ERO ELECTRONIC

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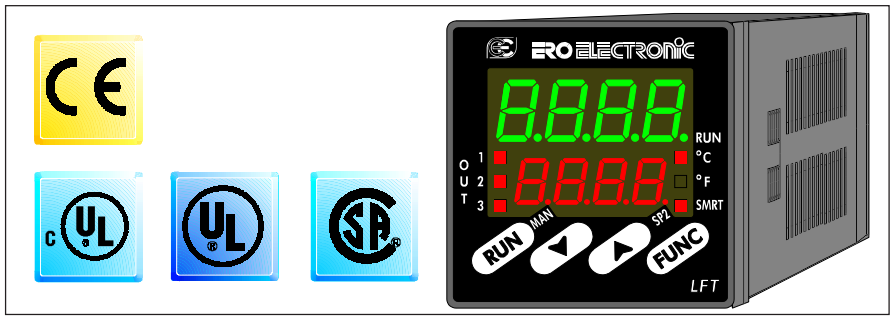

❒ USER MANUAL

LFT

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MOUNTING REQUIREMENTS

Select a location, for instrument mounting, where no vibrations are present and the ambient temperature is within 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 Fig. 2.
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.

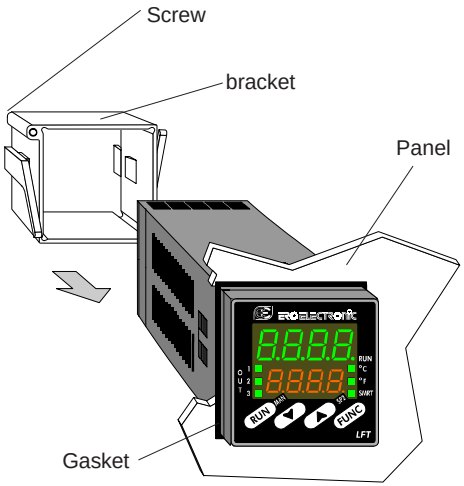


Fig. 1

OUTLINE AND CUT OUT DIMENSIONS

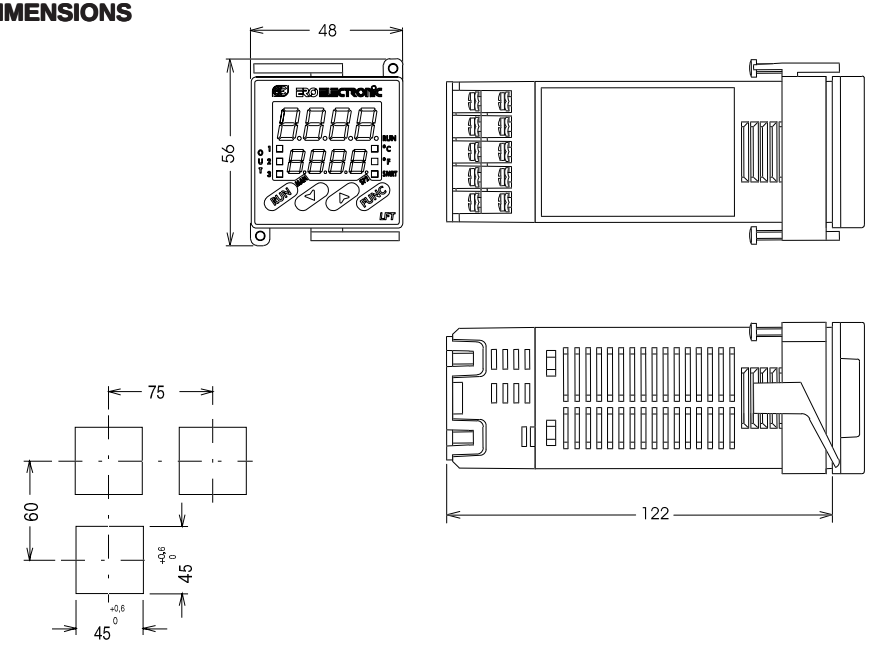


Fig. 2 - OUTLINE AND CUT-OUT DIMENSIONS

CONNECTION DIAGRAMS

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

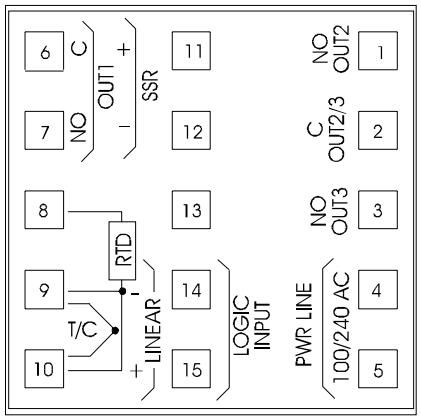


Fig. 3 REAR TERMINAL BLOCK

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

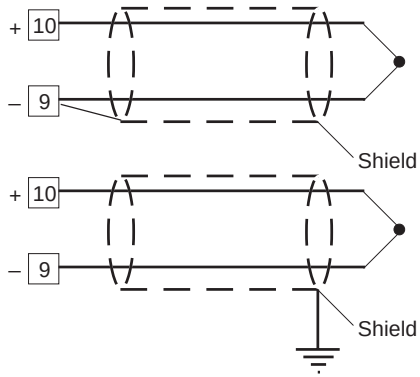


Fig. 4 THERMOCOUPLE INPUT WIRING

NOTES:

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

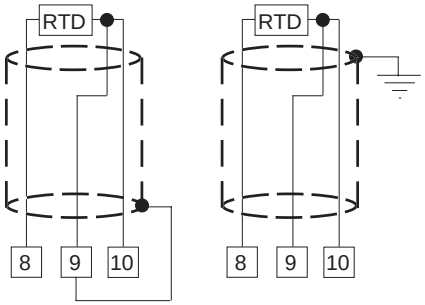


Fig. 5 RTD INPUT WIRING

NOTES:
1) Don't run input wires together with power cables.
2) Pay attention to the line resistance; a high line resistance 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.

