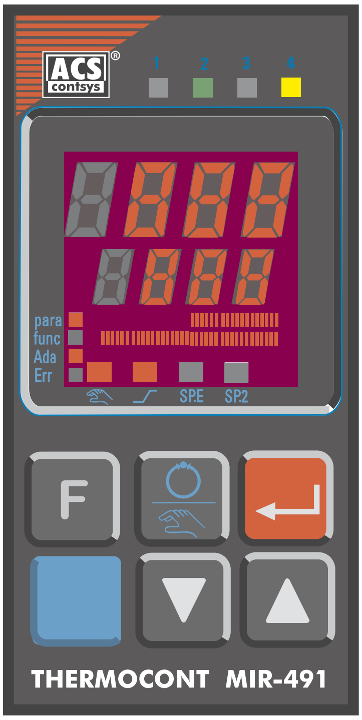
ACS-Control System GmbH

Industrial and process controller MIR-491



MIR-491

Operating manual

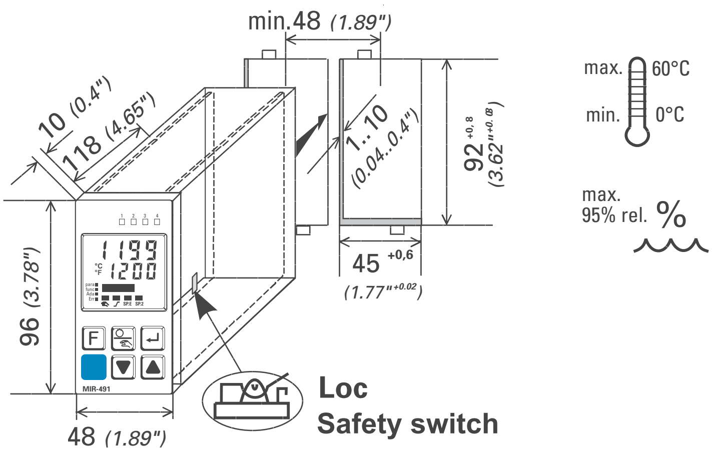
English

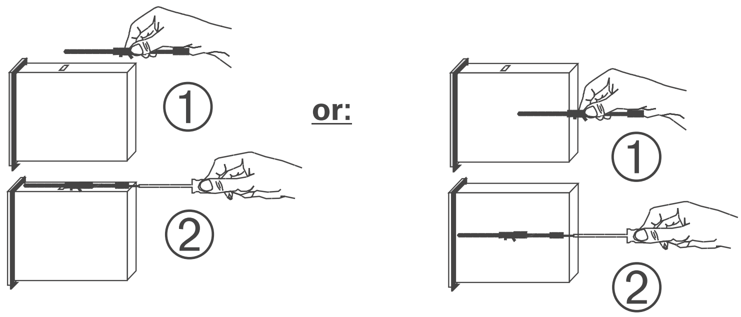
BAL-491-65511

Valid from: 07/2002

Contents

1 Mounting





Safety switch:
For access to the safety switch, the controller must be withdrawn from the housing. Squeeze the top and bottom of the front bezel between thumb and forefinger and pull the controller firmly from the housing.

Loc	open	Access to the levels is as adjusted by means of BlueControl (engineering tool) ❷
	closed ❶	all levels accessible wihout restriction

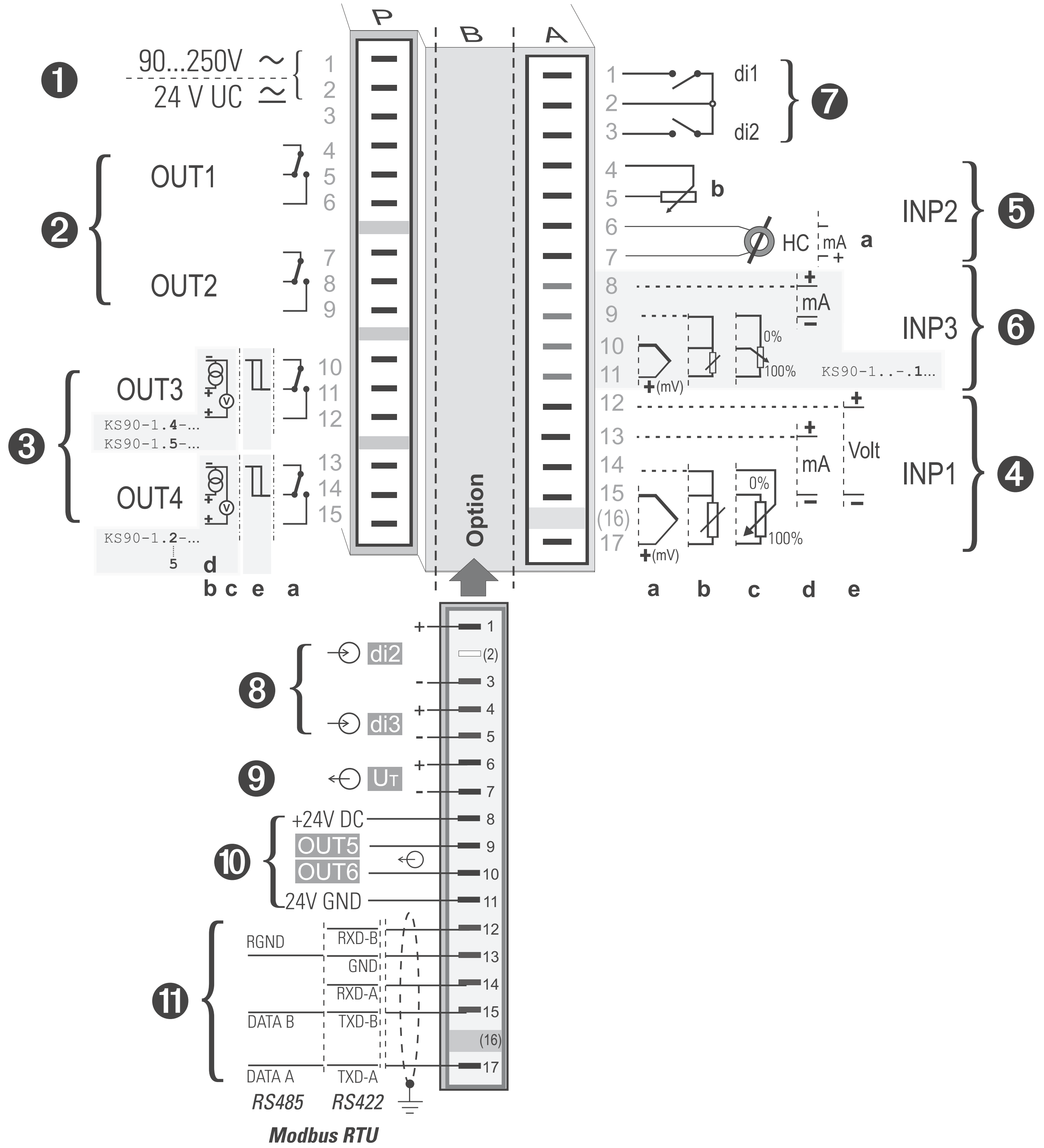
❶ Factory setting

❷ Default setting: display of all levels suppressed, password PASS = OFF

Caution! The unit contains ESD-sensitive components.

2 Electrical connections

2.1 *Connecting diagram*



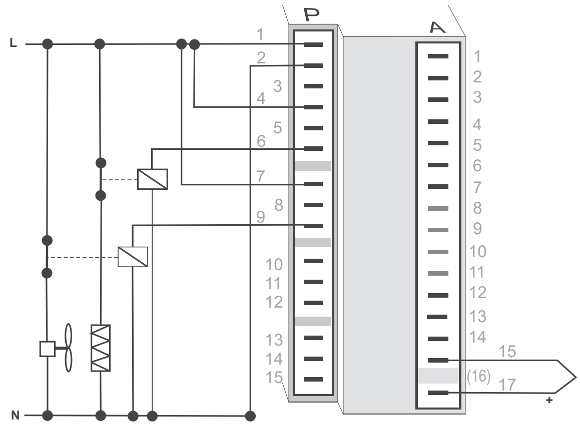
The controller is fitted with flat-pin terminals 1 x 6,3mm or 2 x 2,8mm to DIN 46 244

2.2 *Terminal connection*

***Power supply connection* ❶**
See chapter 10 "Technical data"

***Connection of outputs OUT1/2* ❷**
Relay outputs (250V/2A), potential-free changeover contact

❷ *OUT1/2 heating/cooling*

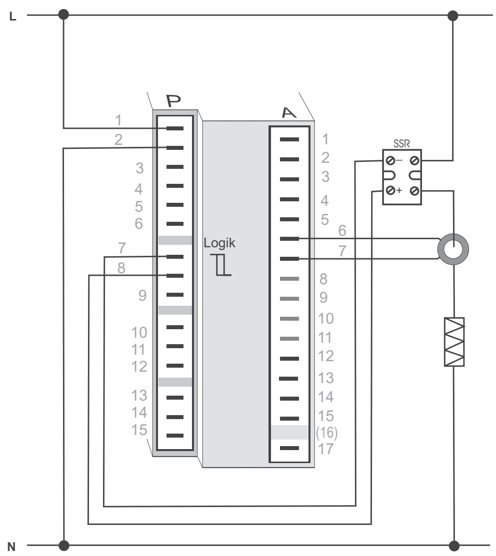


***Connection of outputs OUT3/4* ❸**
a relay (250V/2A), potential-free changeover contact
universal output
b current (0/4...20mA)
c voltage (0/2...10V)
d transmitter supply
e logic (0..20mA / 0..12V)

***Connection of input INP1* ❹**
Input for variable x1 (process value)
a thermocouple
b resistance thermometer (Pt100/ Pt1000/ KTY/ ...)
c current (0/4...20mA)
d voltage (0/2...10V)

***Connection of input INP2* ❺**
a Heating current input (0...50mA AC) or input for ext. set-point (0/4...20mA)
b Potentiometer input for position feedback

❺ *INP2 current tansformer*



***Connection of input INP3* ❻**
As input INP1, but without voltage

***Connection of inputs di1, di2* ❼**
Digital input, configurable as switch or push-button

Connection of inputs di2/3* ❽ *(option)
Digital inputs (24VDC external), galvanically isolated, configurable as switch or push-button

Connection of output U_T* ❾ *(option)

Supply voltage connection for external energization

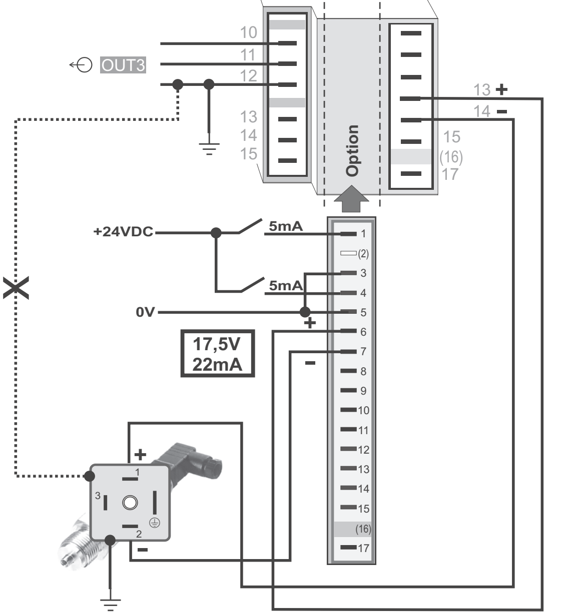
Connection of outputs OUT5/6* ❿ *(option)

Digital outputs (opto-coupler), galvanic isolated, common positive control voltage, output rating: 18...32VDC

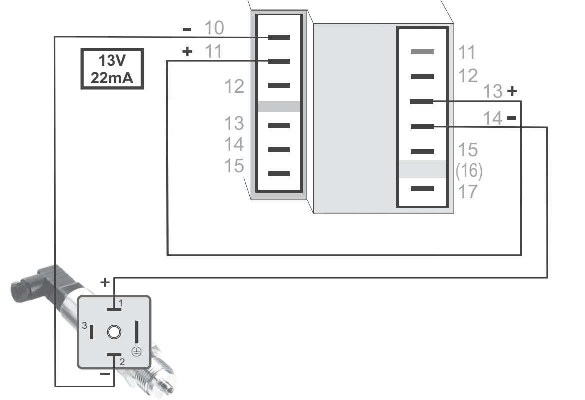
Connection of bus interface* ⓫ *(option)

RS422/485 interface with Modbus RTU protocol

❽ ❾ *di2/3, 2-wire transmitter supply*

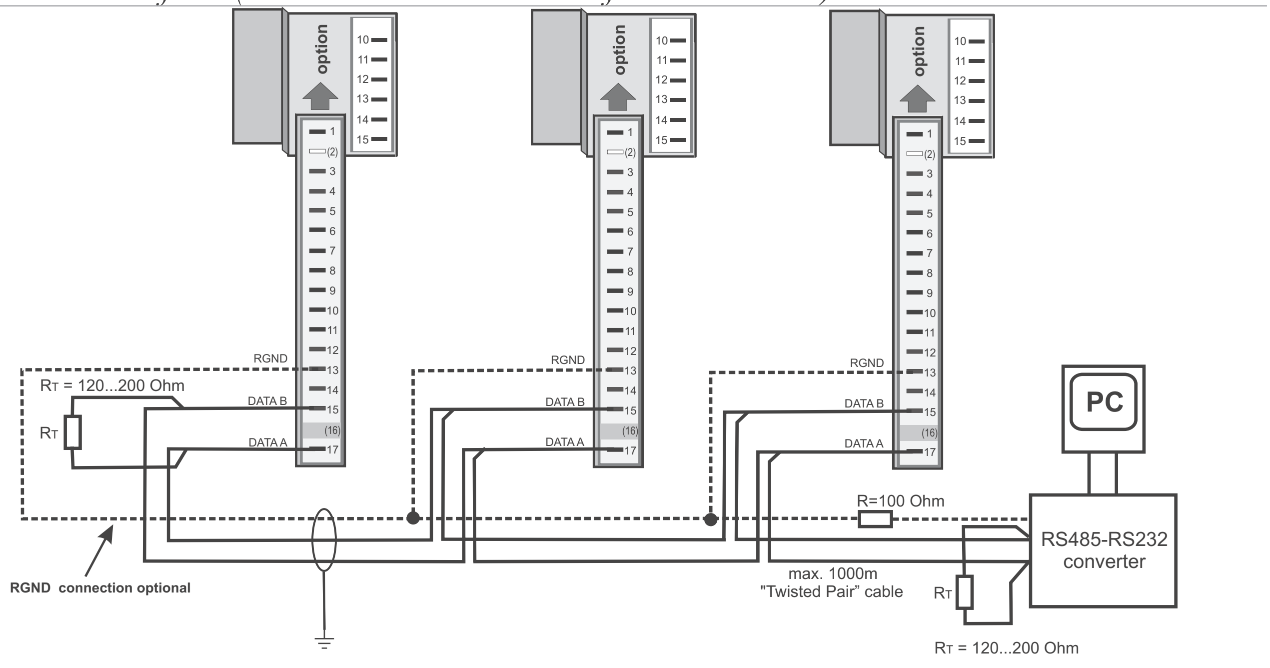


❸ *OUT3 transmitter supply*



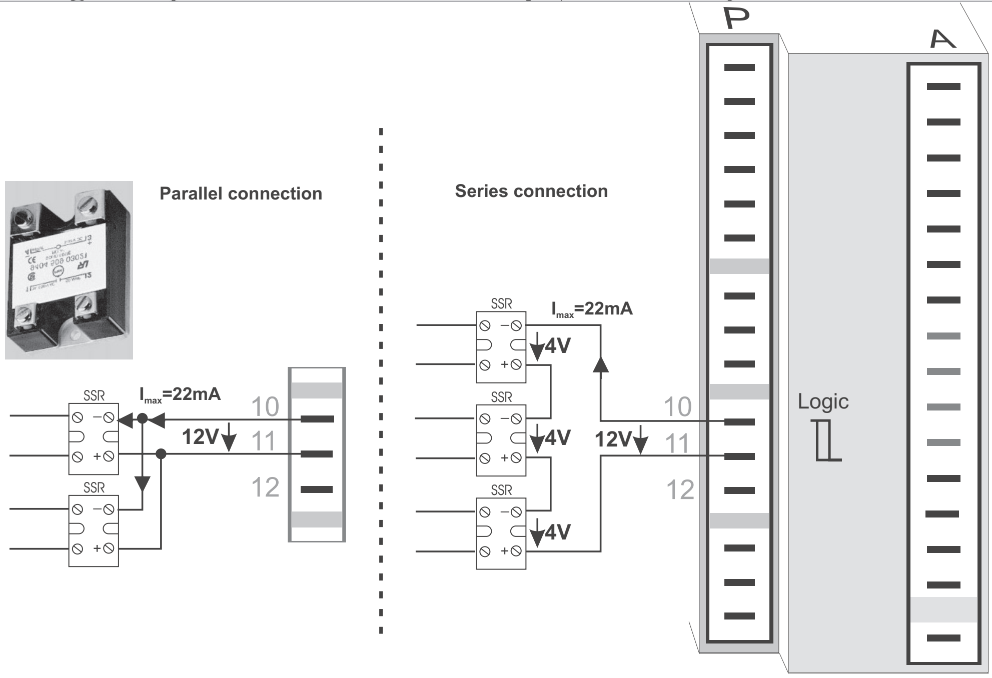
⚠ If the universal output OUT3 or OUT4 is used there may be no external galvanic connection between measuring and output circuits!

