

# *SSi* Super Systems

## *Instruction Manual*



***Model AC20***

Part No. 31069 - Standard Atmosphere Controller  
with expanded event capability

August 2004

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## MOUNTING REQUIREMENTS

This instrument is intended for permanent installation, for indoor use only, in an electrical panel which encloses the rear housing, exposed terminals and wiring on the back.

Select a location, for instrument mounting, where minimum vibrations are present and the ambient temperature is within 0 and 50 °C (32 and 122°F).

The instrument can be mounted on a panel up to 15 mm thick with a cutout 92 x 92.

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 4X 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 gasket in the instrument case;
- 2) insert the instrument in the panel cutout;
- 3) pushing the instrument against the panel;
- 4) insert the mounting brackets as shown in fig.1;
- 5) with a screwdriver, turn the screws with a torque between 0.3 and 0.4 Nm.

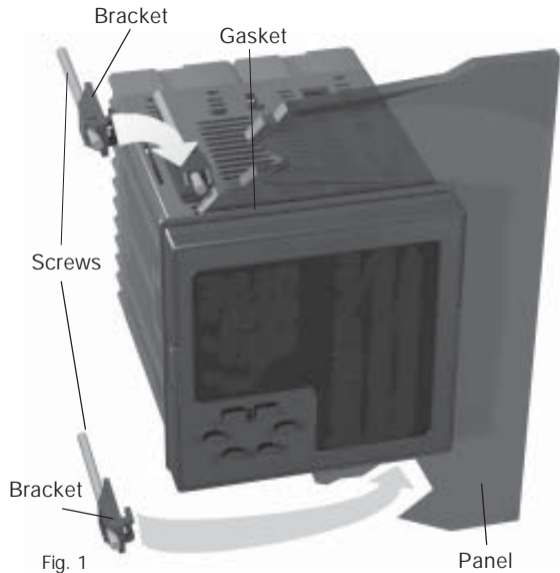


Fig. 1

# OUTLINE AND CUT OUT DIMENSIONS

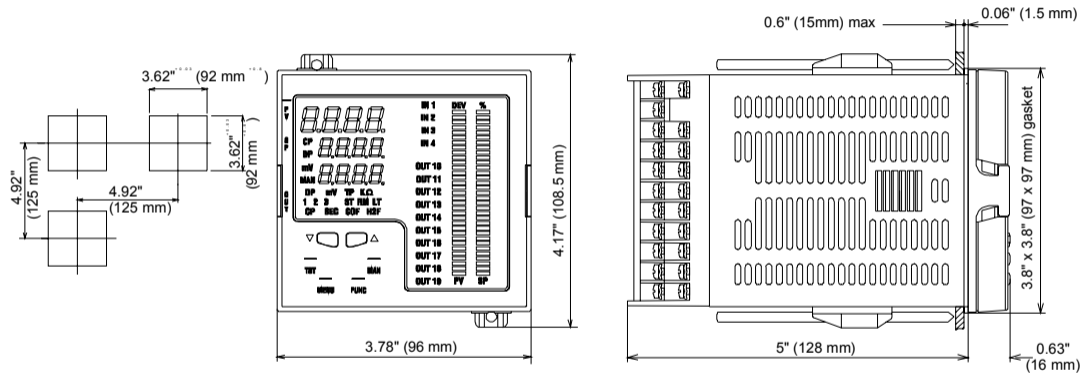


Fig. 2. OUTLINE AND CUT-OUT DIMENSIONS

# CONNECTION DIAGRAMS

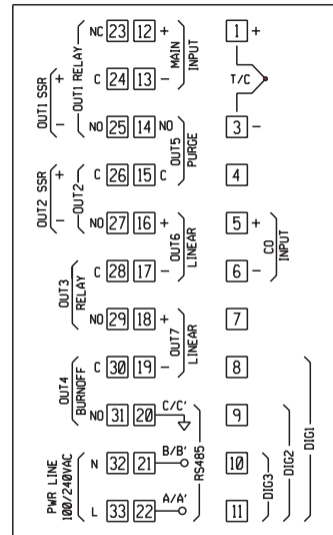
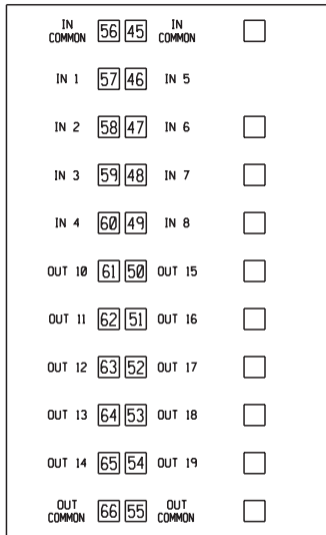


Fig. 3. REAR TERMINAL BLOCK

## CONNECTIONS

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

## MEASURING INPUTS

**NOTE:** Any external component (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.

### A) PROBE SENSOR INPUT (MAIN INPUT)

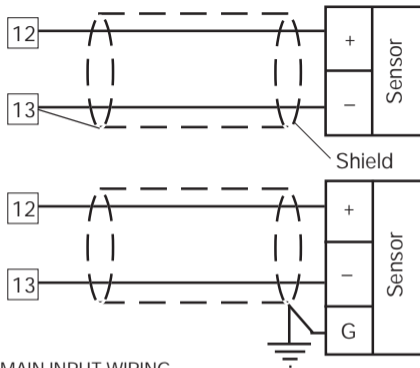


Fig. 4 MAIN INPUT WIRING

#### NOTES:

- 1) This input is isolated from others measuring inputs and digital inputs.
- 2) Don't run input wires together with power cables.
- 3) When a shielded cable is used, it should be connected at one point only.

## A.1) TEMPERATURE (THERMOCOUPLE) INPUT

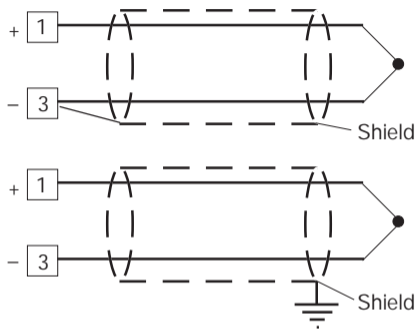


Fig. 5 TEMPERATURE INPUT WIRING

### NOTES:

- 1) This input is not isolated from others measuring inputs and digital inputs.
- 2) Don't run input wires together with power cables.
- 3) For TC wiring use proper compensating cable preferable shielded.
- 4) When a shielded cable is used, it should be connected at one point only.

## A.2) AUXILIARY INPUT (CARBON MONOXIDE)

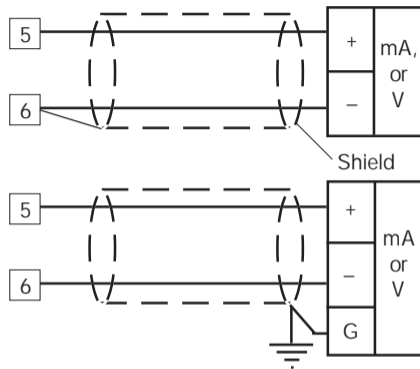


Fig. 6 AUXILIARY INPUT WIRING

### NOTES:

- 1) This input is not isolated from others measuring inputs and digital inputs. A double or reinforced insulation between instrument output and power supply must be assured by the external instrument.

- 2) Don't run input wires together with power cables.
- 3) Pay attention to the line resistance; a high line resistance may cause measurement errors.
- 4) When shielded cable is used, it should be grounded at one side only to avoid ground loop currents.
- 5) The input impedance is equal to:
  - < 5  $\Omega$  for 20 mA input
  - > 200 k $\Omega$  for 5 V input
  - > 400 k $\Omega$  for 10 V input

## B) LOGIC INPUTS

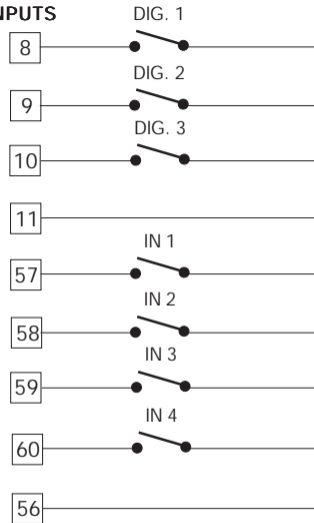


Fig. 7.A - LOGIC INPUTS DIG 1 TO DIG 3 AND IN1 TO IN4 WIRING



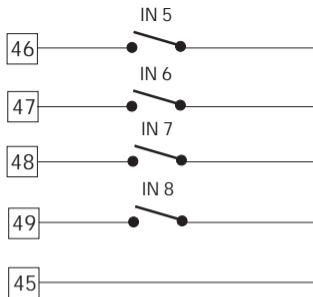


Fig. 7.B - LOGIC INPUTS IN5 TO IN8 WIRING

Logic inputs from IN1 to In8 are optional.

**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 110 ms to recognize a contact status variation.
- 4) The logic inputs are **NOT** isolated from measuring inputs.

**C.1) RELAY OUTPUTS**

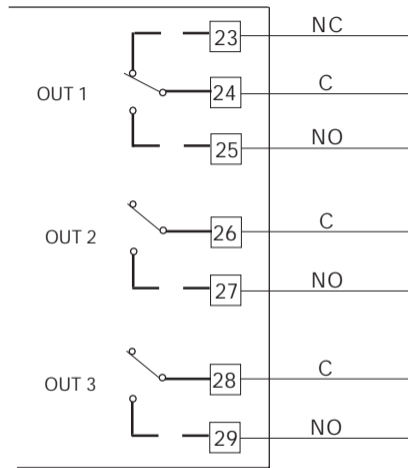


Fig. 8.A RELAY OUTPUTS 1, 2, 3 WIRING

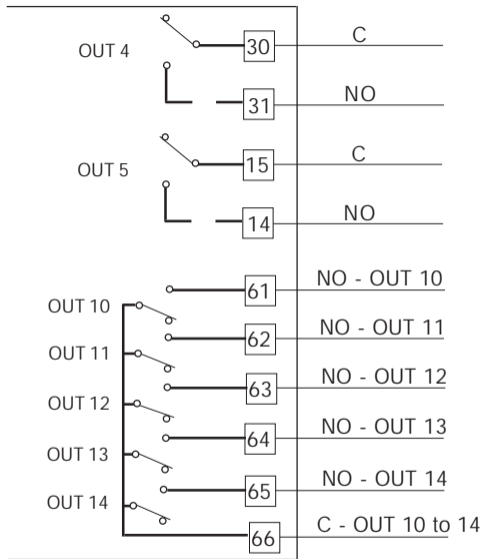


Fig. 8.B RELAY OUTPUTS 4, 5 and 10 TO 14 WIRING

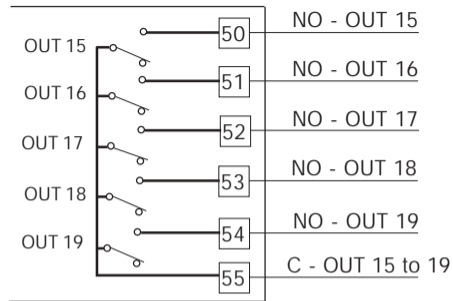


Fig. 8.C RELAY OUTPUTS 15 TO 19 WIRING

Outputs from OUT 10 to OUT 19 are optional.

The contact rating from OUT 1 and OUT 2 is 3A/250V AC on resistive load.

The contact rating from OUT 3 and OUT 4 is 2A/250V AC on resistive load.

The contact rating of OUT 5 is 1A/250V AC on resistive load.

The contact rating from OUT 10 to OUT 19 is 0.5 A/250V AC on resistive load.

The number of operations is  $1 \times 10^5$  at specified rating.

- NOTES:**
- 1) To avoid electrical 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 least 75 °C.
  - 3) Use copper conductors only.
  - 4) Don't run input wires together with power cables.
  - 5) When a relay output is used to drive a low power signal (PLC input, alarm annunciator, etc..) it is necessary to use an external relay with a gilded contact.

All relay contacts are protected by varistor against inductive load with inductive component up to 0.5 A.

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

### INDUCTIVE LOADS

High voltage transients may occur switching inductive loads. Through the internal contacts these transients may introduce disturbances which can affect the performance of the instrument.

For all the outputs, 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.

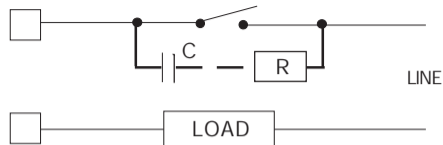


Fig. 9 EXTERNAL SWITCH IN SERIES WITH THE INTERNAL CONTACT

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 ( $\mu$ F)	R ( $\Omega$ )	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.

## C.2) VOLTAGE OUTPUTS FOR SSR DRIVE

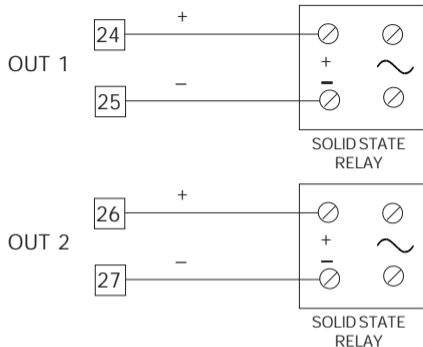


Fig. 10 SSR DRIVE OUTPUT WIRING

**Logic level 0:**  $V_{out} < 0.5 \text{ V DC}$ .

**Logic level 1:**

- 14 V + 20 % @ 20 mA

- 24 V + 20 % @ 1 mA.

Maximum current = 20 mA

**NOTE:** These outputs are not insulated.

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

## C.3) ANALOG OUTPUTS

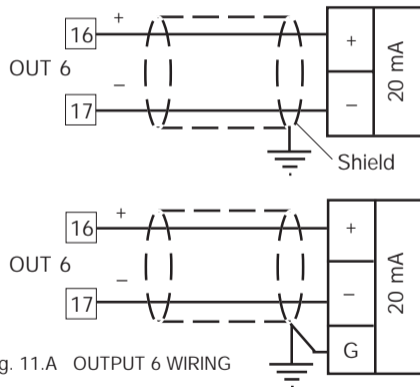


Fig. 11.A OUTPUT 6 WIRING

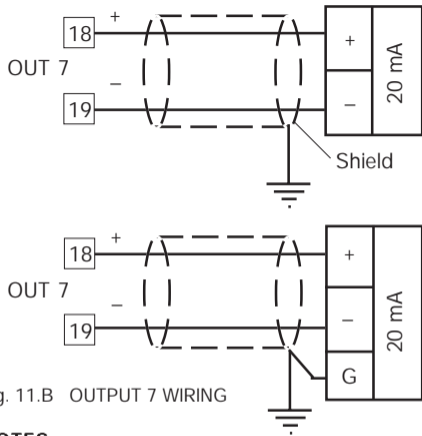


Fig. 11.B OUTPUT 7 WIRING

**NOTES:**

- 1) Do not run analog output wires together with AC power cables.
- 2) Out 6 and 7 are isolated outputs.
- 3) The maximum load is equal to 600  $\Omega$ .

**D) SERIAL INTERFACE**

RS-485 interface allows you to connect up to 30 devices with one remote master unit.

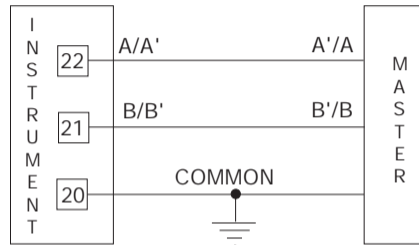


Fig. 12 - RS-485 WIRING

The cable length must not exceed 1.5 km at 9600 BAUD.

**NOTES:**

- 1) This is an isolated RS 485 serial interface.
- 2) The following report describes the signal sense of the voltage appearing across the interconnection cable as defined by EIA for RS-485.
  - a) The " A " terminal of the generator shall be negative with respect to the " B " terminal for a binary 1 (MARK or OFF) state.

- b) The " A " terminal of the generator shall be positive with respect to the " B " terminal for a binary 0 (SPACE or ON).
- 3) The EIA standard establishes that by RS-485 interface it is possible to connect up to 30 devices with one remote master unit. The serial interface of these instruments is based on "High input impedance" transceivers; this solution allows you to connect up to 127 devices (based on the same transceiver type) with one remote master unit.

#### E) POWER LINE WIRING

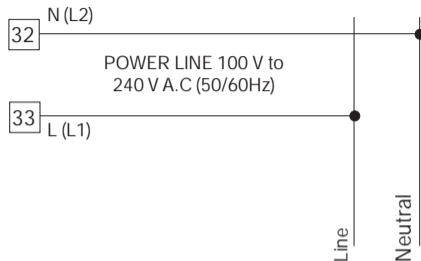


Fig. 13 POWER LINE WIRING

#### NOTES:

- 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 electrical 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) The power supply input is fuse protected by a sub miniature fuse rated T, 1A, 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.

- 7) 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.

- 8) When a neutral line is present please connect it to the 32 terminal.

## PRELIMINARY HARDWARE SETTINGS

### How to remove the instrument from its case

- 1) Switch off the instrument.
- 2) Push gently the lock A on the right.
- 3) While the lock A is maintained out, slide out the right side of the instrument (see fig. 14.a)

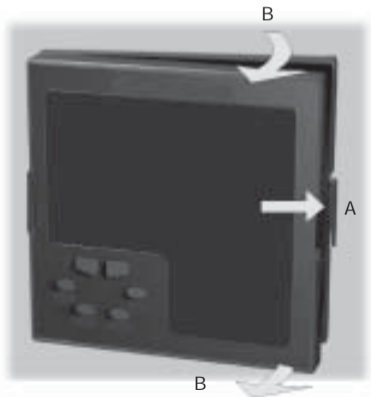


Fig. 14

- 4) Push gently the lock C on the left.
- 5) While the lock C is maintained out, slide out the instrument (see fig. 14.b)

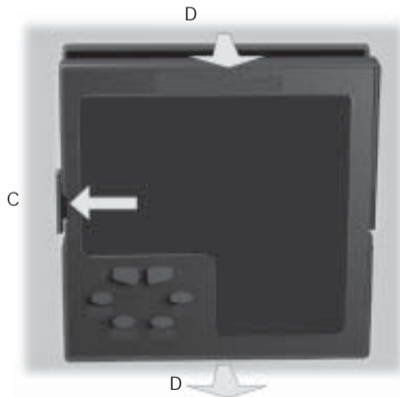


Fig. 14.b



## J103 SETTING

J103 (see fig. 15) must be set as follows:

J103	
1-2	open
3-4	open
5-6	open
7-8	open
5-7	close
6-8	close

## AUXILIARY INPUT SELECTION

Set J102 (see fig. 15) according to the desired input type as shown in the following table.

J102	INPUT TYPE		
	5 V	10 V	20 mA
1-2	close	open	open
3-4	close	close	open
5-6	open	open	close
7-8	open	open	close
5-7	open	close	open
6-8	open	open	open

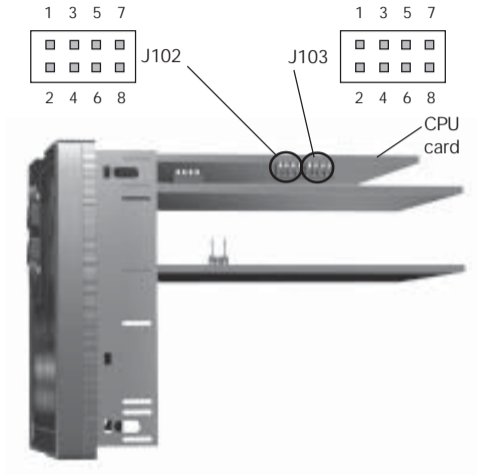


Fig.15

## Operative mode and Hardware lock

1) By V101 (see fig. 16) it is possible to select one of the following operative modes:

- a) run time mode without configuration mode
- b) run time and configuration modes
- c) security code setting mode

Set V101 according to the following table:

Modes	V101.1	V101.2	V101.3	V101.4
a	OFF	ON	ON	ON
b	OFF	ON	OFF	ON
c	OFF	ON	OFF	OFF

2) When run time mode is selected (mode a or b), V101.3 allows you to activate/deactivate the hardware lock for configuration parameters.

If V101.3 is ON, the lock is activated.

If V101.3 is OFF, the lock is deactivated.

When the lock is activated, no one of the configuration parameter can be modified.

3) All the others switch combinations are reserved.

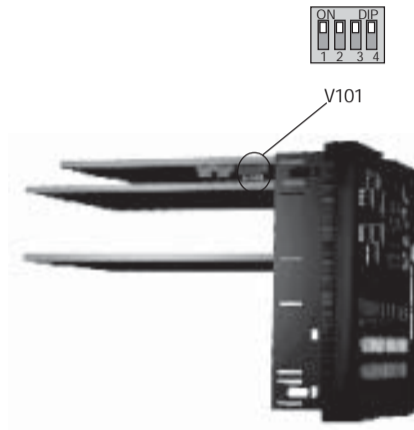


Fig. 16

## SECURITY CODE SETTING MODE

### General notes

The instrument parameters are divided in two families and each family is divided in groups.

- The first family encompasses all the run time parameters.
- The second family comprises all the configuration parameters.

A specific security code enables the parameter modification of each family.

For run time parameters, it is possible to select which groups of them will be protected by the security code and in this case it is necessary to set the run time security code before to modify one or more parameters of a protected group.

The configuration security code protects all configuration parameters and it will be necessary to set the configuration security code before to start the configuration parameters modification.

For configuration parameters an hardware lock is also available.

### Security code setting:

- 1) Remove the instrument from its case.
- 2) Set the internal dip switch V101 as follows:
  - V101.1 = OFF - V101.2 = ON
  - V101.3 = OFF - V101.4 = OFF
- 3) Re-insert the instrument.
- 4) Switch on the instrument. The display will show:

Scrt

AD1

The upper display shows that the security code setting mode is selected while the lower display shows the firmware version.