LINEAR INPUT

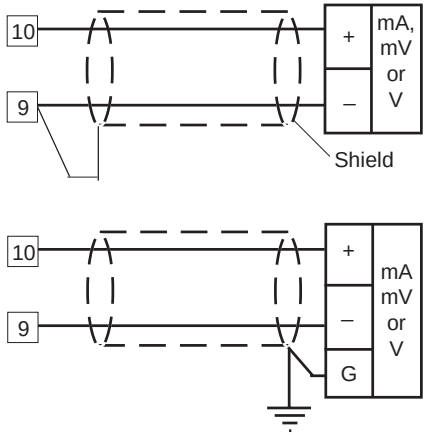


Fig. 6 mA, mV AND V INPUTS WIRING

NOTES:
1) Don't run input wires together with power cables.
2) Pay attention to the line resistance; a high line resistance 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 input impedance is equal to:
   < 5 Ω for 20 mA input
   > 1 MΩ for 60 mV input
   > 200 kΩ for 5 V input
   > 400 kΩ for 10 V input

B) LOGIC INPUT

Safety notes:

1) Do not run logic input wiring together with power cables.
2) Use an external dry contact capable of switching 0.5 mA, 5 V DC.
3) The instrument needs 100 ms to recognize a contact status variation.
4) The logic inputs are **NOT** isolated by the measuring input

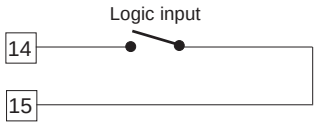


Fig. 7 - LOGIC INPUT WIRING

This logic input allows to start/stop the program execution by an external contact.

C) RELAY OUTPUTS

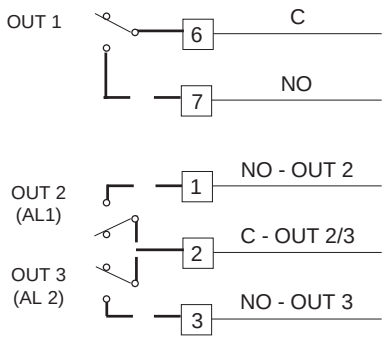


Fig. 8 RELAY OUTPUTS WIRING

All relay outputs are protected by varistor against inductive load with inductive component up to 0.5 A.
The contact rating of the OUT 1 is 3A/250V AC resistive load.
The contact rating of the OUT 2 and 3 is 2A/250V AC 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) For output 1, the relay output or SSR drive output are mutually exclusive.

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.
The same problem may occur when a switch is used in series with the internal contacts as shown in Fig. 9.

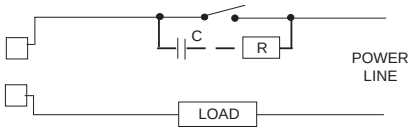


Fig. 9 EXTERNAL SWITCH IN SERIES WITH THE INTERNAL CONTACT

In this case it is recommended to install an additional RC network across the external contact as show in Fig. 9

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 OUTPUT FOR SSR DRIVE

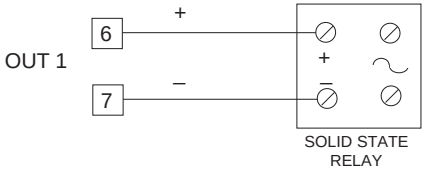


Fig. 10 SSR DRIVE OUTPUT WIRING

It is a time proportioning output.
Logic level 0: Vout < 0.5 V DC.
Logic level 1:
- 14 V ± 20 % @ 17 mA
- 24 V ± 20 % @ 1 mA.
  Maximum current = 17 mA.

NOTES:
1) 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.
2) For output 1, the relay output or SSR drive output are mutually exclusive.

D) POWER LINE WIRING

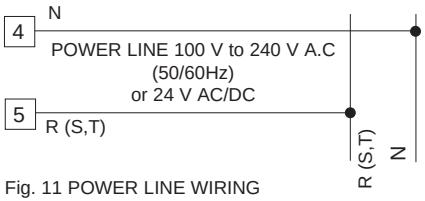


Fig. 11 POWER LINE WIRING

NOTES:

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 DC the polarity is a do not care condition.
7) The power supply input is **NOT** fuse protected. Please, provide it externally.

Power supply	Type	Current	Voltage
24 V AC/DC	T	500 mA	250 V
100/240 V AC	T	125 mA	250 V

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 e neutral line is present, connect it to terminal 4

PRELIMINARY HARDWARE SETTINGS

1) Remove the instrument from its case.
2) It is necessary to set J106 according to the desired input type as shown in the following figure.

INPUT	J106				
TYPE	1-2	3-4	5-6	7-8	9-10
TC-RTD	open	close	open	open	open
60 mV	open	close	open	open	open
5 V	close	open	close	open	open
10 V	open	open	close	open	open
20 mA	open	open	open	close	close

NOTE : the not used jumper can be positioned on pin 7-9

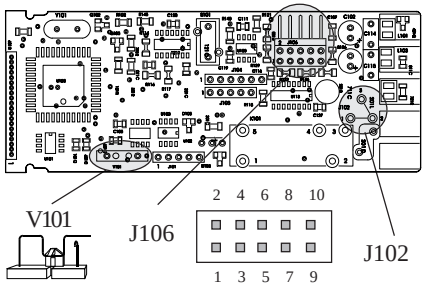


Fig. 12

3) Select the output 1 contact: NO (standard) or NC by setting J102 according to the following table:

Contact	NO (standard)	NC
J102	1 - 2	2 - 3

OPEN INPUT CIRCUIT

This instrument is able to identify the open circuit for TC and RTD inputs.
The open input circuit condition for RTD input is shown by an "overrange" indication.
For TC input, it is possible to select overrange indication (standard) or underrange indication setting the CH101 and SH101 according to the following table:

Overrange (STD)	CH101 = close	SH101 = open
Underrange	CH101 = open	SH101 = close

Both pads are located on the soldering side of the CPU card

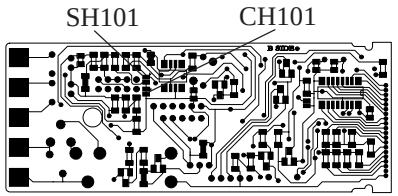


Fig. 15

GENERAL NOTES for configuration.

FUNC = It allows to memorize the new value of the selected parameter and go to the next parameter (increasing order).

RUN = It allows to scroll back the parameters without memorization of the new value.

▲ = It allows to increase the value of the selected parameter

▼ = It allows to decrease the value of the selected parameter.

CONFIGURATION PROCEDURE

1) Remove the instrument from its case.
2) Set the dip switch V101 in open condition (see fig. 12).
3) Re-insert the instrument.
4) Switch on the instrument.
   The display will show COnF.
   NOTE : If "CAL" indication will be displayed, press immediately the ▲ pushbutton and return to the configuration procedure.
5) Push the FUNC pushbutton.

