1600V / 1800V

CONTROLLER FOR VALVE

ISO 9001

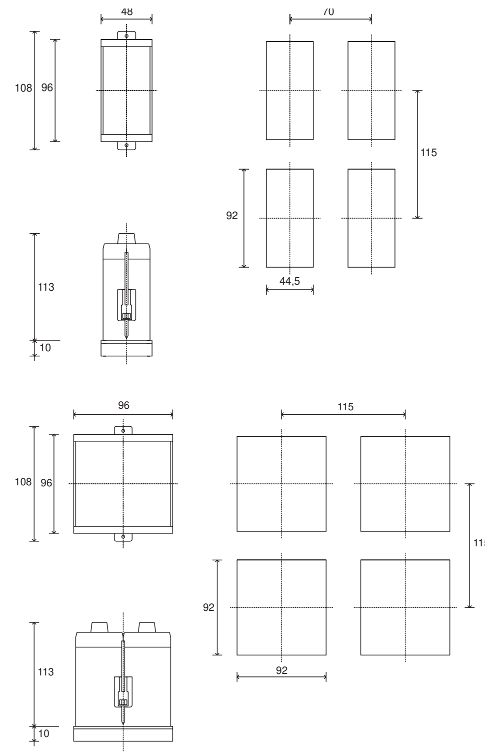
USERS' MANUAL

SOFTWARE VERSION **3.0x**
code **80086** / Edition **0.5** - **01/2001**

SPIRAX SARCO Srl
Via Pasubio, 8
20063 Cernusco sul Naviglio
Tel. +39 02.92119511 - Fax +39 02.9240321

1 • INSTALLATION

• Dimensions and cut-out; panel mounting



To ensure a correct installation, heed the warnings in the manual

Panel mounting:
To fix the instrument, insert the brackets provided into the seats on either side of the case. To mount two or more instruments side by side, respect the cut-out dimensions shown in the drawing. In order to get the IP65 protection, take the instruments out from its case and apply the supplied gasket of the front edge of the case itself using some adhesive. The replace the instruments inside the case.

CE MARKING: EMC conformity (electromagnetic compatibility) with EEC Directive 89/336/CEE with reference to the generic Standard EN50082-2 (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.
Limitations: the 1800V model conforms to EN55011 standard for radiated emissions in industrial environment.
MAINTENANCE: Repairs must be carried out only by trained and specialised personnel. Remove the power to the instrument before accessing the internal parts.
DO NOT clean the case with solvent (trichlorethylene, petrol, etc.). The use of such solvents can have adverse effects on the mechanical reliability of the instrument. To clean the plastic case please use a clean cloth with ethilic alcohol or water.
SERVICE: SPIRAX-SARCO has a service department. The guarantee excludes defects caused by usage that does not conform to the instructions.

2 • TECHNICAL SPECIFICATIONS

Display	2 x 4 digits green of height 10 and 7mm (1600V), 20 and 13mm (1800V)
Keys	5 mechanical keys (*, Man/Auto, INC, DEC, F)
Accuracy	0.2% full scale a 25°C ambient 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- or open-circuit probe, LBA alarm, HB alarm
°C / °F selection	faceplate configurable
Linear scale ranges	-1999 to 9999 with configurable decimal point position
Control terms	PID, Auto-tune, on-off
pb / dt / di	0.0 ... 999.9% / 0.00 ... 99.99min / 0.00 ... 99.99min
Control actions	Heat / Cool
Control outputs	on / off, pwm, Apri / Chiudi
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 of type: high, low, deviation, 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 relay	11Vdc, Rout = 220Ω (6V/20mA)
(option) remote set-point or *Ammeter input* *Feed-back input* *Valve position from potentiometer*	0 ... 10V, 2 ... 10V, Ri ≥ 1MΩ 0 ... 20mA, 4 ... 20mA, Ri = 5Ω Potentiometer > 500Ω, CT 50mAac, 50/60Hz, Ri = 1,5Ω, isolation 1500V
CT scale range	configurable from 0, ... , 100.0A
Transmitter power (optional)	filtered 10 / 24Vdc, max 30mA short-circuit protection, isolation 1500V
Analogue retransmission signal (optional)	10V / 20mA, isolation 1500V
Logic inputs (optional)	24V NPN, 4.5mA; 24V PNP, 3.6mA isolation 1500V
Serial interface (optional)	CL; RS422/485; RS232; isolation 1500V
Baude rate	1200 ... 19200
Protocol	GEFRAN / MODBUS
Power supply (switching type)	(std) 100 ... 240Vac/dc ±10%; 50/60Hz, 12VA max (opz.) 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% Ur non condensing
Installation	Panel, plug-in from the front
Weight	400g (1600V); 600g (1800V) in complete version

The EMC conformity has been tested with the following connections

FUNCTION	CABLE TYPE	LENGTH
Power supply cable	1 mm^2	1 mt
Relais output cable	1 mm^2	3,5 mt
Digital communication wires	0,35 mm^2	3,5 mt
C.T. connection cable	1,5 mm^2	3,5 mt
TC input	0,8 mm^2 compensated	5 mt
Pt100 input	1 mm^2	3 mt

3 • FACEPLATE DESCRIPTION

Function indicator
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" keys:
Used to increment (decrement) any numerical parameter •• The increment (decrement) speed is proportional to the time the key remains depressed •• The operation is not cyclic. Once the maximum (minimum) value of a field is reached, the value will not change further even if the key is held down

Auto/Manual selection:
Function definited defined by "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, PTC or input values lower than min. limits
(i.e.: TC wrong connection)

SV display: Indication of setpoint

Bargraph: % indication of a variable defined by the bArG parameter

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

"" key:*
Function definited defined by but.2 parameter

4 • CONNECTIONS

• Power supply

~	12	Standard: 100...240Vac/dc ±10%
PWR		Optional: 20...27Vac/dc ±10%
~	13	50/60Hz, 12VA max

• Outputs

+W2	33	User configurable generic output	User configurable generic output	11	-
+W1	32	analogue output 1500V (0 ... 10V, 0 ... 20mA, 4 ... 20mA)	- 5A/250Vac relay, cosφ=1 - 11Vdc logic, Rout = 220Ω (6V/20mA)		Out4 (AL2 / HB)
0V	31			10	+

• Outputs

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

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

• Transmitter supply

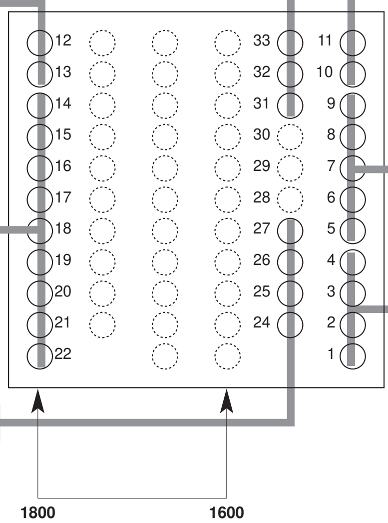
Transmitter supply isolated 1500V
10/24Vdc, max. 30mA short-circuit protection

9 — +Vt
5 — GND

• Digital inputs

Digital input isolated to 1500V
- NPN 24V, 4,5mA
- PNP 24V, 3,6mA (12V, 3,6mA)

8 — IN2
7 — IN1
5 — COM



• Auxiliary inputs

Auxiliary input isolated 1500V

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

Remote setpoint
0...20, 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
Passive current loop (max. 1200 baud)

RS422/485 or RS232 (optional)