- 5) Push the FUNC pushbutton.

## Run time security code

The display will show:

S CRT

S RUN

**Note:** the middle display shows the current status of the run time security code ("0", "1" or "On").

By ▲ and ▼ push-button, set "S.run" parameter as follows:

- 0 No protection (it is always possible to modify all run time parameters);
  - 1 always protected (it is never possible to modify a run time parameter);
- from 2 to 250 security code for run time parameter protection.

### NOTES:

- 1) The selected value of a security code cannot be displayed anymore and, coming back to the "S.run" parameter, the display will show "On" when "S.run" is different from 0 or 1, "0" when "S.run" is equal to 0, "1" when "S.run" is equal to 1.  
When the security code is forgotten, a new value can be set.
- 2) When "S.run" is different from 0 or 1, the "run time default " and the "run time hidden" groups are always protected by security code.

## Run time groups protected by security code

The display will show:

S CRT  
YES  
Gr 1

By this parameter it is possible to set if the run time group 1 will be protected or not by the run time security code.

By ▲ and ▼ push-button, set "Gr1" parameter as follows:

- n0 No protection (it is always possible to modify run time group 1 parameters).
- Yes the run time group 1 parameter modification will be protected by security code.

Push the FUNC push-button; the instrument memorizes the new setting and goes to the next parameter.

- NOTES:**
- 1) This selection may be performed only if a run time security code has been set (from 2 to 250).
  - 2) The above described selection may be repeated for all groups of the run time mode.

## Configuration security code

The display will show:

Scrt

S.CnF

**Note:** the middle display shows the current status of the configuration security code ("0", "1" or "On").

By ▲ and ▼ push-button, set "S.CnF" parameter as follows:

- 0 No protection (it is always possible to modify all configuration parameters);
  - 1 always protected (it is never possible to modify a configuration parameter);
- from 2 to 250 security code for configuration parameter protection.

- NOTES:**
- 1) The selected value of a security code cannot be displayed anymore and, coming back to the "S.CnF" parameter, the display will show "On" when "S.CnF" is different from 0 or 1, "0" when "S.CnF" is equal to 0, "1" when "S.CnF" is equal to 1.  
When the security code is forgotten, a new value can be set.
  - 2) At the end of the security code setting, set the V101 as described at page16.

## RUN TIME AND CONFIGURATION MODES







The hardware selection described in "Operative mode and hardware lock" paragraph allows you to start one of the two following operative modes:

- run time mode
- configuration mode.

At power up, the instrument starts in the same mode it was prior to the power OFF.

### General note about graphic symbols used for mnemonic code visualization.

The instrument displays some characters with special symbols. The following table shows the correspondence between the symbols and the characters.

symbol	character
" 	k
" 	m
" 	V
" 	W
" 	Z
" 	J

## Keyboard description

**MENU** = is used to select a parameter group.

**FUNC** =  When the instrument is in "normal display mode" it changes the indication on the lower display (see "displayfunction").

During parameter modification, it allows you to memorize the new value of the selected parameter and go to the next parameter (increasing order).

**MAN** =  When the instrument is in "normal display mode", pushing **MAN** push-button for more than 1 s, it is possible to enable or disable the manual function.

During parameter modification, it allows you to scroll back the parameters and groups without memorizing the new setting.

**▲** =  During parameter modification, it allows you to increase the value of the selected parameter.

During **MANUAL** mode, it allows you to increase the output value.

**▼** =  During parameter modification, it allows you to decrease the value of the selected parameter.

During **MANUAL** mode, it allows to decrease the output value.

**TST + MAN** = By pressing these keys it is possible to start the **BURNOFF** function.

**TST + FUNC** = By pressing these keys it is possible to start the **PROBE TEST** function.

**▼+MENU** = Are used to start the lamp test function (the command is accepted when push-buttons are kept depressed for more than 5 s and the instrument is in normal display mode)

**▲+FUNC** or **▼+FUNC**

During parameter modification they allow you to increase/decrease the value under modification with higher rate.

**▲+MAN** or **▼+MAN**

During parameter modification they allow you to jump to the max or min programmable value.

## NOTES:

- 1) All the actions explained above which requires two or more push-buttons must follow exactly the push-button sequence shown.
- 2) A 10 or 30 seconds time out (see "CnF.6 - t.out" [C.I08]) can be selected for parameter modification during run time mode. If, during parameter modification, no push-button is depressed for more than 10 (30) seconds, the instrument goes automatically to the "normal display mode" and the modification (if carried out) of the last displayed parameter will be lost.

## CONFIGURATION MODE

Switch on the instrument.

The instrument will start in the same way it was prior to the power down (configuration mode or run time mode).

If the instrument starts in configuration mode, push the MENU pushbutton and go to the "Configuration group 1" (see page 25). If the instrument starts in run time mode, by keeping depressed the MENU push-button for more than 5 seconds the instrument will show:



CONF  
non.  
AD1

where:

- the upper display shows the selected parameter family;
- the middle display shows the selected action;
- the lower display shows the firmware version.

If no push-button is depressed for more than 10 s (or 30 s according to "CnF.6 - "t.out" [time out selection" C.I08] parameter setting), the instrument automatically returns to the normal display mode.

By ▲ or ▼ push-button it is possible to select between:

*mon.t.* = (monitor) this selection allows you to monitor but not to modify the value assigned to the configuration parameters.

*modF.* = (modify) this selection allows you to monitor and to modify the value assigned to the configuration parameters.

#### NOTES:

- 1) During monitor mode, the instrument continues to operate as in run time mode.
- 2) When modify mode is started, the instrument stops the control and:
  - sets to OFF the control outputs;
  - turns to OFF the bargraph displays;
  - sets analog retransmissions to the retransmitted initial scale value;
  - sets to OFF the alarms;
  - disables the serial link;
  - the time out will be disabled.
- 3) When the modify mode is disabled by V101 (V101.3), the ▲ or ▼ push-button pressure has no effect.

#### MONITOR MODE

During the run time mode, it is possible to monitor but not modify all configuration parameters.

When it is desired to verify the instrument configuration, proceed as follows:

- 1) By ▲ or ▼ push-button select the monitor mode.
- 2) Push the MENU push-button the display will show:

*CnF. 1*

*inPt.*

it shows that configuration group 1 is selected and it encompasses all the input parameters.

The configuration parameter "Monitor mode" follows the "Modify mode" sequence.

#### NOTES:

- 1) During monitor mode, the instrument continues to operate as in run time mode.
- 2) During monitor mode, if no push-button is depressed for more than 10 s (or 30 s according to "CnF.6 - t.out" [C.I08] parameter setting), the instrument returns automatically to the normal display mode.



## MODIFY MODE

- 1) By ▲ or ▼ push-button select the modify mode.
- 2) Push the MENU push-button.

If a security code is applied to the configuration parameter, the instrument will show:



CONF  
----  
SCrt

- 3) By ▲ and ▼ push-button set a value equal to the security code assigned to the configuration mode (see "Configuration security code " at page 19).

If the code is different from the security code, the instrument automatically returns to the first configuration display otherwise the display will show:



CONF  
OFF  
dFlt.

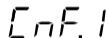
The modify mode is started.

This display allows you to load the default configuration parameter (table 1 or table 2).

For more details see chapter "Default parameter" (see Appendix A).

- 4) By ▲ or ▼ push-button select the OFF indication and push the MENU push-button.

The display will show:



CONF.1



InPt.

This is the starting display of the first group of configuration parameters.

## NOTES:

- 1) In the following pages we will describe all the parameters of the instrument but the instrument will show only the parameters related with the specific hardware and in accordance with the specific instrument configuration [i.e. setting OUT 6 as "nonE" (not used), all the parameters related with this output will be automatically skipped].

- 2) During configuration parameters modify mode, the upper display shows the selected parameter group, the lower display shows the mnemonic code of the selected parameter while the central display shows the value or status assigned to the selected parameter.
- 3) For an easy consultation of this manual, a sheet named "Reference parameter guide" with all the parameter visualizations is enclosed.

The groups of configuration parameters are identified by the "C" letter followed by A, B etc.

The "code" formed by the group and the row (i.e. C.D01 where "C.D" is configuration group1 and "01" is the row 1) is reported, in the user manual, before each parameter description and allows you to quickly find out the respective parameter.

## CONFIGURATION GROUP 1 [C.Dxx] INPUT CONFIGURATION

CnF.1

LnPt.

Push the FUNC push-button

### **C.D01- Line frequency**

Upper display: CnF.1

Lower display: Ln.Fr

Range: 50 Hz  
60 Hz

### **C.D02- Controlled variable selection**

Upper display: CnF.1

Lower display: PV.SL

Ranges:

CP = Carbon potential (span limits within 0.00% to 2.00%).

dP = Dew point (span limits within -100 to 100 °F or -75 to 40°C).

nV = Sensor output in mV (span limits within 0 to 1500 mV).

O2 = Oxygen value as primary control variable

( The span limits are 0.0 to 25.0)

## NOTES:

- 1) Changing the controlled variable, the following parameters:  
"CnF.6 - brG.L" [C.I03] and "CnF.6 - brG.H" [C.I04] (Bargraph initial and full scale values);  
"CnF.2 - O6.Lr" [C.E06] and "CnF.2 - O6.Hr" [C.E07] (Out 6 retransmission initial and full scale values);  
"CnF.2 - O7.Lr" [C.E11] and "CnF.2 - O7.Hr" [C.E12] (Out 7 retransmission initial and full scale values);  
"Gr.5 - rL" [R.E10] and "Gr.5 - rH" [R.E11] (set point low and high limits); will be forced to the span limits of the new selected variable.
- 2) SP, SP2, SP3, SP4 values and alarm thresholds, if out of the limits for the new selected variable, will be forced to the low limit value.

### C.D03- Filter on probe sensor input (Main input)

Upper display: CnF.1

Lower display: Pb.FL

Ranges: from 0 (no filter) to 8 seconds.

## NOTES:

- 1) This is a first order digital filter applied on probe sensor input value.
- 2) This filter can affect the control action, the alarms, the SMART algorithm and the process variable retransmission.

### C.D04 - Temperature input - TC type selection

Upper display: CnF.1

Lower display: tP.In

Ranges:

1 = TC	K	From -100 to 1370	°C
2 = TC	S	From -50 to 1760	°C
3 = TC	R	From -50 to 1760	°C
4 = TC	K	From -150 to 2500	°F
5 = TC	S	From -60 to 3200	°F
6 = TC	R	From -60 to 3200	°F
7 = TC	B	From 0 to 1820	°C
8 = TC	B	From 32 to 3300	°F

**NOTE:** When the controlled variable selected is dP, the span limits of the following parameters:

"CnF.6 - brG.L" [C.I03] and "CnF.6 - brG.H" [C.I04]

(Bargraph initial and full scale values);

"CnF.2 - O6.Lr" [C.E06] and "CnF.2 - O6.Hr" [C.E07] (Out 6 retransmission initial and full scale values);

"CnF.2 - O7.Lr" [C.E11] and "CnF.2 - O7.Hr" [C.E12] (Out 7 retransmission initial and full scale values);

"Gr.5 - rL" [R.E10] and "Gr.5 - rH" [R.E11]

(set point low and high limits); will be forced to:

-100 to 100 °F if the temperature input has been changed from a °C to a °F type;

-75 to 40 °C if the temperature input has been changed from a °F to a °C type.

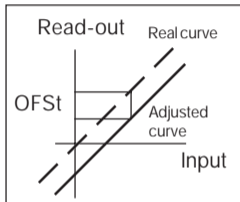
### C.D05 - Temperature input offset adjustment

Upper display: CnF.1

Lower display: OFSt

Range: from -500 to 500

**NOTE:** The offset value is algebraically added to temperature input value.



### C.D06 - Filter on temperature input value

Upper display: CnF.1

Lower display: tP.FL

Ranges: from 0 (no filter) to 8 seconds.

#### NOTES:

1) This is a first order digital filter applied to the temperature input value.

2) When "dP" or "CP" or O2 are selected as the controlled variable, this filter can affect the control action, the alarms, the SMART algorithm and the process variable retransmission.

### C.D07 - Auxiliary input function

Lower display: A.In.F

Range: nonE = Input not used

CO = Input used for CO measurement

rSP = Input used as remote set point

Available: Always

Note: The scalable for CO measurement is fixed from 000 to 100

When CO input is not used the CO value will be set to 20

The scalable for rSP measurement is fixed to:

0.00 / 2.00 if carbon potential is selected as primary control variable or

0 / 100 °F (-18 / 40 °C) if dew point is selected as primary control variable or

0 / 1500 if sensor output in mV is selected as primary control variable

0.0 / 25.0 if oxygen value is selected as primary control variable

### C.D08 - Auxiliary input type selection

Lower display: A.In.t

Range: 0-20 = 0 ÷ 20 mA

4-20 = 4 ÷ 20 mA

0-5 = 0 ÷ 5 V

1-5 = 1 ÷ 5 V

0-10 = 0 ÷ 10 V

2-10 = 2 ÷ 10 V

Available: When auxiliary input is used

### C.D09 - TIME CONSTANT FOR FILTER ON REMOTE SETPOINT VALUE (CnF.1)

Lower display: A.I.FL  
Range: From 0(filter OFF) to 8 s  
Available: When auxiliary input is used as remote set point  
Note: First order filter with selected time constant

### C.D10 - REMOTE SETPOINT ACTIVITY MODE (CnF.1)

Lower display: A.I.Añ  
Range: norñ = The remote set point is activated by external contact(or is always activated if none contacts are configured for this feature) and the value is limited at its min/max value when out of range  
Cnd.A = The remote set point activation is controlled by status of auxiliary input.  
(The device works with local set point when auxiliary input is out of range while it works with remote set point when auxiliary input is in range)  
Available: When auxiliary input is used as remote set point

### C.D11 - LOCAL / REMOTE SETPOINT OPERATING MODE (CnF.1)

Lower display: L.r.Oñ  
Range: ALG = The local setpoint will be aligned to last remote setpoint value when transfer from remote to local setpoint action is performed through external contact  
n.ALG = The local setpoint will be not be changed when transfer from remote to local setpoint action is performed (The programmed ramp (Grd1/Grd2) may be activated)

Available: When auxiliary input is used as remote set point and ("A.I.Añ = norñ)  
Note :If transfer from remote to local setpoint is due to auxiliary input status("A.I.Añ = Cnd.A) the local setpoint **will never been** aligned.

## CONFIGURATION GROUP 2 [C.Exx]

### OUTPUTS CONFIGURATION

CnF.2

OUT.

#### C.E01 - OUT 1 function

Upper display: CnF.2

Lower display: O1.Fn

Range: nonE = Output not used

ñAin = Time proportional main control output

SECn = Time proportional secondary control output

ALr.1 = Alarm 1 output

#### C.E02 - OUT 2 function

Upper display: CnF.2

Lower display: O2.Fn

Range: nonE = Output not used

ñAin = Time proportional main control output

SECn = Time proportional secondary control output

ALr.2 = Alarm 2 output

#### C.E03 - OUT 3 function

Upper display: CnF.2

Lower display: O3.Fn

Range: nonE = Output not used

ñAin = Time proportional main control output

SECn = Time proportional secondary control output

ALr.3 = Alarm 3 output

#### C.E04 - OUT 6 function

Upper display: CnF.2

Lower display: O6.Fn

Range: nonE = Output not used

ñAin = Main control output (linear)

SECn = Secondary control output (linear)

PV.rt = Process variable retransmission

SP.rt = Operative set point retransmission

#### C.E05 - OUT 6 range

This parameter is available only when OUT 6 ("O6.Fn" [C.E04]) is different from "nonE".

Upper display: CnF.2

Lower display: O6.rn

Range: 0-20 = 0-20 mA

4-20 = 4-20 mA

### **C.E06 -OUT 6 retransmission - initial scale value**

This parameter is available only when Out 6 function [C.E04] is configured as "PV.rt" or "SP.rt"

Upper display: CnF.2

Lower display: O6.Lr

Range: From -1999 to 9999

**NOTE:** The decimal point position will be the same as the "CnF.1 - PV.SL" [C.D02] previously selected.

### **C.E07 -OUT 6 retransmission - full scale value**

This parameter is available only when Out 6 function [C.E04] is configured as "PV.rt" or "SP.rt"

Upper display: CnF.2

Lower display: O6.Hr

Range: From -1999 to 9999

**NOTE:** The decimal point position will be the same as the "CnF.1 - PV.SL" [C.D02] previously selected.

### **C.E08 -OUT 6 filter on the retransmitted value**

This parameter is available only when OUT 6 ("O6.Fn" [C.E04]) is configured "PV.rt".

Upper display: CnF.2

Lower display: O6.FL

Range: From 0 (no filter) to 8 seconds

**NOTE:** this is a first order digital filter applied to the retransmitted output value.

### **C.E09 -OUT 7 function**

Upper display: CnF.2

Lower display: O7.Fn

Range: nonE = Output not used

ñAin = Main control output (linear)

SECn = Secondary control output (linear)

PV.rt = Process variable retransmission

SP.rt = Operative set point retransmission

### **C.E10 - OUT 7 range**

This parameter is available only when Out 7 ("O7.Fn" [C.E09]) is different from "nonE".

Upper display: CnF.2

Lower display: O7.rn

Range: 0-20 = 0 to 20 mA

4-20 = 4 to 20 mA

### **C.E11 -OUT 7 retransmission - initial scale value**

This parameter is available only when Out 7 function [C.E09] is configured as "PV.rt" or "SP.rt"

Upper display: CnF.2

Lower display: O7.Lr

Range: From -1999 to 9999

**NOTE:** The decimal point position will be the same as the "CnF.1 - PV.SL" [C.D02] previously selected.

### **C.E12 -OUT 7 retransmission - full scale value**

This parameter is available only when Out 7 function [C.E09] is configured as "PV.rt" or "SP.rt"

Upper display: CnF.2

Lower display: O7.Hr

Range: From -1999 to 9999

**NOTE:** The decimal point position will be the same as the "CnF.1 - PV.SL" [C.D02] previously selected.

### **C.E13 -OUT 7 filter on the retransmitted value**

This parameter is available only when OUT 7 ("O7.Fn" [C.E09]) is configured as "PV.rt".

Upper display: CnF.2

Lower display: O7.FL

Range: From 0 (no filter) to 8 seconds

**NOTE:** this is a first order digital filter applied to the retransmitted output value.



## General note on configuration group 2

Exiting from the configuration group 2 the instrument automatically verifies the congruence of all parameters.

If a wrong setting is detected, the device will show:



CnF.2  
Err  
OUT.

The parameter group 2 passes the congruence test when:

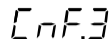
- 1) No one of the 5 outputs is configured as control output.
- 2) Only one of the 5 outputs is configured as main output ("ñAin").
- 3) Only one of the 5 outputs is configured as secondary output ("SECn").
- 4) If only one control output is configured, it should be the main control output ("ñAin").

When changing menu, the following actions are performed:

- 1) The "CnF.4 - Añ.UL" [C.G04] parameter will be forced to "buñ" if its value is less than zero and only one control output has been configured.
- 2) The "Gr.4 - IP" [R.D05] parameter will be forced to 50.0 if only one control output has been configured and its value is < 0.

## CONFIGURATION GROUP 3 [C.Fxx]

### CONTROL OUTPUT CONFIGURATION



CnF.3



C.Cn.

### C.F01 - Main control output conditioning

This parameter is available only when main control output is configured.

Upper display: CnF.3

Lower display: ñC.Cn

Range: norñ = The control output is as calculated by the PID.

CñPL = The control output is complemented (100-PID calculated value).

### C.F02 - Main control output in engineering unit

This parameter is available only when main control output is configured.

Upper display: CnF.3

Lower display: ñ.SCL

Range: nO = Scalable is not required

YES = Scalable is required

**NOTE:** This scaling allows you to display the output value in engineering units instead of in percent.

### **C.F03 - Main output decimal point position**

This parameter will be available only when "ñ.SCL" ("Main control output in engineering units" [C.F02]) is set to "YES".

Upper display: CnF.3

Lower display: ñC.dP

Range: ---. = No decimal figure  
--.- = One decimal figure  
-.- = Two decimal figures

### **C.F04 - Main control output initial scale value**

This parameter is available only when "ñ.SCL" ("Main control output in engineering units" [C.F02]) is set to "YES".

Upper display: CnF.3

Lower display: ñC.E.L

Range: from -199 to 999

### **C.F05 - Main control output full scale value**

This parameter is available only when "ñ.SCL" ("Main control output in engineering units" [C.F02]) is set to "YES".

Upper display: CnF.3

Lower display: ñC.E.H

Range: from -199 to 999

### **C.F06 - Main output auxiliary conditioning**

This parameter is available only when main control output is configured and "ñC.Cn" ("Main control output conditioning" [C.F01]) is different from "norñ".

Upper display: CnF.3

Lower display: ñC.A.C

Range: bEFr = The functions listed at Note (A) are calculated **before** to apply the action selected by "ñC.Cn" ("Main control output conditioning" [C.F01]) parameter.  
AFtr = The functions listed at Note (A) are calculated **after** to apply the action selected by "ñC.Cn" ("Main control output conditioning" [C.F01]) parameter.

### **Note (A)**

- "Main control output limiters" - for more details see [r.E02] and

[r.E03] parameters.

- "Main control output max rate of rise" (see [r.E04]).
- "Control output display value" - for more details see "Display function" paragraph at pag. 43 and [C.F02], [C.F03], [C.F04], [C.F05] parameters.
- The control output value displayed by bargraph.

### **C.F07 - Secondary control output conditioning**

This parameter is available only when secondary control output is configured.

