8004-2

Temperature Controller with Servomotor Output

Issue date
May 2000

❒ USER'S MANUAL

INDEX GB

Model identification

Model

8004 1/16 DIN Temperature Controller

Code	Outputs
21	1 servomotor + 1 relay + 3 logic inputs

Code	Output 2 - Alarm
0	None
1	Out #4
2	Out #4 + RS-485

Code	Instrument Power
3	100 - 240 Vac
5	24 V AC/DC

Code	
000	Add to complete model number

8004 21 1 3 000 Typical Model Number

MOUNTING REQUIREMENTS

Select a mounting location where there is minimum vibration and the ambient temperature range between 0 and 50 °C.
The instrument can be mounted on a panel up to 15 mm thick with a square cutout of 45 x 92 mm. For outline and cutout dimensions refer to Fig. 2.
The surface texture of the panel must be better than 6,3 μm.
The instrument is shipped with rubber panel gasket (50 to 60 Sh).
To assure the IP65 and NEMA 4 protection, insert the panel gasket between the instrument and the panel as 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, insert the mounting bracket;
4) with a screwdriver, turn the screws with a torque between 0.3 and 0.4 Nm.

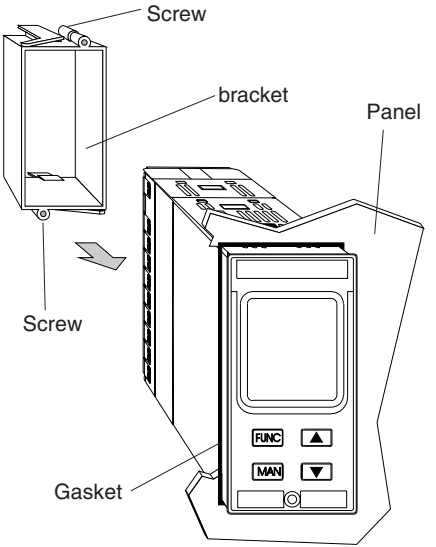


Fig. 1

OUTLINE AND CUT OUT DIMENSIONS

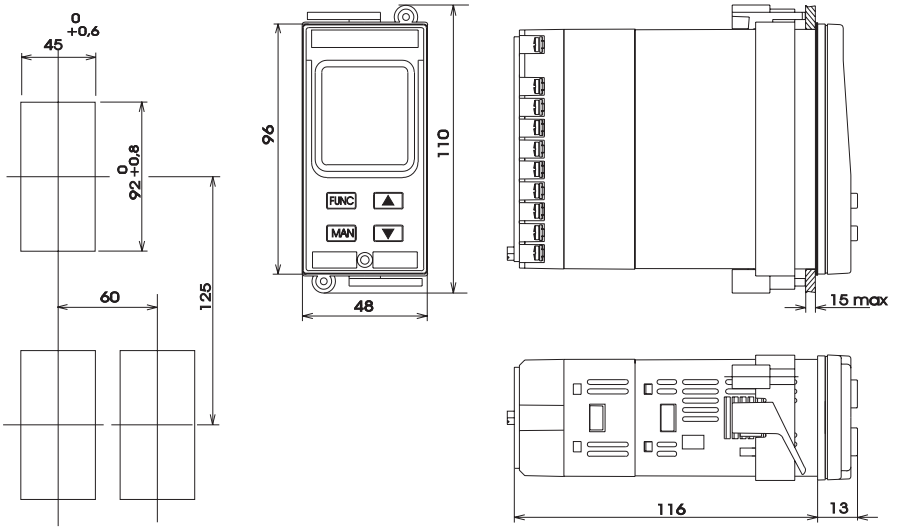


Fig. 2

CONNECTION DIAGRAMS

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

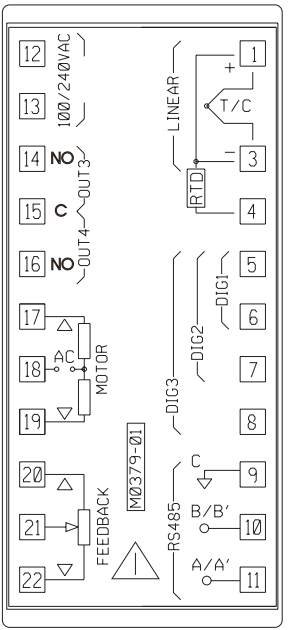


Fig. 3 REAR TERMINAL BLOCK

A) MEASURING INPUT

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

TC INPUT

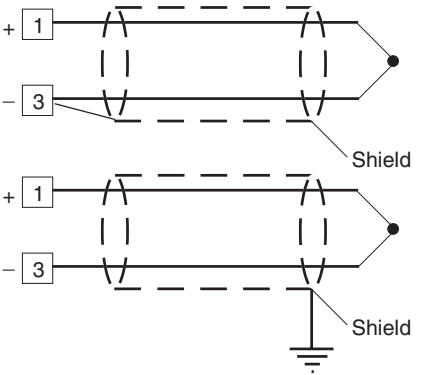


Fig. 4 THERMOCOUPLE INPUT WIRING

NOTE:

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

RTD INPUT

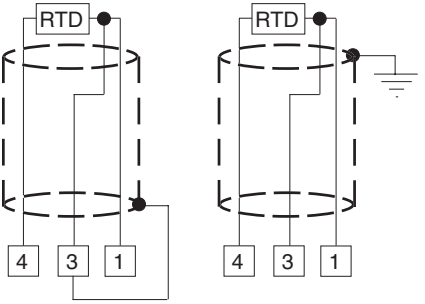


Fig. 5 RTD INPUT WIRING

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

LINEAR INPUT

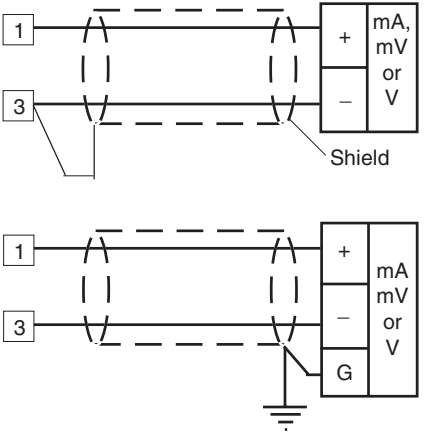


Fig. 6 mA, mV AND V INPUTS WIRING

NOTE:
1) Don't run input wires together with power cables.
2) Pay attention to the line resistance; a high line resistance may cause measurement errors.
3) When shielded cable is used, it should be grounded at one side only to avoid ground loop currents.
4) The input impedance is equal to:
   < 5 Ω for 20 mA input
   > 1 MΩ for 60 mV input
   > 200 kΩ for 5 V input
   > 400 kΩ for 10 V input

B) LOGIC INPUT

Safety note:

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

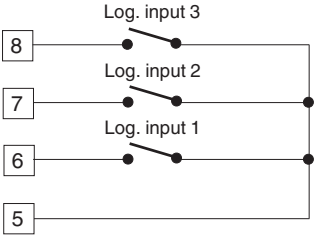


Fig. 7 - LOGIC INPUT WIRING

This instrument is provided with 3 logic inputs. The binary combination of the logic input 1 and 3 allows to select the operative set point according with the following table:

logic input 3	logic input 1	op. set point
open	open	SP
open	close	SP2
close	open	SP3
close	close	SP4

The logic input 2 function is programmed by P 24 parameter.

C) VALVE MOTOR DRIVE OUTPUT.

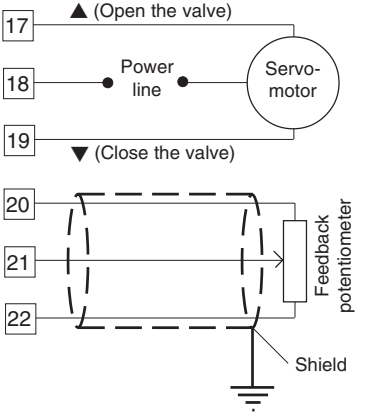


Fig. 8 - SERVOMOTOR WIRING

The two relay outputs are interlocked.