27 - Tx
26 + Tx
25 - Rx
24 + Rx

A + / B - : RS485 2-wires
Tx / GND / Rx : RS232

• Inputs

• TC

Available thermocouples: J, K, R, S, T, B, E, N, Ni-Ni18Mo, L NiCr-CuNi
- Observe polarity
- For extensions, use the correct compensating cable for the type of TC used

2 — -
1 — +

• Linear (V)

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

Potentiometer 0...10V

2 — -
1 — +

• Linear (I)

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

4
2 — -
1 — +

• Pt100 2-wires or PTC

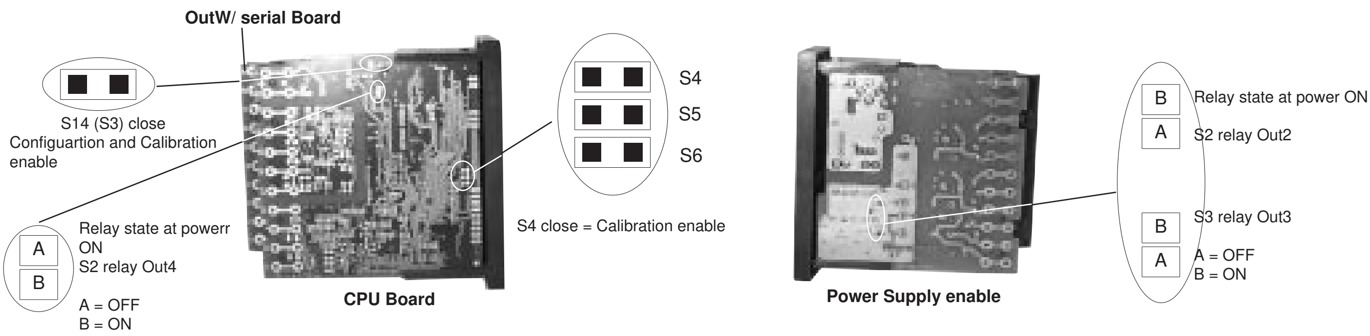
Use wires of adequate diameter (min. 1mm²)
PT100, JPT100, PTC

3, 2, 1 — T

• Pt100 3-wires

3, 2, 1 — T

Instrument layout



5 • PROGRAMMING and CONFIGURATION

LEVEL 1 MENU

P.V. / S.V.	Process variable (PV display) Current setpoint (SV display) or manual control output	
_SP_	Setpoint value	1
_SP.1	Setpoint 1	212
_SP.2	Setpoint 2	213
_SP.3	Setpoint 3	214
_SP.4	Setpoint 4	215
__tS	Timer Setpoint 0 ... 9999 sec	217
InP.2	Value of auxiliary input, remote setpoint or valve position (with auxiliary input enabled) (*)	2
_AL.1	Alarm point 1 (scale points)	3
_AL.2	Alarm point 2 (scale points)	4
_AL.3	Alarm point 3 (scale points)	5
AL.Hb	Heater break alarm point (scale points of current transformer input)	6
OutP	Control output value (+Heat / -Cool) (*)	7

(*) The automatic return *PV/SV* display is disabled for this parameters

After 30sec, if no keys are pressed, the instrument returns automatically to PV/SV display.
This function is not present in INFO and dAtA menu.

F — Press for approx. 2sec

INFO	Information display
dAtA	Menù custom
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 linearisation
CuSt	Custom “dAtA” menu
U.CAL	User calibration
S4 = ON (NO / YES)	
_CAL	Select calibration menu [0...12]

Keep the F key pressed to browse the menus

Release the F key to enter the displayed menu

Press the F key to browse the parameters

Keep the F key pressed to exit any menu at any time

Keeping pressed F+Auto/Man keys (whichener is the selected menu) for 2sec, the display immediately changes to level 1

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

• Info display

8	INFO	Information display	
9	CodE	Serial communication code	
10	UPdt	Software version	
11	Prot	Software protection code	
12	Er.nr	Self diagnostic error code	0 No Error; 1 Lo; 2 Hi; 3 ERR; 4 SBR

• CFG

	CFG	Control parameters	
15	S.tun	Enabling selftuning, autotuning, softstart	see table below

S.tun	Continuous Autotuning	Selftuning	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

16	h_Pb	Proportional band for heating or hysteresis on ON-OFF action	0 ... 999.9% full scale
17	h_it	Integral time for heating	0.00 ... 99.99 min
18	h_dt	Derivative time for heating	0.00 ... 99.99 min
19	h.P.Hi	Maximum power limit for heating	0.0 ... 100.0%
254	h.P.Lo	Minimum power limit for heating (not available for double heat/cool action)	0.0 ... 100.0%
97	C.MEd	Cooling Medium	0 ... 2

C.MEd		Relative Gain (rG) (see applicative note)
0	Air	1
1	Oil	0,8
2	Water	0,4

20	c.SP.o	Proportional band for heating or hysteresis on ON-OFF action	± 25.0% full scale
21	c_Pb	Proportional band for cooling or hysteresis on ON-OFF action	0 ... 999.9% full scale
22	c_it	Integral time for cooling	0.00 ... 99.99 min
23	c_dt	Derivative time for cooling	0.00 ... 99.99 min
24	c.P.Hi	Maximum power limit for cooling	0.0 ... 100.0%
255	c.P.Lo	Cooling power lower limit (not available for heating/cooling double action)	0.0 ... 100.0%
25	_rSt	Manual reset	-999 ... 999 scale points
26	P.rSt	Reset power	-100.0 ... 100.0%
27	A.rSt	Antireset	0 ... 9999 scale points
28	_FFd	Feedforward	-100.0 ... 100.0%
29	SoFt	Softstart time	0.0 ... 500.0 min
30	HYS.1	Alarm 1 hysteresis	± 999 scale points
31	HYS.2	Alarm 2 hysteresis	± 999 scale points
32	HYS.3	Alarm 3 hysteresis	± 999 scale points
33	Hb_t	Waiting time for HB alarm intervention (The value must be higher than the cycle time of the output associated to HB alarm)	0 ... 999 sec
34	LbA.t	Waiting time for LBA alarm intervention (Enter "0" to disable LBA alarm)	0.0 ... 500.0 min (*)
35	LbA.P	Power limit for LBA alarm condition	-100.0 ... 100.0% ON / OFF (*)
36	FAC.P	Power output in fault condition (when probe is faulty)	-100.0 ... 100.0% ON / OFF
216	Gr.SP	Setpoint gradient (see notes)	0.0 ... 999.9 digit / min. (digit / sec) see SP.ty
207	-At-	Actuator time (time required by the valve to move from completely open to completely closed)	0 ... 2000 sec
208	t_Lo	Minimum pulse time (useful to reduce mechanical stress of the valve)	0.0 ... 25.0%
209	t_Hi	Pulsating control band (set in percentage of opening valve time)	0.0 ... 100.0%
210	-db-	Dead Band, symmetrical to Setpoint and selectable in full scale percentage (when the process value is within this band, the valve is locked) Only for valve control type V0, V1, V2	0.0 ... 25.0% full scale

(*) When the LBA alarm is active, it can be reset by pushing the $\Delta + \nabla$ keys together when the display shows the control output value (OutP), or switching the unit to Manual control.

