0116

PID CONTROLLER

EUROTHERM

USER MANUAL

INDEX GB

Home Screen Definition

The 0116 display indicates the measured value or the set point value.
When the set point value is displayed the SP LED will be flashing.
To revert the display to the measured value press the ▲ pushbutton.

CONFIGURATION ENTRY & EXIT

Entry and Exit *See page 5 "Preliminary Hardware settings" section*

POWER OUTPUT On/Off

These products allow you manually turn off the output power.
See page 12 "Output Power Off" section

Off To turn the power off press the ▲ key followed by the SCROLL key.
Keep both buttons pressed for 3 seconds until the display shows **OFF**

On To tune the power on press the ▲ key followed by the SCROLL key.
Keep both buttons pressed for 3 seconds until the display returns to normal numeric display.

DIRECT SETPOINT ENTRY

See page 12 "Direct Access To The Set Point Modification "
While viewing the normal display hold either the ▲ or ▼ button for more than 2 seconds. The value will change. After reaching the new set point do not press any keys for a further 2 seconds and the new value will be entered.

PARAMETER ENTRY

See page 11 "Pushbuttons Function"
Whenever a parameter is changed using either the ▲ or ▼ buttons there are 2 options:

Accept new value Press the SCROLL key
Cancel the change Press the PAGE key

LAMP TEST

See page 13 "Lamp Test"
The instrument display LED's can be tested as follows:

Activate Test Press ▼ and together
Cancel Test Press ▼ and together

DEFAULT CONFIGURATION

See section B
The instrument can be pre-loaded with factory default values.
Using the factory default values is ideal for completely resetting the instrument before commencing a new configuration.

PARAMETER SECURITY

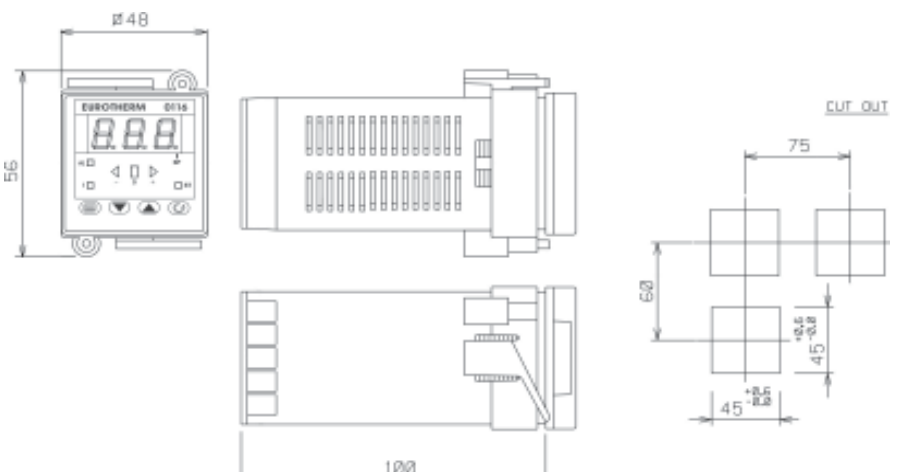
See page 8 and 9 section P11 & P14
The instrument is supplied with access to the main parameters which are required for the set-up procedure.

After commissioning it is necessary to select the correct level of Parameter Security, simplifing the instrument user interface for normal operation.
The most common security setting would be:
P11 = 1
P14 = Off

RECOVERY FROM A LOST PASSWORD

See page 8 and 9 section P11 & P14
If you lose your password
Enter Configuration using the Master Code of 408
Go to parameter P11 and enter the Master Code of 408
You can now reset the password.

OUTLINE AND CUT OUT DIMENSIONS



MOUNTING REQUIREMENTS

Select a mounting location where there is minimum vibration and the ambient temperature range between 0 and 50 °C.
The instrument can be mounted on a panel up to 15 mm thick with a square cutout of 45 x 45 mm.
For outline and cutout dimensions refer to page IV.
The surface texture of the panel must be better than 6,3 µm.
The instrument is shipped with rubber panel gasket (50 to 60 Sh).
To assure the IP65 and NEMA 4 protection, insert the panel gasket between the instrument and the panel as show in fig. 1.
While holding the instrument against the panel proceed as follows:

1) insert the gasket in the instrument case;
2) insert the instrument in the panel cutout;
3) pushing the instrument against the panel, insert the mounting bracket;
4) with a screwdriver, turn the screws with a torque between 0.3 and 0.4 Nm.

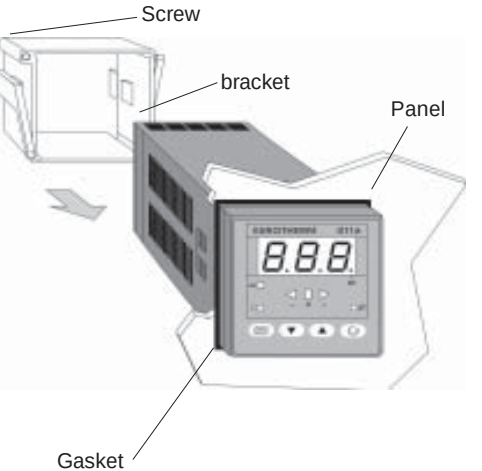


Fig. 1

CONNECTION DIAGRAMS

Connections are to be made with the instrument housing installed in its proper location.

