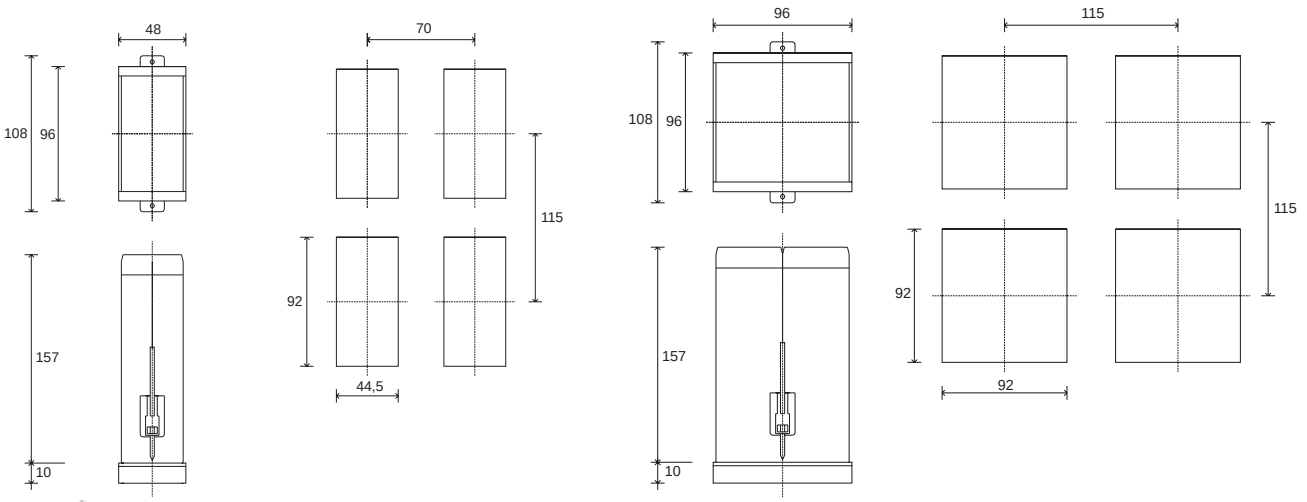
1 • INSTALLATION

• Dimensions and cut-out



Fastening single instrument

Panel mounting.
Front panel dimensions:
3400 - 48x96mm1.89"x3.78"(1/8 DIN) Depth: 152mm /5.98"
Cut-out dimensions:
45(+0.6/-0)x92(+0.8/-0)mm/1.77"(+0.02/ -0)x3.62"(+0.03/-0).
Front panel dimensions:
4400 - 96x96mm 3.78"x3.78"(1/4 DIN) Depth: 152mm /5.98"
Cut-out dimensions:
92(+0.8/-0)x92(+0.8/-0)mm/3.62"(+0.03/ -0)x3.62"(+0.3/-0).
To fasten the instrument, insert the two blocks into the seats on top and bottom side of the box and lock with the screws. To mount two or more instruments side by side, use the locking blocks and respect the following cut-out dimensions:

3400
Side by side
Base (48 x n) -3, (1.89"x n) -0.11" Height 92(+0.8/ -0) /3.62"(+0.3/ -0)
4400
Side by side
Base (96 x n) -4, (3.78"x n) -0.15" Height 92(+0.8/ -0) /3.62"(+0.3/ -0)
where "n" is the number of instruments
On request, we can supply blocks to group the instrument boxes side by side or stacked.

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

2 • TECHNICAL DATA

INPUTS
Precision 0.1% f.s. ± 1 digit
Sampling time: 120msec
TC- Thermocouple
J (Fe-CuNi) 0...1000°C / 32...1832°F
K (NiCr-Ni) 0...1300°C / 32...2372°F
R (Pt13Rh-Pt) 0...1750°C / 32...3182°F
S (Pt10Rh-Pt) 0...1750°C / 32...3182°F
T (Cu-CuNi) -100...400°C / -148...752°F
B (Pt30Rh-Pt6Rh) (*) 50...1800°C / 122...3272°F
E (NiCr-CuNi) -100...750°C / -148...1382°F
N (NiCr-Si-NiSi) 0...1300°C / 32...2372°F
Ni-Ni18Mo (Ni-Ni18Mo) 0...1100°C/ 32...2012°F
(*) for type **B** thermocouple, the precision class applies for temperature values > 500°C.
RTD 2/3 wires
Pt100 -200...600°C / -328...1112°F
DC - Linear
0...50mV, 10...50mV for signals 0...10V, 0...20mA, 4...20mA use external shunts. 32-section custom linearization available.
Input impedance > 1MW.
Auxiliary input
Isolation 1500V
For remote setpoint: 0...10V - Ri > 100KW; 0...20mA - Ri = 50W; 4...20mA - Ri = 50W
For potentiometer: 0...1V - Ri > 10MW (potentiometer with value from 100W to 20KW)
For current transformer: 0...5Aac, 50/60Hz - Ri = 20mW
Digital
Isolation 1500V. 3 control inputs for functions: Start/Stop/Reset, Set Local / Remote, Auto/Man, Hold, direct selection of one of 4 program setpoints:
- NPN 12V/3.5mA
- PNP 24V/6mA (12V/2mA)
OUTPUTS
Isolation 1500V
Functions programmable and settable from faceplate keys:
• Direct control (Heat)
• Reverse control (Cool)
• Repeat of local or remote setpoint
• Repeat of input
• Repeat of deviation between setpoint and input value.
• Alarm 1 or 2
• Open/Close for motorized valve
Continuous
0...10V max 20mA ; 0...20, 4...20mA Rmax = 500W
Resolution 4000 points, max. refresh time 80msec.
Relay
Selectable contact NO/NC 5A/250Vac at cosj = 1 (resistive load) with spark suppression on NO contacts.
Logic
23Vdc, Rout = 470W (20mA, max.12V). To control solid state relays (SSR).
MD81
Interface for alarm expansion unit (alarms 3...10)
SERIAL LINE
Instrument accepts Passive Current Loop (1200 baud) or RS422/485, RS232 (1200 / 2400 / 4800 / 9600 baud) interface. Protocol: GEFRAN CENCAL
POWER SUPPLY
100...240Vac/dc ± 10%, 50/60Hz
12VA max (3400), 15VA max. (4400)
Protected by internal fuse not serviceable by user.
AMBIENT CONDITIONS
Working temperature: 0...50°C
Storage temperature: -20...70°C
Humidity: 20...85% relative humidity, non-condensing
CONTROLLER
On/Off, P, PD, PI, PID control with settable and independent parameters for two heat and cool control actions. Controller can be defined as single loop, ratio, cascade by setting a configuration parameter.
• Cooling setpoint relative to heating setpoint ±25% f.s.

2 • TECHNICAL DATA

• Double control output (Heat/Cool) with setting of Cool setpoint relative to Heat setpoint in range ±25.0% f.s.
• Proportional band for Heat 0.0...999.9% f.s.
Proportional band for Cool 0.0...999.9% f.s.
• Manual reset (deviation correction factor) ±999 scale points
• Main input offset ±999 scale points
• Secondary input offset ±999 scale points
• Digital filter on input variable 0.1...20.0 sec
Mathematical processing of inputs:
square root extraction: (A x Input ^D + B)/C
Scale setting range: -1999...9999.
• Reset power for heat/cool (0...100% / 0...-100%)
• Antireset (limitation band of integral action) 0...9999 scale points
• Feed Forward 500...-199%
• Integral time for heat/cool 0.00...99.99 min
• Derivative time for heat/cool 0.00...9.99 min
• Maximum/minimum limit of direct/reverse output 0...100%
Main support and control functions:
• Soft-start: gradual supply of main output power when instrument is turned on (0.0...100.0 min)
• Self-Tuning: automatic search for best control parameters during startup.
• Auto-Tuning: automatic updating of control parameters following changes in controlled system and/or changes in setpoint.
• Auto/Man station with bumpless transfer
• LBA: loop-break alarm with setting of delay (0.0...20.0 min) and tripping power (0.0...100.0%)
• HB: Heat Break or load interrupt alarm referred to ammeter input.

PROGRAMMER

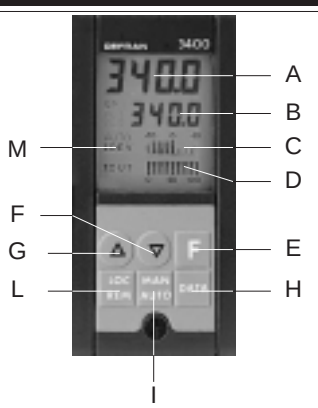
The programmer function lets you run a program as a set of 8 segments (4 setpoints + 4 ramps).
Each step is composed of the following data:
• Setpoint
• Setpoint and ramp time programmable up to 99 days 23 hrs 59 min. 59 sec.
• Time base accuracy better than ± 4 sec every 10 hours
• H: Holdback Band or maximum deviation allowed for progress of program: 1...1000 scale points.
START/STOP/RESET program control:
- from faceplate keys
- from logic inputs
- from serial line
In STOP condition you can:
- change the current setpoint with the Raise and Lower keys
- display/change the program step being run.

ALARMS

2 + 8 (with MD81 expansion unit) intercepts settable in absolute value, deviation, symmetrical deviation compared to setpoint or auxiliary input with high or low function and inhibition at power-on.
- Faceplate keys can be used to configure LBA, HB and H alarm states and program end.
- Setting limits programmable in selected scale range.
- Hysteresis programmable for each alarm in ±999 scale points.
- Non-repetitive response time: 80 msec max.
- Signals: messages AL1 and AL2 or the LEDs of the MD81 expansion unit are on during setting and flash when the relay is energized or the output is active.

WEIGHT 600g (3400) - 850g (4400)

3 • DESCRIPTION OF FACEPLATE



A Display
4-digit display (-1999/9999). Value of variable. Positive (-HI-) or negative (-LO-) off-scale signal. Indication of broken sensor (Sbr), incorrect connection (Err), mathematical processing error. Configuration and calibration messages. Signal flashes when self-tuning is active.

B Display
4-digit display (-1999/9999). Value of local setpoint or auxiliary input.
Value of alarm limits AL1 and AL2. Percentage value of main output or valve position in manual mode. Parameters and configuration and calibration codes.

