User manual

Universal controller

UREG 200

Version 2.1.1

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Content

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1. General

1.1 For Information

- These operating manual provides important information on handling the measuring element. A prerequisite for safe working is compliance with all specified safety notes and instuctions for action.
- The qualified personnel must have read and understood these operating manual before mounting and starting up the sensor.
- These operating manual is a component part of the product. Therefore, keep them in a place that is accessible to all users at all times, close to the place of use.
- The local regulations and safety rules applicable to the area of application of the sensor must be observed.
- If the serial number on the type label is no longer readable (e.g. due to mechanical damage), traceability is no longer ensure.
- The sensor described in the user manual are developed and manufactured according to the newest finding. All components are subject strict quality and environmental criteria during production.
- The manufacturer shall not be liable if damage is caused by improper use, non-observance of these operating instructions, use of insufficiently qualified personnel and unauthorized modifications to the sensor.

1.2 Signs and abbreviations

Warning!
Non-observance can lead to injuries to persons and / or destuction of the device. There may be danger to life.

Attention!
Non-observance can lead to incorrect operation of the device or damage to property.

Information!
Non-observance can influence the operation of the device or cause undesired device reactions.

Danger!
If the safety instructions are not observed, there is a risk of serious or fatal injury from electric current.

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Warning!
A dangerous situation may possibly occur, which can lead to burns due to hot surfaces or liquids if they are not avoided.

2. transport, packaging and storage

2.1 transport

Inspect the device for a damage that may have occurred during transport. Report obvious damage immediately.

2.2 packaging

Do not remove the packaging until immediadtely before assembly. Keep the packaging, because it provides optimal protection during transport (e.g. chageable installation location, return).

2.3 storage

Avoid the following influences during longer storage:

- Direct sinlight or close to hot ojects
- Mechanical vibration, mechanical shock (hard set up)
- Soot, steam, dust and corrosive gases

If possible, store the device in the original packaging or appropriate packaging.

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3. safety instructions

Further important safety instructions can be found in the individual chapters.

3.1 Intended use of the product

The sensor is desiged and constructed exclusively for the intended use described here and may only be used as follows. The technical specifications in these operating instructions must be observed.
Improper handling or operation of the device unit outside the technical specifications requires immediate decommissioning and inspection by the manufacturer. If the unit is transported from a cold to a warm environment, condensation may cause the unit to malfunction. Wait for the temperature of the appliance to adjust to the room temperature before starting it up again. Claims of any kind are excluded due to improper use.

3.2 Personnel qualification

Risk of injury due to inadequate qualification. Improper handling can lead to considerable personal injury and damage to property.
The activities described in these operating instructions may only be carried out by qualified personnel with the following qualifications.
Keep unqualified personnel away from the hazardous areas.

For installation and commissioning of the sensor, these persons must be familiar with the applicable country-specific directives and standards and have the appropriate qualificationions. They must have knowledge of measurement and control technology be familiar with electrical circuits and be able to carry out the work described and recognise possible dangers independently. Depending on the conditions of use, other knowledge may also be required, e.g. about aggressive media.

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3.3 Special hazards

Observe the country- specific regulations (e.g. standards) and, in the case of special applications, observe the applicable standards and directives (e.g. for hazardous media such as Acetylene, flammable or toxic substances as well as refrigeration plants and compressors).
If the relevant regulations are not observed, serious personal injury and damage to property may result!

Electrostatic discharge (ESD) protection is required. Proper use of grounded work surfaces and personal wrist straps is required when working with open circuit (printed circuit boards) to prevent damage to sensitive electronic components from electrostatic discharge.

There is danger to life from electric current. There is a immediate risk of death if live parts are touched. Installation and mounting of electrical equipment may only be carried out by qualified electricans. When operating with a defective power supply unit (e.g. short-circuit from mains voltage to output voltage), life-threatening voltages can result at the device.

Residual media in device that have been removed can be hazardous to persons, that environment and equipment. Sufficiet precations must be taken. This device must not be used in safety or emergency stop devices. Incorrect applications of the device can lead to inuries. In case of a fault, aggressive media at extreme temperatures and under high pressure or vacuum may be present at the device.

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4. Commissioning and operation

4.1 Equipment

High-resolution 18-Bit AD Input converter
High-resolution 15-Bit DA Output converter
High input scanning (5Hz)
Two menu levels
Parameterisation in the user menu
Pump control
Fuzzy + PID microprocessor-based control
Differential control
Automatic setting
Self-optimisation
Sleep mode function
"Soft-start" via ramp and ramp-up time
Programmable input (TC, RTD, mA, VDC)
Analogue input for remote setpoint and CT
Event input for switching function and setpoint
Programmable digital filter
Hardware Menu Lock + Remote Menu Lock
Alarm in case of control loop interruption
Alarm in case of heating failure
Sensor break alarm + Bumpless transfer
RS-485, RS-232 interface
Analogue retransmission
DC Power supply for head transmitter
Safety UL / CSA / IEC1010-1
EMC / CE EN61326

The UREG200 is a fuzzy logic + PID microprocessor-based controller with a bright, 4-digit LED display for process value display. The fuzzy logic technique enables the process to reach the setpoint as quickly as possible, without overdriving and disturbing the external load. The controllers have a 1/8 DIN housing with the dimensions 48mm x 96mm and a mounting depth of 70mm. All parameters and input configurations can be set via the three operating keys. With the user-defined quick access menu it is possible to set the five most common parameters individually in front of the normal setup menu (Parameters SEL1 to SEL5).

The operating voltage of the UREG200 is 90 – 264 VAC or 11-26 VAC/VDC. Depending on the equipment, the controller has two 2A relay control outputs and two 2A alarm relays, alternatively analogue output 0/4-20mA or SSR relay driver. The 1st analogue input is freely programmable for PT100, thermocouples type J, K, T, E, B, R, S, N, L, Current input 0/4-20mA or voltage input 0-1VDC, 0-5VDC, 1-5VDC or 0-10VDC. The 2nd input can be set to current input 0/4-20mA or Voltage input 0-1VDC, 0-5VDC, 1-5VDC or 0-10VDC. The inputs are digitised with an 18-bit A-D converter for further processing. The high sampling rate of 5Hz enables the use in

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dynamic processes such as pressure and flow control. The integrated self-optimisation adjusts the control parameters and ensures rapid optimisation of the control process.

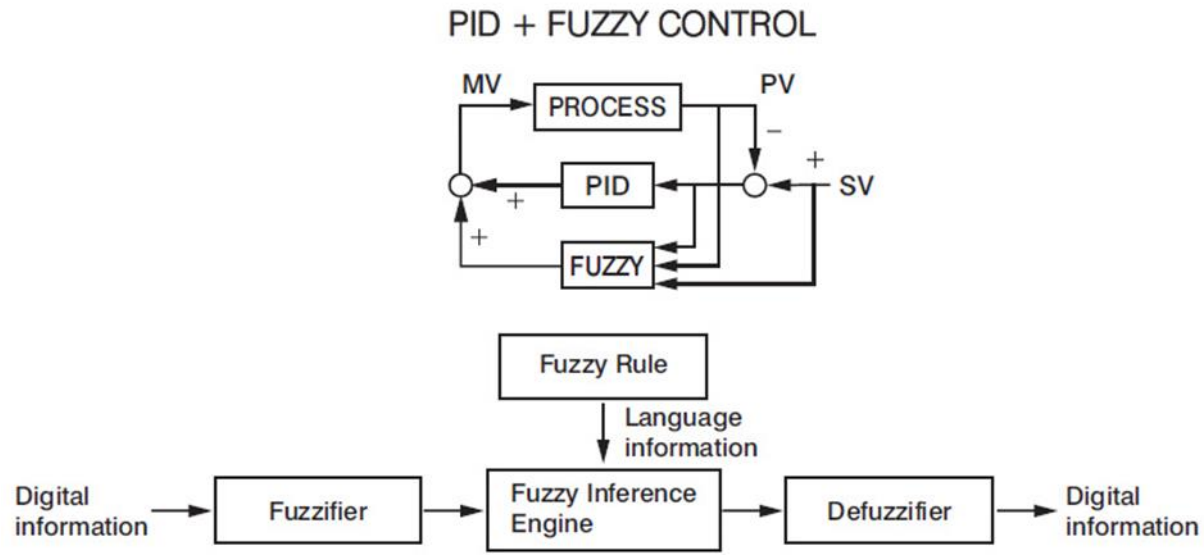
Options available for the UREG200 include RS-232, RS-485 and an additional 0/4-20mA analogue output for retransmission. These interfaces enable communication with a process control system or for displaying the values on a separate display, as well as for data logging on an external device.

The controller can be programmed 1. manually using the front keys, or 2. using the UREG-Konfig software with the PC and transmitted via RS232 or RS485 interface.

What is Fuzzy Control?

The PID control principle is based on a mathematical calculation between setpoint and actual value. Conventional PID controllers react to the changes of the process value with the delay of the calculation depending on the dynamics of the actual value.

The fuzzy controller enables the process to be controlled dynamically; by observing the actual values depending on the control, the fuzzy controller learns to act faster and more efficiently in similar constellations. The fuzzy logic is a linguistic controller and not numerical like the PID controller. Through the "experiences" of the fuzzy control, the control behaviour of the PID is constantly optimised.



PID+FUZZY Block diagram

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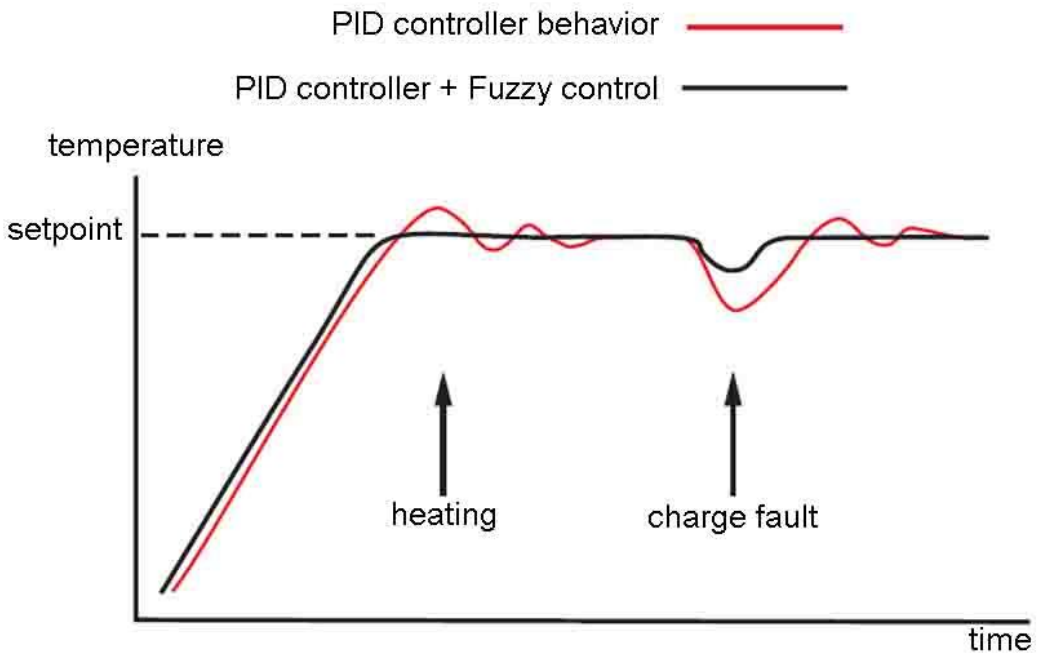
The function of the fuzzy logic is to set the PID parameters internally to achieve a flexible and adaptive output manipulation MV for different processes. For example:

The temperature difference is large and the change is fast, then ΔMV is large.
The temperature difference is large and the change is slow, then ΔMV is small.

The combination of PID + Fuzzy Control has proven to be an efficient method for optimising the control behaviour, please refer to the following diagram for a comparison of the control curves.



Comparison curve PID to FUZZY+PID controller

4.2 Order code

See datasheet

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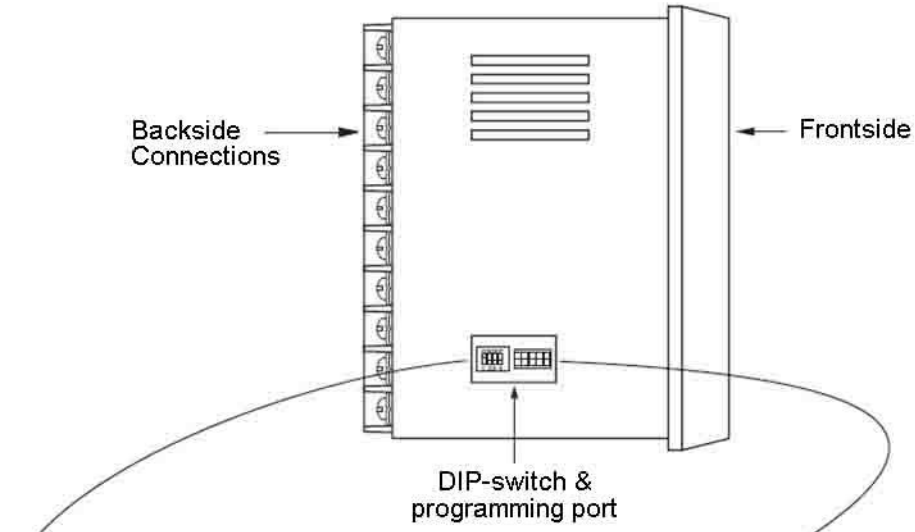
4.3 Programming interface & DIP switches



DIP-Switch ■ ON □ OFF		1	2	3	4
selection input 1	TC, RTD, mV	■	□		
	0-1V, 0-5V, 1-5V, 0-10V	□	■		
	0-20mA, 4-20mA	■	■		
Menu lock	All parameters released			□	□
	Only SP1, SEL1 - SEL5* released			■	□
	Only SP1 released			□	■
	All parameters locked			■	■
Factory setting at delivery		■	□	□	□

Programming port & DIP switch

The programming port can be used for offline programming and diagnostics. Do not use this port during normal control operation.

When delivered, input 1 is preset for the connection of thermocouples or resistance thermometers and all menu parameters are enabled.

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The menu lock can be used to restrict access to the parameters. Even when locked, all parameters are displayed in the menu.

SEL1- SEL5 show the parameters enabled in quick access.

4.4 Buttons and display

The UREG200 controller is fully programmable via the front keys. The available key functions can be found in the following table.

Key functions:

Key	Function	describtion
▲	Button HIGH	Pressing once increases the parameter value by one digit. By holding down the parameter value is quickly increased.
▼	Button DOWN	Pressing once decreases the parameter value by one digit. By holding down the parameter value is quickly decreased.
↻	Button BLANK	Pressing takes you to the next parameter.
↻ for 3 sec.	Enter button	Allows access to the "USER MENU", in various other menus this confirms the entry or saves a value.
↻ for 6 sec.	Start recording	Deletes the stored process values PVHI and PVLO and starts the new recording of the process limit values.
↻ ▲ simultaneously	Scroll backwards	Pressing takes you to the previous parameter.
↻ ▼ simultaneously	MODE	Press to select the operating mode.
▲ ▼ simultaneously	RESET	Press to return to the operating display.
▲ ▼ for 3 sec.	SLEEP Mode	The controller goes into SLEEP mode, but this must be enabled in the menu item SLEP.
↻ ▲ ▼ simultaneously	Internal setup	**This menu item is only available for maintenance work by promesstec.** Incorrect settings can cause the controller to behave incorrectly!

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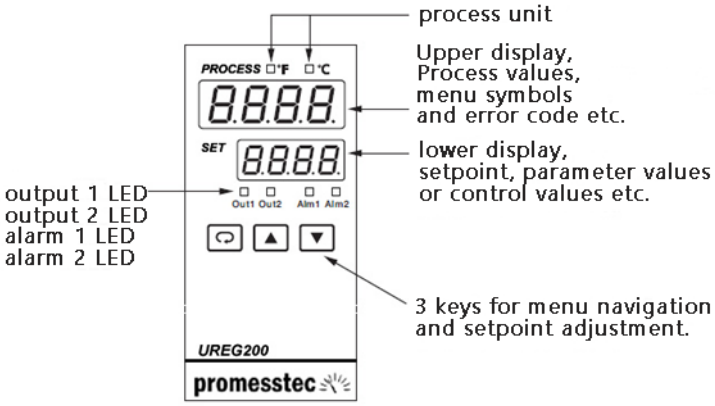


Display description

A	A	E	E	I	i	N	n	S	S	X	
B	b	F	F	J	J	O	o	T	t	Y	y
C	C	G	G	K	K	P	P	U	u	Z	
c	c	H	H	L	L	Q		V	v	?	?
D	d	h	h	M	m	R	r	W		=	=

Meaning of the display symbols

Display of a 5-digit number!

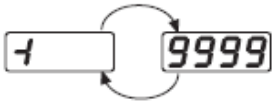
For numbers with decimal places, the last digit is not displayed.

-199,99 is displayed as -199,9.

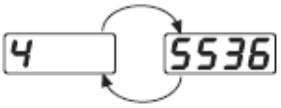
4553,6 is displayed as 4553.

For numbers without decimal places, the value is displayed alternately.

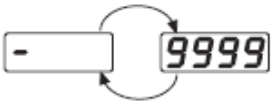
-19999 is displayed as:



45536 is displayed as:



-9999 is displayed as:



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All segments and LEDs remain off for 0.5 sec.

All display elements light up for 2 sec.

The current programme version is displayed for 2.5 sec.

Example: Programme version

For 2.5 sec. the serial number is shown on both displays.

Example: Serial number 1.5.22.192

The internal operating hours counter is displayed for 2.5 sec.

Example: 23456.2 hours

Display when switching on

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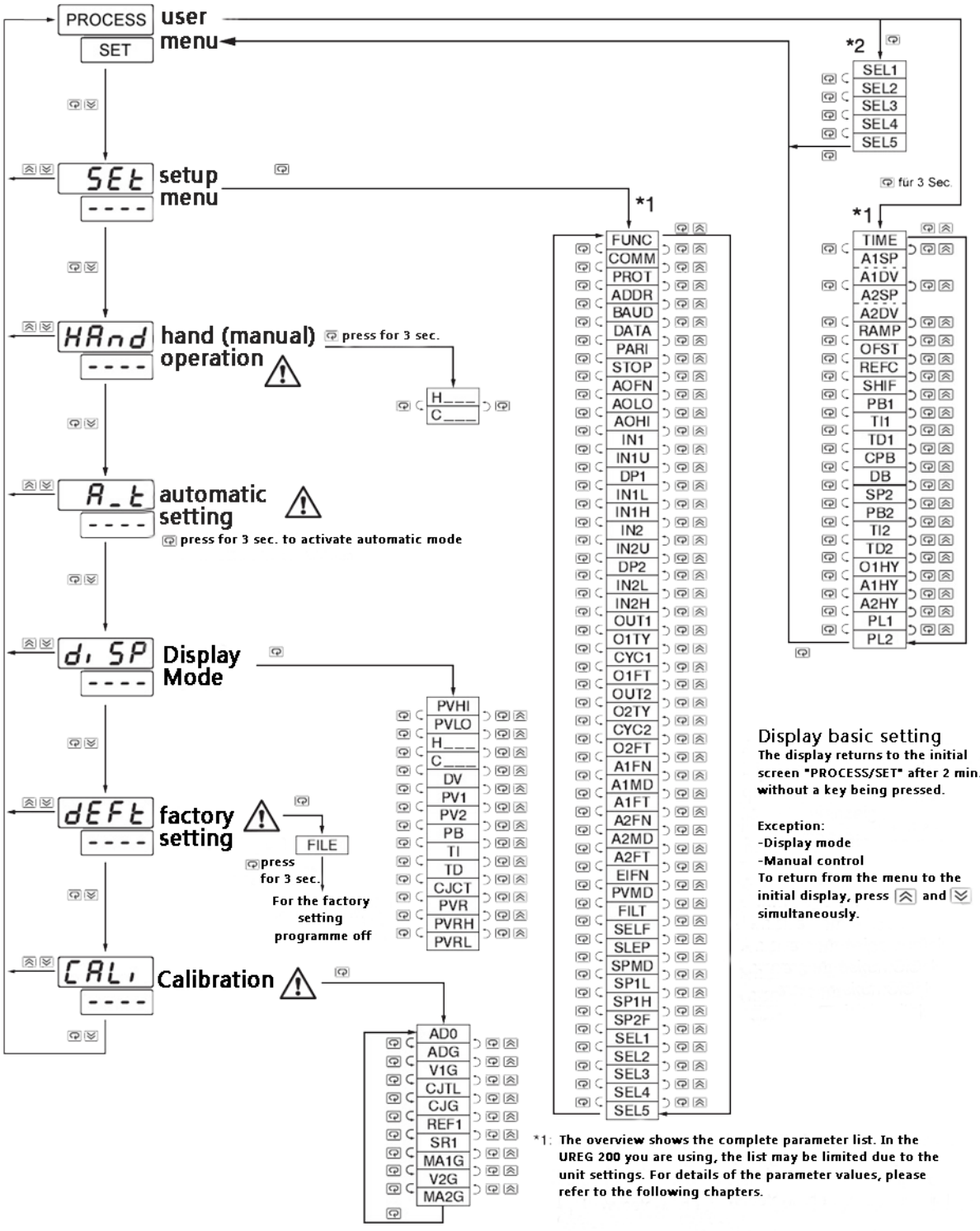
4.5 Menu overview



Display basic setting

The display returns to the initial screen "PROCESS/SET" after 2 min. without a key being pressed.

Exception:
-Display mode
-Manual control
To return from the menu to the initial display, press ⩓ and ⩔ simultaneously.

*1: **The overview shows the complete parameter list. In the UREG 200 you are using, the list may be limited due to the unit settings. For details of the parameter values, please refer to the following chapters.**

*2: **You can set the 5 most common parameters with SEL1 to SEL5 in front of the user menu as quick access.**

⚠ **Confirming these menu items interrupts the control loop and changes the previous settings. Make sure that the system allows these settings.**

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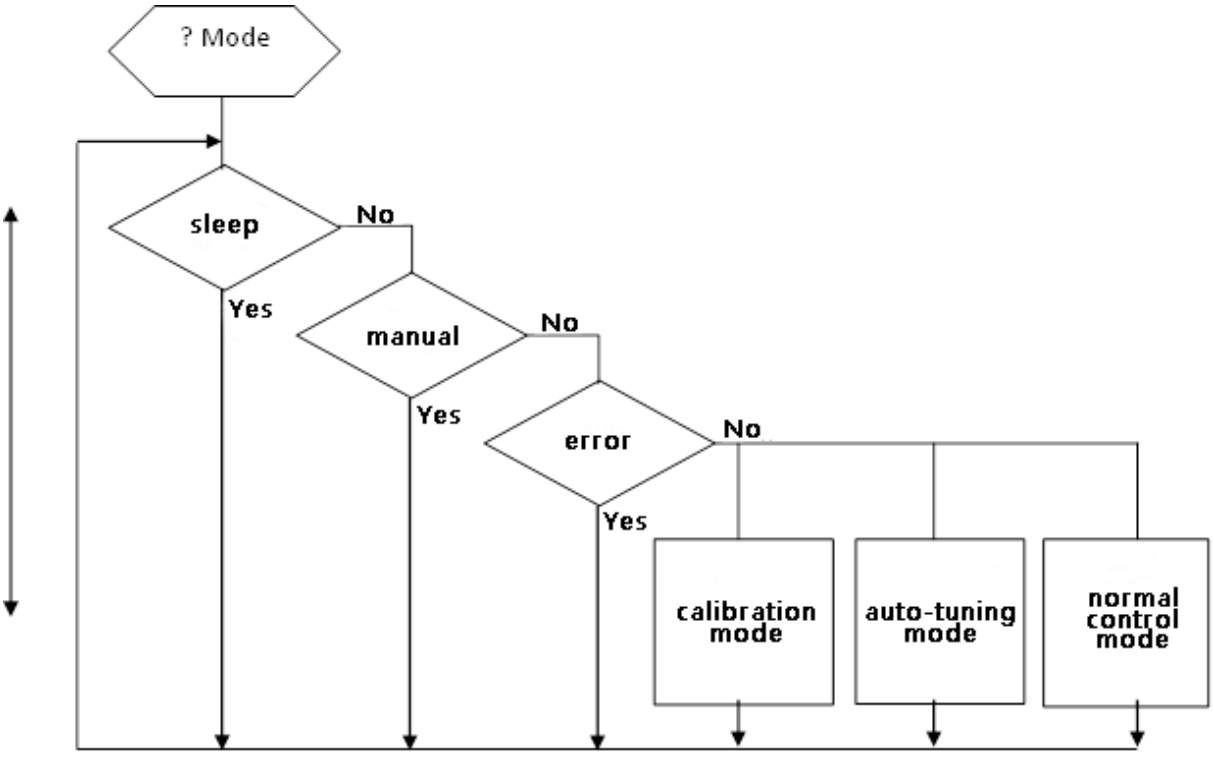
4.6 System Modes

The controller works as a closed control loop in normal operation. If you call up the "User Menu", "Setup Menu" or "Display Mode" in control mode, the control loop is not interrupted. This also applies to the activation of the event input.

Under certain conditions, the controller leaves normal operation and enters an exception mode. The exception modes are: Sleep mode, Manual regulation mode, error mode, calibration mode and Auto-tuning mode. These modes operate in open loop except for Auto-tuning mode, which operates in ON-OFF plus PID loop.

The operating modes are staggered in the following priorities. A low priority mode cannot affect a higher priority mode, see picture.

System Modes
sleep mode
see chapter 4-11
manual regulation mode
see chapter 3-22
error mode
see chapter 3-16
calibration mode
see chapter 6
auto-tuning mode
see chapter 3-19
Normal control mode
see chapter 3-23, 3-25, 4-1



Priorities of the operating modes

Calibration mode, auto-tuning mode and normal control mode have the same priority. The sleep mode has the highest priority.