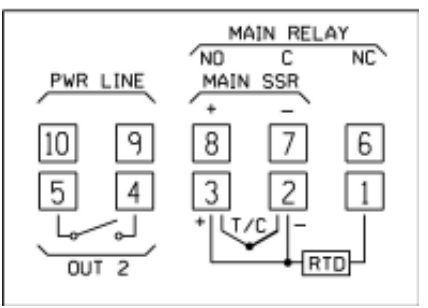


Fig. 2 REAR TERMINAL BLOCK

A) MEASURING INPUTS

NOTE: Any external components (like zener barriers etc.) connected between sensor and input terminals may cause errors in measurement due to excessive and/or not balanced line resistance or possible leakage currents.

TC INPUT

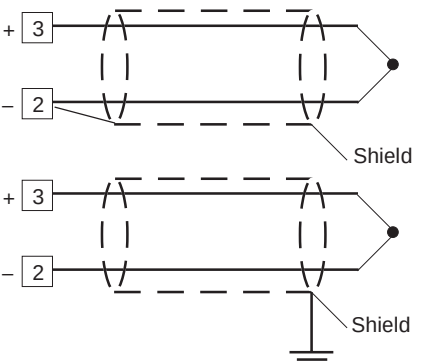


Fig. 4 THERMOCOUPLE INPUT WIRING

NOTE:

1) Don't run input wires together with power cables.
2) For TC wiring use proper compensating cable preferable shielded.
3) when a shielded cable is used, it should be connected at one point only.

RTD INPUT

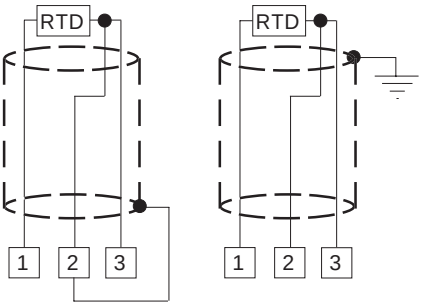


Fig. 5 RTD INPUT WIRING

NOTE:
1) Don't run input wires together with power cables.
2) Pay attention to the line resistance; a resistance higher than 20 Ω/wire may cause measurement errors.
3) When shielded cable is used, it should be grounded at one side only to avoid ground loop currents.
4) The resistance of the 3 wires must be the same.

B) RELAY OUTPUTS

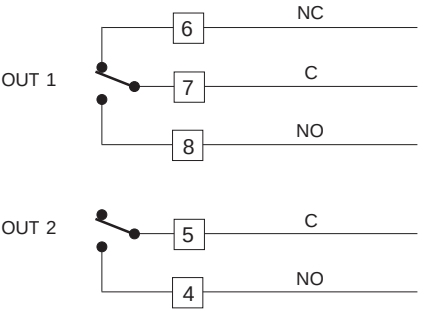


Fig. 6 RELAY OUTPUTS WIRING

The OUT 1 NO contact and the OUT 2 contact areprotected by varistor against inductive load with inductive component up to 0.5 A.
The contact rating of the OUT 1 is 3A/250V AC on resistive load.
The contact rating of the OUT 2 is 1A/250V AC on resistive load.
The number of operations is 1 x 10^5 at specified rating.

NOTES 1) To avoid electric shock, connect power line at the end of the wiring procedure.
2) For power connections use No 16 AWG or larger wires rated for at last 75 °C.
3) Use cupper conductors only.
4) Don't run input wires together with power cables.

The following recommendations avoid serious problems which may occur, when using relay output for driving inductive loads.

INDUCTIVE LOADS

High voltage transients may occur when switching inductive loads.
Through the internal contacts these transients may introduce disturbances which can affect the performance of the instrument.
The internal protection (varistor) assures a correct protection up to 0.5 A of inductive component but the OUT 1 NC contact is not protected.
The same problem may occur when a switch is used in series with the internal contacts as shown in Fig. 7.

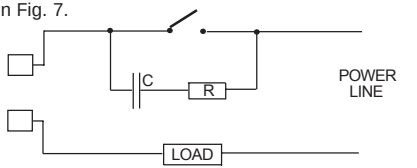


Fig. 7 EXTERNAL SWITCH IN SERIES WITH THE INTERNAL CONTACT

In this cases it is recommended to install an additional RC network across the external contact as show in Fig. 7
The value of capacitor (C) and resistor (R) are shown in the following table.

LOAD (mA)	C (µF)	R (Ω)	P. (W)	OPERATING VOLTAGE
<40 mA	0.047	100	1/2	260 V AC
<150 mA	0.1	22	2	260 V AC
<0.5 A	0.33	47	2	260 V AC

Anyway the cable involved in relay output wiring must be as far away as possible from input or communication cables.

VOLTAGE OUTPUTS FOR SSR DRIVE

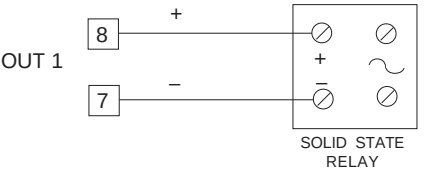


Fig. 8 SSR DRIVE OUTPUT WIRING
It is a time proportioning output.
Logic level 0: Vout < 0.5 V DC.
Logic level 1:
- 14 V + 20 % @ 20 mA
- 24 V + 20 % @ 1 mA.
  Maximum current = 20 mA.