C Deviation bargraph
Deviation between controlled variable and setpoint expressed as percentage of full scale, with segment size equal to 2% of full scale in a range equal to 10% of such size, with indication of when such limit is exceeded, and other indications for no deviation, <-10% and >+10% (flashing). Indication flashes when auto-tuning is active.

D Main output bargraph
Percentage value of main output or valve position. Percentage value of input of remote setpoint. Bargraph flashes when Soft-start is active or in power limitation state due to LBA alarm.

M Signals
SP, SPR indication of setpoint type displayed.
AL1, AL2 indication of alarm limits.
COOL indication of active cooling.
MAN, AUTO indication of manual or automatic work mode.
Indication SP flashes to show programmer activity, with display of local setpoint. Indication REM, AL1 and AL2, flash to signal, respectively, selection of remote setpoint or relative alarm states without display of the relative variable.

CONTROLS

E "FUNCTION" Button
Under normal operating conditions, accesses the following functions: local setpoint (SP), auxiliary input (SPR), alarm 1 (AL1) and alarm 2 (Al 2), to read and/or change values. If the button is not pushed to confirm a change, the change will be saved automatically after about 10 seconds, and the display will return to the setpoint value in automatic mode or to the main input value in manual mode. Key F also accesses various configuration and calibration phases, and confirms set data so you can go to the next data item. It also lets you interrupt programmer configuration (DAt1).

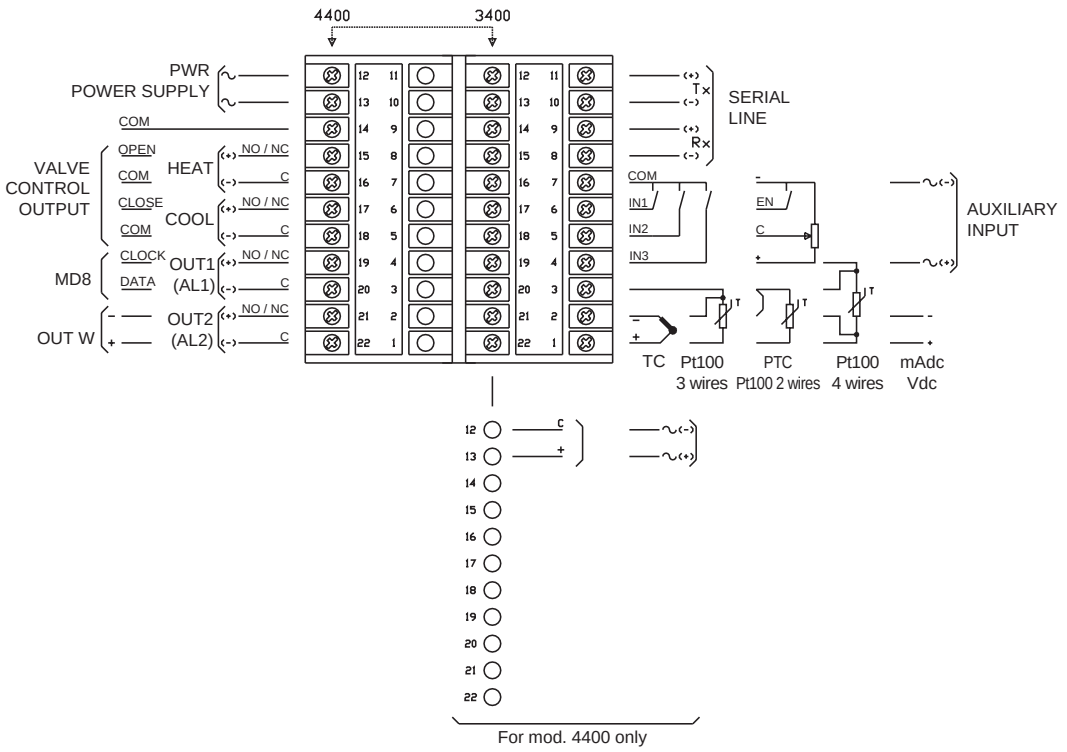
F/G Raise and Lower Buttons
These keys raise or lower the data value.
In manual mode, they raise or lower the value of the main output shown as a percentage on display B. The raising (lowering) speed is proportional to the time the key is pushed. When the maximum (minimum) of the setting range is reached, the function stops with the key pushed.

H Data Button
Under normal operating conditions, accesses the setting of some control parameters. If the button is not pushed to confirm a change, the change will be saved automatically after about 10 seconds, and the display will return to the setpoint value in automatic mode or to the main input value in manual mode. Key D also accesses various programmer configuration phases, and confirms set data so you can go to the next data item.
It also accesses the output from the 'CFG' and 'CAL' menu. Simultaneous pressing of the "Man" and "Data" keys causes switching between programmer (Start) and wait (Stop) modes.

I Manual/Automatic Button
Switches from Manual (indication MAN) to Automatic (indication AUTO) mode and vice versa. Switching from MAN to AUTO is "Bumpless" to avoid breaks in control. The button can be activated or deactivated by setting the protection level. In MAN, the main output value can be forced from the faceplate keys. Simultaneous pressing of the "Man" and "Data" keys causes switching between programmer (Start) and wait (Stop) modes.

L Local/Remote Button
Lets you choose between local and remote setpoint according to the protection level set. The button can be activated or deactivated by setting the protection level. In local, with programmer inactive, the setpoint can be changed by means of the "Raise" and "Lower" keys." The remote setpoint chosen has priority over the local one, even if a program is running. This key is active only for a hot/cold controller.

4 • ELECTRICAL CONNECTIONS



Always check the configuration code before turning on the instrument.
Instrument 3400 (48x96) is composed of two basic cards and has 22 screw attachments.
Instrument 4400 (96x96) is composed of a minimum of two basic cards up to a maximum of four, and has 44 screw attachments 22(A) + 22(B).
The following terminal numbers refer to the 4400; for 3400 connections, there is correspondence between the following terminals:
1A-11A and 12B-22B with terminals 1-11 and 12-22; terminals 12A-13A refer to the 4400 only.

Main inputs
Inputs from CT and in DC are attached to terminals 1A(+) and 2A(-).
For RTDs with 4 wires, a pair is connected to terminals 3A and 4A, the other to terminals 1A and 2A;
for RTDs with 3 wires, the single wire is connected to terminal 1A, one of the remaining wires goes to terminal 2A and the other to terminal 3A;
for RTDs with 2 wires, connect the two wires to terminals 1A and 2A; connect terminal 2A to terminal 3A.

Auxiliary input from potentiometer (4400 only)
The input can be used with retroaction function on the controller for motorized valves.
The input from potentiometer (>= 100 Ohm) is at terminal 12A (cursor), the max. end has to be connected to terminal 13A (+ power = 1V) and the min. end to terminal 7A (-).

Auxiliary input from current transformer (4400 only)
If the instrument accepts this input, it is attached to terminals 12A and 13A.
Display of load value is enabled during.
The CT input is alternate to the potentiometer input signal.

Auxiliary input from linear signals: 0-1V, 0-10V, 0-20mA, 4-20mA (4400 only)
The linear input is connected to terminals 12A (+) and 7A (-).

Isolated logic inputs
The input function is: IN1 (6A) - IN2 (5A) - IN3 (4A) for:
- local/remote switching, manual/automatic switching, Hold for controller.
- Start, Stop, Reset for programmer.
- Direct selection of step for remote programmer attributed to a configuration parameter (see CFG2).
The common reference is terminal 7A. The Reset function for the programmer is also accessed by simultaneously activating inputs IN1 and IN2 (Start and Stop).

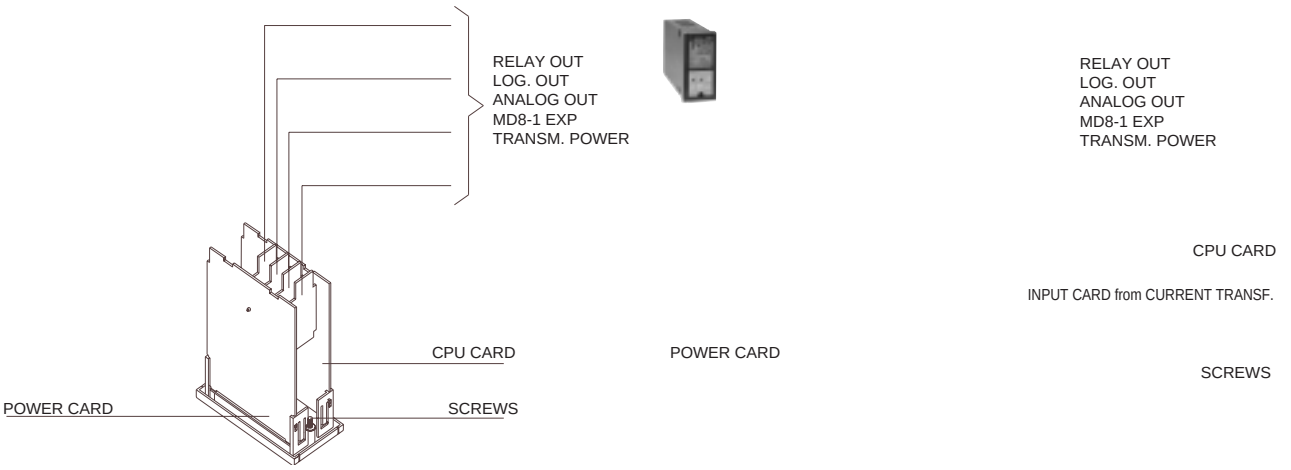
Digital communication
Configure the interface type with jumpers (see hardware configuration).
- Interface type C.L.: the reception diode is available to terminals 9A (+Rx) and 8A (-Rx); the transmission transistor to terminals 11 A(+Tx) and 10A(-Tx).
Resistance in series to the diode is 1 KW, in series to the transistor collector 100W.
For the series connection, resistance in series to the diode is reduced to 100W.
- Interface type RS485 4 wires (RS422 compatible): reception line available to terminals 9A (+Rx) and 8A (-Rx), transmission line to terminals 11A (+Tx) and 10A (-Tx).
- Interface type RS232: reception line available to terminal 9A (+Rx) and transmission to terminal 11 A (+Tx), common reference is terminal 8A (-Rx) and 10A (-Tx) to be connected to one another.

