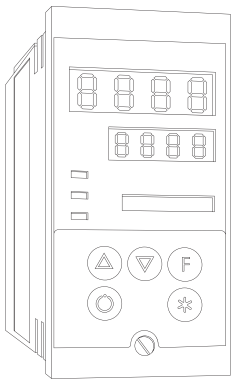
Capacitive electrode based electronic level controller

Model 276



Direct current regulator. RAC-1

PID Control output 4-20 mA for operating a pump motor frequency control or a pneumatic valve.
Three auxiliary relays are available for additional functions

Direct current regulator. RAC-2

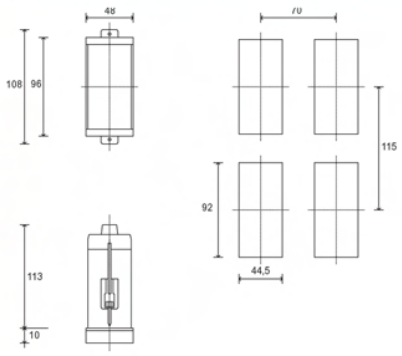
PID control for operating a motor-driven valve.
An axiliary relay is available for additional functions

Direct current regulator. RAC-3

Stop-Start control for operating a feed valve or solenoid valve.
Two auxiliary relays are available for additional functions.

1 • INSTALLATION

• Dimensions and cut-out; panel mounting



For correct and safe installation, follow the instructions and observe the warnings contained in this manual.

Panel mounting:

To fix the unit, insert the brackets provided into the seats on either side of the case. To mount two or more units side by side, respect the cut-out dimensions shown in the drawing. To obtain IP65 faceplate protection level, remove the device from the box, apply the gasket (supplied) with adhesive to the front edge of the box, and then reinsert the device.

CE MARKING: EMC conformity (electromagnetic compatibility) with EEC Directive 89/336/CEE with reference to the generic Standard EN61000-6-2 (immunity in industrial environments) and EN50081-1 (emission in residential environments). BT (low voltage) conformity respecting the Directive 73/23/CEE modified by the Directive 93/68.

MAINTENANCE: Repairs must be done only by trained and specialized personnel. Cut power to the device before accessing internal parts.
Do not clean the case with hydrocarbon-based solvents (Petrol, Trichlorethylene, etc.). Use of these solvents can reduce the mechanical reliability of the device. Use a cloth dampened in ethyl alcohol or water to clean the external plastic case.
SERVICE: VYC has a service department. The warranty excludes defects caused by any use not conforming to these instructions.

2 • TECHNICAL SPECIFICATIONS

Display	2 x 4 digits, green, height: 10 and 7 mm (1600V); 20 and 13 mm (1800V)
Keys	5 mechanical keys (•,Man/Aut, INC, DEC, F)
Accuracy	0.2% full scale at 25°C room temperature
Main input	TC, RTD (Pt100 - JPT100), PTC, 60mV, Ri ≥ 1MΩ; 10V, Ri ≥ 10KΩ; 20mA, Ri = 50Ω
Thermocouples	IEC 584-1 (J, K, R, S, T, B, E, N, Ni-Ni18Mo, L NiCr-CuNi)
Cold junction error	0,1° / °C
RTD type (scale configurable within indicated range, with or without decimal point)	DIN 43760 (Pt100, JPT100)
PTC type (on request)	990Ω, 25°C
Max line resistance for RTD	20Ω
Safety	detection of short-circuit or opening of probes, LBA alarm, HB alarm
°C / °F selection	configurable from faceplate
Linear scale ranges	-1999 to 9999 with configurable decimal point position
Controls	PID, Self-tuning, on-off
pb / dt / di	0.0 ... 999.9% / 0.00 ... 99.99min / 0.00 ... 99.99min
Action	Heat / Cool
Control outputs	on / off, pwm, Open / Close
Cycle time	0.1 ... 200 sec
Main output type	Relay, Logic, Continuous (optional)
Softstart	0.0 ... 500.0 min
Maximum power limit heat / cool	0.0 ... 100.0 %
Fault power setting	-100.0 ... 100.0 %
Automatic blanking	Optional exclusion, displays PV value
Configurable alarms	3 configurable alarms type: max, min, symmetrical, absolute or relative, LBA, HB
Alarm masking	- exclusion during warm up - latching reset from faceplate or external contact
Type of relay contact	NO (NC), 5A, 250V, cosφ = 1
Logic output for static relays	11Vdc, Rout = 220Ω (6V/20mA)
(option) remote Setpoint or Amperometric input Feedback input Potentiometer valve position	0 ... 10V, 2 ... 10V, Ri ≥ 1MΩ 0 ... 20mA, 4 ... 20mA, Ri = 5Ω Potentiometer > 500Ω, TA 50mAac, 50/60Hz, Ri = 1,5Ω, isolation 1500V
CT scale range	configurable from 0, ... , 100.0A
Transmitter power supply (optional)	filtered 10 / 24Vdc, max 30mA short-circuit protection, isolation 1500V
Analogue retransmission signal (opt)	10V / 20mA, isolation 1500V
Logic inputs (optional)	24V NPN, 4.5mA; 24V PNP, 3.6mA isol. 1500V
Serial interface (optional)	CL; RS422/485; RS232; isolation 1500V
Baud rate	1200 ... 19200
Protocol	MODBUS
Power supply (switching type)	(std) 100 ... 240Vac/dc ±10%; 50/60Hz, 18VA max (opt.) 20...27Vac/dc ±10%; 50/60Hz, 12VA max
Faceplate protection	IP65
Working / Storage temperature range	0...50°C / -20...70°C
Relative humidity	20 ... 85% non-condensing
Environmental conditions of use	for internal use only, altitude up to 2000m
Installation	Panel, plug-in from front
Weight	400g (1600V), 600g (1800V) for the complete version

EMC conformity has been tested with the following connections

FUNCTION	CABLE TYPE	LENGTH
Power supply cable	1 mm²	1 m
Relay output cable	1 mm²	3,5 m
Digital communication wires	0,35 mm²	3,5 m
C.T. connection cable	1,5 mm²	3,5 m
TC input	0,8 mm² compensated	5 m
Pt100 input	1 mm²	3 m

3 • DESCRIPTION OF FACEPLATE

Function indicators
Indicates modes of operation
MAN = OFF (Automatic control)
MAN = ON (Manual control)
AUX = OFF (IN1 = OFF - local Setpoint 1)
AUX = ON (IN1 = ON - local Setpoint 2)
REM = OFF (local Setpoint)
REM = ON (remote Setpoint)

"Raise" and "Lower" key
Press to increment (decrement) any numerical parameter •• Increment (decrement) speed is proportional to time key stays pressed •• The operation is not cyclic: once the maximum (minimum) value of a field is reached, the value will not change even if the key remains pressed.

M/A key
Function defined with butt parameter

Indication of output states
OUT 1 (Open); OUT 2 (Close);
OUT 3 (AL 1); OUT 4 (HB)

PV Display: Indication of process variable
Error Indication: LO, HI, Sbr, Err
LO= the value of process variable is < di LO_S
HI= the value of process variable is > di HI_S
Sbr= faulty sensor or input values higher than max. limits
Err= PT100 third wire opened for PT100, PTC or input values lower than min. limits (i.e.: TC wrong connection)

SV display: Indication of setpoint

Bargraph: Percentage display for variable defined with bArG parameter

Function key
Gives access to the various configuration phases •• Confirms change of set parameters and browses next or previous parameter (if Auto/Man key is pressed)

Key "":*
Function defined with but.2 parameter

4 • CONNECTIONS

• Power Supply

PWR
~ 12
~ 13

Standard:
100...240Vac/Vdc ±10%

Optional:
20...27Vac/Vdc ±10%

50/60Hz

• Outputs

+W2 33
+W1 32
0V 31

User configurable generic output

- analogue output isolated to 1500V (0 ... 10V, 0 ... 20mA, 4 ... 20mA)

User configurable generic output

- 5A/250Vac relay, cosφ=1
- 11Vdc logic, Rout=220Ω (6V/20mA)

11 -
Out4 (AL2 / HB)
10 +

• Outputs

Out1 (Open): (-) NC 14, C 15, (+) NO 16
Out2 (Close): (-) NC 17, C 18, (+) NO 19
Out3 (AL1): (-) NC 20, C 21, (+) NO 22

User configurable generic output

- 5A/250Vac relay, cosφ=1
- 11Vdc logic, Rout=220Ω (6V/20mA)

• Transmitter supply

Transmitter supply isolated 1500V

10/24Vdc, max. 30mA short-circuit protection

9 + Vt
5 GND

• Digital inputs

Digital inputs isolated 1500V
- NPN 24V, 4,5mA
- PNP 24V, 3,6mA
(12V, 1,2mA)

8 IN2
7 IN1
5 COM

• Auxiliary input

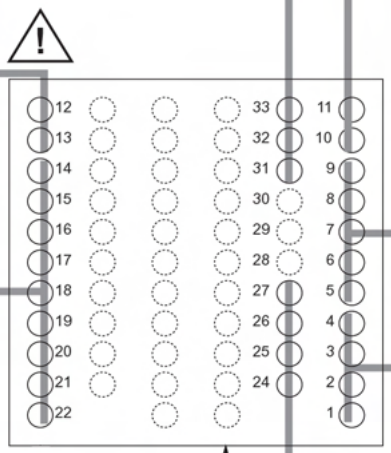
Auxiliary input isolated 1500V

Current transformer 50mAac; 1,5Ω; 50/60Hz

Remote setpoint 0...20mA, 4...20mA, 5Ω, 0...1V, 0...10V,> 1MΩ

Potentiometer > 500Ω

9 +Vt +10V
6 ~ +
Pot
5 GND ~ -



• Serial line

Configurable serial line isolated to 1500V
RS422/485 or RS232
Passive current loop (max. 1200 baud) (optional R60 special version)

27 - Tx
26 +
25 - Rx
24 +

A (Data +)
B (Data -)
RS485 2-wires
Tx
GND
Rx
RS232

• Inputs

Available thermocouples: J, K, R, S, T, B, E, N, Ni-Ni18Mo, L NiCr-CuNi

- Observe polarities
- For extensions, use the correct compensating cable for the type of TC used

• TC

2 -
1 +

• Linear (V)

Linear input in dc voltage 0...50mV, 10...50mV, 0...10V, 2...10V

2 -
1 +

• Linear (I)