NOTE: This output is not isolated.
A duble or reinforced Isolation between instrument output and power supply must be assured by the external solid state relay.

A) POWER LINE WIRING

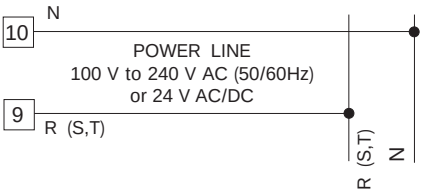


Fig. 3 POWER LINE WIRING

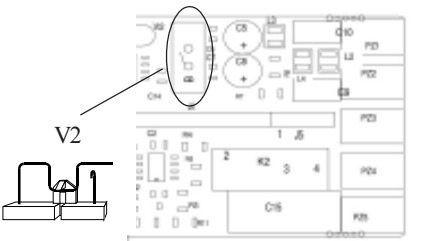
NOTE:

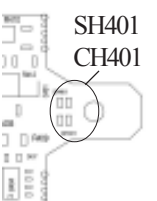
1) Before connecting the instrument to the power line, make sure that line voltage corresponds to the descrtiption on the identification label.
2) To avoid electric shock, connect power line at the end of the wiring procedure.
3) For supply connections use No 16 AWG or larger wires rated for at last 75 °C.
4) Use copper conductors only.
5) Don't run input wires together with power cables.
6) For 24 V AC/DC the polarity is a do not care condition.
7) The power supply input has NO fuse protection. Please, provide externally a T type 1A, 250 V fuse.
8) The safety requirements for Permanently Connected Equipment say:
   - a switch or circuit-breaker shall be included in the building installation;
   - It shall be in close proximity to the equipment and within easy reach of the operator;
   - it shall be marked as the disconnecting device for the equipment.

NOTE: a single switch or circuit-breaker can drive more than one instrument.

PRELIMINARY HARDWARE SETTINGS

1) Remove the instrument from its case.
2) Set the internal switch V2 in open condition





3) These device are able to detect leads break for TC and RTD inputs. It shows this status as an overrange condition as standard factory setting.
For termocouple input only, it is possible, if underrange indication is desired, to set SH401 and CH401 in accordance with the following table .

Fig. 9

SH401	CH401	Indication
open	close	overrange (standard)
close	open	underrange

4) If, during configuration procedure, a readout in °F has been selected, it is necessary to put on the front of the instrument, the additional label, located at the INDEX page, in order to cover the °C indication.

5) Re-insert the instrument.
6) Switch the instrument “ON”.
The display will show COnF.
NOTE : If “CAL” indication is displayed, press immediately the ▲ pushbutton to return to the configuration procedure.
7) Push the ↺ pushbutton.
The instrument shows the parameter code and its value alternately on the display.

GENERAL NOTES for configuration.

↺ = This will memorize the new value of the selected parameter and go to the next parameter (increasing order).
▤ = This will scroll back the parameters without memorization of the new value.
▲ = This will increase the value of the selected parameter
▼ = This will decrease the value of the selected parameter.

CONFIGURATION PROCEDURE

P1 - Input type and standard range

0	= TC type	L	range	0 / +800 °C
1	= TC type	J	range	0 / +800 °C
2	= TC type	K	range	0 / +999 °C
3	= TC type	N	range	0 / +999 °C
4	= RTD type	Pt 100	range	-199 / +500 °C
5	= RTD type	Pt 100	range	-19.9 /+99.9 °C
6	= TCtype	T	range	0 / +400 °C
8	= TC type	L	range	0 / +999 °F
9	= TC type	J	range	0 / +999 °F
10	= TC type	K	range	0 / +999 °F
11	= TC type	N	range	0 / +999 °F
12	= RTD type	Pt 100	range	-199 / +999 °F
13	= TC type	T	range	0 / +752 °F

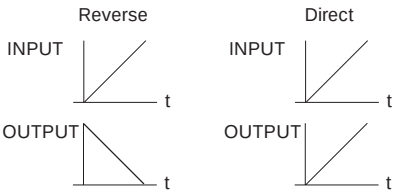
NOTE: setting a readout with °F as engineering unit it is necessary to put on the front of the instrument, the additional label located in the “INDEX” of this manual.

P2 = Initial scale value
Not present when P1 = 5
Insert the initial and full scale values which are going to be used by the PID algorithm to calculate the input span.

P3 = Full scale value
Not present when P1 = 5
Insert the initial and full scale values which are going to be used by the PID algorithm to calculate the input span.
NOTES:
1) the minimum input span (P3 - P2) is 300 °C or 600 °F for TC input and 100 °C or 200 °F for RTD input.
2) Changing P2 and/or P3 parameters, the rL and rH parameters will be realligned to it.

P4 = Main output action

The LHS skips this parameter when P5 = 5
r = reverse action (heating)
d = direct action (cooling)



P5 = Output 2 functions

0 = Not provided
1 = Process alarm
2 = Band alarm
3 = Deviation alarm
4 = instrument failure indicator

P6 = Output 2 operative mode.