Control outputs 1, 2, 3 and 4
1 to terminals 15B and 16B,
2 to terminals 17B and 18B,
3 to terminals 19B and 20B,
4 to terminals 21 B and 22B.
Type of available outputs:
- relay outputs with contact capacity 5A / 220Vac
- isolated logic outputs type D2 PNP 24V/20mA max
- isolated continuous outputs 0-10V or 0-20mA or 4-20mA
- outputs for MD8-1 expansion module, Clock and Date with negative reference (GND) to terminal 14B.
Logic and isolated continuous outputs are protected against short circuit of load.

Transmitter power output
Isolated output 24V/ 30mA (protected against short circuit of load): available as alternative to any control output on terminals 15B(+), 16B(-) or 17B(+),18B(-) or 19B(+), 20B(-) or 21B(+), 22B(-).

Instrument power supply
Power supply of 90...260Vac/Vdc is applied to terminals 12B and 13B.

5 • HARDWARE CONFIGURATION



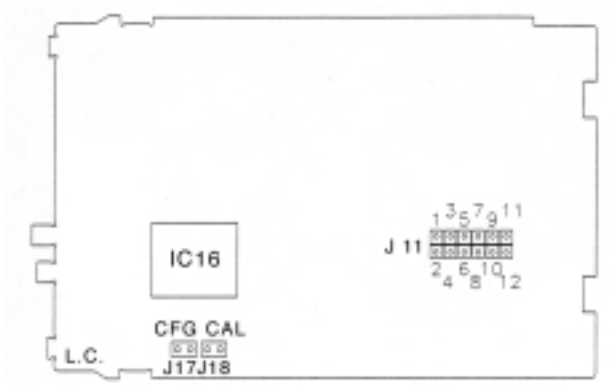
HOW TO CONFIGURE

To configure the instrument, you first have to configure the hardware based on the type of inputs and outputs you want; then configure the software.
The 3400/4400 has a configurable structure of cars that are freely assignable to software functions. For standard applications, we offer preconfigurations corresponding to the connection diagrams shown.
If you have to change the configuration, remove the electronic part from its seat by unscrewing the front screw until the part is released, then remove the part by hand.

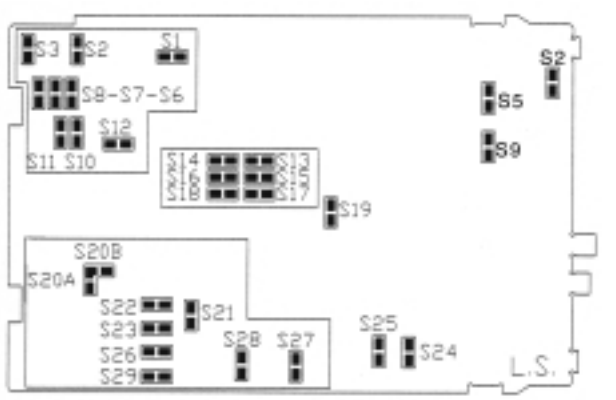
Access to programming of configuration and calibration depends on the position of jumpers J17 and J13 on the CPU card:
Jumper J17(CFG) ON = enable configuration
Jumper J18(CAL) ON = enable calibration

A CPU card configuration is assigned to each version by execution of sealed jumpers and the J11 jumper group as described below (see figure of CPU components side).
The following terminal numbers refer to the 4400; for 3400 connections, there is correspondence between the following terminals:
terminals 1A - 11A and 12B - 22B with terminals 1-11 and 12-22; terminals 12A - 13A refer to the 4400 only

CPU CARD Components Side



CPU CARD Solder Side



The following have to be configured for all versions:
- CPU card for inputs and any serial interface (table D);
- cards for control outputs 1, 2, 3, 4;
- card for input from Current Transformer (4400 only).

HOW TO CONFIGURE THE MAIN INPUT
The instrument is supplied in standard version, with ability to configure the sensor type only from the faceplate keys by setting the “tYPE” parameter, accessible in configuration CFG2.
Inputs from thermocouple, resistance thermometer (2 or 3 wires), linear inputs 0-50mV and 10-50mV are standard.
Configuration for 4-wire RTD (TYPE=11) requires a specific hardware setting with jumpers (see table A).
For inputs 0-10V, 2-10V, 0-20mA, 4-20mA, you can keep the configuration as for 0-50mV or 10-50mV by means of external shunts (or dividers).
Order codes:
- 10V/50mV adapter module; input impedance ≥1MΩ: 960000000010
- 20mA/50mV adapter module; input impedance ≥ 5Ω:960000000020

Table A
Configuration by type of sensor input (see figure of CPU solder side):
(remember to set the relative “tyPE” code in configuration CFG2)

Sensor Type	**S21**	**S22**	**S20A**	**S20B**
TC	X			X
RTD 2/3 wires	X			X
RTD 4 wires (*)		X	X	
Linear 0-50mV	X			X
10-50mV	X			X

(*) as alternative to digital input 3 (RESET)

HOW TO CONFIGURE THE AUXILIARY INPUT

On the 4400, the auxiliary input is used to acquire the current value from the CT, or the potentiometer position for valve control, or the remote setpoint. The auxiliary input is enabled by means of jumper 9 - 11 or 7-9 on J11 (see table B).
When it is configured for the input from the CT, it has to be connected with terminals 12A and 13A (for 4400).

When configured for the Potentiometer input, this has to be connected to the power supply with terminals 13A(+) and 7A(-), the cursor with terminal 12A. When configured for the linear input used for remote setpoint, this has to be connected with terminals 12A(+) and 7A(-).

Table B
Configuration by instrument version (numbers refer to jumper J11 group - see figure of CPU components side).

Selection of auxiliary input	4400	3400
CT or Potentiometer	7 - 9	9 - 11
0 - 1V	7 - 9	9 - 11
0 - 10V	7 - 9, 1 - 2	9 - 11, 1 - 2
0-20mA/4-20mA	7 - 9, 1 - 3	9 - 11, 1 - 3

See also table E for configuration of inputs card from CT Jumper J23 for choosing between CT or Potentiometer and Linear

HOW TO CONFIGURE LOGIC INPUTS
Table C
Input IN1 is always present.

Selection of auxiliary input	J11 (see CPU card components side)
IN2 (**)	11 - 12
IN3 (*)	5 - 6

(*) Input not available with main input from 4-wire RTD
(**) Input not available for 3400 with SPR

CONFIGURATION BY TYPE OF ISOLATED LOGIC INPUTS
IN1, IN2 and IN3 (see figure of CPU solder side)
Table C1

INPUT	Input Type: - switch 3.5A - relays - open collector NPN (12V / 3.5mA)			- Open collector PNP (24V / 6mA) (12V / 1.8mA)		
	S14	S16	S18	S13	S15	S17
IN1	X			X		
IN2		X			X	
IN3			X			X

Input function is defined by the value of parameter SP.Pr (CFG2).

HOW TO CONFIGURE THE SERIAL INTERFACE

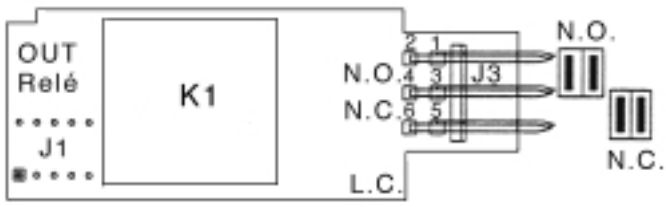
May be configured according to most common standards (table D); instruments normally have the configuration for parallel serial current-loop.

Table D
Configuration by type of serial interface, see figure of CPU solder side.

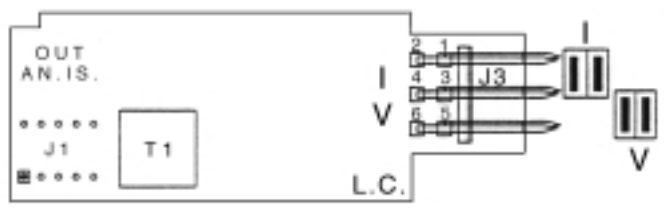
Serial Type	Reception						Transmission		
	S8	S7	S6	S10	S11	S12	S1	S2	S3
RS232			X	X		X	X	X	
RS422			X	X		X	X	X	
RS485			X	X		X	X	X	
Parallel CL		X			X				X
Series CL	X				X				X

CONTROL OUTPUTS

Relay output card
Insertable in any position, manages output based on configuration (CFG3). In standard version, proposed in position 1 and 2 for heat/cool control outputs, in position 3 and 4 for alarm 1 and alarm 2 outputs (see electrical connection). Indication of jumpers for connection of NO/NC contact:
- NC contact: jumpers J3 on NC
- NO contact: jumpers J3 on NO



Continuous output card isolated in voltage/current
Insertable in any position, manages output based on configuration (CFG3). In standard version, proposed in position 1 and 2 for heat/cool control outputs, in position 4 for repeat output as alternative to alarm 2 (see electrical connection).
Indication for configuration of output for voltage or current:
- voltage output (V): jumper J3 on V
- current output (I): jumper J3 on I



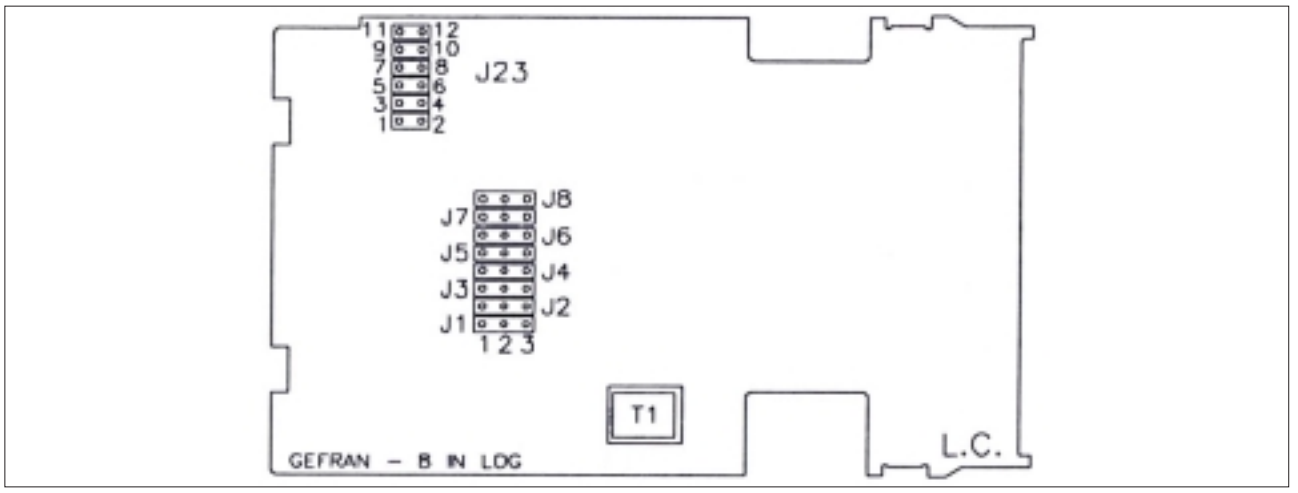
Logic voltage output card
Insertable in any position, manages output based on configuration (CFG3). In standard version, proposed in position 1 and 2 for heat/cool control outputs, in position 3 and 4 for alarm 1 and alarm 2 outputs (see electrical connection).