Linear input in dc current 0...20mA, 4...20mA

4
2 -
1 +

• Pt100 2 wires o PTC

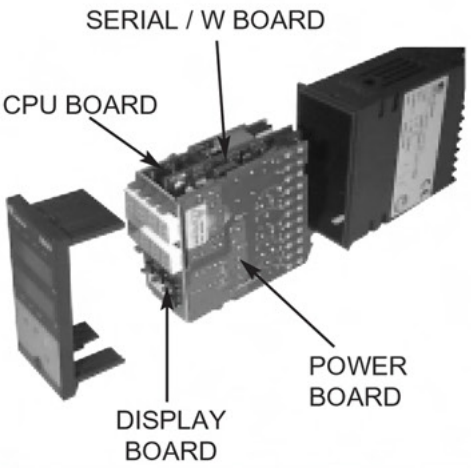
Use wires of adequate diameter (min. 1mm²) PT100, JPT100, PTC

3
2 T
1

• Pt100 3 wires

3
2 T
1

Device structure: identification of boards



5 • PROGRAMMING and CONFIGURATION

LEVEL 1 MENU

P.V. / S.V.	Process variable (PV display) Work Setpoint (SV display) or control output value with regulator in manual	
_SP_ (1)	Local Setpoint	
_SP.1 (212)	Setpoint 1	
_SP.2 (213)	Setpoint 2	
_SP.3 (214)	Setpoint 3	
_SP.4 (215)	Setpoint 4	
__t5 (217)	Limit value of timer 0...9999 sec	
InP.2 (2)	Amperometric input value or remote Setpoint (with auxiliary input enabled)	(*)
_AL.1 (3)	Alarm point 1 (scale points)	
_AL.2 (4)	Alarm point 2 (scale points)	
_AL.3 (5)	Alarm point 3 (scale points)	
AL.Hb (6)	Heater break alarm point (scale points of ammeter input)	
Out.P (7)	Control output value (+Heat / -Cool)	(*)

(*) The automatic return *PV/SV* display is disabled for these displays

If Inc, Dec, F keys are not pressed within 30 sec, display returns automatically to PV/SV value. All INFO and dAtA data on config menu remain displayed and are not timed.

F — Press for approx. 2 sec

INFO	Information display
dAtA	Custom menu
CFG	Control parameters
SEr	Serial communications
InP	Input settings
Out	Output settings

S3 = ON? NO / YES

PASS	Password

PASS = 99? NO / YES

Prot	Protection code
Hrd	Hardware configuration
Lin	Input linearization
CuSt	"dAtA" menu setting
U.CAL	User calibration

S4 = ON? NO / YES

_CAL	Select calibration menu [0...12]

Keep the F key pressed to scroll the menus

Release the F key to select the displayed menu

Press the F key to access the parameters

Keep the F key pressed to exit any menu

Keep F + Auto/Man keys pressed for 2 sec. on any menu to go immediately to level 1 display

N.B.: Once a particular configuration is entered, all unnecessary parameters are no longer displayed

• InFo Display

INFO — Information display — 8

CodE — Serial communication code — 9

UPdt — Software version — 10

Prot — Software protection code — 11

Er.nr — Self diagnostic error code — 12

0	No Error
1	Lo
2	Hi
3	ERR
4	SBR

• CFG

CFG — Control parameters

S.tun — Enabling self-tuning, autotuning, softstart — 15

S.tun	Continuous autotuning	Self-tuning	Softstart
0	NO	NO	NO
1	YES	NO	NO
2	NO	YES	NO
3	YES	YES	NO
4	NO	NO	YES
5	YES	NO	YES
6	-	-	-
7	-	-	-
8	WAIT	NO	NO
9	GO	NO	NO
10	WAIT	YES	NO
11	GO	YES	NO
12	WAIT	NO	YES
13	GO	NO	YES

h_Pb — Proportional band for heating or hysteresis on ON-OFF action — 0.0 … 999.9% full scale — 16

h_it — Integral time for heating — 0.00 ... 99.99 min — 17

h_dt — Derivative time for heating — 0.00 ... 99.99 min — 18

h.P.Hi — Maximum power limit for heating — 0.0 ... 100.0% — 19

h.P.Lo — Minimum power limit for heating (not available for double heat/cool action) — 0.0 ... 100.0% — 254

C.MEd — Cooling medium — 0 ... 2 — 97

C.MEd		Relative gain (Rg) (see applicable note)
0	Air	1
1	Oil	0,8
2	Water	0,4

c.SP.o — Setpoint for cooling relative to heating setpoint — ± 25.0% f.s. — 20

c_Pb — Proportional band for cooling or hysteresis for ON/OFF control — 0.0 … 999.9% full scale — 21

c_it — Integral time for cooling — 0.00 ... 99.99 min — 22

c_dt — Derivative time for cooling — 0.00 ... 99.99 min — 23

c.P.Hi — Maximum power limit for cooling — 0.0 ... 100.0% — 24

c.P.Lo — Minimum power limit for cooling (not available for heating/cooling double action) — 0.0 ... 100.0% — 255

_rSt — Manual reset — -999 … 999 scale points — 25

P.rSt — Reset power — -100.0 ... 100.0% — 26

A.rSt — Antireset — 0 ... 9999 scale points — 27

_FFd — Feedforward — -100.0 ... 100.0% — 28

SoFt — Softstart time — 0.0 ... 500.0 min — 29

HyS.1 — Alarm 1 hysteresis — ± 999 scale points — 30

HyS.2 — Alarm 2 hysteresis — ± 999 scale points — 31

HyS.3 — Alarm 3 hysteresis — ± 999 scale points — 32

Hb_t — Waiting time for HB alarm intervention — 0 ... 999 seconds — 33

(Value has to be higher than cycle time value of output to which HB alarm is assigned)

LbAt — Waiting time for LBA alarm intervention (Set to "0" to disable LBA alarm) — 0.0 ... 500.0 min (*) — 34

LbAP — Power limit for LBA alarm condition — -100.0 ... 100.0% ON / OFF (*) — 35

FAC.P — Power output in fault condition (when probe is faulty) — -100.0 ... 100.0% ON / OFF — 36

Gr.SP — Set gradient (see applicable note) — 0.0...999.9 digit/min. (digit / sec see SP.ty) — 216

-At- — Actuator travel time (time employed by the valve to change from entirely open to entirely closed) — 0 ... 2000 sec — 207

t_Lo — Impulse min. time/actuator travel time (useful to avoid excessive valve activity) — 0.0 ... 25.0% — 208

t_Hi — Impulsive intervention threshold as percentage of valve opening time — 0.0 ... 100.0% — 209

-db- — Dead zone which can be set as a percentage of the bottom of scale, symmetrical with respect to the set point (if the variable is within this band the valve is immobile and the integral action is blocked) Only for control of valve type V0, V1, V2 — 0.0 ... 25.0% f.s. — 210

(*) LBA alarm may be reset by simultaneously pressing $\Delta + \nabla$ keys when OutP is displayed or by switching to Manual.

Note:
h_Pb, h_it, h_dt, h.P.Hi, hPLo, c_Pb, c_it, c_dt, c.P.Hi, c.P.Lo parameters are "read only" if the option "control parameter groups" has been selected (showing current values)
c_Pb, c_it, c_dt parameters are "read only" if the option "relative gain heat/cool control" (Ctrl = 14) has been selected.

• Ser

Ser — Serial communications

CodE (38) — Unit identification code for serial communication (if enabled) [see "hrd.1" in Hrd] — 0 ... 9999

SEr.P (39) — Serial interface protocol CENCAL, MODBUS

SEr.P	Serial protocol
0	CENCAL
1	MODBUS RTU

bAud (40) — Select Baudrate

bAud	Baudrate	CENCAL Interface	MODBUS Interface
0	1200	485 / 232	485
1	2400	485 / 232	485
2	4800	485 / 232	485
3	9600	485 / 232	485
4	19200	485 / 232	485

_PAr (101) — Parity selection

PAr	Parity
0	No parity
1	Odd
2	Even

• InP

InP — Input settings

SP.tY (44) — Setpoint type: LOC/REM, Select type of remote setpoint [0...7]

SP.tY	Type of remote setpoint	Absolute Relative
0	analogue (InP.2)	absolute
1	analogue (InP.2)	relative to local setpoint
2	digital (from serial line)	absolute
3	digital (from serial line)	relative to local setpoint

+4 set gradient in digit / sec

tYPE (45) — Probe type, signal, enable custom linearization, and main input scale

PROBE:TC (SEnS=0)

tYPE	Probe type	Scale (C/F)	Scale range max. without decimal point	Scale range max. with decimal point
0	J (Fe-CuNi)	C	0 / 1000	0.0 / 999.9
1	J (Fe-CuNi)	F	32 / 1832	32.0 / 999.9
2	K (NiCr-Ni)	C	0 / 1300	0.0 / 999.9
3	K (NiCr-Ni)	F	32 / 2372	32.0 / 999.9
4	R (Pt13Rh - Pt)	C	0 / 1750	not available
5	R (Pt13Rh - Pt)	F	32 / 3182	not available
6	S (Pt10Rh - Pt)	C	0 / 1750	not available
7	S (Pt10Rh - Pt)	F	32 / 3182	not available
8	T (Cu-CuNi)	C	-200 / 400	-199.9 / 400.0
9	T (Cu-CuNi)	F	-328 / 752	-199.9 / 752.0
10	B (Pt30Rh - Pt6Rh)	C	44 / 1800	not available
11	B (Pt30Rh - Pt6Rh)	F	111 / 3272	not available
12	E (NiCr-CuNi)	C	-100 / 750	-100.0 / 750.0
13	E (NiCr-CuNi)	F	-148 / 1382	-148.0 / 999.9
14	N (NiCrSi-NiSi)	C	0 / 1300	0.0 / 999.9
15	N (NiCrSi-NiSi)	F	32 / 2372	32.0 / 999.9
16	(Ni - Ni18Mo)	C	0 / 1100	0.0 / 999.9
17	(Ni - Ni18Mo)	F	32 / 2012	32.0 / 999.9
18	L - GOST (NiCr-CuNi)	C	0 / 600	0.0 / 600.0
19	L - GOST (NiCr-CuNi)	F	32 / 1112	32.0 / 999.9
20	TC	C	custom scale	(*)
21	TC	F	custom scale	(*)

