



Heat/Cool temperature controller 1/4 DIN - 96 x 96



ISO 9001
Certified

Q1 line

User Manual • 07 / 05 • Code: ISTR_M_Q1_E_04_--

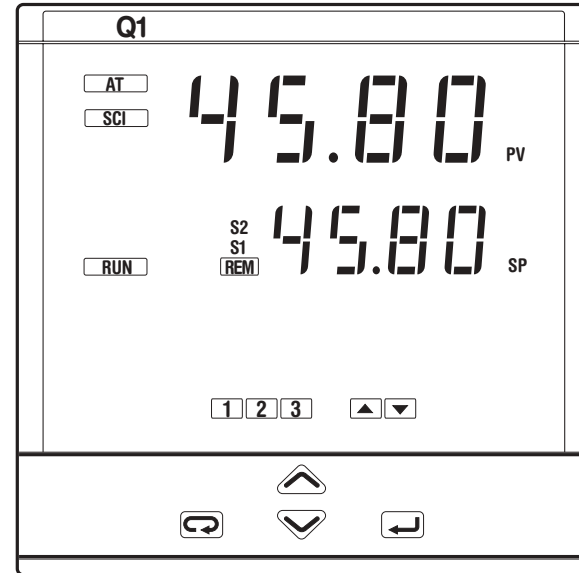


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**Heat / Cool
temperature controller**
1/4 DIN - 96 x 96

Q1 line





**ON ELECTRIC
SAFETY AND
ELECTROMAGNETIC
COMPATIBILITY**

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

Class II instrument, real 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/EEC amended by the European Community directive 93/68/EEC and the Regulations on the essential protection requirements in electrical apparatus EN61010-1 : 93 + A2:95.

Regulations on Electromagnetic Compatibility according to the European Community directive n089/336/EEC, amended by the European Community directive n° 92/31/EEC, 93/68/EEC, 98/13/EEC and the following regulations:

Regulations on RF emissions:

EN61000-6-3: 2001

residential environments

EN61000-6-4: 2001

industrial environments

Regulation on RF immunity

EN61000-6-2: 2001

industrial equipment and system

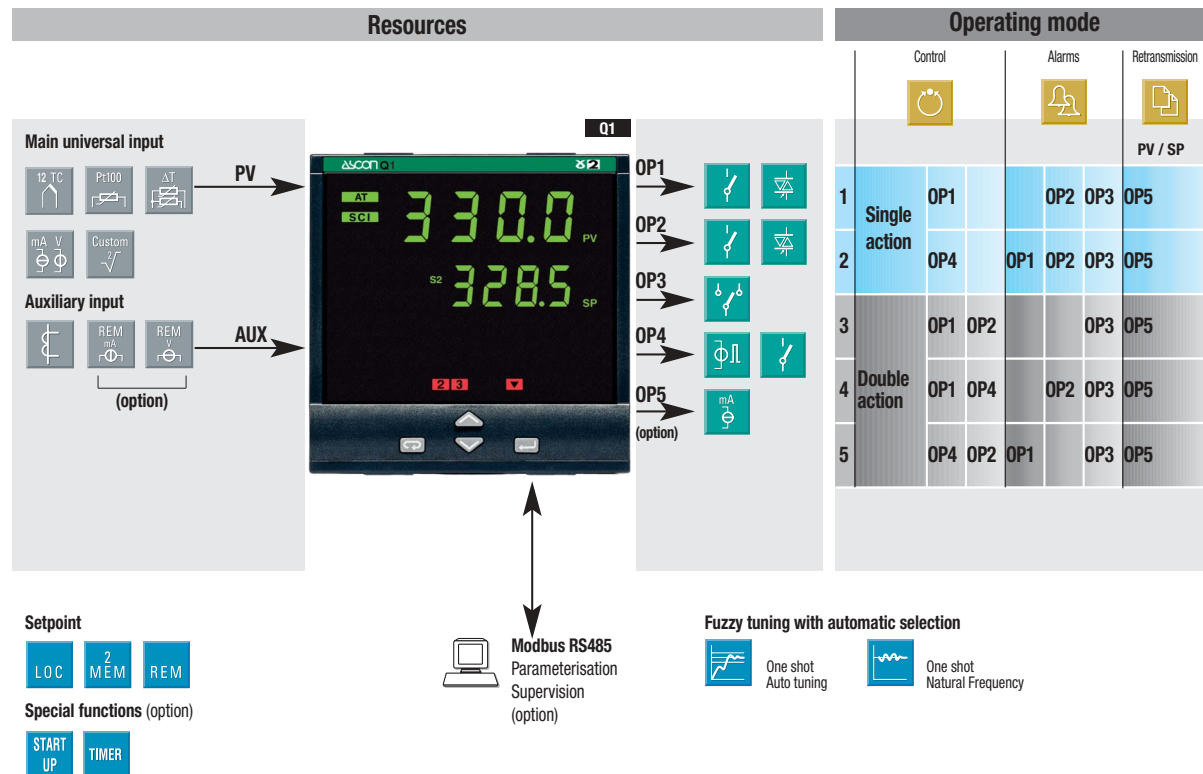
It is important to understand that it's responsibility of the installer to ensure the compliance of the regulations on safety requirements and EMC.

The device 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  CE sign, at the side of the note.


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INSTALLATION

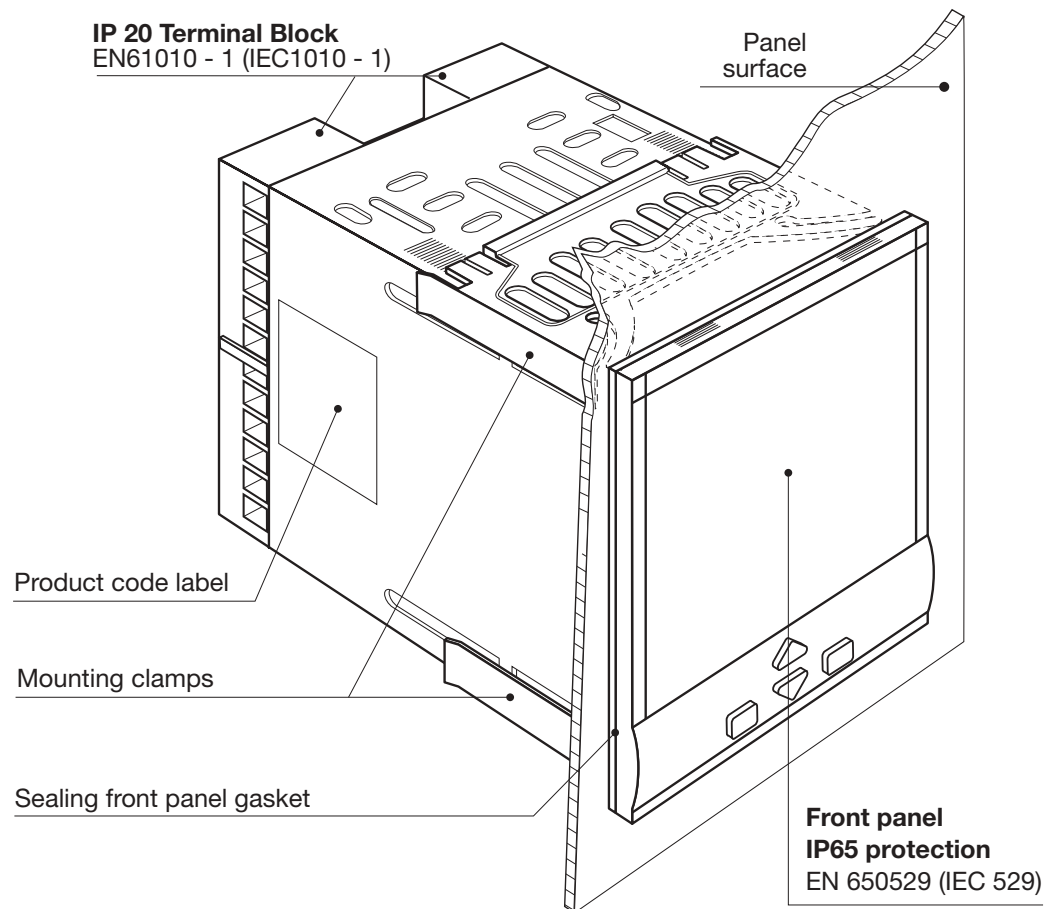
Installation must only be carried out by qualified personnel.

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.

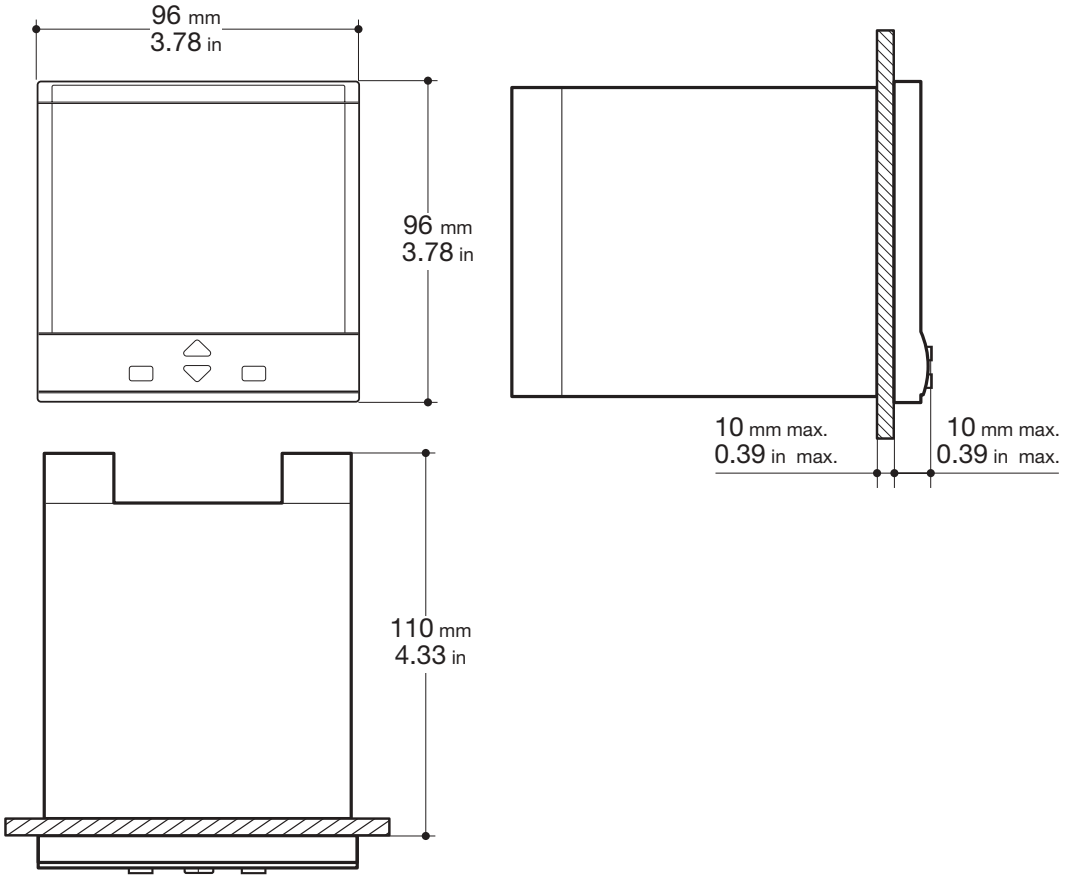


To prevent hands or metal touching parts that may be electrically live, **the controllers must be installed in an enclosure and/or in a cubicle.**