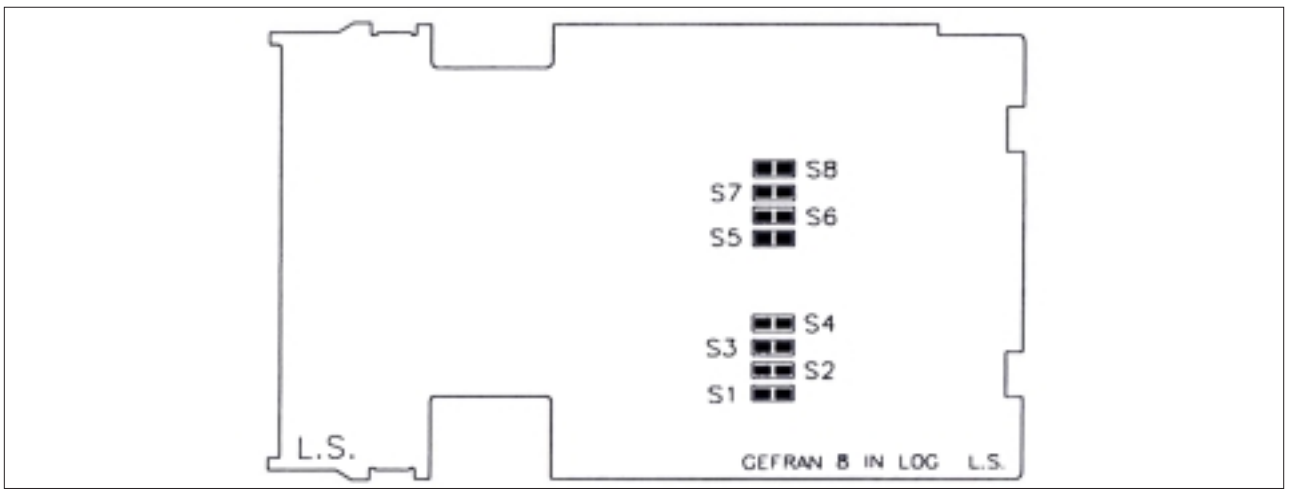
Card for connection of MD8-1 expansion
Insertable in any position, manages output based on configuration (CFG3). In standard version, proposed in position 3 as alternative to alarm 1 (see electrical connection of MD8-1 expansion).

Transmitter power card
Insertable in any position, supplies isolated 24Vdc/30mA non-stabilized power.

Table E
Configuration by stage of input from CT or Potentiometer and linear

Version	position of jumper J23
CT	1-2, 9-10, 5-6, 7-8, 11-12
Potentiometer 0-1V, 0-10V, 0-20mA, 4-20mA	3-5, 2-4, 6-8, 10-12, 9-11





6 • SOFTWARE CONFIGURATION

In normal operation, display A shows the variable measured in input (&). Values are set with the raise/lower buttons.
Key F lets you select and display (display B) the following values in rotation:
- SPR auxiliary input
- SP setpoint
- AL1 alarm 1
- AL2 alarm 2 with signal (display M).

In manual mode you add a phase with % indication of POWER in output.
After setting , push button F to confirm the data and update the next item; return to normal operation is timed: display of variable with setpoint.
Press key F for a few seconds to access the controller configuration phases.
Press key D for a few seconds to access the settings needed for the programmer.
(**&**) For ratio controller, display **A** and display **B** show two fixed decimal points (XX.XX).

SETTING CONTROL PARAMETERS
Key D lets you select and display the following control parameters in rotation (indication on display A, value on display B):

HPb- / proportional band in heating (0.0% - 999.9%) (heating hysteresis for ON/OFF) (1), (2)
Hlt- / integral time in heating (0.00 - 99.99 min) (1), (2)

Hdt- / derivative time in heating (0.00 - 99.99 min) (1), (2)

CPb- / proportional band in cooling (0.0% - 999.9%) (cooling hysteresis for ON/OFF) (3)

Clt- / integral time in cooling (0.00 - 99.99 min) (3)

Cdt- / derivative time in cooling (0.00 - 9.99 min) (3)

rSt_ / manual reset (±99 scale points) or corrective deviation factor added algebraically to setpoint value

P.rSt / reset power for heating (0/ +100%) or for cooling (-100.0%-0) (2)

S.tun / self-tuning code (0-15) to enable self-tuning, auto-tuning, soft-start. The self-tuning phase starts when the instrument is turned on, or by pressing keys F + raise + lower; it turns off automatically after correct execution. One-shot autotuning (codes 8-15) turns off automatically after execution; it can be reactivated simply by incrementing the code by 1.
Auto-tuning (codes 1-3-5-7) is permanently on; it is deactivated simply by decrementing the code. Calculated control parameters are replaced by programmed parameters.

Cod	AUTO permanent	SELF	SOFT	Cod	AUTO on-shot	SELF	SOFT
0	NO	NO	NO	8	WAIT	NO	NO
1	YES	NO	NO	9	GO	NO	NO
2	NO	YES	NO	10	WAIT	YES	NO
3	YES	YES	NO	11	GO	YES	NO
4	NO	NO	YES	12	WAIT	NO	YES
5	YES	NO	YES	13	GO	NO	YES
6	NO	YES	YES	14	WAIT	YES	YES
7	YES	YES	YES	15	GO	YES	YES

ArSt / integral action or anti-reset band, under SP for Heat and over SP for Cool (0 - 9999 scale points, 0 = action disabled) (integral power is not updated externally) (2)

FFd- / feed forward (-199.9...+500.0%), power to be added to P.I.D., proportionality factor on percentage value of setpoint in range of variability (power of FFW = FFd_* SP%; 0 = action disabled) (3)

6 • SOFTWARE CONFIGURATION

PrOG / enable program (0...1, 0 = program not enabled).
This item is accessible only if parameter **SP.Pr=1** (see list of items in configuration 2 CFG2).
(**1**) For ratio controller, parameter refers to PID1 Fig. 2
(**2**) For cascade controller, parameter refers to PID1 Fig. 3
(**3**) For cascade controller, parameter refers to PID2 Fig. 3

When setting is finished, press button D to confirm the data and go to the next item. In all cases, return to normal operation is timed or by pushing button F.

CONFIGURATION PROCEDURE
In normal operation, press button F to display data:

_**no**_ with indication of instrument code no. in serial line,

UPdt with indication of software version implemented.
Release button F to return to normal operation.
To access the configuration phase, press button F until the message CFG appears on display A.
There are four configuration levels:

CFG_ 0: return to normal operation
CFG_ 1: configuration of control parameters and alarm functions
CFG_ 2: first level configuration for hardware
CFG_ 3: second level configuration for hardware
CFG_ 4: linearization setting for custom sensor.

Select with the raise/lower keys and confirm with key F.
Use key F to confirm every data item set during various configuration phases.
Return to normal operation by pressing the “Data” key.

CONFIGURATION CFG1:
To access this configuration, parameter Prot (CFG2) must be 0.

_**no**_ / instrument code number (0 - 9999)

SOFt / softstart time (0.0 - 100.0 min).

HPHI / max. heating power limit (0.0 - 100.0%) (1), (2)

CPHI / max. cooling power limit (0.0 - 100.0%) (3)

HPLO/ min. heating power limit (0.0 - 100.0%) (1), (2)

CPLO / min. cooling power limit (0.0 - 100.0%) (3)

Psbr/ power supplied by instrument in case of broken sensor
_**Sbr** (±100.0%)

CSPO / cooling setpoint relative to heating setpoint
(± 25.0% scale range). Significant for Hot/Cold controller (see Crt. in CFG2).

HyS1 / hysteresis for AL1 (± 999 scale points). A negative (positive) number indicates a hysteresis band positioned below (above) the alarm limit and is characteristic of a direct (reverse) alarm.

HyS2 / hysteresis for AL2 (± 999 scale points).). A negative (positive) number indicates a hysteresis band positioned below (above) the alarm limit and is characteristic of a direct (reverse) alarm.

Continue setting the limits and hystereses for alarms 3, 4, 5, 6, 7, 8, 9, 0, only if management of the MD8-1 expansion unit is enabled in CFG2 as alarm outputs:

AL3 / alarm limit in scale range if absolute, -1999/+f.s. if deviation

HYS3 / hysteresis for AL3 (± 999 scale points).
....
AL0 / alarm limit in scale range if absolute, -1999/+f.s. if deviation

HYS0 / hysteresis for alarm 3 : AL3 (± 999 scale points).

Return to CFG_ 0.

CONFIGURATION CFG2:

To access this configuration, jumper J17 (CFG) must be in ON position.