PROBE: RTD 3 wires (SEnS=1)

tYPE	Probe type	Scale (C/F)	Scale range max. without decimal point	Scale range max. with decimal point
0	PT100	C	-200 / 850	-199.9 / 850.0
1	PT100	F	-328 / 1562	-199.9 / 999.9
2	JPT100 (JIS C 1609/81)	C	-200 / 600	-199.9 / 600.0
3	JPT100 (JIS C 1609/81)	F	-328 / 1112	-199.9 / 999.9
4	RTD	C	custom scale	(*)
5	RTD	F	custom scale	(*)

PROBE: PTC (SEnS=2) — on request, instead of RTD 3 wires

tYPE	Probe type	Scale (C/F)	Scale range max. without decimal point	Scale range max. with decimal point
0	PTC 990Ω	C	-55 ... 120	-55.0 ... 120.0
1	PTC 990Ω	F	-67 ... 248	-67.0 ... 248.0
2	PTC 990Ω	C	custom scale	(*)
3	PTC 990Ω	F	custom scale	(*)

PROBE: VOLTAGE 50mV (SEnS=3)

tYPE	Signal type	Scale	Scale range max.
0	0...50mV	linear	-1999 / 9999
1	0...50mV	custom linear	see table 32 values in Lin
2	10...50mV	linear	-1999 / 9999
3	10...50mV	custom linear	see table 32 values in Lin

PROBE: CURRENT 20mA or TRANSMITTER (SEnS=4)

tYPE	Signal type	Scale	Scale range max.
0	0...20mA	linear	-1999 / 9999
1	0...20mA	custom linear	see table 32 values in Lin
2	4...20mA	linear	-1999 / 9999
3	4...20mA	lineare custom	see table 32 values in Lin

PROBE: VOLTAGE 10V or TRANSMITTER (SEnS=5)

tYPE	Signal type	Scale	Scale range max.
0	0...10V	linear	-1999 / 9999
1	0...10V	custom linear	see table 32 values in Lin
2	2...10V	linear	-1999 / 9999
3	2...10V	custom linear	see table 32 values in Lin

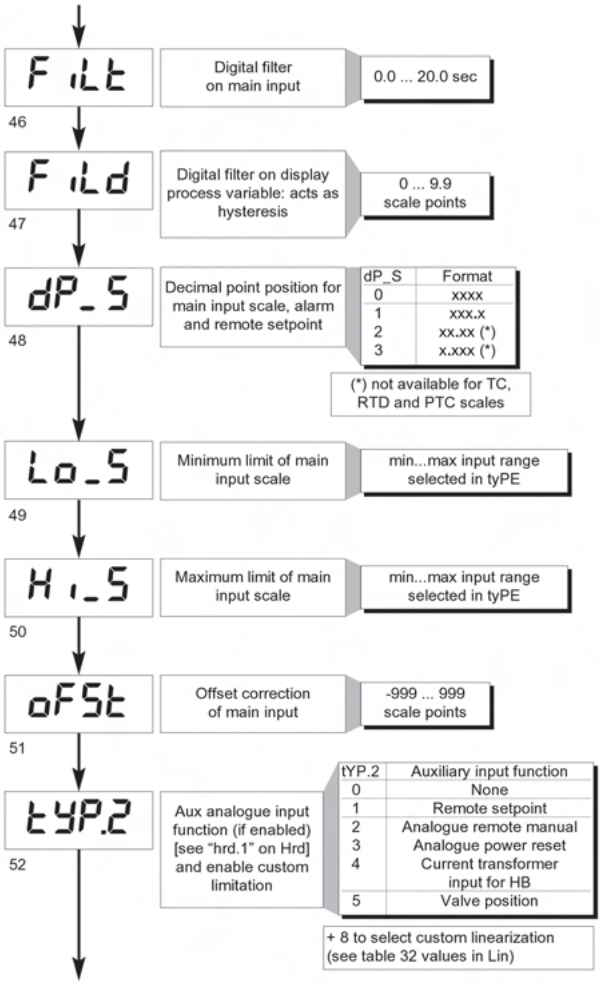
PROBE: CUSTOM 10V (SEnS=6)

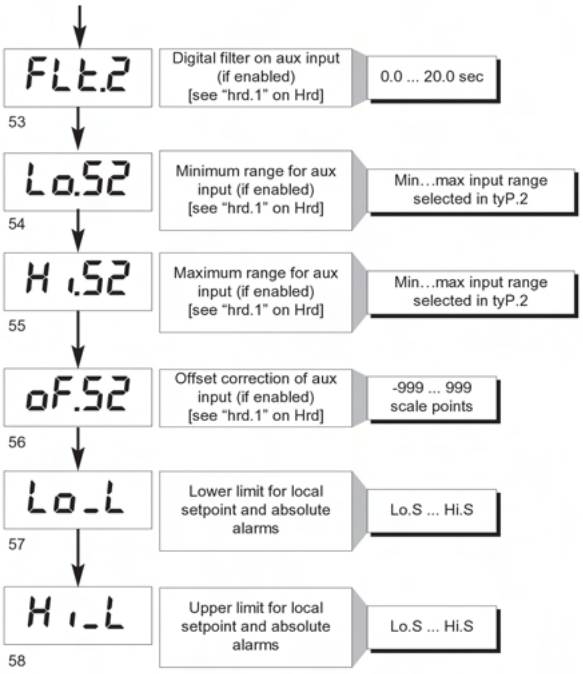
tYPE	Signal type	Scale	Scale range max.
0	Custom 0...10V	linear	-1999 / 9999
1	Custom 0...10V	custom linear	see table 32 values in Lin

PROBE: CUSTOM 50mV, 20mA (SEnS=7)

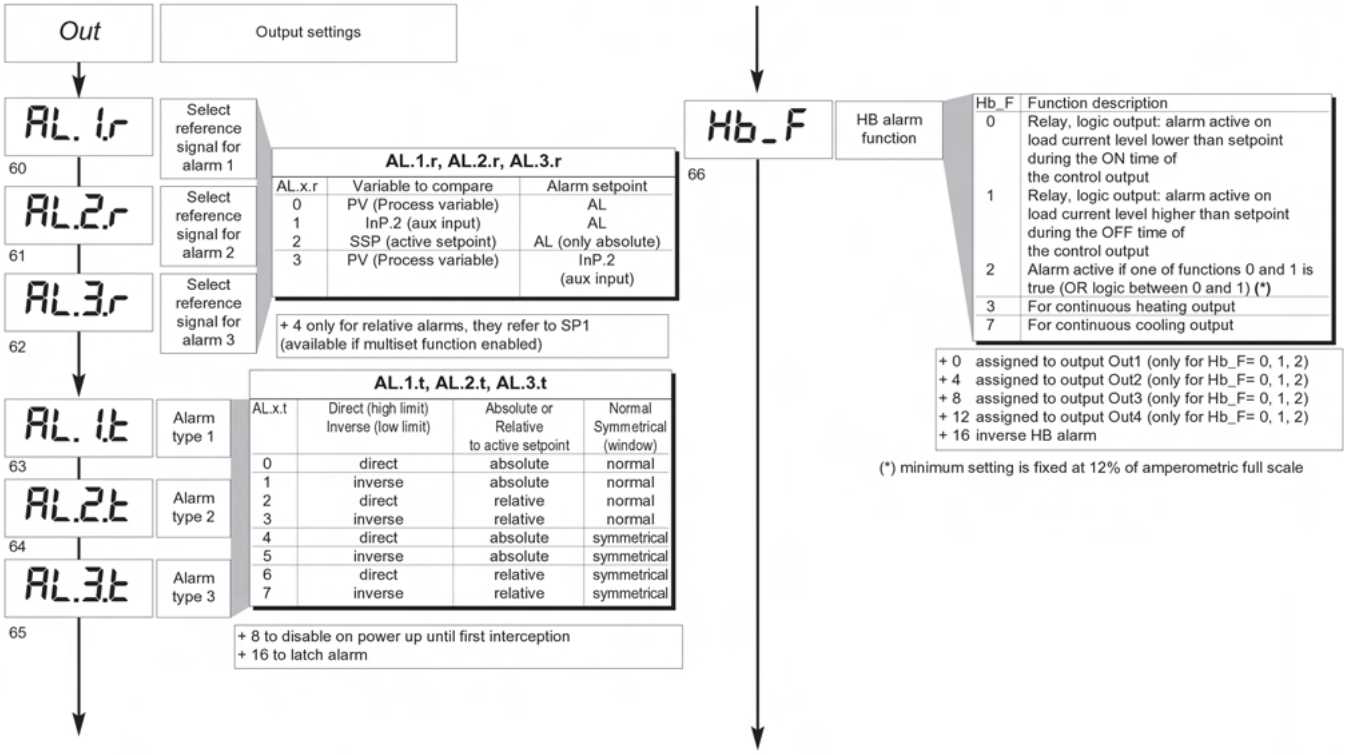
tYPE	Signal type	Scale	Scale range max.
0	Custom	lineare	-1999 / 9999
1	Custom	custom linear	see table 32 values in Lin

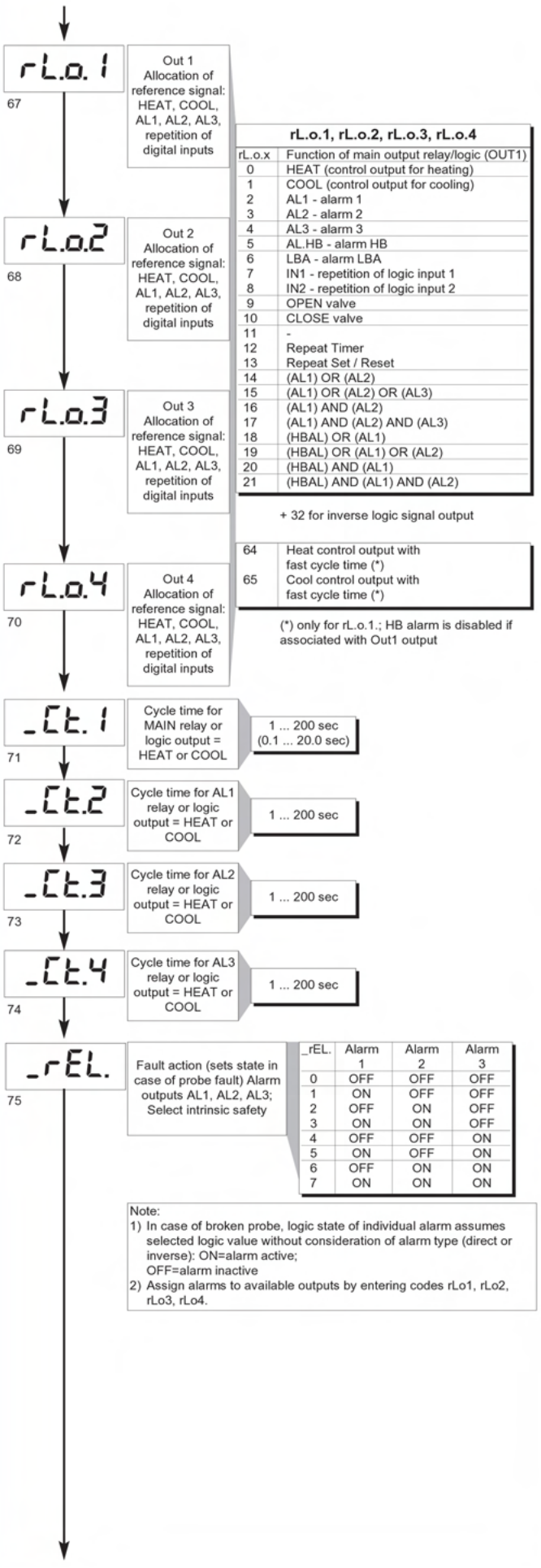
(*) Linearization and scale limit settings (with or without decimal point) are selectable from PC via serial line

