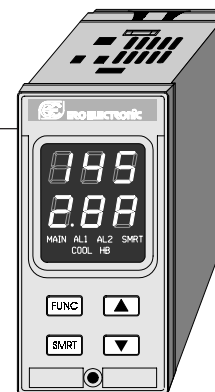




170.IU0.TMS.000 4.3-99/D



☐ USER MANUAL

TMS

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MOUNTING REQUIREMENTS

Select a mounting location having the following characteristics:

- 1) it should be easy accessible also on the rear side.
- 2) there is no vibrations or impact
- 3) there are no corrosive gases (sulphuric gas, ammonia, etc.).
- 4) there are no water or other fluid (i.e. condense)
- 5) the ambient temperature is in accordance with the operative temperature of the instrument (from 0 to 50 °C).
- 6) the relative humidity is in accordance with the instrument specifications (20% to 85 % non condensing).

The instrument can be mounted on a panel up to 15 mm thick with a square cutout of 45 x 92 mm. For outline and cutout dimensions refer to Fig. 2. The surface texture of the panel must be better than 6,3 µmm.

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 shown in fig. 1.

While holding the instrument against the panel proceed as follows:

- 1) insert the instrument through the panel gasket,
- 2) insert the instrument, with the panel gasket, through the panel cut out,
- 3) while pressing the instrument firmly against the panel, insert the mounting bracket and slide it up to the end of the case,
- 4) with a screwdriver, turn the screws with a torque between 0.3 and 0.4 Nm,

- 5) Make sure you cannot move the case within the cut out otherwise you do not have a NEMA 4X/IP65 protection.

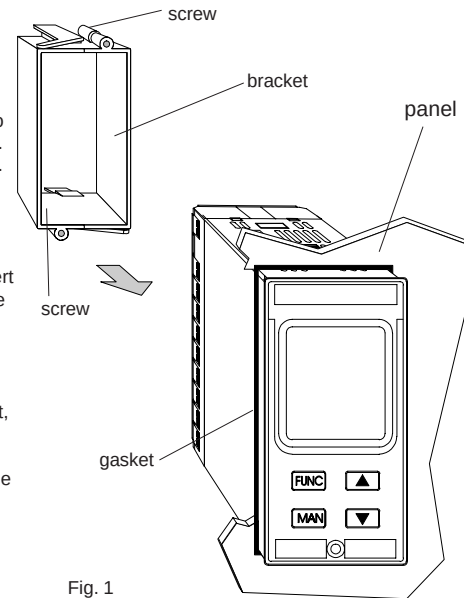


Fig. 1

DIMENSIONS AND PANEL CUT OUT

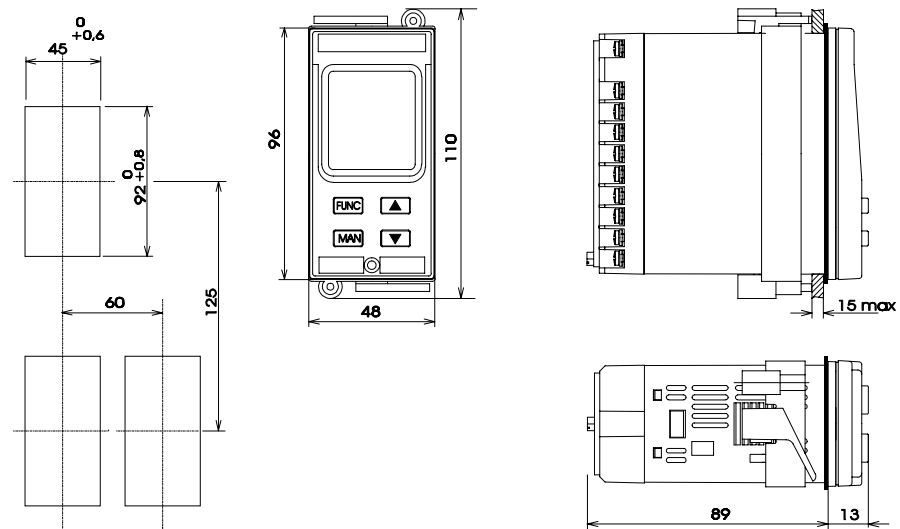


Fig. 2

WIRING GUIDELINES

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

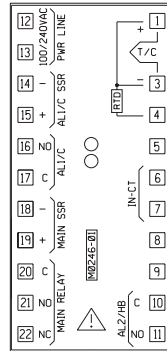


Fig. 3.A TERMINAL BLOCK (for 100/240 V AC models)

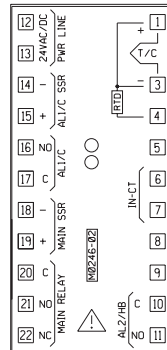


Fig. 3.B TERMINAL BLOCK (for 24 V AC/DC models)

A) MEASURING INPUT

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.

