LJ	=	a,A and b switched on
1 Bur, HJ	=	a and A switched on
1 Bur, LJ	=	a switched on

Under reverse priority setting (PrX = 1):

a and A reversed with b and B.

The operation of a burner is enabled if the corresponding input (EnA or EnB) is at 1. When operation of a burner has not been enabled, the second one automatically receives priority to start running. If neither is enabled (EnA and EnB at 0), the LED is red.

The enable signals EnA and EnB also switch-off the activation signals of controllers Ra and Rb, and pump controls Pa and Pb.

Typical application

The Fbox Heat Request has been developed as to define the set-point signal W of the burner cascade.

The temperature holding can be realized with the auxiliary function of controllers P-PI and P-PID.

6.5 Generalities About Continuous Controllers

This general description is valid for all controllers (P, PI, PID). Individual descriptions contain only particularities and differences compared to this general description.

The HVC-Controllers family contain 2 types of regulation Fboxes.

The first generation of controllers:

- Controller PZ
- Controller PI
- Controller PID

The second generation of controllers:

- Controller P
- Controller P-PI
- Controller P-PID

The second generation of controllers has been introduced from version $136 as to answer to the following need:

- More simple P Controller
- Optional parameters for P factor or Xp Band
- Relative outpout limit
- Dead range integrated in the contoller
- Automatic integral switching
- Derivation on X or Xw
- Auxiliary functions
- Initialization at set-point value for controllers in cascade

Inputs

X	Input X	Controlled variable. E.g. measurement of the actual temperature.
W	Set-point	Set-point value
Z	Disturbance	Measurement of the disturbance value. For PZ controller only.
A	Auxiliary	Auxiliary value. Function according to option for auxiliary value. For P-PI and P-PID controller only.
En	Enable	Activation signal of controller

Output

Y	Output Y	Controller output. E.g. Position of the mix valve

LED

The LED may be red in the following situations:

- Capacity overflow during calculation
- The controller is in manual mode
- The integrator reduction is active
- The integrator is deactivated by the automatic switching function
- The integrator is deactivated by the output reduction function

The LED turns automatically back to green, without acknowledge, as soon as the controller works normally again.

Parameters

Comment: the units mentioned below do not apply in all cases.

Action	Option for controller action.
- Inverted	For example heating. The correction of the controller output Y is operated in opposite direction as the controlled variable X.
- Direct	For example cooling. The correction of the controller output Y is operated in same direction as the controlled variable X.
Limits	Option for limited output values. Operating point for P controller is also affected by this option. For controllers without this option, the limits are always considered as absolute.
- Absolute	The upper and lower limits are absolute values for the output Y.
- Relative	The upper and lower limits are relative values to the set-point W.
Proportional factor	Option for parameters of the proportional part. For controllers without this option, the parameters are given by the amplification factor.
- Band Xp	The proportional factor is given as band Xp.
- Amplification Fp	The proportional factor is given as amplification Fp.
Initialization option	Option for initialization point.
- Initial	The controller is initialized with the fix value defined below.
- Old Yi	The controller is initialized with the Yi value when deactivated.
	For PI and PID controllers, the initialization is applied to output Y.
- Set-point W	The controller is initialized with the value of set-point W.
Derivated signal	Option for the derivated signal. Controller P-PID only. For PID controller without this option, the derivate is always operated on the difference Xw.
- Difference Xw	The derivative is operated on difference Xw.
- Input X	The derivative is operated on input X. It does react to set-point variations.
Auxiliary function	Option for activation of an auxiliary function

- None	No auxiliary function. The A input is not used.
- Reduction I	The A input reduces proportionally the integration effect if lower than 100.0%.
- Reduction Y	The A input interrupts the integration and reduces proportionally the output signal Y if lower than 100.0%.
Deactivated value [%]	Value of Y output when En input is at 0. See following diagram.
Initialization point [%]	Initialization point if above option is defined on 'Fix'.

-----[Online parameters]-----

Offset X [°C]	Offset value applied to signal X before calculation of regulation difference.
Proportional factor Fp/Xp	Parameter for proportional part of the controller. Xp or Fp according to above option.
Integration time Ti [sec]	Parameter for the integral part of the controller.
Switching PD-PID [%]	Threshold of Xw difference for integrator switching.
Derivation time Td [sec]	Parameter for derivated part of controller.
Filter time T1 [sec]	Parameter for filter of the derivated part of controller.
Lower limit Yi [%]	Lower limit of integration memory Yi
Upper limit Yi [%]	Upper limit of integration memory Yi
Lower limit Y [%]	Lower limit of output signal Y
Upper limit Y [%]	Maximum limit of output signal Y
Dead range [%]	Dead range for output signal Y.

-----[Operation point with disturbance compensation]----- For controller PZ only

Operation point [%]	Operating point value at disturbance reference
Disturbance reference	Disturbance reference (Z) for starting point of working point slide
Shift [%]	Shift of operation point in % of the disturbance difference compared to the reference
Lower limit OP [%]	Lower limit of working point
Upper limit OP [%]	Upper limit of working point

-----[Functional control]-----

Controlled variable X [°C]	Measurement of controlled variable X or Xoff. Xoff is the X value corrected by the adjusted offset.
Regulation difference Xw [K]	Calculation of actual regulation difference. Monitoring of difference allows to check the controller stability.
Proportion of Yp [%]	Proportional part of controller
Proportion of Yi [%]	Limited integral part of controller
Proportion of Yd [%]	Filtered derivated part of controller
Controlled value Y [%]	Output signal of controller

-----[Manual mode]-----

Mode	Switching button and display of manual or automatic mode.
Y manual [%]	Y output value in manual mode.

Description

Generally, the controller has the mission of keeping a controlled variable (Input X) as close as possible as a set-point (Input W) in acting on the controlled value (Output Y). Moreover, the controller has to keep the process stable and must react as quick as possible to set-point and disturbance modifications.

Basic knowledge of regulation techniques is required for selecting a regulation strategy and correct putting into service a regulation loop. It is important to note that a regulation loop behavior is influenced by all elements (hardware and software) being in the regulation loop. Some important characteritic among others are the resolution, accuracy, working range, linearity, interference immunity, dimensions and location of the measuring and regulating elements.

The following Fboxes play a role in the use of a controller:

- Set-point and set-point corrections
- Filters
- Output 2-Points
- Output 3-Points
- Output 3-Points with Reference
- Air Mixer
- Air Mixer Economic
- Sequence, Master, Heating / Cooling
- Sequence, Master, Heating / Mix / Cooling
- Sequence, Master Burner

Units

The indicated units correspond to a typical temperature regulation application (°C and K). The output signal is foreseen for a proportional valve (0..100%). It means that all parameters with unit [°C] or [K] are regarding the controlled variable 'X'. The parameters with unit [%] are regarding the controller output 'Y'.

If the controller is used for other physical values, the units must be replaced by applicable ones.

Example 1: Regulation of relative humidity.

The units [°C] and [K] must be replaced by [rH] (relative humidity).

Example 2: Regulation of cascade temperature.

Units

The controller of ambient temperature provides a temperature set-point for pulsion controller.

For the first controller, the units [%] must be replaced by [°C].

Offset

Available for PZ, PI and PID controllers.

At controller input, the measured signal X is increased with an adjustable offset. It allows, among others, to correct the difference between the effective controlled variable Xoff and the measuring point X.

For other controllers, if necessary, the offset can be realized by an 'Add' Fbox on the measurement of the controlled variable 'X'.

Proportional part

The P part acts in fact on the complete algorithm (P, I and D parts).

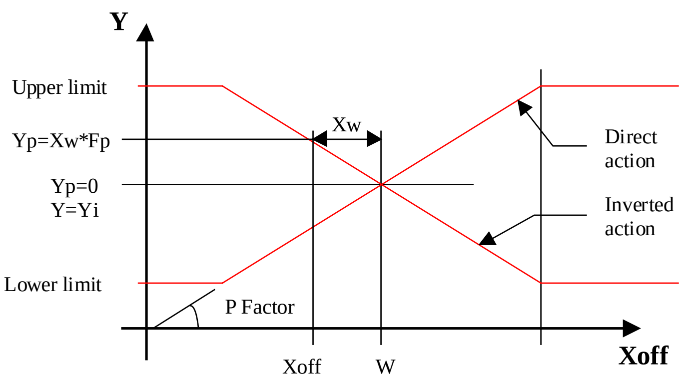
The amplification regards the difference Xw. The amplification is not depending on the output range. The more Fp is high, the more the controller reacts strongly to regulation differences. A too high amplification leads to an unstable regulation loop.

The Xp band represents the difference (Xw = X-W) which leads to a maximum correction of output (Ymax-Ymin).

The proportional band (Xp) has an inverted behavior compared to amplification. The more the proportional band is low, the more the controller reacts strongly to regulation differences. A too low band Xp leads to an unstable regulation loop.

Relations: Fp = (Ymax - Ymin) / Xp

Xp = (Ymax - Ymin) / Fp



Offset

Proportional_part

[#] Operating point

This function is available with controllers P and PZ.

The working point is also concerned by the option 'Absolute/relative limits'. If the limits are relative, the working point is equal to the set-point W. It means that the controller output Y is equal to the set-point W when the difference is zero. The correction of the output Y is then made from this point. This option has only a meaning if the the output signal has the same units as the set point (for example W in °C and Y in °C).

In the PI and PID controllers, the working point function is insured by the integration memory.

[#] Operating point with disturbance compensation

The PZ' controller has a working point with slide. The controller works around a point that can be slided depending on a disturbance given on input Z.

For example:

- outside temperature
- room occupation
- set-point

The sliding has always a indirect effect. It increases the output when the disturbance decreases. This is the case for a heating regulation controlled by the outside temperature. For a good performance, the working point and its slide must be adjusted so that the remaining difference is zero, or as small as possible, in the known disturbance conditions.

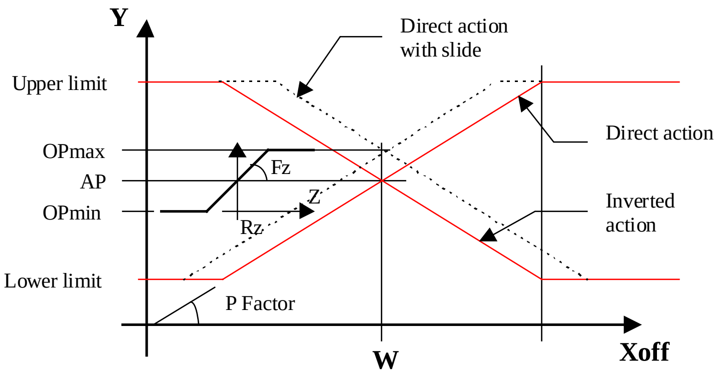
For deactivating the compensation effect, the slide of the working point must be set to 0 %. As to invert the compensation effect, the slide parameter must be negative.

[#]

[#] Operating_point

[#] Disturbance_compensation

[#] Diagram1



Fz = Correction factor for the working point slide
Rz = Disturbance reference
Z = Disturbance
OP = Operating point
OPmax = Upper limit of operating point
OPmin = Lower limit of operating point

Integral part

The integral part, corrects progressively the remaining differences after correction of the P part. The integration time is the necessary time for the I part to provide the same correction as the P part. In this way, the more the time Ti is short, the more the controller corrrects quickly. If the time is too short, the regulation loop becomes unstable.

As to reduce the integrator effect, the time Ti must be high.

The integration memory is limited to adjustable limit values. In standard cases, the integrator limits are the same as output Y. In P-PI and P-PID controllers, the same parameters are applied to the integrator and to the output Y.

Integrator switching

This automatic switching of the structure is available with controllers P-PI and P-PID.It is useful at controller start and for all cases where the regulation difference is very high. In this situation, the suppression of the integration avoids that big differences modifies deeply the integration memory. The controller dynamism is than improved when the set-point value is reached. The switching in PI or PID mode is done automatically when the difference goes below the adjusted value. When the intragrator is deactivated, the LED is red.

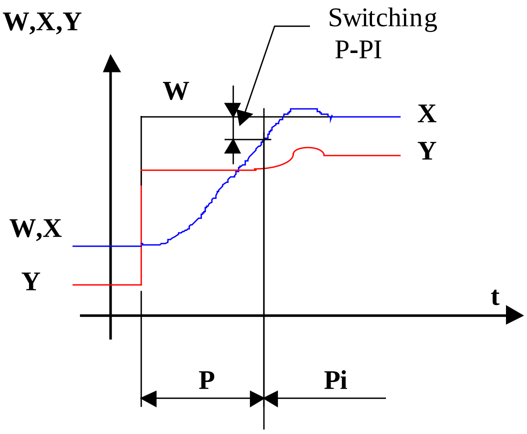
Caution ! if the switching point is too low, it may occur that the controller in P mode is no more able to reduce the difference below the limit and the changeover in PI mode is no more possible.

Integral_part

Integrator_switching

During deactivation of integration, the P and D parts remain active.

Diagram:



Integrator reduction

This function is available with controllers P-PI and P-PID.

It is foreseen for usage in sequence regulation structures. The integration effect can be reduced in the dead ranges between the various sequences. It avoids small remaining differences causing a too quick switching to the next sequence. When the integrator reduction is active, the LED is red.

Derivated part

The derivated part corrects immediately the difference variation before correction of the P part. The derivation time is the time of one variation from 0 to a given difference as to provide the same correction than the P part for the same difference.The more the time Td is high the more the controller corrects strongly. If the time is set to high, the regulation loop becomes unstable.

To smoothen the nervous reaction of the D part, it is associated to a 1st order filter whose time constant is adjustable.

Typical values: Td = Ti/4

T1 = Td/4

To attenuate the derivate effect, introduce a low Td time and a high T1 time.

The derivated part of a controller is often difficult to use. In standard cases, it is advisable to use a PI controller only.

Integrator_reduction

Derivated_part

Derivated on Xw or on X

Available with P-PID controller. This option allows to activate the derivated function on the Xw difference or on the X signal directly.

The derivate on the difference allows to react to variations of the controlled variable X and to set-point modifications. It is not advised in casees where the set-point regulation varies suddently (set-point jumps, regular manual changes of set-point).

The derivate on the X signal, reacts to variations of the controlled variable but not set-point changes. It avoids output signal jumps when set-point is changing.

[#] Reduction of Y output

This auxiliary function is available with controllers P-PI and P-PID. It allows to reduce the Y output value of controller proportionally to the auxiliary signal. It is useful for controllers for flow temperature. It allows to keep the boiler temperature by acting directly on the flow valves.

The auxiliary signal A must be controlled by a P controller with direct action, connected to return water temperature (X). In normal regulation mode, the auxiliary signal is at 100.0 %. The controller works free. When the signal A is lower than 100.0%, the controller output Y is reduced proportionally. To avoid the compensation due to the resulting difference, the integration function is deactivated. Only the P and D are still in function.

When the Y output reduction is activated, the LED is red.

[#] Dead range

The dead range allows to avoid permanent movements of the valves due to measurement variations. The output signal remains fix as long as the correction that has to be made is lower than the dead range value. A too high zone value reduces the regulation performances or lead to unstable regulation loop.

For controllers without integrated dead range, the Fbox Dead Range can be connected to the output Y of the controller.

[#] Manual mode

To avoid 'windup' effects, it is advisable to use the internal manual mode instead of a manual Fbox outside the controller.

[#] Reduction_of_Y_input

[#] Dead_range

[#] Manual_mode

For using the manual mode it is necessary to switch first from automatic mode to manual mode. The output remains then fixed to the actual value. The introduction and the transfer of a manual value allows to force the output. When switching in automatic mode, the regulation is made from the manual actual value. In manual mode the LED is red. The output limitation is not valid in manual mode but is activated when switching in automatic mode.

Working range and limitation of output signal Y

The controller working range is an important characteristic.

- It influences the controller behavior when using the band Xp.
- Some auxiliary Fboxes and regulation devices require a symetrical working range (positive and negative)
- The controller working range is defined by the limits of the output signal Y. It must be adapted to the working range of the regulation device and take into account all Fboxes and elements concerned.
- In a cascade structure, the working range of the main controller defines the set-point limits of the subordonate controller.

Controller restart

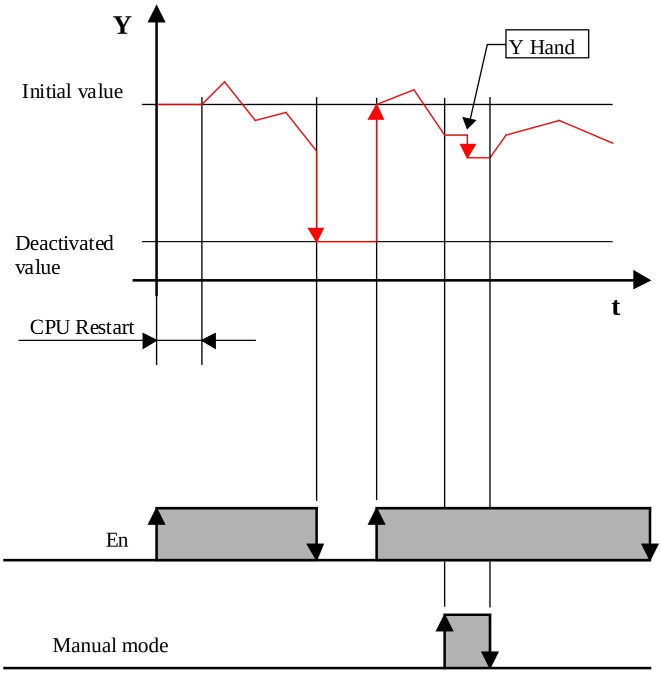
During the restart cycle and during the first time of the activation of input 'En', the output takes the state defined by the initialization option. For P and PZ controllers, the output takes the operating point value.

When the input 'En' is at 0, the controller is deactivated. The output Y is then fixed to the adjusted value.

Various options are available for output initialization and integrator memory.

Initial	The memory is initialized at the adjustable initial value. This mode is used when the start conditions are known and always the same. It is also useful for tests or demonstrations.
Old Yi	The memory Yi is initialized at its value when switching off the system. This mode is useful for short system stops. At first putting into service, the memory must be initialized manually in setting the controller shortly in manual mode. In PI and PID controllers, the initialization is done on output Y insted of Yi. In this way these controllers do not take into account high regulation differences at start.
Set-point W	The memory integration Yi is initialized with the actual set-point value. This mode can only be used if the output signal has the same unit as the set-point. It requires no manual initialization.

Diagram



See function HVC-Init, Subfunction CPU Performance for more details about the restart cycle.

Sampling

All controllers use the standard sampling signal of one second.

Algorithm

Offset: Xoff = X + Offset

hereunder Xoff is same as X

Regulation difference:

Direct action Xw = W - X

Inverted action: Xw = X - W

Conversion Fp-Xp: Fp = (Ymax - Ymin) / Xp

Xp = (Ymax - Ymin) / Fp

Part P: Yp = Fp * Xw

Operating point: PT = Y0 + (Z-Z0) * Fz (OP with slide)

Part I: Yi = Yi_1 + Yp * Te / Ti

Part D:	Yd = (Yp - Yp_1) * Td / Te	(Derivated on Xw)
	Yd = Fp * (X - X_1) * Td / Te	(Derivated on X)
Part D filtered:	Ydt = Yd_1 + (Yd - Yd_1) * Te / T1	
Controller P:	Y = Yp + OP	(OP without slide)
Controller PZ:	Y = Yp + OP	(OP without slide)
Controller PI:	Y = Yp + Yi	
Controller PID:	Y = Yp + Yi + Ydt	

with:

Y	= Output = controller output
Yp	= Proportional part of Y
Yp_1	= Former value of Yp
OP	= Part of Y, operating point
Yi	= Integral part of Y limited
Yi_1	= Former value of Yi
Yd	= Part derivated, not filtered
Yd_1	= Former value of Yd
Ydt	= Part derivated, filtered
Z	= Disturbance
Z0	= Disturbance reference
Y0	= Working point at reference
X	= Controlled variable
X_1	= Former value of X
W	= Set-point
Xw	= Regulation difference
Xp	= Proportional band
Fp	= Proportional factor
Fz	= Slide factor of working point
Te	= Sampling interval
Ti	= Integration time
Td	= Derivation time
T1	= Time constant of filter T1

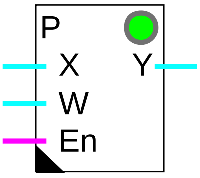
6.6 Controller P

Family: **HVC-Controllers**

Name: **Controller P**

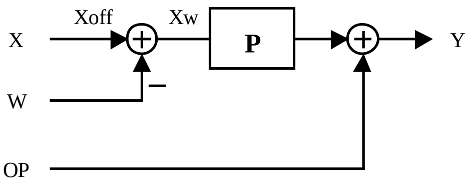
Macro name: _HeaPP

Fbox:



Short description

Proportional controller. It allows to work in various conditions and is adaptable to some utilization modes.



Inputs

X	Input X	Controlled variable, e.g. Measurement of actual temperature.
W	Set-point	Set-point value.
En	Enable	Activation signal of controller.

Output

Y	Output Y	Controller output, e.g. Position of mixing valve.

Description of the function

See Generalities About Controllers

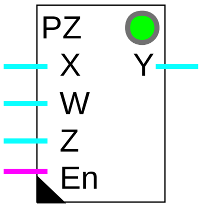
6.7 Controller PZ

Family: **HVC-Controllers**

Name: **Controller PZ**

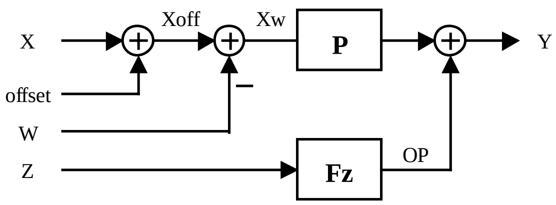
Macro name: _HeaP

Fbox:



Short description

Proportional controller with disturbance compensation.



Inputs

X	Input X	Controlled variable. E.g. Measurement of actual temperature.
W	Set-point	Set-point value.
Z	Disturbance	Measurement of disturbance value. E.g. Outside temperature.
En	Enable	Controller activation signal.

Output

Y	Output Y	Controller output. E.g. position of mixing valve.

Description of the function

See Generalities About Controllers

6.8 Controller PI

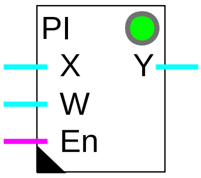
Family: **HVC-Controllers**

Name: **Controller PI**

Macro name: _HeaPi

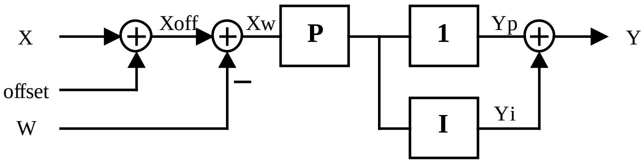
Dialogue: Dialogue Fbox, see below.

Fbox:



Short description

Proportional and integral controller.



Inputs

X	Input X	Controlled variable, e.g. measurement of actual temperature.
W	Set-point	Set-point value
En	Enable	Controller activation signal.

Output

Y	Output Y	Controller output, e.g. position of mixing valve.

Description of the function

See Generalities About Controllers

Particularities with Dialogue Fbox

When the PI controller is combined with the PI dialogue function, it can be switched in manual mode by the terminal. The manual mode of the adjust window and of the terminal are independent. However, the manual value is the same. When the controller has been set in manual mode by the terminal, the LED is red, but the mode in the Fbox remains automatic.

Dialogue

A dialogue function with the same name is available in the family HVC-Dialogue-HVC.

Option Dialogue

- Standard The standard parameters are adjustable from terminal
- Manual The manual mode is also accessible from terminal

Accessible parameters from terminal

Offset [K]

Factor P

Time I [sec]

Controlled variable Xoff [°C]

Control deviation [K]

Controller output Y [%]

Manual mode

Y manual [%]

When the PI controller is combined with the dialogue Fbox, it can also be switched in manual mode from the terminal. The manual mode of the adjust window and the terminal are independent. However, the manual value is the same. When the controller is in manual mode from the terminal, the LED is red but the status in the adjust window displays 'Automatic'.

See also: Family HVC-Dialogue HVC

HVC-Dialogue, Overview

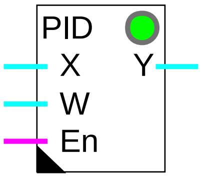
6.9 Controller PID

Family: **HVC-Controllers**

Name: **Controller PID**

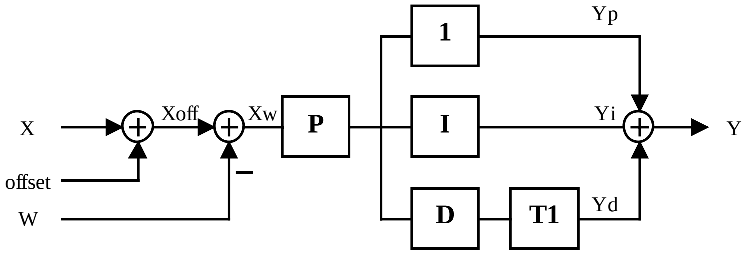
Macro name: _HeaPid

Fbox:



Short description

Proportional, integral and differential controller.



Inputs

X	Input X	Controlled variable, e.g. measurement of actual temperature.
W	Set-point	Set-point value
En	Enable	Controller activation signal.

Output

Y	Output Y	Controller output, e.g. position of mixing valve.

Description of the function

See Generalities About Controllers

Dialogue

A dialogue function with the same name is available in the family HVC-Dialogue-HVC.

Option Dialogue

- Standard The standard parameters are adjustable from terminal
- Manual The manual mode is also accessible from terminal

Accessible parameters from terminal

Offset X [K]

Factor P [%]

Time I [sec]

Time D [sec]

Filter time D-T1 [sec]

Controlled variable Xoff [°C]

Control deviation [K]

Controller output Y [%]

Manual mode

Y manual [%]

When the PI controller is combined with the dialogue Fbox, it can also be switched in manual mode from the terminal. The manual mode of the adjust window and the terminal are independent. However, the manual value is the same. When the controller is in manual mode from the terminal, the LED is red but the status in the adjust window displays 'Automatic'.

See also: Family HVC-Dialogue HVC

HVC-Dialogue, Overview

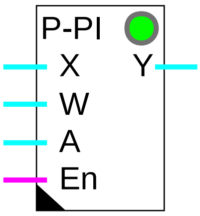
6.10 Controller P-PI

Family: **HVC-Controllers**

Name: **Controller P-PI**

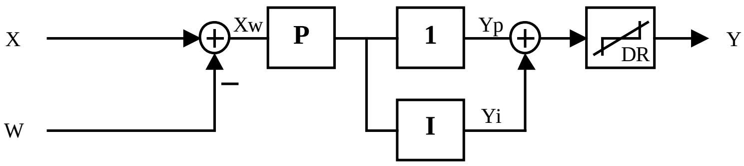
Macro name: _HeaPPI

Fbox:



Short description

Proportional and integral controller with integrator switching. This controller allows to work in various conditions and is adaptable to some utilization modes.



Inputs

X	Input X	Controlled variable, e.g. measurement of actual temperature.
W	Set-point	Set-point value
A	Auxiliary	Auxiliary value. Function according to option for auxiliary function.
En	Enable	Controller activation signal.

Output

Y	Output Y	Controller output, e.g. position of mixing valve.

Description of the function

See Generalities About Controllers

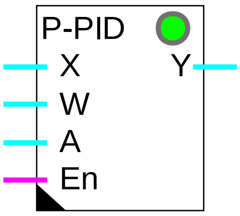
6.11 Controller P-PID

Family: **HVC-Controllers**

Name: **Controller P-PID**

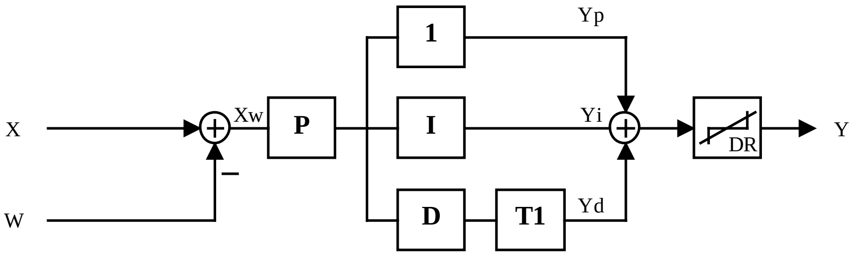
Macro name: _HeaPPID

Fbox:



Short description

Proportional, integral, differential controller with integrator switching. This controller allows to work in various conditions and is adaptable to some utilization modes.



Inputs

X	Input X	Controlled variable, e.g. measurement of actual temperature.
W	Set-point	Set-point value
A	Auxiliary	Auxiliary value. Function according to option for auxiliary function.
En	Enable	Controller activation signal.

Output

Y	Output Y	Controller output, e.g. position of mixing valve.

Description of the function

See Generalities About Controllers

6.12 Output, 2 Points

Family: **HVC-Controllers**

Name: **Output 2 Points**

Macro name: _HeaPm1

Fbox:

Short description

Auxiliary control function, modulated pulse. It allows to convert the continuous signal (controller P, PI, or PID) in pulses on a binary signal.

Input

Input	Numeric input signal

Output

Output	Modulated pulse output depending on the numeric input signal

Parameters

Pulse time [sec]	Minimum duration of control pulse. The time corresponds also to the modulation resolution of the output signal.
Minimum level -> 0%	Minimum level of input signal. The output signal modulation begins above this minimum level only.
Maximum level -> 100%	Maximum level of input signal. The output signal modulation works below this maximum level only.
Memory	Display of the internal working memory.

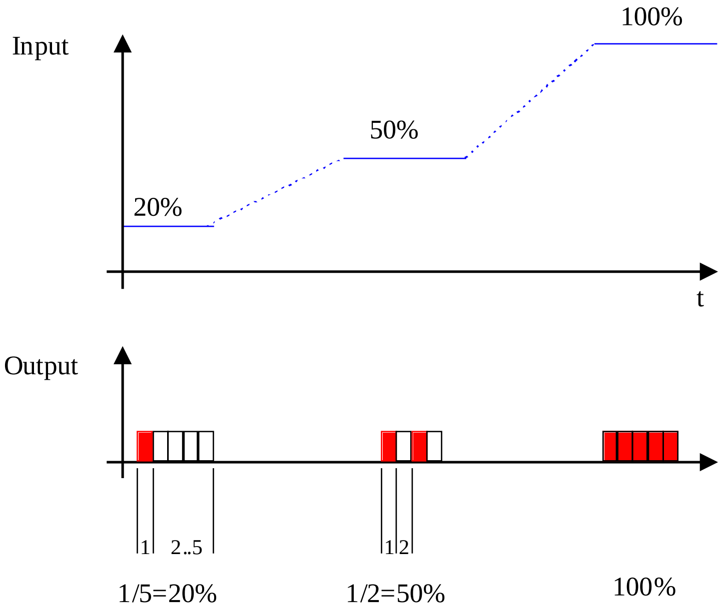
Description of the function

This function generates pulses on a binary output as a function of a numeric control signal. At 50% of the range, pulses and pauses are generated alternatively. Above 50%, pulses are longer. Below 50% pauses are longer.

The minimum range value should be considered as an offset.

A memory buffer integrates the intput signal (after offset). Its operation can be viewed in the adjust window. When the value is greater than the range value (max-min), a pulse is given on the output.

Diagram



Typical applications

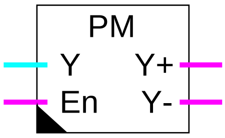
- Power modulation of a heat element by switching on and off.
- Control of valve equipped with thermal motor

This function has been developed for use with a continuous controller (P, PI or PID). It can also be connected to an output of the function Sequence Master HC or Sequence Master HMC.

6.13 Output, 3 Points

Family:	**HVC-Controllers**
Name:	**Output 3 points**
Macro name:	_HeaPmd2

Fbox:



Short description

Auxiliary function for 3-points valves without control of the effective valve position. It operates the conversion of a continuous signal (controller P, PI or PID) in binary signal pulses.

Inputs

Y	Input Y	Numeric signal to control movements
En	Enable	Activation or closing of valve

Outputs

Y+	Y Open	Pulse output depending on numeric input signal (positive range)
Y-	Y Close	Pulse output depending on numeric input signal (negative range)

Parameters

Pulse time [sec]	Minimum duration of control pulse. The time influences also to the resolution of the valve position.
Dead range	Dead range between the output control Y+ and Y- applied to an integrated value of the input signal. See description below.
Pulse value	Input signal range in positive value. The same value is applied in the positive and negative range. The range value corresponds to a permanent switch-on of the output signal.
Run time, deactivation	Time during the output Y- is forced to 1 when the output 'En' switches to 0.

Fix time pulses are generated in such a way that the average of the + and - signals is equal to the numeric input signal. Pulse time and pulse values are adjustable.

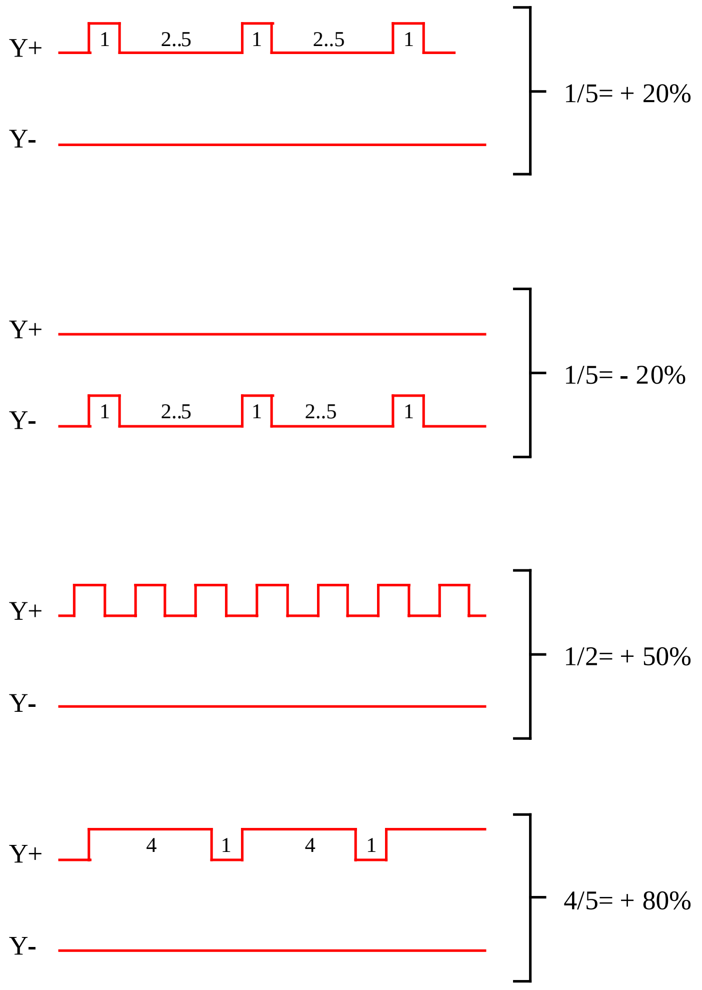
Description of the function

In the positive range, pulses are generated at the positive output 'Y+'. In the negative range, pulses are generated at the negative output 'Y-'. At 50% of the range, pulses and pauses are generated alternatively. Above 50%, pulses are longer. Below 50% pauses are longer.

In case of PI or PID controller, the integrator must be attenuated, as the valve's own motor is itself an integrator. Parameters of the controller must be set as to work in the positive and negative ranges (open-closed).

Caution !
The numeric control signal (Input Y) does not represent a valve position but a movement speed. If this characteristic raises problems for the controller stabilisation, the function Output, 3 Points with Reference must be used.

Diagram



Use of the dead range

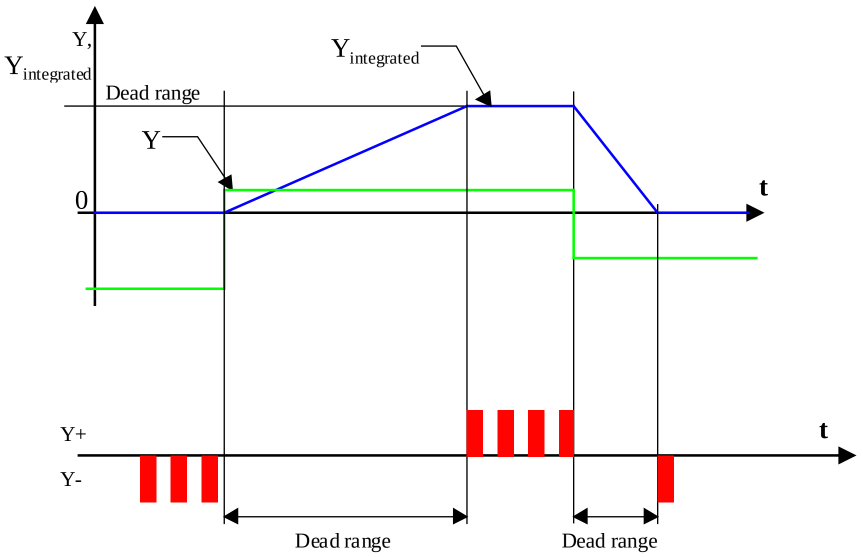
During the transition between positive and negative ranges, in either direction, signals remain at zero until dead range has been passed. The dead range is applied to an integrated value of the input signal. It means that the the dead range is only active for a given time.

The desired dead range must be given as a time for a given input signal. For example, a signal of 5.0% must be temporized during 20 seconds, the pulse time is 2 seconds. The number of intervals is then 10 (20 seconds / 2 seconds). The dead range must be adjusted to 50.0 (10 times 5.0%).