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4.7 Parameter description

Parameter description

Included in	Base function	Parameter Name	Display	Parameter description	Range	Default Value
User Menu	Yes	SP1		Set point 1	Low: SP1L High SP1H	100,0 °C
	Yes	TIME	tı nE	Timer	Low: 0 High: 6553,5 min.	0
	Yes	A1SP	A 1SP	Alarm 1 Switching point	See table 1.5, 1.6	100,0 °C
	Yes	A1DV	A 1dY	Alarm 1 Difference	Low: -200,0 °C High: 200,0°C	10,0 °C
	Yes	A2SP	A2SP	Alarm 2 Switching point	See table 1.5, 1.7	100,0 °C
	Yes	A2DV	A2dY	Alarm 2 Difference	Low: -200,0 °C High: 200,0°C	10,0 °C
	No	RAMP	rAnP	Ramps rate	Low: 0 High: 500,0 °C	0
	Yes	OFST	oFSt	Offset value for P control	Low: 0 High: 100,0	25
	No	REFC	rEFC	Reference constant for special functions	Low: 0 High: 60	2
	Yes	SHIF	SHı F	PV1 Switch back offset	Low: -200,0 °C High: 200,0°C	0
	Yes	PB1	Pb 1	Proportional band 1	Low: 0 High: 500,0 °C	10,0 °C
	Yes	TI1	tı 1	Integral time 1	Low: 0 High: 1000sec.	100
	Yes	TD1	td 1	Difference time 1	Low: 0 High: 360,0 sec.	25
	Yes	CPB	CPb	Cooling proportional band	Low: 1 High: 255%	100
	Yes	DB	db	Heating-Cooling Dead Band / negative value = overlapping	Low: -36,0 High: 36,0%	0
	No	SP2	SP2	Set point 2	See table 1.5, 1.7	37,8 °C
	No	PB2	Pb2	Proportional band 2	Low: 0 High: 500,0 °C	10,0 °C
	No	TI2	tı 2	Integral time 2	Low: 0 High: 1000sec.	100
	No	TD2	td2	Difference time 2	Low: 0 High: 360,0 sec.	25
	Yes	O1HY	o 1HY	Output hysteresis 1	Low: 0,1 High: 55,6 °C	0,1
	Yes	A1HY	A 1HY	Hysterese-Alarm 1	Low: 0,1 High: 10,0 °C	0,1
	Yes	A2HY	A2HY	Hysterese-Alarm 2	Low: 0,1 High: 10,0 °C	0,1
	No	PL1	PL 1	Limitation output 1	Low: 0 High: 100%	100
	No	PL2	PL2	Limitation output 2	Low: 0 High: 100%	100
Setup Menu	Yes	FUNC	FunC	Setup menu catch	0 bASC : Basic function 1 FuLL : all function	1
	No	COMM	Conn	Communication interfaces selection	0 nonE : No interface 1 485 : RS-485 interface 2 232 : RS-232 interface 3 4-20 : 4-20mA Retransfer 4 0-20 : 0-20mA Retransfer 5 0-1Y : 0-1V Retransfer 6 0-5Y : 0-5V Retransfer 7 1-5Y : 1-5V Retransfer 8 0-10 : 0-10V Retransfer	1
	No	PORT	Prot	Transfer protocol	0 rtu : Modbus RTU	0
	No	ADDR	Addr	Interface address	Low: 1 High: 255	-

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Included In	Base Function	Parameter Name	Display	Parameter describtion	Range	Standard Value
Setup Menu	No	BAUD	bAud	Transmission speed	0 03 : 0,3 Kbits/s 1 06 : 0,6 Kbits/s 2 12 : 1,2 Kbits/s 3 24 : 2,4 Kbits/s 4 48 : 4,8 Kbits/s 5 96 : 9,6 Kbits/s 6 144 : 14,4 Kbits/s 7 192 : 19,2 Kbits/s 8 288 : 28,8 Kbits/s 9 384 : 38,4 Kbits/s	5
	No	DATA	dAtA	Number of bits	0 7bit : 7 Data bit 1 8bit : 8 Data bit	1
	No	PARI	PAri	Parity	0 EvEn : straight 1 odd : odd 2 nonE : none	0
	No	STOP	StoP	Stop bit	0 1bit : one Stop bit 1 2bit : two Stop bits	
	No	AOFN	AoFn	Analog output function	0 Pv1 : Value IN1 1 Pv2 : Value IN2 2 P1-2 : Difference IN1 - IN2 3 P2-1 : Difference IN2 - IN1 4 Sv : Set point SV 5 nv1 : OUT1 Manipulation 6 nv2 : OUT2 Manipulation 7 dv : Difference PV-SV	0
	No	AOLO	AoLo	Analog output LOW-scaling	Low: -19999 High: 45536	0°C
	No	AOHI	AoHi	Analog output HIGH-scaling	Low: -19999 High: 45536	100°C
	Yes	IN1	in1	IN1 Sensor type	0 J_tC : TC type J 1 K_tC : TC type K 2 t_tC : TC type T 3 E_tC : TC type E 4 b_tC : TC type B 5 r_tC : TC type R 6 S-tC : TC type S 7 n_tC : TC type N 8 L-tC : TC type L 9 Pt.dn : PT100 DIN 10 Pt.JS : PT100 JIS 11 4-20 : 4...20mA linear 12 0-20 : 0...20mA linear 13 0-1v : 0...1VDC linear 14 0-5v : 0...5VDC linear 15 1-5v : 1...5VDC linear 16 0-10 : 0...10VDC linear 17 SPEC : Special adjustment	1
	Ja	IN1U	in1u	IN1 unit	0 °C : °C 1 °F : °F 2 Pu : Process unit	
	Ja	DP1	dP1	IN1 Decimal point	0 nodP: without decimal point 1 1-dP: 1 decimal point 2 2-dP: 2 decimal point 3 3-dP: 3 decimal point	1
	Ja	IN1L	in1L	IN1 LOW-scaling	Low: -19999 High: 45536	0
	Ja	IN1H	in1H	IN1 HIGH-scaling	Low: -19999 High: 45536	1000

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Included in	Base Function	Parameter Name	Display	Parameter describtion	Range	Standard Value
Setup Menu	No	IN2	in2	IN2 Sensor type	0 none : IN2 deactivated 1 Ct : Current transformer 2 4-20 : 4...20mA linear 3 0-20 : 0...20mA linear 4 0-1V : 0...1VDC linear 5 0-5V : 0...5VDC linear 6 1-5V : 1...5VDC linear 7 0-10 : 0...10VDC linear	1
	No	IN2U	in2u	IN2 unit	see IN1	2
	No	DP2	dP2	IN2 Decimal point	see IN1	1
	No	IN2L	in2L	IN2 LOW-scaling	Low: -19999 High: 45536	0
	No	IN2H	in2H	IN2 HIGH-scaling	Low: -19999 High: 45536	1000
	Yes	OUT1	out1	output 1 fuction (OUT1)	0 rEVr: Heating (opposite) 1 dirt: Cooling (direct)	0
	Yes	O1TY	o1tY	OUT1 Signal type	0 rELY: Relay 1 SSrd: SSR Driver 2 SSr : SSR Relay 3 4-20: 4...20mA module 4 0-20: 0...20mA module 5 0-1V: 0...1VDC module 6 0-5V: 0...5VDC module 7 1-5V: 1...5VDC module 8 0-10: 0...10VDC module	0
	Yes	CYC1	CYC1	OUT1 cycle time	Low: 0,1 High: 100,0sec.	18
	Yes	O1FT	o1Ft	OUT1 Error behavior	BPLS for bumpless transfer or 0,0...100,0% as default value for OUT1 in case of error, when switching on or activating the manual mode	BPSL
	Yes	OUT2	out2	output 2 function (OUT2)	0 none: OUT1 deactivate 1 CooL: PID cooling 2 dCPS: DC Sensor supply installed	0
	Yes	O2TY	o2tY	OUT2 Signal type	see O1TY	0
	Yes	OYC2	CYC2	OUT2 Cycle time	Low: 0,1 High: 100,0sec.	18
	Yes	O2FT	o2Ft	OUT2 Error behavior	BPLS for bumpless transfer or 0,0...100,0% as default value for OUT2 in case of error, when switching on or activating the manual mode	BPSL
	Yes	A1FN	A1Fn	Alarm 1 function	0 none No alarm function 1 ti mr Timer action 2 dEHi Difference high alarm 3 dELo Difference low alarm 4 dbHi Difference band deviation alarm 5 dbLo Difference band alarm 6 PV 1H IN1 Process value high alarm 7 PV 1L IN1 Process value low alarm 8 PV2H IN2 Process value high alarm 9 PV2L IN2 Process value low alarm 10 P 12H IN1 or IN2 high alarm 11 P 12L IN1 or IN2 low alarm 12 d 12H IN1-IN2 high Difference alarm 13 d 12L IN1-IN2 low Difference alarm 14 Lb Control loop alarm 15 SEnb Sensor break or A-D error	2
	Yes	A1MD	A1md	Alarm 1 Mode	0 norm Normal alarm mode 1 Ltch Storing alarm 2 HoLd Alarm held 3 LtHo Storing & held alarm	0

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Included in	Base function	Parameter Name	Display	Parameter describtion	Range	Standard Value
Setup Menu	Yes	A1FT	A 1Ft	Alarm 1 Error behavior	0 oFF Alarm output OFF in case of error 1 on Alarm output ON in case of error	1
	Yes	A2FN	A2Fn	Alarm 2 function	See alarm 1 function	2
	Yes	A2MD	A2md	Alarm 2 mode	See alarm 1 mode	0
	Yes	A2FT	A2Ft	Alarm 2 Error behavior	See alarm 1 Error behavior	1
	No	EIFN	Ei Fn	Event input function	0 nonE : No event function 1 SP2 : SP2 replaces SP1 2 Pid2 : PB2, TI2, TD2 replaces PB1, TI1, TD1 3 SPP2 : SP2, PB2, TI2, TD2 replaces SP1, PB1, TI1, TD1 4 rSA1 : Reset alarm output 1 5 rSA2 : Reset alarm output 2 6 rA12 : Reset alarm 1 & 2 7 do1 : Output 1 deactivate 8 do2 : Output 2 deactivate 9 do12 : Output 1 & 2 deactivate 10 Loc : Lock all parameters	1
	No	PVMD	PUnd	PV Mode selection	0 PU1 : PV1 as process value 1 PU2 : PV2 as process value 2 P1-2 : PV1 - 2 as process value 3 P2-1 : PV2 - 1 as process value	0
	No	FILT	Fi Lt	Damping filter for PV	0 0 : 0 Seconds 1 0.2 : 0,2 Seconds 2 0.5 : 0,5 Seconds 3 1 : 1 Seconds 4 2 : 2 Seconds 5 5 : 5 Seconds 6 10 : 10 Seconds 7 20 : 20 Seconds 8 30 : 30 Seconds 9 60 : 60 Seconds	2
	yes	SELF	SELF	Self-optimization	0 nonE : deactivate 1 YES : activate	0
	Yes	SLEP	SLEP	Sleep mode	0 nonE : deactivate 1 YES : activate	0
	No	SPMD	SPnd	Set point mode	0 SP12 : SP1 or SP2 as setpoint (depending on EIFN-setting 1 ni nr : Minute ramp as setpoint 2 Hrr : Hour ramp as setpoint 3 PU1 : IN1 as set point 4 PU2 : IN2 as set point 5 PunP : Selection for pump control	0
	Yes	SP1L	SP 1L	SP1 LOW-Value	Low: -19999 High: 45536	0 °C
	Yes	SP1H	SP 1H	SP1 HIGH-Value	Low: -19999 High: 45536	1000 °C
	No	SP2F	SP2F	Setpoint 2 format	0 ACtu : SP2 is a direct value 1 dEVi : SP2 is a difference value	0

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Included in	Base function	Parameter Name	Display	Parameter describtion	Range	Standard Value
Setup Menu	Yes	SEL1	SEL 1	1. Select parameters	0 nonE: no parameter prepended 1 t, nE: Parameter TIME prepended 2 A1SP: Parameter A1SP prepended 3 A1dY: Parameter A1DV prepended 4 A2SP: Parameter A2SP prepended 5 A2dY: Parameter A2DV prepended 6 rAnP: Parameter RAMP prepended 7 oFSt: Parameter OFST prepended 8 rEFC: Parameter REFC prepended 9 SHi F: Parameter SHIF prepeded 10 Pb 1: Parameter PB1 prepended 11 t, 1: Parameter TI1 prepended 12 td 1: Parameter TD1 prepended 13 CPb: Parameter CBP prepended 14 db: Parameter DB prepended 15 SP2: Parameter SP2 prepended 16 Pb2: Parameter PB2 prepended 17 t, 2: Parameter TI2 prepended 18 td2: Parameter TD2 prepended	0
	Yes	SEL2	SEL2	2. Select parameters	See SEL1	0
	Yes	SEL3	SEL3	3. Select parameters	See SEL1	0
	Yes	SEL4	SEL4	4. Select parameters	See SEL1	0
	Yes	SEL5	SEL5	5. Select parameters	See SEL1	0
Calibrat-ion Menu	Yes	AD0	Ad0	A to D zero calibration coefficient	Low: -360 High: 360	-
	Yes	ADG	AdG	A to D Gain calibration coefficient	Low: -199,9 High: 199,9	-
	Yes	V1G	U 1G	Voltage input 1 Gain Calibration coefficient	Low: -199,9 High: 199,9	-
	Yes	CJTL	CJtL	Cold junction LOW Temperature Calibration coefficient	Low: -5,00 °C High: 40,00 °C	-
	Yes	CJG	CJG	Reference junctions Gain Calibration coefficient	Low: -199,9 High: 199,9	-
	Yes	REF1	rEF 1	Reference voltage 1 Calibration coefficient for RTD1	Low: -199,9 High: 199,9	-
	Yes	SR1	Sr. 1	Serial resistance 1 Calibration coefficient for RTD1	Low: -199,9 High: 199,9	-
	Yes	MA1G	nA 1G	mA input 1 Gain Calibration coefficient	Low: -199,9 High: 199,9	-
	Yes	V2G	U2G	Voltage input 2 Gain Calibration coefficient	Low: -199,9 High: 199,9	-
	Yes	MA2G	nA2G	mA input 2 Gain Calibration coefficient	Low: -199,9 High: 199,9	-

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Included in	Base function	Parameter Name	Display	Parameter describtion	Range	Standard Value
Display mode Menu	Yes	PVHI	PV.Hi	Max. value memory PV1	Low: -19999 High: 45536	-
	Yes	PVLO	PV.Lo	Min. value memory PV1	Low: -19999 High: 45536	-
	Yes	MV1	H___	actual OUT1 value	Low: 0 High: 100,00%	-
	Yes	MV2	C___	actual OUT2 value	Low: 0 High: 100,00%	-
	Yes	DV	dv	actual difference (PV-SV) value	Low: -12600 High: 12600	-
	Yes	PV1	PV 1	IN1 value	Low: -19999 High: 45536	-
	Yes	PV2	PV2	IN2 value	Low: -19999 High: 45536	-
	Yes	PB	Pb	actual proportional band value	Low: 0 High: 500,0 °C	-
	Yes	TI	ti	actual integral time	Low: 0 High: 4000 sec.	-
	Yes	TD	td	actual Difference time	Low: 0 High: 1440 sec.	-
	Yes	CJCT	CJCt	Reference junction com pensations temperature	Low: -40,00°C High: 90,00°C	-
	Yes	PVR	PVr	actuel procss rate value	Low: -16383 High: 16383	-
	Yes	PVRH	PVr.H	max. process rate value	Low: -16383 High: 16383	-
	Yes	PVRL	PVr.L	min. process rate value	Low: -16383 High: 16383	-

input (IN1 or IN2) range

input type	J-TC	K-TC	T-TC	E-TC	B-TC	R-TC	S-TC
LOW	-120 °C	-200 °C	-250 °C	-100 °C	0 °C	0 °C	0 °C
HIGH	1000 °C	1370 °C	400 °C	900 °C	1820 °C	1767,8 °C	1767,8 °C

Input type	N-TC	L-TC	PT.DN	PT.JS	CT	Linear (V,mA) or SPEC
LOW	-250 °C	-200 °C	-210 °C	-200 °C	0 A	-19999
HIGH	1300 °C	900 °C	700 °C	600 °C	90 A	45536

Range definition A1SP

If A1FN=

Range of A1SP, like parameter

PV1.H, PV1.L	PV2.H, PV2.L	P1.2.H, P1.2.L D1.2.H, D1.2.L
IN1	IN2	IN1, IN2

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Range definition of A2SP
If A1FN=

Range of A1SP, like Parameter			
	PV1.H, PV1.L	PV2.H, PV2.L	P1.2.H, P1.2.L D1.2.H, D1.2.L
	IN1	IN2	IN1, IN2

Range definition of SP2
If PVMD=

Range of ASP, like Parameter			
	PV1	PV2	P1 - P2, P2 - P1
	IN1	IN2	IN1, IN2

Exception: If A1SP, A2SP or SP2 are configured with reference to the CT input, the setting range is unlimited.

5. Installation

Note:
To avoid possible material damage or damage to the unit, we strongly recommend fitting a protective shutdown device (protective interrupter contact) that will cause the unit to shut down when a preset condition is reached.

5.1 Before mounting

Check whether a completely assembled controller has been delivered.
Inspect the controller for any damage that may have occurred during transport. If such damage is present, inform the transport company and supplier immediately.
Keep the packaging as it provides optimum protection during transport. Make sure that the housing and the connection contacts are not damaged.

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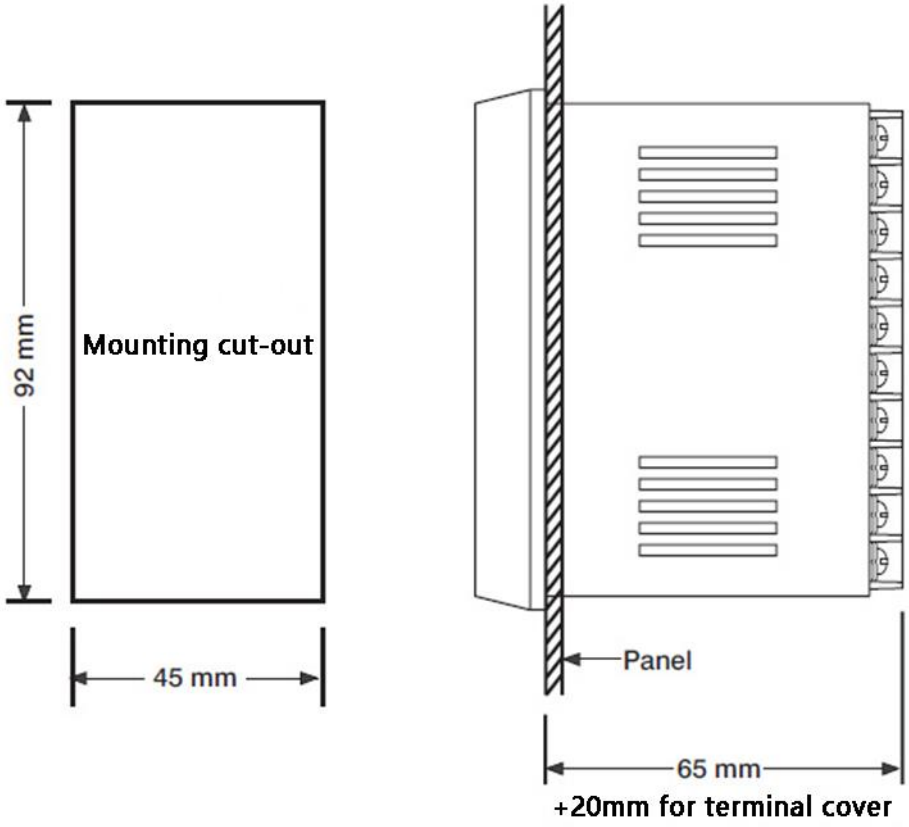
5.2 Installation

Create an assembly cut-out with the dimensions in picture. Remove the transparent terminal covers and the mounting brackets. Place the controller in the mounting cut-out and secure it with the mounting brackets. The terminal covers must be refitted to the unit after installation.



Cutout/ Mounting

! Please ensure that the inside of the mounting plate corresponds to the operating temperature of the unit and that sufficient air can circulate to avoid overheating.

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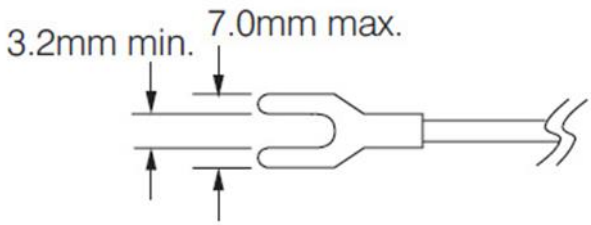
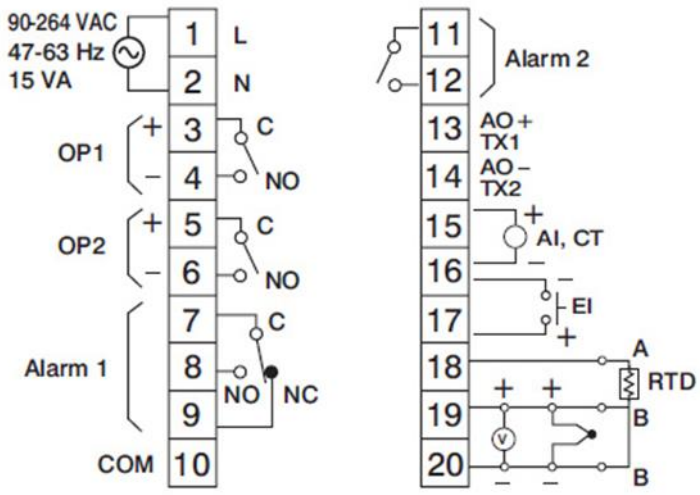
5.3 Connection preparation

- Before connecting the controller, make sure you have the correct unit by referring to the order code. Switch off the power supply.
- Make sure that the supply voltage corresponds to the unit specification.
- The supply circuit must be protected by a suitable protective device, the fuse should be chosen as low as possible.
- The installation and connection of the unit must be carried out in accordance with the applicable regulations of the respective country concerning the installation of electrical equipment, e.g. with regard to cable cross-section, (electrical) pre-fusing and positioning.
- Do not overtighten the connection screws.
- Make sure that the signal inputs and outputs correspond to the unit specification.
- In industrial environments, external voltages on the signal lines can lead to interference and the unit can be damaged. We recommend the use of shielded connection cables, the shield must be connected to ground on one side.



Line connection



Pin assignment

All relay contacts max. 2A / 240VAC for resistive loads.

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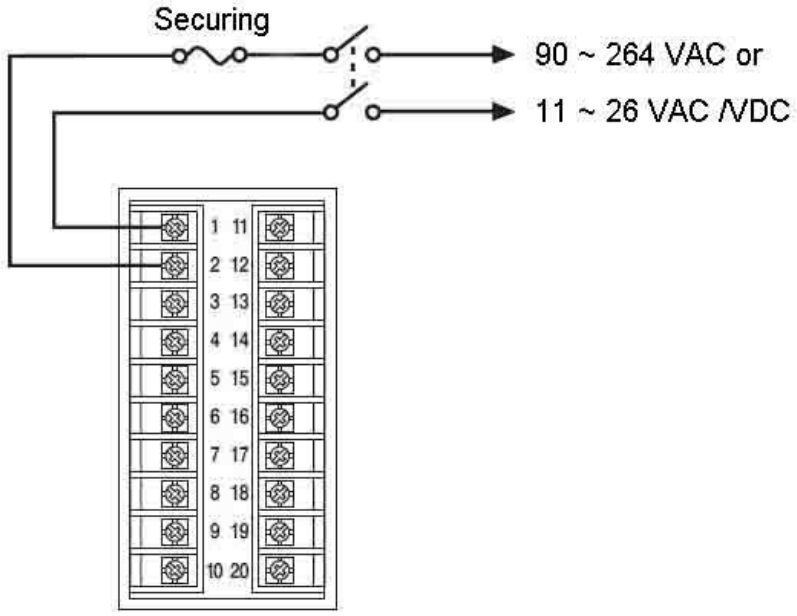
5.4 Power supply

The UREG200 controller can be operated with 11-26 V AC/DC or 90-264 VAC 47 - 63 Hz mains voltage, please observe the information on the unit before connecting it.



Power supply connection

! The supply circuit must be protected by a suitable protective device Local regulations for electrical installation and safety must be observed.

5.5 Sensor connection in general

If the temperature sensor is exposed to a corrosive or caustic environment, it must be protected by suitable measures. The sensor must be positioned so that it shows the actual process temperature:

1. in a liquid medium: in the area with the most movement
2. in air: in the area with the highest air circulation

! If the sensors are inserted in pipes at some distance from the heating vessel, this leads to a thermal "transport" delay (gradient) and thus to poor control behaviour.

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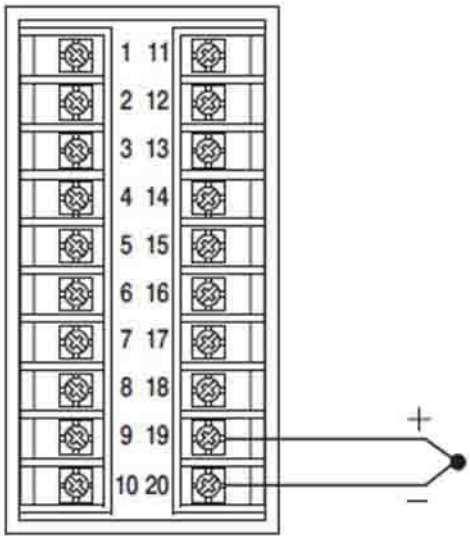
5.6 Connecting thermocouples

If possible, the sensor (see figure 2.5) should only be connected via the thermocouple cable or a compensation cable. Avoid intermediate connections if possible. Using the wrong type of cable will lead to inaccurate measurement results. Make sure the polarity of the leads is correct and compare the terminal colours with the thermocouple reference table.