Remark:
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 "read only" if the option "relative gain heat/cool control" (Ctrl = 14) has been selected

• Ser

Ser — Serial communications

CodE (38) — Instrument identification code when connected in serial line (if enabled) [see "hrd.1" in Hrd] — 0 ... 9999

SEr.P (39) — Digital communication protocol: CENCAL, MODBUS

SEr.P	Digital communication protocol
0	CENCAL GEFRAN
1	MODBUS RTU

bAud (40) — Baudrate

bAud	Baudrate	CENCAL Interface	MODBUS Interface
0	1200	CL / 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

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...3]

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 gradient to setpoint (digit/sec)

tYPE (45) — Probe type, signal and scale of main input

SENSORE: 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: 3 wires RTD (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, alternative to 3-wires RTD)

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 linearised	see table in menu Lin
2	10...50mV	linear	-1999 / 9999
3	10...50mV	custom linearised	see table in menu 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 linearised	see table in menu Lin
2	4...20mA	linear	-1999 / 9999
3	4...20mA	custom linearised	see table in menu 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 linearised	see table in menu Lin
2	2...10V	linear	-1999 / 9999
3	2...10V	custom linearised	see table in menu 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 linearised	see table in menu Lin

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

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

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

46 **FiLt** — Digital filter on main input — 0.0 ... 20.0 sec

47 **FiLd** — Digital filter on display process variable: acts as hysteresis — 0 ... 9.9 scale points

48 **dP_S** — Decimal point position for the main input scale, alarms 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

49 **Lo_S** — Minimum limit of the main input scale — min...max input range selected in tyPE

50 **Hi_S** — Maximum limit of the main input scale — min...max input range selected in tyPE

51 **oFSt** — Offset correction of the main input — -999 ... 999 scale points

52 **tYP.2** — Function of auxiliary analogue input (if enabled) [see “hrd.1” in HrD] and custom scale limitation enable

tYP.2	Auxiliary input function
0	none
1	remote setpoint
2	remote analogue manual
3	analogue reset power
4	current transformer input for HB
5	Valve position

+ 8 to select custom linearisation (see table in menu Lin)

53 **FLt.2** — Digital filter on auxiliary input (if enabled) [see “hrd.1” in Hrd] — 0.0 ... 20.0 sec

54 **Lo.S2** — Minimum limit of the auxiliary input scale (if enabled) [see “hrd.1” in Hrd] — min...max input range selected in tyP.2

55 **Hi.S2** — Maximum limit of the auxiliary input scale (if enabled) [see “hrd.1” in Hrd] — min...max input range selected in tyP.2

56 **oF.S2** — Offset correction of the auxiliary input (if enabled) [see “hrd.1” in Hrd] — -999 ... 999 scale points

57 **Lo_L** — Low limit for the local setpoint and absolute alarms — Lo.S ... Hi.S

58 **Hi_L** — High limit for the local setpoint and absolute alarms — Lo.S ... Hi.S

• Out

Out — Output settings

60 **AL.1.r** — Select reference signal for alarm 1

61 **AL.2.r** — Select reference signal for alarm 2

62 **AL.3.r** — Select reference signal for alarm 3

AL.1.r, AL.2.r, AL.3.r

AL.x.r	Variable to compare	Alarm Setpoint
0	PV (process variable)	AL
1	InP.2 (auxiliary input)	AL
2	SSP (active setpoint)	AL (only absolute)
3	PV (process variable)	InP.2 (auxiliary input)

+ 4 for relative allarms only, referring to SP1 only
4available if the “multiset” function has been selected)

63 **AL.1.t** — Alarm 1 type

64 **AL.2.t** — Alarm 2 type

65 **AL.3.t** — Alarm 3 type

AL.1.t, AL.2.t, AL.3.t

AL.x.t	Direct (high limit) Inverse (low limit)	Absolute or Relative to setpoint	Normal Symmetric (window)
0	direct	absolute	normal
1	reverse	absolute	normal
2	direct	relative	normal
3	reverse	relative	normal
4	direct	absolute	symmetric
5	reverse	absolute	symmetric
6	direct	relative	symmetric
7	reverse	relative	symmetric

+ 8 to disable on power up until the first interception
+ 16 to latch the alarm

66 **Hb_F** — HB alarm function

Hb_F	Function description
0	Relay, logic output: alarm active on load current level lower than setpoint during the ON time of the control outptut
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 the functions 0 and 1 is true (OR logic between 0 and 1) **(*)**
3	HB alarm for heating analog output
7	HB alarm for cooling analog output

+ 0 associated to output OUT1 (only for Hb_F= 0, 1, 2)
+ 4 associated to output Out2 (only for Hb_F= 0, 1, 2)
+ 8 associated to output Out3 (only for Hb_F= 0, 1, 2)
+ 12 associated to output Out4 (only for Hb_F= 0, 1, 2)
+ 16 inverse HB alarm

(*) the minimum set is fixed at 12% f.s.

rL.o.1 (67) — Allocation of reference signal to the Out1 output: HEAT, COOL, AL1, AL2, AL3, input repetition signal

rL.o.2 (68) — Allocation of reference signal to the Out2 output: HEAT, COOL, AL1, AL2, AL3, input repetition signal

rL.o.3 (69) — Allocation of reference signal to the Out3 output: HEAT, COOL, AL1, AL2, AL3, input repetition signal

rL.o.4 (70) — Allocation of reference signal to the Out4 output: HEAT, COOL, AL1, AL2, AL3, input repetition signal

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	Timer status repetition
13	Manual 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 cicle time) (*)
65	Cool (control output with fast cicle time) (*)

(*) Only for rL.o.1, HB alarm disabled if associated to Out 1

_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 condition 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, the logic state of the individual alarm takes up the logic value assigned without taking into account the alarm type (direct or inverse): ON=alarm active; OFF=alarm inactive
2) The assignment of the alarms to the available outputs is made by entering codes in rLo1, rLo2, rLo3, rLo4.

An.o.1 (78) — Out W1 Allocate 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 - auxiliary 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 the reference value
+ 32 for output with 2...10V, 4...20mA signal

(*) - Fixed scale limits
- Not available with ON/OFF control action

L.An.1 (76) — Minimum limit of the analogue repetition signal output 1 — -100.0 ... 100.0% for power; -1999 ... 9999 for input and setpoint

H.An.1 (77) — Maximum limit of the analogue repetition signal output 1 — -100.0 ... 100.0% for power; -1999 ... 9999 for input and setpoint

An.o.2 (81) — Out W2 Allocate signal or reference value: PV, SP, SP-PROG, DEV+, DEV-, IN.AUX, HEAT, COOL, AL1, AL2, AL3, serial line value

L.An.2 (79) — Minimum limit of the analogue repetition signal output 2 — -100.0 ... 100.0% for power; -1999 ... 9999 for input and setpoint

H.An.2 (80) — Maximum limit of the analogue repetition signal output 2 — -100.0 ... 100.0% for power; -1999 ... 9999 for input and setpoint

At.tY (211) — Valve Control Type

0	disabled
1	V0, V1 Heating control
2	V2 Heating control
3	V3, V4 Heating control

+ 4 for Cooling control
+ 8 for Manual control of the valve with "up" and "down" keys.

