JUMO dTRON 16.1

Compact microprocessor controller

B 70.3011
Operating Manual

04.04/00346816

Please read this Manual carefully before starting up the instrument. Keep this Manual in a place which is at all times accessible to all users. Please assist us to improve this Manual where necessary. Your suggestions will be most welcome.

All necessary settings are described in this Operating Manual. If any difficulties should still arise during start-up, you are asked not to carry out any manipulations on the unit which are not permitted. You could endanger your rights under the warranty. Please contact the nearest office or the main factory.

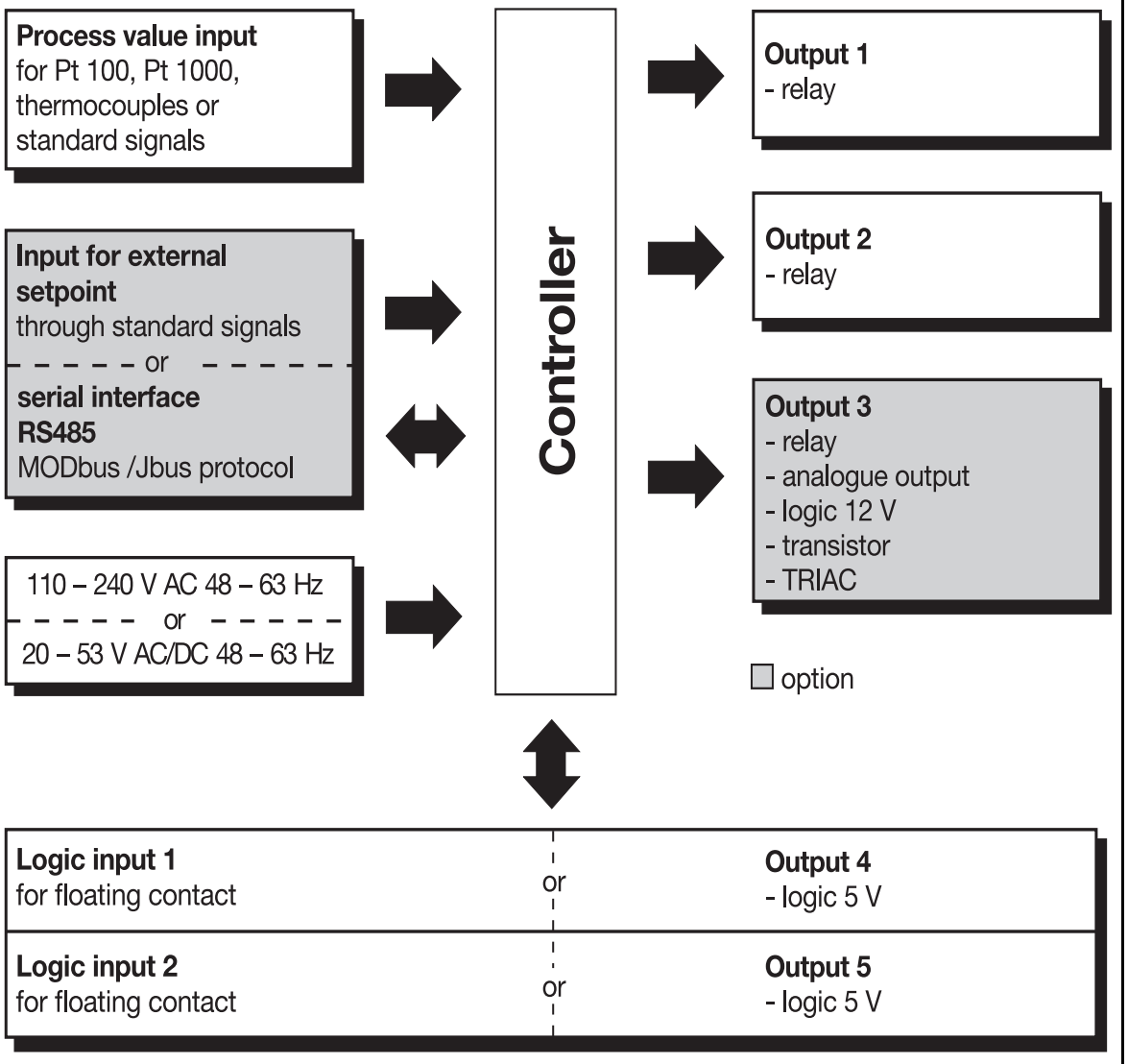
When returning chassis, assemblies or components, the rules of EN 100 015 “Protection of electrostatically endangered components” have to be observed. Use only the appropriate ESD packaging material for transport.

Please note that we can not be held liable for any damages caused by ESD (electrostatic discharges).

Contents

1 Description

- Programmable single/double setpoint controller or proportional controller with PID structure.
- Self-optimisation
- Ramp function
- Programme function
- Programmable input filter
- 2 limit comparators
- 5 outputs with freely assigned functions
- Process value output
- 2 setpoints with setpoint switching
- 2 parameter sets with parameter set switching



2 Identifying the instrument version

Basic type (1) (2) (3) (4) (5) (6)

703011/ [..] – [...] – [...] – [...] – [..] / [...]

(1) Controller function	Code
Single-setpoint controller, O function (relay de-energised above setpoint)	10
Single-setpoint controller, S function (relay de-energised below setpoint)	11
Double-setpoint controller switching/switching analogue/switching switching/analogue	3 . . 0 . 1 . 2
Proportional controller falling characeristic (reverse action) rising characteristic (direct action)	5 . . 0 . 1

(2) Process value input	Code
Pt 100	001
Pt 1000	006
Fe-Con J	040
Cu-Con U	041
Fe-Con L	042
NiCr-Ni K	043
Pt10Rh-Pt S	044

(2) Process value input (continued)	Code
Pt13Rh-Pt R	045
Pt30Rh-Pt6Rh B	046
NiCrSi-NiSi N	048
Linearised transducers	
0 — 20mA	052
4 — 20mA	053
0 —10V	063
2 — 10V	071

(3) Input for external setpoint/ interface (option)	Code
not used	000
Interface RS485, isolated	053
External setpoint 0 — 20mA 4 — 20mA 0 — 10V 2 — 10V	11 . . . 1 . . 2 . . 7 . . 8

(4) Output 3 (option)	Code
not used	000
Relay	101
Logic output 0/12V	113
Analogue output/process value output 0 — 20mA 4 — 20mA 0 — 10V 2 — 10V	 001 005 065 070
Transistor output 30V DC 50mA	106
TRIAC output 230V AC 1A	107

(5) Supply	Code
110 — 240V +10/-15% AC 48 — 63Hz	23
20 — 53V AC/DC 48 — 63Hz	22

(6) Extra Codes	Code
no extra Code	000
UL approval	061

Delivery package:

- controller
- 1 seal
- 1 mounting frame
- Operating Manual B70.3011

Factory assignment of outputs	Output				
on	1	2	3	4	5
Single-setpoint controller (O function)	H	X	—	X	X
Single-setpoint controller (S function)	X	C	—	X	X
Double-setpoint controller (switching/switching)	H	C	—	X	X
Double-setpoint controlller (analogue/switching)	X	C	H	X	X
Double-setpoint controller (switching/analogue)	H	X	C	X	X
Proportional controller (falling characteristic, indirect action)	X	X	H	X	X
Proportional controller (rising characteristic, direct action)	X	X	C	X	X

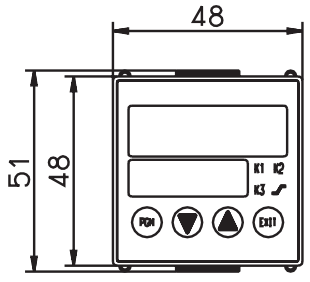
H -heating contact
C - cooling contact
lk1 - limit comparator 1
lk2 - limit comparator 2
X - no function
— - not available

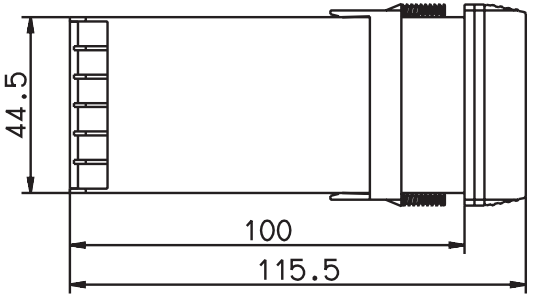
In principle, the outputs can be freely assigned through configuration codes.
Outputs 4 and 5 are normally logic outputs (0/5V).

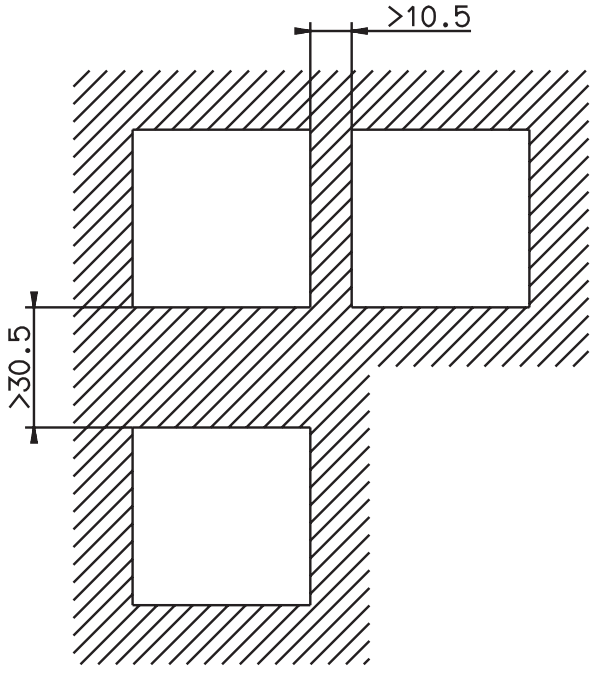
mm	inch
10.5	0.41
30.5	1.20
44.5	1.75
$45^{+0.5}$	$1.77^{+0.02}$
48	1.89
51	2.01
100	3.93
115.5	4.55