Upper display: CnF.3

Lower display: SC.Cn

Range: norñ = The control output is as calculated by the PID.

CñPL = The control output is complemented (100-PID calculated value).

### **C.F08 -Secondary control output in engineering unit**

This parameter is available only when secondary control output is configured.

Upper display: CnF.3

Lower display: S.SCL

Range: nO = Scalable is not required

YES = Scalable is required

**NOTE:** This scaling allows to display the output value in engineering units instead of in percent.

### **C.F09 -Secondary control output decimal point position**

This parameter is available only when "S.SCL" ("Secondary control output in engineering units" [C.F08]) is set to "YES".

Upper display: CnF.3

Lower display: SC.dP

Range: ---. = No decimal figure

--.- = One decimal figure

-.-- = Two decimal figures

### **C.F10 -Secondary control output initial scale value**

This parameter will be available only when "S.SCL" ("Secondary control output in engineering units" [C.F08]) is set to "YES".

Upper display: CnF.3

Lower display: SC.E.L

Range: from -199 to 999

### **C.F11 -Secondary control output full scale value**

This parameter will be available only when "S.SCL" ("Secondary control output in engineering units" [C.F08]) is set to "YES".

Upper display: CnF.3

Lower display: SC.E.H

Range: From -199 to 999

### C.F12 -Secondary control output auxiliary conditioning

This parameter will be available only when secondary control output is configured and "SC.Cn" ("Secondary control output conditioning" [C.F07]) is different from "norñ".

Upper display: CnF.3

Lower display: SC.A.C

Range: bEFr = The functions listed at Note (B) are calculated **before** to apply the action selected by "SC.Cn" ("Secondary control output conditioning" [C.F07]) parameter.

AFtr = The functions listed at Note (B) are calculated **after** to apply the action selected by "SC.Cn" ("Secondary control output conditioning" [C.F07]) parameter.

#### Note (B)

- "Secondary control output limiters" - for more details see [r.E06] and [r.E07] parameters.
- "Secondary control output max rate of rise" (see [r.E08]).
- "Control output display value" - for more details see "Display function" paragraph at pag. 43 and [C.F08], [C.F09], [C.F10], [C.F11] parameters.
- The control output value displayed by bargraph.

### CONFIGURATION GROUP 4 [C.Gxx]

#### AUXILIARY CONTROL PARAMETER CONFIGURATION

CnF.4

ACCn

#### C.G01 - Smart function

This parameter is available only when at least one control output is configured

Upper display: CnF.4

Lower display: Sñ.Fn

Range: dIS = Smart function disabled

Enb = Smart function may be enabled

#### C.G02 - Control action type

This parameter will be available only when at least one control output is configured.

Upper display: CnF.4

Lower display: Cn.tP

Range: Pid = The process is controlled by PID actions

Pi = The process is controlled by PI actions

**NOTE:** if the control action type is changed, the control parameter values (P, I, D) are updated with values calculated by the last TUNE function (first part of SMART algorithm).

If these values are wrong, they are not updated and the E.120 error is displayed (for details see "Error messages" at pag. 83).

When run time is activated, it will be necessary to enable a new TUNE procedure.

### **C.G03 - Manual function**

This parameter will be available only when at least one control output is configured

Upper display: CnF.4

Lower display: ñAn.F

Range: dIS = Manual function disabled

Enb = Manual function may be enabled

### **C.G04 - Output value for AUTO to MAN transfer**

This parameter will be available only when at least one control output is configured and manual function is enabled ("ñAn.F" [C.G03] = "Enb")

Upper display: CnF.4

Lower display: Añ.UL

Range: - from 0.0 to 100.0 % of the output span if device is configured with one control output only

- from -100.0 to 100.0 % of the output span if device is configured with two control outputs.

Above the 100.0 % the display shows "buñ." meaning that the transfer from AUTO to MANUAL is bumpless (the instrument sets for MANUAL mode the same power output used in AUTO mode)

### **C.G05 - MANUAL to AUTO transfer type**

This parameter is available only when at least one control output is configured and manual function is enabled ("ñAn.F" [C.G03] = "Enb")

Upper display: CnF.4

Lower display: ñ.A.t.t

Range: buñ. = Bumpless balance transfer.

buñ.b = Bumpless balanceless transfer.

## NOTES:

- 1) During the manual to auto transfer, the instrument maintains the same power output as in manual mode.
- 2) Selecting the "buñ.b", the operative set point will be aligned to the measured value.
- 3) The "alignment" is not performed if measure is in error condition.
- 4) The selected local set point will be changed even if it is software protected.

Cnd.b = It starts in the same way it was left prior to power shut down (if in manual mode the power output will be equal to the last value prior to power shut down).

## C.G06 - Device status at start up

This parameter will be available only when at least one control output is configured and manual function is enabled ("ñAn.F" [C.G03] = "Enb").

Upper display: CnF.4

Lower display: St.Fn

Range: Auto = It starts always in auto mode

ñan = It starts always in manual mode with power output set to 0

Cnd.A = It starts in the same way it was left prior to power shut down (if in manual mode the power output is set to 0)

## CONFIGURATION GROUP 5 [C.Hxx]

### DIGITAL INPUT CONFIGURATION

CnF.5

In.0t

#### C.H01 - Digital input 1 function

Upper display: CnF.5

Lower display: d1.Fn

Range: nonE = Input contact not used

SP1.2 = Input contact used for SP /SP2 set point selection.

SP3.4 = Input contact used for SP3/SP4 set point selection.

Au.ñA = Input contact used for Auto/Manual selection (Manual when logic level is "1")

O.LIñ = Input contact used for output limiter activation (Output limited when logic level is "1").

ñ.rSt = Input contact used to reset (acknowledge) alarm (Reset when logic level is "1").

SP.L.r = Input contact used for Local/Remote set point selection (Remote when logic level is "1")

#### NOTE:

When one logic input is set to "SP.1.2" and no other logic input is set to "SP.3.4", the relation between the logic level and the selected set point is the following:

Logic level 0 = SP

Logic level 1 = SP2

When one logic input is set to "SP.1.2" and a second logic input is set to "SP.3.4", the relation between the logic levels and the selected set point is the following:

"SP.3.4" level	"SP.1.2" level	selected set point
0	0	SP
0	1	SP2
1	0	SP3
1	1	SP4

When one logic input is set to "SP.3.4" and no other logic input is set to "SP.1.2", the relation between the logic level and the selected set point is the following:

Logic level 0 = SP

Logic level 1 = SP3

### C.H02 - Digital input 1 contact status

This parameter is available only when "d1.Fn" [C.H01] is different from "nonE".

Upper display: CnF.5

Lower display: d1.St

Range: CLSd = The input is at logic level "1" when contact is closed.

OPEn = The input is at logic level "1" when contact is open.

### C.H03 - Digital Input 2 function

Upper display: CnF.5

Lower display: d2.Fn

Range: nonE = Input contact not used.

SP1.2 = Input contact used for SP /SP2 set point selection.

SP3.4 = Input contact used for SP3/SP4 set point selection.

Au.ñA = Input contact used for Auto/Manual selection (Manual when logic level is "1").

O.LIñ = Input contact used for output limiter activation (Output limited when logic level is "1").

ñ.rSt = Input contact used to reset (acknowledge) alarm (Reset when logic level is "1").

SP.L.r = Input contact used for Local/Remote set point selection (Remote when logic level is "1")

#### NOTE:

When one logic input is set to "SP.1.2" and no other logic input is set to "SP.3.4", the relation between the logic level and the selected set point is the following:

Logic level 0 = SP

Logic level 1 = SP2

When one logic input is set to "SP.1.2" and a second logic input is set to "SP.3.4", the relation between the logic levels and the selected set point is the following:

"SP.3.4" level	"SP.1.2" level	selected set point
0	0	SP
0	1	SP2
1	0	SP3
1	1	SP4

When one logic input is set to "SP.3.4" and no other logic input is set to "SP.1.2", the relation between the logic level and the selected set point is the following:

Logic level 0 = SP

Logic level 1 = SP3



#### **C.H04 - Digital input 2 contact status**

This parameter will be available only when "d2.Fn" [C.H03] is different from "nonE".

Upper display: CnF.5

Lower display: d2.St

Range: CLSd = The input is at logic level "1" when contact is closed.

OPEn = The input is at logic level "1" when contact is open.

#### **C.H05 - Digital input 3 contact status**

Used to carry out the Burn Off procedure.

See on page 50 for details.

Upper display: CnF.5

Lower display: d3.St

Range: CLSd = The input is at logic level "1" when contact is closed

OPEn = The input is at logic level "1" when contact is open

#### **General notes on configuration group 5**

- 1) Digital input function selection should be "consistent" with other configuration parameters otherwise this digital input will remain unused.
- 2) Changing menu the device will check that the same function is not assigned to more than one digital input, otherwise the display will show:  
Upper display: CnF.5  
Middle display: Err  
Lower display: d.InP

## CONFIGURATION GROUP 6 [C.Ixx] OTHERS CONFIGURATION PARAMETERS

CnF.6

DEv

### C.I01 - Green bargraph function

Upper display: CnF.6

Lower display: G.brG

Range: Pr.Ur = the green bargraph will show the process variable value.

DEV. = the green bargraph will show the deviation (process value minus set point).

### C.I02 - Orange bargraph function

Upper display: CnF.6

Lower display: O.brG

Range: OP.SP= The orange bargraph will show the operative set point value.

P.Out. = The orange bargraph will show the process output value.

### C.I03 - Bargraph initial scale value

This parameter is available when "G.brG" [C.I01] is equal to "Pr.Ur" and/or "O.brG" [C.I02] is equal to "OP.SP".

Upper display: CnF.6

Lower display: brG.L

Range: span limits of "CnF.1- PV.SL" [C.D02].

### C.I04 - Bargraph full scale value

This parameter is available when "G.brG" [C.I01] is equal to "Pr.Ur" and/or "O.brG" [C.I02] is equal to "OP.SP".

Upper display: CnF.6

Lower display: brG.H

Range: span limits of "CnF.1- PV.SL" [C.D02].

### C.I05 - Resolution of the deviation bargraph

This parameter is available when "G.brG" [C.I01] is equal to "DEV.".

Upper display: CnF.6

Lower display: brG.d

Range: 1-2-5-10-20 or 50 = Digits per segment

### C.I06 - Set point display type

Upper display: CnF.6

Lower display: SP.dS

Range: Fn.SP = When device is in normal display mode and it is performing a set point ramp, the middle display will show the final set point value.

OP.SP= When device is in normal display mode and it is performing a set point ramp, the middle display will show the operative set point value.

### C.I07 - Burn Off and Purge activation threshold

Upper display: CnF.6

Lower display: t.t.Ac

Range: the instrument will start the Burn Off and the Purge procedure according with the following selection:

No = without testing the temperature limit (1000 °F)

YES= if the temperature test is satisfy.

Available: When mV is selected as primary control variable.

### C.I08 - Time out selection

Upper display: CnF.6

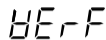
Lower display: t.out

Range: tñ.10 = 10 s time out

tñ.30 = 30 s time out

## CONFIGURATION GROUP [C.Lxx]

INPUT/OUTPUT TEST



This group is displayed only when configuration modify mode is enabled.

This group allows you to verify the correct working of:

- the relay outputs (OUT 1 up to OUT5),
- digital inputs (diG.1 up to diG.3),
- the inputs from In1 up to In8 and the relays of the outputs from OUT10 up to OUT19, if the optional I/O card is fitted.

When an output is in "On" status, the related LED will light up (for OUT 5 is used the "ST" LED)

### C.L01 OUT 1 status

Upper display: VErF

Lower display: OU.1

Range: On = Output enabled (relay energized)

OFF = Output disabled (relay deenergized)

**NOTE:** By pushing the ▲ or ▼ key it is possible to change the output state. The setting above described is the same for the remaining outputs.

### **C.L02 OUT 10 status**

This parameter is available only if the optional card is fitted.

Upper display: VErF

Lower display: OU.10

Range: On = Output enabled (relay energized)

OFF = Output disabled (relay deenergized)

**NOTE:** By pushing the ▲ or ▼ key it is possible to change the output state. The setting above described is the same for the remaining outputs.

### **C.L03 Digital Input dIG.1 status**

Upper display: VErF

Lower display: dIG.1

Range: Open = Input open

CLSd = Input closed

**NOTE:**The setting above described is the same for the remaining inputs.

### **C.L04 Digital input In.1 status**

This parameter is available only if the optional card is fitted.

Upper display: VErF

Lower display: In.1

Range: Open = Input open

CLSd = Input closed

**NOTE:**The setting above described is the same for the remaining inputs.

### **General note for configuration group "VErF"**

Returning in the "run time mode", the instrument restarts to control the process, the settings performed into this group do not affect the working settings.

## CONFIGURATION GROUP END [C.Mxx]

END CONFIGURATION

This group is displayed only when configuration modify mode is enabled.

Upper display: ConF

Lower display: End

Range: nO = with this selection the instrument comes back to the first display of the configuration modify mode.

YES = this selection ends the configuration modify mode; the instrument performs an automatic reset and restarts in the run time mode.

Pushing "▲" or "▼" push-button select the desired action and then push "MENU" push-button.

## RUN TIME MODE

If V101 is correctly set (see "Operative mode and hardware lock" at page 16), and the configuration mode has been terminated, the instrument will be in run time mode and in "normal display mode" (see below).

During run time mode the instrument performs the loop control and manages all the instrument functions (SMART, ALARMS, etc.).

## DISPLAY FUNCTION

When device is powered and it is operating in automatic mode, the upper display shows the process variable, the middle display shows the set point value (final or operative according to "SP.dS" [C.I06] parameter setting).

We define the above condition as "normal display mode".

The lower display will show:

a) the control output value.

### NOTES:

- 1) If the instrument is configured with one control output (linear or time proportional), the control output value is displayed in the 0 to 100% range.

2)if the device is configured with two control outputs; the value of the MAIN output is shown on the two most significant digits, while the value of the SECONDARY output is shown on the two less significant digits.

The decimal point between the two values will be flashing.

The graphic symbol " □ □ " shows that the specific control output is > 100%.

b) Pushing the FUNC push-button; it is possible to display the sensor output in mV, the "mV" LED lights up.

**NOTE:** this selection is available:

- if "mV" is not selected as controlled variable,
- even if a measure error is shown on the upper display,
- even if Burnoff or Probe test procedure are in progress.

c) Pushing FUNC push-button again, it is possible to display the sensor temperature, the "TP" LED lights up.

d)Pushing FUNC push-button again, it is possible to display the Dew point value, the "DP" LED lights up.

**NOTE:** this selection is available:

- if Dew point or O2 are not selected as controlled variable,
- even if a measure error is shown on the upper display,
- even if Burnoff or Probe test procedure are in progress.

e) Pushing FUNC push-button again, it is possible to display the Carbon potential, the "CP" LED lights up.

**NOTE:** this selection is available:

- if Carbon potential or O2 are not selected as controlled variable,
- even if a measure error is shown on the upper display,
- even if a Burnoff or Probe test procedure is in progress.

f)Pushing FUNC push-button again, it is possible to display the Carbon monoxide factor value, the "COF" LED lights up.

g) Pushing FUNC push-button again, it is possible to display the Hydrogen factor value, the "H2F" LED lights up.

h) Pushing FUNC push-button again, it is possible to display the Probe resistance value, the "KΩ" LED lights up (the graphic symbol "□ □ □ □" shows that the Probe resistance value is greater than 99.99 KΩ).

i) Pushing FUNC push-button again, it is possible to display the Probe response time, the "SEC" LED lights up.

l) Pushing FUNC push-button again, it is possible to display the Probe temperature at last probe test, the "LT" LED lights up.

m)Pushing FUNC push-button again, it is possible to display the Carbon monoxide value, the display will show "CO." followed by the value measured on the auxiliary input (the graphic symbol "□ □" shows that its value is more than 99).

## NOTES:

- 1) The CO. value will be set to 20 if the auxiliary input is out of range.
  - 2) This indication is available only if the auxiliary input is configured as CO input.
- n) Pushing FUNC push-button again, the display will show "ñ.", followed by the MAIN control output value with a range scaled as configured by "CnF.3 - ñ.C.EL" [C.F04] and "CnF.3 - ñ.C.EH" [C.F05] parameters.

**NOTE:** this selection is available only if a scaled MAIN output is selected.

- o) Pushing FUNC push-button again, the display will show "S.", followed by the SECONDARY control output value with a range scaled as configured by "CnF.3 - S.C.EL" [C.F10] and "CnF.3 - S.C.EH" [C.F11] parameters.

**NOTE:** this selection is available only if two outputs are set and a scaled SECONDARY control output is configured.

Pushing FUNC push-button again, the control output value is displayed.

All the visualization types described (exception made for "mV" and "TP") are bound by time out (see "t.out" [C.I08] parameter), at the end of the time out the display will return to show the control output value.

## NOTES:

- 1) The previous information will be displayed only if the relative function has previously been configured.
- 2) After parameter modification or monitoring, the instrument comes back to the "normal display mode" with, on the lower display, the indication previously selected.

## INDICATORS

Two green LEDs located on the left of the middle display;

CP Lit when the carbon potential is the controlled variable.

DP Lit when the dew point is the controlled variable.

Two red LEDs located on the left of the lower display;

mV Lit when the sensor output (in mV) is the controlled variable.

MAN Lit when device is in manual mode.

Fourteen red LEDs located down the lower display;

DP Lit when the dew point value is shown on the lower display.

mV Lit when the sensor output (in mV) is shown on the lower display.

TP Lit when the sensor temperature is shown on the lower display.

KΩ Lit when the probe resistance value is shown on the lower display available if O2 is not selected as primary control variable.

CP Lit when the carbon potential value is shown on the lower display.

SEC Lit when the sensor response time is shown on the lower display available if O2 is not selected as primary control variable.

COF Lit when the carbon monoxide factor value is shown on the lower display available if O2 is not selected as primary control variable.

H2F Lit when hydrogen factor value is shown on the lower display available if O2 is not selected as primary control variable.

LT Lit when the probe temperature of the last probe test is shown on the lower display available if O2 is not selected as primary control variable.

1 Lit when:  
- OUT 1 is used as control output and it is in ON condition;  
- alarm 1 is in alarm state and acknowledged.  
Flashes when alarm 1 is in alarm state and it is not acknowledged.

2 Lit when:  
- OUT 2 is used as control output and it is in ON condition;  
- alarm 2 is in alarm state and acknowledged.  
Flashes when alarm 2 is in alarm state and it is not acknowledged.

3 Lit when:  
- OUT 3 is used as control output and it is in ON condition;  
- alarm 3 is in alarm state and acknowledged.  
Flashes when alarm 3 is in alarm state and it is not acknowledged.

ST Flashes when the first step of SMART algorithm is activated.  
Lit when the second step of SMART algorithm is activated.

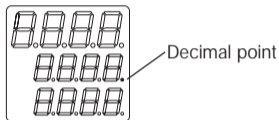
RM Lit when the device is controlled by serial link.



**NOTE:** an additional indication is available, the decimal point shown below is:

- flashing when the set point is controlled by the serial link;
- steady lit when the auxiliary set point (SP2 or SP3 or SP4 or remote set point (RSP)) is used.

This indication will be turned off during monitor and modify parameter procedures.



### Optional input/output indicators

For optional inputs the LED's In1 to In4 are lit when the contact of the related input is closed.

No indication is available for inputs In5 to In8.

For optional outputs the LED's from OUT10 to OUT19 are lit when the related relay is energized.

### BARGRAPH DESCRIPTION

This device includes two 33 LED's bargraphs indicators.

On the right bargraph, with orange LED's, it is possible to show:

- the operative set point scaled as configured by "brG.L" [C.I03] and "brG.H" [C.I04]; the "SP" LED, located on the base of the bargraph, is lighted.

If the operative set point is out of the range scaled, the first or the last LED's will flash.

- the power output value; the "%" LED, located on the top of the bargraph, is lighted.

When the device has two process outputs, the central LED (which is a two-colored LED) becomes green.

It divides the bargraph into two parts: the MAIN process output is shown on the upper part while the SECONDARY process output is shown on the lower part.

On the left bargraph, with green LED's, it is possible to show:

- the process variable scaled as configured by "brG.L" [C.I03] and "brG.H" [C.I04]; the "PV" LED, located on the base of the bargraph, is lighted.
- The deviation error (PV - SP) with resolution configured at "brG.d" [C.I05]; the "DEV" LED, located on the top of the bargraph, is lighted.

When the deviation error indication is selected, the central LED (which is a two-colored LED) becomes orange.

It divides the bargraph in two parts: the positive error is shown on the upper part while the negative error is shown on the lower part.

If the process variable or the deviation error are out of the range, the first or the last LED's will flash.

**NOTE:** The upper or lower bargraph LED's will flash if the displayed value is respectively higher or lower than the range scaled for the specific bargraph visualization.

### **DIRECT ACCESS TO THE SET POINT**

When the device is in AUTO mode and in "Normal Display Mode", it is possible to access directly to the selected set point modification (SP, SP2, SP3 or SP4).

Pushing ▲ or ▼ for more than 2 s, the set point will begin changing.

The new set point value becomes operative when the instrument returns in "Normal Display Mode" (at the end of 2 s time out).

The direct access to the set point is disabled if the run time group 1 is software protected or RSP is selected.

### **MANUAL FUNCTION**

The MANUAL mode function can be accessed (only if configured) by depressing the MAN push-button for more than 1 sec or by acting on a logic input configured as "Au.nA" (auto/manual selection).

The command from keyboard is accepted and executed only if the instrument is in "Normal Display Mode" while the command from logic input is always accepted.

When in MANUAL mode the LED's MAN lights up while the middle display shows "ñ." followed by the main output values (from 0.0 to 99.9%) and the lower display shows "S." followed by the secondary output value (from 0.0 to 99.9%).

