

ASCON spa

ISO 9001 Certified

ASCON spa 20021 Bollate (Milano) Italy via Falzarego, 9/11 Tel. +39 02 333 371 Fax +39 02 350 4243 http://www.ascon.it e-mail info@ascon.it

Heat / Cool temperature controller ¹/₈ DIN - 48 x 96



X1 line



User Manual • M.I.U.X1 -2/01.01 • Cod. J30-478-1AX1 IE



Heat / Cool temperature controller ¹/₈ DIN - 48 x 96

X1 line



Notes
ON ELECTRIC
SAFETY AND
ELECTROMAGNETIC
COMPATIBILITY

Please, read carefully these instructions before proceeding with the installation of the controller.

Class II instrument, rear panel mounting.

This controller has been designed with compliance to:

Regulations on electrical apparatus (appliance, systems and installations) according to the European Community directive 73/23 CEE amended by the European Comunity directive 93/68 CEE and the Regulations on the essential protection requirements in electrical apparatus EN 61010-1 (IEC 1010 - 1): 90 +A1:92 + A2:95.

Regulations on Electromagnetic Compatibility according to the European Community directive n°89/336/CEE, amended by the European Community directive n° 92/31/CEE and the following regulations:

Regulations on RF emissions

EN50081 - 1 residential environments EN50081 - 2 for industrial environments

Regulation on RF immunity

EN500082-2 for industrial equipment and system

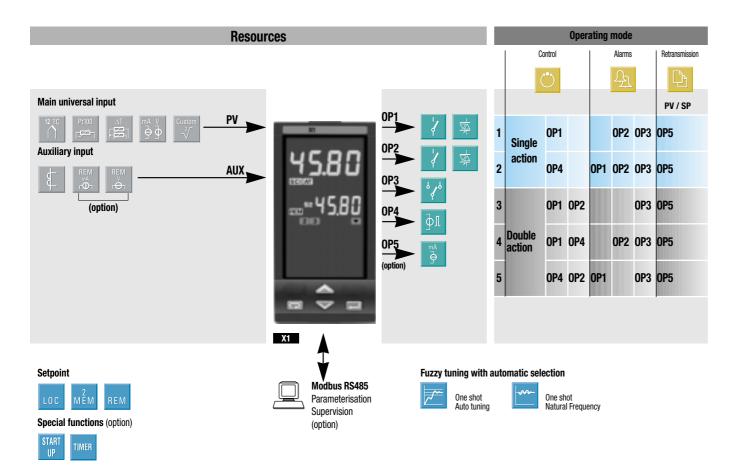
It is important to understand that it's responsibility of the installer to ensure the compliance of the regulations on safety requirements and EMC.

The repair of this controller has no user serviceable parts and requires special equipment and specialised engineers. Therefore, a repair can be hardly carried on directly by the user. For this purpose, the manufacturer provides technical assistance and the repair service for its Customers.

Please, contact your nearest Agent for further information.

All the information and warnings about safety and electromagnetic compatibility are marked with the Δ sign, at the side of the note.

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INSTALLATION

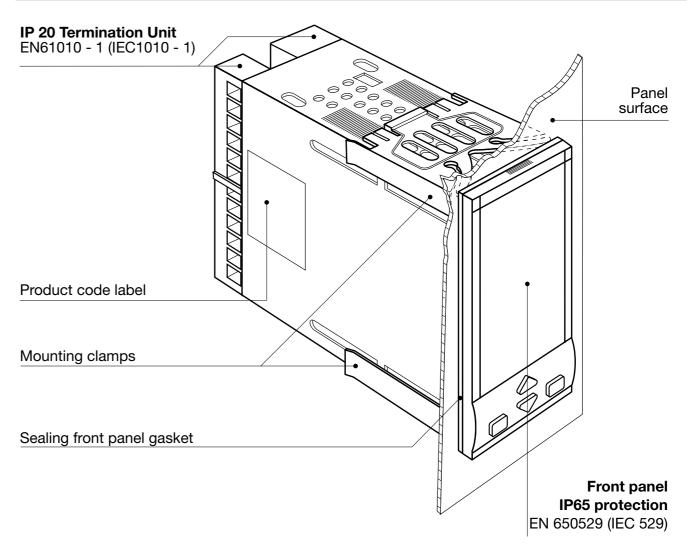
Installation must only be carried out by qualified personnel.

Before proceeding with the installation of this controller, follow the instructions illustrated in this manual and, particularly the installation precautions marked with the symbol, related to the European Community directive on electrical protection and electromagnetic compatibility.

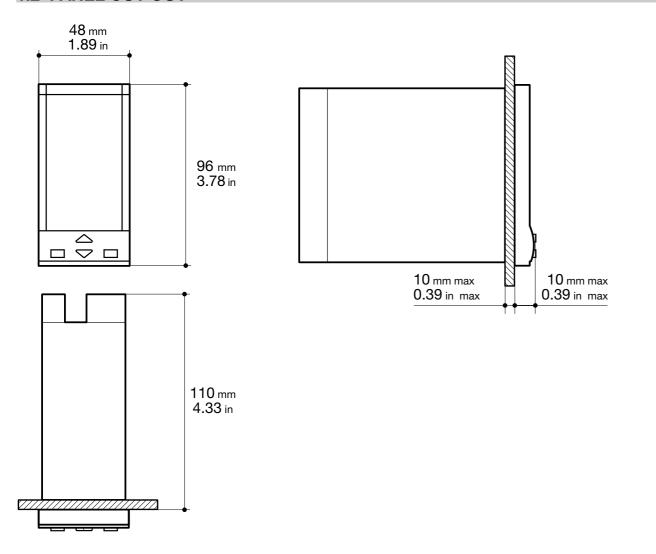
\mathbb{A}

To prevent hands or metal touching parts that may be electrically live, the controllers must be installed in an enclosure and/or in a cubicle.

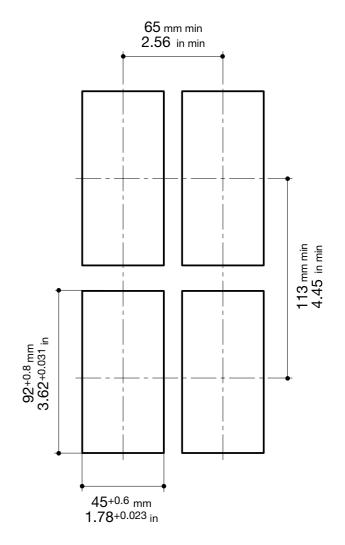
1.1 GENERAL DESCRIPTION



1.2 PANEL CUT-OUT



1.3 PANEL CUT-OUT



1.4 ENVIRONMENTAL RATINGS

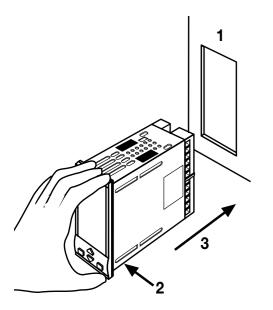


Operating cor	Operating conditions				
2000	Altitude up to 2000 m				
₽ c	Temperature 050°C				
%Rh	Relative humidity 595 % non-cor	ndensing			
Special condi	tions	Suggestions			
2000	Altitude > 2000 m	Use 24V∼ supply version			
‡°c	Temperature >50°C	Use forced air ventilation			
%Rh	Humidity > 95 %	Warm up			
No. A strain Strain Strain Strain Strain Strain Strain	Conducting atmosphere	Use filter			
Forbidden Co	nditions 🛇				
	Corrosive atmosphere				
	Explosive atmosphere				

1.5 PANEL MOUNTING

1.5.1 INSERT THE INSTRUMENT

- **1** Prepare panel cut-out
- 2 Check front panel gasket position
- **3** Insert the instrument through the cut-out



1.5.2 INSTALLATION SECURING

- 1 Fit the mounting clamps
- **2** Push the mounting clamps towards the panel surface to secure the instrument

1.5.3 CLAMPS REMOVING

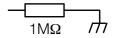
- 1 Insert the screwdriver in the clips of the clamps
- 2 Rotate the screwdriver

1.5.4 INSTRUMENT UNPLUGGING

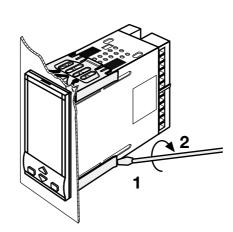


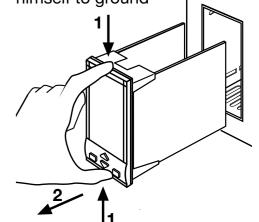
- 1 Push and
- 2 pull to remove the instrument

Electrostatic discharges can damage the instrument



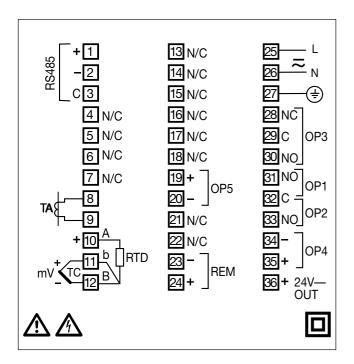
Before removing the instrument the operator must discharge himself to ground





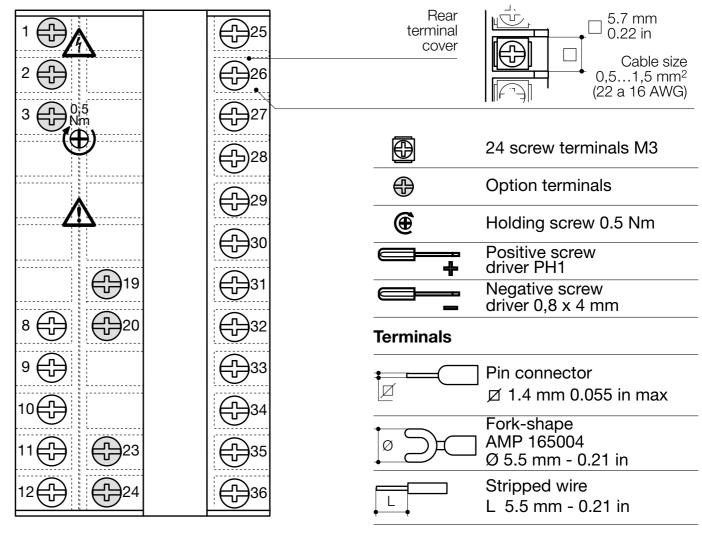


ELECTRICAL CONNECTIONS



2.1 TERMINATION UNIT





PRECAUTIONS



Despite the fact that the instrument has been designed to work in an harsh and noisy environmental (level IV of the industrial standard IEC 801-4), it is recommended to follow the following suggestions.