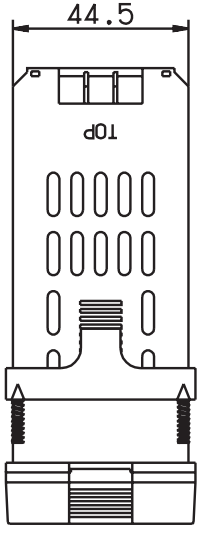
3 Installation

3.1 Dimensions

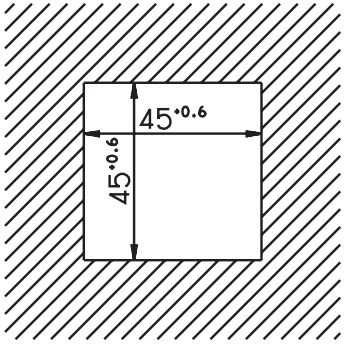






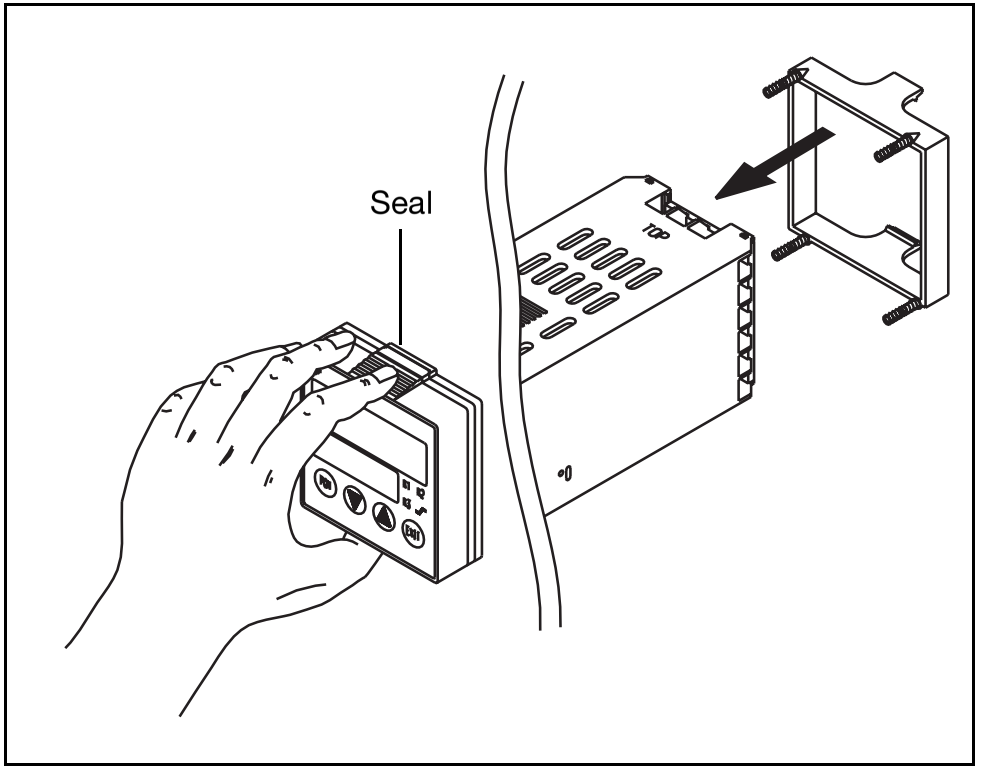


panel cut-out
to DIN 43 700



3.2 Fitting in position and removing the controller chassis

* Fit the seal provided onto the instrument housing
* Insert the controller from the front into the panel cut-out.
* From the back of the panel, push the mounting frame onto the instrument housing and press it against the back of the panel, compressing the springs, until the latches snap into the notches provided and it is securely fixed in position.
* Press together the knurled areas (top and bottom) on the front panel and pull out the controller chassis.



3.3 Cleaning the front panel

The front panel can be cleaned with the usual wash and rinse agents and cleaners. It has a limited degree of resistance to organic solvents (e. g. petrol, benzene, P1, xylene and similar). Do not use any high-pressure cleaners.

4 Electrical connection

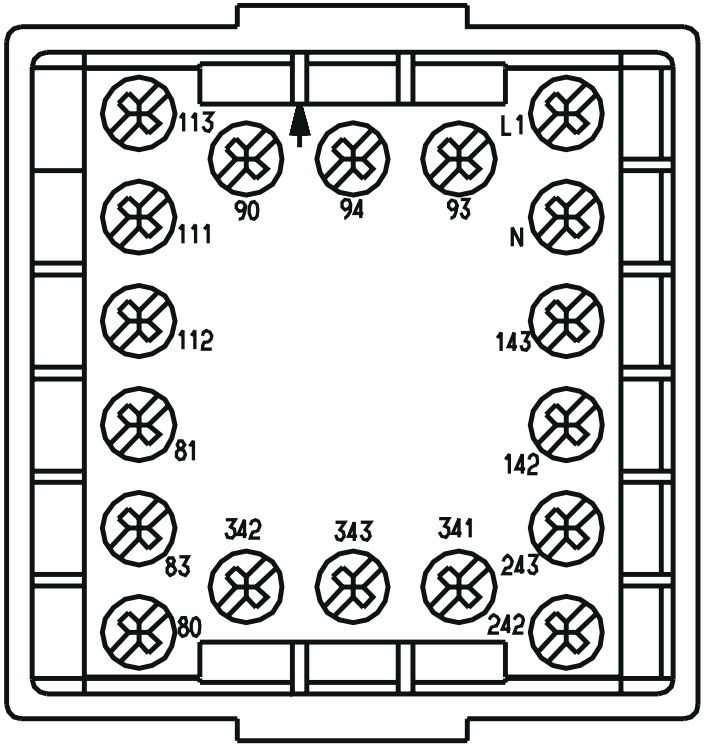
4.1 Notes on installation

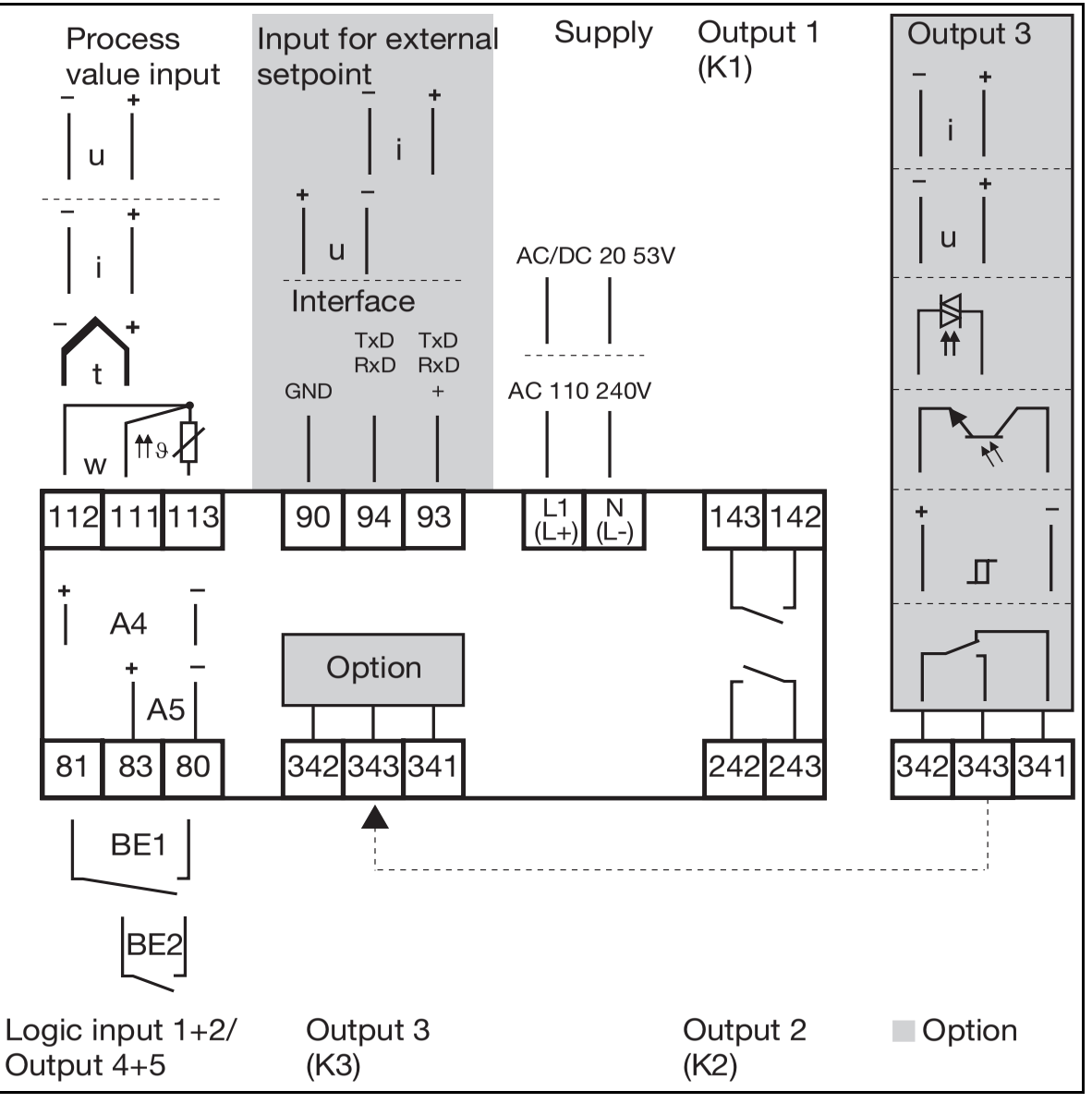
- The choice of cable, the installation and the electrical connection must conform to the requirements of VDE 0100 “Regulations on the Installation of Power Circuits with nominal voltages below 1000V” or the appropriate local regulations.
- The electrical connection must only be carried out by properly qualified personnel.
- If contact with live parts is possible when working on the instrument, it has to be isolated on both poles from the supply.
- A current limiting resistor interrupts the supply circuit in case of a short-circuit. The external fuse of the supply should not be rated above 1A (slow). The load circuit must be fused for the maximum relay current in order to prevent welding of the output relay contacts in case of an external short-circuit.
- Electromagnetic compatibility conforms to the standards and regulations listed under Technical Data.
- Run input, output and supply lines separately and not parallel to each other.