NOTE:

1) Before connecting the instrument to the power line, make sure that line voltage and the load current are in accordance with the contact rating (3A/250V AC on resistive load).
2) To avoid electric shock, connect power line at the end of the wiring procedure.
3) For servomotor connections use No 16 AWG or larger wires rated for at last 75 °C.
4) Use copper conductors only.
5) Don't run input wires together with power cables.
6) For feedback potentiometer, use shielded cable with the shield connected to the earth at one point only.
7) The relay outputs are protected by varistor against inductive load with inductive component up to 0.5 A.

D) RELAY OUTPUTS

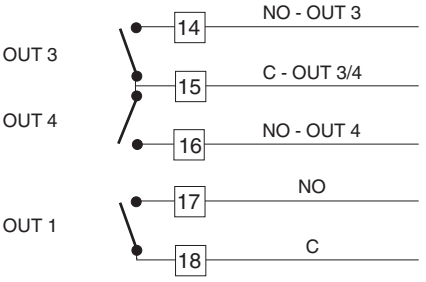


Fig. 9 RELAY OUTPUTS WIRING

NOTE: OUT 1 can be used either as servomotor output or as time proportional relay output; by the P5 parameter (see pag.11) it is possible to set the desired output.

All relay outputs are protected by varistor against inductive load with inductive component up to 0.5 A.
The contact rating of OUT 1 is 3A/250V AC on resistive load, the contact rating of OUT 3 and 4 is 2A/250V AC on resistive load.
The contact rating of the OUT 3 and 4 is 2A/250V AC resistive load.
The number of operations is 1 x 10^5 at specified rating.
Alarm 2 and alarm 3 are in OR condition on the out 4.
The following recommendations avoid serious problems which may occur, when using relay output for driving inductive loads.

INDUCTIVE LOADS

High voltage transients may occur when switching inductive loads.
Through the internal contacts these transients may introduce disturbances which can affect the performance of the instrument.
The internal protection (varistor) assures a correct protection up to 0.5 A of inductive component.
The same problem may occur when a switch is used in series with the internal contacts as shown in Fig. 10.

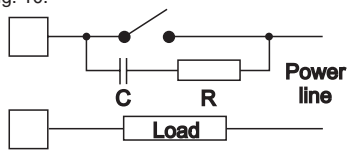


Fig. 10 EXTERNAL SWITCH IN SERIES WITH THE INTERNAL CONTACT

In this case it is recommended to install an additional RC network across the external contact as shown in Fig. 10

The value of capacitor (C) and resistor (R) are shown in the following table.

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

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

SERIAL INTERFACE

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

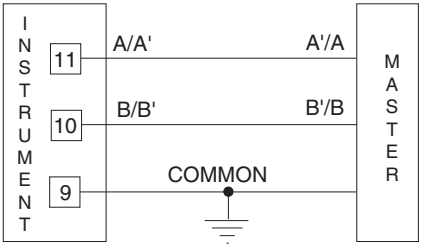


Fig. 11 - RS-485 WIRING

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

NOTE: 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)

E) POWER LINE WIRING

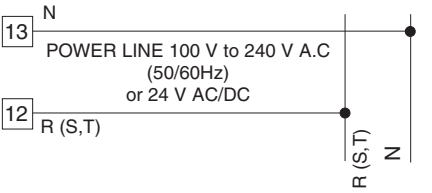


Fig. 12 POWER LINE WIRING

NOTE:

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

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

9) When a neutral line is present, connect it to terminal 13.

PRELIMINARY HARDWARE SETTINGS

1) Remove the instrument from its case.
2) It is necessary to set J1 according to the desired input type as shown in the following figure.

INPUT	J1				
TYPE	1-2	3-4	5-6	7-8	9-10
TC-RTD	open	close	open	open	open
60 mV	open	close	open	open	open
5 V	close	open	close	open	open
10 V	open	open	close	open	open
20 mA	open	open	open	close	close

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

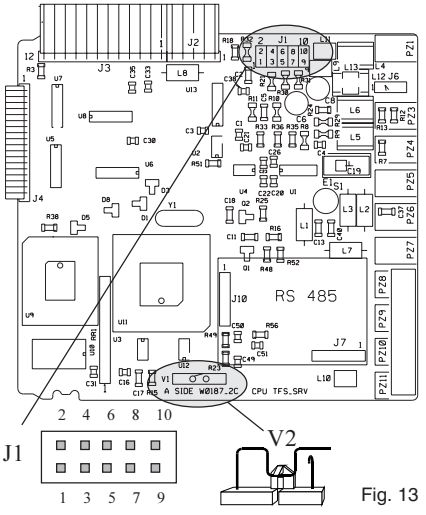


Fig. 13

OPEN INPUT CIRCUIT

This instrument is able to identify the open circuit for TC and RTD inputs.
The open input circuit condition for RTD input is shown by an "overrange" indication.
For TC input, it is possible to select overrange indication (standard) or underrange indication setting the CH2 and SH2 according to the following table:

Overrange (STD)	CH2 = close	SH2 = open
Underrange	CH2 = open	SH2 = close

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

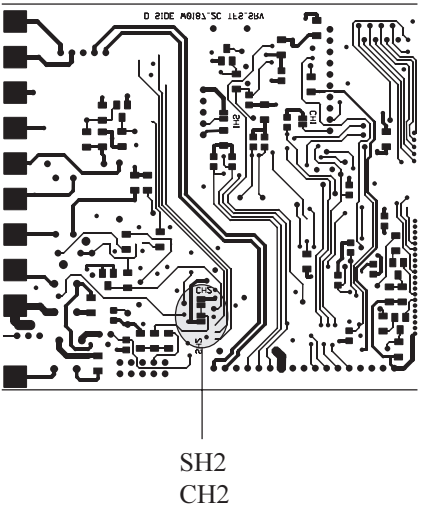


Fig. 14

GENERAL NOTES for configuration.

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

MAN = This will scroll back the parameters without memorization of the new value.

▲ = This will increase the value of the selected parameter

▼ = This will decrease the value of the selected parameter.

CONFIGURATION PROCEDURE

1) Remove the instrument from its case.
2) Set the dip switch V2 to the open condition (see fig. 13).
3) Re-insert the instrument.
4) Switch on the instrument.

The display will show COnF.

NOTE : If "CAL" indication is displayed, press immediately the ▲ pushbutton and return to the configuration procedure.

5) Push the FUNC pushbutton.

SEr1 = Serial interface protocol

OFF = No serial interface
Ero = Polling/selecting ERO
nbUS = Modbus
jbUS = Jbus

SEr2 = Serial link device address

Not available when SEr1 = OFF
From 1 to 95 for ERO protocol
From 1 to 255 for all the other protocols
NOTE: the electrical characteristic of the RS 485 serial interface will allow the connection of 31 devices maximum.

SEr3 = Baude rate for serial link

Not available when SEr1 = OFF
From 600 to 19200 baud.
NOTE: 19200 baud is shown on display as 19.2.

SEr4 = Byte format for serial link

Not available when SEr1 = OFF
7E = 7 bits + even parity (For ERO protocol only)
7O = 7 bits + odd parity (For ERO protocol only)
8E = 8 bits + even parity
8O = 8 bits + odd parity
8 = 8 bits without parity

P1 - Input type and standard range

0	= TC type	L	range	0	/	+400.0 °C
1	= TC type	L	range	0	/	+900 °C
2	= TC type	J	range	-100.0	/	+400.0 °C
3	= TC type	J	range	-100	/	+1000 °C
4	= TC type	K	range	-100.0	/	+400.0 °C
5	= TC type	K	range	-100	/	+1370 °C
6	= TC type	T	range	-199.9	/	+400.0 °C
7	= TC type	N	range	-100	/	+1400 °C
8	= TC type	R	range	0	/	+1760 °C
9	= TC type	S	range	0	/	+1760 °C
10	= TC type	B	range	0	/	+1820 °C
11	= RTD type	Pt 100	range	-199.9	/	+400.0 °C
12	= RTD type	Pt 100	range	-200	/	+800 °C
13	= mV	Linear	range	0	/	60 mV
14	= mV	Linear	range	12	/	60 mV
15	= mA	Linear	range	0	/	20 mA
16	= mA	Linear	range	4	/	20 mA
17	= V	Linear	range	0	/	5 V
18	= V	Linear	range	1	/	5 V
19	= V	Linear	range	0	/	10 V
20	= V	Linear	range	2	/	10 V
21	= TC type	L	range	0	/	+1650 °F
22	= TC type	J	range	-150	/	+1830 °F

23 = TC type K range -150 / +2500 °F
24 = TC type T range -330 / +750 °F
25 = TC type N range -150 / +2550 °F
26 = TC type R range 0 / +3200 °F
27 = TC type S range 0 / +3200 °F
28 = TC type B range 0 / + 3310 °F
29 = RTD type Pt 100 range -199.9 / +400.0 °F
30 = RTD type Pt 100 range -330 / +1470 °F

NOTE: selecting P1 = 0, 2, 4, 6, 10,11, 28 or 29, the instrument set automatically P43 = FLtr. For all the remaining ranges it will set P43 = nOFL.