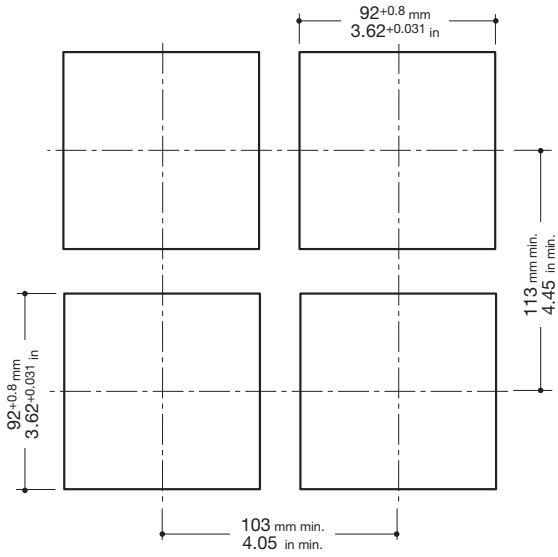
1.1 GENERAL DESCRIPTION



1.2 DIMENSIONS



1.3 PANEL CUT-OUT



1.4 ENVIRONMENTAL RATINGS

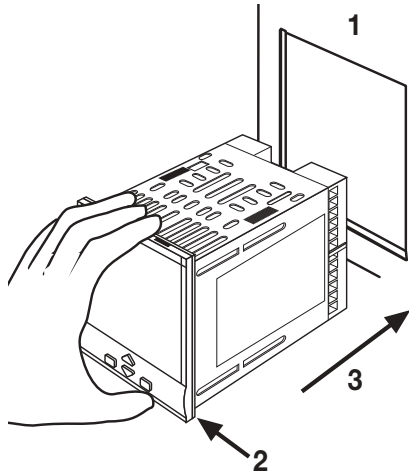


Operating conditions		
	Altitude up to 2,000 m	
	Temperature 0...50°C	
%Rh	Relative humidity 5...95 % non-condensing	
Special conditions		Suggestions
	Altitude > 2,000 m	Use 24Vac supply version
	Temperature >50°C	Use forced air ventilation
%Rh	Humidity > 95 %	Warm up
	Conducting atmosphere	Use filter
Forbidden Conditions		
	Corrosive atmosphere	
	Explosive atmosphere	

1.5 PANEL MOUNTING [1]

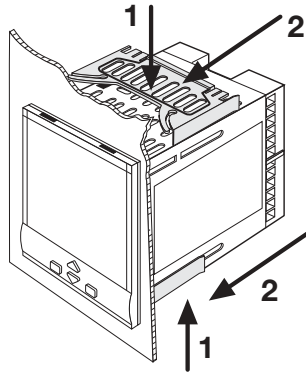
1.5.1 INSERT THE INSTRUMENT

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



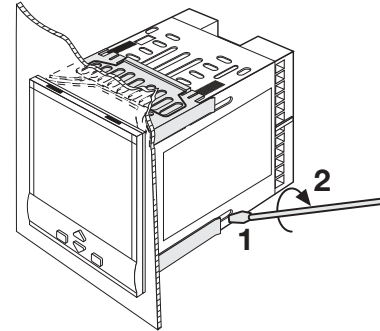
1.5.2 INSTALLATION SECURING

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



1.5.3 CLAMPS REMOVING

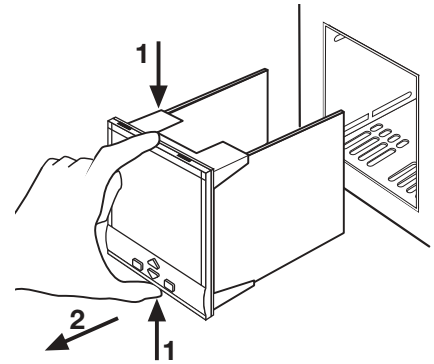
- 1 Insert the screwdriver in the clips of the clamps;
- 2 Rotate the screwdriver.



1.5.4 INSTRUMENT UNPLUGGING



- 1 Push and
- 2 pull to remove the instrument.



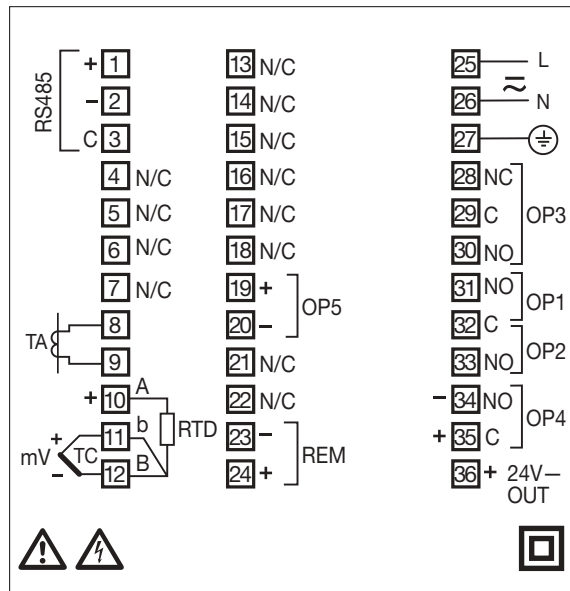
Electrostatic discharges can damage the instrument. Before removing the instrument the operator must discharge himself to ground.



UL note

[1] For Use on a Flat Surface of a Type 2 and Type 3 'raintight' Enclosure.

2 ELECTRICAL CONNECTIONS

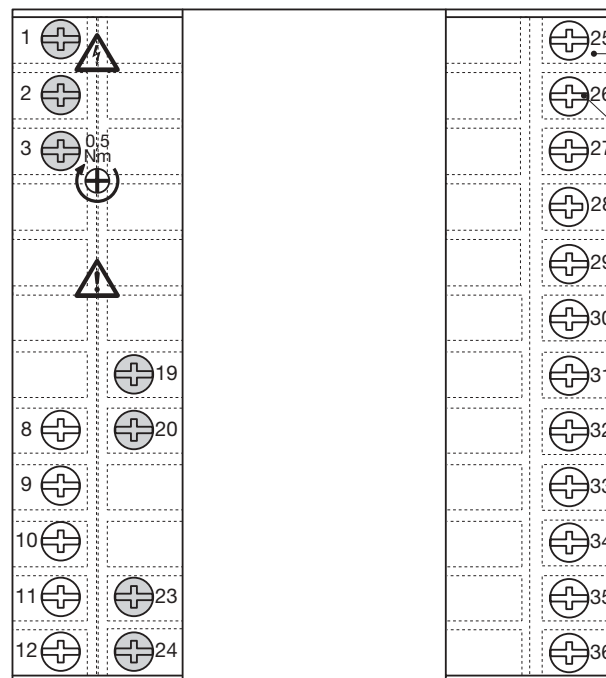


UL note

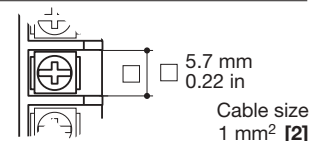
[1] Use 60/70 °C copper (Cu) conductor only.

[2] Wire size 1mm² (18 AWG Solid/Stranded)

2.1 TERMINAL BLOCK [1]



Rear terminal cover



24 screw terminals M3



Option terminals



Tightening torque 0.5 Nm

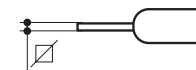


Positive screw-driver PH1



Negative screw-driver
0.8 x 4 mm

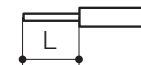
Terminals



Pin connector
Ø1.4 mm 0.055 in max.



Fork-shape AMP 165004
Ø5.5 mm - 0.21 in



Stripped wire
L 5.5 mm - 0.21 in

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.



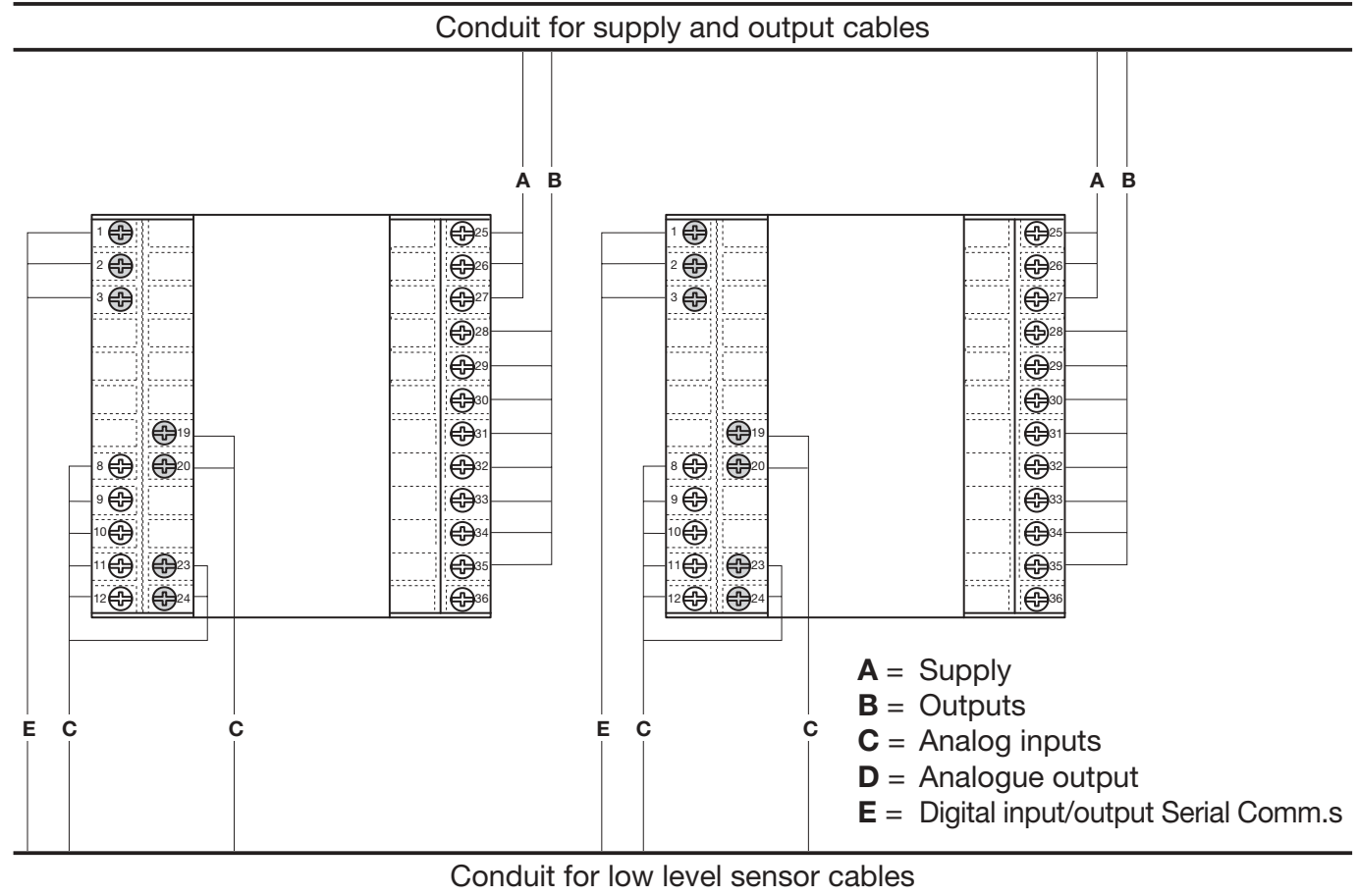
All the wiring must comply with the local regulations.