• Prot

Prot (42) — Protection code

Prot	Display only	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 to disable manual power latching
+64 to disable manual power modification

Hrd — Hardware configuration

hrd.1 — Installation of auxiliary input, digital input, serial interface, timer function, multiset function

hrd.1	Auxiliary 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 timer function
+ 32 to enable multiset function (2 setpoints)
+ 64 to enable multiset function (4 setpoints)

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

hrd.2	MAIN output (relay, logic)	AL1 output (relay, logic)	AL2 output (relay, logic)	AL3 output (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 the state of the LEDs with respect to the state of the output

hrd.3 — "*" Key and bargraph installation

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

CtrL — Control type [0...11]

	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 coll
14	PID heat + cool with relative gain (see C.MEd parameter)

43

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

In case of ON/OFF control the LBA alarm is not enabled

_S.S.t. — Timer Start / Stop

_ _r.t. — Timer Reset (0 ... 15)

0	from 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)
(for the _S.S.t. parameter)

SEnS — Selection of the input type for the 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 50mV

+ 8 to enable the main input curve 4 point correction (alternative to custom linearisation).
See the "Input Reading Correction Function" section.
+16 to disabled the averaging filter on input sampled value (available from software release 3.05)

Note: scale selected under "tYPE" in "InP".

SnS.2 — Selection of the input type for the auxiliary 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	CT 50mA ~

+8 to disabled the averaging filter on input sampled value (available from software release 3.05)

AL.nr — Select the 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 key

but.2 — Function of "*" key

	butt , but.2
0	none (key disabled)
1	MAN / AUTO selection
2	LOC / REM
3	HOLD
4	Start / Stop selftuning
5	Start / Stop autotuning
6	Set/Reset outputs OUT 1 ... OUT 4
7	Reset alarm memory
8	SP1 / SP2 selection
9	Integral action reset
10	START / STOP timer (if enable in S.S.t.)
11	RESET timer (if enable in _ _ r.t.)

+ 16 disable the function display in the configuration menu

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	none (key disabled)
1	MAN / AUTO selection
2	LOC / REM
3	HOLD
4	Start / Stop timer
5	Reset timer
6	Software power on/off
7	Reset alarm memory
8	SP1 ... SP2 selection (2SP) SP1 ... SP4 selection - bit Lo
9	SP1 ... SP4 selection - bit Hi

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

diSP — Defining SV display function

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

(*) + 4 Timer (when active)

LEd.1 / **LEd.2** / **LEd.3**

Function of the "MAN": M/A, L/R, ATUN LEDs, IN1, IN2 repetition, event programmer, serial port enabled, errors present

LEd.1 (MAN), LEd.2 (AUX), LEd.3 (REM)

LEd.x	Function
0	None
1	MAN/AUTO (ON in manual, OFF in auto)
2	LOC/REM (ON in remote, OFF in local)
3	Selftuning active
4	Autotuning active
5	IN1 repetition
6	IN2 repetition
7	Serial communications in operation
8	HOLD inserted
9	Error present (error code <> 0)
10	Softstart in operation
11	SP1 ... SP4 indication - Lo bit
12	SP1 ... SP4 indication - Hi bit
13	Start / Stop Timer
14	Reset Timer

+ 16 for flashing indication

bArG Bargraph function

bArG	
0	Heat
1	Cool
2	Heat + Cool
3	PV
4	Aux. input (V2 valve position)
5	Setpoint
6	V0 or V1 valve position
7	Time (timer)
8	Deviation (PV - setpoint) -10% ... +10%

• Lin

Lin Custom linearisation for main or auxiliary input (*)

St.00 Step 0 — Scale limits

......

St.32 Step 32 — Scale limits

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

• CuSt

CuSt Custom “dAtA” menu

HEAd Number of parameters in the custom menu [0 ... 14]

PA.01 Identification code for parameter 1

......

PA.14 Identification code for parameter 14

X X X X

x ← The identification code is specified in this position, under the parameter name

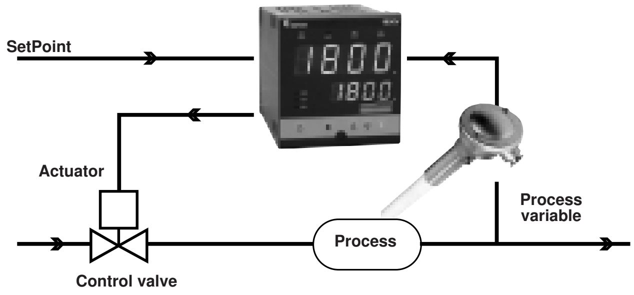
• U.CAL

U.CAL User calibration

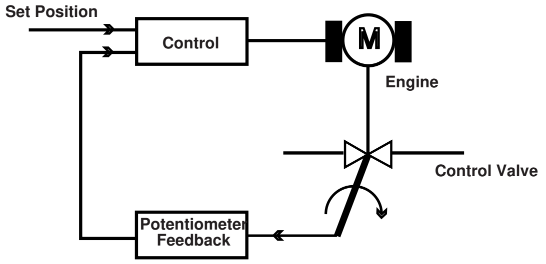
U.CAL	Function
1	Analogue output 1
2	Analogue output 2
3	Input 1 - custom probe 10V
4	Input 1 - custom probe 50mV
5	Input 2 - potentiometer

6 • MOTORIZED VALVE CONTROL

In a control process the control valve has to adjust the liquid fuel flow rate (often corresponding to the thermal energy of the process) depending on the signal coming from the controller. To this purpose , the valve is equipped with an actuator capable to modify its opening value, forcing the resistance produced by the fluid flowing inside it. Control valves change flow rate according to a modulated mode, producing finite variations of the inside flowing path of the fluid, corresponding with finite variations of the actuator input signal, coming from the controller.
The servomechanism is made up, for example, by an electic motor, by a reducer unit and of a transmission mechanical system that operates the valve.
Various auxiliary components could be present such as electrical and mechanical limit switches for safety, manual override devices, position detectors and indicators.
The controller determines the drive output for the valve from the dynamic behaviour of the process in order that the required value of the process variable can be maintained.
When position feedback is required, it is usually supplied by a potentiometer fitted to the actuator.



V0 CONTROL EXAMPLE



VALVE POSITION CONTROL

The controller determines the drive output for the valve from the dynamic behaviour of the process in order that the required value of the process variable can be maintained.
When position feedback is required, it is usually supplied by a potentiometer fitted to the actuator.

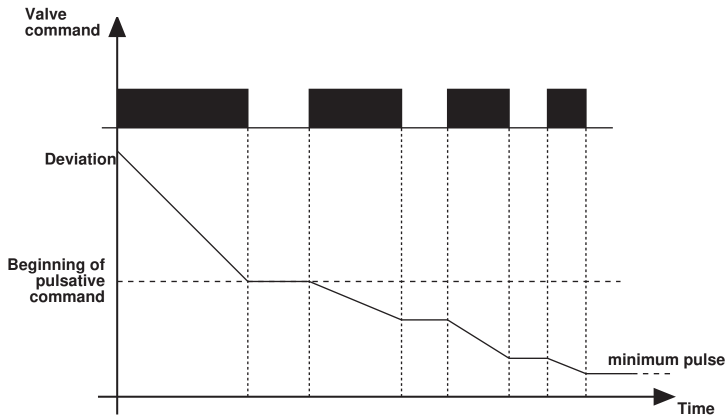
Valve control parameters

- Actuator time (_At_): time required by the valve to move from completely open to completely closed (and viceversa), selectable in seconds; it is a mechanical characteristics of the valve + actuator assembly.
NOTE: if the actuator run is mechanically reduced it is necessary to reduce the _At_ parameter value accordingly.

- Minimum pulse time (t_Lo): selectable in % of the actuator time (resolution 0.1%).
This parameter sets the minimum value of command below which the actuator does not move; by increasing t_Lo it is possible to lower the mechanical stress on the valve, allowing a higher accuracy in positioning.