All the wiring must comply with the local regulations.

The supply wiring should be routed away from the power cables. Avoid to use electromagnetic contactors, power Relays and high power motors nearby.

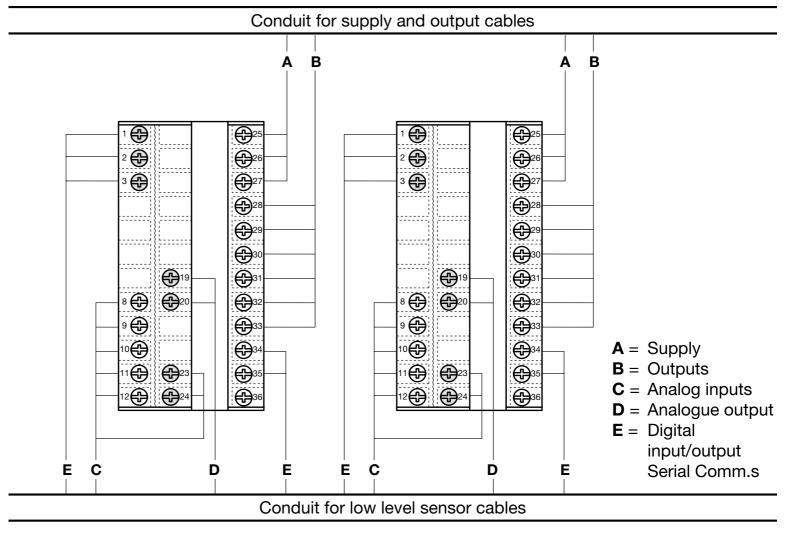
Avoid power units nearby, especially if controlled in phase angle

Keep the low level sensor input wires away from the power lines and the output cables.

If this is not achievable, use shielded cables on the sensor input, with the shield connected to earth.

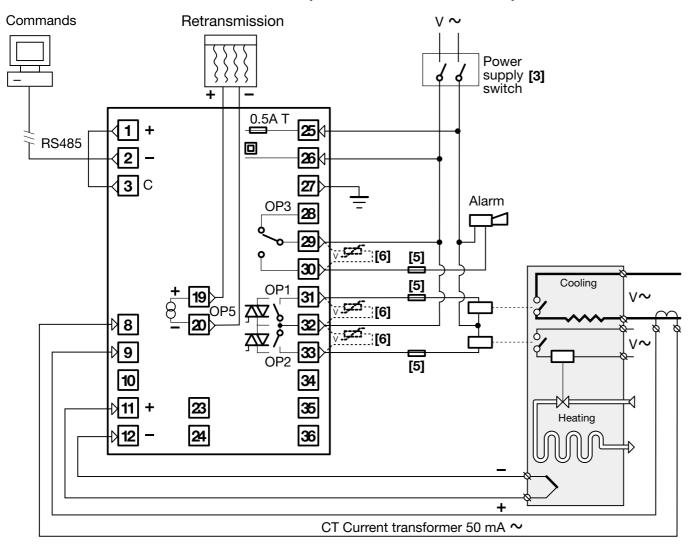
2.2 PRECAUTIONS AND ADVISED CONDUCTOR COURSE





Λ (ϵ

2.3 EXAMPLE OF WIRING DIAGRAM (HEAT / COOL CONTROL)



Notes:

- 1] Make sure that the power supply voltage is the same indicated on the instrument.
- 2] Switch on the power supply only after that all the electrical connections have been completed.
- 3] In accordance with the safety regulations, the power supply switch shall bring the identification of the relevant instrument. The power supply switch shall be easily accessible from the operator.
- 4] The instrument is protected with a 0.5 A~ T fuse. In case of failure it is suggested to return the instrument to the manufacturer for repair.
- 5] To protect the instrument internal circuits use:
 - 2 A ~ T fuses for Relay outputs
 - 1 A∼ T fuses for Triac outputs
- 6] Relay contacts are already protected with varistors.

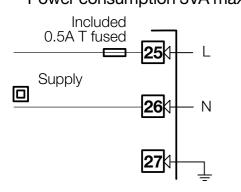
Only in case of 24 V \sim inductive loads, use model A51-065-30D7 varistors (on request)

2.3.1 POWER SUPPLY ACE

2.3.2 PV CONTROL INPUT

Switching power supply with multiple isolation and internal fuse

- Standard version:
 nominal voltage:
 100 240V~ (- 15% + 10%)
 Frequency 50/60Hz
- Low Voltage version:
 Nominal voltage:
 24V~ (- 25% + 12%)
 Frequency 50/60Hz
 or 24V− (- 15% + 25%)
 Power consumption 3VA max



For better protection against noise, it is recommended not to connect the earth clamp provided for civilian installations.

A L-J-K-S-R-T-B-N-E-W thermocouple type

- Connect the wires with the polarity as shown
- Use always compensation cable of the correct type for the thermocouple used
- The shield, if present, must be connected to a proper earth.

B For Pt100 resistance thermometer

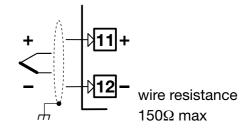
- If a 3 wires system is used, use always cables of the same diameter (1mm 2 min.) (line 20 Ω /lead maximum resistance)
- When using a 2 wires system, use always cables of the same diameter (1,5mm² min.) and put a jumper between terminals 11 and 12

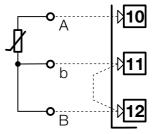
C For ΔT (2x RTD Pt100) Special

When the distance between the controller and the sensor is 15 mt. using a cable of 1.5 mm² diameter, produces an error on the measure of 1°C.

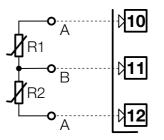
R1 + R2 must be $<320\Omega$







For 3 wires only 20 Ω/lead maximum resistance



Use wires of the same length and 1.5 mm² size.

20 Ω /lead maximum resistance.

2.3.2 PV CONTROL INPUT

D1 With 2 wires transducer

External

shunt 2.5Ω

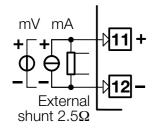
4...20mA



2.3.3 AUXILIARY INPUT (OPTION)

∧ (€

D For mA, mV

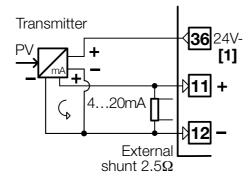


36 24V-

 $Rj > 10M\Omega$

Transducer

D2 With 3 wires transducer



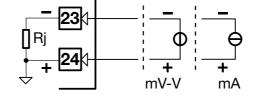
[1] Auxiliary power supply for external transmitter 24V- ±20% /30mA max. without short circuit protection

A - From Remote Setpoint

Current 0/4...20mA Input resistance = 30Ω

Voltage

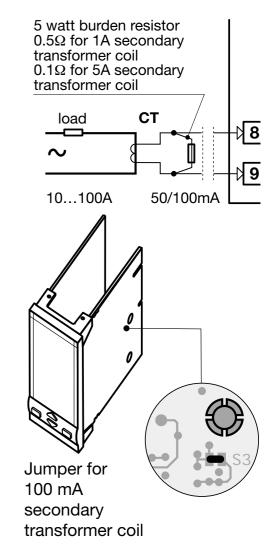
1...5V, 0...5V, 0...10V Input resistence = 300K Ω



B- For current transformer CT Not isolated

For the measure of the load current (see page 45)

- Primary coil10A...100A
- Secondary coil 50mA default 100mA \$3 internal jumper selectable



2.3.5 OP1 - OP2 - OP3 - OP4 - OP5 OUTPUTS (OPTION)

The functionality associated to each of the OP1, OP2 and OP3 output is defined during the configuration of the instrument index **N** (see page 19).

The suggested combinations are:

	Co	ntrol output	tputs Alarms Retransn		Alarms		
		Heat	Cool	AL1	AL2	AL3	PV / SP
Α	Single	0P1			0P2	0P3	0P5
В	action	0P4		0P1	0P2	0P3	0P5
С		0P1	0P2			0P3	0P5
D	Double action	0P1	0P4		0P2	0P3	0P5
E		0P4	0P2	0P1		0P3	0P5

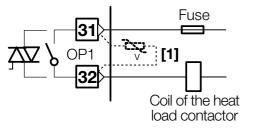
where:

0P1 - 0P2	Relay or Triac output
0P3	Relay output (for AL3 only)
0P4	SSR drive control output
0P5	Retransmission analogue output

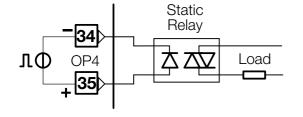
2 - Electrical connections

2.3.5-A SINGLE ACTION RELAY (TRIAC) CONTROL OUTPUT

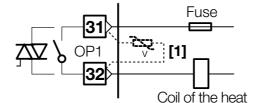


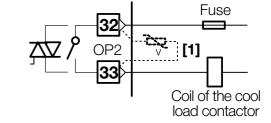


2.3.5-B SINGLE ACTION SSR DRIVE CONTROL OUTPUT



2.3.5-C SINGLE ACTION ANALOGUE OUTPUT

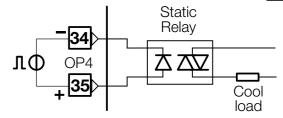


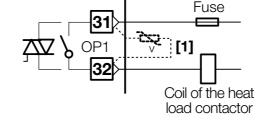


2.3.5-D DOUBLE ACTION

RELAY (TRIAC)/RELAY (TRIAC) CONTROL OUTPUT

load contactor



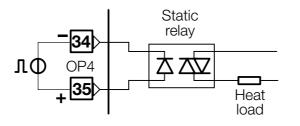


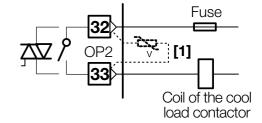
2.3.5-E DOUBLE ACTION RELAY (TRIAC)/SSR DRIVE CONTROL OUTPUT

∆(€

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 $\Delta C \in$

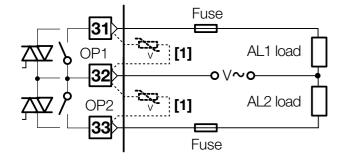


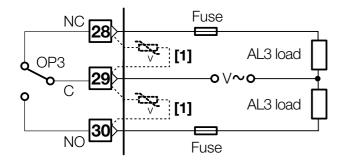


2.3.6 ALARM OUTPUTS



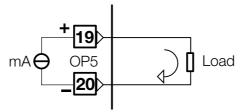
↑ The relay/triac output OP1, OP2 and OP3, can be used as alarm outputs only if they are not used as control outputs.





