GEFRAN

1600P / 1800P

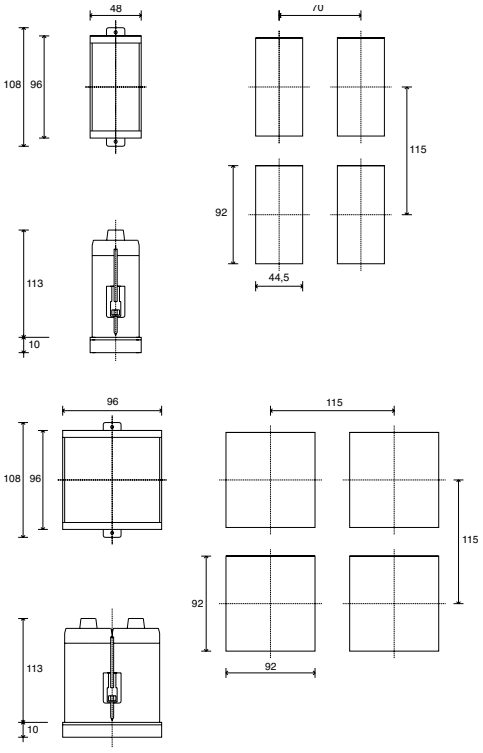
CONTROLLER / PROGRAMMER

INSTALLATION AND OPERATION MANUAL

SOFTWARE VERSION **3.2x**
code **80090G** / Edit **14** - **04-2013**

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*:** The instrument conforms to the European Directives 2004/108/CE and 2006/95/CE with reference to the generic standards: **EN 61000-6-2** (immunity in industrial environment) **EN 61000-6-3** (emission in residential environment) **EN 61010-1** (safety).
Limitations: model 1800P conforms to Standard EN61000-6-4 for emissions radiated in industrial environment.

***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*:** GEFRAN 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 7mm (1600P), 20 and 30 mm (1800P)
Keys	5 mechanical keys (≠, Man/Auto, INC, DEC, F)
Accuracy	0.2% full scale at 25°C room temperature
Main input	TC, RTD (Pt100 - JPT100), PTC, 50mV 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
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)
Remote setpoint or ammeter input (options)	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 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 isolation 1500V
Serial interface (optional)	CL; RS422/485; RS232; isolation 1500V
Baud 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% non-condensing
Environmental conditions of use	for internal use only, altitude up to 2000m
Installation	Panel, plug-in from front
Weight	400g (1600P); 600g (1800P) 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 indicator
Indicates modes of operation
MAN = OFF (Automatic control)
MAN = ON (Manual control)
AUX = ON (program in reset)
PRG = ON (program running)

"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 (Main); OUT 2 (AL 1);
OUT 3 (AL 2); 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

~ 12
PWR
~ 13

Standard:
100...240Vac/dc ±10%

Optional:
20...27Vac/dc ±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 (AL3/HB)
10 +

• Outputs

Out1 (Main): (-) NC 14, C 15, (+) NO 16
Out2 (AL1): (-) NC 17, C 18, (+) NO 19
Out3 (AL2): (-) NC 20, C 21, (+) NO 22

User configurable generic outputs

- 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

6 ~ +
5 ~ -

• Serial line

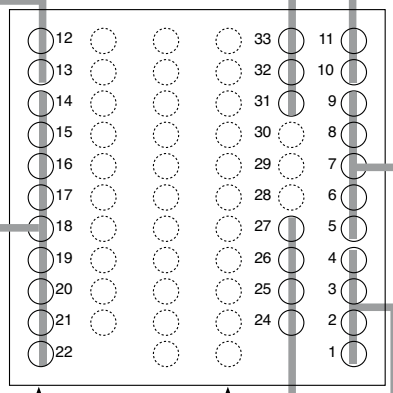
Configurable serial line isolated to 1500V

RS422/485 or RS232

Passive current loop (max. 1200 baud) (optional R60 special version)

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

A (Data +)
B (Data -)
GND
RS485 2 wires
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 or PTC

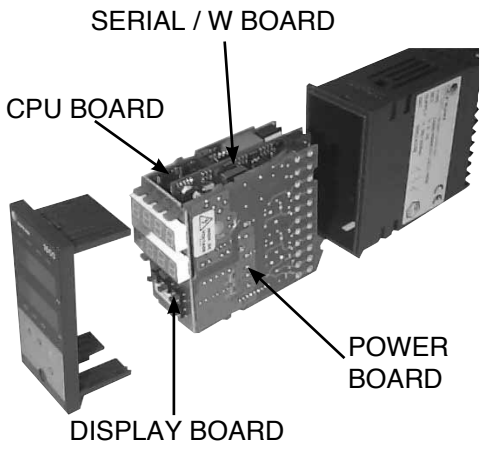
Use wires of adequate diameter (min. 1mm²)
PT100, JPT100, PTC