❾ *RS485 interface (with RS232-RS485 interface converter)* *

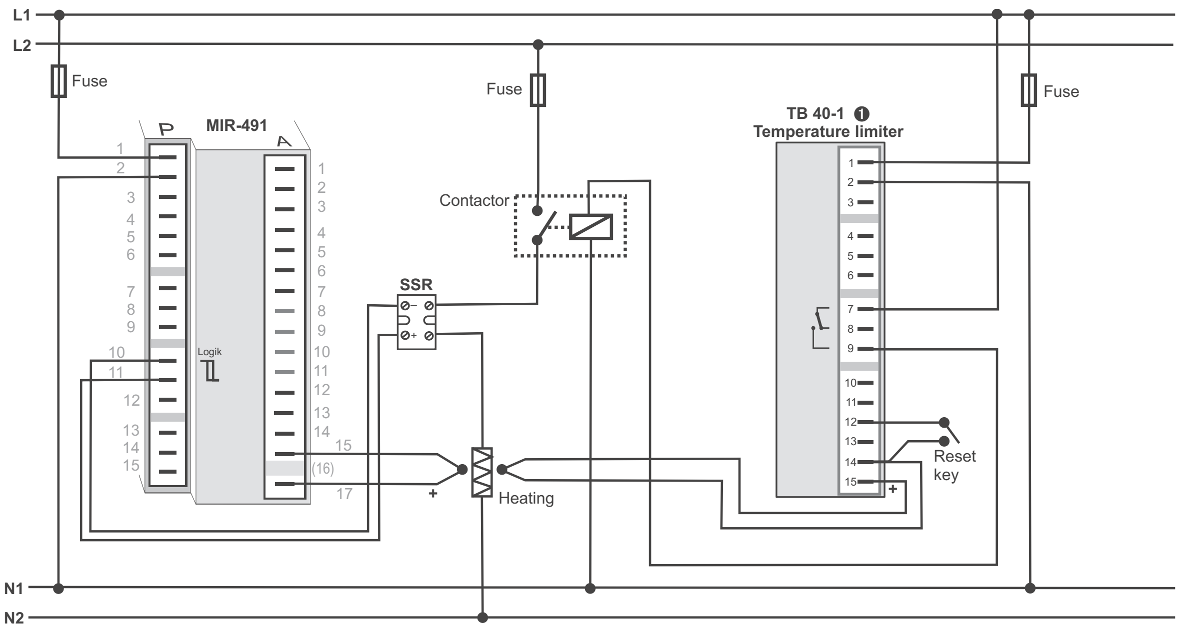


* **Interface description Modbus RTU in speperate manual: see page 62.**

❸ *OUT3 as logic output with solid-state relay (series and parallel connection)*



MIR-491 connecting example:

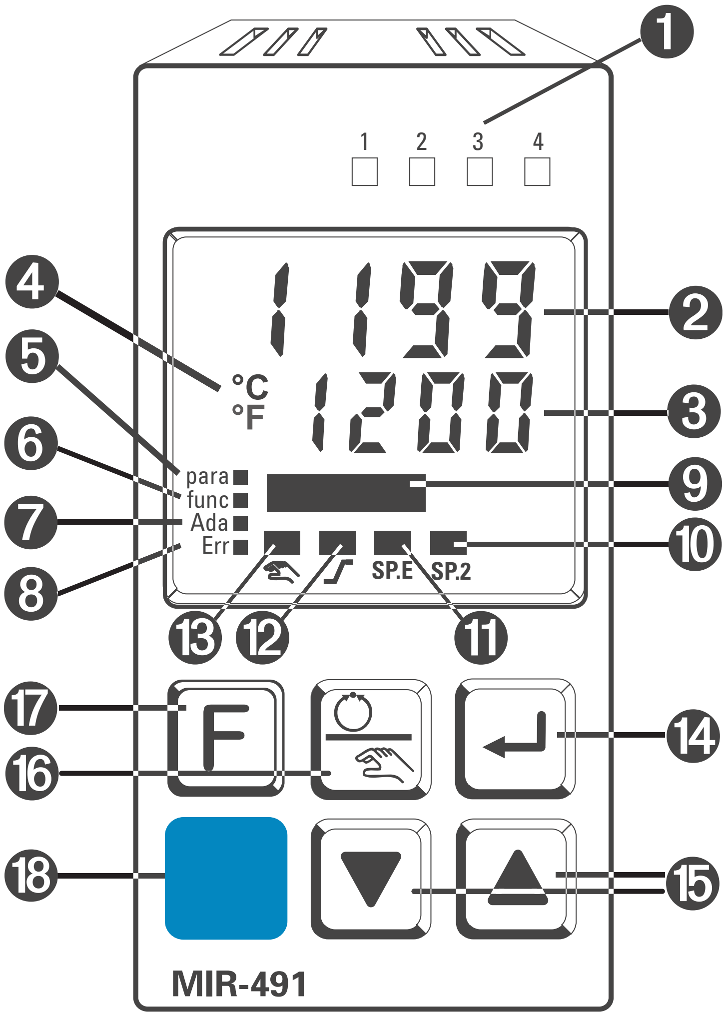


❶ **TB 40-1 Temperature limiter**
Standard version (3 relays):
TB40-100-0000D-000
→ Product of the PMA Prozeß- und Maschinen-Automation GmbH

⚠ **CAUTION: Using a temperature limiter is recommendable in systems where overtemperature implies a fire hazard or other risks.**

3 Operation

3.1 *Front view*



1. Status of switching outputs Out.1...6
2. Process value display
3. Set-point, controller output
4. Signals display on °C or °F
5. Signals ConF and PArA level
6. Signals aktive function key
7. Self-tuning active
8. Entry in error list
9. Bargraph or clear text display
10. SP.2 is effective
11. SP.E is effective
12. Set-point gradient effective
13. Manual/automatic switch-over:
    Off: Automatic
    On: Manual
    (changing possible)
    Blinks: Manual
    (changing not possible
    (→ConF/Cntr/mAn)
14. Enter key:
    calls up extended operating level / error list
15. Up/down keys:
    changing the set-point or the controller output value
16. Manual mode /spec. function
    (→ConF /LOGI)
17. Freely programmable function key
18. PC connection for BlueControl (engineering tool)

LED colours:

LED 1, 2, 3, 4:	yellow
Bargraph:	red
other LEDs:	red

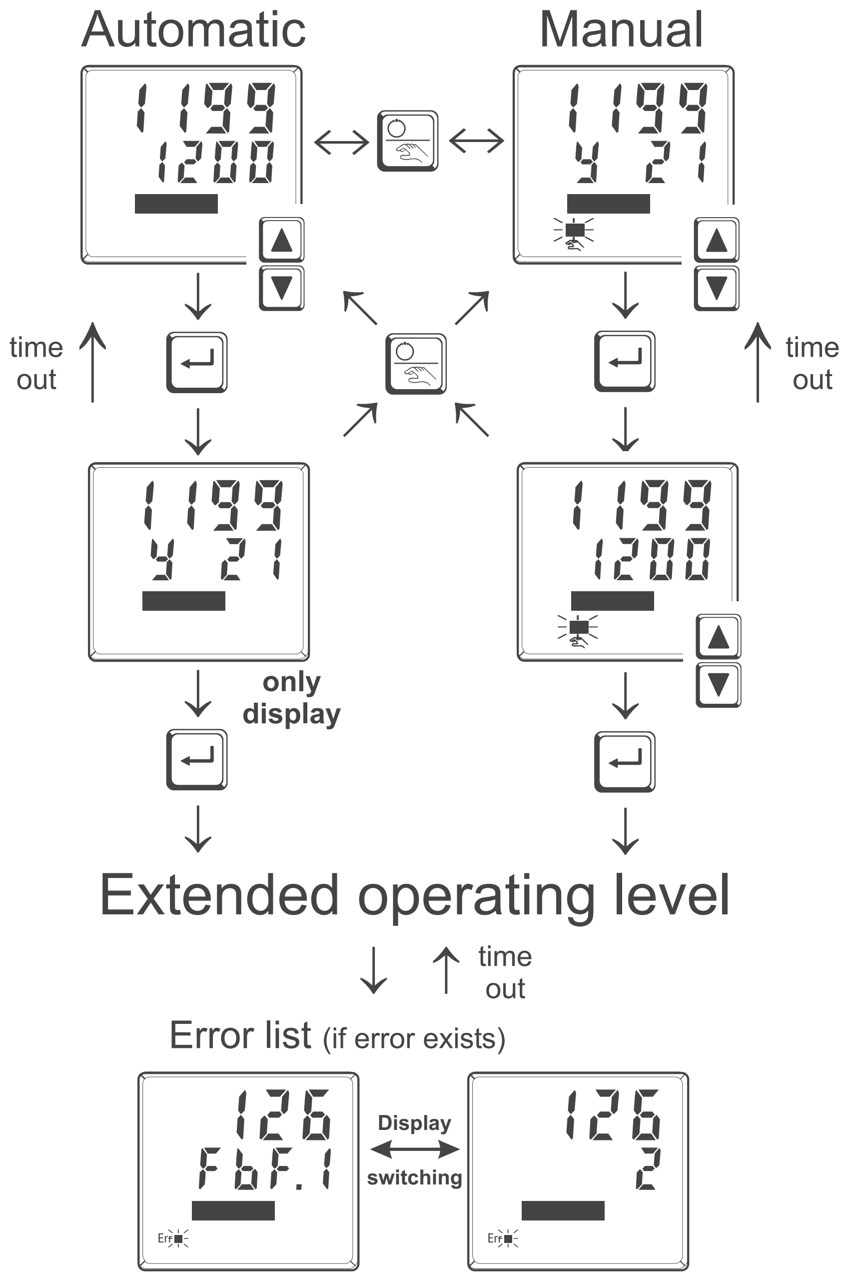
In the upper display line, the process value is always displayed. At parameter, configuration, calibration as well as extended operating level, the bottom display line changes cyclically between parameter name and parameter value.

3.2 *Behaviour after power-on*

After supply voltage switch-on, the unit starts with the **operating level**.
The unit is in the condition which was active before power-off.
If MIR-491 was in manual mode before power-off, the controller starts with correcting value Y2 after switching on again.

3.3 *Operating level*

The content of the extended operating level is determined by means of BlueControl (engineering tool). Parameters which are used frequently or the display of which is important can be copied to the extended operating level.



3.4 *Mainenance manager / Error list*

With one or several errors, the extended operating level always starts with the error list. Signalling an actual entry in the error list (alarm, error) is done by the Err LED in the display. To reach the error list press ↵ twice.

Err LED status	Signification	Proceed as follows
blinks	Alarm due to existing error	- Determine the error type in the error list via the error number - Remove the error
lit	Error removed, Alarm not acknowledged	- Acknowledge the alarm in the error list pressing key ▲ or ▼ - The alarm entry was deleted.
off	No error, all alarm entries deleted	

Error list:

Name	Description	Cause	Possible remedial action
E.1	Internal error, cannot be removed	- E.g. defective EEPROM	- Contact ACS service - Return unit to our factory
E.2	Internal error, can be reset	- e.g. EMC trouble	- Keep measurement and power supply cables in separate runs - Ensure that interference suppression of contactors is provided
E.3	Configuration error, can be reset	- wrong configuration - missing configuration	- Check interaction of configuration / parameters
FbF.1	Sensor break INP1	- Sensor defective - Faulty cabling	- Replace INP1 sensor - Check INP1 connection
Sht.1	Short circuit INP1	- Sensor defective - Faulty cabling	- Replace INP1 sensor - Check INP1 connection
POL.1	INP1polarity error	- Faulty cabling	- Reverse INP1 polarity
FbF.2	Sensor break INP2	- Sensor defective - Faulty cabling	- Replace INP2 sensor - Check INP2 connection
Sht.2	Short circuit INP2	- Sensor defective - Faulty cabling	- Replace sensor INP2 - Check INP2 connection
POL.2	INP2 polarity	- Faulty cabling	- Reverse INP2 polarity
FbF.3	Sensor break INP3	- Sensor defective - Faulty cabling	- Replace INP3 sensor - Check INP3 connection
Sht.3	Short circuit INP3	- Sensor defective - Faulty cabling	- Replace sensor INP3 - Check INP3 connection
POL.3	INP3 polarity	- Faulty cabling	- Reverse INP3 polarity

Name	Description	Cause	Possible remedial action
HCA	Heating current alarm (HCA)	- Heating current circuit interrupted, I< HC.A or I> HC.A (dependent of configuration) - Heater band defective	- Check heating current circuit - If necessary, replace heater band
SSr	Heating current short circuit (SSR)	- Current flow in heating circuit with controller off - SSR defective	- Check heating current circuit - If necessary, replace solid-state relay
LooP	Control loop alarm (LOOP)	- Input signal defective or not connected correctly - Output not connected correctly	- Check heating or cooling circuit - Check sensor and replace it, if necessary - Check controller and switching device
AdA.H	Self-tuning heating alarm (ADAH)	- See Self-tuning heating error status	- see Self-tuning heating error status
AdA.C	Self-tuning heating alarm cooling (ADAC)	- See Self-tuning cooling error status	- see Self-tuning cooling error status
Lim.1	stored limit alarm 1	- adjusted limit value 1 exceeded	- check process
Lim.2	stored limit alarm 2	- adjusted limit value 2 exceeded	- check process
Lim.3	stored limit alarm 3	- adjusted limit value 3 exceeded	- check process
InF.1	time limit value message	- adjusted number of operating hours reached	- application-specific
InF.2	duty cycle message (digital ouputs)	- adjusted number of duty cycles reached	- application-specific

Saved alarms (Err-LED is lit) can be acknowledged and deleted with the digital input di1/2/3, the F-key or the -key.
Configuration, see page 30: ConF / LOGI / Err.r

If an alarm is still valid that means the cause of the alarm is not removed so far (Err-LED blinks), then other saved alarms can not be acknowledged and deleted.

Error status:

Error status	Signification	
2	Existing error	Change to error status 1 after error removal
1	Stored error	Change to error status 0 after acknowledgement in error list
0	No error/message	not visible, except with acknowledgement

Self-tuning heating (AdA.H) and cooling (AdA.C) error status:

Error status	Description	Behaviour
0	No error	
3	Faulty control action	Re-configure controller (inverse ↔ direct)
4	No response of process variable	The control loop is perhaps not closed: check sensor, connections and process
5	Low reversal point	Increase (AdA.H) max. output limiting Y.Hi or decrease (AdA.C) min. output limiting Y.Lo
6	Danger of exceeded set-point (parameter determined)	If necessary, increase (inverse) or reduce (direct) set-point
7	Output step change too small (dy > 5%)	Increase (AdA.H) max. output limiting Y.Hi or reduce (AdA.C) min. output limiting Y.Lo
8	Set-point reserve too small	Increase set-point (invers), reduce set-point (direct) or increase set-point range (→ PArA / SEtP / SP.LO and SP.Hi)
9	Impulse tuning failed	The control loop is perhaps not closed: check sensor, connections and process

DAC function (dAC) error status:

Error status	Description	Behaviour
0	No error	
3	Output is blocked	Check the drive for blockage
4	Wrong method of operation	Wrong phasing, defect motor capacitor
5	Fail at Yp measurement	Check the connection to the Yp input
6	Calibration error	Manual calibration necessary

3.5 *Self-tuning*

After starting by the operator, the controller makes a self-tuning attempt. The controller uses the process characteristics for quick line-out to the set-point without overshoot.

ⓘ Self-tuning start can be locked via BlueControl (engineering tool) (P.Loc).

ⓘ ti and td are taken into account only, if they were ≠ OFF previously.

3.5.1 Selecting the method (ConF/Cntr/tunE)

tunE = 0 — ***Step attempt during start-up (if X SP - 60 K):***
The controller outputs 0% or Y.Lo and waits, until the process is at rest. This is followed by:
2-point controller: step attempt for heating loop. Then, the determined parameters are used for line-out to the set-point.
3-point controller: as *2-point controller*. Now, the heating output is frozen and a cooling pulse (100%) for the cooling loop is output.
After determination of cooling parameters, control is continued using the heating and cooling parameters.

tunE = 1 — ***Pulse attempt during start-up (if X SP - 60 K):***
Controller outputs 0% or Y.Lo and waits, until the process is at rest. This is followed by:
2-point controller: pulse attempt (100%) for heating loop. followed by line-out to the set-point using the determined parameters.
3-point controller: as *2-point controller*. The heating output is frozen and a cooling pulse (100%) for the cooling loop is output.
After determination of cooling parameters, control is continued using the heating and cooling parameters.

tunE = 2 — ***Always step attempt during start-up:*** see tunE = 0

ⓘ With 3-point stepping controller configured, only the step attempt after start-up is available for self-tuning (tunE = 0).

3.5.2 Self-tuning start

Strt = 0 — Only manual start by pressing keys ↵ and ▲ simultaneously or via interface is possible.

Strt = 1 — Manual start by press keys ↵ and ▲ simultaneously via interface and automatic start after power-on and detection of process oscillations.

ⓘ If the process value is higher than the set-point minus 60 K (X ≥ SP - 60 K) and self-tuning is started manually, the control to the set-point is using the old parameters followed by an *optimization at the set-point*.

If the process value is smaller than the set-point minus 60 K (X ≤ SP - 60 K), self-tuning after start-up is done automatically by the controller (tunE = 0 / 1).

If the controller detects process oscillations of more than ± 2,5K with Strt = 1 configured, the control parameters are preset for calming the process followed by *optimization at the set-point.*

Ada LED status	Signification
blinks	Waiting, until process calms down
lit	Self-tuning is running
off	Self-tuning not activ or ended

3.5.3 Optimization at the set-point

With the difference between process value and set-point smaller than 60 K and self-tuning started manually, optimization at the set-point is used.
For this, control to the set-point is using the control parameters.
When the process value has reached the set-point, a pulse attempt with reduced correcting variable (for process protection, max. 20%) is made with the active loop (Y >0 heating pulse, Y <0 cooling pulse). I.e. by optimization at the set-point, the optimum control parameters either for the heating or the cooling loop are determined.
The correcting variable pulse can be output by the controller in positive or negative direction. If possible, the controller outputs a pulse in negative direction (process protection against temperature increase).

In which case does the controller use the optimization at the set-point?

- Process ≥ set-point - 60K with manual self-tuning start
- after step attempt failure after start-up or power-on
- with active gradient (PArA/SEtP/r.SP ≠ OFF) and manual self-tuning start or self-tuning start after power on
- with active start-up circuit (ConF /Cntr /SP.Fn = 10) and manual self-tuning start or self-tuning start after power-on

3.5.4 Self-tuning cancellation

By the operator:
Self-tuning can always be cancelled by the operator. For this, press [↵] and [▲] key simultaneously. With manual-automatic switch-over configured via [H] key, self-tuning can also be canceled by actuating [H] key. The controller continues operating with the old parameters in automatic mode in the first case and in manual mode in the second case.

By the controller:
If the Err LED starts blinking whilst self-tuning is running, successful self-tuning is prevented due to the control conditions. In this case, self-tuning was cancelled by the controller. The controller continues operating with the old parameters in automatic mode. In manual mode it continues with the old controller output value.

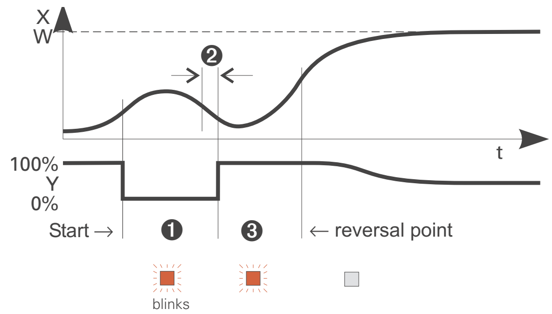
3.5.5 Acknowledgement procedures in case of unsuccessful self-tuning

1. Press keys [↵] *and* [▲] simultaneously:
   The controller continues controlling using the old parameters in automatic mode. The Err LED continues blinking, until the self-tuning error was acknowledged in the error list.
2. *Press key* [H] *(if configured):*
   The controller goes to manual mode. The Err LED continues blinking, until the self-tuning error was acknowleged in the error list.
3. *Press key* [↵] *:*
   Display of error list at extended operating level. After acknowledgement of the error message, the controller continues control in automatic mode using the old parameters.