**NOTE:** the graphic symbol "□ □ □" shows that the related control output value is > 100.0%.

The control output value can be modified by using "▲" and "▼" keys.

To come back to the AUTO mode, depress "MAN" push-button for more than 1 sec. or toggle the logic input.

The transfer from AUTO to MANUAL is bumpless (this function is not provided if an output value has been selected at configuration parameter "Añ.UL" [C.G04]).

The transfer from MANUAL to AUTO is bumpless or bumpless balanceless (the bumpless feature is not provided if integral action is excluded).

If transfer from AUTO to MANUAL is performed during the first part of SMART algorithm (TUNE) the SMART will be aborted and when returning to AUTO, it will be necessary to start the SMART algorithm again.

If transfer from AUTO to MANUAL is performed during the second part of SMART algorithm (ADAPTIVE), when returning to AUTO, the instrument will automatically restore the ADAPTIVE algorithm.

At power up the device starts as configured at "St.Fn" [C.G06] configuration parameter.

#### NOTES:

- 1) When auto/manual control mode is selected by logic input, at power up the instrument will start in accordance with the logic input status.
- 2) If the logic input status requires the manual mode, the instrument will verify the "St.Fn" [C.G06] parameter setting and if "St.Fn" [C.G06] is equal to "Auto", "nan" or "Cnd.A" the power output will be set to zero otherwise the power output will be set equal to the last value (in manual mode) prior to power shut down.

#### SPECIAL OUTPUT FEATURES

The control action is deactivated (control outputs forced to zero) and alarms are forced in non alarm condition when:

- a) The set point is set to minimum value,
  - 0.00 when the controlled variable is Carbon Potential;
  - 0 when the controlled variable is mV;
  - 100 °F (-75 °C) when the controlled variable is Dew Point.
- b) The probe output is lower than 900 mV or greater than 1300 mV and the controlled variable is Carbon Potential or Dew Point.
- c) The probe temperature is lower than 900 °F (482 °C) or greater than 2100 °F (1149 °C) and the controlled variable is Carbon Potential or Dew Point.

**NOTE:** when condition b) or c) occurs (independently from the primary variable selected); the Carbon Potential is forced to 0.00 and the Dew Point is forced to 250 °F (121 °C).

## BURN OFF PROCEDURE

(Available only if "O2" is not selected as primary control variable)

The Burn off function allows to remove the carbon or soot deposit inside the probe. It is carried out by putting air into the probe; the oxygen present in the air will burn the carbon deposit. The Purge function is used to evacuate the not combusted air present in the probe after the Burn off (for details see the probe instruction manual).

The Burn off procedure may be carried out:

- manually (by pressing TST + MAN keys), or
- by external contact (Dig.3), or
- by serial link, or
- automatically, after a period (set by the "bF.tr" [R.H03] parameter) started from the end of the previous Burn off procedure.

The Burn off procedure cannot be carried out if:

- 1) The first part of the SMART algorithm (TUNE) is in progress.
- 2) Five minutes are not elapsed from instrument power on or from the end of another procedure (Burn off or Probe test).
- 3) The probe temperature is less than 1000 °F (538 °C) or in error condition.

**Note:** the temperature value will not be taken into account if mV is the selected controlled variable and "t.t.Ac" parameter [C.I07] is equal to "nO".

## NOTES:

- a) If one or more conditions previously described still exist the automatic Burn off will be frozen, the state of these conditions are checked by the instrument every minute. During this time, the instrument operates as previously set before the Burn off request. When the checking will be successful, these conditions no longer exist and the automatic Burn off will be immediately performed. The timer programmed to perform the next Burn off will start only at the end of the previous Burn off.
- b) If the procedure is requested by keys and it cannot be started, the following information is displayed for 2 seconds:  
Upper display: burn  
Middle display: inh  
Lower display: Number of the first not complied condition (1, 2 or 3 previously described).  
Once these conditions no longer exist, repeat manually the Burn off starting command.

During the Burn off procedure, the upper display shows "burn" or "PurG", while the middle display shows the remaining time to end the related procedure.

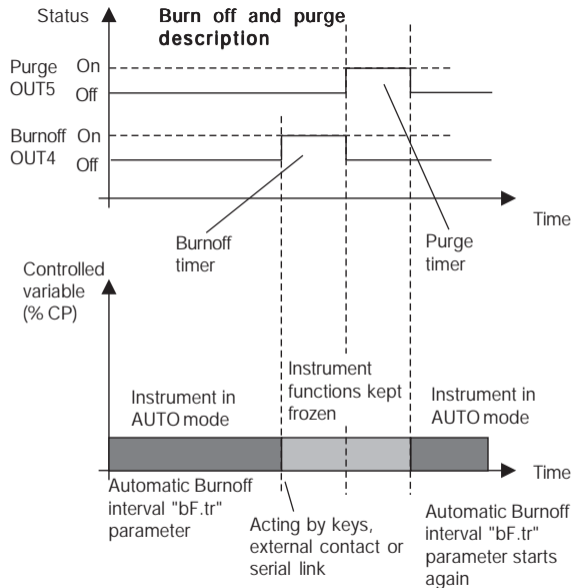
The lower display shows the probe value in mV, the information shown on this display may be changed as described in the "Display function" paragraph (see pag. 43).

The Burn off sequence is the following:

- The Burn off output (OUT 4) will be turned ON for a programmable period (by "Gr. 8 - "t.bOF" [R.H01] parameter).
- At the end of this period, OUT 4 will be turned OFF and the Purge output (OUT 5) will be turned ON for a programmable period (by "Gr. 8 - "t.PrG" [R.H02] parameter).
- At the end of this period, OUT 5 will be turned OFF, the procedure is completed and the normal control is resumed.

**NOTES:**

- During the Burnoff and Purge procedures the control output, the Adaptive algorithm and alarm status are frozen.
- During the Burnoff and Purge procedures the input span 0 to 1500mV will be enabled, independently of the primary controlled variable selected.
- If a power down occurs, the current Burn off status and timings will be lost (if automatic burn off was set, the timer will start again from the value set by the "bF.tr" [R.H03] parameter).



## PROBE TEST PROCEDURE

(Available only if "O2" is not selected as primary control variable)

The Probe test may be carried out:

- manually (by pressing TST + FUNC keys), or
- from serial link, or
- automatically, after a period (set by the "Pb.tr" [R.H04] parameter) started from the end of the previous Probe test.

The Probe test cannot be carried out if:

- 1) the first part of the SMART algorithm (TUNE) is in progress;
- 2) five minutes are not elapsed from instrument power on or from the end of another procedure (Burn off, Purge or Probe test);
- 3) The probe temperature is less than 1000 °F (538 °C) or in error condition.

**Note:** the temperature value will not be taken into account if mV is the selected controlled variable and "t.t.Ac" parameter [C.I07] is equal to "nO".

- 4) the probe output is less than 1000 mV;
- 5) the probe output is unstable (drift more than 10 mV/minute).

If one or more conditions previously described still exist the automatic Probe test will be frozen, the state of these conditions are checked by the instrument every minute.

During this time, the instrument operates as previously set before the Burn off request.

When the checking will be successful, these conditions no longer exist and the automatic Probe test will be immediately performed.

The timer programmed to perform the next Probe test will start only at the end of the previous Probe test.

If the Probe test is requested by keys and it cannot be started, the following information is displayed for 2 seconds:

Upper display: Prob

Middle display: inh

Lower display: Number of the first not complied condition (1 up to 5 previously described).

During the Probe test, the instrument will operate as follows:

- 1) it shows
  - on the upper display: Prob
  - on the middle display: tESt
- 2) It connects a 47.5 K $\Omega$  shunt across the probe terminals and waits for 15 seconds in order to stabilize the measure.
- 3) It calculates the probe resistance Rp by applying the following formula:

$$R_p \text{ (in K}\Omega\text{)} = (E_c/E_s - 1) \cdot 47.5$$

where:

$E_c$  is the sensor output (in mV) measured before the shunt connection.

Es is the sensor output (in mV) measured after the shunt connection.

- 4) It removes the 47.5 K $\Omega$  shunt resistor.
- 5) It displays the calculated value on the lower display and stores it in a memory location for later recall.

### **Probe response time**

The probe response time is the time which takes the mV measured value (after the shunt is removed) to return to the original value before the shunt connection (+ 4 mV).

The probe response time is stored in a memory location for later recall.

If the probe response time is greater than 60 seconds, the probe response time calculation will be aborted.

### **NOTES:**

- a) During the Probe test, the control output, the Adaptive algorithm and alarm status are frozen.  
All functions will be automatically restored at the end of this procedure.
- b) If a power down occurs, the current probe test status and timings will be lost (if automatic probe test was set, the timer will start again from the value set by the "Pb.tr" [R.H04] parameter).

### **SERIAL LINK**

The device can be connected to a host computer by a serial link.

The host can put the device in LOCAL (functions and parameters are controlled via keyboard) or in REMOTE (functions and parameters are controlled via serial link).

The REMOTE status is signalled by the RM LED.

This instrument allows you to modify the operative and configuration parameters, via serial link.

The necessary conditions to implement this function are the following:

- 1) the serial parameters (see Run time group 7) should be properly configured.
- 2) the device must be in the run time mode.
- 3) when it is desired to modify configuration parameter, the dip switch V101.3 should be set to "OFF" (configuration parameter enabled).

During configuration parameter downloading the device goes in open loop with all output in OFF state.

At the end of configuration procedure, the device performs an automatic reset and then returns to close loop control.

## LAMP TEST

When it is desired to verify the display efficiency, put the instrument in "normal display mode" and push ▼ + MENU push-buttons for more than 5 s.

The instrument will turn ON, with a 50 % duty cycle, all the LEDs of the display (we define this function "LAMP TEST").

No time out is applied to the LAMP TEST.

When it is desired to revert to the normal display mode, push any push-button.

During the LAMP TEST the instrument continues to control the process.

## SMART FUNCTION

It is used to automatically optimize the control action.

To enable the SMART function proceed as follows:

- 1) push the MENU push-button until "Gr. 2" run time parameter group is shown.
- 2) push the FUNC push-button until "Sñrt" parameter is shown.
- 3) push ▲ or ▼ and set the "On" indication on the middle display.
- 4) push the FUNC push-button.

The ST LED is flashing during the first part of SMART algorithm (TUNE), while is steady lit during the second one (ADAPTIVE).

When the smart function is enabled, it is possible to display but not to modify the control parameters.

To disable the SMART function proceed as follows:

- 1) push the MENU push-button until "Gr. 2" run time parameter group is shown.
- 2) push the FUNC push-button until "Sñrt" parameter is shown.
- 3) push ▲ or ▼ and set the "OFF" indication on the middle display.
- 4) push the FUNC push-button.

The ST LED will turn off.

The instrument maintains the current set of control parameters and it enables parameter modification.

If a power down occurs and the instrument was performing the first part of SMART algorithm (TUNE), at the next power up, all



data regarding the TUNE will be lost, so it will be necessary to re-start the SMART function.

If a power down occurs during the second part of SMART algorithm (ADAPTIVE), at the next power up, the instrument restarts the ADAPTIVE function.

### **CONTROL ACTION FEATURE**

The control action is de-activated (control output forced to 0) and alarms forced in no alarm condition when:

- a) The setpoint is set at minimum value (0.00 for CP/0 for mV/-100°F (-75°C) for Dew Point/0.0 for O2)
- b) The remote set point( if selected) is out of range and "A.I.Añ = norñ."
- c) The probe output is lower than 900 mV or greater than 1300 mV and "Carbon potential or "Dew Point" are configured as primary control variable.

When "O2" is configured as primary control variable the probe mV limits are -15 / 200 mV

- d) The probe temperature is lower than 900 °F (482 °C) or greater than 2100 °F (1149 °C) and "Carbon potential or Dew Point" are configured as primary control variable.

When "O2" is configured as primary control variable the temperature limits are 1200 /2900 °F (650/1590 °C)

**Note:** When conditions c) or d) occur (independently from primary control variable selection), the Carbon potential, Dew Point and O2 are not calculated but forced respectively to 0.00 ,250 °F (121 °C) or 0.0

## COF AND H2F ADJUSTMENT DIAGRAM

Others gas present in the atmosphere can affect the carbon potential or the dew point measurement.

By this chart it is possible to get the COF or H2F factors able to correct the variation above described.

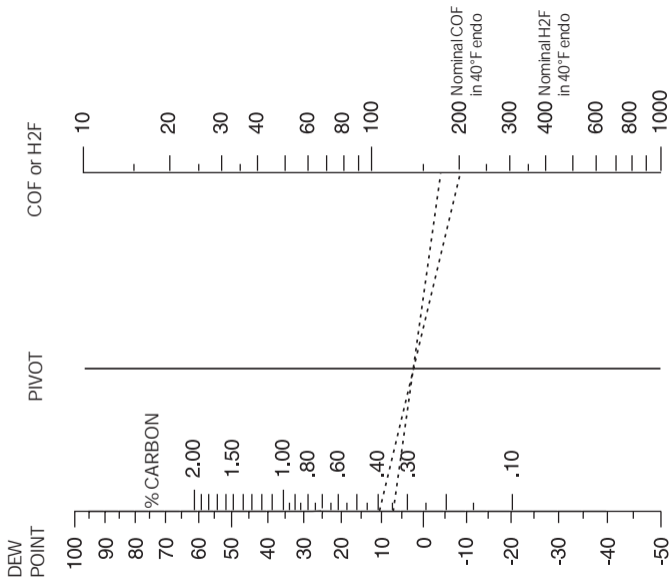
If, for example, the instrument measures 0.4% of carbon with a COF of 200 and the shim stock analysis shows an actual carbon value of 0.35%,

draw a line between 0.4% and 200 and mark the intersection on the pivot line.

Connect 0.35 of % Carbon with that intersection and extend it till the COF scale (the new COF value will be approximately 175).

Correct the COF [R.A05] parameter with the new value.

**NOTE:** COF is equal to  $10 \cdot \%CO$  and H2F is  $10 \cdot \%H2$ .



## PARAMETER PROTECTION

Moving from one run time parameter group to another, the instrument will show, first, the group number (on the upper display), the mnemonic code (on the lower display) and the security status (on the middle display) of the group.

The possible security status are:

Enb = the parameters of this group are not protected and they may be modified;

inh = the parameters of this group are always protected and they cannot be modified;

- - - = the parameters of this group are software protected. In this case, by using "▲" and "▼" push-button, set a value equal to the security code programmed during the "Run time security code " (see page 18) and then push "FUNC".

If the programmed value matches the security code, the parameters of this group can be modified otherwise they will remain protected.

**CAUTION:** A software key protects one or more run time parameter groups so that when the software key is set, it is possible to modify the run time parameters of all groups. The software protection will be automatically restored when the instrument reverts to the "normal display mode" (by "MENU" push-button pressure or by the time out).

## RUN TIME PARAMETER MODIFICATION

By "MENU" push-button it is possible to start the run time parameter modification by selecting desired run time parameter group.

During the run time parameter modification, the upper display shows the selected parameter group, the lower display shows the mnemonic code of the selected parameter while the middle display shows the value or status assigned to the selected parameter.

The parameter monitoring and modification are bound by time out (see "t.out" [C.108] parameter), after that, the display returns in "Normal display mode" and the modification (if carried out) of the last displayed parameter will be lost.

### NOTES:

- 1) In the following pages we will describe all the parameter of the instrument but it will show only the parameters related with the specific hardware and in accordance with the specific instrument configuration.
- 2) If all the parameters of a group are not available, the entire group will not be displayed.

- 3) For an easy consultation of this manual, a sheet named "Reference parameter guide" with all the parameter visualizations is enclosed.  
The groups of run time parameters are identified by the "R" letter followed by A, B etc.  
The "code" formed by the group and the row (i.e. R.A01 where "R.A" is run time group1 and "01" is the row 1) is reported, in the user manual, before each parameter description and allows you to quickly find out the respective parameter.

### **Run time group 1 [R.Axx]**

Set point and factor values

```
Gr. 1  
----  
SPn
```

#### **R.A01 - Main set point**

Upper display: Gr.1

Lower display: SP

Range: from "rL" [R.E10] to "rH" [R.E11].

#### **R.A02 - Set point 2**

This parameter is available only when one of the logic inputs is configured for SP/SP2 selection

Upper display: Gr.1

Lower display: SP2

Range: from "rL" [R.E10] to "rH" [R.E11].

### **R.A03 - Set point 3**

This parameter is available only when one of the logic inputs is configured for SP3/SP4 selection.

Upper display: Gr.1

Lower display: SP3

Range: from "rL" [R.E10] to "rH" [R.E11].

### **R.A04 - Set point 4**

This parameter is available only when one of the logic inputs is configured for SP/SP2 selection and the other for SP3/SP4 selection.

Upper display: Gr.1

Lower display: SP4

Range: from "rL" [R.E10] to "rH" [R.E11].

### **R.A05 - Carbon monoxide factor setting**

Upper display: Gr.1

Lower display: COF

Range: from 1 to 1000

When a primary variable different from "O2" is selected.

#### **NOTES:**

1) COF is the keyboard selectable correction factor applied to the Carbon algorithm.

It is used to bring carbon potential as calculated by the

instrument into alignment with actual carbon potential as determined by shim stock analysis.

The default value of 200 corresponds to carbon potentials for plain carbon steel in an atmosphere containing 20% carbonmonoxide (CO). (See COF and H2F adjustment diagram at pag. 56).

2) Changing the A.In.F [C.D07] parameter from "nonE" to "CO"; this parameter is forced to 200.

### **R.A06 - Hydrogen factor setting**

Upper display: Gr.1

Lower display: H2F

Range: from 1 to 1000.

When a primary variable different from "O2" is selected.

#### **NOTE:**

H2F is the keyboard selectable correction factor applied to the dew point algorithm.

It is used to bring dew point as calculated by the instrument into alignment with actual dew point as determined by a direct dew point measuring instrument.

The default value of 400, corresponds to endothermic gas containing 40% Hydrogen (H<sub>2</sub>).

(See COF and H2F adjustment diagram at pag. 56).

### R.A07 - Group 1 default data loading.

Upper display: Gr.1

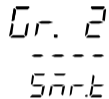
Lower display: dFLt.

Range: OFF = No loading data

ON = Loading data

### Run time group 2 [R.Bxx]

SMART ENABLE/DISABLE



Gr. 2  
----  
Sñrt

### R.B01 - SMART

This parameter is available when at least one control output is configured and SMART function is enabled ("Sñ.Fn" [C.G01]= "Enb")

Upper display: Gr.2

Lower display: Sñrt

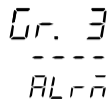
Range: OFF = SMART algorithm is deactivated

ON = SMART algorithm is activated

Set On or OFF to activate/deactivate the SMART algorithm.

### Run time group 3 [R.Cxx]

ALARM THRESHOLD AND HYSTERESIS VALUE



Gr. 3  
----  
ALrñ

### R.C01 - Manual reset of the alarms

Upper display: Gr.3

Lower display: ñ.rSt

Range: ON/OFF

Change to ON and then depress "FUNC" key to reset/acknowledge the alarm condition.

#### NOTES:

- 1) The reset/acknowledge function is always enabled but it is possible to protect it by security code.
- 2) When one of the logic input is configured as alarm reset, both actions (of "ñ.rSt" parameter and of the logic input) are active.

### R.C02 - Alarm 1 threshold

This parameter is available when alarm 1 is configured as process or deviation output alarm ("A1.tP" [RF.01] = "Proc" or "dEV")

Upper display: Gr.3

Lower display: AL1

Range: - in engineering units within the span limits for process alarm;  
- from -1000 to 1000 digits for deviation alarm;

**NOTE:** The span limits are related to the controlled variable set by the "PVSL" [C.D02] parameter.

### R.C03 - Low threshold used when the alarm 1 is a band alarm.

This parameter is available only when the alarm 1 is configured as band alarm ("A1.tP" [RF.01] = "bAnd")

Upper display: Gr.3

Lower display: bA1.L

Range: from 0 to -1000 digits.

### R.C04 - high threshold used when the alarm 1 is a band alarm.

This parameter is available only when the alarm 1 is configured as band alarm ("A1.tP" [RF.01] = "bAnd")

Upper display: Gr.3

Lower display: bA1.h

Range: from 0 to 1000 digits.

**NOTE:** The "bA1.L" and "bA1.h" values are algebraically added to the operative set point in order to obtain the band limits.

### R.C05 - Alarm 2 threshold

This parameter is available when alarm 2 is configured as process or deviation output alarm ("A2.tP" [RF.05] = "Proc" or "dEV").

Upper display: Gr.3

Lower display: AL2

Range: - in engineering units within the span limits for process alarm;  
- from -1000 to 1000 digits for deviation alarm;

**NOTE:** The span limits are related to the controlled variable set by the "PVSL" [C.D02] parameter.

**R.C06 - Low threshold used when the alarm 2 is a band alarm.**

This parameter is available only when the alarm 2 is configured as band alarm ("A2.tP" [RF.05] = "bAnd")

Upper display: Gr.3

Lower display: bA2.L

Range: from 0 to -1000 digits.

**R.C07 - high threshold used when the alarm 2 is a band alarm.**

This parameter is available only when the alarm 2 is configured as band alarm ("A2.tP" [RF.05] = "bAnd")

Upper display: Gr.3

Lower display: bA2.h

Range: from 0 to 1000 digits.

**NOTE:** The "bA2.L" and "bA2.h" values are algebraically added to the operative set point in order to obtain the band limits.

**R.C08 - Alarm 3 threshold**

This parameter is available when alarm 3 is configured as process or deviation output alarm ("A3.tP" [RF.09] = "Proc" or "dEV").