From this situation (5.0% -> 20 sec), the more the input signal is high, the more the time will be short.

The modification of the pulse time changes also the dead range effect. The more the pulse time is big, the more the time is long.

Diagramme



Typical application

This function has been developed for use with a continuous controller (P, PI or PID) and 3-point control valves. It may also be connected to an output of the function Sequence Master HC or Sequence Master HMC.

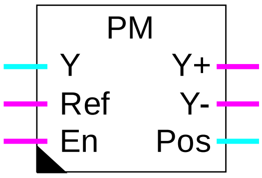
6.14 Output, 3 Points with Reference

Family: **HVC-Controllers**

Name: **Output 3 points+ref.**

Macro name: _HeaPMR

Fbox:



Short description

This function operates the control of 3 points valves, and simulates the effective valve position. It applies to valves with a contact giving a reference signal at a defined position. It may also be used without reference signal with a reduced accuracy.

Inputs

Y	Input Y	Numeric input signal to modulate
Ref	Reference	Contact signal position reference
En	Enable	Activation of modulation

Outputs

Y+	Y Open	Positive pulse output signal depending on numeric input signal (positive range)
Y-	Y Close	Negative pulse output signal depending on numeric input signal (negative range)
Pos	Position	Numeric value of the calculated actual position

Parameters

-----[Zones]-----

Null zone	Range in which the valve will not be opened. The input signal is considered as zero.
Discontinuous zone	Range in which the valve is controlled in a discontinuous way. The opening is time modulated. The valve is always open until the discontinuous limit value is reached.

-----[Reference]-----

Reference position	Position of reference contact.

State valve closed	Contact state when the valve is closed.
- Open	Reference contact open. Input 'Ref' =0.
- Closed	Reference contact closed. Input 'Ref' =1.
-----[Valve]-----	
Pulse time [sec]	Minimum duration of control pulses. The time corresponds also to the modulation resolution of the output signal.
Max stroke time [sec]	Time for the valve to run the complete stroke, from closed position 0% to open position 100%.

Description of the function

The valve position is simulated in the function. The valve control signals Y+ and Y- are operated until the valve simulated position corresponds to the Y position signal of the Fbox input.

The simulation is adapted at 3 positions as follows:

In the null zone, the Y- signal is activated permanently as to insure a complete valve closing.

When the valve reaches the reference contact, the simulation is immediately adapted to the adjusted value. The adaptation is insured in both working directions.

When the control signal Y reaches 100%, the Y+ output is activated permanently as to insure the complete valve opening.

For a good operation and regulation stability, it is important to adjust the running time correctly. The parameter of the contact position must also match to the actual valve position.

If the valve is not equipped with contact, its position may be adjusted to 0. Then the input signal must be permanently at 1 and the option 'State valve closed' on 'Open'. The adaptation to the reference position will not be possible.

The module operates in 3 different zones. The value of the first 2 zones are adjustable. The 3rd zone goes always upto 100%.

Null zone:

In this zone the valve remains closed permanently. It allows to avoid little flows where the energy measurement is not possible or incorrect.

Discontinuous zone:

In this zone the valve is operated in discontinuous way. The valve never remains in intermediate position. Intermittent openings occur until the final value of the zone. The opening frequence is proportional to the input signal Y. To optimize the function, the reference signal should be in the discontinuous zone.

Continuous zone:

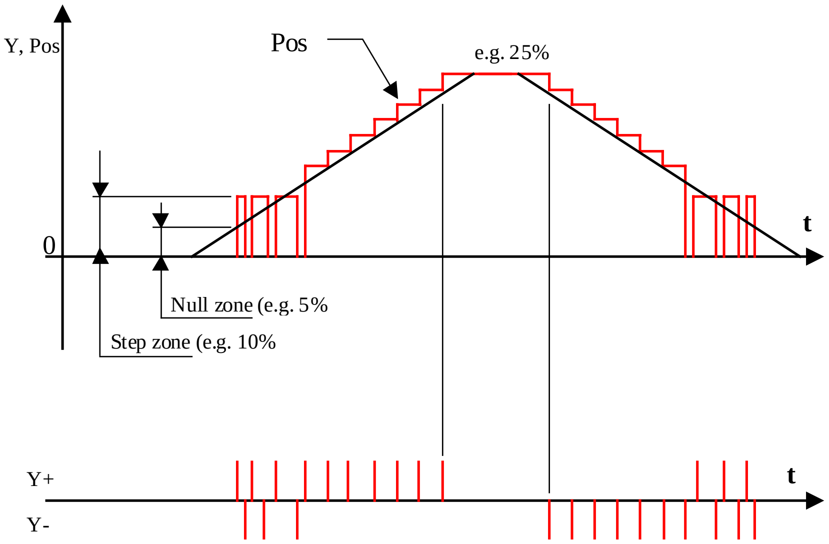
In this zone the valve position is controlled in continuous way. The simulation of the position allows to control the Y+ and Y- signals in time. For a correct operation in this zone, it is important to adjust the maximum stroke time correctly (standard value=120.0 sec).

The parameter 'Pulse time' specifies the minimum pulse duration on the Y+ and Y- control signals (standard=1.0 to 2.0 sec). Too short pulses generate unaccurate movements (mechanical clearance) and the simulated position differs from the actual position. Too long pulses generate unaccurate corrections of the valve position and reduces the regulation performances or produces unstable regulation loop.

At system start, the position simulator checks the state of the reference contact and initializes the position at maximum or minimum. If the valve is in intermediate position, the adaptation will be operated automatically in one of the 3 above mentioned conditions.

Diagram

Behavior by slow variations



Behavior by quick variations

(Example: 0 - 100% and 100% - 0%)

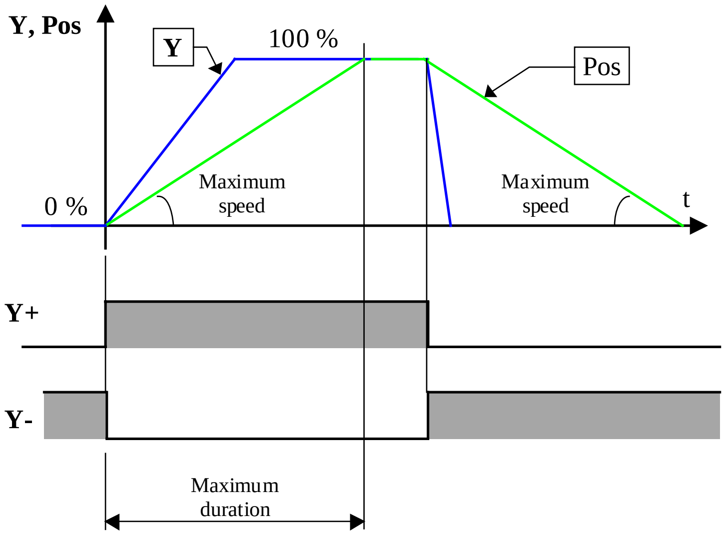
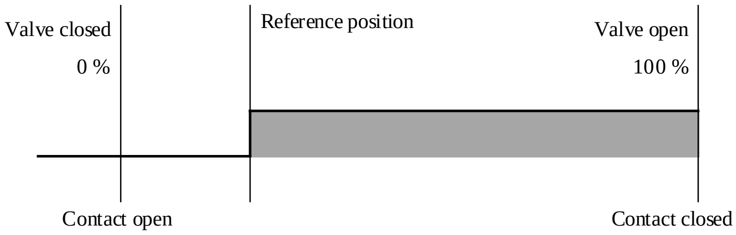
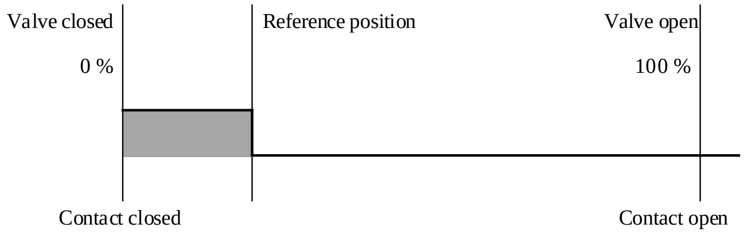


Diagramm for the reference contact



For the above functioning, the_option must be adjusted on 'Open'.



For the above functioning, the_option must be adjusted on 'Closed'.

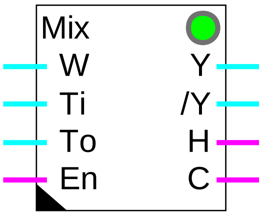
Typical application

This function has been developed for use with a continuous controller (P, PI or PID) and 3-point control valves. It may also be connected to an output of a function Sequence Master HC or Sequence Master HMC.

6.15 Air Mixer

Family:	**HVC-Controllers**
Name:	**Air mixer**
Macro name:	_HeaMix2

Fbox:



Short description

Mixer of inside and outside air with controls signals for heating and cooling systems.

Inputs

W	Set-point	Set-point value for air mixed temperature
Ti	Inside temperature	Measurement of inside or outlet air temperature
To	Outside temperature	Measurement of outside or inlet air temperature
En	Enable	Activation signal for the mixer

Outputs

Y	Output Y	Control for inside and outside air
/Y	Y reversed	Control of inlet air, reversed signal compared to Y
H	Heater	Activation signal for the heatinfg system
C	Cooling	Activation signal for the cooling system

Parameters

Deactivated value [%]	Value of 'Y' output when input 'En'=0.
Offset inside temp. [K]	Offset to be added to the ambient temperature.
Offset outside temp. [K]	Offset to be added to the ambient temperature.
Lower limit of mixer [%]	Lower limit of output signal 'Y'.
Upper limit of mixer [%]	Upper limit of output signal 'Y'.
Lower dead range [%]	Dead range of 'Y' value for 'C' or 'H' output switch-off from lower limit.
Upper dead range [%]	Dead range of 'Y' value for 'C' or 'H' output switch-off from upper limit.

Dead range Ti=To [°C]	Dead range of difference Ti-To in which outputs 'Y', 'C, and 'H' remain unchanged.
-----[Functional control]-----	
Energy	Display of energy request or offer.
- Request	Energy request if To<Ti.
- Offer	Energy offer if To>=Ti.
Mixer Y output	Calculation of the mixing valves position, output signal 'Y'.
Heating system	Display the control of the heating system(On or Off)
Cooling system	Display the control of the cooling system(On or Off)
-----[Manual mode]-----	
Mode	Switch button and display Automatic/Manual mode
Y manual [%]	Value of 'Y' output in manual mode. The '/Y' output takes the value 100.0 % - Y.

Description of the function

The mixer determines what blend of inside and outside air is necessary to produce inlet air at a temperature corresponding to the set-point. When the mixer reaches its min. or max. limits, it produces a signal to activate the controller of the heating or cooling systems, depending on the shortage in the blend.

Regulation of heat or cold is produced using P, PI or PID regulation modules activated by the mixer.

This structure means that the parameters of all 3 controllers can be adjusted individually. Pumping or competition between the controllers is avoided by setting upper and lower dead ranges.

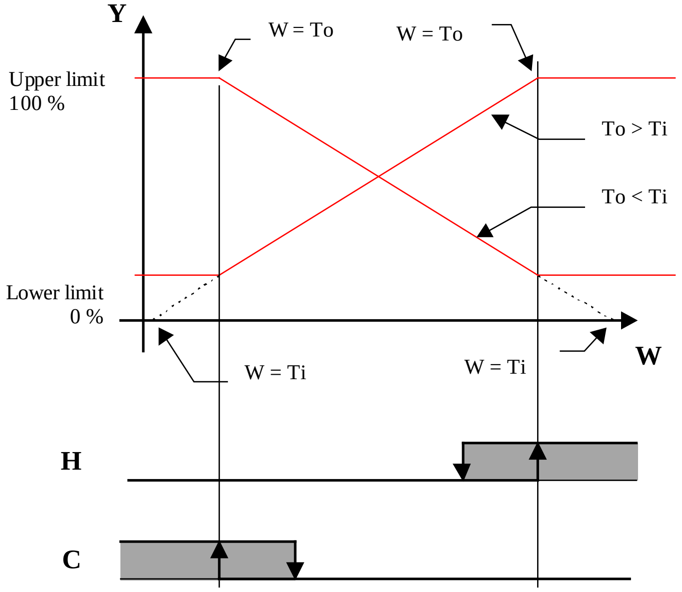
When the mixer enters its operating range, the control signal for the heating or cooling battery remains on for as long as the difference does not exceed the dead range. This allows the heating or cooling controller to unload itself and avoids any pumping effects.

At the mixer input, an offset is added to the temperature signals. This offset is online adjustable and allows, among others, the correction of any difference of the measurement signal.

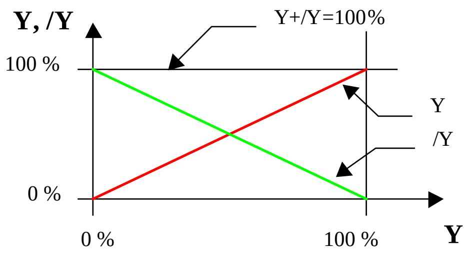
Output signal Y varies between 0% and 100% and corresponds to the fresh air throughput. Minimum and maximum values make it possible, to ensure permanent recycling of fresh air.

The complement of signal Y is at output /Y available and varies between 100% and 0%.

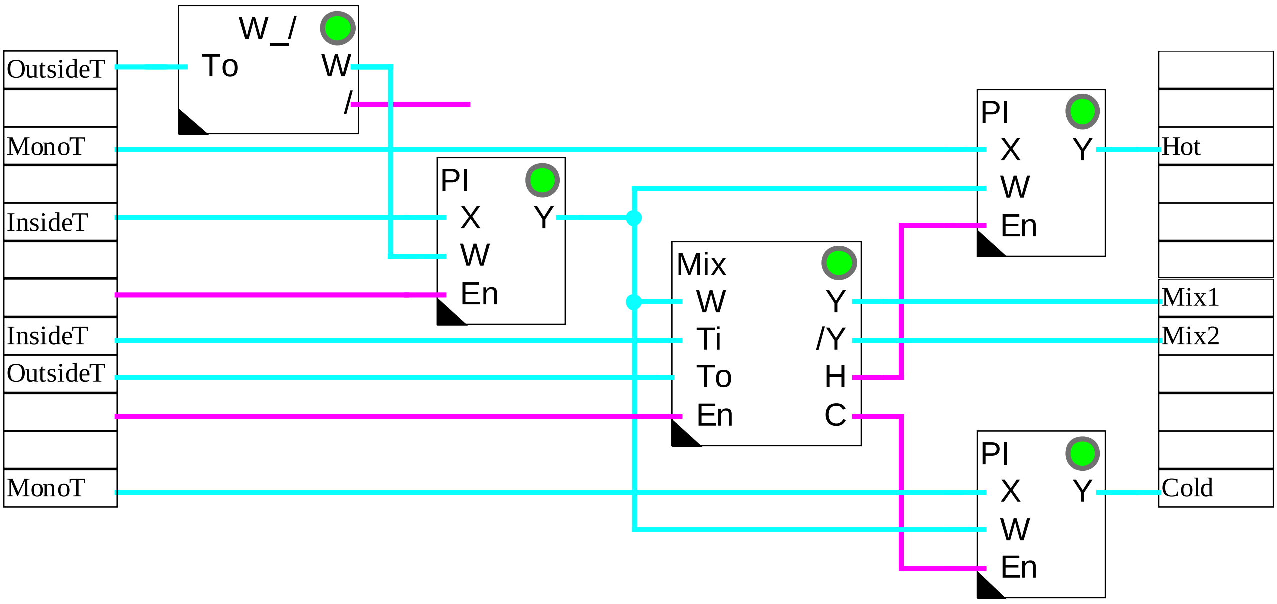
Diagram



Y, /Y Diagram



Typical application


OutsideT
MonoT
InsideT
InsideT
OutsideT
MonoT
W_/
To
W
/
PI
X
Y
W
En
Mix
W
Ti
To
En
Y
/Y
H
C
PI
X
Y
W
En
PI
X
Y
W
En
Hot
Mix1
Mix2
Cold

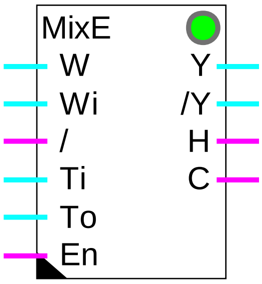
6.16 Air Mixer Economic

Family: **HVC-Controllers**

Name: **Air mixer economic**

Macro name: _HeaMixe

Fbox:



Short description

Inside air mixer with economic function, heating latching safety and efficiency compensation.

Inputs

W	Set-point	Set-point value for the air inlet temperature
Wi	Set-point	Set-point value for room temperature
/	Slide	Slide signal. Latching of heater.
Ti	Inside temperature	Measurement of inside or outlet temperature
To	Outside temperature	Measurement of outside or inlet temperature
En	Enable	Activation of the mixer

Outputs

Y	Output Y	Control of incoming and outgoing air valves
/Y	Y inversed	Control of recycled air valves, inversed signal compared to Y
H	Heating	Activation signal for controller of heating system
C	Cooling	Activation signal for controller of cooling system

Parameters

Deactivated value [%]	Value of 'Y' output when input 'En'=0.
Offset inside temp. [K]	Offset to be added to the ambient temperature.
Offset outside temp. [K]	Offset to be added to the ambient temperature.
Lower limit of mixer [%]	Lower limit of output signal 'Y'.

Upper limit of mixer [%]	Upper limit of output signal 'Y'.
Lower dead range [%]	Dead range of 'Y' value for 'C' or 'H' output switch-off from lower limit.
Upper dead range [%]	Dead range of 'Y' value for 'C' or 'H' output switch-off from upper limit.
Dead range Ti=To [°C]	Dead range of difference Ti-To in which outputs 'Y', 'C, and 'H' remain unchanged.
Economy range Ti>Wi [°C]	Economy range: If Ti-Wi <= Economy range, the 'C' cooling control is latched.
Recuperation efficiency [%]	Efficiency of recuperation system in %. This parameter represents the percentage of saved energy when the system control (ouput 'Y') is at 100%.
-----[Functional control]-----	
Energy	Display of energy request or offer.
- Request	Energy request if To<Ti.
- Offer	Energy offer if To>=Ti.
Mixer Y output	Calculation of the mixing valves position, output signal 'Y'.
Heating battery	Displays the control of the heating battery (On or Off)
Cooling battery	Displays the control of the cooling battery (On or Off)
Function economy	Displays the state of the economy function. It is switched on if Ti-Wi <= Economy range. The cooling control 'C' is latched.
-----[Manual mode]-----	
Mode	Switch button and display Automatic/Manual mode
Y manual [%]	Value of 'Y' output in manual mode. The '/Y' output takes the value 100.0 % - Y.

<u>Description of the function</u>

The mixer determines what blend of inside and outside air is necessary to produce inlet air at a temperature corresponding to the set-point. When the mixer reaches its min. or max. limits, it produces a signal to activate the controller of the heating or cooling system, depending on the shortage in the blend.

Regulation of heat or cold is produced using P, PI or PID regulation modules activated by the mixer.

This structure means that the parameters of all 3 controllers can be adjusted individually. Pumping or competition between the controllers is avoided by setting upper and lower dead ranges.

When the mixer enters its operating range, the control signal for the heating or cooling battery remains on for as long as the difference does not exceed the dead range. This allows the heating or cooling controller to unload itself and avoids any pumping effects.

At the mixer input, an offset is added to the temperature signals. This offset is online adjustable and allows, among others, the correction of any difference of the measurement signal.

Output signal Y varies between 0% and 100% and corresponds to the fresh air throughput. Minimum and maximum values make it possible, to ensure permanent recycling of fresh air.

The complement of signal Y is at output /Y available and varies between 100% and 0%.

The above function is the same as the simple air mixer. This block includes the additional inputs Wi and /. While the room temperature set-point is sliding, heating remains latched. Cooling is delayed while room temperature rises (economy zone). Parameters can define the level of efficiency of the recuperation plant.

Inputs Wi and / are provided for direct connection to the 'Set-point slide' (W_/) function. Wi shows the actual room temperature set-point. The signal / indicates that this temperature is now within the slide zone. In this zone, outside temperature is higher and the room temperature is constantly increased.

Cooling economy function:

If the mixer enters the cooling zone (e.g. To > Ti and Y at minimum) cooler control C remains latched until room temperature Ti has reached a certain distance relative to set-point Wi. This distance is called the economy zone and its parameters can be defined online.

Heater latching:

If the / signal is active, the mixer latches heater control H. This prevents energy from being used to heat up the room temperature, while the outside temperature is high.

Efficiency:

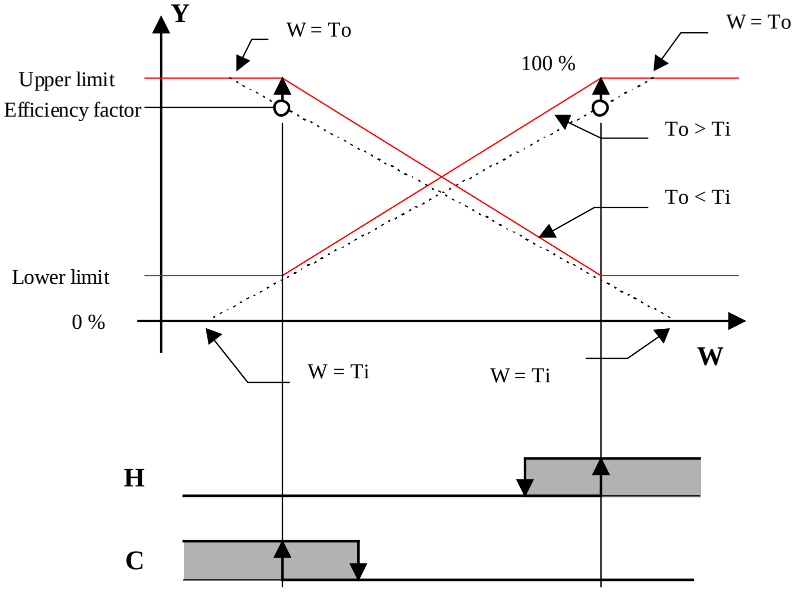
When recuperation plant with an efficiency less than 100% is used, an adjustment is possible by correcting the output signals. The parameter 'Recuperation efficiency factor' is online adjustable. Output signal /Y shows the remainder relative to 100%. The limits and the dead range always refer to the value of Y signal.

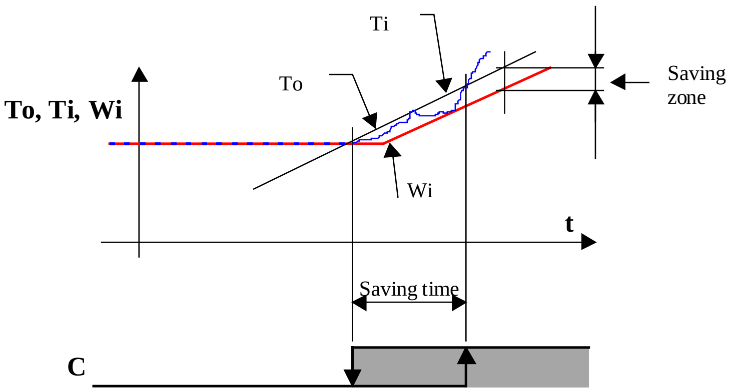
Example:

A recuperation wheel has an efficiency of approx. 70%. Control is via the /Y signal. The lower and upper limits of Y are 0% and 100%.

Caution! The limits and dead range refer to the Y signal. Efficiency refers to the /Y signal.

Diagram


Y
W = To
W = To
100 %
Upper limit
Efficiency factor
To > Ti
To < Ti
Lower limit
0 %
W = Ti
W = Ti
W
H
C


Ti
To
To, Ti, Wi
Saving
zone
Wi
t
Saving time
C

6.17 Generalities about Controller Sequences

Introduction

In the Heavac library, regulation sequences can be realized through the combination of multiple Fboxes. The realization is made using three Fbox categories.

- The controllers
- The master sequences
- The sequences output

For each category, several Fboxes are available. Thank to this modular concept, the user may use a large variety of regulation stuctures and adapt the solution to his application particularities. Moreover, all other library functions as well as the basic Fupla functions can be used in this structure if necessary.

These possibilities are available from version $138 of the HVC library.

Function of controllers

Like in all controller applications, the controller is the main function for correcting the controller output as a function of the controlled variable and the set-point. The controller output is then transmitted to the function 'Sequence Master'.

All controllers can be used the same way:

- Controller P
- Controller PZ
- Controller PI
- Controller PID
- Controller P-PI
- Controller P-PID

A sequence regulation can still be combined with a cascade regulation structure.

Master sequences

The Master sequence functions allow to divide the controller output signal in several sequences. The working range of each sequence is free adjustable by the user. It can be contiguous or separated by dead ranges. For each sequence a new continuous signal, calibrated from 0 to100% is provided. Only one sequence is activated at the time. The others are kept in minimum position (0%) or maximum (100%).

The following Master sequences are available:

Sequence, Master, Heating / Cooling	Simple application with one heating sequence and one cooling sequence

Sequence, Master, Heating / Mix / Cooling	Complex application with 1 to 4 heating sequences and 1 to 4 cooling sequences and 1 to 2 sequences of recuperation (Mix)
Sequence Master, Hot, Mix, and Cooling Compact	
	Standard case with one sequence Hot, one recuperation sequence (Mix), and one sequence Cooling
Sequence, Master Burner	Control of sequences with 1 to 8 burners

Each sequence can be divided in sub-sequences. This is the case for the sequence 'Mix' which can be followed by an output function sequence for 2 recuperation systems. In this way a total of 10 sequences can be obtained.

Sequences output function

These functions take the standard signals provided by the sequence Master and convert them depending on the regulation device used for each sequence. Other functions of the Heavac library can also be used as output Master sequence. In a simple case, this function can also be left out. The standard signal of the sequence Master (0-100%) is then directly transmitted to an analogue output Fbox.

The following sequence output functions are available:

Sequence, 1-4 Levels	Successive switch-on of heating or cooling systems
Sequence, 2 Points	Intermittent switch-on of heating or cooling systems
Sequence, 3 Points	Intermittent switch-on with 3 positions
Sequence, Proportional	Linear adaptation of the continuous signal with option direct/inverted
Sequence, Mixer 1	Control of a recuperation system
Sequence, Mixer 2	Control of two successive recuperation systems

The following functions can also be used:

Output, 2 Points	Pulse modulation
Output, 3 Points	Pulse modulation -, 0, +
Output, 3 Points with Reference	Control of 3-point value with reference

It is important to differentiate the function of a 2 or 3 points sequence from a 2 or 3 points output.

The 2 and 3 points sequences have fix switch-on and switch-off points. The behavior is comparable to a discontinuous controller with 2 or 3 points.

The 2 or 3 points outputs realize a continuous pulse modulation on the binary outputs. The behavior of a continuous controller is obtained.

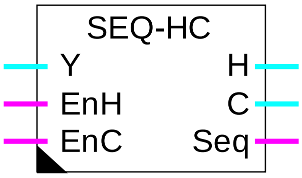
6.18 Sequence, Master, Heating / Cooling

Family: **HVC-Controllers**

Name: **Sequence Master HC**

Macro name: _HeaSm2

Fbox:



Short description

Main Fbox for the realization of heating-cooling sequences. The controller output signal is divided in two signals, one direct, the other indirect, each one in a definable range.

See also:

Generalities about Controller Sequences.

Inputs

Y	Input	Controller output Y. The controller must work in a symetric range. E.g. -100.0 to +100.0 %
EnH	Enable Heating	Activation of the heating sequence.
EnC	Enable Cooling	Activation of the cooling sequence.

Outputs

H	Heating	Command output of the heating sequence. Signal from 0.0 to 100.0 %
C	Cooling	Command output of the cooling sequence. Signal from 0.0 to 100.0 %
Seq	Sequence	Indication that a sequence is in the working range. The output is at 0 in the dead range and outside the ranges heating and cooling.

Parameters

-----[Heating Sequence]-----

Upper point Y	Upper point of the input Y range for the heating sequence. This value provides 100.0 % of the output signal 'H'.
Lower point Y	Lower point of the input Y range for the heating sequence. This value provides 0.0 % of the output signal 'H'.

-----[Cooling Sequence]-----

Upper point Y	Upper point of the input Y range for the cooling sequence. This value provides 100.0 % of the output signal 'C'.
Lower point Y	Lower point of the input Y range for the cooling sequence. This value provides 0.0 % of the output signal 'C'.

Description

The output signal of the controller is divided in two signals, one direct, the other indirect. Each one has its own adjustable range. It is recommended to adjust the heating and cooling sequences parameters within the controller working range. Usually, a standard symetric range, going from -100.0 % to +100.0 % has been used.

Between 2 ranges, a dead range may be foreseen. It means that the lower point of the heating sequence is bigger than the upper point of the Cooling sequence. Is it also possible to adjust an overlap of 2 ranges.

The range value of each sequence indicates the available power of the corresponding device compared to the total available power. The correct parameter adjustment is unavoidable as to get a good stability of the regulation loop.

Heating sequence:

The input signal, in the adjusted range, is converted in a standard signal going from 0.0 to 100.0 %. Outside of this range, the output signal remains limited at value 0.0, respectively 100.0. The calculated signal is available at output H. If the input EnH is at 0, the heating sequence is deactivated and the output H remains at 0.0.

Cooling sequence:

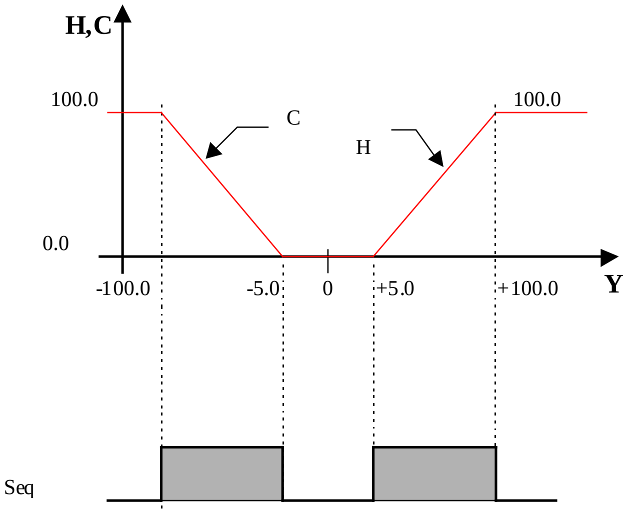
The input signal, in the adjusted range, is converted in an inverted standard signal going from 0.0 to 100.0 %. The value of the upper point corresponds to 0.0 %. The value of the lower point corresponds to 100.0 %. Outside of this range, the output signal remains limited at value 100.0, respectively 0.0. The calculated signal is available at output C. If the input EnC is at 0, the heating sequence is deactivated and the output C remains at 0.0.

The 2 outputs H and C are calculated independently. There is no locking between them. If these 2 signals must work in another range than 0.0..100.0 %, they can be converted with auxiliary Fbox for proportional sequence.

The output signal Seq indicates if at least one sequence is in the active range. It means that the input signal is in one of the adjusted range. This signal is foreseen for indicating to the controller if it is in a dead range or outside of the sequencer active range. This programming is interesting for controllers P-PI and P-PID. With the integration reduction function, it is possible to slow down the passing from one sequence to the next and to better use the dead ranges.

Diagram

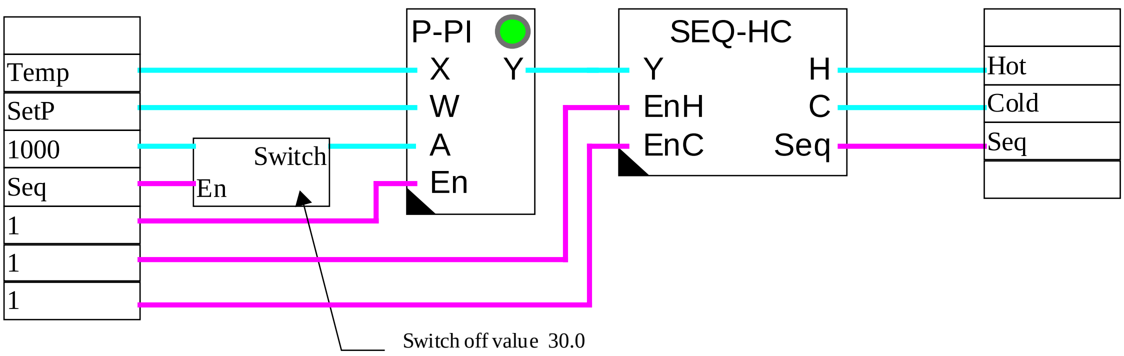
Example with standard parameters.



Typical application

This function is useful and facilitate the programming of an application of 2 heating-cooling sequences.

Example of program with a P-PI controller and 30.0% integrator reduction.



References

For more complexe applications with more than 2 sequences, the Fbox Sequence HMC can be used.

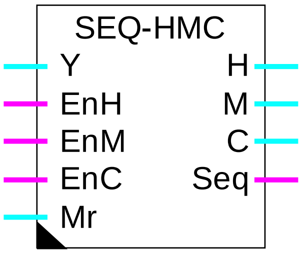
6.19 Sequence, Master, Heating / Mix / Cooling

Family: **HVC-Controllers**

Name: **Sequence Master HMC**

Macro name: _HeaSm3

Fbox:



Short description

Main Fbox for heating-mix-cooling sequence realization. The controller output signal is divided in 3 signal types. 1 to 4 direct signals are available for heating sequences. A signal is foreseen for the recuperation system. 1 to 4 other indirect signals are used for cooling sequences.

See also: Generalities about Controller Sequences.

Inputs

Y	Input	Controller output Y. The controller must work in a symetric range. E.g. -100.0 to +100.0 %
EnH	Enable Heating	Activation of the heating sequence.
EnM	Enable Mix	Activation of the mix sequence.
EnC	Enable Cooling	Activation of the cooling sequence.
Mr	Mix Range	Modulation signal of the 'mix' range (optional use).

Outputs

H0...3	Heating 0...3	Command output of the heating sequence. Signal from 0.0 to 100.0 %
M	Mix	Command output of the sequence 'mix'. Signal from 0.0 to 100.0 %
C0...3	Cooling 0...3	Command output of the cooling sequences. Signals from 0.0 to 100.0 %
Seq	Sequence	Indication that a sequence is in the working range. The output is at 0 in the dead range and outside the ranges Heating and Cooling.

Parameters

-----[Heating Sequence H0 to H3]-----

Upper point Y — Upper point of the input Y range for the heating sequence. This value provides 100.0 % of the output signal 'H'.

Lower point Y — Lower point of the input Y range for the heating sequence. This value provides 0.0 % of the output signal 'H'.

-----[Mix Sequence]-----

Upper point Y — Upper point of the input Y range for the heating sequence. This value provides 100.0 % of the output signal 'H'.

Lower point Y — Lower point of the input Y range for the heating sequence. This value provides 0.0 % of the output signal 'H'.

Option range 'Mix' — Option for the operating of the range 'mix'

- Fix, Inverted — The sequence range 'Mix' is fix. It is given by the above upper and lower points.

  The output M is inversely proportional to the input signal Y.

- Var, Inverted — The range of the sequence 'Mix' is variable. The maximum range is given by above upper and lower points. These values are reduced by the input signal value 'Mr'. The reduction goes from 100.0 % to 0.0 %. With this option, the heating and cooling sequence ranges must be positionned without taking into account the range 'Mix' (supposed Mr = 0.0).

  The output M is inversely proportional to the input signal Y.

- Fix, Direct — The sequence range 'Mix' is fix. It is given by the above upper and lower points.

  The output M is directly proportional to the input signal Y.

- Var, Direct — The range of the sequence 'Mix' is variable. The maximum range is given by above upper and lower points. These values are reduced by the input signal value 'Mr'. The reduction goes from 100.0 % to 0.0 %. With this option, the heating and cooling sequence ranges must be positionned without taking into account the range 'Mix' (supposed Mr = 0.0).

  The output M is directly proportional to the input signal Y.

Upper point reduced — Calculation of the upper point 'Mix' after possible calculation of the reduction made by the input 'Mr'.

Lower point reduced — Calculation of the lower point 'Mix' after possible calculation of the reduction made by the input 'Mr'.

-----[Cooling Sequence C0 to C3]-----

Upper point Y — Upper point of the input Y range for the cooling sequence. This value provides 100.0 % of the output signal 'C'.

Lower point Y — Lower point of the input Y range for the cooling sequence. This value provides 0.0 % of the output signal 'C'.

<u>Description</u>

The output signal of the controller is divided in several signals, some direct, the others indirect. Each one has its own adjustable range. It is recommended to adjust the heating and cooling sequences parameters within the controller working range. Usually, a standard symetric range, going from -100.0 % to +100.0 % is used. However, when the number of sequences is high (more than 4), or if some ranges are smaller than the others, the output signal resolution can be increased by using a range going from-1000.0 to +1000.0.

Between 2 ranges, a dead range may be foreseen. It means that the lower point of a sequence is bigger than the upper point of the preceeding cooling sequence. Is it also possible to adjust an overlap of 2 ranges.

The range value of each sequence indicates the available power of the corresponding device compared to the total available power. The correct parameter adjustment is unavoidable as to get a good stability of the regulation loop.

Given that the Fbox has always the same number of Heating and Cooling sequences, it is possible that some sequences have unused output. The unused sequences must be adjusted outside of the input signal range as to not influence the the output 'Seq'.

Heating sequence:

The input signal, in each adjusted range, is converted in a standard signal going from 0.0 to 100.0 %. Outside of this range, the output signal remains limited at value 0.0, respectively 100.0. The calculated signal is available at output H. If the input EnH is at 0, the heating sequences are deactivated and the outputs H remains at 0.0.