DIP switch



TC connection

Thermocouples wire colours

Thermocouple Type	Cable Material	British BS	American ASTM	German DIN	French NFE
T	Copper (Cu) Constantan (Cu-Ni)	+ white – blue * blue	+ blue – red * blue	+ red – brown * brown	+ yellow – blue * blue
J	Iron (Fe) Constantan (Cu- Ni)	+ yellow – blue * black	+ white – red * black	+ red – blue * blue	+ yellow – black * black
K	Nickel-Chromium (Ni-Cr) Nickel-Aluminum (Ni-Al)	+ brown – blue * red	+ yellow – red * yellow	+ red – green * green	+ yellow – purple * yellow
R S	Pt-13%Rh,Pt Pt-10%Rh,Pt	+ white – blue * green	+ black – red * green	+ red – white * white	+ yellow – green * green
B	Pt-30%Rh Pt-6%Rh	Use Copper Wire	+grey – red * grey	+red –grey * grey	Use Copper Wire

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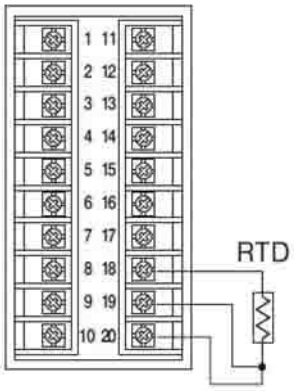
5.7 RTD connect

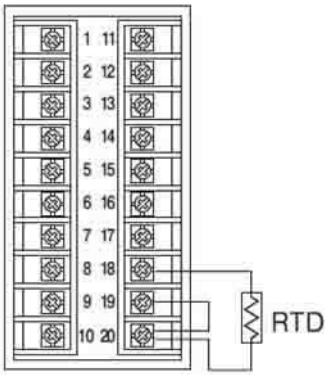
For three-wire RTD probes or RTD temperature probes, connect the resistive terminal and the common terminal as shown in the diagram. With two-wire RTDs, a wire jumper should be used instead of the third wire. Two-wire RTD sensors should only be used for cable lengths of less than 3 metres. Avoid cable joints/solder joints.

DIP switch

3-wire RTD



2-wire RTD



RTD- Connection

5.8 Linear voltage input

The inputs for linear DC voltage or milliamps are connected according to the diagram shown here. Please pay careful attention to the correct polarity.

The connections for input 1 are shown in Figs. 1 and 2,
For the connections for input 2, see Figs. 3 and 4.

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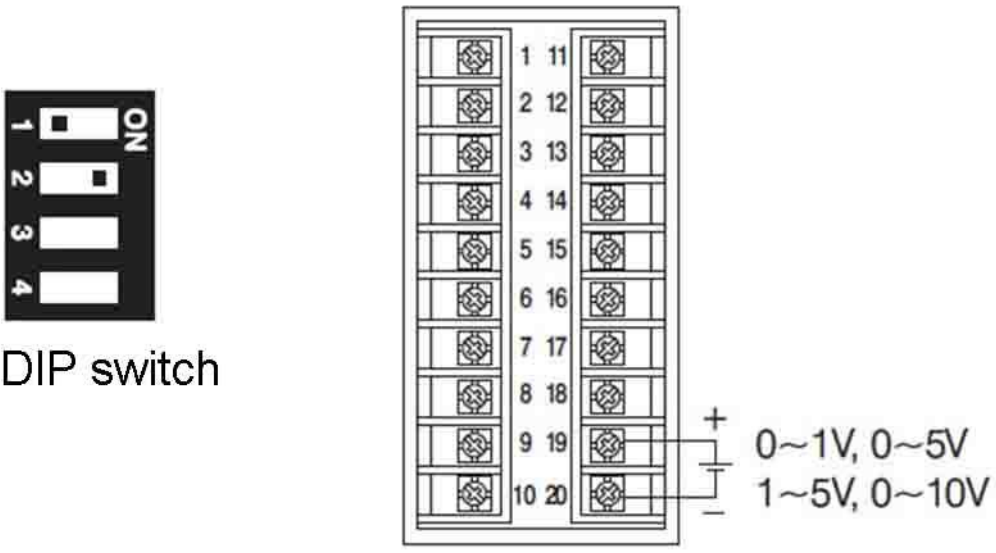

Figure 1: Input 1, voltage input

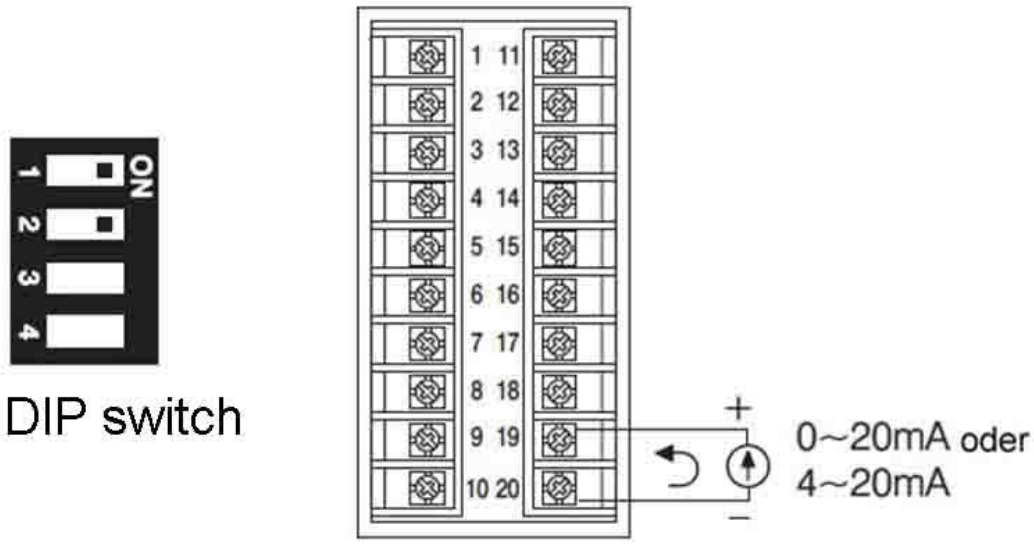

Figure 2: Input 1, mA input

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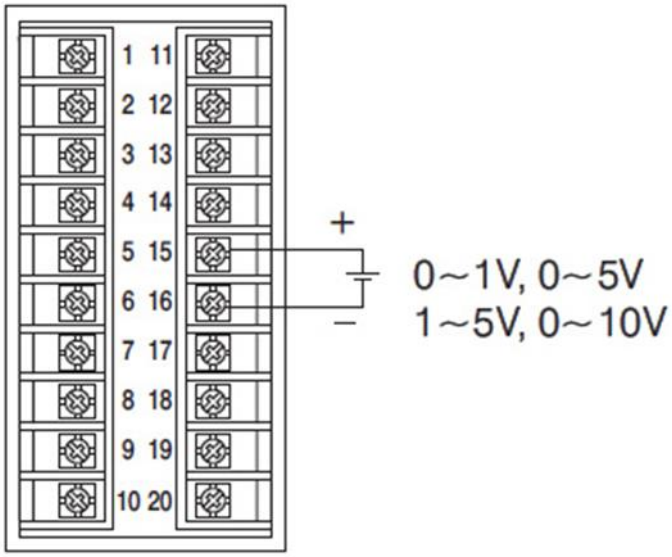

Figure 3: Input 2, voltage input

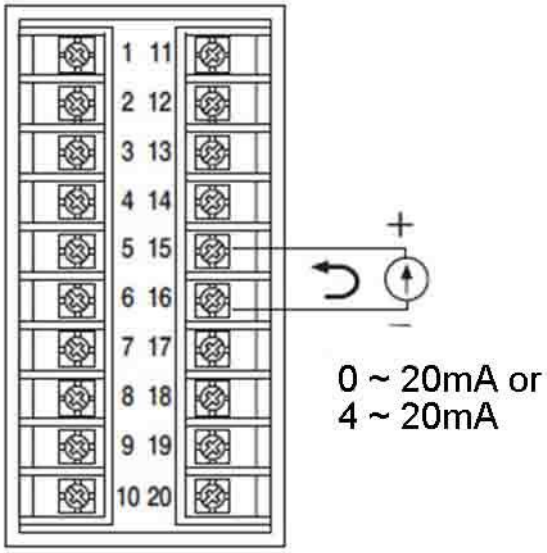

Figure 4: Input 2, mA input

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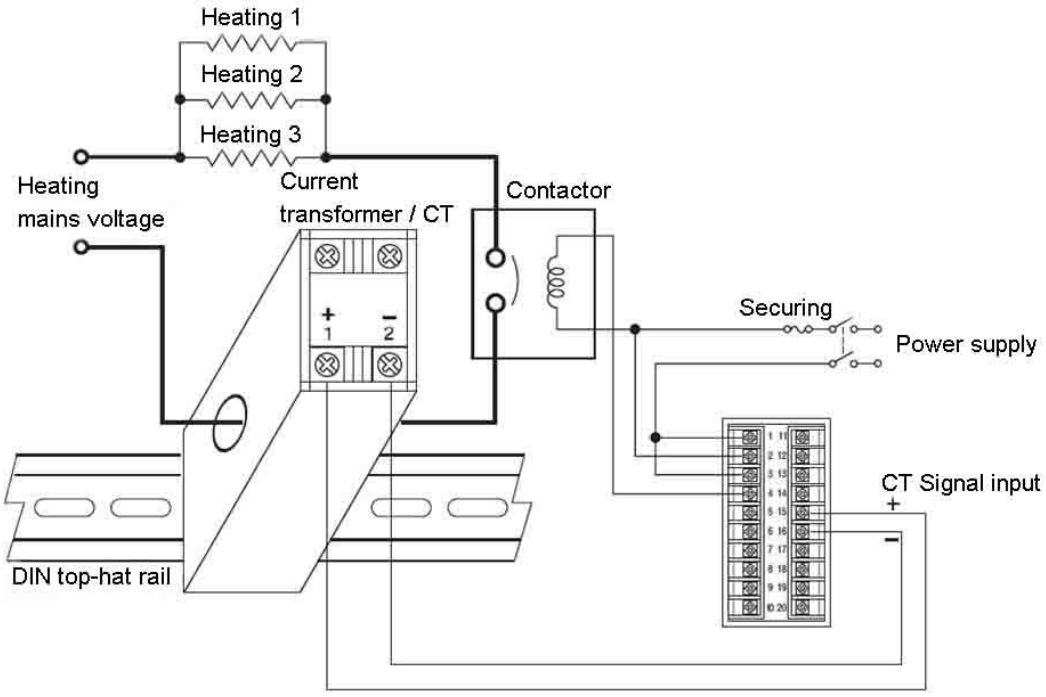
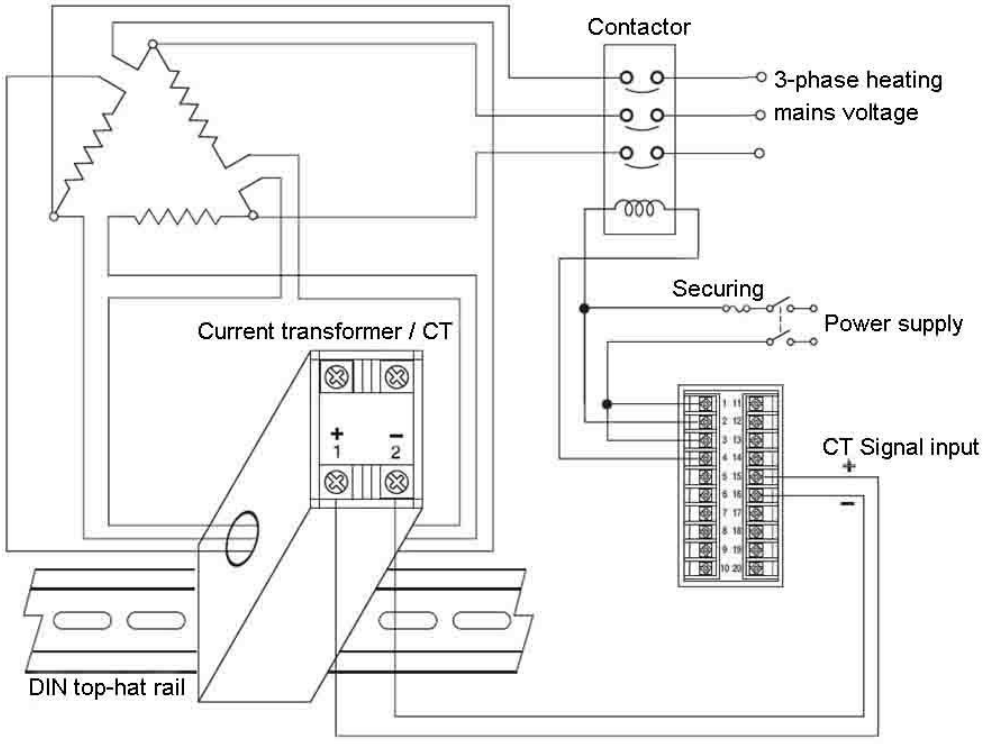
5.9 CT/Current transformer connection



Connection 1-phase heating



Connection 3-phase heating

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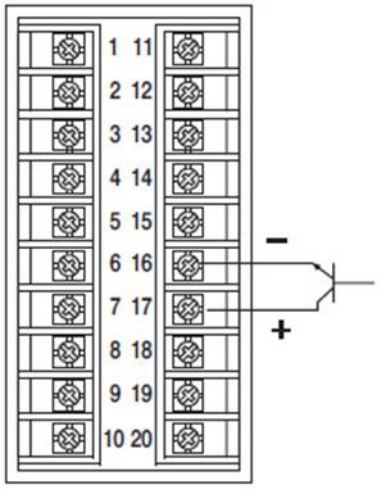
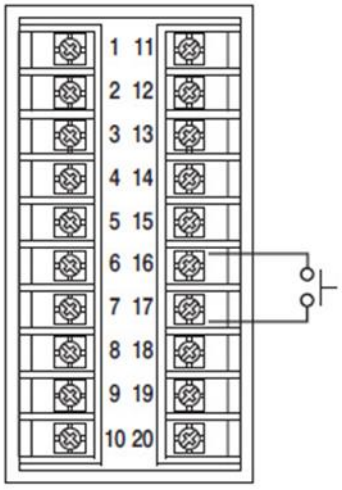
5.10 Event input

Open collector connection



Switch / Button connection



Event input connection

The event input can be wired with a switch or open collector signal. The event input function (EIFN) is active when the switch is closed or the open collector is switched.

The functions of the event input can be found in chapter 7.1.

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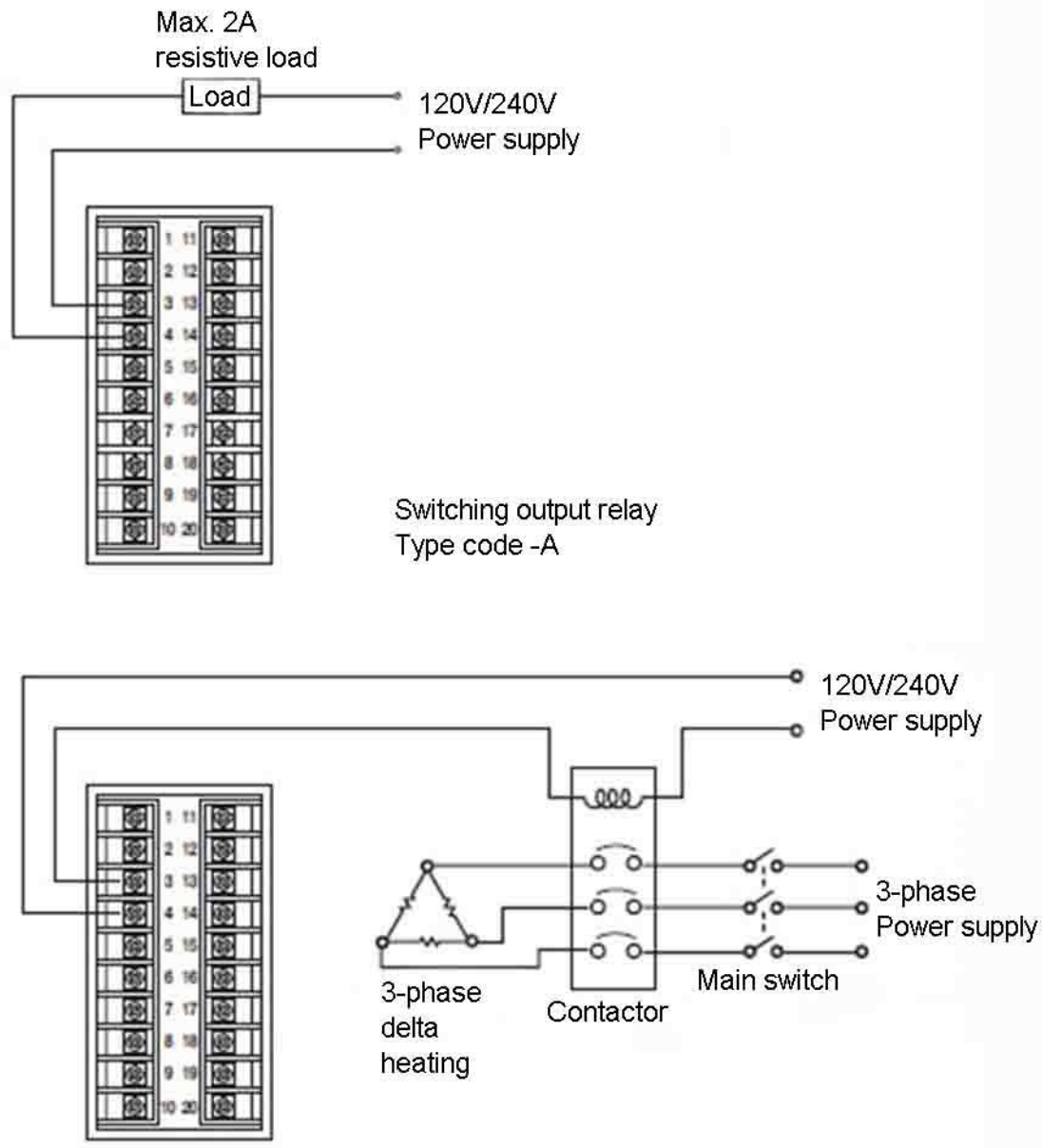
5.11 Control output OUT1



Connection relay output OUT 1

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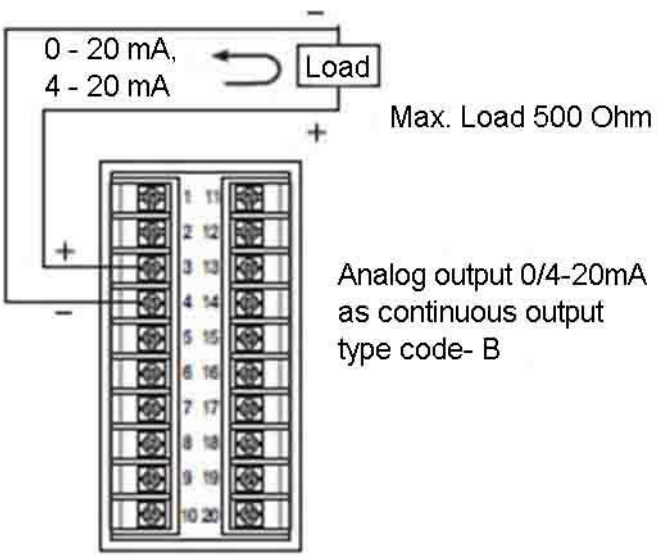
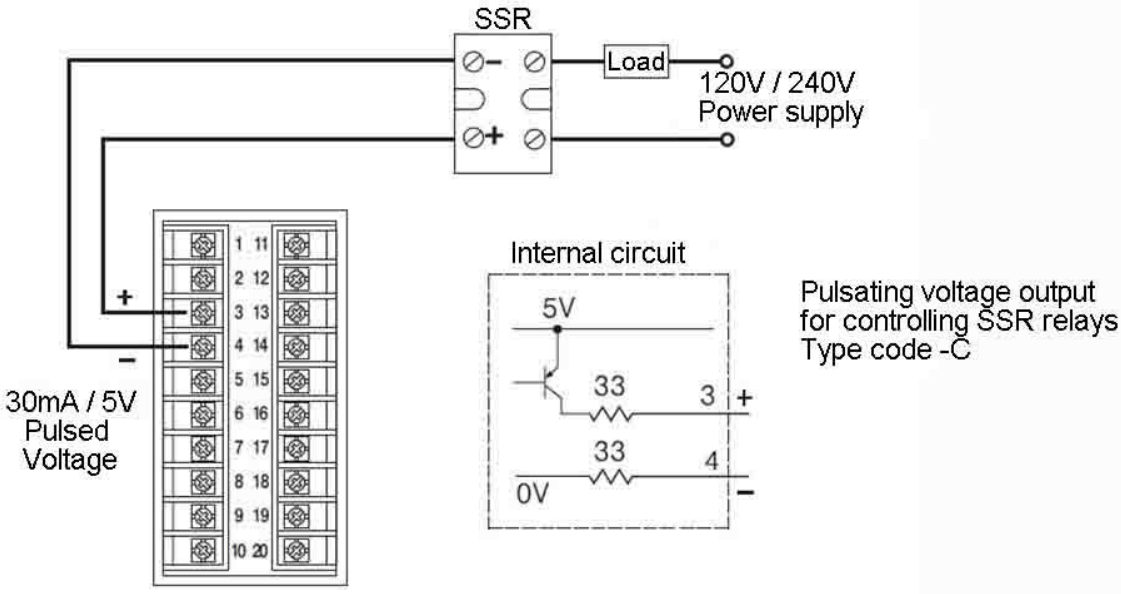


connection analogue output OUT 1



Switching output for controlling solid state relays OUT1

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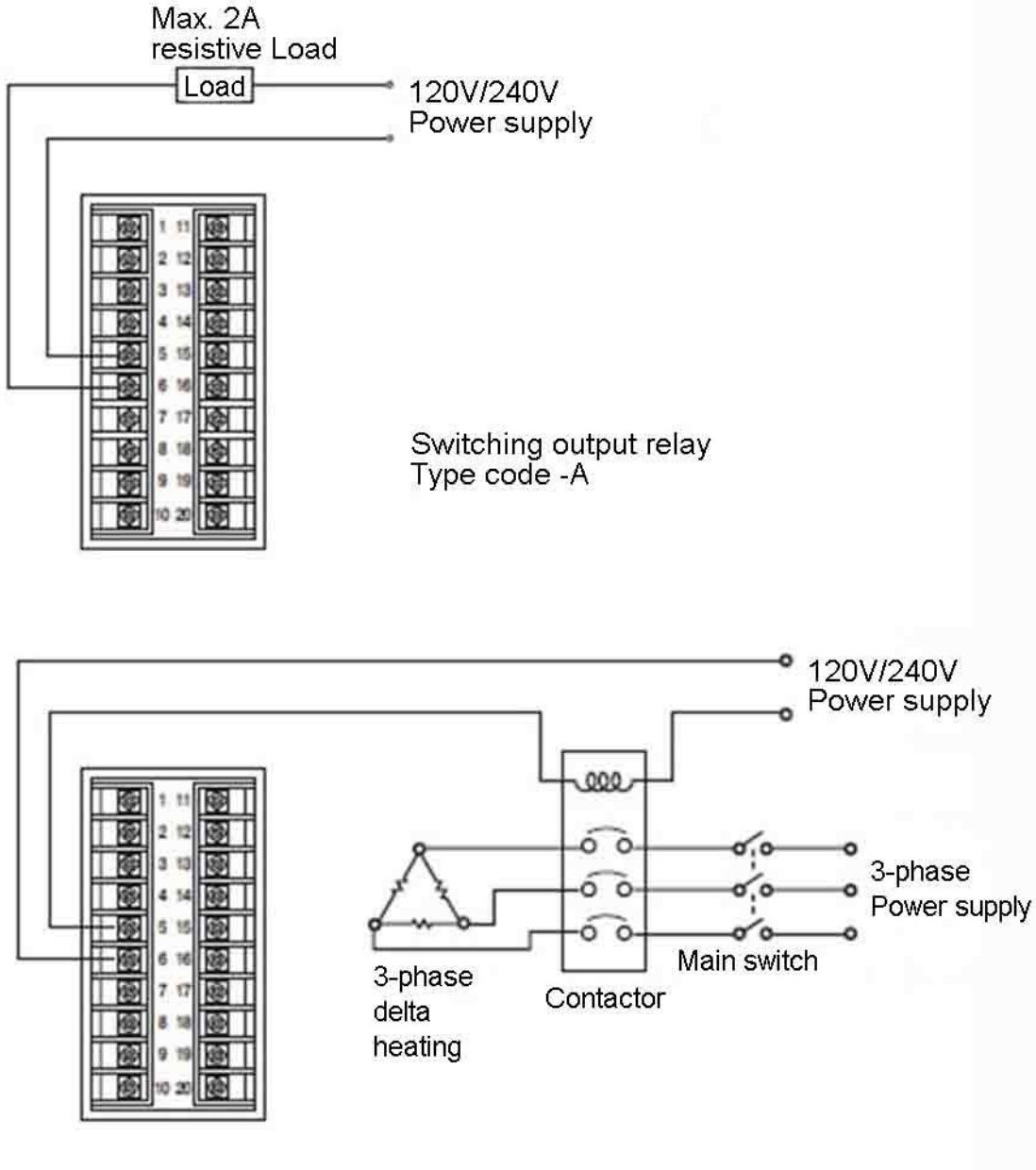
5.12 Control output OUT2



