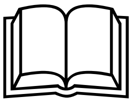
JUMO
mTRON

Controller Module

70.4010
System Manual Part 3

1.1 Preface



The System Manual is addressed to equipment manufacturers and users with appropriate technical know-how. It describes the range of functions of the JUMO mTRON automation system with its modules, and provides all the information which is required for project design and start-up.

This Part 3 of the System Manual “JUMO mTRON controller module” contains all the module-specific information.

Part 1 of the System Manual “General section” summarises the information which applies to all modules.

Part 2 of the System Manual “JUMO mTRON-iTOOL project design software” describes project design for the JUMO mTRON automation system.

1.2 Type designation

The type designation includes all the factory-configured settings for the analogue inputs (1), the outputs (2) and the supply (3). The supply voltage which is connected must correspond to the voltage specified on the label. The label is affixed to the housing.

(1) (2) (3)

704010/0- ... - ... - ..

(1) Analogue inputs

Standard version 888

Measurement input	Inputs	
	1	2
Pt 100 resistance thermometer	X	X
Thermocouples Fe-Con L Fe-Con J NiCr-Ni K Cu-Con U Cu-Con T NiCrSi-NiSi N Pt10Rh-Pt S Pt13Rh-Pt R Pt30Rh-Pt6Rh B		
Standard signals 0 — 50 mV 10 — 50 mV –50 to +50 mV 0 — 1 V 0.2 — 1 V –1 to +1 V 0 — 10 V 2 — 10 V –10 to +10 V 0 — 20 mA 4 — 20 mA		
AC current 0 — 50mA		
Resistance 0 — 400Ω		
Potentiometer 0.1 —10kΩ		

Special version 999

Factory-configured to customer specification.

X = factory setting, freely programmable

(2) Outputs . . .

Outputs	Code
2 relays 250V 3A (changeover) and 1 programmable analogue output[1]	302
2 logic outputs 12V 20mA and 1 programmable analogue output[1]	304
2 solid-state relay outputs 250V 1A and 1 programmable analogue output[1]	305

Special version 999

Factory-configured to customer specification.

(3) Supply voltage . .

Type	Code
110 — 240V AC +10/-15%, 48 — 63Hz	23
20 — 53V AC/DC 48 — 63Hz	22

Neuron-ID

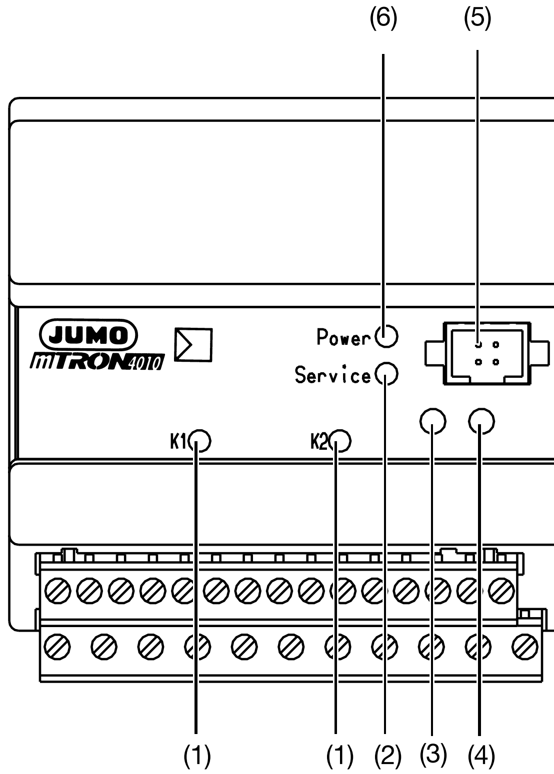
Each module carries a 12-digit number, so that it can be uniquely identified in the JUMO mTRON-iTOOL project design software.

This number can be found next to the label.

1. analogue output:

0 —10V	X
2 —10V	
0 —20mA	
4 —20mA	

X = factory setting, freely programmable



LEDs

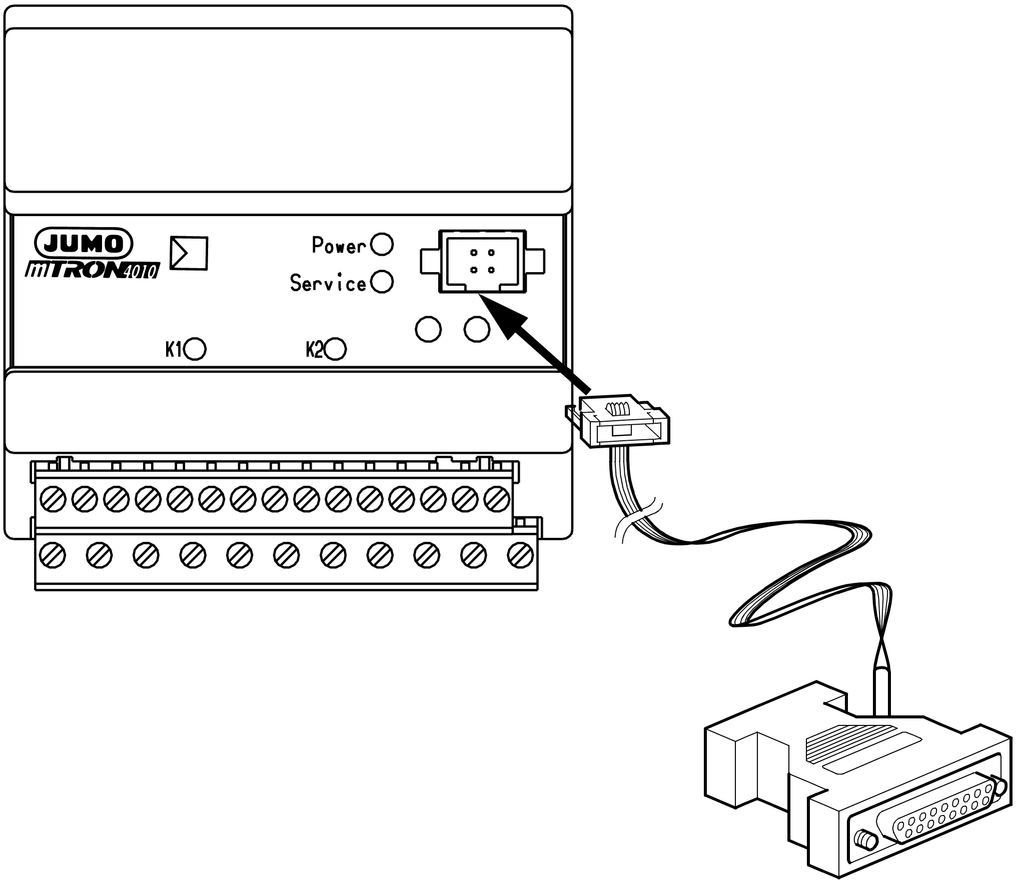
(1)	**Status LED, yellow** for the switching outputs K1 and K2; lights up when a relay is energised, or logic / solid-state relay output is activated. There is no LED for the analogue output.
(2)	**Service LED, red** - lights up / blinks continuously at one second intervals on operating fault ✱ replace module - blinks at one second intervals for 10 sec if the network connection to the module from the JUMO mTRON-iTOOL project design software or the operating unit is being tested by a test signal (“wink”) - long blink pulses (3 sec on, 1 sec off) if a Plug & Play fault occurs
(6)	**Power LED, green** lights up when the supply is switched on.

Keys/switches

(3)	**Switches (termination resistance)** ⇨ System Manual Part 1 “General section”, Section 4.2 “Network connection”
(4)	**Installation key** the module reports to the JUMO mTRON-iTOOL project design software.

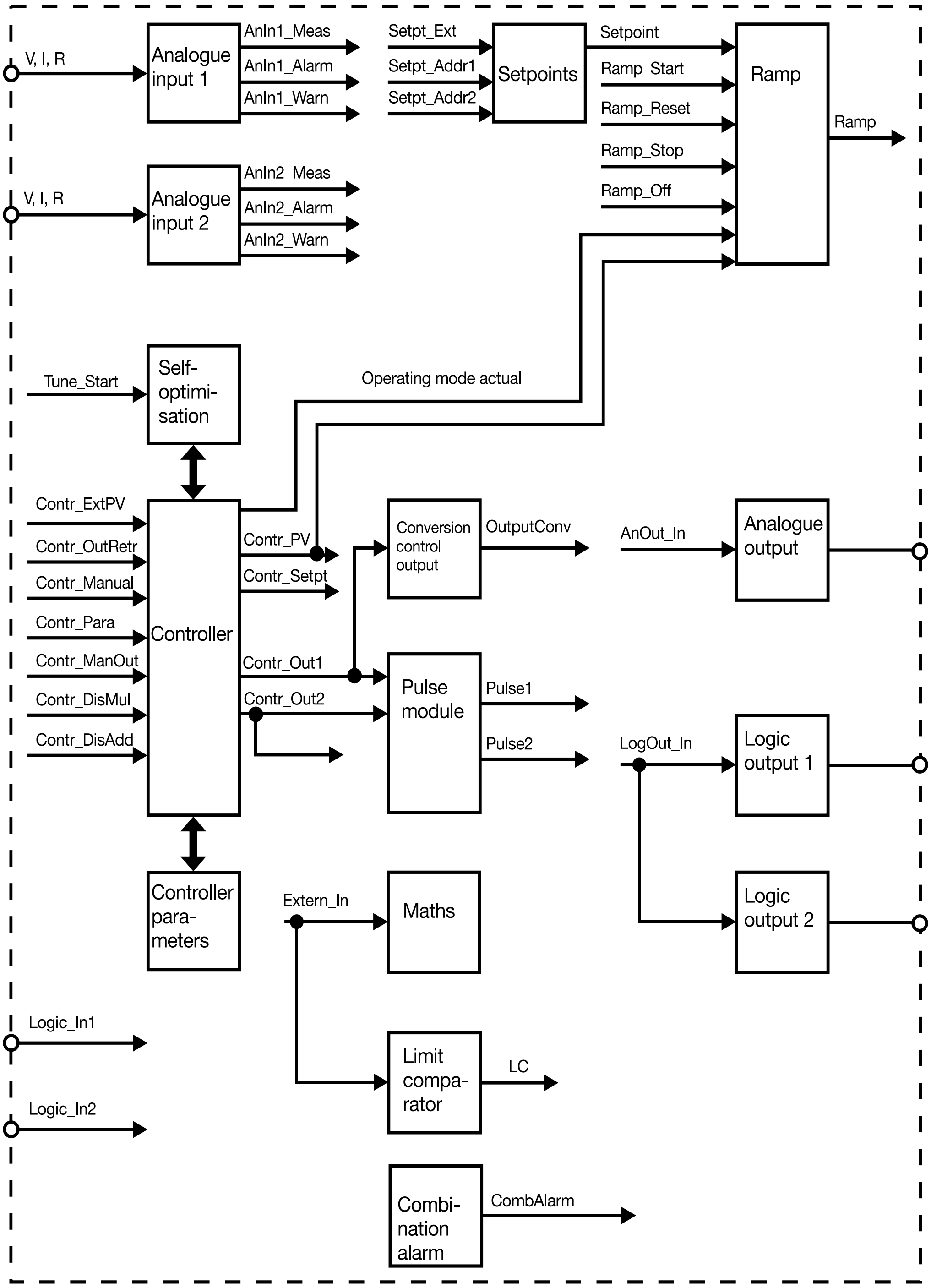
Interface

(5)	**Setup interface** for the setup interface line which links the module to the PC. This connector can be used to set the parameters not only for the relay module, but for **all the modules which are connected to the LON bus.**



☞ While the interface cable is connected, the module only fulfills the function of a PC-LON interface converter. All other module functions are switched off.

The functional overview shows the relationships between the individual functions, the assignment of the network variables, and the internal connections between the function blocks.

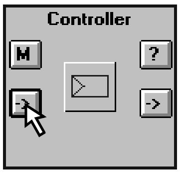


Explanation of symbols

Symbol	Meaning
Extern_In3	Network variable ⇨ Chapter 4 “Network variables”
	Hardware input
	Hardware output

4.1 Input network-variables

List of input network-variables



Input network-variables can be used to transfer values and operating signals from other modules to the controller module via the network.

Name	Type	Default	Explanation
AnOut_In	float value	OoR	Enables the output of a value via the analogue output of the controller module ⇨ Section 5.12 “Analogue output”
LogOut_In	logic	0	Enables the output of a signal via the logic outputs of the controller module. ⇨ Section 5.13 “Logic output”
Extern_In	float value	OoR	Input into the maths and limit comparator function ⇨ Section 5.9 “Mathematics” Section 5.10 “Limit comparator”
Ramp_Start	float value	OoR	External start value for the ramp function ⇨ Section 5.4 “Ramp”
Ramp_Off	logic	0	Sets the ramp function to the setpoint ⇨ Section 5.4 “Ramp”
Ramp_Reset	logic	0	Sets the ramp function back to the start value ⇨ Section 5.4 “Ramp”
Ramp_Stop	logic	0	Stops the ramp function ⇨ Section 5.4 “Ramp”
Contr_ExtPV	float value	OoR	Can be selected as the process value for the controller ⇨ Section 5.5 “Controller”
Contr_Manual	logic	0	Can be selected as the manual / auto changeover for the controller ⇨ Section 5.5 “Controller”
Contr_Para	logic	0	Switches between the first and second controller parameter set ⇨ Section 5.7 “Controller parameters”
Contr_ManOut	float value	0	Defines the output in manual operation ⇨ Section 5.5 “Controller”
Contr_OutRetr	float value	OoR	Output retransmission for modulating controller and actuator ⇨ Section 5.5 “Controller”
Contr_DisAdd	float value	0	Enables the application of an additive disturbance to the control output. ⇨ Section 5.5 “Controller”
Contr_DisMul	float value	100 %	Enables the application of a change in gain for the controller. ⇨ Section 5.5 “Controller”
Tune_Start	logic	0	Starts self-optimisation. ⇨ Section 5.6 “Self-optimisation”

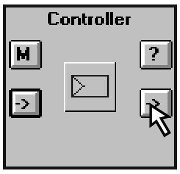
Default setting: Value of the input network-variables on errors of communication or in unlinked condition
OoR = **O**ut **o**f **R**ange (invalid value); produces a combination alarm.

Name	Type	Default	Explanation
Setpt_Addr1	logic	0	To select the programmable setpoints 1 — 4 ⇨ Section 5.3 “Setpoints”
Setpt_Addr2	logic	0	To select the programmable setpoints 1 — 4 ⇨ Section 5.3 “Setpoints”
Setpt_Ext	float value	OoR	Enables the definition of a setpoint via the network ⇨ Section 5.3 “Setpoints”

Default setting: Value of the input network-variables on errors of communication or in unlinked condition
OoR = **O**ut **o**f **R**ange (invalid value); produces a combination alarm.

4.2 Output network-variables

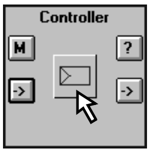
List of output network-variables



Output network-variables can be used to transmit values and operating signals from the controller module to other modules via the network.

Name	Type	Explanation
AnIn1_Alarm	logic	Outputs the alarm signal for range monitoring (analogue input 1)
AnIn1_Meas	float value	Outputs the measurement value for analogue input 1
AnIn1_Warn	logic	Outputs the warning alarm for range monitoring (analogue input 1)
AnIn2_Alarm	logic	Outputs the alarm signal for range monitoring (analogue input 2)
AnIn2_Meas	float value	Outputs the measurement value of analogue input 2
AnIn2_Warn	logic	Outputs the warning signal for range monitoring (analogue input 2)
OutputConv	float value	Outputs the setpoint for slave controller (cascade controller) or the control output 1
LC	logic	Outputs the output signal of the limit comparator
Contr_Setpt	float value	Outputs the setpoint of the controller
Contr_PV	float value	Outputs the process value of the controller
Contr_Out	float value	Outputs the controller output 2 (2-setpoint controller)
CombAlarm	logic	Outputs the combination alarm signal ⇨ Section 5.14 “Combination alarm”

Basic menu



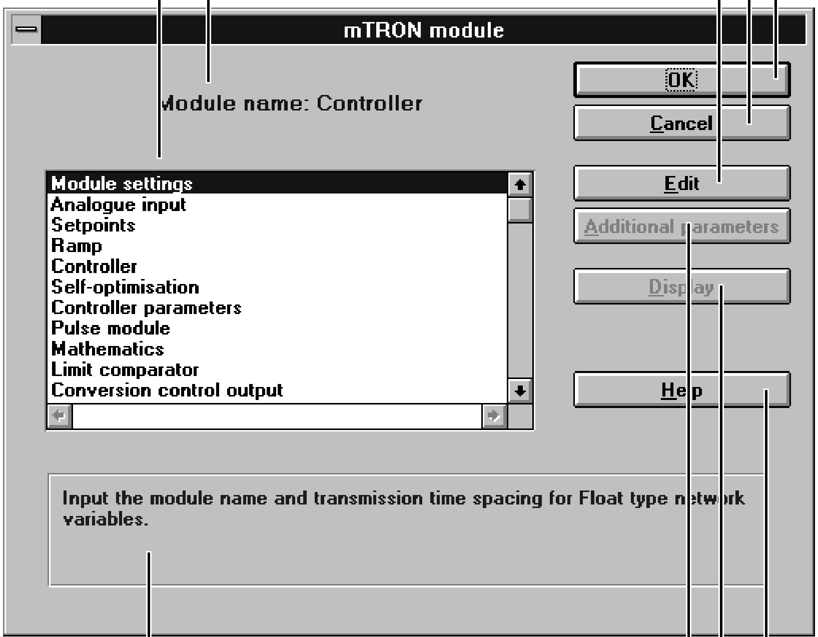
Module name
Name of the module

Setup dialogs
The functions of the module are assigned to so-called setup dialogs

OK
for entering and storing all inputs

Cancel
for aborting inputs. The data are not stored.

Edit
for editing parameters in the setup dialog which is marked



Additional parameters
Further settings can be made here when there are differences between the versions of module software and setup program

Display
Using this function, individual parameters can be removed from the operating unit (parameter level)

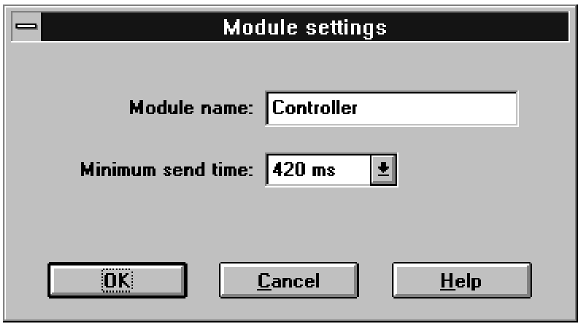
Info text
provides information on the setup dialog which is marked

Help
calls up help text for the basic menu

5.1 Module settings

A characteristic designation for the task of the module in the process is assigned here, and the time interval of the send repetition of network variables is determined.

Setup dialog



Parameters

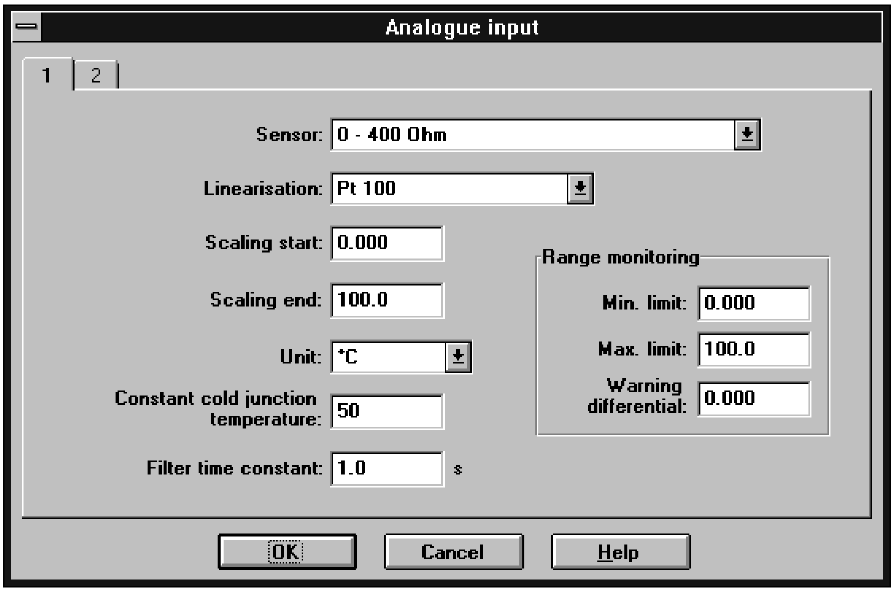
Parameter	Selection/settings	Explanation
Module name [ModName]	(Text) Controller	Name of the module (16 characters)
Min Send Time [MinSendTim]	n x 420ms max. time = 8.4s 420ms	Determines in which time intervals network variables of the “float value” type are sent via the network. The output network-variables of the “float value” type are sent without repetition at intervals of MinSendTime. The output network-variables of the “logic” type are instantly output with 2 repetitions at a status change (0 ⟶ 1, 1 ⟶ 0). If the status has not changed after 6 sec, there is, for security reasons, an automatic output to the signal destinations via the network.