P2 = Decimal point position

This parameter is available only when a linear input is selected (P1 = 13, 14, 15, 16, 17, 18, 19 or 20).

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

P3 = Initial scale value

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

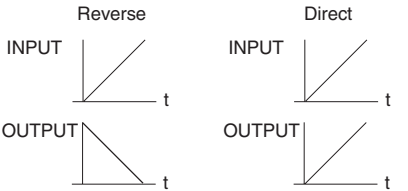
P4 = Full scale value

For linear inputs it is programmable from -1999 to 4000.
For TC and RTD inputs, it is programmable within the input range.
When this parameter is modified, rH parameter will be re-alligned to it.
The initial and full scale values determine the input span which is used by the PID algorithm, the SMART and the alarm functions.

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

P5 = Output 1 type

Sn.OL= servomotor open loop.
Sn.CL = servomotor close loop.
rEv = time proportional control output with reverse action
dir = time proportional control output with direct action.



NOTES:

1) If P5 is changed to "Sn.OL" or it is changed from "Sn.OL" to another selection, the parameter P41 will be forced to 0.
2) If P5 is changed to "rEv" the cycle time (Cy1) will be forced to 15 s
3) If P5 is changed to "dir" the cycle time (Cy1) will be forced to: 10 s when P25 = Air
   4 s when P25 = OIL
   2 s when P25 = H2O

P6 = Valve position indication.
This parameter is available only if P5 = Sn.OL
Fb = the valve position will be displayed
no.Fb = the valve position will not be displayed (the feedback potentiometer can be omitted)

P7 = Output 3 function.
nonE = output not used.
AL1.P = it is used as Alarm 1 output and the alarm 1 is programmed as process alarm.
AL1.b = it is used as Alarm 1 output and the alarm 1 is programmed as band alarm.
AL1.d = it is used as Alarm 1 output and the alarm 1 is programmed as deviation alarm.
rEv = it is used as second time proportional control output with reverse action.
dir = it is used as second time proportional control output with direct action.

NOTES:
1) If P7 is changed to "rEv" the cycle time (Cy3) will be forced to 15 s
2) If P7 is changed to "dir" the cycle time (Cy3) will be forced to: 10 s when P25 = Air
   4 s when P25 = OIL
   2 s when P25 = H2O
3) Only one of the two outputs (see P5 and P7) can be configured as "rEv" control output.
4) Only one of the two outputs (see P5 and P7) can be configured as "dir" control output.
5) If the servomotor output is selected (P5="Sn.OL" or "Sn.CL") the OUT 3 can be set as alarm output only (P7 = "AL1.P" or "AL1.b" or "AL1.d").

P8 = Alarm 1 operating mode
Available only when P7 is equal to AL1.P, AL1.b or AL1.d.
H.A. = High alarm (outside for band alarm) with automatic reset.
L.A. = Low alarm (inside for band alarm) with automatic reset.
H.L. = High alarm (outside for band alarm) with manual reset (latched).
L.L. = low alarm (inside for band alarm) with manual reset (latched).

P9 = Alarm 2 function (OUT 4).
nonE = output not used.
AL2.P = it is used as Alarm 2 output and the alarm 2 is programmed as process alarm.
AL2.b = it is used as Alarm 2 output and the alarm 2 is programmed as band alarm.
AL2.d = it is used as Alarm 2 output and the alarm 2 is programmed as deviation alarm.

P10 = Alarm 2 operating mode
Available only when P9 is different from "nonE".
H.A. = High alarm (outside for band alarm) with automatic reset.
L.A. = Low alarm (inside for band alarm) with automatic reset.
H.L. = High alarm (outside for band alarm) with manual reset (latched).
L.L. = low alarm (inside for band alarm) with manual reset (latched).

P11 = Alarm 3 function (OUT 4)
nonE = output not used.
AL3.P = it is used as Alarm 3 output and the alarm 3 is programmed as process alarm.
AL3.b = it is used as Alarm 3 output and the alarm 3 is programmed as band alarm.
AL3.d = it is used as Alarm 3 output and the alarm 3 is programmed as deviation alarm.
NOTE : The output 4 operates as a logic OR between the alarm 2 and the alarm 3.

P12 = Alarm 3 operating mode
Available only when P11 is different from "nonE".
H.A. = High alarm (outside for band alarm) with automatic reset.
L.A. = Low alarm (inside for band alarm) with automatic reset.
H.L. = High alarm (outside for band alarm) with manual reset.
L.L. = low alarm (inside for band alarm) with manual reset.

P13 = Programmability of the alarm 3.
Available only when P11 is different from "nonE".
OPrt = Alarm 3 threshold and hysteresis are programmable in operating mode.
COnF = Alarm 3 threshold and hysteresis are programmable in configuration mode.
SPEC= During configuration mode, the user assigns to the alarm 3 the hysteresis value and two threshold values while, during operative mode, he can select the first or the second threshold value as operative threshold value.

P14 = Alarm 3 first threshold value.
Available only when P11 is different from "nonE" and P13 is equal to "COnF" or "SPEC".
Range:
- For process alarm - within the range limits.
- For band alarm - from 0 to 500 units.
- For deviation alarm - from -500 to 500 units.

P15 = Alarm 3 second threshold value
Available only when P11 is different from "nonE" and P13 is equal to "SPEC".
Range:
- For process alarm - within the range limits.
- For band alarm - from 0 to 500 units.
- For deviation alarm - from -500 to 500 units.

P16 = Alarm 3 hysteresis value
Available only when P11 is different from "nonE" and P13 is equal to "COnF" or "SPEC".
Range: from 0.1% to 10.0 % of the span selected with P3 and P4 parameters.

P17 = Threshold of the "Soft Start" function.
Available only when P5 is different from "Sn.OL" or "Sn.CL".
Threshold value, in eng. units, to initiate the "Soft start" function (output power limiting) at start up.
Range : within the readout span.
NOTE: this threshold value will not be taken into account when tOL = InF.

P18 = Safety lock
NOTE: When P18 is selected, the display will show:
- "0" if P18 is equal to 0
- "1" if P18 is equal to 1
- "SFt.A" if P18 is included from 2 to 4999
- "SFt.B" if P18 is included from 5000 to 9999.

Using ▲ and ▼ pushbutton set the P18 according to the following conditions:
0 = No parameter protection. The device is always in unlock condition and all parameters can be modified.
1 = The device is always in lock condition and no one of the parameters (exception made for SP, SP2, SP3, SP4 and alarm manual reset) can be modified (for SMART status see P33 parameter).
From 2 to 4999 = This combination number is a secret value to be used, in run time (see nnn parameter) to put device in lock/unlock condition.
With this selection, the lock/unlock condition has no effect on SP, SP2, SP3, SP4 and manual reset of the alarms (for SMART status see P33).

From 5000 to 9999 = This combination number is a secret value to be used, in run time (see nnn parameter) to put device in lock/unlock condition.
With this selection, the lock/unlock condition has no effect on SP, SP2, SP3, SP4 , manual reset of the alarms and AL1/ AL2/ AL3 thresholds (for SMART status see P33).

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

When it is desired to access to the advanced configuration parameter procede as follows:
1) using ▲ and ▼ pushbutton set the 275 code.
2) push the FUNC pushbutton.

NOTE: P19, P20, P21, P22 and P23 are not used.

P24 = Logic input 2 function (contact)
nonE = Logic input 2 not used
AU.nA = Logic input 2 used for AUTO/ MAN control mode selection.
Open = AUTO
Closed = MANUAL
rE.dr = Logic input 2 used for REVERSE/ DIRECT control mode selection.
Open = REVERSE
Closed = DIRECT
NOTE: this selection is available only when P5 = "Sn.OL" or "Sn.CL".