- Sensor and interface lines should be arranged as twisted and screened cables.
  Do not run them close to current-carrying components or cables.
- Do not connect any additional loads to the supply terminal of the instrument.
- The instrument is not suitable for installation in hazardous areas.
- Apart from faulty installation, there is a possibility of interference or damage to controlled processes due to incorrect settings on the controller (setpoint, data of parameter and configuration levels, internal adjustments). Safety devices independent of the controller, such as overpressure valves or temperature limiters/monitors, should always be provided and should be capable of adjustment only by specialist personnel. Please refer to the appropriate safety regulations in this connection. Since auto-tuning (self-optimisation) can not be expected to handle all possible control loops there is a theoretical possibility of unstable parameter settings. The resulting process value should therefore be monitored for its stability.
- All input and output cables without connection to the mains supply must be arranged as twisted and screened cables.
  Ground the screen on the instrument side to the potential earth.

4.2 Connection diagram

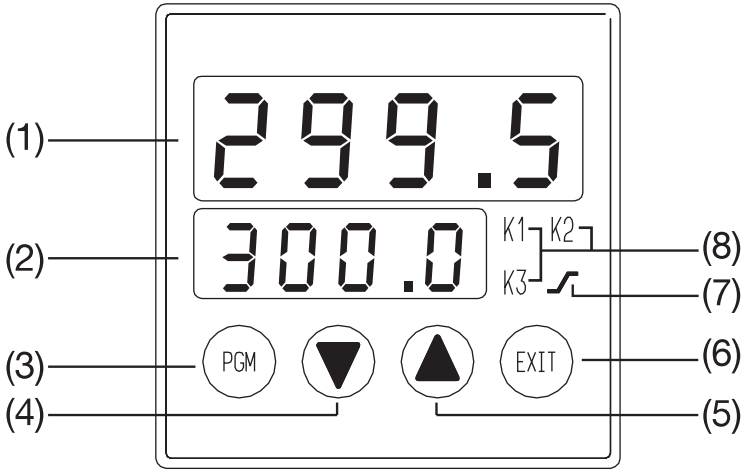
The electrical connection must only be made by properly qualified personnel.





5 Operation

5.1 Displays and keys



(1)	**Process value display** red, 10mm, 4 digits
(2)	**Setpoint display** green, 7mm, 4 digits
(3)	**PGM key** to select the parameters
(4)	**Decrement key** to alter values
(5)	**Increment key** to alter values
(6)	**EXIT key** to quit the levels
(7)	**LED for ramp/programme function** lights up when configured; green
(8)	**LED for status indication** for outputs 1 to 3; yellow

5.2 Principle of operation

Generally, the following applies:

* Change to the next level with PGM (Press key for at least 2 sec!)
* Change to the next parameter with PGM
* Return to standard display with EXIT

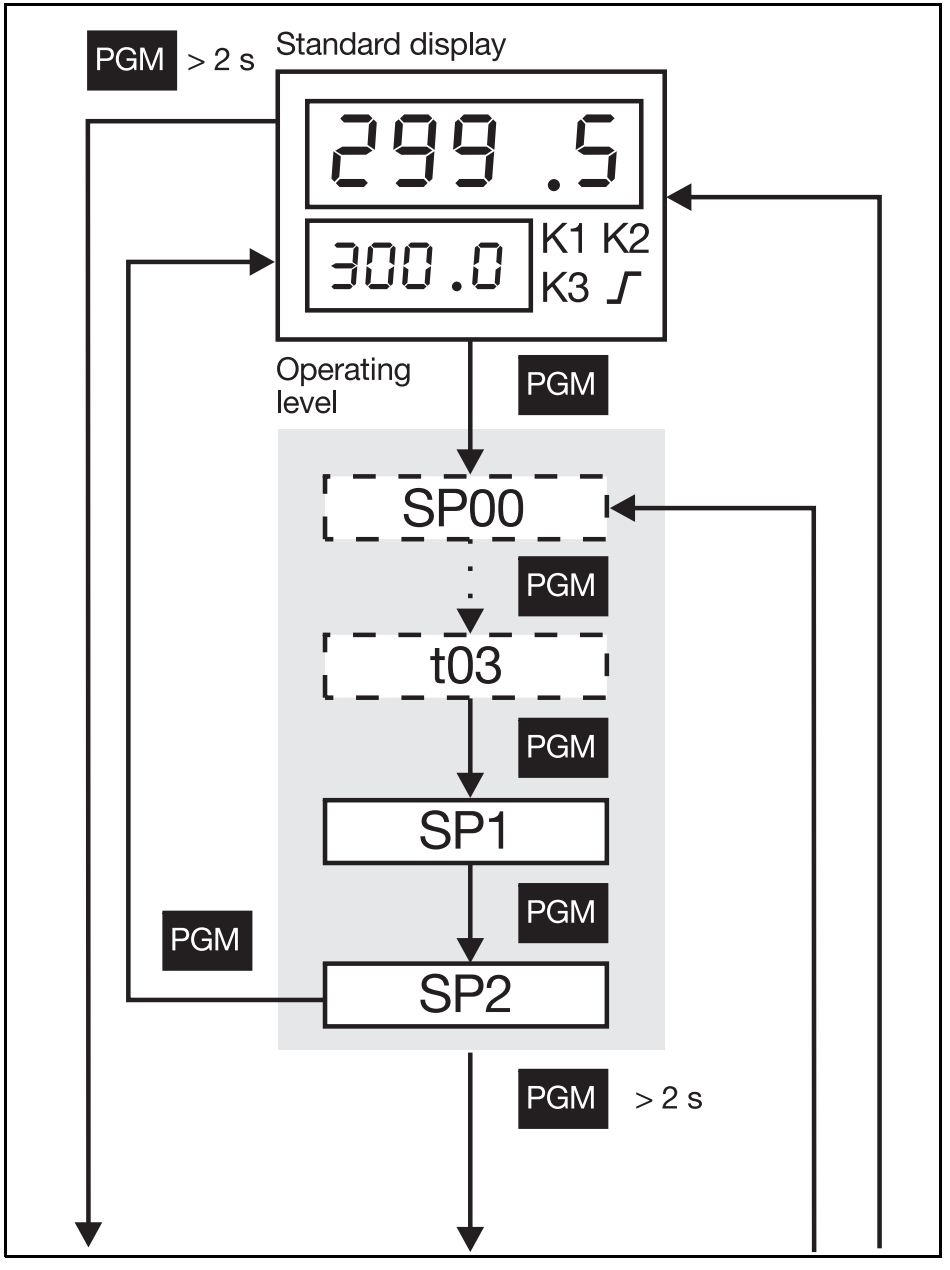
Standard display

The displays show the process value and the active setpoint or the programme/ramp setpoint. The active setpoint can be changed here.

⇨ Section 5.3

Operating level

Here the setpoints SP1 and SP2 are input and the profile segments of the programme function are programmed (if the programme function is configured).



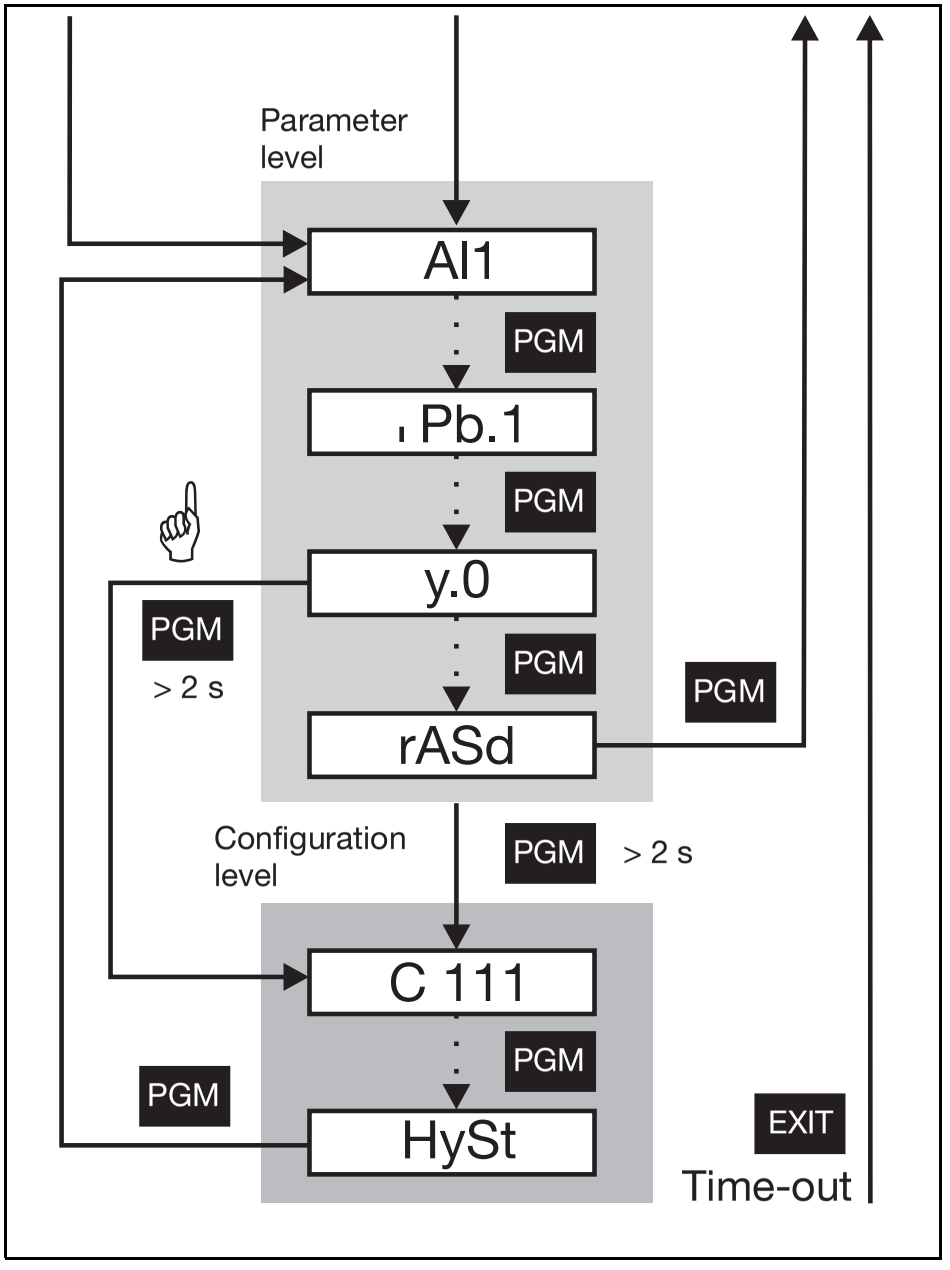
Parameter level
The limit values of the limit comparators and the controller parameters are programmed here.
The instrument has two parameter sets. Display switching of the parameter sets is via parameter Pb.1.