= factory setting [ ] = short name in the operating unit

5.2 Analogue input

Two measurement inputs measure thermovoltages, resistances and standard signals which are listed in the table.

Setup dialog



Parameters

Parameter	Selection/settings	Explanation
Sensor [Sensor]	No sensor connected [NoSens]	Defines the transducer to be connected to the specific analogue input
	Thermocouple CJ temperature internal [CJInt]	
	Thermocouple CJ temperature constant [CJ const]	
	Potentiometer [Potent]	"0—400Ω" must be set for Pt100 transducer in 3-wire circuit!
	0—400 Ohm [0/400 Oh]	
	0—50 mV [0/50 mV]	
	0—10 V [0/10 V]	
	2—10 V [2/10 V]	
	0—20 mA [0/20 mA]	
	4—20 mA [4/20 mA]	
	0—1 V [0/1 V]	
	0.2—1 V [0.2/1 V]	
	10—50 mV [10/50 mV]	
	-1 to +1 V [-/+1 V]	
	-10 to +10 V [-/+10 V]	
	Heater current 0—50 mA AC [50 mA AC]	Heater current 0 — 50 mA AC with analogue input 2 only!
	-50 to +50 mV [-/+50 mV]	

▒ = factory setting [ ] = short name in the operating unit

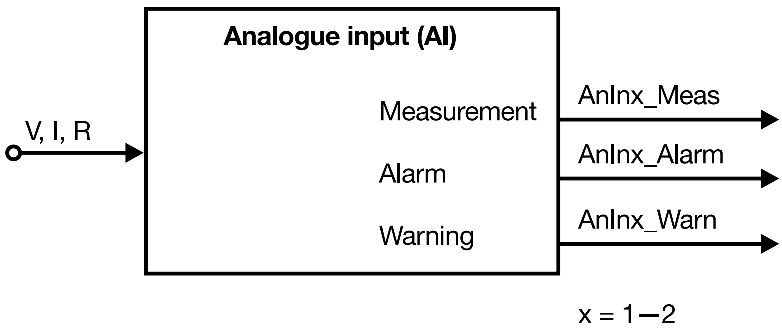
☞ If no sensor is connected, then the process value is set to 1.4 E38 and no alarm or warning alarm is generated.

Parameter	Selection/settings	Explanation
Linearisation [Linearisn]	Linear [Linear] Pt100 [Pt100] Type L Fe-Con [TypeL] Type K NiCr-Ni [TypeK] Type S Pt10Rh-Pt [TypeS] Type R Pt13Rh-Pt [TypeR] Type B Pt30Rh-Pt6Rh [TypeB] Type U Cu-Con [TypeU] Type T Cu-Con [TypeT] Type J Fe-Con [TypeJ] Type N NiCrSi-NiSi [TypeN]	Determines the linearisation function for the sensor
Scaling start [ScalStart]	-1999 to +9999 unit 0 unit	With standard signals, potentiometer and heater current: Defines the display value (measurement value) of the start value of the input signal range. With Pt 100 (sensor: 0 — 400Ω/ linearisation: Pt 100) and thermocouples: makes an offset correction.
Scaling end [ScalEnd]	-1999 to +9999 unit 100 unit	The value defines the display value (measurement value) for the end value of the standard signal or potentiometer range.
Unit [Unit]	(various) °C	Defines the physical unit of the measurement value
Constant cold junction temperature [CJTemp]	-5 to +100°C 50°C	Indicates the cold junction temperature of the thermocouple. It is only valid when "Thermocouple constant cold junction temperature" is selected under the parameter *Sensor.*
Filter time constant [FiltTime]	0.0 — 40.0 sec 1.0 sec	The time constant which is used to filter the measurement value with two digital PT1 filters.
Min. limit [MinLimit]	-1999 to +9999 unit 0 unit	If the measurement value falls below the preset value, an alarm is producced.
Max. limit [MaxLimit]	-1999 to +9999 unit 100 unit	If the measurement value goes above the preset value, an alarm is produced.
Warning differential [WarnDiff]	-1999 to +9999 unit 0 unit	The value of the process value produces a warning alarm if: process value > max.limit - warning limit and also if: process value < min. limit + warning limit.

▒ = factory setting [ ] = short name in the operating unit

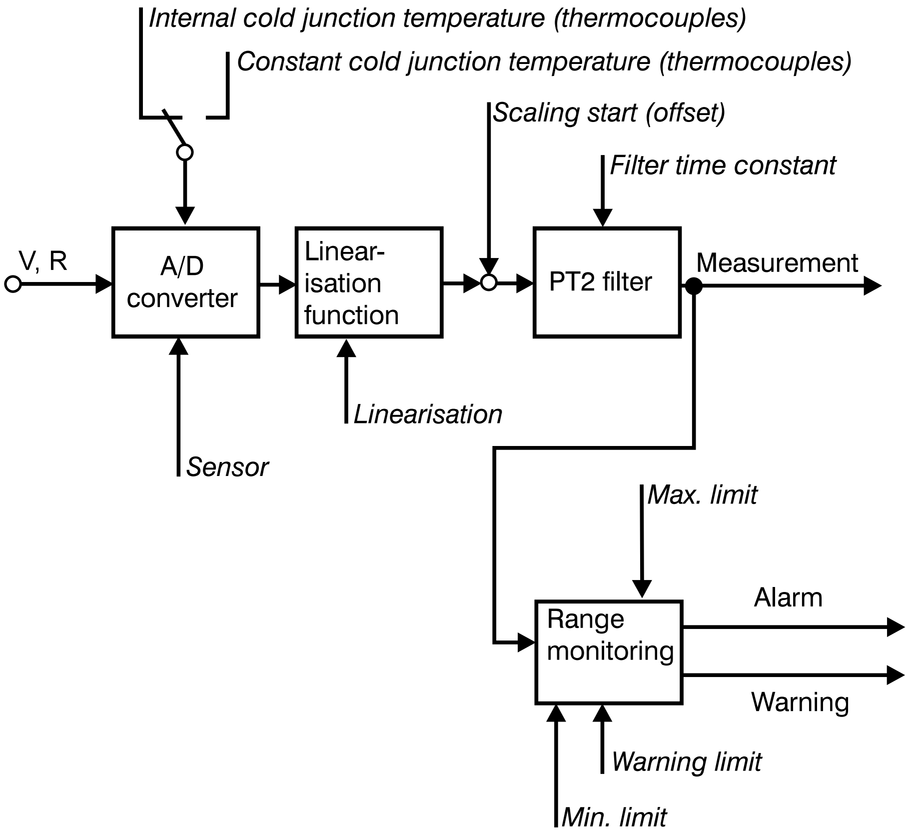
Function

The block structure shows the input and output signals of the function.



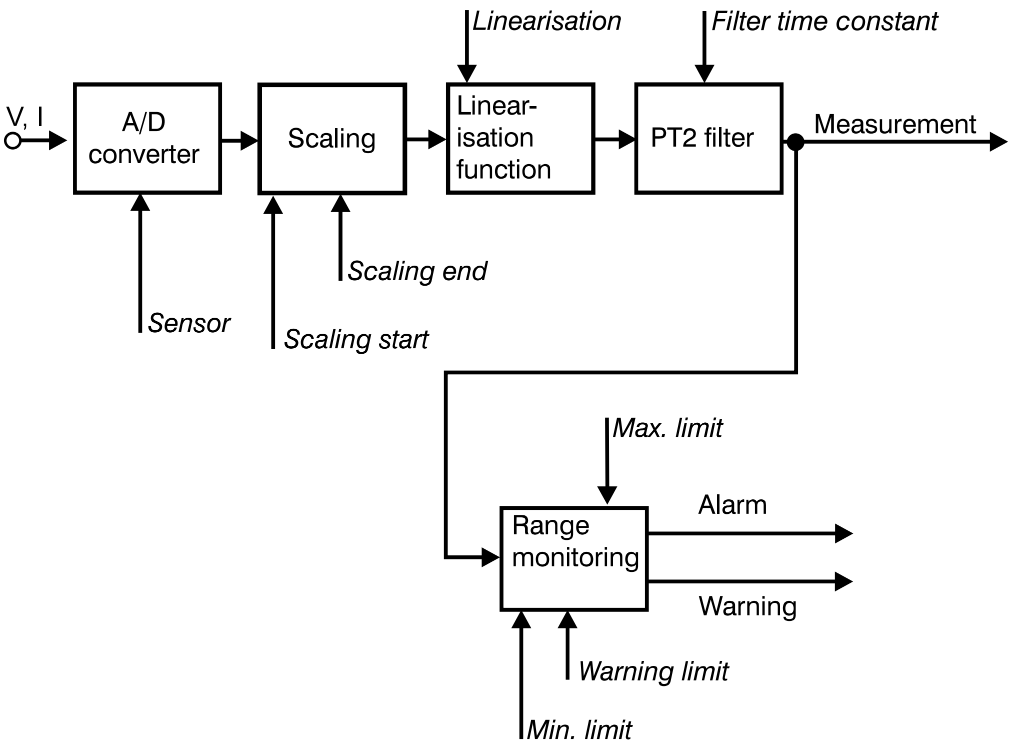
Block structure with thermo-couple and resistance

The block diagram shows the signal flow when connecting thermocouples and resistances / resistance thermometers of the Pt100 type.



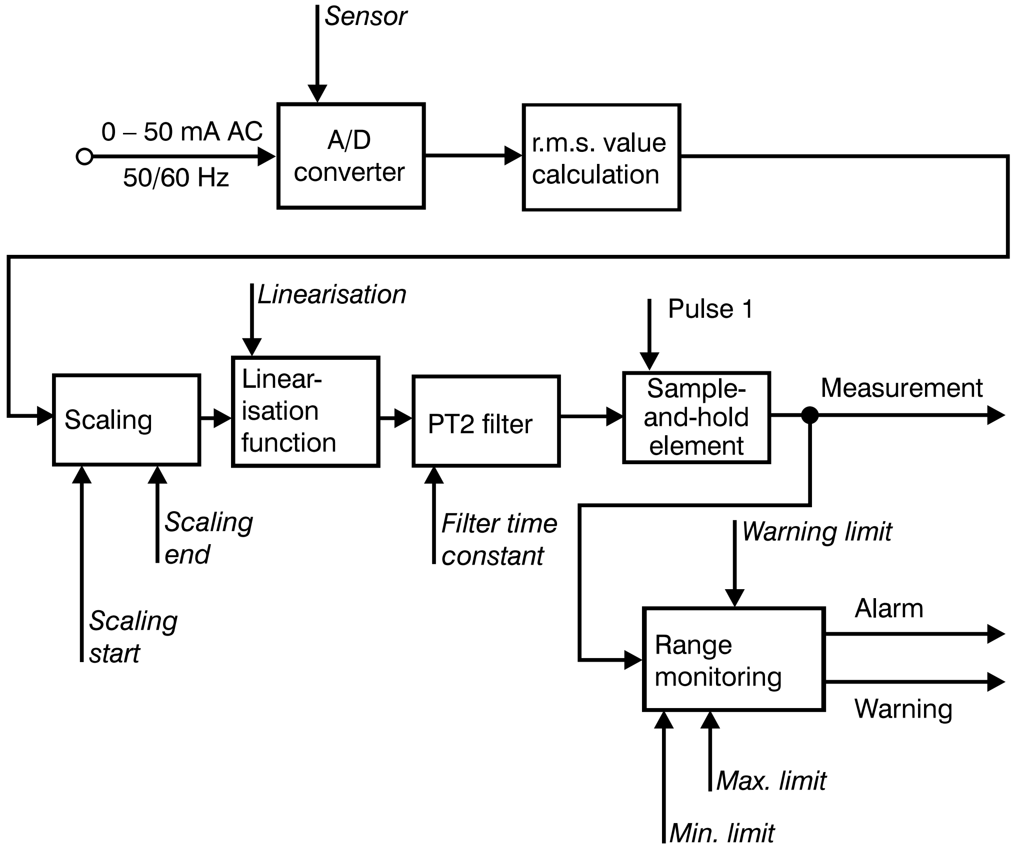
Block structure with standard signal and potentiometer

The block diagram shows the signal flow when connecting standard signals and potentiometers.



Block structure with AC current (heater current)

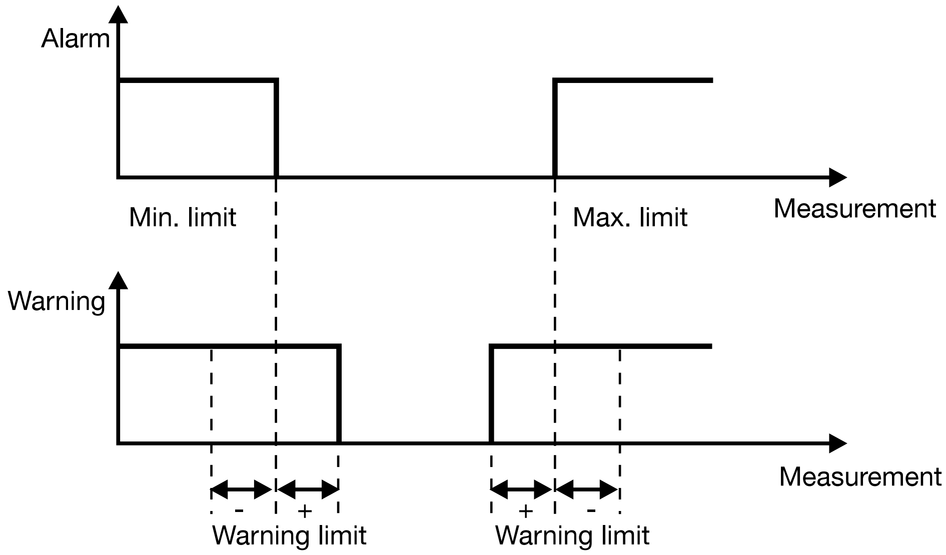
The block diagram shows the signal flow when connecting an AC current. An AC current can only be measured via the analogue input 2.



The AC current (heater current) is measured with the heating contact closed (operation via the pulse module 1 (pulse 1 = 1)). The measurement value is held until the next measurement (sample-and-hold element).

Range monitoring

A range monitoring function is integrated into each of the analogue input functions. This function can be freely set via parameter to monitor the measurement. The alarm signals (AnInx_Alarm, AnInx_Warn) are available as output network-variables and can be used to link up with other functions.



Measurement range monitoring

On over/underrange of the selected current or voltage input range, the measurement itself is characterised as an invalid value by the “Out of Range” message, so that the operated functions can evaluate the invalid measurement. The table below shows on which sensor signals a sensor break is recognised and reported.

Transducer	Sensor break	Short cicuit	max. overrange
Resistance thermometer	X	X	0%
Thermocouples	X	–	0%
0 — 50mV	X	–	+/-20%
10 — 50mV	X	X	+/-20%
-50 to +50mV	X	–	+/-10%
0 — 10V	–	–	+/-20%
2 — 10V	X	X	+/-20%
-10 to +10V	–	–	+/-10%
0 — 1V	–	–	+/-20%
0.2 — 1V	X	X	+/-20%
-1 to +1V	–	–	+/-10%
0 — 20mA	–	–	+/-20%
4 — 20mA	X	X	+/-20%
AC 0—50mA	–	–	+/-10%
Potentiometer	X (slider)	–	0%

X = recognised — = not recognised

Error treatment

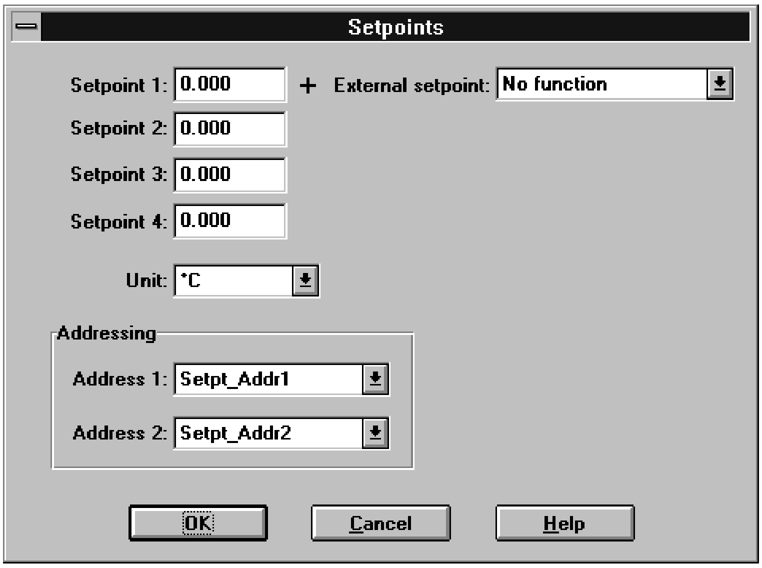
In the event of a measurement error (e. g. sensor break),

- the alarm and warning alarm are activated and
- the measurement is set to “Out of Range” (invalid value).

5.3 Setpoints

There is a choice of four setpoints. In addition, an external setpoint provision can be made.

Setup dialog



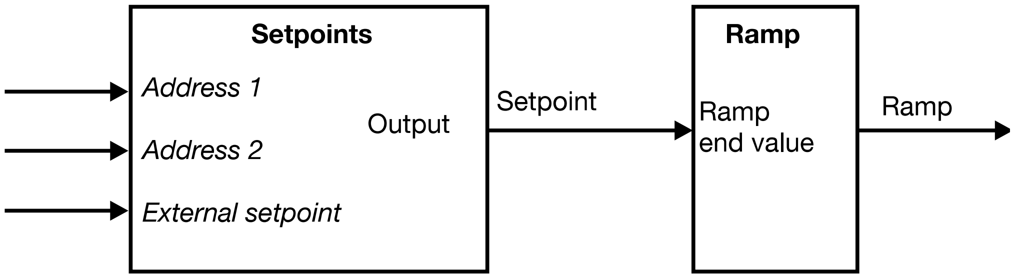
Parameters

Parameter	Selection/settings	Explanation
Setpoint 1 [Setpt 1]	-1999 to +9999 unit	Four setpoints can be programmed which can be selected either by the logic inputs or by two network variables. An external setpoint can be added to setpoint 1. An external setpoint is thus provided using setpoint 1 as a correction value.
Setpoint 2 [Setpt 2]	0 unit	
Setpoint 3 [Setpt 3]		
Setpoint 4 [Setpt 4]		
External setpoint [SelExtSetp]	No function [0] Setpt_Ext [1] AnIn1_Meas [2] AnIn2_Meas [3]	The selected external setpoint is added to the given setpoint 1.
Unit [unit]	(various) °C	Determines the physical unit of the setpoints.
Address 1 [SelAddress1]	Setpt_Addr1 [0] Setpt_Addr2 [1] Logic_In 1 [2] Logic_In 2 [3]	Determines via which signal sources the setpoints are selected
Address 2 [SelAdress2]	Setpt_Addr1 [0] Setpt_Addr2 [1] Logic_In 1 [2] Logic_In 2 [3]	

= factory setting [ ] = short name in the operating unit

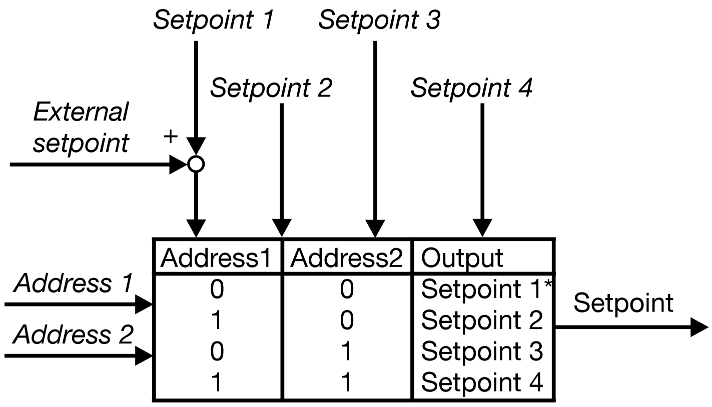
Function

The diagram shows the input and output signals of the function. The output signal of the setpoint function is firmly linked to the ramp function. If the status of the ramp function is on “OFF”, the output signal of the setpoint function is looped through the ramp function.