- Pulsating command band (t_Hi): selectable in % of the actuator time (resolution 0.1%).
Whenever the valve has to move to another position, this parameter defines a band inside which the valve positioning command is pulsating instead of continuos; the length of each pulse is proportional to the deviation and higher or equal to t_Lo.
This type of pulsating command allows a very accurate positioning of the valve, with or without feedback, expecially in case of high mechanical inertia. The pulsating command positioning is disabled by setting t_Hi = 0.

PULSATING COMMAND VALVE POSITIONING, AVAILABLE ONLY ON V0, V1 AND V2 CONTROL TYPES



- Dead Band (_db_): selectable in display units, defines a band around the Setpoint inside which the controller gives no command to the valve (Open = OFF; Close = OFF).
This parameter is useful to save the actuator from mechanical stress when the process has already settled; the dead band function is disabled by setting _db_ = 0.

7 • VALVE CONTROL TYPES

V0 - for floating valves without feedback potentiometer;
V1 - for floating valves with potentiometer and position indication;
V2 - for valves with position feedback potentiometer and position indication.

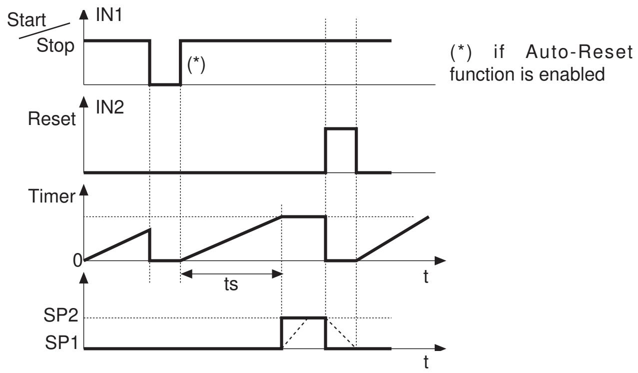
Models V0 and V1 have a similar behaviour.
Every request for change that is greater than the minimum pulse is sent to the actuator via an OPEN/CLOSE relay.

Every action updates the presumed position of a virtual potentiometer calculated on the basis of the declared actuator time. In this way, there is always a presumed position of the valve that is compared with the controller output.
Once the valve reaches a fully opened or fully closed position as calculated by the virtual potentiometer, the controller will supply a series of pulses in the same direction in equal intervals of time with the length of the minimum pulse in order to ensure that the actual end stop is reached.
The actuators are usually protected against an OPEN command when in the fully open position and a CLOSE command in the fully closed position.
The V2 model reads the position of the valve through an auxiliary analogue input, conditioned to give a percentage (0.0 - 100.0%), it compares it with the controller output, and sends the appropriate command to the valve.
The auxiliary input of the controller is used to acquire the valve position.
Calibration is required to detect the potentiometer readings that correspond to the maximum and minimum valve positions.
The potentiometer is normally powered by the same controller.

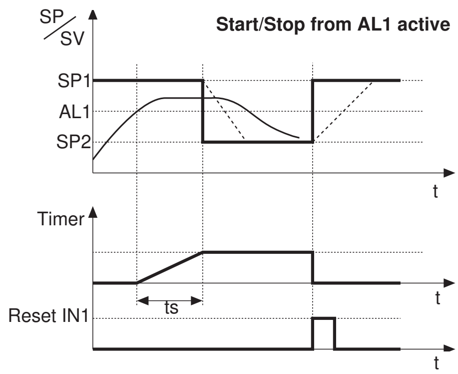
V3 - for floating valves without position indication, PI control
V4 - for floating valves with valve position potentiometer indication, PI control; when the difference between the requested position from the controller and the proportional component is greater than the value that corresponds to the minimum pulse, the controller supplies an OPEN or CLOSE command equal to the minimum pulse.
The integral component of the controller is reset to zero, each time the controller change the valve position (integral desaturation).
The frequency and the width of the pulses is related to the integral time that has been set. (_ti_).

8 • TIMER, TIMER + 2 SETPOINTS FUNCTIONS

The timer function can be enabled in **Hrd** configuration by setting parameter hrd.1 = +16 (+48 to enable the 2 setpoints selection). The timer operating mode can be defined through parameters **_S.S.t.** (timer start/stop) and **_ _r.t** (timer reset).
The timer setpoint can be programmed in level 1 configuration (full scale 9999 sec.).
The Start/Stop and Reset of the timer can be executed through a digital input or the tripping of an alarm (AL1, AL2, AL3, ALHb).
The Reset command (active on state) reset the timer and keeps it zeroed even if the Start Command is active.
It is possible to configure the timer for Auto-Reset function (timer Reset at every Stop).
It is possible (through diSP parameter) to show the timer count on display SV.
When the timer Setpoint (tS) is reached, it is possible to turn ON an output or select SP2 control Setpoint.

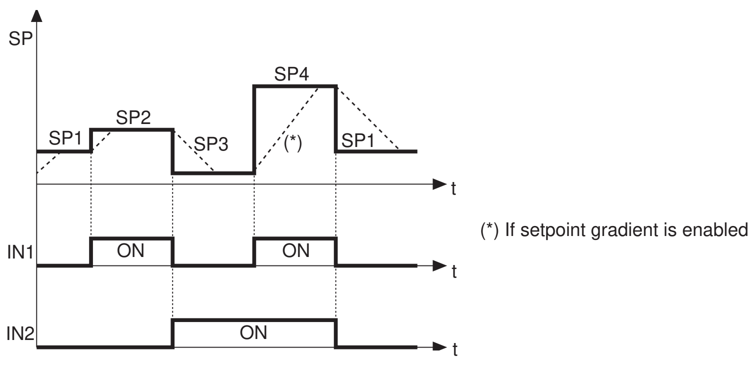


The ramp between SP1 and SP2 is defined through GrSP parameter (setpoint gradient). GrSP = 0 means immediate change.



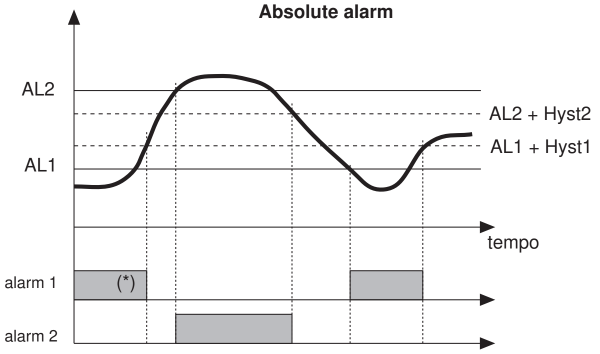
9 • MULTISET FUNCTION / SETPOINT GRADIENT

The multiset function can be enabled in Hrd configuration by setting parameter hrd.1 = +64. It is possible to use up to 4 local setpoints, selectable through binary combinations of digital inputs (IN1, IN2); the M/A configurable key can be used to select SP1/SP2. The faceplate LEDs can be configured to display the active SP.
SETPOINT GRADIENT (parameter Gr.SP): if Gr.SP = 0 the change from one SP to another is immediate; if Gr.SP ≠ 0 the instrument goes from one the SP to another with the defined ramp. If Gr.SP ≠ 0, at power-on and on AUTO/MAN commutation the SP is assumed equal to PV and then reaches the local or remote SP with the defined ramp.