THERMOCOUPLE INPUT

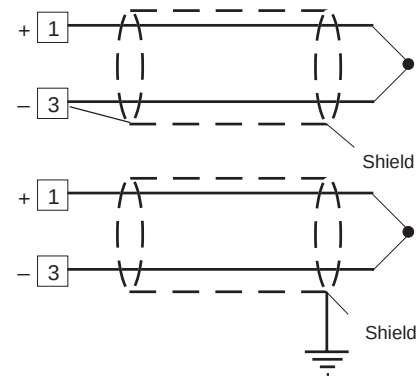


Fig. 4 THERMOCOUPLE INPUT WIRING

NOTE:

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

RTD INPUT

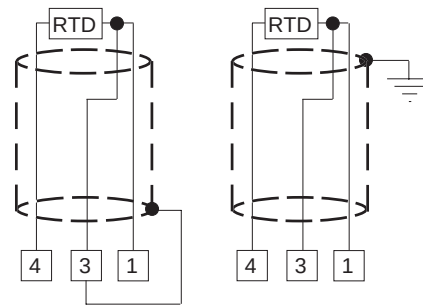


Fig. 5 RTD INPUT WIRING

NOTE:

- 1) Don't run input wires together with power cables.
- 2) Pay attention to the line resistance; a high line resistance (higher than 20 Ω /wire) may cause measurement errors.
- 3) If shielded cable is used, it should be grounded at one point only.
- 4) The resistance of the 3 wires must be the same.

B) CURRENT TRANSFORMER INPUT

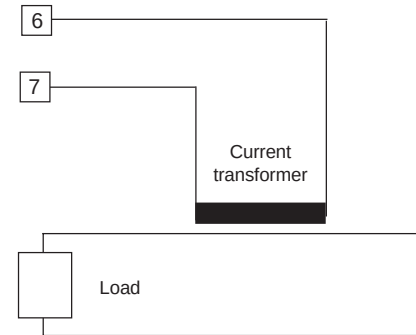


Fig. 6 CURRENT TRANSFORMER INPUT WIRING

Note:

- 1) The input impedance is equal to 10 Ω .
- 2) the maximum input current is equal to 50 mA (50 / 60 Hz).

C) RELAY OUTPUTS

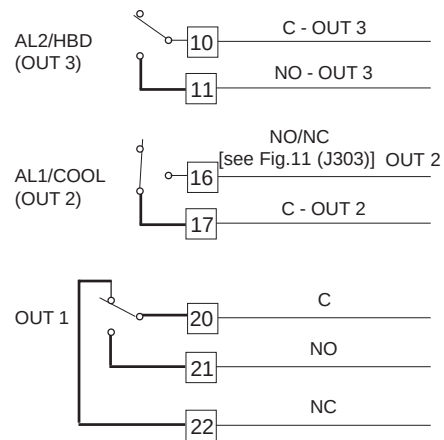


Fig. 7 RELAY OUTPUT WIRINGS

The output 2 and the NO contact of the output 1 are protected, by varistor, from inductive load with an inductive component up to 0,5 A.

The rating of the out 1 contact is equal to 3A/250 V AC on resistive load.

The rating of the out 2 and 3 contacts is equal to 2A/250 V AC on resistive load.

The number of operations is 1×10^5 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 copper conductors only.

4) Don't run input wires together with power cables.

5) Relay output and SSR drive output are both available. When a relay output is desired it is necessary to enable the SSR output and viceversa (see chapter "Preliminary hardware settings").

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 and out 3 are not protected.

The same problem may occur when a switch is used in series with the internal contacts as shown in Fig. 8.

Fig. 8 EXTERNAL SWITCH IN SERIES WITH THE INTERNAL CONTACT

In these cases it is recommended to install an additional RC network across the external contact (or close to the non protected contact of the instrument) as shown in Fig. 8.

The capacity (C) and resistive (R) values are shown in the following table.

LOAD (mA)	C (μ F)	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

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

D) LOGIC OUTPUT FOR SSR DRIVE

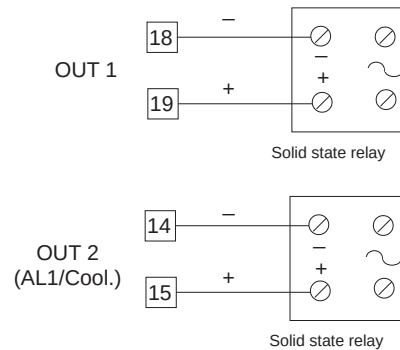


Fig. 9 SSR DRIVE OUTPUT WIRING.

These are time proportioning outputs.

Logic level 0: Vout < 0.5 V DC.

Logic level 1:

- 14 V $\pm$ 20 % @ 20 mA

- 24 V $\pm$ 20 % @ 1 mA.