P1 - Input type and standard range

0	= TC type	L	range	0	/	+400.0 °C
1	= TC type	L	range	0	/	+900 °C
2	= TC type	J	range	0	/	+400.0 °C
3	= TC type	J	range	0	/	+1000 °C
4	= TC type	K	range	0	/	+400.0 °C
5	= TC type	K	range	0	/	+1200 °C
6	= TC type	T	range	0	/	+400.0 °C
7	= TC type	N	range	0	/	+1400 °C
8	= TC type	R	range	0	/	+1760 °C
9	= TC type	S	range	0	/	+1760 °C
10	= RTD type	Pt 100	range	-199.9	/	+400.0 °C
11	= RTD type	Pt 100	range	-200	/	+800 °C
12	= mV	Linear	range	0	/	60 mV
13	= mV	Linear	range	12	/	60 mV
14	= mA	Linear	range	0	/	20 mA
15	= mA	Linear	range	4	/	20 mA
16	= V	Linear	range	0	/	5 V
17	= V	Linear	range	1	/	5 V
18	= V	Linear	range	0	/	10 V
19	= V	Linear	range	2	/	10 V
20	= TC type	L	range	0	/	+1650 °F
21	= TC type	J	range	0	/	+1830 °F
22	= TC type	K	range	0	/	+2190 °F
23	= TC type	T	range	0	/	+750 °F
24	= TC type	N	range	0	/	+2550 °F
25	= TC type	R	range	0	/	+3200 °F
26	= TC type	S	range	0	/	+3200 °F
27	= RTD type	Pt 100	range	-199.9	/	+400.0 °F
28	= RTD type	Pt 100	range	-330	/	+1470 °F

NOTE: selecting P1 = 0, 2, 4, 6, 10 or 27, the instrument set automatically P32 = FLtr. For all the remaining ranges it will set P32 = nOFL.

P2 = Decimal point position

This parameter is available only when a linear input is selected (P1 = 12, 13, 14, 15, 16, 17, 18 or 19).

----. = No decimal figure.
---.- = One decimal figure.
--.-- = Two decimal figures.
-.--- = Three decimal figures.

P3 = Initial scale value

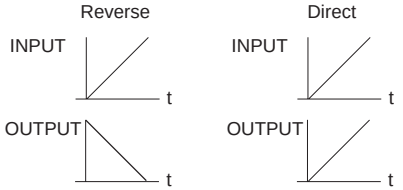
For linear inputs it is programmable from -1999 to 4000.
For TC and RTD input it is programmable within the input range.
When this parameter is modified, rL parameter will be realigned to it.

P4 = Full scale value
For linear inputs it is programmable from -1999 to 4000.
For TC and RTD input it is programmable within the input range with the limits shown below.
When this parameter is modified, rH parameter will be realigned to it.
The initial and full scale values determine the input span which is used by the PID algorithm, the SMART and the alarm functions.

NOTE: the minimum input span (S = P4 - P3), in absolute value, should be set as follows:
For linear inputs, $S \geq 100$ units.
For TC input with °C read-out, $S \geq 300$ °C.
For TC input with °F read-out, $S \geq 550$ °F.
For RTD input with °C read-out, $S \geq 100$ °C.
For RTD input with °F read-out, $S \geq 200$ °F.

P5 = Output 1 type
rEL = Relay [the cycle time (CY1) will be forced to 15 s]
SSr = SSR [the cycle time (CY1) will be forced to 4 s]

P6 = Output 1 action.
rEV = Reverse action (Heating action)
dir = Direct action (Cooling action)



P7 = Output 2 function.
0 = output not used.
1 = it is used as Alarm 1 output and the alarm 1 is programmed as process alarm.
2 = it is used as Alarm 1 output and the alarm 1 is programmed as band alarm.
3 = it is used as Alarm 1 output and the alarm 1 is programmed as deviation alarm.
4 = it is used as break event output
NOTE: setting P7 = 4, the OUT2 assumes the logic state programmed, for each region, with the EV1, EV2, EV3, EV4 and EV5 parameters.

P8 = Alarm 1 operating mode
Available only when P7 is equal to 1, 2 or 3.
H.A. = High alarm (outside for band alarm) with automatic reset.
L.A. = Low alarm (inside for band alarm) with automatic reset.
H.L. = High alarm (outside band) with manual reset.
L.L. = Low alarm (inside band) with manual reset.

P9 = Program Start/Stop
0 = Start /stop program driven by front pushbutton.
1 = Start/stop program driven by external contact.

P10 = Output 3 function and how the instrument operates after the execution of the last programmed cycle.
0 = output not used. At the end of the last cycle the instrument will go in STAND BY mode.

1 = it is used as Alarm 2 output and the alarm 2 is programmed as process alarm. At the end of the last cycle the instrument will go in STAND BY mode.
2 = it is used as Alarm 2 output and the alarm 2 is programmed as band alarm. At the end of the last cycle the instrument will go in STAND BY mode.
3 = it is used as Alarm 2 output and the alarm 2 is programmed as deviation alarm. At the end of the last cycle the instrument will go in STAND BY mode.
4 = it is used as "End of cycle" indicator. At the end of the last cycle the instrument will go in STAND BY mode.
5 = it is used as "End of cycle" indicator. At the end of the last cycle the instrument will operate as a controller using the set point of the region 5 but at this point the set point can be modified by keyboard.

NOTE: setting P10 = 4 or 5, if the instrument is configured to perform more than one program cycle, two different situations may occurs:
1) the instrument completes one of the intermediate cycle. At the end of the region 5, the OUT 3 will be forced in ON status for a time equal to the value assigned to P11 parameter.
2) the instrument completes the last cycle (or a single cycle has been programmed). At the end of the region 5, the OUT 3 will be forced in ON status for a time equal to the value assigned to P12 parameter. If P12 is equal to "InF", the OUT 3 remain in ON condition until a new START command is detected.

P11 = time for the "end of the intermediate cycle" indicator
Available only when P10 is equal to 4 or 5.
From 0 to 60 s.

P12 = time for the "end of the last cycle" indicator
Available only when P10 is equal to 4 or 5.
From 10 to 60 s. Above this limit, the display will show "InF" and, at the end of the last programmed cycle, the OUT 3 is forced in ON condition until a new START command is detected.

P13 = Alarm 2 operating mode
Available only when P10 is equal to 1, 2 or 3.
H.A. = High alarm (outside for band alarm) with automatic reset.
L.A. = Low alarm (inside for band alarm) with automatic reset.
H.L. = High alarm (outside band) with manual reset.
L.L. = low alarm (inside band) with manual reset.