P6 is available only when P5 is different from 0.
When P5 = 1,2 or 3
H.A = high alarm (outside band) with automatic reset
L.A = low alarm (inside band) with automatic reset
H.L= high alarm (outside band) with manual reset
L.AL= low alarm (inside band) with manual reset

When P5 = 4 theselections H.A and L.A show an instrument failure indicator with automatic reset while the H.L and L.L selections show an instrument failure indicator with manual reset.

P7 = Alarm action

Available only when P5 is different from 0 or 5.
r = reverse (relay de-energized in alarm condition)
d = direct (relay energized in alarm condition)

P8 = Stand by of the alarm

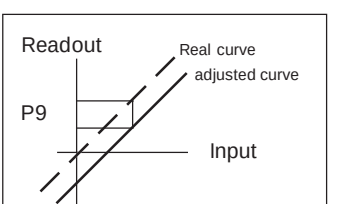
Available only when P5 is different from 0,4 or 5.
OFF = stand by disabled
ON = stand by enabled

NOTE: the alarm stand by function allows to disable the alarm indication at instrument start up and/or after a set point modification until the process variable reach the alarm threshold.

P9 = OFFSET applied to the measured value

This OFFSET is applied along the whole range.

When P1= 5	P9 is programmable from -19.9 to 19.9 °C.
When P1 ≠ 5	P9 is programmable from -199 to 199 °C or °F.



P10 = Threshold of the "Soft Start" function.

The "Soft start" function allows to limit the maximum output power (see OLH operative parameter) for a programmable time (see tOL operative parameter) at the instrument start up when the measured value is lower then the programmable threshold.
Insert the threshold value, in eng. unit.

P11 = Safety lock

0 = device unlocked. All the parameters can be modified

1 = device locked. No one of the parameters can be modified except the SP.

2 to 499 = Select the secret code (to be remembered) and **during the "operative mode"** and scrolling the "software key" parameter, the display will show one of the following figures:

A) The device is "Unlocked" and all parameters can be modified.

To make the device "Locked" insert a number different from the "secret code". Now no one of the parameters can be modified except the SP.

B) 

The device is "locked" and no one of the parameters can be modified except the SP.
To "Unlock" the device, insert the "secret code".

500 to 999 = Selecting a secret code between these two numbers, every thing will occur as explained above except that when the device is "Locked" the parameters that can be modified are the set point and the alarm threshold.

P12 = output maximum rate of rise

This parameter is available only if Pb is different from 0.
It is programmable from 1 to 10 % of the output signal per second.
Setting a value greater then 10%/s the instrument shows "InF" and no ramp limitation is applied.

P13 = Deviation bar graph resolution

For RTD input with decimal figure, P13 is is programmable from 0.2 to 20.0 °C.
For all the other inputs, it is programmable from 2 to 200 engineering units.

The configuration procedure is completed and the instrument shows " -.-.-.-. " on both displays.
When it is desired to end the configuration procedure push the ↺ pushbutton; the display will show "COnF".

When it is desired to access to the advanced configuration parameter procede as follows:
1) using ▲ and ▼ pushbutton set the 219 code.
2) push the ↺ pushbutton.

P14 -Display of the protect parameter enabling/disabling.
This parameter is available only if P11 is different from 0.
This parameter allows to enable/disable the display of the protected parameter during "operative mode".
OFF = protected parameter cannot be displayed
ON = protected parameter can be displayed

P15 - SMART function enabling/ disabling
0 = The SMART function is disabled
1 = The SMART function enabling/disabling is NOT protected by the safety key.
2 = The SMART function enabling/disabling is protected by the safety key.

P16 - Maximum value of the proportional band settable by the SMART function
This parameter may be programmed from P17or P18 value to 99.9.

P17 - Minimum value of the proportional band settable by the SMART function in heating control only.
This parameter is present only if P5 is different from 5.
It may be programmed from 1.0% to P16 value.

P20 - Minimum value of integral time settable by SMART function.
P20 is programmable from 00.1 (10 seconds) to 02.0 (2 minutes).

P21 = Extension of the anti-reset-wind up
Range: from -30 to +30 % of the proportional band.
NOTE: a positive value encreases the high limit of the anti-reset-wind up (over set point) while a negative value decreases the low limit of the anti-reset-wind up (under set point).

The advanced configuration procedure is completed and the instrument shows " CnF" on the display.

OPERATIVE MODE

PRELIMINARY

To make the instrument operative as controller the internal switch V2 located on the input card (see Fig. 9) must be closed.

It is assumed, at this point, that the instrument has been correctly configured as detailed in Section 3.

The 0116 shows the measured value or the set point value (in this case the SP LED will be flashing). In order to revert the indication push the ▲ pushbutton. (We define this display condition as "normal display mode").

Pressing the ↻ pushbutton it is possible to scroll all the parameters.
The instrument will alternate its reading between the parameter code and its value and, during modification, it will show only the parameter value.

To modify a parameter, first select the desired parameter by the ↻ pushbutton, then set the new value by ▲ or ▼ pushbuttons. Press ↻ pushbutton to memorize the new value and step to the next parameter.