Maximum current = 20 mA.

NOTES:

1) These outputs are not isolated.

A double or reinforced isolation between instrument output and power supply must be assured by the external solid state relay.

2) Relay output and SSR drive output are both available. When a SSR output is desired it is necessary to enable the relay output and viceversa (see chapter "Preliminary hardware settings").

E) POWER SUPPLY

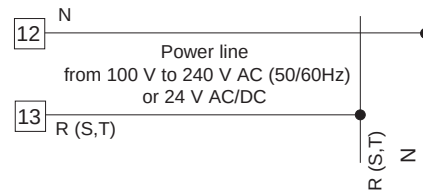


Fig. 10 POWER LINE WIRING

NOTE:

- 1) Before connecting the instrument to the power line, make sure that line voltage corresponds to the description 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 least 75 °C.
- 4) Use copper conductors only.
- 5) Don't run input wires together with power cables.
- 6) For 24 V AC/DC power supply, the input polarity is a do not care condition.
- 7) The power supply input has no fuse protection. Please, provide a fuse type T, 1 A, 250 V externally.
When fuse is damaged, it is advisable to verify the power supply circuit, so that it is necessary to send back the instrument to your supplier.
- 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.

- 9) When a neutral line is present, connect it to terminal 12.

- J303 (AL1, Cool.) 1-2 = Out NO 2-3 = Out NC
Note : J303 is a soldering jumper and it is located
 on the soldering side of the card.



These device are capable to detect leads break for TC and RTD inputs. For RTD input it shows this status as an overrange condition.

GB 8

GENERAL NOTES for configuration.

- FUNC** = This will memorize the new value of the selected parameter and go to the next parameter (increasing order).
- SMRT** = 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.

- 3) Re-insert the instrument..
- 4) Switch the instrument "ON".
The display will show CONf.
- NOTE** : If "CAL" indication is displayed, press immediately the **▲** push-button to return to the configuration procedure.
- 5) Push the FUNC push-button.
The instrument will show on the lower display the parameter code and on the upper display the actual parameter value.

CONFIGURATION PROCEDURE

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

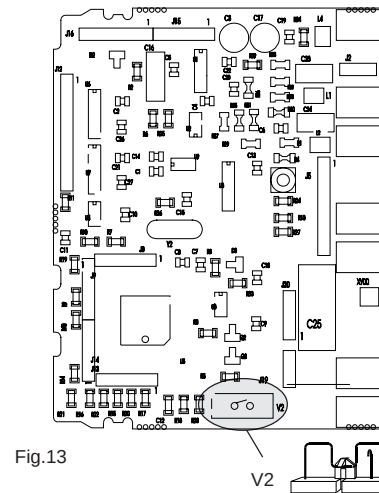


Fig.13

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	= TC type 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

P2 = Initial scale value

Not present when P1 = 5

Initial scale value used by the PID algorithm to calculate the input span.

P2 is programmable within the input span selected by P1.

When P2 has been modified, the instrument assigns to the rL parameter the new P2 value.

P3 = Full scale value

Not present when P1 = 5

Full scale value used by the PID algorithm to calculate the input span.

P3 is programmable within the input span selected by P1.

When P3 has been modified, the instrument assigns to the rH parameter the new P3 value.

NOTE: the minimum input span (P3 - P2) is

- 300 °C or 600 °F for TC input

- 100 °C or 200 °F for RTD input.

P4 = Output configuration

H = heating

HC = heating/cooling

P5 = Main output type

rEL = Relay output.

SSr = SSR output.

NOTE:

Setting P5 = rEL, the C parameter will be automatically set to 20 s.

Setting P5=SSr, the C parameter will be automatically set to 2 s.

P6 = Cooling output type

Available only when P4 = HC

Air = air

OIL = oil

H2O = water

NOTE:

Setting P6 = Air, the C2 parameter will be automatically set to 10 s and rC parameter will be set to 1.00.

Setting P6=Oil, the C2 parameter will be automatically set to 4 s and rC parameter will be set to 0.80.

Setting P6=H2O,

the C2 parameter will be automatically set to 2 s and rC parameter will be set to 0.40.

P7 = Alarm 1

Available only when P4 = H.

0 = Not provided

1 = Process alarm

2 = Band alarm

3 = Deviation alarm

P8 = Alarm 1 operative mode

Available only when P7 is different from 0 and

P4 = H.

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.L= low alarm (inside band) with manual reset

P9 = Stand by (mask) of the alarm 1

Available only when P7 is different from 0 and

P4 = H.

OFF = stand by (mask) disabled

ON = stand by (mask) enabled

NOTE: the alarm stand by function allows to disable the alarm indication at instrument start up or, for band and deviation alarms, after a set point modification.

The alarm will be automatically reactivated when the initial alarm condition disappears.