connection relay output OUT2

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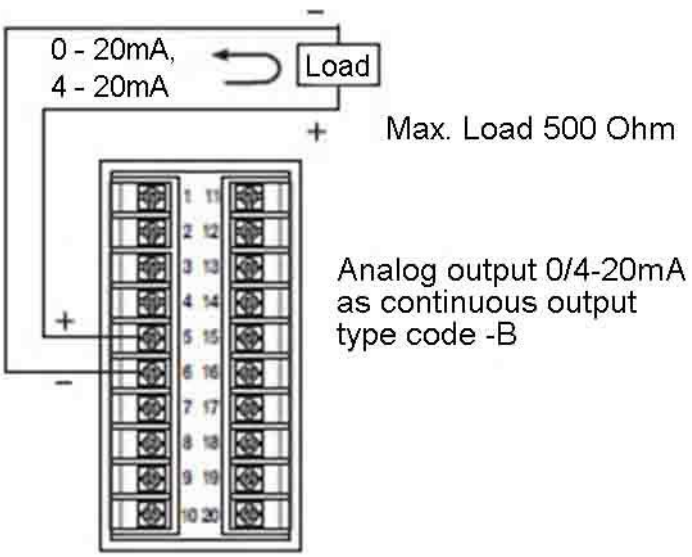
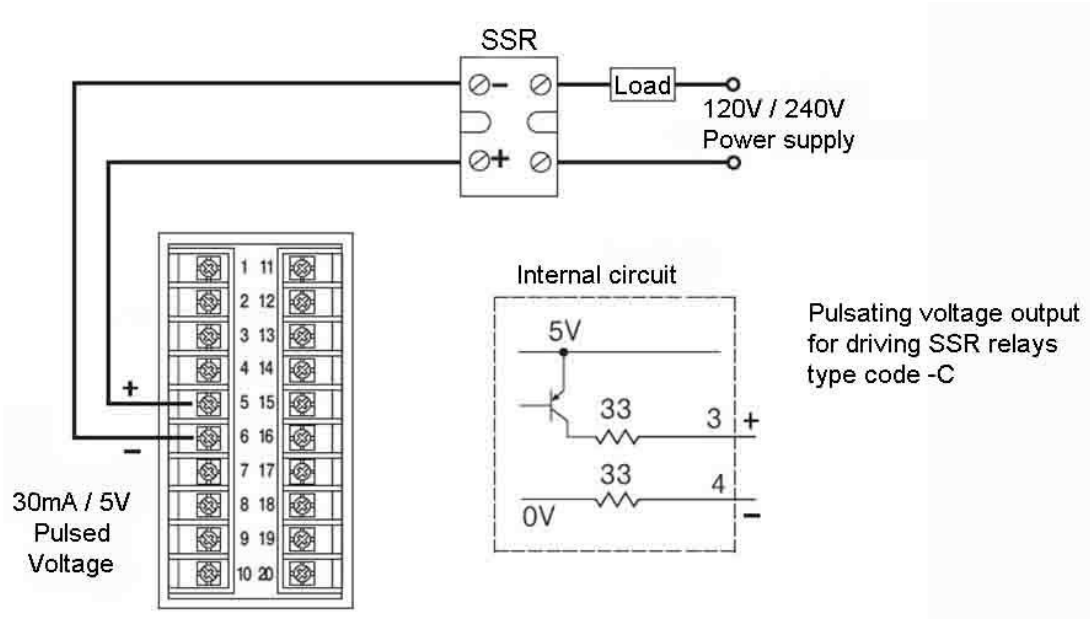


connection analogue output OUT2



Switching output for controlling solid state relays OUT 2

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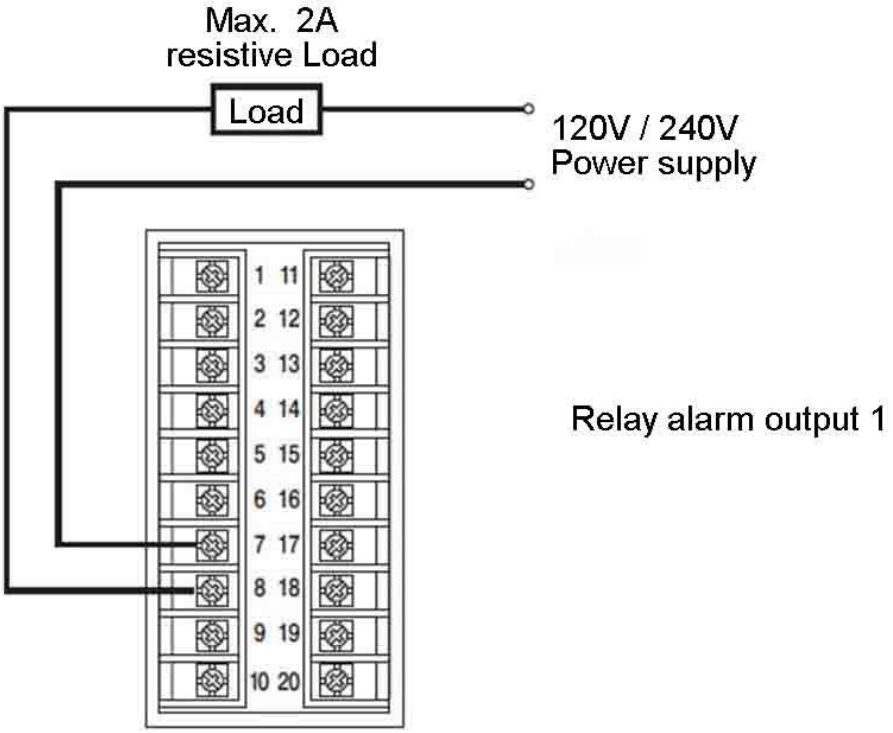
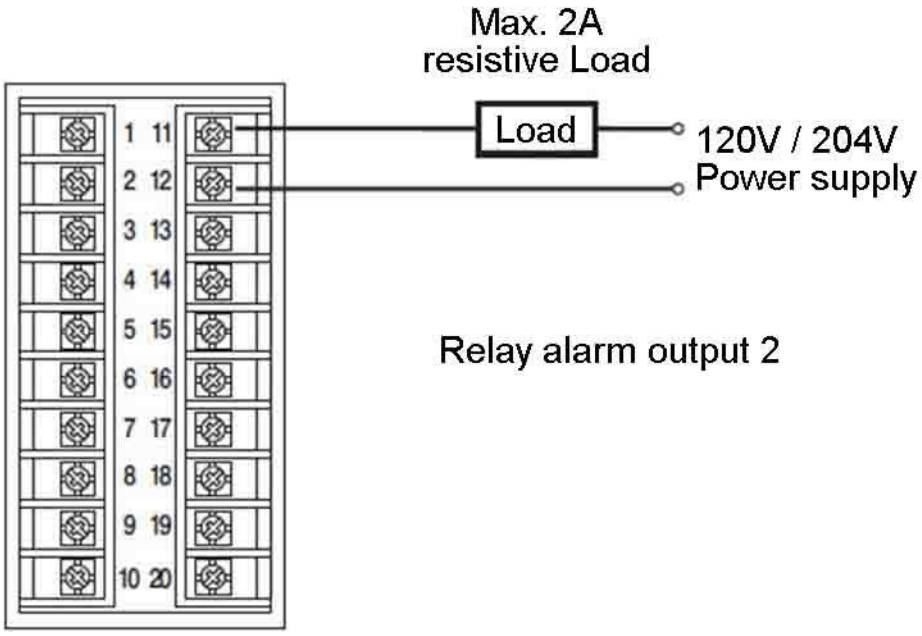
5.13 Alarm outputs



connection Alarm output 1



connection Alarm output 2

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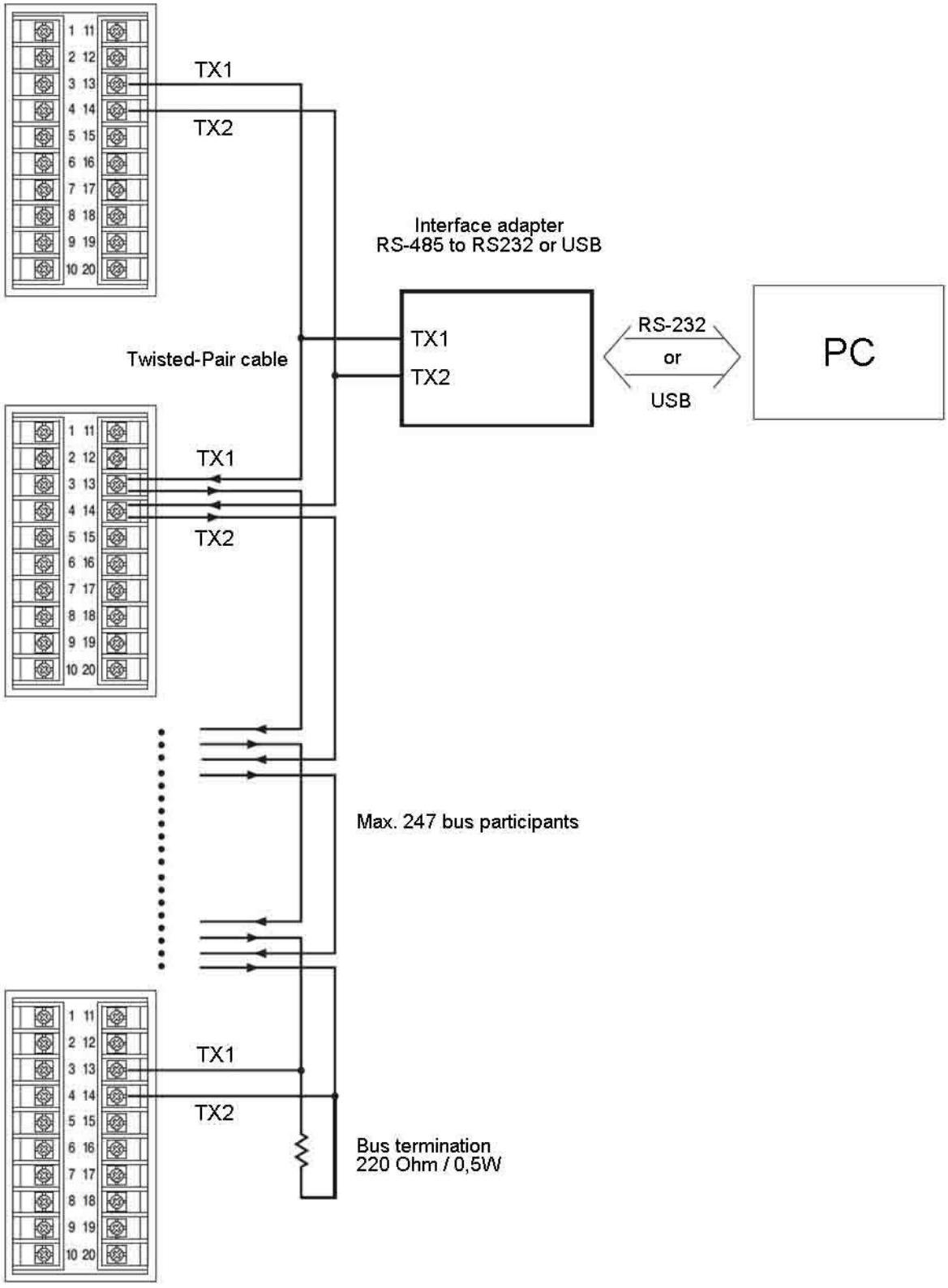
5.14 RS-485 interface



RS-485 Wiring diagram

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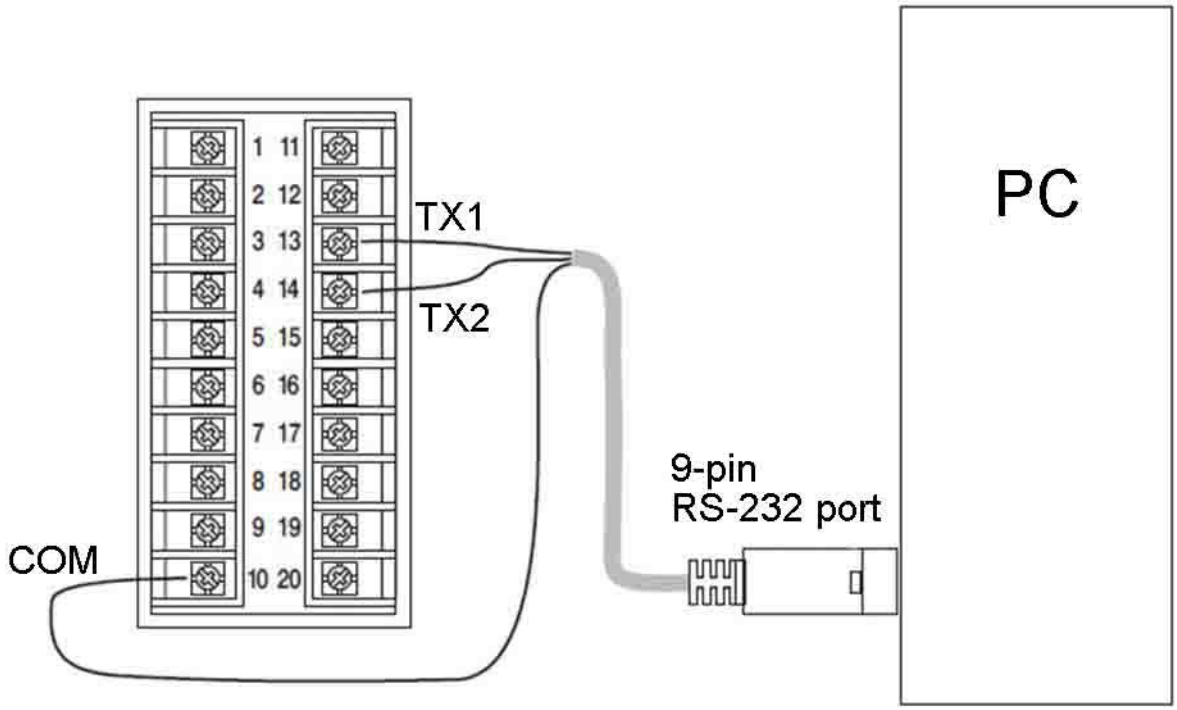
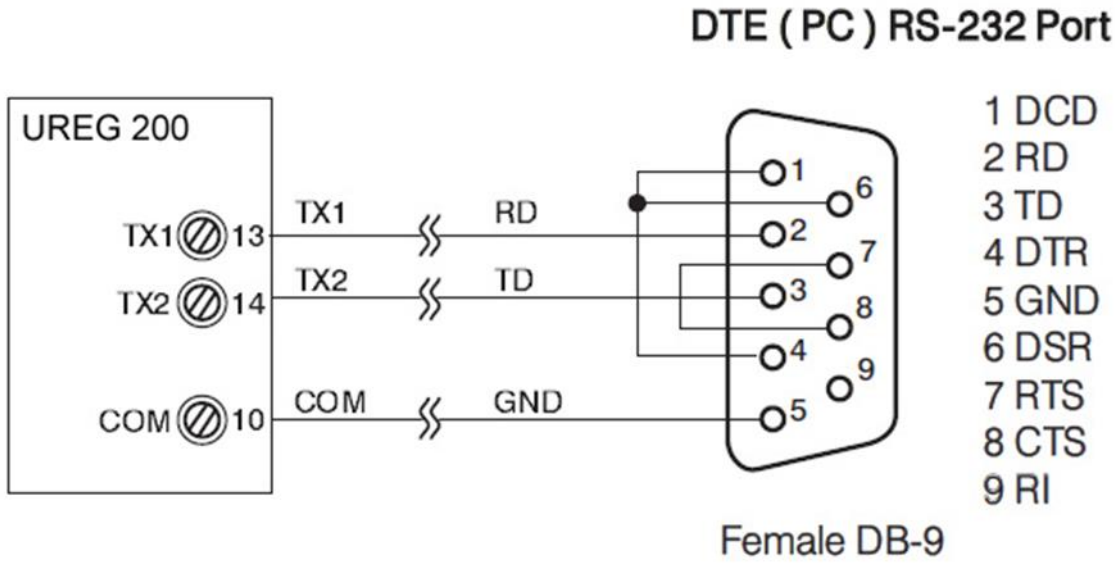
5.15 RS-232 interface



RS-232 Wiring diagram



RS-232 Pin assignment

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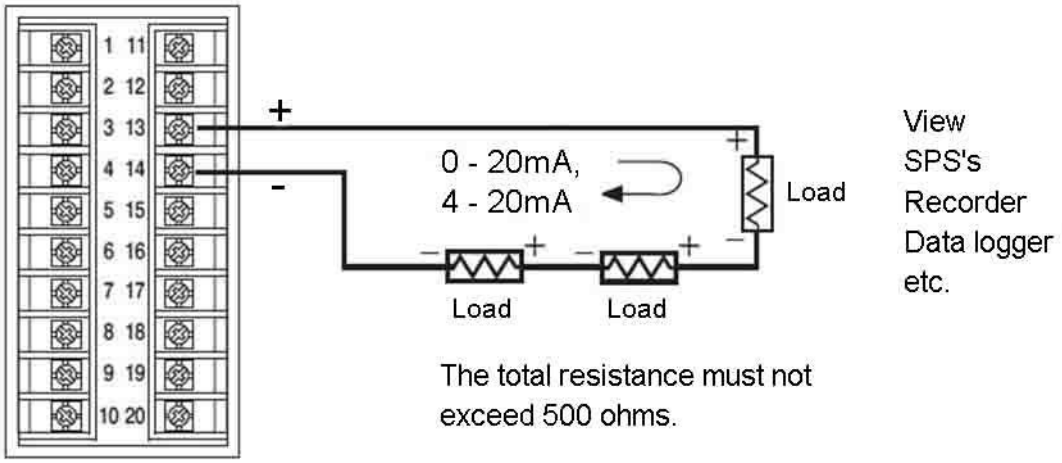
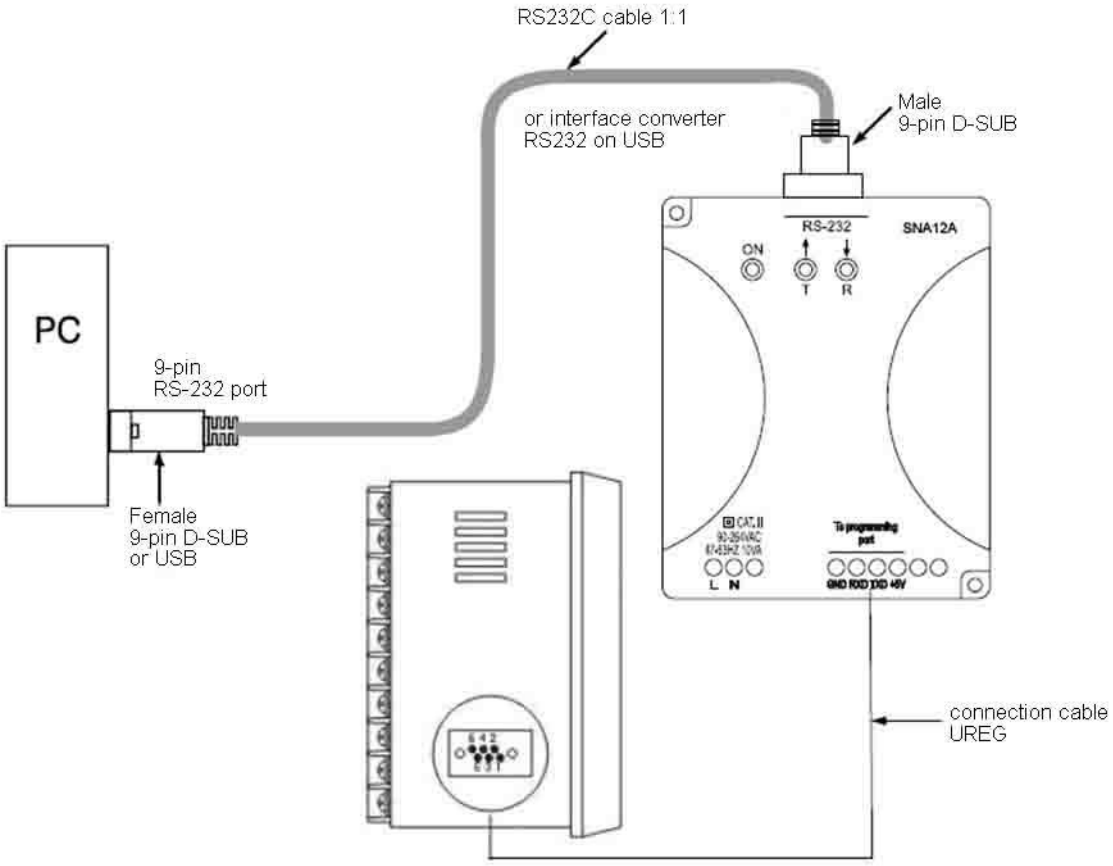
5.16 Analogue retransmission



Retransmission Connection diagram

5.17 Programming interface



Offline programming

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! The programming interface is used exclusively for offline programming and test purposes. Never connect this port during normal regular operation.

6. Programming the basic functions

The UREG200 has the option of selecting the menu range with the "FUNC" parameter at the beginning of programming. The Basic Menu (FUNC = BASC) should be selected for simple applications. The following functions are not available in the basic menu: RAMP, SP2, PB2, TI2, TD2, PL1, PL2, COMM, PROT, ADDR, BAUD, DATA, PARI, STOP, AOFN, AOLO, AOHI, IN2, IN2U, DP2, IN2L, IN2H, EIFN, PVMD, FILT, SLEP, SPMD and SP2F.
These functions are described in chapter 4.

If you do not need the following functions, select the basic menu range:

(1) second set point
(2) second PID
(3) Event input
(4) Remote setpoint (RAMP)
(5) Remote setpointt
(6) Complex process values
(7) Output limit
(8) Digital communication
(9) Analogue retransmission
(10) Sleep mode
(11) Digital Filter
(12) Pump control
(13) Remote lock

The basic menu functions are:

(1) input 1: Thermocouple, RTD, Volt, mA
(2) input 2: Current transformer (CT) for heating monitoring
(3) output 1: Heating or cooling (Relay, SSR, Volt, mA)
(4) output 2: Cooling (Relay, SSR, Volt, mA), DC Power supply.
(5) Alarm 1: Relay for differential, differential band, process, heating interruption or sensor breakage
Alarm as normal, latching or latched alarm.
(6) Alarm 2: Relay for differential, differential band, process, heating interruption or sensor breakage
Alarm as normal, latching or latched alarm.
(7) Heating time
(8) Heating interruption alarm
(9) Control circuit interruption alarm
(10) Sensor break alarm
(11) Error behaviour / reporting
(12) Bumpless Transfer
(13) PV1 Reverse offset
(14) Programmable SP1 range
(15) Heating-cooling control
(16) Hardware menu lock
(17) Automatic setting
(18) Self-optimisation
(19) ON-OFF, P, PD, PI, PID Regulation
(20) User defined menu (SEL)

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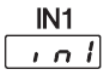
(21) Manual regulation
(22) Display Mode
(23) Restore factory setting
(24) DC Power supply for sensors

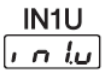
6.1 input 1 (IN1)

Press [SET] [▼] to enter the Setup Menu. Press [SET] to select a parameter. The upper display shows the parameter symbol, the lower display shows the current setting or value.

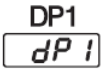
IN1: Select the sensor type for input 1.
range: (Thermocouple) J_TC, K_TC, T_TC, E_TC, B_TC, R_ TC, S_TC, N_TC, L_TC
(RTD) PT.DN, PT.JS
(Linear) 4-20, 0-20, 0-1V, 0-5V, 1-5V, 0-10
Factory setting: K_TC at °C, J_TC at °F as a unit.



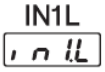
IN1U: Select the unit for input 1
range: °C, °F, PU
factory setting: °C



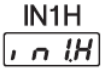
DP1: Select the number of decimal places
range: (At TC and RTD) NO.DP, 1-DP
(At linear) NO.DP, 1-DP, 2-DP, 3-DP
Factory setting: 1-DP



IN1L: Select LOW scaling for linear input 1.
Is hidden when TC or RTD sensors are on IN1.



IN1H: Select HIGH scaling for linear input 1.
Is hidden when TC or RTD sensors are on IN1.



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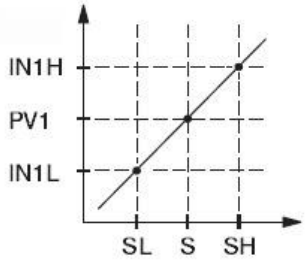
Example IN1L and IN1H settings:
If a 4-20mA sensor is selected as IN1, the sensor LOW value (SL) is 4mA, the sensor HIGH value (SH) is 20mA. The input signal looks like this:

Input for linear sensors

Process value



Input signal

Formula: $PV1 = IN1L + (IN1H - NI1L) * \frac{S-SL}{SH-S}$

Example: Pressure transmitter with the range of 0 - 15 bar is connected to input 1, with 4-20mA
Output signal connected. Please make the following settings:

IN1 = 4 - 20 IN1L = 0.0
IN1U = PU IN1H = 15.0
DP1 = 1-DP

To change the resolution, you can also make other settings at DP1.