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

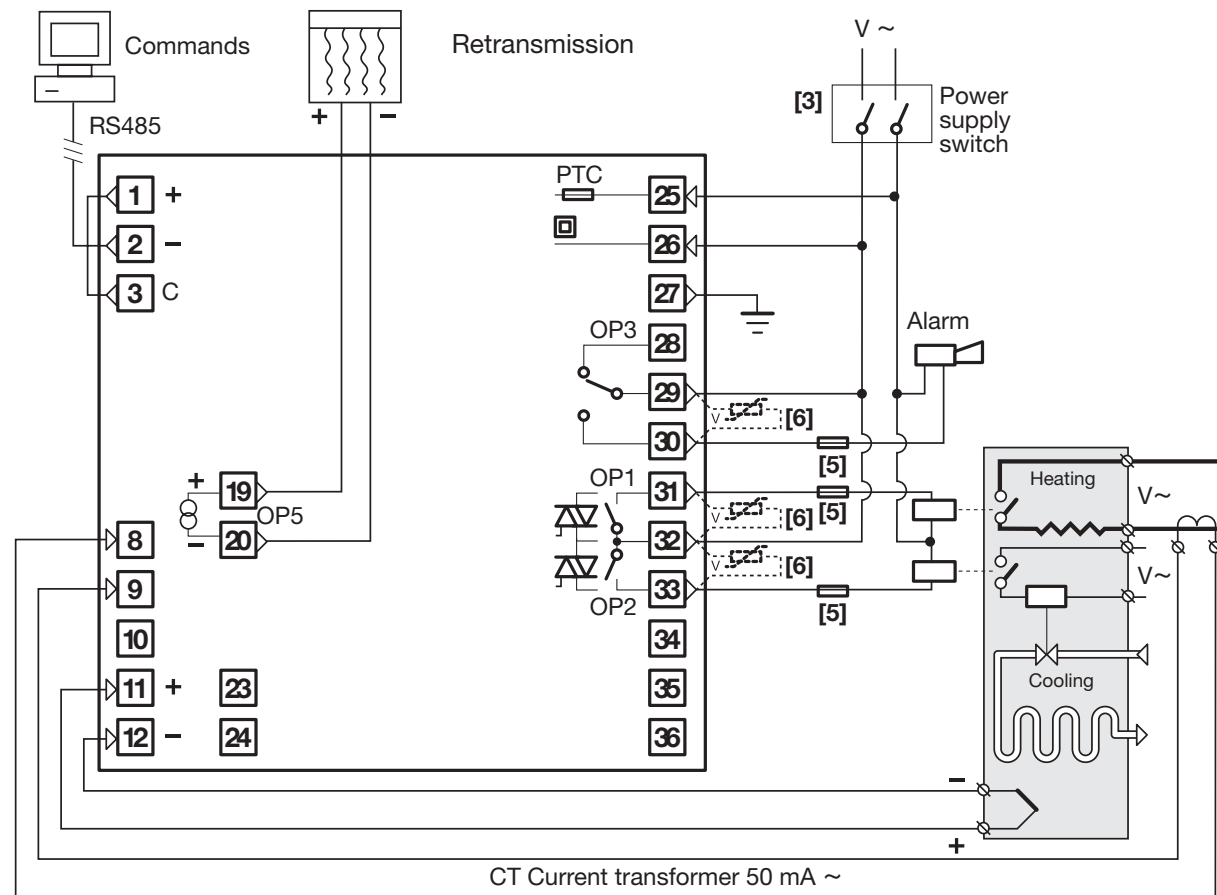
Avoid power units nearby, especially if controlled in phase angle.

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 SUGGESTED WIRES ROUTING

2.3 EXAMPLE OF WIRING DIAGRAM (HEAT / COOL CONTROL)

**Notes:**

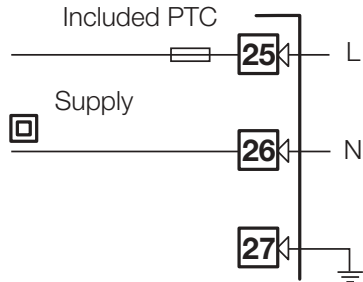
- 1] Make sure that the power supply voltage is the same indicated on the instrument.
- 2] Switch on the power supply only after that all the electrical connections have been completed.
- 3] In accordance with the safety regulations, the power supply switch shall bring the identification of the relevant instrument. The power supply switch shall be easily accessible from the operator.
- 4] The instrument is PTC protected. 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 fuse for Relay outputs (220 Vac);
 - 4 A ~ T fuse for Relay outputs (110 Vac);
 - 1 A ~ T fuse for Triac outputs.
- 6] Relay contacts are already protected with varistors.

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

2.3.1 POWER SUPPLY

Switching power supply with multiple isolation and internal PTC.

- **Standard version:**
 - nominal voltage: 100...240Vac (-15...+10%);
 - frequency 50/60Hz.
 - **Low Voltage version:**
 - nominal voltage: 24Vac (-25...+12%);
 - frequency 50/60Hz or 24Vdc (-15...+25%).
- Power consumption 4W max.

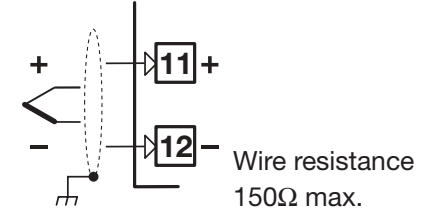


For better protection against noise, it is recommended not to connect the earth clamp provided for civilian installations.

2.3.2 PV CONTROL INPUT

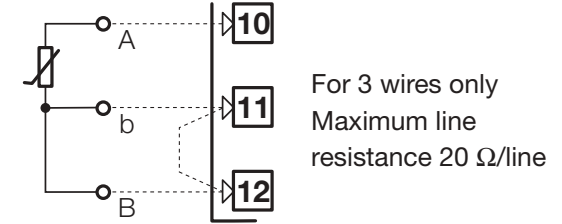
A L-J-K-S-R-T-B-N-E-W thermocouple type

- 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

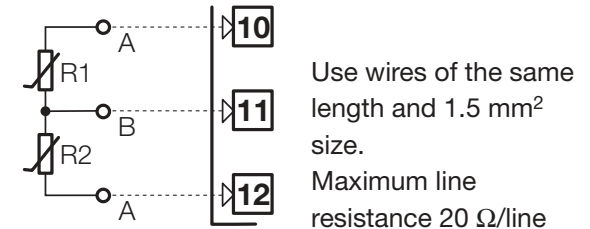
- If a 3 wires system is used, use always cables of the same diameter (1mm² min.) (line 20 Ω/lead maximum resistance);
- When using a 2 wires system, use always cables of the same section (1.5mm² min.) and put a jumper between terminals 11 and 12.



C For ΔT (2x RTD Pt100) Special

- ⚠ When the distance between the controller and the sensor is 15 m using a cable having a section of 1.5 mm², produces an error on the measure of 1°C.

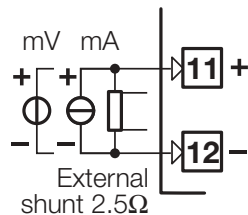
R1 + R2 must be <320Ω.



2.3.2 PV CONTROL INPUT

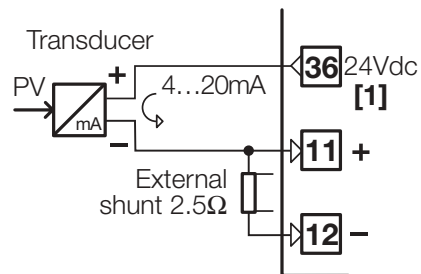


D For mA, mV

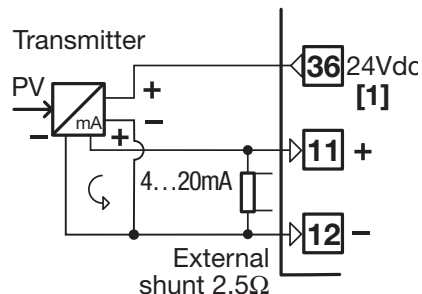


$R_j > 10M\Omega$

D1 With 2 wires transducer



D2 With 3 wires transducer



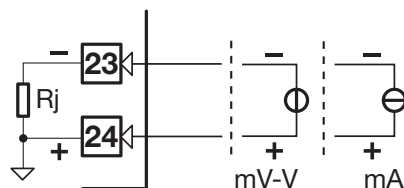
[1] Auxiliary power supply for external transmitter 24Vdc $\pm 20\%$ /30mA max. without short circuit protection.

2.3.3 AUXILIARY INPUT (OPTION)

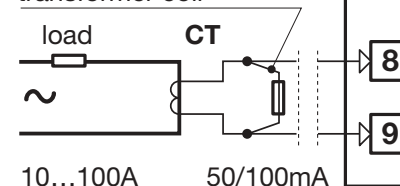


A - From Remote Setpoint

Current: 0/4...20mA;
Input resistance: 30Ω;
Voltage: 1...5V, 0...5V, 0...10V;
Input resistance: 300KΩ.