[1] Varistor for inductive load 24V \sim only

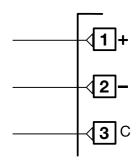
2.3.7 OP5 ANALOGUE CONTROL OUTPUT (OPTION) ⚠C€



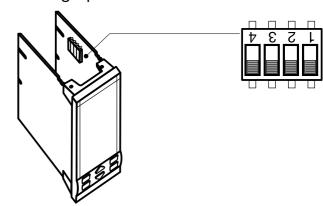
For control or PV/SP retransmission

- Galvanic isolation 500V∼/1 min
- 0/4...20mA, (750Ω) or 15V-max)

2.3.8 SERIAL COMMUNICATIONS (OPTION)



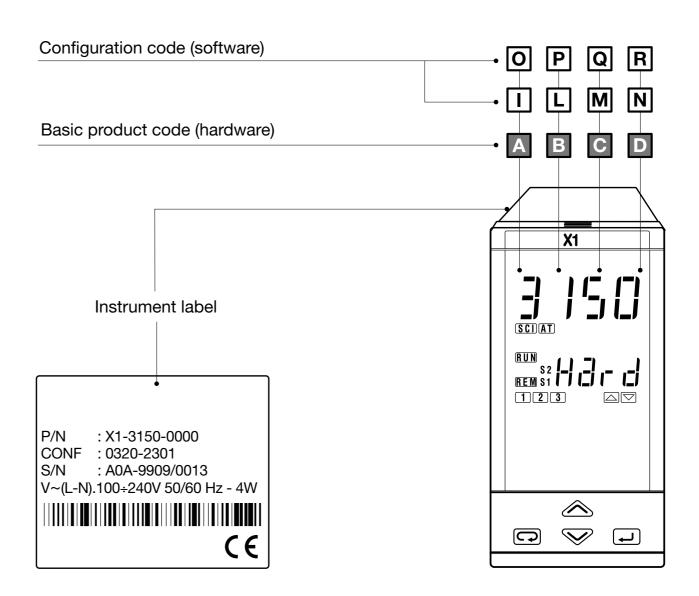
- Galvanic isolation 500V~/1 min Compliance to the EIA RS485 standard for Modbus/Jbus
- Setting dip switches



♠ Please, read the user instructions on the "X1 controller MODBUS/JBUS protocol"

3 PRODUCT CODING

The complete code is shown on the instrument label. The informations about product coding are accessible from the front panel by mean of a particular procedure described at section 5.2 page 47



3.1 MODEL CODE

The product code indicates the specific hardware configuration of the instrument, that can be modified by specialized engineers only.

Mod.: Line Basic Accessories Configuration

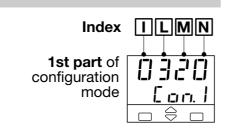
| Stock |

Line	X 1
Power supply	Α
100 - 240V~ (- 15% + 10%)	3
24V~ (- 25% + 12%) or 24V- (- 15% + 25%)	5
Outputs OP1 - OP2	В
Relay - Relay	1
Triac - Triac	5
Serial Communications	C
None	0
RS485 Modbus/Jbus SLAVE	5
Options	D
None	0
Analogue output + Remote Setpoint	5

Setpoint Programmer - special function	E
Not fitted	0
Start-up + Timer	2
User manual	F
Italian/English (std)	0
French/English	1
German/English	2
Spanish/English	3
<u> </u>	<u>'</u>
Front panel colour	G
Dark (std)	0
Beige	1

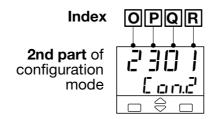
3.2 CONFIGURATION CODING

A 4+4 index code follows the model of the controller. The code has to be set to configure the controller it. (see chapter 3.1 page 17)



E.g. Enter the code 0320 to choose:

- T/C type J input with range 0...600°C
- Single PID control algorithm, reverse action
- Relay output



E.g. Enter the code 2301 to choose:

- AL1 absolute, active high
- AL2 absolute, active low
- AL3 Used by Timer
- Local + 2 Stored Setpoints with tracking function

Input type and range TR Pt100 IEC751 -99.9300.0 °C -99.9572.0 °F 0 TR Pt100 IEC751 -200600 °C -3281112 °F 0 TC L Fe-Const DIN43710 0600 °C 321112 °F 0 TC J Fe-Cu45% Ni IEC584 0600 °C 321112 °F 0
TR Pt100 IEC751 -200600 °C -3281112 °F 0 1 TC L Fe-Const DIN43710 0600 °C 321112 °F 0 2
TC L Fe-Const DIN43710 0600 °C 321112 °F 0 2
TC J Fe-Cu45% Ni IEC584 0600 °C 321112 °F 0 3
TC T Cu-CuNi -200400 °C -328752 °F 0 2
TC K Cromel-Alumel IEC584 01200 °C 322192 °F 0 5
TC S Pt10%Rh-Pt IEC584 01600 °C 322912 °F 0 6
TC R Pt13%Rh-Pt IEC584 01600 °C 322912 °F 0 7
TC B Pt30%Rh Pt6%Rh IEC584
TC N Nicrosil-Nisil IEC584 01200 °C 322192 °F 0 9
TC E Ni10%Cr-CuNi IEC584 0600 °C 321112 °F 1 (
TC NI-NiMo18% 01100 °C 322012 °F 1 1
TC W3%Re-W25%Re 02000 °C 323632 °F 1 2
TC W5%Re-W26%Re 02000 °C 323632 °F 1 3
Dc input 050mV linear Engineering and units
Dc input 1050mV linear Engineering and units 1 5
Custom input and range [1]

[1] For instance, other thermocouples types, ΔT (with 2 PT 100), custom linearisation etc.

Engineering and units		М
ON-OFF reverse action		0
ON-OFF direct action		1
P.I.D. single reverse action		2
P.I.D. single direct action		3
	Linear cool output	4
P.I.D. double action	ON-OFF cool output	5
P.I.D. GOUDIE ACTION	Water cool output [2]	6
	Oil cool output [2]	7

Output configuration		
Single action Double action		IN
Relay	Heat Relay, Cool Relay	0
SSR drive	Heat Relay, Cool SSR drive	1
	Heat SSR drive, Cool Relay	2

[2] In consideration of the thermal characteristics of the different cooling liquids, 2 different correcting methods of the control output are available. One for water and the other for oil

OP water = $100 \cdot (OP2/100)^2$ OP oil = $100 \cdot (OP2/100)^{1.5}$

[3] Only possible whether "Output configuration" $\mathbb{N} = 0$ or 1) and HE.F.5. parameter is different to $\square FF$, see page 29)

Alarm 1 type a	and function	0
Disabled		0
Sensor break/Loop break alarm (LBA)		1
Abaaluta	active high	2
Absolute	active low	3
Deviation	active high	4
Deviation	active low	5
Band	active out	6
Dariu	active in	7
Heater break	active during ON output state	8
by CT [3]	active during OFF output state	9

Alarm 2 type a	nd function	Р
Disabled		0
Sensor break/Loop break alarm (LBA)		1
Absolute	active high	2
Absolute	active low	3
Deviation	active high	4
	active low	5
Band	active out	6
Dallu	active in	7
Heater break	active during ON output state	8
by CT [3]	active during OFF output state	9

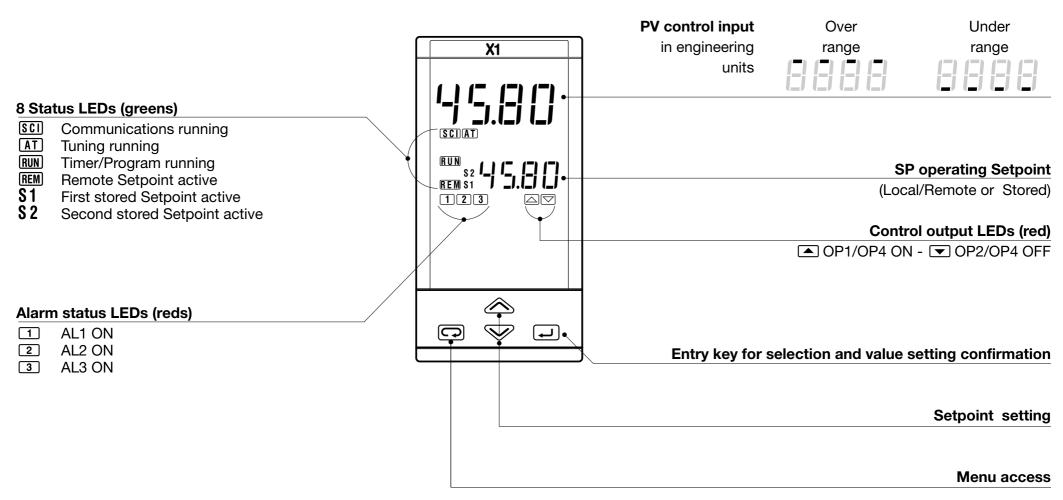
3 - Product coding

Alarm 3 type a	nd function	Q
Disabled or used by Timer		0
Sensor break/Loop break alarm (LBA)		1
Absolute	active high	2
Absolute	active low	3
Deviation	active high	4
Deviation	active low	5
Band	active low	6
Dariu	active in	7
Heater break	active during ON output state	8
by CT [3]	active during OFF output state	9

Setpoint type	R
Local only	0
Local and 2 tracking stored Setpoints	1
Local and 2 Stand-by stored Setpoints	2
Local and Remote	3
Local with trim	4
Remote with trim	5

OPERATIONS

4.1.1 KEYS FUNCTIONS AND DISPLAY IN OPERATOR MODE



4.1.2 KEYS FUNCTIONS AND DISPLAY IN PROGRAMMING MODE



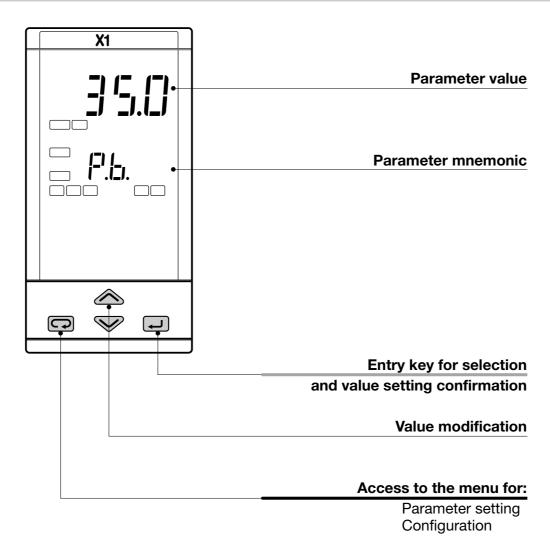
The parameter setting procedure has a timeout. If no keys are pressed for, at least, 30 seconds, the controller switches back, automatically, to the operator mode.