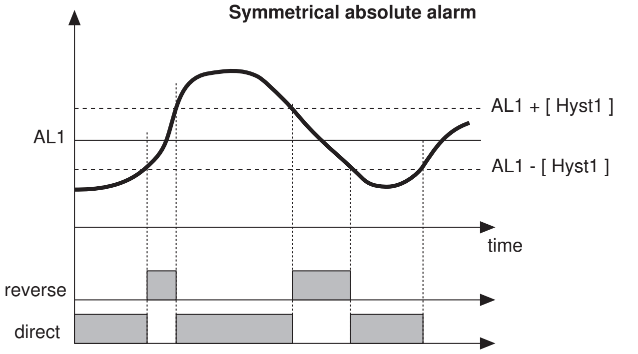
10 • ALARMS

Absolute alarm



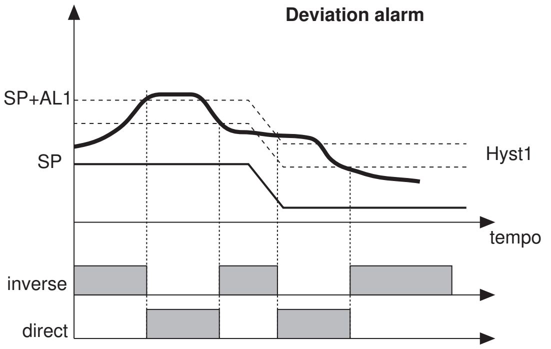
For AL1 = Lo absolute alarm with positive Hysteresis Hyst1, AL1 t = 1
(*) = OFF if disabled on power-up
For AL2 = Hi absolute alarm with negative Hysteresis Hyst2, AL2 t = 0

Symmetrical absolute alarm



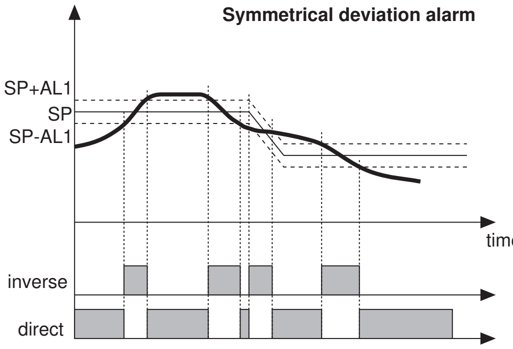
For AL1 = symmetrical Lo absolute alarm with Hysteresis Hyst1, AL1 t = 5
For AL1 = symmetrical Hi absolute alarm with Hysteresis Hyst1, AL1 t = 4

Deviation alarm



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

Symmetrical deviation alarm



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

HB ALARM

The type of alarm requires the current transformer input (CT).
It can indicate the variations of load current measured through HB input, in the range (Lo.S2 ... HI.S2).
It is enabled by a configuration code (Hrd, AL.nr); in this case the alarm set-point is expressed as HB scale digits.
The alarm function and the associated control output are selected through parameter Hb_F (“Out” menu).
The setpoints for alarm is AL.Hb.
The direct HB alarm intervenes if the current transformer input falls below the entered setpoint for a time set in Hb_t during periods in which the main output is ON.
The HB alarm can be activated only if the ON times are greater than 0,4 seconds.
The HB alarm provides monitoring of the load current even during the OFF period of the cycle time of the MAIN output:
If the measured current exceeds 12% of the CT input scale for a time set in Hb_t during periods in which the main control relay is in the OFF state, the alarm intervenes.
The alarm is reset automatically when the alarm conditions have been cleared.
If the alarm AL.Hb is entered as = 0, both types of HB alarm are disabled and the associated relay is disenergised.
The load current reading is displayed as InP.2 in level 1 menu.
NOTE: the ON/OFF times refer to the entered cycle time.
The 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 control output is lower than 2%.

LBA ALARM FUNCTION

This alarm detects (when current should be flowing) an interruption in the control loop caused by a possible shortcircuit probe, an inverted probe connections or broken heater circuit.
If enabled (AL.nr) the alarm is activated if the variable does not increase when the controller should be heating (reduce when cooling) at maximum power within a set time (LbA.t).
The value of the variable is enabled only outside the proportional band, when alarm is ON the power is limited at a set value (LbA.P). The alarm condition resets as soon as an increase in temperature is detected (or reduction if on the cooling channel) or by pressing the “ ∇ ” and “Raise” keys simultaneously in the Out.P position of level 1 menu.
If LbA.t = 0 the LBA function is disabled.

11 • SOFT-START

This function, if enabled, partializes the output power and increases it proportionally to the time elapsed since the power-up of the instrument with respect to the preset time 0.0 ... 500.0 min (“ SoFt ” parameter, CFG). The soft-start is mutually exclusive with self-tuning and it is activated each time the instrument is powered up. The soft-start function is reset by switching the unit to Manual control.

12 • NOTES ON THE CONTROL ACTIONS

Proportional Action:
the term whose contribution to the output is proportional to the deviation of the input (the deviation is the difference between the measured variable and the set-point).
Derivative Action:
the term whose contribution to the output is proportional to the rate of variation of the input signal deviation.
Integral Action:
the term whose contribution to the output is proportional to the integral with time of the input signal deviation.

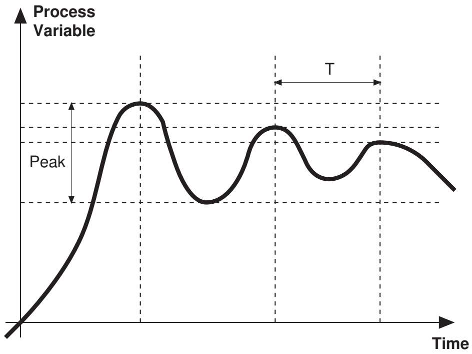
The influence that the Proportional, Derivative and Integral terms have on the process under control

* An increase in the P.B. reduces the oscillations but increases the deviation.
* A reduction of the P.B. reduces the deviation but provokes oscillation of the controlled variable (if the value of the P.B. is too low, the system will tend to be unstable).
* An increase in the Derivative Action, which corresponds to an increase of the Derivative Time, reduces the deviation and also prevents oscillation up to a critical value of the Derivative Time, above which the deviation increases and prolonged oscillations will occur.
* An increase of the Integral Action, which corresponds to a reduction of the Integral Time, helps to remove the deviation between the controlled variable and the set-point when the system has settled down.

If the value of the Integral Time is too long (Weak integral action) it is possible that there will be a persistent deviation between the input and the set-point.
Contact SPIRAX-SARCO to receive further information concerning controls action

13 • MANUAL TUNING

A) Enter the set-point at its working value.
B) Set the proportional band at 0,1% (with a cycle time set at zero to have on-off action with a relay output).
C) Switch to automatic and observe the behaviour of the variable.
It will be similar to that in the illustration:



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 instrument in manual, enter the calculated values. Return to PID action by setting the appropriate relay output cycle time, and switch back to Automatic.
F) If possible, to evaluate the optimised parameters, change the set-point and observe how the system reacts to the transitory change.
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 OFF: hold down the “ F ” and “Raise” keys together for 5 seconds to disactivate the instrument, which puts itself in the OFF state while keeping the line supply connected, keeping the process value displayed, while the SV display is OFF.
All the outputs (alarm as well as control) are in the OFF state (logic 0 or relay disenergised) and all the functions of the instrument are disabled except the switch-on function and the digital communication.
How to switch ON: hold down the “ F ” key for 5 seconds and the instrument will pass from the OFF state to the ON state.
If the power is removed during the OFF state, the next time the power is connected, the instrument will find itself in the same OFF state (the ON or OFF state is memorised).
The function is normally enabled. The function can be disabled by setting the parameter Prot = Prot +16.
This function can be executed through a digital input (d.i.F.1 or d.i.F.2).