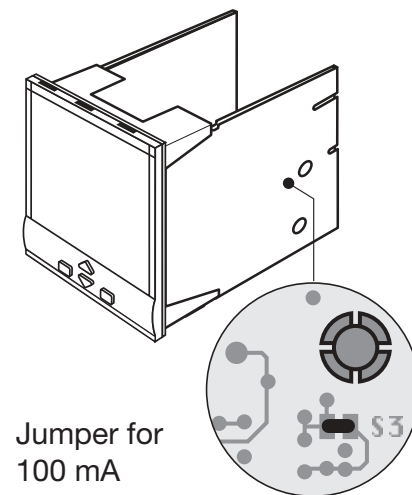
5 watt burden resistor
0.5Ω for 1A secondary transformer coil
0.1Ω for 5A secondary transformer coil



B- For current transformer CT Not isolated

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

- Primary coil 10A...100A;
- Secondary coil 50mA default 100mA **S3** internal jumper selectable.



Jumper for 100 mA secondary transformer coil.

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



The functionality associated to each of the OP1, OP2 and OP4 output is defined during the configuration of the instrument index **N** (see page 19).

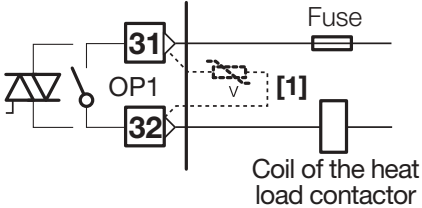
The suggested combinations are:

		Control outputs		Alarms			Retransmission
		Heat	Cool	AL1	AL2	AL3	PV/SP
A	Single action	OP1			OP2	OP3	OP5
B		OP4		OP1	OP2	OP3	OP5
C	Double action	OP1	OP2			OP3	OP5
D		OP1	OP4		OP2	OP3	OP5
E		OP4	OP2	OP1		OP3	OP5

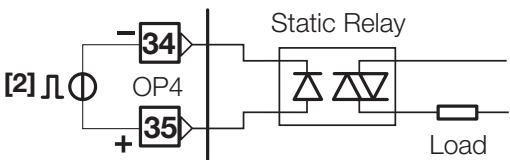
where:

OP1 - OP2	Relay or Triac output
OP3	Relay output (for AL3 only)
OP4	SSR drive control or Relay output
OP5	Retransmission analogue output

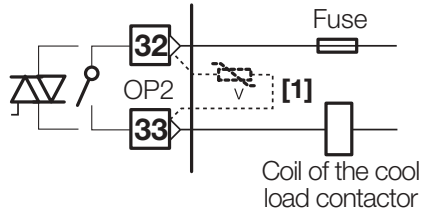
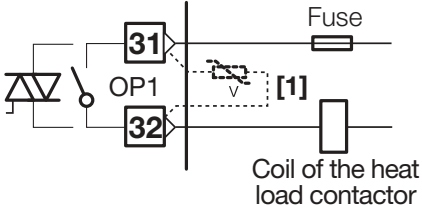
2.3.5-A SINGLE ACTION RELAY (TRIAC) CONTROL OUTPUT



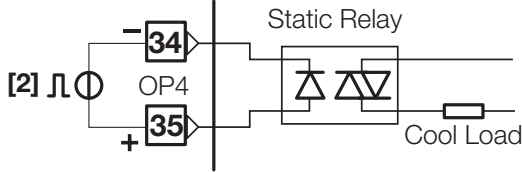
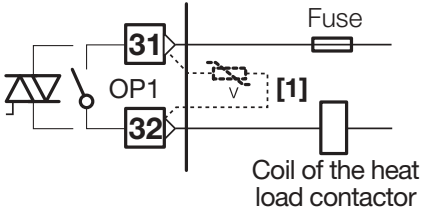
2.3.5-B SINGLE ACTION SSR DRIVE CONTROL OUTPUT



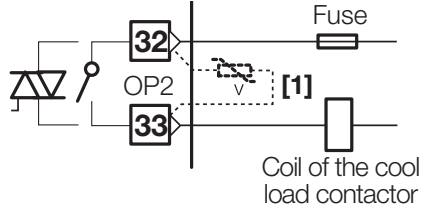
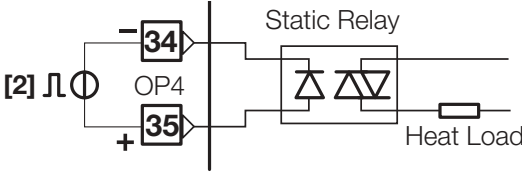
2.3.5-C SINGLE ACTION ANALOGUE OUTPUT



2.3.5-D DOUBLE ACTION RELAY (TRIAC)/RELAY (TRIAC) CONTROL OUTPUT



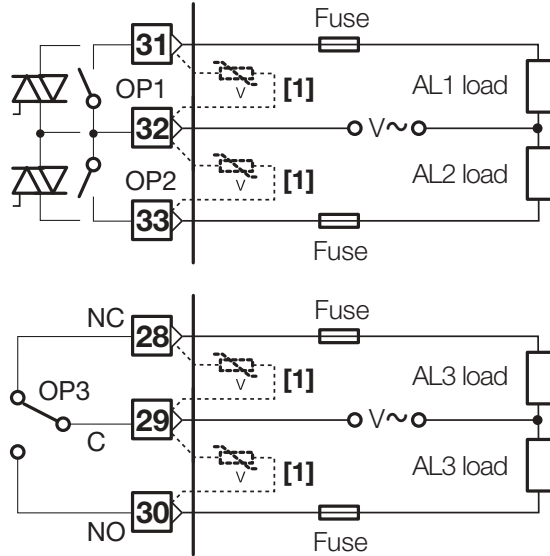
2.3.5-E DOUBLE ACTION RELAY (TRIAC)/SSR DRIVE CONTROL OUTPUT



2.3.6 ALARM OUTPUTS



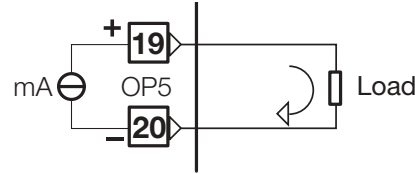
⚠ The relay/triac output OP1, OP2 and OP3, can be used as alarm outputs only if they are not used as control outputs.



Notes:

[1] Varistor for inductive load 24Vac only.
[2] When basic product code **B** = 9 (pag. 17), OP4 (terminals 34, 35) is a Relay output

2.3.7 OP5 ANALOGUE RETRANSMISSION OUTPUT (OPTION)



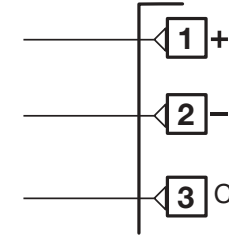
For PV/SP retransmission only:

- Galvanic isolation: 500Vac/1 min;
- 0/4...20mA, (750Ω or 15Vdc max.).

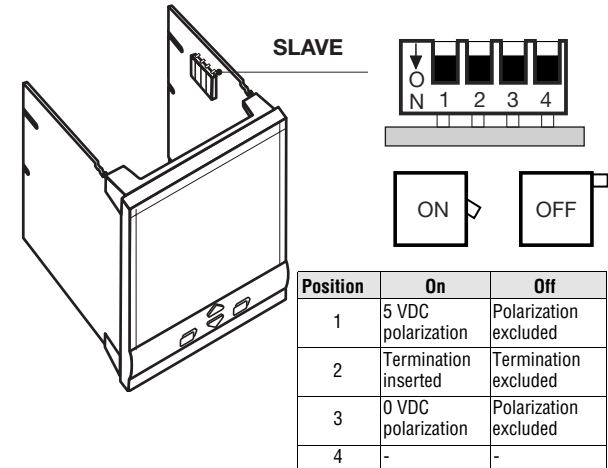


Please carefully read the manual: **gamma**due® and **delta**due® controller series serial communication and configuration.

2.3.8 SERIAL COMMUNICATIONS (OPTION)

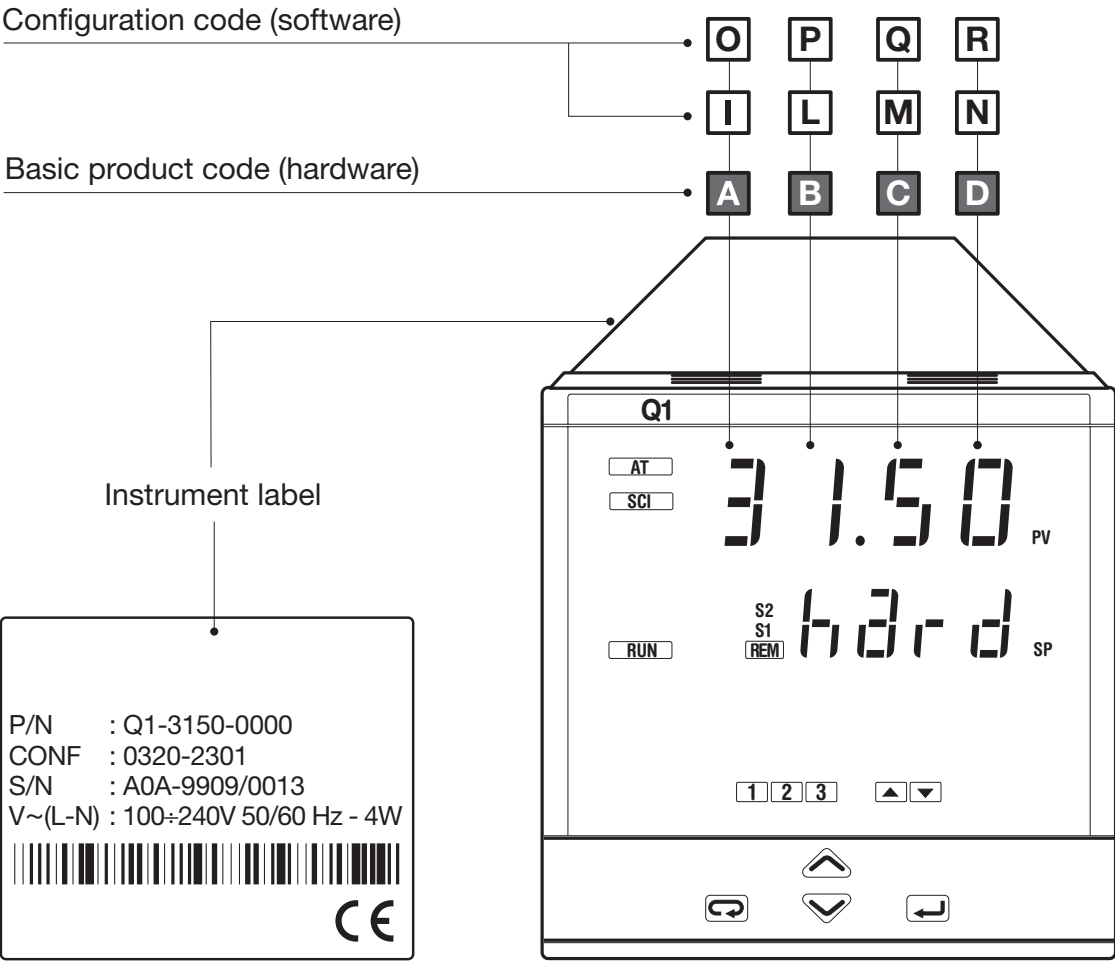


- Galvanic isolation: 500Vac/1 min;
Compliance to the EIA RS485 standard for Modbus/Jbus;
- Setting dip switches.