After having selected the parameter or the code, press and to display or modify the value (see page 23)

The value is entered when the next parameter is selected, by pressing the è key.

Until the or or are pressed or if you wait for 30 seconds the parameter value is not inserted

Pressing the key, the next group of parameters is presented on the display.



4.2 PARAMETER SETTING

4.2.1 NUMERIC ENTRY

(i.e. the modification of the Setpoint value from 275.0 to 240.0)

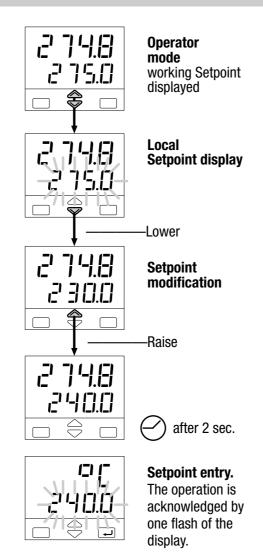
Press or momentarily to change the value of 1 unit every push

Continued pressing of or changes the value, at rate that doubles every second. Releasing the button the rate of change decreases.

In any case the change of the value stops when it has reached the max/min limit set for the parameter.

In case of Setpoint modification: press or once to display the local Setpoint instead of working Setpoint.

To evidence this change the display flashes once. Then the Setpoint can be modified

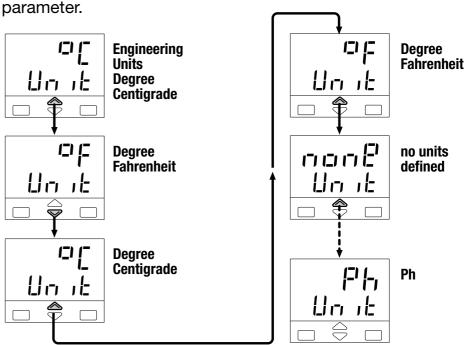


4.2.2 MNEMONIC CODES SETTING

(e.g. configuration see page 28)

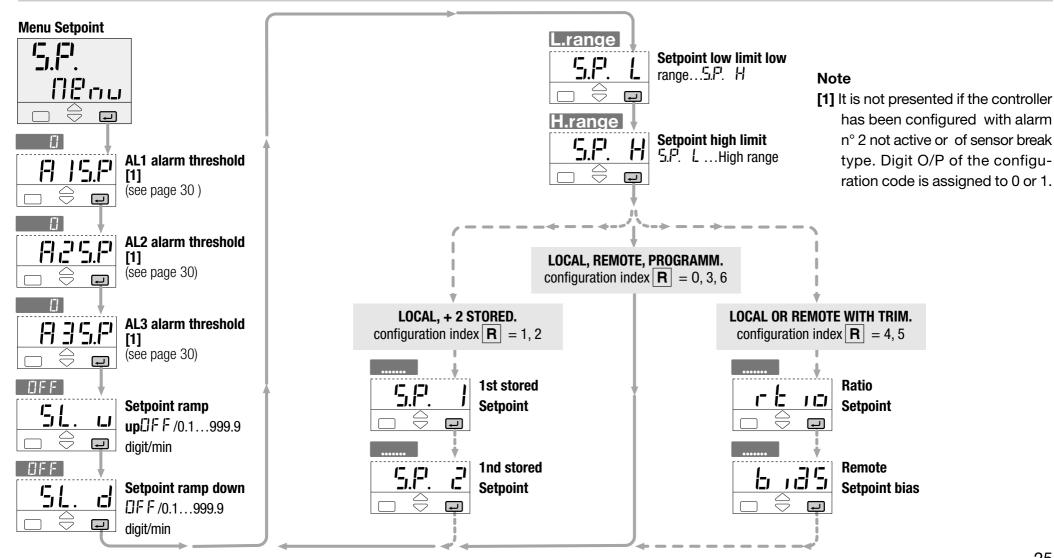
Press the or to display the next or previous mnemonic for the selected parameter.

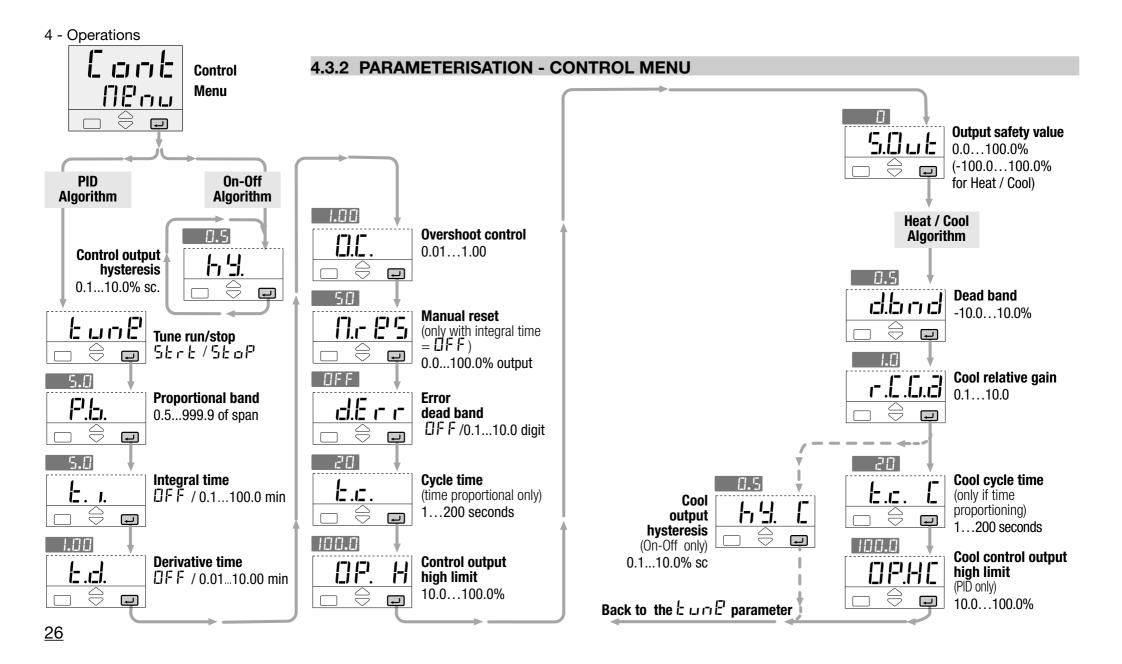
Continued pressing of or will display further mnemonics at a rate of one mnemonic every 0.5 sec. The mnemonic displayed at the time the next parameter is selected, is the one stored in the parameter.



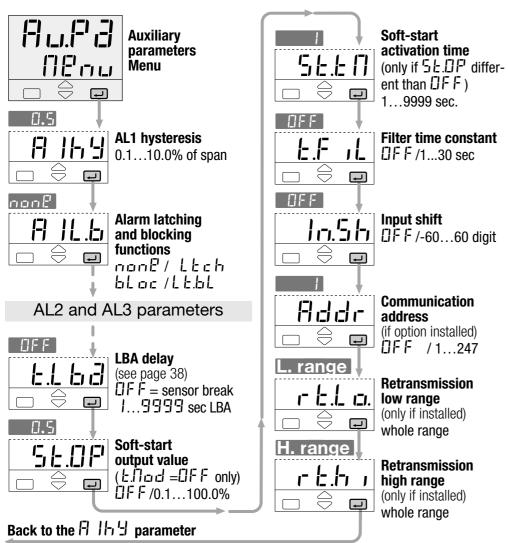
4.3 **PARAMETERISATION - MAIN MENU Back to the Operator mode** 2748 **Operator** mode 2750 **Control Menu Configuration Menu Setpoint Menu Aux.** parameters Menu (see page 27) (see page 25) (see page 26) (see page 28 and 29) (T) 5.8. Au.Pa Eart Lonf **COMMANDS** Nenu Nenu Nenu Nenu (if configured) Q Direct access to the parameter >--(only if [-1] = [-Timer にょついつ run/stop (see page 49) C **Password Entry** Only if $E \supset J E$ value **OPTION** ≥5000 (if installed) **Setpoint selection** local/remote (see page 50) Must be equal to the \bigcirc value of the parameter Cade5.581 Stored **Setpoint selection Timer/Start-up Menu** (see page 50) C) (see page 27) P355 Nean YES Q NO **Back to the Operator mode**

4.3.1 PARAMETERISATION - SETPOINT MENU

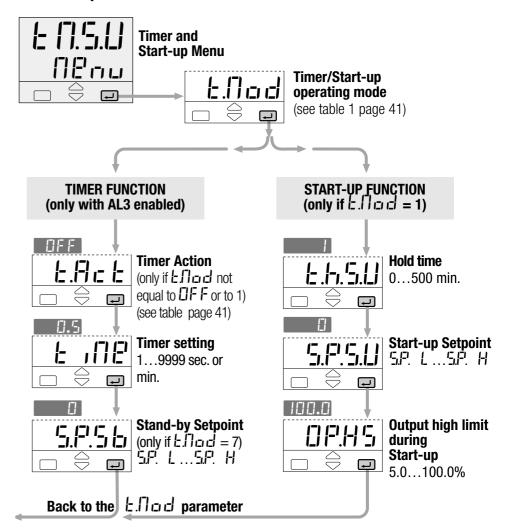




4.3.3 PARAMETERISATION - AUXILIARY PARAMETERS MENU



4.3.4 PARAMETERISATION - TIMER AND START-UP MENU If options installed



4.3.5 CONFIGURATION MENU

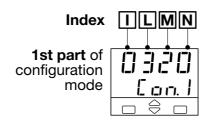
Enter the password before accessing to the configuration menu.

If a not configured controller is supplied, when powered up for the first time, the display shows:



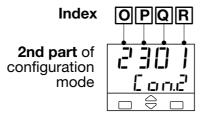
Until the configuration code is set correctly, the controller remains in stand-by with input and output deactivated.