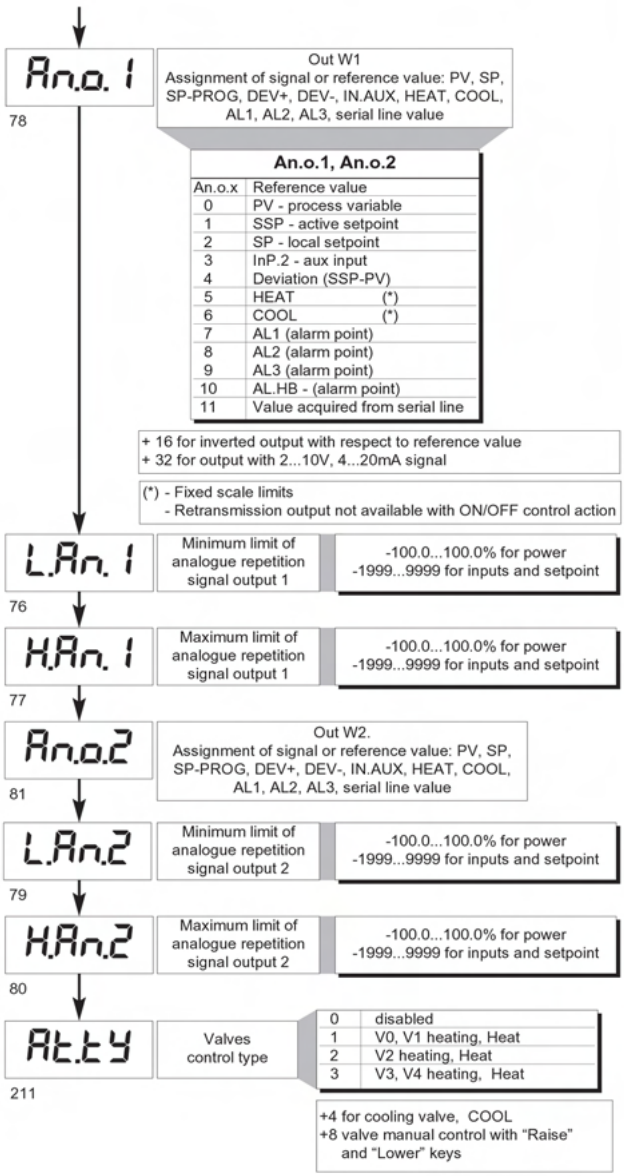

FiLt
Digital filter on main input
0.0 ... 20.0 sec
46
FiLd
Digital filter on display process variable: acts as hysteresis
0 ... 9.9 scale points
47
dP_S
Decimal point position for main input scale, alarm and remote setpoint
dP_S | Format
0 | xxxx
1 | xxx.x
2 | xx.xx (*)
3 | x.xxx (*)
(*) not available for TC, RTD and PTC scales
48
Lo_S
Minimum limit of main input scale
min...max input range selected in tyPE
49
Hi_S
Maximum limit of main input scale
min...max input range selected in tyPE
50
oFSt
Offset correction of main input
-999 ... 999 scale points
51
tYP.2
Aux analogue input function (if enabled) [see "hrd.1" on Hrd] and enable custom limitation
tYP.2 | Auxiliary input function
0 | None
1 | Remote setpoint
2 | Analogue remote manual
3 | Analogue power reset
4 | Current transformer input for HB
5 | Valve position
+ 8 to select custom linearization (see table 32 values in Lin)
52


FLt.2
Digital filter on aux input (if enabled) [see "hrd.1" on Hrd]
0.0 ... 20.0 sec
53
Lo.S2
Minimum range for aux input (if enabled) [see "hrd.1" on Hrd]
Min…max input range selected in tyP.2
54
Hi.S2
Maximum range for aux input (if enabled) [see "hrd.1" on Hrd]
Min…max input range selected in tyP.2
55
oF.S2
Offset correction of aux input (if enabled) [see "hrd.1" on Hrd]
-999 ... 999 scale points
56
Lo_L
Lower limit for local setpoint and absolute alarms
Lo.S ... Hi.S
57
Hi_L
Upper limit for local setpoint and absolute alarms
Lo.S ... Hi.S
58

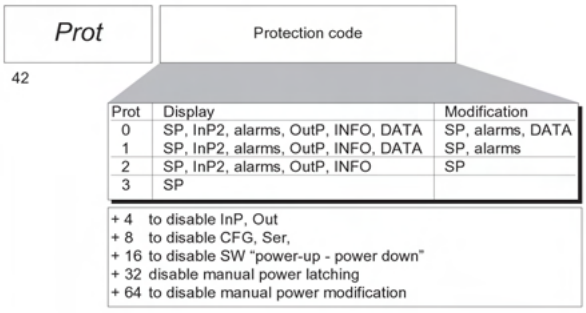
• Out


Out
Output settings
AL.1r
Select reference signal for alarm 1
60
AL.2r
Select reference signal for alarm 2
61
AL.3r
Select reference signal for alarm 3
62
AL.x.r | Variable to compare | Alarm setpoint
0 | PV (Process variable) | AL
1 | InP.2 (aux input) | AL
2 | SSP (active setpoint) | AL (only absolute)
3 | PV (Process variable) | InP.2 (aux input)
+ 4 only for relative alarms, they refer to SP1 (available if multiset function enabled)
AL.1t
Alarm type 1
63
AL.2t
Alarm type 2
64
AL.3t
Alarm type 3
65
AL.x.t | Direct (high limit) Inverse (low limit) | Absolute or Relative to active setpoint | Normal Symmetrical (window)
0 | direct | absolute | normal
1 | inverse | absolute | normal
2 | direct | relative | normal
3 | inverse | relative | normal
4 | direct | absolute | symmetrical
5 | inverse | absolute | symmetrical
6 | direct | relative | symmetrical
7 | inverse | relative | symmetrical
+ 8 to disable on power up until first interception
+ 16 to latch alarm
Hb_F
HB alarm function
66
Hb_F | Function description
0 | Relay, logic output: alarm active on load current level lower than setpoint during the ON time of the control output
1 | Relay, logic output: alarm active on load current level higher than setpoint during the OFF time of the control output
2 | Alarm active if one of functions 0 and 1 is true (OR logic between 0 and 1) (*)
3 | For continuous heating output
7 | For continuous cooling output
+ 0 assigned to output Out1 (only for Hb_F= 0, 1, 2)
+ 4 assigned to output Out2 (only for Hb_F= 0, 1, 2)
+ 8 assigned to output Out3 (only for Hb_F= 0, 1, 2)
+ 12 assigned to output Out4 (only for Hb_F= 0, 1, 2)
+ 16 inverse HB alarm
(*) minimum setting is fixed at 12% of amperometric full scale


rL.o.1
67
Out 1 Allocation of reference signal: HEAT, COOL, AL1, AL2, AL3, repetition of digital inputs
rL.o.2
68
Out 2 Allocation of reference signal: HEAT, COOL, AL1, AL2, AL3, repetition of digital inputs
rL.o.3
69
Out 3 Allocation of reference signal: HEAT, COOL, AL1, AL2, AL3, repetition of digital inputs
rL.o.4
70
Out 4 Allocation of reference signal: HEAT, COOL, AL1, AL2, AL3, repetition of digital inputs
rL.o.1, rL.o.2, rL.o.3, rL.o.4
rL.o.x Function of main output relay/logic (OUT1)
0 HEAT (control output for heating)
1 COOL (control output for cooling)
2 AL1 - alarm 1
3 AL2 - alarm 2
4 AL3 - alarm 3
5 AL.HB - alarm HB
6 LBA - alarm LBA
7 IN1 - repetition of logic input 1
8 IN2 - repetition of logic input 2
9 OPEN valve
10 CLOSE valve
11 -
12 Repeat Timer
13 Repeat Set / Reset
14 (AL1) OR (AL2)
15 (AL1) OR (AL2) OR (AL3)
16 (AL1) AND (AL2)
17 (AL1) AND (AL2) AND (AL3)
18 (HBAL) OR (AL1)
19 (HBAL) OR (AL1) OR (AL2)
20 (HBAL) AND (AL1)
21 (HBAL) AND (AL1) AND (AL2)
+ 32 for inverse logic signal output
64 Heat control output with fast cycle time (*)
65 Cool control output with fast cycle time (*)
(*) only for rL.o.1.; HB alarm is disabled if associated with Out1 output
_Ct.1
71
Cycle time for MAIN relay or logic output = HEAT or COOL
1 ... 200 sec (0.1 ... 20.0 sec)
_Ct.2
72
Cycle time for AL1 relay or logic output = HEAT or COOL
1 ... 200 sec
_Ct.3
73
Cycle time for AL2 relay or logic output = HEAT or COOL
1 ... 200 sec
_Ct.4
74
Cycle time for AL3 relay or logic output = HEAT or COOL
1 ... 200 sec
_rEL.
75
Fault action (sets state in case of probe fault) Alarm outputs AL1, AL2, AL3; Select intrinsic safety
_rEL. Alarm 1 Alarm 2 Alarm 3
0 OFF OFF OFF
1 ON OFF OFF
2 OFF ON OFF
3 ON ON OFF
4 OFF OFF ON
5 ON OFF ON
6 OFF ON ON
7 ON ON ON
Note:
1) In case of broken probe, logic state of individual alarm assumes selected logic value without consideration of alarm type (direct or inverse): ON=alarm active; OFF=alarm inactive
2) Assign alarms to available outputs by entering codes rLo1, rLo2, rLo3, rLo4.