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	
				1st part	2nd part
	Q 1	A B C D	- E F G 0	/ I L M N	- O P Q R

Line **Q 1**

Power supply	A
100... 40Vac (-15...+10%)	3
24Vac (-25...+12%) or 24Vdc (-15...+25%)	5

Outputs OP1 - OP2- OP4	B
Relay - Relay - SSR Drive	1
Triac - Triac - SSR Drive	5
Relay - Relay - Relay	9

Serial Communications	C
None	0
RS485 Modbus/Jbus SLAVE	5

Options	D
None	0
Retransmission output + Remote Setpoint input	5

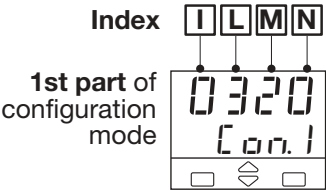
Special function	E
Not fitted	0
Start-up + Timer	2

User manual	F
Italian/English (std)	0
French/English	1
German/English	2
Spanish/English	3

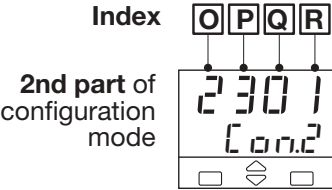
Front panel colour	G
Dark (std)	0
Beige	1

3.2 CONFIGURATION CODING

A 4+4 index code follows the model of the controller.
This code must be set to configure the controller (see chapter 3.1 pages 16 and 17)



- E.g.: Enter 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 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			I	L
TR Pt100 IEC751	-99.9...300.0 °C	-99.9...572.0 °F	0	0
TR Pt100 IEC751	-200...600 °C	-328...1,112 °F	0	1
TC L Fe-Const DIN43710	0...600 °C	32...1,112 °F	0	2
TC J Fe-Cu45% Ni IEC584	0...600 °C	32...1,112 °F	0	3
TC T Cu-CuNi	-200 ...400 °C	-328...752 °F	0	4
TC K Chromel-Alumel IEC584	0...1,200 °C	32...2,192 °F	0	5
TC S Pt10%Rh-Pt IEC584	0...1,600 °C	32...2,912 °F	0	6
TC R Pt13%Rh-Pt IEC584	0...1,600 °C	32...2,912 °F	0	7
TC B Pt30%Rh Pt6%Rh IEC584	0...1,800 °C	32...3,272 °F	0	8
TC N Nichrosil-Nisil IEC584	0...1,200 °C	32...2,192 °F	0	9
TC E Ni10%Cr-CuNi IEC584	0...600 °C	32...1,112 °F	1	0
TC NI-NiMo18%	0...1,100 °C	32...2,012 °F	1	1
TC W3%Re-W25%Re	0...2,000 °C	32...3,632 °F	1	2
TC W5%Re-W26%Re	0...2,000 °C	32...3,632 °F	1	3
Dc input 0...50mV linear	Engineering and units		1	4
Dc input 10...50mV linear	Engineering and units		1	5
Custom input and range [1]			1	6

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

Engineering and units		M
ON-OFF reverse action		0
ON-OFF direct action		1
PID single reverse action		2
PID single direct action		3
PID double action	Linear cool output	4
	ON-OFF cool output	5
	Water cool output [2]	6
	Oil cool output [2]	7

Output configuration		N
Single action	Double action	
Relay (OP1)	Heat OP1, Cool OP2	0
SSR drive or relay (OP4)	Heat OP1, Cool OP4	1
	Heat OP4, Cool OP2	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

$$OP\ water = 100 \bullet (OP2/100)^2$$

$$OP\ oil = 100 \bullet (OP2/100)^{1,5}$$

[3] Only possible whether "Output configuration" **N** = 0 or 1 and *H.E.F.S.* parameter is different to *OFF* (see page 29)

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

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

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

4 OPERATIONS

4.1.1 KEYS FUNCTIONS AND DISPLAY IN OPERATOR MODE

8 Status LEDs (green)

- [SCI]** Communications running
- [AT]** Tuning running
- [RUN]** Timer running
- [REM]** Remote Setpoint active
- S1** First stored Setpoint active
- S2** Second stored Setpoint active

Alarm status LEDs (red)

- [1]** AL1 ON
- [2]** AL2 ON
- [3]** AL3 ON

Menu access

PV control input
in engineering
units

Over
range

Under
range

8888

8888

SP operating Setpoint

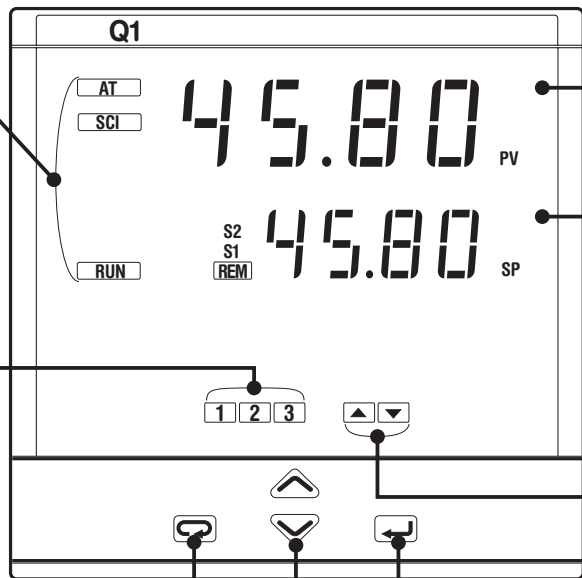
(Local/Remote or Stored)

Control output LEDs (red)

▲ OP1/OP4 ON - ▼ OP2/OP4 OFF

Entry key for selection and value setting confirmation



Setpoint setting






4.1.2 KEYS FUNCTIONS AND DISPLAY IN PROGRAMMING MODE




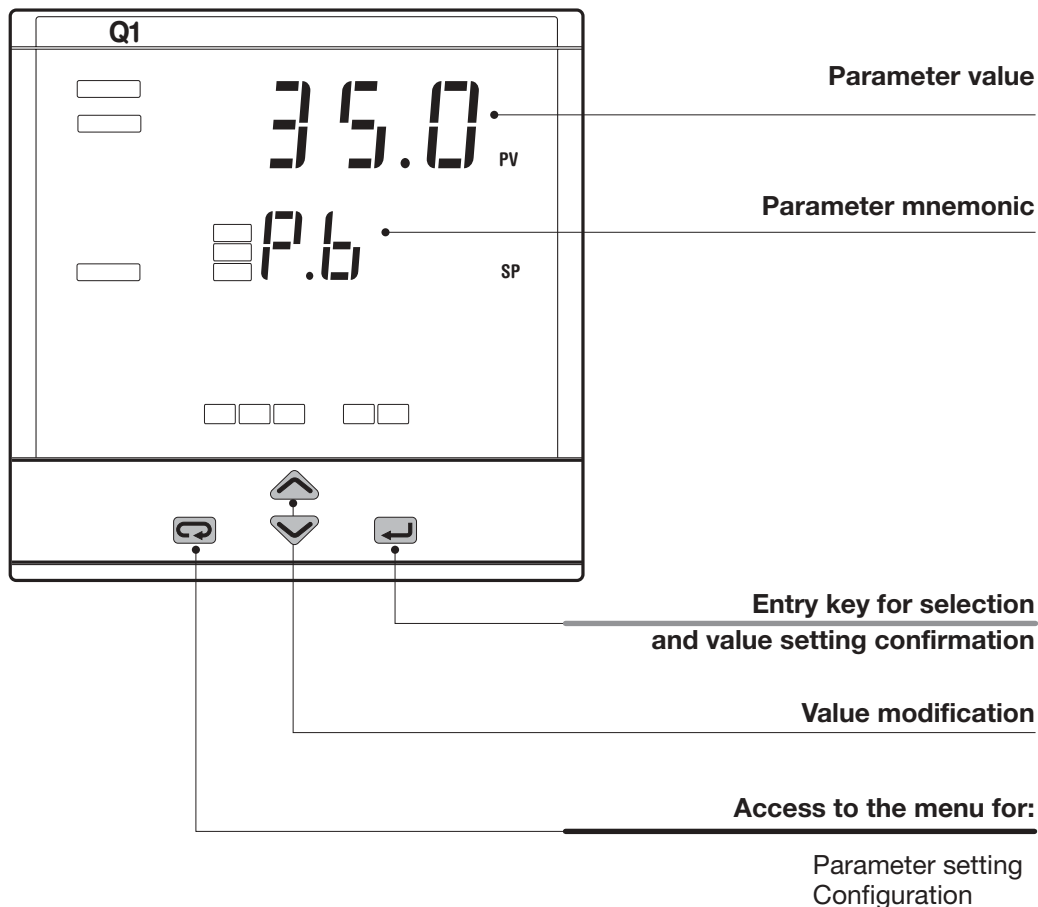
The parameter setting procedure has a timeout. If no keys are pressed for, at least, 30 seconds, the controller switches back, automatically, to the operator mode.

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  key.

Until the  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)

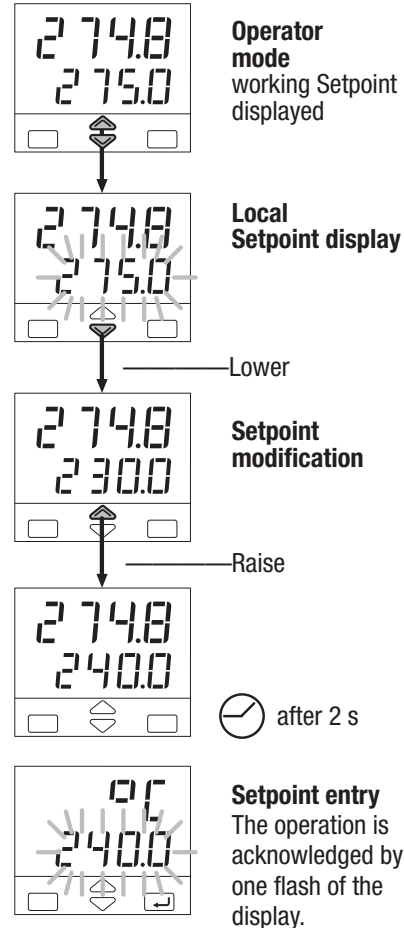
Press or momentarily to change the value of 1 unit every push.