P14 = Tracking below
0 = Function not used.
From 1 to 400 digits for linear input ranges.
From 1 to 40 °C for TC and RTD inputs with °C readout.
From 1 to 72 °F for TC and RTD inputs with °F readout.
NOTE: when this function is enabled, the instrument calculates the control error (SP - measure) and it will operate as follows:
- When error is positive and its absolute value is greater than P14 value, the instrument stops the

ramp execution and operates as controller with constant set point.
- When the control error becomes lower than the P14 value or it becomes negative, the ramp execution will restart.

P15 = Tracking above
0 = Function not used.
From 1 to 400 digits for linear input ranges.
From 1 to 40 °C for TC and RTD inputs with °C read-out.
From 1 to 72 °F for TC and RTD inputs with °F read-out.
NOTE: when this function is enabled, the instrument calculates the control error (SP - measure) and it will operate as follows:
- When error is negative and its absolute value is greater than P15 value, the instrument stops the ramp execution and operates as controller with constant set point.
- When the control error become lower than the P15 value or it become positive, the ramp execution will restart.

P16 = Guaranteed soak
0 = Function not used.
From 1 to 100 digits for linear input ranges.
From 1 to 10 °C for TC and RTD inputs with °C read-out
From 1 to 18 °F for TC and RTD inputs with °F read-out.
NOTE: this parameter defines a symmetrical band (±P16) around the soak.
When the measured value goes out of this band, the soak time will be stopped. When the measured value return in band, the soak time will restart.

P17 = Safety lock
0 = No parameter protection. The device is always in unlock condition and all parameters can be modified.
1 = The device is always in lock condition and no one of the parameters (exception made for alarm manual reset) can be modified (for SMART status see P25 parameter).
From 2 to 9999 = This combination number is a secret value to be used, in run time (see "nnn" parameter) to put device in lock/unlock condition.
For alarm manual reset, the lock/unlock condition has no effect (for SMART status see P25).

The configuration procedure is completed and the instrument shows " -.-.-.-. " on both displays.
To access to the advanced configuration parameter proceed as follows:
1) By ▲ or ▼ pushbutton set the 263 code on the display.
2) push the FUNC pushbutton.

P18 = Alarm 1 action
Available only when P7 is different from 0 or 4.
dir = direct action (relay energized in alarm condition)
rEV = reverse action (relay deenergized in alarm condition)

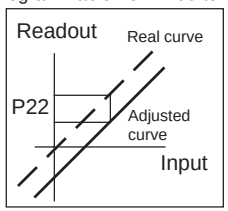
P19 = alarm 1 stand-by (mask) function
Available only when P7 is different from 0 or 4.
OFF = stand-by (mask)function disabled
ON = stand-by (mask) function enabled
NOTE: If the alarm is programmed as band or deviation alarm, this function masks the alarm condition after a set point change or at the instrument start-up until the process variable reaches the alarm

threshold plus or minus hysteresis. If the alarm is programmed as a process alarm, this function masks the alarm condition at instrument start-up until process variable reaches the alarm threshold plus or minus hysteresis.

P20 = Alarm 2 action
Available only when P10 is different from 0 or 4.
dir = direct action (relay energized in alarm condition)
rEV = reverse action (relay de-energized in alarm condition).

P21 = Alarm 2 stand-by (mask) function
Available only when P10 is different from 0 or 4.
OFF = Stand-by (mask) function disabled
ON = Stand-by (mask) function enabled
NOTE: for more details on stand-by function, see P19 parameter.

P22 = OFFSET adjustment added to the measured value
This parameter allows to set a constant OFFSET throughout the read-out range.
It is skipped for linear inputs
- For read-out ranges with decimal figure, P22 is programmable from -19.9 to 19.9.
- For read-out ranges without decimal figure, P22 is programmable from -199 to 199.



P23 = Control output maximum rate of rise
It is programmable from 1% to 10% of the output per second.
Above the 10%, the display will show "InF" meaning that no ramp is imposed.
NOTE: when an ON/OFF control action is selected, P23 parameter will be ignored.

P24 = Displayable protected parameters
This parameter is skipped when P17 = 0.
OFF = Protected parameters cannot be displayed.
ON = Protected parameter can be displayed.

P25 = SMART function
0 = SMART function disabled.
1 = SMART function in NOT protected by safety lock.
2 = SMART function is under safety lock protection.

P26 = Maximum value of the proportional band calculated by the SMART algorithm.
This parameter is programmable from P27 value to 100.0 %.

P27 = Minimum value of the proportional band calculated by the SMART algorithm.
It is programmable from 1.0 % to P26 value.

P28 = Minimum value of the integral time calculated by the SMART algorithm.
It is programmable from 20 seconds (00.20) to 2 minutes (02.00).

P29 = Device status at instrument start up.

0 = The instrument starts in STAND BY mode.
WARNING: when an hot start occurs (i.e. after a power supply failure) the program execution will be aborted and the instrument restart in STAND BY mode.

1 = It starts in the same way it was left prior to power shut down.
NOTES:
A) If the instrument was performing a ramp (region 2 or 4) it aligns the operative set point to the actual measured value and then it restarts the execution of the ramp (up or down) with the programmed gradient.
B) If the instrument was performing a soak (region 1,3 or 5) it divides the soak time in 4 quarters and then it will restart from the beginning of the quarter that was in execution prior to the power shut down.

P30 = Integral pre-load.

It is programmable from 0 to 100 % of the output span.

P31 = Time-out selection

This parameter allows to set the time duration of the Time-out for parameter setting used by the instrument during the operating mode.
tn. 10 = 10 seconds.
tn. 30 = 30 seconds.

P32 = Digital filter on the displayed value

It is possible to apply to the displayed value a digital filter of the first order with a time constant equal to :
- 4 s for TC and RTD inputs
- 2 s for linear inputs

noFL. = no filter
FLtr = filter enabled

P33 = Conditions for output safety value

0 = No safety value ("Standard" effect)
1 = Safety value applied when overrange or underrange condition is detected.
2 = Safety value applied when overrange condition is detected.
3 = Safety value applied when underrange condition is detected.

P34 = Output safety value

This parameter is skipped when P33 = 0
This value can be set from 0 to 100 %.

The configuration procedure are terminated and the display return to show "COnF".

OPERATIVE MODE

1) Remove the instrument from its case.
2) Set the internal dip switch V101 in closed condition
3) Re-insert the instrument.
4) Switch on the instrument.