Addressing setpoints

Setpoints are selected according to the table below:



Setpoint 1* = setpoint 1 + external setpoint

Error treatment

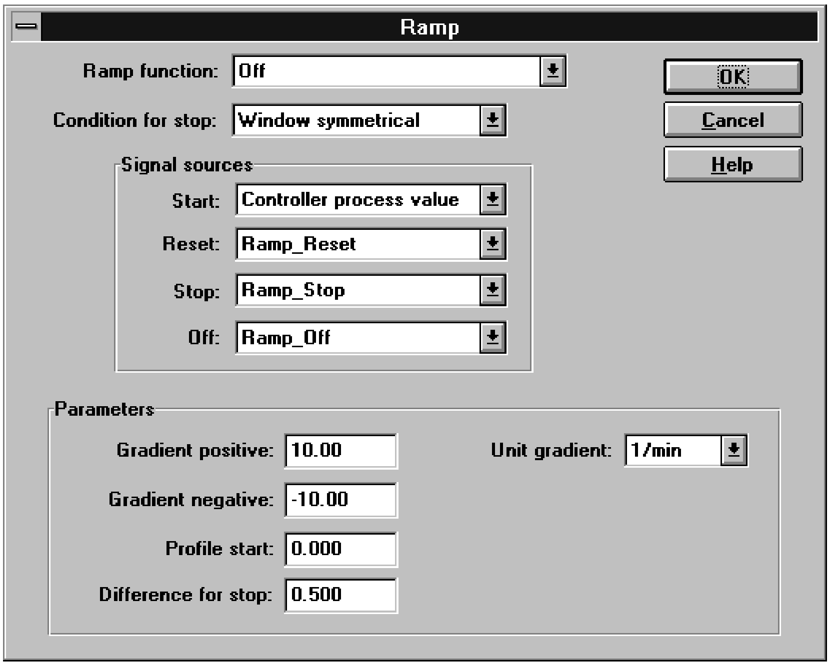
Source	**Action on**	
	errors of communication	**Out of Range**
External setpoint	- Out of Range	- Out of Range
Address 1 + 2	- Network variables are set to 0 (setpoint switching!)	-

If the input network-variables Setpt_Addr1 or Setpt_Addr2 have been selected as address outputs and they are not operated by the network, then they have the status 0, i.e. setpoint1* is output.

5.4 Ramp

A setpoint ramp with different gradients for rising and falling edges can be implemented. The ramp profile can be influenced by different operating functions. In addition, the process value can be monitored with regard to the setpoint (stop comparator).

Setup dialog



Parameters

Parameter	Selection/settings	Explanation
Ramp function [RampFunct]	Off [Off] Ramp active [RampAct] Ramp active with ramp stop [RampStp]	Altogether two ramp types can be activated.
Condition for stop [CondStop]	Window symmetrical [WinSym] Comparator high [CompHi] Comparator low [CompLow]	The stop function selected defines the process value range in which a ramp stop is active.
Start [SelStart]	Contr_PV [0] Ramp_Start [1] Profile start [2]	Defines the start condition for the ramp. With an active ramp reset, the ramp output equals the value of the ramp start.
Reset [SelReset]	Ramp_Reset [0] Logic_In1 [1] Logic_In 2 [2]	The current ramp setpoint is set to the ramp start by the ramp reset.
Stop [SelStop]	Ramp_Stop [0] Logic_In1 [1] Logic_In 2 [2]	External signal which stops the ramp output. The stop comparator compares the control variable (process value) with the current ramp output. The ramp is stopped if the control variable is outside the set range.
Off [SelOff]	Ramp_Off [0] Logic_In1 [1] Logic_In2 [2]	The ramp output corresponds to the ramp end, i.e. the preset setpoint.

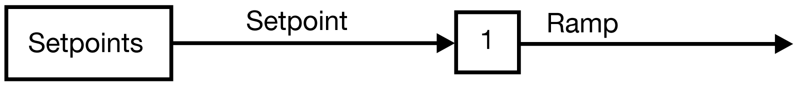
▒ = factory setting [ ] = short name in the operating unit

Parameter	Selection/settings	Explanation
Gradient positive [GradntPos]	0 — 9999 unit 10 unit	These two variables determine the speed of the ramp change. The parameter "Gradient positive" is active when: ramp output < ramp end. The parameter "Gradient negative" is active when: ramp output > ramp end.
Gradient negative [GradntNeg]	-1999 — 0 unit -10 unit	
Profile start [Start]	-1999 to +9999 unit 0 unit	Defines a value for the ramp start
Difference for stop [DiffStop]	0 — 9999 unit 0.5 unit	Defines the limit for ramp with ramp stop
Unit gradient [UnitGrad]	1/min [1/min] 1/h [1/h] 1/day [1/day]	Defines the physical unit of the gradient

▒ = factory setting [ ] = short name in the operating unit

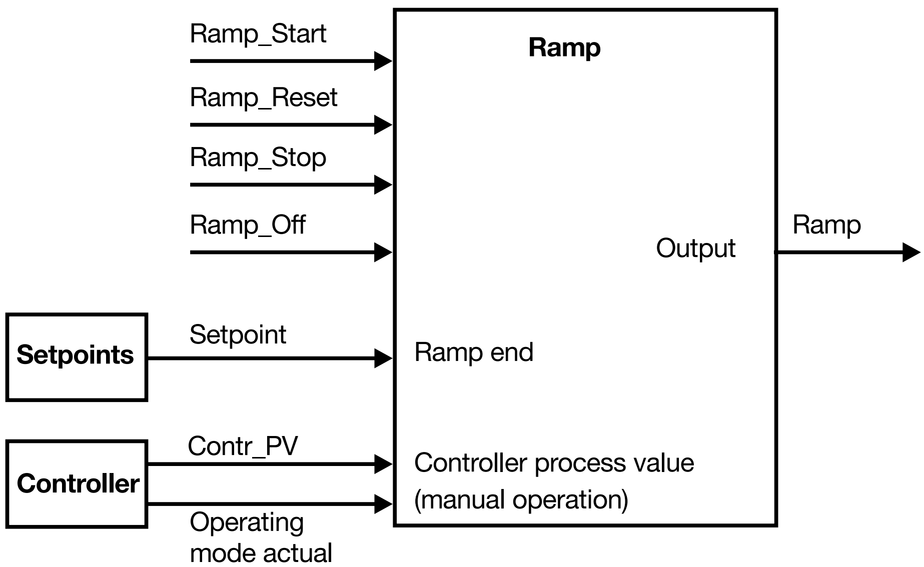
"Ramp Off" function

The diagram shows the input and output signals of the function when the ramp function is on "OFF".
The "current" setpoint is looped through the ramp function and appears at the output (ramp).



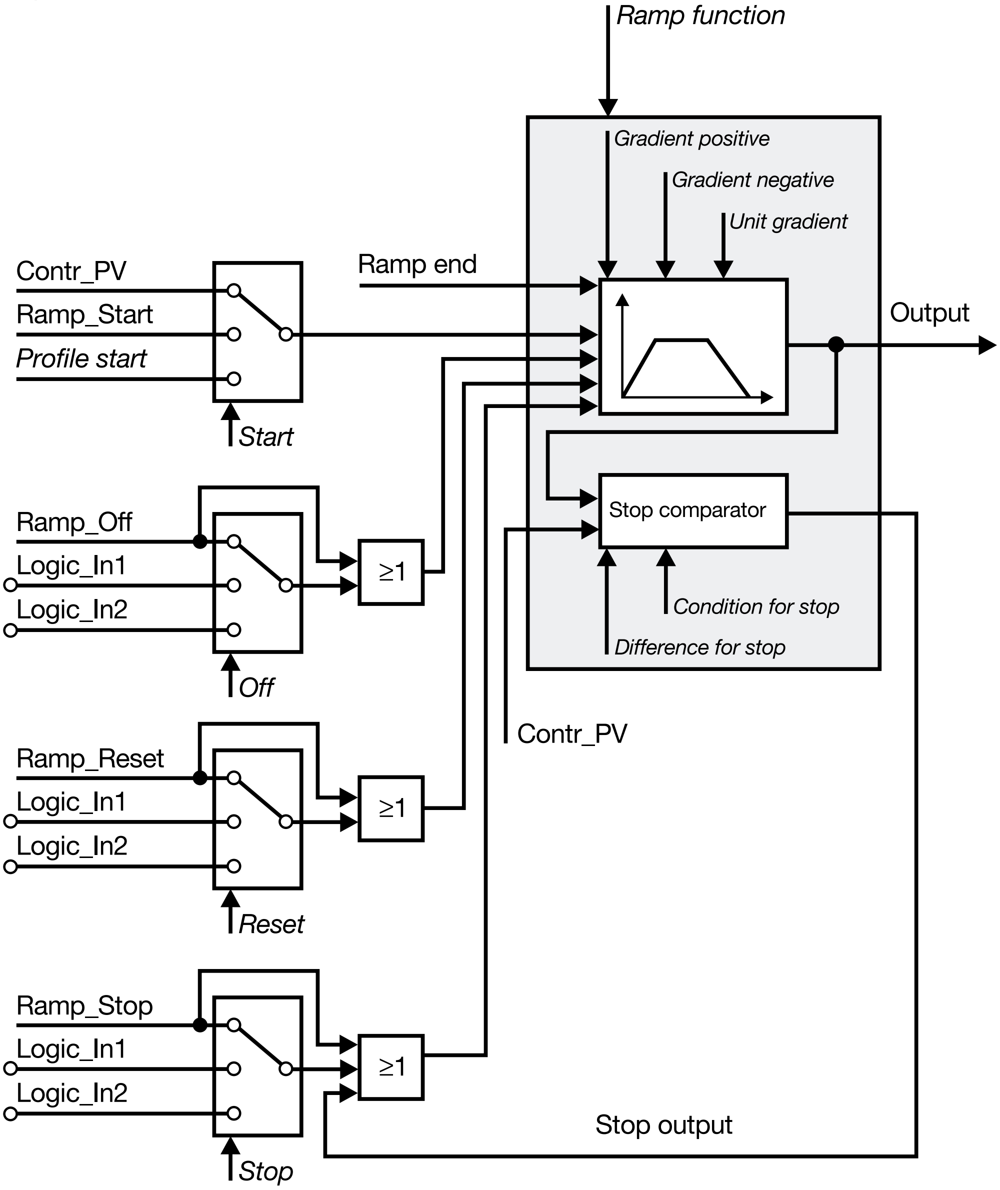
"Ramp active" function with/without ramp stop

The diagram shows the input and output signals of the function when the ramp function is active.



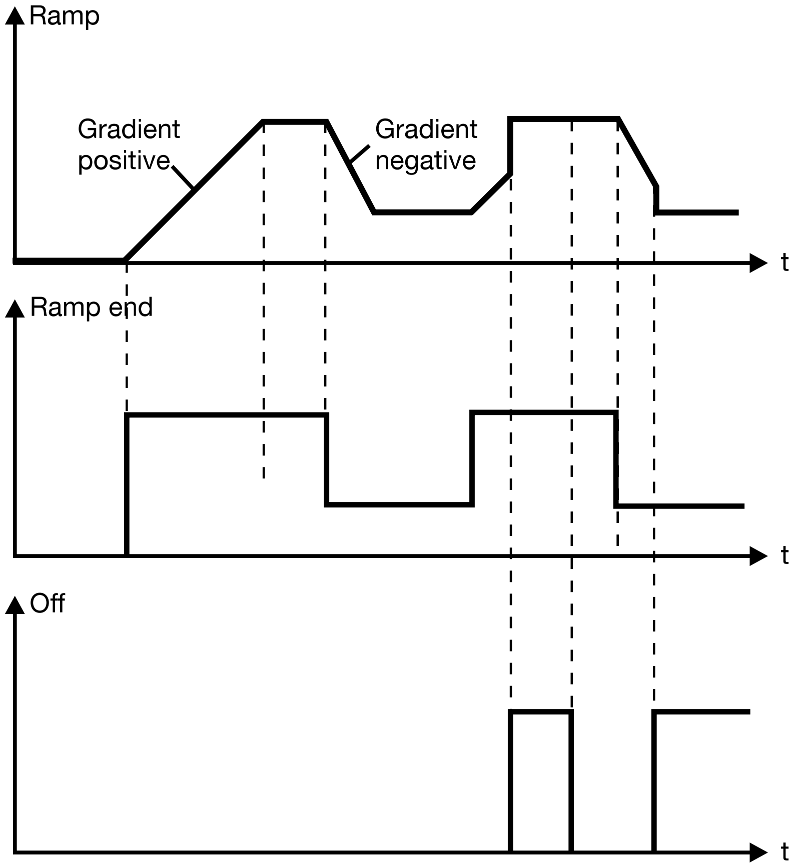
If the controller is in manual operation, the output of the ramp function is set to the process value.
The ramp end value is fixed by the setpoint function.

Block structure The block structure shows the internal processing of the signals and the influence of the parameters.

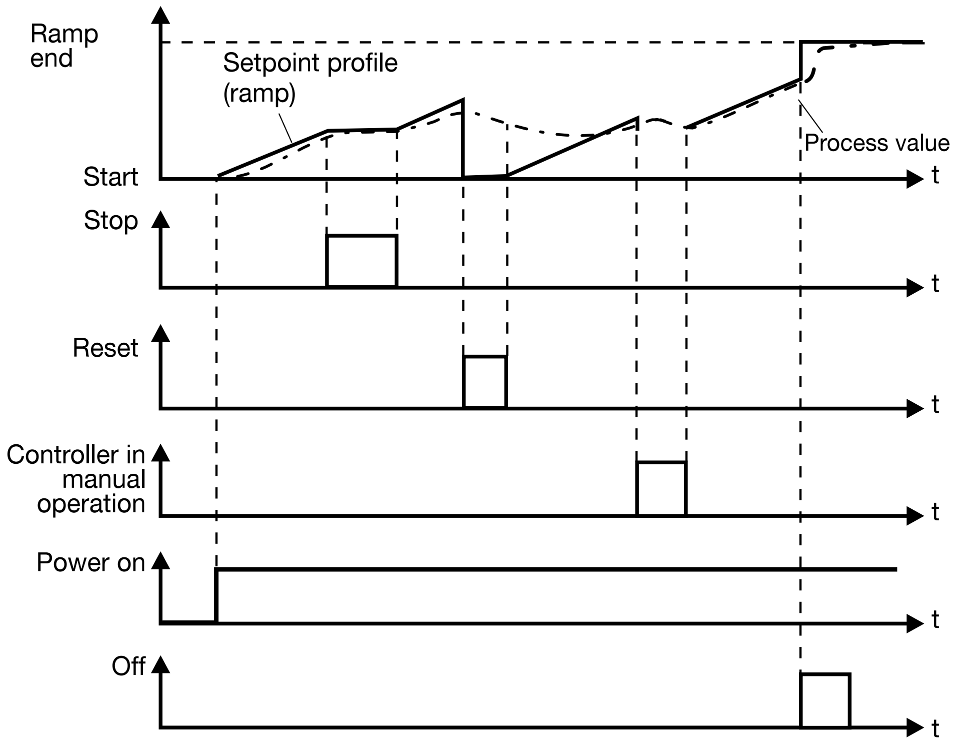


Ramp profile

On a setpoint change (ramp end), the parameters *Gradient positive/negative* become effective in the following way:

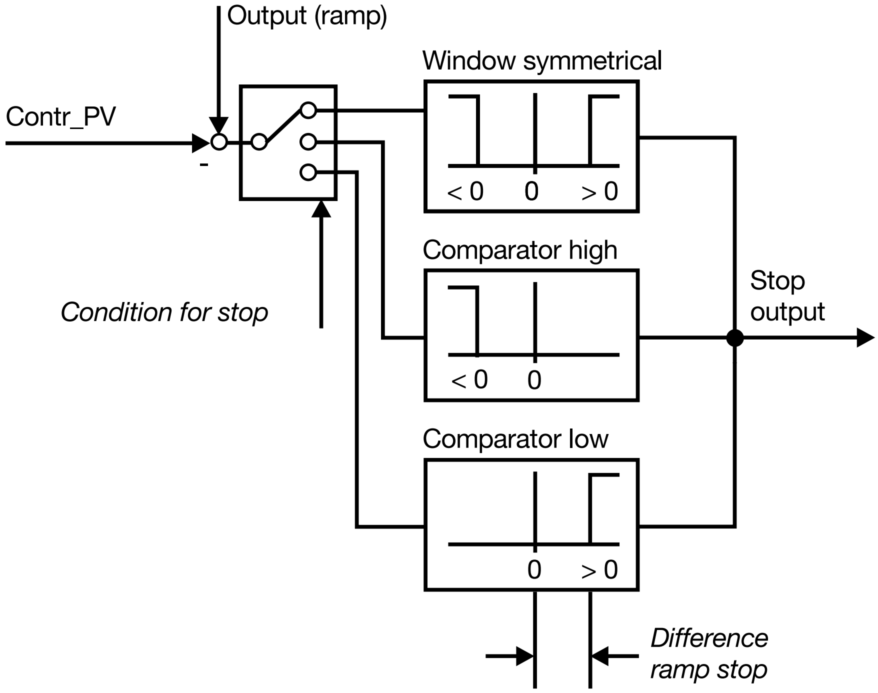


The diagram below shows the ramp profile with different operating functions and module conditions.



Ramp active with stop comparator

The progress of the process value along the ramp profile can be monitored by the selectable comparators which are available. Using the parameter *Difference for ramp stop,* the distance to the ramp output signal can be set.



Error treatment

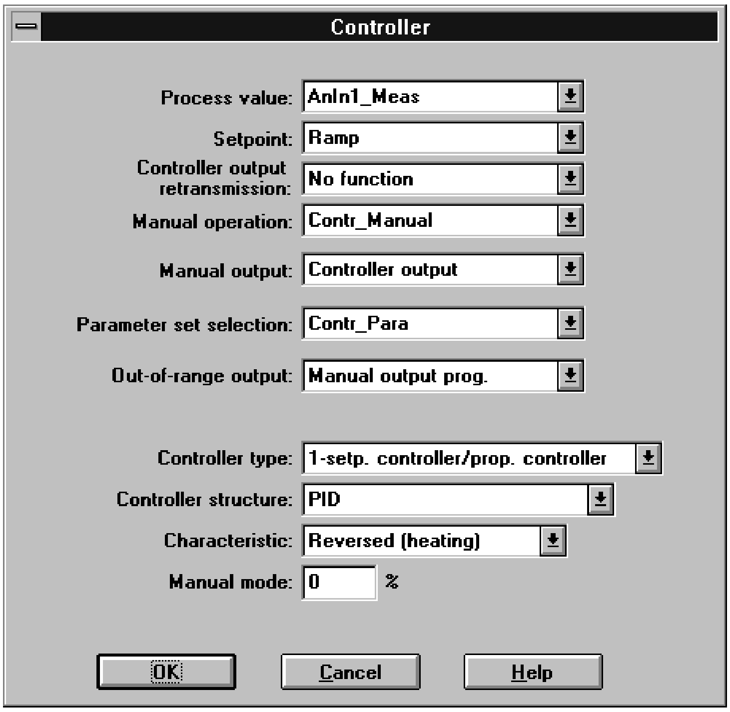
Source	**Action on**	
	errors of communication	**Out of Range**
Start	- program is reset to the value for *Profile start*	- program is reset to *Profile start*
Ramp end value	-	- output is set to “Out of Range” When an error has been corrected, the output is set to the controller process value

Source	Action on	
	errors of communication	**Out of Range**
Controller process value	-	- Ramp output is Out of Range When the error has been corrected, a (ramp) reset is automatically activated, or the ramp function outputs the following value: - if a (ramp) stop has been activated ➔ *Profile start* - if a (ramp) reset has been activated ➔ *Profile start* - if a (ramp) Off has been activated ➔ *Ramp end* - if manual operation has been activated ➔ *Ramp setpoint = Process value*

5.5 Controller

Different controller types can be configured here.