⇨ Section 6.4

Configuration level
The basic functions of the controller are set here.

Settings can only be made after leaving the parameter level via the y.0 parameter.

Time-out
If no operation occurs, the controller returns automatically to standard display after approx. 30 sec.



5.3 Entering setpoints and parameters

Parameters and setpoints are input and altered by continually altering the value. The change speeds up the longer the key is held down.

* Increase the setpoint (parameter) with ▲
* Decrease the setpoint (parameter) with ▼

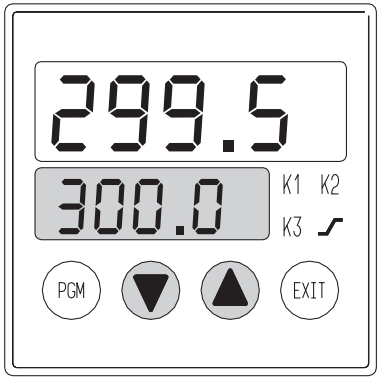
The setpoint (parameter) is accepted automatically after approx. 2 sec; display flashes briefly

* Abort the input with EXIT

The value alters only within the permitted range of values.

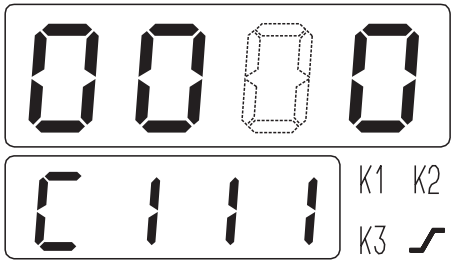
⇨ Section 6.2 (setpoint limits)

Example: Altering the setpoint in standard display



5.4 Entering the configuration codes

* Select the digit with ▼ (digit flashes!)
* Alter the value with ▲
* Confirm the code with PGM
  or
  abort the input with EXIT



6 Configuration

The following sections describe the functions of the instrument with their relevant parameters and settings.

The parameter and the configuration codes are listed in the sequence in which they appear within the level structure. The following procedure is however recommended:

- ✱ Familiarise yourself with the controller functions
- ✱ Enter the parameter values and the configuration codes in the table provided for this purpose on the back cover. The parameters and configuration codes are listed in the order of their appearance.
- ✱ Enter the parameters and configuration codes into the instrument

Presentation

The configuration codes have 4 positions. For functionally relevant positions, the kind of function and its selection possibility is described in the appropriate column. Positions which are not relevant for the function are marked with an “X” in the column.

For the experienced user, the parameters and configuration codes are summarised in the tables which are provided in the Appendix.

⇨ Section 7.1

6.1 Process value input

The process variable is fed into the controller via the process value input.

Parameter	Value range	factory-set	Notes
dF	0.0—100.0 sec	0.6 sec	Filter time constant to adapt the digital input filter (0 sec = filter off)

C111	Transducer		X	X	X
	Pt 100	0			
	Pt 1000	1			
	Fe-Con L	2			
	NiCr-Ni K	3			
	Pt10Rh-Pt S	4			
	Pt13Rh-Pt R	5			
	Pt30Rh-Pt B	6			
	Cu-Con U	7			
	NiCrSi-NiSi N	8			
	Fe-Con J	9			
	Standard signal 0 — 20 mA / 0 — 10 V (note the instrument version!)	A			
	Standard signal 4 — 20 mA / 2 — 10 V (note the instrument version!)	b			

= factory setting X = position functionally not relevant

<table>
<tr><th>Parameter</th><th>Value range</th><th>factory-set</th><th>Notes</th></tr>
<tr><td>SCL</td><td>-1999 to +9999 digit[1]</td><td>0</td><td rowspan="2">Start/end of value range for standard signals
Example: 0—20 mA→20—200°C:
SCL = 20 /SCH = 200

SCL and SCH are simultaneously the calibration for the process value output
⇨ Section 6.6</td></tr>
<tr><td>SCH</td><td>-1999 to +9999 digit[1]</td><td>100</td></tr>
<tr><td>OFFS</td><td>-1999 to +9999 digit[1]</td><td>0</td><td>Process value correction (offset)
The offset can be used to correct the measured value by a certain amount up or down.
Examples:
Measured value Offset Displayed value
294.7 + 0.3 295.0
295.3 – 0.3 295.0</td></tr>
</table>

1. On a display with one or two decimal places the value range and the factory setting change accordingly (e. g. 1 decimal place → value range: -199.9 to +999.9).

6.2 External setpoint input

Via this input (option) a setpoint can be provided using a standard signal.

C111	Transducer	X		X	X
	no function		0		
	Standard signal 0 — 20mA		1		
	Standard signal 4 — 20mA		2		
	Standard signal 0 — 10V		3		
	Standard signal 2 — 10V		4		

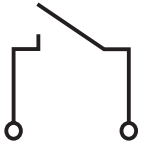
= factory setting X=position functionally not relevant

Parameter	Value range	factory-set	Notes
SPL	-1999 to +9999 digit[1]	-200	Display start/end with external setpoint input. Low/high setpoint limit for SP1 and SP2. Example: 4 — 20mA → 0 — 250°C: SPL = 0, SPH = 250 Setpoint limits Setpoint inputs below or above these limits are not accepted. The value of SPL/ SPH flashes on the display.
SPH	-1999 to +9999 digit[1]	850	

1. On displays with one or two decimal places the value range and the factory setting change accordingly (e. g. 1 decimal place → value range: -199.9 to +999.9).

6.3 Logic inputs

Various operating functions can be activated via the two logic inputs.

		
Key inhibit	Operation is possible by keys	**No** operation by keys
Level inhibit	Access possible to parameter and configuration level. Start of self-optimisation is possible.	**No** access to parameter and configuration level **No** start of self-optimisation
Programme/ ramp stop	Programme/ramp running (when configured!)	Programme/ramp stopped
Programme/ ramp start	–	Programme/ramp (re)started
Setpoint switching	Setpoint SP1 is activated.	Setpoint SP2 is activated.
Parameter set switching	Parameter set 1 is activated. (, Pb. 1)	Parameter set 2 is activated. („ Pb. 1)
Enabling the limit comparators	Limit comparators are off.	Limit comparators are activated.

C111	Logic inputs 1 (BE1) and 2 (BE2)	X	X	BE1	BE2
	no function			0	0
	Key inhibit			1	1
	Level inhibit			2	2
	Programme/ramp stop			3	3
	Programme/ramp start			4	4
	Setpoint switching			5	5
	Parameter set switching			6	6
	Enabling limit comparators			7	7

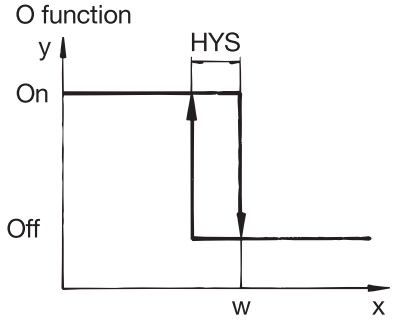
= factory setting X = position functionally not relevant

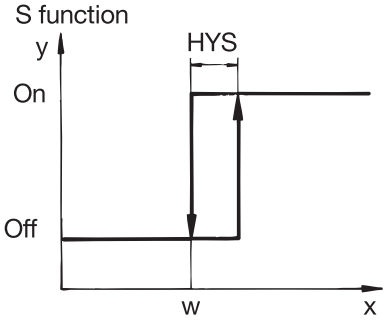
Different functions can be combined.

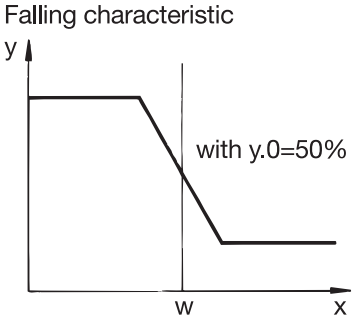
6.4 Controller

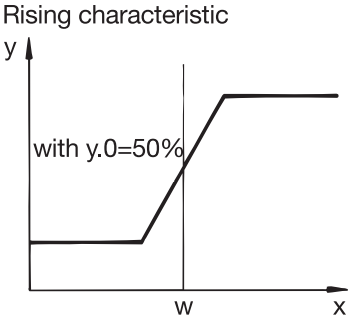
The controller type is set here, and the controller is adjusted to the process.

Controller functions







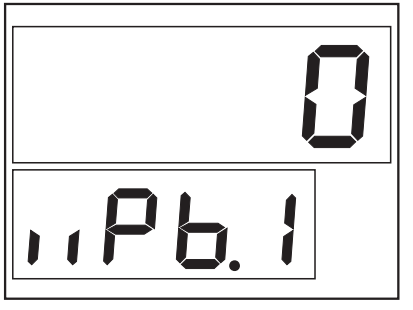


Selecting the parameter set

The controller has two parameter sets; a logic input can be used to switch between them.
Both parameter sets can be displayed for setting the parameters.

* Change between the display of the parameter sets with PGM , when parameter Pb.1 is displayed (hold key down for at least 2 sec!).

The parameter set which is displayed is shown by lit-up segments on parameter Pb.1.