An.o. 1
78
Out W1
Assignment of signal or reference value: PV, SP, SP-PROG, DEV+, DEV-, IN.AUX, HEAT, COOL, AL1, AL2, AL3, serial line value
An.o.1, An.o.2
An.o.x Reference value
0 PV - process variable
1 SSP - active setpoint
2 SP - local setpoint
3 InP.2 - aux input
4 Deviation (SSP-PV)
5 HEAT (*)
6 COOL (*)
7 AL1 (alarm point)
8 AL2 (alarm point)
9 AL3 (alarm point)
10 AL.HB - (alarm point)
11 Value acquired from serial line
+ 16 for inverted output with respect to reference value
+ 32 for output with 2...10V, 4...20mA signal
(*) - Fixed scale limits
- Retransmission output not available with ON/OFF control action
L.An. 1
76
Minimum limit of analogue repetition signal output 1
-100.0...100.0% for power
-1999...9999 for inputs and setpoint
H.An. 1
77
Maximum limit of analogue repetition signal output 1
-100.0...100.0% for power
-1999...9999 for inputs and setpoint
An.o.2
81
Out W2.
Assignment of signal or reference value: PV, SP, SP-PROG, DEV+, DEV-, IN.AUX, HEAT, COOL, AL1, AL2, AL3, serial line value
L.An2
79
Minimum limit of analogue repetition signal output 2
-100.0...100.0% for power
-1999...9999 for inputs and setpoint
H.An2
80
Maximum limit of analogue repetition signal output 2
-100.0...100.0% for power
-1999...9999 for inputs and setpoint
Ab.tY
211
Valves control type
0 disabled
1 V0, V1 heating, Heat
2 V2 heating, Heat
3 V3, V4 heating, Heat
+4 for cooling valve, COOL
+8 valve manual control with "Raise" and "Lower" keys

• Prot


Prot
42
Protection code
Prot Display Modification
0 SP, InP2, alarms, OutP, INFO, DATA SP, alarms, DATA
1 SP, InP2, alarms, OutP, INFO, DATA SP, alarms
2 SP, InP2, alarms, OutP, INFO SP
3 SP
+ 4 to disable InP, Out
+ 8 to disable CFG, Ser,
+ 16 to disable SW "power-up - power down"
+ 32 disable manual power latching
+ 64 to disable manual power modification

• Hrd

Hrd — Hardware configuration

hrd.1 — Auxiliary input installation, digital inputs, serial interface. Timer and multiset enabling

hrd.1	Aux analogue input	Logic input 1 (IN1)	Logic input 2 (IN2)	Serial interface
0				
1	x			
2		x		
3	x	x		
4			x	
5	x		x	
6		x	x	
7	x	x	x	
8				x
9	x			x
10		x		x
11	x	x		x
12			x	x
13	x		x	x
14		x	x	x
15	x	x	x	x

+16 to enable the Timer function
+32 to enable the Multiset function (2SP)
+64 to enable the Multiset function (4SP)

hrd.2 — Installation of relay, logic outputs MAIN, AL1, AL2, AL3, and analogue outputs W1, W2

hrd.2	OUT 1 (relay, logic)	OUT 2 (relay, logic)	OUT 3 (relay, logic)	OUT 4 (relay, logic)
0				
1	x			
2		x		
3	x	x		
4			x	
5	x		x	
6		x	x	
7	x	x	x	
8				x
9	x			x
10		x		x
11	x	x		x
12			x	x
13	x		x	x
14		x	x	x
15	x	x	x	x

+ 16 to enable analogue output W1
+ 32 to enable analogue output W2
+ 64 to invert state of LEDs compared to state of output

hrd.3 — " * " key and bargraph installation

hrd.3	Key "*"	Bargraph
0		
1	x	
2		x
3	x	x

CtrL — Control type [0...78]

CtrL	Control type
0	P heat
1	P cool
2	P heat / cool
3	PI heat
4	PI cool
5	PI heat / cool
6	PID heat
7	PID cool
8	PID heat / cool
9	ON-OFF heat
10	ON-OFF cool
11	ON-OFF heat / cool
12	PID heat + ON-OFF cool
13	ON-OFF heat + PID cool
14	PID heat + cool with relative gain (see C.MEd parameter)

Selection of derivative action sampling time:
+ 0 sample 1 sec.
+ 16 sample 2 sec.
+ 32 sample 8 sec.
+ 64 sample 240 msec.

Note: LbA alarm is not enabled with ON/OFF type control

_S.S.t. — Start / Stop Timer

_ _r.t. — Reset Timer (0 ... 15)

0	from enabled digital input
1	from AL1 ON
2	from AL2 ON
3	from AL3 ON
4	from ALHB ON
5	from serial line (address 0049H, bit 0)
6	from serial line (address 0049H, bit 1)
7	from keys

+8 inverse action

+16 Autoreset enabled (Stop = program reset) (only for _S.S.t. parameter)

SEnS — Selection of probe type for main input

SEnS	Probe type for main input
0	Thermocouple (TC)
1	Resistance Thermometer (RTD)
2	Thermistor (PTC)
3	Voltage 0...50mV / 10...50mV
4	Current 0...20mA / 4...20mA
5	Voltage 0...10V / 2...10V
6	Custom 10V
7	Custom max 50mV

+ 8 to enable main input curve 4 point correction (alternative to custom linearization).
See description in "Main Input Correction Function" section.
+16 to disable averaging filter on sampled value (available from software release 3.05)

Note: scale selection with "tYPE" code in InP.

SnS.2 — Selection of probe type for aux input

SnS.2	Signal
0	0 ... 1V
1	0.2 ... 1V
2	0 ... 10V
3	2 ... 10V
4	0 ... 20mA
5	4 ... 20mA
6	Potentiometer
7	TA 50mA ~

+ 8 to disable averaging filter on sampled value (available from software release 3.05)

AL.nr — Select number of enabled alarms

AL.nr	Alarm 1	Alarm 2	Alarm 3
0	disabled	disabled	disabled
1	enabled	disabled	disabled
2	disabled	enabled	disabled
3	enabled	enabled	disabled
4	disabled	disabled	enabled
5	enabled	disabled	enabled
6	disabled	enabled	enabled
7	enabled	enabled	enabled

+ 8 to enable HB alarm
+ 16 to enable LBA alarm

butt — Function of M/A keys

but.2 — Funzione tasto "*"

butt , but.2	
0	No function (key disenabled)
1	MAN / AUTO controller
2	LOC / REM
3	HOLD
4	Start / Stop selftuning
5	Start / Stop autotuning
6	Set / Reset outputs Out 1... Out 4
7	Alarms memory reset
8	SP1 / SP2 Selection
9	Integral contribution instantaneous zero setting
10	Start / Stop Timer (se S.S.t. = 7)
11	Reset Timer (se _rt = 7)

+ 16 disable function in configuration menu (butt)

d.i.F.1 — Function of digital input 1 (IN1)

d.i.F.2 — Function of digital input 2 (IN2)

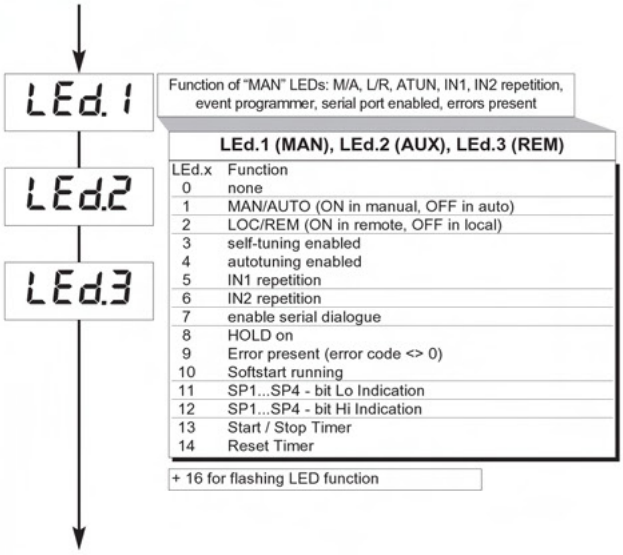
d.i.F.1, d.i.F.2	
0	No function (disabled input.)
1	MAN / AUTO controller
2	LOC / REM
3	HOLD
4	Start / Stop timer
5	Reset timer
6	Software on/off
7	Alarms memory reset
8	Selection SP1 ... SP2 (2SP) Selection SP1 ... SP4 - bit Lo
9	Selection SP1 ... SP4 - bit Hi

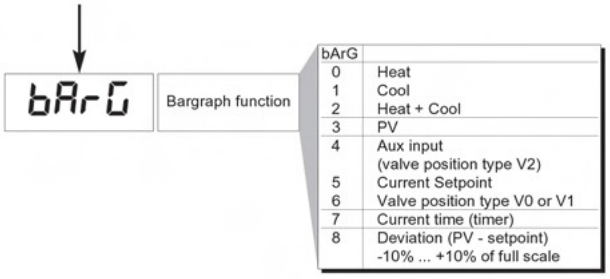
+ 16 for inverse logic input
+ 32 to force logic state 0 (OFF)
+ 48 to force logic state 1 (ON)

diSP — Defining SV display function

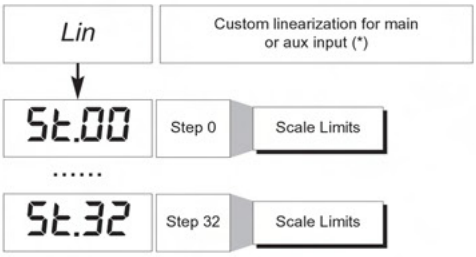
diSP	Lower display (SV) function
(*) 0	SSP - setpoint enabled
(*) 1	InP.2 - aux input
(*) 2	Control output value
(*) 3	Deviation (SSP - PV)
8	Visualisation of current time on PV display and tS time on SV display