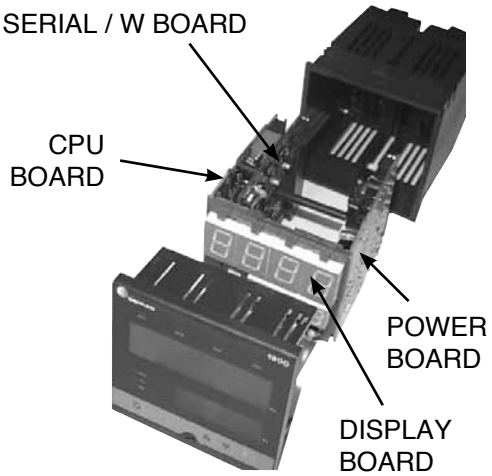
3
2 T
1

• Pt100 3-wires

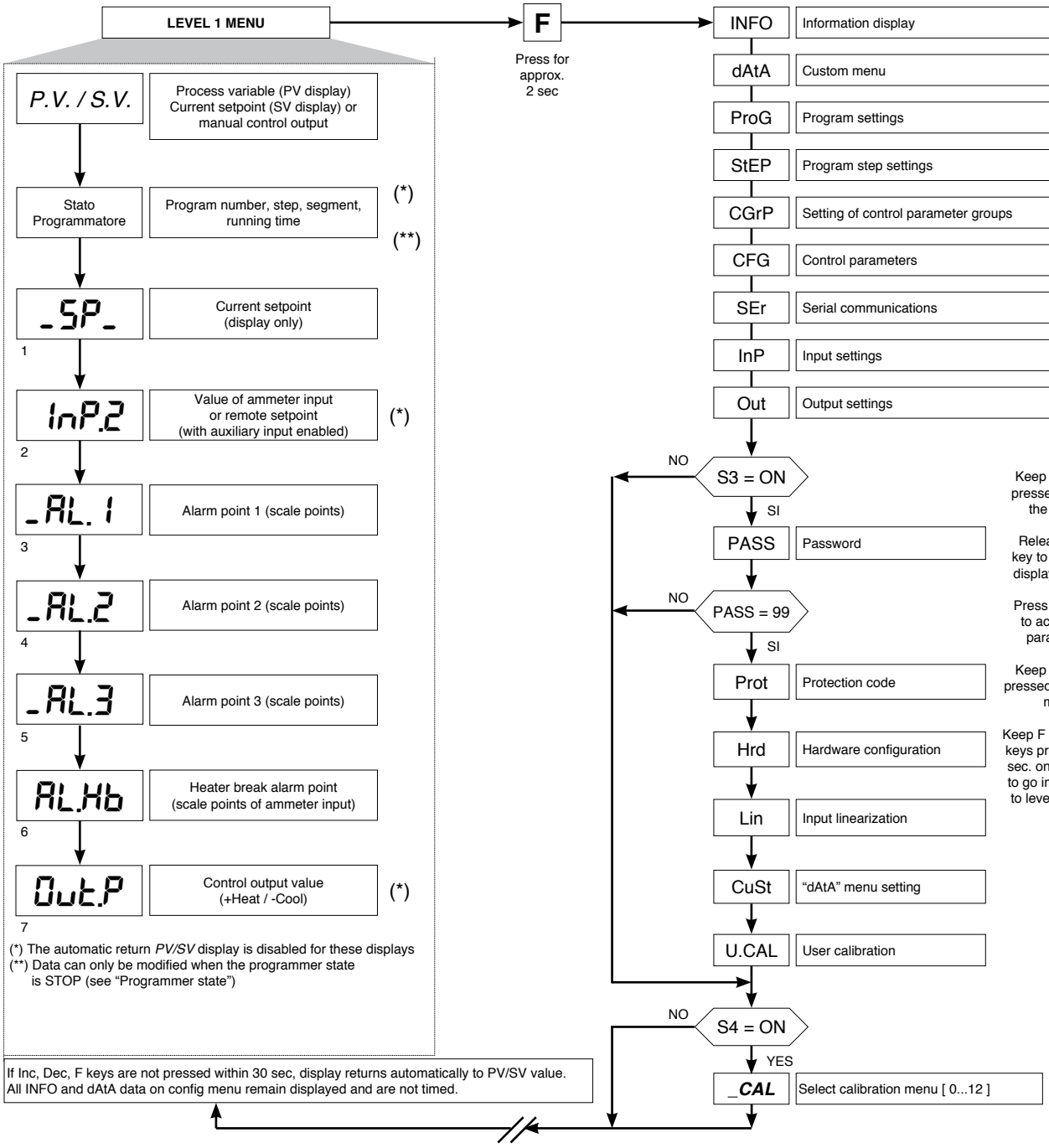
3
2 T
1

Unit layout





5 • PROGRAMMING and CONFIGURATION



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

• ProG

ProG — Program number — 0 ... 3 — 222

LEn — Number of program steps — 1 ... 8 — 223

P.tY — Program type and restart mode — 0 ... 127 — 224

	Program type and restart mode
0	Restart from first step; the setpoint copies the value of PV
1	Restart from conditions prior to stop
2	Restart with step search (see “Programmer Functions”)

+ 8 Wait for STOP / START switching
+ 16 Continuous loop; at end of cycle the program restarts from first step (excludes +32 function)
+ 32 At end of cycle the control output goes to “FAcP” value, set in “CFG” menu
+64 Fast simulation (see “Programmer Functions”)

• StEP

StEP — Selects program and step to set — P0-0 ... P3-7 — 226

SP.S — S step setpoint — Lo_L ... Hi_L — 227

rP.t — “S” step ramp time (time set refers to time base selected [HH:MM or MM:SS] - see “SP. Pr” parameter in “Hrd” menu) — 0.0 ... 99.59 — 228

So.t — “S” step hold time (time set refers to time base selected [HH:MM or MM:SS) — 0.0 ... 99.59 — 229

St.y — Defines “S” step type. Hold Back Band (HBB) function; lets you disable HBB during a segment or entire step. Parameter is ON if HBB is enabled (see “SP.Pr” parameter on “Hrd” menu) — 230

Sty	HBB enabled for ramp	HBB enabled for hold	HBB referred to PV or auxiliary input
0			PV
1	x		PV
2		x	PV
3	x	x	PV
4			aux. input
5	x		aux. input
6		x	aux. input
7	x	x	aux. input

+ 8 to enable slave setpoint ramp

SL.S — Setpoint slaved to step “S”, for second external channel (to be retransmitted to a slave controller); available if enabled (see “SP.Pr” parameter on “Hrd” menu) — 0.0 ... 100.0% retransmitted output value — 231

EU.r — “S” step ramp events — 232

EU.S — “S” step hold events — 233

Eu.ro Eu.S	Event 1	Event 2	Event 3	Event 4
0	OFF	OFF	OFF	OFF
1	ON	OFF	OFF	OFF
2	OFF	ON	OFF	OFF
3	ON	ON	OFF	OFF
4	OFF	OFF	ON	OFF
5	ON	OFF	ON	OFF
6	OFF	ON	ON	OFF
7	ON	ON	ON	OFF
8	OFF	OFF	OFF	ON
9	ON	OFF	OFF	ON
10	OFF	ON	OFF	ON
11	ON	ON	OFF	ON
12	OFF	OFF	ON	ON
13	ON	OFF	ON	ON
14	OFF	ON	ON	ON
15	ON	ON	ON	ON

IPt — Step “S” advanced through digital input function. When digital inputs have state set in this function, program automatically advances to next step, otherwise it “waits” at end of previous step (function is enabled through “SP.Pr” parameter on “Hrd” menu); *“d.i.F.1” and/or “d.i.F.2” set to 12.* — 234

IPt	IN1 = ON	IN2 = ON
0		
1	x	
2		x
3	x	x

Hbb — Hold Back Band value, symmetrical to active setpoint. Available if enabled (see “SP.Pr” parameter on “Hrd” menu); can be disabled during a program segment (see “Sty” parameter). — 0 ... 999 scale points — 235

GrP. — Selection of a control parameter group during ramp phases and holding of setpoint programmer. — 242

GrP.	Ramp group	Hold group
0	0	0
1	0	1
2	0	2
3	0	3
4	1	0
5	1	1
6	1	2
7	1	3
8	2	0
9	2	1
10	2	2
11	2	3
12	3	0
13	3	1
14	3	2
15	3	3