Prot / Protection level; password to configurations, calibrations and enabling of A/M, L/R keys according to table:

	Display only	**Display and Change**
0		SP / Alarm / Data / CFG1 **(*)**
1		SP / Alarm
2	Alarm	SP
3	SP / Alarm	

+4	to lock MAN/AUTO key
+8	to lock LOC/REM key
+16	to lock Programmer data (dAt1, dAt2)

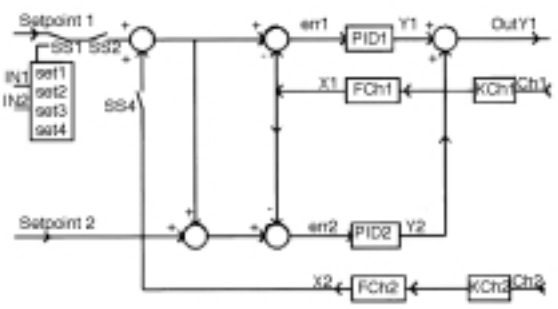
(*) jumper J17 = ON enables CFG2, 3, 4
jumper J18 + ON enables CAL

Ctr.t / type of controller (0-3) (see descriptions below)

Type of controller
0 Hot/Cold
1 Cascade
2 Ratio
3 Hot/Cold with set limit

(Fig.1-2-3 below show the diagrams for the controllers used in the instrument)

Fig. 1 - SINGLE LOOP CONTROLLER



Ch1 = process variable
Ch2 = remote setpoint
KCh1 or KCh2 = table with 32 values for linearization
Setpoint (heat) = Setpoint 1 (local setpoint)
Setpoint (heat) = Setpoint 1 (local setpoint) +remote set X2 (Ch2)
Setpoint (heat) = Remote set X2 (Ch2)
Setpoint (cool) = Setpoint 2 + Setpoint (heat)

Y1 = Heating (0...100%)
Y2 = Cooling (0...100%)

OuY1 = control output

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Fig. 2 - RATIO CONTROLLER

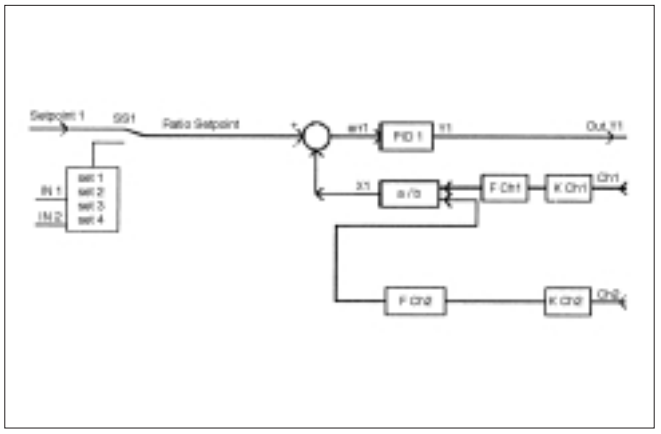
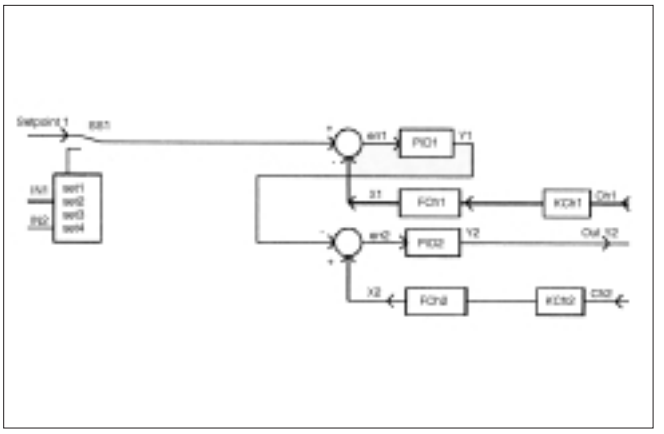


Fig. 3 - CASCADE CONTROLLER



Out.C / type of controller

Type of output controller	
0	normal (type ON/OFF o continuo)
1	with heating valve without potentiometer V0 (or floating)
2	with heating valve with indication by potentiometer V1
3	with heating valve with reaction by potentiometer V2
4	normal (type ON/OFF or continuous)
5	with cooling valve without potentiometer V0 (or floating)
6	with cooling valve with indication by potentiometer V1
7	with cooling valve with reaction by potentiometer V2

-At- / actuator stroke time (only on valve controller) (0.0 - 20.0 min). Actuator stroke time is the time the valve takes to go from completely open to completely closed.

t_LO / minimum pulse time for actuator stroke time (only on valve controller) in range 0.0 -100.0 % of actuator stroke time; minimum pulse time is necessary to avoid excessive valve activity.

-db- / band of symmetrical inactivity around setpoint (only on valve controller) (0-1000 scale points)

tyPE / type of sensor or linear input.

0=J	(Fe-CuNi, type TC)	max.range	0-1000C	(32/1832F)
1=K	(NiCr-Ni, tipo TC)	max.range	0-1300C	(32/2372F)
2=R	(Pt13Rh-Pt, tipo TC)	max.range	0-1750C	(32/3182F)
3=S	(Pt10Rh-Pt, tipo TC)	max.range	0-1750C	(32/3182F)
4=T	(Cu-CuNi, tipo TC)	max.range	-100-400C	(-148/752F)
5=B•	(Pt30Rh-Pt6Rh,tipo TC)	max.range	50-1800C	(122/3272F)
6=E	(NiCr-CuNi, tipo TC)	max.range	-100-750C	(-148/1382F)
7=N	(Nicrosil-Nisil, tipo TC)	max.range	0/1300C	(32/2372F)
8=Ni-Ni18Mo	(Ni-Ni18Mo, tipo TC)	max.range	0/1100C	(32/2012F)
10=Pt100	(type RTD 3 wires)	max.range	-200-600C	(-328/1112F)
11=Pt100	(type RTD 4 wires)	max.range	-200-600C	(-328/1112F)

+ 16	16 for thermocouples or temperature thermometers on which you want to see the temperature in °F, add 16 to the code.

12=0-50mV	(linear type)	max.range	-1999/9999
13=0-10V	(linear type)	max.range	-1999/9999
14=0/20mA	(linear type)	max.range	-1999/9999
15=0-50mV*	(custom 32 segment type)	max.range	-1999/9999

28=10-50mV	(linear type)	max.range	-1999/9999
29=2-10V	(linear type)	max.range	-1999/9999
30=4/20mA	(linear type)	max.range	-1999/9999
31=10-50mV*	(custom 32 segment type)	max.range	-1999/9999

Input 0/10V or 0/20mA or 2/10V or 4/20mA by means of divider or external shunts

* check attribution of function of custom sector (_Ch.t in configuration CFG4)
• Measurement with type B thermocouple input conforms to precision class 0.1% for temperatures exceeding 500°C.

dP_S / position of decimal point (0 - 3), (0 or 1 for TC and RTD sensors; only 0 for type R, S, B TC sensors).

LO_S / minimum scale limit (-1999/9999), for TC and RTD sensors, value is limited by max range of selected scale (min. scale limit for input calculated mathematically).

HI_S / maximum scale limit (-1999/9999), for TC and RTD sensors, value is limited by max range of selected scale (max. scale limit for input calculated mathematically).

OFSt / offset of input (±999 scale points)

SPr.t/ type of auxiliary input (0...8):

Code		
0	0 -1V o Potentiometer	Type aux. imput
1	0 -10V	
2	0 -20mA	
3	4 -20mA	
4	0 -1V	Type of auxiliary input as SPR relative to local set
5	0 -10V	
6	0 -20mA	
7	4 -20mA	
8	TA 0 - 5A	For ammeter input (4400 only)

dPSP / decimal point position for aux. input scale (0-3)

LOSP / minimum scale for auxiliary input (required only for normal controller or for V0 valves) setting within limits of input scale.

HISP / maximum scale for auxiliary input (required only for normal controller or for V0 valves) setting within limits of input scale.

OFSP / offset of auxiliary input (±999 scale points)

_LO_ / lower setting limit of setpoint (*), setting within limits of input scale (min. scale limit for input calculated mathematically).

_HI_ / upper setting limit of setpoint (*), setting within limits of input scale (max. scale limit for input calculated mathematically).

(*) L0_ and _HI are also the limits for the repeat output for the input and setpoint.

SP.Pr / selection of programmer type:

0 Non-programmer
inhibits display of “PrOG” in control parameters and programmer “Dat” menu. Logic inputs assume function of Loc/Rem switching (IN1), Aut/Man switching (IN2), Hold (IN3).

1 Single programmer
enables display of “PrOG” in control parameters and access to programmer “Dat” data. Logic inputs assume function of Start (IN1), Stop (IN2) and Reset (IN3).

2 Programmer
with direct selection of a program step by means of binary combination of digital inputs (IN1 lsb, IN2 msb)

bArG / selection of variable indicated on % bargraph (see faceplate D)
0: power % with indication of heat/cool
1: valve input position

bAud / baud rate for serial communication
0: 1200 baud for interface type CL, RS232, RS485
1: 2400 baud for interface type RS232, RS485
2: 4800 baud for interface type RS232, RS485
3: 9600 baud for interface type RS232, RS485

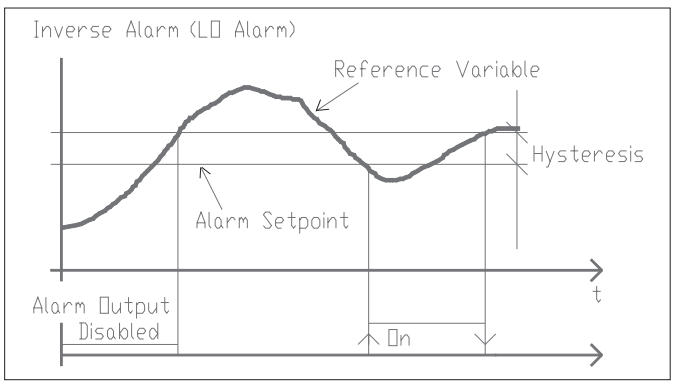
FLt_ / acts as digital filter on variable 0 for filter excluded, range 0.1 - 20.0 sec

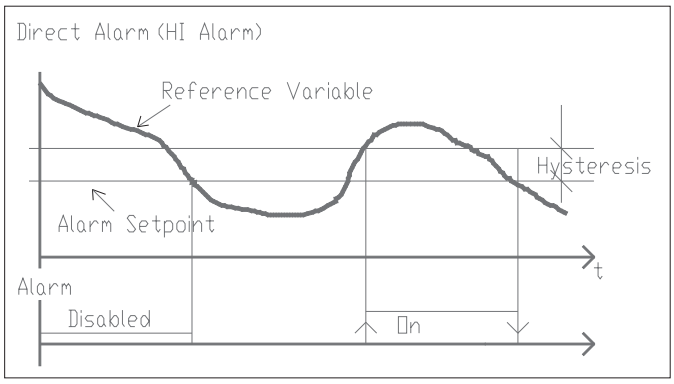
E8_ / enables management of expansion unit for alarms 3-10:
0: MD8-1 expansion disabled **1**: MD8-1 expansion enabled

L.b.A.t./ wait for tripping of LBA alarm (0.0...20.0 min); if 0.0, alarm disabled.