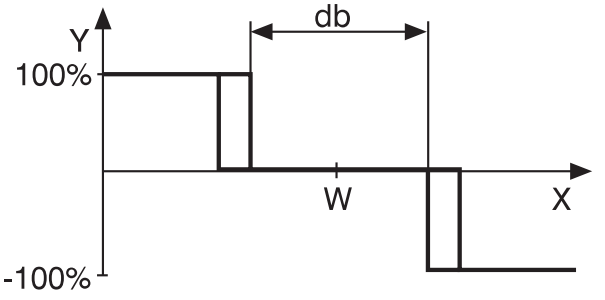
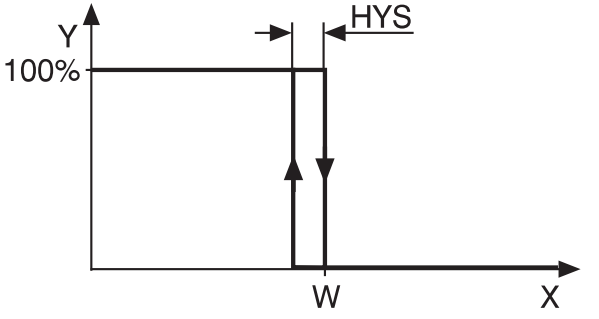
1 segment = parameter set 1
2 segments = parameter set 2

Controller structure

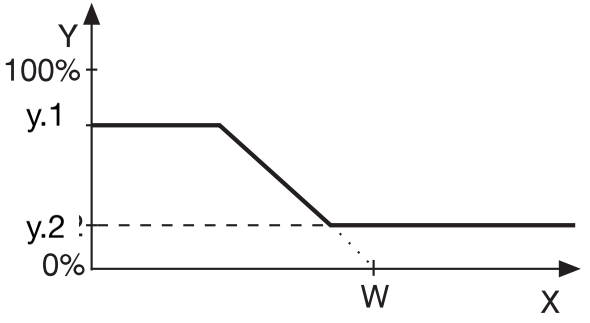
The controller structure is defined through parameters Pb, dt and rt.
Example: PI → Pb≠0, dt=0, rt≠0

Parameter	Value range	factory-set	Notes
Pb 1	0—9999 digit[1]	0	Proportional band 1 (controller output 1) Proportional band 2 (controller output 2) Influences the P action of the controller If Pb = 0, the controller structure is ineffective.
Pb 2	0—9999 digit[1]	0	
dt	0—9999 sec	80 sec	Derivative time Influences the D action of the controller. If dt=0, the controller has no D action.
rt	0—9999 sec	350 sec	Reset time Influences the I action of the controller. If rt=0, the controller has no I action.
Cy 1	0.5—999.9 sec	20.0 sec	Duration of switching cycle 1 (controller output 1) Duration of switching cycle 2 (controller output 2) Duration of switching cycle on switching outputs. The cycle time should be selected so that the energy supply to the process is virtually continuous while the switching elements are not subject to excessive wear.
Cy 2	0.5—999.9 sec	20.0 sec	

1. On the display with one or two decimal places the value range and the factory setting change accordingly (e. g. 1 decimal place → value range: -199.9 to +999.9).

Parameter	Value range	factory-set	Notes
db	0 — 1000 digit[1]	0.0	Contact spacing For switching double-setpoint controllers 
HYS 1	0 — 9999 digit[1]	1.0	Differential 1 (controller output 1) Differential 2 (controller output 2) For controllers with Pb=0 
HYS 2	0 — 9999 digit[1]	1.0	
y.0	-100 — 100 %	0 %	Working point Output at x=w

1. On the display with one or two decimal places the value range and the factory setting change accordingly (e. g. 1 decimal place → value range: -199.9 to +999.9).

Parameter	Value range	factory-set	Notes
y.1	0—100%	100%	Maximum/minimum output Example: proportional controller with falling characteristic (indirect action)  On controllers without controller structure (Pb=0) it is necessary that y.1=100% and y.2=–100%
y.2	-100 to +100%	-100%	

C113

Controller type		X	X	X
Single-setpoint controller O function	0			
Single-setpoint controller S function	1			
Double-setpoint controller	2			
Proportional controller with falling characteristic (indirect action)	3			
Proportional controller with rising characteristic (direct action)	4			

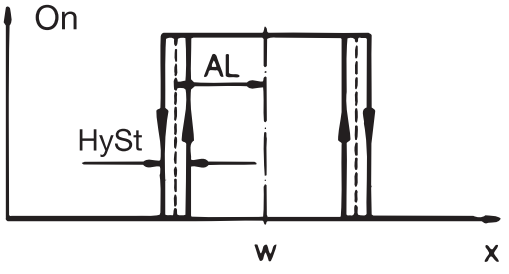
= factory setting X= position functionally not relevant

6.5 Limit comparators

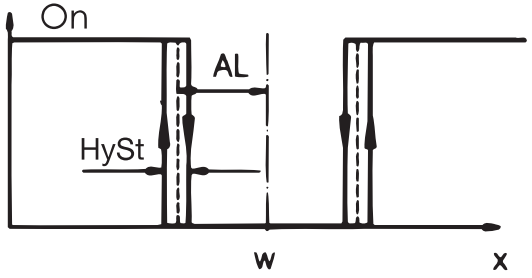
The measurements of the two inputs can be monitored with reference to the setpoint or a fixed value using two limit comparators.

Functions of the limit comparators

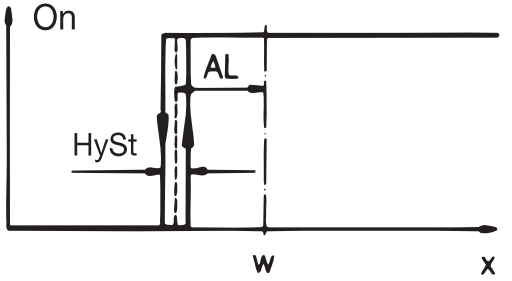
lk1



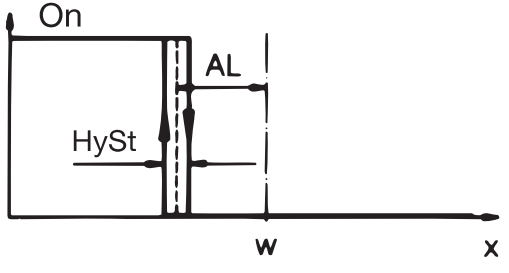
lk2



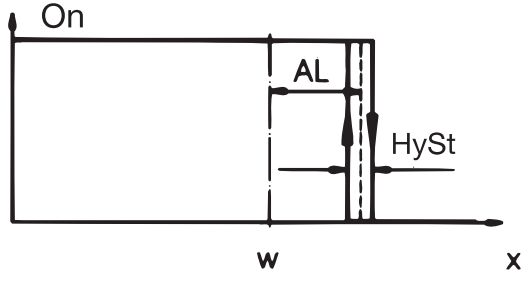
lk3



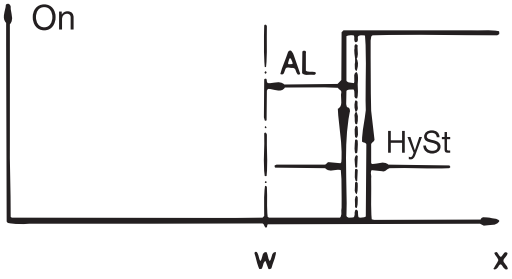
lk4



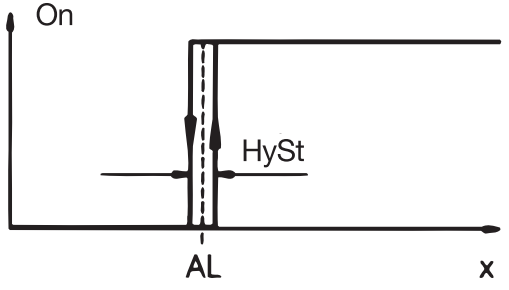
lk5



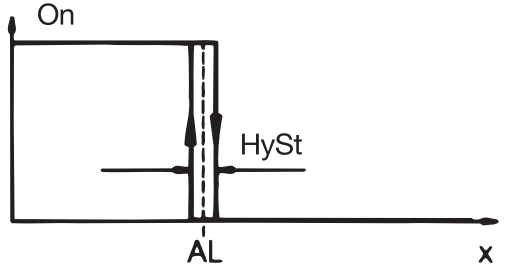
lk6



lk7



lk8



lk1 — lk6: Monitoring referred to the setpoint
lk7 / lk8: Monitoring referred to a fixed value AL.

Parameter	Value range	factory-set	Notes
AL 1	-1999 to +9999 digit[1]	0	Limit limit comparator 1
AL 2	-1999 to +9999 digit[1]	0	Limit limit comparator 2

C112

Limit comparator 1 (LK1) and 2 (LK2)	LK1	LK2	X	X
no function	0	0		
lk 1 (process value input)	1	1		
lk 2 (process value input)	2	2		
lk 3 (process value input)	3	3		
lk 4 (process value input)	4	4		
lk 5 (process value input)	5	5		
lk 6 (process value input)	6	6		
lk 7 (process value input)	7	7		
lk 8 (process value input)	8	8		
lk 7 (external setpoint)	9	9		
lk 8 (external setpoint)	A	A		

= factory setting X = position functionally not relevant

Parameter	Value range	factory-set	Notes
HySt	-1999 to +9999 digit[1]	1	Switching differential of the limit comparators

1. In the display with one or two decimal places the value range and the factory setting change accordingly (e. g. 1 decimal place → value range: -199.9 to +999.9).

6.6 Outputs

The five outputs can be freely assigned to the functions.