P25 = Cooling media.
Available only when the device is configured with two control outputs.
AIr = Air OIL = Oil H2O = water
Changing P25 parameter, the instrument forces the cycle time and relative cooling gain parameter to the default value related with the chosen cooling media.
When P25 = AIr - Cyx = 10 s and rC = 1.00
P25 = OIL - Cyx = 4 s and rC = 0.80
P25 = H2O - Cyx = 2 and rC = 0.40

P26 = Alarm 1 action
Available only when P7 is equal to "AL1.P" or "AL1.b" or "AL1.d".
dir = direct action (relay energized in alarm condition)
rEV = reverse action (relay de-energized in alarm condition)

P27 = Alarm 1 stand-by function (mask)
Available only when P7 is equal to "AL1.P" or "AL1.b" or AL1.d".
OFF = stand-by function (mask alarm) disabled
On = stand-by function (mask alarm) enabled

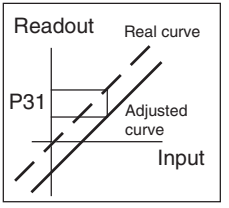
NOTE: If the alarm is programmed as band or deviation alarm, this function masks the alarm condition after a set point change or at the instrument start-up until the process variable reaches the alarm threshold plus or minus hysteresis. If the alarm is programmed as a process alarm, this function masks the alarm condition at instrument start-up until the process variable reaches the alarm threshold plus or minus hysteresis.

P28 = Action of the alarm 2 and 3
Available only when P9 or P11 are different from "nonE".
dir = direct action (relay energized in alarm condition)
rEV = reverse action (relay de-energized in alarm condition)

P29 = Alarm 2 stand-by function (mask alarm)
Available only when P9 is different from "nonE".
OFF = Stand by (mask) disabled
On = Stand by (mask) enabled

P30 = Alarm 3 stand-by function (mask alarm)
Available only when P11 is different from "nonE".
OFF = Stand by (mask) disabled
On = Stand by (mask) enabled

P31 = OFFSET applied to the measured value
This will set a constant OFFSET throughout the readout range. It is skipped for linear inputs
- For readout ranges with decimal figure, P31 is programmable from -19.9 to 19.9.
- For readout ranges without decimal figure, P31 is programmable from -199 to 199.



P32 = Displayable protected parameters
This parameter is skipped when P18 = 0.
OFF = Protected parameters cannot be displayed.
On = Protected parameter can be displayed.

P33 = SMART function
0 = SMART function disabled.
1 = SMART function in NOT protected by safety lock.
2 = SMART function is under safety lock protection.

P34 = Maximum value of the proportional band calculated by the SMART algorithm.
This parameter is skipped if P33=0.
It is programmable from P35 value to 200.0 %.

P35 = Minimum value of the proportional band calculated by the SMART algorithm
This parameter is skipped if P33=0.
It is programmable from 1.0 % to P34 value.

P36 = Minimum value of the integral time calculated by the SMART algorithm.
This parameter is skipped if P33=0.
It is programmable from 1 second (00.01) to 2 minutes (02.00).

P37 = Relative cooling gain calculated by SMART function.
This parameter available only when device is configured with two control output and P33 is different from 0.
OFF = SMART algorithm does not calculate the rC parameter value
On = SMART algorithm calculates the rC parameter value.

P38 = MANUAL function

OFF = manual function is disabled

On = manual function can be enabled/ disabled by MAN pushbutton or by contact closure on logic input 2.

P39 = Device status at instrument start up.

This parameter is skipped when P38 = OFF.

0 = the instrument starts in AUTO mode.

1 = the instrument starts in manual mode.

❑ If the time proportioning output is configured, the power output will be set to 0.

❑ If servomotor control is configured, the instrument will not modify the valve position.

2 = It starts in the same way it was prior to the power shut down.

❑ If the time proportioning output is configured and the instrument was in manual mode, the power output will be set to 0.

❑ If servomotor control is configured and the instrument was in manual mode, the instrument will not modify the valve position.

3 = It starts in the same way it was prior to the power shut down.

❑ If: - the time proportioning output is configured
- the instrument was in manual mode

the power output will be set equal to the last value prior to power shut down.

❑ If: - servomotor control is configured
- the instrument was in manual mode
- P40 = "bUnP"

the instrument will not modify the valve position.

❑ If: - servomotor control is configured
- the instrument was in manual mode
- P40 is different from "bUnP"

the instrument will modify the valve position in order to reach the value set in P40.

P40 = Transfer from AUTO to MANUAL

This parameter is skipped if P38 = OFF

When P5 = "Sn.OL" and P6 = "no.Fb", this parameter is forced to "bUnP" and it cannot be modified.

- When the device is configured for one control output, P40 can be set from 0 to 100
- When device is configured for two control outputs, P40 can be set from -100 to 100.

Above the 100 value the instrument will show "bUnP" and the transfer will be bumpless (the manual mode starts with an output value equal to the last value in the auto mode)

NOTE: If P40 is different from "bUnP" and an open loop servomotor control with feedback potentiometer is programmed, the instrument will reach the P40 value using the feedback indication.

P41 = Conditions for output safety value

When P5 is different from "Sn.OL" the P41 possible selections are:

0 = No safety value ("Standard" effect)

1 = Safety value applied when overrange or underrange condition is detected.

2 = Safety value applied when overrange condition is detected.

3 = Safety value applied when underrange condition is detected.

When P5 is equal to "Sn.OL" the P41 possible selections are:

0 = No safety value ("Standard" effect)

4 = When an overrange or an underrange condition is detected the instrument will close the OUT 1 (▲) relay contact.

5 = When an overrange or an underrange condition is detected the instrument will close the OUT 2 (▼) relay contact.

6 = When an overrange or an underrange condition is detected the instrument will revert the "standard" effect.

NOTE: For "Standard effect" see chapter "Error messages".

P42 = Output safety value

This parameter is skipped when P41 = 0, 4, 5 or 6.

This value can be set

- from 0 to 100 % when one control output is configured
- from -100 % to 100 % when two control outputs are configured.

P43 = Digital filter on the displayed value

It is possible to apply to the displayed value a digital filter of the first order with a time constant equal to :

- 4 s for TC and RTD inputs
- 2 s for linear inputs

noFL. = no filter

FLtr = filter enabled

P44 = Control action type

Pid - the instrument operates with a PID algorithm.

Pi - the instrument operates with a PI algorithm.

P45 = Operative set point alignement at instrument start up.

0 = The operative set point will be aligned to SP, SP2, SP3 or SP4 according to the status of the logic inputs 1 and 3.

1 = The operative set point will be aligned to the measured value and then it will reach the selected set point with a programmable ramp (see Grd1 and Grd2 operative parameters).

NOTE: if the instrument detects an out of range or an error condition on the measured value it will ever operate as P45 = 0.

P46 = Timeout selection

This parameter allows to set the time duration of the timeout for parameter setting used by the instrument during the operating mode.

tn. 10 = 10 seconds

tn 30 = 30 seconds

P47 = Servo behaviour when PID is limited by "Sn.LL" and "Sn.HL"

This parameter is available only when P5 = "Sn.CL".

0 = when the PID value is higher than "Sn.HL" or lower than "Sn.LL" the instrument will reach the respective limit value and than it will maintain the output relays in open condition.

1 = - When PID value is higher than "Sn.HL", the OUT 1 (▲) relay contact is ever closed.
- When PID value is lower than "Sn.LL", the OUT 2 (▼) relay contact is ever closed.

P48 = Set point indication

Fn.SP = during operative mode, when the instrument performs a ramp, it will show the final set point value.

OP.SP = during operative mode, when the instrument performs a ramp, it will show the operative set point.

P49 = Extension of the anti-reset-wind up

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

NOTE: a positive value increases the high limit of the anti-reset-wind up (over set point) while a negative value decreases the low limit of the anti-reset-wind up (under set point).

P50 - Set point access

0 only SP is accessible.
1 only SP and SP2 are accessible.
2 all 4 set points are accessible.