+ 16 to force the power limit of group 0 when in “hold” phase

• C.GrP

C.GrP — Selection of a control parameter group to be set. — 0 ... 3 — 243

h_Pb — Proportional band for heating or hysteresis for ON/OFF control — 0.0 ... 999.9% full scale — 244

h_It — Integral time for heating — 0.00 ... 99.99 min — 245

h_dt — Derivative time for heating — 0.00 ... 99.99 min — 246

h.PHi — Maximum power limit for heating — 0.0 ... 100.0% — 247

h.PLo — Minimum power limit for heating (not available for double heat/cool action) — 0.0 ... 100.0% — 248

c_Pb — Proportional band for cooling or hysteresis on ON-OFF action — 0.0 ... 999.9% full scale
249

c_ It — Integral time for cooling — 0.00 ... 99.99 min
250

c_dt — Derivative time for cooling — 0.00 ... 99.99 min
251

c.P.H i — Maximum power limit for cooling — 0.0 ... 100.0%
252

c.P.Lo — Cooling power lower limit (not available for heating/cooling double action) — 0.0 ... 100.0%
253

• CFG

CFG — Control parameters

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

S.tun	Continuos 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

Note:
1) Active S.tun functionS reset when switching from Automatic to Manual

h_Pb — Proportional band for heating or hysteresis on ON-OFF action — 0 ... 999.9% f.s.
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.H i — 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
97

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

c.SP.o — Setpoint for cooling relative to heating setpoint — ± 25.0% (full scale)
20

c_Pb — Proportional band for cooling or hysteresis for ON/OFF control — 0 ... 999.9% f.s.
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.H i — 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 punti scala
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 sec
33

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

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

LbA.P — 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

(*) 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, h.P.Lo, c_Pb, c_It, c_dt, c.P.Hi, c.P.Lo 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 communication

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

38

SEr.P — Serial interface protocol CENCAL, MODBUS

SEr.P	Serial protocol
0	CENCAL GEFRAN
1	MODBUS RTU

39

bAud — Selects Baudrate

40

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 — Parity selection (MODBUS only)

_PAr	Parity
0	No parity
1	Odd
2	Even

101

• InP

InP — Input settings

SP.tY — 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

44

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

45

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	Max. scale range
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	custom linear	see table 32 values in Lin

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

tYPE	Signal type	Scal	Scale range max.
0	0...10V	lineare	-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

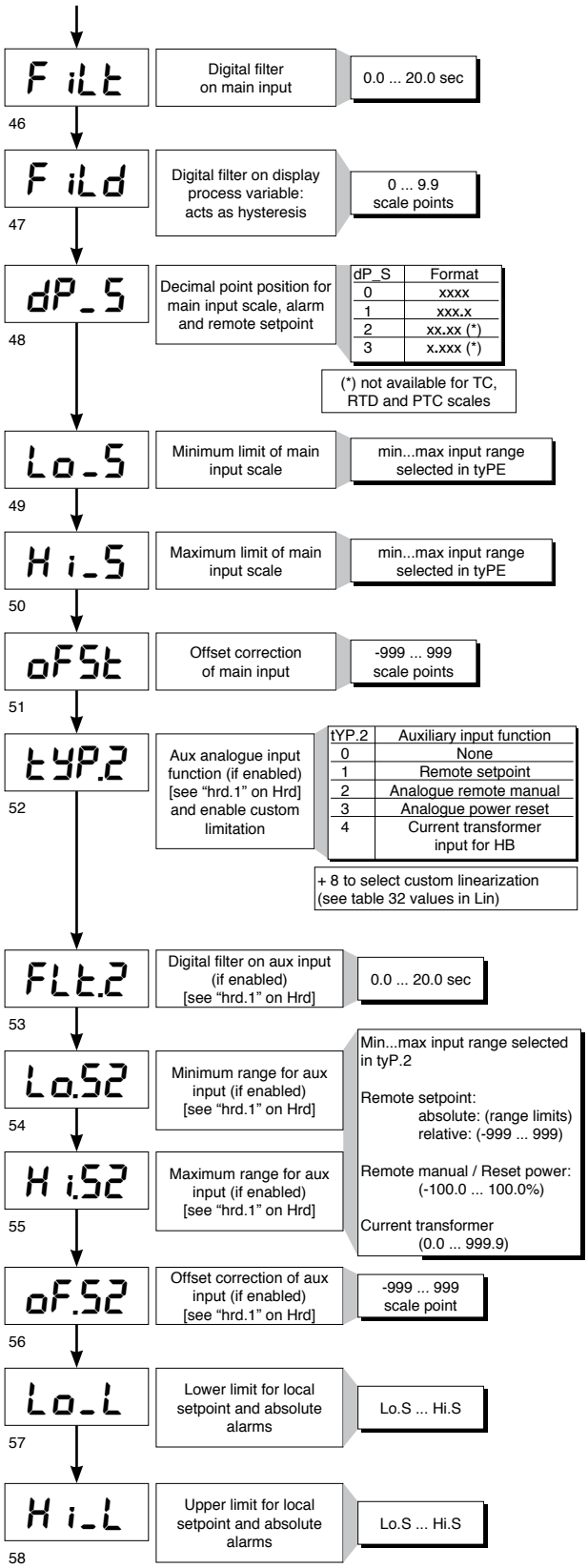
PROBE: CUSTOM 10V (SEnS=6)