Upper display: Gr.3

Lower display: AL3

Range: - in engineering units within the span limits for process alarm;

- from -1000 to 1000 digits for deviation alarm;

**NOTE:** The span limits are related to the controlled variable set by the "PVSL" [C.D02] parameter.

**R.C09 - Low threshold used when the alarm 3 is a band alarm.**

This parameter is available only when the alarm 3 is configured as band alarm ("A3.tP" [RF.09] = "bAnd")

Upper display: Gr.3

Lower display: bA3.L

Range: from 0 to -1000 digits.



**R.C10 - High threshold used when the alarm 3 is a band alarm.**

This parameter is available only when the alarm 3 is configured as band alarm ("A3.tP" [RF.09] = "bAnd")

Upper display: Gr.3

Lower display: bA3.h

Range: from 0 to 1000 digits.

**NOTE:** The "bA3.L" and "bA3.h" values are algebraically added to the operative set point in order to obtain the band limits.

**R.C11 - Alarm 1 hysteresis**

This parameter is available only when Out 1 is configured as alarm output ("O1.Fn" [C.E01] = "ALr.1")

Upper display: Gr.3

Lower display: HSA1

Range: from 1 to 200 digits

**R.C12 - Alarm 2 hysteresis**

This parameter is available only when Out 2 is configured as alarm output ("O2.Fn" [C.E02] = "ALr.2")

Upper display: Gr.3

Lower display: HSA2

Range: from 1 to 200 digits

**R.C13 - Alarm 3 hysteresis**

This parameter is available only when Out 3 is configured as alarm output ("O3.Fn" [C.E03] = "ALr.3")

Upper display: Gr.3

Lower display: HSA3

Range: from 1 to 200 digits

**R.C14 - Group 3 default data loading**

Upper display: Gr.3

Lower display: dFLt.

Range: OFF = No loading data

ON = Loading data

## Run time group 4 [R.Dxx]

### CONTROL PARAMETERS

Gr. 4  
-----  
Enter

**NOTE:** when SMART function is activated, all the parameters calculated by SMART (Pb, Ti, Td and RCG) cannot be modified.

### R.D01 - Proportional band

This parameter is available when at least one control output is configured.

Upper display: Gr.4

Lower display: Pb

Range: from 0.5% to 999.0% of the input span.

Set 0.0% for On/OFF control action

### NOTES:

- 1) The Pb resolution is:  
0.1% up to 10.0%;  
1% from 10% up to 999.0%.
- 2) When the instrument is working with SMART algorithm, the "Pb" value will be limited as selected by "Pb.Hi" [R.M02] and "Pb.Lo" [R.M01] parameters (if the value is out of limits, the "E.140" indication will be shown on the middle display, for details see "Error messages" at page 83)

### R.D02 - Hysteresis (for ON/OFF control)

This parameter is available when Pb [r.d01]=0 (On/OFF control action)

Upper display: Gr.4

Lower display: HYS

Range: from 0.1% to 10.0% of the input span.

### R.D03 - Integral time

This parameter is available when at least one control output is configured and Pb [R.D01] is different from 0.

Upper display: Gr.4

Lower display: ti

Range: from 00.01 to 20.00 mm.ss

Above this value the display blanks and the integral action is excluded

**NOTE:** When the instrument is working with SMART algorithm the "ti" value will be limited as selected by "ti.Hi" [R.M04] and "ti.Lo" [R.M03] parameters (if the value is out of limits, the "E.140" indication will be shown on the middle display, for details see "Error messages at pag. 83).

#### **R.D04 - Derivative time**

This parameter is available when at least one control output is configured, "Cn.tP" [C.G02] is equal to "Pid" and "Pb" [R.D01] is different from 0.

Upper display: Gr.4

Lower display: td

Range: From 00.00 to 10.00 mm.ss

#### **NOTE:**

When device is working with SMART algorithm and "Cn.tP" [C.G02] is equal to "Pid", the "td" value will be proportional to the "ti" value with a ratio established during the "TUNE" function.

#### **R.D05 - Integral preload**

This parameter is available when at least one control output is configured and "Pb" [R.D01] is different from 0.

Upper display: Gr.4

Lower display: IP

Ranges:

- from 0.0 to 100.0 % of the output when device is configured with only one control output.
- from -100.0 to 100.0 % of the output when device is configured with two control outputs.

#### **R.D06 - Relative secondary output gain**

This parameter is available when two control outputs are configured.

Upper display: Gr.4

Lower display: r.Gn

Range: from 0.20 to 2.00

#### **R.D07 - Overlap/dead band between main and secondary outputs**

This parameter is available when two control outputs are configured.

Upper display: Gr.4

Lower display: OLAP

Range: from -20 to 50

**NOTE:** A negative value means a dead band while a positive value means an overlap.

### R.D08 - Group 4 default data loading.

This parameter is not available when SMART function is activated (parameters related to SMART function cannot be modified).

Upper display: Gr.4

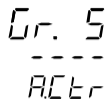
Lower display: dFLt.

Range: OFF = No loading data

ON = Loading data

### Run time group 5 [R.Exx]

AUXILIARY CONTROL PARAMETER



Gr. 5  
- - - -  
ACTr

### R.E01 - Anti reset wind up

This parameter is available when at least one control output is configured and "Pb" [R.D01] is different from 0.

Upper display: Gr.5

Lower display: ArW

Range: from 10% to 200% of the input span.

### R.E02 - Main control output low limit

This parameter is available when one control output is configured as main output.

Upper display: Gr.5

Lower display: ñ.OLL

Range: from 0.0 % (of the output span) to ñ.OLH [R.E03]

### **R.E03 - Main control output high limit**

This parameter is available when one control output is configured as main output.

Upper display: Gr.5

Lower display: n.OLH

Range: from n.OLL [R.E02] to 100.0 % of the output span.

### **R.E04 - Main control output max rate of rise**

This parameter is available when one control output is configured as main output.

Upper display: Gr.5

Lower display: n.rnP

Ranges: from 0.1%/s to 25.0%/s.

Above this value the display shows "Inf" meaning that no limit is imposed.

#### **NOTES:**

- 1) This parameter will be active even if device is configured for On/OFF control.
- 2) During the transfer from AUTO to MANUAL, if this action is programmed as a not bumpless transfer, the "n.rnP" function will be ignored and the output will step up to the value set by "Añ.UL" [C.G04] parameter.

### **R.E05 - Main control output cycle time.**

This parameter is available when time proportional main control output is configured.

Upper display: Gr.5

Lower display: nC.CY

Range: from 1 to 200 s

### **R.E06 - Secondary control output low limit**

This parameter is available when one control output is configured as secondary control output.

Upper display: Gr.5

Lower display: S.OLL

Range: From 0.0 % of the output span to S.OLH [R.E07].

### **R.E07 - Secondary control output high limit**

This parameter is available when one control output is configured as secondary control output.

Upper display: Gr.5

Lower display: S.OLH

Range: from S.OLL [R.E06] to 100.0 % of the output span.

### **R.E08 -Secondary control output max rate of rise**

This parameter is available when one control output is configured as secondary control output.

Upper display: Gr.5

Lower display: S.rñP

Ranges: from 0.1%/s to 25.0%/s.

Above this value the display shows "Inf" meaning that no limit is imposed

#### **NOTES:**

- 1) This parameter will be active even if device is configured for On/OFF control.
- 2) During the transfer from AUTO to MANUAL, if this action is programmed as a not bumpless transfer, the "S.rñP" function will be ignored and the output will step up to the value set by "Añ.UL" [C.G04] parameter.

### **R.E09 - Secondary control output cycle time.**

This parameter is available when a time proportional secondary control output is configured.

Upper display: Gr.5

Lower display: SC.CY

Range: from 1 to 200 s

### **R.E10 - Set point low limit**

Upper display: Gr.5

Lower display: rL

Range: from input low range (depending on the "PV.SL" [C.D02] setting) to rH [R.E11].

**NOTES:** Whenever "PV.SL" [C.D02] has been modified, the following occurs:

- 1) rL will be realigned to the low limit; the realignment will be carried out even if the set point is software protected.
- 2) If the set point values are out of the new limits, they automatically assume the default value even if software protected.

### **R.E11 - Set point high limit.**

Upper display: Gr.5

Lower display: rH

Range: from rL [R.E10] to input high range (depending on the "PV.SL" [C.D02] setting).

**NOTES:** Whenever "PV.SL" [C.D02] has been modified, the following occurs:

- 1) rH will be realigned to the low limit; the realignment will be carried out even if the set point is software protected.
- 2) If the set point values are out of the new limits, they automatically assume the default value even if software protected.

**R.E12 -Rate of change for positive set point variations**

Upper display: Gr.5

Lower display: Grd1

Range: from 1 to 200 digits per minutes.

Above this value the display shows "Inf" and the transfer will be a step change.

**R.E13 -Rate of change for negative set point variations**

Upper display: Gr.5

Lower display: Grd2

Range: from 1 to 200 digits per minutes.

Above this value the display shows "Inf" and the transfer will be a step change.

**R.E14 -External control for AUTO /MANUAL mode**

This parameter is available when one of the digital inputs is configured for Auto/Manual selection.

Upper display: Gr.5

Lower display: E.Añ

Range: On the Auto/Manual selection is made by digital input only.

OFF the Auto/Manual selection is made by "Man" key or serial link only.

**R.E15 - Group 5 default data loading.**

Upper display: Gr.5

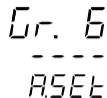
Lower display: dFLt.

Range: OFF = No loading data

ON = Loading data

## Run time group 6 [R.Fxx]

### ALARM SETTING



Gr. 6  
-----  
R.SET

### R.F01 -Alarm 1 type

This parameter is available only when OUT 1 is configured as alarm 1 output ("O1.Fn" [C.E01] = "ALr.1")

Upper display: Gr.6

Lower display: A1.tP

Range: Proc = Alarm on process variable

bAnd = Band alarm on process variable

dEV = Deviation alarm on process variable

**NOTE:** When alarm type has been changed the alarm threshold will be forced to its default value and alarm status will be cleared.

### R.F02 -Alarm 1 configuration

This parameter is available only when OUT 1 is configured as alarm 1 output ("O1.Fn" [C.E01] = "ALr.1")

Upper display: Gr.6

Lower display: A1.Cn

Range: H.A. = High alarm (outside band) with automatic reset.

L.A. = Low alarm (inside band) with automatic reset.

H.A.Ac= High alarm (outside band) with automatic reset and acknowledge.

L.A.Ac= Low alarm (inside band) with automatic reset and acknowledge.

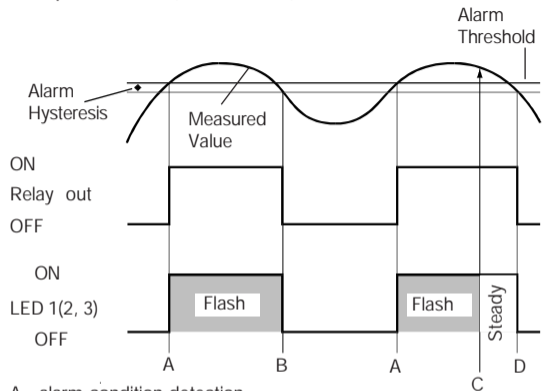
H.L. = High alarm (outside band) with manual reset.

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

**NOTE:** When alarm configuration has been changed, the alarm status will be cleared.



**Example** for A1.Cn (A2.Cn, A3.Cn) = H.A.

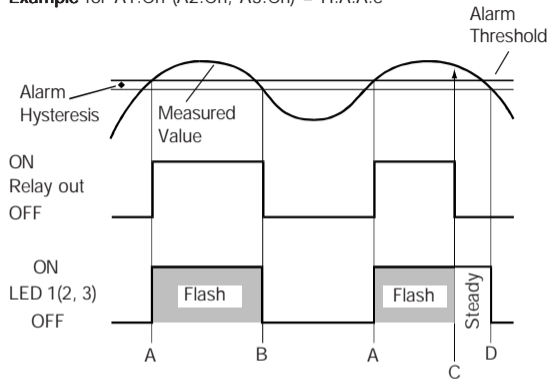


A= alarm condition detection

B= automatic reset of alarm

C= manual reset; the LED gets steady lit, the alarm remains in the alarm status until the process variable reaches the alarm threshold minus hysteresis (D).

**Example** for A1.Cn (A2.Cn, A3.Cn) = H.A.A.c

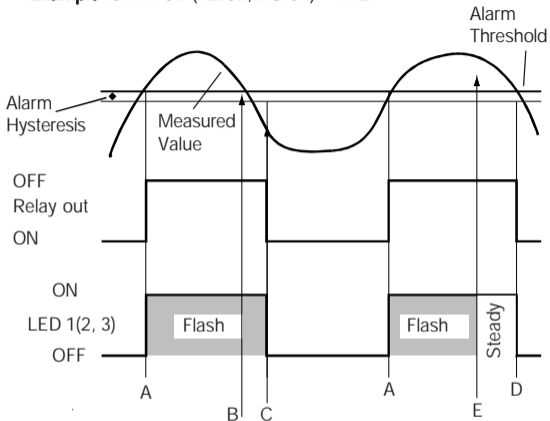


A= alarm condition detection

B= automatic reset of alarm

C= manual reset; the LED gets steady lit, the relay output goes OFF but the LED remains steady lit until the process variable reaches the alarm threshold minus hysteresis (D).

**Example** for A1.Cn (A2.Cn, A3.Cn) = H.L.



- A= alarm condition detection
- B= the alarm remains in alarm status (even if the measured value is under the threshold) until a manual reset is performed (C).
- E= if a manual reset is performed when the alarm condition still exist; the LED gets steady lit, the alarm remains in the alarm

status until the process variable reaches the alarm threshold minus hysteresis (D).

**NOTES:**

- 1) The alarm status is present when:
  - the relay is energized (A1.Ac, A2.Ac or A3.Ac = dir)
  - the relay is deenergized (A1.Ac, A2.Ac or A3.Ac = rEV)
- 2) The manual reset (acknowledgment) may be performed by the "ñ.rSt" [R.C01] parameter or by logic input or by serial link.

**R.F03 -Alarm 1 action**

This parameter is available only when OUT 1 is configured as alarm 1 output ("O1.Fn" [C.E01] = "ALr.1")

Upper display: Gr.6

Lower display: A1.Ac

- Range: dir = direct action (Relay energized or SSr=1 in alarm condition).
- rEV = Reverse action (Relay energized or SSr=1 in non alarm condition).

### R.F04 -Alarm 1 stand by (mask) function

This parameter is available only when OUT 1 is configured as alarm 1 output ("O1.Fn" [C.E01] = "ALr.1")

Upper display: Gr.6

Lower display: A1.St

Range: OFF = Stand-by function disabled

On = Stand-by function enabled

#### NOTES:

- 1) 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 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.
- 2) The change from On to OFF has immediate effect, while the change from OFF to On has effect at the next start up or set point change.

### R.F05 -Alarm 2 type

This parameter is available only when OUT 2 is configured as alarm 2 output ("O2.Fn" [C.E02] = "ALr.2")

Upper display: Gr.6

Lower display: A2.tP

Range: Proc = Alarm on process variable

bAnd = Band alarm on process variable

dEV = Deviation alarm on process variable

**NOTE:** When alarm type has been changed the alarm threshold will be forced to its default value and alarm status will be cleared.

### R.F06 -Alarm 2 configuration

This parameter is available only when OUT 2 is configured as alarm 2 output ("O2.Fn" [C.E02] = "ALr.2")

Upper display: Gr.6

Lower display: A2.Cn

Range: H.A. = High alarm (outside band) with automatic reset.

L.A. = Low alarm (inside band) with automatic reset.

H.A.Ac= High alarm (outside band) with automatic reset and acknowledge.

L.A.Ac= Low alarm (inside band) with automatic reset and acknowledge.

H.L. = High alarm (outside band) with manual reset.

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

**NOTE:** When alarm configuration has been changed, the alarm status will be cleared.

### **R.F07 -Alarm 2 action**

This parameter is available only when OUT 2 is configured as alarm 2 output ("O2.Fn" [C.E02] = "ALr.2")

Upper display: Gr.6

Lower display: A2.Ac

Range: dir = direct action (Relay energized or SSr=1 in alarm condition)

rEV = Reverse action (Relay energized or SSr=1 in non alarm condition)

### **R.F08 -Alarm 2 stand by (mask) function**

This parameter is available only when OUT 2 is configured as alarm 2 output ("O2.Fn" [C.E02] = "ALr.2")

Upper display: Gr.6

Lower display: A2.St

Range: OFF = Stand-by function disabled

On = Stand-by function enabled

### **NOTES:**

- 1) 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 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.
- 2) The change from On to OFF has immediate effect, while the change from OFF to On has effect at the next start up or set point change

### **R.F09 -Alarm 3 type**

This parameter is available only when OUT 3 is configured as alarm 3 output ("O3.Fn" [C.E03] = "ALr.3")

Upper display: Gr.6

Lower display: A3.tP

Range: Proc = Alarm on process variable

bAnd = Band alarm on process variable

dEV = Deviation alarm on process variable

**NOTE:** When alarm type has been changed the alarm threshold will be forced to its default value and alarm status will be cleared.

### R.F10 -Alarm 3 configuration

This parameter is available only when OUT 3 is configured as alarm 3 output ("O3.Fn" [C.E03] = "ALr.3").

Upper display: Gr.6

Lower display: A3.Cn

Range: H.A. = High alarm (outside band) with automatic reset.

L.A. = Low alarm (inside band) with automatic reset.

H.A.Ac= High alarm (outside band) with automatic reset and acknowledge.

L.A.Ac= Low alarm (inside band) with automatic reset and acknowledge.

H.L. = High alarm (outside band) with manual reset.

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

**NOTE:** When alarm configuration has been changed, the alarm status will be cleared.

### R.F11 -Alarm 3 action

This parameter is available only when OUT 3 is configured as alarm 3 output ("O3.Fn" [C.E03] = "ALr.3").

Upper display: Gr.6

Lower display: A3.Ac

Range: dir = direct action (Relay energized or SSr=1 in alarm condition).

rEV = Reverse action (Relay energized or SSr=1 in non alarm condition).

### R.F12 -Alarm 3 standby (mask) function

This parameter is available only when OUT 3 is configured as alarm 3 output ("O3.Fn" [C.E03] = "ALr.3")

Upper display: Gr.6

Lower display: A3.St

Range: OFF = Stand-by function disabled

On = Stand-by function enabled

#### NOTES:

- 1) 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 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.
- 2) The change from On to OFF has immediate effect, while the change from OFF to On has effect at the next start up or set point change

### R.F13 - Group 6 default data loading.

Upper display: Gr.6

Lower display: dFLt.

Range: OFF = No loading data

ON = Loading data

### Run time group 7 [R.Gxx]

SERIAL LINK PARAMETER

Gr. 7  
-----  
S.L.n

### R.G01 - Serial interface protocol

Upper display: Gr.7

Lower display: S.L.Pr

Range: OFF = No serial interface

nUS = Modbus

jUS = Jbus

### R.G02 - Serial link device address

This parameter is available only when "S.L.Pr" [R.G01] is different from "OFF".

Upper display: Gr.7

Lower display: S.L.Ad

Range: from 1 to 255

### R.G03 - Serial link baud rate

This parameter is available only when "S.L.Pr" [R.G01] is different from "OFF".

Upper display: Gr.7

Lower display: S.L.bd

Range: from 600 to 19200 baud (19200 baud is shown, on display, as 19.20)

### R.G04 - Serial link byte format

This parameter is available only when "S.L.Pr" [R.G01] is different from "OFF".

Upper display: Gr.7

Lower display: S.L.bF

Range: 8 = 8 bits without parity

8E = 8 bits + even parity

8O = 8 bits + odd parity

### R.G05 - Group 7 default data loading.

Upper display: Gr.7

Lower display: dFLt.

Range: OFF = No loading data

ON = Loading data

### Run time group 8 [R.Hxx]

TIMERS SETTING

Gr. 8

tI nE

### R.H01 - Burnoff duration

Upper display: Gr.8

Lower display: t.bOF

Range: from 1.00 to 15.00 mm.ss

When a primary variable different from "O2" is selected.

**NOTE:** the time setting may be modified any time but it will be activated at the next operation.

### R.H02 - Purge duration

Upper display: Gr.8

Lower display: t.PrG

Range: from 1.00 to 15.00 mm.ss

When a primary variable different from "O2" is selected.

**NOTE:** the time setting may be modified any time but it will be activated at the next operation.

### **R.H03 - Automatic Burnoff interval**

Upper display: Gr.8

Lower display: bF.tr

Range: from 1.00 to 24.00 hh. mm.

Above this 24.00, the display shows "no.tr" (no time interval is programmed)

When a primary variable different from "O2" is selected.

**NOTE:** the time setting may be modified any time but it will be performed at the next Burn off, exception made for the changement from/to "no.tr" that it will be immediately activated.

### **R.H04 - Automatic probe test interval**

Upper display: Gr.8

Lower display: Pb.tr

Range: from 1.00 to 24.00 hh. mm.

Above this 24.00, the display shows "no.tr" (no time interval is programmed)

When a primary variable different from "O2" is selected.

**NOTE:** the time setting may be modified any time but it will be performed at the next Probe test, exception made for the change from/to "no.tr" that it will be immediately activated.

### **R.H05 - Time remaining to the next automatic Burnoff**

This is a reading parameter only and it is available when "bF.tr" is different from "no.tr".

Upper display: Gr.8

Lower display: bF.ñn

Range: from 1.00 to 24.00 hh. mm.

When a primary variable different from "O2" is selected.

**NOTE:** if a power down occurs, this information will be lost, when power is restored, the countdown will restart from the "bF.tr" [R.H03] value.

### **R.H06 - Time remaining to the next automatic Probe test**

This is a reading parameter only and it is available when "pb.tr" is different from "no.tr".