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

OPERATIVE MODE

1) Remove the instrument from its case.
2) Set the internal dip switch V2 in closed condition
3) Re-insert the instrument.
4) Switch on the instrument.

DISPLAY FUNCTION

The upper display shows the measured value while the lower display shows the programmed set point value (we define the above condition as “normal display mode”).

Note: When the rate of change (Grd1, Grd2) is utilized, the displayed set point value may be different from the operating setpoint (see P48).

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

- Push the FUNC pushbutton for more than 3 s but less than 10 seconds. The lower display will show "P. " followed by the valve position indication.
- Push "FUNC" pushbutton again. The lower display will show " r. " followed by power value assigned to the output programmed with "rEv" action (from 0 to 100%).
- Push "FUNC" pushbutton again. The lower display will show " d. " followed by power value assigned to the output programmed with "dir" action (from 0 to 100%).
- Push FUNC pushbutton again. The display will return in "Normal Display Mode".

NOTE : These informations will be displayed only if relative function has been previously configured.

When no pushbutton is pressed during the time out (see P46), the display will automatically return in "Normal Display Mode".

In order to keep the desired information continuously on the lower display, depress "▲" or "▼" push- buttons to remove the timeout.
When is desired to return in "Normal Display Mode" push FUNC push-button again.

INDICATORS

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

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

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

▲ Lit when the OUT 1 (▲) relay contact is closed (the instrument is opening the valve) or this output is used as time proportioning control output and it is in ON condition.

▼ Lit when the OUT 2 (▼) relay contact is closed (the instrument is closing the valve).

OUT3 Lit when the alarm 1 is in the alarm state or this output is used as time proportioning control output and it is in ON condition.

OUT4 Lit when the alarm 2 is in alarm condition.
Flashing with slow rate when the alarm 3 is in alarm condition.
Flashing with high rate when the alarm 2 and 3 are in alarm condition.

REM Lit when the instrument is in REMOTE condition (functions and parameters are controlled via serial link).

SPX Lit when SP2, SP3 or SP4 is used.
Flashes when a temporary set point from serial link is used.

MAN Lit when the instrument is in MANUAL mode.

Pushbutton functionality during operating mode.

FUNC = ❑ when the instrument is in "normal display mode"
1) with a brief pressure (<3s) it starts the parameter modification procedure.
2) with a pressure longer than 3s but briefer than 10 s it changes the indication on the lower display (see "display function").
3) with a long pressure (>10 s) it starts the lamp test.
❑ During parameter modification, it allows to memorize the new value of the selected parameter and go to the next parameter (increasing order).

MAN = pressed for more than 1 s, it allows to enable or disable the manual function and, during parameter modification, to scroll back the parameters without memorizing the new setting.

▲ = ❑ when the instrument is in AUTO mode, it allows to increase the value of the selected parameter.
❑ when the instrument is in MANUAL mode, it allows to close OUT 1 (▲) relay contact.

▼ = ❑ when the instrument is in AUTO mode, it allows to decrease the value of the selected parameter.
❑ when the instrument is in MANUAL mode, it allows to close OUT 2 (▼) relay contact.

▲+MAN = During parameter modification they allow to jump to the maximum programmable value.

▼+MAN = During parameter modification they allow to jump to the minimum programmable value.

NOTE: during run time mode a 10 or 30 seconds time out (see P46) is applied to parameter modification procedure.
If, during operative parameter modification, no pushbutton is pressed for more than 10 (30) seconds, the instrument goes automatically to the “normal display mode” and the eventual modification of the last parameter will be lost.

FEEDBACK POTENTIOMETER CALIBRATION

NOTE: this function is available only if a closed loop servomotor control (P5 = "Sn.CL")or a servomotor control open loop with feedback indication (P5="Sn.OL" and P6 = "Fb.")has been selected during configuration procedure.
When it is desired to calibrate the feedback potentiometer, proceed as follow:

1) Switch On the instrument.
2) Push the MAN pushbutton for more than 1 s. The instrument will go in MANUAL mode and the MAN indicator will lit.
3) Keep pushing the FUNC pushbutton until the "F.CAL" parameter is shown on the lower display.
4) Pushing ▲ or ▼ select the "ON" indication and then push the FUNC pushbutton. The instrument will show on the upper display the actual valve position in percent and, on the lower display the "POS.L" message.
5) Pushing continuously ▲ or ▼ pushbutton, drive the servomotor to the beginning of its stroke.
6) Push the FUNC pushbutton. The display will show "Fb.LC" (feedback low limit calibration).
7) Pushing ▲ or ▼ select the "ON" indication and push the FUNC pushbutton. The instrument will show on the upper display the actual valve position in percent and, on the lower display the "POS.H" message.
8) Pushing continuously ▲ or ▼ pushbutton, drive the servomotor to the end of its stroke.
9) Push the FUNC pushbutton. The display will show "Fb.HC" (feedback high limit calibration).
10) Pushing ▲ or ▼ select the "ON" indication and push the FUNC pushbutton. The instrument memorizes the new feedback potentiometer calibration and return in MANUAL mode.

NOTES:

1) The minimum span (Fb.LC - FbHC) acceptable for the instrument is equal to 20 % of the potentiometer stroke.
2) The instrument is able to assure a 1% resolution for the potentiometer indication only if the calibrated span is greater than 50 % of the potentiometer stroke.

ENABLE/DISABLE THE CONTROL OUTPUT

NOTE: when the instrument is programmed for servomotor control drive, this function is not available.

When the instrument is in "normal display mode", by keeping depressed for more than 5 s ▲ and FUNC pushbuttons, it is possible to disable the control outputs. In this open loop mode the device will function as an indicator, the lower display will show the word OFF and all control outputs will be in the OFF state.
When the control outputs are disabled the alarms are also in non alarm condition.

The alarms output conditions depend on the alarm action type (see P26-P28).
Depress for more than 5 s ▲ and FUNC pushbuttons to restore the control status.
The alarm standby function, if configured, will be activated as per power up.
If a shut down occures when the control output is disabled, at instrument power up the control output will be disabled again.

MANUAL FUNCTION

The MANUAL mode function can be accessed (only if enabled by P38=On) by depressing the MAN pushbutton for more than 1 sec or by closing the external contact 2 (see P24 parameter).
The command from keyboard is accepted and executed only if the display is in "Normal Display Mode".
The command from external contact is always accepted.
When in MANUAL mode the LED's MAN annunciator will light up while the lower display shows the valve position (if configured) or power output values if time proportioning control output is configured.
When time proportioning control output is configured, the power of the "rEv" output is shown in the two most significant digit field while the power of the "dir" output (if present) is shown in the two less significant digit field.
The decimal point between the two values will be flashing to indicate instrument in MANUAL mode.
Note: The instrument shows the "rEv" output = 100 with the graphic simbol " □□ ".
The instrument shows the "dir" output = 100 with the graphic simbol " □□ ".
The power output can be modified by using ▲ and ▼ pushbuttons.

By depressing, for more than 1 second, MAN again, or by opening the contact 2, the device returns in AUTO mode.
The transfer from AUTO to MANUAL will be in accordance with P40 parameter set.
The transfer from MANUAL to AUTO will be bumpless (this function is not provided if integral action is excluded).
If transfer from AUTO to MANUAL is performed during the first part of SMART algorithm (TUNE) when returning in AUTO the device will be forced automatically to the second part of the SMART algorithm (ADAPTIVE).

At power up the device will start as selected with P39.
Notes:
1) When device is configured for two control outputs and start up occurs in Manual mode with power output set to 0, the signal output will be in accordance with the following formula: "rEv" output - "dir" output = 0.
2) When the AUTO/MANUAL control is selectable by logic input and P39 = 0 or 1, the instrument starts in accordance to the logic input status and ,for MANUAL mode, it will start with a power output equal to zero.

DIRECT ACCESS TO SETPOINT

When the device is in AUTO mode and in “Normal Display Mode”, it is possible to modify directly the selected set point (SP, SP2, SP3 or SP4).
Pushing ▲ or ▼ for more than 2 s, the setpoint will begin changing.
The new setpoint value becomes operative since no pushbutton has been depressed at the end of 2 s timeout.