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

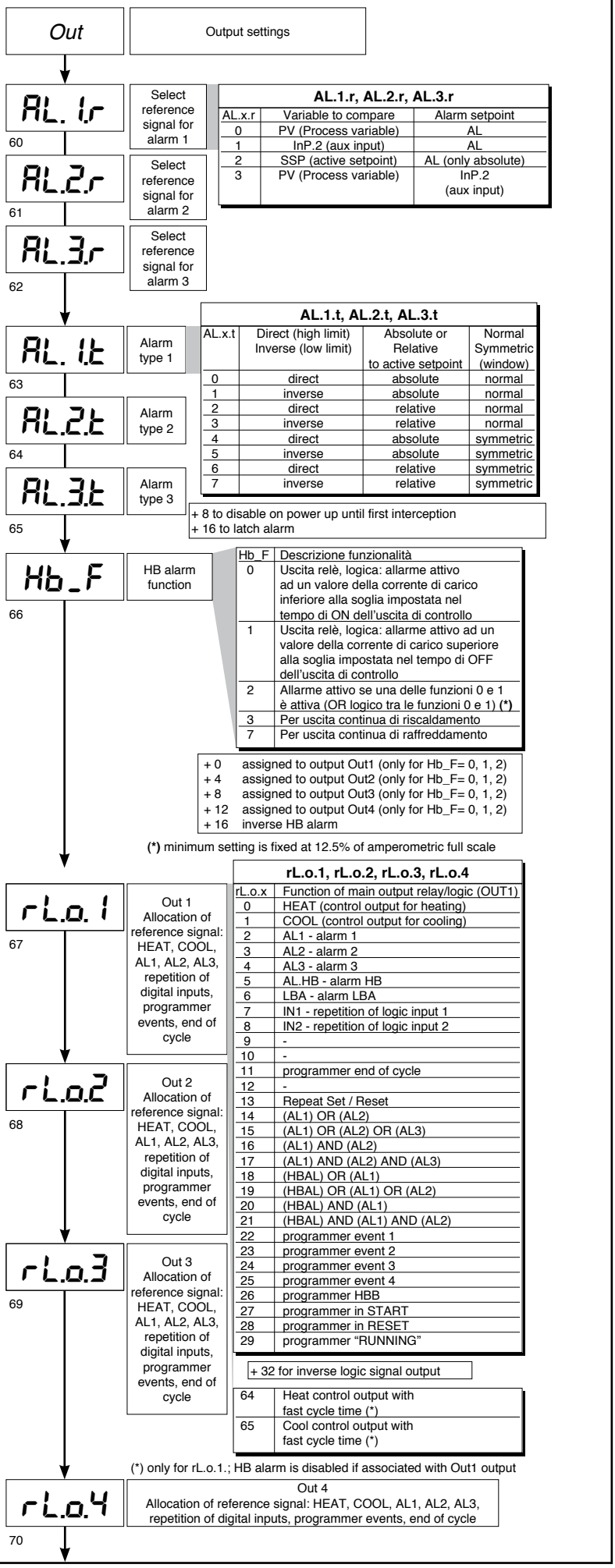
PROBE: CUSTOM 50mV, 20mA (SEnS=7)

tYPE	Signal type	Scale	Scale range max.
0	Custom	linear	-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
+ 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
Remote setpoint:
absolute: (range limits)
relative: (-999 ... 999)
Remote manual / Reset power:
(-100.0 ... 100.0%)
Current transformer
(0.0 ... 999.9)
54
Hi.S2
Maximum range for aux input (if enabled) [see "hrd.1" on Hrd]
55
oF.S2
Offset correction of aux input (if enabled) [see "hrd.1" on Hrd]
-999 ... 999 scale point
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.1.r, AL.2.r, AL.3.r
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)
AL.1t
Alarm type 1
63
AL.2t
Alarm type 2
64
AL.3t
Alarm type 3
65
AL.1.t, AL.2.t, AL.3.t
AL.x.t | Direct (high limit) Inverse (low limit) | Absolute or Relative to active setpoint | Normal Symmetric (window)
0 | direct | absolute | normal
1 | inverse | absolute | normal
2 | direct | relative | normal
3 | inverse | relative | normal
4 | direct | absolute | symmetric
5 | inverse | absolute | symmetric
6 | direct | relative | symmetric
7 | inverse | relative | symmetric
+ 8 to disable on power up until first interception
+ 16 to latch alarm
Hb_F
HB alarm function
66
Hb_F | Descrizione funzionalità
0 | Uscita relè, logica: allarme attivo ad un valore della corrente di carico inferiore alla soglia impostata nel tempo di ON dell'uscita di controllo
1 | Uscita relè, logica: allarme attivo ad un valore della corrente di carico superiore alla soglia impostata nel tempo di OFF dell'uscita di controllo
2 | Allarme attivo se una delle funzioni 0 e 1 è attiva (OR logico tra le funzioni 0 e 1) (*)
3 | Per uscita continua di riscaldamento
7 | Per uscita continua di raffreddamento
+ 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 12.5% of amperometric full scale
rL.o.1
Out 1 Allocation of reference signal: HEAT, COOL, AL1, AL2, AL3, repetition of digital inputs, programmer events, end of cycle
67
rL.o.2
Out 2 Allocation of reference signal: HEAT, COOL, AL1, AL2, AL3, repetition of digital inputs, programmer events, end of cycle
68
rL.o.3
Out 3 Allocation of reference signal: HEAT, COOL, AL1, AL2, AL3, repetition of digital inputs, programmer events, end of cycle
69
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 | -
10 | -
11 | programmer end of cycle
12 | -
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)
22 | programmer event 1
23 | programmer event 2
24 | programmer event 3
25 | programmer event 4
26 | programmer HBB
27 | programmer in START
28 | programmer in RESET
29 | programmer "RUNNING"
+ 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
rL.o.4
Out 4
Allocation of reference signal: HEAT, COOL, AL1, AL2, AL3, repetition of digital inputs, programmer events, end of cycle
70

_Ct.1 — Cycle time for OUT1 relay or logic output = HEAT or COOL — 1. ... 200 sec (0.1...20.0 sec)

71

_Ct.2 — Cycle time for OUT2 relay or logic output = HEAT or COOL — 1. ... 200 sec

72

_Ct.3 — Cycle time for OUT3 relay or logic output = HEAT or COOL — 1. ... 200 sec

73

_Ct.4 — Cycle time for OUT4 relay or logic output = HEAT or COOL — 1. ... 200 sec

74

_rEL. — Fault action (sets state in case of probe fault)
Alarm outputs AL1, AL2, AL3;
Select intrinsic safety

75

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 — Out W1
Assignment of signal or reference value: PV, SP, SP-PROG, DEV+, DEV-, IN.AUX, HEAT, COOL, AL1, AL2, AL3, serial line value

78

An.o.1, An.o.2

An.o.x	Reference value
0	PV - process variable
1	SSP - active setpoint
2	-
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
12	Setpoint slaved to programmer

+ 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 — Minimum limit of analogue repetition signal output 1 — -1999...9999

76

H.An.1 — Maximum limit of analogue repetition signal output 1 — -1999...9999

77

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

81

L.An.2 — Minimum limit of analogue repetition signal output 2 — -1999...9999

79

H.An.2 — Maximum limit of analogue repetition signal output 2 — -1999...9999

80

• Prot

Prot — Protection code

42

Prot	Dispaly	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

SP.Pt — Programmer installation and resource selection

SP.Pt	Type of programmer
0	Programmer disabled (with programmer disabled, operation is as described in the 1600/1800 controller manual)
1	12-step programmer without control parameters group
2 (*)	12-step programmer with control parameter groups
3 (*)	16-step programmer without control parameter groups

(*) as alternative to the custom input linearization function

SP.Pr — Programmer function

SP.Pr	
1	Program selection from keypad; time base HH : MM
2	Program selection from digital inputs; time base HH : MM

+ 4 time base MM : SS
+ 8 to enable slaved setpoint
+ 16 to enable 4 events (ramp and/or hold)
+ 32 to enable step advance from digital inputs
+ 64 to enable Hold Back Band

hrd.1 — Installation of aux input, digital inputs, serial interface

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

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

hrd.2	OUT1 (relé, logic)	OUT2 (relé, logic)	OUT3 (relé, logic)	OUT4 (relé, 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	Taste "*"	Bargraph
0		
1	x	
2		x
3	x	x

CtrL — Control type [0...78]

43

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.