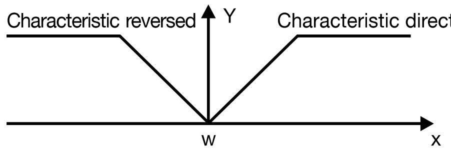
Setup dialog



Parameters

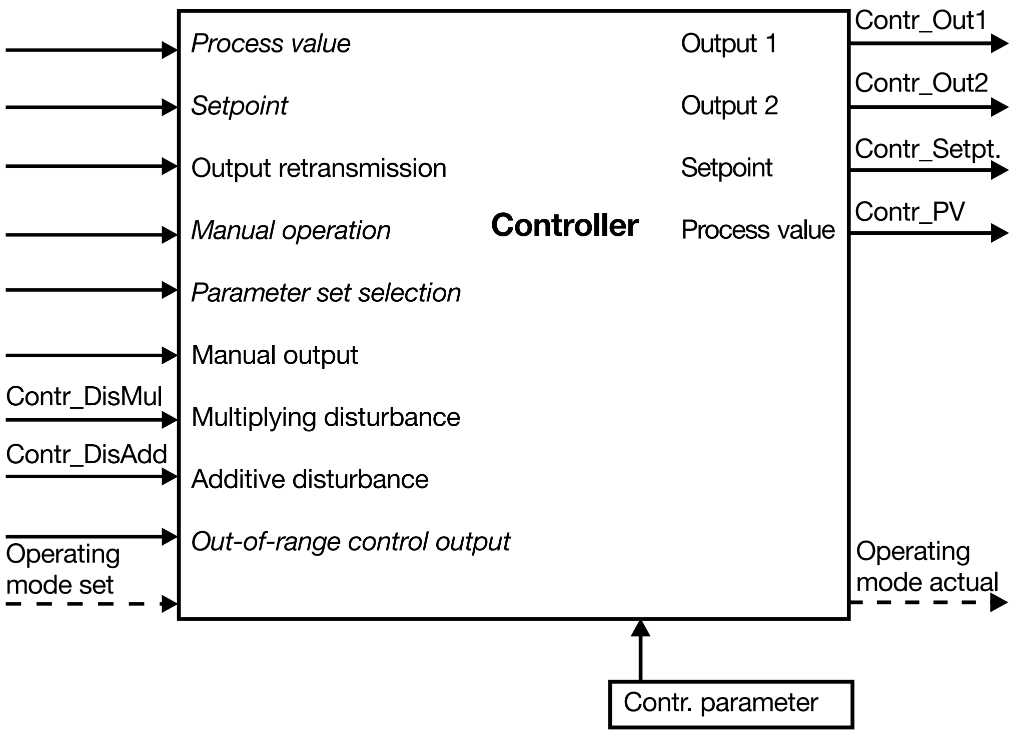
Parameter	Selection/settings	Explanation
Process value [SelProcVal]	AnIn1_Meas [0] AnIn2_Meas [1] Maths [2] Contr_ExtPV [3]	Signal source for controller process value
Setpoint [SelSetpt]	Ramp [0] Maths [1] Setpoint [2]	Signal source for controller setpoint
Controller output retransmission [OutRetrans]	No function AnIn2_Meas Contr_OutRetr	Signal source for output retransmission on modulating controllers and proportional controllers with integral actuator driver
Manual operation [ManOp]	Contr_Manual Logic_In1 Logic_In2 Operating unit	Signal source for changeover to manual operation ⇨ “Manual operation”
Manual output [SelManOut]	Contr_ManOut Controller output Manual output prog.	Signal source for the control output in manual operation
Parameter set selection [SelParSeln]	Contr_Para [0] Logic_In1 [1] Logic_In2 [2] Operating unit [3]	Signal source for parameter set switching
Out of Range output [OffROutp]	Manual output prog.	Signal source for the output which is output in case of process value or setpoint errors.

= factory setting [ ] = short name in operating unit

Parameter	Selection/settings	Explanation
Controller type [ContrType]	1-setpoint controller/ prop.controller [1SptCon] 2-setpoint controller [2SptCon] Modulating controller [ModCon] Prop.controller with act. driver [ActCont]	The functionality of the controller is defined here. The controller types are described below.
Controller structure [Structure]	P [P] I [I] PD [PD] PI [PI] PID [PID]	Transfer characteristic of the controller for controlling the process
Manual output prog. [ManOutProg]	-100 to +100% 0 %	Fixed controller output which is to be output in manual operation
Characteristic [Charistic]	Direct (cooling) [Direct] Reversed (heating) [Reversd]	Defines the controller characteristic.  With the setting “Characteristic reversed” the control deviation (xw) is formed from w - x. The output Y of the controller is > 0 if the process value is smaller than the setpoint. If the characteristic is switched to “Characteristic direct”, then the controller output Y is > 0 if the process value is larger than the setpoint.

= factory setting [ ] = short name in operating unit

Function The diagram shows the input and output signals of the function.



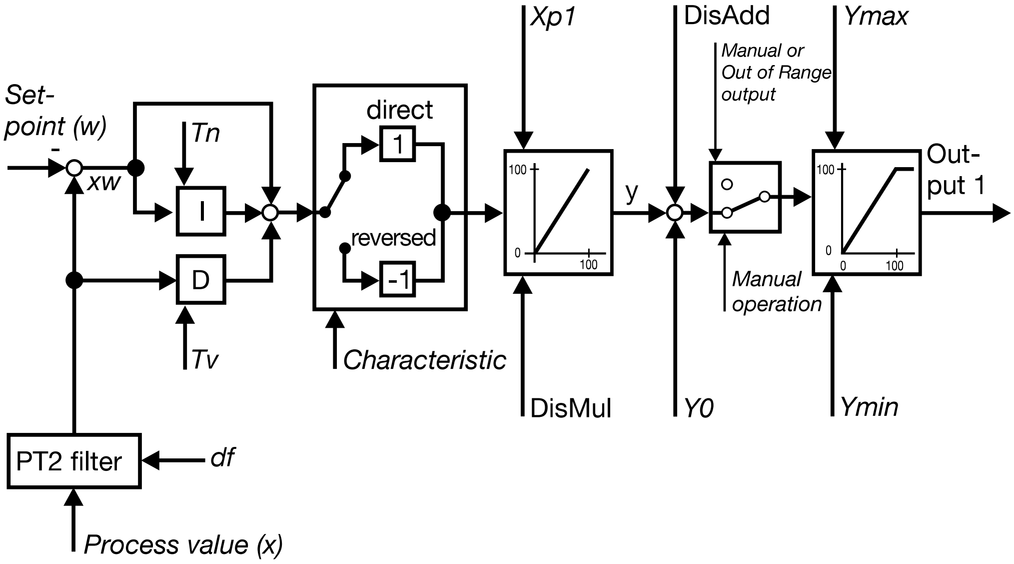
Controller parameters

⇨ Section 5.7 “Controller parameters”

Proportional controller

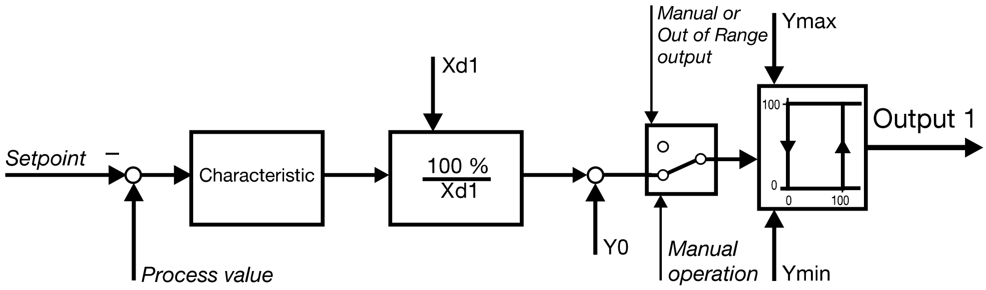
The block structure shows the internal processing of the signals and the influence of the parameters with proportional controllers.

⇨ “Additive disturbance”
“Multiplying disturbance”



Proportional controller with Xp1 = 0

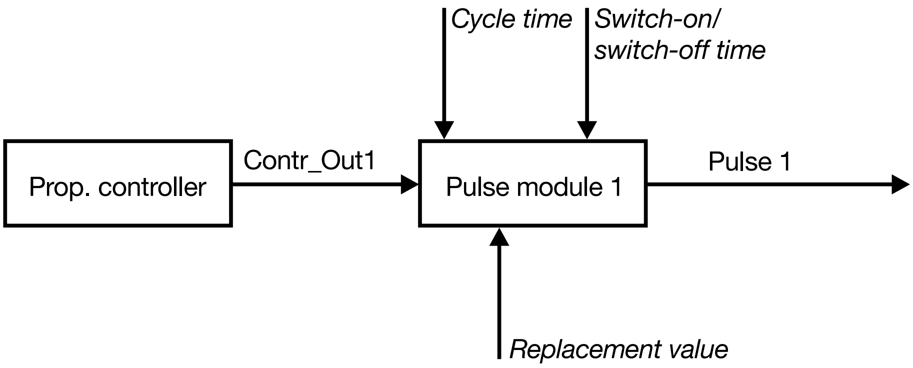
The block structure shows the internal processing of the signals and the influence of the parameters with proportional controllers with Xp = 0.



1-setpoint controller

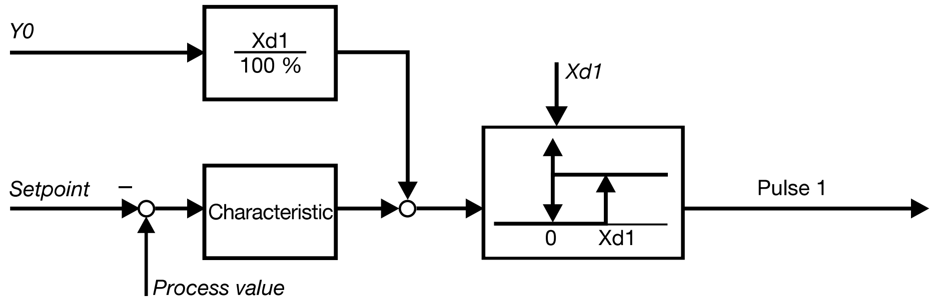
The block structure shows the internal processing of the signals and the influence of the parameters with 1-setpoint controllers. The analogue controller output signal is converted to switching pulses by a pulse module.

⇨ Section 5.8 “Pulse module”



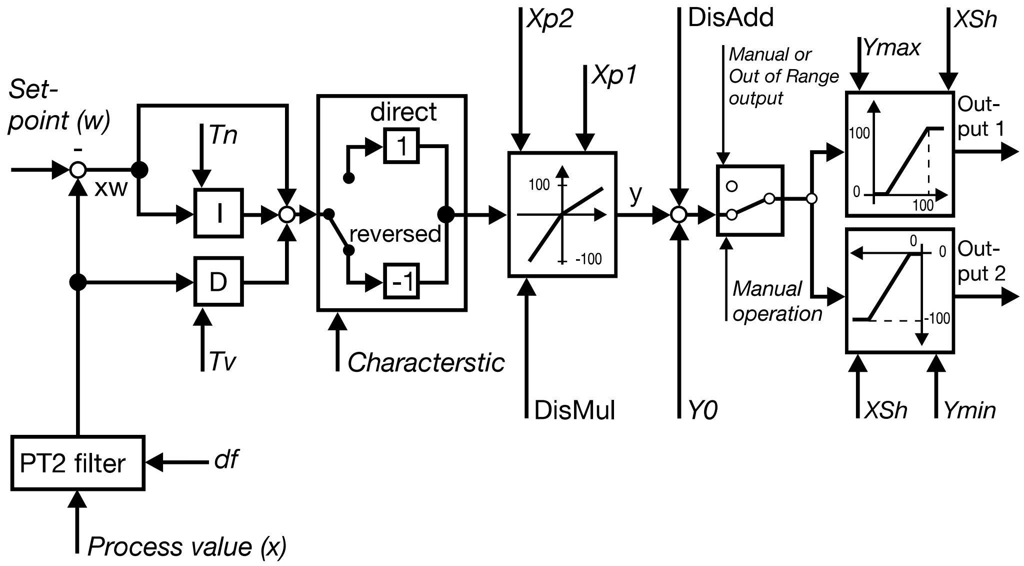
1-setpoint controller with Xp1 = 0

The block structure shows the internal processing of the signals and the influence of the parameters with 1-setpoint controllers with Xp = 0.



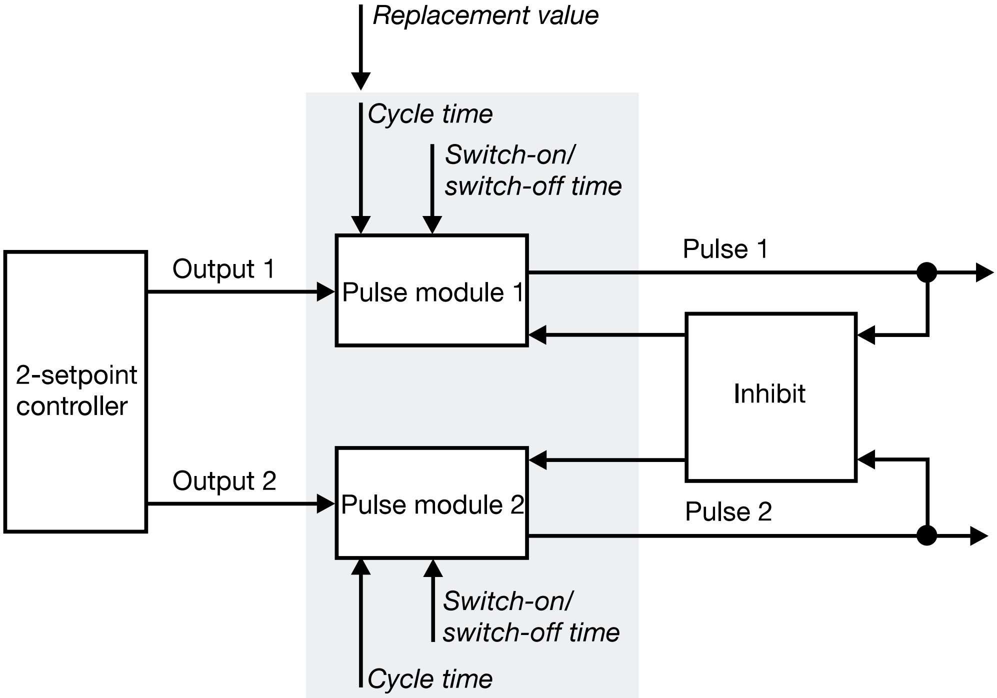
2-setpoint controller

The block structure shows the internal processing of the signals and the influence of the parameters with 2-setpoint controllers.



The preset value for the contact spacing XSh refers to the control deviation xw. It affects the output limiting by an amount of XSh/2 · 100 %/Xp.

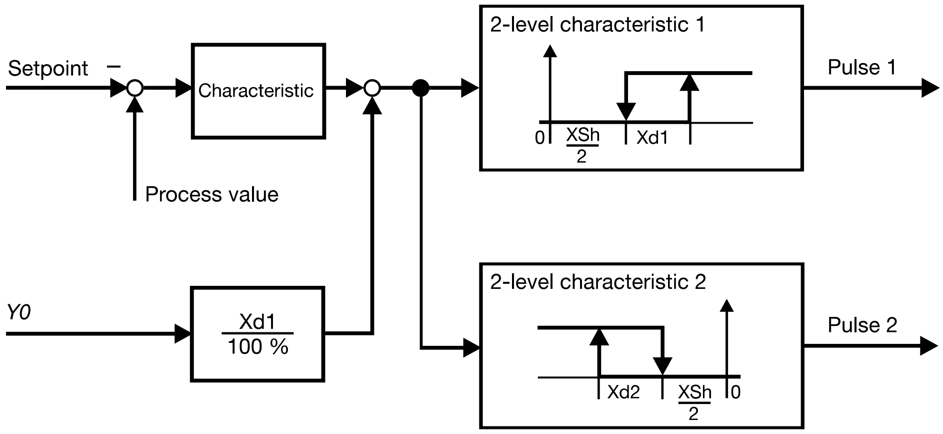
$$Xp = \begin{cases} \text{Xp1 with output 1} \\ \text{Xp2 with output 2} \end{cases}$$



The inhibit prevents the status pulse 1 = pulse 2 = 1.
The replacement value is set on pulse module 1.

Double-setpoint controller with Xp1 and Xp2 = 0

The block structure shows the internal signal processing and the influence of the parameters for double-setpoint controllers without a feedback structure (Xp1 = Xp2 = 0).



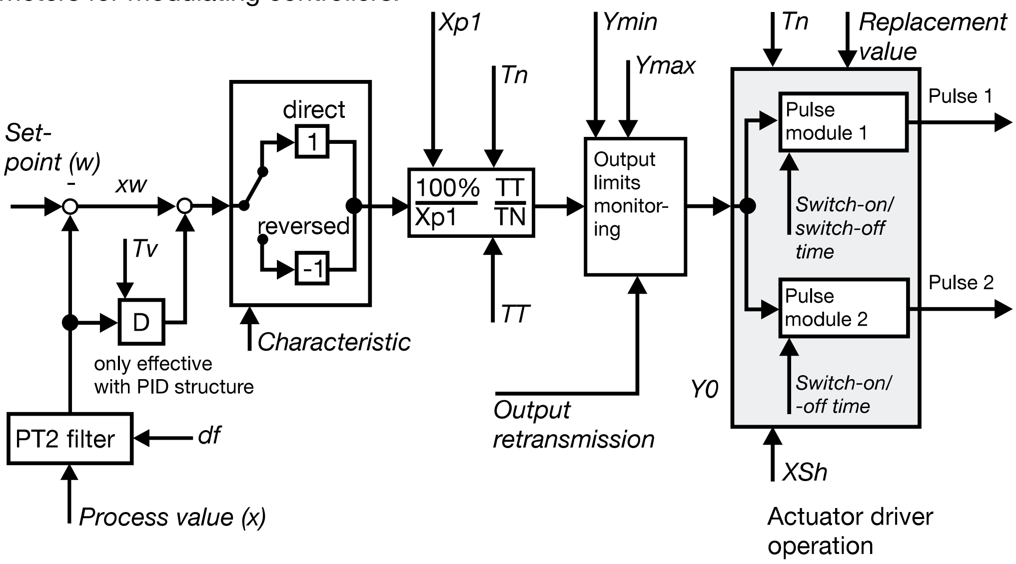
Further mixed structures can be set up for double-setpoint controllers, e.g.

- Xp1 > 0 and Xp2 > 0
- Xp1 = 0 and Xp2 > 0
- Xp1 > 0 and Xp2 = 0

The corresponding functional sections of the block structures will then be active.

Modulating controller

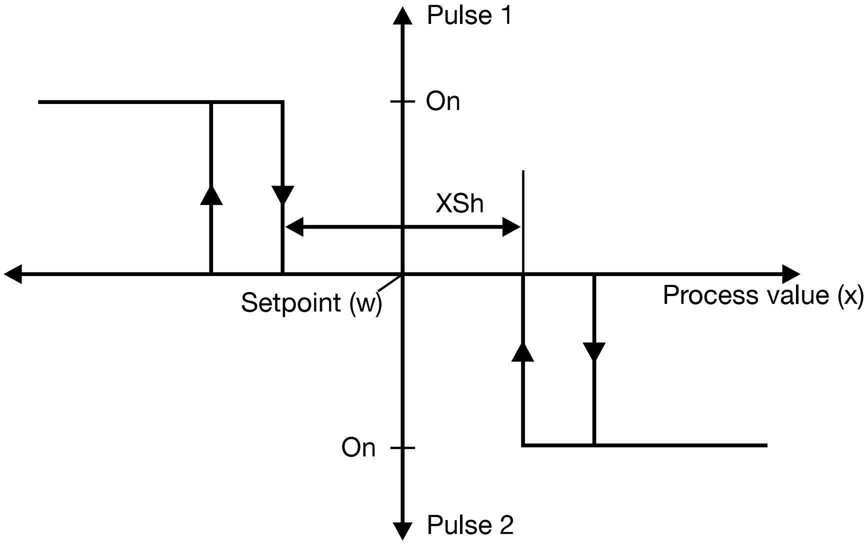
The block structure shows the internal signal processing and the influence of the parameters for modulating controllers.



When the integrating effect of the actuator motor is considered, the result is a PI or PID response for the control system.