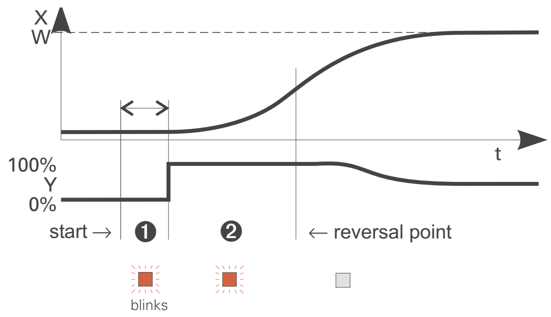
Cancellation causes:
→ page 14: "Error status self-tuning heating (AdA.H) and cooling (AdA.C)"

3.5.6 Examples for self-tuning attempts (controller inverse, heating or heating/cooling)

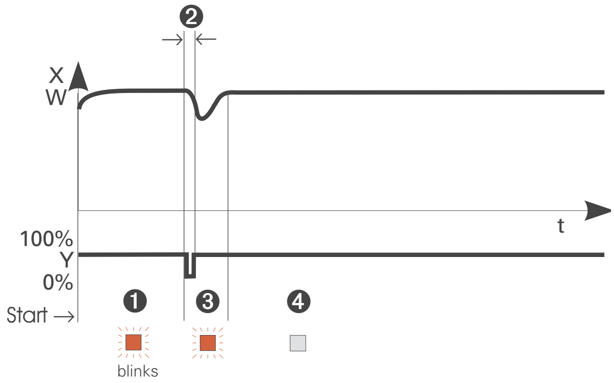
Start: heating power switched on
Heating power Y is switched off (❶). When the change of process value X was constant during one minute (❷), the power is switched on (❸). At the reversal point, the self-tuning attempt is finished and the new parameter are used for controlling to set-point W.



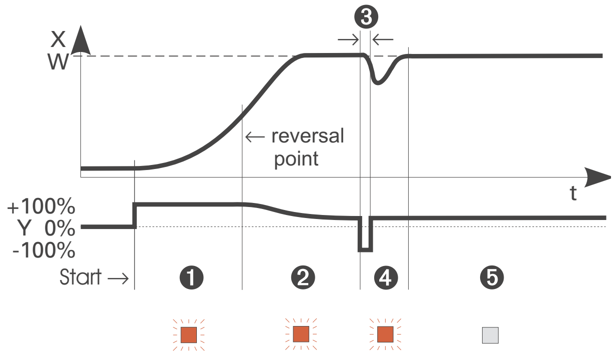
Start: heating power switched off
The controller waits 1,5 minutes (❶). Heating power Y is switched on (❷). At the reversal point, the self-tuning attempt is finished and control to the set-point is using the new parameters.



Self-tuning at the set-point ⚠
The process is controlled to the set-point. With the control deviation constant during a defined time (❶), i.e. with the process value equal to the set-point, the controller outputs a reduced correcting variable pulse (max. 20%) (❷). After determination of the control parameters using the process characteristic (❸), control is started using the new parameters (❹).



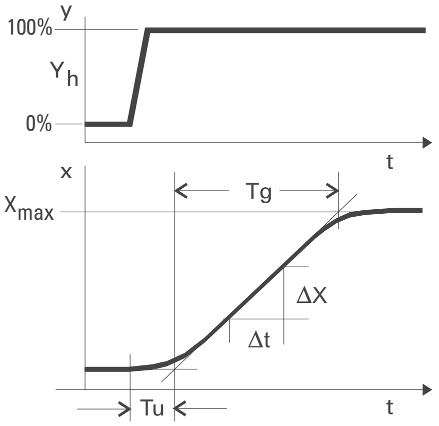
Three-point controller ⚠
The parameter for heating and cooling are determined in two attempts. The heating power is switched on (❶). Heating parameters Pb1, ti1, td1 and t1 are determined at the reversal point. The process is controlled to the set-point (❷). With constant control deviation, the controller provides a cooling correcting variable pulse (❸). After determining its cooling parameters Pb2, ti2, td2 and t2 (❹) from the process characteristics , control operation is started using the new parameters (❺).



⚠ During phase ❸, heating and cooling are done simultaneously!

3.6 *Manual self-tuning*

The optimization aid should be used with units on which the control parameters shall be set without self-tuning.
For this, the response of process variable x after a step change of correcting variable y can be used. Frequently, plotting the complete response curve (0 to 100%) is not possible, because the process must be kept within defined limits.
Values T_g and x_{max} (step change from 0 to 100 %) or Δt and Δx (partial step response) can be used to determine the maximum rate of increase v_{max}.



y = correcting variable
Y_h = control range
Tu = delay time (s)
Tg = recovery time (s)
X_{max} = maximum process value

$$V_{max} = \frac{Xmax}{Tg} = \frac{\Delta x}{\Delta t} \triangleq$$ max. rate of increase of process value

The control parameters can be determined from the values calculated for delay time T_u , maximum rate of increase v_{max}, control range X_h and characteristic K according to the **formulas** given below. Increase Xp, if line-out to the set-point oscillates.

Parameter adjustment effects

Parameter		Control	Line-out of disturbances	Start-up behaviour
Pb1	higher	increased damping	slower line-out	slower reduction of duty cycle
	lower	reduced damping	faster line-out	faster reduction of duty cycle
td1	higher	reduced damping	faster response to disturbances	faster reduction of duty cycle
	lower	increased damping	slower response to disturbances	slower reduction of duty cycle
ti1	higher	increased damping	slower line-out	slower reduction of duty cycle
	lower	reduced damping	faster line-out	faster reduction of duty cycle

K = Vmax * Tu

With 2-point and 3-point controllers, the cycle time must be adjusted to t1 / t2 ≤ 0,25 * Tu

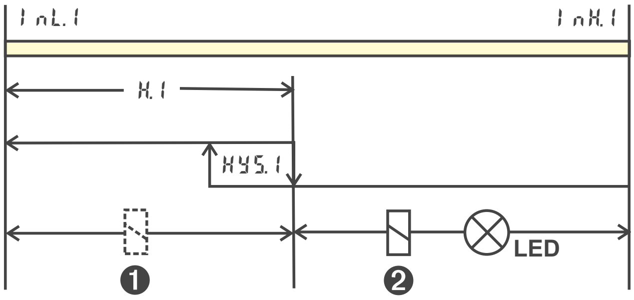
Formulas

controller behavior	Pb1 [phy. units]	td1 [s]	ti1 [s]
PID	1,7 * K	2 * Tu	2 * Tu
PD	0,5 * K	Tu	OFF
PI	2,6 * K	OFF	6 * Tu
P	K	OFF	OFF
3-point-stepping	1,7 * K	Tu	2 * Tu

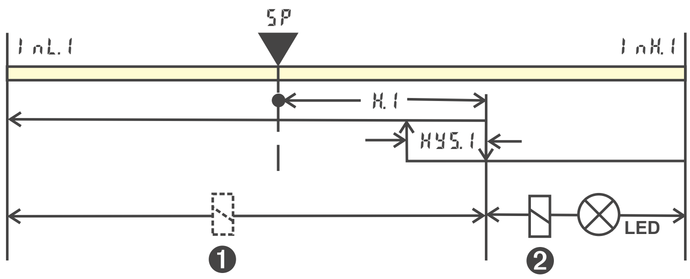
3.7 *Alarm handling*

Max. three alarms can be configured and assigned to the individual outputs. Generally, outputs Out.1... Out.6 can be used each for alarm signalling. If more than one signal is linked to one output the signals are OR linked. Each of the 3 limit values Lim.1 … Lim.3 has 2 trigger points H.x (Max) and L.x (Min), which can be switched off individually (parameter = “OFF”). Switching difference HYS.x of each limit value is adjustable.

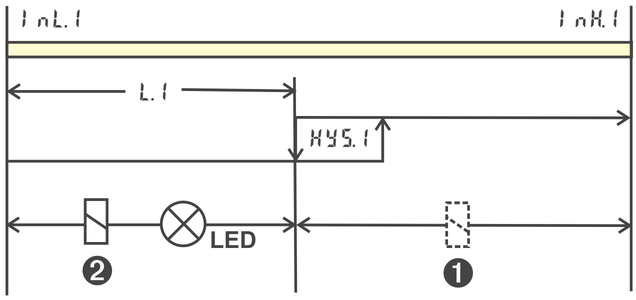
① *Operaing principle* Src.x = 0, 6, 7
L.1 = OFF



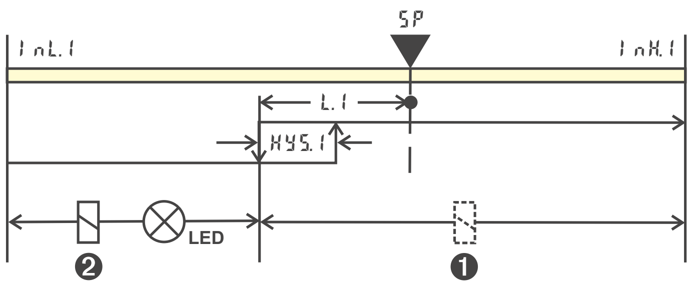
② *Operating principle* Src.x = 1, 2
L.1 = OFF

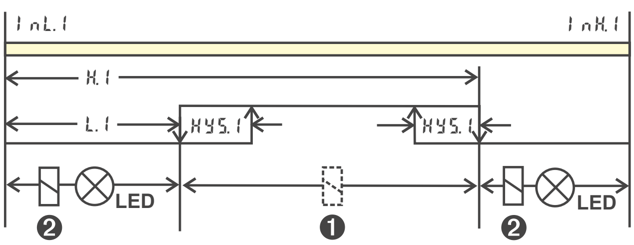


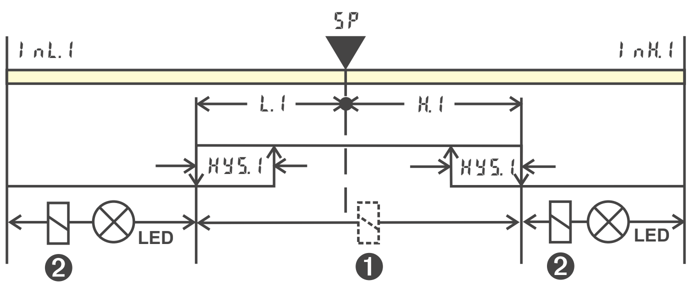
H.1 = OFF



H.1 = OFF







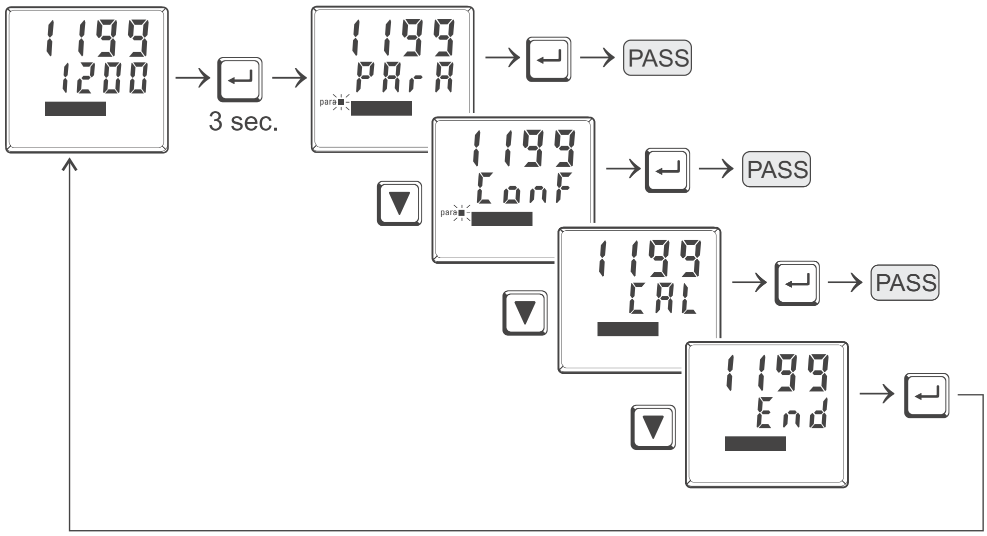
❶: normally closed (ConF / Out.x / O.Act = 1)
❷: normally open (ConF / Out.x / O.Act = 0)

The variable to be monitored can be selected seperately for each alarm via configuration
The following variables can be monitored:
- process value
- control deviation xw (process value - set-point)
- control deviation xw + suppression after start-up or set-point change
- effective set-point Weff
- correcting variable y (controller output)

If measured value monitoring + alarm status storage is chosen (ConF / Lim / Fnc.x = 2), the alarm relay remains switched on until the alarm is resetted in the error list (Lim 1..3 = 1).

3.8 *Operating structure*

After supply voltage switch-on, the controller starts with the **operating levels**. The controller status is as before power off.



PArA - level: At PArA - level, the right decimal point of the bottom display line is *lit continuously*.

ConF - level: At ConF - level, the right decimal point of bottom display line *blinks*
.

PASS When safety switch **Loc** is open, only the levels enabled by means of BlueControl (engineering tool) are visible and accessible by entry of the password adjusted by means of BlueControl (engineering tool). Individual parameters accessible without password must be copied to the extended operating level.

Factory setting: Safety switch **Loc** closed: all levels accessible without restriction, password PASS = OFF .

4 Configuration level

4.1 *Configuration survey*

ConF	Configuration level																
Cntr	Control and self-tuning																
SP.Fn	C.tYP	C.Fnc	mAn	C.Act	FAIL	rnG.L	rnG.H	CYCL	tunE	Strt							
InP.1	Input 1																
StYP	S.Lin	Corr															
InP.2	Input 2																
I.Fnc	S.tYP	Corr	In.F														
InP.3	Input 3																
I.Fnc	S.Lin	S.Typ	Corr	In.F													
Lim	Limit value functions																
Fnc.1	Src.1	Fnc.2	Src.2	Fnc.3	Src.3	HC.AL	LP.AL	dAc.A									
OUt.1	Output 1																
O.Act	Y.1	Y.2	Lim.1	Lim.2	Lim.3	dAc.A	LP.AL	HC.AL	HC.SC	P.End	FAi.1	FAi.2	FAi.3				
OUt.2	Output 2	see output 1															
OUt.3	Output 3																
O.tYP	O.Act	Y.1	Y.2	Lim.1	Lim.2	Lim.3	dAc.A	LP.AL	HC.AC	HC.SC	P.End	FAi.1	FAi.2	FAi.3	Out.0	Out.1	O.Src
OUt.4	Output 4																
O.tYP	O.Act	Y.1	Y.2	Lim.1	Lim.2	Lim.3	dAc.A	LP.AL	HC.AC	HC.SC	P.End	FAi.1	FAi.2	FAi.3	Out.0	Out.1	O.Src
Out.5	Output 5	see output 1															
Out.6	Output 6	see output 1															
LOGI	Digital inputs																
L-r	SP.2	SP.E	Y.2	Y.E	mAn	C.oFF	m.Loc	Err.r	Pid.2	I.ChG	di.Fn						
othr	Display, operation, interface																
bAud	Addr	PrtY	dELY	Unit	dP	LEd	dISP	C.dEL									

Adjustment:

- The configuration can be adjusted by means of keys ▲▼ .
- Transition to the next configuration is by pressing key ↵ .
- After the last configuration of a group, donE is displayed and followed by automatic change to the next group

Return to the beginning of a group is by pressing the ↵ key for 3 sec.

4.2 *Configuration parameters*

CntR

Name	Value range	Description	Default
SP.Fn		**Basic configuration of setpoint processing**	0
	0	set-point controller can be switched over to external set-point (-> LOGI / SP.E)	
	8	standard controller with external offset (SP.E)	
C.tYP		**Calculation of the process value**	0
	0	standard controller (process value = InP.1)	
	1	ratio controller (InP.1/X2)	
	2	difference (InP.1 - X2)	
	3	Maximum value of InP.1and X2. It is controlled with the bigger value. At sensor failure it is controlled with the remaining actual value.	
	4	Minimum value of InP.1and X2. It is controlled with the smaller value. At sensor failure it is controlled with the remaining actual value.	
	5	Mean value (InP.1, X2). With sensor error, controlling is continued with the remaining process value.	
	6	Switching between InP.1 and X2 (-> LOGI / I.ChG)	
C.Fnc		**Control behaviour (algorithm)**	1
	0	on/off controller or signaller with one output	
	1	PID controller (2-point and continuous)	
	2	Δ / Y / Off, or 2-point controller with partial/full load switch-over	
	3	2 x PID (3-point and continuous)	
	4	3-point stepping controller	
	5	3-point stepping controller with position feedback Yp	
	6	continuous controller with integrated positioner	
mAn		**Manual operation permitted**	0
	0	no	
	1	yes (→ LOGI / mAn)	
C.Act		**Method of controller operation**	0
	0	inverse, e.g. heating	
	1	direct, e.g. cooling	
FAIL		**Behaviour at sensor break**	1
	0	controller outputs switched off	
	1	y = Y2	
	2	y = mean output. The maximum permissible output can be adjusted with parameter Ym.H . To prevent determination of inadmissible values, mean value formation is only if the control deviation is lower than parameter L.Ym .	