P10 = Alarm 2

0 = Not provided
 1 = Process alarm
 2 = Band alarm
 3 = Deviation alarm

Alarm 2 and HBD functions are in OR condition on the output 3 (see P16 parameter).

P11 = Alarm 2 operative mode and reset of the HBD alarm.

Available only when P10 is different from 0 or P16 is different from OFF.

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

NOTE: The HBD alarm is a low alarm but it assumes the same reset type selected for alarm 2.

P12 = Stand by (mask) of the alarm 2

Available only when P10 is different from 0.

OFF = stand by (mask) disabled

ON = stand by (mask) enabled

For other details see P9 parameter.

P13 = Type of OFFSET applied to the measured value

P13 = 0 the OFFSET (P14) is constant all over the range.

P13 different from 0 P13 is the application point of the OFFSET selected by P14 parameter.

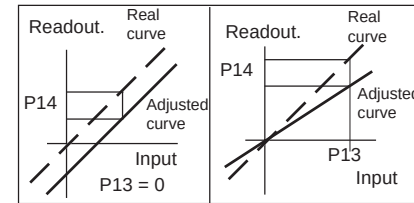
NOTE: the P13 and P14 parameters do not modify the measuring or read-out limits of the instrument so that when one of this limit has been exceeded, the instrument will show an out of range condition.

P14 = OFFSET value

When P13 = 0, P 14 is programmable, in engineering units, from -20% to + 20% of the input span (see P1).

When P13 ≠ 0 P14 is programmable, in engineering units, from -20% to + 20% of the P13 value.

NOTE: the P14 parameter can not be set lower than -199 units.

**P15 = Threshold of the "Soft Start" function.**

Threshold value, in engineering units, used by the instrument for automatic enabling of the "soft start" function (timed output power limiting).

At instrument start up, if the measured value is lower than the programmed threshold value, the instrument will automatically enable the output power limiter (see OLH parameter) and it maintains this limit for a time programmed by tOL parameter.

At instrument start up, if the tOL parameter is equal to "InF", the P15 setting has no effect.

P16 = Measure of the current consumed by the load driven by the main output (HBD)

OFF = measure disabled

n.O. = measure enabled during the ON period (logic status 1 for SSR output or contact NO for relay output)

n.C. = measure enabled during the OFF period (logic status 0 for SSR output or contact NC for relay output)

P17 = Full scale of the current transformer.

Available only when P16 is different from OFF.

10 = 10 A (resolution: 0.1 A)

25 = 25 A (resolution: 1 A)

50 = 50 A (resolution: 1 A)

100 = 100 A (resolution: 1 A)

P18 = Safety lock

0 = device unlocked. All the parameters can be modified

1 = device locked. No one parameters can be modified exception made for SP.

From 2 to 499 = during operative mode, SP parameter can be modified and this number allows to enable/disable the modification of all the other parameters.

From 500 to 999 = SP, A1 and A2 parameters can be modified and this number allows to enable/disable the modification of all the other parameters.

NOTE: After FUNC push-button pressure it will be impossible to display this value again. If you don't remember the old key, set a new value.

The configuration procedure is completed and the instrument will show " " on both displays. When it is desired to end the configuration procedure push the FUNC push-button; the display will show "CONF".

When it is desired to access to the advanced configuration parameter, proceed as follows:

- 1) using ▲ and ▼ push-button set the 217 code.
- 2) push the FN push-button; the instrument will start the auxiliary configuration procedure and it will show the following additional parameters.

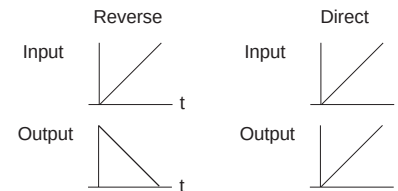
P19 - Main output action

Available only when P4 = H.

r = Reverse (heating)

d = direct (cooling)

Note : when P4 = HC, this parameter is equal to "r".



P21 - Alarm 1 output action

Available only when P7 is different from 0 and P4 is equal to H.

r = reverse (relay de-energized in alarm condition).

d = Direct (relay energized in alarm condition)

P22 - Alarm 2 output action

Available only when P10 is different from 0 and P16 is different from "OFF".

r = reverse (relay de-energized in alarm condition).

d = Direct (relay energized in alarm condition)

P23 - Automatic modification of the "relative cooling gain"

Available only when P4=HC.

OFF = The SMART function will **NOT** modify the "relative cooling gain" parameter value.

ON = The SMART function will modify the "relative cooling gain" parameter value.

P24 - Control output maximum rate of rise

This parameter allows to set the maximum rate of rise of the control output.

It is programmable from 1 to 10 % of the output signal per second.

Setting a value greater than 10%/s the upper display will blank and no limit is applied.

P25 - Display of the protect parameter enabling/disabling.

Available only when P18 is different from 0.