DISPLAY FUNCTION

The upper display shows the measured value while the lower display shows:

- OFF when the instrument is in stand-by mode.
- the remaining time during the initial delay (region 1)
- the operative set point value during a ramp.
- the remaining time during a soak.

(we define the above conditions as “normal display mode”).

It is possible to change the information on the lower display as follows:

- Push the FUNC pushbutton for more than 3 s. The lower display will show " H. " followed by OUT 1 power value (from 0 to 100%).
- Push FUNC pushbutton again. The display will return in "Normal Display Mode".

When no pushbutton are pressed during the time out (see P31), the display will automatically return in "Normal Display Mode".

In order to keep the desired information continuously on the lower display, depress ▲ or ▼ push-button to remove the Time-out.

When it is desired to come back to "Normal Display Mode", push FUNC push-button again.

INDICATORS

°C Lit when the process variable is shown in Celsius degree.

°F Lit when the process variable is shown in Fahrenheit degree.

SMRT Lit when the SMART algorithm is active.

OUT1 Lit when OUT 1 is ON.

OUT2 Lit when OUT 2 (used as break event output) is ON or alarm 1 is in alarm condition.

OUT3 Lit when the alarm 2 is in alarm condition or the OUT 3 is used as logic output ("End of cycle") and it is showing the end of a cycle .

Other functions are shown by decimal points:

A) The decimal point at the right hand of the LSD of the lower display lights when SP2 is operative.

B) When the decimal point at the right hand of the MSD of the lower display is flashing , it shows that the instrument is in MANUAL mode.

C) When the decimal point at the right hand of the LSD of the upper display lit when:
   - the program is running or
   - the instrument is performing the 2 initial regions ("wait" and "ramp to SP1") before to operate as controller.

   It is flashing when:
   - the tracking or guaranteed soak functions suspend the program execution
   - an out of range on the measured value is detected.

Pushbutton functionality during operating mode :

FUNC = - During parameter modification It allows to memorize the new value of the selected parameter and go to the next parameter (increasing order).
- During program execution or when the instrument operate as controller (without program) pushing the FUNC pushbutton for more than 3 s the lower display will show " H. " followed by OUT 1 power value (from 0 to 100%).
Pushing FUNC pushbutton again the display will return in "Normal Display Mode".

RUN = - When P9 = 0 and the instrument is in STAND BY mode, it allows to start the program execution (kept depressed this pushbutton for more than 1 second).
- When P9 = 0, during the program execution, it allows to abort the program execution (kept depressed this pushbutton for more than 5 second).
- During parameter modification, it is used to scroll back the parameters without memorizing the new setting.

▲ = It allows:
- during parameter modification, to increase the value of the selected parameter
- when the instrument operates as controller, the direct access to the set point modification
- when the instrument is in manual mode, to increment the output value.

▼ = It allows:
- during parameter modification, to decrease the value of the selected parameter
- when the instrument operates as controller, the direct access to the set point modification
- when the instrument is in manual mode, to decrement the output value.

▲ + FUNC = Are used to toggle from STAND BY mode to MANUAL mode and viceversa.

▲ + FUNC or ▼ + FUNC = During parameter modification they are used to increase or decrease the value of the selected parameter at higher rate.

▲ + ▼ = When SMART function is disabled, they are used to start the default parameter loading procedure.

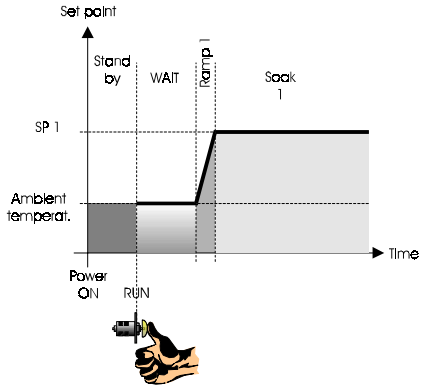
NOTE: a 10 or 30 seconds time out (see P 31) can be selected for parameter modification during run time mode.
If, during parameter modification, no pushbutton is depressed for more than 10 (30) seconds, the instrument goes automatically to the “normal display mode” and the eventual modification of the last parameter will be lost.

OPERATIVE MODES

The LFT is a controller/programmer.
This instrument can be operative in 3 different modes:

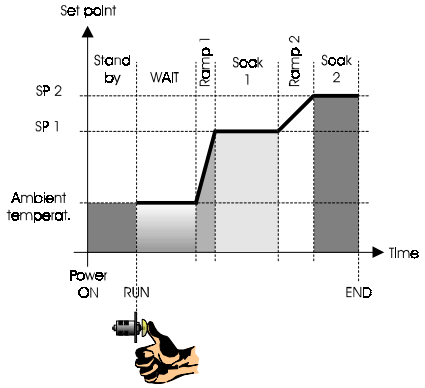
- **MODE A "Stand-by Mode"**
  The device operates as an indicator; the power output is OFF and alarms are in no alarm status. The upper display shows the process variable while the lower display shows "OFF".
  Only when the instrument is in Stand-by Mode it is possible to enable the MANUAL mode (MODE C).

- **MODE B "Run mode"**
  This phase can be started by depressing the "RUN" pushbutton or by keeping closed the external contact for more than 1 s (see P9). The RUN LED will be lit.
  The device operates as follows:
  B.1) as a controller



Setting the SP1 soak time equal to infinite the instrument performs the first 2 regions ("Wait" and "Ramp to SP1") and then it will operate as standard controller.
Note: when the instrument operates as a controller it is possible to modify the operative set point (SP1) using the "Direct access to the set point modification" function or selecting the SP1 parameter and setting a new value.
When the instrument reaches the SP1 value, it turns OFF the RUN LED.

B.2) as a controller/programmer.
The program is made up by 5 regions:



1. WAIT REGION

In this region the power output is OFF and alarms are in no alarm status. The time duration of this region is programmed by "WAIT TIME" parameter

The upper display shows the process variable while the lower display shows, flashing, the time to reach the end of this region.

2. RAMP to SP1

At the beginning of this region the instrument aligns the operative set point to the actual measured value and then it will start ramping towards SP1

The gradient of this ramp is programmed by “Grd 1” parameter.

During ramp the tracking function may be active (see P14 and P15).

The upper display shows the process variable while the lower display shows the final set point (SP1).

3. SOAK at SP1

In this region the guaranteed soak feature may be active (see P16 parameter).

The upper display shows the process variable while the lower display shows the time to reach the end of this region.

4. RAMP to SP2

The instrument starts ramping from SP1 to SP2.

The gradient of this ramp is programmed by “Grd 2” parameter.