If the Mix range is variable, the adjusted ranges are shifted above the actual value of the Mix range. In this case, the ranges Heating must be adjusted for the situation when the 'Mix' range is 0 (no shifting).

Mix Sequence with option Mix Range = Fix, Inverted or Fix, Direct:

The Mix sequence is foreseen for activating one or two energy recuperation systems. It will be connected to an output Fbox for mixer sequence.

The input signal , in the adjusted range, is converted in a standard signal going from 0.0 to 100.0%.

Outside of this range, the output signal remains limited at value 0.0, respectively 100.0. The calculated signal is available at output M. If the input EnM is at 0, the sequence 'Mix' is deactivated and the output M remains at 0.0. The adjusted range may have positive, negative or both values. It must imperatively contain the value 0.0.

With the option Fix, Direct, the output signal M is directly proportional to the input signal Y. This characteristic can be inverted in selecting the option Fix, Inverted.

Mix sequence with option Mix Range = Var, Inverted or Var, Direct:

The working mode decribed for a fix range is applicable. However, the adjusted range is variable as a function of the input signal Mr. The parameters define the maximal range. The working range of the signal Mr goes from 0.0% to 100.0%. The actual range, is reduced and displayed in the adjust window. The reduction is made symetrically compared to 0.

This input Mr represents the available power with recuperation system. This reduction allows to take into account the fact that the energy recuperation is depending on the temperature (or enthalpy) difference between inlet air and recycled air. In this way, the regulation goes quickly to the next sequence when the energy recuperation is low. The signal Mr is provided by the output Fbox for mixer sequence.

The reduction of the Mix range provokes simultaneously the shifting of the heating and cooling sequences. The sequences must be adjusted for the case where the Mix range is zero. The possible contigous dead range between 0 and heating and cooling sequences are shifted without reduction.

If the ranges of the heating and cooling sequences cover the whole range of the input signal, the shifting induced by the Mix sequence will make the external sequences to be overrun. A part of the installation will not be used in the extreme situations.

Cooling sequence:

The input signal, in each adjusted range, is converted in an inverted standard signal going from 0.0 to 100.0 %. The value of the upper point corresponds to 0.0 %. The value of the lower point corresponds to 100.0 %. Outside of this range, the output signal remains limited at value 100.0, respectively 0.0. The calculated signal is available at output C. If the input EnC is at 0, the cooling sequence is deactivated and the output C remains at 0.0.

If the Mix range is variable, the adjusted ranges are shifted below the actual value of the Mix range. In this case, the cooling range must be adjusted for the situation when the Mix range is 0 (no shifting).

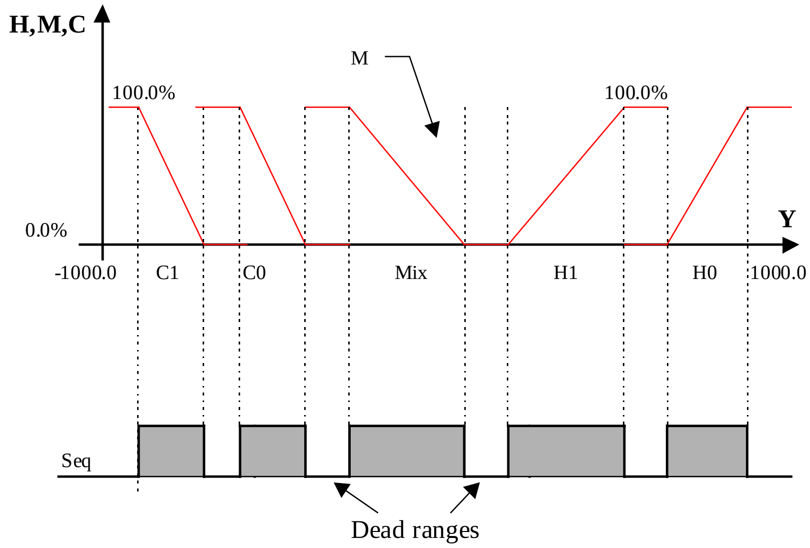
The heating sequences are calculated independently. They may be adjusted in increasing or decreasing order. There is no locking between them. The same is valid for the cooling sequences, which have always negative values. However, the priority is always given to the Mix sequence compared to the other sequences. As soon as the Mix sequence is active, all heating or cooling sequences are locked (output at 0.0).

If the output signals must work in a different range as 0.0..100.0 %, they can be converted by the auxiliary Fbox for proportional sequence. It allows also to invert the signal caracteristic (direct or inverted) if necessary.

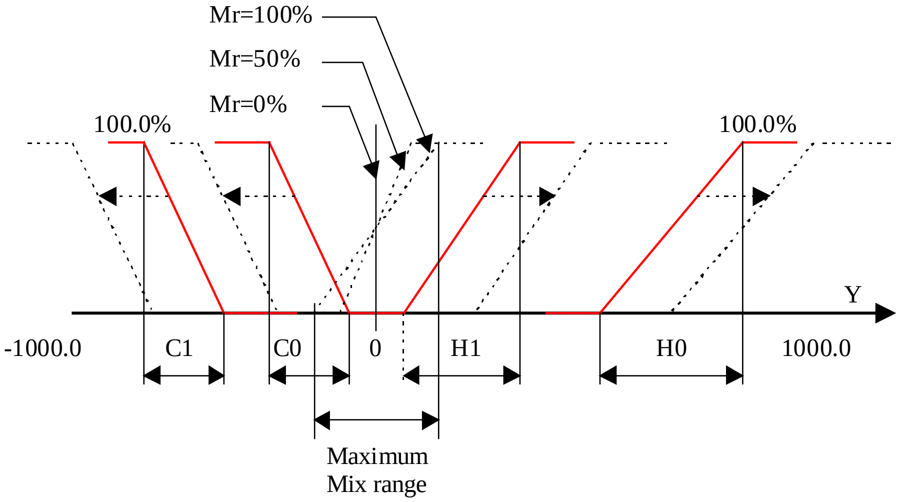
The output signal Seq indicates if at least one sequence is in the active range. It means that the input signal is in one of the adjusted range. This signal is foreseen for indicating to the controller if it is in a dead range or outside of the sequencer active range. This programming is interesting for controllers P-PI and P-PID.

With the integration reduction function, it is possible to slow down the passing from one sequence to the next and to better use the dead ranges.

Diagram



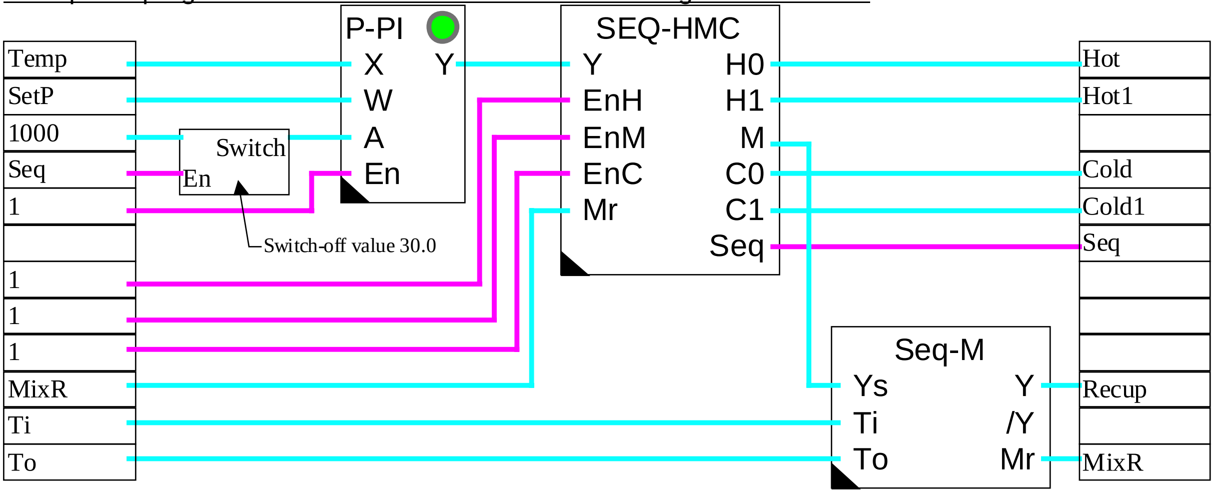
Parameters with variable Mix range



Typical application

This function is useful and facilitate the programming in a heating, cooling sequences application with one or two energy recuperation system.

Example of program with a P-PI controller and 30.0% integrator reduction.



References

For simple application with one heating and one cooling sequence only, the Fbox Sequence, Master, Heating / Cooling can be used.

For standard applications with one heating sequence, one Mix sequence and one cooling sequence only, the Fbox Sequence Master, Hot, Mix, and Cold Compact can be used.

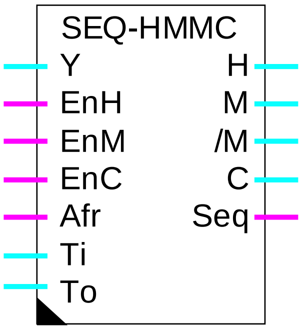
6.20 Sequence Master, Heating, Mix, and Cooling Compact

Family: **HVC-Controllers**

Name: **Sequence Master HMMC**

Macro name: _HeaSm4

Fbox:



Short description

Fbox compact for heating-mix-cooling sequence realization. The controller output signal is divided in 3 parts. One signal for the heating sequence. Two additional signals for the recuperation and one signal for the cooling sequence.

See also: Generalities about Controller Sequences.

Generalities about Mixer Sequences

Inputs

Y	Input	Controller output Y. The controller must work in a symetric range. E.g. -100.0 to +100.0 % or - 1000.0 to + 1000.0
EnH	Enable Heating	Activation of the heating sequence.
EnM	Enable Mix	Activation of the mix sequence.
EnC	Enable Cooling	Activation of the cooling sequence.
Afr	Antifrost	Antifrost danger.
Ti	Temp. inside	Measurement of the inside or the outlet air temperature
To	Temp. outside	Measurement of the outside or the inlet air temperature

Outputs

H	Heating	Command output of the heating sequence. Signal from 0.0 to 100.0 %
M	Mix	Mix sequence. Command of the recuperation system.
/M	Mix inverted	Mix sequence. Command of the recuperation system. Inverted signal compared to M.

C	Cooling	Command output of the cooling sequence. Signal from 0.0 to 100.0 %
Seq	Sequence	Indication that a sequence is in the working range. The output is at 0 in the dead range and outside the ranges Heating and Cooling.

<u>Parameters</u>

-----[Heating Sequence]-----

Upper point Y — Upper point of the input Y range for the heating sequence. This value provides 100.0 % of the output signal H.

Lower point Y — Lower point of the input Y range for the heating sequence. This value provides 0.0 % of the output signal H.

-----[Mix Sequence]-----

Upper point Y — Upper point of the input Y range for the heating sequence. This value provides 100.0 % of the output signal M (upper limit), respectively 100% in inverted mode (lower limit).

Lower point Y — Lower point of the input Y range for the heating sequence. This value provides 0.0 % of the output signal M (lower limit), respectively 100% in inverted mode (upper limit).

Option range 'Mix' — Option for the operating of the range 'mix'

- Fix, Inverted — The sequence range 'Mix' is fix. It is given by the above upper and lower points.

  The output M is inversely proportional to the input signal Y.

- Var, Inverted — The range of the sequence 'Mix' is variable. The maximum range is given by above upper and lower points. These values are reduced in function of the difference To-Ti. The reduction goes from 100.0 % to 0.0 %. With this option, the heating and cooling sequence ranges must be positionned without taking into account the range Mix.

  The output M is inversely proportional to the input signal Y.

- Fix, Direct — The sequence range 'Mix' is fix. It is given by the above upper and lower points.

  The output M is directly proportional to the input signal Y.

- Var, Direct — The range of the sequence Mix is variable. The maximum range is given by above upper and lower points. These values are reduced by the input signal value Mr. The reduction goes from 100.0 % to 0.0 %. With this option, the heating and cooling sequence ranges must be positionned without taking into account the range Mix (supposed Mr = 0.0).

  The output M is directly proportional to the input signal Y.

Upper point reduced	Calculation of the upper point Mix after possible calculation of the reduction.
Lower point reduced	Calculation of the lower point Mix after possible calculation of the reduction.
-----[Cooling Sequence]-----	
Upper point Y	Upper point of the input Y range for the cooling sequence. This value provides 100.0 % of the output signal C.
Lower point Y	Lower point of the input Y range for the cooling sequence. This value provides 0.0 % of the output signal C.

Description

The controller output signal is divided in 3 signals, each in a adjustable range. The heating and cooling sequences work exactly the same way as in the Fbox Sequence, Master, Heating / Mix / Cooling.

The Mix sequence is immediately converted in command signals (M and /M) for a recuperation system. No auxiliary function are needed for for the Mix sequence. This signal is conditionned by the temperatures Ti and To as well as by the parameters of the Mix sequence, exactly as in the Fbox Sequence, Mixer 1. The recuperation system outputs are called here M and /M instead of Y and /Y.

Antifrost

If the antifrost signal is on at input Afr, the HMMC function is deactivated and the outputs are forced to the following values:

H = 100.0%

M = 0.0%

/M = 100.0%

C=0.0%

The antifrost function has the priority on the En signal.

Reference

For simple applications with one heating and one cooling sequence only, the Fbox Sequence, Master, Heating / Cooling can be used.

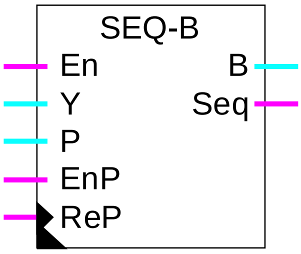
6.21 Sequence, Master Burner

Family: **HVC-Controllers**

Name: **Sequence Master B**

Macro name: _HeaSmb

Fbox:



Short description

Main sequence Fbox for the control of burner cascade. The output signal of the controller is divided in 2 to 8 signals which can be handled by auxiliary sequence functions. It is possible to mix burners with On-Off command, burners with several power levels and burners with modulable power.

See also Generalities about Controller Sequences.

Inputs

En0..7	Enable	Authorized sequence 0..7.
Y	Input	Controller output Y. The controller must work in a symetric range. E.g. 0 to +100.0 % or 0 to + 1000.0
P	Priority	Definition of a priority sequence
EnP	Enable priority	Activation of the priority sequence.
ReP	Reset priority	Reset of all sequences from the priority sequence.

Outputs

B0...7	Burner 0...7	Command outputs of burners. Signals from 0.0 to 100.0 %
Seq	Sequence	Indication that a sequence is in the working range. The output is at 0 in the dead ranges and outside the whole working range.

Parameters

-----[Sequences control]-----

Priority option	Future extensions.
- Standard	Standard option.

Priority sequence	Manual introduction of a priority sequence.
Reset sequences	Reset of all sequences from the priority sequence.
Active sequence	Display of the actual active sequence.
Set button	Changeover of the active sequence by the priority sequence defined above.
-----[Sequence 0...7]-----	
Range	Range of the input signal Y for each sequence (dead range included).
Dead range	Dead range before sequence start.

<u>Description</u>

The controller output signal is divided in several signals (2 to 8), each one in an adjusted range. It is recommended to adjust the used sequences inside the total controller working range. This total range should correspond to the sum of the used sequences. Usually, a positive range going from 0.0 % to +100.0 % should be used. However, when the number of sequences is high (more than 4), or if some ranges are smaller than the others, the output signal resolution can be increased by using a range going from -0.0 to +1000.0.

The range value of each sequence indicates the available power of the corresponding device compared to the total available power. The correct parameter adjustment is unavoidable as to get a good stability of the regulation loop.

At a given time, only one sequence is active. The active sequence is the one with the B signal variying in the range 0.0 ...100.0% as a function of the input signal. The preceeding sequences are forced to 100.0% and the following sequences remain at 0.0%.

The dead range is within the range of the corresponding sequence and in the lower part. It means that the sequence lower point for the output value 0.0 is shifted upward. It is not possible to have an overlap of two ranges. In this way, the dead range is dedicated to one burner. It remains valid when the preceeding burner is switched off.

If input En of one sequence is at 0, it is deactivated and the ouput B remains at 0.0. The sequences calculation is made in shifting the following sequences as to compensate the range of the deactivated sequence.

The sequence choice begins from a priority sequence. At start, as default, the sequence 0 is the priority sequence (input EnP=0 and ReP=0). When signal Y increases, the sequences are progressively activated in increasing order from the priority sequence. When the request decreases, the sequences are reduced in inverted order as to finish with the priority sequence.

There are 3 ways to modify the priority sequence as to balance the use of the 3 various installations.

- automatic progressive change
- immediat change by Reset of the calculation

- manual sequence changes

Automatic progressive change of sequence

If input EnP is activated, the priority sequence can be indicated by input P. When moving from an active sequence to the next or to the preceeding, the calculation is made from the indicated priority sequence. In this way, after several changes, the sequences designated after the priority sequence are put into operation. The change is made without immediat cut off. However, the changeover is not ensured if the request at input Y does not change.

Immediat change of priority sequence

If input ReP is activated (positive pulse only). The priority sequence is immediately put into service and the calculation of all sequences is immediately reset. This method can immediately switch-on and off some installations. However, it insures the changeover to new sequences even if the request at input Y does not change.

Manual sequences changes

In the adjust window, the active sequence as well as the priority sequence are displayed for checking.

The priority sequence can be modified manually. It enables a progressive change as described above.

The Set button allows to modify the active sequence. The new active sequence is first introduced as priority sequence. The Set button allows to exchange it with the active sequence. The previous active sequence takes the state of the exchanged one (0.0 or 100.0%). If the 2 sequences exchanged have not the same range, a new sequence becomes immediately the active sequence.

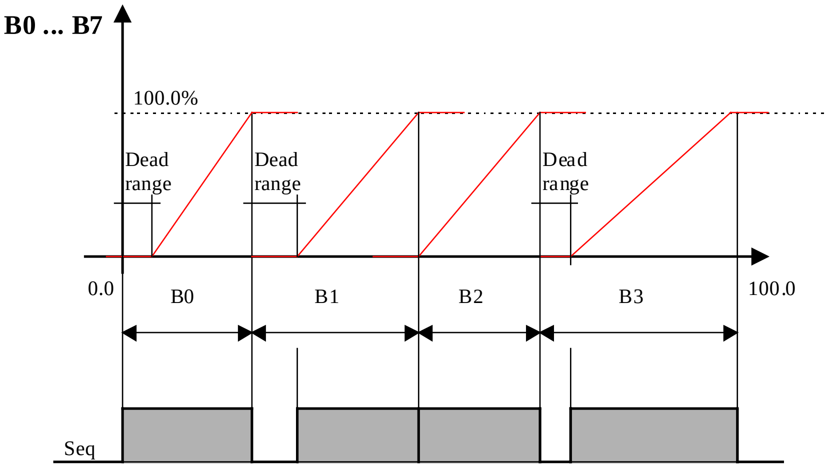
The Reset button allows to recalculate immediately all sequences, taking into account the introduced value as priority sequence. It allows to realize an immediate changeover as described above.

If the output signals must work in a different range as 0.0..100.0 %, they can be converted with auxiliary Fbox for proportional sequence.

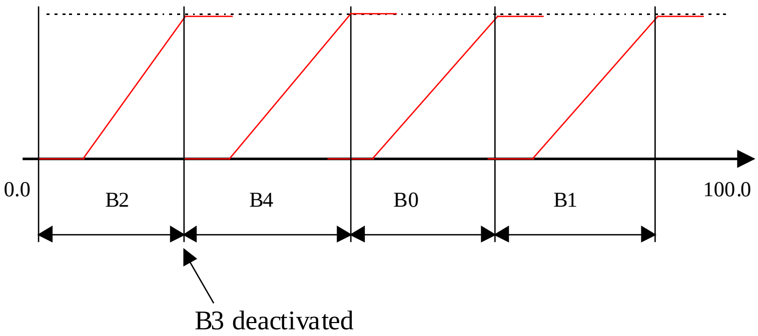
The output signal Seq indicates if at least one sequence is active. It means that the active sequence is not in the dead range. This signal has been foreseen as to indicate to the controller its output is located in dead range or outside of the whole range. This programming is interesting for P-PI and P-PID controllers. By means of the integrator reduction function, it is possible to slow down the passing from one sequence to the other and to better use the dead ranges.

<u>Diagram</u>

Example with 4 burners, priority at B0



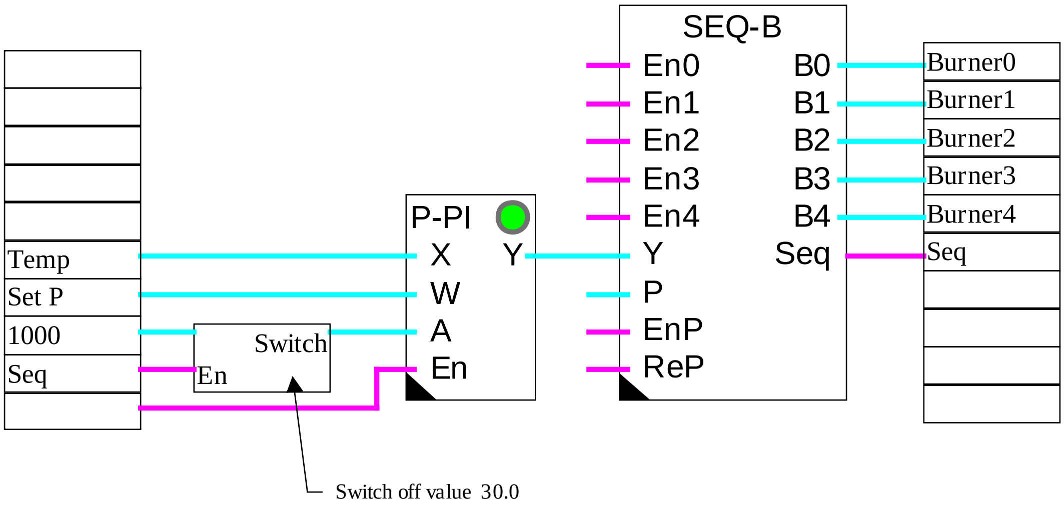
Example with 5 burners, priority at B2, B3 is deactivated



Typical application

This function is very useful and facilitates the programming of an application using multiple burners with modulated jet. It also allows to regulate the burners with On-Off or stepping command using an integrator function in the controller. This is not possible neither with 2-point controllers nor with the function burner cascade 2*2.

Program example with a P-PI controller and integrator reduction to 30.0%.



References

For more simple applications with 2 burners only, the Fbox Burner cascade 2*2 can be used.

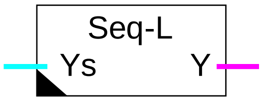
6.22 Sequence, 1-4 Levels

Family: **HVC-Controllers**

Name: **Sequence 1-4 levels**

Macro name: _HeaSeq41

Fbox:



Short description

Sequence auxiliary Fbox for definition of a sequence having 1 to 4 binary signals switched on at successive levels.

See also Generalities about Controller Sequences.

Input

Ys	Y sequence	Controller output Y of a sequence Master. This signal is always working in the range 0.0 to 100.0 %.

Output

Y, Y0...3	Sortie 0...3	Successive binary command.

Parameters

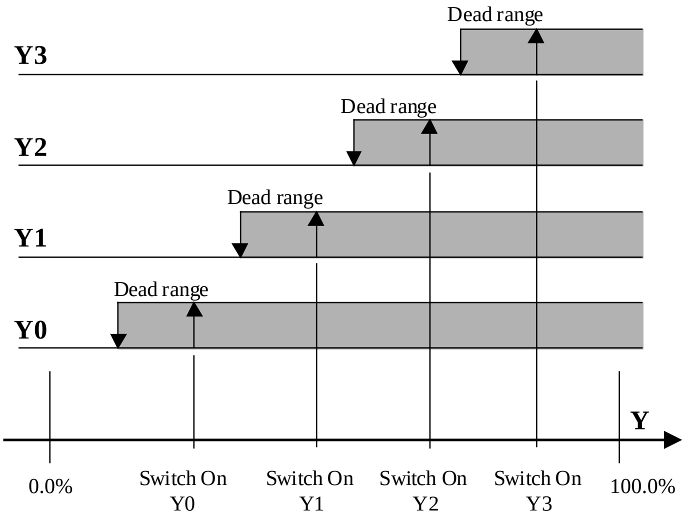
Switch-on point Y0 to Y3	Switch point of the corresponding output signal. The output is switched on when the input value overtakes the switch-on point.
Dead range Y0-Y3	Dead range between the switch-on point and the switch-off point. The dead range is the same for all outputs.

Description

The 4 outputs are successively commuted as the input signal goes above the adjusted switch-on point. Each output is switched off when the input signal goes below its switch-on point less the dead range value.

Each output is switched on and off indenpendently of the others. Therefore, they can be adjusted in any order.

Diagram


Dead range
Y3
Dead range
Y2
Dead range
Y1
Dead range
Y0
Y
0.0%
Switch On
Y0
Switch On
Y1
Switch On
Y2
Switch On
Y3
100.0%

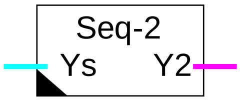
6.23 Sequence, 2 Points

Family: **HVC-Controllers**

Name: **Sequence 2 points**

Macro name: _HeaSeq2p

Fbox:



Short description

Sequence auxiliary Fbox for definition of a 2 points binary output.

See also Generalities about Controller Sequences.

Input

Ys	Y sequence	Controller output Y of a sequence Master. This signal is always working in the range 0.0 to 100.0 %.

Output

Y2	Sortie Y	Binary output of 2 point regulation.

Parameters

Action Option for the sequence action.

- Direct	Direct action. Standard case for heating and cooling sequences.
- Inverted	Inverted action. Particular case.

Switch-on point	Switch-on point of output signal. The output is switched on when the input value overtakes the switch-on point.
Switch-off point	Switch-off point of output signal. The output is switched off when the input value becomes lower than the switch-off point.

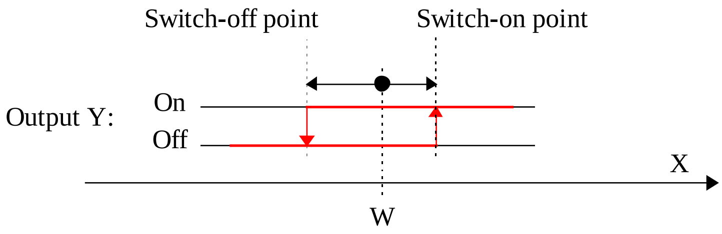
Description

This Fbox allows to realize a 2-point controller with a sequence of a continuous controller PI or PID.

The output is switched on when the input value exceeds the switch-on point.

The output is switched off when the input value goes below the switch-off point.

Diagram



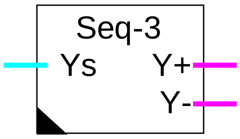
6.24 Sequence, 3 Points

Family: **HVC-Controllers**

Name: **Sequence 3 points**

Macro name: _HeaSeq3p

Fbox:



Short description

Sequence auxiliary Fbox for definition of a 3 points binary output.

See also Generalities about Controller Sequences.

Input

Ys	Y sequence	Controller output Y of a sequence Master. This signal is always working in the range 0.0 to 100.0 %.

Output

Y+	Y open	Binary signal for positive regulation. E.g. opening of mix valve
Y-	Y close	Binary signal for negative regulation. E.g. closing of mix valve

Parameters

Action Option for the sequence action

- Direct	Direct action. Standard case for heating and cooling sequences.
- Inverted	Inverted action. Particular case.

Switch-on point Y+	Switch-on point of output signal Y+. The output is switched on when the input value overtakes the switch-on point.
Switch-off point Y+	Switch-off point of output signal Y+. The output is switched off when the input value becomes lower than the switch-off point.
Switch-off point Y-	Switch-off point of output signal Y-. The output is switched off when the input value becomes lower than the switch-off point.
Switch-on point Y-	Switch-on point of output signal Y-. The output is switched on when the input value overtakes the switch-on point.

Maximum time Y- Maximum time[sec] of activation signal Y-. This time must correspond to the valve maximum closing time. After this time, the signal Y- is automatically switched off.

Description

This Fbox allows to realize a 3-point controller with a sequence of a continuous controller PI or PID.

The output Y+ is switched on when the input value exceeds the switch-on point Y+.

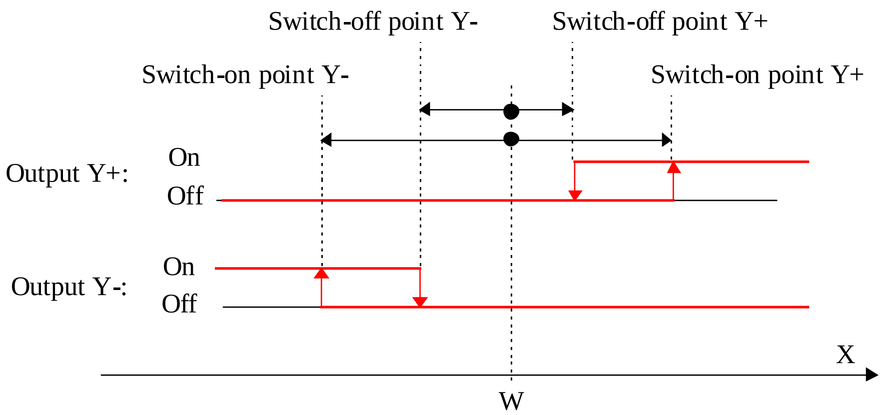
The output Y+ is switched off when the input value goes below the switch-off point Y+.

The output Y- is switched off when the input value exceeds the switch-off point Y-.

The output Y- is switched on when the input value goes below the switch-on point Y-.

This function can be used for controlling 3-point command valves. As to avoid the output relay to be activated during switch-off periods, a maximum closing time has been integrated. The switch-on time of the Y- signal is monitored. After the maximum adjusted time, the Y signal is automatically cut off.

Diagram



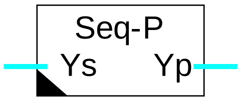
6.25 Sequence, Proportional

Family: **HVC-Controllers**

Name: **Sequence P**

Macro name: _HeaSeqp

Fbox:



Short description

Sequence auxiliary Fbox for definition and calibration of a proportional output.

See also Generalities about Controller Sequences.

Input

Ys	Y sequence	Controller output Y of a sequence Master. This signal is always working in the range 0.0 to 100.0 %.

Output

Yp	Output Y	Proportional numeric signal. E.g. position of the mix valve

Parameters

Action	Option for the sequence action
- Direct	Direct action. Standard case for sequences heating and cooling.
- Inverted	Inverted action. Particular case. The input signal (0.0 to 100.0 %) is converted in a signal from 100.0 to 0.0 %.
Output range	Output signal range fot the standard input range 0.0 to 100.0 %.
Offset	Offset applied to the signal after range conversion.

Description

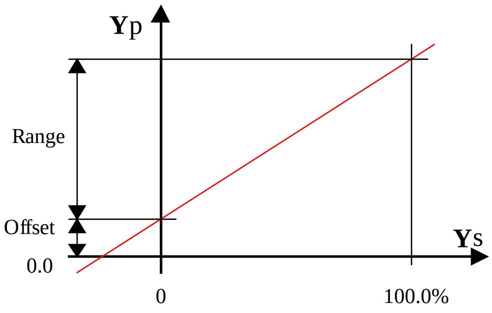
The input signal is converted in a linear way according to the parameters for range and offset. Moreover, through an option, the caracteristic of the output signal can be inverted compared to the input signal.

The input signal is first converted according to the range parameters. The offset is then added. In this way, the offset value corresponds to the units of the output value.

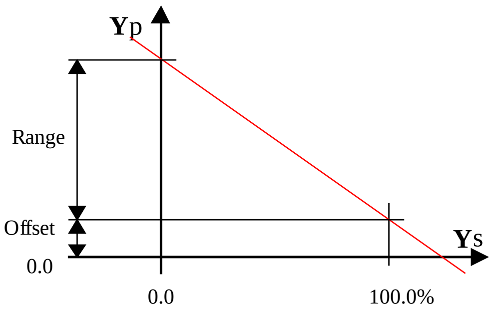
The output signal is not limited. However, if the input signal comes from a sequence Fbox HC or HMC, it is limited between 0.0 and 100.0%. In this case, the output signal goes frome 'Offset' to 'Offset' + 'Range'.

Comment: For Hot and Cold valves commands with sequence Fboxes HC and HMC, the caracteristic must always stay at 'Direct' since the signal is already converted by this Fbox.

Diagram, caracteristic 'Direct'



Diagram, caracteristic 'Inverted'



6.26 Generalities about mixer sequences

See also Generalities about Controller Sequences

Inputs

Ys	Y sequence	Controller output Y of a sequence Master. This signal is always working in the range 0.0 to 100.0 %.
Ti	T ambient	Measurement of the ambient temperature or the outlet air temperature
To	T outside	Measurement of the outside temperature or the air inlet temperature

Outputs

Y, Y1	Output Y1	Control of the first recuperation system
/Y,/Y1	Y1 inverted	Control of the first recuperation system. Inverted signal compared to Y1. E.g. Control of hygroscopic wheel.
Y2	Sortie Y2	Control of the second recuperation system. E. g. Control of inlet air valves.
/Y2	Y2 inversé	Control of the second recuperation system. Inverted signal compared to Y2. E.g. Control of recuparated air valves.
Mr	Mix Range	Modulation signal of the 'mix' sequence. Values from 0.0 to 100.0 % in the range of adjusted temperature difference Ti-To.

Parameters

Lower limit Y, Y1	Lower limit of the output signal 'Y' or 'Y1'.
Upper limit Y, Y1	Upper limit of the output signal ''Y' or Y1'.
Lower limit Y2	Lower limit of the output signal 'Y2'.
Upper limit Y2	Upper limit of the output signal 'Y2'.
Changeover Y1-Y2	For function with two sequences only. Value of input signal defining the switching point from system 1 to system 2. The working range of system 1 goes from 0.0 % up to this point. The working range of system 2 goes from this point to 100.0 %.
Dead range Ti=To [K]	Dead range on the difference Ti-To in which no outputs 'Y' and '/Y' changeover occurs. Moreover, a null range is defined. The null range equals half of the dead range. In the null range, output 'Y' is set to the lower limit value.
To-Ti for 100% Mr	Range for the difference To-Ti corresponding to 100.0 % of the sequence Mr. Below this difference, the ouput Mr is proportionally reduced. This value represents for the Master sequence, the available power in the sequence 'Mix'. Above this range, the output Mr remains at 100.0 %.
Energy	Display of the offer or the request of energy.
- Request	Energy request if To<Ti.
- Offer	Energy offer if To>=Ti.

Description

The input signal coming from the sequence HMC has a range of 0.0 to 100.0%.

The output signals Y or Y1 and Y2 move from 0.0% to 100.0% and correspond for example to the inlet air flow. The minimum and maximum values allow among others to guanrantee a permanent fresh air recycling. The complement of the Y signal is given at /Y output (respectively /Y1 and /Y2) which moves from 100.0% to 0.0%.

For the 2 systems function, an additional parameter defines the passing from the first to the second system. The range of the input signal is always from 0.0 to 100.0%. This parameter allows to divide the range in two parts. Each part must represent the maximum power available for each system dcompared to the total of the two. The maximum power is the one provided when the output is at upper limit and the difference To-Ti equal to the adjusted value for 100.0% Mr.

The command of each system is automatically inverted when the difference To-Ti is inverted. In both situations, the system 1 has still priority.

When the difference To-Ti is inverted, the valves move from the maximum to the minimum position. The dead range avoids the repetition of these movements if the temperatures change. In this range, the valves position is not modified.

Moreover, a null range, corresponding to the half of the dead range is applied. In this range, the output signal Y is set to 0.0. This allows to stop a recuperation signal of a recuperation hygroscopic wheel when the difference To-Ti is low.

In the range where To is close to Ti, the recuperated energy is low. However, with a high difference, the available power for the controller is bigger. This difference has an influence on the controller loop. This fact can be taken into account by using the Mr signal. The output Mr indicates in %, the available power compared to the maximum adjusted To-Ti range. This signal is foreseen for the sequence function HMC. The function must have the option 'Mix Range = Variable' as to be taken into account. With this structure, the sequence Mix is automatically adapted to the available power of the recuperation system. If the difference To-Ti is low, the following sequences will be neared. When this difference is bigger, the following sequences are farther.

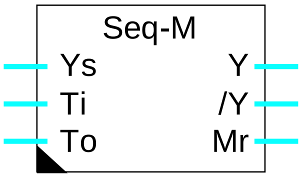
6.27 Sequence, Mixer 1

Family: **HVC-Controllers**

Name: **Sequence mixer 1**

Macro name: _HeaSeqm

Fbox:



Short description

Auxiliary Fbox for the control of air mixing or other recuperation system.

See also Generalities about mixer sequences.

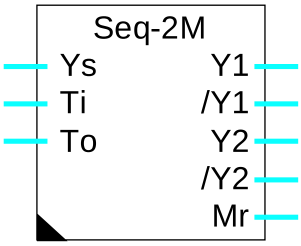
6.28 Sequence, Mixer 2

Family: **HVC-Controllers**

Name: **Sequence mixer 2**

Macro name: _HeaSeq2m

Fbox:



Short description

Auxiliary Fbox for the control of 2 recuperation system.

See also: Generalities about Regulation Sequences.

Notes

7. HVC-Analogue

Contents

7.1 Analogue-Generalities

Introduction

This general description is valid for all analogue Fboxes. Individual Fbox descriptions contain particularities and possible differences in comparison with this general description.