6.2 output 1 and 2 (OUT1 / OUT2)

O1TY: Select the output signal for output 1 (OUT1)
The selection must match the installed module (see type code)

Possible output signals are:
RELY: Switching output relay (type –A)
SSRD: Pulsed voltage output as SSR driver (type -C)
SSR: Switching output for controlling SSR relays (in planning)
4 - 20: 4 - 20 mA Current output (type –B)
0 - 20: 0 - 20 mA Current output (type –B)
0 - 1 V: 0 - 1 V Voltage output (in planning)
0 - 5 V: 0 - 5 V Voltage output (in planning)
1 - 5 V: 1 - 5 V Voltage output (in planning)
0 - 10V: 0 - 10 V Voltage output (in planning)

O1TY
o1tY

O2TY
o2tY

O2TY: Select the output signal for output 2 (OUT2)
The selection must match the installed module (see type code)

Same selection options as output 1 (O1TY).

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6.3 Setting the User Menu (SEL1 – SEL5)

The UREG200 is equipped with a flexible user menu. In order to reach frequently used parameters quickly, it is possible to place them in front of the actual menu. These can be stored in the parameters SEL1 to SEL5 in an application-optimised manner:

SEL1
SEL 1
SEL2
SEL 2
SEL3
SEL 3
SEL4
SEL 4
SEL5
SEL 5

SEL1: For the most frequently required parameter
SEL2: For the second most frequently required parameter
SEL3: For the third most frequently required parameter
SEL4: For the fourth most frequently required parameter
SEL5: For the fifth most frequently required parameter

Range: NONE, TIME, A1.SP, A1.DV, A2.SP, A2.DV, RAMP, OFST, REFC, SHIF, PB1, TI1, TD1, C.PB, DB, SP2, PB2, TI2, TD2

Parameters that are hidden due to settings cannot be selected.

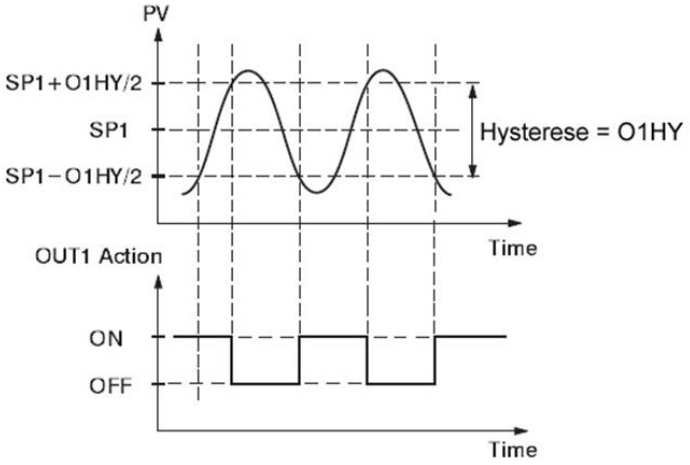
6.4 Heating only control

Heating ON-OFF control:
Select REVR for OUT1, set PB1 to 0, SP1 is the setpoint, O1HY is the ON-OFF hysteresis, TIME is for setting the heating time.

Setting ON-OFF:
OUT1 = rEVr
PB1 = 0
Parameter:
SP1, O1HY, TIME

Note: The TIMR parameter in A1FN or A2FN cannot be selected with this setting, the output 1 hysteresis (O1HY) can only be set if PB1 = 0.

The heating ON-OFF control is shown in the following diagram:



Heating ON-OFF control

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The ON-OFF control leads to strong oscillating process fluctuations, the hysteresis should be set to a sensible minimum to reduce fluctuations. If the ON-OFF control is activated (PB1 = 0), the parameters are TI1, TD1, CYC1, OFST, CPB and PL1 hidden and without function, the hand operation, self-tuning and bumples transfer (BPLS) are deactivated.

Heating P or PD control:
Select REVR for OUT1, set TI1 to 0, SP1 is the setpoint, TIME is for setting the heating time.

Note: The TIMR parameter in A1FN or A2FN is selectable with this setting, the offset (OFST) can be set at TI1 = 0 and is used for manual adjustment.

Setting P-control:
OUT1 =
TI1 = 0
CYC1 (at relay rEVr or SSR – O1TY select)
Parameter:
SP1, OFST, TIME (when released),
PB1 ≠ 0, TD1

Set CYC1 depending on the output module.
Typical settings:

Output SSR:	CYC1 = 0,5 ~ 2 sec.
Output relay:	CYC1 = 10 ~ 20 sec.
Analogue output:	CYC1 = Not adjustable (hidden)

O1HY is hidden when PB1 ≠ 0.
OFST function: The OFST parameter measures in % in the range 0 - 100.0 %. After control, when a stable process situation is reached, when the process value is lower than the setpoint (assumed to be 5°C lower) and PB1 = 20°C. This corresponds to 25%, then the OFST of 25% causes the regulation, with a higher process value the other way round.
After adjusting the OFST value, the process value varies around the setpoint.
If P-control is activated (TI1 = 0), self-tuning and automatic adjustment are deactivated.

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Heating PID control:
Select REVR for OUT1, SP1 is the set point, TIME is for setting the heating time.

Note: The TIMR parameter in A1FN or A2FN is selectable with this setting, PB1 and TI1 must not be set to 0.

Set CYC1 depending on the output module.
Typical settings:
output SSR: CYC1 = 0,5 ~ 2 sec.
Output Relay: CYC1 = 10 ~ 20 sec.
Analogue output: CYC1 = Not adjustable (hidden)

setting PID-regulation:
OUT1 = rEVr
O1TY
CYC1 (for relay or SSR - select O1TY)
SELF = NONE or YES
Parameter:
SP1, TIME (when released), PB1 ≠ 0, TI1 ≠ 0, TD1
Auto-tuning:
Use for a new process, in set-up mode
Self-optimisation:
Use in regular operation
Manual Tuning:
Can be used for manual optimisation

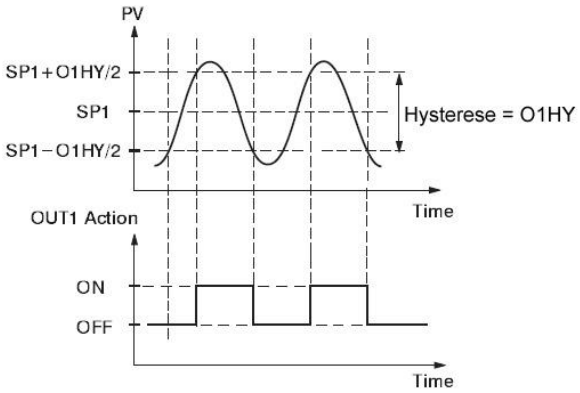
In most cases, self-tuning can replace the automatic setting (see chapter 6.18). If self-tuning is not used (select NONE for parameter SELF), the automatic setting for a new process is used or you set PB1, TI1 and TD1 with experience values (see chapter 6.19). If the control result does not meet your expectations, manual settings can be made (see chapter 6.20).

The UREG200 is equipped with a sophisticated PID and fuzzy algorithm, which ensures fast process optimisation with low overshoot and fast control times.

6.5 Cooling only control

ON-OFF control, P (PD) control and PID control can also be used for cooling control. For this purpose, the parameter OUT1 must be set to DIRT (direct). The other settings for ON-OFF control, P (PD) control and PID control correspond to the "Heating only control" described in chapter 6.4. The cooling control works inversely to the heating control, as shown in the following diagram:

setting cooling:
OUT1 = dirt



Cooling control

Please note the settings as described in chapter 6.4, only OUT1 = dirt.

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6.6 Heating-cooling control

Six different controller configurations can be set for the heating-cooling control. Please refer to the following table for the parameter settings:

Rule mode	Heating uses	Cooling uses	Setup value											
			OUT1	OUT2	O1HY	OFST	PB1	TI1	TD1	CPB	DB	A1FN or A2FN	A1MD or A2MD	A1HY or A2HY
Heating: ON-OFF Cooling: ON-OFF	OUT1	ALM1 or ALM2	REVR	NONE	☆	×	=0	×	×	×	×	DE.HI or PV1.L	NORM	☆
Heating: ON-OFF Cooling: P (PD)	ALM1 or ALM2	OUT1	DIRT	NONE	×	☆	≠0	=0	☆	×	×	DE.LO or PV1.L	NORM	☆
Heating: ON-OFF Cooling: PID	ALM1 or ALM2	OUT1	DIRT	NONE	×	×	≠0	≠0	☆	×	×	DE.LO or PV1.L	NORM	☆
Heating: P (PD) Cooling: ON-OFF	OUT1	ALM1 or ALM2	REVR	NONE	×	☆	≠0	=0	☆	×	×	DE.HI or PV1.H	NORM	☆
Heating: PID Cooling: ON-OFF	OUT1	ALM1 or ALM2	REVR	NONE	×	×	≠0	≠0	☆	×	×	DE.HI or PV1.H	NORM	☆
Heating: PID Cooling: PID	OUT1	OUT2	REVR	COOL	×	×	≠0	≠0	☆	☆	☆	×	×	×

× : not needed
☆ : Process-related setting

Note: The ON-OFF control can lead to strong process fluctuations.
The P (PD) control can also lead to slight deviations from the setpoint. For a stable and low-deviation process result, the PID heating-cooling control is required.

Further settings required: O1TY, CYC1, O2TY, CYC2, A2SP, A2DV,
O1TY & O2TY are set depending on the control configuration.
CYC1 & CYC2 depending on O1TY resp. O2TY

Typical settings OUT1 /OUT2:
output SSR: CYC1/CYC2 = 0,5 ~ 2 sec.
output relay: O1TY/O2TY = 10 ~ 20 sec.
Analogue output: CYC1/CYC2 = not adjustable (hidden)

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Example:
Heating PID & Cooling ON-OFF: OUT1 = REVR, A1FN or A2FN = PV1.H, A1MD or A2MD = NORM, A1HY or A2HY = 0,1, PB1 ≠ 0, TI1 ≠ 0, TD1 ≠ 0, and suitable values for O1TY and CYC1

Heating PID & Cooling PID: OUT1 = REVR, OUT2 = COOL, CBP = 100, DB = -4,0, PB1 ≠ 0, TI1 ≠ 0, TD1 ≠ 0, and suitable values for O1TY, CYC1, O2TY, CYC2

CPB setting: The cooling proportional band measures % of PB (proportional band) with a range of 1 - 255 %, CBP factory setting = 100%. CBP monitors the cooling process. If the cooling is to be increased, lower CBP, if the cooling is too strong, increase CBP. CBP is linked to PB and remains unaffected by self-tuning and auto-setting.

The CPB setting depends on the coolant used.

Recommendation:

Coolant	CBP-value
Air	100%
Oil	125%
Water	250%

DB setting: The heating-cooling dead band depends on the process requirements, setting range from -36% to +36%. In the positive value range, unintentional cooling is prevented, but strong exceeding of the setpoint can occur. In the negative value range (overlapping), strong exceeding of the setpoint is minimised, but unintentional cooling can occur.

DB is in the range of -36% to 36% adjustable and refers to PB1 (resp. PB2, if PB2 is activated). A negative DB value creates an overlap, both outputs are active. A positive DB value creates a dead zone, no output is activated.

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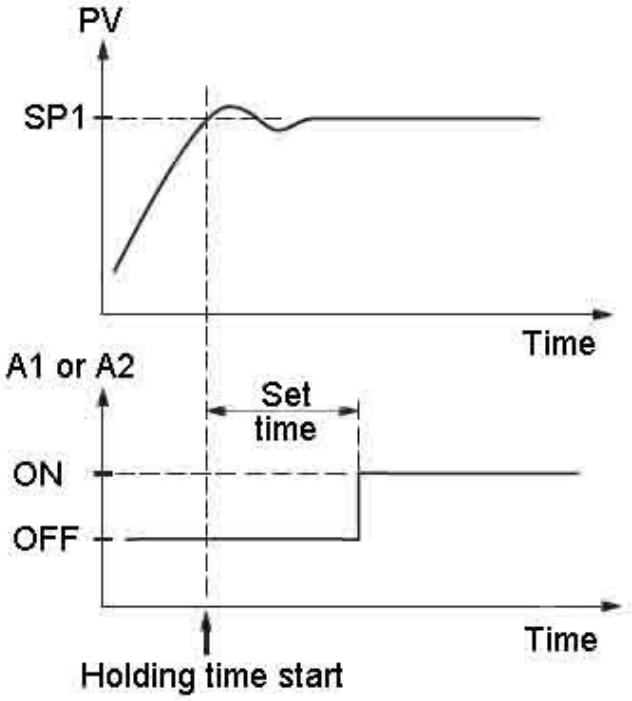
6.7 Holding time

Error code

Alarm 1 or Alarm 2 can be set as a timer with hold time, select TIMR for A1FN or A2FN. However, the function can only be set for one alarm, otherwise error Er07 is displayed. When the hold time is activated, use the TIME parameter to set the time value between 0 and 6553,5 min.
When the setpoint is reached, the timer is activated and runs from 0 to the set value. The alarm relay remains unchanged until the timer expires and only switches after it has expired, the function is shown on the following diagram:



Hold time function

If alarm 1 is configured as a timer, the parameters A1SP, A1DV, A1HY and A1MD are hidden. The same applies to alarm 2.

Example:
Set A1FN = TIMR or A2FN = TIMR (never both at the same time!) and for parameter TIME the desired time in minutes.

A1MD or A2MD are hidden depending on the output used.

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6.8 Process alarms

8 Alarmfunktionen einstellbar:
PV1.H, PV1.L, PV2.H, PV2.L,
P1.2.H, P1.2.L, D1.2.H, D1.2.L

Alarm 1
Einstellung: A1FN, A1MD
Parameter: A1SP, A1HY

Alarm 2
Einstellung: OUT2, A2FN, A2MD
Parameter: A2SP, A2HY
Trigger level = A1SP_1/2 A1HY
Trigger level = A2SP_1/2 A2HY

Rücksetzen speichernder Alarm
1. Netzspannung AUS
2. Über den Ereigniseingang, EIFN- Parameter beachten!

The alarm function switches off when the set value is reached, this can refer to PV1, PV2 or PV1-PV2. The alarm setting is independent of the setpoint, 8 alarm functions are available for setting, PV1.H, PV1.L, PV2.H, PV2.L, P1.2.H, P1.2.L, D1.2.H, D1.2.L.

PV1.H and PV1.L refer to PV1.
PV2.H and PV2.L refer to PV2.
P1.2.H and P1.2.L refer to PV1 and PV2, both values are monitored.
D1.2.H and D1.2.L refer to PV1 – PV2, the difference is monitored.

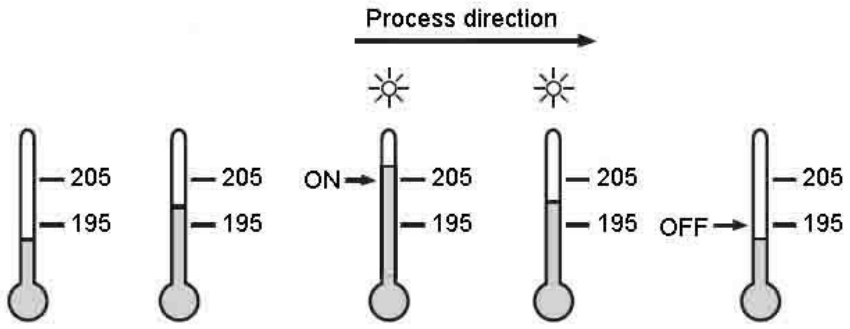
The switching point depends on the value A1SP and the hysteresis A1HY for Alarm1, resp. A2SP and A2HY for Alarm2. Hysteresis prevents frequent switching when the process fluctuates rapidly.

Normally you can A1HY / A2HY in the factory setting 0,1 remain.
A1DV and/or A2DV are hidden when Alarm 1 and /or Alarm 2 is activated.

Normal alarm: A1MD = NORM
With the setting NORM, the alarm is switched depending on the alarm value A1SP and the hysteresis A1HY.

Example:

A1SP = 200 A1HY = 10.0
A1MD = NORM A1FN = PV1.H



Normal alarm

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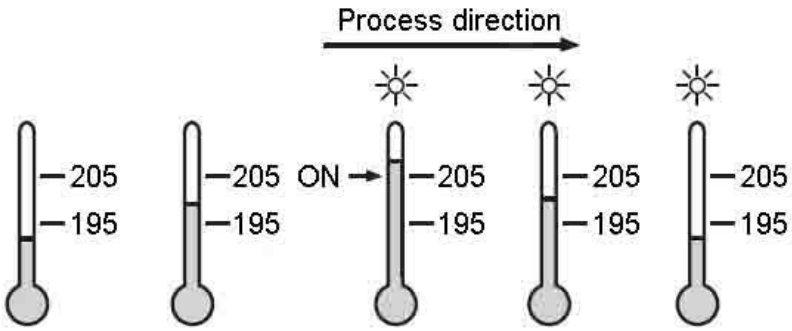
Storing Alarm: A1MD = LTCH

With the setting LTCH, the alarm is activated depending on the alarm value A1SP and the hysteresis A1HY switched on and by the event input EIFN or the switching off of the operating voltage reset.
The setting of the EIFN must RS.A1, RS.A2 or R.A1.2.

Example:

A1SP = 200 A1HY = 10.0
A1MD = LTCH A1FN = PV1.H



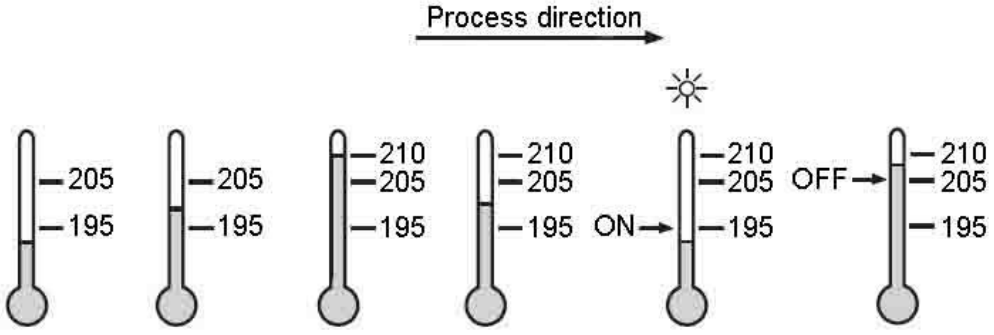
Storing alarm

Alarm held: A1MD = HOLD

With the setting HOLD, the alarm is activated depending on the alarm value A1SP and the hysteresis A1HY switched (like setting NORM), however, the function only becomes active when the control setpoint has been reached. This helps to avoid unnecessary alarms when starting a process.

Example:

A1SP = 200 A1HY = 10.0 SP1 = 210
A1MD = HOLD A1FN = PV1 I



Alarm held

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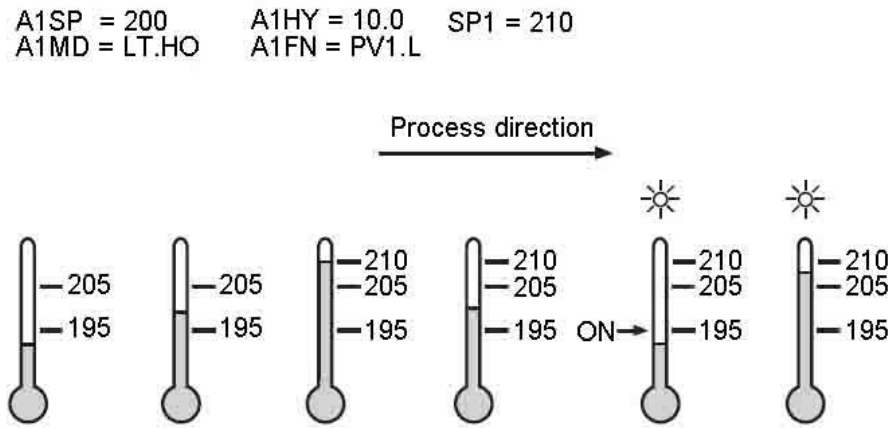
Storing / Held Alarm: A1MD = LT.HO
With the HOLD setting, the switching function is a combination of LTCH and HOLD, i.e. the alarm function is only activated after the control setpoint has been reached for the first time and switches on at the alarm value. The alarm is switched off by the EIFN or by switching off the operating voltage.

Example:



Storing & held alarm

All examples show the settings for alarm 1, the settings for alarm 2 are corresponding.

6.9 Differenzalarm

The differential alarm indicates to the user that the process deviates too far from the setpoint. One can use the positive or negative difference (A1DV, A2DV) for Alarm 1 and Alarm 2 and set the hysteresis (A1HY, A2HY). The hysteresis prevents the alarm from flashing when the process value fluctuates slightly. Normally, the hysteresis (A1HY, A2HY) can remain set to factory setting 0.1.

The switch-on point of the alarm changes with the setpoint value.

Alarm 1 setpoint = SP1 + A1DV ± ½ A1HY
Alarm 2 setpoint = SP1 + A1DV ± ½ A2HY

2 Differenzalarm adjustable:
DE.HI, DE.LO

Differenzalarm 1:
Setting: A1FN, A1MD
Parameter: SP1, A1DV, A1HY
Switching point=SP1+A1DV±1/2 A1HY

Differenzalarm 2:
Setting: OUT2, A2FN, A2MD
Parameter: SP1, A2DV, A2HY
Switching point=SP1+A2DV±1/2 A2HY

A1SP and/or A2SP are hidden if the corresponding alarm is set to differential alarm. The 4 alarm settings (NORM, LTCH, HOLD, LT.HO) can also be set for the differential alarm (for description see chapter 3.8).

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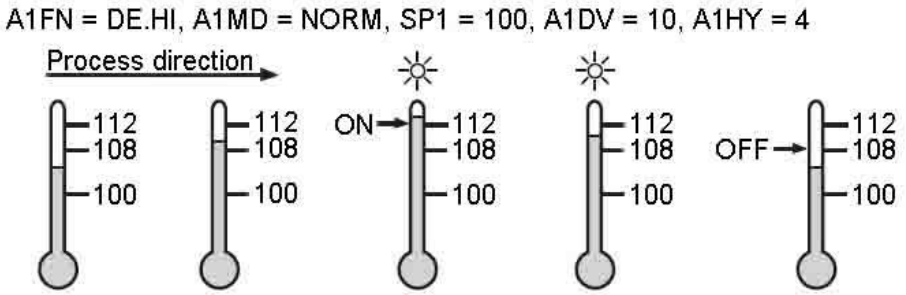
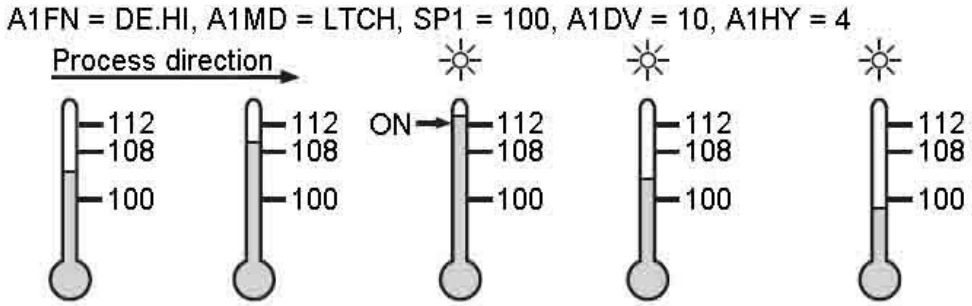
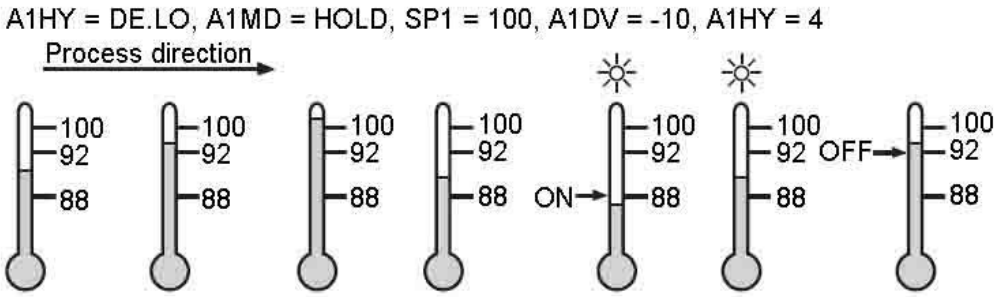
Example:



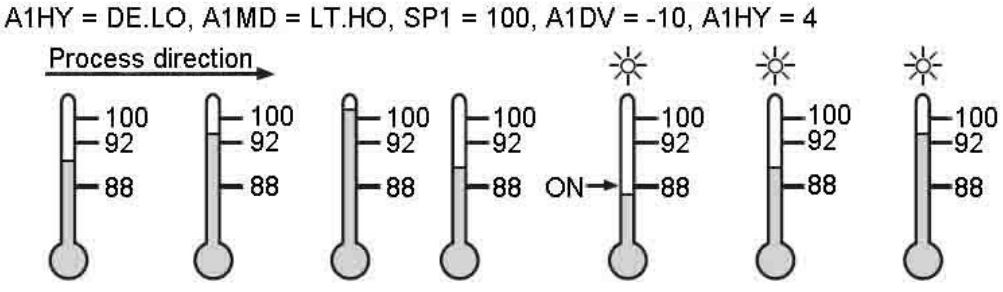
Differenzalarm NORM



Differenzalarm LTCH



Differenzalarm HOLD



Differenzalarm LT.HO

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6.10 Differential band alarm

The differential band alarm generates two switching points, relative to the setpoint value. Two types of differential band alarms can be set for alarms 1 and 2, DB.HI (Differential band deviation alarm) and DB.LO (Differential band alarm), A1SP and A1HY resp. A2SP and A2HY are hidden.

DB.HI switches the alarm if the difference (positive and negative) between process and setpoint is greater than set in A1DV or A2DV.
DBLO switches the alarm as long as the difference between the process value and the setpoint is smaller than set in A1DV or A2DV.