Alarm is not enabled with ON/OFF type control.

_S.S.t. — Start/Stop Programmer (0...63)

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

__rt. — Reset Programmer (0...15)

+8 inverse action
+16 Autoreset enabled (Stop = program reset) (only for _S.S.t. parameter)
+16 reset from the set it puts into effect them without zero setting power (only for _ _ rt parameter)
+32 start from current value of process variable (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	CT 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: "≠"

	Function
0	none (key disabled)
1	MAN / AUTO select
2	LOC / REM
3	HOLD
4	Start / Stop self-tuning
5	Start / Stop autotuning
6	Set / Reset outputs OUT 1 ... OUT 4
7	Reset alarms memory
8	-
9	Instantaneous integral reset
10	START / STOP Programmer (if enabled in S.S.t.)
11	RESET Programmer (if enabled in _ _ r.t.)

but.2

+16 disable function in configuration menu (only for butt parameters)

d. iF. 1. — Function of digital input 1 (IN1)

d. iF.2. — Function of digital input 2 (IN2)

d.i.F.1, d.i.F.2

d.i.F.x	Digital input function
0	none (key disabled)
1	MAN / AUTO select
2	LOC / REM
3	HOLD
4	Start / Stop programmer
5	Reset programmer
6	Software power on/off
7	Reset alarms memory
8	Select program 0, 1, 2, 3 (LS bit)
9	Select program 0, 1, 2, 3 (MS bit)
10	Advance program to end of cycle
11	Advance program to last step
12	Enable program advance

+ 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)

LEd. 1 — Function of "MAN" LEDs: M/A, L/R, ATUN, IN1, IN2 repetition, event programmer, serial port enabled, errors present

LEd2

LEd3

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

LEd.x	Function
0	none
1	MAN/AUTO (ON in manual, OFF in auto)
2	LOC/REM (ON in remote, OFF in local)
3	self-tuning enabled
4	autotuning enabled
5	IN1 repetition
6	IN2 repetition
7	enable serial dialogue
8	HOLD on
9	Error present (error code <> 0)
10	Softstart running
11	Program 0, 1, 2, 3 (LS bit)
12	Program 0, 1, 2, 3 (MS bit)
13	Programmer in START
14	Programmer in RESET
15	Programmer RUNNING

+ 16 for flashing LED function

bArG — Bargraph function

bArG	
0	Heat
1	Cool
2	Heat + Cool
3	PV
4	Aux input (position V2 valve)
5	Current setpoint
6	-
7	-
8	Deviation (PV-setpoint) 10%… + 10% of full scale

• Lin

Lin — Custom linearization for main or aux input (*)

St.00 — Step 0 — Scale limits

.....

St.32 — Step 32 — Scale limits

(*) Not available for:
16-step programmer (SPPt = 3)
programmer with control parameter groups (SPPt = 2)
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 — Set custom "dAtA" menu

HEAd — Set number of parameters in custom menu [0 ... 14]

PA.01 — Identification code for parameter 1

.....

PA.14 — Identification code for parameter 14

XXXX

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

• U.CAL

U.CAL — User calibration

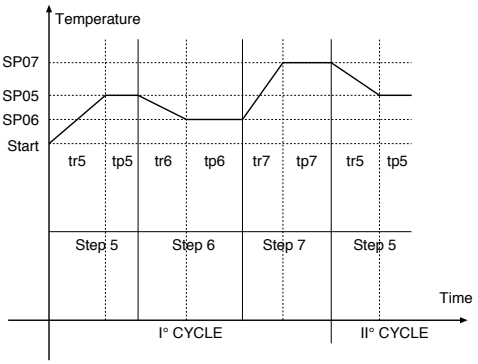
U.CAL	Function
1	Analogue output 1
2	Analogue output 2
3	Input 1 - custom probe 10V
4	Input 1 - custom probe 50mV
5	Input 2 - potentiometer

6 • PROGRAMMER

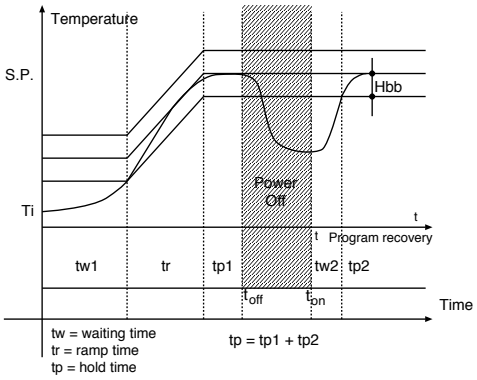
The unit combines the functions of a single loop controller and programmer.
The programmer function lets you run a program as a series of steps, each of which has two segments:
√ a ramp
√ a hold.
Every step has its associated data:
• SPs: a setpoint value
• rPt: ramp time from 0.0 to 99h59m (time base in h. m.) or 99m59s (time base in m. s.); set a time that gives a faster or slower variation depending on the initial value and on the final setpoint.
• Sot: hold time from 0.0 to 99h59m (time base in h. m.) or 99m59s (time base in m. s.).
• Hbb: tolerance band, symmetrically positioned above and below the setpoint, and referenced to the main input or the auxiliary input.
• Eur: outputs 1...4; combination codes for outputs (0-15) programmable for the ramp phase.
• EuS: outputs 1...4; combination codes for outputs (0-15) programmable for the hold phase.
• iPt: active inputs (ON) as clearance for execution.
• SLS: slave setpoint to transmit to a slave controller with the same time base.
• GrP: parameter groups to control and limit power (up to 4), selectable by single segment.
There are 12 (16*) program steps available that can make up a maximum of 4 programs.
Examples of arrangements:
2 program of 8 and 4 steps; 4 programs of 3 steps; 2 programs of 6 steps; etc...
It is important to remember that the parameter Sty defines enabling of Hbb (on the ramp, in hold, or both) and the reference value (PV or aux input).

(*) Alternative to custom linearization function (see parameter SP.Pr, Hrd menu).