Name	Value range	Description	Default
rnG.L	-1999...9999	**X0 (low limit range of control)** ❶	0
rnG.H	-1999...9999	**X100 (high limit range of control)** ❶	900
CYCL		**Characteristic for 2-point- and 3-point-controllers**	0
	0	standard	
	1	water cooling linear	
	2	water cooling non-linear	
	3	with constant cycle	
tunE		**Auto-tuning at start-up**	0
	0	At start-up with step attempt, at set-point with impulse attempt	
	1	At start-up and at set-point with impulse attempt. Setting for fast controlled systems (e.g. hot runner control)	
	2	Always step attempt at start-up	
Strt		**Start of auto-tuning**	0
	0	Manual start of auto-tuning	
	1	Manual or automatic start of auto-tuning at power on or when oscillating is detected	
AdtO		**Optimization of T1, T2** (only visible with BlueControl!)	0
	0	Automatic optimization	
	1	No optimization	

❶ rnG.L and rnG.H are indicating the range of control on which e.g. the self-tuning is refering

InP.1

Name	Value range	Description	Default
S.tYP		**Sensor type selection**	1
	0	thermocouple type L (-100...900°C) , Fe-CuNi DIN	
	1	thermocouple type J (-100...1200°C) , Fe-CuNi	
	2	thermocouple type K (-100...1350°C), NiCr-Ni	
	3	thermocouple type N (-100...1300°C), Nicrosil-Nisil	
	4	thermocouple type S (0...1760°C), PtRh-Pt10%	
	5	thermocouple type R (0...1760°C), PtRh-Pt13%	
	6	thermocouple type T (-200...400°C), Cu-CuNi	
	7	thermocouple type C (0...2315°C), W5%Re-W26%Re	
	8	thermocouple type D (0...2315°C), W3%Re-W25%Re	
	9	thermocouple type E (-100...1000°C), NiCr-CuNi	
	10	thermocouple type B (0/100...1820°C), PtRh-Pt6%	
	18	special thermocouple	
	20	Pt100 (-200.0 ... 100,0 °C)	
	21	Pt100 (-200.0 ... 850,0 °C)	
	22	Pt1000 (-200.0 ... 200.0 °C)	

Name	Value range	Description	Default
	23	KTY 11-6 (special 0...4500 Ohm)	
	24	special 0...450 Ohm	
	30	0...20mA / 4...20mA ❶	
	40	0...10V / 2...10V ❶	
	41	special 0...100 mV ❶	
	50	potentiometer 0...160 Ohm	
	51	potentiometer 0...450 Ohm	
	52	potentiometer 0...1600 Ohm	
	53	potentiometer 0...4500 Ohm	
S.Lin		**Linearization (only at S.tYP = 23 (KTY 11-6), 24 (0...450 W), 30 (0..20mA), 40 (0..10V) and 41 (0...100mV))**	0
	0	none	
	1	Linearization to specification. Creation of linearization table with BlueControl (engineering tool) possible. The characteristic for KTY 11-6 temperature sensors is preset.	
Corr		**Measured value correction / scaling**	0
	0	Without scaling	
	1	Offset correction (at CAL level)	
	2	2-point correction (at CAL level)	
	3	Scaling (at PArA level)	
FAI1		**Forcing INP1** (only visible with BlueControl!)	0
	0	No forcing	
	1	Forcing via serial interface	

InP.2

Name	Value range	Description	Default
I.Fnc		**Function selection of INP2**	1
	0	no function (subsequent input data are skipped)	
	1	heating current input	
	2	external set-point (SP.E)	
	3	Yp input	
	4	Second process value X2	
	5	Y.E input	
	6	no controller input (e.g. transmitter input instead)	
S.tYP		**Sensor type selection**	30
	30	0...20mA / 4...20mA ❶	
	31	0...50mA AC ❶	
	50	Potentiometer (0...160 Ohm)	

❶ with current and voltage input signals, scaling is required (see chapter 5.3)

Name	Value range	Description	Default
	51	Potentiometer (0...450 Ohm)	
	52	Potentiometer (0...1600 Ohm)	
	53	Potentiometer (0...4500 Ohm)	
Corr		**Measured value correction / scaling**	0
	0	Without scaling	
	1	Offset correction (at CAL level)	
	2	2-point correction (at CAL level)	
	3	Scaling (at PArA level)	
I nF	-1999...9999	**Alternative value for error at INP2**	OFF
FAI 2		**Forcing INP2** (only visible with BlueControl!)	0
	0	No forcing	
	1	Forcing via serial interface	

InP.3

Name	Value range	Description	Default
I.Fnc		**Function selection of INP3**	1
	0	no function (subsequent input data are skipped)	
	1	heating current input	
	2	external set-point (SP.E)	
	3	Yp input	
	4	Second process value X2	
	5	Y.E input	
	6	no controller input (e.g. transmitter input instead)	
S.Lin		**Linearization (only at S.tYP = 30 (0..20mA) and 40 (0..10V) adjustable)**	0
	0	none	
	1	Linearization (only at S.tYP = 30 (0..20mA) and 40 (0..10V) adjustable) to specification. Creation of linearization table with BlueControl (engineering tool) possible. The characteristic for KTY 11-6 temperature sensors is preset.	
S.tYP		**Sensor type selection**	30
	0	thermocouple type L (-100...900°C) , Fe-CuNi DIN	
	1	thermocouple type J (-100...1200°C) , Fe-CuNi	
	2	thermocouple type K (-100...1350°C), NiCr-Ni	
	3	thermocouple type N (-100...1300°C), Nicrosil-Nisil	
	4	thermocouple type S (0...1760°C), PtRh-Pt10%	
	5	thermocouple type R (0...1760°C), PtRh-Pt13%	
	6	thermocouple type T (-200...400°C), Cu-CuNi	
	7	thermocouple type C (0...2315°C), W5%Re-W26%Re	
	8	thermocouple type D (0...2315°C), W3%Re-W25%Re	

Name	Value range	Description	Default
	9	thermocouple type E (-100...1000°C), NiCr-CuNi	
	10	thermocouple type B (0/100...1820°C), PtRh-Pt6%	
	18	special thermocouple	
	20	Pt100 (-200.0 ... 100,0 °C)	
	21	Pt100 (-200.0 ... 850,0 °C)	
	22	Pt1000 (-200.0 ... 200.0 °C)	
	23	KTY 11-6 (special 0...4500 Ohm)	
	24	special 0...450 Ohm	
	30	0...20mA / 4...20mA ❶	
	41	special 0...100 mV ❶	
	50	potentiometer 0...160 Ohm	
	51	potentiometer 0...450 Ohm	
	52	potentiometer 0...1600 Ohm	
	53	potentiometer 0...4500 Ohm	
Corr		**Measured value correction / scaling**	0
	0	Without scaling	
	1	Offset correction (at CAL level)	
	2	2-point correction (at CAL level)	
	3	Scaling (at PArA level)	
	4	Automatic calibration (DAC)	
I n.F	-1999...9999	**Alternative value for error at INP3**	OFF
FAI 3		**Forcing INP3** (only visible with BlueControl!)	0
	0	No forcing	
	1	Forcing via serial interface	

LiM

Name	Value range	Description	Default
Fnc.1		**Function of limit 1**	1
	0	switched off	
	1	measured value monitoring	
	2	Measured value monitoring + alarm status storage. A stored limit value can be reset via error list, [F]-key, [key]-key or a digital input (-> LOGI / Err.r)	
Src.1		**Source of imit 1**	1
	0	process value	
	1	control deviation xw (process value - set-point)	
	2	control deviation xw (with suppression after start-up and set-point change)	
	3	measured value INP1	

❶ with current and voltage input signals, scaling is required (see chapter 5.3)

Name	Value range	Description	Default
	4	measured value INP2	
	5	measured value INP3	
	6	effective setpoint Weff	
	7	correcting variable y (controller output)	
	8	control variable deviation xw (actual value - internal setpoint) = deviation alarm to internal setpoint	
	9	difference x1 - x2	
Fnc.2		**Function of limit 2**	0
	0	switched off	
	1	measured value monitoring	
	2	Measured value monitoring + alarm status storage. A stored limit value can be reset via error list, F-key, -key or a digital input (-> LOGI / Err.r)	
Src.2		**Source of limit 2**	0
	0	process value	
	1	control deviation xw (process value - set-point)	
	2	control deviation xw (with suppression after start-up and set-point change)	
	3	measured value INP1	
	4	measured value INP2	
	5	measured value INP3	
	6	effective setpoint Weff	
	7	correcting variable y (controller output)	
	8	control variable deviation xw (actual value - internal setpoint) = deviation alarm to internal setpoint	
	9	difference x1 - x2	
Fnc.3		**Function of limit 3**	0
	0	switched off	
	1	measured value monitoring	
	2	Measured value monitoring + alarm status storage. A stored limit value can be reset via error list, F-key, -key or a digital input (-> LOGI / Err.r)	

Name	Value range	Description	Default
Src.3		**Source of limit 3**	0
	0	process value	
	1	control deviation xw (process value - set-point)	
	2	control deviation xw (with suppression after start-up and set-point change)	
	3	measured value INP1	
	4	measured value INP2	
	5	measured value INP3	
	6	effective setpoint Weff	
	7	correcting variable y (controller output)	
	8	control variable deviation xw (actual value - internal setpoint) = deviation alarm to internal setpoint	
	9	difference x1 - x2	
HC.AL		**Alarm heat current function (INP2)**	0
	0	switched off	
	1	Overload short circuit monitoring	
	2	Break and short circuit monitoring	
LP.AL		**Monitoring of control loop interruption for heating**	0
	0	switched off / inactive	
	1	active. If ti1=0 LOOP alarm is inactive!	
dAc.A		**DAC alarm function**	0
	0	DAC alarm switched off / inactive	
	1	DAC alarm active	
Hour	OFF...10000	**Operating hours** (only visible with BlueControl!)	OFF
Swit	OFF...10000	**Output switching cycles** (only visible with BlueControl!)	OFF

Out.1

Name	Value range	Description	Default
O.Act		**Method of operation of output OUT1**	0
	0	direct / normally open	
	1	inverse / normally closed	
Y.1		**Controller output Y1**	1
	0	not active	
	1	active	
Y.2		**Controller output Y2**	0
	0	not active	
	1	active	

Name	Value range	Description	Default
Lim.1		**Limit 1 signal**	0
	0	not active	
	1	active	
Lim.2		**Limit 2 signal**	0
	0	not active	
	1	active	
Lim.3		**Limit 3 signal**	0
	0	not active	
	1	active	
dAc.A		**Valve monitoring (DAC)**	0
	0	not active	
	1	active	
LP.AL		**Interruption alarm signal (LOOP)**	0
	0	not active	
	1	active	
HC.AL		**Heat current alarm signal**	0
	0	not active	
	1	active	
HC.SC		**Solid state relay (SSR) short circuit signal**	0
	0	not active	
	1	active	
FAi.1		**INP1 error signal**	0
	0	not active	
	1	active	
FAi.2		**INP2 error signal**	0
	0	not active	
	1	active	
FAi.3		**INP3 error signal**	0
	0	not active	
	1	aktiv	
FOut		**Forcing OUT1** (only visible with BlueControl!)	0
	0	No forcing	
	1	Forcing via serial interface	

Out.2

Configuration parameters Out.2 as Out.1 except for: Default Y.1 = 0 Y.2 = 1

Out.3

Name	Value range	Description	Default
O.tYP		**Signal type selection OUT3**	0
	0	relay / logic (only visible with current/logic voltage)	
	1	0 ... 20 mA continuous (only visible with current/logic/voltage)	
	2	4 ... 20 mA continuous (only visible with current/logic/voltage)	
	3	0...10 V continuous (only visible with current/logic/voltage)	
	4	2...10 V continuous (only visible with current/logic/voltage)	
	5	transmitter supply (only visible without OPTION)	
O.Act		**Method of operation of output OUT3 (only visible when O.TYP=0)**	1
	0	direct / normally open	
	1	inverse / normally closed	
Y.1		**Controller output Y1 (only visible when O.TYP=0)**	0
	0	not active	
	1	active	
Y.2		**Controller output Y2 (only visible when O.TYP=0)**	0
	0	not active	
	1	active	
Lim.1		**Limit 1 signal (only visible when O.TYP=0)**	1
	0	not active	
	1	active	
Lim.2		**Limit 2 signal (only visible when O.TYP=0)**	0
	0	not active	
	1	active	
Lim.3		**Limit 3 signal (only visible when O.TYP=0)**	0
	0	not active	
	1	active	
dAc.A		**Valve monitoring (DAC) (only visible when O.TYP=0)**	0
	0	not active	
	1	active	
LP.AL		**Interruption alarm signal (LOOP) (only visible when O.TYP=0)**	0
	0	not active	
	1	active	
HC.AL		**Heating current alarm signal (only visible when O.TYP=0)**	0
	0	not active	
	1	active	

Name	Value range	Description	Default
HC.SC		**Solid state relay (SSR) short circuit signal (only visible when O.TYP=0)**	0
	0	not active	
	1	active	
FA i.1		**INP1 error (only visible when O.TYP=0)**	1
	0	not active	
	1	active	
FA i.2		**INP2 error (only visible when O.TYP=0)**	0
	0	not active	
	1	active	
FA i.3		**INP3 error (only visible when O.TYP=0)**	0
	0	not active	
	1	aktiv	
Out.0	-1999...9999	**Scaling of the analog output for 0% (0/4mA or 0/2V, only visible when O.TYP=1..5)**	0
Out.1	-1999...9999	**Scaling of the analog output for 100% (20mA or 10V, only visible when O.TYP=1..5)**	100
O.Src		**Signal source of the analog output OUT3 (only visible when O.TYP=1..5)**	1
	0	not used	
	1	controller output y1 (continuous)	
	2	controller output y2 (continuous)	
	3	process value	
	4	effective set-point Weff	
	5	control deviation xw (process value - set-point)	
	6	measured value position feedback Yp	
FOut		**Forcing OUT3** (only visible with BlueControl!)	0
	0	No forcing	
	1	Forcing via serial interface	

Out.4

Name	Value range	Description	Default
O.tYP		**Signal type selection OUT4**	0
	0	relay / logic (only visible with current/logic voltage)	
	1	0 ... 20 mA continuous (only visible with current/logic/voltage)	
	2	4 ... 20 mA continuous (only visible with current/logic/voltage)	
	3	0...10 V continuous (only visible with current/logic/voltage)	
	4	2...10 V continuous (only visible with current/logic/voltage)	
	5	transmitter supply (only visible without OPTION)	

Name	Value range	Description	Default
O.Act		**Method of operation of output OUT4 (only visible when O.TYP=0)**	0
	0	direct / normally open	
	1	inverse / normally closed	
Y.1		**Controller output Y1 (only visible when O.TYP=0)**	0
	0	not active	
	1	active	
Y.2		**Controller output Y2 (only visible when O.TYP=0)**	0
	0	not active	
	1	active	
Lim.1		**Limit 1 signal (only visible when O.TYP=0)**	0
	0	not active	
	1	active	
Lim.2		**Limit 2 signal (only visible when O.TYP=0)**	0
	0	not active	
	1	active	
Lim.3		**Limit 3 signal (only visible when O.TYP=0)**	0
	0	not active	
	1	active	
dAc.A		**Valve monitoring (DAC) (only visible when O.TYP=0)**	0
	0	not active	
	1	active	
LP.AL		**Interruption alarm signal (LOOP) (only visible when O.TYP=0)**	0
	0	not active	
	1	active	
HC.AL		**Heat current alarm signal (only visible when O.TYP=0)**	0
	0	not active	
	1	active	
HC.SC		**Solid state relay (SSR) short circuit signal (only visible when O.TYP=0)**	0
	0	not active	
	1	active	
FAi.1		**INP1 error (only visible when O.TYP=0)**	0
	0	not active	
	1	active	
FAi.2		**INP2 error (only visible when O.TYP=0)**	0
	0	not active	
	1	active	

Name	Value range	Description	Default
FAi.3		**INP3 error (only visible when O.TYP=0)**	0
	0	not active	
	1	aktiv	
Out.0	-1999...9999	**Scaling of the analog output for 0% (0/4mA or 0/2V, only visible when O.TYP=1..5)**	0
Out.1	-1999...9999	**Scaling of the analog output for 100% (20mA or 10V, only visible when O.TYP=1..5)**	100
O.Src		**Signal source of the analog output OUT4 (only visible when O.TYP=1..5)**	0
	0	not used	
	1	controller output y1 (continuous)	
	2	controller output y2 (continuous)	
	3	process value	
	4	effective set-point Weff	
	5	control deviation xw (process value - set-point)	
	6	measured value position feedback Yp	
FOut		**Forcing OUT1** (only visible with BlueControl!)	0
	0	No forcing	
	1	Forcing via serial interface	

Out.5

Configuration parameters Out.2 as Out.1 except for: Default Y.1 = 0 Y.2 = 0

Out.6

Configuration parameters Out.2 as Out.1 except for: Default Y.1 = 0 Y.2 = 0

Method of operation and usage of output Out.1 to Out.6:
Is more than one signal chosen active as source, those signals are OR-linked.

LOGI

Name	Value range	Description	Default
L_r		**Local / Remote switching (Remote: adjusting of all values by front keys is blocked)**	0
	0	no function (switch-over via interface is possible)	
	1	always active	
	2	DI1 switches	
	3	DI2 switches (only visible with OPTION)	
	4	DI3 switches (only visible with OPTION)	
	5	[F] - key switches	
SP.2		**Switching to second setpoint SP.2**	0
	0	no function (switch-over via interface is possible)	
	2	DI1 switches	
	3	DI2 switches (only visible with OPTION)	
	4	DI3 switches (only visible with OPTION)	
	5	[F] - key switches	
SP.E		**Switching to external setpoint SP.E**	0
	0	no function (switch-over via interface is possible)	
	1	always active	
	2	DI1 switches	
	3	DI2 switches (only visible with OPTION)	
	4	DI3 switches (only visible with OPTION)	
	5	[F] - key switches	
Y2		**Y/Y2 switching**	0
	0	no function (switch-over via interface is possible)	
	2	DI1 switches	
	3	DI2 switches (only visible with OPTION)	
	4	DI3 switches (only visible with OPTION)	
	5	[F] - key switches	
	6	 - key switches	
Y.E		**Switching to fixed control output Y.E**	0
	0	no function (switch-over via interface is possible)	
	1	always activated (manual station)	
	2	DI1 switches	
	3	DI2 switches (only visible with OPTION)	
	4	DI3 switches (only visible with OPTION)	
	5	[F] - key switches	
	6	 - key switches	

Name	Value range	Description	Default
mAn		**Automatic/manual switching**	0
	0	no function (switch-over via interface is possible)	
	1	always activated (manual station)	
	2	DI1 switches	
	3	DI2 switches (only visible with OPTION)	
	4	DI3 switches (only visible with OPTION)	
	5	F - key switches	
	6	- key switches	
C.oFF		**Switching off the controller**	0
	0	no function (switch-over via interface is possible)	
	2	DI1 switches	
	3	DI2 switches (only visible with OPTION)	
	4	DI3 switches (only visible with OPTION)	
	5	F - key switches	
	6	- key switches	
m.Loc		**Blockage of hand function**	0
	0	no function (switch-over via interface is possible)	
	2	DI1 switches	
	3	DI2 switches (only visible with OPTION)	
	4	DI3 switches (only visible with OPTION)	
	5	F - key switches	
Err.r		**Reset of all error list entries**	0
	0	no function (switch-over via interface is possible)	
	2	DI1 switches	
	3	DI2 switches (only visible with OPTION)	
	4	DI3 switches (only visible with OPTION)	
	5	F - key switches	
	6	- key switches	
Pid.2		**Switching of parameter set (Pb, ti, td)**	0
	0	no function (switch-over via interface is possible)	
	2	DI1 switches	
	3	DI2 switches (only visible with OPTION)	
	4	DI3 switches (only visible with OPTION)	
	5	F - key switches	
I.ChG		**Switching of the actual process value between Inp1 and X2**	0
	0	no function (switch-over via interface is possible)	
	2	DI1 switches	
	3	DI2 switches (only visible with OPTION)	
	4	DI3 switches (only visible with OPTION)	
	5	F - key switches	

Name	Value range	Description	Default
di.Fn		**Function of digital inputs (valid for all inputs)**	0
	0	direct	
	1	inverse	
	2	toggle key function	
Fdi1		**Forcing di1** (only visible with BlueControl!)	0
	0	No forcing	
	1	Forcing via serial interface	
Fdi2		**Forcing di2** (only visible with BlueControl!)	0
	0	No forcing	
	1	Forcing via serial interface	
Fdi3		**Forcing di3** (only visible with BlueControl!)	0
	0	No forcing	
	1	Forcing via serial interface	

othr

Name	Value range	Description	Default
bAud		**Baudrate of the interface (only visible with OPTION)**	2
	0	2400 Baud	
	1	4800 Baud	
	2	9600 Baud	
	3	19200 Baud	
Addr	1...247	**Address on the interace (only visible with OPTION)**	1
PrtY		**Data parity on the interface (only visible with OPTION)**	1
	0	no parity (2 stop bits)	
	1	even parity	
	2	odd parity	
dELY	0...200	**Delay of response signal [ms] (only visible with OPTION)**	0
Unit		**Unit**	1
	0	without unit	
	1	°C	
	2	°F	
dP		**Decimal point (max. number of digits behind the decimal point)**	0
	0	no digit behind the decimal point	
	1	1 digit behind the decimal point	
	2	2 digits behind the decimal point	
	3	3 digits behind the decimal point	