A 4+4 index code follows the model of the controller. It has to be set to configure the controller. (see chapter 3.1 page 17)



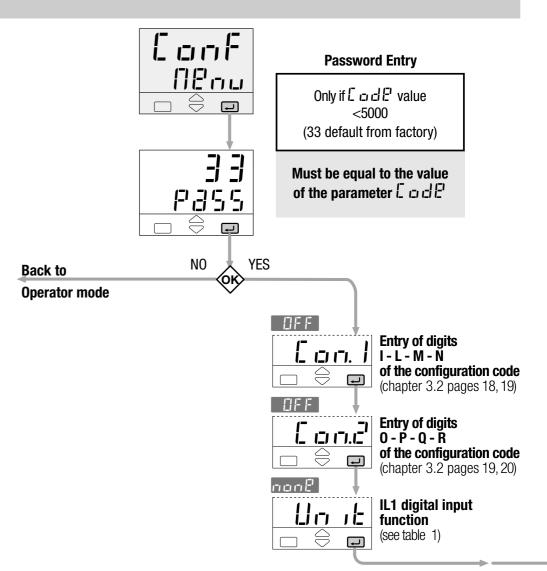
E.g. Enter the code $\square \exists 2 \square$ to choose:

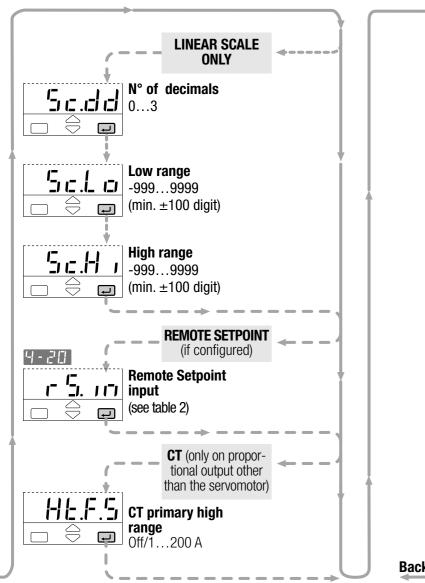
- T/C type J input with range 0...600°C
- Single PID control algorithm , reverse action
- Relay output



E.g. Enter the code 2301 to choose:

- AL1 absolute, active high
- AL2 absolute, active low
- AL3 Used by Timer
- Local + 2 Stored Setpoints with Tracking function





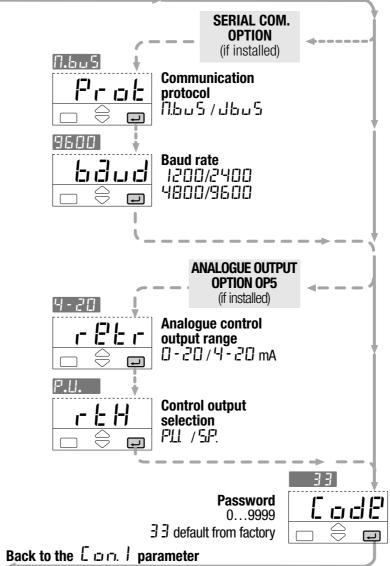


Table 1 Engineering units

un it		
Value	Description	
οĽ	degree centigrade	
ot	degree Fahrenheit	
nonE	none	
пIJ	mV	
IJ	Volt	
nΒ	mA	
FI	Ampere	
68-	Bar	
P5 I	PSI	
r h	Rh	
Ph	рН	

Table 2 Remote Setpoint input type

r 5. In		
Value	Description	
0 - 5	05 Volt	
1-5	15 Volt	
0 - 10	010 Volt	
0 - 20	020 mA	
4-20	420 mA	

4.4 PARAMETERS

For a simpler use of the controller, its parameters have been organised in groups (menu), according to their functionality area.

4.4.1 SETPOINT MENU

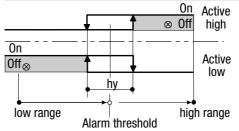
The OP1, OP2 or OP3 outputs, can be used for alarms if they are not used as control outputs

It is possible to configure up to 4 alarms: AL1, AL2, AL3, AL4 (see page 19 and 20), selecting, for each of them:

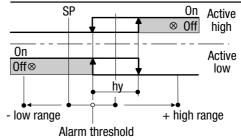
- A the type and the operating condition of the alarm
- B the functionality of the alarm acknowledge (latching) L t c h (see page 37)
- the start-up disabling (blocking)
- **D** Loop break or sensor break (see page 38)

A ALARM TYPE AND OPERATION CONDITIONS

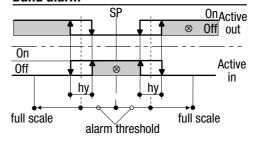
Absolute alarm (full scale)



Deviation alarm



Band alarm







AL2 alarm threshold AL3 alarm threshold

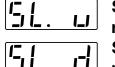
AL1 alarm

threshold

Alarm occurrences of OP1,OP2 and OP3 outputs, respectively linked to AL1, AL2 and AL3.

The range of the alarm threshold correspond to the whole span and it is not limited by the SP Setpoint span.

When the event occures, the display will shows the red leds 1, 2 or 3, respectively on.



Setpoint ramp up **Setpoint** ramp down

This parameter specifies the maximum rate of change of the Setpoint in digit/min.

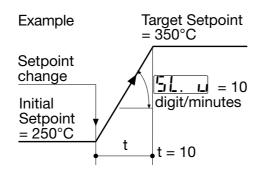
When the parameter is $\square F F$, this function is disabled and the new Setpoint is reached immediately after beina entered.

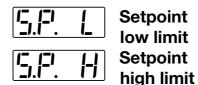
Otherwise, the Setpoint value is reached according to the configured rate of change.

The new Setpoint value is called "Target Setpoint". It can be displayed by means the parameter E.S.P.

(see procedure at page 47).

When Remote Setpoint is configured, we suggest to disable 5L. u and 5L. d parameters OFF.

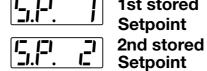




Low / high limit of the Setpoint value.

1st stored

Setpoint



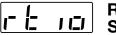
Preset Set values can be set from the keyboard and serial communication. The Setpoint active is indicated by the \$1 or \$2 green led.

If index $|\mathbf{R}| = 1$ (tracking), the previous Local Setpoint value will be lost, when the stored Setpoint is selected.

If index $|\mathbf{R}| = 2$ (Stand-by), the Local Setpoint value will not be lost, when the Stand-by Setpoint is selected. It will operate again when back to Local.

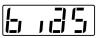
See stored Setpoint selection procedure at page 50

4.4.1 SETPOINT MENU



Remote Setpoint Ratio

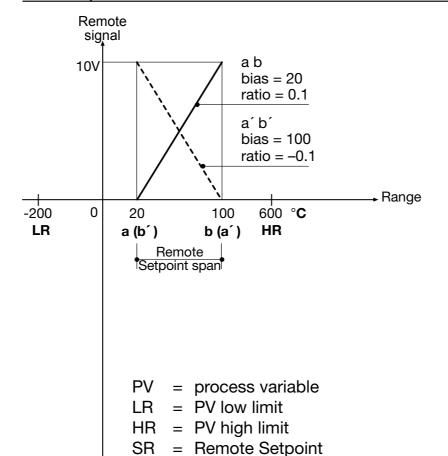
Ratio is the coeff. which defines the remote Setpoint span with respect to the input span.



Remote Setpoint

Bias defines the starting point of analogue Remote Setpoint in eng. units corresponding to the low limit (current or voltage) of the remote signal.

Remote Setpoint Bias and Ratio



a(a') = SR starting point b(b') = SR ending point

If SR starting point is **lower** then the ending point, both expressed in engineering units:

$$b \cdot 35 = \text{starting point} = a$$

$$r = \frac{b-a}{HR-LR}$$

Example:

$$\frac{100 - 20}{600 - (-200)} = \frac{80}{800} = 0.$$

If SR starting point is **higher** then the ending point, both expressed in engineering units

$$b \cdot 35 = \text{starting point} = a'$$

$$r = \frac{b' - a'}{HR - LR}$$

Example:

$$\frac{1}{5} \cdot \frac{1}{3} \cdot \frac{5}{5} = 100$$

$$\frac{20 - 100}{600 - (-200)} = \frac{-80}{800} = -0.5$$

Working Setpoint (SP) as combination of Local Setpoint (SL) and remote signal

Examples:

Local Setpoint (SL) with an external Trim with multiplying coeff. of 1/10: Setpoint type = L ac.b

Remote Setpoint (SR) with an internal Trim with multiplying coeff. of 1/5:
Setpoint type = r Pfl.t
r t 10 = 0.2
t 135 = 0

4.4.2 CONTROL MENU



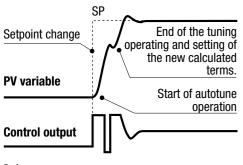
4.4.2.1 AUTOMATIC TUNE

The Fuzzy-Tuning determines automatically the best PID term with respect to the process behaviour.

The controller provides 2 types of "one shot" tuning algorithm, that are selected automatically according to the process condition when the operation is started.

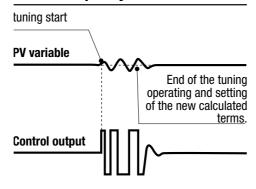
This type is selected when, at

STEP response



the start of the autotune operation, the PV is far from the Setpoint of more than 5% of the span. This method has the big advantage of fast calculation, with a reasonable accuracy in the term calculation.

Natural frequency



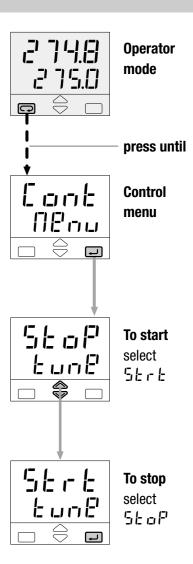
This type is selected when the PV is close to the SP Setpoint.

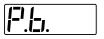
This method has the advantage of a better accuracy in the term calculation with a reasonable speed calculation. The Fuzzy Tuning determines automatically the best method to use to calculate the PID term, according the process conditions.

FUZZY-TUNING START/STOP PROCEDURE

Start/stop of the Fuzzy Tuning The Tuning operation can be started or stopped any time.

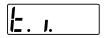
The green led AT is ON when the Fuzzy Tuning is in progress. At the end of this operation, the calculated PID terms parameter are stored and used by the control algorithm and the controller goes back to the operator mode. The green led AT becomes off.





Proportional band

This parameter specifies the proportional band coefficient that multiplies the error (SP - PV)



Integral time

It is the integral time value, that specifies the time required by the integral term to generate an output equivalent to the proportional term. When $\square F F$ the integral term is not included in the control algorithm.



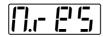
Derivative time

It is the time required by the proportional term P to repeat the output provided by the derivative term D. When $\square F$ the derivative term is not included in the control algorithm.



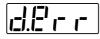
Overshoot control

This parameter specifies the span of action of the overshoot control. Setting lower values $(1.00 \rightarrow 0.01)$ the overshoot generated by a Setpoint change is reduced. The overshoot control doesn't affect the effectiveness of the PID algorithm. Setting 1, the overshoot control is disabled.



Manual Reset

This specifies the control output value when PV = SP, in a PD only algorithm (lack of the integral term).