OPERATIVE SET POINT SELECTION

It is possible to select the operating set point (SP, SP2, SP3 or SP4) only by the binary conbination of the logic inputs 1 and 3.

logic input 3	logic input 1	op. set point
open	open	SP
open	close	SP2
close	open	SP3
close	close	SP4

By setting the P50 parameter it is possible to limit the number of the available set points.

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) mode.

The REMOTE status is signalled by a LED labelled REM.

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

The necessary conditions to implement this function are the following:

1) Serial parameters from SEr1 to SEr4 should be properly configurated.
2) Device must be in the OPERATING mode During the downloading of configuration 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.

NOTE: from serial link it is not possible to perform the "Feedback potentiometer calibration" as well as the action performed by logic input 2 (Cnt 2).

SMART function

It is used to optimize automatically the control action.

At instrument power up, if the SMART is ON, the second algorithm will be enabled.

To enable the SMART function, push the FUNC pushbutton until "Snrt" parameter is shown. Pushing ▲ or ▼ set the display "On" and push the FUNC pushbutton.

The SMRT LED will turn on or flashing according to the selected algorithm.

When the smart function is enabled, it is possible to display but not to modify the control parameters (Pb, ti, td, and rC).

To disable the SMART function, push the FUNC pushbutton again until "Snrt" parameter is shown. Pushing ▲ or ▼ set the display "OFF" and push the FUNC pushbutton. The SMRT LED will turn off.

The instrument will maintain the actual set of control parameter and will enabled parameter modification.

NOTES:
1) When ON/OFF control is programmed (Pb=0), the SMART function is disabled.
2) The SMART enabling/disabling can be protected by safety key (see P33).

LAMP TEST

When it is desired to verify the display efficiency, push FUNC pushbutton for more than 10 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 come back to the normal display mode, push FUNC pushbutton again.
During the LAMP TEST the instrument continues to control the process but no keyboard functions are available (exception made for the FUNC pushbutton).

OPERATIVE PARAMETERS

Push the FUNC pushbutton, the lower display will show the code while the upper display will shows the value or the status (ON or OFF) of the selected parameter.
By ▲ or ▼ pushbutton it is possible to set the desired value or the desired status.
Pushing the FUNC pushbutton, the instrument memorizes the new value (or the new status) and goes to the next parameter.
Some of the following parameter may be skipped according to the instrument configuration.

Param.	DESCRIPTION
SP	**Set point** (in eng. units). Range: from rL to rH. SP is operative when logic inputs 1 and 3 are open.
Snrt	**SMART status**. The On or OFF indication shows the actual status of the SMART function (enabled or disabled respectively). Set On to enable the SMART function. Set OFF to disable the SMART function.
n.rSt	**Manual reset of the alarms**. This parameter is skipped if none of the alarms have the manual reset function. Set On and push FUNC to reset the alarms.
SP2	**Set point 2** (in eng. units). Range: from rL to rH. SP2 is operative when logic input 3 is open while the logic input 1 is closed. and P50 is different from 0.
SP3	**Set point 3** (in eng. units). Range: from rL to rH. SP3 is operative when logic input 3 is closed while the logic input 1 is open. and P50 = 2

SP4 **Set point 4** (in eng. units).
Range: from rL to rH.
SP4 is operative when logic input 1 and the logic input 3 are closed and P50 = 2..

nnn **Software key for parameter protection**.
This parameter is skipped if P18 = 0 or 1
On = the instrument is in LOCK condition
OFF = the instrument is in UNLOCK condition
When it is desired to switch from LOCK to UNLOCK condition, set a value equal to P18 parameter.
When it is desired to switch from UNLOCK to LOCK condition, set a value different from P18 parameter.

AL1 **Alarm 1 threshold**
This parameter is available only if P 7 is equal to "AL1.P", "AL1.b" or "AL1.d".
Ranges:
- Span limits for process alarm.
- From 0 to 500 units for band alarm.
- From -500 to 500 units for deviation alarm.

HSA1 **Alarm 1 hysteresis**
This parameter is available only if P 7 is equal to "AL1.P", "AL1.b" or "AL1.d".
Range:From 0.1% to 10.0% of the input span or 1 LSD.
Note: If the hysteresis of a band alarm is larger than the alarm band, the instrument will use an hysteresis value equal to the programmed band minus 1 digit.

AL2 **Alarm 2 threshold**
This parameter is available only if P 9 is equal to "AL2.P", "AL2.b" or "AL2.d".
For other details see AL1parameter.

HSA2 **Alarm 2 hysteresis**
This parameter is available only if P 9 is equal to "AL2.P", "AL2.b" or "AL2.d".
For other details see HSA1parameter.

AL3 **Alarm 3 threshold**
This parameter is available only if P 11 is equal to "AL3.P", "AL3.b" or "AL3.d" and P13 = OPrt or SPEC.
For range details see AL1parameter.
When P13 = SPEC, it allows to select one of the two values programmed by P14 and P15 parameters.

HSA3 **Alarm 3 hysteresis**
This parameter is available only if P 11 is equal to "AL3.P", "AL3.b" or "AL3.d" and P13 = OPrt.
For other details see HSA1parameter.
Note: the alarm 2 and 3 are in OR condition on the OUT 4.

Pb **Proportional band**
Range: from 1.0% to 200.0% of the input span. When Pb parameter is set to zero, the control action becomes ON-OFF.
Note: When device is working with SMART algorithm the Pb value will be limited by P34 and P35 parameters.

HYS **Hysteresis for ON/OFF control action**
This paameter is available only when Pb=0.
Range: from 0.1% to 10.0% of the input span.

ti **Integral time**
This parameter is skipped if Pb=0 (ON/OFF action).
Range: from 0.0 to 10.0 [mm.ss]. Above this value the display blanks and integral action is excluded
Note: When the device is working with SMART algorithm, the minimum value of

the integral time will be limited by P36 parameter.

td **Derivative time**
This parameter is skipped if Pb=0 (ON/OFF action).
Range:From 00.00 to 10.00 mm.ss.
Notes:
1)When device is working with SMART algorithm the td value will be equal to a quarter of Ti value.
2)When P44 is equal to "Pi", the derivative action is always excluded.

IP **Integral pre-load**
This parameter is skipped if Pb=0 (ON/OFF action).
Ranges:
- From 0.0 to 100.0 % of the output if device is configured with one control output.
- From -100.0% to 100.0% of the output if device is configured with two control outputs.

Sn.tt **Servomotor travel time**
This parameter is available only when P5 = Sn.OL.
Range: from 0.06 to 3.00 [mm.ss].

Sn.db **Servomotor dead band** .
This parameter is available only when P5 = Sn.CL or Sn.OL and Pb is different from 0.
Range: from 1% to 50 % of the travel timo or of the feedback potentiometer span

Sn.LL **Servomotor low limit**.
This parameter is available only when P5 = Sn.CL
Range: from 0 (in % of the travel time or of the feedback potentiometer span) to Sn.HL.

Sn.HL **Servomotor high limit**
This parameter is available only when P5 = Sn.CL
Range from SnLL to 100 (in % of the travel time or of the feedback potentiometer span).

Cy1 **Output 1 cycle time**
This parameter is available only if P5 is equal to "rEv" or "dir".
Range:From 1 to 200 s.

Cy3 **Output 3 cycle time**
This parameter is available only if P7 is equal to "rEv" or "dir".
Range:From 1 to 200 s.

rC **Relative Cooling gain**.
This parameter is available only if device is configured with two control outputs and
A) Pb is different from 0 or.
B) device is in manual mode
Range: from 0.20 to 1.00
Note: When the device is working with SMART algorithm and P37 is set to ON the rC value is limited in accordance with the selected type of cooling media:
- from 0.85 to 1.00 when P25 = AIr
- from 0.80 to 0.90 when P25 = OIL
- from 0.30 to 0.60 when P25 = H2O

OLAP **Dead band/Overlap between H/C outputs**.
This parameter is available only if device is configured with two control outputs and
A) Pb is different from 0 or.
B) device is in manual mode
Range: from -20 to 50 % of the proportional band.
A negative OLAP value shows a dead band while a positive value shows an overlap.

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

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

Grd1 **Ramp applied to an increasing set point change**
Range: from 1 to 100 digits per minutes. Above this value the display shows “Inf” meaning that the transfer will be done as a step change.