The Heavac library contains a function family for the control and the calibration of the analogue modules. An individual calibration of each analogue input and output is provided. The reason for calibration is to work in Fupla with effective process value only (°C for temperature, % for valve opening, etc.).

The Fboxes are developed as to handle one hardware analogue module each. For that reason, one Fbox per PCD analogue module must be placed in the Heavac application. For simplification, the same has been used for the hardware module as for the Fbox. For some modules, several analogue Fbox exist. For indicating the concerned module to the Fbox, the base address of the hardware module is given as parameter.

All values of the Heavac library are theoretically calibrated and calculated with a 1/10 resolution. For example: 22.5 °C, 55.0 %. However, the registers are used in integer format. The decimal point disappears and the physical values are multiplied by 10. The analogue modules have to be calibrated, taking the 10 factor into account.

Addresses which are in conflict with the Watchdog may not be used:

PCD2:	I/O 240				
PCD4:	I/O 240	I/O 496			
PCD6:	I/O 240	I/O 496	I/O 752	I/O 1008	+ 256...etc
PCD1:	no WD hardware				

Fbox Inputs

The Fbox inputs receive the values to be transmitted to the analogue output module.

o0	Output 0	Value for analogue output 0 of the module
...		
o7	Output 7	Value for analogue output 7 of the module
...		

Fbox Outputs

The Fbox outputs supply the values received from the analogue module inputs.

i0	Input 0	Calibrated value of analogue module input 0
...		
i7	Input 7	Calibrated value of analogue module input 7

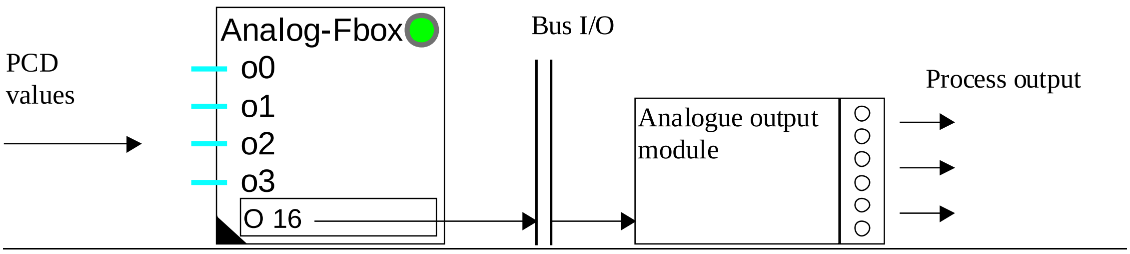
...

Err	Error binary	For Fboxes with replacement value for faulty sensors. The output is set to 1 if at least one faulty sensor has been detected.
Err	Error num.	For Fboxes with replacement value for faulty sensors. The output shows a numeric code indicating the faulty sensors. The bits 0 to 7 corresponds to inputs 0 to 7. This value can be converted in 8 binary bits(one bit per sensor) with a conversion function 'Int-Bin 1-8'.

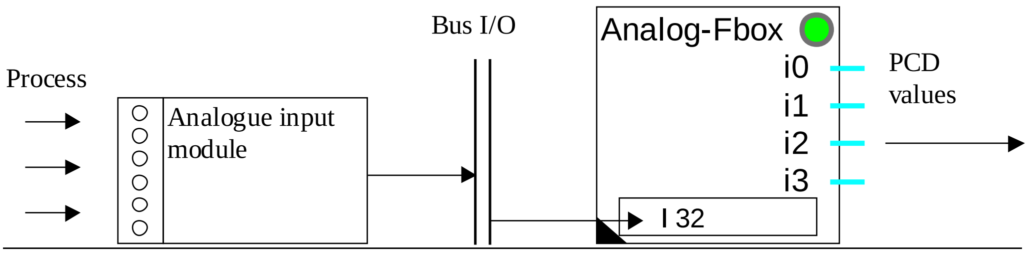
Fbox fields for address

The Fbox field allows to define the base address of the corresponding hardware module.

Analogue output principle diagram



Analogue intput principle diagram



LED and error acknowledge button

In case of wrong calibration, an overrun of the calculation capacity may occur. The LED turns red. The parameters have to be corrected. The LED can be acknowledged by the acknowledge button

Depending on the module type, the LED may be red in the following cases:

- overrun of calculation capacity
- the analogue module is not present at the specified location
- the analogue module at the specified location is not compatible with the Fbox type
- the analogue module is faulty

- the CPU is overloaded and cannot handle this module
- an output has been switched in manual mode (for module with manual mode)
- a temperature sensor connected to the module is faulty (module with faulty sensor detection)

If the error is not produced by the hardware and not occuring cyclically, it may be acknowledged by the acknowledge button in the adjust window.

Parameters

See details below according to calibration type.

Inputs calibration

Two main calibration concepts for Fbox inputs are available.

1. Predefined calibration with various options

Examples:

PCD2.W22 Pt-Ni	Predefined calibration with oversampling, filter and sensor type
PCD4.W3 Pt-Ni	Predefined calibration with filter and sensor type

For this calibration type, see Predefined Calibration for Temperature Sensors.

2. Calibration with free adjustable parameters

Examples:

PCD2.W22

PCD4.W3

PCD6.W3

For this calibration type, see Individual Calibration of Analogue Inputs .

Mixed Fboxes having free calibration channels and predefined calibration channels are also available.

Outputs calibration

Outputs are always with free adjustable parameters.

See Calibration of Analogue Outputs.

7.2 Calibration of Analogue Outputs

The analogue Fboxes with calibration options O-R and R-O and individual parameters provides the calibration of each analogue output by adjusting the range and offset parameters as to find ideal values.

The analogue output Fboxes shows the following parameters:

Method	Option for calibration method, valid for all outputs
1-1	No conversion. The range and offset parameters have no effect. The value depends on the D/A converter
O-R	Subtraction of offset, then conversion of range. This allows the offset to be given as a useful value (before conversion).
R-O	Conversion of range, then subtraction of offset. This allows the range to be adjusted without affecting the offset.
Output, range	Parameter, conversion range of the signal
Output, offset	Parameter, signal offset
Output	Display of the actual value at Fbox input.

Value ranges valid with option 1-1

Resolution:	8 bits	Range:	0..255
	10 bits		0..1023
	12 bits		0..4095

The output values are limited at minimum and maximum values corresponding to the resolution before being transferred the the analogue module.

The output devices (valves, drive, etc.) are generally linear, the range and the offset are known. The conversion is then correct over the whole range. If the device is not linear, the points must be selected in such a way that the non-linearity is insignificant in the working range.

Procedure for analogue output calibration

- Calibration of linear devices
  See Calibration of Outputs with Range and Offset Known .

- Calibration of analogue outputs with non linear regulation devices.

  See specific calibration methods for input modules:
  Individual Calibration, Option O-R
  Individual Calibration, Option R-O

7.3 Calibration of Outputs with Range and Offset Known

In this situation the default calibration option must be selected (Method = 'O-R').

The parameter range allows to define the value total range corresponding to the output signal total range. For example, for a 0-10V module and a range parameter of 250.0, the voltage signal goes from 0 to 10V when the value goes from 0.0 to 250.0.

The parameter offset allows to shift this range until the 0V signal corresponds to another value. This offset must be given in calibrated value (°C, %, etc.).

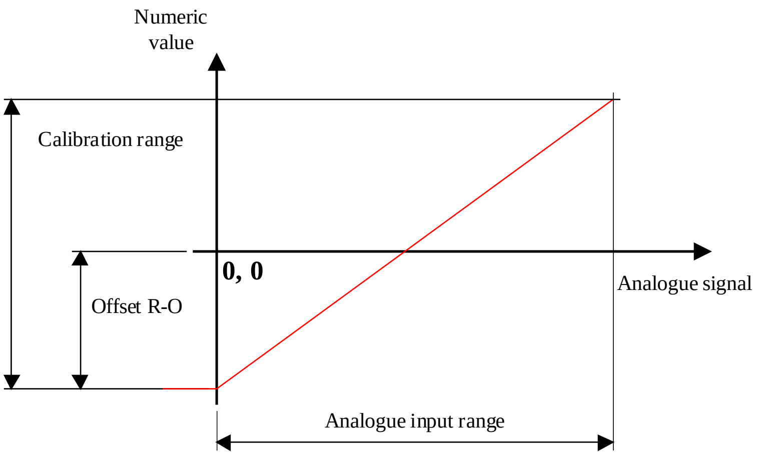
For example, if the above value 100.0 must correspond to a 0V signal, the offset is 100.0. The voltage values will then be between 0 and 10V for 100.0 and 350.0.

It is also possible to position the value 0 within the voltage range. The offset signal must then be negative. For example, if the 0-10V signal corresponds to a value between -250.0 and +250.0, the total range is 500.0 (parameter range) and the offset is -250.0 (parameter offset). The 0V voltage signal corresponds then to -250.0.

The value may also move in the other direction than the voltage signal. In this case, the parameter range takes a negative value.

Diagram

Analogue module, linear signal, calibration O-R



Comments

The parameter range corresponds always to the total range of the analogue signal for which the module has been designed, even if the range is not completely useable.

Some typical calibrations

Outputs for valve control 2-10V:

Range	125.0
Offset	-25.0
Values	0.0-100.0%

Adaptation 4-20 mA for outputs 0-20 mA:

Range	125.0
Offset	-25.0
Values	0.0-100.0%

7.4 Individual Calibration of Analogue Inputs

The analogue Fboxes having calibration options O-R and R-O and individual parameters allows a calibration of each analogue input in adjusting the parameters range and offset as to find ideal values.

The analogue input Fboxes with individual calibration shows the following parameters:

Method	Option for calibration method, valid for all outputs
1-1	The value is not calibrated. It depends on the converter resolution.
O-R	Addition of offset, then conversion of range.
R-O	Conversion of range, then addition of offset.
Input, range	Parameter, conversion range of the signal
Input, offset	Parameter, signal offset.
Input	Display of the calibrated value at Fbox output.

Value ranges with option 1-1

Resolution:	8 bits	Range:	0..255
	10 bits		0..1023
	12 bits		0..4095
	12 bits+sign		-4095..+4095

The target of the calibration is to define 2 known reference points by wihch the interpolation line is passing. If the sensor is linear, the conversion is then correct over the whole range. However, if the sensor is not linear, the points must be selected in such a way that the non-linearity is insignificant in the working range.

Procedure for the calibration of individual analogue inputs.

For Fboxes with calibration parameters, 3 situations may occur:

- Range and offset are well known in advance
  See Calibration of Inputs with Range and Offset Known.
- A standard sensor Pt 100, Pt 1000, Ni 100 or Ni 1000 is used with the corresponding module.
  The standard parameters are given in each module description.
  In this case, the use of a Fbox with predefined calibration is probably the best solution.
- A specific calibration must be performed.
  Individual Calibration, Method O-R
  Individual Calibration, Method R-O

The user has also the possibility to define his own particular calibration. It is for example possible to calibrate the analogue inputs for working in mV.

However, it is not interesting to select a calibration that reduces too much the signal resolution.

Bad example: A calibration in mA for a range 4 to 20 mA, with one decimal point, offers only 200-40 = 160 steps. A module 10 bits offers 1024 steps !

Good example: A calibration in mV for a range 0 to 10 V offers 10'0000 steps. The resolution will be limited by the module (10 Bits -> 1024 steps).

7.5 Calibration of Inputs with Range and Offset Known

This calibration method applies only to Fboxes with calibration options O-R and R-O as well as individual parameters.

In this situation the default calibration option must be selected (R-O for inputs).

The parameter range allows to define the total range of the calibrated value which correspond to the input signal total range. For example, for a 0-10V module and a parameter range of 250.0, the calibrated value goes from 0.0 to 250.0 when the voltage signal goes from 0 to 10V.

The parameter offset allows to shift this range in order to adapt the 0V signal to another calibrated value. This offset will be given in calibrated value (°C, %, etc.).

For example, if the above value 100.0 must correspond to a 0V signal, the offset is 100.0. The calibrated values will then be between 100.0 and 350.0.

It is also possible to position the value 0 within the voltage range. The offset signal becomes then negative. For example, if the 0-10V signal corresponds to a value between -250.0 and +250.0, the total range is 500.0 (parameter range) and the offset is -250.0 (parameter offset). The 0V voltage signal corresponds then to -250.0.

The value may also move in the other direction than the voltage signal. In this case, the parameter range takes a negative value.

Comments:

The parameter range corresponds always to the total range of the analogue signal for which the module has been designed, even if the range is not completely useable.

For the direct connection to temperature sensors, the total range in not easy to define.

See typical values given in each module description. For other sensor type, a specific calibration is necessary.

Individual Calibration, Method R-O

Individual Calibration, Method O-R

For non linear sensors (and not linearized by a hardware module), a linear interpolation may be made on a selected range and a specific calibration is necessary.

Some typical calibrations

Adaptation 4-20 mA for outputs 0-20 mA:

Range	125.0
Offset	-25.0
Values	0.0-100.0%

7.6 Individual Calibration, Option O-R

Principle of the O-R option:

Addition of offset, then conversion of range.

This allows the range to be adjusted without affecting the offset. This method is used when the range is known, and when calibration takes place with 2 points, starting with 0. For example with a sensor Ni 1000, a resistance of 1000 Ohms makes it possible to simulate 0 °C and ajust the offset. A second point, e.g. 100 °C can be simulated and the range (amplification) can be ajusted without any shift of the point 0 °C.

The O-R method is therefore useful when the point 0 of the calculated value can be used as one of the calibration point.

Procedure:

The range conversion is neutralized when introducing exaclty the binary range value (102.3 for 10 bits / 409.5 for 12 bits).

The signal corresponding to zero point is applied to the analogue input. As example, for a Pt 1000 sensor, a resistance of 1000 Ohms can be applied.

The value read as converted input signal is introduced as offset with inverted sign.

The input value must then show 0.0.

The signal corresponding to the second point is applied to the analogue input. As example, for a Pt 1000 sensor, a resistance of 1385 Ohms is applied for calibration of point 100°C.

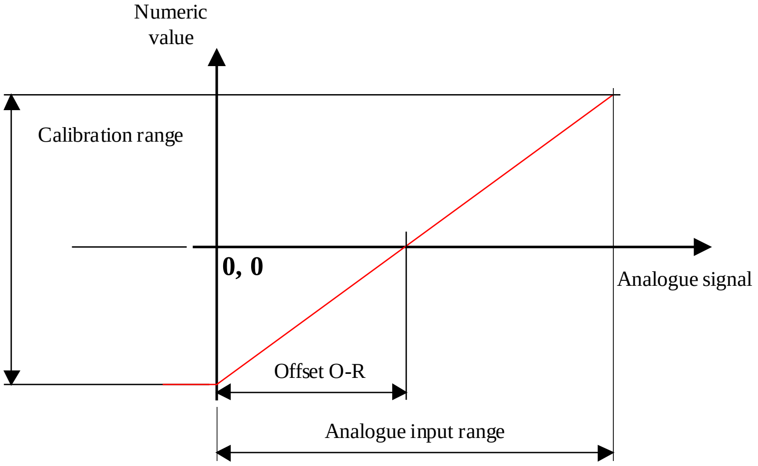
The parameter range is then adjusted until the display of the input signal shows exaclty 100.0.

Thank to method O-R, the zero point is not modified by this operation. The channel is then calibrated and an linear interpolation exactly through these 2 points is done.

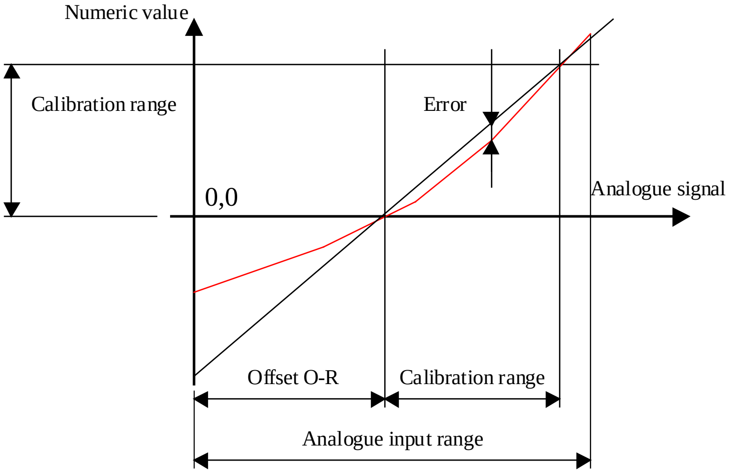
As to evaluate the calibration quality, values inside and possibly outside the range, must be simulated and read.

Diagram

Analog module, linear signal, calibration O-R



Calibration for non-linear signal



Comments:

For non linear sensors (Pt, Ni, etc.), the choice of the 2 calibration points is quite important. If the 2 points are close (0 and 20 °C), the error between these points becomes insignificant. However, the error outside the 2 points becomes important. When none of the 2 points correspond to 0, the modification of the parameter range shifts the 0. The R-O method should then be used.

7.7 Individual Calibration, Option R-O

Principle of the R-O option

Conversion of range, then addition of offset.

This allows the offset to be given as a useful (converted) value. This method is used when the range is known in advance. For example, with an active sensor providing a voltage of 0 to 10V for temperatures from -50 to +50 °C: range = 100.0, offset = -50.0.

The R-O method can therefore be used universally for every calibration from 2 known points.

Procedure

The parameter is set to 0. The parameter range is initialized at 100.0

At first the offset must be left out, and the partial range must be defined between the 2 points used for calibration. For example, for a calibration through points -40.0 °C and +40.0 °C, the partial range is 80.0.

The signal corresponding to the first point is applied to the analogue input.

The value indicated as input signal is read (value 1).

The signal corresponding to the second point is applied to the analogue input.

The new value indicated as input signal is read (value 2).

The obtained partial range can be calculated (value 2 minus value 1). The initial parameter 100.0 is corrected until the converted value range corresponds to the desired partial range.

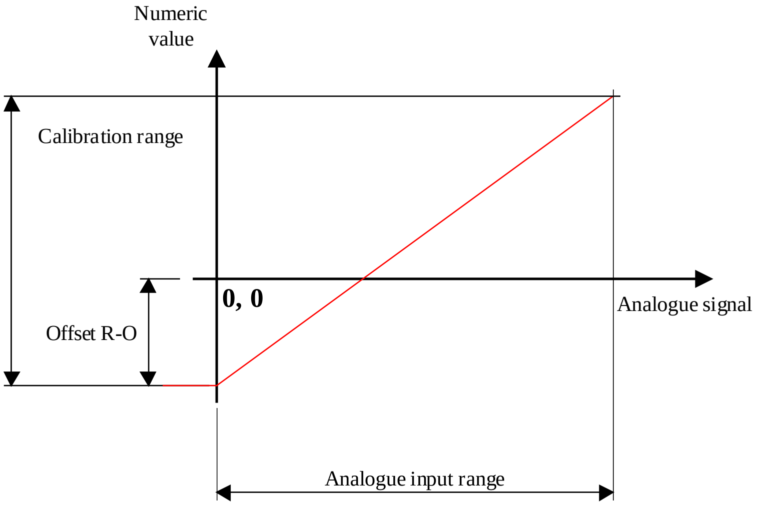
Formula: 100.0 * desired partial range / (value 2 - value 1)

The parameter offset is then introduced as to match value 1 to the corresponding input signal (-40.0 in this example).

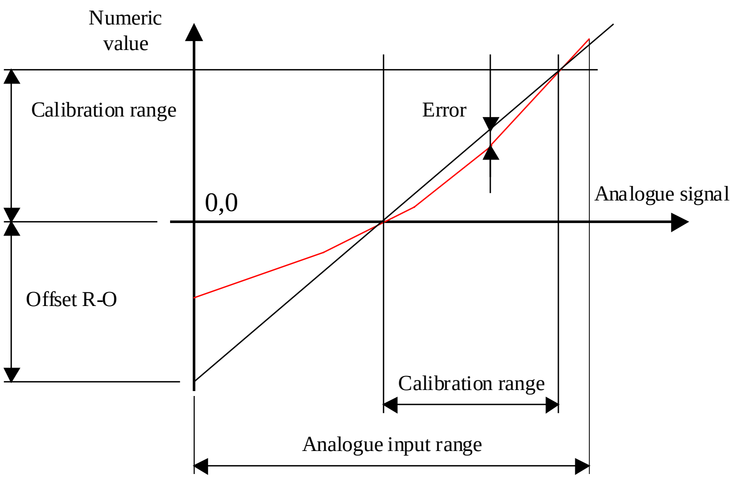
As to evaluate the calibration quality, value inside and possibly outside the range must be simulated and read.

Diagram

Analogue module, linear signal, Calibration R-O



Calibration for non-linear signal



Comments:

For non-linear sensors (Pt, Ni, etc.), the choice of the 2 calibration points is quite important. If the 2 points are close (0 and 20 °C), the error between these points becomes insignificant. However, the error outside the 2 points becomes important.

7.8 Predefined Calibration for Temperature Sensors

The predefined calibration method is much more comfortable than the one with individual parameters. The type of filter and the calibration may be freely selected through options in each Fbox. The most known calibrations are foreseen in each Fbox.

For the case where these options are not available, a Fbox with individual parameters must be used.

This filtration and calibration method has been provided as an answer to fluctuations problems often met with analogue modules. As a matter of fact, some 'low cost' modules do not perform a differential measurement but a measurement compared to the ground signal. In this case, all fluctuations going through the ground wires disturb the measurements.

On the other hand, the measurement result is not accurate given that a small part of the whole signal range is used. The accuracy is increased by an oversampling for the modules having a 10 bits resolution only.

The channels are calibrated in 2 or 3 groups. The division into groups is defined in the adjust window. If the channels are the same, it is preferable to select only the option "for channels 0 to 7". In this case, the option for the second (or third) group is ignored. This make the generated program code more compact.

<u>Overview of the parameters</u>

Error	Acknowledge button for error display
--[Calibration Group]--	Titel of groups 1 to 3
Calibration for channels	Selection of calibrated channel depending on the following options
Oversampling	Oversampling factor. Advised values 8 to 16. It allows to improve the resolution of about 0,1 °C.
Filter	The filter reduces the possible measurement fluctuations.
- None	For quick signals
- 10 sec	For most temperature regulations
- 30 sec	For slow regulations
- 1 min	For external temperatures and slow measurement without régulation
Type of sensor	The standard sensor types Pt1000 or Ni1000 can be used
- 1-1	Provides digital gross values, 12 bits.
- Pt 1000	For standardized sensors Pt 1000
- Ni 1000	For standardized sensors Ni 1000
- NTC 10	For sensors NTC 10 with module PCD2.W220-Z02
Calibration range	The value is converted by linear interpolation according to the selected range.
- 16...26 °C	For inside temperature
- 20...80 °C	For temperature of heating water

- -30, -10...+30 °C	For outside temperature, -30...+30 for Pt+Ni and -10...+30 for NTC10
- 1-1	Provides digital gross values, 12 bits.
Offset [K]	This parameters allows to compensate long cables. Typical data for 100m cables (200m of wires) of 1mm2 at 20°C: Sensor Pt 1000 = -0.9 K. Sensor Ni 1000 = -0.6 K

-----[Replacement values for faulty sensors]-----

Replacement value 0..7	Output value 0..7 of the Fbox in case of detection of faulty sensor.

Filter 2nd order

Thank to a 2nd order filter the disturbances are strongly smoothed out. The filter smoothes also the fluctuations in measurement. The time constant of the 2 elements is the same and adjustable at predefined values:

Option	**Application**
None	For quick signals
10 sec	For most temperature controllers (water flow, heating unit)
30 sec	For slow controllers (ambient temperature)
1 min	For outside temperatures and slow measurement without control

Oversampling

Oversampling factor. Advised values 8 to 16. It produces higher resolution in the order of 0,1 °C.

This method allows the accumulation of results from a number of successive measurements. Fboxes with 10 bits resolution are equipped with oversampling which increases the resolution to 12 bits.

Increasing the size of the oversampling factor improves the result, but it also increases the load on the CPU. Oversampling factors of 32 to 64 should only be used in special cases and only with a small number of analogue modules (max 4 modules with 8 inputs, resp. 2 modules with 16 inputs). If the CPU is not able to process all modules in a single sampling cycle, this is indicated by the red LED.

Calibration to temperature range

The value measured is converted into a temperature within the range selected by linear interpolation.

Calibration range	**Application to various ranges:**
1-1	No calibration. Provides 12 bits digital values.
16...26 °C	For ambient temperatures, air conditioned
20...80 °C	Hot water temperature for heating
-30, -10...+30 °C	Outside temperature

This option do not represent a limit for the measured values but only reference points for the calibration.

This values correspond to the points where the error is zero. Inside the range, the error increases when the range becomes bigger. Outside the range, the error increases when the actual value is getting distant from the calibration points. It is therefore important to select the calibration according to the working range.

Sensor type

This option allows to define the type of sensor connected to the analogue input. Standard Pt1000 or Ni1000 temperature sensors can be used.

1-1	No calibration. Provides digital gross values, 12 bits.
Pt 1000	Standard sensor, type Pt 1000 (IEC 751)
Ni 1000	Standard sensor, type Ni 1000 (DIN 43760)
NTC 10	For sensor NTC 10 with module PCD.W220-Z02

Compensation offset for wire length

This parameter can be used to compensate for cable length.

Copper resistance can be calculated with R = Rs * l / s

Rs:	Specific resistance, for copper 0.0175 [ohms * mm^2 / m]
l:	Wire length (2 * l of cable) [m]
s:	Cross section [mm^2]
R:	Resistance [ohms]

Typical values for cable 100m (wires 200m) with 1mm^2 at 20°C:

- Sensor Pt 1000 = -0.9 K (give negative value).
- Sensor Ni 1000 = -0.6 K (give negative value).

This correction may vary depending on the sensor type and the selected temperature range. An accurate adjustment can only be done after measurement.

Replacement value for faulty sensors

For modules with detection of faulty sensors:

PCD2.W2 Pt-Ni VR

PCD4.W3 Pt-Ni VR

When the module detects a faulty sensor on an input:

- the Fbox output value is replaced by the defined replacement value
- the filter is also adapted to the replacement value
- the LED turns red
- the binary error output is set to 1
- the bit corresponding to the numeric out put is set to 1

When the error disappears:

- the sensor value is automatically considered again
- the binary error output is set to 0
- the bit corresponding to the numeric out put is set to 0
- the LED remains ar 1 but can be acknowledged with the button in the adjust window

In this way it is possible to detect temporary errors by watching the LED.

Valid ranges for sensors according to sensor and calibration option

- For sensors Pt and Ni

All calibration options:	-50°C to +150°C.

- For sensors NTC 10

Option 16..26°C	-10°C to +100°C
Option 20..80°C	-10°C to +100°C
Option -10..+30°C	-10°C to +50°C

Outside theses ranges the detector is considered as faulty.

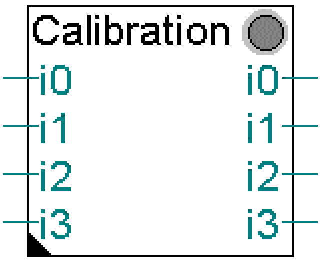
7.9 Calibration

Family: **HVC-Analogue**

Fupla name: Calibration

Macro name: [_HeaCal]

Fbox:



Short description

Auxiliary Fbox for calibration of analogue modules:

- PCD.W22 Pt-Ni
- PCD.W2-Z12
- PCD.W2-G4
- PCD.W3 Pt-Ni

In case of use with predefined calibration modules, it might be necessary to execute an individual calibration of some input channels. The calibration can be cancelled in the analogic conversion Fbox in selecting:

Sensor type = 1-1

Calibration range = 1-1

In the calibration Fbox, the parameter 'Module' must be selected according to the module used.

The calibration can be made in the same way as the individual calibration, using the parameters 'Range' and 'Offset'.

See also: Analogue Generalities

Individual Calibration of Analogue Inputs

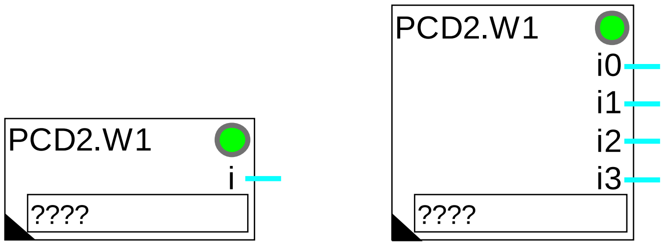
7.10 Analogue Input Module PCD2.W1

Family: **HVC-Analogue**

Name: **PCD2.W1**

Macro name: _HeaD2w1

Fbox:



Short description

Fbox for conversion and calibration of analogue module PCD2.W1.

Module with 1 to 4 inputs.

Resolution 10 bits.

Individual calibration.

By default, the function is configurated for modules PCD2.W110, W111, W112 and W113. For these modules, the calibration and the linearization are operated by hardware in the temperature range -50°C to 150°C.

See also:

Analogue Generalities

Individual Calibration of Analogue Inputs

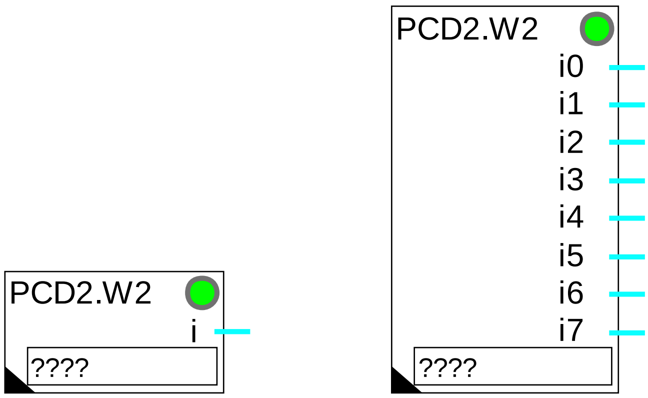
7.11 Analogue Input Module PCD2.W2

Family: **HVC-Analogue**

Name: **PCD2.W2**

Macro name: _HeaD2w2

Fbox:



Short description

Fbox for conversion and calibration of analogue modules:

- PCD2.W200
- PCD2.W210
- PCD2.W220

Module with 1 to 8 inputs.

Resolution 10 bits.

Individual calibration.

See also:

Analogue Generalities

Individual Calibration of Analogue Inputs

Calibration for PCD2.W220 and temperature sensors Pt 1000

Temperature range [°C]	15...25	0...40	0...100	-40...+40
Calibration mode	O-R	O-R	O-R	O-R
Range	639.4	629.5	651.6	615.3
Offset	-48.2	-48.1	-48.2	-48.1
Resolution [°C]	0.63	0.62	0.64	0.60
Maximum error [°C]	< 0.4°C	< 0.7°C	< 1.25°C	< 1.0°C

Calibration for PCD2.W220 and temperature sensors Ni 1000

Temperature range [°C]	15...25	0...40	0...100	-40...+40
Calibration mode	O-R	O-R	O-R	O-R
Range	430.1	426.3	417.6	440.0
Offset	-48.1	-48.1	-48.0	-48.2
Resolution [°C]	0.42	0.42	0.41	0.43
Maximum error [°C]	< 0.2°C	< 0.4°C	< 0.8°C	< 0.9°C

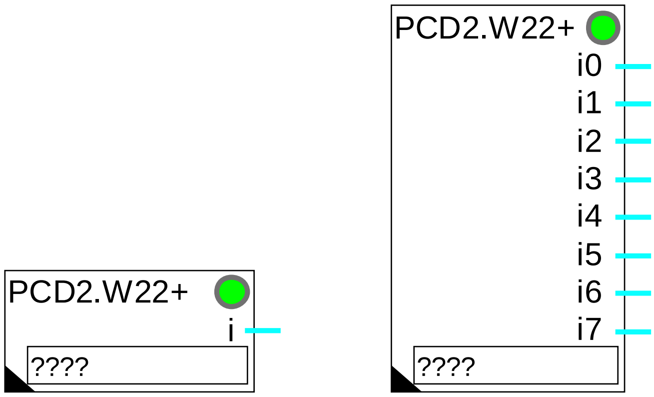
7.12 Analogue Input Module PCD2.W22 Pt-Ni

Family: **HVC-Analogue**

Name: **PCD2.W22 Pt-Ni**

Macro name: _HeaD2w2o

Fbox:



Version: 2

Version info

The old version, with 2 groups, is no more available but still supported in existing programs. For having 3 calibration groups, the old Fboxes must be cleared and replaced by new ones. The version 2 uses less registers.

Short description

Fbox for conversion and calibration of analogue module PCD2.W220 with sensors Pt 1000 (IEC 751) and Ni 1000 (DIN 43760). The option NTC can be used with the special module PCD2.W220 (-Z02).

Module for 1 to 8 inputs.

Resolution 10 bits.

Predefined calibration in 3 groups.

Oversampling function, filter 2nd order and offset.

See also:

Analogue Generalities

Predefined Calibration for Temperature Sensors

This FBox offers a simple and flexible way of using the PCD2.W220 (Z02) module with standard Pt1000 and Ni1000 temperature sensors (NTC 10).

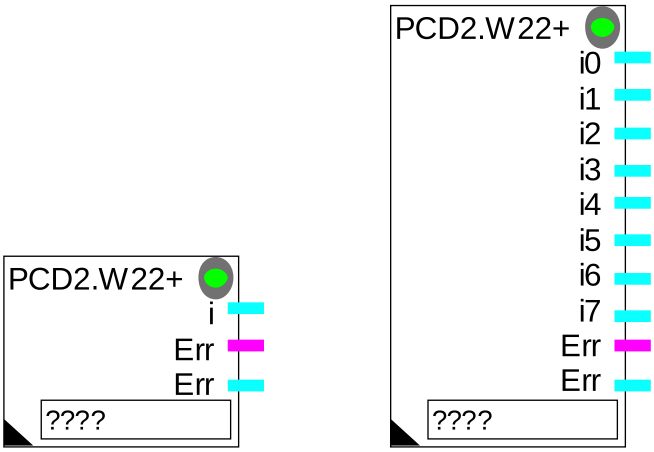
7.13 Analogue Input Module PCD2.W22 Pt-Ni RV

Family: **HVC-Analogue**

Name: **PCD2.W22 Pt-Ni RV**

Macro name: _HeaD2w2oe

Fbox:



Short description

Fbox for conversion and calibration of analogue module PCD2.W220 with sensors Pt 1000 (IEC 751) and Ni 1000 (DIN 43760). The option NTC can be used with the special module PCD2.W220 (-Z02).

Module for 1 to 8 inputs.

Resolution 10 bits.

Predefined calibration in 3 groups.

Oversampling function, filter 2nd order and offset.

Replacement value for faulty sensors.

See also:

Analogue Generalities

Predefined Calibration for Temperature Sensors

This Fbox allows an easy and flexible handling of the analogue module PCD2.W220 (Z02) with the standard temperature sensors Pt1000 and Ni1000 (NTC 10).

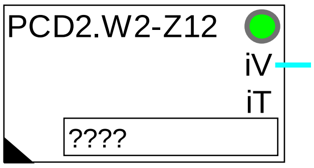
7.14 Analogue Input Module PCD2.W2-Z12

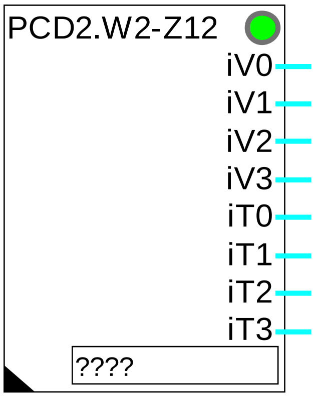
Family: **HVC-Analogue**

Name: **PCD2.W2-Z12**

Macro name: _HeaD2w2z

Fbox:





Short description

Fbox for conversion and calibration of analogue module PCD2.W220-Z12. This module has 4 inputs for voltage 0-10V and 4 inputs for temperature sensors Pt 1000 (IEC 751) and Ni 1000 (DIN 43760).

Module for 1 to 4 voltage inputs and 1 to 4 inputs for temperature sensors.

Resolution 10 bits.

Individual calibration of inputs 0 to 3.

Predefined calibration for inputs 4 to 7.

Oversampling function, filter 2nd order and offset for inputs 4 to 7.

See also:

Analogue Generalities

Individual Calibration of Analogue Inputs

Predefined Calibration for Temperature Sensors

See also similar Fbox Analogue Input Module PCD2.W22, Pt-Ni

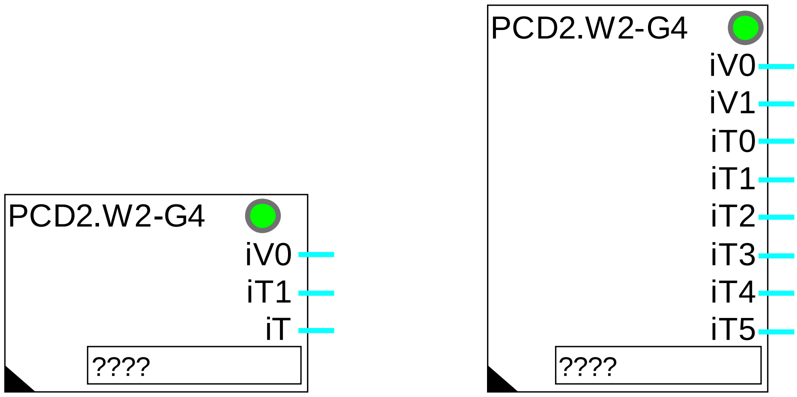
7.15 Analogue Input Module PCD2.W2-G4

Family: **HVC-Analogue**

Name: **PCD2.W2-G4**

Macro name: _HeaD2w2g

Fbox:



Short description

Fbox for conversion and calibration of analogue module PCD2.G400. This combined module contains a W200/W220 part which must be handled with this Fbox. It has 2 voltage inputs 0-10V and 6 inputs for temperature sensors Pt 1000 (IEC 751) and Ni 1000 (DIN 43760).