L.b.A.P./ limit of power supplied in LBA alarm state (0.0...100.0%); reset is automatic following a logical variation of indication, but may be performed by simultaneously pressing “Data” and “F” keys.

AL1.t/ alarm 1 function according to table:
(see also: function notes)





AL1.t/ alarm 1 function according to table:

Note	Code	Alarm Function
-	0	Direct absolute
-	1	Reverse absolute
-	2	Direct deviation
-	3	Reverse deviation
-	4	Direct symmetrical deviation
-	5	Reverse symmetrical deviation
*	6	Direct HB (Heat Break)
*	7	Reverse HB (Heat Break)
-	8	Direct LBA (Loop Break Alarm)
-	9	Reverse LBA (Loop Break Alarm)
-	10	Direct H (Holdback)
-	11	Reverse H (Holdback)
-	12	Direct program end
-	13	Reverse program end
♣	14	Direct absolute
♣	15	Reverse absolute
♣	16	Direct deviation
♣	17	Reverse deviation
♣	18	Direct symmetrical deviation
♣	19	Reverse symmetrical deviation
♥	20	Direct absolute
♥	21	Reverse absolute
♥	22	Direct deviation to remote set
♥	23	Reverse deviation to remote set
♥	24	Direct symmetrical deviation to remote set
♥	25	Reverse symmetrical deviation to remote set
	+32	For deactivation at power-up (option valid for alarms with code 0,...5 and 14,...25).

* Function allowed only if slot 1 has a relay or logic output card with Heat or Cool function.
♣ Referred to auxiliary input
♥ Referred to setpoint

AL2t / alarm 2 function according to table: as per alarm 1

AL3t / alarm 3 function according to table: as per alarm 1.

AL0t / alarm 10 function according to table: as per alarm 1.

Return to CFG_0

CONFIGURATION CFG3:

To access this configuration, jumper J17 (CFG) must be in ON position. This configuration phase regards the instrument’s hardware structure. You can insert four output cards on the basic power card (see control outputs). The four output cards must be assigned a logic function.

SLOt / select control output (1...4; 0=output from CFG3 phase);
control output 1 connected through terminals 15B, 16B (slot 1)
control output 2 connected through terminals 17B, 18B (slot 2)
control output 3 connected through terminals 19B, 20B (slot 3)
control output 4 connected through terminals 21B, 22B (slot 4)

Based on the type of card inserted in the selected slot (1...4), the configuration is proposed in relation to the type of output:

a) if isolated analog output (0.3% f.s):

An.O.x/ attribution of reference signal:
for Crt.t = 0

0	Main Heat output
1	Main Cool output
2	Repeat setpoint (of programmer) output
3	Repeat input output
4	Repeat SPR output
5	Repeat setpoint (of controller) output
6	Deviation output (setpoint - input)
7	Deviation output (input - setpoint)
+8	If 2/10V or 4/20mA
+16	Reverse output

for Crt.t = 1

0 Main output
1 Main reverse output
2 Repeat setpoint (of programmer) output
3 Repeat setpoint Y1 output (see fig. 3)
4 Repeat input X2 output (see fig.3)
5 Repeat set point (of controller) output
6 Deviation output (setpoint - input) err2
7 Deviation output (input - setpoint) err2

+8 If 2/10V or 4/20mA
+16 Reverse output

for Crt.t = 2

0 Main output
1 Main reverse output
2 Repeat setpoint (of programmer) output
3 Repeat ratio input output
4 Repeat SPR remote input output
5 Repeat ratio setpoint (of controller) output
6 Deviation output (setpoint - input) err1
7 Deviation output (input - setpoint) err1

+8 If 2/10V or 4/20mA
+16 Reverse output

L.OUx/ correction of minimum (-200/+1000 converter points) with immediate action on output to check voltage or current value (output assumes minimum value).

H.OUx/ correction of maximum (-1000/+ 200 converter points) with immediate action on output to check voltage or current value (output assumes maximum value).

b) if isolated logic output:
LOOx / attribution of reference signal:
0 Main Heat output
1 Main Cool output
2 alarm 1 output
3 alarm 2 output
4 valve open output
5 valve close output

Ct_x / cycle time for main output (0 - 200 sec)
0 = ON/OFF type Heat/Cool control

c) if relay output:
rL.O.x / attribution of reference signal:
0 Main Heat output
1 Main Cool output
2 alarm 1 output
3 alarm 2 output
4 valve open output
5 valve close output

Ct_x / cycle time for main output (0 - 200 sec)
0 = ON/OFF type Heat/Cool control
Note: Set powers below 3.2% to 0 and powers above 96.8% to 100.
d) if output for MD8-1 expansion interface:
E8_x / attribution of reference
0 excluded
1 alarms (Alarm 3 -10)
e) if output for transmitter power supply
E8_x In absence of card, indication **E8_x** is shown.

Return to CFG_ 0.

CONFIGURATION CFG4:
(setting of custom scale)
To access the configuration, jumper J17 (CFG) must b
in ON position.

_Ch.t / functional attribution of custom sector.

0 no attribution (return to CFG0)
1 attribution of sector for linearization of main input
2 attribution of sector for linearization of auxiliary input
3 attribution of sector for linearization of ratio input

_Pn.t / step number (0-32) of sector for linearization of
custom sensor.

St.xx / engineering value corresponding to step xx (xx= _Pnt set)
Press key F: if xx = 32 you return to CFG_0.

CONFIGURATION CFG5:

Mathematical processing of inputs according to formula:
(An* (Input) ^Dn + Bn) / Cn for 1 <=n<=2.

If **n = 1** processing of main input:
_A1_ / multiplication coefficient (-19.99...99.99)
_B1_ / addition coefficient (-19.99...99.99)
_C1_ / division coefficient (-19.99...99.99)
_D1_ / exponent of input (0...2)

0 input ^0
1 input ^1
2 input ^1/2 (square root)

SETTING THE PROGRAMMER

(only for instruments configured as programmer at item SP_Pr= 1 or 2 (NPN); [SP_Pr = 5 or 6 (PNP) of CFG2]
To access configuration, press button D until message **_dAt 0** appears on the display.
There are two configuration levels:
0 - dAt0: return to normal operation
1 - dAt1: set programs
2 - dAt2: set control parameters
Select with the raise/lower keys and confirm with key D.
To access the configuration, parameter Prot (CFG2) must be <16..

CONFIGURATION DAt1: Setting programs.

There are two separate phases:
description of program and insertion of individual steps.
The display shows the message: **PrG.n**/ n inclusive (0- 1)
if **n=0** to display the program being run:

CS.tP/ current step
(•)
-tH- / step time days.hrs (max. 9999 23hh referred to entire step).
(•)
-tL- / step time in mm.ss. (referred to entire step)
(•)
LOOP / number of cycles to run
(•)
(•) All of these parameters are changeable with the programmer stopped.

Insertion of single steps

If **n = 1**, proceed with:

F.St_ / number of first step 0 – 3

L.St / number of last step 0 – 3

LOOP / number of program cycles (0-200; 0 = perpetual loop)

Setting of single step:

StP.n / step no. 0-3 (=xx)

SPxx / setpoint of step xx, range in scale limits

rHxx / ramp time days.hrs (max 99.23 days.hours)

rLxx / ramp time mm.ss (max 59.59 minutes.seconds)

SHxx / hold time on setpoint days.hrs (max 99.23)

SLxx / hold time on setpoint mm.ss (max 59.59)

Hbxx/ symmetrical tolerance band relative to setpoint (hold-back band) and referred to main or auxiliary input as per table (1..1000 scale points)
When the variable is not within these limits, the programmer time base stops and wait for it to return within limits. (*)
When key **F** is pressed, if set number set xx = last program step **LSt_** ,you return to phase **Prg.n.0**; otherwise, xx is incremented and you return to phase **StPnxx** for programming of the next step.

7 - CALIBRATION

CALIBRATION PROCEDURE

The 3400/4400 instruments are supplied already calibrated. Therefore, perform the procedure only when necessary.
In normal operating conditions, press button F until CAL_ 0 appears on display (A) (there must also be enabling by means of jumper J18 [CAL]). Set the software password to access the calibration phase in question:

8 calibration of input based on type of sensor specified in Type (in CFG2) (*)
9 calibration of auxiliary input (SPR or CT or Potentiometer) based on type of sensor specified in SPrt (in CFG2) (*)

The following codes allow calibration independent of the type of sensor configured:

0..7,20 !not significant
10 ! calibration inputs from CT
11 ! calibration inputs from RTD 3 wires (%)
12 ! calibration linear inputs 0/50mV or 10/50mV (*)
13 ! calibration linear inputs 0/10V or 2/10V (*)
14 ! calibration linear inputs 0/20mA or 4/20mA (*)
15 ! calibration inputs from custom sensor

16 ! calibration SPR linear inputs 0/1V, pot. or CT
17 ! calibration SPR linear inputs 0/10V
18 ! calibration SPR linear inputs 0/20mA or 4/20mA (*)

19 ! recall factory calibration

Note: none of these calibrations modify the type of sensor configured.

(%) Calibration of sensor Pt100 RTD 4 wires is performed only by setting code CAL 8 on the correctly configured instrument (TyPE = 11 in CFG 2)

(*) Calibration of sensors 10/50mV, 2/10V, 4/20mA is performed with minimum at 0mV, 0V, 0mA respectively.

CALIBRATION TYPE 10

C_50 / apply a 50mV signal at input terminal 1A(+) terminal 2A(-). Press key F to confirm.