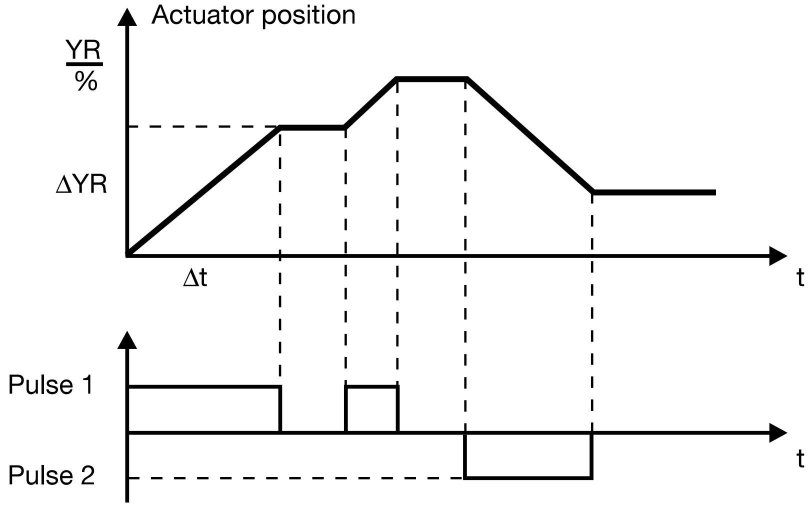
⇨ Section 5.8 “Pulse module”

Static characteristic of the actuator operation



The value set for the contact spacing XSh is referred to the control deviation xw.

Apart from the effect of the D-element, the control deviation (xw) must lie outside the contact spacing, so that pulses can be produced.

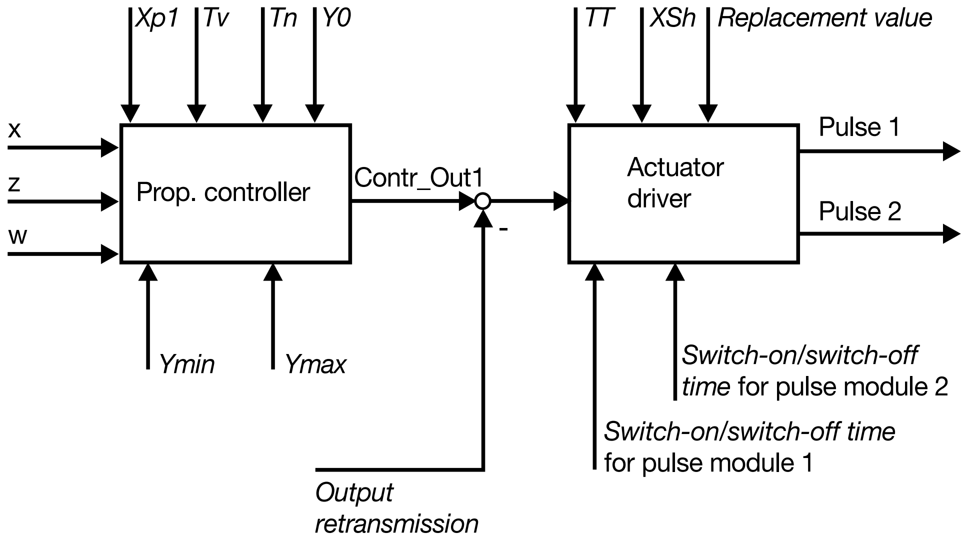


$$\frac{\Delta YR}{\Delta t} = \frac{100}{TT}$$

YR - output retransmission

Proportional controller with integral actuator driver

The block structure shows the internal signal processing and the influence of the parameters for a proportional controller with an integrated actuator driver.



The advantages of the actuator driver:
An actuating controller has the advantage over a modulating controller of providing a subordinate control loop. If a control deviation occurs, the actuator driver runs the motor to a new position. This is achieved by comparing the actuator position with the controller output of the proportional controller. An actuating controller is more dynamic than a modulating controller in correcting a control deviation. The subordinate control loop, consisting of the actuator driver and the motor actuator, forms a PDT_1 transfer function. This control loop can be adjusted by the value entered for the actuator stroke time TT. In this case, the setting and effect of the parameter XSh is referred to the output difference, not the control deviation. With an entered value of, for instance, 3% for XSh, no further pulses will appear in a range of +/- 1.5% about the output variable (output 1) (see “Modulating controller”).

Error handling

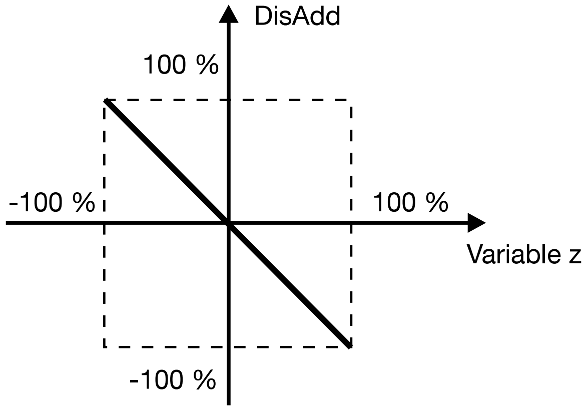
Source	**Reaction to Out of Range**
Process value	- Output of *Out-of-Range output*
Setpoint	- Output of *Out-of-Range output*
Output retransmission	- Output corresponds to the replacement value for pulse module 1 (only for actuating controllers!)
Manual output	- Output of *Manual output prog.* (only in manual mode!)
Additive disturbance	- Disturbance correction inactive
Multiplying disturbance	- Disturbance correction inactive

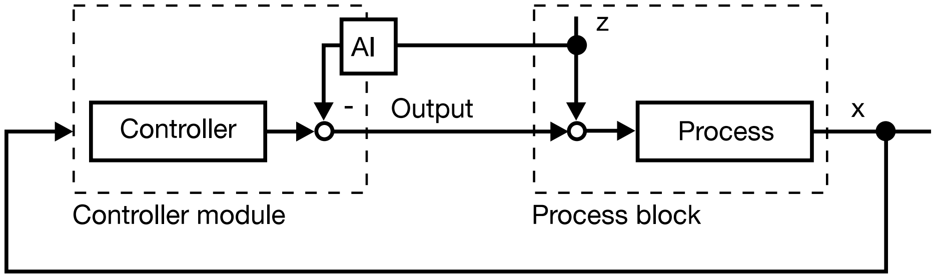
5.5.1 Disturbance correction

Additive disturbance correction

The additive disturbance correction signal (DisAdd) has the effect of shifting the output relative to the controller output variable (Y).
The additive disturbance correction is made so that it compensates for the disturbing influence (z) acting on the input of the process.
In order to achieve this compensation of the disturbance, the DisAdd signal must be equal to the disturbance z, but of opposite sign.

The dimension of the DisAdd signal is scaled as % of the shift in the output.





Multiplying disturbance correction

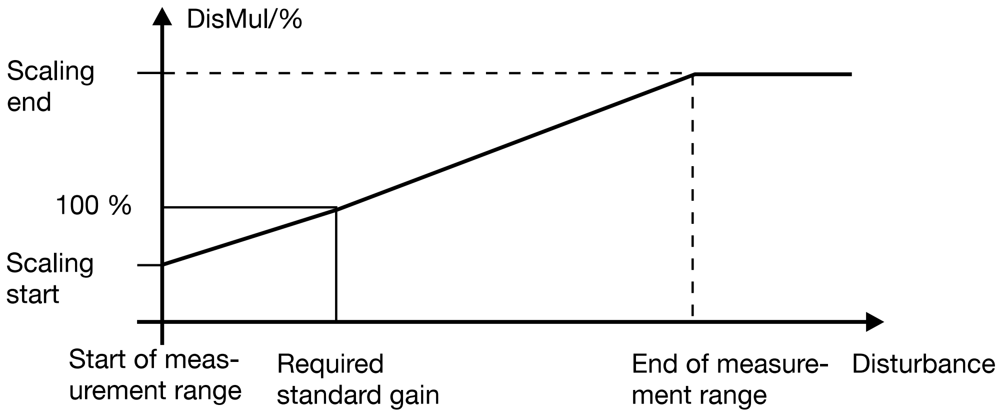
A multiplying disturbance correction alters the gain factor in the transfer function of the controller. This makes it possible to adjust the controller gain to match a varying process amplification. To do this, it must be possible to measure the change of amplification in the process.
The gain factor (Kp) can be calculated from the set proportional range (Xp) as

$$Kp = \frac{100\%}{Xp}$$

The signal input DisMul (0 — 1000 %) can be used to set the controller gain according to the relationship

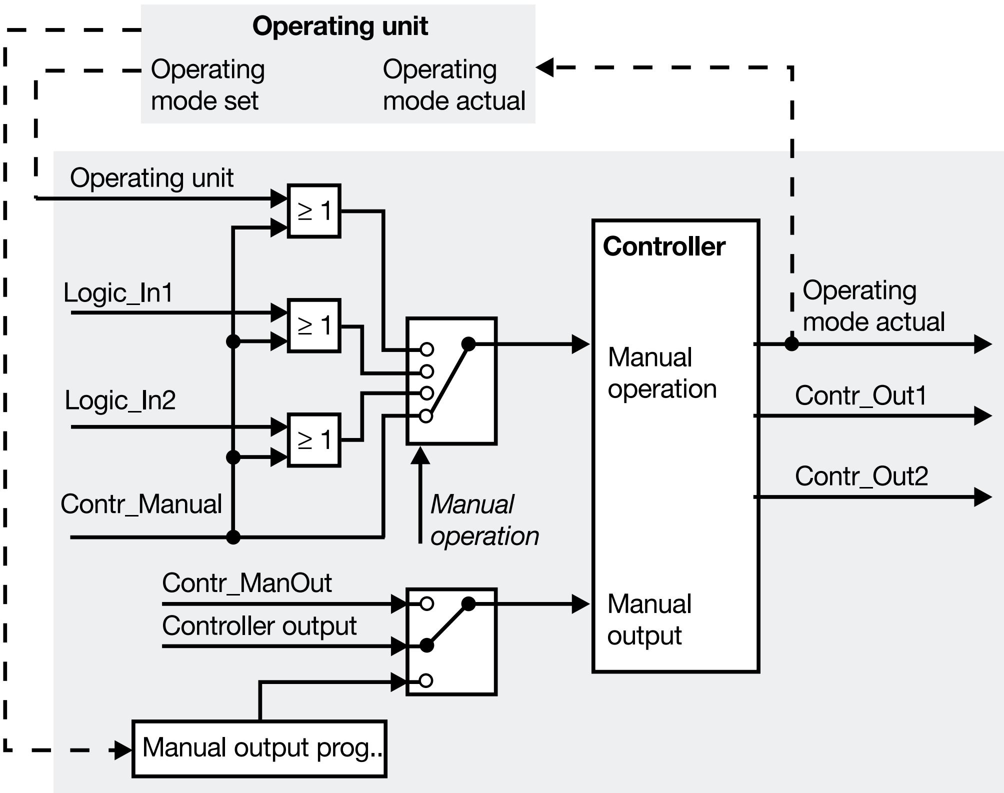
$$Kp = \frac{DisMul}{Xp}$$

The dimension of the DisMul signal must be scaled in % of the desired normal controller gain. DisMul = 100 means that the disturbance correction is switched off.



5.5.2 Manual operation

The diagram illustrates manual control, using an operating unit.

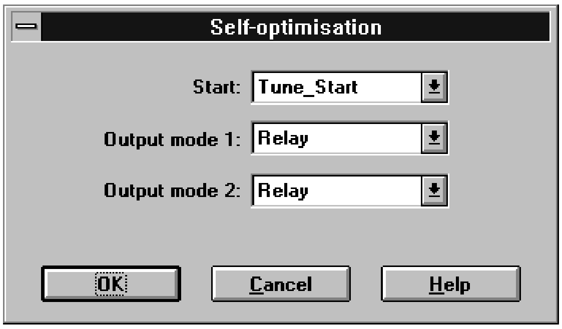


The controller can be changed over to manual mode by using the process variable “Operating mode set”. The process variable “Operating mode actual” can be used to read out the actual operating status of the controller (display: “Manual”, “Auto”). If the manual output value is provided from the operating unit, then “Manual output prog.” (“Manual mode”) must be selected for the manual value control of the controller. This can be included in a process window, in which the output values are entered.

5.6 Self-optimisation

The self-optimisation function SO is a pure software function unit which is integrated into the controller. The SO uses a special procedure to investigate the response of the process to an output step. The process response (process value) of the control loop is then used in a complex algorithm to calculate and then store the controller parameters for a PID or PI controller. The SO procedure can be repeated as often as is required.

Setup dialog



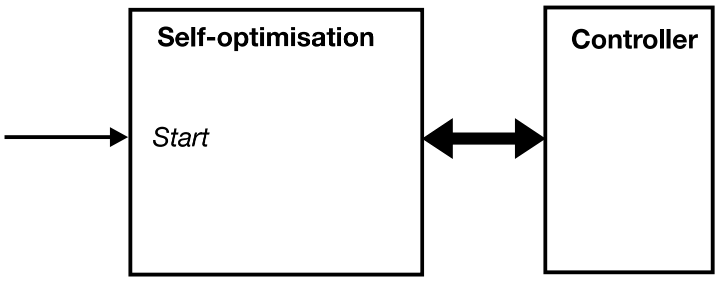
Parameters

Parameter	Selection/ settings	Explanation
Start [SelStart]	Tune_Start [0]	Starts the self-optimisation
	Logic_In1 [1]	
	Logic_In2 [2]	
	Operating unit [3]	
Output mode 1 [OutpMode]	Relay [Relay]	The controller parameters are calculated according to the output mode.
	Analogue [Analog]	For relay outputs: the *Cycle time* parameter is calculated for the pulse modules.
	Semiconductor [Semicon]	
Output mode 2 [OutpMode]	Relay [Relay]	For semiconductor relay outputs: the *Cycle time* parameter is fixed at 8 x controller sampling time.
	Analogue [Analog]	For analogue outputs: there is no optimisation of the *Cycle time* parameter.
	Semiconductor [Semicon]	

▒ = factory setting   [ ] = short name in the operating unit

Function

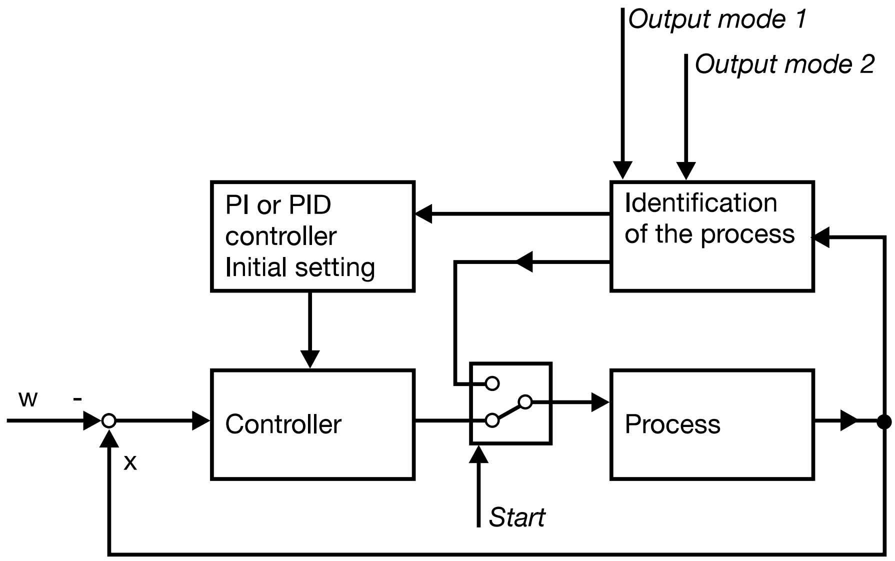
The diagram shows the input and output signals of the function.



If a PI controller is configured, then the optimisation is for PI response. If a PID controller is configured, then a PI response is optimised for 1st order control loops, PID in other cases. For all other controller structures the configuration is optimised for PID response.

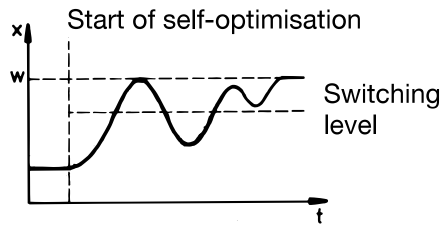
Block structure

The block structure shows the internal processing of the signals and the influence of the parameters.

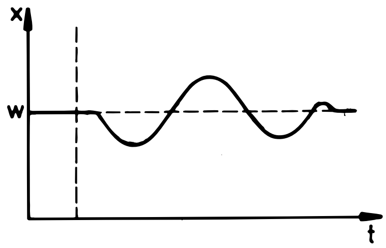


Self-optimisation procedure

The SO operates by two different methods which are automatically selected at the start, depending on the dynamic state of the process variable and its distance to the setpoint. The SO can be started from any dynamic state of the process value.
If there is a large difference between the setpoint and the process value when the self-optimisation is activated, then a switching level is established, about which the process value performs a forced oscillation during the self-optimisation procedure. The switching level is chosen so that the process value, as far as possible, does not exceed the setpoint.



If the control deviation betweeen setpoint and process value is small, for instance when the control loop has already stabilised, then forced oscillations are made about the setpoint.

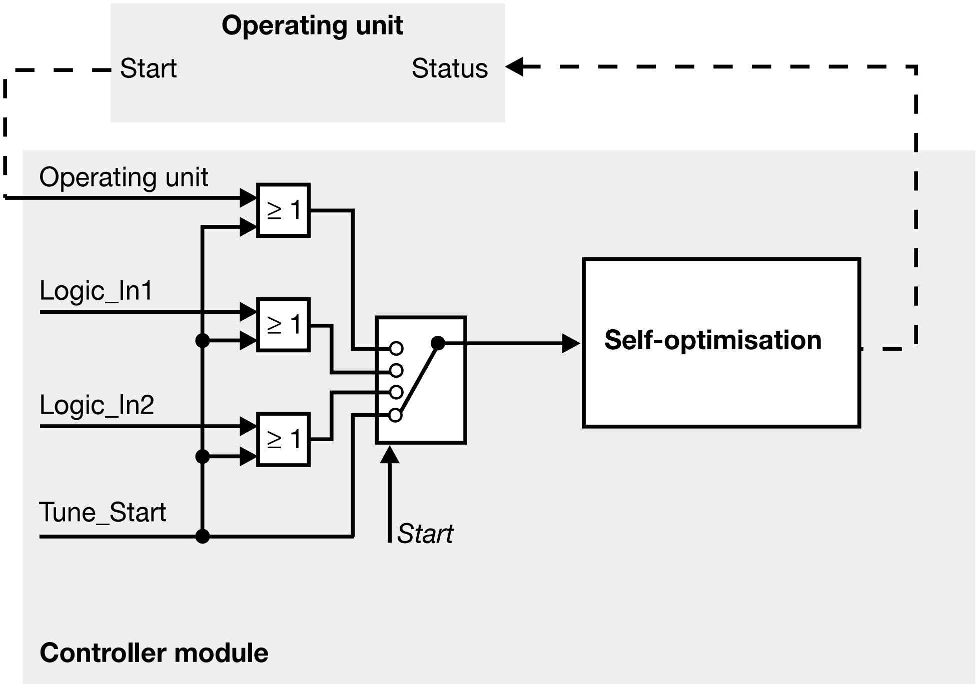


The recorded process data from this forced oscillation are used to calculate the controller parameters Tn, Tv, Xp1, Xp2, the cycle times for the pulse modules, an optimum controller structure for this control loop, as well as a filter time constant for filtering the process values, and to store them in the active parameter set.

If the second controller parameter set is selected, then only Xp1, Xp2, Tn and Tv are calculated.

Starting from an operating unit

The diagram shows the control of the self-optimisation from an operating unit.

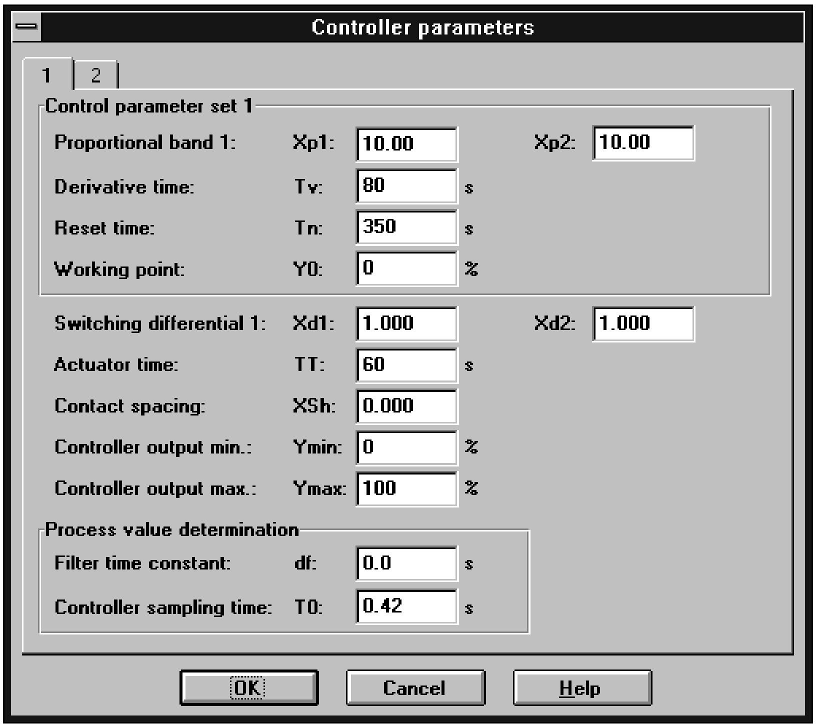


The process variable "Start" is used to start the self-optimisation. The "Status" process variable can be used to read out the actual state of the self-optimisation (display: "active", "inactive", "ready").