This module has also a W400 part which contains 6 voltage outputs. These must be handled with a Fbox Analogue Output Module PCD2.W4.

Module for 2 voltage inputs and 1 to 6 inputs for temperature sensors.

Resolution 10 bits.

Individual calibration of inputs 0 and 1.

Predefined calibration for inputs 2 to 7.

Oversampling function, filter 2nd order and offset for inputs 2 to 7.

The basic address in the Fbox field must be the address of the W200/W220 module part. It correspond to the basic address of the module PCD2.G400 plus 48.

See also:

Analogue Generalities

Individual Calibration of Analogue Inputs

Predefined Calibration for Temperature Sensors

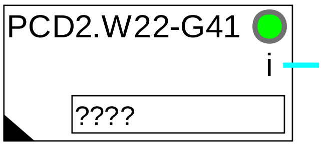
7.16 Analogue Input Module PCD2.W22-G41

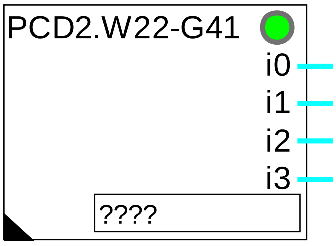
Family: **HVC-Analogue**

Name: **PCD2.W22-G41**

Macro name: _HeaD2w2h

Fbox:





Short description

Fbox for conversion and calibration of analogue module PCD2.G410. This combined module contains a W200/W220 part which must be handled with this Fbox. It has 4 inputs for temperature sensors Pt 1000 (IEC 751), Ni 1000 (DIN 43760) which can be configurated in voltage or in current. The parameters of the used inputs in voltage or in current must be set with the option 1-1. They can be calibrated individually by the Fbox Calibration.

This module has also a W410 part which contains 4 voltage outputs. These must be handled with a Fbox Analogue Output Module PCD2.W4.

Module for 4 inputs for temperature sensors.

Resolution 10 bits.

Predefined calibration.

Oversampling function, filter 2nd order and offset.

The basic address in the Fbox field must be the address of the W200/W220 module part. It correspond to the basic address of the module PCD2.G410 plus 48.

See also:

Analogue Generalities

Individual Calibration of Analogue Inputs

Predefined Calibration for Temperature Sensors

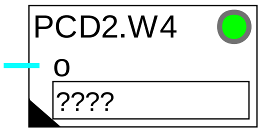
7.17 Analogue Output Module PCD2.W4

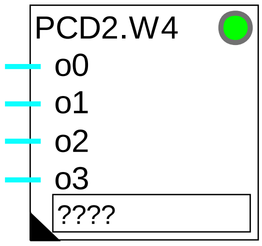
Family: **HVC-Analogue**

Name: **PCD2.W4**

Macro name: _HeaD2w4

Fbox:





Short description

Fbox for the conversion and calibration of analogue module PCD2.W4.

Module for 1 to 4 inputs.

Resolution 8 bits.

Individual calibration.

See also

Analogue Generalities

Calibration of Analogue Outputs

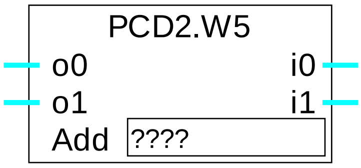
7.18 Analogue I/O Module PCD2.W5

Family: **HVC-Analogue**

Name: **PCD2.W5**

Macro name: _HeaD2w5

Fbox:



Short description

Fbox for conversion and calibration of analogue module PCD2.W5.

Combined module for inputs and 2 outputs.

Resolution 12 bits.

Individual calibration.

See also:

Analogue Generalities

Individual Calibration of Analogue Inputs

Calibration of Analogue Outputs

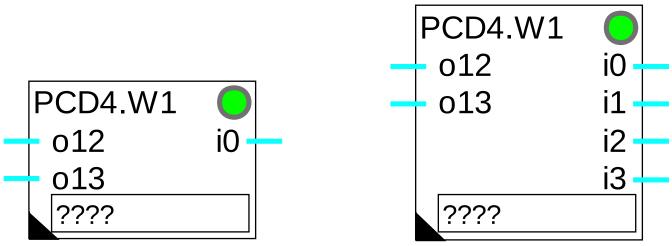
7.19 Analogue I/O Module PCD4.W1

Family: **HVC-Analogue**

Name: **PCD4.W1**

Macro name: _HeaD4w1

Fbox:



Short description

Fbox for conversion and calibration of analogue module PCD4.W1.

Combined module for 2 inputs and 1 to 4 outputs.

Resolution 12 bits.

Individual calibration.

See also:

Analogue Generalities

Individual Calibration of Analogue Inputs

Calibration of Analogue Outputs

Restriction

This function cannot be used with passive temperature sensors supplied by the 2 current outputs RTD 0 and RTD 1.

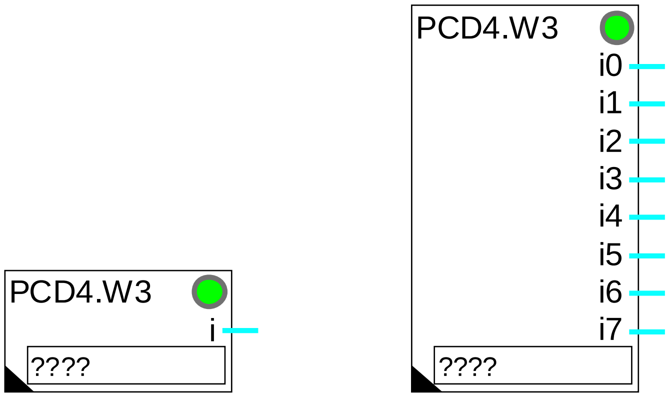
7.20 Analogue Input Module PCD4.W3

Family: **HVC-Analogue**

Name: **PCD4.W3**

Macro name: _HeaD4w3

Fbox:



Short description

Fbox for conversion and calibration of analogue module PCD4.W3.

Module for 1 to 8 inputs.

Resolution 12 bits + sign.

Individual calibration.

See also:

Analogue Generalities

Individual Calibration of Analogue Inputs

When the module is equipped with constant current module PCD7.W120 for temperature sensors Pt-Ni, only 4 analogue inputs are available (in connection with module PCD7.W100).

When the module is equipped with module PCD7.W110 ou PCD7.W111 for temperature sensors Pt-Ni, the use of Fbox PCD4.W3, Pt-Ni is advised.

Calibration for PCD4.W300 with PCD7.W120 + PCD7.W100 and temperature sensor Pt 100

Temperature range[°C]	15...25	0...40	0...100	-40...+40
Calibration mode	O-R	O-R	O-R	O-R
Range	1279.7	1289.8	1300.0	1279.7
Offset	-81.9	-81.9	-82.0	-81.9
Resolution [°C]	0.31	0.31	0.32	0.31
Maximum error [°C]	< 0.2°C	< 0.3°C	< 0.6°C	< 0.4°C

Calibration for PCD4.W300 with PCD7.W120 + PCD7.W100 and temperature sensor Ni 100

Temperature range [°C]	15...25	0...40	0...100	-40...+40
Calibration mode	O-R	O-R	O-R	O-R
Range	871.3	871.3	809.3	912.5
Offset	-81.7	-81.8	-81.2	-82.3
Resolution [°C]	0.21	0.21	0.20	0.22
Maximum error [°C]	< 0.2°C	< 0.3°C	< 1.6°C	< 1.1°C

Calibration for PCD4.W300 with PCD7.W110 and temperature sensor Pt 1000

Temperature range [°C]	15...25	0...40	0...100	-40...+40
Calibration mode	O-R	O-R	O-R	O-R
Range	422.2	422.2	432.4	415.2
Offset	-270.2	-270.1	-270.5	-269.7
Resolution [°C]	0.10	0.10	0.11	0.10
Maximum error [°C]	< 0.1°C	< 0.15°C	< 0.5°C	< 0.4°C

Calibration for PCD4.W300 with PCD7.W111 and temperature sensor Ni 1000

Temperature range [°C]	15...25	0...40	0...100	-40...+40
Calibration mode	O-R	O-R	O-R	O-R
Range	353.0	351.5	333.7	364.4
Offset	-216.4	-216.5	-215.5	-217.5
Resolution [°C]	0.09	0.09	0.08	0.09
Maximum error [°C]	< 0.1°C	< 0.2°C	< 1.2°C	< 0.8°C

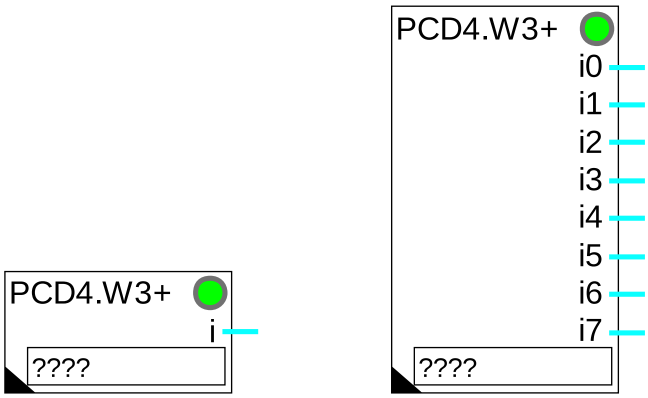
7.21 Analogue Input Module PCD4.W3 Pt-Ni

Family: **HVC-Analogue**

Name: **PCD4.W3 Pt-Ni**

Macro name: _HeaD4w3c

Fbox:



Short description

Fbox for conversion and calibration of analogue module PCD4.W3 with module range:

- PCD7.W110 for temperature sensors Pt 1000 (IEC 751)
- PCD7.W111 for temperature sensors Ni 1000 (DIN 43760)

Module for 1 to 8 inputs.

Resolution 12 bits.

Predefined calibration in 3 groups.

Function filter 2nd order and offset.

See also:

Analogue Generalities

Predefined Calibration for Temperature Sensors

This function offers a simple and flexible method for the use of module PCD4.W3 with standard temperature sensors Pt1000 and Ni1000.

Comments

This Fbox cannot be used with other modules but the ones mentioned above.

The 3 elements:

- sensor type used
- range module
- option selected in the adjust window

must always correspond, otherwise the converted value will not be correct.

The analogue module is equipped with a A/D converter having a signal integration function. This function replaces the oversampling function existing on the similar Fbox PCD2.W22, Pt-Ni.

Caution !
This Fbox has an integrated filter which uses a sampling interval of 1 sec. It means that it must be able to convert the 8 channels within 1 sec. In a PCD4 system with a large application, the number of cycles per second can be lower than 8 (See HVC-Init, Subfunction CPU Performance). In this case the LED turns red and the time constants are wrong. However, it is possible to use this Fbox without sampling in removing all filters (Option='None'). The channels are then converted at the maximum frequence. If necessary, filters can be connected to the Fbox outputs.

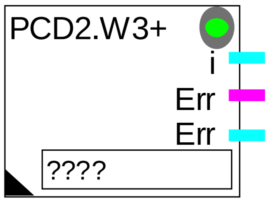
7.22 Analogue Input Module PCD4.W3 Pt-Ni RV

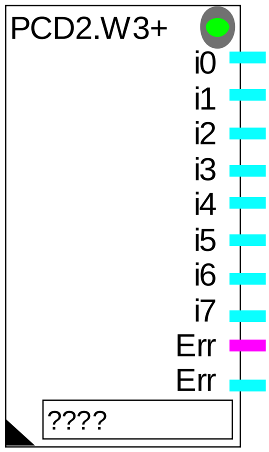
Family: **HVC-Analogue**

Name: **PCD4.W3 Pt-Ni RV**

Macro name: _HeaD4w3ce

Fbox:





Short description

Fbox for conversion and calibration of analogue module PCD4.W3 with range modules:

- PCD7.W110 for temperature sensors Pt 1000 (IEC 751)
- PCD7.W111 for temperature sensors Ni 1000 (DIN 43760)

Module for 1 to 8 inputs.

Resolution 12 bits.

Predefined calibration in 3 groups.

Function filter 2nd order and offset.

Replacement value for faulty sensors.

See also:

Analogue Generalities

Predefined Calibration for Temperature Sensors

This function offers a simple and flexible method for use of module PCD4.W3 with standard temperature sensors Pt 1000 (IEC 751)and Ni 1000 (DIN 43760).

Comments

This Fbox cannot be used with other modules than the ones mentioned above.

The 3 elements:

- type of sensor
- range module
- selected option in adjust window must always correspond. Otherwise the converted value will not be correct.

The analogue module is equipped with an A/D converter with a signal integration function. This function replaces the oversampling function which exists on the similar Fbox PCD2.W22, Pt-Ni.

Caution !

This Fbox has an integrated filter which uses a sampling interval of 1 sec. It means that it must be able to convert the 8 channels within 1 sec. In a PCD4 system with a large application, the number of cycles per second can be lower than 8 (See HVC-Init, Subfunction CPU Performance). In this case the LED turns red and the time constants are wrong. However, it is possible to use this Fbox without sampling in removing all filters (Option='None'). The channels are then converted at the maximum frequence. If necessary, filters can be connected to the Fbox outputs.

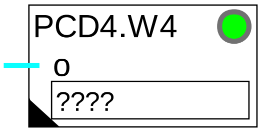
7.23 Analogue Output Module PCD4.W4

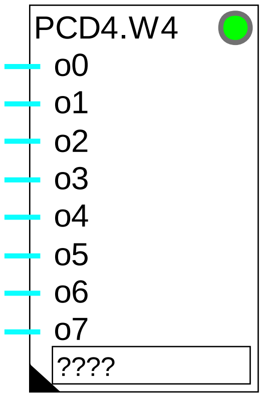
Family: **HVC-Analogue**

Name: **PCD4.W4**

Macro name: _HeaD4w4

Fbox:





Short description

Fbox for conversion and calibration of analogue module PCD4.W4.

Module for 1 to 8 outputs.

Resolution 8 bits.

Individual calibration.

See also:

Analogue Generalities

Calibration of Analogue Outputs

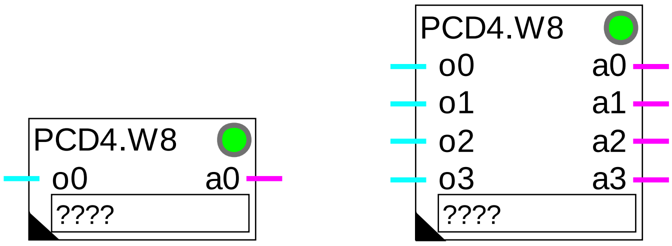
7.24 Analogue Output Module PCD4.W8

Family: **HVC-Analogue**

Name: **PCD4.W8**

Macro name: _HeaD4w8

Fbox:



Short description

Fbox for conversion and calibration of analogue module PCD4.W8.

Modul for 1 to 4 outputs.

Resolution 8 bits.

Individual calibration.

See also:

Analogue Generalities

Calibration of Analogue Outputs

When the output is forced manually, the corresponding binary signal (a0..a3) is switched on and the LED is red. When all outputs are in automatic mode, the LED can be acknowledged with the 'Acknowledge' button of the adjust window.

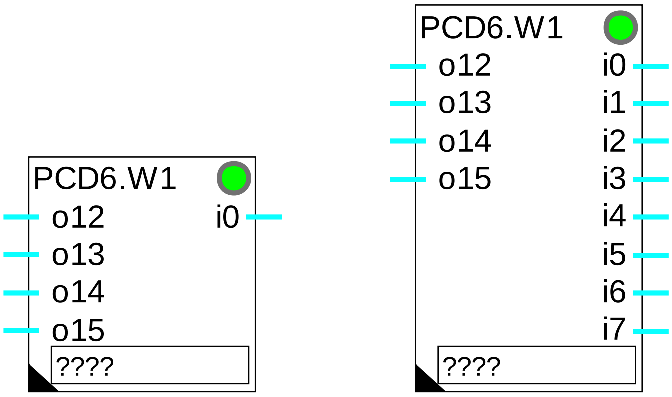
7.25 Analogue I/O Module PCD6.W1

Family: **HVC-Analogue**

Name: **PCD6.W1**

Macro name: _HeaD6w1

Fbox:



Short description

Fbox for conversion and calibration of analogue module PCD6.W1.

Combined module for 4 inputs and 1 to 8 outputs.

Resolution 8 bits.

Individual calibration.

See also:

Analogue Generalities

Individual Calibration of Analogue Inputs

Calibration of Analogue Outputs

This Fbox cannot be used with passive temperature sensors supplied by a 4 current source module PCD7.W120.

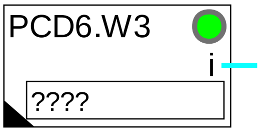
7.26 Analogue Input Module PCD6.W3

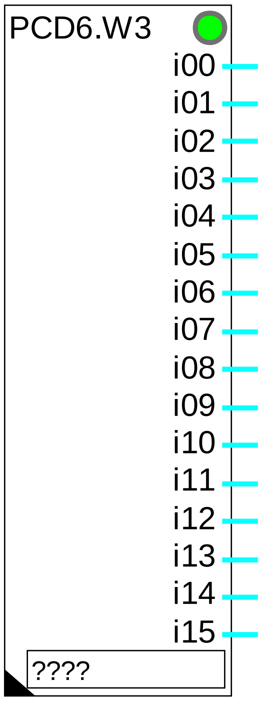
Family: **HVC-Analogue**

Name: **PCD6.W3**

Macro name: _HeaD6w3

Fbox:





Short description

Fbox for conversion and calibration of analogue module PCD6.W3.

Module for 1 to 16 inputs.

Resolution 12 bits plus sign.

Individual calibration.

See also:

Analogue Generalities

Individual Calibration of Analogue Inputs

For the calibration of the standard temperature sensors "Pt" and "Ni", the standard parameters of the module PCD4.W3 are also valid.

See: Analogue Input module PCD4.W3

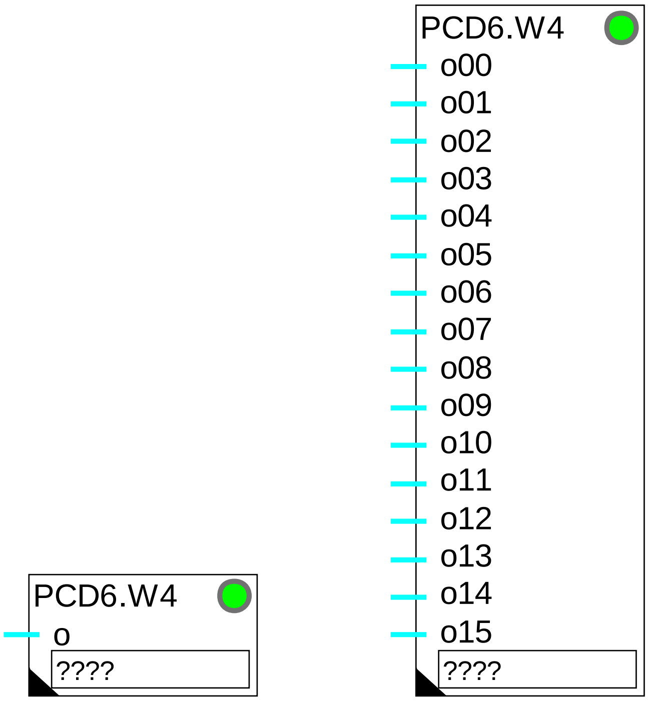
7.27 Analogue Output Module PCD6.W4

Family: **HVC-Analogue**

Name: **PCD6.W4**

Macro name: _HeaD6w4

Fbox:



Short description

Fbox for conversion and calibration of analogue module PCD6.W4.

Module for 1 to 16 outputs.

Resolution 8 bits.

Individual calibration.

See also:

Analogue Generalities

Calibration of Analogue Outputs

Notes

8. HVC-Test and Simulation

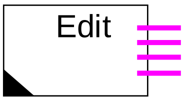
Contents

8.1 Digital Reference

Family: **HVC-Test**

Name: **Digital reference**

Macro name: _HeaTog

Fbox:  

Outputs

Output	Binary signal 0
Output	Binary signal 1
Output	Binary signal 2
Output	Binary signal 3

Parameters

Output 0, Change	Switch button and display of state, binary output 0.
Output 1, Change	Switch button and display of state, binary output 1.
Output 2, Change	Switch button and display of state, binary output 2.
Output 3, Change	Switch button and display of state, binary output 3.

Description of the function

Binary signals (1-4) can be switched manually with the buttons.

8.2 Numeric Reference

Family: **HVC-Test**

Name: **Numeric reference**

Macro name: _HeaEdit

Fbox:

Outputs

Output	numeric value 0
Output	numeric value 1
Output	numeric value 2
Output	numeric value 3

Parameters

Output 0	Value of numeric output 0.
Output 1	Value of numeric output 1.
Output 2	Value of numeric output 2.
Output 3	Value of numeric output 3.

Description of the function

The numeric values (1-4) can be predefined OFFLINE, then modified and transmitted ONLINE.

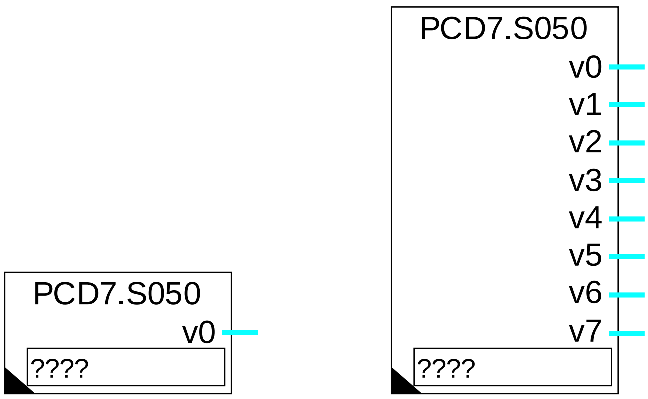
8.3 Multiplexer for Entering BCD Values

Family: **HVC-Test**

Name: **PCD7.S050**

Macro name: _HeaMbcd

Fbox:



Short description

Entering of BCD values. Multiplexing for PCD7.S050 simulator or other similar wiring.

Outputs

v0	Value 0	Activation of reading for value 0.
...		
v7	Value 7	Activation of reading for value 7.

Parameters

Wiring	Wiring option	
	- Direct	Direct wiring =LSB on base address.
	- Inverted	Inverted wiring =MSB on base address.
BCD offset		Offset between the base address and the first BCD bit.
Number of BCD digits		Number of BCD digits to be read.
Range		Conversion range of BCD value. See below.
BCD value		Display of actual value on BCD inputs.

Description of the function

This function has been specially designed for use with the simulators SAIA PCD7.S050 and PCD2.S010.

It can also be used with various similar devices of the PCA type. On these devices the "inverse wiring" option should generally be selected.

Similar wiring can also be used as desired to enable BCD parameters to be entered.

The function receives memory controls for the selected value at the first few inputs (8 for the PCD7.S050). This value is given in BCD code at addresses starting from the specified offset. The number of addresses used depends on the number of digits to be read (4 bits per digit).

The range parameter defines a conversion factor for the value supplied at the function outputs. With ranges 10.0, 100.0 and 1000.0, the values supplied are slightly higher than the BCD selection, but this makes it possible to reach, for example, a value of 100.0 % (rather than only 99.0 %).

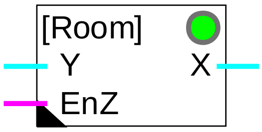
8.4 Room Simulator

Family: **HVC-Test**

Name: **Room simulator**

Macro name: _HeaRoom

Fbox:



Short description

Simulation of an air conditioned room with disturbances.

Inputs

Y	Input Y	Simulation of inlet temperature
EnZ	Enable Z	Disturbance enable

Output

X	Output X	Simulated room temperature

Parameters

-----[Initialization options]-----

Initialization options	Option for the initialization temperature
- Initial	The filter is initialized with the initial set temperature
- Input	The filter is initialized with the input temperature
- Old	The filter is initialized with the old output temperature
Initial temperature	Initialization temperature for option 'Initial'

-----[ONLINE parameters]-----

Time constant [sec]	Time constant of simulation filter.
Disturbance [K]	Disturbance value activated by the input 'EnZ'.
Upper limit	Upper limit of simulated temperature.
Lower limit	Lower limit of simulated temperature.

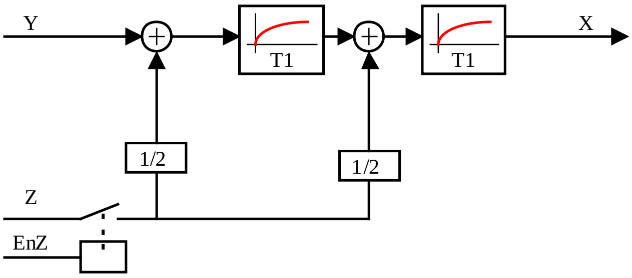
Description of the function

A 2nd order filter simulates a disturbance in an air conditioned room. Both filter parts have the same time constant, which is adjustable.

The adjustable disturbance is activated by an enable signal on input 'EnZ. It is divided into two halves, one half before the 1st filter and the other half between the 2 filters.

The output signal is limited by parameters of minimum and maximum value.

Diagram



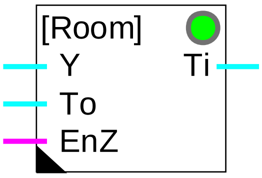
8.5 Room Simulator with To

Family: **HVC-Test**

Name: **Room simulator with To**

Macro name: _HeaRoome

Fbox:



Short description

Simulation of an air conditioned room with disturbance and simulation of the outside temperature.

Inputs

Y	Input Y	Air conditioning: Inlet temperature
		Heating: Flow temperature
To	Outside temperature	
EnZ	Enable Z	Disturbance enable

Output

Ti	Room temperature	Simulated room temperature

Parameters

-----[Initialization options]-----	
Initialization option	Option for initialization temperature
- Initial	The filter is initialized with the initial set temperature
- Input	The filter is initialized with the input temperature
- Old	The filter is initialized with the old output temperature
Initial temperature	Initialization temperature for option 'Initial'
-----[ONLINE parameters]-----	
Time constant [sec]	Time constant of simulation filter.
Disturbance [K]	Disturbance value activated by the input 'EnZ'.
Insulation conductance [%]	Parameter for simulation of wall conductance. Perfect insulation=0.0%.
Upper limit	Upper limit of simulated temperature.

Lower limit	Lower limit of simulated temperature.
Efficiency of radiators	Parameter for simulation of the radiators efficiency. It defines the temperature proportion dissipated in the room. A high value (50..80%) simulates a big radiator. A low value (10..40%) simulates a small radiator. For ventilation, the air flow is pulsed at the defined temperature. The efficiency must be adjusted to 100.0%.

Description of the function

A 2nd order filter simulates a disturbance in an air-conditioned room. Both filter parts have the same time constant, which is adjustable.

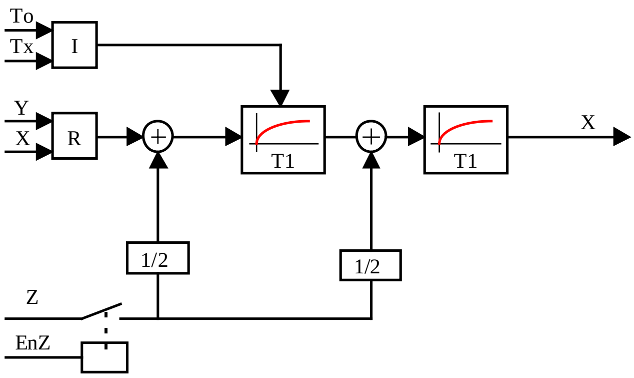
The ONLINE-adjustable disturbance is activated by an enable signal on input 'EnZ'. It is divided into two halves, one half before the 2 1st order filters and the other half between them.

The influence of outside temperature (To) is defined by an adjustable parameter representing insulation conductance (the inverse of resistance). This parameter defines a percentage of additional disturbance at the simulator input, proportional to the difference between inside and outside temperature:

(To-Ti) * Conductance / 100

The output signal is limited by parameters of min and maximum value.

Diagram



I = Factor for insulation conductance

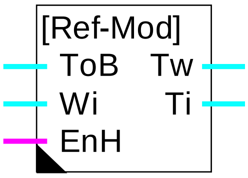
R = Factor for radiator efficiency

8.6 Building Reference Model

Family: **HVC-Test**

Name: **Building reference model**

Macro name: _HeaRMod

Fbox: 

Short description

The function represents a building model and simulates its temperature behavior, depending on the outside temperature and the heating plant function. It is useful for the realization of a anti-freeze system as well as for simulating the wall temperature.

Caution! The simulation do not represent the real behavior but shows the trend of the ambient and the wall temperatures. The simulation quality strongly depends on the settings of the building time constant.

Inputs

ToB	T Building	Filtered outside temperature according to building characteristics
Wi	Set-point	Set-point for the outside temperature or measurement of inside temperature
EnH	Enable	Binary signal for heating activation

Output

Tw	T Wall	Simulation of wall temperature
Ti	T ambient	Simulation of ambient temperature

Parameters

T Wall [min]	Time constant of simulation filter for wall heat storage.
T Surface [min]	Time constant of simulation filter for wall surface temperature.
T Restart heating [min]	Time constant of simulation for temperature stabilization when heating is restarted.

Description of the function

The model has been developed for use with the Function Filter T2 Building (T2B). This function provides a filtered outside temperature according to the global building characteristic. The filtered temperature must be given on input ToB.

The Wi input receives the ambient temperature actual set-point. If the temperature is measured, the measurement may replaces the set-point. The function remains useful for simulating the surface temperature.

The binary input EnH indicates if the heating plant is working (EnH=1) or not (EnH=0).

The model calculates the walls temperature Tw (weighted temperature between walls and windows) and the ambient temperature Ti.

Two adjustable filters 1st order controls the simulated temperature of the wall surface. A third filter represents the heating contribution when the heater is switched on.

The first filter (T Wall) represents the heat dissipation inside the wall damped by the building filter and the wall inside surface. Given that the building filter takes windows surface into account, the surface temperature Tw is weighted between the walls and windows temperature.

The second filter (T Surface) represents the dissipation between the wall surface and the ambient air. When the heating plant is not working, the dissipation occurs from walls to the ambient air. The ambient temperature nears slowly the outside filtered temperature. When the heating plant is working the dissipation occurs from ambient air to the wall. The wall temperature is balanced between the ambient temperature and the outside filtered temperature.

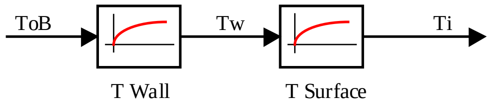
The relation between the 2 times defines the balanced point of the surface temperature. The filter times define the speed for the balanced temperature.

The last filter (T Restart heating) represents the ability of the heating plant compared to the building size. It must be adjusted taking into account the time needed to reach the ambient set-point when the heating plant has been switched off.

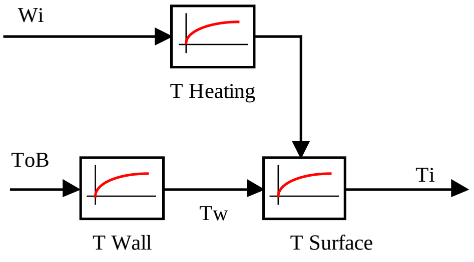
The Tw output represents the wall temperature. It can be used for the correction function of the water flow set-point when no sensor has been installed. The Ti ambient temperature output can be used as antifreeze system. Caution ! The simulated temperature is not exact, the antifreeze function must be activated before reaching 0 °C.

Diagram

Without heating



With heating

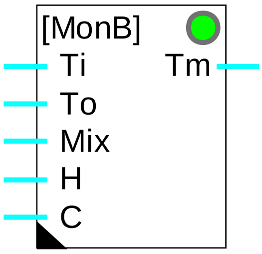


8.7 System Simulator

Family: **HVC-Test**

Name: **System simulator**

Macro name: _HeaMonob

Fbox: 

Short description

Simulation of air conditioning system (Monobloc).

Inputs

Ti	Inside temperature	Simulation of inside or outlet temperature
To	Outside temperature	Simulation of outside temperature
Mix	Mixer	Position of air mixer dampers
H	Heating	Position of heating valve
C	Cooling	Position of cooling valve

Output

Tm	T Monobloc	Simulated inlet room temperature

Parameters

Error Hot-Cold, Acknowledge	Acknowledge button for errors: Control 'Hot' and 'Cold' at same time.
-----[Online parameters]-----	
Heating power [K]	Temperature increase for 100% heating value position.
Cooling power [K]	Temperature decrease for 100% heating value position (absolute value).
Time constant [sec]	Time constant T1 at simulator output.
-----[Functional control]-----	
Temperature mix	Display of temperature after mixer dampers.
Heating [K]	Display of temperature increase by heating unit.

Cooling[K] Display of temperature decrease by cooling unit.

<u>Description of the function</u>

The output temperature is calculated as a function of inside and outside temperatures, and of the air mixer dampers.

Then the heating effect is added and the cooling effect is deducted (positive value -> reduction of temperature). The parameter 'Cooling power' must be entered unsigned.

If heating and cooling are activated simultaneously, the LED turns red. It is reset green with the acknowledge button.

The output is filtered by a T1 filter with an adjustable time constant.

Heating power and cooling power are both adjustable.

The values entered represent temperature differences at 100% valve position.

None of the values are limited.

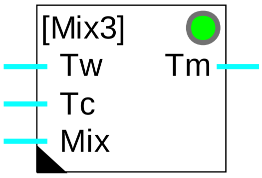
8.8 Mixer Valve 3 Port Simulator

Family: **HVC-Test**

Name: **Mixer valve 3 port sim**

Macro name: _HeaMix3

Fbox:



Short description

Simulation of a three port valve.

Inputs

Tw	T warm	Warm water temperature
Tc	T cold	Cold water temperature
Mix	Mixer	Open position of mixer valve

Output

Tm	T Mixer	Simulated temperature from mixer valve

Parameters

Time constant [sec]	T1 Filter at valve simulator output.

Description of the function

The Mix input defines the position of the valve and the percentage of warm water. This must range between 0.0% and 100.0%. The remainder from 100.0% defines the proportion of cold water. The output is defined by calculating the mix of warm water (temperature at input Tw) and cold water (temperature at input Tc).

The output is filtered by a T1 filter whose parameters can be set to simulate valve positioning time and the temperature inertia of the pipes.

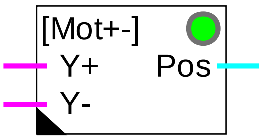
8.9 Mixer Motor Simulator

Family: **HVC-Test**

Name: **Mixer motor simulator**

Macro name: _HeaMixm

Fbox:



Short description

Simulation of the motor of a mixer valve with 3-point control.

Inputs

Y+	Y Open	Operating signal, "Open"
Y-	Y Close	Operating signal, "Close"

Output

Pos	Position	Simulated position of motor

Parameters

Initialization	Initial position at start.
Time min-max [sec]	Time between minimum and maximum position.
Minimum position	Value at minimum opening position.
Maximum position	Value at maximum opening position.

Description of the function

A 3-point control motor is controlled by 2 digital signals. The Y+ signal controls opening and the Y- signal controls closing.

The input of this function must be connected to an 'Output 3 points' function. The output position represents the simulated valve position. This signal can be connected to the '3-way mixer valve' simulation function.

It is important to notice that a 3-point control represents an integration element within the control loop. For this reason the integrator of a PI or PID controller must be moderated (high integration time).

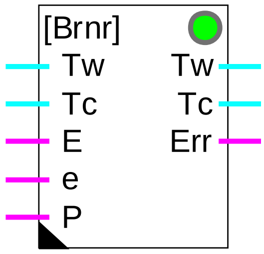
8.10 Burner, 2 Power Stages

Family: **HVC-Test**

Name: **Burner 2 power stages**

Macro name: _HeaBrnr

Fbox:



Short description

Functional simulation of a burner with 2 power stages.

This simulation is not comparable with a practical application, but is sufficient to test a control system using a burner cascade circuit.

Inputs

Tw	Flow temperature	Measurement/Simulation of flow temperature
Tc	Return temperature	Measurement /Simulation of return temperature
E	Enable	Activate high stage
e	enable	Activate low stage
P	Pump	Activate pump

Outputs

Tw	Flow temperature	Simulation of flow temperature
Tc	Return temperature	Simulation of return temperature
Err	Error	Display/Simulation of burner error

Parameters

-----[Initialization options]-----

Initial value	Option for initialization temperature
- Start value	The filter is initialized with the defined start temperature
- Input value	The filter is initialized with the input temperature

- Old value	The filter is initialized with the old outside temperature
Start temperature burner	Initialization temperature for option 'Initial'
-----[Online parameters]-----	
Time constant [sec]	Filter time constant simulating the burner temperature increase.
Delta-T level 1 [°C]	Temperature difference obtained at low power.
Delta-T level 2 [°C]	Temperature difference obtained at high power.
Level alarm	Temperature considered as alarm level.
Upper limit	Upper limit of temperature simulation.
Lower limit	Lower limit of temperature simulation.
-----[Functional control]-----	
Burner temperature	Display of the actual burner temperature.

Description of the function

Function structure is symmetrical (inputs "Tw" and "Tc" --> outputs "Tw" and "Tc") to simplify the creation of a cascade circuit. "Tw" represents the warm water (flow) and "Tc" the cold water pipe (return).