NOTE: 1) If, during parameter modification, no pushbutton is pressed for more than 10 seconds, the instrument reverts automatically to the "normal display mode" and the new setting of the last parameter will be lost.

2) The instrument doesn't displays all the parameters.
It select the parameters in accordance with:
a) The instrument configuration in general (see chapter 3),
b) The P14 parameter in particular (see chapter 3),
c) The set of the proportional band (see page 4.2).

INDICATORS

ST Flashing when the first part of the SMART algorithm is active.
Lit when the second part of the SMART algorithm is active.

1 Lit when the OUT 1 is in ON condition.

AL - Lit when the alarm 1 is in the alarm state or, for LDS only, when this output is used as time proportioning control output and it is in ON condition.

SP Flashing when the display shows the operative set point.

Pushbuttons function:

- ↺ = It allows to memorize the new value of the selected parameter and go to the next parameter (increasing order).
- ▭ = It allows to enable or disable the SMART function and to scroll back all the parameters without storing them.
- ▲ = It allows to increase the value of the selected parameter or to display the set point value or the measured value.
- ▼ = It allows to decrease the value of the selected parameter.
- ▼ + ↺ = allows to enable/disable the "LAMP TEST"

NOTE: a 10 seconds time out become operational during parameter modification.
If, during operative parameter modification, no pushbutton is pressed during this time out, the instrument reverts automatically to the “normal display mode”. The new setting of the last parameter modified is going to be memorizzed, prior to the time out, only if the ↺ pushbutton was depressed.

MANUAL RESET OF THE ALARMS
If the alarm has been configured as a latched alarm, the alarm status persists also after the alarm condition disappears.
When it is desired to reset the alarm, pushing ↺ pushbutton select the "n.rS" parameter (the display will show "n.rS" and "OFF"). By the ▲ and ▼ pushbuttons select "ON" and push the ↺ pushbutton again.
The alarm reset action will be successful if the alarm condition has disappeared only.

SMART ALGORITHM
It is used to obtain automatically the best control action.
To enable the SMART function, push the ▭ pushbutton for more than 1,5 s, when the instrument is in normal display mode. The ST LED will lit continuously or flashing according to the algorithm automatically selected.
When the smart function is enabled, it is possible to display but not to modify the control parameters (PB, TI, TD and rC).
When the traditional control (PID) is desired, push the ▭ pushbutton again (for more than 1.5 s) to turn the "SMART" OFF. The instrument maintains the actual set of control parameters and allows parameter modification.
NOTES:

1) The SMART function use a derivative time equal to 1/4 of the integral time.
2) The limits of the proportional band settable by the SMART function is programmed by P16 and P17 parameters.
3) The lower limit of the integral time settable by SMART function is programmed by P20 parameter.
4) When ON/OFF control is programmed (PB=0), the SMART function is disabled.
5) The SMART enabling/disabling can be protected by the safety lock (see P15 parameter).

OUTPUT POWER OFF

These products allow to turn OFF, manually, the output signal in order to stop the control.
To turn OFF the output signal, push continuously the ▲ pushbutton first and then push ↺ pushbutton.
Maintaining pressure on both of them for more than 3 seconds, the instrument will show "OFF" instead of the measured value.
0116 model, since it has only one display, it is possible to toggle from "OFF" to measured value by depressing the ▲ pushbutton (the LEDs of the bargraph will be flashing to show that the instrument is working as an indicator only).
In the output power off condition the alarms are in no alarm condition (the alarm output status depends by the type of alarm action programmed) and the parameters can be re-viewed and modified.
When it is desired to come back to the normal control, push continuously the ▲ pushbutton first and then push the ↺ pushbuttons.
Maintaining the pressures on both of them for more than 3 seconds, the instrument returns in NORMAL DISPLAY MODE.

NOTES :

1) If the output is turned OFF when the SMART function was performing the first part of the algorithm (LED ST is flashing), the SMART function will be aborted and when the instrument comes back to the normal control, the SMART function will be disabled.
   If the output is turned OFF when the SMART function was performing the second part of the algorithm (LED ST is lighting), the SMART function will be stopped and, when the instrument comes back to the normal control, the smart function also will be activated.
2) If the instrument is turned OFF with the output power off function enabled, at the next start up the instrument will automatically enabled again this function.

DIRECT ACCESS TO THE SET POINT MODIFICATION

The instrument allows to modified the set point value without to use the ↺ pushbutton.
When a direct access to set point modification is required, proceed as follow:

1) Push, for more than 3 seconds, the ▲ or ▼ pushbutton; the set point value, will be displayed and it will start to change.
2) Using the ▲ and ▼ pushbuttons, it is possible to set the desired value.
3) When the desired value is reached, do not push any pushbutton for more than 3 second, the new set point will become operative after 3 second from the last pushbutton pressure.

If, during this procedure, there is no interest in memorizing the new value, push the ↺ pushbutton; the instrument returns automatically to the normal display mode without having memorized the new set point.

DISPLAY OF THE SET POINT VALUE

To display the programmed set point value push the ▲ pushbutton.
The display will show the set point value and the decimal point of the last significant digit will flash to indicate that the number shown is the set point value.
To come back to display the measured value, push the ▲ pushbutton again.