Grd2 **Ramp applied to a decreasing set point changes**
For other details see Grd1 parameter.

OLH **Output high limit**
This parameter is not available when P5 = Sn.CL or Sn.OL
Range:
- From 0 to 100% when the device is configured with one control output.
- From -100% to 100% when the device is configured with two control outputs.

tOL **Time duration of the output power limiter**
This parameter is not available when P5 = Sn.CL or Sn.OL
Range: from 1 to 540 min.Above this value the display shows “InF” meaning that the limiting action is always on
Note: The tOL can be modified but the new value will become operative only at the next instrument start up.

rnP **Control output max. rate of rise**
This parameter is available when Pb is different from zero.
Range: from 0.1 to 25.0 %/s.Above this value the display shows “InF” meaning that no ramp limitation is imposed.

Sn.CA **Servomotor control action**
("rEv" for reverse control action and "dir" for direct control action).
This parameter is available when P5 = Sn.CL or P5 = Sn.OL
Notes:
1) When P24 = nonE or AU.nA, this parameter can be modified.
2) When P24 = rE.dr, this parameter can be displayed only.

F.CAL see "Feedback potentiometer calibration".

POS.L see "Feedback potentiometer calibration"

Fb.LC see "Feedback potentiometer calibration"

POS.H see "Feedback potentiometer calibration"

Fb.HC see "Feedback potentiometer calibration"

ERROR MESSAGES

OVERRANGE, UNDERRANGE AND SENSOR LEADS BREAK INDICATIONS

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

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

When P41 is different from zero and an out of range condition is detected, the instrument operates in accordance with P41 and P42 parameters.

When P41 is equal to 0 (standard effect) and time proportional outputs are configured, the following conditions may occur:

- The instrument is set for one output only and an OVERRANGE is detected, the OUT 1 turns OFF (if reverse action) or ON (if direct action).
- The instrument is set for heating/cooling action and an OVERRANGE is detected, OUT 1 turns OFF and OUT 3 turns ON.
- The instrument is set for one output only and an UNDERRANGE is detected, the OUT 1 turns ON (if reverse action) or OFF (if direct action).
- The instrument is set for heating/cooling action and an UNDERRANGE is detected, OUT 1 turns ON and OUT 3 turns OFF.

When P41 is equal to 0 (standard effect) and the servomotor control output is configured, the following conditions may occur:

- The instrument detects an OVERRANGE and a reverse action is assigned to the servomotor output, the OUT 1 (▲) turns OFF while OUT 2 (▼) turns ON.
- The instrument detects an OVERRANGE and a direct action is assigned to the servomotor output, the OUT 1 (▲) turns ON while OUT 2 (▼) turns OFF.
- The instrument detects an UNDERRANGE and a reverse action is assigned to the servomotor output, the OUT 1 (▲) turns ON while OUT 2 (▼) turns OFF.
- The instrument detects an UNDERRANGE and a direct action is assigned to the servomotor output, the OUT 1 (▲) turns OFF while OUT 2 (▼) turns ON.

The sensor leads break can be signalled as:

- for TC/mV input : OVERRANGE or UNDERRANGE selected by a solder jumper
- for RTD input : OVERRANGE
- for mA/V input : UNDERRANGE

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

ERROR MESSAGES

The instrument performs same self-diagnostic algorithm.

When an error is detected, the instrument shows on the lower display the “Err” indication while the upper display shows the code of the detected error.

ERROR LIST

SEr	Serial interface parameter error
100	Write EEPROM error.
150	CPU error.
200	Tentative to write on protected memory.
201 - 2xx	Configuration parameter error. The two less significant digit’s shown the number of the wrong parameter (ex. 209 Err show an Error on P9 parameter)
299	Error in control outputs selection
301	Error on calibration of the selected input
302	Feedback potentiometer calibration error
307	RJ input calibration error
400	Control parameters error
500	Auto-zero error
502	RJ error
510	Error during calibration procedure
512	Error during feedback calibration procedure.

NOTE

1) When a configuration parameter error is detected, it is sufficient to repeat the configuration procedure of the specify parameter.
2) If error 400 is detected, push contemporarily the ▲ and ▼ pushbuttons for loading the default parameters then repeat control parameter setting.
3) When an error 302 is detected, push contemporarily the ▲ and ▼ pushbuttons for loading the default feedback potentiometer calibration values then repeat the feedback potentiometer calibration.
4) For all the other errors, contact your supplier.

GENERAL INFORMATIONS

GENERAL SPECIFICATIONS

Case: PC-ABS black color; self-extinguishing degree: V-0 according to UL 94.
Front protection - designed and tested for IP 65 (*) and NEMA 4X (*) for indoor locations (when panel gasket is installed).
(*) Test were performed in accordance with CEI 70-1 and NEMA 250-1991 STD.
Installation: panel mounting.
Rear terminal block:21 screw terminals (screw M3, for cables from ϕ 0.25 to ϕ 2.5 mm^2 or from AWG 22 to AWG 14) with connection diagrams and safety rear cover.
Dimensions: DIN 43700 48 x 96 mm, depth 116 mm.
Weight: 450 g/ 1 lb.
Power supply:
- 100V to 240V AC 50/60Hz (-15% to + 10% of the nominal value).
- 24 V AC/DC ($\pm$ 10 % of the nominal value).
Power consumption: 10 VA max.
I**nsulation resistance**: > 100 MΩ according to IEC 1010-1.
Dielectric strength: 1500 V rms according to IEC 1010-1.
Display updating time: 500 ms.
Sampling time: 250 ms for linear inputs
500 ms for TC and RTD inputs.
Resolution: 30000 counts.
Accuracy: $\pm$ 0,2% f.s.v.. $\pm$ 1 digit @ 25 °C ambient temperature.
Common mode rejection: 120 dB at 50/60 Hz.
Normal mode rejection: 60 dB at 50/60 Hz.
Electromagnetic compatibility and safety requirements: This instrument is marked CE. Therefore, it is conforming to council directives 89/336/EEC (reference harmonized standard EN-50081-2 and EN-50082-2) and to council directives 73/23/EEC and 93/68/EEC (reference harmonized standard EN 61010-1).
Installation category: II
Temperature drift: (CJ excluded)
< 200 ppm/°C of span for mV and TC ranges 1, 3, 5, 7, 21, 22, 23, 25.
< 300 ppm/°C of span for mA/V
< 400 ppm/°C of span for RTD range 12, 30 and TC ranges 0, 2, 4, 6, 24.
< 500 ppm/°C of span for RTD range 11 and TC ranges 8, 9, 26, 27.
< 800 ppm/°C of span for RTD range 29 and TC ranges 10,28.
Operative temperature: from 0 to 50 °C.
Storage temperature : -20 to +70 °C
Humidity: from 20 % to 85% RH, non condensing.
Protections:
1) WATCH DOG circuit for automatic restart.
2) DIP SWITCH for protection against tampering of configuration and calibration parameters.

INPUTS

A) THERMOCOUPLE

Type : L -J -K -T -N -R -S- B. °C/°F selectable.
External resistance: 100 Ω max, maximum error 0,1% of span.
Burn out: It is shown as an overrange condition (standard). It is possible to obtain an underrange indication by cut and short.
Cold junction: automatic compensation from 0 to 50 °C.
Cold junction accuracy : 0.1 °C/°C
Input impedance: > 1 MΩ
Calibration : according to IEC 584-1 and DIN 43710 - 1977.

STANDARD RANGES TABLE

T/C type	Ranges			
L	0	0/ +400.0°C		---
L	1	0 / + 900°C	21	0 / + 1650 °F
J	2	-100.0/ +400.0°C		---
J	3	-100/ + 1000°C	22	-150/ + 1830 °F
K	4	-100.0/ +400.0°C		---
K	5	-100/ + 1370°C	23	-150/ + 2500 °F
T	6	-199.9/ +400.0°C	24	-330/ + 750 °F
N	7	-100/ + 1400°C	25	-150/ + 2550 °F
R	8	0 / + 1760°C	26	0 / + 3200 °F
S	9	0 / + 1760°C	27	0 / + 3200 °F
B	10	0 / +1820 °C	28	0 / + 3310 °F

B) RTD (Resistance Temperature Detector)
Input: for RTD Pt 100 Ω, 3 wire connection.
Input circuit: current injection (135 μA).
°C/°F selection: via front pushbuttons or serial link.
Line resistance: automatic compensation up to 20 Ω/wire with no measurable error.
Calibration: according to DIN 43760
Burn out : The instrument detect the open condition of one or more wires. It is able to detect also the short circuit of the sensor.