Input "e" activates the burner's low stage (Delta-T, Level 1) and input "E" its high stage (Delta-T, Level 1+2). The power is represented by the temperature differences produced by the burner between input "Tw" and output "Tw". To simulate the inertia of the burner, fluctuations in this power are attenuated by a first order filter. The filter's time constant can be adjusted. This power is additionally monitored by the upper and lower limits. The temperature inside the burner is monitored by an adjustable alarm level. If this temperature is exceeded, the "Err" (Error) output is activated.

If input "P" (pump) is not activated, the temperature of the burner remains constant.

Output "Tc" always has the same value as input "Tc".

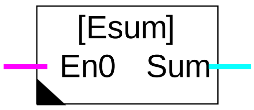
8.11 Sum, Selective

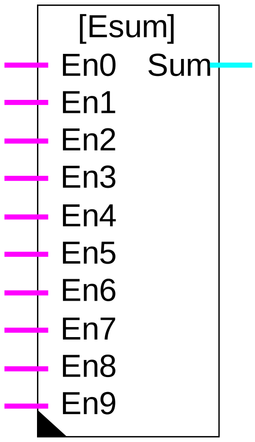
Family: **HVC-Test**

Name: **Sum selective**

Macro name: _HeaEsum

Fbox:





Short description

Calculation of the sum value selected by binary inputs.

Inputs

En0	Enable 0	Enable of value 0
...		
En9	Enable 9	Enable of value 9

Output

Sum	Sum	Sum result of activated values

Parameters

Value 0	Value selected by input 0
...	
Value 9	Value selected by input 9

Description of the function

Inputs En0 to En9 allow to activate the values defined in the adjust window. The sum of the activated values is available at output Sum. The function may be used for simulating used or produced powers.

9. Old Fboxes and renamed Fboxes

Contents

Old Name	Renamed
Summer Shift	Set-point
Fix Shift Controller	Set-point Correction, Clock
Universal Shift Controller	Set-point Correction, 3-Points Controller

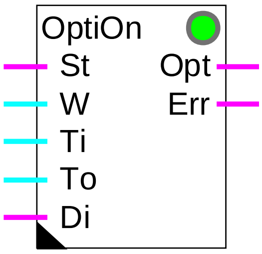
9.1 Temperature Optimum A

Family: **HVC-General**

Name: **Temp. optimum A**

Macro name: _HeaOptia

Fbox:



Version info

This Fbox has been replaced by a new one Optimum Start. The function is the same. The time parameters are different. The old Fbox is still supported in the library.

Short description

This function calculates the time necessary for a heated or air-conditioned room to attain its setpoint temperature. The plant is switched on as late as possible in order to save as much energy as possible.

The effective time to attain the temperature is measured and the calculation factors are automatically adapted for the next sequence.

Inputs

St	Start	Prestart signal for the switching on optimization
W	Set-point	Set-point for the inside temperature
Ti	Inside temperature	Measurement of the inside temperature
To	Outside temperature	Measurement (filtered) of the outside temperature
Di	Disable	Switching off of the optimization and parameter adaptation

Outputs

Opt	Optimization	Optimized Switching on signal
Err	Error signal	General binary error signal
Err	Error code	Numeric error code

Description of the function
For a complete description, see:

Optimum Start

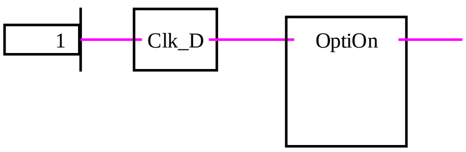
Particularities of the function 'Temperature Optimum A'

The start input St activates the optimization function. This signal (provided by a clock) must be activated sufficiently in advance of the temperature attainment time to allow the temperature to stabilise under the least favourable conditions. A parameter defines how much in advance this signal is given.

For example

Occupation from:	08:00
Max. time for temperature attainment:	2 hours
Switching on of the clock function:	06:00

In this case, the parameter 'Advance' must be set at 2.0 hours.



An option allows to set the time in hours, minutes or seconds (hours is advised).

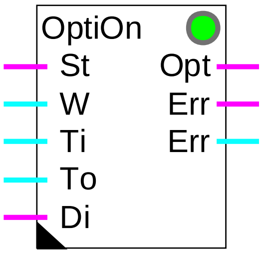
9.2 Temperature Optimum B

Family: **HVC-General**

Name: **Temp. optimum B**

Macro name: _HeaOptib

Fbox:



Version info

This Fbox has been replaced by a new one Optimum Start. The function is the same. The time parameters are different. The old Fbox is still supported in the library.

Short description

This function calculates the time necessary for a heated or air-conditioned room to attain its set-point temperature. The plant is switched on is set as late as possible in order to save as much energy as possible.

The effective time to attain the temperature is measured and the calculation factors are automatically adapted for the next sequence.

Inputs

St	Start	Prestart signal for the switching on optimization
W	Set-point	Set-point for the inside temperature
Ti	Inside temperature	Measurement of the inside temperature
To	Outside temperature	Measurement (filtered) of the outside temperature
Di	Disable	Switch-off of the optimization and parameter adjustment

Outputs

Opt	Optimization	Optimized switch-on signal
Err	Error signal	General binary error signal
Err	Error code	Numeric error code

Description of the function

For a complete description, see:

Optimum Start

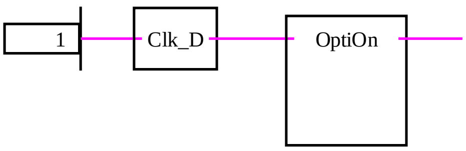
Particularities of the function 'Temperature Optimum B'

The start input St activates the optimization function. This signal (provided by a clock) must be activated sufficiently in advance of the temperature attainment time to allow the temperature to stabilize under the least favourable conditions. A parameter defines how much in advance this signal is given.

Example

Occupation from:	08:00
Max. time for temperature attainment:	2 hours
Switch-on of the clock function:	06:00

In this case, the parameter 'Advance' must be set at 2.0 hours.



An option allows to set the time in hours, minutes or seconds (hours is advised).

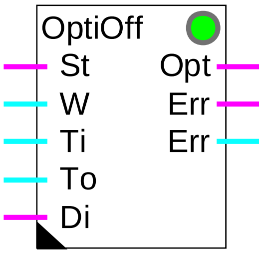
9.3 Temperature Optimum G

Family: **HVC-General**

Name: **Temp. optimum G**

Macro name: _HeaOptig

Fbox:



Version info

This Fbox has been replaced by a new one. Optimum Stop. The function is the same. The time parameters are different. The old Fbox is still supported in the library.

Short description

The function calculates the optimal switch-off time of the heating plant.The room is put in a free running state before the end of occupation in order to save as much energy as possible.

The effective time of the free running sequence is measured and the calculation factors are automatically adapted for the next sequence.

Caution ! Works for a heated room only. Temperature drifts downward only.

Inputs

St	Stop	Advanced signal for optimization stop
W	Set-point	Set-point for inside temperature
Ti	Inside T	Measurement of inside temperature
To	Outside T	Measurement (filtered) of outside temperature
Di	Disable	Disable of the optimization function

Outputs

Opt	Optimization	Optimized stop signal
Err	Error	General binary error signal
Err	Error code	Numeric error code

Description of the function

For a complete description, see:

Optimum Stop

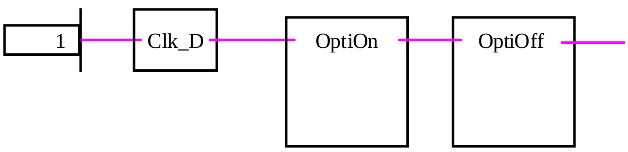
Particularities of function Temperature Optimum G

The stop input activates the optimisation function. This signal (provided by a clock) must be activated sufficiently in advance before the end of room occupation. A parameter defines how much in advance this signal is given.

Example:

End of room occupation:	18:00
Max. time for plant swiching off:	1.0 heures
Free run clock signal:	17:00
In this case, the parameter 'Advance stop' is set at	1.0

The function can be connected be connected with the function Temperature Optimum B (old version).



An option allows to set the time in hours, minutes or seconds (hours is advised).

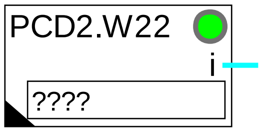
9.4 Analogue Input Module PCD2.W22, filtered

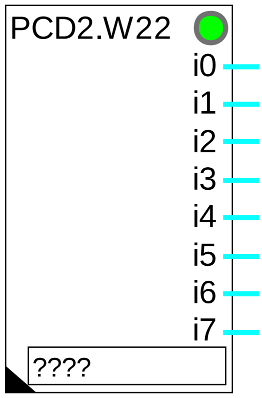
Family: **HVC-Analogue**

Name: **PCD2.W22 filtered**

Macro name: _HeaD2w22

Fbox:





Version info

This Fbox has been replaced. The already programmed Fboxes are still supported by the library.

The disadvantage of this Fbox is that the time constant of the filter depends on the PCD program cycle. It provides only a 1st order filter. The same filter is applied to all inputs.

It is advised to replace the present Fbox with the new version PCD2.W22 Pt/Ni with predefined calibration.

Short description

Fbox for conversion and calibration of analogue module PCD2.W220.

Module for 1 to 8 inputs.

Resolution10 bits.

Individual calibration.

Filter 1st order.

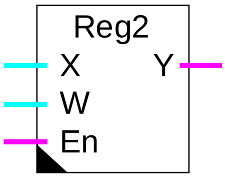
9.5 Two Points Controller, old Version

Family: **HVC-Controllers**

Name: **Controller 2 points old**

Macro name: _HeaReg2

Fbox:



Info version

This function has been replaced by a new version Two Points Controller.

Short description

Two points controller: one digital output with hysteresis (Dead range).

Inputs / Output

See new Fbox.

Parameters

Action See new function.

Initialization state	See new function.
Disabled state	See new function.
Dead range	Range between the switching on and the switching off points.
Offset	Offset added to the measured value X
X + Offset	Signal X calculation plus offset.

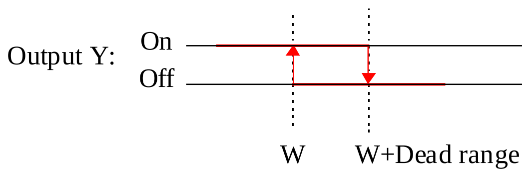
Description of the function

See new function.

Operation for Action = Inverted

E.g. heating

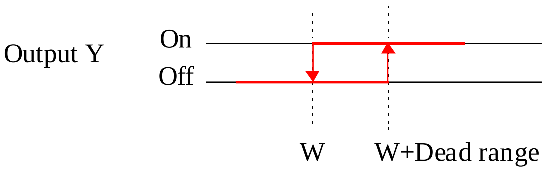
The output signal is switched on when controlled variable X is less than set-point W. It switches off when X is greater than (W+Dead Range)



<u>Operation for Action = Direct</u>

E.g. refrigeration

The output signal is switched off when controlled variable X is less than set-point W. It switches on when X is greater than (W+Dead Range)



If the activation signal En is at 0, the output takes the state defined in the option 'Disable state'.

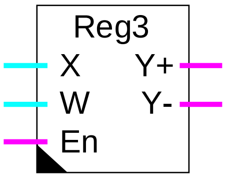
9.6 Three Points Controller, old Version

Family: **HVC-Controllers**

Name: **Controller 3 points old**

Macro name: _HeaReg5

Fbox:



Info version

This function has been replaced by a new version Output, 3 Points.

Short description

Three points controller: two digital outputs (Plus and Minus) with hysteresis.

Inputs / Output

See new Fbox.

Parameters

Action See new function.

Initialization state	See new function.
Disabled state	See new function.
Dead range Y+	Range between the switching on point and the switching off point for Y+.
Dead range Y+..Y-	Range between the working range of Y+ the working range of Y-.
Dead range Y-	Range between the switching on point and the switching off point for Y-.
Offset	Offset added to the measured value of X
X + Offset	Calculation of signal X plus offset.

Description of the function

See new function.

Function for action = Inverted(e.g. Heating)
The output signal Y+ is switched on when controlled variable X is less than set-point W1. The output signal Y+ is switched off when X is greater than the point W2.

The output signal Y- is switched on when controlled variable X is greater than point W4. The output signal Y- is switched off when X is less than the point W3.

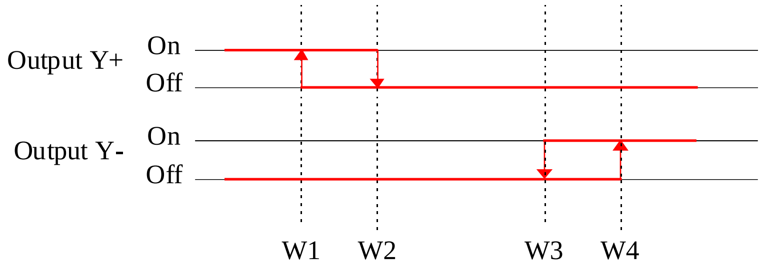
Where:

W1: Set-point, Input W

W2: W1 + dead range for Y+

W3: W2 + dead range for Y+..Y-

W4: W3 + dead range for Y -



Function for action = Direct (e.g. Cooling)

The output signal Y- is switched on when controlled variable X is less than set-point W1. The output signal Y- is switched off when X is greater than the point W2.

The output signal Y+ is switched on when controlled variable X is greater than point W4. The output signal Y+ is switched off when X is less than the point W3.

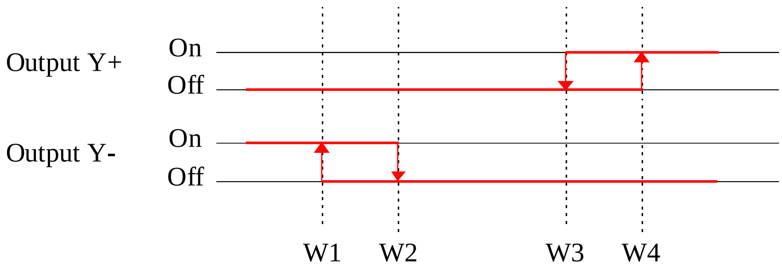
Where:

W1: Set-point, Input W

W2: W1 + dead range for Y-

W3: W2 + dead range for Y+..Y-

W4: W3 + dead range for Y+



If the activation signal En is at 0, the output takes the state defined in the option 'Disable state'.

10. HVC-Dialogue

Contents

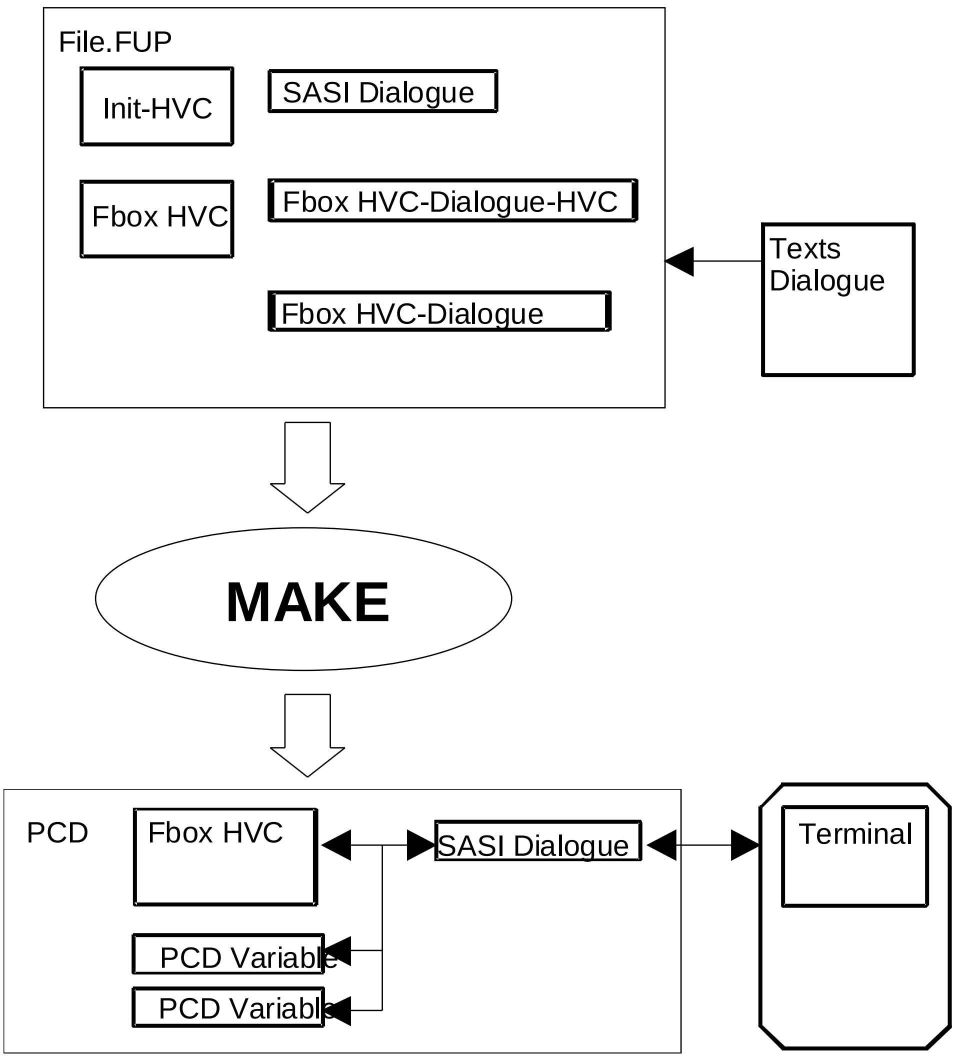
10.1 Generalities about HVC-Dialogue

This library is useful for creating a dialogue on a terminal for a Heavac application. With this dialogue it will be possible to display process values, modify set-points, set clock programs, manage alarm messages and act manually on output signals.

The dialogue structure, the access to the various signals and the dialogue with the Heavac Fboxes, are supported by the Fboxes of the family HVC-Dialogue and HVC-Dialogue-HVC.

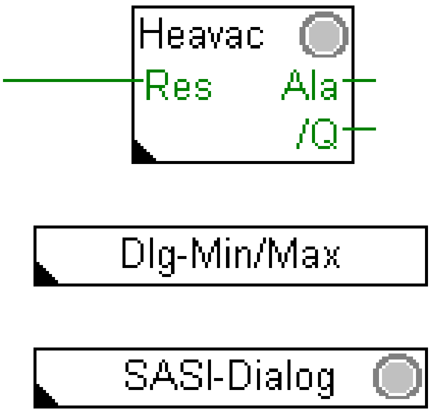
The various texts are memorized in ASCII files and can be adapted to the particularities of each application.

Principle diagram



The dialogue is mainly supported by the SASI-Dialogue Fbox. This Fbox must be programmed at the begining of the program, after the HVC-Init Fbox. The optional Fbox for minimum and maximum must be placed between the 2 Fboxes.

Example:



Steps to program a dialogue on a terminal:

- The programming of the Heavac application must be realized as usual.
- Insert the SASI-Dialogue Fbox after the HVC-Init function.
- For a first trial, select the terminal type and the serial channel used.
- Connect the terminal. The introduction screen for code input must be correctly displayed with the minimum program.
- Program some Display, Edit and Manual Fboxes to access to some PCD variables.
- Program some HVC-Dialogue-HVC Fboxes to access to parameters in Heavac-Fboxes.
- Adjust the number of objects in the SASI-Dialogue Fbox

See also:

Use of the Terminal	For more information about terminals
Construction of the dialogue structure	For more information on the various dialog structures which can be realized.
Dialogue over SBUS	To allow access to SBUS Slave stations from a terminal on the Master Station.

Memory and PCD resources

The routines for Heavac dialogue need a relatively important memory capacity in the program and the text area of the PCD. The PCD1 and PCD2 must be equipped with an extra RAM memory.

If the program is located in EPROM, or if the RAM is write protected (Jumper WP), an extension memory (RAM) must be available. In the dynamic resource table, the RAM text must be mapped on the extension range (from 4000).

10.2 Use of the Terminal

The dialogue on the terminal is structured by menu. The parameter to display or to modify is found by navigation from menu to menu in a tree structure.

For an installation without PCD network, the following functions can be found:

- Code introduction
- Sections menu
- Objects menu
- Element list of an object
- Modification of the state of a parameter
  or
- Acknowledgement and clearing of alarms

For an installation with PCD network, the structure is extended as follows:

- Code introduction
- SBUS stations menu
- Sections menu

For an installation with a terminals network, the structure is again extended as follows:

- Stand by screen
- BUS Busy screen
- Code introduction
- SBUS stations menu
- Sections menu

See also: Inactivity and Backlight
Maxima and Minima

For each menu, the cursor can be moved vertically by using the arrow key to select the required position. The Enter key can be used to confirm the selection.

An escape key allow to exit each menu level and to come successively back to code introduction screen.

Some menu position can be a simple mark or comment to get better lisibility. If the Enter key is depressed, no access to further menu is possible.

Each terminal type uses an acknowledged key to liberate overriden variables or to acknowldge alarms in the alarm buffer. To introduce negative values, some terminals use a key to toggle from + to - sign as well as the opposite way.

A direct access to the sections and the objects can be done using F-keys. However this option must be activated by the program. F1 access to the first position, F2 to the second and so on. Depending on the terminal type, this function can also be realized by other keys like A to Z.

10.3 Function Levels

Code introduction

At system startup, a standard screen is automatically displayed. In this state, it is possible to enter a code. Up to 4 codes may exist to allow the following access:

- Code 1 Read only Full access
- Code 2 Read+Write Full access
- Code 3 Read only Reduced access
- Code 4 Read+Write Reduced access

For the code introduction, all keys are evaluated excepted the Enter key wich is used to end the code introduction. The code can have 1 to 8 numbers.

The codes can not be read nor modified on the terminal.

SBUS stations menu

This menu presents the different stations on the SBUS network.

If the SBUS network is not ready to work when a station is selected, (station powered or disconnected network), the station menu is displayed again after a short time.

Sections menu

This menu presents the different available parts of the installation. This menu may be different if a code for full access or limited access has been entered.

Objects menu

This menu presents the different objects which are part of the selected section. For section containing only one object, the objects menu can be left out.

List of the elements of an object

This list presents the different elements which are part of the selected object. Each element can use one or two lines on the terminal and is made of a text, a parameter and a status.

The text is the element definition in clear text. The parameter is a variable of the process in a numeric or a binary format (ON / OFF). The status indicates if the variable is only displayed, if it can be modified or overridden.

[#] Modification of a parameter

Type	Symbol	Access
Comment	none	No variable, no access
Display	none	The value can only be read
Parameter	<	The value can be read and modified
Override	=	The value can be read and overriden, actually in automatic state
Override	#	The value can be read and overriden, actually in forced state
Parameter or override	*	The parameter modification is in progress
Immediate execution	!	An action is immediatly executed if the Enter key is depressed

As to modify a parameter or to override a value, depress the Enter key after the desired line has been selected. However, the parameter modification is only possible if a code for Write access has been entered.

Once the Enter key has been depressed, the * sign indicates that the modification is in progress. The value can be modified using the up and down keys or the numeric keys.

The parameter modification is ended by depressing the Enter key. A this moment, the value is compared with the maximum and minimum values allowed for the parameter.

For binary variables, only the numeric keys 0, 1, up and down are accepted. The state ON and OFF is displayed.

The week number is displayed with the number 1 to 7 for Monday to Sunday.

A parameter modification can be aborted by pressing the escape key.

The override of a variable is possible if the = sign is displayed. It is simply done by introducing a value as described above. Once the variable is overridden, the # sign appears. To liberate the override, select the element with the arrow keys, press the Enter key as for parameter modification, depress then the key for acknowledgement.

When overriding a binary variable, the state (0 or 1) is immediately sent. This allows to check the effect of the switching and to switch back immediately if necessary. This immediate positioning is not applied in case of a dialogue over SBUS.

[#] Modifizierung_der_Parameter

Copy of values

A function allows to copy up to 4 values in an internal memory. This values can then be pasted in any other element.

To copy a value, position the cursor in regard to the value to copy without pressing the Enter key. Press then the Copy key. This operation can be repeated up to 4 times to save 4 different parameters.

To past a value, position the cursor in regard to the value to modify and press the Enter key. Press then the copy key. This operation can be repeated up to 4 times to paste 4 different parameters. If the paste operation is repeated more than 4 times, the first value is pasted again.

[#] Acknowledgement and clearing of alarms

The alarms can be displayed on the terminal in an object called Alarm buffer. This buffer allows to receive up to 100 alarm texts (limit defined when programming).

To ensure that all alarms are read in the buffer, the begining and the end of the buffer are marked with the lines:

--Buffer Start-- (optional)
--Buffer end--

2 types of alarms exist:

- Text alarms (optional with date and time)
- Status alarms

The alarms with text can be removed from the buffer by positionning the cursor on the first text line, pressing the Enter key and finally the acknowledgement key.

The alarms with status have a refreshed display of:

- the actual state of the alarm (ALA or OK)
- the actual state of the acknowledgement (NAK=not acknowledged or OK)
- a counter of the number of alarm events

They can be removed from the buffer as described above. By selecting the status line, the alarm can be acknowledged. The 'NAK' status changes to 'OK'.

[#] Alarme_quittieren_und_l_schen

10.4 Inactivity and Backlight

As soon as a key is depressed on the terminal, the backlight is turned on. It is automatically turned off in case of inactivity.

The inactivity means that no key is depressed on the terminal keyboard during a given time (standard = 5 minutes). When this time is elapsed, the code introduction screen is also displayed.

In an installation with bus terminals, the inactivity liberates also the bus occupation. The other terminals can again access to the dialogue.

Remark: The switchable backlight is not available on all terminal types.

10.5 Maxima and Minima

Three mechanism exists to limit the parameters introduced on the terminal.

- the default limits
- the limits defined by the programer
- the limits for special formats like date, time, etc..).

The limits are checked at the end of the introduction of the value when the Enter key is depressed. If the value is then out of the limit, the maximum or minimum value is taken in acount.

Default limits

Format xxx.x, one decimal

Maximum	999.9
Minimum	-99.9

Format xxxxx, no decimal

Maximum	99999
Minimum	-9999

Limits defined by the programmer

By using the Fbox Minima/Maxima, it is possible to define minima and maxima for each parameter. The use of this Fbox is optional. If it is not used, the above default values are used.

Limits for special formats

For clock functions, the following limit values are always used:

Hours:	00.00 to 23.59
Date:	00.00 to 31.12 with 00.00 = function disabled
day of week	0 to 9, with

1 to 7 = Monday to Sunday

0 = function disabled

8 and 9 = special functions

Year: 00 to 99

For binary variables only the values 0 and 1 can be introduced. The display shows 'ON' and 'OFF'.

10.6 Use of Bus Terminal

In case of use of bus terminals, two new screens are automatically inserted before being able to introduce the access code. It is important to notice that only one terminal can be used at the same time for the dialogue on the terminal bus.

'Stand by' screen

This screen is displayed when no dialogue is in progress. The terminal bus is free. By pressing any key on a terminal will allow to access to the dialogue and will occupy the bus.

'Busy' screen

This screen, sent to all terminals indicating that the bus is occupied by another terminal. It is only displayed for short time on the terminal actually using the bus. On this terminal the code introduction screen will be then displayed. It remains on all other terminals up to the end of the dialogue.

10.7 Terminals

10.8 PCD7.D100

Functions and specific keys for the PCD7.D100 terminal:

Backlight:	Support switchable backlight
Acknowledge:	Right arrow key
Toggle +/- sign:	F4
F-key:	F1 to F4
Enter:	Arrow key down and left
Entrer to the menu:	Arrow key down and left
Back from menu:	Left arrow key
Copy function:	F3

Recommended settings for the PCD7.D100

Channel:	All channels 0 to 3
Transmission speed:	9'600 bauds
Number of bits:	8 bits, fixed
Parity bit:	Even, fixed
Stop bit:	1 bit, fixed
Handshaking:	RTS-CTS. Cable with control signals according to the manual.
F-key number:	4

The DIP-Switch settings corresponding to the default parameters are the following:

SW1	DP	1	2	3	4	5	6
		off	on	on	on	on	on

SW2	DP	1	2	3	4
		on	off	off	on

10.9 PCD7.D110

Functions and specific keys for the PCD7.D110 terminal:

Backlight:	Support switchable backlight
Acknowledge:	Right arrow key
Toggle +/- sign:	F4
F-key:	F1 to F4
Enter:	Arrow key down and left
Enter the menu:	Arrow key down and left
Back from menu:	Left arrow key
Copy function:	F3

Recommended settings for the PCD7.D110

Channel:	All channels 0 to 3
Transmission speed:	9'600 bauds
Number of bits:	8 bits, fixed
Parity bit:	Paire, fixed
Stop bit:	1 bit, fixed
Handshaking:	Must be RS 485 ! Two wires, cabling according to the manual
F-key number:	4

The DIP-Switch settings corresponding to the default parameters are the following:

SW1	DP	1	2	3	4	5	6
		off	on	on	on	on	on

SW2	DP	1	2	3	4
		on	off	off	on

SW3	DP	1	2	3	4	5
		See manual for address coding.				

SW3	DP	6	7	8
		on	off	off

10.10 PCD7.D150

Functions and specific keys for the PCD7.D150 terminal:

Backlight:	Support switchable backlight
Acknowledge:	Right arrow key
Toggle +/- sign:	not supported
F-key:	not supported
Enter:	Arrow key down and left
Enter the menu:	Right arrow key
Back from menu:	Left arrow key
Copy function:	FN

Transmission speed:	9'600 bauds, fixed
Number of bits:	8 bits, fixed
Parity bit:	Paire, fixed
Stop bit:	1 bit, fixed
Handshaking:	XON-XOFF

10.11 PCD7.D160 and 170

Functions and specific keys for the PCD7.D160 and D170 terminal:

Backlight:	Support switchable backlight
Acknowledge:	Shift+Q
Toggle +/- sign:	Not supported
F-key:	None
Enter:	Shift+E
Enter the menu:	Right arrow key
Back from menu:	Left arrow key
Copy function:	Shift+Right arrow key

Recommended settings for the PCD7.D160 and D170:

Channel:	Channel 2 for integrated terminals.
Transmission speed:	9'600 bauds
Number of bits:	8 bits
Parity bit:	Even
Stop bit:	1 bit
Handshaking:	RTS-CTS
F-key number:	0

10.12 PCD7.D200

Functions and specific keys for the PCD7.D200 terminal:

Backlight:	Support switchable backlight
Acknowledge:	Quit
Toggle +/- sign:	- (with Shift)
F-key:	F1 to F4
Enter:	Arrow key down and left
Enter the menu:	Arrow key down and left
Back from menu:	Esc
Copy function:	+

Recommended settings for the PCD7.D200

Channel:	All channels 0 to 3
Transmission speed:	9'600 bauds
Number of bits:	8 bits
Parity bit:	Even
Stop bit:	1 bit
Handshaking:	RTS-CTS over Setup menu. Cable with control signals according to the manual.
F-key number:	4

10.13 PCD7.D810

Comment: The functioning in bus RS 485 described below is foreseen in the library HVC. However, the actual terminals do not allow this functioning.

Functions and specific keys for the PCD7.D810 terminal:

Backlight:	Doesn't support switchable backlight
Acknowledge:	Del
Toggle +/- sign:	Key -
F-key:	F1 to F12
Enter:	Enter
Enter the menu:	Arrow key right
Back from menu:	Arrow key left
Copy function:	Arrow key center

Recommended settings for the PCD7.D200

Channel:	All channels
Handshaking:	RS 485 for function in bus and in point-to-point on RS 485. No handshaking for RS 232, CL or RS 422 in point-to-point. Cable with control signals according to the manual.
Transmission speed:	9'600 bauds
Number of bits:	8 bits
Parity bit:	Even
Stop bit:	1 bit
Handshaking:	RTS-CTS over Setup menu..
F-key number:	4

For use with CVC library, the Free terminal firmware must be loaded in the terminal.
In point-to-point link, the address must be adjusted at 0.
When the terminal is used in bus RS 485, each terminal receives one address from 1 to 31.
When the terminal is used in point-to-point with RS 485, the address must be adjusted at 1.
The terminal address is adjusted in the setup.

To enter the setup:

- switch off the terminal
- switch on the terminal
- press 'Enter' when the display shows 'Free terminal x.xx'.

10.14 Portable

Functions and specific keys for the Portable terminal

Backlight:	No backlight
Acknowledge:	=
Toggle +/- sign:	-
F-key:	A to Z
Enter:	Right arrow key = Enter without ALT
Enter the menu:	Right arrow key = Enter without ALT
Back from menu:	Left arrow key
Copy function:	+

Recommended settings for the Portable terminal.

Channel:	Channel 0. Only the channel 0 has the supply voltage for the portable terminal.
Transmission speed:	9'600 bauds, fixed
Number of bits:	8 bits, fixed
Parity bit:	Even, fixed
Stop bit:	1 bit, fixed
Handshaking:	PGU
F-key number:	26

10.15 Text Edition

Introduction

The text are defined in the two files:

Standard Texts	HEADL0_S.TXT
User Texts	HEADL0_U.TXT

During installation, these files are copied in the Fbox Directory.

The text files must be edited with an ASCII editor like EDIT from MS-DOS.

Caution !

Windows editors (Notepad, Write, Word) are not ASCII editors.

The code input screen, the objects and all elements are prepared with standard texts. For objects and elements, the programmer has the choice to keep the standard texts or to select user texts. The station and the sections use always user texts. The alarm texts are also located in the user texts file.

As to create specific file for each application without deleting each time the old files, they can be copied in the project directory. The assembler will automatically use the files from the working directory and ignore the files from the Fbox directory. Only the above mentioned text files must be copied.

Caution ! The format of the standard and the user files may change from one version of the Heavac library to the next. The user must then use the new files and copy its special texts according to the new format. This is the case from version 1.21 to 1.3 and from 1.3 to 1.4.

For applications developed with the version 1.3 it is possible to use the files with the version 1.4. In the SASI-Dialogue Fbox, the option 'Number of lines' must be set to '1 L Old file' or '2 L Old file'.

In this case, the following restriction must be considered:

- the old SASI-Dialogue Fboxes do only support the old files
- with the option '2L Old file' only 14 characters are displayed on 20 characters terminals.
- the binary values are displayed with 1 and 0 instead of 'ON' and 'OFF'
- the alarm states are displayed with 'A=0' and 'A=1' instead of 'ALA' and 'OK'
- the acknowledge states are displayed with 'Q=0' and 'Q=1' instead of 'NAK' and 'OK'

Particularities with dialogue over SBUS.
In case of application with dialogue over SBUS, it is important that all stations are programmed with the same text files. See Dialogue over SBUS for more details.

10.16 Standard Texts

The standard text file HEADL0_S.TXT contents the following parts:

- code input screen, in different versions
- the screen for bus terminals
- the list of addresses for bus terminal
- system texts
- standard texts for objects
- standard texts for elements with Min/Max references.

Caution !

When modifying the standard texts, the length of each line must not be altered.

It is not guaranteed that the same text is located on the same line from one version to the next.

10.17 User Texts

The user text file HEADL0_U.TXT contents the following parts:

- user texts for the SBUS stations
- user texts for sections
- user texts for objects
- user texts for the elements with Min/Max references
- alarm texts

The stations and the sections use always user texts. For objects, mainly the universal Fboxes will use the user texts.

The part containing the section texts is prepared for 10 sections. If necessary, it can be extended up to 100 sections (0 to 99) by respecting the same syntax.

The second and the third part contain object texts and elements. The user texts for the objects and the elements works in the same way. Once the Fbox is programmed, open the adjust window. The parameter 'Text object' and 'Text element' have the default value 0. This means standard text is used. By modifying this parameter to a value > 0 the user text of this number will be used.

The number of the user text for the elements indicates only the first text allocated to the first element of the object. The following elements will automatically be allocated to the next texts.

The part of the file for element texts contains 10 groups of 100 texts. The first group is for the text from 0 to 99. The 9 next groups contain only one text but can be extended up to 100 texts each (100 to 199, 200 to 299... 900 to 999) by respecting the same syntax. The maximum amount of text is 1000 for the elements.

By defining the allocation of user text for the elements, the Min/Max references are also defined in this file. This user text allocation can also be used to have different Min/Max limits from one Fbox to the other.

The last part of the user text file contains the alarm texts. This texts can be modified and the number can be extended up to 1000 by respecting the same rules as for the element texts.

10.18 Building of the Dialogue Structure

The menu structure is already predefined. When programming, Fboxes must be placed to define the different sections. Object Fboxes must be programmed to introduce the different objects in the defined sections. Moreover, some options allow to adapt the structure to some particular situations.

Remark: The following chapters, present vatious examples, beginning with a simple case up to complex ones.

Overview of the structure examples:

Code Introduction Screen

Objects Menu

Sections Menu

Section with a Single Object

Marks

Stations Menu

Screen for Bus Terminals

10.19 Code Introduction Screen

By programming the SASI-Dialogue, the code introduction screen is automatically included. This screen present the start point (highest level) in the menu structure. It is automatically displayed at powerup of the PCD. By leaving all dialogue menu, it is always possible to comme back to this screen.

The form of this screen can be chosen between some versions. The choice is made by modifying the value of the symbol OPTION in the standard text file.

OPTION LEQU 1

Standard option. Display of the date and time, indication of the introduced code with 8 marks.

```
--[SAIA DDC+]--
 DATE:18/08/94
 TIME:16:48
 CODE:#.......
```

OPTION LEQU 2

The whole screen is reserved for text. The code can be introduced but without mark.

```
---------------
SAIA  SAIA  SAIA
---------------
TEL 037/72 71 11
```

OPTION LEQU 3

Maximum place reserved for text. Only 4 marks indicate the code introduction. However, 8 numbers can still be entered.

```
---------------
- YOUR COMPANY -
---------------
037/72 71 11 #...
```

OPTION LEQU other values

Only 8 marks for code introduction are displayed.

```
##......
```

10.20 Objects Menu

In a simple installation with a low amount of objects, they will be placed at the first menu level. After code introduction, the objects menu is immediately displayed. As to introduce this structure, the parameter 'Number of sections' in the SASI-Dialogue must be set to 0 (default value). All object Fboxes programmed after the SASI-Dialogue will automatically appear in this menu.