Name	Value range	Description	Default
LEd		**Function allocation of status LEDs 1 / 2 / 3 / 4**	0
	0	OUT1, OUT2, OUT3, OUT4	
	1	Heating, alarm 1, alarm 2, alarm 3	
	2	Heating, cooling, alarm 1, alarm 2	
	3	Cooling, heating, alarm 1, alarm 2	
dISP	0...10	**Brightness of display**	0
C.dEL	0..200	**Modem delay [ms]**	0
FrEq		**Switching 50 Hz / 60 Hz** (only visible with BlueControl!)	0
	0	50 Hz	
	1	60 Hz	
ICoF		**Block controller off** (only visible with BlueControl!)	0
	0	Released	
	1	Blocked	
IAdA		**Block auto tuning** (only visible with BlueControl!)	0
	0	Released	
	1	Blocked	
IExo		**Block extended operating level** (only visible with BlueControl!)	0
	0	Released	
	1	Blocked	
PASS	OFF...9999	**Password** (only visible with BlueControl!)	OFF
IPAr		**Block parameter level** (only visible with BlueControl!)	0
	0	Released	
	1	Blocked	
ICnF		**Block configuration level** (only visible with BlueControl!)	0
	0	Released	
	1	Block	
ICAL		**Block calibration level** (only visible with BlueControl!)	0
	0	Released	
	1	Blocked	
CdIS3		**Display 3 controller operating level** (only visible with BlueControl!)	2
	0	No value / only text	
	1	Display of value	
	2	Output value as bargraph	
	3	Control deviation as bargraph	
	4	Process value as bargraph	

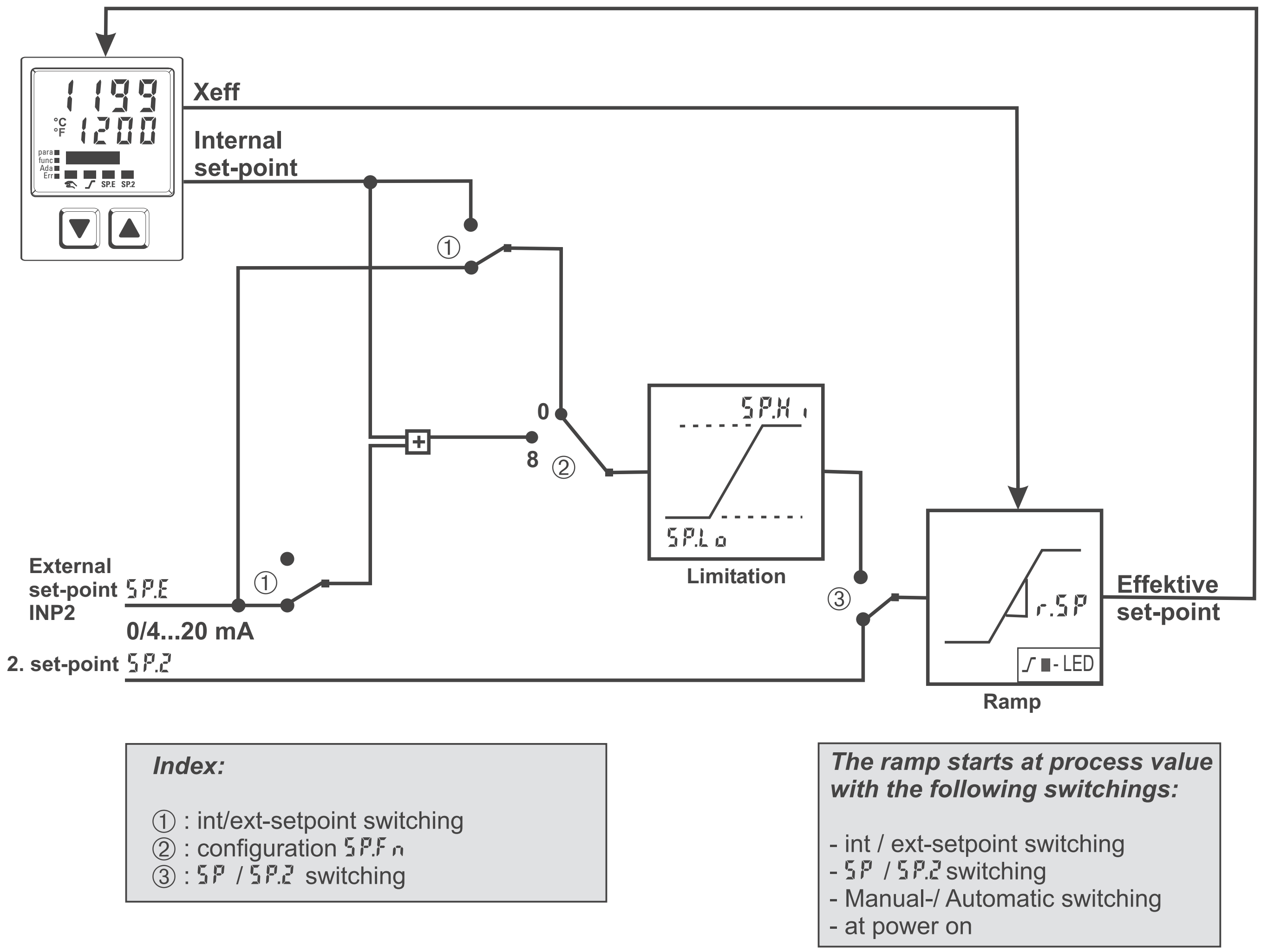
Resetting the controller configuration to factory setting (Default)
→ chapter 11.1 (page 69)

BlueControl - the engineering tool for the controller MIR-491

3 engineering tools with different functionality facilitating MIR-491 configuration and parameter setting are available (see chapter 9: *Accessory equipment with ordering information*).
In addition to configuration and parameter setting, the engineering tools are used for data acquisition and offer long-term storage and print functions. The engineering tools are connected to MIR-491 via the front-panel interface "BluePort" by means of PC (Windows 95 / 98 / NT) and a PC adaptor.
Description BlueControl: see chapter 8: *BlueControl* (page 61).

4.3 *Set-point processing*

The set-point processing structure is shown in the following picture:

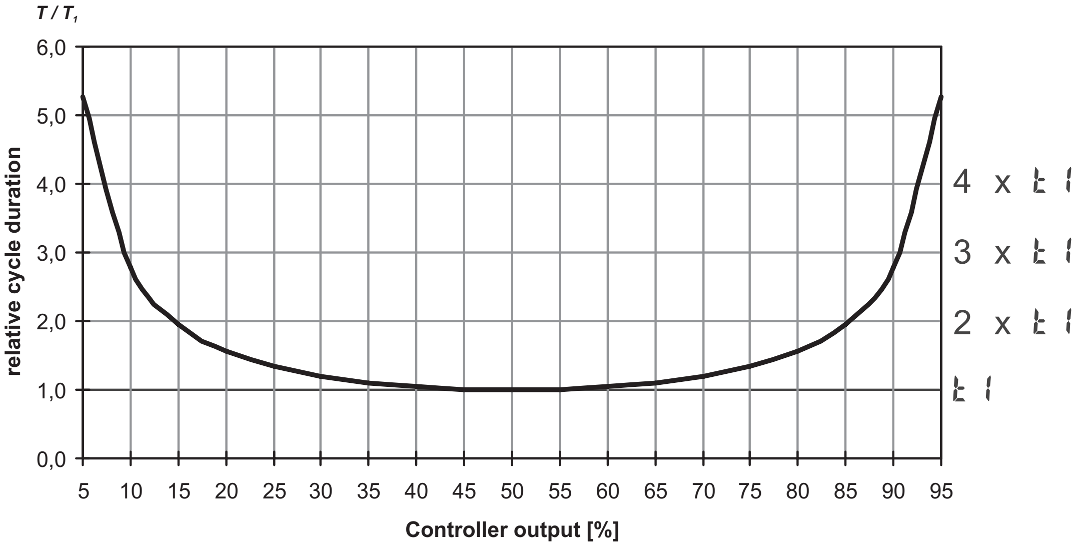


4.4 *MIR-491 cooling functions*

With MIR-491, configuration parameter CYCL (ConF/Cntr/CYCL) can be used for matching the cycle time of 2-point and 3-point controllers. This can be done using the following 4 methods.

4.4.1 Standard (CYCL = 0)

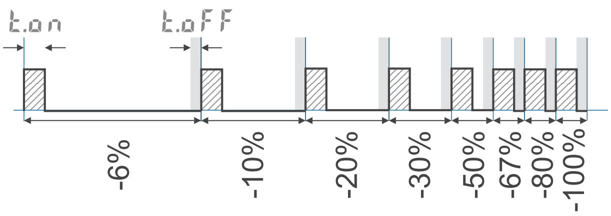
The adjusted cycle times t1 and t2 are valid for 50% or -50% correcting variable. With very small or very high values, the effective cycle time is extended to prevent unreasonably short on and off pulses. The shortest pulses result from ¼ x t1 or ¼ x t2. The characteristic curve is also called “bath tub curve”



Parameters to be adjusted: (PArA/Cntr)

t1 : min. cycle time 1 (heating) [s]
t2 : min. cycle time 2 (cooling) [s]

4.4.2 Water cooling linear (CYCL = 1)



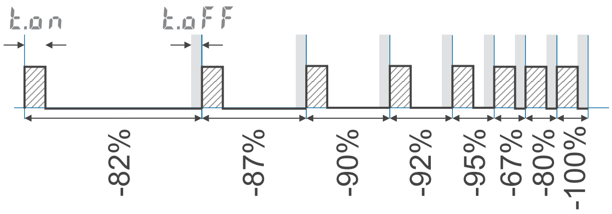
For heating (Y1), the standard method (see chapter 4.4.1) is used. For cooling (Y2), a special algorithm for cooling with water is used. Generally, cooling is enabled only at an adjustable process temperature (E.H2O), because low temperatures prevent evaporation with related cooling, whereby damage to the plant is avoided. The cooling pulse length is adjustable using parameter t.on and is fixed for all output values.

The "off" time is varied dependent of output value. Parameter t.oFF is used for determining the min "off" time. For output of a shorter off pulse, this pulse is suppressed, i.e. the max. effective cooling output value is calculated according to formula t.on / (t.on + t.oFF) • 100%.

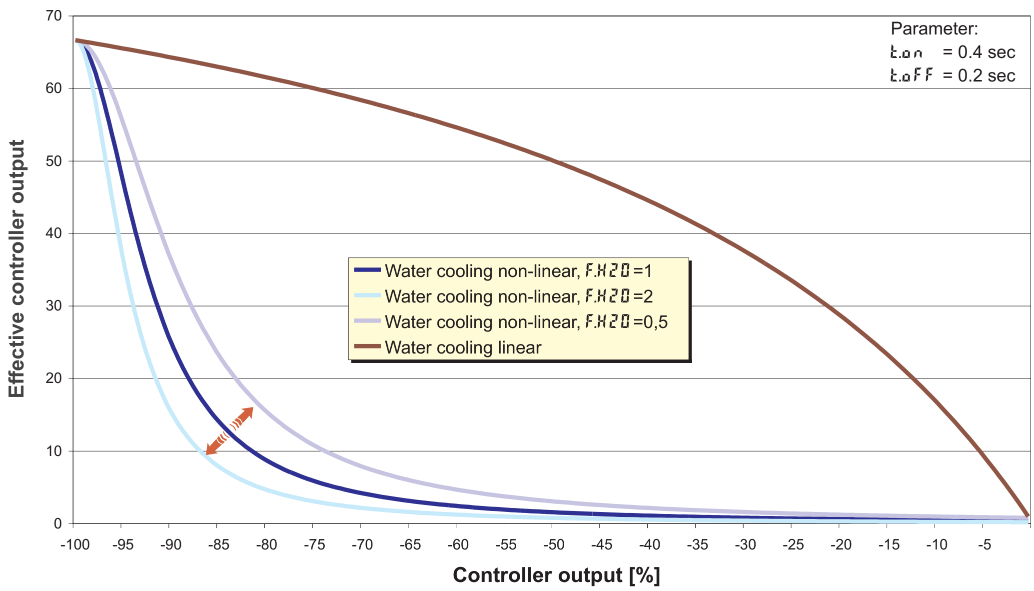
Parameters to be adjusted: (PArA / Cntr)	E.H2O:	minimum temperature for water cooling
	t.on:	pulse duration water cooling
	t.oFF:	minimum pause water cooling

4.4.3 Water cooling non-linear (CYCL = 2)

With this method, the cooling power is normally much higher than the heating power, i.e. the effect on the behaviour during transition from heating to cooling may be negative. The cooling curve ensures that the control intervention with 0 to -70% correcting variable is very weak.



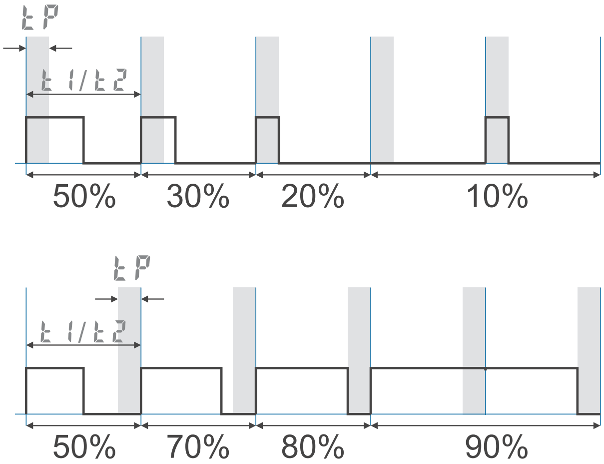
Moreover, the correcting variable increases very quickly to max. possible cooling. Parameter F.H2O can be used for changing the characteristic curve. The standard method (see section 4.4.1) is also used for heating. Cooling is also enabled dependent of process temperature .



Parameters to be adjusted: (PArA / Cntr)	F.H2O:	adaptation of (non-linear) characteristic Water cooling
	t.on:	Pulse duration water cooling
	t.oFF:	min. pause water cooling
	E.H2O:	min. temperature for water cooling

4.4.4 Heating and cooling with constant period (CYCL = 3)

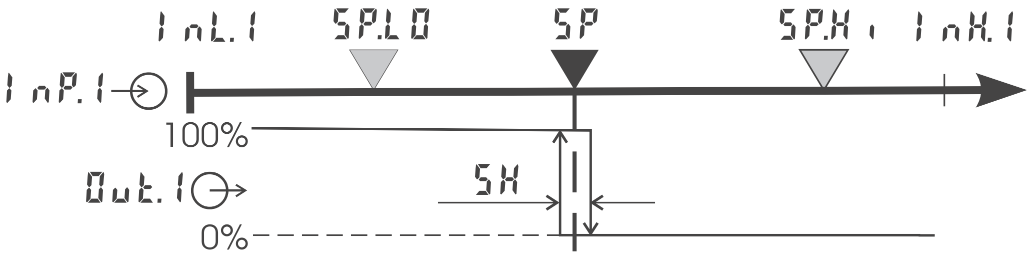
1 and t2 are met in the overall output range . To prevent unreasonably short pulses, parameter tP is used for adjusting the shortest pulse duration. With small correcting values which require a pulse shorter than the value adjusted in tP, this pulse is suppressed. However, the controller stores the pulse and totalizes further pulses, until a pulse of duration tP can be output.



Parameters to be adjusted:	t1 :	Min. cycle time 1 (heating) [s]
(PArA/Cntr)	t2 :	min. cycle time 2 (cooling) [s]
	tP:	min. pulse length [s]

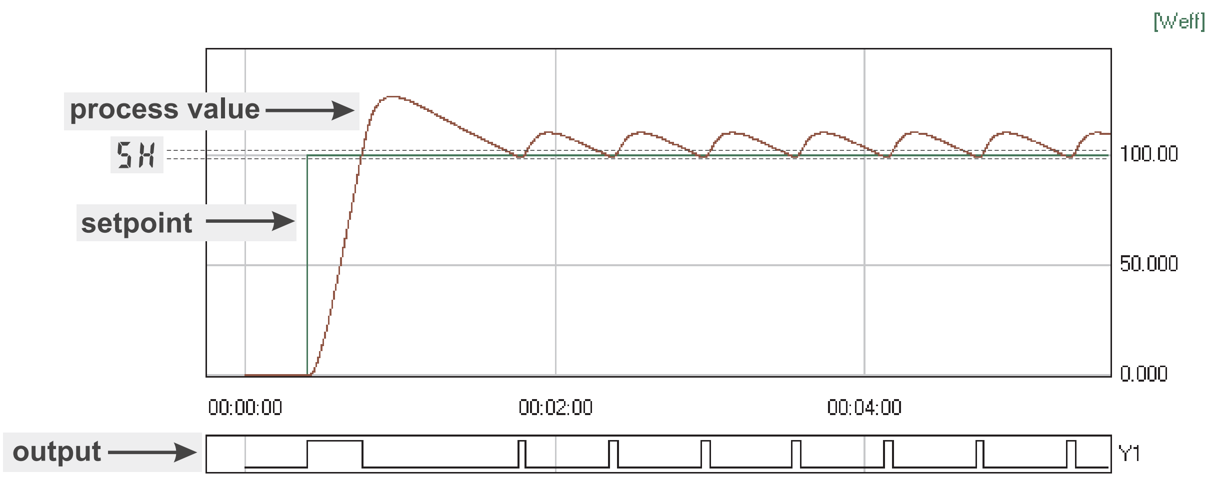
4.5 *Configuration examples*

4.5.1 Signaller (inverse)

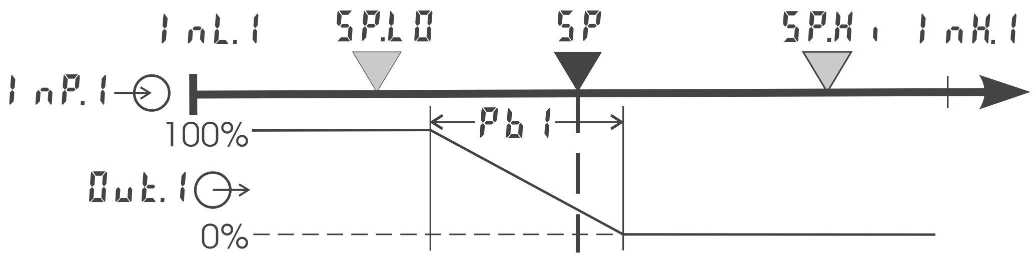


ConF / Cntr:	SP.Fn	=	0	set-point controller
	C.Fnc	=	0	signaller with one output
	C.Act	=	0	inverse action (e.g. heating applications)
ConF / Out.1:	O.Act	=	0	action Out.1 direct
	Y.1	=	1	control output Y1 active
PArA / Cntr:	SH	=	0...9999	switching difference (symmetrical to the trigger point)
PArA / SEtP:	SP.LO	=	-1999...9999	set-point limit low for Weff
	SP.Hi	=	-1999...9999	set-point limit high for Weff

For direct signaller action, the controller action must be changed (ConF / Cntr / C.Act = 1)

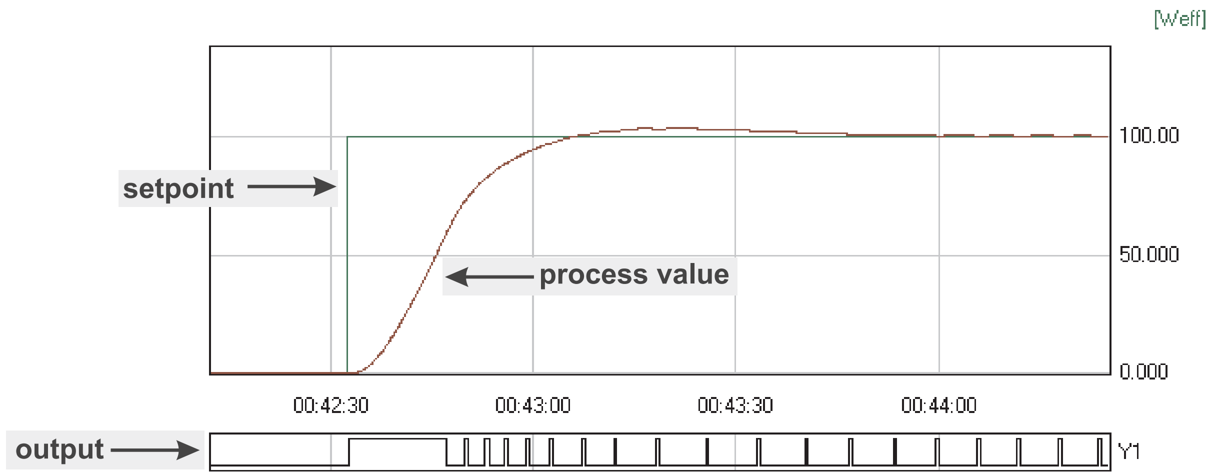


4.5.2 2-point controller (inverse)

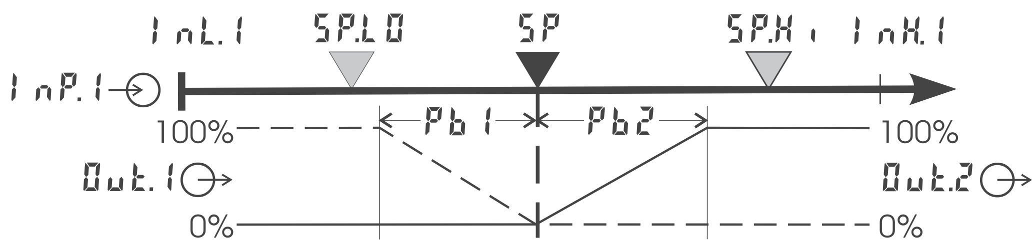


ConF / Cntr:	SP.Fn	=	0	set-point controller
	C.Fnc	=	1	2-point controller (PID)
	C.Act	=	0	inverse action (e.g. heating applications)
ConF / Out.1:	O.Act	=	0	action Out.1 direct
	Y.1	=	1	control output Y1 active
PArA / Cntr:	Pb1	=	0,1...9999	proportional band 1 (heating) in units of phys. quantity (e.g. °C)
	ti1	=	1...9999	integral time 1 (heating) in sec.
	td1	=	1...9999	derivative time 1 (heating) in sec.
	t1	=	0,4...9999	min. cycle time 1 (heating)
PArA / SEtP:	SP.LO	=	-1999...9999	set-point limit low for Weff
	SP.Hi	=	-1999...9999	set-point limit high for Weff

For direct action, the controller action must be changed (ConF / Cntr / C.Act = 1).