OFF = protected parameter cannot be displayed

ON = protected parameter can be displayed

P26 - 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.

P27 - Maximum value of the proportional band settable by the SMART function

Available only when P26 is different from 0.

This parameter may be programmed from P28 or P29 value to 99.9.

P28 - Minimum value of the proportional band settable by the SMART function

Available only when P4=H and P26 is different from 0.

This parameter may be programmed from 1.0 % to P27 value.

P29 - Minimum value of the proportional band settable by the SMART function in heating/ cooling control only

Available only when P4=HC and P26 is different from 0.

This parameter may be programmed from 1.5 % to P27 value.

P30 - Minimum value of integral time settable by SMART function.

Available only when P26 is different from 0.

This parameter may be programmed from 00.1 (mm.s) to 02.0 (mm.s).

P31 - Extension of the anti-reset-wind up

Range: from -30 to +30 % of the proportional band.

NOTE: a positive value increases 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 auxiliary configuration is finished and the instrument will show "CnF" on the upper display.

OPERATIVE MODE

- 1) Remove the instrument from its case.
- 2) Set the V2 jumper (see fig. 13) in close condition.
- 3) Re-insert the instrument.
- 4) Switch on the instrument.

The upper display will show the measured value while the lower display will show the programmed set point (we define this display condition as "normal display mode").

Note: When a ramp is applied to the set point value (see rP parameter), the displayed set point value may be different from the operative set point.

When the HBD function is configured, the control output is enabled and the instrument is in normal display mode, pushing the ▲ push-button the lower display will show the current, followed by the "A" symbol, consumed by the load driven by the main output.

NOTE: the time out has no effect on this indication.

When it is desired to come back to the normal display mode, push the ▲ push-button again.

SMART function

The SMART algorithm is a NEW self-tuning function of the instrument. It is used by the instrument to calculate and set automatically the control parameters.

The SMART algorithm may be ever operative; in this case it will adapt continuously the control parameter in order to perform the best control action.

To start "SMART" function, depress the SMRT push-button for more than 1.5 seconds when the instrument is in NORMAL DISPLAY MODE, the SMRT indicator will start blinking or lighting according to the special function performing. When it is desired to disable the SMART function, push the SMRT push-button again, the SMRT indicator will turn to OFF.

NOTES:

- 1) During the SMART function operation, the relative cooling gain (if present) is limited within the following ranges:

Cooling element	range
Air	0.85 to 1.00
OIL	0.80 to 0.90
H ₂ O	0.30 to 0.60
- 2) The SMART function use a derivative action equal to 1/4 of the integral action.
- 3) The limits of the proportional band and of the integral time settable by the SMART function are programmed by P27, P28, P29 and P30 parameter.
- 4) The enabling/disabling of the SMART function may be under safety key protection.
- 5) When SMART function is enabled, it is impossible to modify the Pb, ti and td parameter; for rC parameter see P23 parameter.

OUTPUT POWER OFF

The TMS allows to turn OFF manually the output signal in order to stop the control (the instrument will operate as an indicator only).

To turn OFF the output signal proceed as follows:

- 1) push and maintain the pressure on the ▲ push-button
- 2) push FUNC push-button.
- 3) Maintaining the pressure on both push-buttons for more than 3 seconds; the lower display will show "OFF" and the output signal will be inhibited.

When it is desired to come back to the normal control, repeat the actions 1, 2 and 3; the instrument goes automatically to the NORMAL DISPLAY MODE.

NOTE: 1) The instrument memorizes the output status.
2) If the output is turned OFF when the SMART function was performing the first part of the algorithm (LED SMRT 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 adaptive part of the algorithm (LED SMRT is lit), the SMART function will be stopped and, when the instrument comes back to the normal control, the smart function also will be activated.

HEATER BREAK DOWN ALARM

This alarm allows to verify, continuously, the current consumed by the load driven by the main output and generates an alarm condition when this current is lower than a programmable threshold.

To display the main load consumption, push the ▲ push-button when the instrument is in NORMAL DISPLAY MODE.

The upper display will show the measured value while the lower display will show the main load consumption (in Ampere) followed by the engineering unit (A).

To come back to the normal display mode, push the ▲ push-button.

When an alarm condition is detected, the LED AL2/HB will be flashing and the relay of the out 3 (alarm 2 OR heater break down alarm) will be activated.

DIRECT ACCESS TO THE SET POINT MODIFICATION

The instrument allows to modify the set point value without to use the FUNC push-button. When a rapid set point modification is required, proceed as follows:

- 1) Pushing, for more than 3 seconds, the ▲ or ▼ push-button; the set point value, shown on the lower display, will start to change.
- 2) Using the ▲ and ▼ push-buttons, it is possible to set the desired value.
- 3) When the desired value is reached, do not push any push-button for more than 3 seconds, the new set point will become operative after 3 seconds from the last push-button pressure.