The Section Fbox must never be used is this case.

Example of the menu structure:

Code introduction screen:

```
--[ SAIA DDC+ ]--
  DATE:19/08/94
  TIME:20:30
  CODE:........
```

Objects menu:

```
TEMPERATURES
SETPOINTS
MOTORS
CONTROLLERS
```

Object TEMPERATURES

```
OUTSIDE TEMP    10.5
FLOW TEMP       45.6
PULSION         22.4
ROOM TEMP       23.0
```

10.21 Sections Menu

For a more complex installation, the section menu should be created. The installation is then divided in several sections.

To create this structure, the parameter 'Number of sections' in the SASI-Dialogue must have a value > 0. The maximum number of sections probably used must be entered. As to mark the beginning of each section, the Section Fbox must be placed. The first of them will be immediately after the SASI-Dialogue.

After each Section Fbox, the object Fbox for this section will be placed. In the Section Fbox, the exact number of object wich are part of this section must be entered. The parameter 'Text section' allows to define the text from the user text file which will be associated to this section. The section option will remain to 'Standard' for this example.

Example of the menu structure

Code introduction screen:

```
--[ SAIA DDC+ ]--
  DATE:19/08/94
  TIME:20:30
  CODE:........
```

Sections menu:

```
HEATING PLANT
GROUND FLOOR
1. FLOOR
```

Objects menu of the section HEATING PLANT:

```
TEMPERATURES
SETPOINTS
MOTORS
CONTROLLERS
```

Object TEMPERATURES

```
OUTSIDE TEMP    10.5
FLOW TEMP       45.6
PULSION         22.4
ROOM TEMP       23.0
```

10.22 Section with a Single Object

If an object is important or is often used, it is possible to locate this object alone in a section and to skip the object menu for this section. This kind of section is also introduced with the Section Fbox. In this Fbox, the section option will be set to 'Object'. Only one object can be placed after this Section Fbox.

Example of the menu structure

Code introduction screen:

```
--[ SAIA DDC+ ]--
  DATE:19/08/94
  TIME:20:30
  CODE:........
```

Section menu:

```
HEATING PLANT
GROUND FLOOR
1. FLOOR

CLOCK
```

Object menu of the section HEATING PLANT:

```
TEMPERATURES
SETPOINTS
MOTORS
CONTROLLERS
```

Object TEMPERATURES

```
OUTSIDE TEMP    10.5
FLOW TEMP       45.6
PULSION         22.4
ROOM TEMP       23.0
```

Object CLOCK (no object menu)

```
HOUR HH.MM     20.37
DATE MM.DD     19.08
DAY 1=MON          5
YEAR AA           97
```

10.23 Marks

As to get a better overview of the menu it is possible to introduce marks. The marks are comment lines in the section or object menu. No selection can be done on this line. This mark must also be taken into account for the parameter 'Number of sections' in SASI-Dialogue and for the parameter 'Number of objects' in the Section Fbox.

As to introduce a mark in the sections menu, the Section Fbox must be placed. The parameter 'Option' must be set to 'Mark'. The parameter 'Text section' will indicate the text used as mark in the User text file. The parameter 'Number of objects' is ignored in this case. No Object Fbox can be placed after this Section Fbox.

As to introduce a mark in the object menu, the Fbox Mark must be placed. for the parameter 'Text object', the default value 0 will introduce a line as mark in the menu. Other values will indicate the text used as mark in the User text file.

Example of the menu structure:

Menu of the sections

```
-- SECTIONS MENU ---
HEATING PLANT
-- AIR CONDITIONING ---
GROUND FLOOR
1. FLOOR
----- CLOCKS -------
CLOCK SETTING
CLOCK PROGRAM
--- END OF MENU  ---
```

10.24 Stations Menu

The library allows also to realize a dialogue with several slave stations from a master station over a SBUS network. For this structure a stations menu will be introduced. It contains a list of of available stations and will be displayed immediately after the code introduction.

As to activate the Stations menu, the parameter 'Number of stations' in the SASI-Dialogue must be higher than 0.

See also: Dialogue over SBUS

Example of the menu structure:

Code introduction screen:

```
--[ SAIA DDC+ ]--
  DATE:19/08/94
  TIME:20:30
  CODE:........
```

Stations menu:

```
STATION 0
STATION 1
```

Sections menu of the STATION 1:

```
HEATING PLANT
GROUND FLOOR
1. FLOOR
```

Objects menu of the section HEATING PLANT:

```
TEMPERATURES
SETPOINTS
MOTORS
CONTROLLERS
```

Object TEMPERATURES

```
OUTSIDE TEMP    10.5
FLOW TEMP       45.6
PULSION         22.4
ROOM TEMP       23.0
```

<u>Section menu of the STATION 2:</u>

HEATING PLANT
GROUND FLOOR
1. FLOOR

2. FLOOR

10.25 Screen for Bus Terminals

In case of use of bus terminals, two new screens are automatically inserted before being able to introduce the access code. It is important to notice that only one terminal can be used at the same time for the dialogue on the terminal bus.

Stand by screen

This screen is displayed when no dialogue is in progress. The terminal bus is free. By pressing any key on a terminal will allow to access to the dialogue and will occupy the bus.

Busy screen

This screen, send to all terminals indicates that the bus is occupied by another terminal. It is only displayed for short time on the terminal actually using the bus. On this terminal the code introduction screen will be then displayed. It remains on all other terminals up to the end of the dialogue.

Some options for this screens are prepared in the standard text file.

Example of the menu structure:

Standby screen:

```
--[ SAIA DDC+ ]--
  DATE:19/08/94
  TIME:20:30
PRESS   ANY   KEY
```

Busy screen:

```
--[ SAIA DDC+ ]--
    BUS  BUSY
-----------------
```

Code introduction screen:

```
--[ SAIA DDC+ ]--
  DATE:19/08/94
  TIME:20:30
  CODE:........
```

Stations menu:

```
STATION 0
STATION 1
```

10.26 Dialogue over SBUS

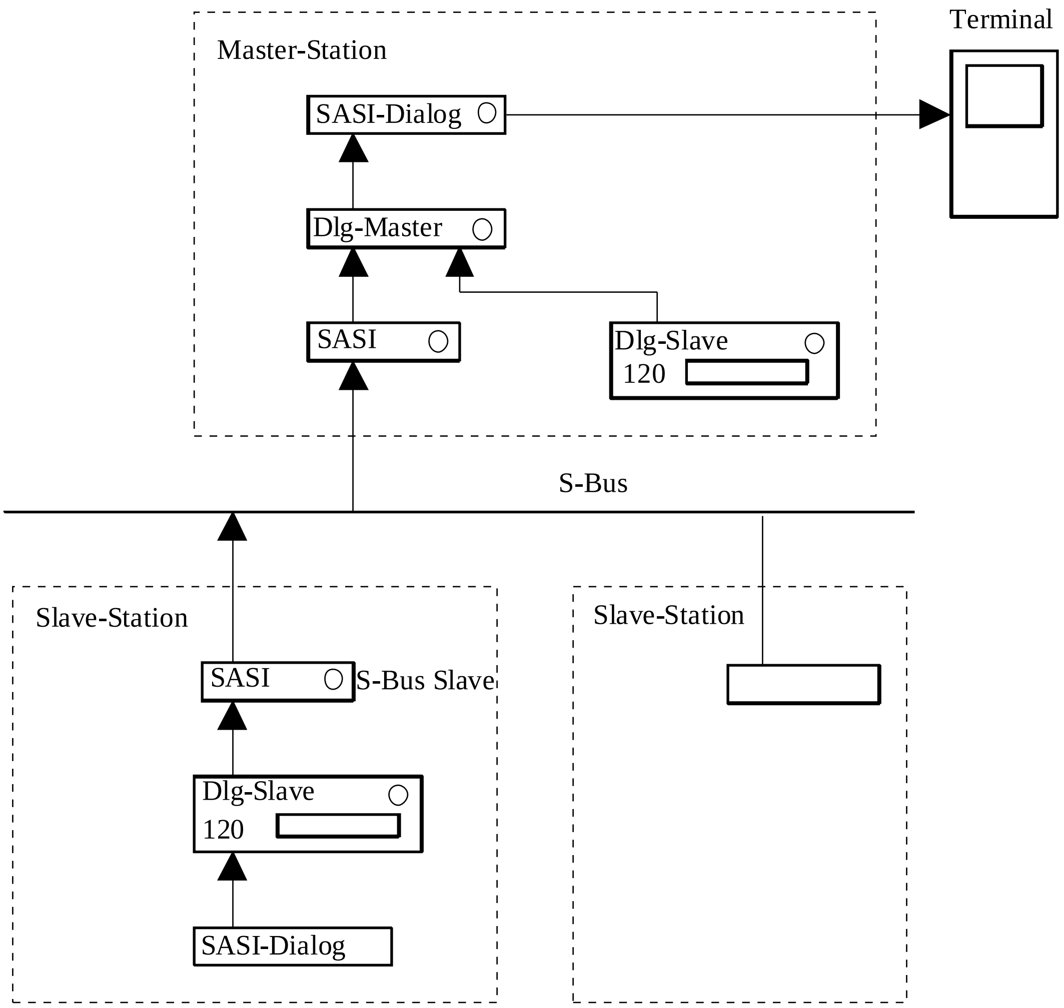
General principle

The general principle is to install only one terminal in an installation made of several PCD stations connected through a SBUS network. The first menu allows to establish a connection to one of the stations of the network and to run a dialogue with the objects programmed in this station.

The following dialogue Fboxes are used:

- Dialogue Master
- Dialogue Slave

Principle diagram:



Restrictions
The follwing restrictions and conditions must be considered before starting the realization of a dialogue over SBUS.

- The slave station number must be in the range 0 to 99. However, the numbers can by mixed and numbers can be left out.
- Only the master station can support a terminal or a terminal bus which allows the access to all stations on the network. However, local terminals can still be connected to the slave stations. These terminals will only be able to access their own slave station.
- The terminal bus must be a separate RS 485 bus.
- The SBUS communication must be initialized by the communication Fboxes of the basic FUPLA library. This must be done in the same file as the dialogue. It is possible to combine dialogue communication and data communication.
- In this kind of structure, several serial lines are used on the PCD. It is important to check the possibility and the restrictions due to the use of several lines and the PCD performances.

Example of maximum speed:

Line 0, PGU line	19'200 bds
Line 1, RS 232 for terminal	9'600 bds
Line 3, RS 485 for SBUS network	9'600 bds

In this cse, the PGU could not be configured at 38,4 bds. The network would not be able to work correctly.

- The texts for all stations are memorized in the Master stations. The programming of all stations must be realized by using the same text numbering.
- The menu structure in all stations must contains the sections menu.
- A range of 120 registers (same range in all stations) must be reserved.

Programming of the dialogue over SBUS

Steps:

- Prepare the wiring of the SBUS network according to the instuction in the SBUS manual.
- Configure the Slave stations by setting a station number (in the range 0 to 99).
- Program the Slave station and the Master station with a SASI-SBUS Fbox of the communication librairy.
- Program a standard communication Fbox (E.g. read the clock data)
- check the good functioning of the network. If the network is functioning perfectly in this way it will be possible to add the dialogue over SBUS.

- The Slave station must first be programmed same as for a dialogue without network. As test, it is possible to connect provisionaly a local terminal to check the menu structure.
- Add the Dialogue Master Fbox in the Master station
- Add the Dialogue Slave Fbox in the Slave stations
- Introduce the number of stations (>=2) as parameteer in the SASI-Dialogue of the Master station.
- If no terminal is required in the Slave stations, the option 'Terminal type' and serial line can be set to 'None' as to spare code memory in these stations. The text file can also be shorted in this case.

Texts with dialogue over SBUS

During the dialogue with the Slave stations, only the text numbers are transmitted over the bus. The texts itself are in the Master station.

It is necessary to coordinate the text numbering for all stations and to introduce all texts in the same file. It is important to prepare the text files before assembling the Master program.

If the slave programs are similar it is possible to use the same text number for several Slave stations. This will make corrections easier and spare PCD memory.

The element texts contains also references to the Min/Max values. These limits are also memorized in the Master station and can only be adjusted in this station.

Definition of the network stations

On the terminal, the network stations, are displayed with names. Default names are prepared in the user text for 10 stations. User texts are always used.

Default texts:

```
"  ** SBUS-Station **    " ;;0  ** = Master (own station)
"  00 SBUS-Station 0     " ;;1
"  01 SBUS-Station 1     " ;;2
"  02 SBUS-Station 2     " ;;3
"  03 SBUS-Station 3     " ;;4
"  04 SBUS-Station 4     " ;;5
"  05 SBUS-Station 5     " ;;6
"  06 SBUS-Station 6     " ;;7
"  07 SBUS-Station 7     " ;;8
"  08 SBUS-Station 8     " ;;9
```

This list can be extended up to 100 lines (lines 0 to 99). The 2 first characters are reserved and should not be modified. The 2 following characters define the SBUS station number. It correspond to the station number introduced in the SBUS configuration. The Master station is indicated with the mark '**'. The master station is optional in this list and can be at any place.

The 5th column is the cursor place and must contain a space character.

The 19 remaining characters are available for the station name.

The length of each line must not be altered.

10.27 Bus Terminals

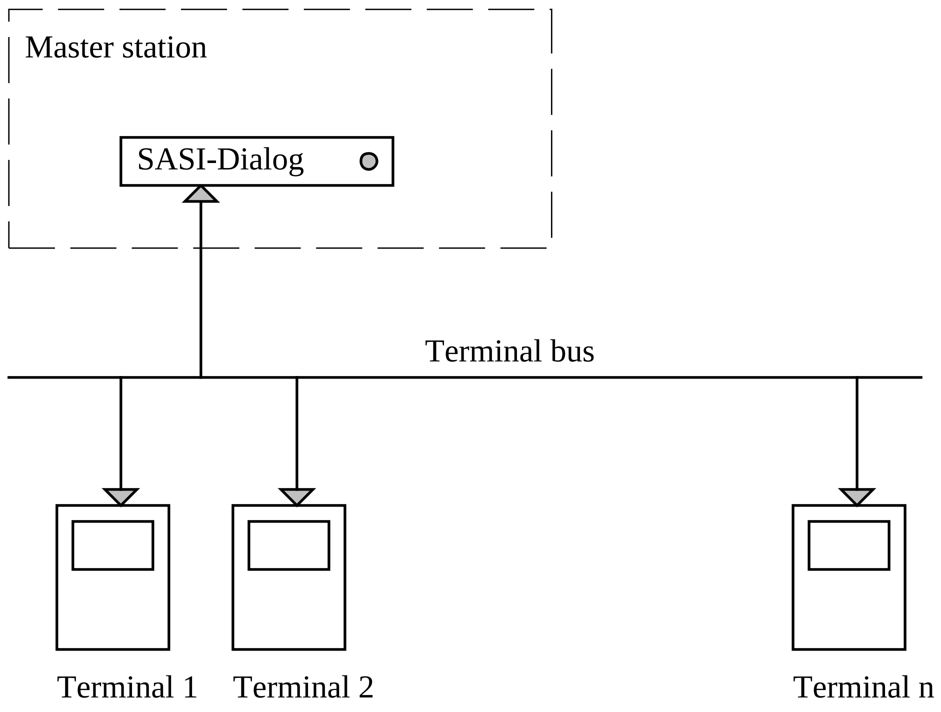
The principle is to install several terminals on an installation made of one or more PCD stations. A RS 485 network is used for the connection of the terminals to the Master station.

If several PCD stations are connected and the Dialogue over SBUS is used, two RS 485 Bus will be used. The first one connects the PCD stations together using the SBUS protocol. It supports the data transfer and the transport of the dialogue information from Slave stations to the Master station. The second one connects only the terminals to the Master station by another communication port.

The following description explains only the principle of the terminals connected to a single PCD.

The dialogue can only be run from a single terminal at the same time. As soon as a terminal is active on the bus, the other are put in a waiting state and a 'BUS BUSY' message is displayed.

Principle diagram:



Restrictions

The following restrictions or conditions must be considered before starting the realization of a dialogue with bus terminals.

- The maximum amount of terminals is 31. The addresses must be in the range 1 to 31.
- No other equipement can be connected to the terminal bus.

- The dialogue can only be run on one terminal at the same time.
- The automatic alarm display is only activated after a terminal is engaged on the bus.
- In case of dialogue over SBUS, the Master station of the SBUS network is the same as the Master of the terminals. This station must always be running to support the dialogue.
- Some restriction exist concerning the choice of serial line type. Please refer to the hardware manual.

See also: Screen for Bus Terminals

Parameter of the SASI-Dialogue

As to activate the functioning of the bus terminals, the SASI-Dialogue must be adjusted as follows:

-----[Serial line]-----

Handshaking: Set this option to 'RS 485'.

-----[Network structure]-----

Number of terminals: Number of connected terminals. Value >1.

-----[Terminal]-----

Type of terminal: Terminal for RS 485. E.g. PCD7.D110

If a terminal is not responding on the bus, a timeout of 3 seconds elaps in the display cycle of the Stand by screen.

Possible errors:

- a terminal which is specified in the terminal number is not installed
- a terminal is not configured correctly
- a terminal is powered down
- a terminal is defective
- the terminals bus is not installed correctly

Particular addressing of the terminals

The default settings assume that successive addresses from 1 to 10 are used. If this addressing is not applicable, the effective addresses can be defined in the standard text file. The part of this file for the terminal address contains the following default settings:

```
"  01"
"  02"
"  03"
"  04"
```

```
"  05"
"  06"
"  07"
"  08"
"  09"
"  10"
```

These addresses can be modified. The length of the line may not be altered. The list can be extended up to 31 lines by respecting the same structure.

See also: PCD7.D110

10.28 Single Terminal on RS 485

It can be necessary to connect a single terminal on a RS 485 line. E.g.: to install a terminal to a distance of up to 1200 meters from the PCD station.

Parameter of the SASI-Dialogue:

-----[Serial line]-----

Handshaking: RS 485

-----[Network structure]-----

Numbre of terminals: 1

-----[Terminal]-----

Type of terminal: PCD7.D110

The address of the terminal is not relevant in this case. However, it is important that no other terminal is connected to the line.

The supplementary screen for the bus access from terminals is not introduced. The terminal is working in the same way as for a point-to-point connection over RS 232.

10.29 HVC-Dialogue-Family

This family contains some Fboxes having a central function in the dialogue and Fboxes for universal usage.

The Fboxes with a central function are used only once in the application. It concerns the following Fboxes:

- SASI Dialogue
- Minima/Maxima
- Dialogue Master
- Dialogue Slave
- Alarm Buffer
- Setup

The following Fboxes help for the building of the structure:

- Section
- Mark

The universal Fboxes allow to create a dialogue with any variable of a FUPLA program which is not a internal variable of a Fbox. These Fboxes are not specific to any Heavac Fbox.

It concerns the following Fboxes:

- Edit binary
- Edit num. xxx.y
- Edit num. xxxxx
- Switch Up/Down
- Display binary
- Display num. xxx.y
- Display num. xxxxx
- Message
- Data List
- Manual binary
- Manual num. xxx.y
- Manual num. xxxxx
- Alarm
- Alarm inhibit

See also:

Generalities about Alarms with Dialogue

Family HVC-Dialogue-HVC

10.30 SASI-Dialogue

Family: **HVC-Dialogue**

Name: SASI-Dialogue

Macro name: [_DI0SASI3]

Fbox

Short description

The task of these function is:

- to assign the serial line of the terminal and define its parameters
- to reserve and initialize internal variables (hidden for the user)
- to reserve and initialize PCD texts according to the text files
- to introduce the routines which supports the dialogue with a non intelligent terminal (hidden for the user)
- to define options for the menu structure (section, objects, a.s.o.)
- to define options for the network function (PCD and terminals network)
- to select the terminal and the terminal characterstics
- to define acces codes
- to define various options.

See also: Generalities about HVC-Dialogue

Some old versions of the Fbox SASI-Dialogue are still supported. However they are not described in this document. Please refer to the former manual if necessary.

Input / Output None

Parameters

-----[Serial line]-----

Channel	Channel where the terminal is connected
Transmission speed	Parameter according to the terminal
Number of bits	Parameter according to the terminal
Parity bit	Parameter according to the terminal
Stop bit	Parameter according to the terminal
Handshaking	

- None	No flow control is supported
- RTS-CTS	RTS and CTS control lines are supported
- XON-XOFF	XON-XOFF control is supported
- RS 485	Terminals on RS 485 bus are supported
- PGU	For channel 0 only. Alternatively, a RS 232 terminal and a programming unit in mode PGU mode can be connected. The control lines RTS-CTS must be connected to the terminal.

-----[Network structure]-----

Number of network stations	
	A value >= 2 introduces automatically the network menu and allows the access to the Slave stations. See 'Dialogue over SBUS network'.
Number of terminals	A value > 1 introduces the function of terminals on an RS 485 bus

-----[Menu options]-----

Number of sections	The total number of sections used must be introduced. A value > 1 introduces automatically the section menu.
Number of objects	The total number of objects used must be introduced.
Option objet title	
- No title	No title in the objects menu.
- Fixed title	The object name is introduced as fixed title before the first element
Line per element	
- 1 Line	One line of the terminal is used per element
- 2 Lines	Two lines of the terminal is used per element
- 1L Old File.	One line per element. The text file is an old file of the version 1.3
- 2L Old File	Two lines per element. The text file is an old file of the version 1.3

----[Terminal]-----

Type of terminal	Choice of the terminal type
- None	No terminal connected. Option for the Slave stations in case of dialogue over SBUS.
- PCD7...	Type of the connected terminal.
Character set	For terminals which support different character sets.
- Setup	The character set can be selected on the terminal using its setup function.
- English	For english character set. The terminal setup is disabled with this option.
...	

----[Function keys]-----

F-Key, Option	
- None	No function keys are supported
- Scn+Obj	Function keys are activated in the objects and sections menu
F-Key, Number	Number of function keys on the terminal

----[Codes]-----

Reading	Code for Read access
Reading+Write	Code for Read and Write access
Limited Read	Code for limited Read access
Limited Read+Write	Code for limited Read and Write access
Limited access, option	
- None	The limited access is not used
- Section	The limited access reduces the number of sections
Limited access, limit	Number of the available sections with a code for limited access
Timeout [sec]	Maximum inactivity time to clear the code

----[Alarm]-----

Alarm option	
- No Alarm	The alarm buffer is not used.
- Standard	The alarm buffer works like a standard object
- Auto	The alarm buffer is automatically displayed in case of a new alarm
- Auto s.code	The alarm buffer is automaticaly displayed in case of a new alarm. The alarms can be cleared and acknowledged without code.

----[Diagnostic]-----

SASI	Error during serial line assignation
Receive diagnostic	Error during character reception
Transmit diagnostic	Error during character or text transmission.
Text execution	Error during the execution of a special command in a text.
Clear All	Button to clear the error diagnostics

Description

This initialization function must be foreseen once at the beginning of the program. If it is missing, various assembling errors may occur:

```
Error 42:   TEST.SRC: Line 50: Symbol not defined
Error 32:   TEST.SRC: Line 50: Invalid expression
```

Network structure

The number of network stations indicates the number of positions that will appear in the stations menu. The own station (Master) must also be included if it is available in this menu. The SBUS number of stations is not of importance for this option. The value 0 must be selected if no SBUS network exists or if the dialogue over SBUS is not used by the application.

Netzwerk_Struktur

Any parameter different from 0 will automatically introduce the stations menu on the terminal.

The terminal number must be set to 1 when the terminal is connected point to point to the PCD (also possible in RS 485). It is connected to the Master station in case of dialogue over SBUS. This parameter can only be set to a higher value for terminal designed to be connected to a RS 485 bus. A parameter >1 will indicate the number of terminals connected on the bus. The terminal addresses are not relevant for this parameter.

See also:

Building of the Dialogue Structure

Stations Menu

Screen for Bus Terminals

Dialogue over SBUS

Bus Terminals

Single Terminal on RS 485

Menu options

The parameter 'Number of sections' can be set to 0 as to remove the sections menu in a simple application. After the code has been introduced, the object menu is immediately displayed.

The parameters 'Number of sections' and 'Number of objects' define the maximum amount of sections and objects which will be used in the application. This parameter is used for a control of possible conflict between text ranges. If one of this limit is overrun, the following message will be displayed by the assembler:

```
Warning 6: TEST.SRC: Line 70: More Sections used than specified in SASI-Dialog
```

or

```
Warning 6: TEST.SRC: Line 47: More Objects used than specified in SASI-Dialog
```

If the option 'Object title' is set to 'Fixed title', the objects will be presented with a fixed first line indicating the object name. Ir does not move when the cursor goes down. The number of available lines for the variables is reduced by 1. On the other hand, it is easier to know which object is displayed at any time.

Particularities with PCD network:

- The parameter 'Number of sections' must correspond exactly to the number of programmed section in the application. It define the number of position that will appear in the section menu.
- The section menu must alway be programmed in the Master and in all Slave stations.

Optionen_Men

See also: Building of the Dialogue Structure

Objects Menu

Sections Menu

Section with a Single Object

Terminal and Character set

The terminal typ must be selected here.

The option 'None' must be selected in a Slave Station where the dialogue in only possible from the Master station. In this case, all definition texts for sections and objects are created but the routine for the terminal handling are not included in the PCD code. The parameters for the serial line, the F-Keys, the access codes, the alarm options and the diagnostics are not significant.

See the chapter for the terminal description for more details.

Function keys

The option 'None' disables the function of the F-keys.

The option 'Scn+Obj' allows to access to the section and objects using the F-keys. Allways the first positions of the menus are accessible.

The parameter 'F-Key, Number' allows to use a terminal which differs from the selected type only by the number of the available F-keys. The first key must have the same code (E.g.: F1 = 65 = 'A' for PCD7.D100). The following keys will have the successiv codes (66, 67…).

Codes

The access to the parameter from the terminal can be subdivided in two levels. The full access is usually foreseen for service personal and the reduced access for the installation users. In addition to that, it is possible to have a Read access and a Read+Write access.

See also: Code introduction

The limit given as parameter is the number of available sections in the sections menu for the reduced access.

Example:

Terminal_und_Charaktersatz

Funktionstasten

Codes

<u>Reduced access</u>

CLOCK SETTINGS
CLOCK DAILY
TEMPERATURES
SETPOINTS

<u>Full access</u>

CLOCK SETTINGS
CLOCK DAILY
TEMPERATURES
SETPOINTS

HEATING GRADIENT
CONTROLLERS

For the code introduction, all keys are evaluated excepted the Enter key. With a terminal bus, the escape key is also not evaluated for the code but it is used to escape from the code input screen and liberate the bus.

For non numeric keys, the following formula must be used to know the value of the key to calculate the effective code:

Value = Modulo 10 of (ASCII Code + 2).

The modulo is egal to the rest of the division

The F1-key (ASCII 65) has then the value 7.

65 + 2 = 67 and Modulo 10 of 67 = 7.

Example: value of the keys for the PCD7.D100 terminal.

Key	Value
Decimal point	8
Upper arrow	3
Right arrow	8
Left arrow	0
Down arrow	7
0..9	0..9
F1	7
F2	8
F3	9

F4 0

If the code 0 is programmed, the access is possible by simply pressing the Enter key. The leading zeros are ignored. For this reason, the keys with a value zero should not be used as first key.

The timeout parameter [sec] defines the maximum inactivity time on the terminal.

See also: Inactivity and Backlight

Particularities with network.

Only the codes, the options and the parameters set in the Master station are valid for the dialogue with all stations on the network. Due to this restriction, only the difference between Read and Read+Write is useful in this case.The other combinations can only be used if the limit can be set to the same value in all station of the network.

[#] Alarm

If the alarm buffer is used in the application, the option 'Auto' or 'Auto n. code' must be selected. In either case, the access to the alarm buffer will be denied. This option allows to reduce the PCD code if the buffer is not used.

The option 'No alarm' is selected if the alarm functions are not used. In case of dialogue over SBUS, the alarm functions must also not be used in the Slave stations.

This option avoid to create a PCD code which is never used.

See: 'Generalities about alarms'

[#] Diagnostics

Possible diagnostics errors:

SASI: An error has been detected during assignation of the serial line. Possible errors:

- The specified line do not exist
- The specified line is the line 0 and is actually connected to a PGU cable.
- The specified line is configured as S-BUS PGU or Gateway Master port
- The specified line is already used by an other Fbox. This can also be done in an other file.

[#] Alarm

[#] Diagnostics

Reception:

A bad caracter has been received.

The communication parameters do not correspond to the terminal settings.

In other case, the diagnostic is temporary and can be acknowledged by the Clear button.

It the error is repetitive and the dialogue function is disturbed, check the quality of the cable connection.

Transmission:

Generally due to a interruption of the communication by the control signals RTS-CTS or XON-XOFF. this diagnostic is normally temporary and disappears alone.

If other diagnostics appears and the communication is disturbed, refer to the programming manuals for more details about serial line diagnostics.

The Clear button allows to acknowledge the errors once known. By the same way, and if the error is not repetitive, the LED turns back to green.

10.31 Minima/Maxima

Family: **HVC-Dialogue**

Name: Minima/Maxima

Macro name: [_Dl0Mima]

Fbox: Dlg-Min/Max

Short description

Definition of minimum and maximum limits for the modification of values on the terminal.

Inputs / Outputs none

Parameters

Minima and Maxima for formats [+/- xxx.x]

Min 0 [+/- xxx.x]	Minimum limit number 0 for the format [+/- xxx.x]
Max 0 [+/- xxx.x]	Maximum limit number 0 for the format [+/- xxx.x]
...	
Max 9 [+/- xxx.x]	Maximum limit number 9 for the format[+/- xxx.x]

Minima and Maxima for formats [+/- xxxxx]

Min 0 [+/- xxxxx]	Minimum limit number 0 for the format[+/- xxxxx]
Max 0 [+/- xxxxx]	Maximum limit number 0 for the format [+/- xxxxx]
...	
Max 4 [+/- xxxxx]	Maximum limit number 4 for the format [+/- xxxxx]

Description

Attention !

The Fbox Minima/Maxima must always be placed before the Fbox SASI-Dialogue.

This Fbox allows to define a list of 10 minimum and 10 maximum values for the format xxx.x (one decimal) and 5 minimum and 5 maximum values for the format xxxxx (no decimal). The applicable format is defined by the dialogue Fbox (which represents the dialogue object). To know the format of a given parameter, open the adjust window of the Heavac Fbox. The format is the same in the adjust window as on the terminal.

Once this value have been defined, they can be individually allocated to each parameter by using the standard text file (HEADL0_S.TXT) or the user text file (HEADL0_U.TXT).

In the part of this files containing the element texts, the 2 characters preceeding the text defines the applicable minimum and the maximum values.

Example:

In the standard text file

```
"__22Setpoint      " ; 55
```

In the Min/Max Fbox

```
Min 2 [+/-xxx.x]  15.0
Max 2 [+/-xxx.x]  25.0
```

The text 55 is allocated to an element called 'Setpoint'. The text 'Setpoint' is preceeded of the number 2 and 2. The minimum 2 and the maximum 2 are applicable. This parameter can be modified on the terminal in the range 15.0 to 25.0.

Other variables can be associated to these limits, for example all setpoints. In this way, the modification of a limit (also possible ONLINE) is automatically applicable to all elements wich are referencing to.

It is also possible to combine a minimum and a maximum with different numbers. This can be used if the number of 10 limits group is not sufficient.

Example:

```
"__18Factor P       " ; 87
```

The minimum 1 and the maximum 8 are applicable.

See also:

Terminals

Maxima and Minima

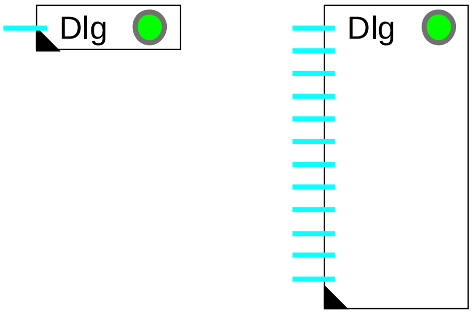
10.32 Fbox Display

Family: **HVC-Dialogue**

Name: Display

Macro name: [_Dl0Dis..]

Fbox:



Short description

Universal Fboxes for the dialogue. These Fboxes allow to display the value of binary or numeric PCD variables.

Inputs — Value to be displayed on the terminal

Parameters

Text object	The value 0 declares the use of the standard text. A value >0 indicates the number of the user text.
Text element	The value 0 declares the use of the standard text. A value >0 indicates the number of the user text.
Input 0..19	Display of the value at input 0..19 which is displayed on the terminal.

Description

The Display Fboxes allow to simply display variables on the terminal. No modification or override is possible.

Each programmed Fbox represents a dialogue object in the objects menu.

These Fboxes are strechable and can contain 1 to 8 or 1 to 20 variables depending on the version. During programming, by streching the Fbox, the number of connections and the number of elements in the corresponding object on the terminal are defined. If the number of elements is not higher than 8, the use of the Fbox 1-8 is recommended. The internal registers will be saved.

Text object
The standard value 0 defines the use of standard text in the file HEADL0_S.TXT. A value > 0 define the user text.

Texts elements

The standard value 0 defines the use of standard text in the file. A value > 0 defines the first element user text.

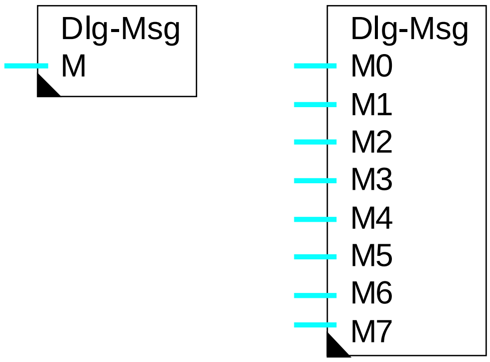
10.33 Fbox Message

Family: **HVC-Dialogue**

Fupla name: Messages

Macro name: [_Dl0Msg]

Fbox:



Short description

Universal dialogue Fbox for displaying messages in clear text.

Parameters

Text object	Number of the text object. The value 0 corresponds to the standard text.
Text elements	Basic number for the texts of the object elements. The value 0 corresponds to standard texts. This text is used only if the message indicated at the input is not valid.

Description

Each programmed Fbox represents a dialogue object which will appear in the object menu.

This Fbox is stretchable and may contain 1 to 8 messages. During programming, by 'pulling down' the Fbox the number of variables to connect can be selected and at the same time the number of elements (message lines) of the object on the terminal.

The messages to display are memorized in PCD texts. They will be edited with the ‘Resource manager' of Fupla. The text number must be given as numeric value on the Fbox input. Each input represents an individual text which will be displayed on one line on the terminal. The text number may also be variable. The text content can be modified only if it is memorized in RAM.

The text number can be given by the text introduction Fbox (in preparation) of basic Fupla. In this way, the texts can be allocated dynamically.

Caution ! The dialogue program can only recognize the end of a text if the last character is a back slash (\ ). If this character is missing, the error LED of the CPU will turn on.

The text may be of any length. The characters beyond the screen space can be scrolled by pressing the introduction key. At the end of the text, after a short pause, the display shows the beginning of the text again. During text scrolling, any key can be pressed as to interrupt scrolling.

See also: Fbox Edit

Fbox Display

Fbox Manuel

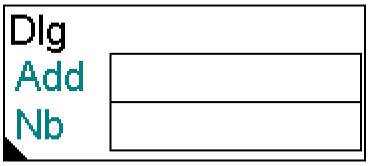
10.34 Data List

Family: **HVC-Dialogue**

Fupla name: Data List xxxxx and Data List xxx.y

Macro name: [_Dl0DisIL] and [_Dl0DisJL]

Fbox:



Short description

Universal dialogue Fbox for the display of up to 100 register values.

Fbox field:

Add	Basic address of the register block.
Nb	Number of register in the block.

Parameters

Text object	Number of the text object. The value 0 corresponds to the standard text.
Text elements	Basic number for the texts of the object elements. The value 0 corresponds to standard texts

Description

Each programmed Fbox represents a dialogue object which will appear in the object menu.

This Fbox allows to display a list of 1 to 100 successive register values. The Fbox field 'Add' receives the basic address of the register block. The field 'Nb' indicates the number of consecutive registers to be displayed on the terminal. The number is limited between 1 and 100.

Only one text is used for the elements. The same text is repeated for all elements with a numeric index. The 2 first characters show the index of the value. The initial index must be given on the element text in the text file. The default text contains the initial index 01.

If the index becomes bigger than 99 it will restart at 00 (E.g. start index 80, number 40).

Example: user text 50 is used:

```
"    01 Nb of impuls     " ;;50
```

Display on the terminal:

```
01 Nb of impuls      10
02 Nb of impuls     234
03 Nb of impuls    1000
04 Nb of impuls       2
```

See also: Ebox Display

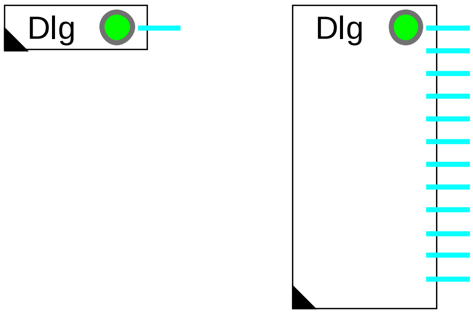
10.35 Fbox Edit

Family: **HVC-Dialogue**

Name: Edit

Macro name: [_Dl0Edit..]