(*) + 4 Timer in start



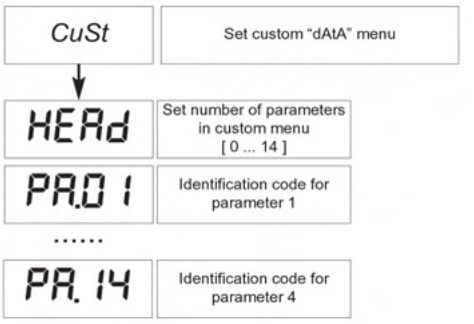


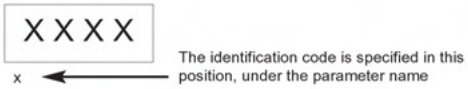
• Lin



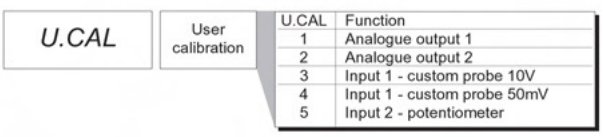
(*) Not available for :
enabled input correction function (SenS + 8)
TC custom input type (SenS = 0; tyPE = 20, 21)
RTD custom input type (SenS = 1; tyPE = 4, 5)
PTC custom input (SEnS = 2 ; tyPE = 2, 3)

• CuSt



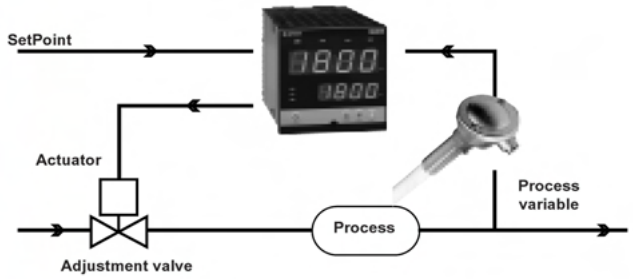


• U.CAL

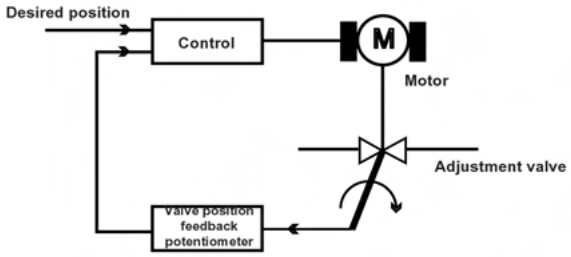


6 • ADJUSTMENT WITH MOTORIZED VALVE

In an adjustment process the adjustment valve has the function of varying fuel delivery (frequently corresponding to the thermal energy introduced into the process) in relation to the signal coming from the controller.
For this purpose it is provided with an actuator able to modify its opening value, overcoming the resistances produced by the fluid passing inside it.
The adjustment valves vary the delivery in a modulated manner, producing finite variations in the fluid passage inner area corresponding to finite variations of the actuator input signal, coming from the controller. The servomechanism, for example, comprises an electric motor, a reducer and a mechanical transmission system which actions the valve.
Various auxiliary components can be present such as the mechanical and electrical safety end travels, manual actioning systems, position location.



CONTROL EXAMPLE FOR V0 VALVE



VALVE POSITION CONTROL

The controller determines, on the basis of the dynamics of the process, the control output for the valve corresponding to the opening of the same in such a way so as to maintain the desired value of the process variable.
With counter-reaction valves the position is normally provided by a potentiometer assembled on the actuator.

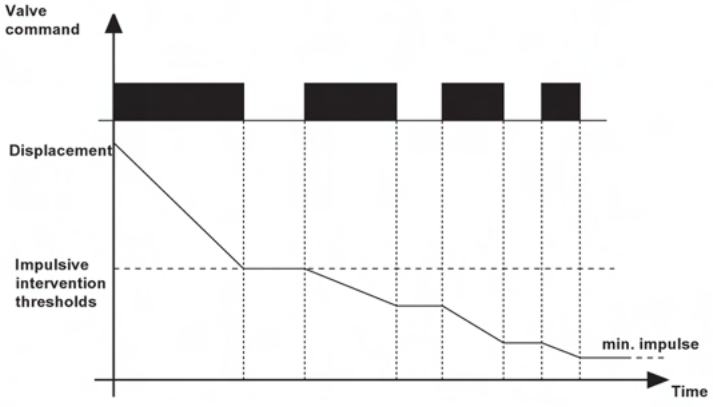
Characteristic parameters for valves control

- Actuator time (_At_) is the time employed by the valve to pass from entirely open to entirely closed (or vice-versa), and can be set with a resolution of one second.
It is a mechanical feature of the valve+actuator unit.
NOTE: if the actuator's travel is mechanically limited it is necessary to proportionally reduce the _At_ value.

- Minimum impulse (t_Lo) expressed as a % of the actuator time (resolution 0.1%).
This represents the minimum variation in position due to which the actuator does not physically respond to the command.
Increasing t_Lo reduces wear on the actuator with less precision in the positioning.

- Impulsive intervention threshold (t_Hi) expressed as a % of the actuator time (resolution 0.1%) represents the position displacement (requested position – real position) due to which the manoeuvre request becomes impulsive.
The duration of the impulses is proportional to the displacement and greater than or equal to t_Lo.
This type of modulated approach allows precise control of the feedback actioned valve, by a potentiometer or not, and is especially useful in cases of high mechanical inertia. Setting t_Hi = 0 excludes modulation in positioning.

VALVE CONTROL WITH IMPULSIVE MODULATED APPROACH, APPLICABLE ONLY TO FUNCTIONING TYPE V0, V1, V2.



- Dead zone (_db_) is a displacement band between the adjustment setpoint and the process variable within which the controller does not supply any command to the valve (Open = OFF; Close = OFF). It is expressed as a percentage of the bottom scale and is symmetrical with respect to the setpoint.
The dead zone is useful in an operative process to avoid straining the actuator with repeated commands and an insignificant effect on the adjustment. Setting _db_ = 0 the dead zone is excluded.

7 • VALVE CONTROL MODES

With the controller in manual, the setting of parameter At.ty ≥ 8 allows direct control of the valve open and close commands; the instrument indicates the presumed or real position (for type V2).

V0 - for floating valve without potentiometer;
V1 - for floating valve with potentiometer and display of position;
V2 - for valve with feedback from potentiometer and display of position.

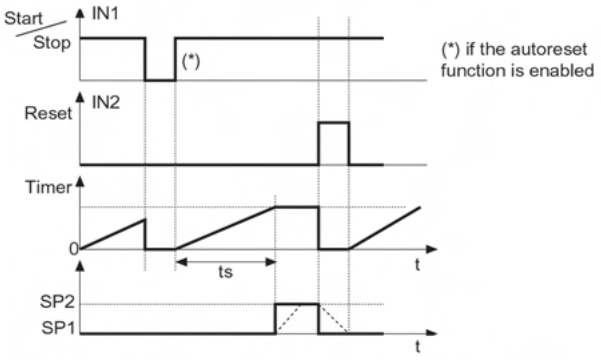
Models V0 and V1 have similar behaviour: every manoeuvre request greater than the minimum impulse is sent to the actuator by means of the OPEN/CLOSE relays; every action updates the presumed position of the virtual potentiometer calculated on the basis of the actuator travel declared time.
In this way there is always a presumed position of the valve which is compared with the position request of the controller.
Having reached a presumed extreme position (entirely open or entirely closed determined by the "virtual potentiometer") the controller provides a command in the same direction, in this way ensuring the real extreme position is reached.
The actuators are usually protected against the OPEN command in the entirely open position or CLOSE command in the entirely closed position.
The V2 model reads the real position of the valve by means of the auxiliary analogue input, expresses the value as a percentage (0.0 – 100.0%) and compares it with the position requested by the controller, then sends the appropriate command to the valve. The auxiliary input of the controller is used to obtain the valve position.
Calibration is requested to memorise the extreme position of the potentiometer, minimum and maximum.
The potentiometer is usually supplied by the controller itself.

V3 - for floating valve without display of position, PI control
V4 - for floating valve with display of position, PI control; the valve position from the potentiometer is only for viewing on the display and is not used in the adjustment.

When the difference between the position calculated by the controller and the only proportional component exceeds the value corresponding to the minimum impulse the controller provides an OPEN or CLOSE command of the duration of the minimum impulse itself.
At each delivery the integral component of the command is set to zero (discharge of the integral).
The frequency and duration of the impulses is correlated to the integral time (_ti_).

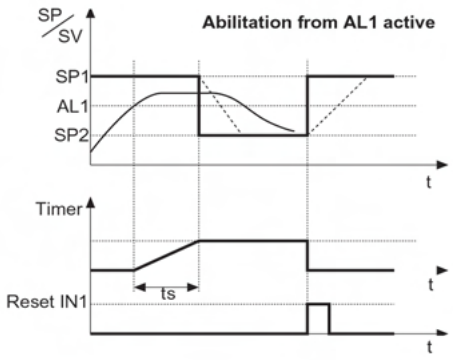
8 • TIMER + 2 SET POINT, TIMER FUNCTION

The timer functionality is enabled in **Hrd** configuration in hrd.1 parameter setting the code +16 or +48 to activate the selection of two set points.
In the case of enabling, parameters **_S.S.t.** (start/stop timer) and _ **_r.t.** (reset timer) define the functioning modality.
The intervention threshold of the tS timer can be set at level 1 of programming with bottom of scale 9999 sec.
The enabling to the timer, as also the reset condition, can occur due to external contact or alarm conditions (AL1, AL2, AL3, ALHb).
The reset function, always active on the status, zero sets the value of the timer and keeps it blocked even if the start is present.
In the absence of enabling (stop) the autoreset condition can be active for which the timer zero sets at each stop.
It is possible to make the timer visible on the SV display during the active counting phase as specified by the diSP parameter.
On reaching the preset time (tS), it is possible to activate a relay of the four available or select set point 2.