BARGRAPH OPERATING

The 3 LEDs bargraph shows the deviation between the measured value and the set point value.
The central LED (green) is lit when the deviation is lower than one half of the value programmed with P13 parameter.
If the deviation is higher than 1/2 P13 but lower than 3/2 P13, one of the red LED will be lit (the right or the left LED according to the deviation direction).
When the deviation is higher than 3/2 P13 the relative LED (left or right) will be flashing.

LAMP TEST

When it is desired to verify the display efficiency, push ▼ + pushbuttons. the instrument will turn ON, with a 50 %duty cicle,all the LED of the display (we define this function "LAMP TEST").
No time out is applied to the LAMP TEST.
When it is desired to come back to the normal display mode, push ▼ + pushbuttons again.
No other keyboard function are available during LAMP TEST.

OPERATIVE PARAMETERS

The following is a list of all the available control parameters. Note that some parameters may be not visualized according to the specific instrument configuration.
Push the pushbutton, the lower display will show the code while the upper display will shows the value or the status (ON or OFF) of the selected parameter.
By ▲ or ▼ pushbutton it is possible to set the desired value or the desired status.
Pushing the pushbutton, the instrument memorizes the new value (or the new status) and goes to the next parameter.

Param.	DESCRIPTION
SP	Set point (in eng. units). Range: from rL to rH.
n.rS	Manual reset of the alarms. This parameter is available only when one alarm with manual reset has been programmed. Set ON and push the pusbutton to reset the alarms.
nnn	Software key for parameter protection. This parameter is skipped if P11 = 0 or 1 ON = the instrument is in LOCK condition OFF = the instrument is in UNLOCK condition When it is desired to switch from LOCK to UNLOCK condition, set a value equal to P11 parameter. When it is desired to switch from UNLOCK to LOCK condition, set a value different from P11 parameter.

AL — Alarm threshold (in eng. units).
This parameters is present if the alarm is configured only.
Ranges:
- From P2 to P3 for process alarm.
- From 0 to 500 units for band alarm.
- From -199 to 500 units for deviation alarm.

HSA — Alarm hysteresis (in % of P3 - P2 span)
This parameters is present if the alarm is configured only.
Range:From 0.1% to 10.0% of the input span or 1 LSD.
NOTE: If the hysteresis of a band alarm is larger than the alarm band, the instrument will use an hysteresis value equal to the alarm band minus 1 digit.

Pb — Proportional band (in % of P3 - P2 span)
Range**:** from 1.0 % to 99.9 % of span.
When PB parameter is set to 0, the instrument performs an ON-OFF control; the ti, td, C, OLH and tOL parameters are skipped and SMART function is disabled.

HS — Hysteresis for ON/OFF control action (in % of P3 - P2 span)
This paameter is available only when Pb=0.
Range: from 0.1% to 10.0% of the input span.

ti — Integral time (in minutes and seconds [mm.ss]). This parameter is skipped if Pb=0 (ON/OFF action).
Range: from 00.1 to 20.0 [mm.ss]. Above this value the display blanks and integral action is excluded

td — Derivative time (in minutes and seconds [mm.ss]). This parameter is skipped if Pb=0 (ON/OFF action).
Range: from 1 s to 9 min. and 59 s; if 0 is set, the derivative action is excluded.

IP — Integral pre-load. This parameter is skipped when PB = 0.
Range: from 0 to 100% for one control output

C — Output 1 (heating) cycle time (in seconds)
This parameter is present if PB parameter is different from 0 only.
Range:From 1 to 200 s.

rL — Set point low limit (in eng. units).
Range: from min. range value (P2) to rH.
NOTE: When P2 has been modified, rL will be realigned to it.

rH — Set point high limit (in eng. units).
Range:from rL to full scale value (P3).
NOTE: When P3 has been modified, rH will be realigned to it

OLH — Output high limit (in % of the output).
This parameter is present if PB parameter is different from 0 only.
Range: From 0.0 to 100.0 when device is configured with one control output.

tOL — Time duration of the output power limiter.
The tOL is a programmable time in which the output level is limited to OLH value.
The count of this time starts at instrument switching on if the measured variable is less than the threshold value programmed (P10 parameter).
This parameter is present if PB parameter is different from 0 only.
Range: from 1 minute to 100 minutes. Above this limit, the upper display shows "InF" and the limiter will be ever enabled independently from P10 parameter value.
NOTE: The tOL can be modified but the new value will become operative only at the next instrument start up.

ERROR MESSAGES

OVERRANGE, UNDERRANGE AND BURN-OUT INDICATIONS

The instrument shows the OVERRANGE and UNDERRANGE conditions with the following indications:

Overrange

Underrange

The sensor leads break can be signalled as:
- for TC input : OVERRANGE or UNDERRANGE selected by a solder jumper (see chapter 3)
- for RTD input : OVERRANGE

Sensor leads short circuit detection:
On RTD input, a special test is provided to signal OVERRANGE when input resistance is less than 15 ohm (Short circuit sensor detection).