During ramp the tracking function may be active (see P14 and P15).

The upper display shows the process variable while the lower display shows the final set point (SP2).

The LED "SP2" will be lit.

5. SOAK at SP2

In this region the guaranteed soak feature may be active (see P16 parameter).

The upper display shows the process variable while the lower display shows the time to reach the end of this region

The LED "SP2" will be lit.

When this region is completed, two different situations may occur:

- No more repetition cycles have been programmed.
  The device returns in Mode A (STAND-BY MODE).
- One or more repetition cycles have been programmed.
  The next cycles restart from region 2 (Ramp to SP1) or from region 1 (Wait) according to the "dELY" (ON/OFF) parameter setting.

- **MODE C "MANUAL MODE"**
  The MANUAL mode can be enabled only when the instrument is in Stand-by Mode by pushing ▲ + FUNC pushbuttons.
  When the instrument is in MANUAL mode the lower display shows "n." followed by OUT1 power output value (from 0 to 100 %).
  The decimal point at the right end of MSD of the lower display will be flashing.
  The power output can be modified by using ▲ and ▼ pushbuttons.
  By depressing ▲ + FUNC pushbuttons again, the device returns in Stand-by Mode.

Note: if a shutdown occurs when the instrument is in MANUAL mode, at instrument power up it will restart in manual mode with the same power output assigned to the instrument before the power shutdown.

INSTRUMENT STATUS INDICATION
The following table resumes the LEDs and displays status during each operative mode and region.

Mode	SMART LED	RUN LED	SP2 LED(#)	MAN LED	Lower display
Stand-by	OFF	OFF	OFF	OFF	"OFF"
Manual	OFF	OFF	OFF	flash	output %
RUN					
Region 1	OFF	ON	OFF	OFF	time(F)
Region 2	ON (*)	ON(**)	OFF	OFF	oper. SP
Region 3	ON (*)	ON	OFF	OFF	time 1
Region 4	ON (*)	ON	ON(F)	OFF	oper. SP
Region 5	ON (*)	ON	ON(F)	OFF	time 2

(#) This LED will be flashing when the instrument detect an out of range of the measured value or the tracking or guaranteed soak functions suspend the program execution.
(*) When this function is enabled.
(**) When the instrument operates as controller the RUN LED will be OFF.
(F) It shows a flashing indication.

DIRECT ACCESS TO THE SET POINT MODIFICATION (as controller only)
When the instrument operates as controller it is possible to modify directly the set point value (SP1).
Pushing ▲ or ▼ for more than 2 s, the set point will start to change.
The new set point value becomes operative at the end of a 2 s Time-out as long as no pushbuttons has been depressed.

SMART function

It is used to automatically optimize the control action.
To enable the SMART function, push the FUNC pushbutton, for less than 3 seconds, the "Snrt" parameter will be shown.
Pushing ▲ or ▼ set the display "On" and push the FUNC pushbutton.
The SMRT LED will turn ON.
When the SMART function is enabled, it is not possible to display or to modify the control parameters (Pb, TI and Td).

To disable the SMART function, push the FUNC pushbutton again until "Snrt" parameter is shown.
Pushing ▲ or ▼ set the display "OFF" and push the FUNC pushbutton.
The SMRT LED will turn off.
The instrument maintains the actual set of control parameters and it enables parameter modification.
NOTE: 1) The SMART enabling/disabling can be protected by safety key (see P25).
2) During the first region (WAIT) the SMART LED will be ever OFF.

OPERATIVE PARAMETERS

Push the FUNC pushbutton for less than 3 seconds, 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.

NOTES:

1) The manual reset of the alarms is ever active.
2) When P24 = ON and the instrument is in MANUAL mode or in STAND-BY mode, parameter modification is limited by the Software key status (see "nnn" parameter) and by SMART status.
3) When P24 = ON and the instrument operates as controller, it is possible to display but not to modify the parameters dELY (hh,mm), EV1, SP1, Grd1, EV2, tIn1, EV3 while the parameters SP2, Grd2, EV4, tIn2, EV5, rPt and dELY (ON/OFF) will be skipped.
   The possibility to display and modify the remaining parameters is limited by the Software key status (see "nnn" parameter) and by SMART status.
4) When P24 = ON and the instrument operates in RUN mode, it is possible to display but not to modify the following parameters: dELY (hh,mm), EV1, SP1, Grd1, EV2, tIn1, EV3, SP2, Grd2, EV4, tIn2, EV5, rPt and dELY (ON/OFF).
   The possibility to display and modify the remaining parameters is limited by the Software key status (see "nnn" parameter) and by SMART status.

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

Some of the following parameter may be skipped according to the instrument configuration.

Param.	**DESCRIPTION**
Snrt	**SMART status**. The ON or OFF indication shows the actual status of the SMART function. Set ON to enable the SMART function. Set OFF to disable the SMART function.
n.rSt	**Manual reset of the alarms**. This parameter is skipped if none of the alarms have the manual reset function. Set ON and than depress the "FUNC" key to reset the alarms.
nnn	**Software key for parameter protection**. This parameter is skipped if P17 = 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 P17. When it is desired to switch from UNLOCK to LOCK condition, set a value different from P17.
dELY	**Wait time** (region 1) in hours and minutes. From 00.00 to 99.59 (hh.mm).
EV1	**Region 1 contact status.** ON = contact closed. OFF = contact open.
SP1	**First set point**. From rL to rH (in engineering units).
Grd1	**Gradient for ramp to SP1** (region 2). From 1 to 500 digits per minute; above this value the display will show "InF" and

the transfer will be a step transfert.

EV2 **Region 2 contact status**.
ON = contact closed.
OFF = contact open.

tin 1 **Soak time at SP1** (region 3).
From 00.00 to 99.59 (hh.mm) or infinite (inF)

EV3 **Region 3 contact status**.
ON = contact closed.
OFF = contact open.

SP2 **Second set point**.
From rL to rH (in engineering units).

Grd2 **Gradient for ramp to SP2** (region 4).
From 1 to 500 digits per minute; above this value the display will show "InF" and the transfert will be a step transfert.

EV4 **Region 4 contact status**.
ON = contact closed.
OFF = contact open.

tin 2 **Soak time at SP2** (region 5).
From 00.00 to 99.59 (hh.mm).