Fbox:



Short description

Universal Fboxes for the dialogue. These Fboxes allow to display, modify or override the value of binary or numeric PCD variables.

Outputs — Values which are edited on the terminal

Parameters

Text object	The value 0 declares the use of the standard text. A value >0 indicates the number of the user text.
Text element	The value 0 declares the use of the standard text. A value >0 indicates the number of the user text.
Output 0..19 / Low / High	Display of the state of the element and switch button.
Output 0..19	Display of the element value and possibility to modify.

Description

The Edit Fboxes, allow to introduced numeric references or to switch binary signals on the terminal. This parameters are not depending on any process variables. However, they can be modified from FUPLA, in the adjust window of the corresponding Fbox. With the use of the absolute addressing, the values can also be put in relation with a supervisor system.

Each programmed Fbox represents a dialogue object in the objects menu.

These Fboxes are strechable and can contain 1 to 8 or 1 to 20 variables depending on the version. During programming, by streching the Fbox, the number of connections and the number of elements in the corresponding object on the terminal are defined. If the number of elements is not higher than 8, the use of the Fbox 1-8 is recommended. The internal registers will be saved.

Text object

The standard value 0 defines the use of standard text in the file HEADL0_S.TXT. A value > 0 define the user text.

Texts elements

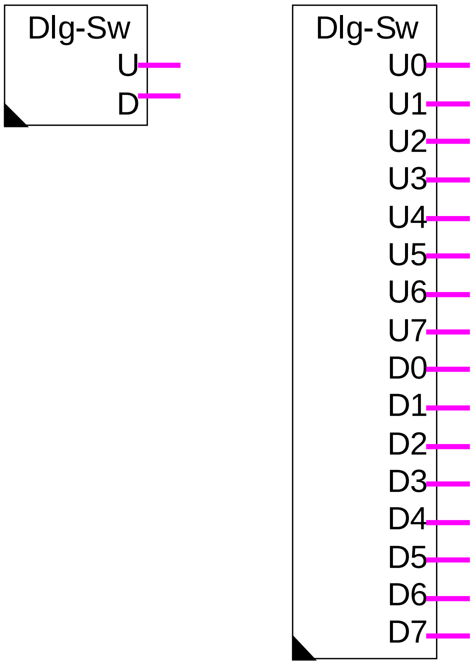
The standard value 0 defines the use of standard text in the file. A value > 0 defines the first element user text. The reference number to the min/max limits concerns the corresponding format of concerned Fbox (format xxx.y or xxxxx).

10.36 Switch Up/Down

Family: **HVC-Dialogue**

Fupla name: Switch Up/Down

Macro name: [_Dl0EdiD]



Fbox:

Short description

Universal dialogue Fbox for switching of two binary signals. It is foreseen for the manual control of an electromechanical valve (open/close) or any other similar device.

Parameters

Text object	Number of the text object. The value 0 corresponds to the standard text.
Text elements	Basic number for the texts of the object elements. The value 0 corresponds to standard texts

Description

Each programmed Fbox represents a dialogue object which will appear in the object menu.

This Fbox is stretchable and may contain 1 to 8 Up outputs and simultaneously 1 to 8 Dn outputs. During programming, by 'pulling down' the Fbox the number of variables to connect can be selected and at the same time the number of object elements on the terminal.

This function allows to switch two binary outputs from the terminal through the arrow keys ‘Up’ and ‘Down’. These signals do not depend on any other process variable. If a key ‘Up’ or ‘Down’ is pressed when a signal is already switched on, the signal is switched off. If another key is pressed, 2 ouputs are switched off and the edition mode is ended.

It is also possible to define a pulse function of fixed time. For this, the ‘Max’ code of the corresponding line of the the text file must contain a value from 1 to 9. This value indicates the pulse time in seconds. A pulse is also interrupted if any key is pressed.

The pulse value ‘0’ defines a functioning without pulse as described above.

The text displayed on screen for the 3 possible states can be selected among 4 options. The second character of the text file must contain a value from 0 to 3.

	0-0	Up=1	Dn=1
0 =	OFF	OPEN	CLOS
1 =	OFF	UP	DOWN
2 =	OFF	VOR	BACK
3 =	OFF	PLUS	MINU

(Only 4 characters can be displayed)

Example 1:

```
" 000Manual valve        " ;;10
```

Display of the states OFF / OPEN / CLOS. The switching is only manual (Pulse time=0).

Example 2:

```
" 305Flow adjustment     " ;;11
```

Display of the states OFF / PLUS / MINU. The adjustment is done through 5 seconds pulse (Pulse time=5).

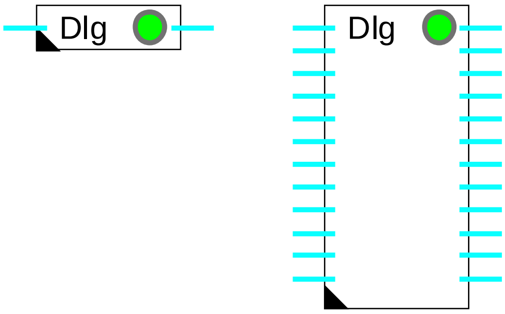
See also: Fbox Edit
Fbox Display
Fbox Manual

10.37 Fbox Manual Override

Family: **HVC-Dialogue**

Name: Manual

Macro name: [_Dl0Man..]



Fbox

Short description

Universal Fboxes for the dialogue. These Fboxes allow to override the value of binary or numeric PCD variables.

Inputs	Values for the automatic state.
Outputs	Values from automatic state or value overridden on the terminal.

Parameters

Text object	The value 0 declares the use of the standard text. A value >0 indicates the number of the user text.
Text element	The value 0 declares the use of the standard text. A value >0 indicates the number of the user text.
Set automatic mode	Button to reset all elements in automatic mode.

Description

The manual Fboxes, allow to visualize and to override the value of PCD variables. A overriden variable can later be set back to automatic. It takes immediately the value at the Fbox input. The override state of a variable is shown in FUPLA by a red LED. In FUPLA it is possible to reset all values to automatic by using the 'Automatic' button in the adjust window.

Each programmed Fbox represents a dialogue object in the objects menu.

These Fboxes are strechable and can contain 1 to 8 or 1 to 20 variables depending on the version. During programming, by streching the Fbox, the number of connections and the number of elements in the corresponding object on the terminal are defined. If the number of elements is not higher than 8, the use of the Fbox 1-8 is recommended. The internal registers will be saved.

Text object

The standard value 0 defines the use of standard text in the file HEADL0_S.TXT. A value > 0 define the user text.

Texts elements

The standard value 0 defines the use of standard text in the file. A value > 0 defines the first element user text. The reference number to the min/max limits concerns the corresponding format of concerned Fbox (format xxx.y or xxxxx).

10.38 Generalities about Alarms with Dialogue

The alarm concept has the following 3 Fboxes:

- Alarm Buffer
- Alarms 1-10
- Alarms 1-10 inhibit

The old versions of Alarm Fboxes are still supported. However they are not described in this document. Please refer to the former manual if necessary.

The task of the binary alarm Fboxes is to detect alarm state given by the binary signals and to transmit alarm messages to the buffer. In the buffer, the alarms can be viewed on the terminal by selecting the object 'Alarm buffer', The alarms can be acknowledged or removed from the buffer if a code for write access has been entered.

Alarms can be loaded until the buffer is full. According to the selected option, new alarms are lost or will shift old alarms out of the buffer. As to prevent buffer overflow, the option with automatic clearing (On+Off) should be used. Other alarms must be removed manually from the buffer on the terminal.

Alarm option

The alarm option must be selected in the adjust window of the Fbox SASI-Dialogue. If this option is not set correctly, the access to the buffer on the terminal is denied.

Option 'Auto' and 'Auto n. code'

With this option, the buffer is automatically displayed when a new alarm is introduced in the buffer. If the dialogue is currently in progress, it will be suspended. The operator, can then acknowledge the alarm. He may exit the alarm buffer and continue the dialogue where it was suspended.

If the alarm option is 'Auto n. code', it is possible to acknowledge alarms without the need to introduce a code for write access.

See also: Use of the Terminal

Function Levels

Alarms with network

See: Dialogue via SBUS network.

Note: The automatic display of alarms is only applied to the alarms of the Master station.

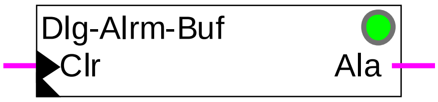
10.39 Alarm Buffer

Family: **HVC-Dialogue**

Name: Alarm-Buffer

Macro name: [_Dl0Albuf3]

Fbox



Sort description

Buffer for alarm handling. The Fbox present sautomatically a dialogue object in the menu structure.

See also: Generalities about Alarms with Dialogue

Use of the Terminal

Binary Alarms

Input

Clr	Clear	Signal to clear and re-initialize the alarm buffer.

Output

Ala	Alarm	General alarm signal indicating the presence of at least one alarm in the buffer.

LED

The LED has the same state as the Ala output: 0=green, 1=red.

Parameters

Option buffer mark	Option for mark of begin and end of the buffer
- Begin+End	Begin and End mark are inserted in the buffer
- End	Only the Begin mark is insert in the buffer
Option buffer full	Option for alarm handling in case of buffer full
- Ignore	New alarms are ignored.
- Shift	New alarms will shift the buffer content. Older alarms are lost.
Buffer length	Maximal length of the buffer in number of lines. An alarm may have up to 6 lines. The maximal ajustable length is 100 lines.
Text object	The value 0 declare the use of the standard text. A value >0 indicates the number of the user text.

Delete buffer	Reset button to clear and initialize the alarm buffer.
Buffer error	Display of errors occured in the buffer structure or in the internal functioning of the buffer. See below.

Important !

This Fbox can only be used once in the whole program.

When used, the alarm option in the SASI-Dialogue must be set correctly.

The alarm buffer must be initialized at least once after downloading of the program using the Heavac Reset signal. If this initialization is not executed or if RAM data (registers or text) are lost, the buffer may display an error code in the adjust window.

If an error code is displayed, the buffer can be initialized using the Reset button in the adjust window or by the Clr Input.

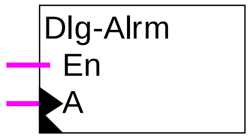
10.40 Binary Alarms

Family: **HVC-Dialogue**

Name: Alarm 1-10 / Alarm 1-10 inhibit

Macro name: [_Dl0Alb2] and [_Dl0Albe2]

Fbox



Short description

Reception of binary alarm signals. The alarm messages are send to the alarm buffer.

See also: Alarm with dialogue
Acknowledgement and clearing of alarms
Alarm buffer
Use of the terminal

Input

En	Enable	Enable / disable of the alarm. Only for the Fbox 'Alarm 1-10 inhibit'.
A0..A9	Alarm	Binary alarm signals.

Output None

Parameters

Text alarm	Number of the first alarm text. Line in the user file.
Handling	Option for the handling of the alarm switching
- On	Only switch-on is handled by the alarm function. The alarm text is send to the alarm buffer.
- On+Off	At switch-on, the alarm text is send to the buffer. At switch-off, the alarm text is removed from the buffer, ev. After acknowledgement.
Line of text per alarm	Number of text lines for each alarm signal.
Date and Time	Option to add an alarm line containing the date and time of the alarm event.

Status and counter — Option to add an alarm line containing the alarm status and an alarm counter. The working principle of alarm with status is different. See following description.

Description

When the binary signal at the Fbox input is switched-on, the associated alarm text is sent to the alarm buffer. Depending on the selected options, the alarm can contain 1 to 4 text lines, one line with date and time and one status line.

Alarm WITHOUT status

This alarm are send to the buffer at each switch-on. They are automatically removed from the buffer if the option On+Off is selected. They can also be removed manually.

Alarm WITH status

When an alarm appears:

- the alarm is send to the alarm buffer if the alarm is first switched-on
- the date and the time are updated
- the alarm status is set to 'ALA'
- the acknowledged status is set to 'NAK'
- the counter is incremented, the value 0001 is displayed if the alarm is first switched-on

If the alarm desappears, the alarm status is reset to 'OK'.

When the alarm is acknowledged, the acknowledge status is reset to 'OK'.

An alarm is automatically removed from the buffer if its signal is switched-off, the alarm is acknowledged and if the option On+Off has been selected. An alarm can also be removed manually.

Attention !

The alarm Fbox do not represent an object in the objects menu. It must no be taken into account for the parameter 'Number of objets' in the Section Fbox.

10.41 Dialogue-Master

Family: **HVC-Dialogue**

Name: Dialogue-Master

Macro name: [_Dl0Mst]

Fbox:

Short description

This Fbox allows a SBUS Master station to access the dialogue objects in SBUS Slave stations.

See also: Dialogue over SBUS

Input None

Output

Bsy Busy Indication of the terminal occupation

Parameters

120 Registers, Slave	Basic address of a range of 120 registers. This registes are reserved for the dialogue via SBUS in all Slave stations. The same address must be entered in the field '120' of all Dialogue-Slave Fboxes in the Slave stations.
Channel	Serial channel used for the access from the SBUS. The selected channel must be assigned in SBUS-Master.
- Channel 0..3	Channel 0..3

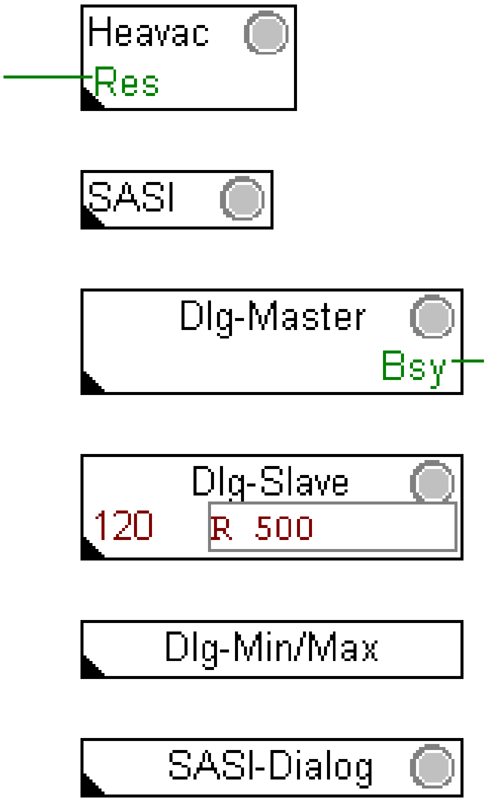
Description

This Fbox will insert SBUS request in the activity cycle of the SASI-SBUS function.

The Bsy output indicates that the terminal is in use. This signal can be used to unload the communication on the bus, as to get a better reaction of the dialogue via SBUS.

As to allow the access to the Master station, the Dialogue-Slave Fbox must also be programmed in the Master station. The 120 registers must also be reserved and programmed in the Fbox field. However, the dialogue do not work via the bus, but through a internal communication between the Fboxes Dialogue-Master and Dialogue-Slave. As to activate this mechanism, the option for the serial channel of the Dialogue-Slave must be adjusted to 'Own Stn' for the Master station.

The order in which the Fboxes are programmed in the Master station must be as follows:



10.42 Dialogue-Slave

Family: **HVC-Dialogue**

Name: Dialogue-Slave

Macro name: [_Dl0Slv]

Fbox:

Short description

This Fbox allows a SBUS Master station to access the dialogue objects in a SBUS Slave station.

See also: Dialogue over SBUS

Input / Output None

Parameters

Channel	Serial channel used for the access from the SBUS. The selected channel must be assigned in SBUS-Slave.
- Channel 0..3	Channel 0..3
- SBUS PGU	The Master access through a channel configured as SBUS PGU.
- Own Stn	Own station. Option for the Master station.

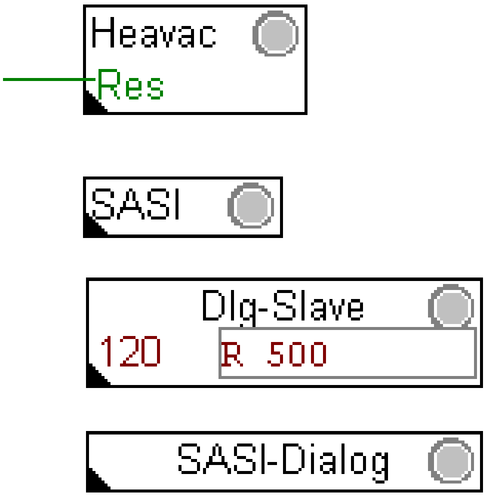
Description

In the Fbox field '120', the base address of a range of 120 registers must be entered.

Caution !

This register range must be the same in all Slave stations and in the Master station.

The order in which the Fboxes are programmed in the Slave station must be as follows:



As to allow the access to the Master station, the Dialogue-Slave Fbox must also be programmed in the Master station. The 120 registers must also be reserved and programmed in the Fbox field. However, the dialogue do not work via the bus, but through a internal communication between the Fboxes Dialogue-Master and Dialogue-Slave. As to activate this mechanism, the option for the serial channel must be adjusted to 'Own Stn' for the Master station.

10.43 Section

Family: **HVC-Dialogue**

Name: Section

Macro name: [_Dl0Sct]

Fbox: Dlg-Section

Short description

This Fbox introduces automatically a position in the section menu.

See also: Building of the Dialogue Structure

Sections Menu

Input / Output None

Parameters

Option	Option for the section type
- Standard	Standard section
- Objet	The section contains only one object. The object is directly accessed without object menu.
- Mark	Mark in the section menu. This section contains no object.
Number of objects	Number of objects programmed after this Fbox which will be part of this section.
Text section	Section texts are always from the user text file.

10.44 Setup

Family: **HVC-Dialogue**

Name: Setup

Macro name: [_Dl0Setup]

Fbox: Dlg-Setup

Short description

Setting of the terminal contrast. Only for termianl supporting this feature.

Input / Output None

Parameters

Text object	The value 0 declares the use of the standard text. A value >0 indicates the number of the user text.
Text element	The value 0 declares the use of the standard text. A value >0 indicates the number of the user text.
Contrast settings	Adjust button. Each times the Enter button is depressed, the contrast is increased. After the maximum value, the contrast is reset to the lower value.

Remark

The contrast can possibly also be modified using the terminal setup. However, this Fbox should be used for terminals where settings are not saved and in all case where the terminal setup is locked.

The contrast has a random value until a Reset is executed from the HVC-Init.

10.45 Mark

Family: **HVC-Dialogue**

Name: Mark

Macro name: [_Dl0Mark]

Fbox 

Short description

Introduction of a mark line in the object menu.

Input / Output None

Parameters

Text object The value 0 declares the use of the standard text. A value >0 indicates the number of the user text.

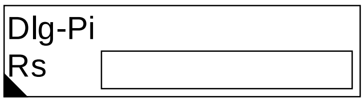
See also: Building of the Dialogue Structure

Marks .

10.46 Family HVC-Dialogue-HVC

Family:	HVC-Dialogue-HVC
Name:	See below
Macro name:	[_Dl0...]

Fbox (example)



Short description

This general description is valid for all Fboxes HVC-Dialogue-HVC. Individual descriptions and the effective accessible parameters from terminal are in the corresponding HVC-Fboxes. You will find also description of particularities and possible deviations from this general description.

Parameters

Option Dialogue	See the description of the corresponding HVC Fbox.
Text object	The value 0 declares the use of the standard text. A value >0 indicates the number of the user text.
Text elements	The value 0 declares the use of the standard text. A value >0 indicates the number of the user text.

Functional description

These Dialogue Fboxes are auxiliary Fboxes to HVC-Fboxes. As to make their use easier, each Dialogue auxiliary Fbox has the same name as the HVC-Fbox. The face is also the same, preceeded by 'Dlg'.

Each programmed Fbox represents a dialogue object which appears in the objects menu on the terminal.

The Fbox must be in relation with its corresponding HVC-Fbox as follows:

- Activate the absolute adressing. The use of the absolute addressing is described in the Fupla manual and in the help file.
- Define the internal variables of the HVC-Fbox (defined by user). The definition of a symbol and comment is sufficient.
- Introduce the same symbol Rs-field of the auxiliary dialogue Fbox.

Caution !
In case, the HVC-Fbox is deleted, the Rs-field must be cleared, and the symbol must be removed from the resource list. A new symbol can be re-entered after it is defined again in the new HVC-Fbox.

See also: HVC-Dialogue-Family

HVC-Dialogue, Overview

11. HVC-Initialization

Contents

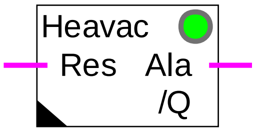
11.1 Initialization HVC 1

Family: **HVC-Initialization**

Name: **Initialization HVC 1**

Macro name: _HeaIni

Fbox:



Version info

It is advised to exchange this Fbox for the newest available version.

Short description

Initialization of the subfunctions for the Heavac library. Version 1 of the function HVC-Init.

See also Initialization-Generalities

Subfunctions:

HVC-Init, Subfunction Reset

HVC-Init, Subfunction Clock

HVC-Init, Subfunction Sommer-Winter Change 1

HVC-Init, Subfunction CPU Performance

HVC-Init, Subfunction Alarm

HVC-Init, Subfunction Special Test

Comments

The function 'Clock, Test' is not active in this function. See HVC-Init, Subfunction Clock for more details.

If this test is desired, the Fbox HVC-Init 3 or higher must be used.

For applications with multiple Fupla files, this Fbox must be placed in each file.

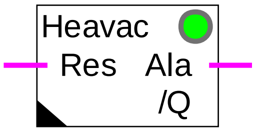
11.2 Initialization HVC 2

Family: **HVC-Initialization**

Name: **Initialization HVC 2**

Macro name: _HeaIni2

Fbox:



Version info

It is advised to exchange this Fbox for the newest available version.

Short description

Initialization of the subfunctions for the HVC library. Version 2 of the HVC-Init.

See also Initialization-Generalities

11.3 Initialization HVC 3

Family: **HVC-Initialization**

Name: **Initialization HVC 3**

Macro name: _HeaIni3

Fbox: 

Version info

It is advised to exchange this Fbox for the newest available version.

Short description

Initialization of the subfunctions for the HVC library. Version 3 of the HVC-Init.

See also Initialization-Generalities

Subfunctions:

HVC-Init, Subfunction Reset

HVC-Init, Subfunction Clock

HVC-Init, Subfunction Sommer-Winter Change

HVC-Init, Subfunction CPU Performance

HVC-Init, Subfunction Alarm

HVC-Init, Subfunction Validity Scope

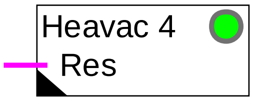
11.4 Initialization HVC 4

Family: **HVC-Initialization**

Name: **Initialization HVC 4**

Macro name: _HeaIni4

Fbox:



Version info

This Fbox replaces versions 1 to 3.

Short description

Initialization of the subfunctions for the HVC library. Version 4 of the HVC-Init.

See also Initialization-Generalities

Subfunctions:

HVC-Init, Subfunction Reset

HVC-Init, Subfunction Clock

HVC-Init, Subfunction Sommer-Winter Change

HVC-Init, Subfunction CPU Performance

HVC-Init, Subfunction Alarm

HVC-Init, Subfunction Validity Scope

11.5 Version HVC

Family: **HVC-Initialization**

Name: **Version HVC**

Macro name: _HeaVers

Fbox: Heavac ?

Short description

Indication of the ONLINE and OFFLINE version of the HVC library.

Inputs None

Outputs None

Description of the function

This FBox shows the OFFLINE version installed in the PC (Personal Computer), as well as the ONLINE version used in the SAIA®-PCD (User program).

The display of the ONLINE version is integrated from version 1.2.

Caution! If the display of the ONLINE version shows <141>, the PC version is newer than the PC version.

In any case, it is not advised to work with a PCD version older than the PCD version. Downward compatibility is not ensured.

11.6 Key Code

Family: **HVC-Initialization**

Fupla Name: Key Code

Macro Name: [_HeaKey]

Fbox: 

Short description

This Fbox allows to enter the Key Code of the Heavac package. Its use is mandatory for Key Code protected and 'Demo' Heavac packages.

Parameters

Key Type	Option to select the type of key for which the package is protected.
- None	For non protected packages.
- Demo	For demo packages
- *Country*	For packages protected according to the country
- Test	Only used during development and test.
Key Code	Numeric Key Code delivered by the distributor of the Heavac package.
	With the option 'None' and 'Demo', the Key Code is ignored.

Description

Demo package

This Fbox must be placed once in the main file of the Heavac project. The option 'Key Type' must be selected on'Demo'. The key code is ignored. If the selection 'Key type' is different, the LED is red and the Heavac package is locked.

The 'Demo' package allows to use maximum 5 controller functions in the whole application.

Beyond this limit the LED of the box turns to red. Some important functions of the Heavac library are locked. This is shown by the LED of the HVC-Init which also turns to red.

If the Fbox 'Key Code' is not programmed, the Heavac functions are also locked and the LED of the HVC-Init is red.

Package protected by key code

This Fbox must be placed once in the main file of the Heavac project. The Key Code, delivered by the distributor, must be entered in the Fbox. The corresponding country must also be correctly selected. Each country distributing protected packages, has its own Key Code.

If the option 'Key Type' or the Key Code is wrong, the LED is red. Some important functions of the Heavac library are locked. This is shown by the LED of the HVC-Init which also turns to red.

If the Fbox 'Key Code' is not programmed, the Heavac functions are also locked and the LED of the HVC-Init is red.

Non protected package

This Fbox must not necessarily be programmed. Programs from former versions work without modifications.

If a program, using the Key Code Fbox is assembled by a non protected package, the country selection must be set to 'None'. The LED will be green and the Key Code is ignored.

If the option 'Key type' is different than 'None', the LED turns to red but the Heavac functions are not locked.

11.7 Initialization-Generalities

Introduction

The use of the Heavac library in a Fupla application requires the initialization of various mechanisms which are used in Heavac-Fboxes. This initialization is done in placing one of the available Initialization Fbox at beginning of the Fupla file.

- Initialization HVC 1 Version 1
- Initialization HVC 2 Version 2. No more available. Replaced by Version 3.
- Initialization HVC 3 Version 3
- Initialization HVC 4 Version 4. For Fupla Version 1.35 or higher.

This functions are also called 'HVC-Init' in this document.

This general description is valid for all Fboxes 'HVC-Init'. Individual descriptions contain only particularities or differences compared to this general description.

Short description

The HVC-Init functions include the following subfunctions:

- Reset Input signal Res and function Reset
- Clock Test and display of the clock
- Time change Winter-Summer Automatic clock time change Summer-Winter
- CPU Performance Sampling and performance control of the CPU
- Alarm Detection and general acknowledgement of the alarm
- Validity scope Use of subfunctions in one or several Fupla files

Important comment!

For a small application or a quick trial, the initialization can be simply done in placing one HVC-Init function at beginning of the program. The adjustment of the parameters is not necessary. The default values are probably acceptable. However, the subfunction **Reset** is very important. The version 4 of the HVC-Init Fbox is very useful. It is able to execute automatically a reset when needed.

Particularities of version 1

- Do not operate any clock test
- Dates for time change are introduced manually

Particularities of version 3 compared to version 1

- Time change is done automatically the last Sunday in March and October
- Validity scopes
- Possibility of sending the clock data on the S-Bus network

Particularities of version 4 compared to version 3

- Automatic Reset Function
- Possibility of deactivating the clock test (from 1.4 Beta-E)

11.8 HVC-Init, Subfunction Reset

The subfunction Reset is very important in the Heavac library concept. This mechanism must be studied before realizing Heavac application programs.

A Reset command is essential after any program modification, as well as after any memory or CPU replacement. A Reset can also be necessary when the data of the RAM memory have been lost.

The Reset function reloads the internal registers of the Heavac Fboxes with the parameters defined during programming. These parameters are the default parameters of the application. They are loaded in the PCD with the program during the 'Download'.

For example: P Factors and integration time of the PI controllers

Switching time of clocks

Set-points of a Heating (Curve) Gradient

It also sets all manual functions to the automatic mode.

However, the Reset input must remain at 0 if the parameters are modified online with Fupla, through a terminal or a supervisor. It avoids that adjusted parameters are replaced by default parameters of the application at every power off and power on.

The Reset function can be executed in 3 different ways:

- Automatic Reset after program loading From option HVC-Init 4
- Input 'Res'
- Manual Reset in the adjust window From option HVC-Init 3

Fonctioning of the Reset input

The state of the Reset input is considered only at system start. This input must be connected to a button with Reset pulse.

For executing a Reset:

- power off CPU
- activate and hold the Reset button (Input Res=1)
- power on PCD
- release the Reset button (Input Res = 0)

Fonctioning of the manual Reset command in HVC-Init 3

For avoiding any wrong manipulation, the manual Reset function is protected by a security.

For executing a manual Reset in Run:

- set Fupla online
- open the HVC-Init 3 function
- select 'Pre-Reset'
- transfer with the button >
- select 'Reset'
- transfer with the button >
- select 'Executed'

Fonctioning of the manual Reset command in HVC-Init 4

For avoiding any wrong manipulation, the manual Reset function must be pressed twice within 5 seconds.

Automatic Reset in HVC-Init 4

With the automatic Reset function, a Reset is automatically executed after each program loading. This function can be activated or desactivated through an option in the adjust window.

See also HVC-Init, Subfunction Validity scope

Caution !

The automatic Reset is foreseen for applications loaded in RAM memory. It is not necessary and does not work if the program is loaded in EPROM. In this case, the automatic Reset must be deactivated through the option in the adjust window. The Reset must be then at least once executed manually.

11.9 HVC-Init, Subfunction Clock

At system start-up, a test procedure checks if the CPU hardware clock is working correctly. The test result is displayed in the adjust window. If an error occurs, any Heavac functions which use the clock will indicate this error with the red LED.

The clock is then read continuously and displayed in the adjust window. The various internal registers of the clock are refreshed. They are used by all clock functions.

The date/time format used has been taken from the Windows settings.

Comment

Some old PCD firmware give a wrong result when testing the clock. In this case, the test of the clock displays an error even if the clock is correctly installed and works properly. All Fboxes using the clock data display also an error, but work correctly.

The problem can be corrected either in using the HVC-Init 1 Fbox, which does not test the clock or in replacing the PCD firmware.

The clock may be set and checked by the PCD configurator.

See also:

HVC-Init, Subfunction Validity scope

HVC-Init, Subfunction Time Change Summer-Winter

Clock, Write

Clock, Read

11.10 HVC-Init, Subfunction Sommer-Winter Change 1

Summertime and wintertime are automatically switched for two future dates set as parameters. The dates at which the time is to change have a default setting of 00/00, which disables automatic switching (day = 00, month = 00). To automate this function, one or both of the planned dates must be entered and the actual season correctly defined. The changeover takes place at 02:00 hours. After switching, both dates are reversed in the registers. When the second date has been used, the first one is once again presented. Both dates must therefore be adjusted once every year. The test button makes it possible to simulate a time change.

It performs the following:

- it shifts the hardware clock
- it changes the season
- it reverses the dates

After 2 tests the initial situation is restored.

The date format corresponds to the Windows settings. Moreover, the slash is always accepted as separator.

Comment

This function is only implemented in this form the function Initialization HVC 1.

11.11 HVC-Init, Subfunction Summer-Winter Change

The summertime or wintertime will always be supervised and displayed. If the automatic change is activated, the chageover will take place the last Sunday in March and October at 02:00 hours.

Comment

The version 1.3 Beta or lower of the Heavac library have September as date for the changeover Summer-Winter. The new date (October) can be introduced in assembling and loading a 1.3 Beta-B program or higher in the library.

The signal for the detection of the summertime or wintertime is available from the Fbox Clock, Read.

See also HVC-Init, Subfunction Clock.

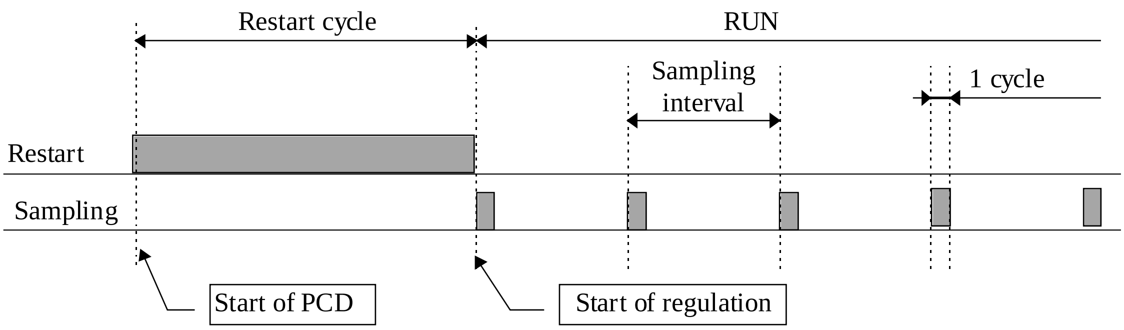
11.12 HVC-Init, Subfunction CPU Performance

A sampling signal is necessary for various functions, such as P, PI or PID regulators and filters. It is also used in all clock functions.

A standard signal with a 1 second interval is generated. The adjust window provides a visual check of sampling operation. This signal is reversed every second (+++++/-----).

At CPU start-up, initial sampling is activated after a restart cycle. This delay is adjustable. During this cycle, the regulators are initialised in a fix, preset state. Among other, this makes possible to wait until all the analogue channels have been converted at least once (maximum time: PCD6.W3 - approx. 1.2 sec). This time can be extended up to 10.0 sec, to take possible external events into account.

Diagram



Any overrun of sampling time is monitored and indicated by the LED, which becomes red. This signal shows that a program cycle has exceeded the sampling interval.

Such a case can arise when the program is deliberately stopped by the user. The LED can then be acknowledged with the acknowledge button.

<u>Reset after sampling with HVC-Init, Version 1</u>

The version 1 of the HVC-Init allows to monitor the remaining CPU capacity available after this cycle and before the next sampling signal. This value has a resolution of only 10% and is rounded upward. Great caution is necessary when this value falls below 100% (90%, 80%...).

According to experience with version 1, during the first cycle the load is never critical. This display has been removed for the following HVC-Init function.

11.13 HVC-Init, Subfunction Alarm

The HVC-Init Fbox monitors a general alarm function. This function has 3 binary signals, 2 inputs and 1 output.

Ala	Alarm	General alarm indication. At least one alarm signal is still present in the Fupla file.
/Q	Not acknowl.	General indication of not acknowledged alarm. At least one alarm is not yet been acknowledged in the whole Fupla file.
Qit	Acknowledge	General acknowledge of all alarms.

HVC-Init 1

In version 1, the outputs Ala and /Q are available as outputs for the HVC-Init Fbox. A general acknowledge is not possible.

HVC-Init 3 and 4

The general alarm signals are available when programming the Fbox Alarm General.

Siehe Alarm General for more details about these signals.

11.14 HVC-Init, Subfunction Validity Scope

The options available in this section allow to declare the validity scope of the subfunctions.

Options:

Remote	For clock data only. The clock data are transmitted from a S-Bus Master
Local	The code and the resources are local to the file.
Public	The code is created in the file and the resources are published for other files.
Extern	The code is not created in the file. It uses the resources published by another file.
None	For clock data only. Allows to deactivate the test and all clock functions.

The combination Public-Extern allows, in the applications with multiple files, to generate subfunctions once in a main file and then use them in all other files.

The notion Local-Public-Extern regards the required code for a subfunction as well as the necessary resources. In an application containing multiple files, it is therefore possible to spare code and resources by using the options Public and Extern.

For applications in one single file the option 'Local' is used (default).

For applications in multiple files, the option 'Public' is selected in a file (main file). The option 'Extern' is then selected in all other files.

For separating a subfunction between several files, the option 'Local' is selected for the files having their own subfunction. This is useful for the subfunctions Reset and General Alarm.

For transmitting the clock data through the S-Bus network

In the Slave stations:

- Select the option 'Remote' for the clock validity scope.
- The option 'Remote' includes also the option 'Public'. 'Remote' and Extern' must therefore be used like 'Public' and 'Extern'.
- Program the Fbox Clock Receive (From version $138 of library).
- Connect the 3 inputs to 3 successive registers.

In the Master station:

- The clock data decoded by the HVC-Init function must be read by the Fbox Clock, Read
- Transmit the 3 numeric outputs HMS, YMD and D in broadcast on the 3 registers defined above.
- If necessary, transmit also the binary outputs SW and Err.

Comment:

- The changeover Summer-Winter is always desactivated with the option 'Remote'. This function is handled by the Master station.
- The display of the season blinks Summer<->Winter.
- An error of the clock indicates that the data are not received by the S-Bus. The waiting time is 8 seconds (4 seconds for library versions older than $135).

Comments: Option Extern for Reset

The Manual Reset function may not be used in this file. It displays always 'Extern'.

Comment: Option 'None' for clock

Available from version 1.4 Beta-E. This option allows to deactivate the clock test. It has been introduced for some FW (Ex. PCD2, V004). The CPU LED is showing an error during the clock test if the clock is not present. The test result will always be Error. If clock Fboxes are programmed, they will always be in error state.

11.15 HVC-Init, Subfunction Special Test

The options Special Test are only available with Fbox Init CVC 1.

Quick simulation	Performs an acceleration of the sampling. This parameter is strictly reserved for tests during development. It must be set to 0 for all applications.
Assembling report	Option Heavac Fbox report used for the assembling
- Masked	The assembly report is deactivated
- Activated	The assembly report is activated

The assembly report is useful in case of assembling error. The indication which preceeds the error message allows to identify the faulty Fbox.

In further HVC-Init options, the assembly report is always executed.