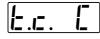


Error Dead Band

Inside this band for (PV - SP), the control output does not change to protect the actuator (output Stand-by)



Control output cycle time



Cool cycle time

It's the cycle time of the SSR drive control output. The PID control output is provided by the pulse width modulation of the waveform.



Control output high limit



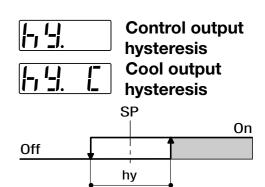
Cool output high limit

It specifies the maximum value the control output can be set. It is applied in manual mode, too.



Output Safety Value

Output Value in case of input anomaly



Control or alarm output hysteresis span, set in % of the full scale.

4.4.2 CONTROL MENU

4.4.2.2 HEAT / COOL CONTROL

By a sole PID control algorithm, the controller handles two different outputs, one of these performs the Heat action, the other one the Cool action.

It is possible to overlap the outputs.

The dead band parameter dend, is the zone where it is possible to separate or overlap the Heat and Cool actions.

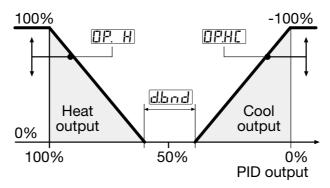
The Cool action can be adjusted using the relative cool gain parameter r.[.[.]]

To limit the Heat and Cool outputs the parameters $\square F$. H and $\square F H L$ can be used.

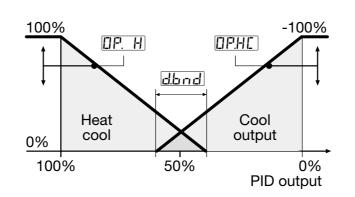
When there is an overlap, the displayed output TILE shows the algebric sum of the Heat and Cool outputs.

A Heat /Cool actions separated

Insert positive [] value (0...10%)

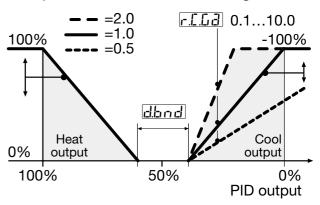


B Heat /Cool actions overlapped

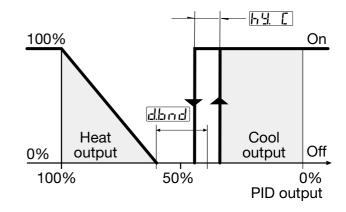


C Cool action adjusting

Example with different relative cool gains



D On-Off Cool action



4.4.3 AUXILIARY PARAMETERS MENU

AL1 alarm hysteresis



AL2 alarm hysteresis



AL3 alarm hysteresis

Hysteresis of the threshold of both the alarms, that activate OP1 and OP2 control output. It is specified as a % of the full scale.



AL1, AL2, AL3 latching and blocking **functions**

and blocking



For each alarm it is possible to select the following functions ⊓⊡⊓E none Ltch latching ២៤២៤ blocking LEBL both latching

LECT ALARM

ACKNOWLEDGE FUNCTION

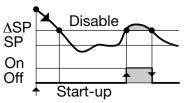
The alarm, once occurred, is presented on the display until to the time of acknowledge. The acknowledge operation consists in pressing any key.

After this operation, the alarm leaves the alarm state only when the alarm condition is no longer present.

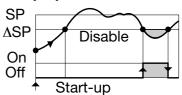
bLock

START-UP DISABLING

Ramp down



Ramp up



 Δ SP Threshold = SP \pm range

4.4.3 AUXILIARY PARAMETERS MENU

ALARMS WITH LBA (LOOP BREAK ALARM) AND SENSOR BREAK OPERATIONSELECT the code 1 on O

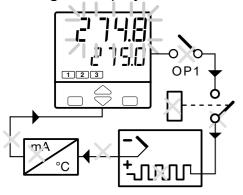
P or **Q** configuration indexes (see pages 21 or 22). The following parameter is then available:



LBA delay

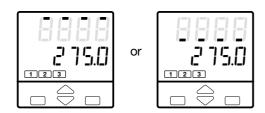
Setting a value between 1 and 9999 sec the alarm works as LBA+Sensor break with delay [1]

This condition is shown by means a red led as well as the blinking PV display.



Setting OFF the alarm works as Sensor break with immediate action.

This condition is shown by means the red led of the selected alarm as well as:



Note [1] In case of sensor break, condition, the alarm action is immediate.

56.08

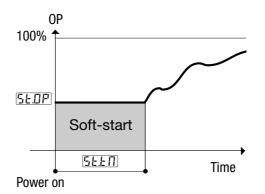
Soft-start control output value

Value of the control output during the Soft-start activation time.

56.67

Soft-start activation time

Time duration (starting from the power on) of the Soft-start function.

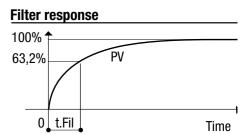


L.F ,L

Input filter time constant

Time constant, in seconds, of the RC input filter applied to the PV input.

When this parameter is set to **DFF** the filter is bypassed.



Input shift

This value is added to the measured PV input value. Its effect is to shift the whole PV scale of up to \pm 60 digits.

When the cause of the alarm disappears, the alarm status stops.



Controller address

the address range is from 1 to 247 and must be unique for each controller on the communication bus to the supervisor.

When set to **IFF** the controller is not communicating



Retransmission low range Retransmission high range

4.4.4 TIMER AND START-UP MENU (OPTION)

To improve the instrument performances and to reduce the wiring and installation costs, two special functions are available:

4.4.4.1 Start-up 4.4.4.2 Timer

In order to have the above functions the product code digit **E** must be **2** (see page 19)

For example: X3 3100-**2**000 To select these functions use the parameter: (see page 41).

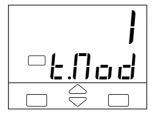


Timer/Start-up operator mode

Selecting Timer or Startup, the Soft-start function is disabled, therefore the parameters 5 1.07 and 5 1.17 will not be shown. (see page 29)

4.4.4.1 START-UP FUNCTION (OPTION)

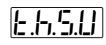
By means of this function it is possible to manipulate the control output when the controller is switched on.



To configure Startup function the parameter

"Timer/Start-up operating mode" must be set to (see page 41)

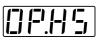
Three parameters are associated to the Start-up function.



Start-up hold time 0...500 min.



Start-up Setpoint (S.P. L...S.P. H)



Control output high limit 5.0%...100.0%

The Start-up function includes three phases:

1st "Limy" - The control output is limited to the [IP.H5]

2nd "Hold" - The process variable is maintained to the Start-up Setpoint for the time fixed by the parameter [E.h.5.L]

3rd "Off" - When the **L.h.S.U** time is elapsed the process variable is maintained to the working Setpoint.

Whether the process variable, for any reason (e.g. load change), decreases at a value lower than (5.7.51) - 40 digits), the Start-up function starts again from the "Limy" phase.

4.4.4.1 START-UP FUNCTION (OPTION)

When the Start-up is in Hold phase, if the local Setpoint becomes lower than the Start-up Setpoint or if the operating mode changes to manual, the Start-up function passes to the "Off" phase.

There are two possibilities:

A Start-up Setpoint 57.51 lower than the local Setpoint.

The "Hold" phase starts when the process variable PV achieves the [5.7.51] (with a tolerance of 1 digit).

B Start-up Setpoint 5.5.5.0 greater than or equal to the local Setpoint.

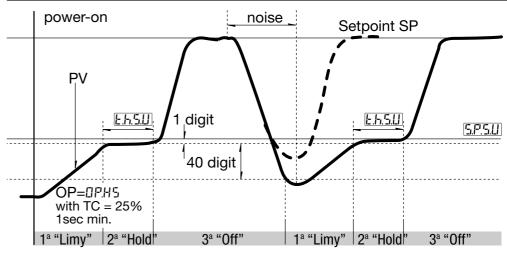
When the process variable PV achieves the local Setpoint (with a tolerance of 1 digit), the Start-up function passes directly to the "Off" phase.

If, at the controller power-on, the process variable PV is greater than the lowest between the [5.7.51] and the working Setpoint, the next phase ("Hold" or "Off") will executed instead of the "Limy" phase.

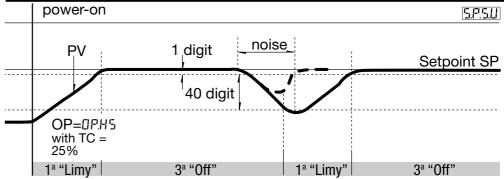


During the "Limy" and "Hold" phases the RUN led is on.

A 5.P.5U < local Setpoint SP







4.4.4.2 TIMER FUNCTION (OPTION)

Timer can't The enabled with Heat / Cool control.

To enable this function do the following:

- 1 In order to use this AL3 function, index | Q | must be set to \square in configuration (see p. 20).
- 2 To select one of the 6 possible functioning modes of the Timer, set the value of the 2 following parameters in parameterisation (see p. 27).



Timer/Start-up operating mode

By this parameter can be defined: (see table 1)

- the counting start time
- the control output status at the end of the counting

table 1

Timer/Start-up	Value			
Disabled	OFF			
Start-up funct	ion	1		
Counting start time				
When inside the	When inside the Control mode			
band	3			
When launched	Control mode	'-		
when launtheu	Output to 0	5		
When launched. Control disabled	Control mod	5		
When launched stand-by Setpoint	7			

Now the other parameter values can be entered:



Timer **Action**

By this parameter can be defined:(see table 2)

- the time units
- the starting mode
- the OP3 status when the timer is running.

When the timer is not running, the OP3 takes the opposite status.

Timer setting

(1...9999 sec/min.)



Stand-by **Setpoint**

(only for $\xi . \Pi = 7$) (S.P. L...S.P. H)

table 2

Time units	Starting mode	OP3 status	Value
	Manual by	Off	
Seconds	keypad Aut at the	On	
	Aut at the	Off	רים
	power on [2]	On	3
	Manual by	Off	닉
Minutes	keypad	On	5
	Aut at the	Off	5
	power on [2]	On	7

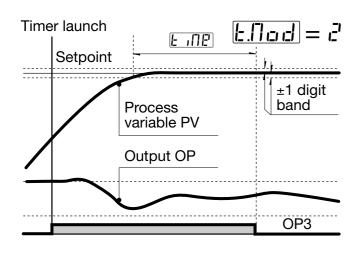
- [1] If used by Timer
- [2] Using this selection, manual starting mode is possible too.