EV5 **Region 5 contact status.**
ON = contact closed.
OFF = contact open.

rPt **Number of program repetitions**.
From 0 (one execution only) to 100 + "InF" (infinite executions).
Note: when the instrument is in RUN mode, it shows the remaining program repetitions.

dELY **Wait time repetition**.
The first program cycle will ever perform the Wait region but, when rPt is different from 0, it is possible to set dELY parameter in order to start the next cycles from region 2 or from region 1.
OFF = the next cycles will restart from region 2 (Ramp to SP1)
ON = the next cycles will restart from region 1 (Wait).

AL1 **Alarm 1 threshold** (in eng. units).
For process alarm: within P4 - P3 span.
For Band alarm: from 0 to 500.
For deviation alarm: from -500 to +500.

HSA1 **Alarm 1 hysteresis**
From 0.1 to 10.0 % of P4 - P3 span.

AL2 **Alarm 2 threshold** (in eng. units).
(for range limits see AL1 parameter).

HSA2 **Alarm 2 hysteresis**
From 0.1 to 10.0 % of P4 - P3 span.

Pb **Proportional band**
From 0.0 (ON/OFF control) to 100.0 % of P4 - P3 span.
Note:When device is working with SMART algorithm the Pb value will be limited by P26 and P27 parameters.

HYS **Hysteresis of the ON/OFF control** (when Pb = 0)
From 0.1 to 10.0 % of P4 - P3 span.

ti **Integral time**
This parameter is skipped if Pb=0 (ON/OFF action).
From 00.20 to 20.00 (in minutes and seconds [mm.ss]). Above this value the display blanks and integral action is excluded
Note: When the device is working with SMART algorithm, the minimum value of the integral time will be limited by P28 parameter.

td **Derivative time**
This parameter is skipped if Pb=0 (ON/OFF action).
From 00.00 to 10.00 (in minutes and seconds [mm.ss]).

Note:When device is working with SMART algorithm the td value will be equal to a quarter of Ti value.

CY1 **Output 1 cycle time**
- When P5 = rEL, CY1 is programmable from 1 to 200 seconds.
- When P5 = SSr, CY1 is programmable from 0.1 to 20.0 seconds.

rL **Set point low limit**
Range: from min. range value (P3) to rH.
Note: When P3 has been modified, rL will be realigned to it

rH **Set point high limit**
Range:from rL to full scale value (P4)
Note: When P4 has been modified, rH will be realigned to it

OLH **Output high limit**
From 0 to 100 % of the output.

ERROR MESSAGES

OVERRANGE, UNDERRANGE AND SENSOR LEADS BREAK INDICATIONS

The device is capable to detect a fault on the process variable (OVERRANGE or UNDER-RANGE or SENSOR LEADS BREAK).
When the process variable exceeds the span limits established by configuration parameter P 1 an OVERRANGE condition will be shown on display as show in the following figure:

An UNDERRANGE condition will be shown on display as show in the following figure:

When P33 is equal to 0, the following conditions may occur:
- When the instrument detects an OVERRANGE condition, the OUT 1 turns OFF (if reverse action) or ON (if direct action).
- When the instrument detects an UNDERRANGE condition, the OUT 1 turns ON (if reverse action) or OFF (if direct action).

When P33 is different from zero and an out of range condition is detected, the instrument operates in accordance with P33 and P34 parameters.

The sensor leads break can be signalled as:
- for TC/mV input : OVERRANGE or UNDER-RANGE selected by a solder jumper
- for RTD input : OVERRANGE
- for mA/V input : UNDERRANGE

Note: On the mA/V input the leads break can be detected only when the range selected has a zero elevation (4/20 mA or 1/5 V or 2/10 V)
On RTD input a special test is provided to signal OVERRANGE when input resistance is less than 15 ohm (Short circuit sensor detection).

ERROR MESSAGES

The instrument performs same self-diagnostic algorithm.
When an error is detected, the instrument shows on the lower display the “Err” indication while the upper display shows the code of the detected error.

ERROR LIST

100	Write EEPROM error.
150	CPU error.
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 error.
305	TC/mV input calibration error.
307	RJ input calibration error.
311	Error on 20 mA input calibration.
313	Error on 5 V input calibration.
315	Error on 10 V input calibration.
400	Operative parameters error.
500	Auto-zero error.
502	RJ error.

GENERAL INFORMATIONS

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.
Rear terminal block:15 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: DIN 43700 48 x 48 mm, depth 122 mm.
Weight: 350 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: 8 VA max.
Insulation voltage: 2300 V rms according to EN 61010-1.
Sampling time: 250 ms for linear inputs
500 ms for TC and RTD inputs.
Resolution: 30000 counts.
Accuracy: $\pm$ 0,2% f.s.v. $\pm$ 1 digit @ 25 °C (77 °F) ambient temperature.
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: (CJ excluded)
< 200 ppm/°C of span for mV and TC ranges 1, 3, 5, 7, 20, 21, 22, 24.
< 300 ppm/°C of span for mA/V
< 400 ppm/°C of span for RTD range 11, 28 and TC range 0, 2, 4, 6, 23.
< 500 ppm/°C of span for RTD range 10 and TC ranges 8, 9, 25, 26.
< 800 ppm/°C of span for RTD range 27.
Operative temperature: from 0 to 50 °C (32 to 122 °F).
Storage temperature : -20 to +70 °C (-4 to 158°F)
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 -T - N -R -S. °C/°F selectable.
External resistance: 100 Ω max, maximum error 0,1% of span.
Burn out: It is shown as an overrange condition (standard). It is possible to obtain an underrange indication by cut and short.
Could junction: automatic compensation from 0 to 50 °C (32 to 122 °F).
Could junction accuracy : 0.1 °C/°C
Input impedance: > 1 MΩ
Calibration : according to IEC 584-1 and DIN 43710 - 1977.

STANDARD RANGES TABLE

T/C type	Ranges				
L	0	0 / + 400.0 °C			---
L	1	0 / + 900 °C	20	0 / + 1650	°F
J	2	0 / + 400.0 °C			---
J	3	0 / + 1000 °C	21	0 / + 1830	°F
K	4	0 / + 400.0 °C			---
K	5	0 / + 1200 °C	22	0 / + 2190	°F
T	6	0 / + 400.0 °C	23	0 / +750	°F
N	7	0 / + 1400 °C	24	0 / + 2550	°F
R	8	0 / + 1760 °C	25	0 / + 3200	°F
S	9	0 / + 1760 °C	26	0 / + 3200	°F

B) RTD (**R**esistance **T**emperature **D**etector)
Input: for RTD Pt 100 Ω, 3-wire connection.
Input circuit: current injection.
°C/°F selection: via front pushbuttons or serial link.
Line resistance: automatic compensation up to 20 Ω/wire with no measurable error.
Calibration: according to DIN 43760
Burn out : overrange. NOTE a special test generates an overrange indication when the input resistange is lower than 15 Ω.