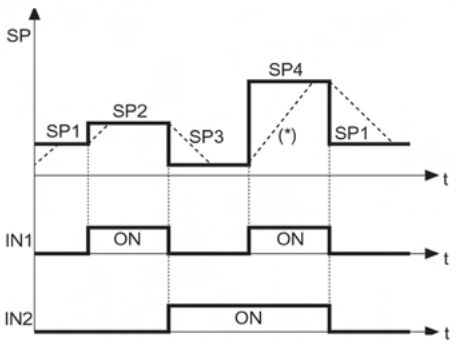
(*) if the autoreset function is enabled

the passage between SP1 and SP2 occurs on the basis of the GrSP value setpoint gradient (0=immediate passage)



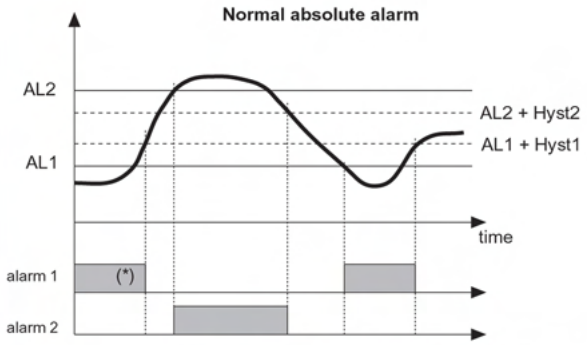
9 • MULTISET FUNCTION, SET GRADIENT

The function is enabled in Hrd configuration in the parameter hrd.1 setting code +64. It allows the setting of n°4 set points which can be selected by means of combinations of digital inputs (IN1, IN2).
The selection between set point 1 and set point 2 can also be carried out by means of front key.
It is possible to visualise the selection between set point 1 / 2 using leds.
SET GRADIENT: if set ≠ 0, when switching on and during the auto/man passage the set point is assumed to be equal to PV, with gradient set it reaches the local set or that selected.
Every set variation is subject to gradient. The set gradient is inhibited on switching on when the self tuning is enabled.
If the set gradient is set ≠ 0, this is active even on local setpoint variations, which can be set only in the relative SP menu.
The adjustment setpoint reaches the value set with a speed defined by the gradient.

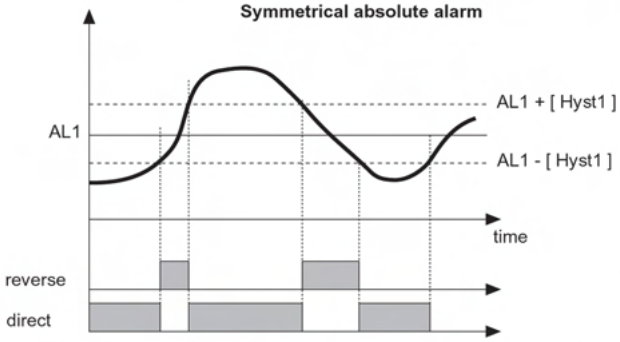


(*) in the case of set gradient

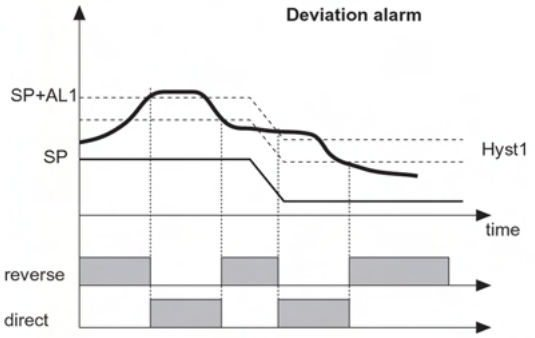
10 • ALARMS



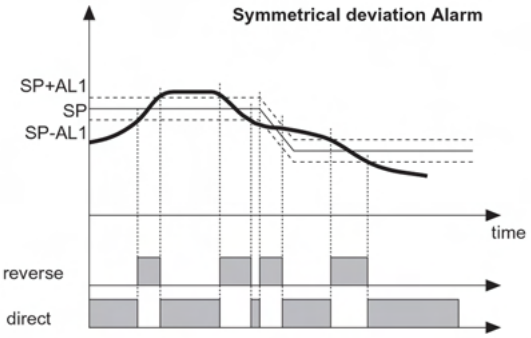
For AL1 = reverse absolute alarm (low) with positive Hyst1, AL1 t = 1
(*) = OFF if disabled on power-up
For AL2 = direct absolute alarm (high) with negative Hyst2, AL2 t = 0



For AL1 = symmetrical Lo absolute alarm with Hyst1, AL1 t = 5
For AL1 = symmetrical Hi absolute alarm with Hyst1, AL1 t = 4



For AL1 = Lo deviation alarm with negative Hyst 1, AL1 t = 3
For AL1 = Hi deviation alarm with negative Hyst 1, AL1 t = 2



For AL1 = Symmetrical Lo deviation alarm with Hyst 1, AL1 t = 7
For AL1 = Symmetrical Hi deviation alarm with Hyst 1, AL1 t = 6

HB ALARM

This type of alarm requires use of a current transformer input (CT).
It can indicate variations of load current measured through transformer input in the range (Lo.S2 ... HI.S2).
It is enabled by means of configuration code (Hrd, AL.nr); in this case the alarm setpoint is expressed as HB scale points.
The alarm function and the assigned control output are selected through parameter Hb_F (“Out” phase).
The alarm setpoint is AL.Hb.
The direct HB alarm trips if current transformer input falls below the setpoint for Hb_t seconds of ON time for the selected output.
The HB alarm can be activated only with ON times exceeding 0.4 seconds.
The HB alarm monitors load current even during the OFF period of the cycle time of the selected output.
The HB alarm will trip if measured current exceeds 12% of the CT input full scale for Hb_t seconds when the output is in OFF state.
The alarm is reset automatically when alarm conditions have been cleared.
If AL.Hb is set at = 0, both types of HB alarm are disabled and the assigned relay is de-energized.
The load current reading is displayed by selecting InP2 (level 1).
NOTE: ON/OFF times refer to the cycle time set for the selected output.
Alarm Hb_F = 3 (7), for analog output is ON when the load current is lower than the alarm setpoint; the alarm is disabled if the heating (cooling) output is lower than 2%.

LBA ALARM

This alarm detects an interruption in the control loop caused by a possible short-circuited probe, inverted probe connections or broken load.
If enabled (AL.nr), the alarm trips if the variable does not increase when heating (reduce when cooling) at maximum power for a set time (LbA.t).
The value of the variable is enabled only outside the proportional band; when the alarm is ON, power is limited to value (LbA.P).
The alarm condition resets as soon as temperature increases for heating (or reduces for cooling), or by simultaneously pressing the “ ∇ ” and “ Δ ” keys in Out.P of level 1.
The LBA function is disabled if LbA.t = 0.

11 • SOFT-START

This function (if enabled) partializes power in proportion to the time elapsed since power-up compared to the preset time 0.0 ... 500.0 min (“SoFt ” parameter, CFG). Soft-start is an alternative to self-tuning and is activated each time the unit is powered up. The soft-start function is reset by switching to Manual control.

12 • CONTROL ACTIONS

Proportional Action:
action in which contribution to output is proportional to deviation at input (deviation = difference between controlled variable and setpoint).
Derivative Action:
action in which contribution to output is proportional to rate of variation input deviation.
Integral Action:
action in which contribution to output is proportional to integral of time of input deviation.

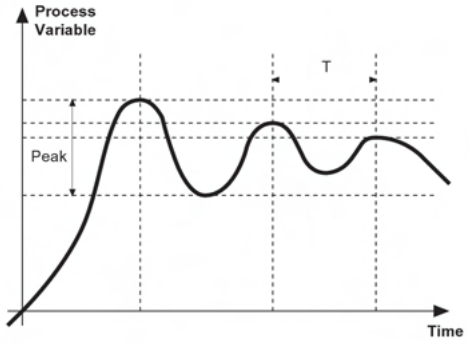
Influence of Proportional, Derivative and Integral actions on response of process under control

* An increase in P.B. reduces oscillations but increases deviation.
* A reduction in P.B. reduces the deviation but provokes oscillations of the controlled variable (the system tends to be unstable if P.B. value is too low).
* An increase in Derivative Action corresponds to an increase in Derivative Time, reduces deviation and prevents oscillation up to a critical value of Derivative Time, beyond which deviation increases and prolonged oscillations occur.
* An increase in Integral Action corresponds to a reduction in Integral Time, and tends to eliminate deviation between the controlled variable and the setpoint when the system is running at rated speed.

If the Integral Time value is too long (Weak integral action), deviation between the controlled variable and the setpoint may persist.
Contact VYC for more information on control actions.

13 • MANUAL TUNING

A) Enter the setpoint at its working value.
B) Set the proportional band at 0.1% (with on-off type setting).
C) Switch to automatic and observe the behavior of the variable. It will be similar to that in the figure:



D) The PID parameters are calculated s follows: Proportional band

$$P.B.= \frac{Peak}{(V\ max - V\ min)} \times 100$$

(V max - V min) is the scale range.
Integral time: It = 1.5 x T
Derivative time: dt = It/4
E) Switch the unit to manual, set the calculated parameters. Return to PID action by setting the appropriate relay output cycle time, and switch back to Automatic.
F) If possible, to optimize parameters, change the setpoint and check temporary response. If an oscillation persists, increase the proportional band. If the response is too slow, reduce it.

14 • SOFTWARE ON / OFF SWITCHING FUNCTION

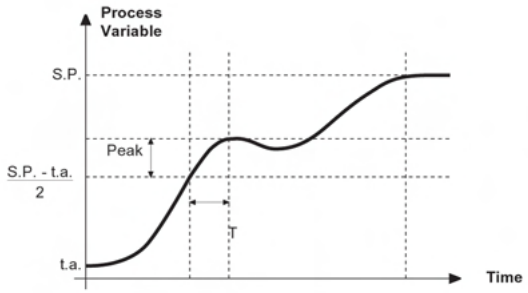
How to switch the unit OFF: hold down the “F” and “Raise” keys simultaneously for 5 seconds to deactivate the unit, which will go to the OFF state while keeping the line supply connected and keeping the process value displayed. The SV display is OFF.
All outputs (alarms and controls) are OFF (logic level 0, relays de-energized) and all unit functions are disabled except the switch-on function and digital communication.
How to switch the unit ON: hold down the “F” key for 5 seconds and the unit will switch OFF to ON. If there is a power failure during the OFF state, the unit will remain in OFF state at the next power-up (ON/OFF state is memorized).
The function is normally enabled, but can be disabled by setting the parameter Prot = Prot +16. This function can be assigned to a digital input (d.i.F.1 or d.i.F.2) and excludes deactivation from the keyboard.

15 • SELF-TUNING

The function works for single output systems (heating or cooling).
The self-tuning action calculates optimum control parameter values during process startup.
The variable (for example, temperature) must be that assumed at zero power (room temperature).
The controller supplies maximum power until an intermediate value between starting value and setpoint is reached, after which it zeros power.
PID parameters are calculated by measuring overshoot and the time needed to reach peak. When calculations are finished, the system disables automatically and the control proceeds until the setpoint is reached.