2 Differential band alarm adjustable:
DB.HI, DB.LO

Differential band alarm 1:
setting: A1FN, A1MD
Parameter: SP1, A1DV
Switching point=SP1 ± A1DV

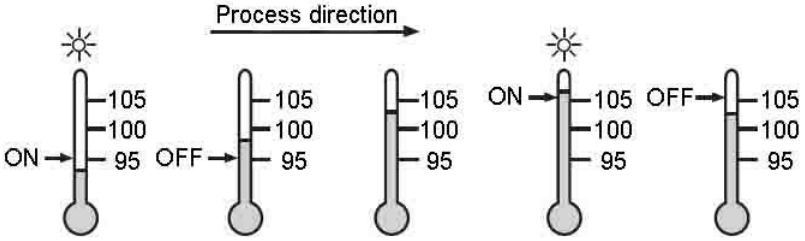
Differential band alarm 2:
Setting: OUT2, A2FN, A2MD
Parameter: SP1, A2DV
Switching point=SP1 ± A2DV

Alarm 1 switching point = SP1 ± A1DV
Alarm 2 switching point = SP1 ± A2DV

The 4 alarm settings can also be used for the differential band alarm (NORM, LTCH, HOLD, LT.HO) can be set (for description see chapter 6.8).

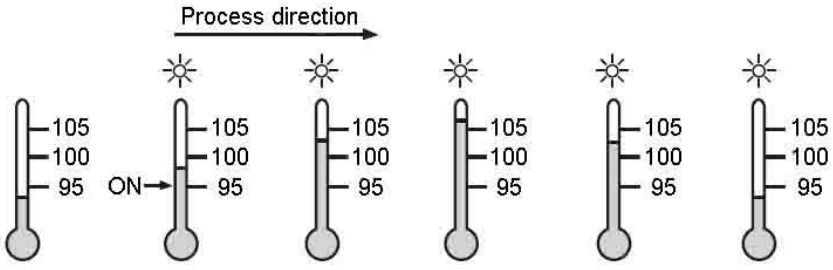
Example:

A1FN = DB.HI, A1MD = NORM, SP = 100, A1DV = 5



Differential band alarm NORM

A1FN = DB.LO, A1MD = LTCH, SP1 = 100, A1DV = 5



Differential band alarm LTCH

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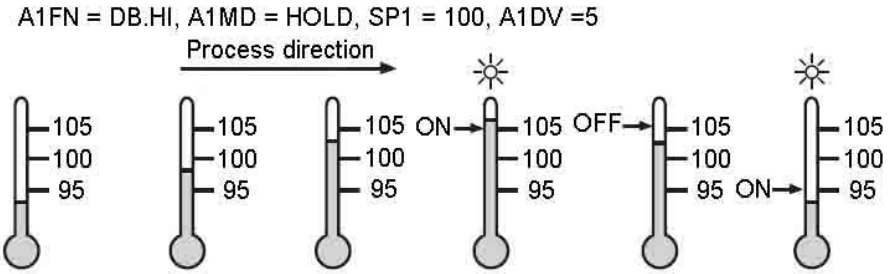
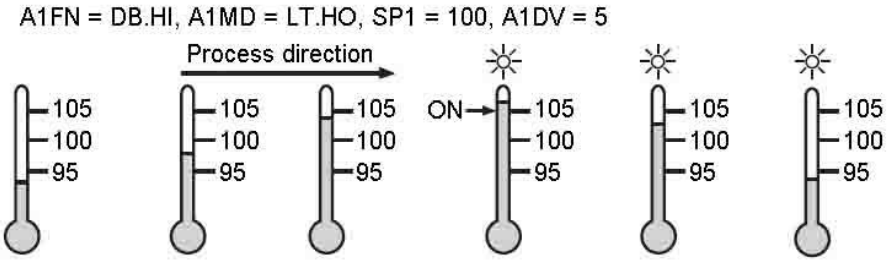


Differential band alarm HOLD



Differential band alarm LT.HO

6.11 Control loop interruption alarm

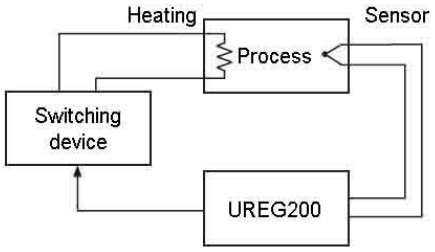
The control loop monitoring observes whether a change in the process value occurs in response to an output manipulation. The change must be made within 2xTI1 (2 times integral time, but max. 120 sec.). For this, set at:

Alarm 1, A1FN on LB
Alarm 2, OUT2 on AL2 and A2FN on LB,

The following parameters are hidden:
TIME, A1SP, A1DV and A1HY
On alarm 2, TIME, A2SP, A2DV and A2HY

Control circuit alarm 1
Parameter: A1FN = LB
A1MD = NORM, LTCH

Control circuit alarm 2
Parameter: OUT2 = =AL2
A2FN = LB
A2MD = NORM, LTCH



Control circuit alarm

Control loop devices: Sensor, UREG200, Heating, Switching device

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6.12 Sensor break alarm

Alarm 1 or Alarm 2 Can be set as sensor break alarm, A1FN or A2FN on parameters SENB [SEnb] . Sensor monitoring starts as early as possible when the unit is switched on, even an internal error in the A/D converter triggers the sensor break alarm. The following parameters are hidden when activated:

On alarm 1 = SENB, TIME, A1SP, A1DV and A1HY
On alarm 2 = SENB, TIME, A1SP, A1DV and A1HY

Sensor break alarm 1
Parameters:
A1FN=SENB
A1MD=NORM, LTCH
Hidden:
TIME, A1SP, A1DV, A1HY

Sensor break alarm 2
Parameters:
OUT2= =AL2
A2FN=SENB
A2MD=NORM, LTCH
Hidden:
TIME, A2SP, A2DV, A2HY

The 4 alarm settings (NORM, LTCH, HOLD, LT.HO) can also be set for the sensor break alarm (for description see chapter 6.8).

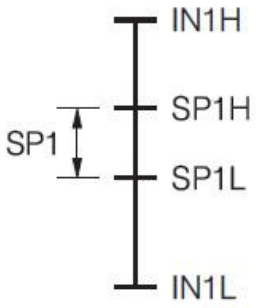
6.13 SP1 Setting range

SP1L (SP1 LOW-Wert) and SP1H (SP1 HIGH-Value) specify the lower and upper limits of the setting range of SP1 (setpoint 1).

Example:
A cold room operates at a temperature of -10°C bis -15°C. To prevent incorrect settings of the set point, SP1L and SP1H are set as follows.

SP1L = -15°C, SP1H = -10°C

SP1 can now only be set in the desired range from -15°C to -10°C.



SP1 setting

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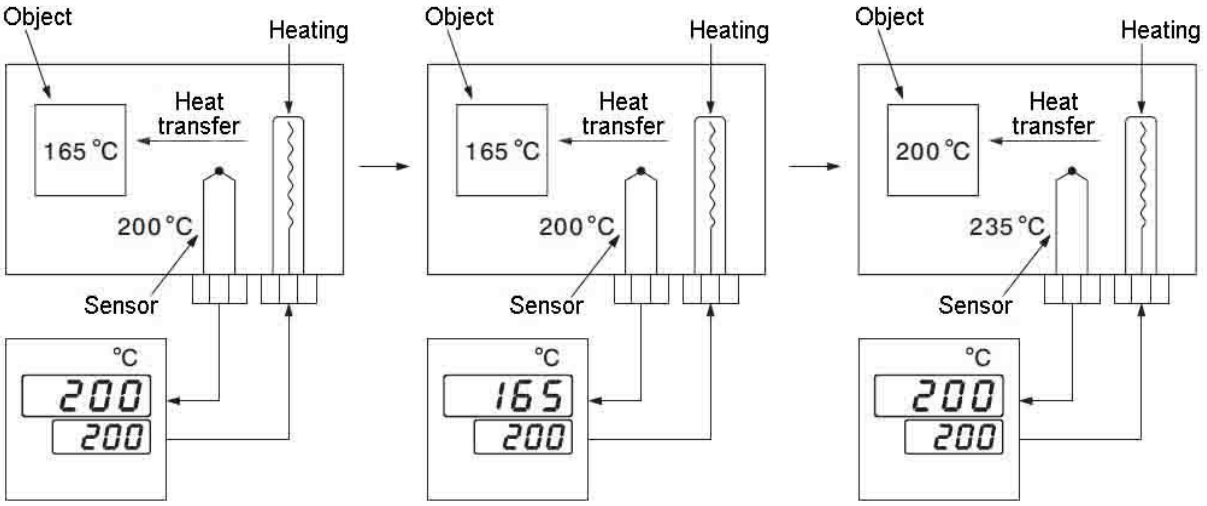
6.14 PV1 Offset

For some applications it is desirable to adjust the ACTUAL process value in the controller display with an offset to the real process value. For this purpose, the SHIF function can be entered as a correction value for PV1 in the UREG200. The set value, positive or negative, is added to the current value. The SHIF function is only available for PV1.

Example:
A process consists of a heater, a sensor and an object to be heated. In the process, the sensor cannot be placed directly on the object, so that there is a measurement difference of e.g. 35°C between sensor temperature and real object temperature. The object should be heated to 200°C, but only has 165°C real. The controller must now be set to 235°C setpoint. However, a correction of the measured value can be entered via the SHIF function, in the example SHIF = -35°C. The value displayed in the controller is now 200°C, like the real temperature of the object.

SHIF / PV1-Offset



35°C Temperature is stated, SHIF = 0	SHIF will be discontinued SHIF = -35°C Provides more heat	Display is correct difference SHIF = -35°C PV = SV

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6.15 Error behaviour / display

The controller activates its error behaviour when one of the following events occurs:

1. **Display SBE1** means: At input 1 there is a sensor break or current below 1mA at 4-20mA input or voltage below 0.25V at 1-5V input.
2. **Display SB2E** means: At input 2, sensor breakage or current below 1mA at 4-20mA input or voltage below 0.25V at 1-5V input if PV2, P1-2 or P2-1 is selected at parameter PVMD or PV2 at SPMD.
3. **Display ADER** means: There is an error in the A/D converter.

Output 1 and 2 start the error behaviour if one of the following events occurs:

1. during switch-on (for 2,5 sec.)
2. the controller goes into error mode
3. the controller goes into manual mode
4. The controller goes into calibration mode

Error display as:
1. SB1E
2. SB2E
3. ADER

Error transmission output 1&2:
1. When switching on (for 2,5 sec.)
2. Error mode active
3. Manual operation active
4. Calibration mode active

Error transmission alarm 1&2:
1. Error mode active

Error behavior Parameter:
1. O1FT
2. O2FT
3. A1FT
4. A2FT

Output 1 Error behavior (when activated)

1. If output 1 is set to proportional rules (PB1 ≠ 0) and BPLS is set in O1FT, then output 1 goes to bumpless transfer. Means, to control output 1 the average of MV1 is taken.
2. When output 1 is set to proportional controls (PB1 ≠ 0) and 0 to 100.0% is set for O1FT, then output 1 goes to error transmission. Means that the set value of O1FT is used to control output 1.
3. If output 1 is set to ON-OFF rules (PB1 = 0), then output 1 goes OFF when O1FT = REVR, when O1FT = DIRT, output 1 goes ON.

Output 2 Error behavior (when activated)

1. If OUT2 = COOL and O2FT = BPLS, output 2 goes to bumpless transfer. Means, to control output 2 the average of MV2 is taken.
2. If OUT2 = COOL and O2FT = 0 to 100%, then output 2 goes to error transmission. This means that the set value of O2FT is used to control output 2.

Alarm 1 Error behavior

Alarm 1 is activated when the controller enters the error mode, at Alarm 1 becomes ON or OFF depending on the setting of A1FT.

Exceptions: If A1FN = LB or SENB, alarm 1 is switched ON independently of A1FT. If A1FN = TIMR, no error is output on alarm 1.

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Alarm 2 Error behavior
Alarm 1 is activated when the controller enters the error mode, at Alarm 1 becomes ON or OFF depending on the setting of A1FT.

Exceptions: If A1FN = LB or SENB, alarm 1 is switched ON independently of A1FT. If A1FN = TIMR, no error is output on alarm 1.

6.16 Bumpless Transfer BPLS

BPLS is a setting for transmission in case of error, the function is adjustable for output 1 and output 2 (OUT2 must be set to COOL).

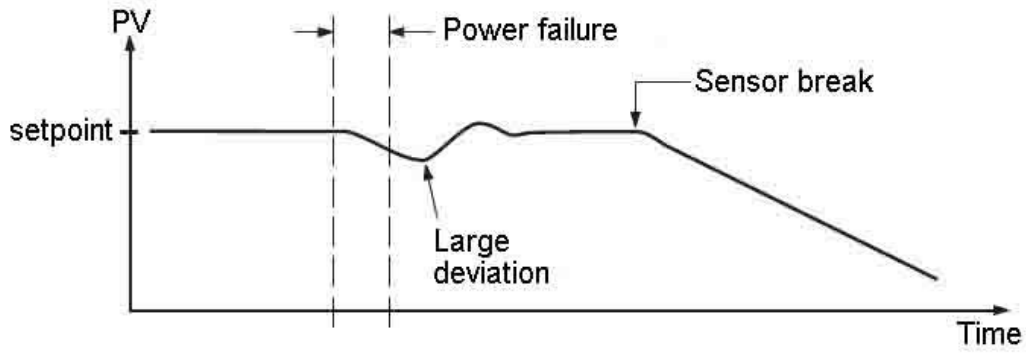
Bumpless Transfer is activated when O1FT and/or O2FT = BPLS and one of the following conditions is met.

1. during power on (for 2,5 sec.)
2. the controller goes into error mode
3. the cotroller goes into manual mode
4. the controller goes into calibration mode

Bumpless Transfer setting:
1. O1FT = BPLS
2. O2FT = BPLS

Bumpless Transfer active:
1. When switching on (for 2,5 sec.)
2. Error mode active
3. Manual operation active
4. Calibration mode active

When BPLS is enabled, the controller goes into open loop control and uses the average values of MV1 or MV2 to control outputs 1 and 2.



Regulation without BPLS

Without BPLS, the controller requires a certain amount of time to return to normal control after a power failure, during this time there are strong deviations in the process. In the event of a sensor failure, the process deviates strongly from the setpoint value.

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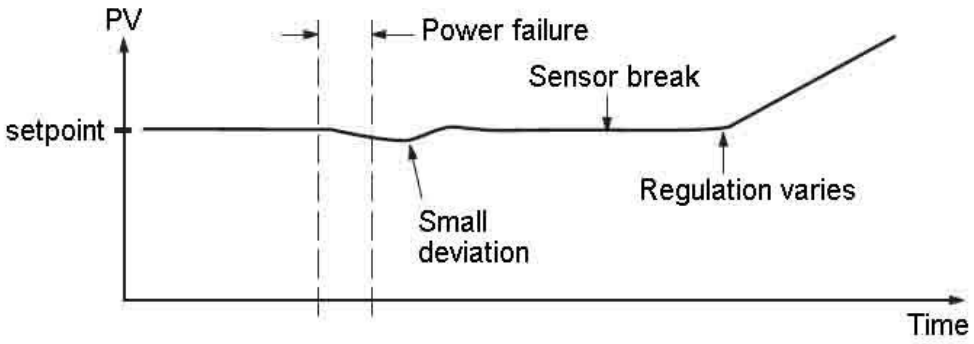

Regulation with BPLS

With active BPLS, the control is quickly restored after a voltage failure with the average of MV1 and the process deviation is smaller.

However, BPLS is not intended for long-term operation, fix the error as soon as possible!

6.17 Self-optimization

The self-tuning works with an innovative algorithm and offers an alterative to the setting of the UREG200. To activate, set the parameter SELF = YES. When self-tuning is enabled, the controller optimizes the PID values independently, based on the comparison between current and previous control cycles. When the UREG200 has found the optimum control parameters, these are stored under PB1, TI1, TD1 or PB2, TI2 and TD2 (depending on the event input). After self-tuning is completed, the SELF parameter is set to NONE to deactivate self-tuning.

Self-tuning settings:

SELF → nonE — Selection activates the Self-optimization

oder

YES — Disables the Self-tuning

Factory setting: SELF = NONE

Self-tuning changes values more slowly than "Automatic setting" and causes less process fluctuation. Usually, the self-tuning works successfully and does not require any subsequent "automatic adjustment".

Exceptions: Self-tuning is disabled under the following conditions:

1. SELF = NONE
2. the ON-OFF control of the controller is active (PB = 0)
3. the controller is reset manually (TI = 0)
4. the controller has detected a control loop interruption
5. the controller is in error mode
6. the controller is in manual mode
7. the controller is in sleep mode
8. the controller is calibrated

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If the self-tuning is active, the "Automatic setting" can also be used, the self-tuning then uses these values as initial situation.

Advantages of self-optimization:

1. In contrast to the "auto setting", the self-tuning has less negative influence on the process.
2. Unlike the "auto-setting", the self-tuning does not change the rule type, it is always the PID control.
3. Occasional changing of the setpoint during self-tuning is allowed.

6.18 Automatic setting

Automatic adjustment is performed to the adjusted setpoint. The process oscillates around the setpoint durig the adjustment, a significant adjustment of the setpoint during or after the automatic adjustment leads to undesired control results and can cause damage.

Automatic setting should be performed under the following conditions:

- Initial setup of process control
- The setpoint has changed significantly from the last automatic setting
- The control behavior is unsatisfactory

Switching on the automatic setting:

1. The system is fully installed
2. The controller is at factory settings for PID control.
   Factory setting: PB1=PB2=10°C
   TI1=TI2=100sec.
   TD1=TD2=25,0sec.
   You can also set other values, but PB1 and TI1 resp. PB2 and TI2 must be unequal to ZERO, otherwise the automatic setting is deactivated.
3. Adjust the set point to or slightly below the desired value.
4. press ⟲ ▼ up to A_t ---- appears on the display.
5. Press ⟲ for 3 sec. The upper display starts flashing and the automatic setting begins.

Condition:
PB1≠0, TI1≠0
if
PB1,TI1,TD1
selected

PB2≠0, TI2≠0,
if
PB2, TI2, TD2
selected

Note: The ramp function, external setpoint setting and pump control are deactivated during automatic setting.

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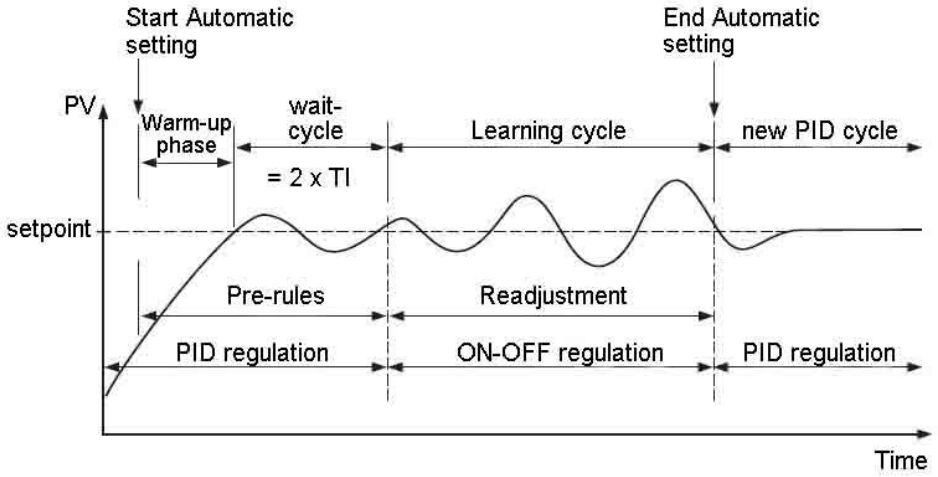
Carrying out the automatic setting

The automatic setting can be activated both before the first heating (cold start, see picture) and when the setpoint has already been reached (warm start, see picture).

If the automatic setting starts with a process value that is far away from the setpoint (cold start), the **warm-up phase** is started. When the set point is reached (warm start), a **waiting cycle** begins. The waiting cycle is 2 times the integral time (TI1 or TI2, depending on the setting). The double integral time allows the process to stabilize. In the first section, we speak of "**pre-regulation**". After the waiting cycle the **learning cycle** begins, the control behavior is changed from PID to ON-OFF, this section is also called **readjustment**. In the learning cycle, the controller tests the process behavior, the measured values are used to determine the optimum PID settings. At the end of two ON-OFF control cycles, the UREG200 switches back to PID control mode and stores the settings in non-volatile memory. When the process is finished, the display stops flashing and the controller goes into normal PID control mode with the new PID values.

Cold start Automatic setting



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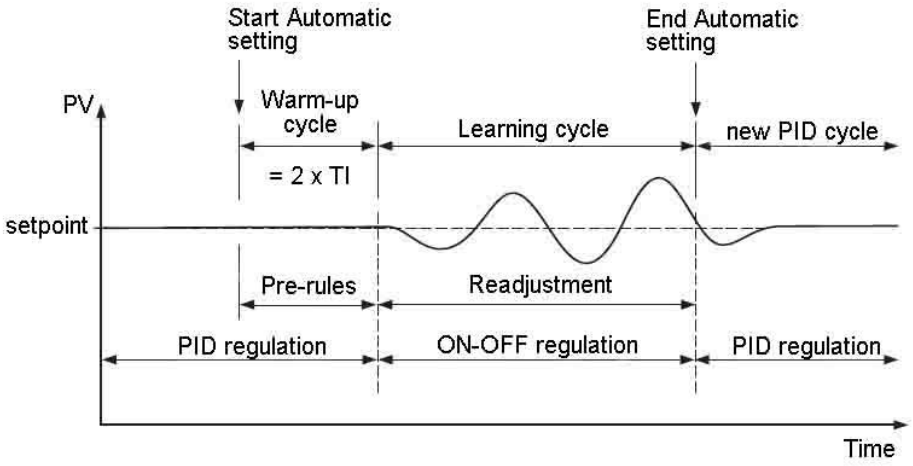
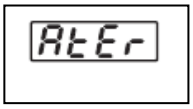
Warm start Automatic setting



The difference between hot and cold start is that the warm-up phase is omitted in the case of a hot start, since the process is already at the target level.

Automatic setting error

If the automatic setting fails, the error message ATER appears in the upper display together with:



- When PB exceeds 9000 (9000 PU, 900,0 °F or 500,0 °C)
- Or TI exceeds 1000sec.
- Or the setpoint has been adjusted during the setting cycle
- Or the event input was switched.

Troubleshooting for errors

- Start the automatic setting again
- Do not change the set point during the setting cycle
- Do not switch the event input during the setting cycle
- Use the manual setting (see chapter 6.19)
- Press a key to delete the message

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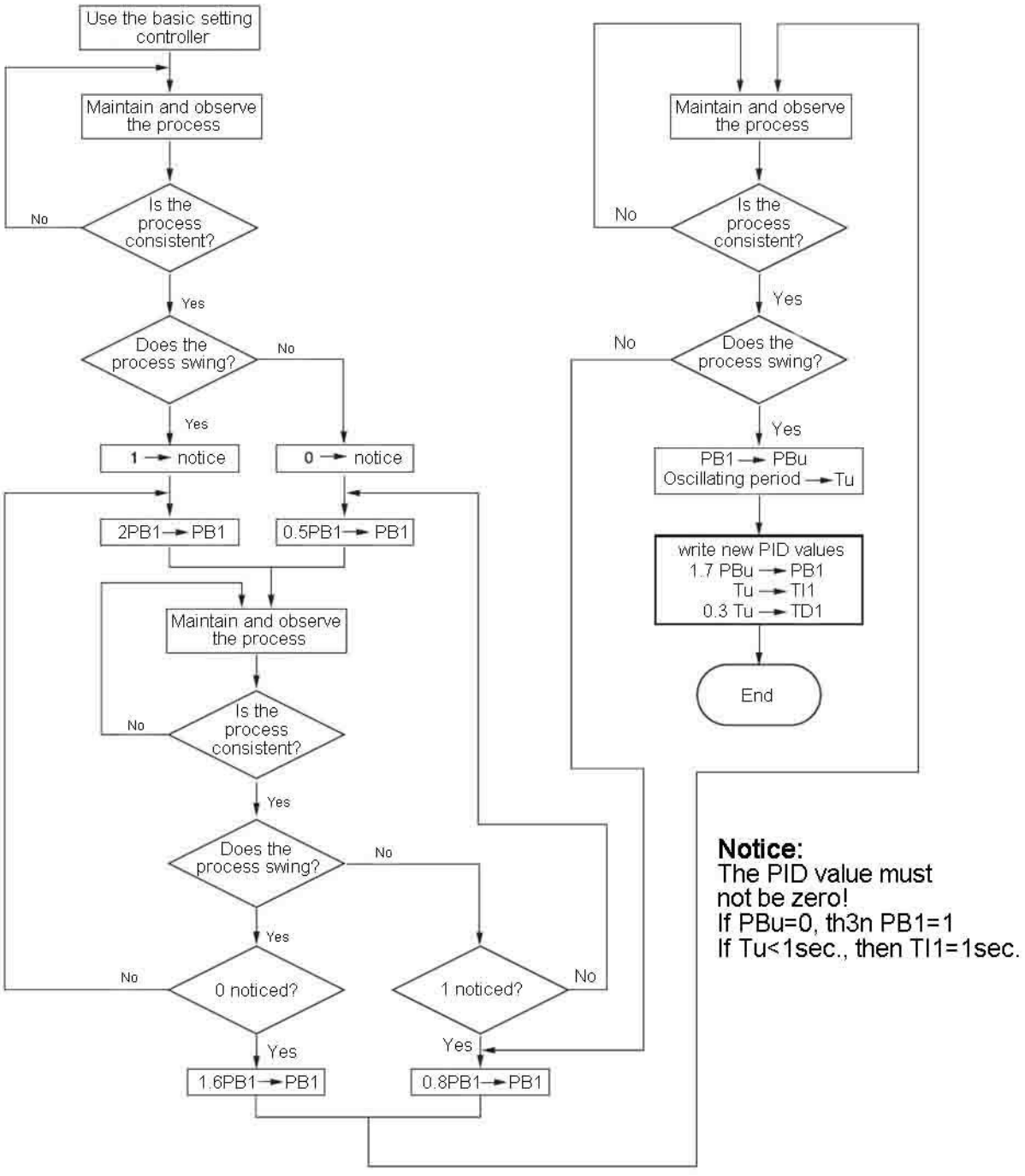
6.19 Manual setting

In a very small number of applications, self-tuning and automatic setting may not achieve the desired control result. In this case you have the possibility to make the settings manually, proceed according to the following flow chart:



Flowchart Manual adjustment

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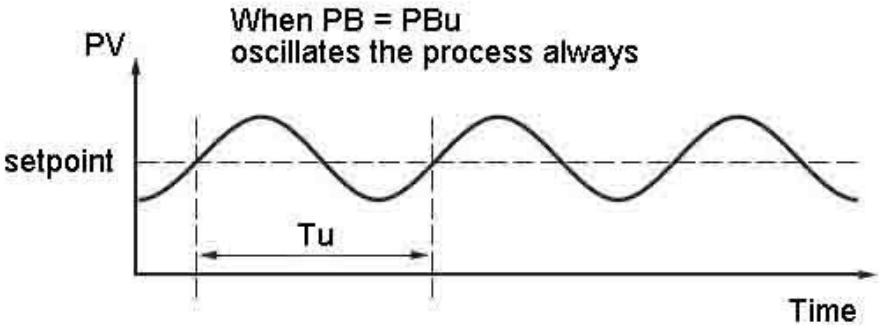
Keep in mind that after changes in the P-band, the process can take a very long time to become consistent again, especially with sluggish processes. Manual adjustment can take from a few minutes to several hours.