If, during this procedure, it is desired to lose the new value, push the FUNC push-button; the instrument automatically returns to the normal display mode without to memorize the new set point.

LAMP TEST

When it is desired to verify the display efficiency, push ▼ and FUNC push-buttons. The instrument will turn ON, with a 50 % duty cycle, 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 ▼ and FUNC push-buttons again.

No other keyboard function is available during LAMP TEST.

OPERATIVE PARAMETERS

Operative parameter modification

Push the FUNC push-button, the lower display will show the code while the upper display will show the value or the status (ON or OFF) of the selected parameter.

By ▲ or ▼ push-button it is possible to set the desired value or the desired status.

Pushing the FUNC push-button, the instrument memorizes the new value (or the new status) and goes to the next parameter.

A pressure of the SMRT push-button allows to come back to the previous parameter without to memorize the new set of the actual parameter.

Some parameters may be not visualized according to the specific instrument configuration.

- NOTE:** 1) If, during operative parameter modification, no push-button is pressed for more than 10 seconds, the instrument reverts automatically to the "normal display mode" without to memorize the last parameter setting.
- 2) The instrument do not display all parameter but it select the parameter in accordance with:
- a) the instrument configuration
 - b) P25 setting
 - c) the proportional band setting.

Param.Description

SP	Main set point 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 FUNC push-button to reset the alarms.
nnn	Software key for parameter protection. This parameter is skipped if P18 = 0 or 1. The instrument will shows the safety key status: 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 P18 parameter When it is desired to switch from UNLOCK to LOCK condition, set a value different from P18 parameter.
A1	Alarm 1 threshold value This parameters is present if the alarm 1 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.
A2	Alarm 2 threshold value For other details see A1 parameter.
H1	Alarm 1 hysteresis This parameters is present if the alarm 1 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 programmed band minus 1 digit.
H2	Alarm 2 hysteresis For other details see H1 parameter.
Pb	Proportional band. Range: from 1.0 % to 99.9 % of span for heating output. From 1.5 % to 99.9 % of span for heating/cooling output. When Pb parameter is set to 0, the instrument performs an ON-OFF control; the ti, td, IP, C, C2, rC, OLP, OLH and tOL parameters are skipped and SMART function is disabled. Note: When SMART is enabled, the Pb parameter range is limited by P27, P28 and P29 parameters.
HS	Hysteresis for ON/OFF control action It is available only when Pb=0. Range: from 0.1% to 10.0% of the input span.
ti	Integral time "ti" 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 Note: When SMART is enabled, the minimum value of the integral time is limited by P30 parameter.
td	Derivative time "td" is skipped if Pb=0 (ON/OFF action). Range: from 0.01 to 9.59 m.ss. Setting the 0 value the derivative action is excluded. Note: When SMART is enabled the td value will be equal to 1/4 of the integral time.

IP	Integral pre-load "IP" is skipped if Pb=0 (ON/OFF action). Ranges: - from 0 to 100 % when P4 = H - from -100 to 100 % when P4 = HC	rP	Ramp applied to the set point changes Range: from 1 to 100 digit/min. Above this value the display shows "inf" and the transfer will be a step transfer.
C	Output 1 cycle time C is available if Pb parameter is different from 0 only. Range: from 1 to 200 s.	OLH	Control output high limit "OLH" is skipped if Pb=0 (ON/OFF action). Range: - from 0 to 100 % when P4 = H - from -100 to 100 % when P4 = HC
C2	Output 2 cycle time C2 is available only if P4 = "HC" and Pb is different from 0 only. Range: from 1 to 200 s.	tOL	Time duration of the output power limiter "tOL" is skipped if Pb=0 (ON/OFF action). Range: from 1 to 100 min. Above this value the display shows "inf" and the limit will be ever enabled. Note: The tOL can be modified but the new value will become operative only at the next instrument start up.
rC	Relative Cooling gain . "rC" is skipped if Pb=0 (ON/OFF action) or P4 = H. Range: from 0.20 to 1.00 Note: When SMART function is enabled, the "rC" parameter is limited in accordance to the selected coolant: - from 0.85 to 1.00 when P6 = Air - from 0.80 to 0.90 when P6 = Oil - from 0.30 to 0.60 when P6 = H2O	Hbd	Threshold of the heater break down alarm "Hbd" is available only when P16 is different from OFF. Range: within the current transformer range (see P17).
OLP	Dead band/Overlap between H/C outputs "OLP" is skipped if Pb=0 (ON/OFF action) or P4 = H. A negative OLAP value shows a dead band while a positive value shows an overlap. Range: from -20 to 50.		
rL	Set point low limit 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 Range: From rL to full scale value (P3). Note: When P3 has been modified, rH will be realigned to it.		