C111	Output 4 (A4) and 5 (A5)	X	X	A4	A5
	no function			0	0
	Controller output 1			8	8
	Controller output 2			9	9
	Limit comparator output 1			A	A
	Limit comparator output 2			b	b
	Programme end			C	C

= factory setting X = position functionally not relevant

C112	Output signal on overrange	X	X	X	
	Output 0 %, limit comparators OFF				0
	Output 100 %, limit comparators OFF				1
	Output -100 %, limit comparators OFF				2
	Output 0 %, limit comparators ON				3
	Output 100 %, limit comparators ON				4
	Output -100 %, limit comparators ON				5

= factory setting X = position functionally not relevant

C113

Output 1 (K1; relay) and 2 (K2; relay)	X	X	K1	K2
no function			0	0
Controller output 1			1	1
Controller output 2			2	2
Limit comparator output 1			3	3
Limit comparator output 2			4	4
Programme end			5	5

= factory setting X = position functionally not relevant

C114

Output 3 (K3; option)	X	X	X	K3
no function				0
Controller output 1 (function: 0 — 20mA/0 — 10V/switching)				1
Controller output 2 (function: 0 — 20mA/0 — 10V/switching)				2
Limit comparator output 1(function: switching)				3
Limit comparator output 2 (function: switching)				4
Programme end (function: switching)				5
Controller output 1 (function: 4 — 20mA/2 — 10V)				6
Controller output 2 (function: 4 — 20mA/2 — 10V)				7
Process value output (function: 0 — 20mA/0 — 10V)				8
Process value output (function: 4 — 20mA/2 — 10V)				9

= factory setting X = position functionally not relevant

6.7 Display

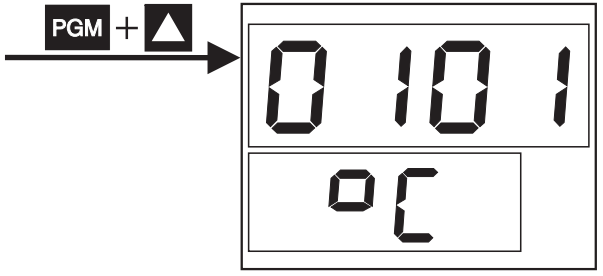
The number of the decimal places when displaying process value and setpoint in the standard display is defined here. In addition, the unit of the process value is determined.

C112	Decimal places/unit	X	X		X
	no decimal place, degree Celsius			0	
	one decimal place, degree Celsius			1	
	two decimal places, degree Celsius			2	
	no decimal place, degree Fahrenheit			3	
	one decimal place, degree Fahrenheit			4	
	two decimal places, degree Fahrenheit			5	

= factory setting X = position functionally not relevant

Displaying the unit and software version

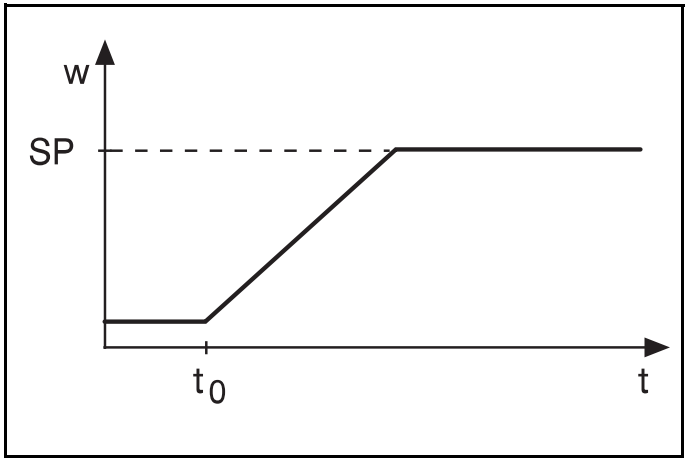
* Display the software version and unit of the process value with PGM + ▲ (hold keys down!)



(example)

6.8 Ramp function

A rising or falling ramp function is possible. When the power is switched on, the ramp function starts with the current process value and the setpoint runs according to the selected gradient until the ramp end point SP is reached. The ramp end point is entered at the setpoint input (SP1, SP2). When the ramp end point is reached, then the ramp setpoint is equal to SP.



Action on sensor break

On sensor break the ramp function is interrupted. The outputs act as for overrange or underrange (can be configured). When the fault has been rectified, the controller accepts the current process value as ramp setpoint and continues the ramp function.

Action on power failure

When the supply is restored, the controller accepts the current process value as ramp setpoint and continues the ramp function with the set parameters.

Ramp stop

Activating the ramp stop via a logic input holds the ramp function. The setpoint display flashes. After the ramp stop has been de-activated, the ramp function continues with the ramp setpoint at the time of the ramp stop.

Re-starting the ramp

* Re-start the ramp with ▼ + ▲ or via the logic input

Parameter	Value range	factory-set	Notes
rASd	0 —999 digit/h or digit/min[1]	0	ramp gradient

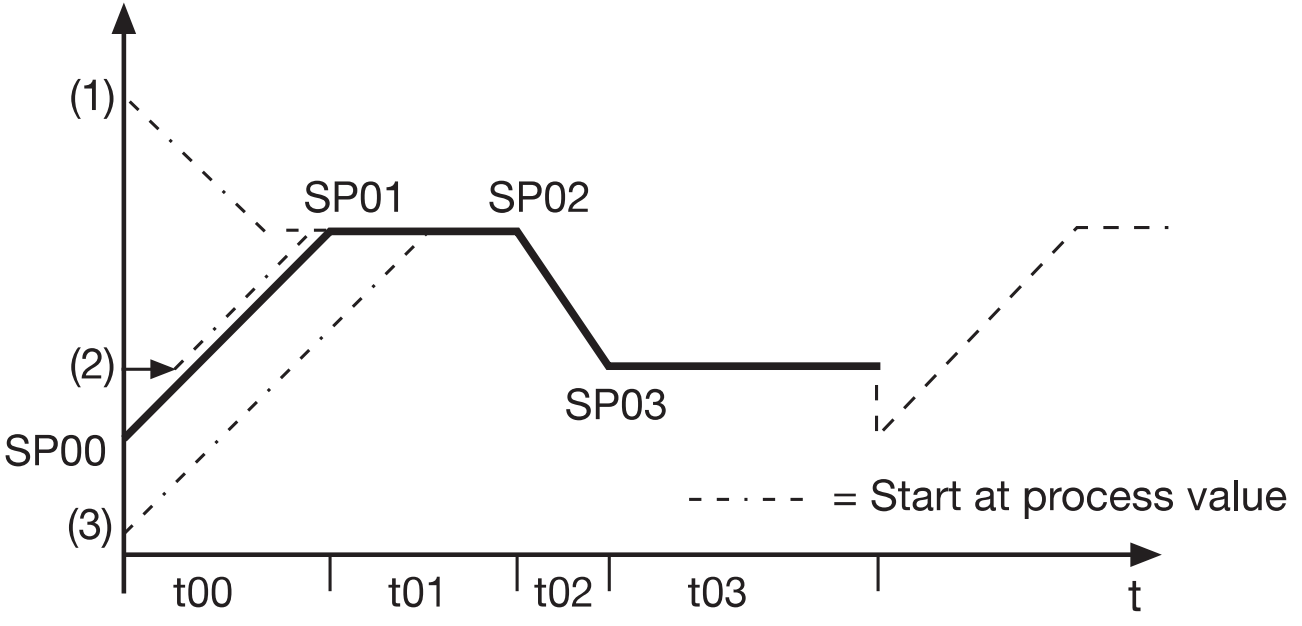
1. In the display with one or two decimal places, the value range changes to 0.0 — 99.9 digit/h (digit/min.)

C113	Ramp function	X		X	X
	Ramp function off		0		
	Ramp function (time base: minutes)		5		
	Ramp function (time base: hours)		6		

= factory setting X = position functionally not relevant

6.9 Programme controller

It is possible to implement a setpoint programme with up to 4 profile segments. The segment setpoints (SP00 — SP03) and the segment times (t00 — t03) are set at the operating level. The time base can be configured in seconds or minutes (max. segment time 9999 min.).



The programme starts at the process value, i. e. the profile is searched to find a setpoint which corresponds to the process value at the instant of start or power-on. ((1), (2), (3)). The profile then continues from this point. If the process value is outside the profile, a start is made at the first profile segment and the segment setpoint is then approached with the gradient of the first segment (positive or negative). The programme can either be run through once or repeated cyclically. In addition, a programme end signal can be output and the programme can be held.

⇨ Section 6.6 “Outputs”

Action on sensor break
On sensor break the programme is interrupted. The outputs act as for overrange or underrange (can be configured). When the fault has been rectified, the programme continues with the process value.

Action on power failure
When the supply is restored, the programme starts at the process value.

Programme stop
The programme is held by activating the programme stop via a logic input. The setpoint display flashes. After the programme stop has been de-activated, the programme continues with the setpoint at the time of the programme stop.

Re-starting the programme
* Re-start the programme with ▼ + ▲ or via the logic input

C113	Programme function	X		X	X
	Programme controller off		0		
	Programme controller (timebase: seconds)		1		
	Programme controller (timebase: seconds; cyclic)		2		
	Programme controller (timebase: minutes)		3		
	Programme controller (timebase: minutes; cyclic)		4		

= factory setting X = position functionally not relevant

6.10 Interface

The controller can be integrated into a data network via the interface. The following applications are possible, e.g.:

- process visualisation
- system control
- report

The bus system is designed according to the master-slave principle. A master computer can address up to 31 controllers and instruments (slaves). The interface is a serial interface to RS485 standard. The MODbus protocol serves as the data protocol.

Interface description B 70.3030.2

The interface can only be retrofitted at the factory.

C114

Instrument address				**X**
Address 0	0	0		
Address 1	0	1		
.	.			
.	.			
Address 99	9	9		
Interface parameters				
9600 baud, no parity			0	
9600 baud, odd parity			1	
9600 baud, even parity			2	
4800 baud, no parity			3	
4800 baud, odd parity			4	
4800 baud, even parity			5	

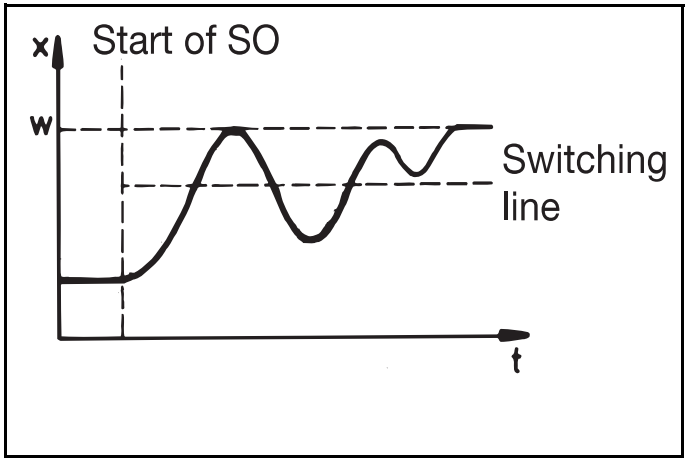
= factory setting X = position functionally not relevant

6.11 Self-optimisation

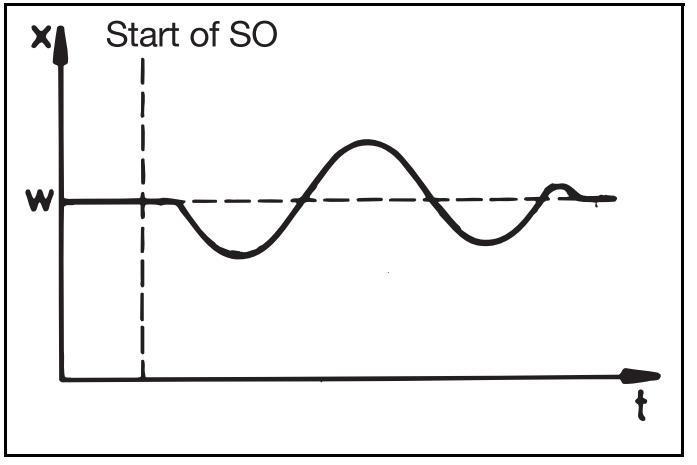
Self-optimisation determines the controller parameters for PID or PI controllers (for PI set dt=0!).