In the flowchart, PBu is the **ultimate P-band**, Tu is the **ultimate period**
If both values are equal, we speak of the critical-stable state (see picture).



Critical steady state

If the control result after manual adjustment according to the flow chart still does not provide a satisfactory result, the following rules can be applied:

Setting sequence	Symptom	Solution
1. proportional band (P) PB1 and/or PB2	Slow response	Reduce PB1 or PB2
	High oversteer or oscillation	Increase from PB1 or PB2
2. integral time (I) TI1 and/or TI2	Slow response	Reduce TI1 or TI2
	Unstable or oscillating	Increase from TI1 or TI2
3. difference time (D) TD1 and/or TD2	Slow response or oscillation	Reduce TD1 or TD2
	High oversteer	Increase from TD1 or TD2

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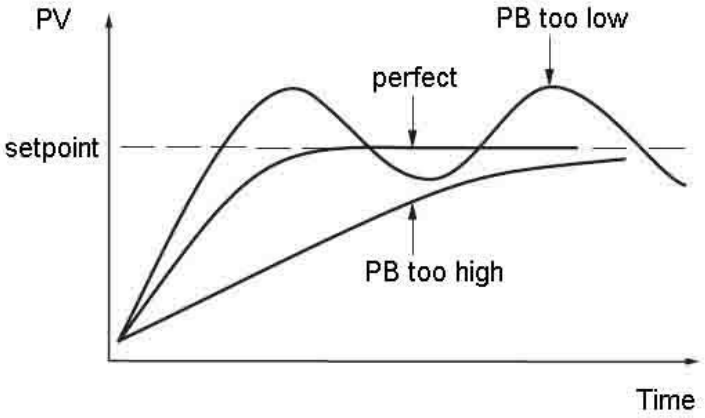
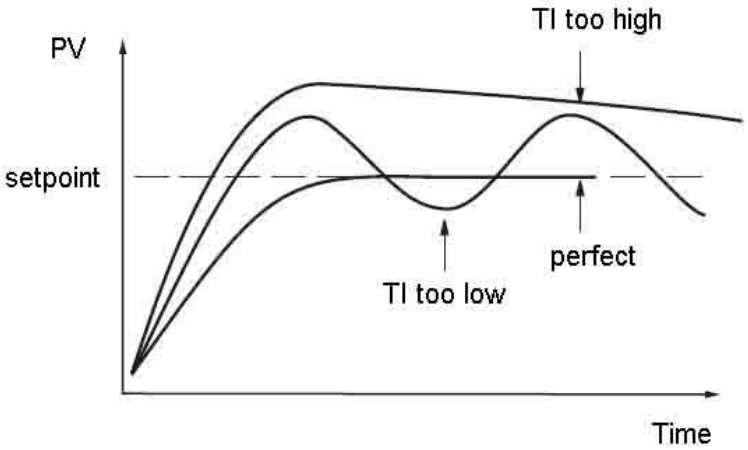
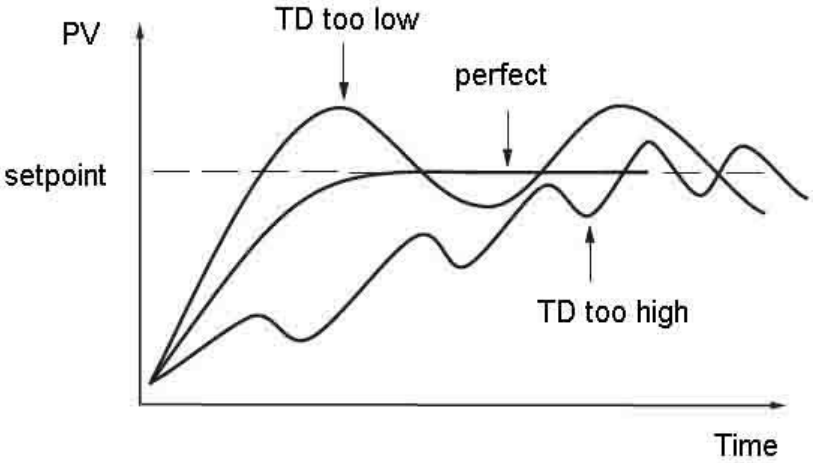
The following pictures show the control effects of the PID values:



P- Value Effect



I- Value Effect



D- Value Effect

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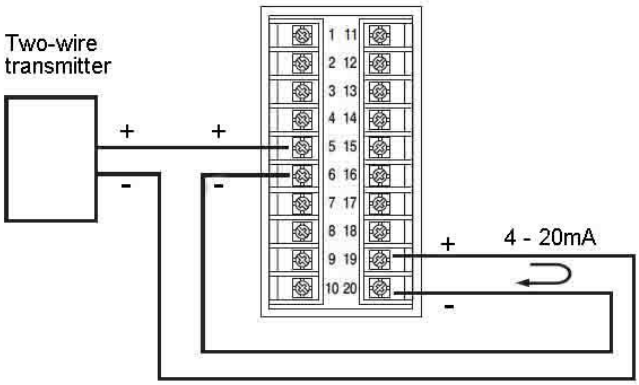
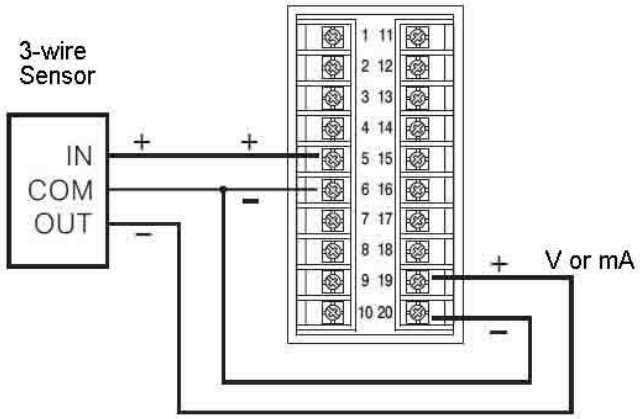
6.20 DC Sensor supply

The integrated DC sensor supply can be ordered as an option instead of the 2nd control output OUT2 (type code –D). The supply voltage is 20VDC / 25mA.

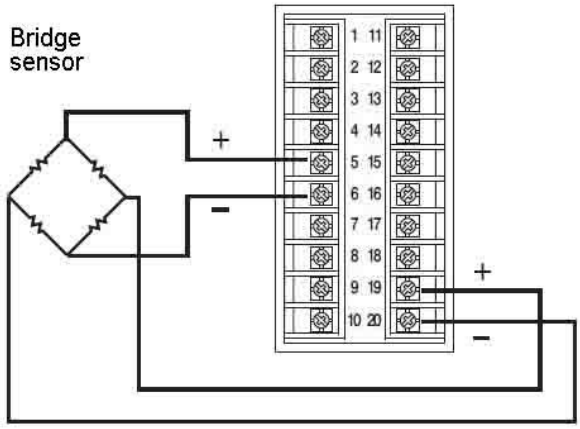
You can see some connection examples in the following pictures.



connection 2-wire sensor



connection 3-wire sensor



connection Bridge sensor

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Attention: Observe the max. current carrying capacity of the sensor supply to avoid damage.

6.21 Manual operation

The hand operation can be used for the following situations:

1. to check the process characteristic by getting a step or im-pulse response and use this data to adjust the controller.
2. to bridge a sensor or controller input defect by manual control.
3. in certain applications it is necessary to supply the process with constant energy.

Switching on the hand operation

Press [⟲][▼] repeatedly until HAnd ---- the display shows. Press [⟲] for 3 sec., the upper display starts flashing and the lower display shows H___. The UREG200 has now activated manual mode. Press [⟲], the lower display now alternates between C___ and H___ back and forth. The display H___ shows the value MV1 for output 1 (or heating) and C___ the value MV2 for output 2 (or cooling) to. Via the up and down keys [▲][▼] you can manually set the output values for H and C.

Example:
H 38.4 means,
MV1 = 38,4% from OUT1 (or heating)

C 7.63 means,
MV2 = 7,63% from OUT2 (or cooling)

Note:
The controller remains in the open control loop until manual operation is switched off again.

Exception:
If OUT1 is set as ON-OFF control (PB1=0 or PB2=0 depending on selection), the controller cannot be operated manually.

Turn off the hand operation
Press [▲][▼] simultaneously to return to the previous control mode.

6.22 Display Mode

Switching on the display mode
Press [⟲][▼] so often until di SP ---- (display) appears in the display. Then press [⟲] to activate the display mode. To display the values of the various parameters, press the [⟲] Button to move forward or [⟲][▲] to scroll backwards. The lower display represents the parameter, the upper display the corresponding value.

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The following values can be displayed:

PVHI/PVLO show the maximum and minimum value of the process, these values are stored non-volatile and are also available after a power failure. Press ⟲ for 6 sec. to delete the values.

MV1/MV2 show the current values for outputs 1 and 2.

DV Shows the current difference between process and setpoint value (PV – SV)

PV1 shows the current process value of input 1

PV2 shows the current process value of input 2

PB displays the current proportional band value of the controller

TI displays the current integral time

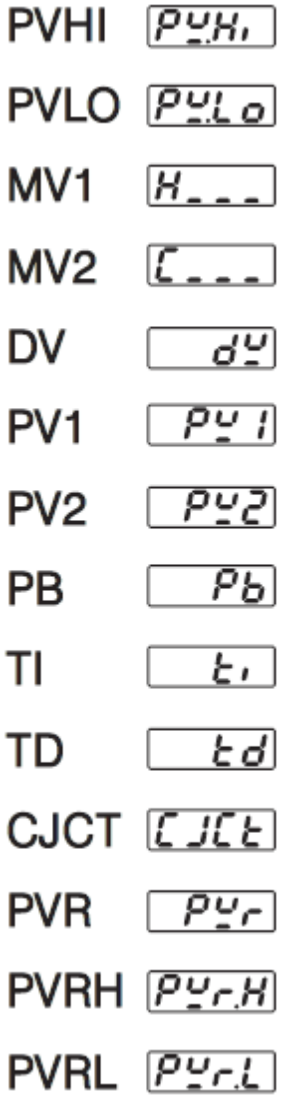
TD displays the current differential time

CJCT displays the current temperature of the internal cold junction in °C (independent of the controller unit)

PVR displays the current rate of change in °C/min. (depending on the setting also °F/min. or PU/min.). The value can be negative if the PV is decreasing.

PVRH/PVRL displays the maximum and minimum values of PVR. PVRH is a positive value, PVRL is a negative value.

Parameter overview:



Switching off the display mode

The display mode remains active until it is switched off. Press ▲▼ together to exit the display mode.

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6.23 Restoring factory settings

The controller factory settings can be found in tables 1.3 to 1.8. These basic values are permanently stored in the UREG200 and can be restored as follows.

Turning on the recovery

Press ⏎ ▼ so often until dEFt ---- appears in the display. Then press ⏎, in the upper display appears FILE. Use the UP-DOWN keys to select program 0 for factory settings in °C or program 1 for °F. After that press ⏎ for 3 sec. to apply the setting.

Attention: All previous settings will be lost, make sure you have saved the configuration as a backup or made a note of it in case you still need it.

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7. Programming the full range of functions (FULL)

7.1 Event input (EIFN)

The connection of the event input is done as described in chapter 5.10. There are three different possibilities for control.

1. potential-free switch or relay
2. open collector on continuity
3. TTL Logic voltage

There are 10 program functions available for the event input:

connections:

⑰ Event input +

⑯ Event input -

EIFN	
0	NONE
1	SP2
2	PID2
3	SP.P2
4	RS.A1
5	RS.A2
6	R.A1.2
7	D.O1
8	D.O2
9	D.O1.2
10	LOCK

NONE: The event input is deactivated. The controller uses PB1, TI1 and TD1 for PID control and SP1 (if not changed via other parameters) as set point.

SP2 : SP2 replaces SP1 when EIFN is activated

PID2 : PB2, TI2, TD2 replace when activating the EIFN, PB1, TI1, TD1

SPP2 : SP2, PB2, TI2, TD2 replace when activating the EIFN, SP1, PB1, TI1, TD1

RSA1 : The EIFN resets the alarm output 1.

RSA2 : The EIFN resets the alarm output 2.

RA12 : The EIFN resets the alarm output 1 and 2.

DO1 : The EIFN deactivates output 1 (OUT1, MV1=0).

DO2 : The EIFN deactivates output 2 (OUT2, MV2=0).

DO12 : DO1 : The EIFN deactivates output 1 and 2 (MV1=0 & MV2=0).

LOCK: All parameters are locked.

SP2F Funktion: With the function SP2F you can define whether SP2 replaces SP1 (setting AC-TU) or whether SP2 is added to SP1 (setting DEVI).

SP2F = ACTU SP2 replaces SP1

SP2F = DEVI Set point = SP1 + SP2

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7.2 Second set point

In some applications it is desirable to change the setpoint automatically. Via the event input it is possible to do this externally (see also chapter 7.1). The signal for the event input can come from a timer, controller, alarm relay or a manual switch. If the second setpoint is to be switched via the event input set EIFN = SP2.

Connection:
⑰ Event input +
⑯ Event input -

Settings:
EIFN = SP2 or SP.P2

Prerequisite:
SPMD = SP1.2 or
SPMD = MINR or
SPMD = HRR

Prerequisite is that SPMD = SP1.2, MIN.R or HR.R and MIN.R or HR.R is used for the ramp function (see chapter 7.4).

SP2 example 1:
In a process it is necessary that the temperature is increased when a certain pressure is reached. Set SPMD = SP1.2, EIFN = SP2 (or SP.P2). A pressure switch switches on the event input at the set pressure, SP1 (Normal temperature) is determined by SP2 (increased temperature) is replaced. (In this case the SP2 function SP2F = ACTU must be).

SP2 example 2:
An oven should have a temperature of SP1 = 300°C in the period from 8:00 to 18:00, from 18:00 the temperature should be lowered to SP2 = 80°C. An external timer is used to switch the event input at 18:00. The settings are, SPMD = SP1.2, EIFN = SP2 and SP2F = ACTU.

7.3 Second PID setting

In some applications, the process behavior is strongly dependent on the process value. The UREG200 provides two PID settings. If the process value changes above a certain limit, the second PID setting can be activated in order to control optimally in this range.

Connection:
⑰ Event input +
⑯ Event input -

Setting:
EIFN = PID2 or SP.P2

Automatic setting of the second PID values
The optimum PID values for a process vary with the process and setpoint value. If a large setpoint range is provided for a process, the second PID values are required to use the controller optimally. During the automatic setting, the first PID values (PB1, TI1 and TD1) are stored when the event input is open. If during the automatic setting the event input is closed and (EIFN = PID2 or SP.P2), the second PID values (PB2, TI2 and TD2) are saved.

Example 1: external switching
Set **EIFN = SP.P2**, by operating the event input the setpoint and the PID values are set to the second values simultaneously.

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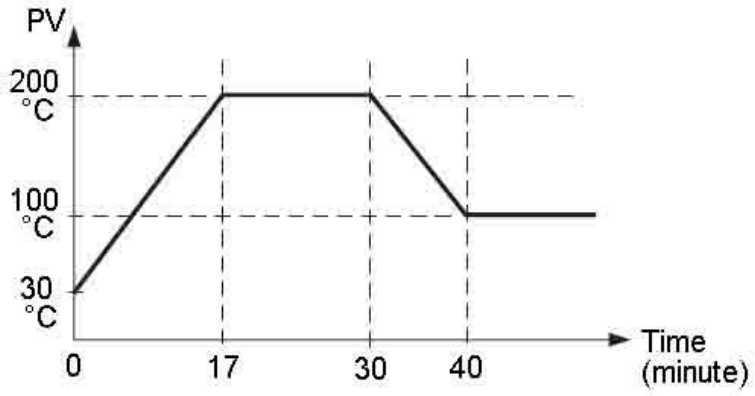
Example 2: Switching by process value
When a process reaches 500°C, it is necessary to use other PID settings for optimal control behavior. Set the alarm set point 1 to 500°C (A1SP = 500°C) to detect the threshold value. Other setting are, alarm 1 function A1FN = PV1H, alarm 1 mode A1MD = NORM and **EIFN = PID2**. Connect the alarm output 1 to the event input, the process reaches the 500°C, the alarm 1 switches the event input and the second PID values (PB2, TI2 and TD2) are active.

7.4 Ramps & Timers

Ramp function
The ramp setting is taken into account during heating or a setpoint change. You can choose between the minute ramp MINR or hour ramp HRR in the set point mode. The rate of change of the ramp is set in the user menu in the parameter RAMP.

SPMD selection:
MInr = minute ramp
or
Hrr = hour ramp
setting:
rAnP = RAMP

Example:
Set are, SPMD = MINR, IN1U = °C, DP1 = 1-DP, RAMP = 10,0 and SP1 = 200°C. The process starts at 30°C, after 30 minutes the set point (SP1) is changed to 100°C.



Ramp function

Note:
If the ramp function is activated, the lower display shows the current ramp value. To display or change the setpoint, press the UP-DOWN keys. Set the RAMP value to 0 to deactivate the ramp function.

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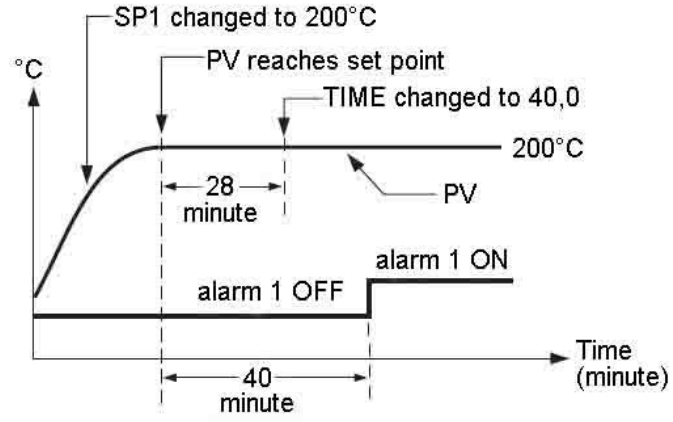
Timer function

The timer function can be used individually or together with the ramp function. If A1FN is set to TIMR, alarm 1 serves as timer (or alarm 2 if A2FN = TIMR). The value for the timer is set in the user menu in the TIME parameter. The timer starts when the process has reached the setpoint (SP1 or SP2).

Selection:
A1FN or A2FN =
 (Timer)

Setting:
 = TIME

Example:
Set are, A1FN = TIMR, IN1U = °C, DP1 = NODP, TIME = 30,0, SP1 =400°C.
The process starts before 200°C is reached, the set point SP1 is changed to 200°C. When the 200°C is reached, the timer is activated. The time value of the timer can be changed at any time before expiration, without disturbing the timer. In the example, the time is changed to TIME = 40.0 after 28 min. The behavior of the process and alarm 1 is shown in picture.



Timer function

The timer output remains set until either the mains voltage is switched off or the event input has been switched.

Note: The timer function can be set only for A1FN or A2FN, if both are set as timer, error code appears ER07.

Ramp & Timer Function

The ramp and timer functions can be combined.

Example:
Set are, SPMD = HHR, IN1U = PU, DP1 = 2-DP, RAMP = 60,00, A2FN = TIMR, TIME = 20,0. The process starts at 0,00, SP1 = 30,00, SP2 = 40,00, the timer output (alarm 2) is connected to the event input.

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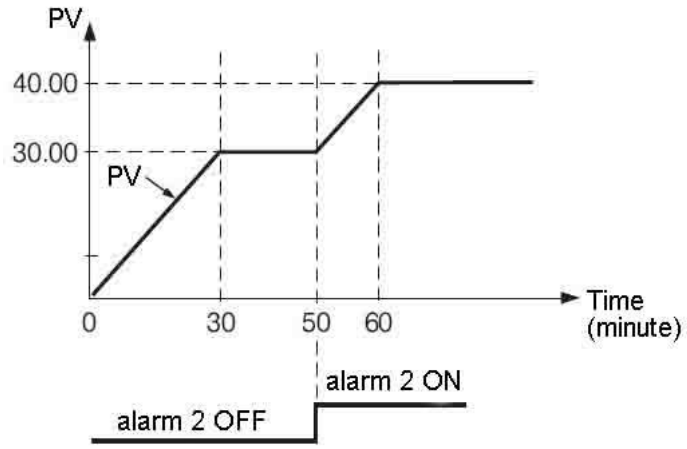

Ramp & timer combination

7.5 External set point

If SPMD is set to PV1 or PV2, the UREG200 can be set with an external setpoint value. If SPMD = PV1, then the external setpoint is connected to input 1 and the process value to input 2. If SPMD = PV2, then the external setpoint is connected to input 2 and the process value to input 1. To achieve this, set the parameters as follows:

Setting

FUNC = FULL
SPMD= PV2, PVMD = PV1
or
SPMD = PV1, PVMD = PV2

Example 1, external setpoint at input 2
FUNC = FULL
IN2, IN2U, DP2, IN2L, IN2H are set according to the external setpoint.
PVMD = PV1
IN1, IN1U, DP1 are set according to the process signal.
IN1L, IN1H are set, if released, according to the process.
SPMD = PV2

Example 2, external setpoint at input 1
FUNC = FULL
IN1, IN1U, DP1, IN1L, IN1H are set according to the external setpoint.
PVMD = PV2
IN2, IN2U, DP2 are set according to the process signal.
IN2L, IN2H are set, if released, according to the process.
SPMD = PV1

Note: If PV1 is set for SPMD and PVMD error code appears Er01. If PV2 is set for SPMD and PVMD, error code appears Er02. Never use the same PV with SPMD and PVMD, be cause then the controller cannot regulate properly.

Error messages

Er01
Er02

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7.6 Difference regulations

In some applications it is necessary to control the deviation of two process signals. To set this differential control, please use the following parameters:

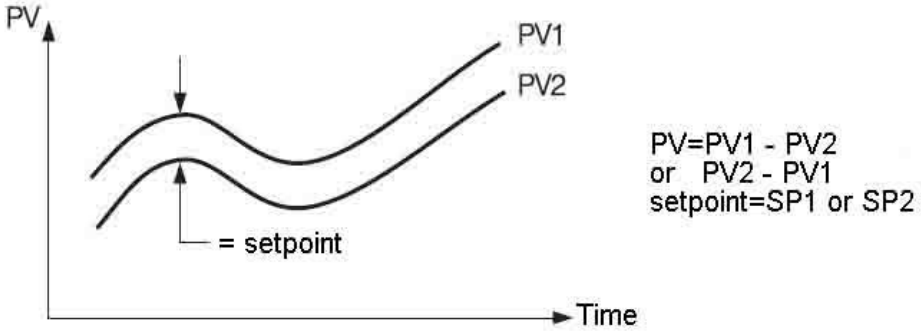
Settings

PVMD = P1-2
or
PVMD = P2-1

SPMD = SP1.2

FUNC = FULL
IN1. IN1L, IN1H are set according to input 1.
IN2. IN2L, IN2H are set according to input 2.
IN1U, DP1, IN2U, DP2 are set according to input 1 & 2.
PVMD = P1-2 or P2-1
SPMD = SP1.2

The control of PV2 will run parallel to PV1, see picture:



Difference regulation

The process display shows the difference PV1 - PV2 if PVMD = P1-2 or the difference PV2 – PV1 if PVMD = P2-1. If you want to display one of the process values PV1 or PV2, you can change the settings as described in chapter 6.22.

Error messages:
If PVMD = P1-2 or P2-1 and at the same time SPMD = PV1 or PV2, an error Er03 is displayed. In this case the settings for IN1U and IN2U as well as DP1 and DP2 must be the same, otherwise error Er05 is displayed.

Error messages

Er03
Er05

7.7 Control limitation

In some applications, the heating or cooling may be oversized. In order to prevent a strong over- or underrun of the setpoint, the control limitation can be activated.