4.4.4.2 TIMER FUNCTION (OPTION)

TIMER COUNTING MODES

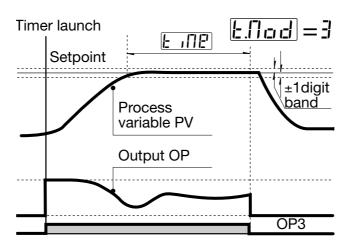
A - Counting start time inside the band, end in control mode.

The time counting starts only when the error is inside $a \pm 1$ digit band. The control action is not affected by the Timer function.



B - Counting start time inside the band, end with control output forced to zero.

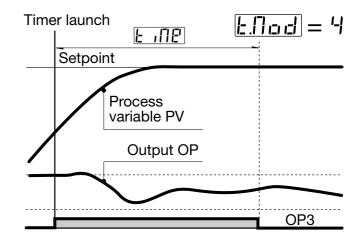
The time counting starts only when the error is inside $a \pm 1$ digit band. At the end, the control output is forced to zero. [1]



[1] When the Timer is not running the control output is forced to zero, also before the Timer launch

C - Counting start time = timer launch time, end in control mode.

The time counting starts when the timer is launched. The control action is not affected by the Timer function.



TIMER COUNTING MODES

D - Counting start time = timer launch time, end with control output forced to zero.

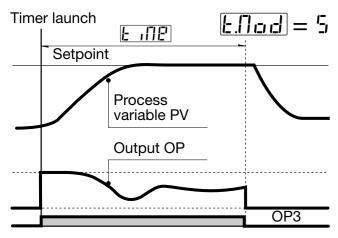
The time counting starts when the timer is launched. At the end, the control output is forced to zero. [1]

E - No control action during the counting time.

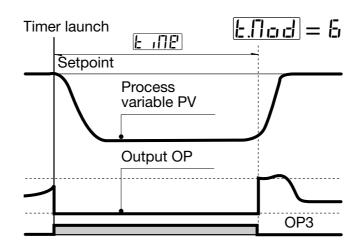
The time counting starts when the timer is launched and the control output is forced to zero. At the end, the control action starts.

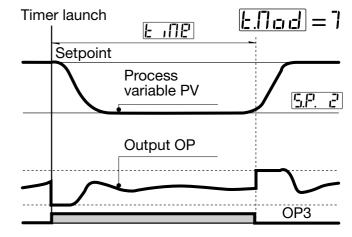
F - Control action with stand-by Setpoint during the counting time

The time counting starts when the timer is launched and the control action use the Stand-by Setpoint. At the end, the control action use the working Setpoint.



[1] When the Timer is not running the control output is forced to zero, also before the Timer launch





4.4.4.2 TIMER FUNCTION (OPTION)

POWER FAILURE

If there is a power failure during the Timer execution, the value of the elapsed time is lost.

Depending on Timer action E.E. selection, when the controller restarts you can have two different situations:

- with automatic mode ([E.] = [2, 3, 5, 7), the Timer function starts again and the counting time is reinitialised.
- with manual mode

 (E.3c E = 0, 1,4,5), the control output is forced to 9

 0 if Enad = 3 e 5; otherwise the control action restarts using the working Setpoint

TIMER STARTING

See the Timer starting procedure at page 49

DISPLAY



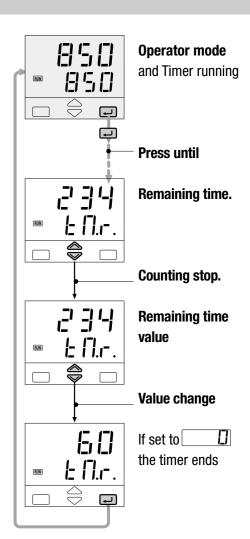
When the Timer is running, the led **RUN** is on.



When the Timer ends, the Setpoint display shows alternatively the message End and the Setpoint value until a key is pressed.

TIMER REMAINING TIME

When the timer is running it is always possible to see the remaining time and to modify it.



4.4.5 CONFIGURATION MENU

RETRANSMISSION

When OP5 output is present and not configured as control output, it retransmits linearised PV or SP.

On configuration (see page 29) it is possible to set



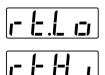
Output range [] - 2[] / 4 - 2[]



Retransmitted signal

none P.U. /S.P.

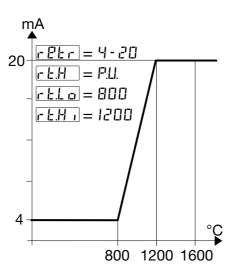
The following parameters define the low and high range of the OP5 retransmission output corresponding to 0...4mA or 20mA (see page 27):



Retransmission low range Retransmission high range

Example:

- T/C S, range 0...1600°C
- Output range, 4...20 mA
- Retransmitted signal PV on 800...1200°C range



With relate greater than relation it is possible to obtain a reverse scale.

CURRENT TRANSFORMER INPUT

With CT option, it is possible to display the load current and set an alarm threshold.

The setting can be done by means the 8 or 9 configuration index of the codes O, P or Q (see pages 19 and 20).

It is possible to set one of the alarms (see pages 19 and 20) to have an alarm when, during the ON time of the time proportional output, the load current is less then the specified threshold (index 8), or during the OFF time there is a value > 3% of full scale load current.

The alarm condition must be longer than 120 ms to set the alarm.

By the parameter



CT primary high range CIF F / 1 200A

the load current display can be adapted to the transformer characteristics. (OFF means disabled)

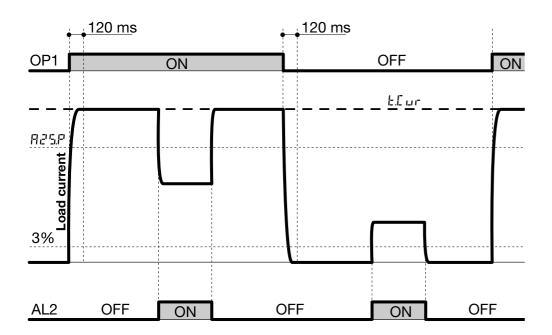
During the OFF time the parameter Lur latches the last on time current value

4.4.5 CONFIGURATION MENU

CURRENT TRANSFORMER INPUT

Example:

CT input on OP1, alarm on AL2 during on time (configuration digit $\boxed{\mathbf{O}}$ = 8, , see page 19)



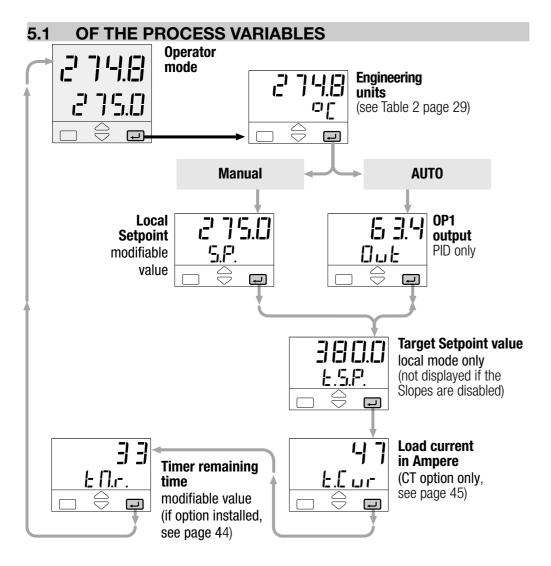
SERIAL COMMUNICATIONS



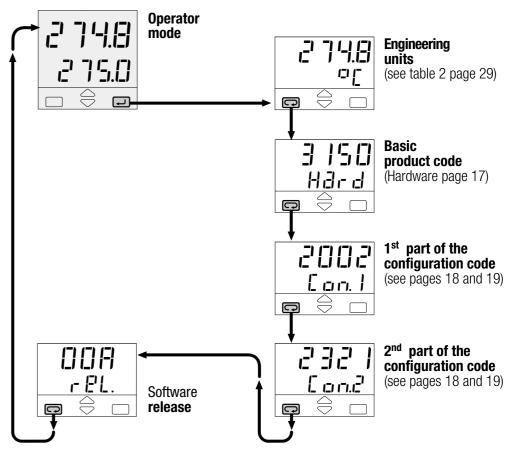


5

DISPLAYS



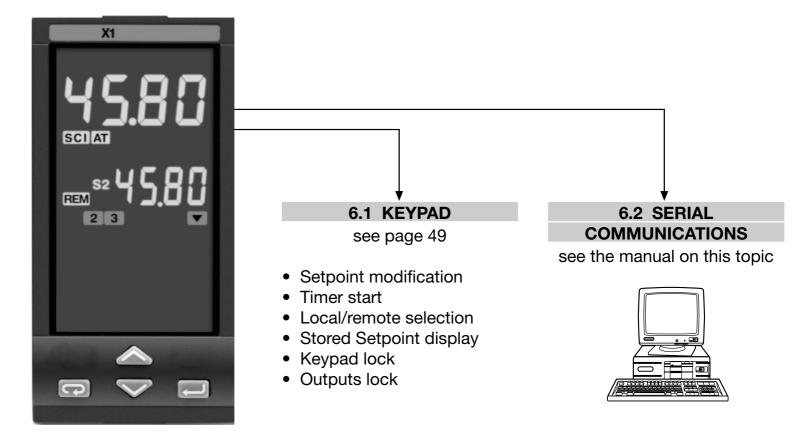
5.2 OF THE CONFIGURATION CODES



6 COMMANDS

COMMANDS TO THE CONTROLLER AND OPERATING PHASES

The commands can be entered in 2 ways:

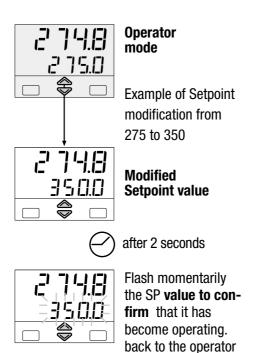


6.1 KEYPAD COMMANDS

6.1.1 SETPOINT MODIFICATION

The Setpoint is directly modified with the keys.

Once entered, the new value is checked and becomes operating after 2 seconds.. The end of this phase is flagged by flashing momentarily the display with SP.



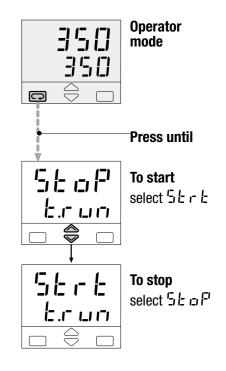
mode

6.1.2 TIMER STARTING (option)

Depending on the Timer action L.J.L selection, there can be two different starting ways:

- Automatic at the power on
- Manual by keypad, digital inputs or serial communications.