Program example



Function Hbb example (holding band)



7 • USING THE PROGRAMMER

There are up to 12 (16*) steps arrangeable in 4 programs. A program step contains the ramp and the hold time. Ramp times and hold times are programmable with a time base selected as 99h59m or 99m59s. Time base accuracy is greater than 4 secs every 10 hours.
Program selection from faceplate, digital input or serial line.
Program control from keys, digital inputs (START/STOP, RESET, end of program), serial line or events AL1/AL2/AL3.
Program stopping and restarting modes:
- from digital input; from “Raise” (START) key, “Lower” (STOP) key or “M/A” (RESET) key in absence of other enablings
- from state of alarms (ON = START)
- different modes of restarting after a power failure
• from setpoint prior to power failure
• from value of process variable at power-up
• with search for best setpoint forward/backward in time
• awaiting a start
In the STOP phase, it is possible to change:
- current setpoint
- current step time
- program number
- step number
- phase or segment (ramp or hold)
The clearance input and event outputs assigned to an individual step. Programmed input conditions are scanned at the beginning of every step.
If satisfied, execution begins with updating of assigned outputs and restart of time base.
Indication of end of program, with or without forcing of control output.
Setting a tolerance band for setpoint: if the process variable is outside the band, the time base stops (Hbb - Hold back band alarm).
Secondary setpoint with the same time base to manage a slave controller using retransmission output W1 or W2.
Full functional modularity, with easy exclusion of functions not needed. Up to 4 parameter groups to control and limit power, selectable by single segment (ramp and/or hold).

Programmer functions

Variation of the local setpoint when the program is stopped will restart the current step, keeping the same ramp time.
If the unit is switched off and then switched on, the program can continue or can start again at the first step.
Or it can search for the step that has the setpoint closest to the PV (see Pty parameter in ProG configuration to define restart conditions).
STOP/START switching at end of program resets and restarts the program.
Fast simulation of program:
A selected program can easily be checked by running it in **fast simulation** mode.
To do this, set code Pty +64 in the ProG menu.
The program runs with the ramp and hold times limited to 20 and 10 seconds, respectively. Lower values entered are accepted.

In this mode, the maximum duration of a step is 30 seconds
In fast simulation mode, hold back band (Hbb) is inhibited, and control output takes on FAc.P value.
All other functions enabled (type of restart, start/stop, reset, manual/automatic, end of cycle or continuous cycle, event outputs, clearance from digital inputs, slave channel setpoint, etc.) are active.
- Autoreset means that programmer reset is active in Stop phase, with acquisition of the variable as current setpoint and resetting of time base.
- With the controller in manual or with absolute remote setpoint, the programmer time base is stopped.
- When switching from remote to local setpoint, the setpoint assumes the value of the remote setpoint at the time of switching.

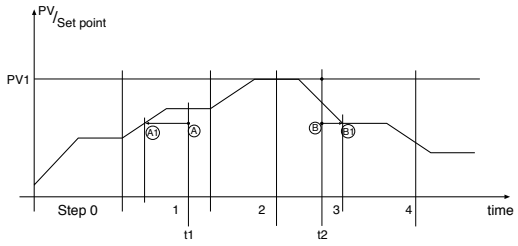
Program control from panel:
In the absence of enabled digital inputs, alarms, M/A key (butt = 10, 11), program control engages when programmer state is displayed by using the Raise, Lower, and M/A keys.
Raise in stop = START; Lower in start = STOP; M/A pressed for 2 seconds = RESET (condition maintained with key pressed); Lower for 2 seconds in stop = enable change of programmer state.
When programmer state is not displayed, M/A key maintains function selected with “butt.”

Programmer Reset Mode:
With standard function, when the control is active the setpoint takes on the value of the process variable and power is forced to zero.
When parameter “_ _ r.t.” is set to +16 and the reset control is active, the current setpoint (prior to reset) and power control are maintained.
This function is applicable with reset from digital inputs or enabled keys, and also with reset following a program change (possible only in STOP) or from STOP/START switching at the end of a program.

Restart with step search

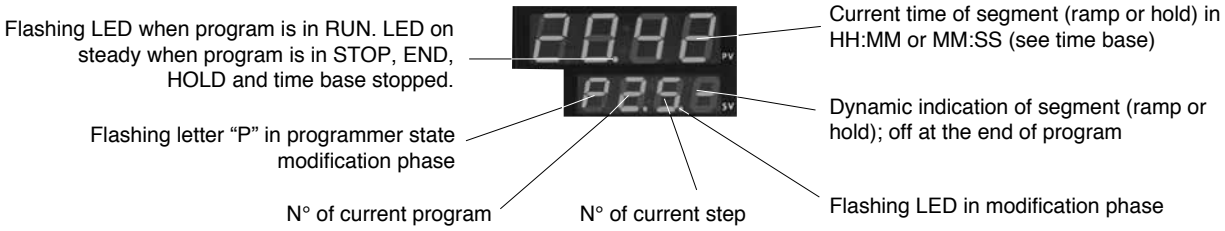
The example shows a typical setpoint profile that can be programmed by setting a single 5-step program. At start, if parameter Pty = 2 (in ProG), the program searches for the setpoint with value equal to PV. The search is performed by moving the current time forward or backward, skipping phases or steps. If the variable is lower than that required during a setpoint increase phase (point A, t1), at restart the current time base is lowered by intercepting the setpoint profile (point A1).

If the variable is lower than that required during a setpoint decrease phase (point B, t2), at restart the current time base is raised by intercepting the setpoint profile (point B1). If interception is not possible, as in the case of variable at PV1, program restart occurs at the current time and setpoint.
If the Hbb control is enabled, the programmer time base remains stopped until the variable re-enters the set tolerance band, symmetrically placed around the setpoint.