STANDARD RANGES TABLE

Input type	Ranges		
RTD Pt 100 Ω DIN 43760	10	- 199,9 / + 400,0	°C
	11	- 200 / + 800	°C
	27	-199,9 / +400,0	°F
	28	-330 / + 1470	°F

C) LINEAR INPUTS
Read-out: keyboard programmable between -1999 and +4000.
Decimal point: programmable in any position
Burn out: the instrument shows the burn out condition as an underrange condition for 4-20 mA, 1-5 V and 2-10 V input types.
It shows the burn out condition as an underrange or an overrange condition (selectable by soldering jumper) for 0-60 mV and 12-60 mV input types. No indication are available for 0-20 mA, 0-5 V and 0-10 V input types.

Input type		impedance	Accuracy
12	**0 - 60 mV**	> 1 MΩ	0.2 % + 1 digit @ 25°C
13	**12 - 60 mV**		
14	**0 - 20 mA**	< 5 Ω	
15	**4 - 20 mA**		
16	**0 - 5 V**	> 200 kΩ	
17	**1 - 5 V**		
18	**0 - 10 V**	> 400 kΩ	
19	**2 - 10 V**		

D) LOGIC INPUTS
The instrument is equipped with one input from contact (voltage free) for program start.
NOTES
1) Use an external contact with a contact rating better than 0.5 mA, 5 V DC.
2) The logic inputs are **NOT** isolated by the measuring input.

CONTROL ACTIONS

Control action: PID + SMART
Type: One (heating or cooling) output.
Proportional Band (Pb):
Range: from 1.0 to 100.0 % of the input span.
When Pb=0, the control action becomes ON/OFF.
Hysteresis (for ON/OFF control action):
from 0.1% to 10.0% of the input span.
Integral time (Ti): from 20 s to 20 min. or excluded.
Derivative time (TD): from 1 s to 10 min.
If zero value is selected, the derivative action is excluded.
Integral pre-load: from 0.0 to 100.0 % of the output
SMART: keyboard enabling/disabling
Auto/Manual: selectable by front pushbutton.
Auto/Manual transfer: bumpless method type

OUTPUT
Type: time proportioning
Control output updating time :
- 250 ms when a linear input is selected
- 500 ms when a TC or RTD input is selected.

Control output resolution: 0.1% of the span.
Direct/reverse action: programmable.
Output level limiter(for control outputs):
from 0.0 to 100.0 % .

Relay outputs
Outputs 1: SPST contact with rated current 3 A at 250 V AC on resistive load (NO contact).
Output 2: SPST contact with rated current 2 A at 250 V AC on resistive load.
Output 3: SPST contact with rated current 2 A at 250 V AC on resistive load.

NOTE: the side C of the OUT 2 and OUT 3 are common.

Logic voltage for SSR driver (output 1 only):
Logic level 0: Vout < 0.5 V DC.
Logic level 1: 14 V DC $\pm$ 20 % @ 17 mA.
24 V DC $\pm$ 20 % @ 1 mA.
Maximum current = 17 mA.

Output status indication: 3 indicators (OUT 1, 2 and 3) are lit when the respective output is in ON condition.

ALARMS
Actions: Direct or reverse acting.
Alarm functions: each alarm can be configured as process alarm, band alarm or deviation alarm.
Alarm reset: automatic or manual reset programmable on each alarm.
Stand by (mask) alarm: each alarm can be configured with or without stand by (mask) function.
This function allows to delete false indication at instrument start up and/or after a set point change.

Process alarm:
Operative mode : High or low programmable.
Threshold : programmable in engineering unit within the input span.
Hysteresis: programmable from 0.1 % to 10.0 % of the input span (P4 - P3).

Band alarm
Operative mode: Inside or outside programmable.
Threshold : programmable from 0 to 500 units.
Hysteresis : programmable from 0.1 % to 10.0 % of the input span.

Deviation alarm
Operative mode : High or low programmable.
Threshold : programmable from - 500 to +500 units.
Hysteresis : programmable from 0.1 % to 10.0 % of the input span.

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 instrument should be in Stand-by mode.

d) Held down ▼ pushbutton and press ▲ pushbutton; the display will show:

e) Press ▲ or ▼ pushbutton; the display will show:

g) Press FUNC pushbutton; the display will show:

It means that the loading procedure has been initiated.

After about 3 seconds the loading procedure is finished 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
Snrt	= ON.
n.RSt	= OFF
nnn	= OFF (UNLOCK)
dELY	= 00.00
EV1	= OFF
SP1	= low scale value
Grd1	= "InF"
EV2	= OFF
tin 1	= 00.00
EV3	= OFF
SP2	= low scale value
Grd2	= "InF"
EV4	= OFF
tin 2	= 00.00
EV5	= OFF
rPt	= 0
dELY	= OFF
AL1	= low range value for process alarm Zero for band or deviation alarms.
HSA1	= 0.1 %
AL2	= low range value for process alarm 0 for band or deviation alarms.
HSA2	= 0.1 %
Pb	= 4.0 %
HYS	= 0.5
ti	= 04.00 [mm.ss]
td	= 01.00 [mm.ss]
CY1	= 15 s when P5 = rEL 4 s when P5 = SSr
rL	= low scale value
rH	= high scale value
OLH	= 100 %

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 (V101, see fig. 12) should be open.
b) The upper display will show:

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

d) Maintaining 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 set of parameters; the display will show:

f) Press FUNC pushbutton; the display will show:

It 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).

PARA.	TABLE 1	TABLE 2
P1	3	21
P2	----.	----.
P3	0	0
P4	400	1000
P5	rEL	rEL
P6	rEV	rEV
P7	4	4
P8	H.A.	H.A.
P9	1	1
P10	4	4
P11	10	10
P12	10	10
P13	H.A	H.A.
P14	8	16
P15	8	16
P16	4	8
P17	0	0
P18	rEV	rEV
P19	OFF	OFF
P20	rEV	rEV

P21	OFF	OFF
P22	0	0
P23	10	10
P24	ON	ON
P25	2	2
P26	10.0	10.0
P27	1.0	1.0
P28	00.50	00.50
P29	0	0
P30	30	30
P31	tn 10	tn 30
P32	nOFL	nOFL
P33	0	0
P34	0	0

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