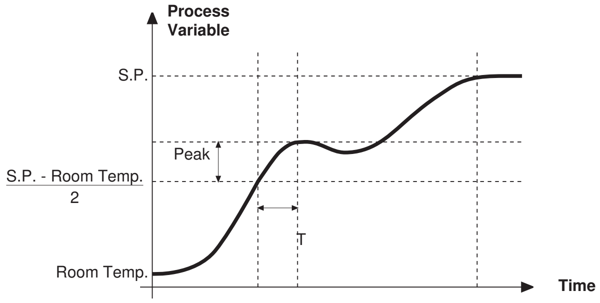
15 • SELF-TUNING

The function works very well for single output systems (heating or cooling). The self-tuning action has the scope of calculating the optimum values for the control parameters during the start up of the process.
The variable (for example the temperature) must be that assumed at zero power (ambient temperature).
The controller supplies maximum output power until a point below the set-point is reached. It then zeros the power again.
By measuring the overshoot, and the time needed to arrive at maximum, the PID parameters are calculated.
Once the action has finished its calculations, it disables itself automatically and the control proceeds normally to bring the system to set-point.

How to activate selftuning:

A. Activation at turn-on

1. Adjust the setpoint at requested value
2. Enable selftuning setting **Stun** parameter at value (CFG menu)
3. Switch the instrument off
4. Be sure that the temperature value approximately corresponds to the ambient temperature
5. Switch the instrument on



B. Activation from keyboard

1. Be sure that the M/A key is enabled for Start/Stop selftuning function (**butt** code = 4 Hrd menu)
2. Adjust the temperature value next to the ambient temperature one.
3. Set the setpoint at requested value.
4. Press M/A key to activate selftuning. (Attention: if the key is pressed twice, selftuning will be disabled)

The procedure takes place automatically until the the end. When finishing, the new PID parameters are stored: proportional band, integral and integrated times calculated for the active action (heat or cool). In case of double action (heat or cool) the parameters of the opposite action are calculated maintaining the initial ratio between the respective parameters
(ex.: CPb = HPb * K; where K = CPb / HPb when starting selftuning). At the end, the Stun code is automatically cancelled.

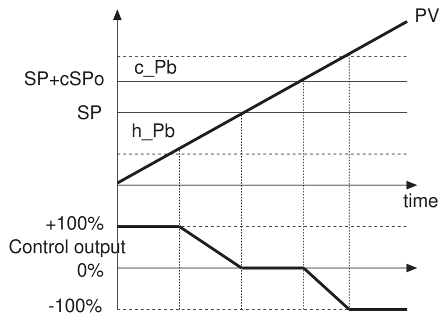
Remarks:

• Procedure interrupts when the setpoint value is exceeded during the course. In this case the **Stun** code is not cancelled.
• It is suggested to enable one of the configurable leds for the selftuning status indication. If one of Led1, Led2, Led3 = 3 (or 19) parameters are set in the Hrd menu, the corresponding led is on (or flashing), during the active selftuning phase.

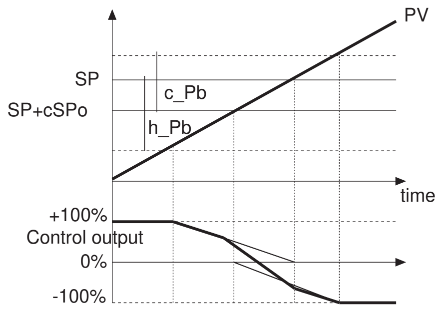
16 • AUTO-TUNING

If this function is enbled, it is not possible to enter the PID parameters manually.
It can be one of two types: permanent or one-shot.
The first continual examines system oscillations to recalculate the optimum values to reduce these oscillations.
It does not intervene if the oscillations are less than 1,0% of the proportional band.
It is interrupted if the set-point is changed, and is reinserted when the set-point is stable.
The calculated PID parameters are not stored.
If power is removed from the instrument, the instrument reverts to the values entered before auto-tuning was enabled.
One-shot auto-tuning is useful for calculating the values around set-point. It produces a variation in output of 10% of the current power and it examines the effect of the overshoot over time. The parameters are stored, and replace those perviously entered. After this disturbance, the controller returns to control at the set-point using the new parameters.

17 • CONTROL OUTPUT



Proportional only control output with heating Proportional band separated from cooling Proportional band



Proportional only control output with heating Proportional band overlapped on cooling Proportional band

PV = Process Value
SP+cSPo = Cooling Set Point
c_Pb = Cooling Proportional band
SP = Heating Set Point
h_Pb = Heating Proportional band

Relative Gain Heat/Cool Control

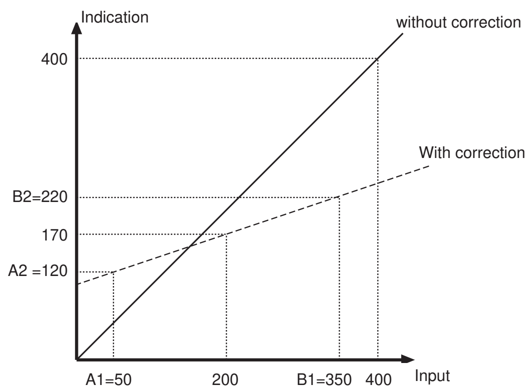
By this control mode (enabled through CtrL = 14 parameter) the type of cooling has to be specified.
Cooling PID parameters are thus calculated starting from the heating ones according to the following ratio.
(i.e.: c.MEd = 1 (oil), H_Pb = 10, H_dt = 1, H_It = 4 brings to: C_Pb = 12,5, C_dt = 1 , C_It = 4) It is suggested to select the following values when setting output cycle times:
Air T Cycle Cool = 10 sec.
Oil T Cycle Cool = 4 sec.
Water T Cycle Cool = 2 sec.
NB.: By this mode cooling parameters **cannot be modified.**

18 • MAIN INPUT CORRECTION FUNCTION

It allows a custom correction of the main input reading throught the setting of four values: A1, B1, A2, B2.
This function can be enabled selecting “Sens” +8 code (menu “Hrd”).
Example: Sens = 1+8 = 9 for RTD sensor with input correction.
If this function is applied to linear scales (50mv, 10V, 20mA, Pot), it is possible to reverse the scale.
The four values are set in menu “Lin” as follows: A1 = St100, B1 = St01, A2 = St02, B2 = St03. Setting limits correspond to the prefixed scale (“LoS” ... “HiS” nel menù “InP”).
The offset function (Parameter “oFt” menu “InP”) remains enabled.
Limits:
B1 always higher than A1;
B1-A1 25% Should be at least 25%, of full scale of selected probe.