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

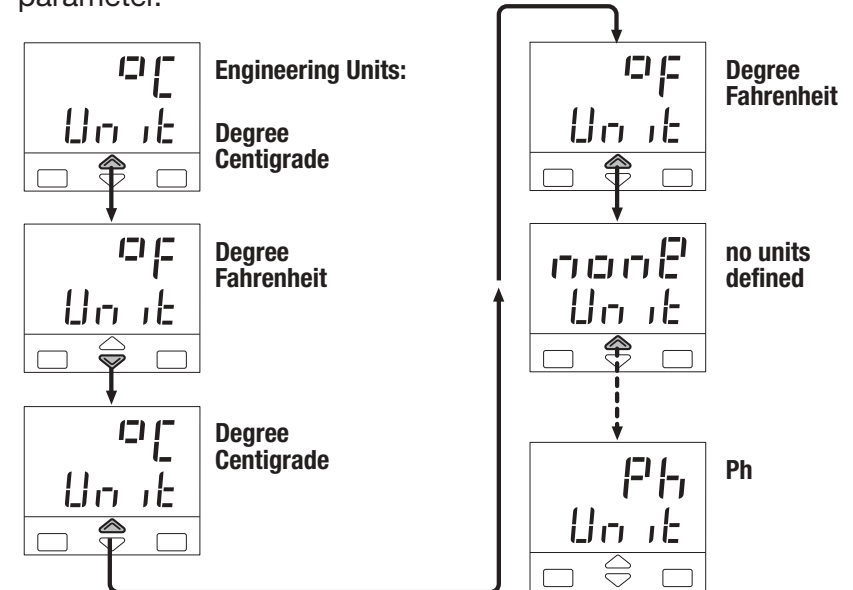


4.2.2 MNEMONIC CODES SETTING

(e.g. configuration see page 28)

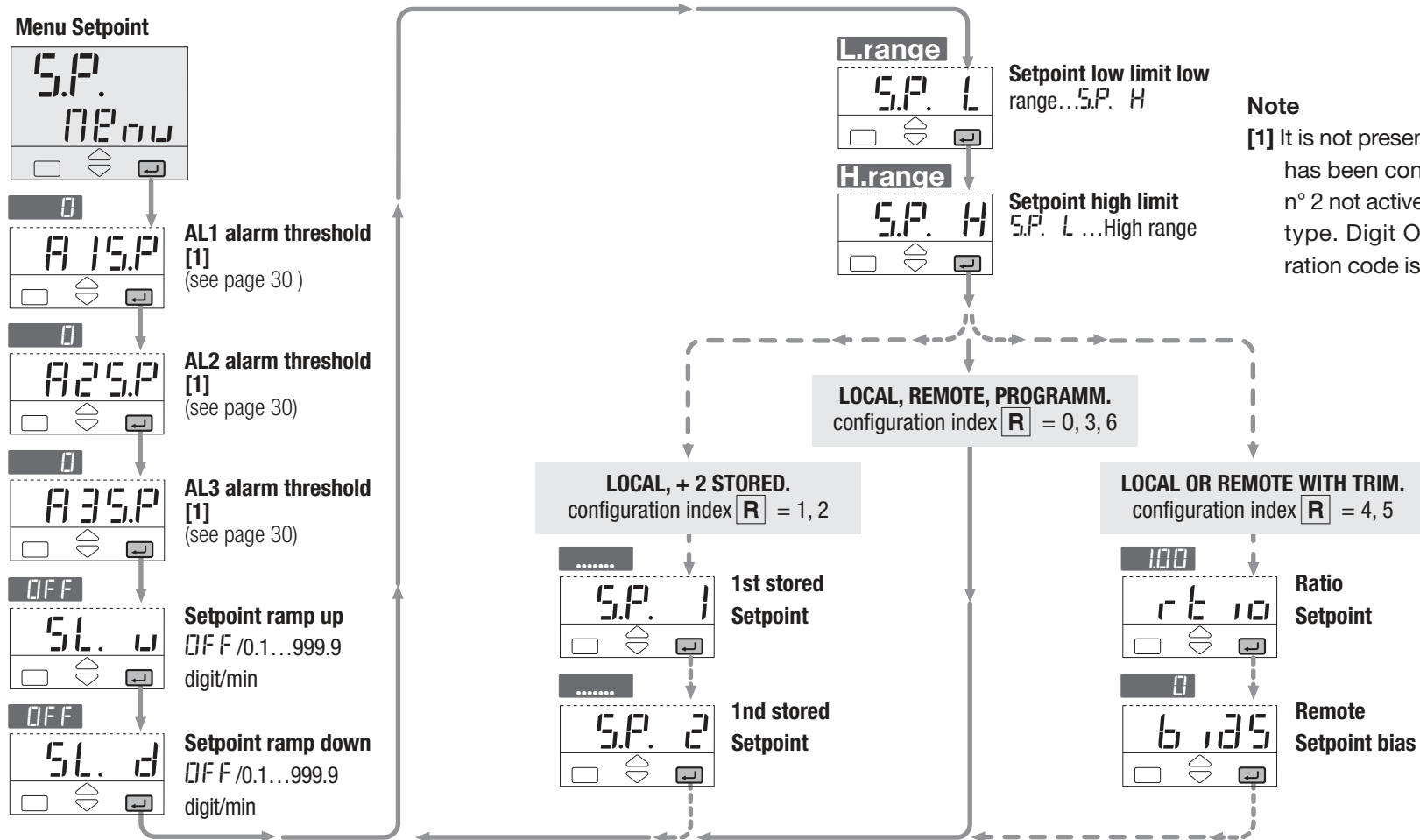
Press the or to display the next or previous mnemonic for the selected parameter.

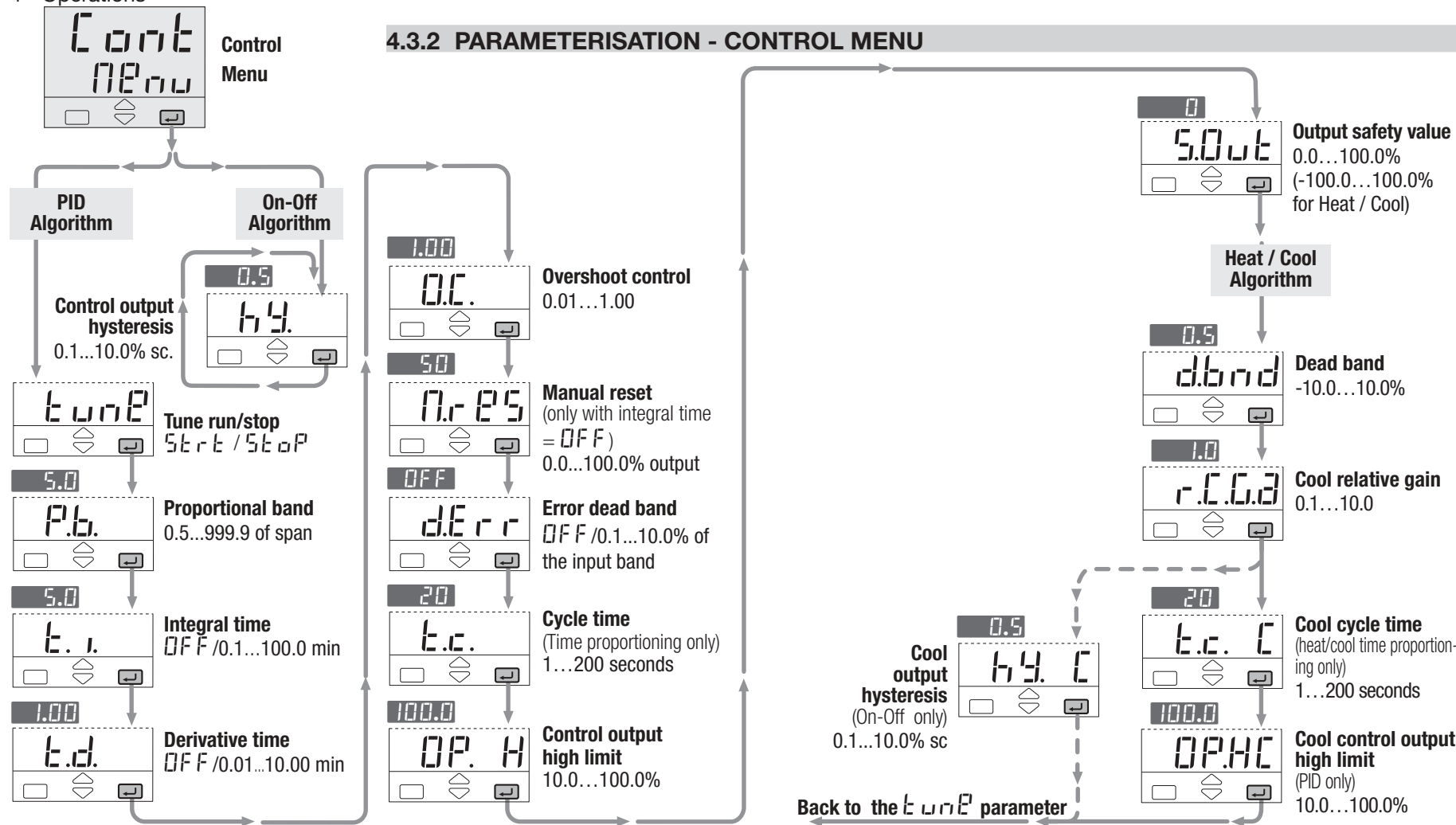
Continued pressing of or will display further mnemonics at a rate of one mnemonic every 0.5 s. The mnemonic displayed at the time the next parameter is selected, is the one stored in the parameter.