The following controller parameters are defined: rt, dt, Pb1, Pb2, Cy1, Cy2, dF

If there is a large deviation between process value and setpoint when SO is activated, a switching level is determined about which the process variable performs a forced oscillation during the SO procedure. The switching level is chosen so that the process value does not exceed the setpoint, if possible.

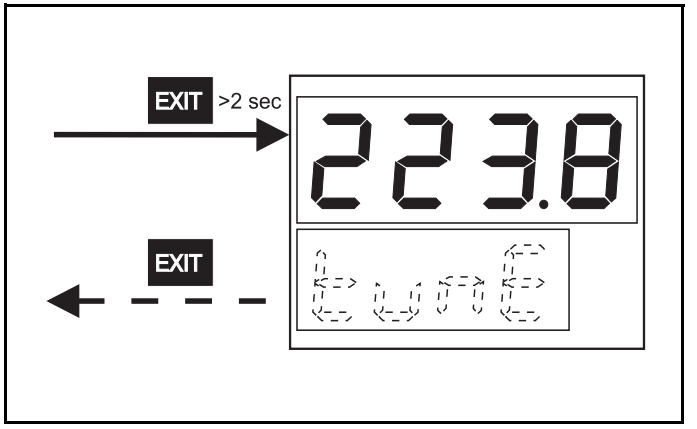


With a small deviation between setpoint and process value, e.g. when the control loop has stabilised, a forced oscillation about the setpoint is produced.



Starting self-optimisation

* Start SO with EXIT
  (hold down key for at least 2 sec !)
* Abort with EXIT
  (while self-optimisation is running)



If "tune" does not flash any longer, self-optimisation is terminated and the controller functions with the parameters which have been established.

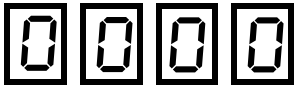
* Store the parameters with EXIT
  (Hold down key for at least 2 sec!)

Starting SO is not possible with active level inhibit.
The active parameter set is optimised.
With active ramp/programme function, the ramp/programme sequence is stopped during self-optimisation.

7 Appendix

7.1 Configuration code and parameter tables

C111



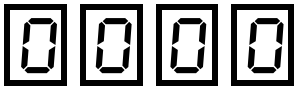
Process value input		
Pt 100		0
Pt 1000		1
Fe-Con	L	2
NiCr-Ni	K	3
Pt10Rh-Pt	S	4
Pt13Rh-Pt	R	5
Pt30Rh-Pt	B	6
Cu-Con	U	7
NiCrSi-NiSi	N	8
Fe-Con	J	9
0 — 20mA/0 — 10V		A
4 — 20mA/2 — 10V		b

External setpoint input	
no function	0
0 — 20mA	1
4 — 20mA	2
0 — 10V	3
2 — 10V	4

Logic input 1 (BE1) and 2 (BE2)	BE1	BE2
no function	0	0
Key inhibit	1	1
Level inhibit	2	2
Programme/ramp stop	3	3
Programme/ramp start	4	4
Setpoint switching	5	5
Parameter set switching	6	6
Enabling the limit comparators	7	7
Output 4 (A4) and 5 (A5)	**A4**	**A5**
Controller output 1	8	8
Controller output 2	9	9
Limit comparator output 1	A	A
Limit comparator output 2	b	b
Programme end	C	C

= factory-set

C112



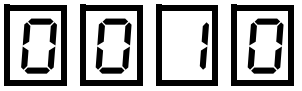
Limit comparator 1 (LK1) and 2 (LK2)	LK1	LK2
no function	0	0
lk 1 (process value input)	1	1
lk 2 (process value input)	2	2
lk 3 (process value input)	3	3
lk 4 (process value input)	4	4
lk 5 (process value input)	5	5
lk 6 (process value input)	6	6
lk 7 (process value input)	7	7
lk 8 (process value input)	8	8
lk 7 (external setpoint)	9	9
lk 8 (external setpoint)	A	A

Decimal places/ unit	
XXXX / °C	0
XXX.X / °C	1
XX.XX / °C	2
XXXX / °F	3
XXX.X / °F	4
XX.XX / °F	5

Output signal on overrange	
Output 0 %, LK1+2 OFF	0
Output 100 %, LK1+2 OFF	1
Output -100 %, LK1+2 OFF	2
Output 0 %, LK1+2 ON	3
Output 100 %, LK1+2 ON	4
Output -100 %, LK1+2 ON	5

= factory-set

C113



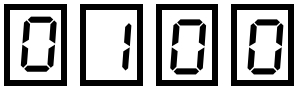
Controller type	
1-setpt. controller O function	0
1-setpt. controller S function	1
2-setpoint controller	2
Proportional controller with falling characteristic	3
Proportional controller with rising characteristic	4

Programme function	
Programme controller/ ramp function off	0
Programme controller time base: seconds	1
Programme controller time base: seconds; cyclic	2
Programme controller time base: minutes	3
Programme controller time base: minutes; cyclic	4
Ramp function	
Ramp function time base: minutes	5
Ramp function time base: hours	6

Output 1 (K1; relay) and 2 (K2; relay)	K1	K2
no function	0	0
Controller output 1	1	1
Controller output 2	2	2
Limit comparator output 1	3	3
Limit comparator output 2	4	4
Programme end	5	5

= factory-set

C114



Instrument address		
Address 0	0	0
Address 1	0	1
.	.	
.	.	
Address 99	9	9

Interface parameters	
9600 baud, no parity	0
9600 baud, odd parity	1
9600 baud, even parity	2
4800 baud, no parity	3
4800 baud, odd parity	4
4800 baud, even parity	5

Output 3 (K3; option)	K3
no function	0
Controller output 1 (0 — 20mA/0 — 10V/switching)	1
Controller output 2 (0 — 20mA/0 — 10V/switching)	2
Limit comparator output 1 (switching)	3
Limit comparator output 2 (switching)	4
Programme end (switching)	5
Controller output 1 (4 — 20mA/2 — 10V)	6
Controller output 2 (4 — 20mA/2 — 10V)	7
Process value output (0 — 20mA/0 — 10V)	8
Process value output (4 — 20mA/2 — 10V)	9

= factory-set

The parameters of the configuration level

Parameter	Value range	factory-set	Notes
SCL	-1999 to +9999 digit[1]	0	Start value of value range for standard signals
SCH	-1999 to +9999 digit[1]	100	End value of value range for standard signals
SPL	-1999 to +9999 digit[1]	-200	Display start with external setpoint input
SPH	-1999 to +9999 digit[1]	850	Display end with external setpoint input
OFFS	-1999 to +9999 digit[1]	0	Process value correction (offset)
HySt	-1999 to +9999 digit[1]	1	Switching differential of limit comparators

1. On displays with one or two decimal places the value range and the factory setting change accordingly (e. g. 1 decimal place → value range: -199.9 to +999.9).