5.7 Controller parameters

The controller is adapted to the control loop here. A choice of two parameter sets is available (the parameters are shown in boxes in the setup dialog).

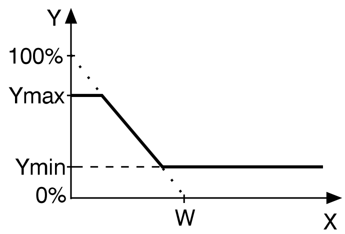
Setup dialog



Parameters

Parameter	Selection/settings	Explanation
Xp1 [Xp1]	0 — 9999 unit 10.00 unit	P range (Proportional band) The proportional band (Xp) is the control deviation range for a 100 % change in the output. $Y = (\Sigma P, I, D) \cdot \frac{100\%}{Xp}$ P, I, D components as functions of the control deviation The proportional band has the same dimension as the process value.
Xp2 [Xp2]	0 — 9999 unit 10.00 unit	
Tv [Tv]	0 — 9999 s 80 s	Derivative time Is the time period by which the rising response of a PD controller structure reaches a certain output value in advance of a P controller structure.
Tn [Tn]	0 — 9999 s 350 s	Reset time Is the time which is required for response to a step change, because of the integrating action, in order to reach the same change in output as for the P component.

= factory setting [ ] = short name in the operating unit

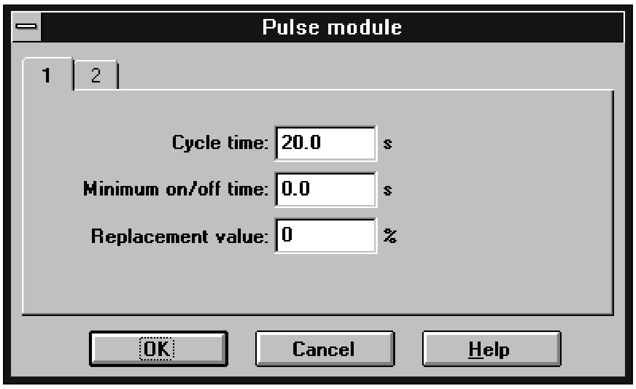
Parameter	Selection/settings	Explanation
Y0 [Y0]	-100 to +100 % 0 %	Working point For P and PD controllers, defines the output when x = w. For controllers with an I component, Y0 defines the first output which is produced after switching on the supply voltage.
Xd1 [Xd1]	0 — 9999 unit 1.000 unit	Switching differential For controllers with mit Xp = 0 the switching differential influences the amount of variation of the process value about the setpoint. Apart from this, these parameters have no effect.
Xd2 [Xd2]	0 — 9999 unit 1.000 unit	
TT [TT]	15 — 9999 s 60 s	The stroke time TT is the time which the actuator requires to move over the range from 0 — 100 %.
XSh [XSh]	-1999 to +9999 unit 0.000 unit	Contact spacing The range of control deviation in which there is no controller ouput.
Ymin [Ymin]	-100 to +100 % 0 %	Controller output limit A controller output limit is used to limit the controller output signal to a maximum ($Y_{max.}$) or minimum ($Y_{min.}$) value. Example: proportional controller 
Ymax [Ymax]	0 — 100 % 100 %	
df [FiltTime]	0 — 40 s 0 s	Filter time constant 1 (PT2 element): Value of the digital filter for smoothing the process value in the controller function.
T0 [SamplTim]	n x 420ms 0.42s	Controller sampling time: Time period for the determination of the process value.

▪ = factory setting   [ ] = short name in the operating unit

5.8 Pulse module

The two pulse modules convert continuous output signals into switching pulses.

Setup dialog



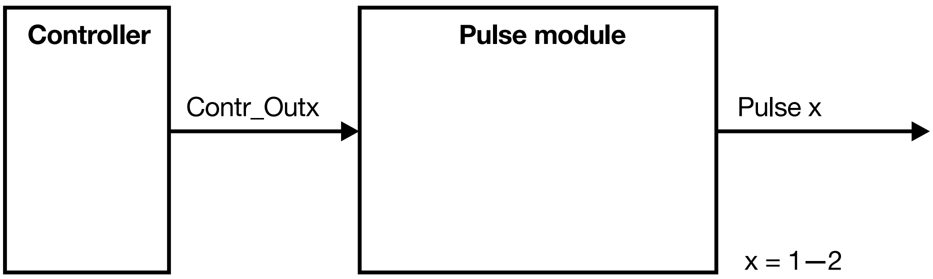
Parameters

Parameter	Selection/settings	Explanation
Cycle time [CycleTim]	1 — 999.9 s 20.0 s	Cycle time of the switching pulses.
On/off time [TOn/Off]	0 — 60 s 0.0 s	This parameter defines the mimum length of the pulse which is output, and also the mimimum pause which is made between pulses. Used to protect the actuators.
Replacement value [ReplVal]	0 — 100 % 100 %	A defined output for the event of a faulty input signal.

= factory setting [ ] = short name in the operating unit

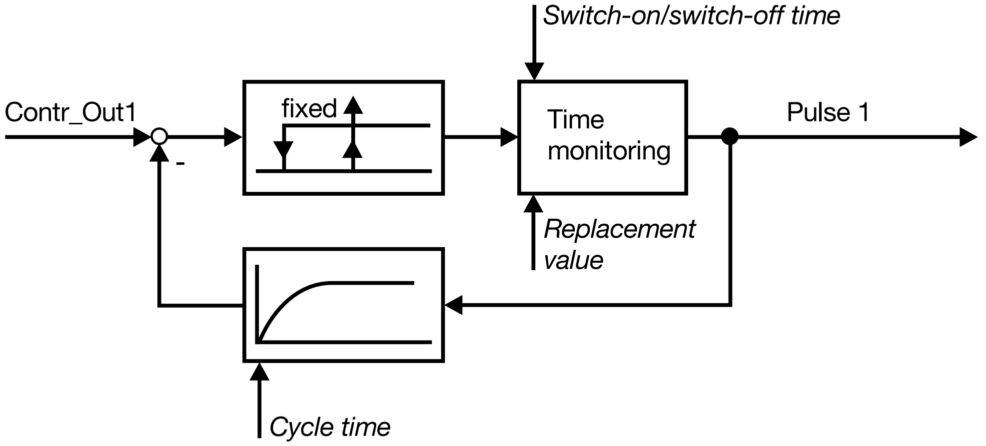
Function

The diagram shows the input and output signals of the function.



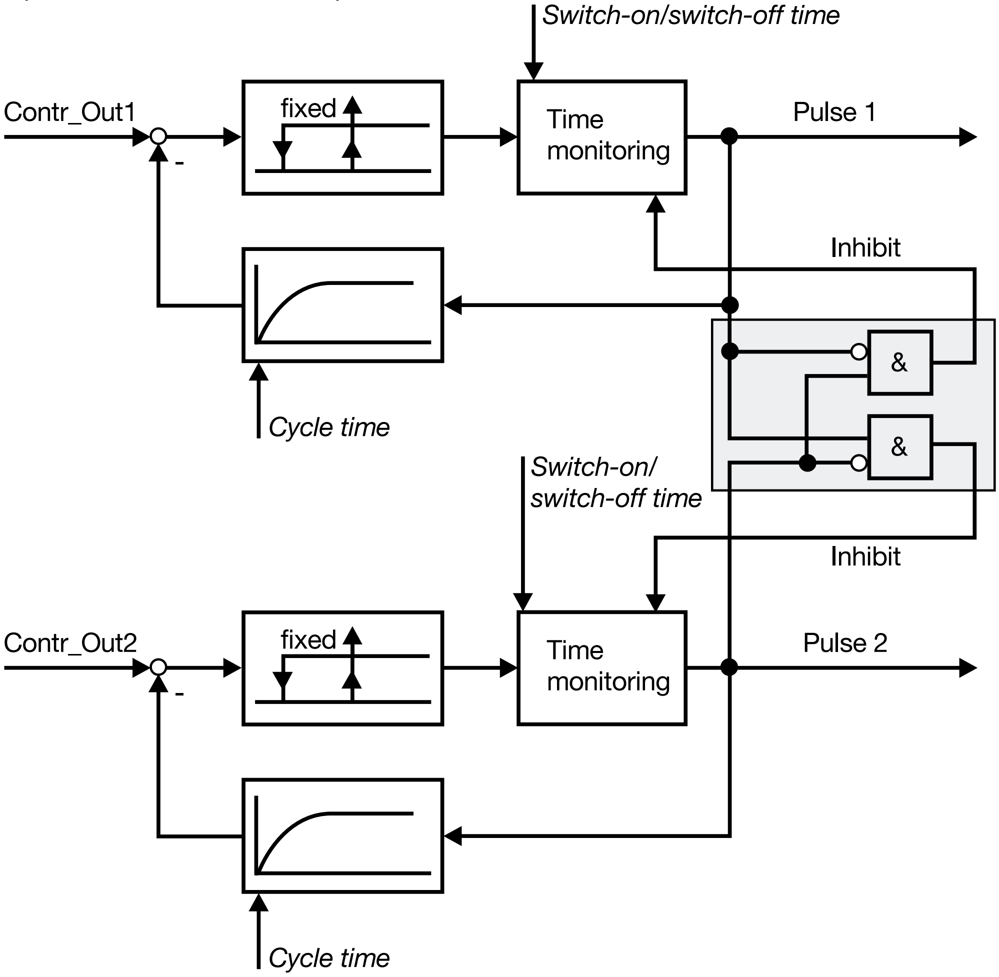
Block structure for 1-setpoint controllers

The block structure shows the internal processing of the signals and the influence of the parameters for single-setpoint controllers.



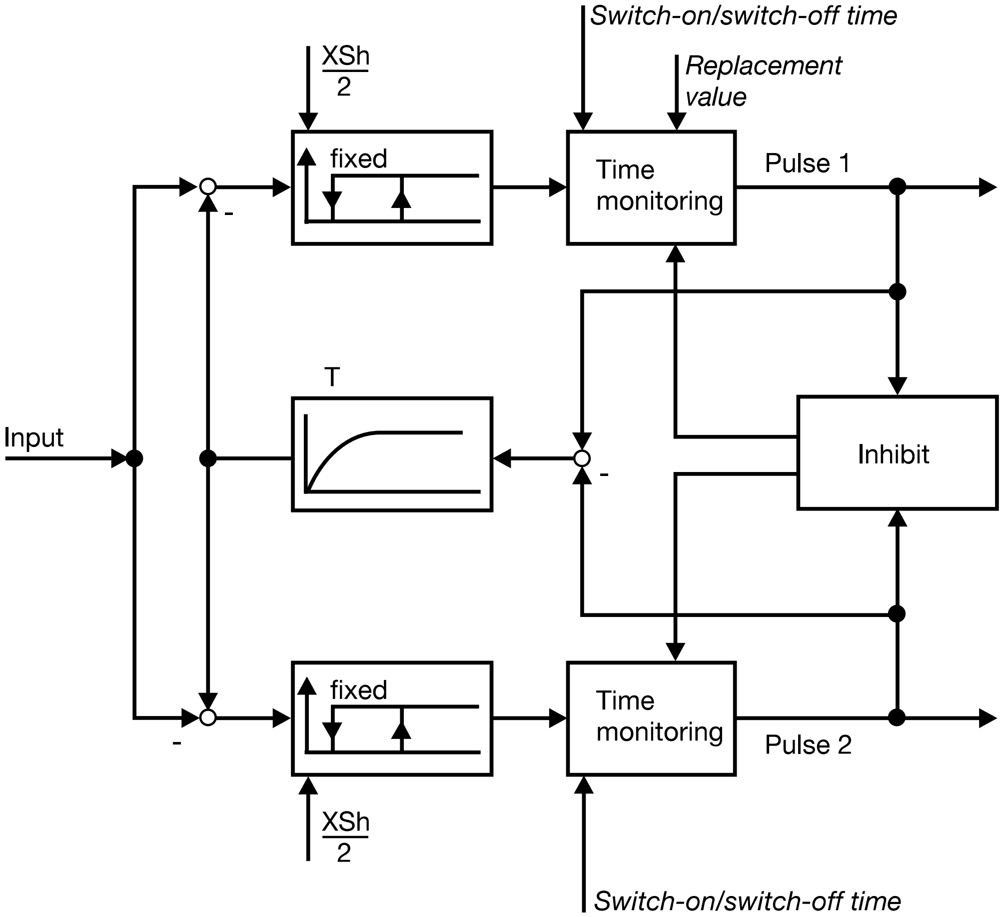
Block structure for 2-setpoint controllers

The block structure shows the internal processing of the signals and the influence of the parameters for double-setpoint controllers.



Block structure for modulating and actuating controllers

The block structure shows the internal processing of the signals and the influence of the parameters for modulating controllers, and for 2-setpoint controllers with an integral actuating controller.



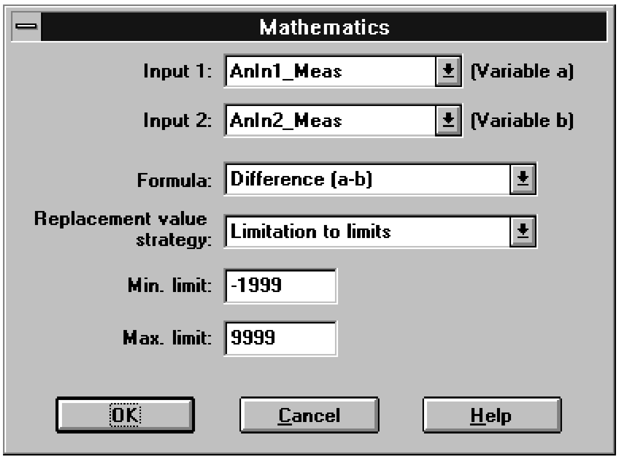
XSh - contact spacing

⇨ Section 5.7 “Controller parameters”

5.9 Mathematics

Two analogue input values can be combined in a mathematical formula.

Setup dialog



Parameter

Parameter	Selection/settings	Explanation
Input 1 [SelInput1]	AnIn1_Meas [0] AnIn2_Meas [1] Extern_In [2] Setpoint [3] Ramp [4] Contr_Out1 [5] Contr_Out2 [6]	Variable a
Input 2 [SelInput2]	AnIn1_Meas [0] AnIn2_Meas [1] Extern_In [2] Setpoint [3] Ramp [4] Contr_Out1 [5] Contr_Out2 [6]	Variable b
Formula [Formula]	Difference (a - b) [Diff] Humidity (a : wet, b : dry) [Hum] Ratio (a/b) [Ratio] Square root (a) [Root] Square (a) [Square] Minimum (a, b) [Minimum] Maximum (a, b) [Maximum] Absolute value (a) [Absolut] Sum (a + ab) [Sum] Product (a * b) [Product] Average (a, b) [Average]	Mathematical function Humidity measurement by the psychrometric method.
Replacement value strategy [ReplVStrat]	Limitation to limits [Limit] Out of range [OutRnge]	Limitation to limits: The output signal is limited to the limits or, in the event of a faulty input signal, is set to Out of range. Out of range: If the limits are exceeded, the output signal is set to Out of range.

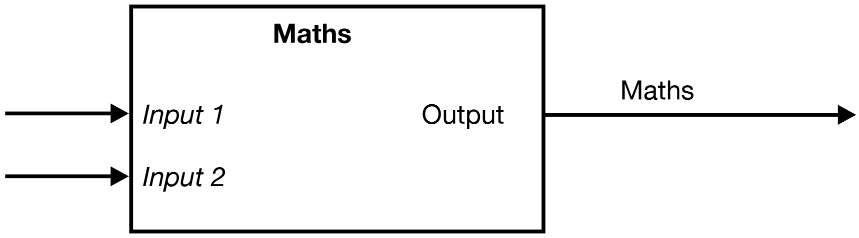
= factory setting [ ] = short name in the operating unit

Parameter	Selection/settings	Explanation
Min. limit [MinLimit]	-1999 to +9999 -1999	Limit values for the replacement value strategy.
Max. limit [MaxLimit]	-1999 to +9999 9999	

= factory setting [ ] = short name in the operating unit

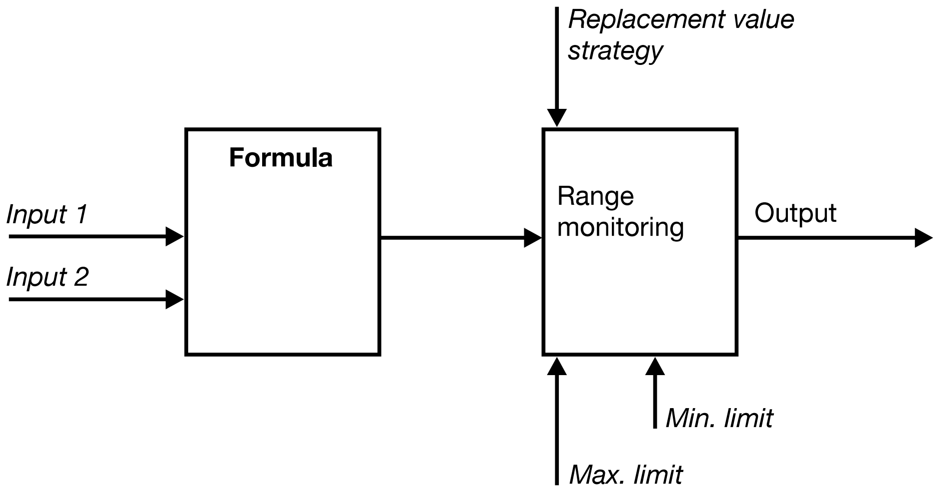
Function

The diagram shows the input and output signals of the function.



Block structure

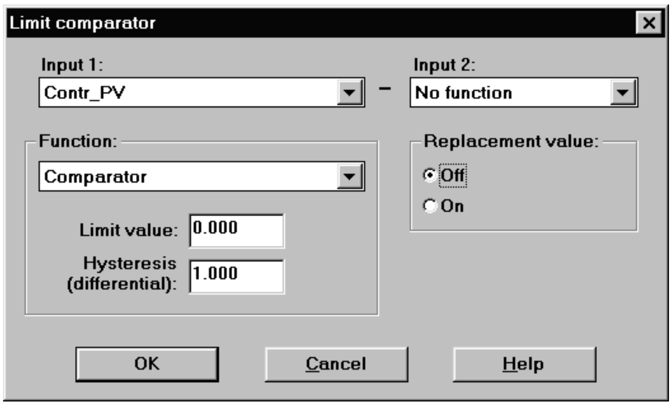
The block structure shows the internal processing of the signals and the influence of the parameters.



5.10 Limit comparator

The limit comparator is used to monitor the difference between two input values for going above / falling below a limit value or a range.