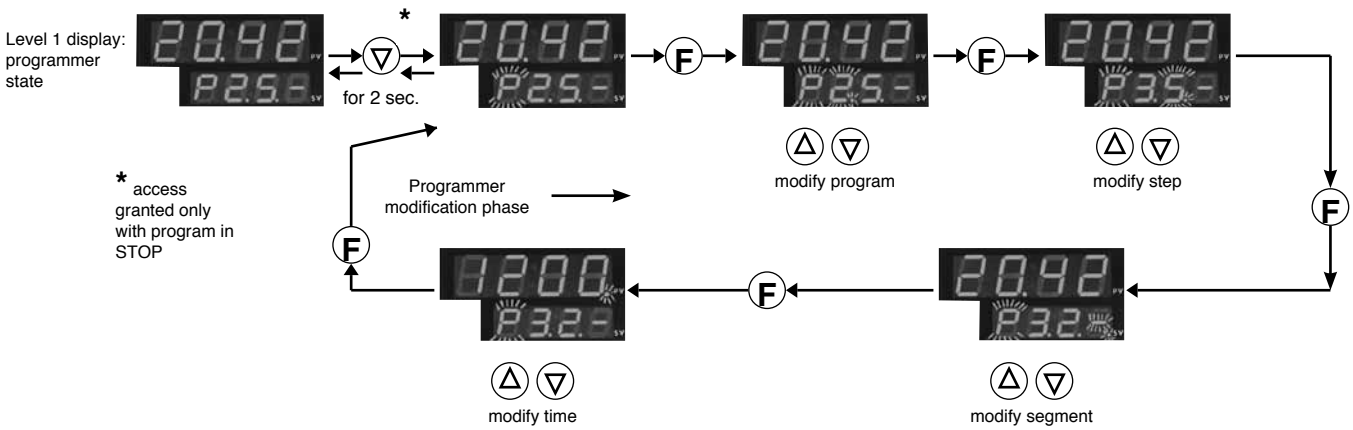
8 • STATE OF THE PROGRAMMER

EXAMPLE of programmer state display: Program = 2, Step = 5, Segment = Hold, time elapsed = 20:42 (MM:SS)



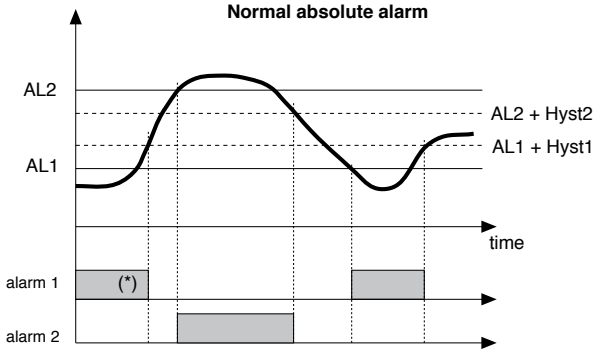
The setpoint can be changed directly from the keyboard only when the program is in STOP.
To change programmer state, press the “Lower” key for 2 seconds: the letter “P” will start flashing rapidly. Press key “F” to scroll: program, step, segment, time.
Flashing of the decimal point in each element indicates that the value is enabled for modification (“P” flashes slowly).
Use the “Raise” and “Lower” keys to set the required values. Press the “Lower” key for 2 seconds while “P” flashes rapidly or go to START to disable programmer state modification phase.
Program change automatically generates a reset.
Reset state is also entered by setting current step 0 (zero) and setting the current segment to “off” (lower right digit off).

Display / Modification of programmer state



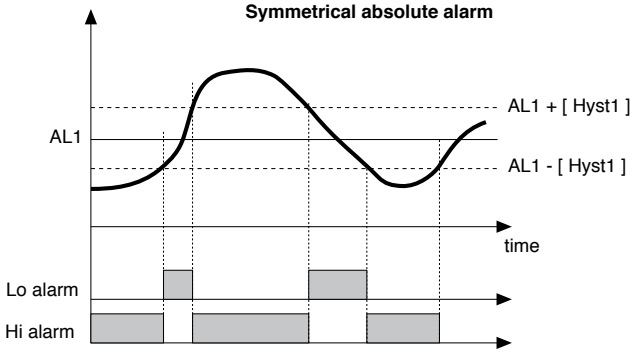
9 • ALARMS

Normal absolute alarm



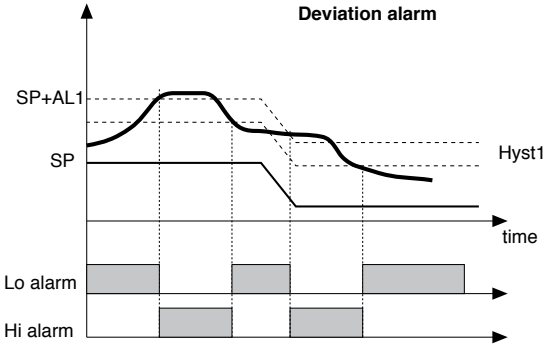
For AL1 = reverse absolute alarm (low) with positive Hyst1, AL1 t = 1
(*) = OFF if disabled on power-up
For AL2 = direct absolute alarm (high) with negative Hyst2, AL2 t = 0

Symmetrical absolute alarm



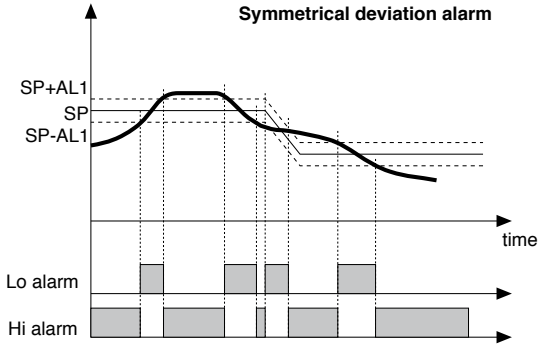
For AL1 = symmetrical Lo absolute alarm with Hyst1, AL1 t = 5
For AL1 = symmetrical Hi absolute alarm with Hyst1, AL1 t = 4

Deviation alarm



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

Symmetrical deviation alarm



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 “ ∇ ” e “ Δ ” keys in Out.P of level 1.
The LBA function is disabled if LbA.t = 0.

10 • 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.

11 • CONTROL ACTIONS

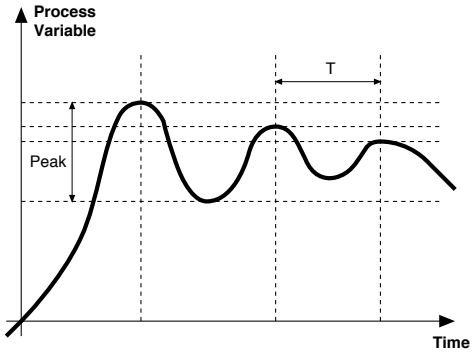
Proportional Action:
action in which contribution to output is proportional to deviation at input (deviation = difference between controlled variable and setpoint).
Derivative Action:
action in which contribution to output is proportional to rate of variation input deviation.
Integral Action:
action 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 GEFRAN for more information on control actions.

12 • 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.

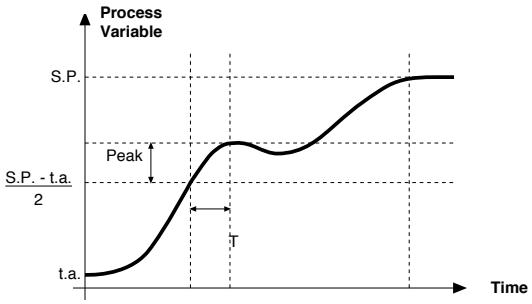
13 • SOFTWARE ON / OFF SWITCHING FUNCTION

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.