NOTE: When:
- The instrument is set for one output only and an OVERRANGE is detected, the OUT 1 turns OFF (if reverse action) or ON (if direct action).
- The instrument is set for heating/cooling action and an OVERRANGE is detected, OUT 1 turns OFF and OUT 2 turns ON.
- The instrument is set for one output only and an UNDERRANGE is detected, the OUT 1 turns ON (if reverse action) or OFF (if direct action).
- The instrument is set for heating/cooling action and an UNDERRANGE is detected, OUT 1 turns ON and OUT 2 turns OFF.

NOTE: when an overrange or an underrange is detected, the alarm operate as in presence of the maximum or the minimum measurable value respectively.

To eliminate the OUT OF RANGE condition, proceed as follows:
1) Check the input signal source and the connecting line.
2) Make sure that the input signal is in accordance with instrument configuration. Otherwise, modify the input configuration (see chapter 3.2).
3) If no error is detected, send back the instrument to your supplier for a check.

ERRORS

Diagnostics are made at instrument switch-on and during normal mode of operation.
If a fault condition (error) is detected, the display will show alternatly "Er" and the error number.
The following is a list of possible errors in numerical order.
Also causes, instrument output conditions and possible remedies are briefly described.
Some errors reset the instrument; if the error persist, send back the instrument to your supplier.

ERROR LIST

100	Write EEPROM error.
150	General hardware error on the CPU card.
200	Tentative to write on protected memory.
201 - 2xx	Configuration parameter error. The two less significant digit's shown the number of the wrong parameter (ex. 209 Err show an Error on P9 parameter)
301	RTD calibration error.
305	Thermocouple input calibration error.
307	RJ input calibration error
400	Control parameters error
500	Auto-zero error
502	RJ error
510	Error during calibration procedure

NOTE

1) When a configuration parameter error is detected, it is sufficient to repeat the configuration procedure of the specify parameter.
2) If an error 400 is detected, push contemporarily the ▼ and ▲ pushbuttons for loading the default parameters then repeat control parameter setting.
3) For all the other errors, contact your supplier.

GENERAL INFORMATION

GENERAL SPECIFICATIONS

Case: ABS grey color (RAL 7043); self-extinguishing degree: V-0 according to UL 94.

Front protection - designed and tested for IP 65 (*) and NEMA 4X (*) for indoor locations (when panel gasket is installed).

(*) Test were performed in accordance with CEI 70-1 and NEMA 250-1991 STD.

Installation: panel mounting by means of mounting braket. Instrument removable from case.

Rear terminal block:10 screw terminals (screw M3, for cables from ϕ 0.25 to ϕ 2.5 mm^2 or from AWG 22 to AWG 14) with connection diagrams and safety rear cover.

Dimensions: 48 x 48 mm, depth 100 mm (DIN 43700).

Weight: 160 g max.

Power supply:

- 100V to 240V AC 50/60Hz (-15% to + 10% of the nominal value).
- 24 V AC/DC (+ 10 % of the nominal value).

Power consumption: 6 VA max.

Insulation voltage: 2300 V rms according to EN 61010-1.

Display updating time: 500 ms.

Sampling time: 500 ms.

Resolution: 30000 counts.

Accuracy (@ 25 °C): +0.3% of the input span +1 °C.

Common mode rejection: 120 dB at 50/60 Hz.

Normal mode rejection: 60 dB at 50/60 Hz.

Electromagnetic compatibility and safety requirements: This instrument is marked CE. Therefore, it is conforming to council directives 89/336/EEC (reference harmonized standard EN-50081-2 and EN-50082-2) and to council directives 73/23/EEC and 93/68/EEC (reference harmonized standard EN 61010-1).

Installation category: II

Temperature drift: < 200 ppm/°C (RJ excluded)
< 400 ppm/°C for RTD input with -19.9/99.9 °C range and TC type T.

Reference junction drift: 0.1 °C/°C.

Operative temperature: from 0 to 50 °C.

Storage temperature : -20 to +85 °C

Humidity: from 20 % to 85% RH, non condensing.

Protections:

1) WATCH DOG circuit for automatic restart.
2) DIP SWITCH for protection against tampering of configuration and calibration parameters.

INPUTS

A) THERMOCOUPLE

Type: L, J, K, N, T programmable by front pushbuttons.

Line resistance: max. 100 Ω with error <+0.1% of the input span.

Engineering unit: °C or °F programmable.

Reference junction: automatic compensation from 0 to +50 °C.

Reference junction drift : 0.1 °C/°C.

Burn-out: Up or down scale selectable.

Calibration: according to IEC 584-1 and DIN 43710 - 1977 (TC L)

STANDARD RANGES TABLE

TC type	Measuring ranges	
L	0 - +800 °C	0 - +999 °F
J	0 - +800 °C	0 - +999 °F
K	0 - +999 °C	0 - +999 °F
N	0 - +999 °C	0 - +999 °F
T	0 - + 400 °C	0 - +752 °F

B) RTD (**R**esistance **T**emperature **D**etector)
Type: Pt 100 3 wires connection.
Current: 135 µA.
Line resistance: automatic compensation up to 20 Ω/wire with :
- error <+0.1% of the input span for range -19.9 a 99.9 °C.
- not measurable error for the other ranges.
Engineering units: °C or °F programmable.
Burn-out: up scale. **NOTE**: a special test is provided to signal OVERRANGE when input resistance is less than 15 Ω.
Calibration: according to DIN 43760