Setup dialog

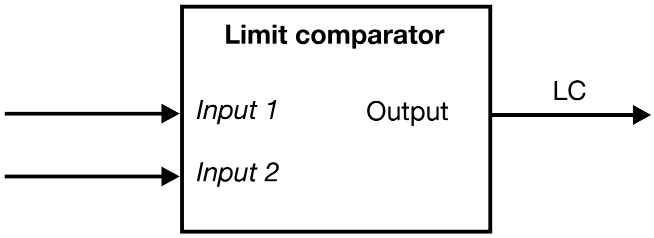


Parameters

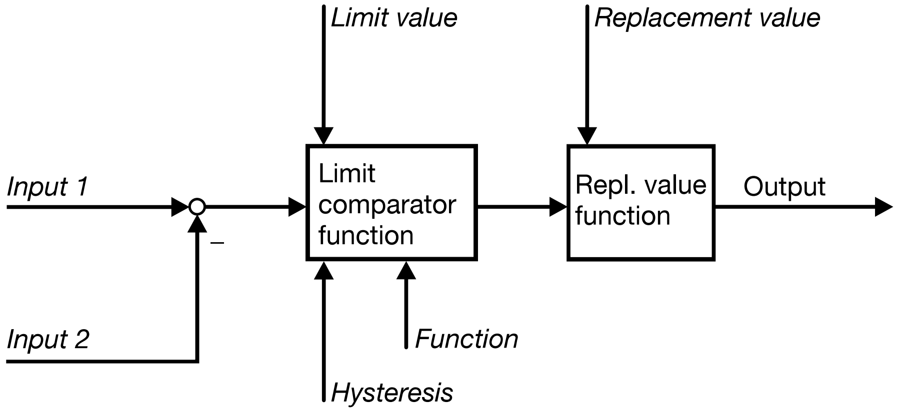
Parameter	Selection/settings	Explanation
Input 1 [SelInp1]	No function [0] Contr_PV [1] Setpoint [2] Ramp [3] AnIn1_Meas [4] AnIn2_Meas [5] Contr_Out1 [6] Contr_Out2 [7] Extern_In [8] Maths [9]	Input value 1 with “No function” the input value is 0
Input 2 [SelInp2]	No function [0] Contr_PV [1] Setpoint [2] Ramp [3] AnIn1_Meas [4] AnIn2_Meas [5] Contr_Out1 [6] Contr_Out2 [7] Extern_In [8] Maths [9]	Input value 2 with “No function” the input value is 0
Function [Function]	Comparator [Comp] Window discriminator [WDis] Comparator reversed [CompRev] Window discriminator reversed [WDisRev]	Defines the function of the limit comparator.
Limit value [LimitVal]	-1999 to +9999 0.000	Defines the switching level(s) of the limit comparator.
Hysteresis (differential) [Hysteresis]	0 — 9999 1.000	Switching differential
Replacement value [ReplVal]	Off On	Switching state of the output in the event of faulty communication

= factory setting [ ] = display in the operating unit

Function The diagram shows the input and output signals of the function.



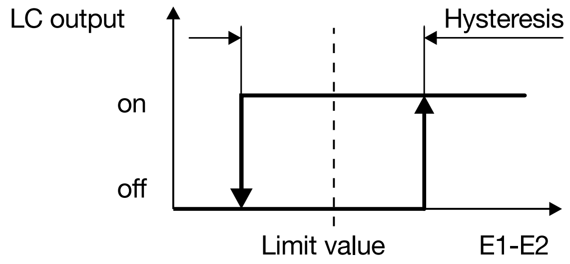
Block structure The block structure shows the internal processing of the signals and the influence of the parameters.



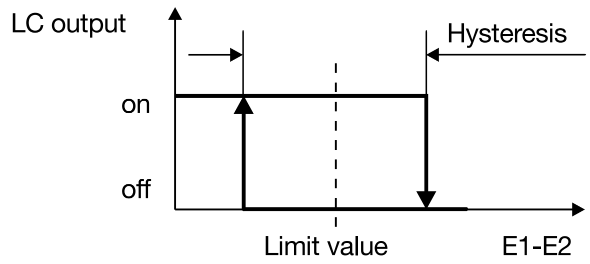
Limit comparator functions

A selection can be made between four different limit comparator functions.

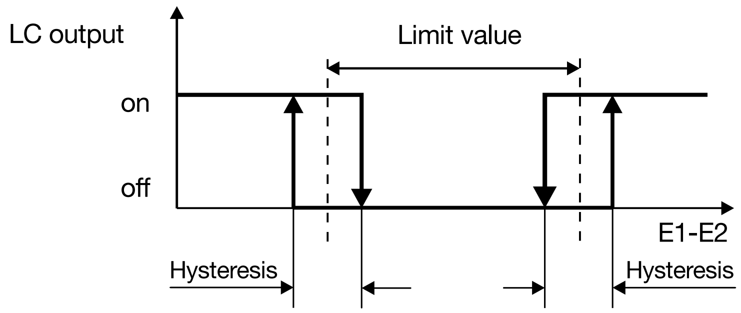
Comparator



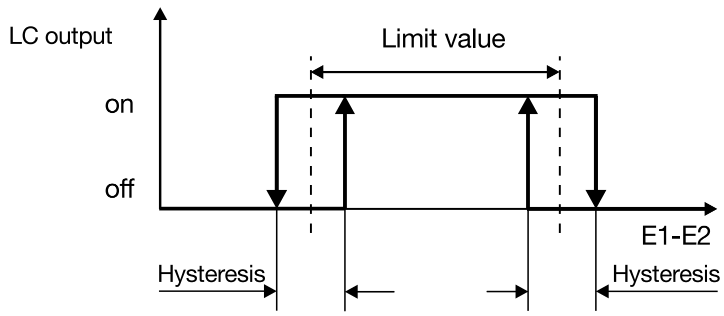
Comparator reversed



Window discriminator



Window discriminator reversed

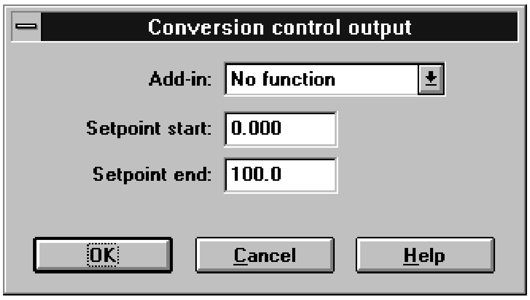


E1 - input 1
E2 - input 2

5.11 Control output conversion

This function is used to implement a cascade control.

Setup dialog



Parameters

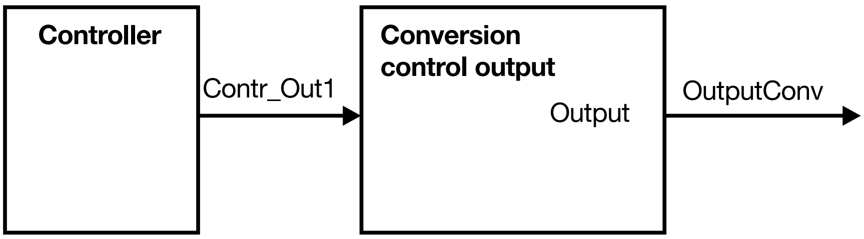
Parameter	Selection/settings	Explanation
Add-in [AddIn]	No function [NoFunct] (factory setting) Setpoint [Setpt] Process value [ProcVal]	The Add-in parameter has the effect that the setpoint or the actual value is added to the normalised control output of the master controller .
Setpoint start [SetptStart]	-1999 to +9999 0.000 (factory setting)	Output signal for 0% controller output
Setpoint end [SetptEnd]	-1999 to +9999 100.0 (factory setting)	Output signal for 100% controller output

= factory setting [Text] = display in the operating unit

Function

This function is used for the scaling of Controller Y1, so that a slave setpoint can be passed to a slave controller. The signal Add-in Y is output via the network.

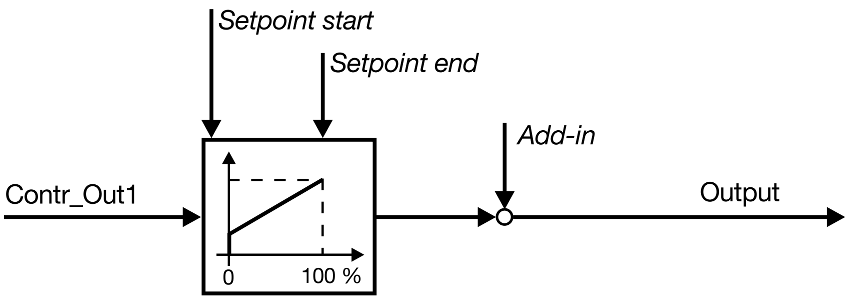
The diagram shows the input and output signals of the function.



With the default settings this function is the same as the signal from Controller Y1 for controlling actuators.

Block structure

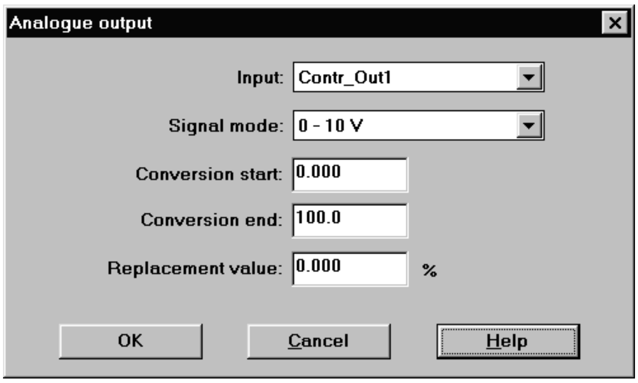
The block structure shows the internal processing of the signals and the influence of the parameters.



5.12 Analogue output

Input values are converted to physical output signals at the analogue output .

Setup dialog



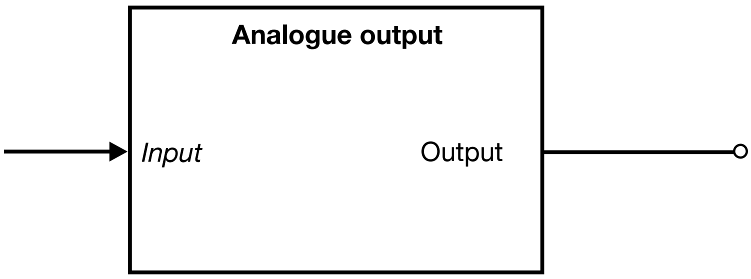
Parameters

Parameter	Selection/settings	Explanation
Input [SelInput]	Contr_Out1 Contr_Out2 AnIn1_Meas AnIn2_Meas AnOut_In Maths	Input signal
Signal mode [SignalMode]	0 — 20 mA [0/20mA] 4 — 20 mA [4/20mA] 0 — 10 V [0/10V] 2 — 10 V [2/10V]	Determines the physical output signal.
Conversion start [ConvStart]	-1999 to +9999 0.000	Input signal which corresponds to the lower range limit of the physical output signal.
Conversion end [ConvEnd]	-1999 to +9999 100.0	Input signal which corresponds to the upper range limit of the physical output signal.
Replacement value [ReplVal]	0 — 100.0 % 0.000 %	Output signal in fault condition.

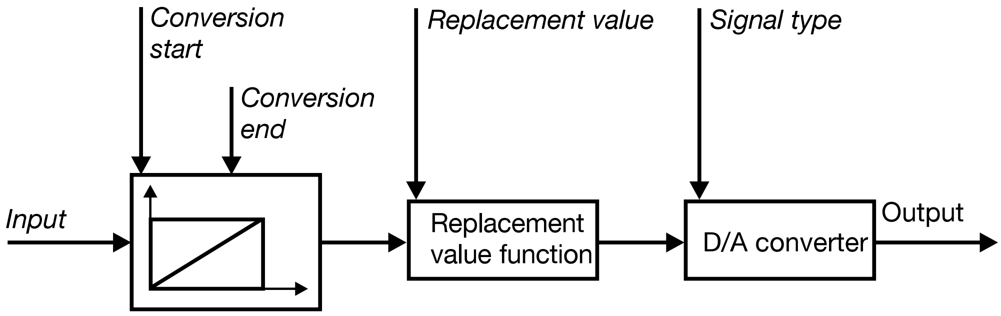
= factory setting [ ] = display in the operating unit

Function

The diagram shows the input and output signals of the function.



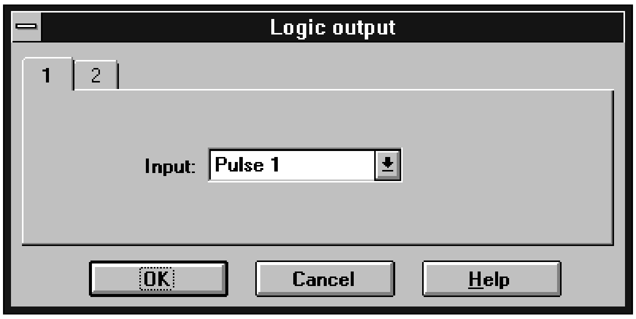
Block structure The block structure shows the internal processing of the signals and the influence of the parameters.



5.13 Logic output

Switching signals can be produced at two logic outputs.

Setup dialog



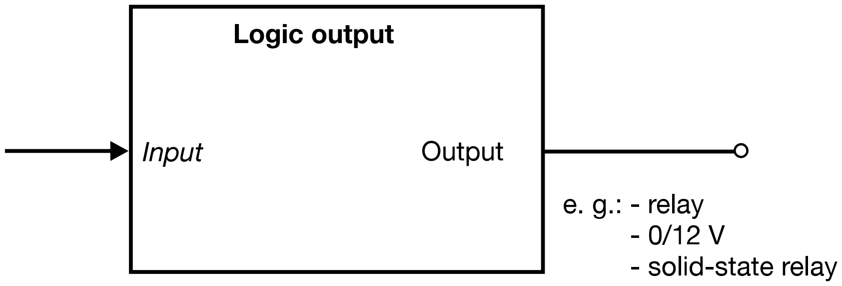
Parameter

Parameter	Selection/settings	Explanation
Input [SelInput]	Pulse 1 [0]	Signal source
	Pulse 2 [1]	
	LC [2]	
	LogOut_In [3]	

= factory setting [ ] = display in the operating unit

Function

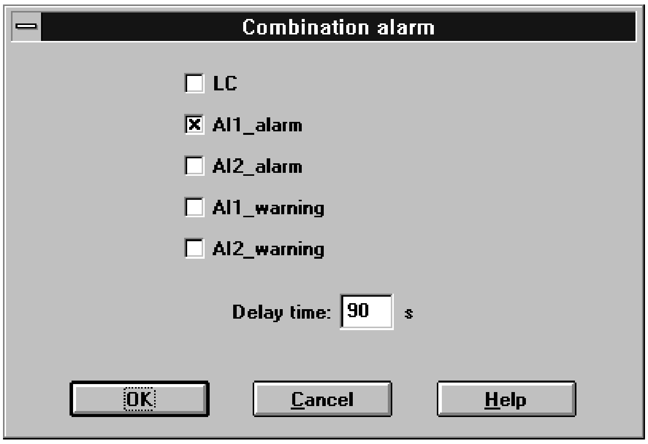
The diagram shows the input and output signals of the function.



5.14 Combination alarm

Various signals can be combined to produce a combination alarm.

Setup dialog



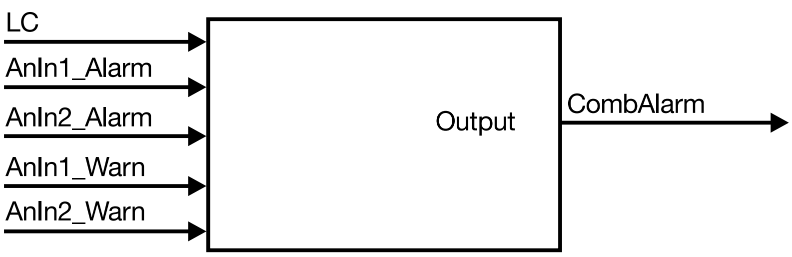
Parameters

Parameter	Selection / settings	Explanation
AnIn1_Alarm [ ]	trigger combination alarm [ ]	The alarms and warning alarms for the two measurement inputs and the limit comparator can trigger a combination alarm.
	no combination alarm	
AnIn2_Alarm [ ]	trigger combination alarm	
	no combination alarm	
AnIn1_Warn	trigger combination alarm	
	no combination alarm	
AnIn2_Warn	trigger combination alarm	
	no combination alarm	
LC [ ]	trigger combination alarm	
	no combination alarm	
Delay time	000...255 s	The combination alarm can be delayed by an adjustable time.
	90 s	

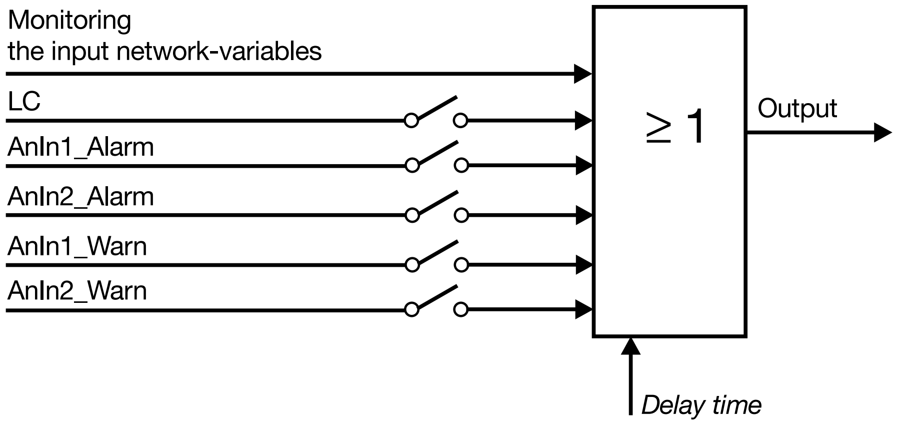
■ = factory setting

Function

The diagram shows the input and output signals of the function.



Block structure The block structure shows the internal processing of the signals and the influence of the parameters.



As well as the selectable network-variables, the input network-variables are checked for communication errors or an Out-of-Range (invalid value).
In both cases, error events will cause a combination alarm.

⇨ Section 6.2 “Response to faulty communication”

6.1 Action after a power failure

After a mains power failure, the module will continue to remain passive (logic/switching outputs = off, analogue output = 0, output network-variables inactive), until the measurement/signal inputs and input network-variables supply valid data (ca. 13sec).

6.2 Response to faulty communication

If the linked input network-variables are no longer being regularly updated, then these variables will be reset to their default values and a combination alarm will be output.

If the variables are assigned to a function, then the function will output the corresponding replacement value.

A

B

C

D

F

I

K

L

M

N

O

P

R

S

T

W

M. K. Juchheim GmbH & Co

36035 Fulda, Germany
Phone (0661) 6003 - 0
Fax (0661) 6003 - 607
Telex 49 701 juf d
email JUMO_de@e-mail.com

UK
Jumo Instrument Co. Ltd.
Temple Bank, Riverway
Harlow, Essex CM20 2TT
Phone (01279) 63 55 33
Fax (01279) 63 52 62

USA
Jumo Process Control Inc.
735 Fox Chase
Coatesville, PA 19320
Phone 610 - 380 - 8002
800 - 554 JUMO
Fax 610 - 380 - 8009

MEASUREMENT AND CONTROL

for stock items see price list

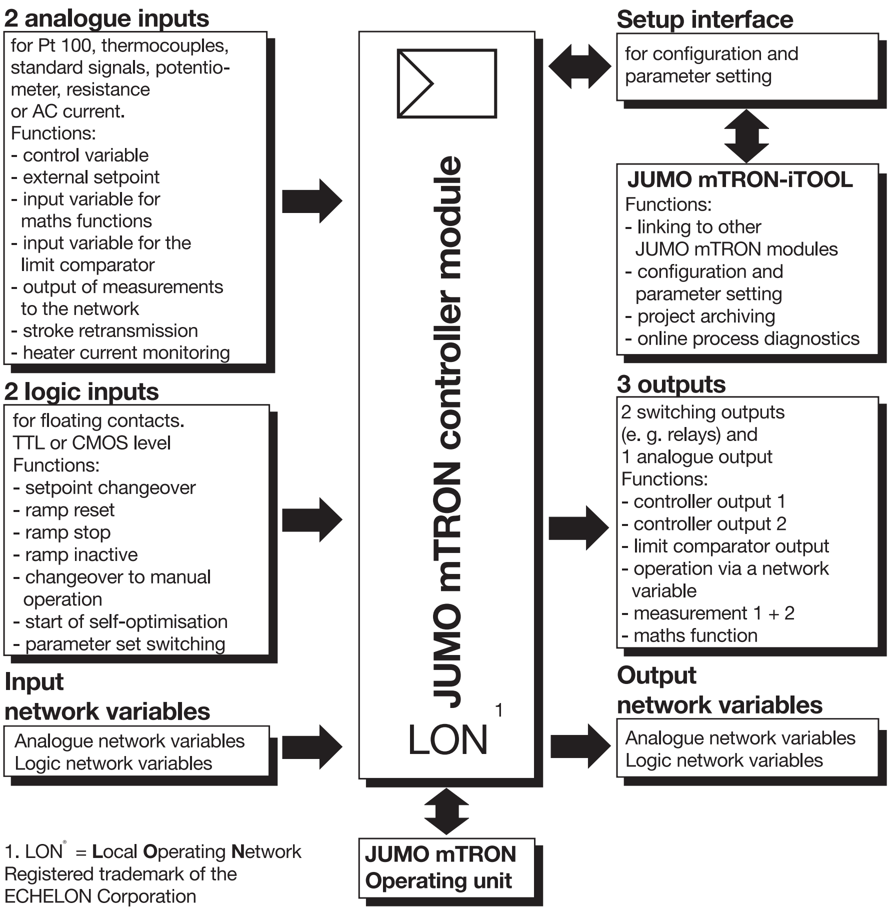
JUMO mTRON Controller module

Brief description

The unit is a module of the JUMO mTRON control and automation system. The plastic housing measures 91 mm x 85.5 mm x 73.5 mm (W x H x D) and is mounted on a standard rail.
Using the function blocks ramp, maths, controller and limit comparator, it is possible to build up a great variety of automation structures. Each of the analogue inputs is monitored against adjustable limit values. In addition to four definable setpoints the memory stores two controller parameter sets. A fully developed auto-tuning function automatically adapts the controller to the characteristics of the process.
In addition to two logic inputs there are 2 analogue inputs for standard signals, Pt100 and thermocouples. There are 2 switching outputs and one analogue output. The analogue inputs and the analogue output can be configured without hardware changes. The controller module incorporates a network connection for data interchange.
A screened twisted pair is used as transmission line. There is a setup interface for module parameter setting and configuration from a PC under the JUMO mTRON-iTOOL project design software. The electrical connections are made through plug-in connectors with screw terminals.