How to activate self-tuning:

A. Activation at switch-on
1. Switch program to STOP
2. Adjust setpoint to required value
3. Enable self-tuning by setting **Stun** parameter to 2 (CFG menu)
4. Switch unit off
5. Make sure that temperature is approximately room temperature
6. Switch the unit on



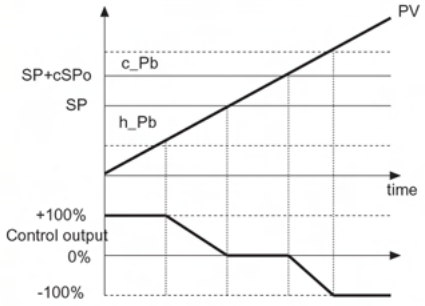
B. Activation from keyboard
1. Make sure that M/A key is enabled for Start/Stop self-tuning function **(butt** code = 4 Hrd menu)
2. Switch program to STOP
3. Adjust temperature to approximately room temperature
4. Adjust setpoint to required value
5. Press M/A key to activate self-tuning (Attention: self-tuning will be disabled if the key is pressed again).

The procedure runs automatically until finished, when the new PID parameters are stored: proportional band, integral and derivative times calculated for the active action (heating or cooling). In case of double action (heating or cooling), parameters for the opposite action are calculated by maintaining the initial ratio between parameters (ex.: CPb = HPb * K; where K = CPb / HPb when self-tuning starts). When finished, the Stun code is automatically cancelled.
Notes:
- The procedure interrupts when the setpoint value is exceeded. In this case, the **Stun** code is not cancelled.
- It is good practice to enable one of the configurable LEDs to signal self-tuning status. By setting one of LED1, LED2, LED3 = 3 (or 19) on the Hrd menu, the corresponding LED will be on (or flashing) when self-tuning is active.
- For the programmer model, the program is in STOP if self-tuning is activated when the unit is switched on.

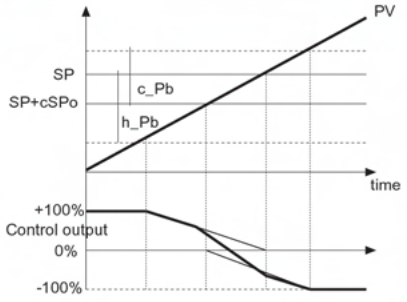
16 • AUTO-TUNING

PID parameters cannot be set if the self-tuning function is enabled.
The function can be one of two types: permanent or one-shot.
The first continuously measures system oscillations to find the optimum PID values to reduce such oscillations.
It does not engage if the oscillations drop below 1.0% of the proportional band.
It is interrupted if the setpoint is changed, and is automatically resumed when the setpoint stabilizes.
The calculated parameters are not stored.
If the unit is switched off, the controller reverts to the values set before self-tuning was enabled.
One-shot self-tuning is useful for calculating values around a setpoint. It produces a variation of 10% of current power at the output and examines the effect of the overshoot over time. These parameters are stored and replace those previously set. After this disturbance, the controller resumes control at the setpoint using the new parameters. The parameter activated in CFG is accepted only if the control power is between 20 and 80%.

17 • CONTROL OUTPUT



Control output with proportional action only if proportional heating band is separated from proportional cooling band.



Control output with proportional action only if proportional heating band overlaps proportional cooling band.

PV = Process Value
SP+cSPo = Cooling Setpoint
c_Pb = Proportional cooling band
SP = Heating Setpoint
h_Pb = Proportional heating band

Heating/Cooling control with relative gain

In this control mode (enabled with CtrL = 14 parameter) the type of cooling has to be specified.
Cooling PID parameters are therefore calculated based on heating parameters according to the specified ratio.
(for example: c.MEd = 1 (oil), H_Pb = 10, H_dt = 1, H_It = 4 implies: C_Pb = 12,5, C_dt = 1 , C_It = 4)
We advise you to apply the following values when setting output cycle times:
Air T Cool Cycle = 10 sec.
Oil T Cool Cycle = 4 sec.
Water T Cool Cycle = 2 sec.

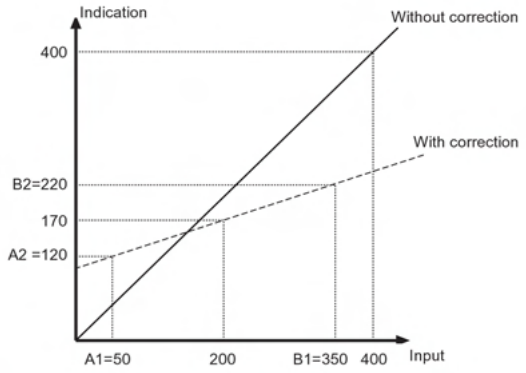
NB.: Cooling parameters **cannot be modified** in this mode.

18 • MAIN INPUT CORRECTION FUNCTION

Lets you custom correct reading of the main input by setting four values: A1, B1, A2, B2.
This function is enabled by setting “Sens” +8 code (“Hrd” menu).
Example: Sens = 1+8 = 9 for RTD probe with input correction.
The scale can be reversed if this function is applied to linear scales (50mv, 10V, 20mA, Pot).
The four values are set on the “Lin” menu as follows: A1 = St100, B1 = St01, A2 = St02, B2 = St03. Setting is limited to the defined scale (“LoS” ... “HiS” on “InP” menu).
The offset function (“oFt” parameter on “InP” menu) remains enabled.
Limits:
B1 always greater than A1;
B1-A1 at least 25% of full scale of selected probe.

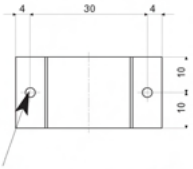
Example:

Sens = 9, TyPE = 0 (Pt100 natural scale -200...+600), dPS = 0
LoS = 0, HiS = 400, oFt = 0
Reference point on real curve: A1 = St00 = 50, B1 = St01 = 350 (B1-A1 = 300, greater than 25% of 800)
Corresponding points on corrected curve: A2 = St02 = 120, B2 = St03 = 220

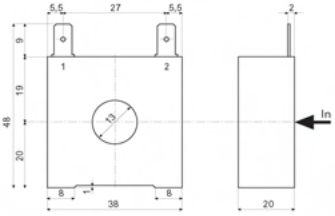


19 • ACCESSORIES

• CURRENT TRANSFORMER



Hole for 2.9 x 9 self-threading screws



These transformers are used to measure currents of 50 ÷ 60Hz from 25A to 600A (nominal primary current). The peculiar characteristic of these transformers is the high number of secondary turns. This provides a very low secondary current, suitable for an electronic measurement circuit. The secondary current may be detected as voltage on a resistor.

CODE	Ip / Is	Ø Secondary Wire	n	OUTPUTS	Ru	Vu	ACCURACY
TA/152 025	25 / 0.05A	0.16 mm	$n_{1\text{-}2}$ = 500	1 - 2	40 Ω	2 Vac	2.0 %
TA/152 050	50 / 0.05A	0.18 mm	$n_{1\text{-}2}$ = 1000	1 - 2	80 Ω	4 Vac	1.0 %

• RS232 interface for instrument configuration

N.B.: RS232 interface for PC configuration is supplied with configuration software.
The digital communication connection must be executed with unit ON and inputs/outputs not connected.

• WARNINGS

WARNING: this symbol indicates danger.
It is placed near the power supply circuit and near high-voltage relay contacts.

Read the following warnings before installing, connecting or using the device:

• follow instructions precisely when connecting the device.
• always use cables that are suitable for the voltage and current levels indicated in the technical specifications.
• the device has no ON/OFF switch: it switches on immediately when power is turned on. For safety reasons, devices permanently connected to the power supply require a two-phase disconnecting switch with proper marking. Such switch must be located near the device and must be easily reachable by the user. A single switch can control several units.
• if the device is connected to electrically NON-ISOLATED equipment (e.g. thermocouples), a grounding wire must be applied to assure that this connection is not made directly through the machine structure.
• if the device is used in applications where there is risk of injury to persons and/or damage to machines or materials, it MUST be used with auxiliary alarm units. You should be able to check the correct operation of such units during normal operation of the device.
• before using the device, the user must check that all device parameters are correctly set in order to avoid injury to persons and/or damage to property.
• the device must NOT be used in inflammable or explosive environments. It may be connected to units operating in such environments only by means of suitable interfaces in conformity to local safety regulations.
• the device contains components that are sensitive to static electrical discharges. Therefore, take appropriate precautions when handling electronic circuit boards in order to prevent permanent damage to these components.

***Installation*:** installation category II, pollution level 2, double isolation

• power supply lines must be separated from device input and output lines; always check that the supply voltage matches the voltage indicated on the device label.
• install the instrumentation separately from the relays and power switching devices
• do not install high-power remote switches, contactors, relays, thyristor power units (particularly if “phase angle” type), motors, etc... in the same cabinet.
• avoid dust, humidity, corrosive gases and heat sources.
• do not close the ventilation holes; working temperature must be in the range of 0...50°C.

If the device has faston terminals, they must be protected and isolated; if the device has screw terminals, wires should be attached at least in pairs.

• *Power*: supplied from a disconnecting switch with fuse for the device section; path of wires from switch to devices should be as straight as possible; the same supply should not be used to power relays, contactors, solenoid valves, etc.; if the voltage waveform is strongly distorted by thyristor switching units or by electric motors, it is recommended that an isolation transformer be used only for the devices, connecting the screen to ground; it is important for the electrical system to have a good ground connection; voltage between neutral and ground must not exceed 1V and resistance must be less than 6Ohm; if the supply voltage is highly variable, use a voltage stabilizer for the device; use line filters in the vicinity of high frequency generators or arc welders; power supply lines must be separated from device input and output lines; always check that the supply voltage matches the voltage indicated on the device label.
• *Input and output connections*: external connected circuits must have double insulation; to connect analog inputs (TC, RTD) you have to: physically separate input wiring from power supply wiring, from output wiring, and from power connections; use twisted and screened cables, with screen connected to ground at only one point; to connect adjustment and alarm outputs (contactors, solenoid valves, motors, fans, etc.), install RC groups (resistor and capacitor in series) in parallel with inductive loads that work in AC *(Note: all capacitors must conform to VDE standards (class x2) and support at least 220 VAC. Resistors must be at least 2W)*; fit a 1N4007 diode in parallel with the coil of inductive loads that operate in DC.

VYC industrial **will not be held liable for any injury to persons and/or damage to property deriving from tampering, from any incorrect or erroneous use, or from any use not conforming to the device specifications.**

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