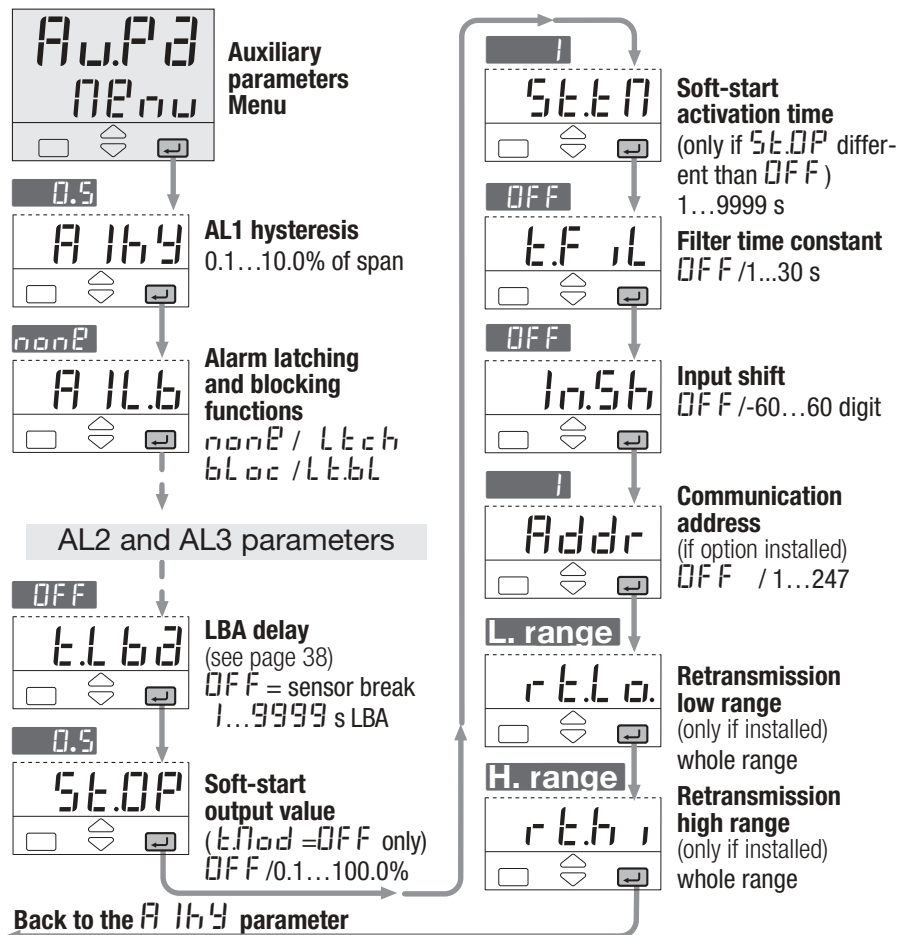


4.3.1 PARAMETERISATION - SETPOINT MENU



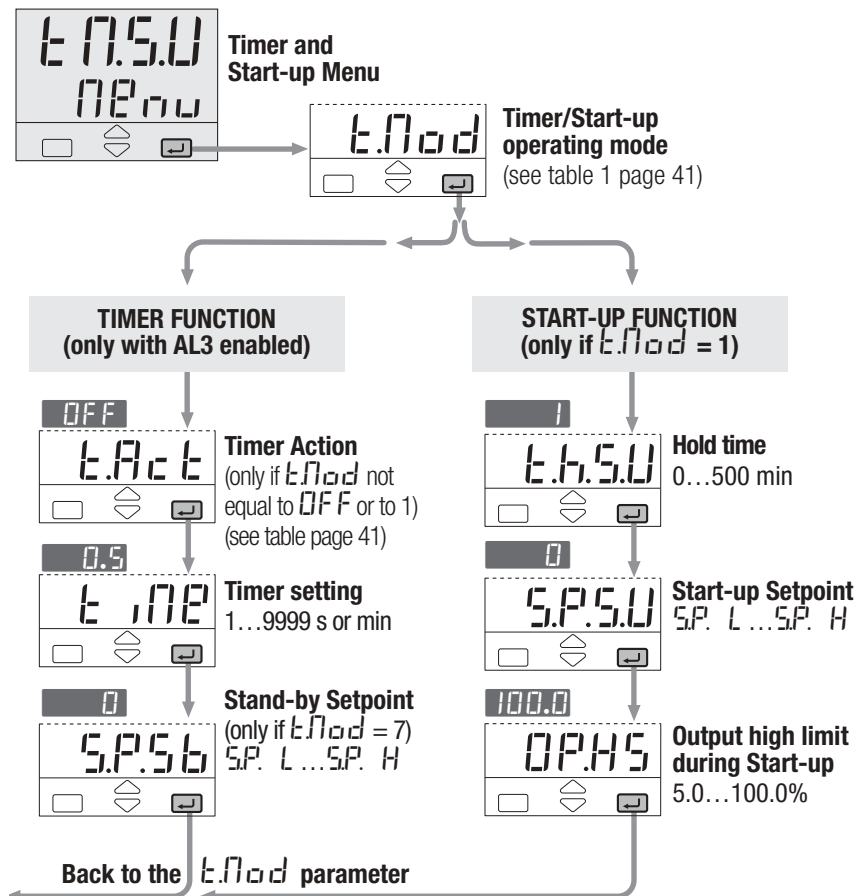


4.3.3 PARAMETERISATION - AUXILIARY PARAMETERS MENU



4.3.4 PARAMETERISATION - TIMER AND START-UP MENU

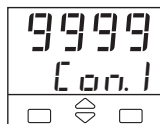
If options installed



4.3.5 CONFIGURATION MENU

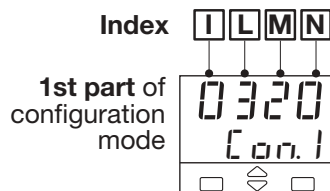
Enter the password before accessing to the configuration menu.

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



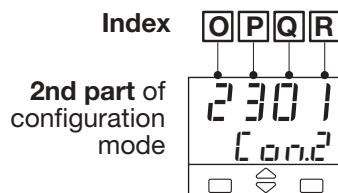
Until the configuration code is set correctly, the controller remains in stand-by with input and output deactivated.

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 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 code **2301** to choose:

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



Password Entry

Only if **Code** value
<5000
(33 default from factory)

Must be equal to the value of the parameter **Code**



Back to Operator mode

NO YES

OK

OFF



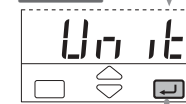
Entry of digits
I - L - M - N
of the configuration code
(chapter 3.2 pages 18, 19)

OFF



Entry of digits
O - P - Q - R
of the configuration code
(chapter 3.2 pages 19, 20)

none



IL1 digital input function
(see table 1)

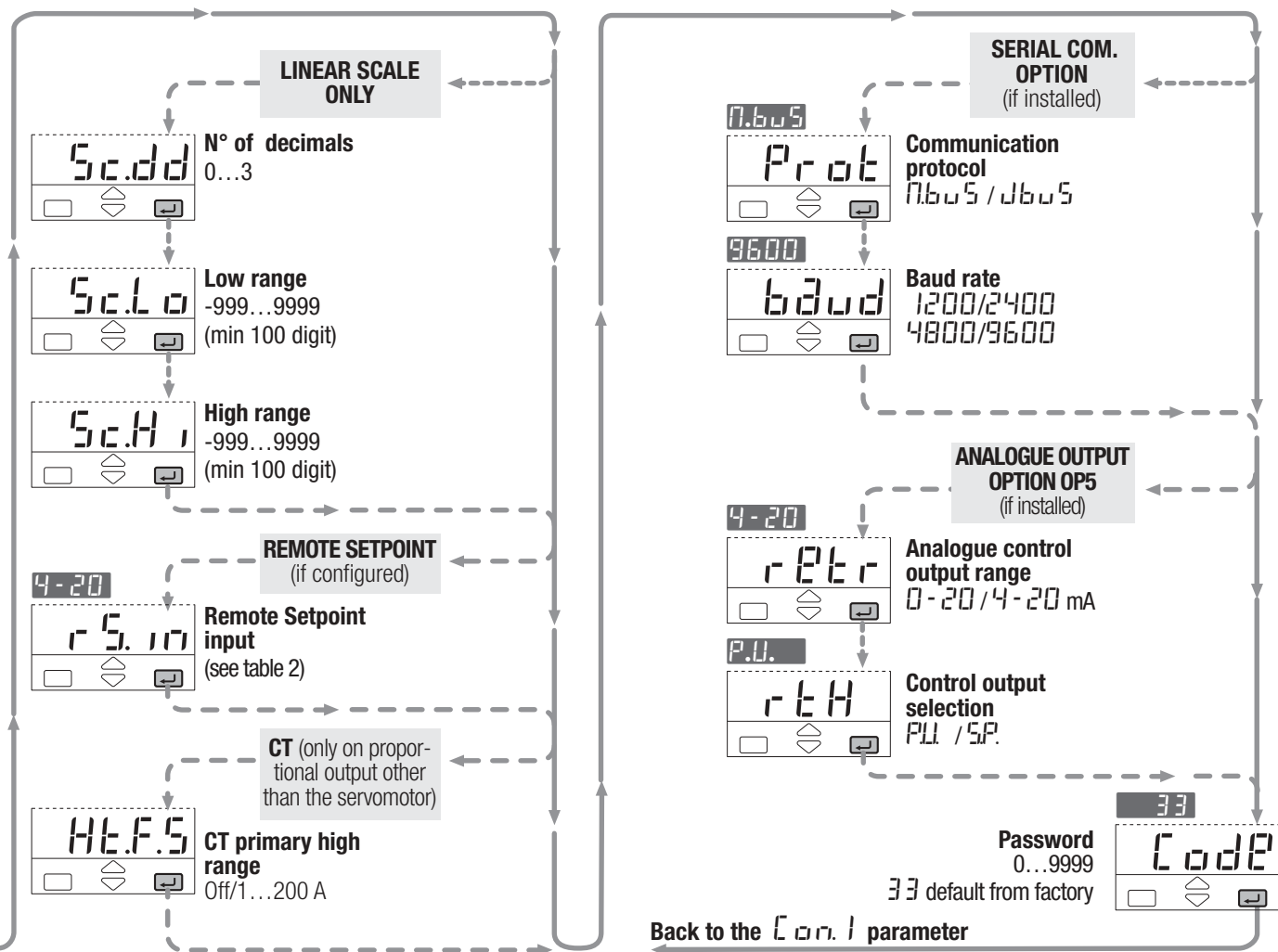


Table 1 Engineering units

unit	
Value	Description
°C	degree centigrade
°F	degree Fahrenheit
none	none
mV	mV
V	Volt
mA	mA
A	Ampere
Bar	Bar
PSI	PSI
Rh	Rh
pH	pH

Table 2 Remote Setpoint input type

rS.in	
Value	Description
0-5	0...5 Volt
1-5	1...5 Volt
0-10	0...10 Volt
0-20	0...20 mA
4-20	4...20 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

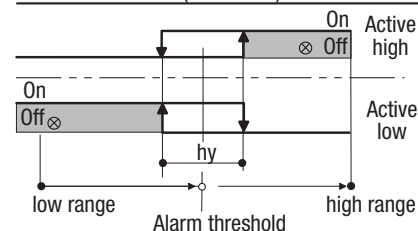
The OP1, OP2 or OP3 outputs, can be used for alarms if they are not used as control outputs

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

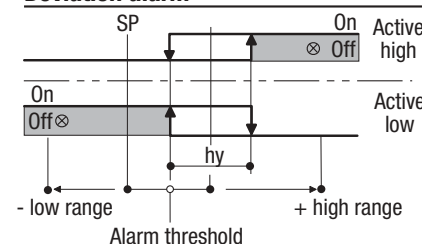
- A** the type and the operating condition of the alarm;
- B** the functionality of the alarm acknowledgement (latching)
l l c h (see page 37);
- C** the start-up disabling (blocking)
b l o c (see page 37);
- D** Loop break or sensor break (see page 38).