Type 704010/0-...

Block structure



1. LON® = **L**ocal **O**perating **N**etwork
Registered trademark of the ECHELON Corporation

Features

- **Maths functions**
  Difference, humidity, ratio, square root, square, minimum, maximum, absolute value, sum, product, mean value
- **Ramp function**
  Setpoint ramp for a time-defined approach of the process to the setpoint
- **Limit comparator**
  Comparator and window functions, direct or reversed
- **Switching setpoint/parameter set**
  Facility for switching between 4 setpoints and 2 controller parameter sets through logic inputs and network variables.
- **Range monitor**
  The analogue inputs are monitored against defined limit values
- **Cascade output**
  Conversion of the setpoint input for an external slave controller
- **Setup interface**
  For configuration and setting of parameters, the module is linked to a PC via a PC interface
- **Plug & Play function**
  Problem-free replacement of modules without re-configuration

8.99/00336359

Technical data

Hardware inputs

Analogue inputs

Measurement input

- resistance thermometer
- thermocouples
- standard signals (current/voltage)
- AC current (50/60Hz sinusoidal)
- resistance
- potentiometer

Sampling time

420msec for all inputs

Functions

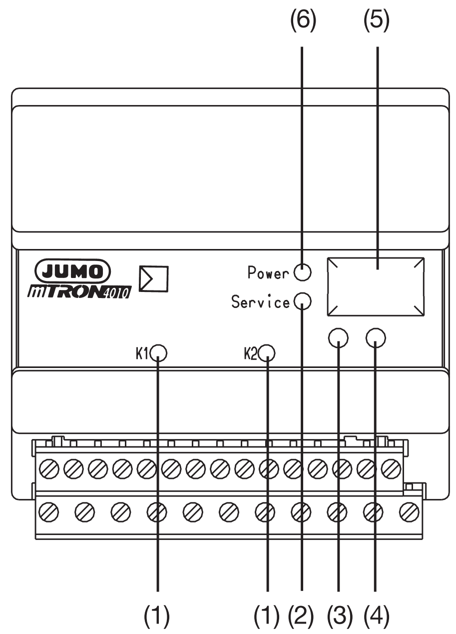
- control variable
- limit comparator
- maths function
- network output
- external setpoint
- heater current monitoring
- stroke retransmission
- analogue output

Sensor	Measurement range[1]	Internal resistance/ voltage drop	Measurement circuit monitoring		Resolution	Measurement accuracy	
			Recognition of sensor break	Recognition of sensor short-circuit		Maximum measure-ment error[1] at 23°C	Ambient temperature drift per 10°C
Pt 100	–200 to +850°C (–200 to +850°C)		X	X	0.025°C	± 0.4°C	± 0.21°C
Fe-Con L	–200 to +900°C (–200 to +900°C)	47MΩ	X	–	0.05°C	± 1.8°C	± 0.9°C
Fe-Con J	–200 to +1200°C (–100 to +1200°C)	47MΩ	X	–	0.05°C	± 1.8°C	± 1.2°C
NiCr-Ni K	–200 to +1372°C (–100 to +1372°C)	47MΩ	X	–	0.07°C	± 1.9°C	± 1.4°C
Cu-Con U	–200 to +600°C (–100 to +600°C)	47MΩ	X	–	0.07°C	± 1.7°C	± 0.6°C
Cu-Con T	–200 to +400°C (–200 to +400°C)	47MΩ	X	–	0.07°C	± 1.6°C	± 0.4°C
NiCrSi-NiSi N	–100 to +1300°C (–100 to +1300°C)	47MΩ	X	–	0.07°C	± 2.3°C	± 1.3°C
Pt10Rh-Pt S	0 — 1768°C (100 — 1768°C)	47MΩ	X	–	0.3°C	± 3.4°C	± 1.7°C
Pt13Rh-Pt R	0 — 1768°C (100 — 1768°C)	47MΩ	X	–	0.25°C	± 3.4°C	± 1.7°C
Pt30Rh-Pt6Rh B	0 — 1820°C (400 — 1820°C)	47MΩ	X	–	0.3°C	± 4.4°C	± 1.4°C
Standard signals	–50 to +50mV	47MΩ	X	–	2.5μV	± 0.04mV	± 0.05mV
Standard signals	0 — 50mV	47MΩ	X	–	2.5μV	± 0.04mV	± 0.05mV
Standard signals	10 — 50mV	47MΩ	X	X	2.5μV	± 0.04mV	± 0.05mV
Standard signals	–10 to +10V	2MΩ	–	–	500μV	± 8mV	± 15mV
Standard signals	0 — 10V	2MΩ	–	–	500μV	± 8mV	± 15mV
Standard signals	2 — 10V	2MΩ	X	X	500μV	± 8mV	± 15mV
Standard signals	–1 to +1V	2MΩ	–	–	50μV	± 0.8mV	± 1.5mV
Standard signals	0 — 1V	2MΩ	–	–	50μV	± 0.8mV	± 1.5mV
Standard signals	0.2 — 1V	2MΩ	X	X	50μV	± 0.8 mV	± 1.5mV
Standard signals	0 — 20mA	less than 1V	–	–	1μA	± 15μA	± 30μA
Standard signals	4 — 20mA	less than 1V	X	X	1μA	± 15μA	± 30μA
AC current	0 — 50mA	less than 1V	–	–	5μA	1mA	± 100μA
Resistance	0 — 400Ω		X	X	0.01Ω	± 0.15Ω	±0.1Ω
Potentiometer	0.1 — 10KΩ		X (slider)	–	0.01%	0.25%	0.1%

X: recognized –: not recognized

1. The accuracy given refers to the ranges given in brackets. With thermocouples, the accuracy is obtained only in the specified operating position and after an operating time of at least 1 hour.

Displays and controls



(1)	**Status LED, yellow** for the logic outputs K1 and K2; lights up when relay is energised or logic output is activated	(4)	**Installation key** the module reports to the JUMO mTRON-iTOOL project design software or the operating unit
(2)	**Service LED, red** - lights up on operating fault - flashes when the mechanical connection to the module from JUMO mTRON-iTOOL or the operating unit is being checked by a test signal (“wink”). - long flashing pulses (3 sec on, 1 sec off) when a Plug & Play fault occurs	(5)	**Setup interface** for the PC interface line which links the module to the PC
(3)	**Switch** for the termination resistance of the LON network	(6)	**Power LED, green** lights up when the supply is switched on

Logic inputs

activation: floating contacts,
TTL or CMOS level

Functions:
- setpoint selection
- ramp reset
- ramp stop
- ramp inactive
- changeover to manual operation
- start autotuning
- parameter set switching

Hardware outputs

Analogue output

Signal	Burden
0 — 10V	500Ω min.
2 —10V	500Ω min.
0 — 20mA	500Ω max.
4 — 20mA	500Ω max.

Accuracy: 0.25 %
Resolution: 16 bit

Functions:
- controller output 1 or 2
- output of a maths function
- output of a network variable
- output of a measurement value of the analogue inputs

Switching outputs

Functions:
- controller output 1 or 2
- limit comparator output
- output of a network variable

Relay outputs
Type: changeover contact
Nominal voltage: 250V
Nominal current: 3A
Contact rating: 3A, 250V AC
resistive load
Life: $5 \cdot 10^5$ operations
on resistive load
Contact material: AgCdO (hard gold plated)
Contact protection circuit:
Varistor (make contact only)
Minimum load: 10mA 5V DC

Solid-state relay output
Type: 1A 250V AC
Overvoltage protection: varistor

Logic output
Type: 0/12V
internal resistance: 600Ω

Input network variables

Analogue network variables

Functions:
- external setpoint
- maths function
- ramp start
- external control variable
- stroke retransmission
- manual control output
- additive disturbance
- multiplying disturbance
- analogue output

Logic network variables

Functions:
- setpoint selection
- ramp reset
- ramp stop
- ramp inactive
- changeover to manual operation
- start of self-optimisation
- parameter set switching
- direct operation of the relays

Output network variables

Analogue network variables

Output cycle:
420msec — 8.4sec, adjustable

Functions:
- measurement analogue input 1
- measurement analogue input 2
- process variable
- setpoint
- setpoint output for slave controller (cascade control)
- controller analogue output 1
- controller analogue output 2

Logic network variables

Output cycle: controlled by event,
but at least every 6sec

Functions:
- limit comparator output
- monitoring the analogue inputs
- monitoring function for the network inputs (combined alarm)

Controller structures

Controller type	Controller structure
1-setpoint controller	P, I, PI, PD, PID
2-setpoint controller	P, I, PI, PD PID
Proportional controller.	P, I, PI, PD, PID
Modulating controller	PI, PID
Proportional controller with integral actuator driver	P, I, PI, PD, PID

General data

Environmental conditions to EN 61 010

Operating and ambient temperature:
0 — 55°C
Permitted storage temperature:
–40 to +70°C
Relative humidity: rH 80 % max.
Pollution degree 2
Overvoltage category 2

Housing

Material: plastic,
self-extinguishing
Flammability Class: UL 94 VO
Protection: IP20 (to EN 60 529)
Mounting: on standard rail

Supply

110 — 240 V AC, +10/–15%, 48 —63 Hz,
or 20 — 53 V AC/DC, 48 — 63 Hz
Power consumption: 5 VA max.

Network (LON interface)

Transceiver: free topology FTT-10A
Topology: ring, star, line or
mixed structure
Baud rate: 78 kbaud
Max. lead length (depending on lead type):

line:	2700 m
star:	500 m
ring:	500 m
mixed:	500 m

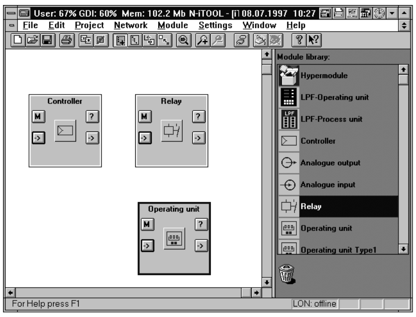
Max. number of modules: 64

Operation and project design

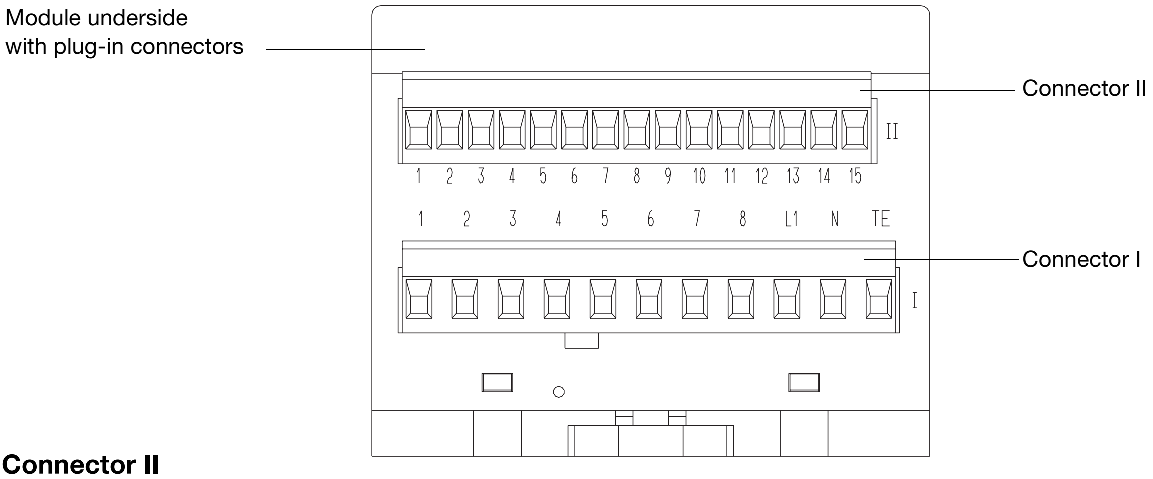
Operation, parameter setting and configuration of JUMO mTRON modules can be carried out from the JUMO mTRON operating unit.

The JUMO mTRON-iTOOL project design software permits convenient design and start-up of a JUMO mTRON system.

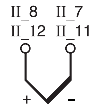
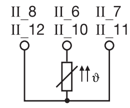
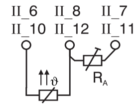
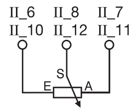
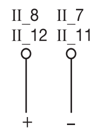
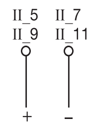
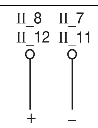
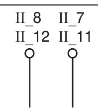
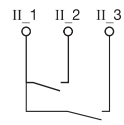
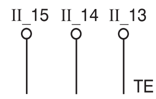
The projects can be archived and documented. Individual modules are linked via LON by assigning network variable (NV) names.



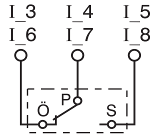
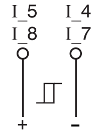
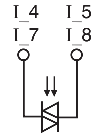
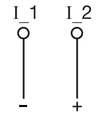
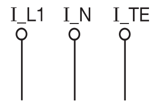
Connection diagram



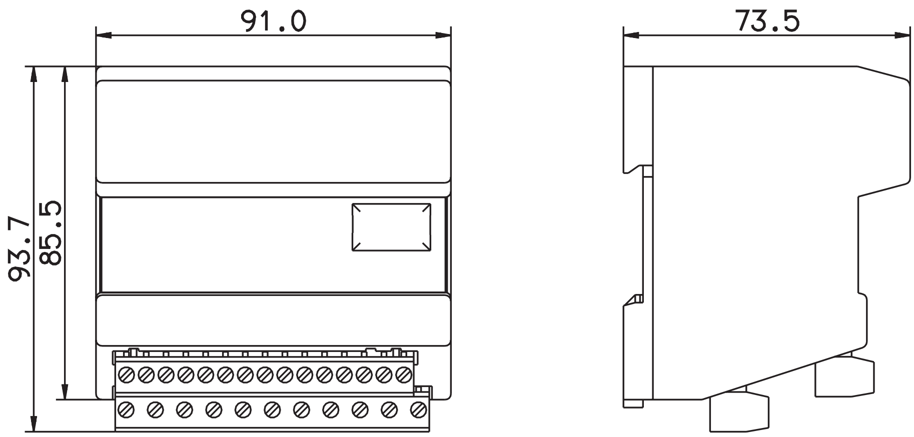
Connector II

Connection for	Terminals			Notes	Diagram
Analogue inputs	**Input 1**	**Input 2**			
Thermocouple	II_8+ II_7–	II_12+ II_11–			
Resistance thermometer in 3-wire circuit	II_8 II_6 II_7	II_12 II_10 II_11			
Resistance thermometer in 2-wire circuit	II_6 II_8 II_7	II_10 II_12 II_11		R_A=R_{lead}	
Potentiometer	II_6 II_8 II_7	II_10 II_12 II_11		E=end S=slider A=start	
Voltage input –50 to +50mV	II_8+ II_7–	II_12+ II_11–			
Voltage input –1 to + 1V –10 to +10V	II_5+ II_7–	II_9+ II_11–			
Current input 0 — 20mA	II_8+ II_7–	II_12+ II_11–			
AC current input 0 — 50mA	II_8 II_7	II_12 II_11			
Logic inputs floating contact	II_1 II_2	II_1 II_3			
LON interface	II_13 = TE			screen	
	II_14 = Net_A II_15 = Net_B			any polarity	
Technical earth	II_4				

Connector I

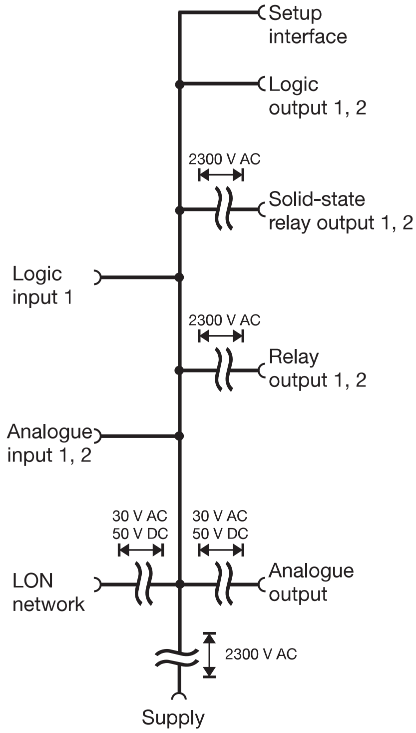
Connection for	Terminals			Notes	Diagram
Outputs	**Output 1**	**Output 2**	**Output 3**		
Relay output 3A 250VAC, resistive load	I_3 I_4 I_5	I_6 I_7 I_8		O=n.c.(break) P=common S=n.o. (make)	
Logic output 12V 20mA	I_5 + I_4 –	I_8 + I_7 –			
Solid-state relay output 250V 1A	I_4 I_5	I_7 I_8			
Analogue output 0 — 10V/ 2 — 10V 0 — 20mA/ 4 — 20mA			I_1 – I_2 +		
Supply as label	**AC**	**DC**			
	I_L1 line I_N neutral I_TE technical earth	I_L1 } any I_N } polarity I_TE technical earth			

Dimensions



mm	inch
73.5	2.89
85.5	3.37
91.0	3.58
93.7	3.69

Isolation



Ordering details

(1) (2) (3)

704010/0- ... - ... - ..

(1) Inputs

Standard version 888

Measurement input	Inputs 1	Inputs 2
Pt 100 resistance thermometer	X	X
Thermocouples Fe-Con L Fe-Con J NiCr-Ni K Cu-Con U Cu-Con T NiCrSi-NiSi N Pt10Rh-Pt S Pt13Rh-Pt R Pt30Rh-Pt6Rh B		
Standard signals 0 — 50 mV 10 — 50 mV –50 to +50 mV 0 — 1 V 0.2 — 1 V –1 to +1 V 0 — 10 V 2 — 10 V –10 to +10 V 0 — 20 mA 4 — 20 mA –20 to +20 mA		
AC current 0 — 50mA		
Resistance 0 — 400Ω		
Potentiometer 0.1 — 10KΩ		

Special version 999
Factory configured to customer specification. Please specify inputs in plain language.

(2) Outputs ....

Outputs	Code
2 relays (changeover) and 1 analogue output[1] (selectable)	**302**
2 logic outputs 12V 20mA and 1 analogue output[1] (selectable)	**304**
2 solid-state relay outputs 250V 1A and 1 analogue output[1]	**305**

1. analogue outputs:

0 — 10V	
2 — 10V	
0 — 20mA	X
4 — 20mA	

Special version 999
Factory configured to customer specification. Please specify outputs in plain language.

X = factory-set, freely programmable

8.99/00336359

(3) Supply.................................. . .

Type	Code
110 — 240V AC +10/–15%, 48 — 63Hz	**23**
20 — 53V AC/DC, 48 — 63Hz	**22**

Standard accessory

1 Installation Instructions M 70.4010

Accessories

PC interface
with TTL/RS232C converter
for connecting the module to a PC; length 2m.
Sales No. 70/00301315

Project design software
JUMO mTRON-iTOOL
Using the JUMO mTRON- iTOOL project design software the modules can be designed graphically on the PC. The user is able to link modules of the JUMO mTRON family and to configure the application-specific parameters.

System Manual JUMO mTRON
Documentation of configuration, parameter setting and installation of the modules.
Sales No. 70/00334336

JUMO mTRON modules

Controller module
Data Sheet 70.4010

Relay module
Data Sheet 70.4015

Analogue input module
Data Sheet 70.4020

Analogue output module
Data Sheet 70.4025

Logic module
Data Sheet 70.4030

Operating unit
Data Sheet 70.4035

Communication module
Data Sheet 70.4040

Project design software
JUMO mTRON-iTOOL
Data Sheet 70.4090