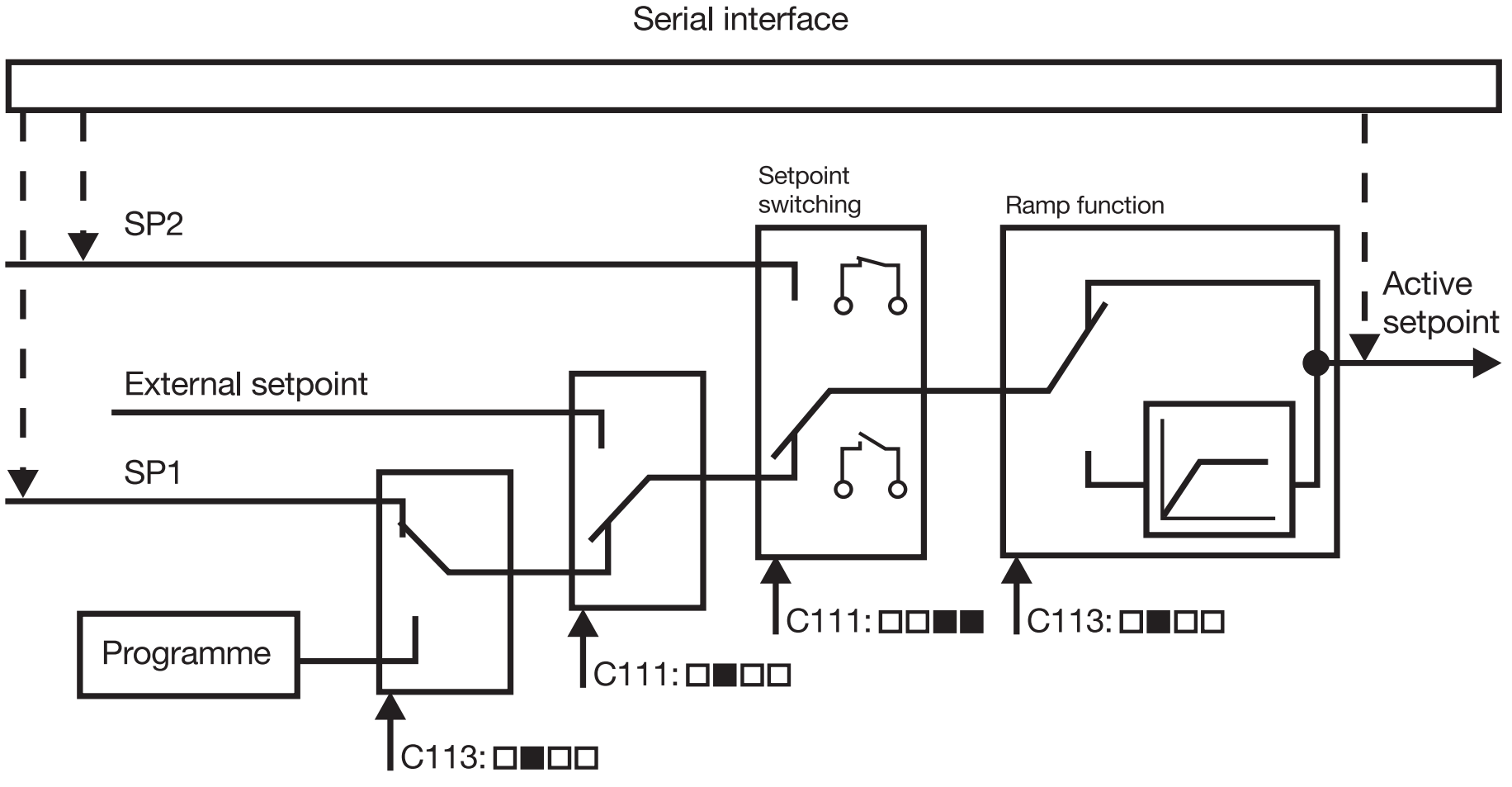
Parameter level

Parameter	Value range	factory-set	Notes
AL 1	-1999 to +9999 digit[1]	0	Limit for limit comparator 1
AL 2	-1999 to +9999 digit[1]	0	Limit for limit comparator 2
Pb 1	0—9999 digit[1]	0	Proportional band 1 (controller output 1)
Pb 2	0—9999 digit[1]	0	Proportional band 2 (controller output 2)
dt	0—9999 sec	80 s	Derivative time
rt	0—9999 sec	350 s	Reset time
Cy 1	0.5—999.9 sec	20.0 s	Switching cycle time 1 (controller output 1)
Cy 2	0.5—999.9 sec	20.0 s	Switching cycle time 2 (controller output 2)
db	0—1000 digit [1]	0.0	Contact spacing
HYS 1	0—9999 digit [1]	1.0	Switching differential 1 (controller output 1)
HYS 2	0—9999 digit [1]	1.0	Switching differential 2 (controller output 2)
y.0	-100—100 %	0 %	Working point
y.1	0—100 %	100 %	Output limitation: maximum output
y.2	-100 to +100 %	-100 %	Output limitation: minimum output
dF	0.0—100.0 sec	0.6 s	Filter time constant for adaptation
raSd	0—999 digit [1]	0	Ramp gradient

1. On displays with one or two decimal places the value range and the factory setting change accordingly (e. g. 1 decimal place → value range: -199.9 to +999.9).

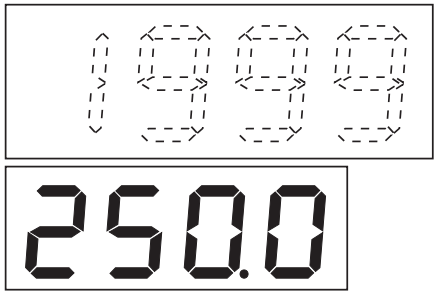
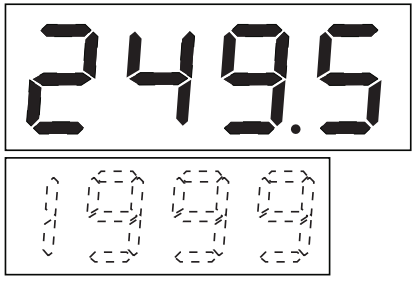
7.2 Setpoint priorities

Input of setpoint



■ = functionally relevant position in the code

7.3 Alarm messages

Display	Description	Cause/response
	The process value display flashes “1999”. The setpoint display indicates the active setpoint	Over/underrange of the process value. Controller and limit comparators referred to the process value input act in accordance with the configuration of the outputs.
	The process value display indicates the process value. The setpoint display flashes “1999”.	Over/underrange of the external setpoint. Limit comparators referred to the input for the external setpoint act according to the configuration of the outputs.

The following events come under the heading over/underrange:
- Sensor break/short-circuit
- Measurement is outside the control range of the connected sensor
- Display overflow

7.4 Technical data

Inputs

These values include the linearisation tolerances.

Transducer	Control range	Measurement accuracy/ Ambient temperature error	Measurement circuit monitoring[1]	
			Sensor break	Short-circuit
Process value input				
Pt 100[2]	-200 +850 °C	≤ 0.1 % /≤ 25 ppm /°C	X	X
Pt 1000[2]	-200 +850 °C	≤ 0.1 % / ≤ 25 ppm/°C	X	X
Fe-Con L[3]	-200 +900 °C	≤ 0.25 % / ≤ 100 ppm/°C	X	–
Fe-Con J[3]	-200 +1200 °C	≤ 0.25 % / ≤ 100 ppm/°C	X	–
NiCr-Ni K[3]	-200 +1372 °C	≤ 0.25 % / ≤ 100 ppm/°C	X	–
Cu-Con U[3]	-200 +600 °C	≤ 0.25 % / ≤ 100 ppm/°C	X	–
NiCrSi-NiSi N[3]	-100 +1300 °C	≤ 0.25 % / ≤ 100 ppm/°C	X	–
Pt10Rh-Pt S[3]	0 — 1768 °C	≤ 0.25 % / ≤ 100 ppm/°C	X	–
Pt13Rh-Pt R[3]	0 — 1768 °C	≤ 0.25 % / ≤ 100 ppm/°C	X	–
Pt30Rh-Pt6Rh B[3]	0 — 1820 °C	≤ 0.25 % / ≤ 100 ppm/°C[4]	X	–
0 — 20 mA[5]	scalable	≤ 0.1 % / ≤ 100 ppm/°C	–	–
4 — 20 mA[5]	scalable	≤ 0.1 % / ≤ 100 ppm/°C	X	X

Transducer	Control range	Measurement accuracy/ Ambient temperature error	Measurement circuit monitoring[1]	
			Sensor break	Short-circuit
0 — 10V[6, 7]	scalable	≤ 0.1 % / ≤ 100ppm/°C	–	–
2 — 10V[6, 7]	scalable	≤ 0.1 % / ≤ 100ppm/°C	X	X
Input for external setpoint				
0 — 20mA[5]	scalable	≤ 0.1 % / ≤ 100ppm/°C	–	–
4 — 20mA[5]	scalable	≤ 0.1 % / ≤ 100ppm/°C	X	X
0 — 10V[6]	scalable	≤ 0.1 % / ≤ 100ppm/°C	–	–
2 — 10V[6]	scalable	≤ 0.1 % / ≤ 100ppm/°C	X	X

1. X=recognised, –=not recognised
   The outputs move to a defined status.
2. Pt 100, Pt 1000 in 2- or 3-wire circuit
   Lead compensation:
   Not required for 3-wire circuit. When used with a resistance thermometer in 2-wire circuit, lead compensation can be provided by an external lead compensation resistor.
   ($R_{comp} = R_{line}$). In addition, the lead resistance can be compensated in software through process value correction.
3. Temperature compensation: internal
4. Within the range of 300 — 1820°C
5. Voltage drop Δu_e less than 1V
6. Internal resistance $R_i = 100k\Omega$
7. The voltage inputs of the process value input differ in hardware from the other inputs. The change between Pt 100, Pt 1000, thermocouples, 0 — 20mA and 4 — 20mA can be configured in software.

Outputs

2 relay outpus, 2 logic outputs and 1 optional output
(relay, analogue, logic 12V, TRIAC or transistor) are available.

1. Relay outputs K1 / K2: n.o. (make) contact)
Rating 3A, 250V AC on resistive load
Contact life more than 5 • 10^5 operations at rated load

2. Relay output K3 (option): Changeover contact
Rating 3A, 250V AC on resistive load
Contact life more than 5 • 10^5 operations at rated load

3. Analogue output K3 (option): 0(2) — 10V, R_{load} 500Ω min.
0(4) — 20mA, R_{load} 450Ω max.
isolation from the inputs:
Δu 30V AC max. /Δu 50V DC max.

4. Transistor output K3 (option): Switching voltage: 30V DC max.
Switching current: 50mA max.

5. TRIAC output K3 (option): Rating 1A, 230V AC

6. Logic output K3 (option): 0/12V R_{load} 650Ω min.

7. Logic outputs: 0/5V R_{load} 250Ω min.

General controller data

A/D converter: resolution better than 15 bit

Controller type: can be configured as single / double setpoint or proportional controller

Sampling time: 210 msec
250 msec on programme controller

Data back-up: EEPROM

Supply: 110 — 240 V +10/-15 % AC 48 — 63 Hz
or 20 — 53 V AC/DC 48 — 63 Hz

Power consumption: 5 VA approx.

Electrical connection: through screw terminals for wires up to 1.5 mm^2 and core end sleeves

Permitted ambient temperature range: 0 to + 55 °C

Permitted storage temperature range: -40 to +70 °C

Climatic conditions: relative humidity not to exceed 75 %, no condensation

Protection: to EN 60 529
front IP65, rear IP20

Electrical safety

to EN 61 010
clearances and creepage distances for
- overvoltage category II
- pollution degree 2

Electromagnetic compatibility

EN 61 326
Immunity to interference: Class B
Interference emission: Industrial requirements

Housing

for flush panel mounting to DIN 43 700, base material PC, with plug-in controller chassis

Operating position: unrestricted

Weight: 140g

Interface RS485

isolated

Baud rate: 4800/9600baud

Protocol: MODbus

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Pb 1	0		22, 43
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db	0		23, 43
HYS 1	1.0		23, 43
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PGM
>2sec

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HySt	0					30, 42

= factory setting

1. This parameter appears only if a double setpoint controller has been configured as controller type.

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