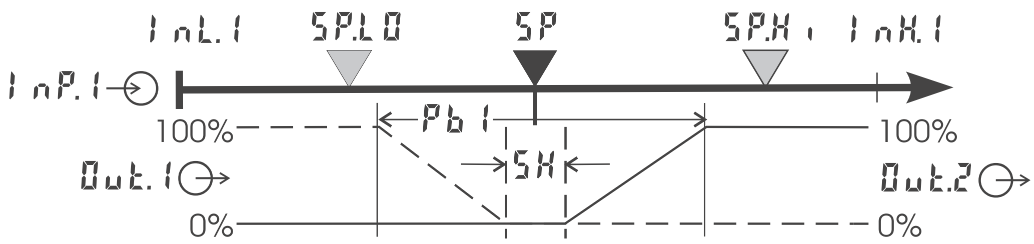
4.5.3 3-point controller (relay & relay)



ConF / Cntr:	SP.Fn	=	0	set-point controller
	C.Fnc	=	3	3-point controller (2xPID)
	C.Act	=	0	action inverse (e.g. heating applications)
ConF / Out.1:	O.Act	=	0	action Out.1 direct
	Y.1	=	1	control output Y1 active
	Y.2	=	0	control output Y2 not active
ConF / Out.2:	O.Act	=	0	action Out.2 direct
	Y.1	=	0	control output Y1 not active
	Y.2	=	1	control output Y2 active
PArA / Cntr:	Pb1	=	0,1...9999	proportional band 1 (heating) in units of phys. quantity (e.g. °C)
	Pb2	=	0,1...9999	proportional band 2 (cooling) in units of phys. quantity (e.g. °C)
	ti1	=	1...9999	integral time 1 (heating) in sec.
	ti2	=	1...9999	derivative time 2 (cooling) in sec.
	td1	=	1...9999	integral time 1 (heating) in sec.
	td2	=	1...9999	derivative time 2 (cooling) in sec.
	t1	=	0,4...9999	min. cycle time 1 (heating)
	t2	=	0,4...9999	min. cycle time 2 (cooling)
	SH	=	0...9999	neutr. zone in units of phys.quantity
PArA / SEtP:	SP.Lo	=	-1999...9999	set-point limit low for Weff
	SP.Hi	=	-1999...9999	set-point limit high for Weff

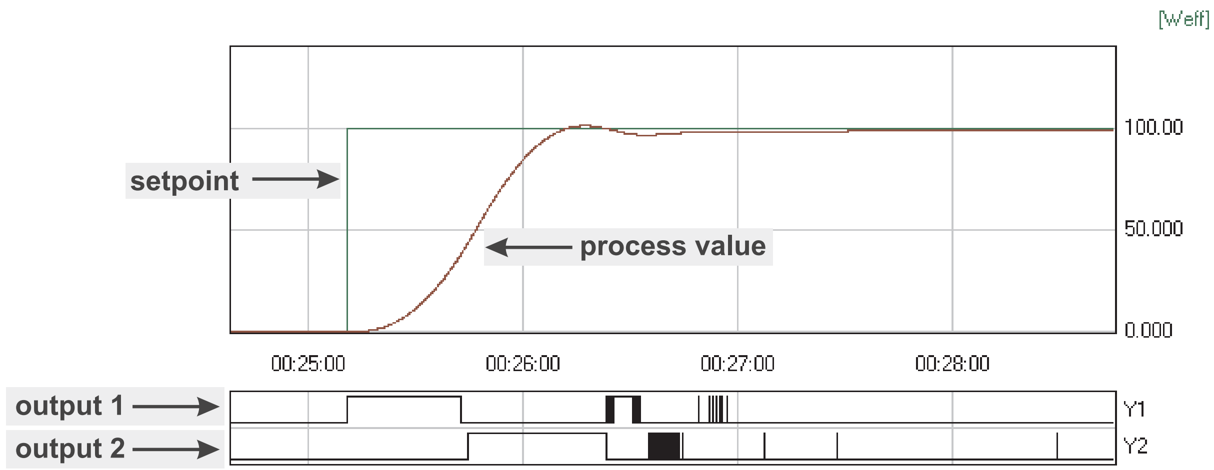
For direct action of the 3-point controller, the controller action must be changed (ConF / Cntr / C.Act = 1)

4.5.4 3-point stepping controller (relay & relay)

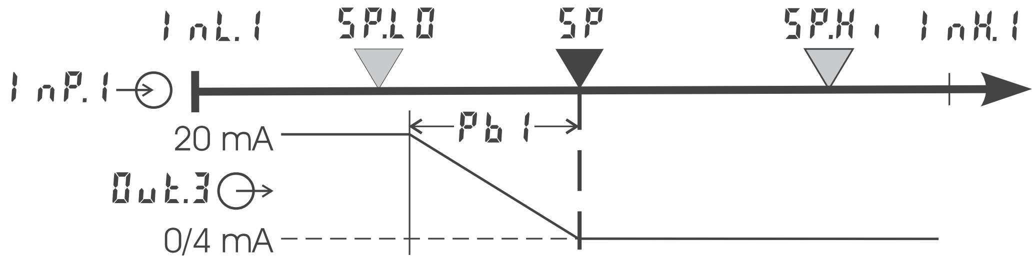


ConF / Cntr:	SP.Fn	=	0	set-point controller
	C.Fnc	=	4	3-point stepping controller
	C.Act	=	0	inverse action
				(e.g. heating applications)
ConF / Out.1:	O.Act	=	0	action Out.1 direct
	Y.1	=	1	control output Y1 active
	Y.2	=	0	control output Y2 not active
ConF / Out.2:	O.Act	=	0	action Out.2 direct
	Y.1	=	0	control output Y1 not active
	Y.2	=	1	control output Y2 active
PArA / Cntr:	Pb1	=	0,1...9999	proportional band 1 (heating)
				in units of phys. quantity (e.g. °C)
	ti1	=	1...9999	integral time 1 (heating) in sec.
	td1	=	1...9999	derivative time 1 (heating) in sec.
	t1	=	0,4...9999	min. cycle time 1 (heating)
	SH	=	0...9999	neutral zone in units of phy. quantity
	tP	=	0,1...9999	min. pulse length in sec.
	tt	=	3...9999	actuator travel time in sec.
PArA / SEtP:	SP.LO	=	-1999...9999	set-point limit low for Weff
	SP.Hi	=	-1999...9999	set-point limit high for Weff

ℹ For direct action of the 3-point stepping controller, the controller output action must be changed (ConF / Cntr / C.Act = 1).



4.5.5 Continuous controller (inverse)

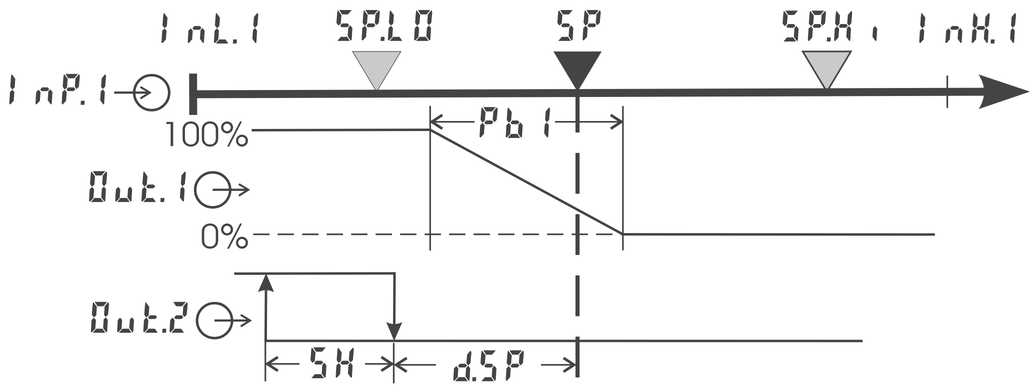


ConF / Cntr:	SP.Fn	=	0	set-point controller
	C.Fnc	=	1	continuous controller (PID)
	C.Act	=	0	inverse action (e.g. heating applications)
ConF / Out.3:	O.tYP	=	1 / 2	Out.3 type (0/4 … 20mA)
	Out.0	=	-1999...9999	scaling analog output 0/4mA
	Out.1	=	-1999...9999	scaling analog output 20mA
PArA / Cntr:	Pb1	=	0,1...9999	proportional band 1 (heating) in units of phys. quantity (e.g. °C)
	ti1	=	1...9999	integral time 1 (heating) in sec.
	td1	=	1...9999	derivative time 1 (heating) in sec.
	t1	=	0,4...9999	min. cycle time 1 (heating)
PArA / SEtP:	SP.LO	=	-1999...9999	set-point limit low for Weff
	SP.Hi	=	-1999...9999	set-point limit high for Weff

ⓘ For direct action of the continuous controller, the controller action must be changed (ConF / Cntr / C.Act = 1).

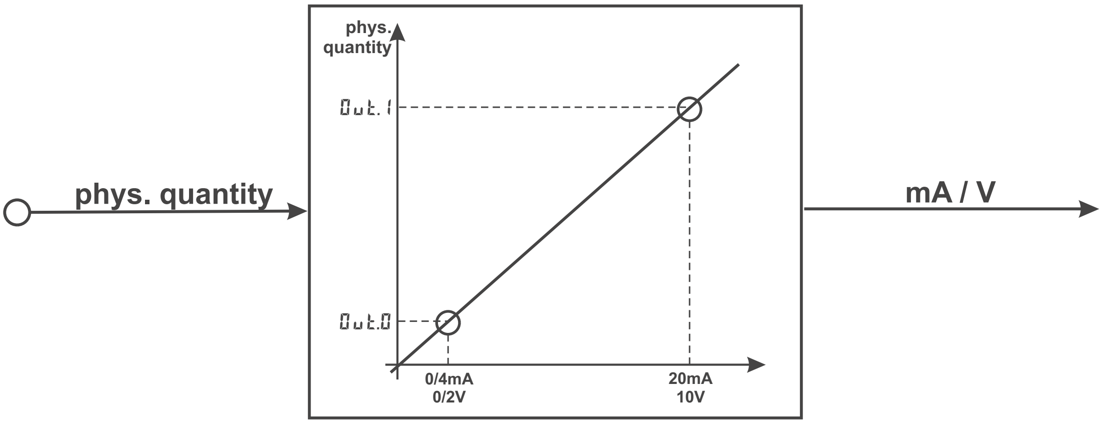
ⓘ To prevent control outputs Out.1 and Out.2 of the continuous controller from switching simultaneously, the control function of outputs Out.1 and Out.2 must be switched off (ConF / Out.1 and Out.2 / Y.1 and Y.2 = 0).

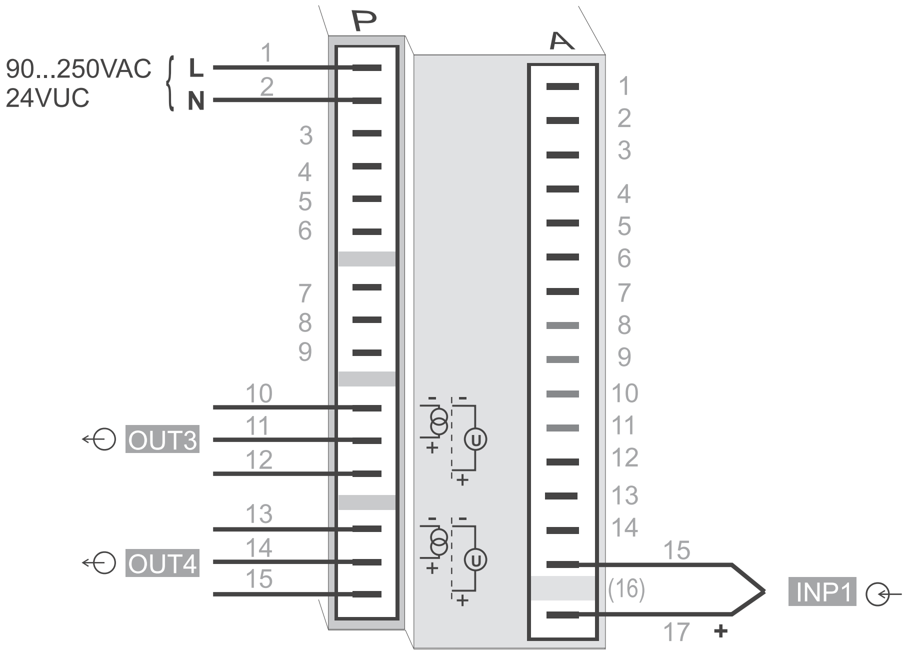
4.5.6 Δ - Y - Off controller



ConF / Cntr:	SP.Fn	=	0	set-point controller
	C.Fnc	=	2	Δ -Y-Off controller
	C.Act	=	0	inverse action (e.g. heating applications)
ConF / Out.1:	O.Act	=	0	action Out.1 direct
	Y.1	=	1	control output Y1 active
	Y.2	=	0	control output Y2 not active
ConF / Out.2:	O.Act	=	0	action Out.2 direct
	Y.1	=	0	control output Y1 not active
	Y.2	=	1	control output Y2 active
PArA / Cntr:	Pb1	=	0,1...9999	proportional band 1 (heating) in units of phys. quantity (e.g. °C)
	ti1	=	1...9999	integral time 1 (heating) in sec.
	td1	=	1...9999	derivative time 1 (heating) in sec.
	t1	=	0,4...9999	min. cycle time 1 (heating)
	SH	=	0...9999	switching difference
	d.SP	=	-1999...9999	trigg. point separation suppl. cont. Δ / Y / Off in units of phys. quantity
PArA / SEtP:	SP.LO	=	-1999...9999	set-point limit low for Weff
	SP.Hi	=	-1999...9999	set-point limit high for Weff

4.5.7 MIR-491 with measured value output





ConF / Out.3 / 4: O.tYP	=	1	Out.3/4 0...20mA continuous
	=	2	Out.3/4 4...20mA continuous
	=	3	Out.3/4 0...10V continuous
	=	4	Out.3/4 2...10V continuous
Out.0	=	-1999...9999	scaling Out.3/4 for 0/4mA or 0/2V
Out.1	=	-1999...9999	scaling Out.3/4 for 20mA or 10V
O.Src	=	3	signal source for Out.3/4 is the process value

5 Parameter setting level

5.1 *Parameter survey*

PAr.A	**Parameter setting level**																	
Cntr	**Control and self-tuning**																	
Pb1	Pb2	ti1	ti2	td1	td2	t1	t2	SH	d.SP	tP	tt	Y.Lo	Y.Hi	Y2	Y0	Ym.H	L.Ym	E.H20
t.on	t.oFF	FH2	oFFS															
PAr.2	**2. set of parameters**																	
Pb12	Pb22	ti12	ti22	td12	td22													
SEtP	**Set-point and process value**																	
SP.Lo	SP.Hi	SP.2	r.SP															
InP.1	**Input 1**																	
InL.1	OuL.1	InH.1	OuH.1	tF.1														
InP.2	Input 2																	
InL.2	OuL.2	InH.2	OuH.2															
InP.3	**Input 3**																	
InL.3	OuL.3	InH.3	OuH.3	tF.3														
Lim	**Limit value functions**																	
L.1	H.1	HYS.1	L.2	H.2	HYS.2	L.3	H.3	HYS.3	HC.A									
End																		

Adjustment:

- The parameters can be adjusted by means of keys ▲▼
- Transition to the next parameter is by pressing key ↵
- After the last parameter of a group, donE is displayed, followed by automatic change to the next group.

Return to the beginning of a group is by pressing the ↵ key for 3 sec.

If for 30 sec. no keypress is excecuted the controler returns to the process value and setpoint display (Time Out = 30 sec.)