To start/stop the Timer:



Press the key 🕡 to confirm

6.1 KEYPAD COMMANDS

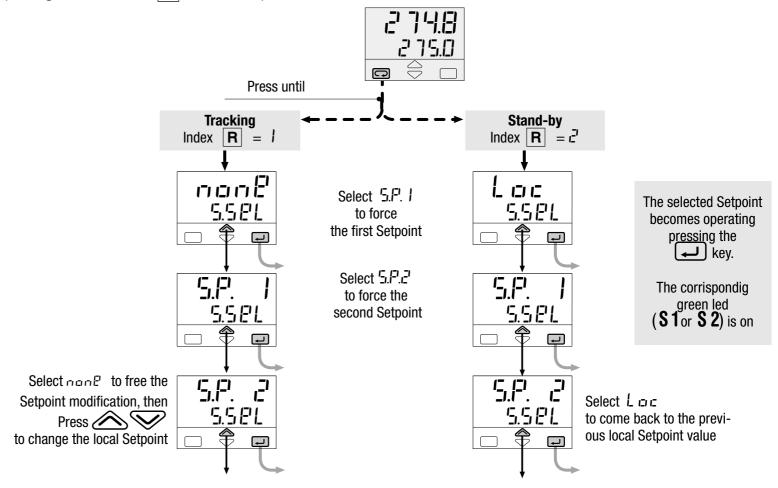
6.1.3 LOC/ REM SELECTION

configuration index $\mathbf{R} = 4$ or 5)

Operator 2748 mode 275.0 Press until Select - PD Loc to enable Remote Setpoint Select L 🖂 to enable **Local Setpoint** له The selected Setpoint becomes operating pressing the When in Remote, the green led REM is on

6.1.4 STORED SETPOINTS SELECTION

(configuration index $\mathbf{R} = I$ or \mathcal{E})



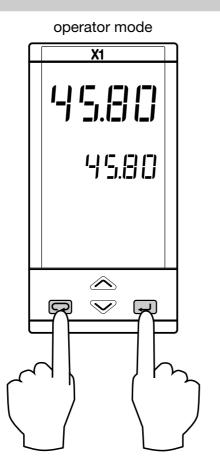
6.1.5 KEYPAD LOCK

To lock/unlock the keypad press the keys and simultaneously for 2 seconds.

To confirm the keypad lock/unlock the display flashes once.

The keypad lock/unlock can be achieved by serial communications too.

The keypad lock is maintained in case of power failure.



Press simultaneously for 2 seconds

6.1.6 OUTPUTS LOCK

The outputs are switched to the OFF status by pressing the keys and together.

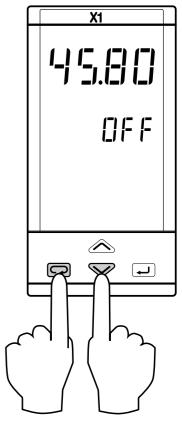
When the outputs are locked, the message **[]** is displayed instead of the Setpoint value.

To unlock the outputs press again the keys simultaneously (the Soft-start will be enabled).

The outputs lock/unlock can be achieved by serial communications too

The outputs lock/unlock is maintained in case of power failure.

operator mode



Press simultaneously for 2 seconds

TECHNICAL SPECIFICATIONS

Features (at 25°C environmental temp.)	Description				
Total configurability (see chapter 3.2 page 18 chapter 4.3.5 page 28)	- the type of input	nm -	- the type and functionality of the alarms - the type of Setpoint - control parameter values		
PV Input (see pages 11,12 and page 18)	Common characteristics	A/D converter with resolution of 50.000 points Update measurement time: 0.2 seconds Sampling time: 0.5 seconds Input bias: - 60+ 60 digit Input filter with enable/disable: 130 seconds			
	Accuracy	$0.25\% \pm 1$ digits for temperature sensors $0.1\% \pm 1$ digits (for mV and mA)		Between 100240V∼ the error is minimal	
	Resistance thermometer (for ΔT : R1+R2 must be <320 Ω)	Pt100Ω at 0°C (IEC 751) °C/°F selectable 2 or 3 wires connection Burnout (with any combination)		Max. wire Res: 20Ω max (3 wires) Sensitivity: $0.1^{\circ}\text{C}/10^{\circ}$ E. T. $<0.1^{\circ}\text{C}/10\Omega$ Wire Res.	
	Thermocouple	L,J,T,K,S, R, B, N, E, W3, W5 (IEC 584) Rj >10MΩ °C/°F selectable	Internal cold junction compensation con NTC Error 1°C/20°C ±0.5°C Burnout	Line: 150Ω max Input drift: <2μV/°C.Env. Temp <0.5μV / 10Ω Wire Res.	
	DC input (current)	420mA,0-20mA with external shunt 2.5Ω Rj >10M Ω	Burnout. Engineering units Conf. decimal point position Init. Scale -9999999	Input drift: <0.1% / 20°C Env. Temp.	
	DC input (voltage)	1050mV, 0-50mV Rj >10MΩ	Full Scale -9999999 (min. range of 100 digits)	$<0.5\mu\text{V} / 10\Omega$ Wire Res.	

Features (at 25°C environmental temp.)	Description							
Auxiliary inputs	Remote Setpoint (option) Not isolated accuracy 0.1%		Current $0/420$ mA $Rj = 30\Omega$ Voltage $1-5/0-5/0-10V$ $Rj = 300$ K Ω	Bias in engineering units and ± range -Ratio from -9.99+99.99 Local + Remote Setpoint				
	CT current transformer (see pages12 and 45)		50 or 100 mA input hardware selectable	Current visualisation 1200A With 1A resolution and Heater Break Alarm				
Operating mode and Outputs	1 single or double action PID loop or On/Off with 1, 2 or 3 alarms	Single action	Control output		AL1 alarm	AL2 alarm	AL3 alarm	Retransmiss.
			OP1 -Relay/Triac		OP2 -Relay/Triac		0P3 -Relay	OP5 -Analogue
			OP4 -SSR drive		OP1 -Relay/Triac OP2 -Relay/Triac		0P3 -Relay	OP5 -Analogue
		Double action Heat / Cool	OP1 -Relay/Triac	0P2 -Relay/Triac			0P3 -Relay	OP5 -Analogue
			OP1 -Relay/Triac	0P4 -SSR drive		0P2 -Relay/Triac	0P3 -Relay	OP5 -Analogue
			0P4 -SSR drive	0P2 -Relay/Triac	OP1 -Relay/Triad		0P3 -Relay	OP5 -Analogue

7 - Technical specifications

Features (at 25°C environmental temp.)	Description					
	Algorithm	PID with overshoot control or On-off - PID with valve drive		algorithm, for controlling motorised positioners		
	Proportional band (P)	0.5999.9%				
	Integral time (I)	0.1100.0 min				
	Derivative time (D)	0.0110.00 min	$\square FF = 0$			
	Error dead band	0.110.0 digit				
	Overshoot control	0.011.00		Single action		
	Manual reset	0.0100.0%	PID algorithm			
	Cycle time (Time proportional only)	1200 sec				
Control mode	Control output high limit	10.0100.0%				
	Soft-start output value	0.1100.0%	Ω FF = 0			
	Output safety value	0.0100.0% (-100.0100.0% for Heat / Cool)				
	Control output hysteresis	0.110.0%		On-Off algorithm Double action PID algorithm (Heat / Cool)		
	Dead band	-10.010.0%				
	Relative cool gain	0.110.0				
	Cycle time (Time proportional only)	1200 sec				
	Control output high limit	10.0100.0%		with overlap		
	Cool output hysteresis	0.110.0%				

Features (at 25°C environmental temp.)	Description							
OP1-OP2 outputs	•	SPST Relay N.O., 2A/250V for resistive load Triac, 1A/250V for resistive load						
OP3 output	SPDT relay N.O., 2A/250V	∕∼ for resistive load						
OP4 output	SPDT relay N.O., 2A/250V	∕∼ for resistive load						
OP5 analogue output (option)	Control or PV/SP retransmission Galvanic isolation: 500 V ~ /1 min Resolution 12bit (0.025%) Accuracy: 0.1 % In current: 0/420mA, 750Ω / 15V max							
	Hysteresis 0.110.0% c.s.							
	Action	Active high Active low	Action type	Deviation threshold	±range			
A14 A10 A10				Band threshold	0range			
AL1 - AL2 - AL3 alarms				Absolute threshold	whole range			
		Special functions	Sensor break, heater break alarm					
			Acknowledge (latching), activation inhibit (blocking)					
			Connected to Timer or program (if options installed)					
	Local							
	Local		Up and down ramps0.1999.9 digit/min. (0FF=0)					
Setpoint	Local and Remote		Low limit: from low range	to high limit				
	Local with trim	If option installed	High limit: from low limit t					
	Remote with trim							

7 - Technical specifications

Features (at 25°C environmental temp.)	Description						
	Timer (see page 41)		Automatic start at the power on, manual start by keypad, Digital inputs or serial comm.s				
			Tempo di esecuzione: 19999 sec/min				
Special functions			Stand-by Setpoint:	and-by Setpoint: from Setpoint low limit to Setpoint high limit			
(option)	Olevet vers		Start-up Setpoint:	from Se	tpoint low limit to Setp	oint high limit	
	Start-up (see page 39)		Hold time:	0500	min		
			Control output high lim	it: 5.01	00.0%		
Fuzzy-Tuning one shoot	The controller selects a				Step response		
according to the proces		ss conditio	ons		Natural frequency		
Serial comm. (option)	RS485 isolated, Modbu	RS485 isolated, Modbus/Jbus protocol, 1200, 2400, 4800, 9600 bit/sec, 3 wires					
Auxiliary Supply	+24V- ± 20% 30mA n	nax - for e	xternal transmitter supp	ly			
	Measure input Detection of out of range, short circuit or sensor break with automatic activation of the safety strategies and alerts on display						
Operation	Control output	put Safety value: -100%100%					
alarm safety	Parameters	Parameter and configuration data are stored in a non volatile memory for an unlimited time					
	Access protection	Password	assword to access the configuration and parameters data, keypad lock, outputs lock				
Power supply (fuse protected) 100 - 240V ~ (-15% + 10%) 50/60Hz or 24V ~ (-15% + 25%) 50/60Hz e 24V – (-15% + 25%)					15% + 25%)		Power consumption 4W max
	Safety	Compliance to EN61010-1 (IEC 1010 – 1), installation class 2 (2500V) pollution class 2, instrument class II					
General characteristics	Electromagnetic compatibility	Compliance to the CE standards (see page 2)					
	Protection EN60529 (IEC529)	IP65 front panel					
	Dimensions	¹ / ₈ DIN - 48 x 96, depth 110 mm, weight 250 gr. apx.					