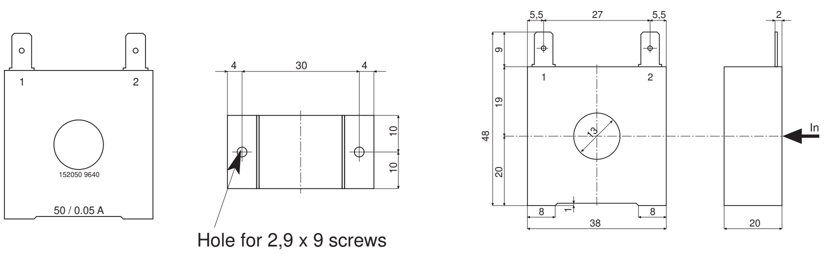
Example:

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



19 • ACCESSORIES

• CURRENT TRANSFORMER



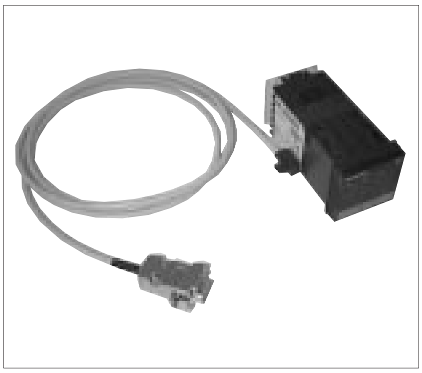
These transformers are used for current measurements at 50 ÷ 60Hz from 25A to 600A (nominal primary current). The peculiar characteristic of these transformers is the high number of secondary turns. This means a very low secondary current directly suitable for an electronic circuit of measurement. The secondary current may be detected as a 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_{1-2} = 500	1 - 2	40 Ω	2 Vac	2.0 %
TA/152 050	50 / 0.05A	0.18 mm	n_{1-2} = 1000	1 - 2	80 Ω	4 Vac	1.0 %

• ORDER CODE

COD. 330200	IN = 50Aac OUT = 50mAac
COD. 330201	IN = 25Aac OUT = 50mAac

• RS232 interface cable for instrument configuration



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

• ORDER CODE

COD. **1108200**	Cable + Floppy

ORDER CODE

MODEL	
1600 V	1600 V
1800 V	1800 V

OUTPUTS 1,2,3,4 *(R/D)*	
Out1 (R) + Out2 (R) + Out3 (R)	RRR0*
Out1 (R) + Out2 (R) + Out3 (R) + Out4 (R)	RRRR
Out1 (R) + Out2 (R) + Out3 (D)	RRD0
Out1 (R) + Out2 (R) + Out3 (D) + Out4 (R)	RRDR

OUTPUT 5, 6	
None	00*
OUT 5 (W1) 0...10V	V0
OUT 5 (W1) 0/4...20mA	I0
OUT 5 (W1) 0...10V OUT 6 (W2) 0...10V	VV
OUT 5 (W1) 0/4...20mA OUT 6 (W2) 0...10V	IV
OUT 5 (W1) 0/4...20mA OUT 6 (W2) 0/4...20mA	II

POWER SUPPLY	
0	20...27Vac/dc ±10%
1*	100...240Vac/dc ±10%

DIGITAL COMMUNICATIONS	
0*	None
1	Current Loop
2	RS 485
3	RS 232C

AUXILIARY INPUTS	
00*	None
01	IN1, IN2 NPN
02	IN1, IN2 PNP
03**	Transmitter Supply 10V
04**	IN1, IN2 NPN + Transmitter Supply 10V
05**	IN1, IN2 PNP + Transmitter Supply 10V
06**	IN SPR (0...1V) + Transmitter Supply 10V
07**	IN SPR (0...10V) / IN Potentiometer # + Transmitter Supply 10V
08**	IN SPR (0/4...20mA) + Transmitter Supply 10V
09**	IN CT (50mAac) + Transmitter Supply 10V
10**	IN1, IN2 NPN, IN SPR (0...1V) + Transm. Sup. 10V
11**	IN1, IN2 NPN IN SPR (0...10V) / IN Potentiometer # + Transmitter Supply 10V
12**	IN1, IN2 NPN IN SPR (0/4...20mA) + Transmitter Supply 10V
13**	IN1, IN2 NPN, IN CT (50mAac) + Transm. Sup.10V
14**	IN1, IN2 PNP, IN SPR (0...1V) + Transm. Sup. 10V
15**	IN1, IN2 PNP IN SPR (0...10V) / IN Potentiometer # + Transmitter Supply 10V
16**	IN1, IN2 PNP IN SPR (0/4...20mA) + Transmitter Supply 10V
17**	IN1, IN2 PNP, IN CT (50mAac) + Transm. Sup. 10V
33	IN SPR (0...1V)
34	IN SPR (0...10V)
35	IN SPR (0/4...20mA)
36	IN CT (50mAac)

(*) Indicates the standard version
(**) Add +15 to obtain Transmitter Supply 24V
Potentiometer input requires 10V transmitter supply

For a PTC input a specific calibration has to be requested

• WARNINGS

WARNING: this symbol indicates danger.
You can see it close the power supply circuit and the relay contacts that may be connected to high voltage.

Before installation, please read the following advices:

• follow the indications of the manual scrupulously when making the connections to the instrument
• use a cable that is suitable for the ratings of voltage and current indicated in the technical specifications
• the instrument has no ON/OFF switch for the power, it operates immediately the supply is connected; for safety reasons, the devices permanently connected to power supply require ON/OFF switch with proper warking; the switch must be close to the unit and should be easily reachable by the user. A single switch can be connected to several units.
• if electrically NON-ISOLATED equipment is connected to the instrument (e.g. thermocouples), a ground wire must be connected to avoid that this connection is made through the machine
• if the instrument is used in applications where there is risk of injury to persons and damage to machines or materials, it is essential that it is used with an auxiliary alarm device. It is advisable to verify frequently that the alarm device is functional even during the normal operation of the equipment
• before using the instrument, it is the user's responsibility to ensure the correct instrument settings to avoid injury to persons or damage to objects and materials
• the instrument must NOT be used in environments where there could be the presence of dangerous atmospheres (inflammable or explosive); if the instrument is used with elements that operate in such atmospheres, they must be connected through an appropriate interface or safety barrier that conforms to the local safety regulations in force
• the instrument contains components that are sensitive to static electrical discharges and appropriate precautions must be taken before handling the electronic circuit boards if permanent damage to these components is to be prevented

Installation: installation category II, pollution degree 2, double isolation
• the power supply wiring must be kept separate from that of inputs and outputs of the instrument; always check that the supply voltage corresponds to that indicated on the instrument label
• install the instrumentation separately from the relays and power switching devices
• in the same cabinet, do not install power contactors,, contactors, relays; thyristor power units "particularly if phase angle"; motors, etc...
• keep away from dust, humidity, corrosive gases and heat sources
• do not close the ventilation holes; the working temperature must be in the range 0...50°C.
If the unit has faston terminals they must be of the protected and isolated type; if the unit has screw terminals it is necessary to fix the cable in pairs.
• *Power supply*: should be taken from an isolator with a fuse for the instrument section; the path of the supply wiring should be as direct as possible from the isolator to the instruments: 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 is used only for the instruments, connecting the screen to ground; it is important the electrical plant has a good ground connection, the voltage between neutral and ground must not exceed 1V and the resistance must be less than 6Ω; if the supply suffers large voltage swings, use a voltage stabiliser for the instrument supply; in the vicinity of high frequency generators or arc welders, use line filters; the power supply wiring must be kept separate from the that of the inputs and that of the outputs of the instruments; always check that the supply voltage corresponds to that indicated on the instrument label
• *Input and output connections:* for connecting analogue signals (TC, RTD) it is necessary to: physically separate the input wiring from that of the power supply wiring, from the wiring to the outputs and from power connections; use twisted and screened cables, with the screen connected to ground at only one point to use RC (resistor and capacitor in series) spark suppression components in parallel with inductive loads that operate in ac (contactors, solenoid valves, motors, fans, etc.) connected to the outputs of the instrument (*Note: all the capacitors must conform to the VDE standard (class x2) and withstand a voltage of at least 220Vac. The resistor must be at least 2W*); fit a diode 1N4007 in parallel with the coil of inductive loads that operate in dc
SPIRAX-SARCO srl **will not be held responsible for injury to persons or damage to objects and materials caused by mishandling,** incorrect or err**oneous use that is not in conformity with the instrument specifications.**