5.2 *Parameters*

Cntr

Name	Value range	Description	Default
Pb1	1...9999	Proportional band 1 (heating) in phys. dimensions (e.g. °C)	100
Pb2	1...9999	Proportional band 2 (cooling) in phys. dimensions (e.g. °C)	100
ti1	1...9999	Integral action time 1 (heating) [s]	180
ti2	1...9999	Integral action time 2 (cooling) [s]	180
td1	1...9999	Derivative action time 1 (heating) [s]	180
td2	1...9999	Derivative action time 2 (cooling) [s]	180
t1	0,4...9999	Minimal cycle time 1 (heating) [s]. The minimum impulse is 1/4 x t1	10
t2	0,4...9999	Minimal cycle time 2 (heating) [s]. The minimum impulse is 1/4 x t2	10
SH	0...9999	Neutral zone or switching differential for on-off control [phys. dimensions)	2
d.SP	-1999...9999	Trigger point seperation for additional contact Δ / Y / Off [phys. dimensions]	100
tP	0,1...9999	Minimum impulse [s]	OFF
tt	3...9999	Motor travel time [s]	60
Y.Lo	-120...120	Lower output limit [%]	0
Y.Hi	-120...120	Upper output limit [%]	100
Y2	-120...120	2. correcting variable	0
Y.0	-120...120	Working point for the correcting variable [%]	0
Ym.H	-120...120	Limitation of the mean value Ym [%]	5
L.Ym	0...9999	Max. deviation xw at the start of mean value calculation [phys. dimensions]	8
E.H2O	-1999...9999	Min. temperature for water cooling. Below the set temperature no water cooling happens	0
t.on	0,1...9999	Impulse lenght for water cooling. Fixed for all values of controller output.The pause time is varied.	1
t.oFF	1...9999	Min. pause time for water cooling. The max. effective controller output results from t.on/(t.on+t.oFF)·100%	10
F.H2O	0,1...9999	Modification of the (non-linear) water cooling characteristic (see page 41)	1
oFFS	-120...120	Zero offset	0

PAr.2

Name	Value range	Description	Default
Pb12	1...9999 ❶	Proportional band 1 (heating) in phys. dimensions (e.g. °C), 2. parameter set	100
Pb22	1...9999 ❶	Proportional band 2 (cooling) in phys. dimensions (e.g. °C), 2. parameter set	100

Name	Value range	Description	Default
ti22	0...9999	Integral action time 2 (cooling) [s], 2. parameter set	10
ti12	0...9999	Integral action time 1 (heating) [s], 2. parameter set	10
td12	0...9999	Derivative action time 1 (heating) [s], 2. parameter set	10
td22	0...9999	Derivative action time 2 (cooling) [s], 2. parameter set	10

SEtP

Name	Value range	Description	Default
SP.LO	-1999...9999	Set-point limit low for Weff	0
SP.Hi	-1999...9999	Set-point limit high for Weff	900
SP.2	-1999...9999	Set-point 2.	0
r.SP	0...9999	Set-point gradient [/min]	OFF
SP	-1999...9999	Set-point (only visible with BlueControl!)	0

InP.1

Name	Value range	Description	Default
InL.1	-1999...9999	Input value for the lower scaling point	0
OuL.1	-1999...9999	Displayed value for the lower scaling point	0
InH.1	-1999...9999	Input value for the upper scaling point	20
OuH.1	-1999...9999	Displayed value for the lower scaling point	20
t.F1	-1999...9999	Filter time constant [s]	0,5

InP.2

Name	Value range	Description	Default
InL.2	-1999...9999	Input value for the lower scaling point	0
OuL.2	-1999...9999	Displayed value for the lower scaling point	0
InH.2	-1999...9999	Input value for the upper scaling point	50
OuH.2	-1999...9999	Displayed value for the upper scaling point	50

InP.3

Name	Value range	Description	Default
InL.3	-1999...9999	Input value for the lower scaling point	0
OuL.3	-1999...9999	Displayed value for the lower scaling point	0
InH.3	-1999...9999	Input value for the upper scaling point	20
OuH.3	-1999...9999	Displayed value for the upper scaling point	20
t.F3	-1999...9999	Filter time constant [s]	0

❶ Valid for ConF / othr / dP = 0. With dP = 1 / 2 / 3 also 0,1 / 0,01 / 0,001 is possible.

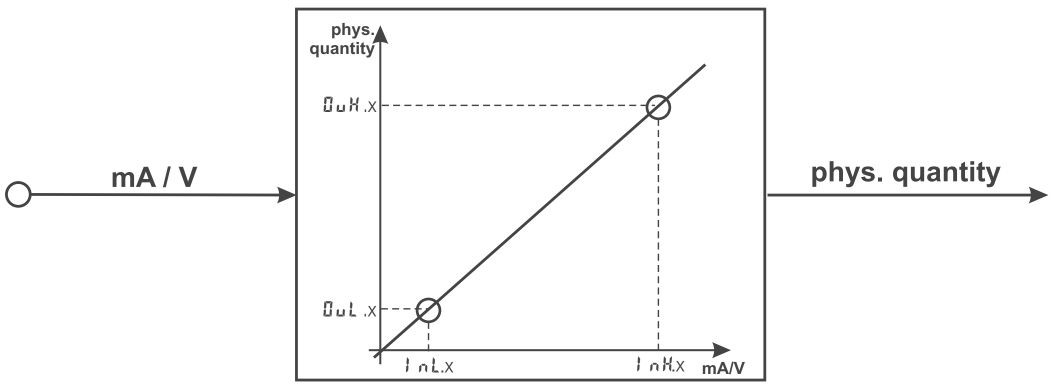
LiM

Name	Value range	Description	Default
L.1	-1999...9999	Lower limit 1	10
H.1	-1999...9999	Upper limit 1	10
HYS.1	0...9999	Hysteresis limit 1	1
L.2	-1999...9999	Lower limit 2	OFF
H.2	-1999...9999	Upper limit 2	OFF
HYS.2	0...9999	Hysteresis limit 2	1
L.3	-1999...9999	Lower limit 3	OFF
H.3	-1999...9999	Upper limit 3	-32000
HYS.3	0...9999	Hysteresis limit 3	1
HC.A	-1999...9999	Heat current limit [A]	50

Resetting the controller configuration to factory setting (Default)
→ chapter 11.1 (page 69)

5.3 *Input scaling*

When using current or voltage signals as input variables for InP.1, InP.2 or/and InP.3 scaling of input and display values at parameter setting level is required. Specification of the input value for lower and higher scaling point is in the relevant electrical unit (mA/ V).



5.3.1 Input InP.1 and InP.3

Parameters InL.x , OuL.x, InH.x and OuH.x are only visible if ConF /InP.x / Corr = 3 is chosen.

S.tYP	Input signal	InL.x	OuL.x	InH.x	OuH.x
30 (0...20mA)	**0 … 20 mA**	0	any	20	any
	4 … 20 mA	4	any	20	any
40 (0...10V)	**0 … 10 V**	0	any	10	any
	2 … 10 V	2	any	10	any

In addition to these settings, InL.x and InH.x can be adjusted in the range (0...20mA / 0...10V) determined by selection of S.tYP .

For using the predetermined scaling with thermocouple and resistance thermometer (Pt100), the settings for InL.x and OuL.x and for InH.x and OuH.x must have the same value.

Input scaling changes at calibration level (→ page 55) are displayed by input scaling at parameter setting level. After calibration reset (OFF), the scaling parameters are reset to default.

5.3.2 Input InP.2

S.tYP	Input signal	InL.2	OuL.2	InH.2	OuH.2
30	**0 … 20 mA**	0	any	20	any
31	**0 … 50 mA**	0	any	50	any

In addition to these settings, InL.2 and InH.2 can be adjusted in the range (0...20/ 50mA) determined by selection of S.tYP.

5.4 *Second set of parameters*

MIR-491 is provided with a second set of parameters (PArA / PAr.2) for heating and cooling.
Switch-over to the second set of parameters is dependent of configuration (ConF / LOGI / Pid.2) via digital input di1/2/3, the function key on the instrument front panel or the interface (OPTION).

Self-tuning is always done using the active parameter set, i.e. for optimizing, the second set of parameters must be active.

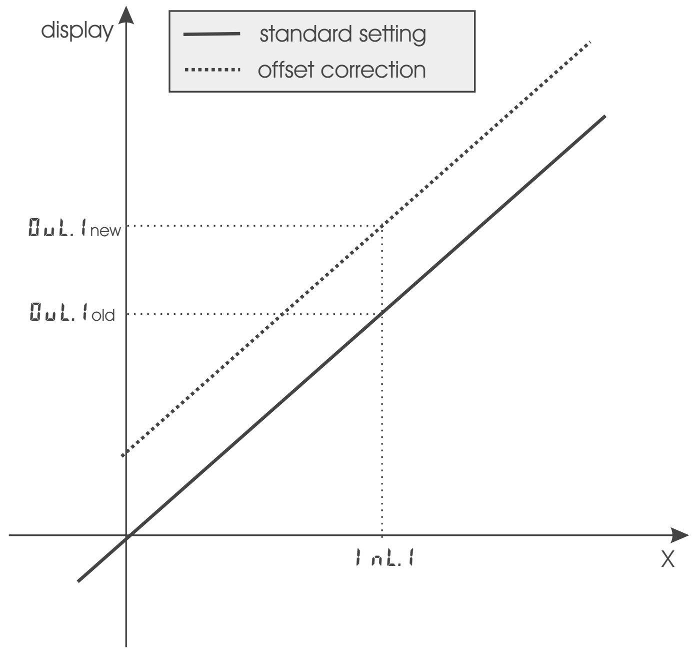
6 Calibration level

Measured value correction (CAL) is only visible if ConF / InP.1 / Corr = 1 or 2 is chosen.

The measured value can be matched in the calibration menu (CAL). Two methods are available:

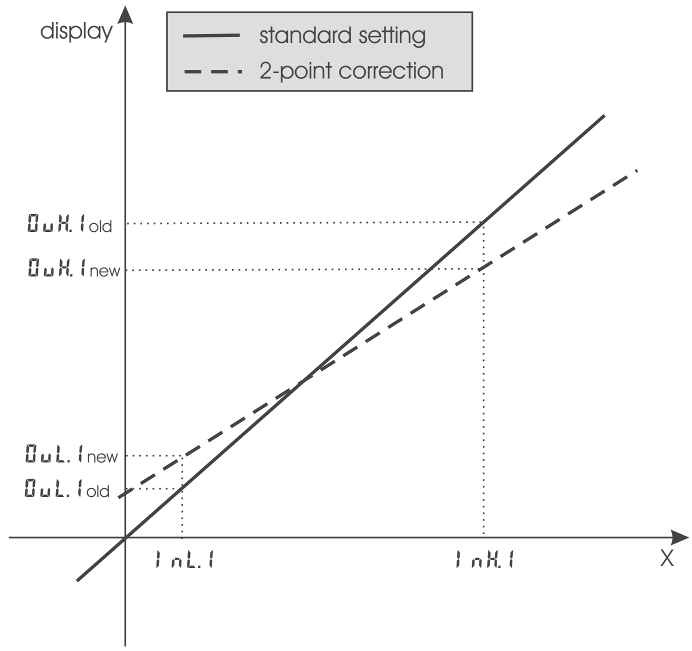
Offset correction
(ConF / InP.1 / Corr = 1):

- possible on-line at the process

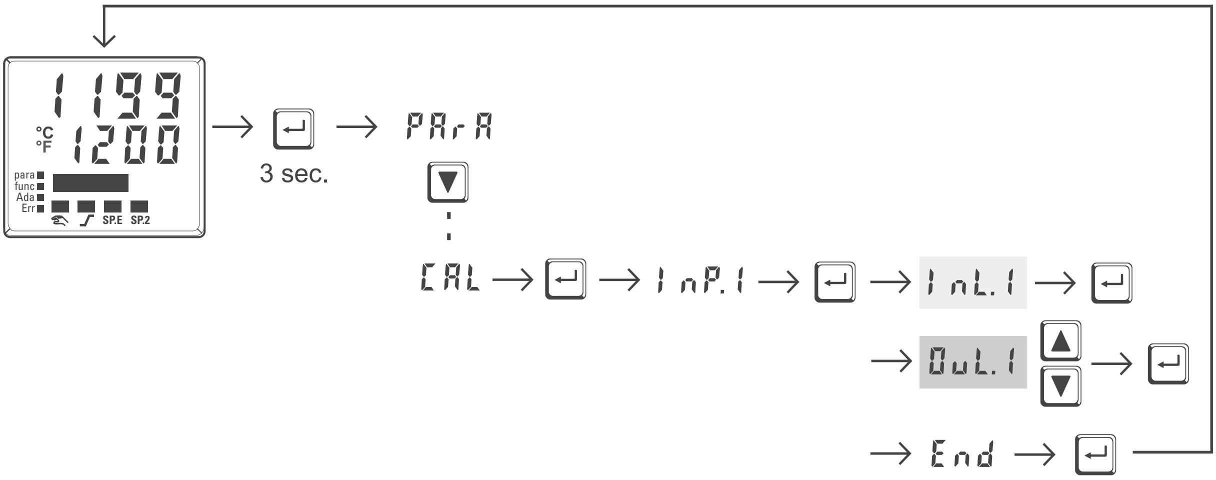


2-point correction
(ConF / InP.1 / Corr = 2):

- is possible off-line with process value simulator



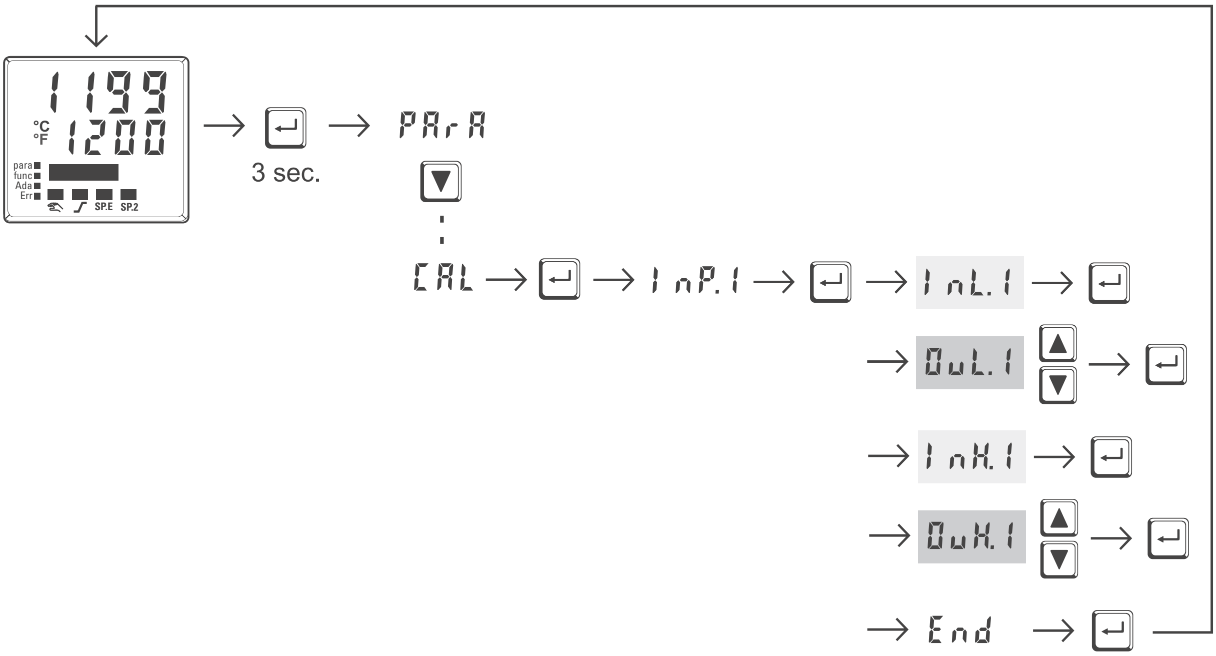
Offset correction **(ConF / InP.1 / Corr = 1):**



InL.1: The input value of the scaling point is displayed.
The operator must wait, until the process is at rest.
Subsequently, the operator acknowledges the input value by pressing key ↵.

OuL.1: The display value of the scaling point is displayed.
Before calibration, OuL.1 is equal to InL.1.
The operator can correct the display value by pressing keys ▲▼ .
Subsequently, he confirms the display value by pressing key ↵.

2-point correction **(ConF / InP.1 / Corr = 2):**



InL.1: The input value of the lower scaling point is displayed.
The operator must adjust the lower input value by means of a process value simulator and confirm the input value by pressing key [↵].

OuL.1: The display value of the lower scaling point is displayed.
Before calibration, OuL.1 equals InL.1.
The operator can correct the lower display value by pressing the [▲][▼] keys. Subsequently, he confirms the display value by pressing key [↵].

InH.1: The input value of the upper scaling point is displayed. .
The operator must adjust the upper input value by means of the process value simulator and confirm the input value by pressing key [↵].

OuH.1: The display value of the upper scaling point is displayed.
Before calibration OuH.1 equals InH.1.
The operator can correct the upper display value by pressing keys [▲][▼]
Subsequently, he confirms the display value by pressing key [↵].

ⓘ The parameters (OuL.1, OuH.1) changed at CAL level can be reset by adjusting the parameters below the lowest adjustment value (OFF) by means of decrement key [▼] .

7 Special functions

7.1 *DAC® – motor actuator monitoring (Digital Actor Control DAC®)*

With all controllers with position feedback Yp, the motor actuator can be monitored for functional troubles. The DAC® function can be started by chosing the parameter C.Fnc = 5 or 6 at the configuration level (ConF):

- ConF / Cntr / C.Fnc = 5 — 3-point-stepping controller with position feedback Yp as potentiometer
- ConF / Cntr / C.Fnc = 6 — Continuous controller with integrated positioner and position feedback Yp as potentiometer

If an error occures, the controller switches to manual operation (- LED blinks) and no impulses are given out any longer. If one of the relays shall switch when a DAC® error occures, parameter dAC.A = 1 and inverse action O.Act = 1 must be selected for the relevant output OUt.1 … OUt.4 in the ConF menu (OUt.3 and 4 only possible if O.tYP = 0 [relay/logic]):

- ConF / OUt.x / dAc.A = 1 — Motor actuator monitoring (DAC) aktive

The system detects the following stepping controller errors:

- defective motor
- defective capacitor (wrong rotating direction)
- wrong phase followers (wrong rotating direction)
- defective force transmission at spindle or drive
- excessive backlash due to wear
- jamming of the control valve e.g. due to foreign body

In these cases the controller will change to manual operation and the outputs will be switched off. Is the controller switched to automatic operation again or any modification is done the controller activates the DAC function again and the outputs will be setted.

Functioning of the DAC function

No input filter should be defined for the Yp input (PArA / InP.x / t.F x = 0). Therewith no wrong detection of blocking or wrong method of operation can be recognized.
The automatic calibration can be used with drives outfitted with spring assembly.

Execution of the calibration:
It is controlled if the mean alteration between two messurements is enough for the DAC monitoring. The calibration will be stopped if the alteration between two messurements is too small.
The position of 0% is searched. Therefor the drive will be closed until there is no changing of the input signal for 0,5 sec.
Assuming that the drive is outfitted with spring assembly, the drive is opened for 2,8 sec. The drive should then still be within the spring assembly. This position is allocated and stored as 0%.
With the same procedure the position for 100% is allocated and stored.
Simultaneously the motor running time is determined and saved as parameter tt .
Afterwards the controller sets the drive in the position before calibration.
Was the controller in automatic mode before calibration it will be set to automatic mode again otherwise it remains in manual mode.

The following errors can be occure during calibration:

- the change of the Yp input is to small, no monitoring is possible
- the motion is in wrong direction
- the Yp input is broken

In these cases the automatic calibration will be stopped and the controller remains in manual mode.

If the automatic calibration leads to no resonable results the calibration of the Yp input can be done manual.

If the conroller reaches the positions of 0% or 100% the outputs will be switched off. Also in manual mode it is not possible to exceed these limits.

Because no controller with continuouse output and Yp input is defined there won't be the DAC function for this controlling type.