ERROR MESSAGES

OVERRANGE, UNDERRANGE AND BURNOUT INDICATIONS

The instrument shows the OVERRANGE condition with the following indication on the upper display:



The instrument shows the UNDERRANGE condition with the following indication on the upper display:



The sensor leads break can be signalled as:

- for TC input : OVERRANGE or
UNDERRANGE selected by a
solder jumper (see Fig. 12).
- 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 turn 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.

ERRORS

Diagnostics are made at instrument switch-on and during normal mode of operation. If a fault condition (error) is detected, the lower display will show the message "Er" while the upper display shows the relative error code.

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 input calibration data error |
| 305 | TC input calibration data error |
| 307 | RJ calibration data error |
| 310 | Current transformer input calibration data 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 ▲ push-buttons for loading the default parameters then repeat control parameter setting.
- 3) For all the other errors, contact your supplier.

GENERAL INFORMATIONS

GENERAL SPECIFICATIONS

Case: PC-ABS black color; 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 bracket. Instrument removable from case.

Rear terminal block: 21 screw terminals (screw M3, for cables from ϕ 0.25 to ϕ 2.5 mm² or from AWG 22 to AWG 14) with connection diagrams and safety rear cover.

Dimensions: 48 x 96 mm, depth 89 mm (DIN 43700).

Weight: 600 g.

Power supply:

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

- 24 V AC/DC ($\pm$ 10 % of the nominal value).

Power consumption: 6 VA max.

Insulation resistance: > 100 M Ω according to IEC 1010-1.

Dielectric strength: 1500 V rms according to IEC 1010-1.

Sampling time: 500 ms.

Resolution: 30000 counts.

Accuracy (@ 25 °C): $\pm$ 0.2% of the input span $\pm$ 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: (RJ excluded)

< 400 ppm/°C for RTD input with -19.9/99.9 °C range and TC type T.

< 200 ppm/°C for all the other ranges.

Operative temperature: from 0 to 50 °C.

Storage temperature : -20 to +70 °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 push-buttons.

Line resistance: max. 100 Ω with error $\leq \pm 0.1\%$ of the input span.

Burnout: Up or down scale selectable by soldering jumpers.

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

Reference junction drift: 0.1 °C/°C.

Input impedance: > 1 M Ω

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

STANDARD RANGE 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
T	0 / + 400 °C	0 / + 752 °F
N	0 / + 999 °C	0 / + 999 °F

B) RTD (Resistance Temperature Detector)**Type:** Pt 100 3 wires connection.**Current:** 135 μ A.**Line resistance:** automatic compensation up to 20 Ω /wire with :- error $\leq \pm 0.1\%$ of the input span for range -19.9 a 99.9 $^{\circ}$ C.

- not measurable error for the other ranges.

Engineering units: $^{\circ}$ C or $^{\circ}$ F programmable.**Burnout:** 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 RANGE TABLE

RTD Type	Measuring range	
RTD Pt 100	-199 - +500 $^{\circ}$ C	-199 - +999 $^{\circ}$ F
RTD Pt 100	-19.9 - +99.9 $^{\circ}$ C	-----

C) CURRENT TRANSFORMER INPUT**Input current:** 50 mA AC.**Read-out:** selectable among 10, 25, 50 or 100 A.**Resolution:**

- 0.1 A for 10 A range.

- 1 A for all the other ranges.

Active period:

- for relay output: NO or NC programmable

- for SSR drive output: logic level 1 or 0 programmable.

Minimum time duration of the active period:

50 ms.

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' 59".**Integral preload:**

- from 0 to 100% for one control output.

- from -100 to 100% for two control outputs

Main output cycle time: from 1 to 200 s.**Cooling cycle time:** from 1 to 200 s**Relative cooling gain:** from 0.20 to 1.00**NOTE:** the Pb, ti, td and rCG parameter may be limited when the SMART function is enabled.**Overlapping/dead band:** from - 20 % to 50 %**CONTROL OUTPUTS****Type:** time proportioning**Output updating time:** 500 ms.**Output resolution:** 1% of the output span.**Action:** direct or reverse programmable.**Output power limiter:**

- from 0.0 to 100.0 % for one control output.

- from -100.0 to +100.0% for two control outputs

This function may be operative at instrument power up for a programmable time (to avoid thermal shock or to pre-heat the plant).

OUTPUT 1

- 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 $\pm$ 20% @ 1 mA.
14 V $\pm$ 20% @ 20 mA
Logic status 0: <0.5 V

Output action: direct/reverse programmable.
The relay or SSR output selection is made by internal jumper and configuration parameter.

OUTPUT 2 - cooling / alarm 1

- a) Relay output with SPST contact;
contact rating 2A / 250 V AC on resistive load
- b) Logic voltage for SSR drive.
Logic status 1: 24 V $\pm$ 20% @ 1 mA.
14 V $\pm$ 20% @ 20 mA
Logic status 0: <0.5 V

The relay or SSR output selection is made by internal jumper and configuration parameter.