STANDARD RANGES TABLE

Input type	Ranges	
RTD Pt 100 Ω DIN 43760	11	- 199,9 / + 400,0 °C
	12	- 200 / + 800 °C
	29	-199,9 / +400,0 °F
	30	-330 / + 1470 °F

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

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

D) FEEDBACK POTENTIOMETER INPUT
Potentiometer type: from 100 Ω to 10 kΩ.
Minimum working stroke: 50 % of the potentiometer rang in order tu assure the 1% display resolution.

E) LOGIC INPUTS
This instrument is provided of 3 logic inputs.
The logic inputs 1and 3 are used to select the operative set point:
The logic input 2 function is programmed by P24 parameter.

NOTES

1) Use an external contact with a contact rating better than 0.5 mA, 5 V DC.
2) The instrument needs 100 ms to recognize a contact status variation.
3) The logic inputs are **NOT** isolated by the measuring input.

SET POINTS

This instrument allows to use 4 set points: SP, SP2, SP3 and SP4.
The set point selection is possible only by logic inputs 1 and 3.
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 rate of change (ramp up and ramp down).
Slope value: 1 - 100 eng. unit/min or step.
Set points limiter: RLO and RHI parameters, programmable.

CONTROL ACTIONS

Control action: PID + SMART
Type: One (heating or cooling) or two (heating and cooling) control outputs.
Proportional Band (Pb): from 1.0 to 200.0 % of the input span.
When Pb=0, the control action becomes ON/OFF.
Hysteresis (for ON/OFF control action):
from 0.1% to 10.0% of the input span.
Integral time (Ti): from 1 s to 20 min. or excluded.
Derivative time (Td): from 1 s to 10 min.
If zero value is selected, the derivative action is excluded.
Integral pre-load:
- from 0.0 to 100.0 % for one control output
- from -100.0 (cooling) to +100.0 % (heating) for two control output.

SMART: keyboard enabling/disabling
Auto/Manual: selectable by front pushbutton.
Auto/Manual transfer: bumpless method type
Indicator "MAN" : OFF in auto mode and lit in manual mode.

OUTPUTS

This instrument is equipped with four relay outputs.
OUT 1 can be used either as servomotor output (together OUT 2, both relays are interlocked) or as independent relay output (in this case, OUT 2 cannot be used); OUT 3 and OUT 4 are independent relay outputs (OUT 4 is optional).
The outputs can be programmed as follows:

Out 1 + Out 2 interlocked	Out 3 relay	OUT 4 relay
servomotor	AL1	AL2+ AL3
Heating	AL1	AL2+ AL3
Cooling	AL1	AL2+ AL3
Heating	Cooling	AL2+ AL3

NOTE: alarm 2 and 3 are in OR condition on the OUT 4 relay.
Control output updating time :
- 250 ms when a linear input is selected
- 500 ms when a TC or RTD input is selected.

Control output resolution: 0.1% of the span.
Direct/reverse action: programmable.
Output level indication (for control outputs):
The instrument displays separately the output 1 value and the output 2 value.

Output level limiter(for control outputs):
- For one control medium: from 0.0 to 100.0 % .
- For two control mediums: from -100.0 to +100.0%
This function may be operative at instrument start up for a programmable time (To avoid thermal shock and/or preheating the plant).

Relay outputs
Outputs 1 and 2: 2 relay interlocked, SPST contact with rated current 3 A at 250 V AC on resistive load (NO contact).
Output 3: SPST contact with rated current 2 A at 250 V AC on resistive load.
Output 4: SPST contact with rated current 2 A at 250 V AC on resistive load.
NOTE: the side C of the OUT 3 and OUT 4 are common.

Output status indication: 4 indicators (▲, ▼, OUT 3 and OUT 4) are lit when the respective output is in ON condition.

ALARMS

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

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

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

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

SERIAL COMMUNICATION INTERFACE
Type: RS-485
Protocol type: MODBUS, JBUS, ERO polling/selecting.
Baud rate: programmable from 600 to 19200 BAUD.
Byte format: 7 or 8 bit programmable.
Parity: even, odd or none programmable.
Stop bit : one.
Address :
- from 1 to 95 for ERO protocol
- from 1 to 255 for all the other protocols

Output voltage levels: according to EIA standard.

MAINTENANCE

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

APPENDIX A
DEFAULT PARAMETERS

DEFAULT OPERATIVE PARAMETERS

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

a) The internal switch should be closed.
b) The SMART function should be disabled.
c) The upper display will show the process variable while the lower display will show the set point value.
d) Held down ▼ pushbutton and press ▲ pushbutton; the display will show:

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

g) Press FUNC pushbutton; the display will show:

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

The following is a list of the default operative parame-ters loaded during the above procedure:

PARAMETER	DEFAULT VALUE
SP	= minimum range-value
Snrt	= Disable
n.rSt	= OFF
SP2, SP3, SP4	= minimum range value
nnn	= OFF
A1, A2, A3	= minimum range-value for process alarms 0 for deviation or band alarms
HSA1, HSA2, HSA3	= 0.1 %
PB	= 4.0 %
hyS	= 0.5 %
ti	= 4.00 (4 minutes)
td	= 1.00 (1 minute)
IP	= 50 % for servomotor control drive 30 % for one time proportional control output 0 % for two control outputs.
Sn.tt	= 1 (minute)
Sn.db	= 5 (%)
Sn. LL	= 0 (%)
Sn.HL	= 100 (%)
Cy1	= 15 (s) When two control outputs are configured and the OUT1 has a "dir" action, the CY1 default value will be equal to: 10 seconds for P25 = AIr 4 seconds for P25 = OIL 2 seconds for P25 = H2O
Cy3	= 15 (s) When two control outputs are configured and the OUT3 has a "dir" action, the CY3 default value will be equal to: 10 seconds for P25 = AIr 4 seconds for P25 = OIL 2 seconds for P25 = H2O

rC	= 1.00 for P25 = Air 0.80 for P25 = OIL 0.40 for P25 = H2O
OLAP	= 0
rL	= initial scale value
rH	= full scale value
Grd 1	= infinite (step transfer)
Grd 2	= infinite (step transfer)
OLH	= 100 %
tOL	= infinite
rnP	= 25 % /s
SnCA	= rEv

DEFAULT CONFIGURATION PARAMETERS

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

a) The internal switch (V2, see fig. 13) should be open.

b) The upper display will show:

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

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

e) Press ▲ pushbutton to select between table 1 (european) or table 2 (american) default set of parameters; the display will show:

f) Press FUNC pushbutton; the display will show:

This means that the loading procedure has been initiated.

After about 3 seconds the loading procedure is terminated and the instrument reverts to display "COnF".

PARA.	TABLE1	TABLE2
SEr 1	ErO	ErO
SEr 2	1	1
SEr 3	19200	19200
SEr 4	7E	7E
P1	5	23
P2	----.	----.
P3	0	0
P4	1200	2190
P5	SnOL	SnOL
P6	Fb	Fb
P7	nonE	nonE
P8	H.A.	H.A.
P9	nonE	nonE
P10	H.A.	H.A.
P11	nonE	nonE
P12	H.A.	H.A.
P13	SPEC	OPrt
P14	750	1380
P15	850	1560
P16	0.1	0.1
P17	0	0
P18	0	0
P24	nonE	nonE
P25	AIr	Air
P26	rEv	rEv
P27	OFF	OFF
P28	rEv	rEv
P29	OFF	OFF
P30	OFF	OFF
P31	0	0
P32	On	On
P33	2	2
P34	30.0	30.0
P35	1.0	1.0
P36	00.20	00.20
P37	OFF	OFF
P38	On	On
P39	3	3
P40	bUnP	bUnP
P41	0	0
P42	0	0
P43	nO.FL	nO.FL
P44	Pid	Pid
P45	0	0
P46	10	30
P47	0	0
P48	Fn.SP	Fn.SP
P49	10	10
P50	0	0

Appendix A.4

Excellence in distribution

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