Upper display: Gr.8

Lower display: Pb.ñn

Range: from 1.00 to 24.00 hh. mm.

When a primary variable different from "O2" is selected.

**NOTE:** if a power down occurs, this information will be lost, when power is restored, the countdown will restart from the "Pb.tr" [R.H04] value.



### **R.H07 - Group 8 default data loading.**

Upper display: Gr.8

Lower display: dFLt.

Range: OFF = No loading data

On = loading data

### **Run time group 9 [R.lxx]**

OPTIONAL OUTPUT SETTING

Gr. 9

d.0U1

### **R.I01 - OUT 10 setting**

This parameter is available when optional output circuitry is fitted.

Upper display: Gr.9

Lower display: Ou.10

Range: OFF = Relay deenergized

On = Relay energized

For OUT 11 up to OUT 19, the instrument will show on the lower display the related output and it is possible to perform the same setting as above described.

### **R.I02 - All relays deenergization**

This parameter is available when optional output circuitry is fitted.

Upper display: Gr.9

Lower display: dEEn

Range: OFF = No action

On = All relays will be deenergized

### Run time group "dF" [R.Lxx]

DEFAULT RUN TIME PARAMETER LOADING

Gr.dF  
-----  
dFLt

#### R.L01 -Default run time parameter loading.

This parameter is not available when SMART function is activated.

Upper display: Gr.dF

Lower display: dFLt.

Range: OFF = No loading data

On = the run time parameters of all groups (exception made for group 9) will be forced to their default values.

### Run time group "Hd" [R.Mxx]

HIDDEN PARAMETERS - SMART LIMITS

Gr.Hd  
-----  
H idn

**NOTE:** This group is accessible from every group by keeping depressed the "MENU" key for 8 seconds.

#### R.M01 - Minimum value of proportional band calculated by SMART algorithm.

This parameter is available only when smart function is configured ("Sñ.Fn" [C.G01] = "Enb")

Upper display: Gr.Hd

Lower display: Pb.Lo

Range: From 2.0% to "Pb.Hi" [R.M02].

**NOTE:** The resolution on "Pb.Lo" value is: 0.1% up to 10.0%; 1% up to 999.0%.

**R.M02 - Maximum value of proportional band calculated by SMART algorithm**

This parameter is available only when smart function is configured ("Sñ.Fn" [C.G01] = "Enb")

Upper display: Gr.Hd

Lower display: Pb.Hi

Range: from "Pb.Lo" [R.M01] to 999.0%

**NOTE:** The resolution on "Pb.Hi" value is: 0.1% up to 10.0%;  
1% up to 999.0

**R.M03 - Minimum value of integral time calculated by SMART algorithm**

This parameter is available only when smart function is configured ("Sñ.Fn" [C.G01] = "Enb")

Upper display: Gr.Hd

Lower display: ti.Lo

Range: from 00.01 mm.ss to "ti.Hi" [R.M04].

**R.M04 - Maximum value of integral time calculated by SMART algorithm.**

This parameter is available only when smart function is configured ("Sñ.Fn" [C.G01] = "Enb")

Upper display: Gr.Hd

Lower display: ti.Hi

Range: from "ti.Lo" [R.M03] to 20.00 mm.ss

**R.M05 - Relative gain of the secondary output calculated by SMART algorithm.**

This parameter is available only when smart function is configured ("Sñ.Fn" [C.G01] = "Enb") and a secondary control output is configured.

Upper display: Gr.Hd

Lower display: rG.CL

Range: OFF = Smart algorithm does not calculate "r.Gn" [R.D06] value.

On = Smart algorithm calculates "r.Gn" [R.D06] value.

**R.M06 - Hidden group default data loading**

Upper display: Gr.Hd

Lower display: dFLt.

Range: OFF = No loading data

On = loading data

## ERROR MESSAGES

### OVERRANGE, UNDERRANGE AND TEMPERATURE INPUT LEAD BREAKING DETECTION

The device is capable to detect a fault condition on input variables (OVERRANGE or UNDERRANGE or TEMPERATURE INPUT LEAD BREAKING).

When an error is detected the error code is shown (flashing) on the upper display as follows:

a) PrHi Sensor input out of range (OVERRANGE).

It is detected when:

- mV is the primary controlled variable and its value is greater than 1515 mV;
- CP or DP is the primary controlled variable and its value is greater than 1303 mV.  
(Greater than 200 mV if "O2" is configured as primary control variable)

b) PrLo Sensor input out of range (UNDERRANGE).

It is detected when:

- mV or O2 are the primary controlled variable and its value is less than -15 mV.
- CP or DP is the primary controlled variable and its value is less than 997 mV.

c) t.OPn Lead breaking detected on temperature input.

**NOTE:** if this error is detected, the instrument operates as in presence of a temperature input OVERRANGE.

d) tchi Out of range detected on temperature input.

e) COft Out of range detected on carbon monoxide input.

**NOTE:** if this error is detected, the CO value is forced to 20.

#### NOTES:

- 1) When "CP" or "DP" is the controlled variable and an error from a) to d) is detected, the device acts as described at "Special output features" (see page 49).
- 2) When "mV" is the controlled variable and the error a) (OVERRANGE) is detected, the "Main" output is forced to 0 and the "Secondary" (if configured) is forced to 100%. The alarms and analog retransmissions operate as in presence of the maximum measurable value.
- 3) When "mV" is the controlled variable and the error b) (UNDERRANGE) is detected, the "Main" output is forced to 100% and the "Secondary" (if configured) is forced to 0. The alarms and analog retransmissions operate as in presence of the minimum measurable value.
- 4) When "mV" is the controlled variable the errors from c) to e) are displayed only without affecting the control action.
- 5) On OVER-RANGE on remote setpoint measurement is

signalled on lower display as "□ □ □ □"  
On UNDER-RANGE on remote setpoint measurement is  
signalled on lower display as "- □ □ □ "  
(indication only when required . See "DISPLAY FUNCTION")  
The sensor leads break can be detected when the range  
selected has a zero elevation (4-20 mA or 1-5 V or 2-10 V)  
and signalled as "OPEn".  
The sensor leads break acts as an UNDER-RANGE condition.  
For functioning during out of range see also "A.I.Añ – CnF.1"

## ERROR MESSAGES

At instrument start up in operative mode all the parameters are checked.

If an error is detected, the display will show the parameter group and the mnemonic code of the group with the wrong parameter setting while "Err" is shown on the central display. The device reset automatically after a time out of 6 s (20 s if serial link is enabled)

Following the normal procedure reach the group with the wrong parameter setting and correct it (during run time mode, every keystroke restarts the time out. During modify configuration parameters mode, the time out is disabled).

When the error is corrected push "MENU" until the device resets (if in run time mode) or end the modify configuration parameters mode following the normal procedure.

Repeat the above described procedure if another error is shown.

Error list for control action setting:

- E.120 Error on control parameter calculated by SMART when the control action type has been changed in the configuration mode.
- E.130 Error during the TUNE mode. The algorithm was not able to correctly calculate the control action parameters.

This error can be detected also at start up in ADAPTIVE mode when the values calculated by SMART are wrong.

In both cases, the instrument will be forced to work as a PI controller.

E.140 Error detected when the control action values calculated by ADAPTIVE algorithm are out of range by the limits set of the "Hidden group".

**NOTE:** push any key in order to remove the E.130 and E.140 error indications if the instrument is in local state. If the instrument is in remote state refer to the Modbus protocol communication.

The instrument is also capable to detect the following errors:

E.100 Error during data saving in FRAM

E.110 Error in FRAM handling

E.500 Error during auto-zero measurement

E.501 Error during zero integrator measurement

**NOTE:** when an error E.500 or E.501 is detected, all input measurement are forced to OVERRANGE condition.

E.502 Error during reference junction measurement.

**NOTES:**

1) If this error is detected, the temperature input is forced to OVERRANGE condition.

2) This error may be generated by an ambient temperature higher than 70 °C (158 °F) or lower than -20 °C (-4 °F).

3) When "mV" is the controlled variable this error is displayed only without affecting the control action.

When one of these errors is detected, contact your supplier. Two errors, related with the preliminary hardware setting, are detectable:

2. change V101 dip switch or end keyboard/serial link configuration.

8. wrong position of the V101 dip switch.

When one of these error is detected, the display blanks and the error code is shown on most significant digit of the upper display. Correct the V101 setting.

## GENERAL INFORMATION

### GENERAL SPECIFICATIONS

**Case:** Polycarbonate black color; self-extinguishing degree: V-0 according to UL 94.

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

(\*) Test were performed in accordance with IEC 529, CEI 70-1 and NEMA 250-1991 STD.

**Installation:** panel mounting.

**Rear terminal block:** 54 screw terminals (screw M3, for cables from  $\phi$  0.25 to  $\phi$  2.5 mm<sup>2</sup> or from AWG 22 to AWG 14) with connections diagram and safety rear cover.

**Dimensions:** according to DIN 43700  
3.78" x 3.78" (96 x 96 mm), depth 5" (128 mm).

**Weight:** 750 g (full option).

#### Power supply:

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

#### Power consumption:

- 16 VA max. (without optional I/O)
- 20 VA max. (with optional I/O)

**Insulation resistance:** > 100 M $\Omega$  according to IEC 1010-1.

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

**Common mode rejection:** 120 dB @ 50/60 Hz.

**Normal mode rejection:** 60 dB @ 50/60 Hz.

**Electromagnetic compatibility and safety requirements:** This instrument is marked CE.

Therefore, it is conforming to council directives 89/336/EEC and to council directives 73/23/EEC and 93/68/EEC.

**Installation category:** II

**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.

**Altitude:** This product is not suitable for use above 2000m (6562ft).

## INPUTS

### A) MAIN INPUT

#### Type:

- 0 to 1500 mV (when mV sensor output or oxygen are selected as primary controlled variable).
- 1000 to 1300 mV (when carbon potential or dew point is selected as primary controlled variable).

**NOTE:** if the probe input value is out of the 1000 to 1300 mV, the range automatically becomes 0 to 1500 mV.

**Input type:** isolated from others measuring inputs and digital inputs.

**Carbon range:** 0.00 to 2.00%

**Dew point range:** -100 to 100 °F or -75 to 40 °C

**Oxygen range:** 0.0 to 25.0 %

**Resolution:** 0.1

**mV range:** 0 to 1500 mV

**Carbon resolution:** 0.01%

**Dew point resolution:** 1°F (1°C)

**mV resolution:** 1 mV

#### Accuracy:

- + 0.02 digits for 0.40 to 1.60 % of the carbon range.
- + 0.03 digits for the remaining carbon range.

#### Temperature drift:

- 350 ppm/°C when the range is 1000 to 1300 mV.
- 200 ppm/°C when the range is 0 to 1500 mV.

**Input impedance:** > 100 MΩ

**Sampling time:** 125 ms (typical).

**Display updating time:** 375 ms.

**Insulation voltage:** 500 VAC

**Probe resistance:** up to 100 KΩ

**Accuracy on probe resistance measurement:** 2% f.s.v.

### B) TEMPERATURE INPUT

**Thermocouple type:** K, S, R, B

**Input type:** not isolated from others measuring inputs and digital inputs.

**Sampling time:** 1125 ms if carbon monoxide/remote set point input is used.  
750 ms otherwise.

**Accuracy:** + 0.2% f.s.v. + 1 digit @ 25 °C and nominal power supply voltage.

**Temperature drift:** < 200 ppm/°C of full span

**Source impedance:** 100 Ω max.

**Current for TC open detection:** -100 nA.

**Cold junction:** automatic compensation from 0 to 50 °C.

**Cold junction accuracy :** 0.1 °C/°C



**Input impedance:** > 1 M $\Omega$

**Calibration :** according to IEC 584-1.

STANDARD RANGES TABLE

T/C type	Ranges		
<b>K</b>	1	-100 / 1370 °C	IEC 584-1:1995-09
<b>S</b>	2	- 50 / 1760 °C	IEC 584-1:1995-09
<b>R</b>	3	- 50 / 1760 °C	IEC 584-1:1995-09
<b>B</b>	4	0 / 1820 °C	IEC 584-1:1995-09
<b>K</b>	5	-150 / 2500 °F	IEC 584-1:1995-09
<b>S</b>	6	- 60 / 3200 °F	IEC 584-1:1995-09
<b>R</b>	7	- 60 / 3200 °F	IEC 584-1:1995-09
<b>B</b>	8	32 / 3300 °F	IEC 584-1:1995-09

### C) AUXILIARY INPUT (CARBON MONOXIDE)

**Input range:** 0/4 - 20 mA, 0/1 - 5 V or 0/2 - 10 V.

**Input type:** not isolated from others measuring inputs and digital inputs.

**Sampling time:** 1125 ms.

**Temperature drift:** < 300 ppm/°C of full span.

**Input span:** from 0 up to 100.

**Note:** The type of inputs are keyboard and jumper selectable

All type of inputs are factory calibrated

**The span is fixed** from 0 upto 100 for Carbone Monoxide or as per Main input for Remote Set point

( 0.0 to 2.00 for carbon potential)

( 0 to 100 °F or -18 to 40 °C for Dew point )

( 0 to 1500 for mV )

STANDARD RANGES TABLE

Input type	Impedance	Accuracy
<b>0 - 20mA</b>	< 5 $\Omega$	0.2 % + 1 digit @ 25°C
<b>4 - 20mA</b>		
<b>0 - 5 V</b>		
<b>1 - 5 V</b>	> 200 k $\Omega$	
<b>0 - 10 V</b>	> 400 k $\Omega$	
<b>2 - 10 V</b>		

## D) LOGIC INPUTS

The instrument is equipped with 3 logic inputs.

**Input type:** Contact closure (voltage free).

**Input function:**

DIG 1 and DIG 2 can be programmed as:

- Set point selection (SP - SP2)
- Set point selection (SP3 - SP4)
- Auto/manual selection
- Output limiter activation
- Manual reset of the alarms (acknowledge).
- Locale / Remote set point selection

DIG 3 is used to start the Burn off routine.

**Active logic level:** Close or open programmable.

## D1) OPTIONAL LOGIC INPUTS

The instrument may be equipped with 8 optional logic inputs (IN1 to IN8).

**Input type:** Contact closure (voltage free).

The input status can be read only through serial link.

## SET POINTS

This instrument allows to use up to 4 set points: SP, SP2, SP3 and SP4.

The set point selection is possible only by logic input.

**Set point transfer:**

The transfer between one set point to another (or between two different set point values) may be realized by a step transfer or by a ramp with two different programmable rates of change (ramp up and ramp down).

**Slope value:** 1 - 200 eng. unit/min or step.

**Set points limiter:** rL [r.E10] and rH [r.E11] parameters, programmable.

## CONTROL ACTIONS

**Algorithm:** PID + SMART

**Types:**

- one control output (digital or analog output)
- two control outputs

**NOTE:** the outputs can be freely selected between analog and digital outputs.

**Digital output types:** Relay or SSR.

**Digital output action type:** Proportional time

**Analog output types:** 20 mA.

**Proportional Band:** programmable from 0.5% to 999.0% of the input span.

Setting a PB equal to 0 the control action becomes ON/OFF.

**Hysteresis (for ON/OFF control action):** programmable from 0.1% to 10.0 % of the input span.

**Integral time:** programmable from 1 second to 20 minutes or excluded.

**Derivative time:** programmable from 1 second to 10 minutes or excluded.

**Integral pre-load:** programmable

- for one control output, from 0 to 100% of the output range.
- for two control outputs, from -100 % to +100 % of the output range.

**Anti reset windup:** from 10 % to 200 % of the input span.

**Main output cycle time:** from 1 second to 200 seconds.

**Secondary output cycle time:** from 1 second to 200 seconds.

**Relative secondary output gain:** keyboard programmable from 0.20 to 2.00 referred to the proportional band.

**Overlap / dead band :** keyboard programmable from - 20 % (dead band) to + 50 % (overlap) of the proportional band.

**Output limiters.**

For the main and/or secondary control outputs it is possible to set:

- output high limits
- output low limits
- output max. rate of rise.

**AUTO/MANUAL mode:** selectable by front push-button or logic input.

## REMOTE SET POINT

The device can be equipped with a remote set point.

This feature must be configured (see "A.In.F / A.In.t / A.I.FL / A.I.Añ / L.r.Oñ" CnF.1 and "d1.Fn / d2.Fn" CnF.5)

If "A.I.Añ" = norñ the remote set point can be activated **only** by selected external contact (If none digital input is configured to select from Local / Remote set point, the Remote set point will be **always active and** will be **the only SET POINT** present on the device.)

If the auxiliary input is out of range or open the control output is de-activated (see "Control Action Feature")

If "A.I.Añ" = Cnd.A the remote set point is activated by status of auxiliary input

(Remote set point if auxiliary input is in range, local set point if it is out of range or open)

When remote set point is selected the decimal point at right hand of LSD on middle display is steady lit.(when device is in "Normal display mode")

The scale for remote set point is fixed and equal to primary control variable; the set point value will be further limited by "rL/ rH". The sampling rate is 1.125 mS

The value can be filtered.

When transfer from Remote to Local setpoint is made (by external contact), the local setpoint can be aligned to last remote setpoint value (see L.r.Oñ – CnF.1)

When remote set point value is displayed on lower display (see "DISPLAYFUNCTION")

the out of range condition are displayed as follow:

OVER-RANGE ("0000"), UNDER-RANGE ("–000"), leads break ("DPEñ").

## OUTPUTS

### Out 1 and 2

**Function:** singularly programmable as

- Control output
- Alarm output

**Type:** Relay or SSR

### Out 1 - Relay

**Relay type:** SPDT

**Contact rating:** 3 A @ 250 V on resistive load.

### Out 2 - Relay

**Relay type:** SPST

**Contact rating:** 3 A @ 250 V on resistive load.

### Out 1 and 2 - SSR

**Type:** not isolated voltage output

- Logic level 1:
  - 14V + 20% @ 20 mA max.
  - 24 V + 20% @ 1 mA.
- Logic level 0:
  - < 0.5 V D.C.

### Out 3

**Function:** programmable as:

- Control output
- Alarm output

**Type:** Relay

**Relay type:** SPST

**Contact rating:** 2 A @ 250 V on resistive load.

### Out 4

**Function:** Burn off function

**Type:** Relay

**Relay type:** SPST

**Contact rating:** 2 A @ 250 V on resistive load.

### Out 5

**Function:** Purge function

**Type:** Relay

**Relay type:** SPST

**Contact rating:** 1 A @ 250 V on resistive load.

## ANALOG OUTPUTS

### Out 6 and 7

**Function:** Programmable as

- Linear control output
- Analog retransmission of the measured value
- Analog retransmission of the operative set point.

**Output type:** Isolated output programmable as

- 0-20 mA
- 4-20 mA.

**Scaling:** from -1999 to 9999 when used as signal retransmission.

**Maximum load:** 600  $\Omega$ .

**Accuracy:**

- 0.1 % when it is used as control output
- 0.05 % when it is used as analog retransmission.

**Filter:** It is possible to apply a first order digital filter on the retransmitted value.

The time constant of the filter may be programmed within 0 and 8 s.

## OPTIONAL OUTPUTS

The instrument may be equipped with 10 optional relay outputs.

**Type:** Relay

**Relay type:** SPST

**Contact rating:** 0.5 A @ 250 V on resistive load.

The status of the optional outputs can be set by keys and by serial link.

## ALARMS

**Alarm action:** direct or reverse function programmable.

**Alarm functions:** each alarm can be configured as process alarm, band alarm, deviation alarm.

**Alarm reset/acknowledge:** automatic or manual reset programmable on each alarm.

**Alarm masking:** each alarm can be configured as masked alarm or standard alarm.

This function allows you to delete false indication at instrument start up and after a set point change.

**Process alarm:**

**Operative mode:** Minimum or maximum programmable.

**Threshold:** programmable in engineering unit within the input range.

**Hysteresis:** programmable in engineering units from 1 to 200 digits.

### **Band alarm**

**Operative mode:** Inside or outside programmable.

**Threshold:** two thresholds programmable:

- Low - from 0 to -1000 digits.

- High - from 0 to +1000 digits.

**Hysteresis:** programmable in engineering units from 1 to 200 digits.

### **Deviation alarm**

**Operative mode:** high or low programmable.

**Threshold:** programmable from - 1000 to +1000 digits.

**Hysteresis:** programmable in engineering units from 1 to 200 digits.

### **SERIAL INTERFACE**

**Types:** Optoisolated RS 485

**Protocol type:** MODBUS, JBUS (RTU mode).

**Baud rate:** programmable from 600 to 19200 BAUD.

**Byte format:** 8 bit.

**Parity:** even, odd or none programmable.

**Stop bit:** one.

**Address:** from 1 to 255.

**Output voltage levels:** according to EIA standard.

**NOTE:** The EIA standard establishes that by RS-485 interface it is possible to connect up to 30 devices with one remote master unit.

The serial interface of these instruments is based on "High input impedance" transceivers; this solution allows you to connect up to 127 devices (based on the same transceiver type) with one remote master unit.

## 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<sup>2</sup>) remove all deposit of dust and dirt which may be present on the louvres 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<sub>2</sub>H<sub>5</sub>OH] or
  - Isopropil Alcohol (pure or denatured) [(CH<sub>3</sub>)<sub>2</sub>CHOH] or
  - Water (H<sub>2</sub>O)
- 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 RUN TIME PARAMETERS

A complete and consistent set of run time parameters is stored in the instrument. These data are the typical values loaded in the instrument prior to shipment from factory.

This instrument allows you to load the default value of a single run time parameter group or to load all the run time parameters

A) When it is desired to load the default parameter of a single group, proceed as follows:

A.1) By MENU pushbutton, select the desired run time parameter group.