C_t.A(25) / set the room temperature (25°C = room temperature default value). Press key F to confirm return to CAL_ 0.

CALIBRATION TYPE 11 (%)

C.18.5/ insert a resistance of 18.49 Ohms (in configuration for RTD 2 or 3 or 4 wires) between the inputs for RTD. Press key F to confirm.

C.313 / insert a resistance of 313.59 Ohms (in configuration for RTD 2 or 3 or 4 wires) between the inputs for RTD. Press key F to confirm return to CAL_ 0.

CALIBRATION TYPE 12, 13, 14, 15
S_LO / apply the signal corresponding to scale minimum to input terminal 1A(+) and terminal 2A(-). Press key F to confirm.

S_HI / apply the signal corresponding to scale maximum to input faston 1A(+) and faston 2A(-). Press key F to confirm return to CAL_ 0.

CALIBRATION TYPE 16,17, 18

NOTE:
If the instrument is configured as controller of valves V1 or V2, the “Raise” and “Lower” keys generate a command to open or close the valve, respectively.

SPLO / apply the signal corresponding to scale minimum to the auxiliary input. Press key F to confirm.

SPHI / apply the signal corresponding to scale maximum to the auxiliary input. Press key F to confirm return to CAL_0.

8 - FUNCTION NOTES

Alarms
Alarms can be absolute, direct (maximum) or reverse (minimum), relative to remote setpoint, symmetrical deviation, referred to the main input, secondary input and setpoint.
With deviation alarms, limits have values in the range -1999 and + f.s. The value set is algebraically added to the deviation variable (the deviation alarm limit may extend below the minimum and above the maximum of the set scale).

code 0: Direct absolute alarm referred to main input: set limit is compared to input value (ex: alarm state: main input = 450, alarm limit 400).

code 1: Reverse absolute alarm referred to main input: set limit is compared to input value (ex: alarm state: main input = 400 alarm limit 450).

code 2: Direct alarm relative to setpoint referred to main input: set limit and setpoint value are compared to value of main input (ex: alarm state main input = 500. alarm limit = 50 setpoint = 400)

code 3: Reverse alarm relative to setpoint referred to main input: set limit and setpoint value are compared to value of main input (ex: alarm state main input = 400 alarm limit = 50 setpoint = 400)

code 4: Direct symmetrical deviation alarm to setpoint referred to main input: set limit and setpoint value are compared to value of main input (ex: alarm state main input = 500 alarm limit = ±50 setpoint = 400)

code 5: Reverse symmetrical deviation alarm to setpoint referred to main input: set limit and setpoint value are compared to value of main input (ex: alarm state main input = 400 alarm limit = ±50 setpoint = 400)

code 14: Direct absolute alarm referred to auxiliary input: set limit is compared to value of auxiliary input (ex: alarm state: auxiliary input = 450 alarm limit 400).

code 15: Reverse absolute alarm referred to auxiliary input: set limit is compared to value of auxiliary input (ex: alarm state: auxiliary input = 450 alarm limit 450).

code 16: Direct alarm relative to setpoint referred to auxiliary input: set limit and setpoint value are compared to value of auxiliary input (ex. alarm state: auxiliary input = 500 alarm limit = 50. setpoint = 400)

code 17: Reverse alarm relative to setpoint referred to auxiliary input: set limit and setpoint value are compared to value of auxiliary input (ex. alarm state: auxiliary input = 400 alarm limit = 50. setpoint = 400).

code 18: Direct symmetrical deviation alarm to setpoint referred to auxiliary input: set limit and setpoint value are compared to value of auxiliary input (ex: alarm state auxiliary input = 500. alarm limit = ±50 setpoint = 400)

code 19: Reverse symmetrical deviation alarm to setpoint referred to auxiliary input: set limit and setpoint value are compared to value of auxiliary input (ex: alarm state auxiliary input = 400. alarm limit = ± 50 setpoint = 400)

code 20: Direct absolute alarm referred to setpoint: set limit is compared to setpoint value (ex. alarm state setpoint = 450 alarm limit 400).

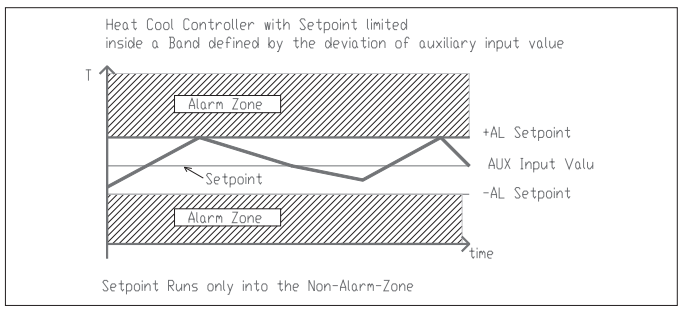
code 21: Reverse absolute alarm referred to setpoint: set limit is compared to setpoint value (ex. alarm state: setpoint = 400 alarm limit 450).

code 22: Direct alarm relative to remote setpoint referred to setpoint: set limit and remote setpoint value are compared to value of setpoint (ex. alarm state: setpoint = 500 alarm limit 50 remote setpoint = 400).

code 23: Reverse alarm relative to remote setpoint referred to setpoint: set limit and remote setpoint value are compared to value of setpoint (ex. alarm state: setpoint = 400 alarm limit 50. remote setpoint = 400).

code 24: Direct symmetrical deviation alarm to remote setpoint referred to setpoint: set limit and remote setpoint value are compared to value of setpoint (ex. alarm state: setpoint = 500 alarm limit ± 50, remote setpoint = 400) .

code 25: Reverse symmetrical deviation alarm al setpoint remote referred al setpoint: to remote setpoint referred to setpoint: set limit and remote setpoint value are compared to value of setpoint (ex. alarm state: setpoint = 400 alarm limit :1 50 remote setpoint = 400).



8 - FUNCTION NOTES

- LBA Function

This alarm identifies interruption of the control loop due short circuit of the sensor, reversed sensor, or load break.
It is always active, and generates an alarm if the variable does not increase its value in heating (does not decrease in cooling) under maximum power supplied for set time **LbAt.**
If the value of the variable is beyond the proportional band, power is limited to set value **LbAP**.
The active alarm state is signaled by flashing of the bargraph that displays the power percentage.
A relay can be assigned to the alarm by means of the configuration code.
The alarm state resets if the temperature rises in heating (lowers in cooling) or by simultaneously pressing the “Data” and “F” keys.

- HB Alarm

This type of alarm depends on use of the current transformer (C.T.) input. It signals changes in load input by indicating the percentage of current in amperometric input (max. 5A).
It is enabled by means of configuration code. In this case, the alarm tripping value is expressed as a percentage (0-100%).
The percentage of current can be displayed on bargraph if the controller type (rEG.t in CFG2) = 2, 3, 6, 7.

- H Alarm

This type of alarm depends on the setting of the H (hold) band. When the controlled variable leaves the symmetrical H band compared to the setpoint, the programmer time base stops and alarm H activates.

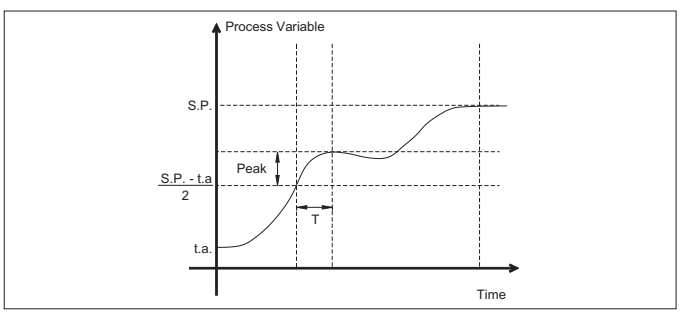
Notes on control actions

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

Influence on Proportional, Derivative, Integral actions on response of controlled process:
- An increase in Proportional Band reduces oscillations but increases deviation.
- Reduction of the Proportional Band reduces deviation, but excessively low values may make the system unstable.
- Increasing Derivative Action, corresponding to an increase in Derivative Time, prevents oscillations up to a critical value, beyond which deviation increases and provokes extended oscillations.
- Increasing Integral Action, corresponding to a reduction in Integral Time, tends to cancel deviation under standard conditions.
For high Integral Time values (weak Integral Action), persistent deviation is possible under standard conditions.

Notes on 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.

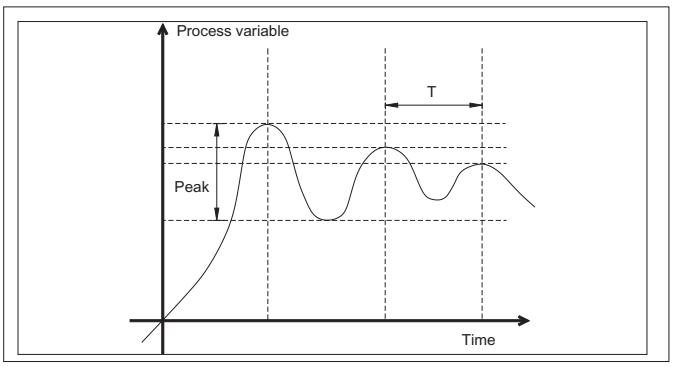


Notes on Auto-tuning

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 0.5% 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.

MANUAL TUNING TECHNIQUES

A) Enter the setpoint at its working value.
B) Set the proportional band at a value of 0 1% (with cycle time zero to have an on-off type control with relay output).
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.