ALARMS

The instrument may accommodate up to 2 independent alarms.

The alarm 1 is a standard features of the instrument while the alarm 2 is an option.

Each alarm can be programmed as follows:

Process alarm:

Operative mode: High or low programmable.

Threshold: Programmable in engineering units within the input span (P3 - P2).

Band alarm

Operative mode: inside or outside band.

Threshold: programmable from 0 to 500 units.

Deviation alarm

Operative mode: upper or lower the programmed value.

Threshold: programmable from - 500 to +500 units.

Action: direct or reverse programmable

Threshold resolution: 1 digit.

Alarm hysteresis: programmable from 0.1 % to 10.0 % of the input span.

Alarm reset: automatic or manual programmable

Stand by (mask) alarm: Each alarm can be programmed with or without mask function.

This function allows to delete not desired alarm indication at instrument power up or after a set point modification.

Alarm indications: the AL1/COOL LED lit when the alarm 1 is in ON condition.

The AL2/HBD LED operate as follows:

HBD status	AL2 status	LED AL2/HBD
0	0	OFF
0	1	ON
1	0	flashing at slow rate
1	1	Flashing at high rate

Alarm outputs:

- 1) Alarm 1 : relay output with SPST contact;
Contact rating 3A/250V AC on resistive load
- 2) Alarm 2 : relay output with SPST contact;
Contact rating 2A/250V AC on resistive load

NOTE: Alarm 2 and HBD alarm are in OR condition on the output 2 relay.

HEATER BREAK DOWN ALARM

This alarm allows to verify, continuously, the current consumed by the load driven by the main output and to generate an alarm condition when this current is lower than a programmable threshold.

Resolution: 1 digit.

Alarm hysteresis: 1 % of the selected range.

Alarm indication: 'AL2 HB" LED flash when the alarm is in ON condition.

SPECIAL FUNCTION

Output power OFF

This function allows to turn OFF manually the output signal and to inhibit the control algorithm and the alarm functions.

In this way the controlled element is turned OFF and the instrument operate as an indicator.

When the control restart, the instrument operates as follows:

- the integral action will be set to 0.
- the soft start function and alarm masking will be reactivated.

LAMP TEST

This function allows to verify the correct LED operativity.

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/cm²) 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) [C₂H₅OH]
 - or
 - Isopropil Alcohol (pure or denatured) [(CH₃)₂CHOH] or
 - Water (H₂O)
- 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 upper display will show the process variable while the lower display will show the set point value or the current measure.
- d) Held down ▼ pushbutton and press ▲ pushbutton; the display will show:



A rectangular display box with a black border. The top half contains the text "OFF" in large, bold, black capital letters. The bottom half contains the text "DFL" in smaller, bold, black capital letters.

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



A rectangular display box with a black border. The top half contains the text "On" in large, bold, black capital letters. The bottom half contains the text "DFL" in smaller, bold, black capital letters.

- g) Press FUNC pushbutton; the display will show:



A rectangular display box with a black border. The top half contains the text "L. d t." in large, bold, black capital letters. The bottom half is empty.

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
n.rS	= OFF
nnn	= OFF
A1, A2	= minimum range-value for process alarms 0 for deviation or band alarms
H1, H2	= 0.1 %
Pb	= 4.0 %
hS	= 0.5 %
ti	= 04.0 (4 minutes)
td	= 1.00 (1 minute)
IP	= 30 % for 1 control output 0 % for two control outputs
C	= 20 seconds for relay output 2 seconds for SSR output
C2	= 10 seconds for P6 = Alr 4 seconds for P6 = OIL 2 seconds for P6 = H2O
rC	= 1.00 for P6 = Alr 0.80 for P6 = OIL 0.40 for P6 = H2O
OLP	= 0
rL	= initial scale value
rH	= full scale value
rP	= infinite (step transfer)
OLH	= 100 %
tOL	= infinite
Hbd	= 50 % of the full scale value.

**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. 13) should be open.
- b) The upper display will show:

C n F

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

**C n F
A. 0 1**

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

**OFF
d F L**

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

**t b. 1
d F L**

- f) Press FUNC pushbutton; the display will show:

L. d t.

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	H	H
P5	rEL	rEL
P6	Air	Air
P7	1	1
P8	HA	HA
P9	OFF	OFF
P10	0	0
P11	HA	HA
P12	OFF	OFF
P13	0	0
P14	0	0
P15	0	0
P16	OFF	OFF
P17	10 A	10 A
P18	0	0
P19	rEv	rEv

P21	dir	dir
P22	dir	dir
P23	OFF	OFF
P24	10	10
P25	ON	ON
P26	2	2
P27	30.0	30.0
P28	1.0	1.0
P29	1.5	1.5
P30	00.3	00.3
P31	10	10



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