**NOTE:** if the selected group is protected by security code, set the assigned value by ▲ and ▼ pushbuttons.

A.2) By FUNC pushbutton, select the last parameter of the selected group.

The middle and lower displays will show:

*OFF*  
*dFLt.*

A.3) By ▲ or ▼ pushbuttons, select the "On" indication on the central display.

A.4) Push the FUNC pushbutton.

The default parameter loading procedure for the selected group is ended.

B) When it is desired to load the default value of all the run time parameters proceed as follows:

B.1) By MENU pushbutton, select the "Run time group dF" [R.Lxx].

**NOTE:** if all run time parameters are protected by security code, set the assigned value by ▲ and ▼ pushbuttons.

B.2) Push the FUNC pushbutton.

The middle and lower displays will show:

*OFF*  
*dFLt.*

B.3) By ▲ or ▼ pushbuttons, select the "On" indication on the central display.

B.4) Push the FUNC pushbutton.

The central display will show:

*LOAD*

The default parameter loading procedure of all run time parameters is ended.

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

#### Run time group 1 [R.Axx]

PARAMETER	DEFAULT VALUE
SP	= Set point low limit ("rL" [R.E10])
SP2	= Set point low limit ("rL" [R.E10])
SP3	= Set point low limit ("rL" [R.E10])
SP4	= Set point low limit ("rL" [R.E10])
COF	= 200
H2F	= 400

#### Run time group 3 [R.Cxx]

PARAMETER	DEFAULT VALUE
ñ.rSt	= OFF
AL1	= Initial range value (for process alarm) = 0 (for deviation alarm)
bA1.L	= -10
bA1.h	= 10
AL2	= Initial range value (for process alarm) = 0 (for deviation alarm)
bA2.L	= -10
bA2.h	= 10
AL3	= Initial range value (for process alarm) = 0 (for deviation alarm)

bA3.L	= -10
bA3.h	= 10
HSA1	= 1
HSA2	= 1
HSA3	= 1

#### Run time group 4 [R.Dxx]

PARAMETER	DEFAULT VALUE
Pb	= 10.0 % (if PID control is configured) = 15.0 % (if PI control is configured)
HYS	= 0.5 %
ti	= 1.50 mm.ss (if PID control is configured) = 2.45 mm.ss (if PI control is configured)
td	= 1.00 mm.ss
IP	= 50.0 (If only one control output is configured). 0.0 (If two control outputs are configured).
r.Gn	= 1.00
OLAP	= 0

#### Run time group 5 [R.Exx]

PARAMETER	DEFAULT VALUE
ArW	= 100%
ñ.OLL	= 0.0%
ñ.OLH	= 100.0%
ñ.rñP	= Inf

ñC.CY	= 16 s (If relay output) 2 s (If SSR output)
S.OLL	= 0.0%
S.OLH	= 100.0%
S.rñP	= Inf
SC.CY	= 16 s (If relay output) 2 s (If SSR output)
rL	= Initial range value
rH	= Final range value
Grd1	= Inf
Grd2	= Inf
E.Añ	= On

#### Run time group 6 [R.Fxx]

PARAMETER	DEFAULT VALUE
A1.tP	= Proc
A1.Cn	= H.A.
A1.Ac	= rEV
A1.St	= OFF
A2.tP	= Proc
A2.Cn	= H.A.
A2.Ac	= rEV
A2.St	= OFF
A3.tP	= bAnd
A3.Cn	= H.A.

A3.Ac	= rEV
A3.St	= OFF

#### Run time group 7 [R.Gxx]

PARAMETER	DEFAULT VALUE
S.L.Pr	= ñbUS
S.L.Ad	= 1
S.L.bd	= 19.20
S.L.bF	= 8

#### Run time group 8 [R.Hxx]

PARAMETER	DEFAULT VALUE
t.bOF	= 3.00 mm. ss.
t.PrG	= 1.00 mm. ss.
bF.tr	= 12.00 hh.mm
pb.tr	= 24.00 hh.mm

#### Run time group Hd [r.Lxx]

PARAMETER	DEFAULT VALUE
Pb.Lo	= 2.0%
Pb.Hi	= 999.0%
ti.Lo	= 00.01 mm.ss
ti.Hi	= 20.00 mm.ss
rG.CL	= OFF

## DEFAULT CONFIGURATION PARAMETERS

A complete and consistent set of configuration parameters is stored in the instrument. These data are the typical values loaded in the instrument prior to shipment from factory.

When it is desired to load the default value of all the configuration parameters, proceed as follows:

If the instrument starts in configuration mode, push the MENU pushbutton.

If the instrument starts in run time mode, by keeping depressed the MENU push-button for more than 5 seconds the instrument will show:



CONF  
non.  
A.00

**NOTE:** If no push-button is depressed for more than 10 s (or 30 s according to "CnF.6" "t.out" [time out selection] C.I10) parameter setting), the instrument returns automatically to the normal display mode.

By ▲ or ▼ push-button select "ñodF."

## NOTES:

- 1) When modify mode is started, the instrument stops the control and:
  - sets to OFF the control outputs;
  - turns to OFF the bargraph displays;
  - sets analog retransmissions to the retransmitted initial scale value;
  - sets to OFF the alarms;
  - disables the serial link;
  - removes the time out.
- 2) When the modify mode is disabled by V101 (SW3), the ▲ or ▼ push-button pressure has no effect.

Push MENU pushbutton again and select the "Default configuration group" [C.Cxx].

**NOTE:** if the configuration parameters are protected by security code, by ▲ or ▼ pushbuttons set the security code assigned and press the FUNC pushbutton.

By ▲ or ▼ push-button select the desired configuration parameter set "tb.1" (european) or "tb.2" (american)

Push MENU pushbutton again

The central display will show:



LOAD

and then the display will show:

*CnF.1*

*InPt.*

The default parameter loading procedure of all configuration parameters is ended.

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

**TABLE 1 (EUROPEAN)**

<b>Configuration group 1 [C.Dxx]</b>		
PARAM.	VALUE	NOTES
Ln.Fr	50	Hz
PV.SL	CP	
Pb.FL	0	(No filter)
tP.In	1	(Tc K)
OFSt	0	°C
tP.FL	0	(No filter)
A.In.F	-	nonE
A.In.t	-	4-20(4-20 mA)

A.I.FL	-	0 (No filter)
A.I.Añ	-	norñ
L.r.Oñ	-	n.ALG

**Configuration group 2 [C.Exx]**

PARAM.	VALUE	NOTES
O1.Fn	ñAin	
O2.Fn	SECn	
O3.Fn	ALr.3	
O6.Fn	PV.rt	
O6.rn	4-20	4-20 mA
O6.Lr	0.00	
O6.Hr	2.00	
O6.FL	0	(No filter)
O7.Fn	nonE	
O7.rn	4-20	4-20 mA
O7.Lr	0.00	
O7.Hr	2.00	
O7.FL	0	(No filter)

**Configuration group 3 [C.Fxx]**

PARAM.	VALUE	NOTES
ñC.Cn	norñ	
ñ.SCL	nO	
ñC.dP	—.	(No decimal figure)

ñC.E.L	0	
ñC.E.H	100	
ñC.A.C	bEFr	
SC.Cn	norñ	
S.SCL	nO	
SC.dP	—.	(No decimal figure)
SC.E.L	0	
SC.E.H	100	
SC.A.C	bEFr	

#### Configuration group 4 [C.Gxx]

PARAM.	VALUE	NOTES
Sñ.Fn	Enb	
Cn.tP	PId	
ñAn.F	Enb	
Añ.UL	buñ.	
ñ.A.t.t	buñ.	
St.Fn	Cnd.b	

#### Configuration group 5 [C.Hxx]

PARAM.	VALUE	NOTES
d1.Fn	nonE	
d1.St	CLSd	
d2.Fn	nonE	
d2.St	CLSd	
d3.St	CLSd	

#### Configuration group 6 [C.lxx]

PARAM.	VALUE	NOTES
G.brG	Pr.Ur	
O.brG	OP.SP	
brG.L	0.00	
brG.H	2.00	
brG.d	10	digits
SP.dS	OP.SP	
t.t.Ac	YES	
t.out	tñ.30	

**TABLE 2 (AMERICAN)**

<b>Configuration group 1 [C.Dxx]</b>		
PARAM.	VALUE	NOTES
Ln.Fr	60	Hz
PV.SL	CP	
Pb.FL	0	(No filter)
tP.In	5	(Tc S)
OFSt	0	°F
tP.FL	0	(No filter)
A.In.F	-	nonE
A.In.t	-	4-20 (4-20 mA)
A.I.FL	-	0 (No filter)
A.I.Añ	-	norñ
L.r.Oñ	-	n.ALG

<b>Configuration group 2 [C.Exx]</b>		
PARAM.	VALUE	NOTES
O1.Fn	ñAin	
O2.Fn	SECn	
O3.Fn	ALr.3	
O6.Fn	PV.rt	
O6.rn	4-20	4-20 mA
O6.Lr	0.00	
O6.Hr	2.00	

O6.FL	0	(No filter)
O7.Fn	nonE	
O7.rn	4-20	4-20 mA
O7.Lr	0.00	
O7.Hr	2.00	
O7.FL	0	(No filter)

<b>Configuration group 3 [C.Fxx]</b>		
PARAM.	VALUE	NOTES
ñC.Cn	norñ	
ñ.SCL	nO	
ñC.dP	—.	(No decimal figure)
ñC.E.L	0	
ñC.E.H	100	
ñC.A.C	bEFr	
SC.Cn	norñ	
S.SCL	nO	
SC.dP	—.	(No decimal figure)
SC.E.L	0	
SC.E.H	100	
SC.A.C	bEFr	

**Configuration group 4 [C.Gxx]**

PARAM.	VALUE	NOTES
Sñ.Fn	Enb	
Cn.tP	PId	
ñAn.F	Enb	
Añ.UL	buñ.	
ñ.A.t.t	buñ.	
St.Fn	Cnd.b	

**Configuration group 5 [C.Hxx]**

PARAM.	VALUE	NOTES
d1.Fn	nonE	
d1.St	CLSd	
d2.Fn	nonE	
d2.St	CLSd	
d3.St	CLSd	

**Configuration group 6 [C.lxx]**

PARAM.	VALUE	NOTES
G.brG	Pr.Ur	
O.brG	OP.SP	
brG.L	0.00	
brG.H	2.00	
brG.d	10	digits
SP.dS	OP.SP	
t.t.Ac	YES	
t.out	tñ.30	



## ALGORITHMS

The following empirical (derived from experiment) equations are included into the instrument firmware and are applied when the probe sensor voltage is within 1000 and 1300 mV range.

For oxygen potential:

$$\text{O2(\%)} = \frac{20.9}{\exp((2.3 * E) / (0.0496 * T_k))}$$

For carbon potential:

$$\%C = \frac{3.792 \cdot e^Z}{\frac{6486000}{CO \cdot COF} + e^Z}$$

For dew point:

$$\text{D.P. (in}^\circ\text{F)} = \frac{4238.7}{9.55731 - \log_{10} P_{H_2} + \frac{E - 1267.8}{0.05512 \cdot T_R}} - 460$$

$$\text{Where: } Z = \frac{E - 820.7}{0.0239 \cdot T_R}$$

E is the sensor input in mV;

$T_R$  is the absolute value in degrees Rankine ( $^\circ\text{F} + 459.67$ );

CO is the carbon monoxide partial pressure, measured on Carbon monoxide input;

COF is the Carbon monoxide factor setting (see [RA02] parameter);

$P_{H_2}$  is the partial pressure of hydrogen in atmosphere and it is equal to  $H_2F/1000$ ;

$T_k$  is the temperature in degree Kelvin

**NOTE:** H2F is the [RA03] parameter.

## CALIBRATION PROCEDURE

The calibration procedure is enabled by internal dip switch.

V101.2 = Off and V101.4 = On. Perform calibration procedure in accordance with jumpers position, otherwise the stored calibration value may be altered.

All calibration parameters are logically divided in groups of two (initial and final scale), followed by a calibration check in which the input is measured and displayed in counts (30000 at fsv for all inputs).

The upper display shows the calibration step (Table A); the lower display shows the action step (Table B); the middle display shows the selection On/Off, or value for Out6/Out7. Use FUNC key to scroll up calibration steps, MAN key to scroll down. Use ▲/▼ keys to select on/off.

To enable calibration and go to the next action step, push FUNC when "on" is displayed. For CJ calibration, use ▲/▼ keys to set a temperature value in 1/10°C read, with appropriate instrument, between 1 - 3 rear terminal. No timeout is applied in the calibration mode.

The last step is for loading default calibration data. The display will show: CAL on upper display; OFF/ON on middle display, and dFLt on lower display. Use the ▲/▼ key to select "on" and then push FUNC key to load data. No action otherwise.

Note: The default calibration data allows the verification of device functioning though they should not be taken as final calibration values. After the default calibration data loading, it is necessary to perform the proper input calibration.

#### Table A. Calibration Steps

Mnemonic code shown in upper display:

Pb.1	=	Main probe input (0 to 1.5 V)
Pb.2	=	Main probe input (0 to 1.3 V)
tP.In	=	Thermocouple input (0 to 60 mV)
CJ.In	=	CJ input
A.1.ñA	=	Carbon Monoxide auxiliary input (0 to 20 mA)
A.1.5	=	Carbon Monoxide auxiliary input (0 to 5 V)
A.1.10	=	Carbon Monoxide auxiliary input (0 to 10 V)
O6.ñA	=	Out 6 (0 to 20 mA)

O7.ñA	=	Out 7 (0 to 20 mA)
CAL	=	Default data loading

#### Table B. Action Steps

Mnemonic code shown on the middle display:

Lr.	=	Low range calibration
Hr.	=	High range calibration
U.	=	Input calibration verify

Note: During CJ input, verify the temperature is displayed in 1/10°C.

For OUT6/OUT7 calibration proceed as follows:

- Low range calibration ("Lr." action). Set, by using ▲/▼ pushbuttons, a value (from 0 to 5000) to read on rear terminal a  $0 \mu\text{A} \pm 5\mu\text{A}$  current.
- High range calibration ("Hr." action). Set, by using ▲/▼ pushbuttons, a value (from 0 to 5000) to read on rear terminal a  $20 \text{ mA} \pm 5\mu\text{A}$  current.
- Input calibration verify (U action). Set, by using ▲/▼ pushbuttons, a value (from 0 to 8000) to read on rear terminal a current value corresponding to: Out = displayed value/8000 \* 20 mA.

Note: Rear terminals are 16(+)/17(-) for OUT 6 and 18(+)/19(-) for OUT 7.



SUPER SYSTEMS INC.

0831106 Rev. 0



Calibration Procedure

AC20

# INSTRUMENT CALIBRATION PROCEDURES

## 1 GENERAL GUIDELINES FOR CALIBRATION

- For an accurate calibration it is necessary to proceed as follows:
- The instrument under calibration should be mounted in its case in order to keep the internal temperature stable.
  - The ambient temperature should be stable. Avoid any drift due to air-conditioning or others.
  - The relative humidity should not exceed 70%.
  - The instrument must be in ON condition from 20 minutes at least.
  - Operate, possibly, in an environment with no electromagnetic disturbances.
  - During calibration, connect to the instrument one input at a time.
  - Before to execute each calibration, be sure that the specific hardware setting has been made (see "Preliminary hardware setting" paragraph).

For this calibration procedure it is necessary to use calibrators with the following accuracy and resolution:

### ACCURACY

- For current input:  $\pm 0.025\%$  output  $\pm 0.0025\%$  range  $\pm 0.01 \mu\text{A}$
- For voltage input :  $+ 0.005\%$  output  $+ 0.001\%$  range  $+ 5 \mu\text{V}$
- For TC input:  $+ 0.005\%$  output  $+ 0.001\%$  range  $+ 5 \mu\text{V}$
- For RTD input:  $\pm 0.02 \%$   $\pm 0.0025 \Omega/\text{decade}$ .
- For cold junction compensation: better than  $0.1 \text{ }^\circ\text{C}$

### RESOLUTION

- For current input:  $0.5 \mu\text{A}$
- For voltage input:  $100 \mu\text{V}$
- For TC input:  $1 \mu\text{V}$
- For RTD input:  $10 \text{ m}\Omega$
- For cold junction compensation: better than  $0.1 \text{ }^\circ\text{C}$

## 2 PRELIMINARY HARDWARE SETTINGS

### 2.1 HOW TO REMOVE THE INSTRUMENT FROM ITS CASE

- Switch off the instrument.
- Push gently the lock A on the right.
- While the lock A is maintained out, slide out the right side of the instrument (see fig. 1).

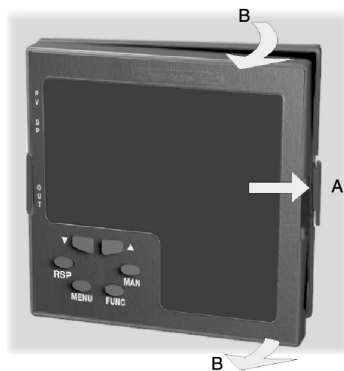


Fig. 1

- Push gently the lock C on the left.
- While the lock C is maintained out, slide out the instrument (see fig. 2).

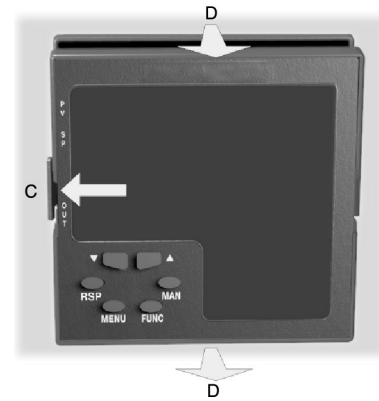


Fig. 2

### 2.2 J103 SETTING

J103 (see fig. 3) must be set as follows:

J103	
1-2	open
3-4	open
5-6	open
7-8	open
5-7	close
6-8	close

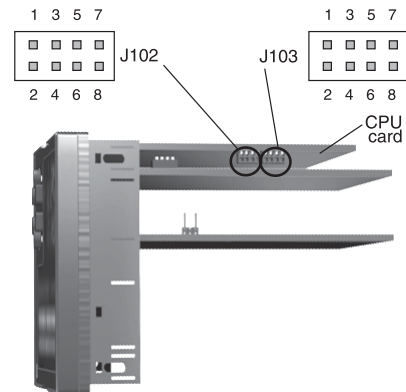


Fig. 3

### 2.3 AUXILIARY INPUT SELECTION (option)

Set J102 (see fig. 3) according to the desired input type as shown in the following table.

J102	INPUT TYPE		
	5 V	10 V	20 mA
1-2	close	open	open
3-4	close	close	open
5-6	open	open	close
7-8	open	open	close
5-7	open	close	open
6-8	open	open	open

## 2.5 CALIBRATION MODE SELECTION

To start the calibration procedure, the DIP SWITCH V101, mounted on CPU card, must be set as follows:

- V101.1 = Not care condition
- V101.2 = OFF
- V101.3 = Not care condition
- V101.4 = ON

**NOTE:** during calibration procedure the serial communication interface will be disabled.



Fig. 4

When it is desired to exit from calibration mode proceed as follows:

- 1) switch off the instrument;
- 2) remove the instrument from its case;
- 3) select the desired operative mode by setting the DIP switch V101 as described in "Operative mode and hardware lock" paragraph reported at page 16 of the USER MANUAL.

## 3 CALIBRATION PROCEDURE

### 3.1 FOREWORD

Calibration parameters are divided in groups. Each group is comprised of two parameters (initial and full scale values) plus a specific calibration check.

Follows a complete list of the "calibrations groups".

- 1) Pb.1 = Main input calibration, (from 0 to 1.5V)
- 2) Pb.2 = Main input calibration, (from 1 to 1.3V)
- 3) r.tSt = probe resistance test
- 4) tP.In = Thermocouple input
- 5) C.J.In = Cold junction
- 6) A.I.ñA = Carbon monoxide auxiliary input calibration (mA)
- 7) A.I.5 = Carbon monoxide auxiliary input calibration (5V)
- 8) A.I.10 = Carbon monoxide auxiliary input calibration (10V)
- 9) 06.ñA = Out 6 calibration
- 10) 07.ñA = Out 7 calibration
- 11) CAL = Default calibration data loading

### GENERAL NOTE ABOUT CALIBRATION PROCEDURE:

During calibration procedure, when the initial or full scale value of a group is selected and the middle display shows "OFF", pushing the FUNC pushbutton the instrument will jump to the next parameter or check **without to modify** the previous calibration setting. In this way it is possible to recalibrate only the desired input or output. It is also possible to make a check of one or more calibration group without to remake the specific calibration.

## 3.2 CALIBRATION PROCEDURE

### HOW TO PROCEED

Switch on the instrument, the upper display will show CAL while the lower display will show the firmware version.

Push the FUNC pushbutton to display the first calibration group on the upper display. Depress FUNC pushbutton more times until the desired calibration group is reached.

### 1) "Pb1" - MAIN INPUT CALIBRATION - PROBE INPUT (0 to 1.5V)

The upper display will show "Pb.1".

#### 1.1) "Lr" - INITIAL SCALE VALUE

The lower display will show "Lr"

- a) Make the specific hardware setting as described at paragraph 2.
- b) Connect the instrument under test to the calibrator as shown in Fig. 5.

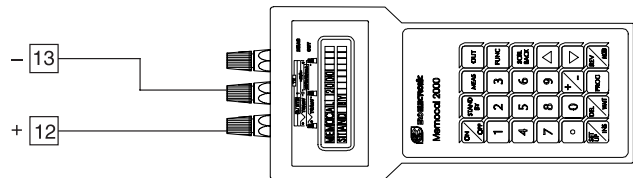


Fig.5

- c) The upper display will show "Pb.1", the lower display will show "Lr" while "OFF" will appear on the middle display.
- d) Set calibrator to 0.000 mV.
- e) Push ▲ pushbutton, the middle display will change to "On".
- f) After few seconds, start calibration by pushing FUNC pushbutton. At the end of this calibration routine, the instrument will go to the next step.