CONTROLLER

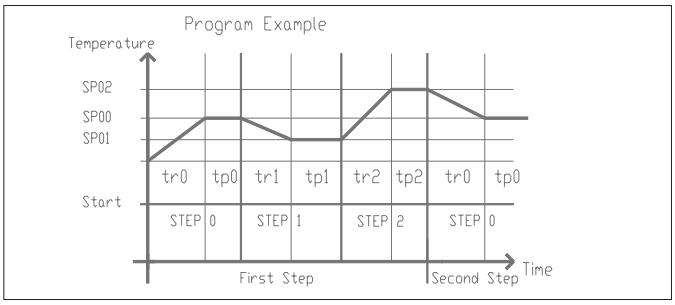
Thanks to their modular structure, Gefran controllers provide application solutions to satisfy a wide variety of needs. All models have configurable control outputs (ON/OFF, continuous (0-20mA, 4-20mA, 0-10V)), and relay outputs to control valve opening/closing with or without potentiometer feedback.
Main features: control outputs galvanically isolated from main input; 32-sector processing; controller type configurable to double-acting hot/cold and ratio controller. A sequence of four setpoint steps can be programmed in time or selectable from inputs. These sensors are used in a wide variety of applications. For example, ratio controllers are typically used in burners to keep the fuel/air flow ratio constant. The fuel flow rate signal (auxiliary input subject to extraction of square root) is compared with the air flow rate value to keep the set Air/Fuel ratio constant. Control of fuel flow made be performed by another temperature controller. A request for more fuel will generate a request for greater air flow. By exploiting alarm function with ability to limit the control setpoint value, you can have the following control: heating of a fluid in a reactor maintaining a maximum thermal gradient between internal temperature of heated fluid and external temperature of the heating element. The external temperature setpoint assumes the maximum value allowed in the range defined by the internal temperature ± the delta T set as an alarm relative to the auxiliary input. The setpoint value is limited by the value assumed by the internal temperature of the reactor, acquired at the auxiliary input by means of a transmitter.

8 - FUNCTION NOTES

PROGRAMMER

The 3400/4400 combines the function of a controller with that of a single-loop programmer.
The programmer function lets you run a program as a set of segments or steps, each consisting of a ramp and a hold.

Example of Program
Example of Function H (hold band)



Each step is composed of the following data:

- (**SPxx**) a setpoint value;

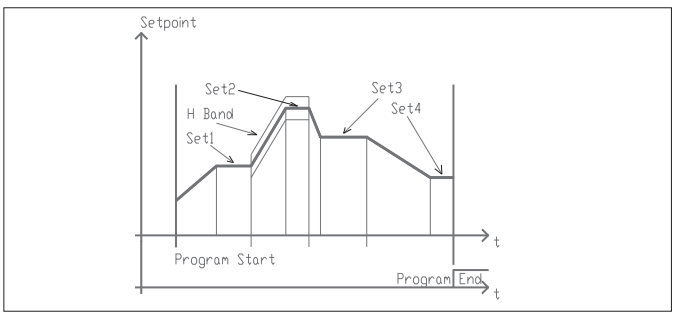
- (**rHxx,rLxx**) a ramp time (from 0 to 99 days, 23h, 59', 59"): set a time that allows more or less rapid variation depending on the starting value and the setpoint to be reached.

- (**SHxx,SLxx**) a hold time (from 0 to 99 days, 23h, 59', 59")

- (**Hbxx**) a symmetrical tolerance band relative to the setpoint (from 1 to 1000 scale points, 0 to disable the action).

A total of 4 program steps are available.

USING THE PROGRAMMER:



With SP.Pr = 1 see CFG1)

Example of setpoint profile in single programmer configuration:
4 setpoints + 4 ramps.
- In the example shown, step 2 admits a holdback band that stops the time base if the controlled variable is extended to it. If the value of this band is set at zero, the programmer generates the setpoint profile independent of the value of the controlled variable.
- At start, the setpoint value is set as equal to value of the controlled variable.
- At the end of the hold, end of program state is activated and remains until the next reset (start + stop).

Enable program
- from faceplate keys by setting parameter ProG = 1
- remote from serial line

Control program: Start - Stop - Reset
from faceplate with keys MAN/AUTO and DATA pressed simultaneously.
Data for current program can be displayed by selecting:
Prg.n = 0 in DAt1.
- remote from START (IN1), STOP (IN2), RESET (IN3) inputs
- remote from serial line.

Stop program:
- remote with STOP (IN2) input
- from faceplate with keys MAN/AUTO and DATA pressed simultaneously
- variation of local setpoint, occurring during a program suspension phase, causes restart of the step currently being run, with conservation of the set gradient or with set ramp time.

Start program:
- at power-on with START (IN1) input
- from faceplate with keys MAN/AUTO and DATA pressed simultaneously.

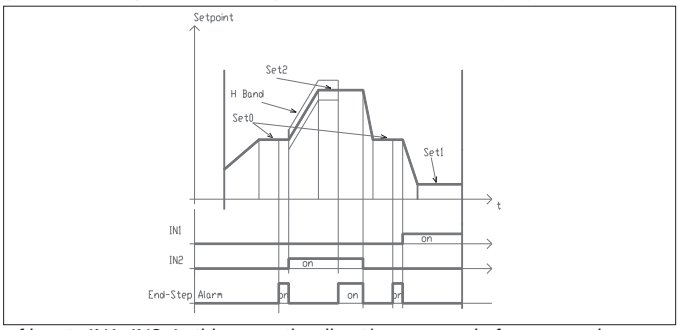
Stop and restart program:
- remote with START (IN1) and STOP (IN2) inputs
- remote with reset input

Change of current program and restart with new program:
- stop the program (STOP)
- rewrite the program (dAt1)
- push RESET
- push START

Program step data is maintained if the instrument turns off.

Direct selection of setpoint (SP.Pr = 2)

Example of setpoint profile in multiple programmer configuration: 4 setpoints + 4 ramps. The four setpoints are selected directly by a combination



of inputs IN1, IN2. In this case, the direct/reverse end of program alarm (code 12/13) performs the end of process function.
The setpoint of each program step can be selected directly (*) by means of a binary combination of digital inputs IN1 and IN2, according to the table:

IN1	IN2	SELECTED STEP NUMBER
0	0	0
1	0	1
0	1	2
1	1	3

(*) For a direct path, set the following for each program step:
- ramp time zero
- hold time zero
- H band zero

PROGRAMMING FROM PC

All configuration and calibration procedures can be run with an industrial personal computer (Gefran industrial terminals or IBM*-compatibile PC) and appropriate management software.

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ORDER CODES

MODEL	
3400	3400
4400	4400

INPUTS	
TC/RTD 2-3 wires linear 0...50mV	A*
RTD 4 wires	B
0...10V	C
0...20, 4...20mA	D

AUXILIARY INPUTS	
None	0
0...1V	1
0...10V	2*
0...20, 4...20mA	3
Potentiometer	4
Current transformer CT (model 4400 only)	5

LOGIC INPUTS IN2, IN3	
None	0
NPN	1*
PNP	2

On 3400, possible only for Auxiliary input = 0

(*) Identifies standard version

OUTPUT 1	
None	0
Rely	R*
Solid State	D
Continuous 0...10V	V
Continuous 0...20, 4...20mA	I
Transmitter powers supply	T

DIGITAL COMMUNICATION	
0*	None
1	Current Loop
2	RS422/485
3	RS232C

OUTPUT 4	
0	None
R*	Rely
D	Solid State
V	Continuous 0...10V
I	Continuous 0...20, 4...20mA
M	Expansion MD81
T	Transmitter powers supply

OUTPUT 3	
0	None
R*	Rely
D	Solid State
V	Continuous 0...10V
I	Continuous 0...20, 4...20mA
M	Expansion MD81
T	Transmitter powers supply

OUTPUT 2	
0	None
R*	Rely
D	Solid State
V	Continuous 0...10V
I	Continuous 0...20, 4...20mA
M	Expansion MD81
T	Transmitter powers supply

Kindly contact GEFRAN for information on available codes.

• WARNINGS

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

Read the following warnings before installing, connecting or using the device:
• follow instructions precisely when connecting the device.
• always use cables that are suitable for the voltage and current levels indicated in the technical specifications.
• the device has no ON/OFF switch: it switches on immediately when power is turned on. For safety reasons, devices permanently connected to the power supply require a two-phase disconnecting switch with proper marking. Such switch must be located near the device and must be easily reachable by the user. A single switch can control several units.
• if the device is connected to electrically NON-ISOLATED equipment (e.g. thermocouples), a grounding wire must be applied to assure that this connection is not made directly through the machine structure.
• if the device is used in applications where there is risk of injury to persons and/or damage to machines or materials, it MUST be used with auxiliary alarm units. You should be able to check the correct operation of such units during normal operation of the device.
• before using the device, the user must check that all device parameters are correctly set in order to avoid injury to persons and/or damage to property.
• the device must NOT be used in inflammable or explosive environments. It may be connected to units operating in such environments only by means of suitable interfaces in conformity to local safety regulations.
• the device contains components that are sensitive to static electrical discharges. Therefore, take appropriate precautions when handling electronic circuit boards in order to prevent permanent damage to these components.
Installation: installation category II, pollution level 2, double isolation
• power supply lines must be separated from device input and output lines; always check that the supply voltage matches the voltage indicated on the device label.
• install the instrumentation separately from the relays and power switching devices
• do not install high-power remote switches, contactors, relays, thyristor power units (particularly if “phase angle” type), motors, etc... in the same cabinet.
• avoid dust, humidity, corrosive gases and heat sources.
• do not close the ventilation holes; working temperature must be in the range of 0...50°C.
If the device has faston terminals, they must be protected and isolated; if the device has screw terminals, wires should be attached at least in pairs.
• *Power:* supplied from a disconnecting switch with fuse for the device section; path of wires from switch to devices should be as straight as possible; the same supply should not be used to power relays, contactors, solenoid valves, etc.; if the voltage waveform is strongly distorted by thyristor switching units or by electric motors, it is recommended that an isolation transformer be used only for the devices, connecting the screen to ground; it is important for the electrical system to have a good ground connection; voltage between neutral and ground must not exceed 1V and resistance must be less than 6Ohm; if the supply voltage is highly variable, use a voltage stabilizer for the device; use line filters in the vicinity of high frequency generators or arc welders; power supply lines must be separated from device input and output lines; always check that the supply voltage matches the voltage indicated on the device label.
• *Input and output connections:* external connected circuits must have double insulation; to connect analog inputs (TC, RTD) you have to: physically separate input wiring from power supply wiring, from output wiring, and from power connections; use twisted and screened cables, with screen connected to ground at only one point; to connect adjustment and alarm outputs (contactors, solenoid valves, motors, fans, etc.), install RC groups (resistor and capacitor in series) in parallel with inductive loads that work in AC *(Note: all capacitors must conform to VDE standards (class x2) and support at least 220 VAC. Resistors must be at least 2W)*; fit a 1N4007 diode in parallel with the coil of inductive loads that operate in DC.
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.