7.2 *MIR-491 as Modbus master*

This function is only selectable with BlueControl (engineering tool)!

Additions othr *(only visible with BlueControl!)*

Name	Value range	Description	Default
mASt		**Controller is used as Modbus master**	0
	0	Slave	
	1	Master	
Numb	0...100	Number of data that should be transmitted by the Modbus master.	0
CYcL	0...200	Cycle time [ms] for the Modbus master to transmit its data to the bus.	60
AdrU	1...65535	Modbus address of the data that Modbus master gives to the bus.	1
AdrO	1...65535	Target address to which the with AdrU specified data is given out on the bus.	1

The MIR-491 can be used as Modbus master (ConF / othr / mASt = 1). The Modbus master sends ist data to all slaves (Broadcast message, controller adress 0). It transmits its data (modbus adress AdrU) cyclic with the cycle time CYcL to the bus. The slave controller receives the data transmitted by the masters and allocates it to the modbus target adress AdrO. If more than one data should be transmitted by the master controller (Numb > 1) , the modbus adress AdrU indicates the start adress of the data that should be transmitted and AdrO indicates the first target adress where the received data should be stored. The following data will be stored at the logically following modbus target adresses. With this it is possible e.g. to specify the process value of the master controller as set-point for the slave controllers.

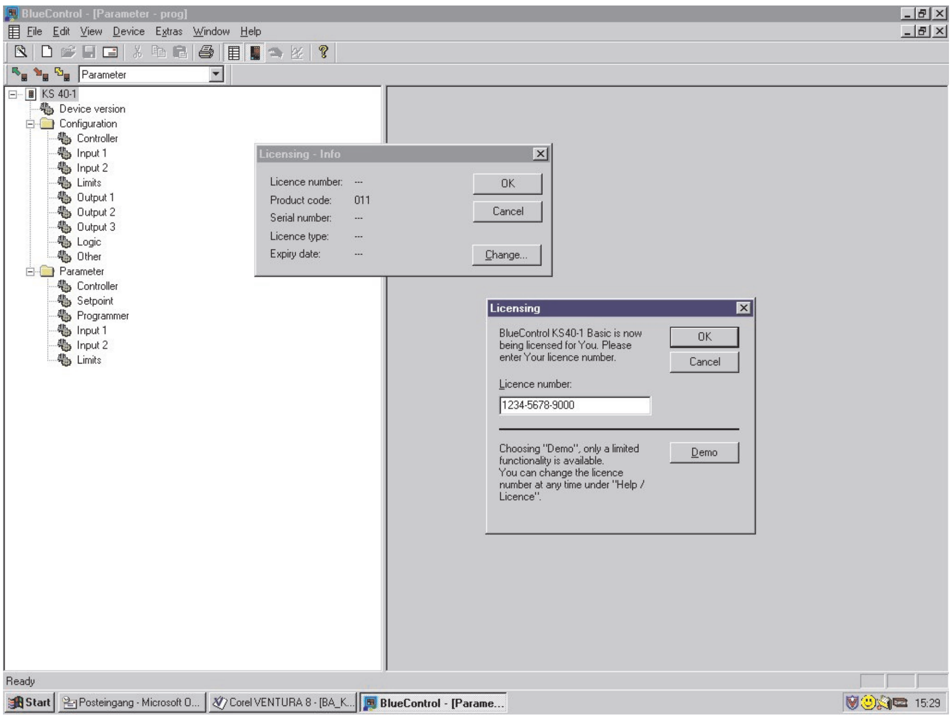
8 BlueControl

BlueControl is the projection environment for the controller MIR-491. The following 3 versions with graded functionality are available:

Functionality	Mini	Basic	Expert
parameter and configuration setting	yes	yes	yes
controller and control loop simulation	yes	yes	yes
download: writes an engineering to the controller	yes	yes	yes
online mode/ visualisation	SIM only	yes	yes
creation of user defined linearizations	SIM only	yes	yes
configuration of extended operating level	SIM only	yes	yes
upload: reads an engineering from the controller	SIM only	yes	yes
basic diagnosis function	SIM only	yes	yes
file, save engineering data	no	yes	yes
printer function	no	yes	yes
online documentation, help system	no	yes	yes
measurement correction (calibration procedure)	no	yes	yes
program editor	SIM only	SIM only	yes
data acquisition and trend function	SIM only	SIM only	yes
network and multiuser licence	no	no	yes
personal assistant function	no	no	yes
extended simulation	no	no	yes
extended diagnostic and service functions	no	no	yes

The mini version is - free of charge - at your disposal as download at ACS homepage ***www.acs-controlsystem.de***.

At the end of the installation the licence number has to be stated or DEMO mode must be chosen. At DEMO mode the licence number can be stated subsequently under ***Help Licence Change***.



9 Versions

MIR-491-10_-__0__-_S

Description	Code
90..250V AC, 4 relays	0
24VAC / 18..30VDC, 4 relays	1
90..250V AC, 3 relays + mA/V/logic	2
24VAC / 18..30VDC, 3 relays + mA/V/logic	3
90..250V AC, 2 relays + 2 mA/V/logic	4
24VAC / 18..30VDC, 2 rel. + 2 x mA/V/logic	5
No option	0
Modbus RTU + U_T + di2/3 + OUT5/6	1
INP1 and INP2	0
INP1, INP2 and INP3	1
Standard configuration	0
Configuration to specification	9
No operating manual	0
Operating manual german	D
Operating manual english	E
Standard	0
UL certified	U
DIN 3440	D

Accessories delivered with the unit

Operating manual (if selected by the ordering code)

- 2 fixing clamps
- operating note in 15 languages

Accessory equipment with ordering information

Description		Order no.
Heating current transformer 50A AC		STW-440-50001
PC-adaptor for the front-panel interface		STK-540-00001
Operating manual	German	BAL-401-62918
Operating manual	English	BAL-401-62911
BlueControl (engineering tool)	Mini	BCM-400-00002
BlueControl (engineering tool)	Basic	BCB-400-00002
BlueControl (engineering tool)	Expert	BCD-400-00003

10 Technical data

INPUTS

SURVEY OF INPUTS

Input	Used for
INP1	x1 (process value)
INP2	Heating current, ext. set-point or ext. correction, position feedback Yp, 2nd process value x2, ext. correcting variable Y.E, input for additional limit signalling abd indication
INP3	as for INP2
di1 di2 di3 (option)	Operation disabled, controller off, disabled auto/manual key, reset of stored alarms, switch-over to … second set-point SP.2, external set-point SP.E, fixed correcting variable Y2, fixed correcting variable Y.E, manual operation, manual operation, parameter set 1 ↔ 2

PROCESS VALUE INPUT INP1

Resolution:	> 14 bits
Decimal point:	0 to 3 digits behind the decimal point
Dig. input filter:	adjustable 0,000...9999 s
Scanning cycle:	100 ms
Measured value correction:	2-point or offset correction

Thermocouples

→ Table 1 (page 67)

Input resistance:	≥ 1 MΩ
Effect of source resistance:	1 µV/Ω

Cold-junction compensation

Maximal additional error:	± 0,5 K

Sensor break monitoring

Sensor current:	≤ 1 µA

Configurable output action

Resistance thermometer

→ Table 2 (page 67)

Connection:	3-wire
Lead resistance:	max. 30 Ohm
Input circuit monitor:	break and short circuit

Special measuring range

BlueControl (engineering tool) can be used to match the input to sensor KTY 11-6 (characteristic is stored in the controller).

Physical measuring range:	0...4500 Ohm
Linearization segments	16

Current and voltage signals

→ Table 3 (page 67)

Span start, end of span:	anywhere within measuring range
Scaling:	selectable -1999...9999
Linearization:	16 segments, adaptable with BlueControl
Decimal point:	adjustable
Input circuit monitor:	12,5% below span start (2mA, 1V)

SUPPLEMENTARY INPUT INP2

Resolution:	> 14 bits
Scanning cycle:	100 ms

Heating current measurement

via current transformer (→ Accessory equipment)

Measuring range:	0...50mA AC
Scaling:	adjustable -1999...0,000...9999 A

Current measuring range

Technical data as for INP1

Potentiometer

→ Table 2 (page 67)

SUPPLEMENTARY INPUT INP3 (OPTION)

Resolution: > 14 bits
Scanning cycle: 100 ms

Technical data as for INP1 except 10V range.

CONTROL INPUTS DI1, DI2

Configurable as switch or push-button! Connection of a potential-free contact suitable for switching "dry" circuits.

Switched voltage: 5 V
Current: 100 µA

CONTROL INPUTS DI2, DI3 (OPTION)

The digital input di2 located on the A-card and di2 located on the option card are or-linked. Configurable as switch or push-button! Optocoupler input for active triggering.

Nominal voltage	24 V DC external
Current sink (IEC 1131 type 1)	
Logic "0"	-3...5 V
Logic "1"	15...30 V
Current requirement	approx.. 5 mA

TRANSMITTER SUPPLY U_T (OPTION)

Power: 22 mA / ≥ 18 V

If the universal output OUT3 or OUT4 is used there may be no external galvanic connection between measuring and output circuits!

GALVANIC ISOLATION

Safety isolation
Function isolation

Mains supply	Process value input INP1 Supplementary input INP2 Optional input INP3 Digital input di1, di2
Relay OUT1	RS422/485 interface
Relay OUT2	Digital inputs di2, 3
Relay OUT3	Universal output OUT3
Relay OUT4	Universal output OUT4
	Transmitter supply U_T
	OUT5, OUT6

OUTPUTS

SURVEY OF OUTPUTS

Output	Used for
OUT1,2 (relays)	Control output heating/cooling or Open/Close, limit contacts, alarms
OUT3,4 (relays or logic)	as OUT1 and OUT2
OUT3,4 (continuous)	Control output, process value, set-point, control deviation, position feedback Yp, transmitter supply 15V/22mA
OUT5 OUT6 (Opto-coupler)	as OUT1 and OUT2

** All logic signals can be OR-linked!*

RELAY OUTPUTS OUT1...OUT4

Contact type:	potential-free changeover contact
Max.contact rating:	500 VA, 250 V, 2A at 48...62 Hz, resistive load
Min. contact rating:	5V, 10 mA AC/DC
Operating life (electr.):	600.000 duty cycles with max. contact rating

Note:
If the relays operate external contactors, these must be fitted with RC snubber circuits to manufacturer specifications to prevent excessive switch-off voltage peaks.

OUT3, 4 AS UNIVERSAL OUTPUT

Galvanically isolated from the inputs.

Freely scalable resolution: 11 bits

Current output

0/4...20 mA configurable.

Signal range:	0...approx.22mA
Max. load:	≤ 500 Ω
Load effect:	no effect
Resolution:	≤ 22 µA (0,1%)
Accuracy	≤ 40 µA (0,2%)

Voltage output

0/2...10V configurable

Signal range:	0...11 V
Min. load:	≥ 2 kΩ
Load effect:	no effect
Resolution:	≤ 11 mV (0,1%)
Accuracy	≤ 20 mV (0,2%)

OUT3, 4 used as transmitter supply

Output power: 22 mA / ≥ 13 V

OUT3, 4 used as logic output

Load ≤ 500 Ω	0/≤ 20 mA
Load > 500 Ω	0/> 13 V

OUTPUTS OUT5/6 (OPTION)

Galvanically isolated opto-coupler outputs.
Grounded load: common positive voltage.
Output rating: 18...32 VDC; ≤ 70 mA
Internal voltage drop: ≤ 1 V with I_{max}
Protective circuit: built-in against short circuit, overload, reversed polarity (free-wheel diode for relay loads).

POWER SUPPLY

Dependent of order:

AC SUPPLY

Voltage:	90...260 V AC
Frequency:	48...62 Hz
Power consumption	approx. 7,0 VA

UNIVERSAL SUPPLY 24 V UC

AC voltage:	20,4...26,4 V AC
Frequency:	48...62 Hz
DC voltage:	18...31 V DC
Power consumption:	approx.. 7,0 VA

BEHAVIOUR WITH POWER FAILURE

Configuration, parameters and adjusted set-points, control mode:
Non-volatile storage in EEPROM

BLUEPORT FRONT INTERFACE

Connection of PC via PC adapter (see "Accessory equipment"). The BlueControl software is used to configure, set parameters and operate the MIR-491.

BUS INTERFACE (OPTION)

Galvanically isolated

Physical:	RS 422/485
Protocol:	Modbus RTU
Transmission speed:	2400, 4800, 9600, 19.200 bits/sec
Address range:	1...247
Number of controllers per bus:	32

Repeaters must be used to connect a higher number of controllers.

ENVIRONMENTAL CONDITIONS

Protection modes

Front panel:	IP 65 (NEMA 4X)
Housing:	IP 20
Terminals:	IP 00

Permissible temperatures

For specified accuracy:	0...60°C
Warm-up time:	≥ 15 minutes
For operation:	-20...65°C
For storage:	-40...70°C

Humidity

75% yearly average, no condensation

Shock and vibration

Vibration test Fc (DIN 68-2-6)

Frequency:	10...150 Hz
Unit in operation:	1g or 0,075 mm
Unit not in operation:	2g or 0,15 mm

Shock test Ea (DIN IEC 68-2-27)

Shock:	15g
Duration:	11ms

Electromagnetic compatibility

Complies with EN 61 326-1
(for continuous, non-attended operation)

GENERAL

Housing

Material:	Makrolon 9415 flame-retardant
Flammability class:	UL 94 VO, self-extinguishing

Plug-in module, inserted from the front

Safety test

Complies with EN 61010-1 (VDE 0411-1):
Overvoltage category II
Contamination class 2
Working voltage range 300 V
Protection class II

Certifications

Type-tested to DIN 3440 (applied for)
For use in:

- Heat generating plants with outflow temperatures up to 120°C to DIN 4751
- Hot water plants with outflow temperatures above 110°C to DIN 4752
- Thermal transfer plants with organic transfer media to DIN 4754
- Oil-heated plants to DIN 4755

UL-approval (applied for)

Electrical connections

- Flat-pin connectors 1 x 6,3 mm or 2 x 2,8 mm to DIN 46 244

Mounting

Panel mounting with two fixing clamps at top/bottom or right/left,
High-density mounting possible

Mounting position:	uncritical
Weight:	0,27kg

Accessories delivered with the unit

Operating manual
Fixing clamps

Table 1 Thermocouples measuring ranges

Thermoelementtyp		Meßbereich		Genauigkeit	Auflösung (∅)
L	Fe-CuNi (DIN)	-100...900°C	-148...1652°F	≤ 2K	0,1 K
J	Fe-CuNi	-100...1200°C	-148...2192°F	≤ 2K	0,1 K
K	NiCr-Ni	-100...1350°C	-148...2462°F	≤ 2K	0,2 K
N	Nicrosil/Nisil	-100...1300°C	-148...2372°F	≤ 2K	0,2 K
S	PtRh-Pt 10%	0...1760°C	32...3200°F	≤ 2K	0,2 K
R	PtRh-Pt 13%	0...1760°C	32...3200°F	≤ 2K	0,2 K
T	Cu-CuNi	-200...400°C	-328...752°F	≤ 2K	0,05 K
C	W5%Re-W26%Re	0...2315°C	32...4199°F	≤ 2K	0,4 K
D	W3%Re-W25%Re	0...2315°C	32...4199°F	≤ 2K	0,4 K
E	NiCr-CuNi	-100...1000°C	-148...1832°F	≤ 2K	0,1 K
B *	PtRh-Pt6%	0(100)...1820°C	32(212)...3308°F	≤ 2K	0,3 K

* Specifications valid for 100°C

Table 2 Resistance transducer measuring ranges

Art	Meßstrom	Meßbereich		Genauigkeit	Auflösung (∅)
Pt100	0,2mA	-200...100°C	-140...212°F	≤ 1K	0,1K
Pt100		-200...850°C	-140...1562°F	≤ 1K	0,1K
Pt1000		-200...200°C	-140...392°F	≤ 2K	0,1K
KTY 11-6 *		-50...150°C	-58...302°F	≤ 2K	0,05K
Spezial		0...4500		≤ 0,1 %	0,01 %
Spezial		0...450			
Poti		0...160			
Poti		0...450			
Poti		0...1600			
Poti		0...4500			

* Or special

Table 3 Current and voltage measuring ranges

Meßbereich	Eingangswiderstand	Genauigkeit	Auflösung (∅)
0-10 Volt	≈ 110 kΩ	≤ 0,1 %	0,6 mV
0-100 mV	≥ 1MΩ	≤ 0,1 %	6 µV
0-20 mA	49 Ω (Spannungsbedarf ≤ 2,5 V)	≤ 0,1 %	1,5 µA

11 Safety hints

This unit was built and tested in compliance with VDE 0411-1 / EN 61010-1 and was delivered in safe condition.
The unit complies with European guideline 89/336/EWG (EMC) and is provided with CE marking.
The unit was tested before delivery and has passed the tests required by the test schedule. To maintain this condition and to ensure safe operation, the user must follow the hints and warnings given in this operating manual.
The unit is intended exclusively for use as a measurement and control instrument in technical installations.

Warning
If the unit is damaged to an extent that safe operation seems impossible, the unit must not be taken into operation.

ELECTRICAL CONNECTIONS
The electrical wiring must conform to local standards (e.g. VDE 0100). The input measurement and control leads must be kept separate from signal and power supply leads.
In the installation of the controller a switch or a circuit-breaker must be used and signified. The switch or circuit-breaker must be installed near by the controller and the user must have easy access to the controller.

COMMISSIONING
Before instrument switch-on, check that the following information is taken into account:

- Ensure that the supply voltage corresponds to the specifications on the type label.
- All covers required for contact protection must be fitted.
- If the controller is connected with other units in the same signal loop, check that the equipment in the output circuit is not affected before switch-on. If necessary, suitable protective measures must be taken.
- The unit may be operated only in installed condition.
- Before and during operation, the temperature restrictions specified for controller operation must be met.

SHUT-DOWN
For taking the unit out of operation, disconnect it from all voltage sources and protect it against accidental operation.
If the controller is connected with other equipment in the same signal loop, check that other equipment in the output circuit is not affected before switch-off. If necessary, suitable protective measures must be taken.

MAINTENANCE, REPAIR AND MODIFICATION
The units do not need particular maintenance.

Warning
When opening the units, or when removing covers or components, live parts and terminals may be exposed.

Before starting this work, the unit must be disconnected completely.

After completing this work, re-shut the unit and re-fit all covers and components. Check if specifications on the type label must be changed and correct them, if necessary.

Caution
When opening the units, components which are sensitive to electrostatic discharge (ESD) can be exposed. The following work may be done only at workstations with suitable ESD protection.
Modification, maintenance and repair work may be done only by trained and authorized personnel. For this purpose, the ACS service should be contacted.

The cleaning of the front of the controller should be done with a dry or a wetted (spirit, water) kerchief.

11.1 *Resetting to factory setting*

In case of faulty configuration, MIR-491 can be reset to the default condition. For this, keep the following two keys pressed during power-on :

[▲] [▼]

Controller reset to default is signalled by displaying FACtorY shortly in the display. Subsequently, the controller returns to normal operation.

По вопросам продаж и поддержки обращайтесь:

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Эл. почта: ang@nt-rt.ru || Сайт: http://acscontsys.nt-rt.ru/