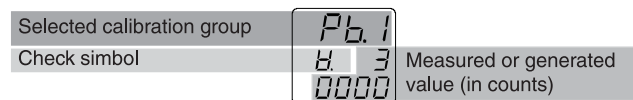
#### 1.2) "Hr" - FINAL SCALE VALUE

The upper display will show "Pb.1", the lower display will show "Hr" while "OFF" will appear on the middle display.

- a) Set the calibrator to 1500 mV (see Fig. 5).
- b) Push ▲ pushbutton, the middle display will change to "On".
- c) After few seconds, start calibration by pushing FUNC pushbutton. At the end of this calibration routine, the instrument will go to the next step.

#### 1.3) "V." -PROBE INPUT CHECK

The lower and the middle display show "V." followed by the measured value in counts as shown in the following figure:



The "Pb.1" "Hr" calibration is correct if the indication is equal to "V. 3 0000" ± 10 counts.

- a) Check the zero calibration, by setting the calibrator to 0.000 mV, the read-out must be equal to "V. 0 0000" ± 10 counts.
- b) Check the half scale linearity by setting the calibrator to 750 mV. The read-out must be "V. 1 5000" ± 10 counts.

**NOTE:** when it is desired to use a different check point, the following formula describes the ratio between the signal input and the instrument read-out (in counts).

$$\text{Instrument readout (in counts)} = \frac{\text{input value}}{1500 \text{ (mV)}} \bullet 30000$$

- c) Push FUNC pushbutton, the instrument will go to the next calibration group.

## 2) "Pb.2" - MAIN INPUT CALIBRATION - PROBE INPUT (1 to 1.3V)

The upper display will show "Pb.2"

### 2.1) "Lr" - INITIAL SCALE VALUE

The lower display will show "Lr"

- Make the specific hardware setting as described at paragraph 2.
- Connect the instrument under test to the calibrator as shown in Fig. 6.

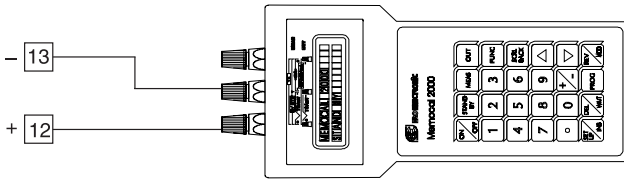


Fig.6

- The upper display will show "Pb.2", the lower display will show "Lr" while "OFF" will appear on the middle display.
- Set calibrator to 1000 mV.
- Push ▲ pushbutton, the middle display will change to "On".
- After few seconds, start calibration by pushing FUNC pushbutton. At the end of this calibration routine, the instrument will go to the next step.

### 2.2) "Hr" - FINAL SCALE VALUE

The upper display will show "Pb.2", the lower display will show "Hr" while "OFF" will appear on the middle display.

- Set the calibrator to 1300 mV (see Fig. 6).
- Push ▲ pushbutton, the middle display will change to "On".
- After few seconds, start calibration by pushing FUNC pushbutton. At the end of this calibration routine, the instrument will go to the next step.

### 2.3) "√." - PROBE INPUT CHECK

The lower and the middle display show "√." followed by the measured value in counts as shown in the following figure:

Selected calibration group	Pb.2	
Check simbol	√.3	Measured or generated value (in counts)
	0000	

The "Pb.2" "Hr" calibration is correct if the indication is equal to "√. 3 0000" ± 10 counts.

- Check the zero calibration, by setting the calibrator to 0.000 mV, the read-out must be equal to "√. 0 0000" ± 10 counts.
- Check the half scale linearity by setting the calibrator to 1150 mV. The read-out must be "√. 1 5000" ± 10 counts.
- Push FUNC pushbutton, the instrument will go to the next calibration group.

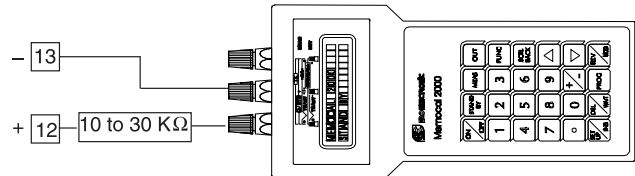
## 3) "r.tSt" PROBE RESISTANCE TEST

The upper display will show "r.tSt".

### 3.1) "Lr" - INITIAL SCALE VALUE

The lower display will show "Lr"

- Make the specific hardware setting as described at paragraph 2.
- Connect the instrument under test to the calibrator with a resistor, connected in series, having a value within 10 KΩ and 30 KΩ as shown in Fig. 7.



- The upper display will show "r.tSt", the lower display will show "Lr" while "OFF" will appear on the middle display.
- Set calibrator to a value within 1.000 mV and 1.500 mV.
- Push ▲ pushbutton, the middle display will change to "On".
- After few seconds, start calibration by pushing FUNC pushbutton, on the middle display the resistor value for 5 seconds will be shown, after that, the instrument will go to the next step.

## 4) "tP.In" - TC INPUT CALIBRATION

The upper display will show "tP.In".

### 4.1) "Lr" - INITIAL SCALE VALUE

The lower display will show "Lr"

- Make the specific hardware setting as described at paragraph 2.
- Connect the instrument under test to the calibrator as shown in Fig. 8.

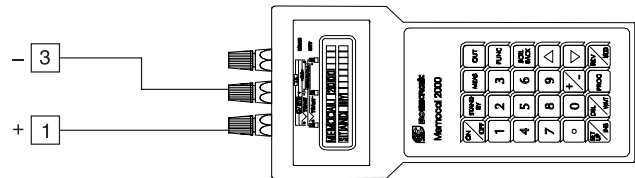


Fig.7

- The upper display will show "tP.In", the lower display will show "Lr" while "OFF" will appear on the middle display.
- Set calibrator to 0.000 mV.
- Push ▲ pushbutton, the middle display will change to "On".
- After few seconds, start calibration by pushing FUNC pushbutton. At the end of this calibration routine, the instrument will go to the next step.

### 4.2) "Hr" - FINAL SCALE VALUE

The upper display will show "tP.In", the lower display will show "Hr" while "OFF" will appear on the middle display.

- Set the calibrator to 60.00 mV (see Fig. 8).
- Push ▲ pushbutton, the middle display will change to "On".
- After few seconds, start calibration by pushing FUNC pushbutton. At the end of this calibration routine, the instrument will go to the next step.

### 4.3) "√." -TC INPUT CHECK

The lower and the middle display show "√." followed by the measured value in counts as shown in the following figure:

Selected calibration group	tP.In	
Check simbol	√.3	Measured or generated value (in counts)
	0000	

The "tP.In" "Hr" calibration is correct if the indication is equal to "∇. 3 0000" ± 10 counts.

- Check the zero calibration, by setting the calibrator to 0.000 mV, the read-out must be equal to "∇. 0 0000" ± 10 counts.
- Check the half scale linearity by setting the calibrator to 30.00 mV. The read-out must be "∇. 1 5000" ± 10 counts.

**NOTE:** when it is desired to use a different check point, the following formula describes the ratio between the signal input and the instrument read-out (in counts).

$$\text{Instrument readout (in counts)} = \frac{\text{input value}}{60 \text{ (mV)}} \cdot 30000$$

- Push FUNC pushbutton, the instrument will go to the next calibration group.

## 5) COLD JUNCTION CALIBRATION

The upper display will show "CJ.In".

**NOTE:** make sure that "tP.In" "Lr", and "tP.In" "Hr" parameters are correctly calibrated before to calibrate "CJ.In" parameter.

### 5.1) Lr - ACTUAL VALUE

The lower display will show "Lr"

- Make the specific hardware setting as described at paragraph 2.
- Measure the temperature close to terminals 1 and 3 using a calibrator, for instance, the MEMOCAL (see Fig. 9).

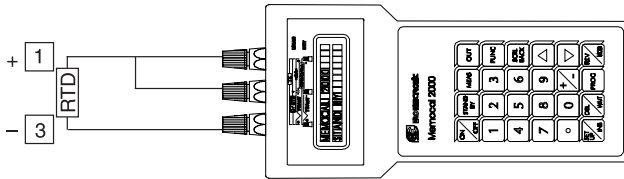


Fig. 9

- Wait a few minutes to allow the temperature stabilisation of the entire system (sensor, calibrator and instrument).
- The middle displays will show "OFF".  
At the first pressure of ▲ or ▼ push-button, the middle display starts to show a read-out value.
- Using ▲ or ▼ push-button, set a read-out value equal to the temperature measured by the measuring device (in °C and tenths of °C).
- After a few seconds, start the calibration by pushing FUNC pushbutton. At the end of this calibration routine, the instrument will go to the next step.

### 5.2) "∇." - COLD JUNCTION COMPENSATION CHECK

The middle display will show "∇.".

The lower display will show the measured cold junction temperature (in °C and tenths of °C).

- Make sure that the cold junction temperature measured by the instrument is equal to the value measured by the measuring device (MEMOCAL).
- Push FUNC pushbutton, the instrument will go to the next calibration group.

## 6) "A.I.ñA" - CARBON MONOXIDE AUXILIARY INPUT CALIBRATION - mA

The upper display will show "A.I.ñA".

### 6.1) "Lr" - INITIAL SCALE VALUE

The lower display will show "Lr"

- Make the specific hardware setting as described at paragraph 2.
- Connect the instrument under test to the calibrator as shown in Fig. 10.

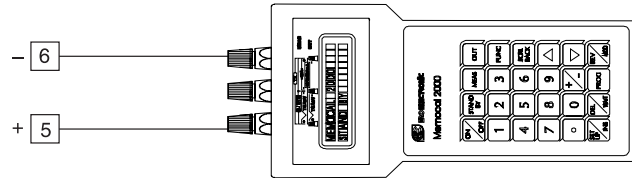


Fig.10

- The upper display will show "A.I.ñA", the lower display will show "Lr" while "OFF" will appear on the middle display.
- Set calibrator to 0.000 mA.
- Push ▲ pushbutton, the middle display will change to "On".
- After a few seconds, start the calibration by pushing FUNC pushbutton. At the end of this calibration routine, the instrument will go to the next step.

### 6.2) "Hr" - FINAL SCALE VALUE

The upper display will show "A.I.ñA", the lower display will show "Hr" while "OFF" will appear on the middle display.

- Set the calibrator to 20.000 mA.
- Push ▲ pushbutton, the middle display will change to "On".
- After a few seconds, start the calibration by pushing FUNC pushbutton. At the end of this calibration routine, the instrument will go to the next step.

### 6.3) "∇." - CARBON MONOXIDE INPUT CHECK

The lower and the middle display show "∇." followed by the measured value in counts.

The "A.I.ñA" "Hr" calibration is correct if the indication is equal to "∇. 3 0000" ± 10 counts.

Selected calibration group	A.I.ñA	
Check simbol	∇. 3	Measured or generated value (in counts)
	0000	

- Check the zero calibration, by setting the calibrator to 0.000 mA, the read-out must be equal to "∇. 0 0000" ± 10 counts.
- Check the linearity by setting the calibrator to 10.000 mA The read-out must be "∇. 1 5000" ± 10 counts.

**NOTE:** when it is desired to use a different check point, the following formula describes the ratio between the signal input and the instrument read-out (in counts).

$$\text{Instrument readout (in counts)} = \frac{\text{input value}}{20 \text{ (mA)}} \cdot 30000$$

- Push FUNC pushbutton, the instrument will go to the next calibration group.

## 7) "A.I.5" - CARBON MONOXIDE AUXILIARY INPUT CALIBRATION - 5 V

The upper display will show "A.I.5".

### 7.1) "Lr" - INITIAL SCALE VALUE

The lower display will show "Lr"

- Make the specific hardware setting as described at paragraph 2.
- Connect the instrument under test to the calibrator as shown in Fig. 11.

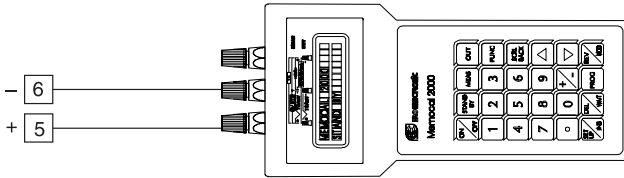


Fig.11

- The upper display will show "A.I.5", the lower display will show "Lr" while "OFF" will appear on the middle display.
- Set calibrator to 0.000 V.
- Push ▲ pushbutton, the middle display will change to "On".
- After a few seconds, start the calibration by pushing FUNC pushbutton. At the end of this calibration routine, the instrument will go to the next step.

### 7.2) "Hr" - FINAL SCALE VALUE

The upper display will show "A.I.5", the lower display will show "Hr" while "OFF" will appear on the middle display.

- Set the calibrator to 5.000 V.
- Push ▲ pushbutton, the middle display will change to "On".
- After a few seconds, start the calibration by pushing FUNC pushbutton. At the end of this calibration routine, the instrument will go to the next step.

### 7.3) "∇." - 5 V INPUT CHECK

The lower and the middle display show "∇." followed by the measured value in counts.

Selected calibration group	A.I.5	
Check simbol	∇.3	Measured or generated value (in counts)
	0000	

The "A.I.5" "Hr" calibration is correct if the indication is equal to "∇. 3 0000" ± 10 counts.

- Check the zero calibration, by setting the calibrator to 0.0000 V, the read-out must be equal to "∇. 0 0000" ± 10 counts.
- Check the linearity by setting the calibrator to 2.500 V. The read-out must be "∇. 1 5000" ± 10 counts.

**NOTE:** when it is desired to use a different check point, the following formula describes the ratio between the signal input and the instrument read-out (in counts).

$$\text{Instrument readout (in counts)} = \frac{\text{input value}}{5 (V)} \cdot 30000$$

- Push FUNC pushbutton, the instrument will go to the next calibration group.

## 8) "A.I.10" -CARBON MONOXIDE AUXILIARY INPUT CALIBRATION - 10 V

The upper display will show "A.I.10".

### 8.1) "Lr" - INITIAL SCALE VALUE

The lower display will show "Lr"

- Make the specific hardware setting as described at paragraph 2.
- Connect the instrument under test to the calibrator as shown in Fig. 12.

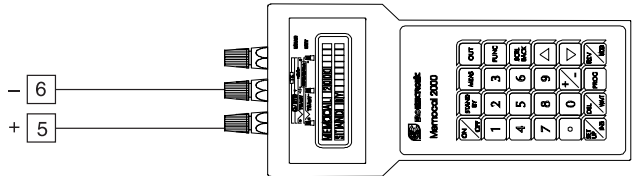


Fig.12

- The upper display will show "A.I.10", the lower display will show "Lr" while "OFF" will appear on the middle display.
- Set calibrator to 0.000 V.
- Push ▲ pushbutton, the middle display will change to "On".
- After a few seconds, start the calibration by pushing FUNC pushbutton. At the end of this calibration routine, the instrument will go to the next step.

### 8.2) "Hr" - FINAL SCALE VALUE

The upper display will show "A.I.10", the lower display will show "Hr" while "OFF" will appear on the middle display.

- Set the calibrator to 10.000 V.
- Push ▲ pushbutton, the middle display will change to "On".
- After a few seconds, start the calibration by pushing FUNC pushbutton. At the end of this calibration routine, the instrument will go to the next step.

### 8.3) "∇." - 10 V INPUT CHECK

The lower and the middle display show "∇." followed by the measured value in counts.

Selected calibration group	A.I.10	
Check simbol	∇.3	Measured or generated value (in counts)
	0000	

The "A.I.10" "Hr" calibration is correct if the indication is equal to "∇. 3 0000" ± 10 counts.

- Check the zero calibration, by setting the calibrator to 0.000 V, the read-out must be equal to "∇. 0 0000" ± 10 counts.
- Check the linearity by setting the calibrator to 5.000 V. The read-out must be "∇. 1 5000" ± 10 counts.

**NOTE:** when it is desired to use a different check point, the following formula describes the ratio between the signal input and the instrument read-out (in counts).

$$\text{Instrument readout (in counts)} = \frac{\text{input value}}{10 (V)} \cdot 30000$$

- Push FUNC pushbutton, the instrument will go to the next calibration group.



## 9) "O6.nA" - OUT 6 CALIBRATION.

The upper display will show "O6.nA".

### 9.1) "Lr" - INITIAL SCALE VALUE

- Connect the instrument under test to the calibrator as shown in Fig. 13.

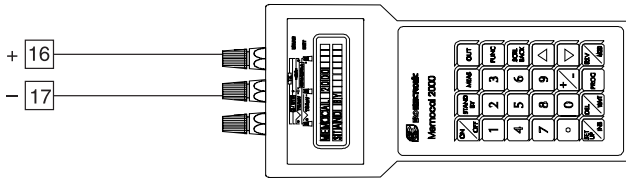


Fig. 13

- The upper display will show "O6.nA", the lower display will show "Lr" while the middle display will show the actual zero offset in counts (a number from 0 to 5000).
- Using ▲ or ▼ push-button, adjust the instrument output until 0.000 mA ± 0.005 mA is shown by the calibrator.
- After a few seconds, start the calibration by pushing FUNC push-button. At the end of this calibration routine, the instrument will go to the next step.

### 9.2) "Hr" - FINAL SCALE VALUE

The upper display will show "O6.nA", the lower display will show "Hr" while the middle display will show the actual full scale offset in counts (a number from 0 to 5000).

- Using ▲ or ▼ push-button, adjust the instrument output until 20.000 mA ± 0.005 mA is shown by the calibrator.
- After a few seconds, start the calibration by pushing FUNC push-button. At the end of this calibration routine, the instrument will go to the next step.

### 9.3) "∇." - OUT 6 CHECK

The upper display will show "O6.nA", the lower display will show "∇." while the middle display will show a read-out value in counts (a number from 0 to 8000).

- The instrument shows a value equal to 4000 count. The calibrator measure must be equal to 10.000 mA ± 0.005 mA  
**NOTE:** when it is desired to use a different check point, the following formula describes the ratio between the signal output and the instrument read-out (in counts).

$$OUT = \frac{\text{displayed value}}{8000} \cdot 20$$

- Using ▲ or ▼ push-button, set a value equal to 0 count. The "O5.nA" "Lr" calibration is correct if the calibrator measure an output equal to 0.000 mA ± 0.005 mA
- Using ▲ or ▼ push-button, set a value equal to 8000 count. The "O5.nA" "Hr" calibration is correct if the calibrator measure an output equal to 20.000 mA ± 0.005 mA
- Push FUNC push-button, the instrument will go to the next calibration group.

## 10) "O7.nA" - OUT 7 CALIBRATION.

The upper display will show "O7.nA".

### 10.1) "Lr" - INITIAL SCALE VALUE

- Connect the instrument under test to the calibrator as shown in Fig. 14.

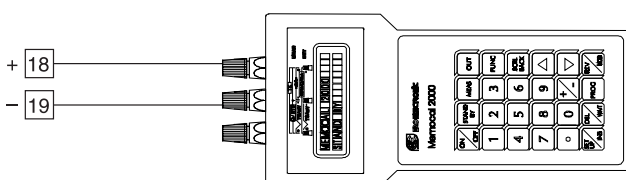


Fig. 14

- The upper display will show "O7.nA", the lower display will show "Lr" while the middle display will show the actual zero offset in counts (a number from 0 to 5000).
- Using ▲ or ▼ push-button, adjust the instrument output until 0.000 mA ± 0.005 mA is shown by the calibrator.
- After a few seconds, start the calibration by pushing FUNC push-button. At the end of this calibration routine, the instrument will go to the next step.

### 10.2) "Hr" - FINAL SCALE VALUE

The upper display will show "O7.nA", the lower display will show "Hr" while the middle display will show the actual full scale offset in counts (a number from 0 to 5000).

- Using ▲ or ▼ push-buttons, adjust the instrument output until 20.000 mA ± 0.005 mA is shown by the calibrator.
- After a few seconds, start the calibration by pushing FUNC push-button. At the end of this calibration routine, the instrument will go to the next step.

### 10.3) "∇." - OUT 7 CHECK

The upper display will show "O7.nA", the lower display will show "∇." while the middle display will show a read-out value in counts (a number from 0 to 8000).

- The instrument shows a value equal to 4000 count. The calibrator measure must be equal to 10.000 mA ± 0.005 mA

**NOTE:** when it is desired to use a different check point, the following formula describes the ratio between the signal output and the instrument read-out (in counts).

$$OUT = \frac{\text{displayed value}}{8000} \cdot 20$$

- Using ▲ or ▼ push-button, set a value equal to 0 count. The "O6.nA" "Lr" calibration is correct if the calibrator measure an output equal to 0.000 mA ± 0.005 mA
- Using ▲ or ▼ push-button, set a value equal to 8000 count. The "O6.nA" "Hr" calibration is correct if the calibrator measure an output equal to 20.000 mA ± 0.005 mA
- Push FUNC push-button, the instrument will go to the next calibration group.

## 11) "CAL" - DEFAULT CALIBRATION PARAMETER LOADING.

The upper display will show "CAL".  
The lower display will show "dFLt".  
The middle display will show "OFF".

A complete and consistent set of calibration parameters is memorized in the instrument. These data are theoretical data and are used only to clear all calibration memory but after a default calibration data loading it is necessary to make **all** calibrations.

When you desire to clear all calibration memory proceed as follows:

- Select the default calibration parameter loading
- Push ▲ push-button, the middle display will change to "On".
- Push the "FUNC". The central display will show

*LOAD*

Then the upper display will show CAL while the lower display will show the firmware version.

The default calibration parameter loading procedure is ended.

**WARNING:** After default calibration data loading, it is necessary to remake **all** instrument calibrations.

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