14 • 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



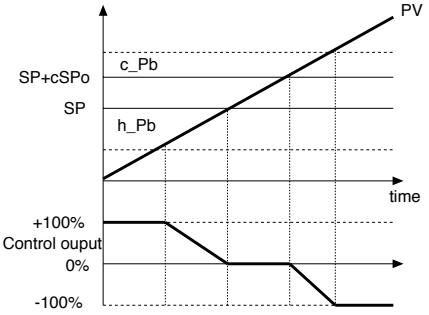
B. Activation from keyboard
1. Make sure that M/A key is enabled for Start/Stop self-tuning function (**butt** code = 4 Hrd menu)
2. Switch program to STOP
3. Adjust temperature to approximately room temperature
4. Adjust setpoint to required value
5. Press M/A key to activate self-tuning (Attention: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

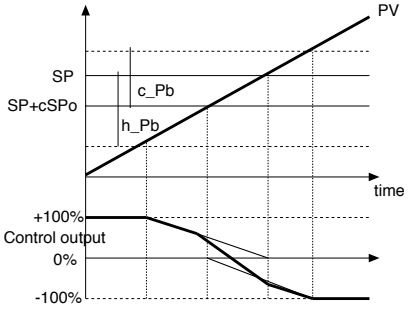
15 • AUTO-TUNING

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%.

16 • 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:

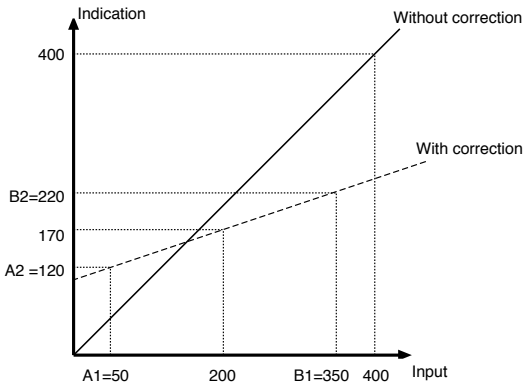
Air T Cool Cycle = 10 sec. Oil T Cool Cycle = 4 sec. Water T Cool Cycle = 2 sec.

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

17 • MAIN INPUT CORRECTION FUNCTION

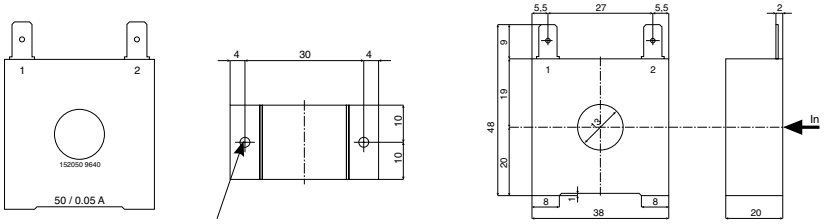
Lets you custom correct reading of the main input by setting four values: A1, B1, A2, B2.
This function is enabled by setting “Sens” +8 code (“Hrd” menu). Example: Sens = 1+8 = 9 for RTD probe with input correction.
The scale can be reversed if this function is applied to linear scales (50mv, 10V, 20mA, 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



18 • ACCESSORIES

• CURRENT TRANSFORMERS



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^{1-2} = 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

• Interface for GEFRAN instrument configuration

KIT PC USB / RS485 o TTL

GF_eXpress

Kit for PC via the USB port (Windows environment) for GEFRAN instruments configuration:
Lets you read or write all of the parameters
• A single software for all models
• Easy and rapid configuration
• Saving and management of parameter recipes
• On-line trend and saving of historical data
Component Kit:
- Connection cable PC USB ... port TTL
- Connection cable PC USB ... RS485 port
- Serial line converter
- CD SW GF Express installation

• ORDERING CODE

GF_eXK-2-0-0	cod F049095

ORDER CODE

MODEL	
1600P	1600P
1800P	1800P

OUTPUTS 1,2,3,4 *(R/D)*	
Out1 (R)	R000
Out1 (R) + Out2 (R)	RR00
Out1 (R) + Out2 (R) + Out3 (R)	RRR0*
Out1 (R) + Out2 (R) + Out3 (R) + Out4 (R)	RRRR
Out1 (D)	D000
Out1 (D) + Out2 (R)	DR00
Out1 (D) + Out2 (R) + Out3 (R)	DRR0
Out1 (D) + Out2 (R) + Out3 (R) + Out4 (R)	DRRR
Out1 (D) + Out2 (D)	DD00
Out1 (D) + Out2 (D) + Out3 (R)	DDR0
Out1 (D) + Out2 (D) + Out3 (R) + Out4 (R)	DDRR
Out1 (D) + Out2 (D) + Out3 (D)	DDD0
Out1 (D) + Out2 (D) + Out3 (D) + Out4 (R)	DDDR
Out1 (D) + Out2 (D) + Out3 (D) + Out4 (D)	DDDD

OUTPUTS 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
1*	100...240Vac/dc

DIGITAL COMMUNICATIONS	
0*	None
2	RS 485 / RS 232

AUXILIARY INPUTS	
00*	None
01	IN1, IN2 NPN/PNP
03	Trasmitter Supply 10V/24V
04	IN1, IN2 NPN/PNP + Trasmitter Supply 10V/24V
06	IN SPR (0...1V) + Trasmitter Supply 10V/24V
07	IN SPR (0...10V) / IN Potentiometer # + Trasmitter Supply 10V/24V
08	IN SPR (0/4...20mA) + Trasmitter Supply 10V/24V
09	IN TA (50mAac) + Trasmitter Supply 10V/24V
10	IN1, IN2 NPN/PNP IN SPR (0...1V) + Trasmitter Supply 10V
11	IN1, IN2 NPN/PNP IN SPR (0...10V) / IN Potentiometer # + Trasmitter Supply 10V
12	IN1, IN2 NPN/PNP IN SPR (0/4...20mA) + Trasmitter Supply 10V/24V
13	IN1, IN2 NPN/PNP IN TA (50mAac) + Trasmitter Supply 10V/24V
33	IN SPR (0...1V)
34	IN SPR (0...10V) / IN Potentiometer #
35	IN SPR (0/4...20mA)
36	IN TA (50mAac)

(*) Indicates standard version
Potentiometer input requires 10V supply
Make specific calibration request for PTC input.

Please, contact GEFRAN sales people for the codes availability.

• 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
The equipment is intended for permanent indoor installations within their own enclosure or panel mounted enclosing the rear housing and exposed terminals on the back
• 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.
GEFRAN spa 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.