STANDARD RANGES TABLE

RTD TYPE	Measuring range	
RTD Pt 100	-199 - +500 °C	-199 - +999 °F
RTD Pt 100	-19.9 - +99.9 °C	-----

CONTROL ACTIONS

Control actions: PID + SMART
Proportional band: from 1.0 % (for heating action) or 1.5 % (for heating and cooling action) to 99.9 % of the input span.
Setting Pb = 0 an ON/OFF control is performed.
Hysteresis (for ON/OFF control action): from 0.1 % to 10.0 % of the input span.
Integral time: from 10 seconds to 20 minutes; resolution 10 second. Setting a value upper than 20 minutes the integral action will be excluded.
Derivative time: from 0 to 9 minutes and 59 seconds.
Integral preload: from 0 to 100% for one control output.
Heating cycle time: from 1 to 200 s.

CONTROL OUTPUTS

OUTPUT 1 - heating:
a) Relay output with SPDT contact;
contact rating 3A / 250 V ac on resistive load.
b) Logic voltage for SSR drive.
Logic status 1: 24 V +20% @ 1 mA.
14 V +20% @ 20 mA
Logic status 0: <0.5 V

OUTPUT 2 - alarm 1
Relay output with SPST contact;
contact rating 1A / 250 V ac on resistive load.
By internal jumper it is possible to select the NC or NO contact.

MAINTENANCE

1) REMOVE POWER FROM THE POWER SUPPLY TERMINALS AND FROM RELAY OUTPUT TERMINALS
2) Remove the instrument from case.
3) Using a vacuum cleaner or a compressed air jet (max. 3 kg/cm^2) remove all deposit of dust and dirt which may be present on the louvers and on the internal circuits trying to be careful for not damage the electronic components.
4) To clean external plastic or rubber parts use only a cloth moistened with:
- Ethyl Alcohol (pure or denatured) [C_2H_5OH] or
- Isopropil Alcohol (pure or denatured) [$(CH_3)_2CHOH$] or
- Water (H_2O)
5) Verify that there are no loose terminals.
6) Before re-inserting the instrument in its case, be sure that it is perfectly dry.
7) re-insert the instrument and turn it ON.

DEFAULT PARAMETERS

DEFAULT OPERATIVE PARAMETERS

The control parameters can be loaded with predetermined default values. These data are the typical values loaded in the instrument prior to shipment from factory. To load the default values proceed as follows:

a) The internal switch should be closed.
b) The SMART function should be disabled.
c) The safety lock must be OFF.
d) The upper display will show the processevariable while the lower display will show the set point value or the current measure.
e) Held down ▼ pushbutton and press ▲ pushbutton; the display will show:

f) Within 10 seconds press ▲ or ▼ pushbutton. The display will show:

g) Press ↺ pushbutton; the display will show:

This means that the loading procedure has been initiated. After about 3 seconds the loading procedure is terminated and the instrument reverts to NORMAL DISPLAY mode.

The following is a list of the default operative parameters loaded during the above procedure:

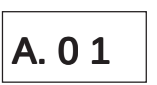
PARAMETER	DEFAULT VALUE
SP	= minimum range-value
nnn	= OFF
AL	= minimum range-value for process alarms 0 for deviation or band alarms
HSA	= 0.1 %
PB	= 4.0 %
HS	= 0.5 %
ti	= 04.0 (4 minutes)
td	= 1.00 (1 minute)
IP	= 30 % for one control output 0 % for two control outputs
C	= 20 seconds for relay output 2 seconds for SSR output
C2	= 10 seconds for P6 = Air 4 seconds for P6 = OIL 2 seconds for P6 = H2O
rC	= 1.00 for P6 = Air 0.80 for P6 = OIL 0.40 for P6 = H2O
OLP	= 0
rL	= initial scale value
rH	= full scale value
OLH	= 100 %
tOL	= infinite

DEFAULT CONFIGURATION PARAMETERS

The configuration parameters can be loaded with predetermined default values. These data are the typical values loaded in the instrument prior to shipment from factory. To load the default values proceed as follows:

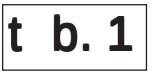
a) The internal switch (V2, see fig. 9) should be open.
b) The upper display will show:

c) Push the ▼ pushbutton; the display will show the firmware version.



d) Mantaining the pressure on the ▼ pushbutton push the ▲ pushbutton also. The instrument will show

e) Press ▲ pushbutton to select between table 1 (european) or table 2 (american) default parameter set. The display will show:



f) Press ↺ pushbutton; the display will show:

This means that the loading procedure has been initiated. After about 3 seconds the loading procedure is terminated and the instrument reverts to visualization as in point b).

The following is a list of the default parameters loaded during the above procedure:

PARAMETER	TABLE 1	TABLE 2
P1	1	9
P2	0 °C	0 °F
P3	400 °C	999 °F
P4	r	r
P5	0	0
P6	H	H
P7	r	r
P8	OFF	OFF
P9	0	0
P10	0	0
P11	0	0
P12	10	10
P13	2	2
P14	ON	ON
P15	2	2
P16	30.0	30.0
P17	1.0	1.0
P18	–	–
P19	–	–
P20	00.3	00.3
P21	10	10

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