The control limit for output 1 is PL1, can be found in the user menu. If output 2 is not used, (OUT2 ≠ COOL), the associated parameter PL2 is hidden. If the controller is in ON-OFF control mode, PL1 and PL2 are hidden.

Setting the control limit
Press ⟲ for 3 sec., then repeatedly until PL1 or PL2 appears in the display. PL1 and PL2 can be set between 0 and 100% via the up and down keys.

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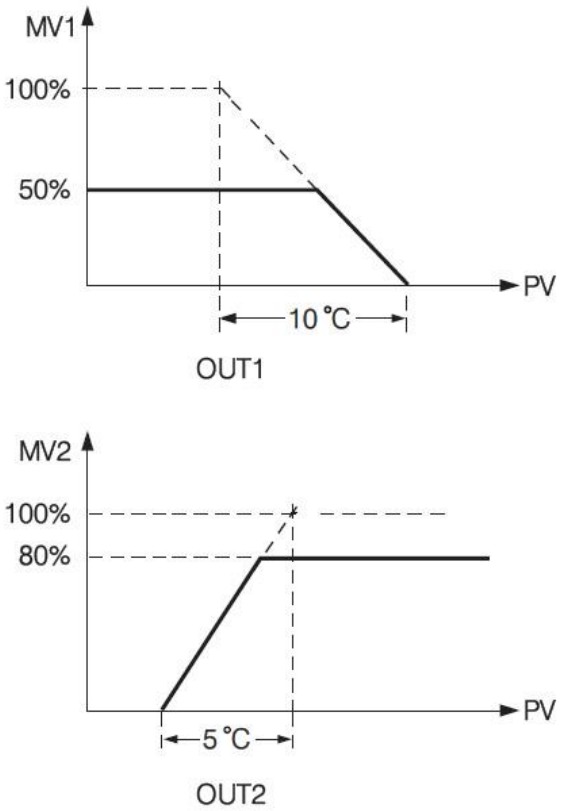
Example:
OUT2 = COOL, PB1 = 10,0°C, CBP = 50, PL1 = 50%, PL2 = 80%
You can see the control process in picture.



Control limit

Note:
In manual operation or in case of error, the control limitation of MV1 (heating) with PL1 and MV2 (cooling) with PL2 is deactivated.

7.8 Data transmission RS interfaces

Two interface cards are available for data transmission in the UREG200, one RS232 interface (type code -1) or one RS485 interface (type code -2). Two major considerations should be made when selecting the interface.

1. how many participants do I want to connect?
   - For more than one participant → RS485
   - For one participant → RS232 or RS485
2. how long is my overtagging distance?
   - Over 20m line path → RS485
   - Up to 20m line path → RS232 or RS485

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The UREG200 can be configured via the PC with the UREG-config software. Make sure that your PC has an appropriate interface or you have an interface adapter.

Setting the data transmission
Go to the setup menu.
Activate the entire menu scope FUNC = FULL.
Depending on the installed module, set COMM = 485 or 232 on and PORT = RTU.
Set an individual address in the ADDR parameter for each controller operated on the same port.
Set the transmission rates (BAUD), the number of bits (DATA), the parity (PARI) and the stop bit (STOP) on the PC and controller in the same way.

For connection please refer to chapter 5.14 and 5.16.

Benefit RS485
Long transmission up to 1 km
Up to 247 participants

Benefit RS232
Direct connection to the PC

Order code:
UREG200-x-x-x-1 for RS232
UREG200-x-x-x-2 for RS485

RS485 Settings:
FUNC=FULL
COMM=485
PORT=RTU
ADDR=Address
BAUD=Baud rate
DATA=Number of bits
PARI=Parity
STOP=Stoppbit

RS485 connection:
⑬ TX1
⑭ TX2

RS232 Settings:
FUNC=FULL
COMM=232
PROT=RTU
ADDR=Address
BAUD=Baud rate
DATA=Number of bits
PARI=Parity
STOP=Stoppbit

RS232 connection:
⑬ TX1
⑭ TX2
⑩ COM

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7.9 Analog retransmission

The analog retransmission is available on the UREG200-x-x-3 as a 0/4...20mA interface.

Setting

FunC FUNC
CoNN COMM
AoFn AOFN
AoLo AOLO
AoHi AOHI

Connection

⑬ AO+
⑭ AO–

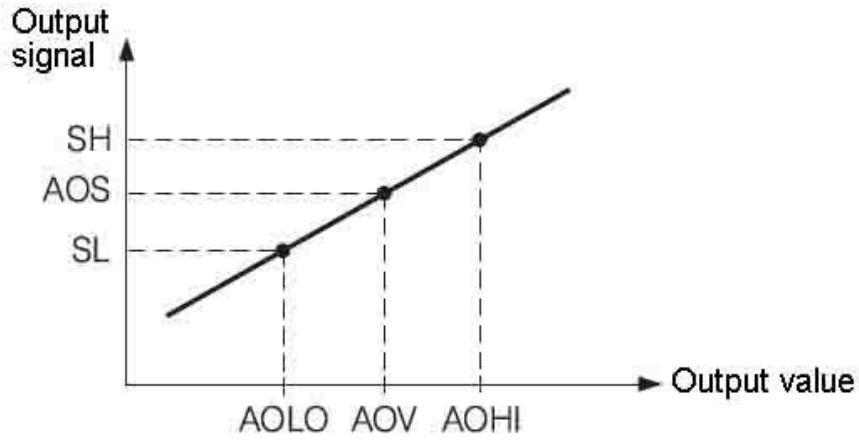
Analog retransmission settings
In the Setup menu, set the parameter FUNC = FULL.
Select the desired signal type under CONN:

4-20 = 4…20mA analog output
0-20 = 0…20mA analog output

The voltage variants are currently not yet available!

With the parameter AOFN (analog output function) you can select which value you want to transmit, e.g. to a control system. The choice is, PV1, PV2, PV1-PV2, PV2-PV1, SV, MV1, MV2 and PV-SV (see also table 1.4). The parameters AOLO, value at which the lower signal should be present (0 or 4 mA) and AOHI, value of the 20mA signal, must be set according to the application.

Scaling of the analog retransmission
AOLO and AOHI serve for scaling the output signal of the LOW signal level „SL“ (E.g. 4mA) and the HIGH signal level "SH" (e.g. 20mA). The analog signal "AOS" is then corresponding to the analog output value "AOV". See on picture.



Analog retransfer

Formulas: $AOS = SL + (AOV - AOLO)\frac{SH - SL}{AOHI - AOLO}$

$$AOV = AOLO + (AOS - SL)\frac{AOHI - AOLO}{SH - SL}$$

Examples: The analog retransmission is used to transmit the difference between PV1 and PV2. 4mA should correspond to -100 and 20mA to +100.

Note:
AOHI ≠ AOLO
AOHI > AOLO
Linear increasing Output

AOHI < AOLO
Linear falling Output

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Make the following settings on the UREG200:

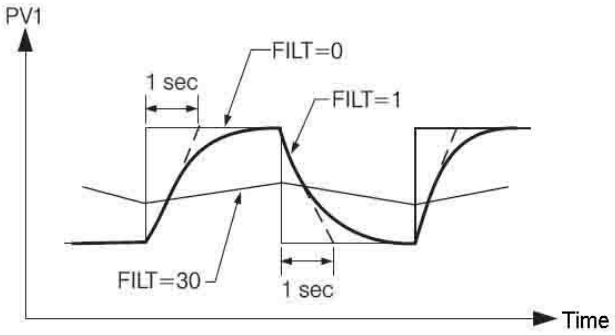
IN1U = PU, DP1 = NODP,
IN2U = PU, DP2 = NODP,
FUNC = FULL, COMM = 4-20,
AOFN = P1-2, AOLO = -100, AOHI = 100

7.10 Digital filter

In some applications the process value is too unstable to be shown directly on the display. To remedy this, a digital filter is integrated in the UREG200, which can be adjusted as required. The filter works with a time constant of first priority and is set in the setup menu, the parameter is FILT. The factory setting is 0.5 sec, the setting range is from 0 (disabled) to 60 sec. Please refer to the picture for the filter property.

Menu
F,LE FILT

The filter is used to stabilize the process display



Filter behavior

Note:
The filter is only available for the display of PV1 and is only effective for the display of the process value. The UREG200 is designed to process unfiltered signals.

7.11 Sleep mode

To enable the sleep mode, proceed as follows:

Setup-menu-settings
FUNC = FULL
SLEP = YES

Switch on sleep mode:
Press ▲▼ for 3 sec. to switch on the sleep mode.

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In sleep mode:

1. switches off the display, only the decimal point flashes cyclically.
2. switch off the outputs and alarms.

Switch off sleep mode:

1. Press ▲▼ to switch off the sleep mode, or
2. Switch the mains voltage off and on again.

Factory setting: SLEP = NONE (Sleep mode disabled)

7.12 Pump control

The UREG200 has a special program item, pump control.
Most often, the pressure is generated in a process via a variable speed pump. The problem is often that the pressure curve of the pump is not linear to the speed. This can cause the process pressure to fluctuate greatly, and when the pump is at a standstill, pressure losses often occur due to leaks in the pump.

With the UREG200 this demanding control task can be done. For this purpose, please make the following settings:

Pump control settings:

FUNC = FULL
EIFN = NONE
PVMD= PV1
FILT = 0.5
SELF = NONE
SPMD= PUMP
SP2F = DEVI

Main parameters
SPMD
SP2F
REFC
SP2

And set values for the following parameters:

REFC = Reference constant
SP2 = Enter a negative value, this will be set to the setpoint value (SP1) added, set point = (SP1 + (-SP2)) to achieve a stable pump still sand to be achieved.

Without UREG200, the pump reduces speed when the process pressure is close to the setpoint, but usually does **not stop completely**.
To prevent this, the UREG200 periodically checks the process with the aid of the **reference constant (REFC)** (prerequisite SPMD = PUMP). If the check shows that the process continues to consume pressure, the pump is controlled accordingly. **If the process no longer consumes pressure**, the controller switches off the pump and reduces the setpoint = (SP1 + (-SP2)) by the value set in SP2. This creates a **stable shutdown** and a **demand-oriented downtime**. Note that SP2 must have a negative value.

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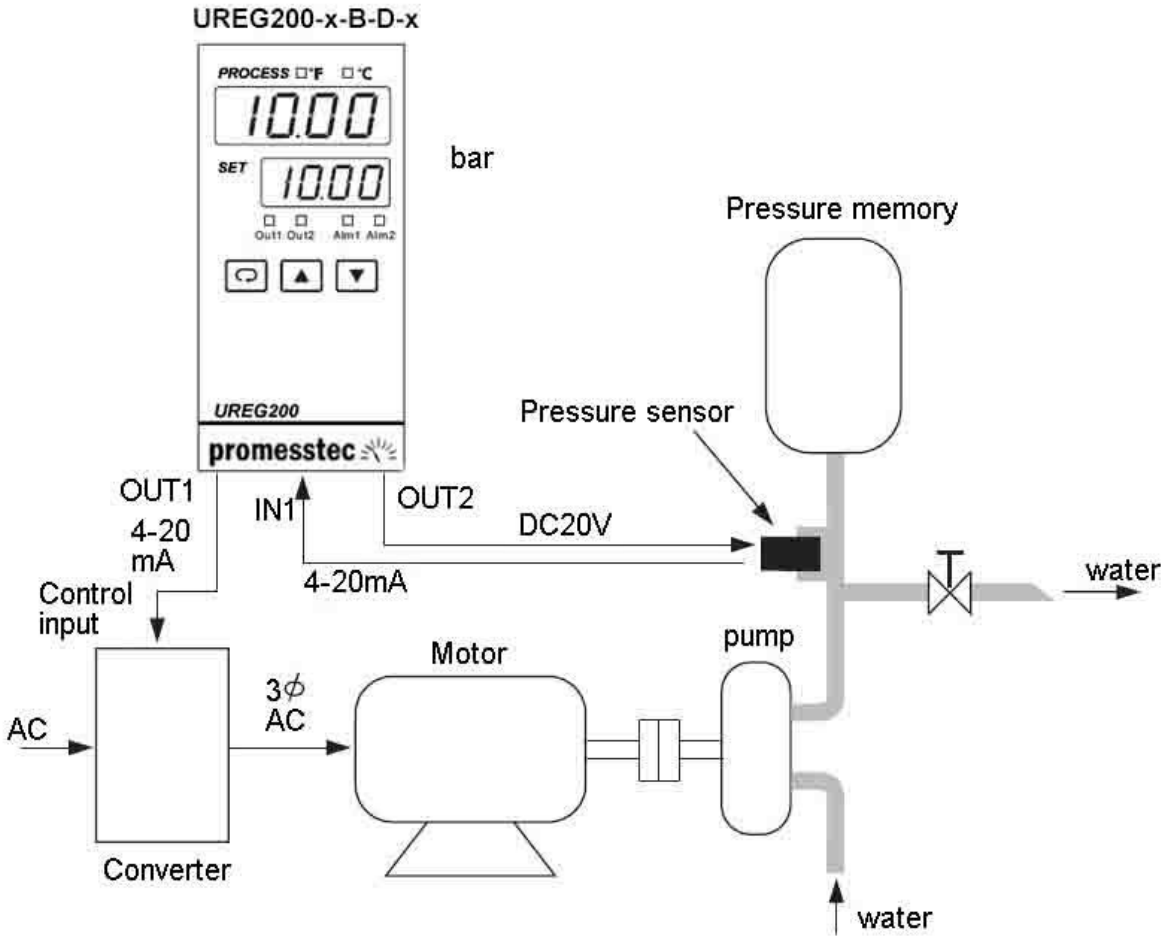
Summary pump control:

1. As long as the process pressure decreases, the UREG200 adjusts the pressure to the set point SP1.
2. If the process does not take any more pressure, the UREG200 switches off the pump as long as possible until the reduced set point = (SP1 + (-SP2) is reached.

Example pump control



Structure pump control

Inverter:	Frequency converter for motor control
Motor:	One AC3 three-phase motor
Pump:	An economical execution
Pressure sensor:	2- or 3-wire pressure sensor with a measuring range of 0-20 bar.
Pressure memory:	For more uniform pressure delivery to the process
Controller:	UREG200-x-B-D-x

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7.13 Parameter lock with event input

The parameters of the UREG200 can be locked via the DIP switches (see chapter 4.3) on the device and/or via the event input Terminals 17 and 18 (see chapter 5.10).

Parameter lock
External switch to terminal ⑰ and ⑯.
EIFN = LOCK set
All parameters are locked.

Setting for locking with the event input:

EIFN = LOCK (see chapter 7.1)

If the switch at the event input is closed, all parameters are locked against adjustment. If the switch is open, the settings of the DIP switches on the device apply.

8. Calibration

Calibration of the UREG200 is to be performed exclusively by the manufacturer or specially trained personnel.

Instructions for calibration will be issued during training. If you feel that your UREG200 needs to be calibrated, please contact:

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Activating the calibration interrupts the control loop, make sure that the process is switched off, qualified personnel and suitable equipment are available is.

Never activate the calibration out of ignorance or curiosity, this can lead to the loss of the current calibration values and the controller must be sent to the factory for recalibration at a charge.

9. Demounting, Return, Cleaning and Disposal

9.1 Demounting

Residual media in dismantled devices can endanger persons, the environment and equipment. Sufficient precautionary measures must be taken.

There is a risk of burns. Allow the sensor to cool down sufficiently before removing it. During dismounting, there is a risk of dangerously hot media escaping.
Only dismantle the resistance thermometer when it is depressurized.

9.2 Return

Use the original packaging or equivalent to return the device.
As protection against damage can be used e.g. antistatic foil, insulating material, labeling as sensitive measuring device.

9.3 Cleaning

Disconnect the electrical connection before cleaning the sensor.
Clean the device with a damp cloth.
Do not allow the electrical connection to come into contact with moisture.
Rinse or clean a dismantled instrument before returning it to protect people and the environment from hazards caused by residual medium adhering to the instrument.
Residual media in dismantled devices can endanger persons, the environment and equipment. Take adequate precautions.

9.4 Disposal

Dispose of device components and packaging materials in an environmentally friendly manner in accordance with the country-specific waste treatment and disposal regulations.

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10. Warranty & Return

The following warranty conditions apply to the products. These warranty conditions apply only to the purchase of these products as new products directly from promesstec GmbH or an authorized dealer or agency. Furthermore, the warranty conditions apply only to first-time buyers of these products and to purchases for purposes other than commercial use (resale, sale, or use for other purposes).

Warranty
The products are flawless in their function and workmanship at the time of delivery ex works and correspond to the technical data of the associated operating instructions or data sheets. This warranty is valid for a period of 2 years.

THERE ARE NO OTHER WARRANTIES, EXPRESS OR IMPLIED, EXCEPT AS NOTED ABOVE. WITH RESPECT TO THE PRODUCTS; PROMESSTEC ASSUMES NO LIABILITY FOR THEIR SUITABILITY FOR NORMAL USE OR FOR USE IN ACCORDACE WITH THE SPECIFICATIONS.

Warranty limitations
promesstec GmbH assumes no liability for consequential or other damages, costs or other expenses except for the repair or replacement costs described above. The products must be installed and maintained in accordance with the provisions of promesstec's operating instructions. There is no warranty for damage due to corrosion. The user is responsible for the intended use of the products. Warranty claims are only valid if the defective product is returned to the supplier in its original packaging and within the valid warranty period. The customer shall bear the costs for the return shipment. The return packaging must be designed in such a way that no damage can occur during transport due to electrostatic discharge or other damage.

Furthermore, the statutory provisions of the Federal Republic of Germany apply to warranty and guarantee claims.

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11. Technical specifications

promesstec GmbH

evaluation devices

universal-controller UREG 200

features

- microprocessor PID fuzzy control universal controller for many application areas
- simple handling about 3 keys and/or pc-software
- 2 analog outputs, therof 1 universal input for resistance thermometer, thermocouple, power 0/4-20mA and voltage 0-10VDC, 2.analog inputs with power 0/4-20mA and voltage 0-10VDC
- universal adjustment of controller as 2 point controller heating, 2 point-controller cooling, 3 point controller heating/cooling, constant controller
- controller outputs as relay and bistabile voltage output for solid-state relay
- optional constant controller with output 0/4-20mA (adäquat for control valve)
- optional additional analog output with many functions like actual value output programmable
- optional with sensor supply unit for feeding off 2-wire transmitter
- optional with different interfaces RS 232 or RS 485
- self improvement
- 2 alarm contacts with programmable switching function
- dimensions 48 x 96 mm installation depth 65 mm

UREG 200-1-B-D-3-1

order-code UREG 200... order example: UREG 200-1-B-D-3-1

voltage supply

-1 90-264VAC, 47-63 Hz
-2 11-26 VAC/DC

adjusting output out1

-A switching output relay
-B analog output 0/4-20mA as constant output
-C switching output to trigger the solid state relay

adjusting output out2 or sensor supply for 2-wire transmitter

-A switching output relay
-B analog output 0/4-20mA as constant output
-C switching output to trigger the solid state relay
-D sensor supply for 2-wire transmitter 20VDC, 25mA

option 1: interfaces, analog output with different functions

-0 without interface
-1 with interface RS 232 for communication
-2 with interface RS 485 for communication
-3 with analog output 0/4-20mA, different. functions programmable like acutual value output, sensor margin output a.s.o..

option 2: higher protection class of the box

-0 protection type IP50 at the front (standard)
-1 protection type IP65 at the front

auxiliary equipment like software, interface adapter, sealing kit upgrate a.s.o.

UREG-config easy parameterizing software for UREG-controller (except UREG100)
UREG-CON interface adapter UREG-controller on PC RS232

UREG-prog-kit complete prog.-kit, made up software, interface adapter and USB-adapter

UREG50-IP65 sealing kit for upgrade the protection type IP50 to IP65 at the front

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evaluation devices

universal-controller UREG 200

technical specifications

voltage supply
90-264VAC, 47-63 Hz, 15VA, 7W max.
11-26 VAC/DC, 15VA, 7W max.

analog input 1

thermocouple type J	-120°C...+1000°C
thermocouple type K	-200°C...+1370°C
thermocouple type T	-250°C...+400°C
thermocouple type E	-100°C...+900°C
thermocouple type B	0°C...+1820°C
thermocouple type R	0°C...+1767,80°C
thermocouple type N	-250°C...+1300°C
thermocouple type L	-200°C...+900°C
PT100 2/3-wire DIN	-210°C...+700°C
power	0/4...20mA, +/-0,05%
voltage	0...10VDC, +/-0,05%

difinition: 18bit
sample rate: 5/s

analog input 2

power	0/4...20mA, +/-0,05%
voltage	0...10VDC, +/-0,05%

difinition: 18bit
sample rate: 5/s

control input binary
logic low 0VDC
logic high 10VDC
different functions programmable

alarm output 1
1 changer max 2A/240VAC
different functions programmable

alarm output 2
1 closer max 2A/240VAC
different functions programmable

adjusting output 1/adjusting ouput 2
at function relay: normally open contact max. 2A 240VAC
at function contant: 0/4-20mA max. 500Ohm
(over 500Ohm extern resistance 0/2-10VDC)
definition: 15bit
at function solid state 14V/40mA

sensor supply unit for 2-wire transmitter
20VDC, 25mA, isolation voltage: 500VAC

communication interface
RS232 (1 unit), RS485 (up to 247 units)
protokoll: modbus RTU
interval: 1...247
baud-rate: 0,3...38,4 Kbits/s
data bits: 7 oder 8
parity bit: none, even or odd
stop bit: 1 or 2
data cage: 50 bytes

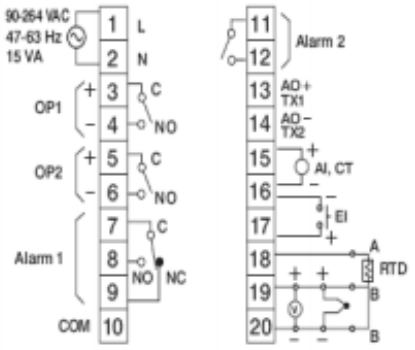
analog output
functions: actual value1, actual value2, act.vaue.1-act.value.2
act.value2-act.value1, act.value-act.value a.s.o.
output 0/4-20mA,
(over 500Ohm extern resistance 0/2-10VDC)
difinition: 15 bit
accuracy: +/-0,05%
working resistance: max 500 Ohm
isolation voltage: 1000VAC

front operation and display
actual value (PROCESS): LED-display, hight 10mm colour red
reference value (SET): LED-display hight 8mm, colour green
LEDs for out1, out2, alarm1, alarm2, °C, °F
operation at the front about 3 keys

interface for the programming
on the side for interface adapter UREG-Con
parameterization with software UREG-Konfig

dimensions etc.,
box 48 x 96mm
installation depth: 65mm
cut-out control panel : 45 x 92mm
weiht: 220g
protection type: IP50 at the front, optional IP65, IP20 ot the back
protection against contact of the clamps about plastics cover, detachable
electronic to extract of the box forwards

connection chart



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12. Your parameters notes

Included in	Parameter Name	Display	Setting
User menu	SP1		
	TIME	t1 nE	
	A1SP	A 1SP	
	A1DV	A 1dY	
	A2SP	A2SP	
	A2DV	A2dY	
	RAMP	rAnP	
	OFST	oFSt	
	REFC	rEFC	
	SHIF	SH1 F	
	PB1	Pb 1	
	TI1	t1 1	
	TD1	td 1	
	CPB	CPb	
	DB	db	
	SP2	SP2	
	PB2	Pb2	
	TI2	t1 2	
	TD2	td2	
	O1HY	o 1HY	
	A1HY	A 1HY	
	A2HY	A2HY	
	PL1	PL 1	
	PL2	PL 2	
Setup menu	FUNC	FunC	

Included in	Parameter Name	Display	Setting
Setup menu	COMM	Conn	
	PROT	Prot	
	ADDR	Addr	
	BAUD	bAud	
	DATA	dAtA	
	PARI	PAr1	
	STOP	StoP	
	AOFN	AoFn	
	AOLO	AoLo	
	AOHI	AoH1	
	IN1	1n 1	
	IN1U	1n 1u	
	DP1	dP 1	
	IN1L	1n 1L	
	IN1H	1n 1H	
	IN2	1n2	
	IN2U	1n2u	
	DP2	dP2	
	IN2L	1n2L	
	IN2H	1n2H	
	OUT1	out 1	
	O1TY	o 1tY	
	CYC1	CYC 1	
	O1FT	o 1Ft	

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Included in	Parameter Name	Display	setting
setup menu	OUT2	out2	
	O2TY	o2ty	
	CYC2	CYC2	
	O2FT	o2FT	
	A1FN	A1Fn	
	A1MD	A1md	
	A1FT	A1FT	
	A2FN	A2Fn	
	A2MD	A2md	
	A2FT	A2FT	
	EIFN	Ei.Fn	
	PVMD	PVmd	
	FILT	Fi.LT	
	SELF	SELF	
	SLEP	SLEP	
	SPMD	SPmd	
	SP1L	SP1L	
	SP1H	SP1H	
	SP2F	SP2F	
	SEL1	SEL1	
	SEL2	SEL2	
	SEL3	SEL3	
	SEL4	SEL4	
	SEL5	SEL5	

Included in	Parameter Name	Display	setting
calibration menu	AD0	Ad0	
	ADG	AdG	
	V1G	V1G	
	CJTL	CJtL	
	CJG	CJG	
	REF1	rEF1	
	SR1	Sr1	
	MA1G	mA1G	
	V2G	V2G	
	MA2G	mA2G	
display mode menu	PVHI	PVHi	
	PVLO	PVLo	
	MV1	H---	
	MV2	C---	
	DV	dV	
	PV1	PV1	
	PV2	PV2	
	PB	Pb	
	TI	ti	
	TD	td	
	CJCT	CJCt	
	PVR	PVr	
	PVRH	PVrH	
	PVRL	PVrL	

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