A ALARM TYPE AND OPERATION CONDITIONS

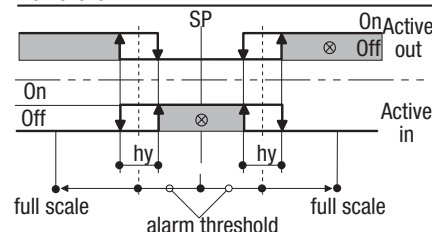
Absolute alarm (full scale)



Deviation alarm



Band alarm



A 15.P

AL1 alarm threshold

A 25.P

AL2 alarm threshold

A 35.P

AL3 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 occurs, the display will show the red leds **1**, **2** or **3**, respectively on.

SL. u**Setpoint
ramp up****SL. d****Setpoint
ramp down**

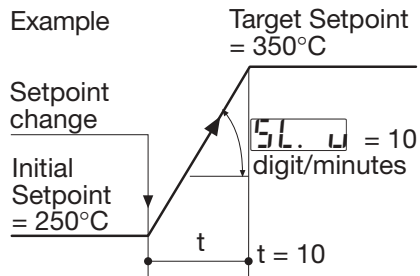
This parameter specifies the maximum rate of change of the Setpoint in digit/min.

When the parameter is OFF, this function is disabled and the new Setpoint is reached immediately after being 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 **ESP.** (see procedure at page 47).

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

**S.P. L****Setpoint
low limit****S.P. H****Setpoint
high limit**

Low / high limit of the Setpoint value.

S.P. 1**1st stored
Setpoint****S.P. 2****2nd stored
Setpoint**

Preset Set values can be set from the keyboard and serial communication. The Setpoint active is indicated by the **S1** or **S2** green led.

If index **R** = 1 (tracking), the previous Local Setpoint value will be lost, when the stored Setpoint is selected.

If index **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

r t 10

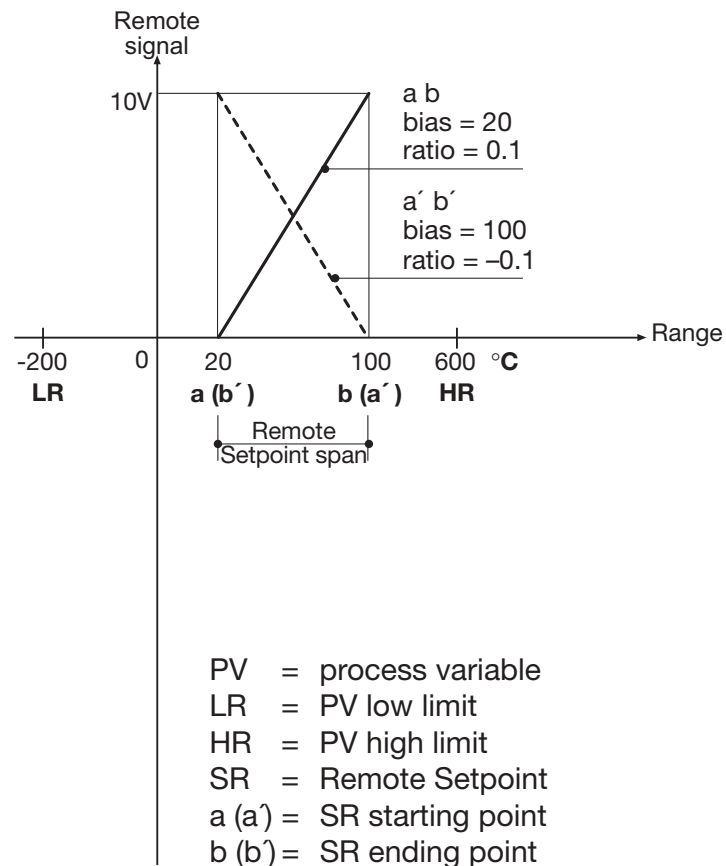
Remote Setpoint Ratio

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

b 125

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

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

$b_{125} = \text{starting point} = a$

$$r t 10 = \frac{b - a}{HR - LR}$$

Example:

$b_{125} = 20$

$$r t 10 = \frac{100 - 20}{600 - (-200)} = \frac{80}{800} = 0.1$$

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

b_{HDS} = starting point = a'

$$r_{\text{LO}} = \frac{b' - a'}{HR - LR}$$

Example:

$b_{\text{HDS}} = 100$

$$r_{\text{LO}} = \frac{20 - 100}{600 - (-200)} = \frac{-80}{800} = -0.1$$

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

Setpoint type L_{OCL}
(configuration index $\boxed{R} = 4$)
 $SP = SL + (r_{\text{LO}} \bullet REM) + b_{\text{HDS}}$

Setpoint type r_{ENL}
(configuration index $\boxed{R} = 5$)
 $SP = REM + (r_{\text{LO}} \bullet SL) + b_{\text{HDS}}$

SIGN = Remote signal
percentage

SPAN = HR-LR

$$REM = \frac{SIGN \bullet SPAN}{100}$$

Examples:

Local Setpoint (SL) with an external Trim with multiplying coeff. of 1/10:

Setpoint type = L_{OCL}

$r_{\text{LO}} = 0.1$

$b_{\text{HDS}} = 0$

Remote Setpoint (SR) with an internal Trim with multiplying coeff. of 1/5:

Setpoint type = r_{ENL}

$r_{\text{LO}} = 0.2$

$b_{\text{HDS}} = 0$

Remote Setpoint range equal to the Input range:

Setpoint type = L_{OCL}

$r_{\text{LO}} = 1$

$b_{\text{HDS}} = LR$

$SL = 0$

4.4.2 CONTROL MENU

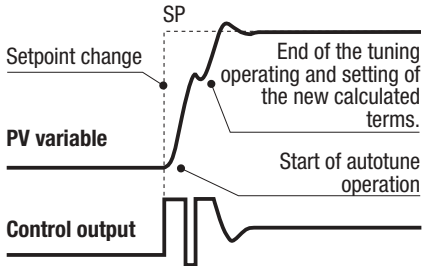


4.4.2.1 AUTOMATIC TUNE

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

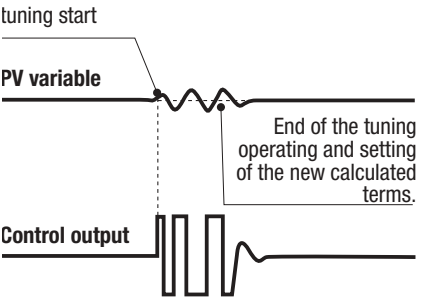
The controller provides 2 types of “one shot” tuning algorithm, that are selected automatically according to the process condition when the operation is started.

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



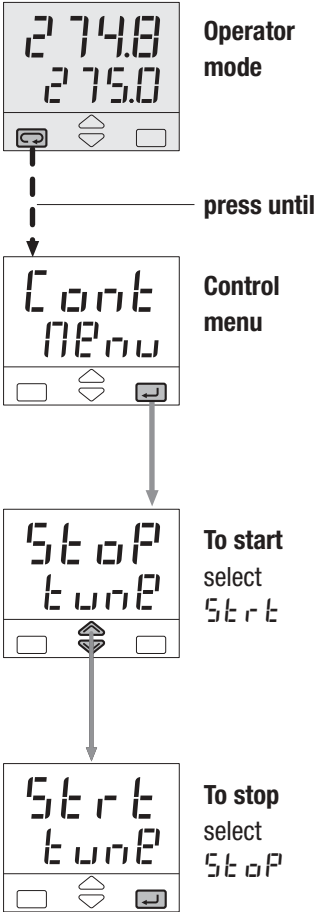
This type is selected when the PV is close to the SP Setpoint. This method has the advantage of a better accuracy in the term calculation with a reasonable speed calculation.

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.



P.b.**Proportional band**

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

t. i.**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 **OFF** the integral term is not included in the control algorithm.

t.d.**Derivative time**

It is the time required by the proportional term P to repeat the output provided by the derivative term D. When **OFF** the derivative term is not included in the control algorithm.

O.C.**Overshoot control**

This parameter specifies the span of action of the overshoot control. Setting lower values (1.00 → 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.

Man. RS**Manual Reset**

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

de r r**Error Dead Band**

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

t.c.**Control output cycle time****t.c. C****Cool cycle time**

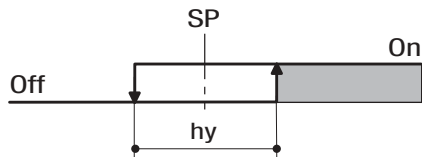
It's the cycle time of the SSR drive control output. The PID control output is provided by the pulse width modulation of the waveform.

OP. H**Control output high limit****OP.C.H****Cool output high limit**

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

5.0 u t**Output Safety Value**

Output Value in case of input anomaly

h9.**Control output hysteresis****h9. C****Cool output hysteresis**

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 `dbnd` is the zone where it is possible to separate or overlap the Heat and Cool actions.

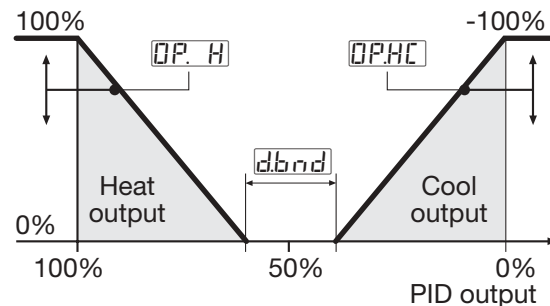
The Cool action can be adjusted using the relative cool gain parameter `rcg`.

To limit the Heat and Cool outputs the parameters `OP.H` and `OP.HC` can be used.

When there is an overlap, the displayed output `OUT` shows the algebraic sum of the Heat and Cool outputs.

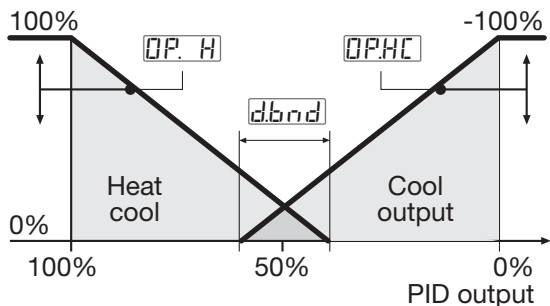
A Heat /Cool actions separated

Insert positive `dbnd` value (0...10%)



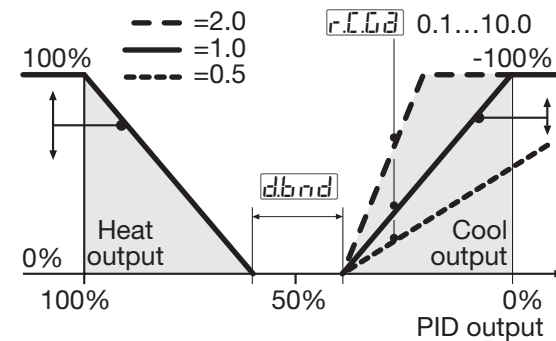
B Heat /Cool actions overlapped

Insert negative `dbnd` value (-10...0%)

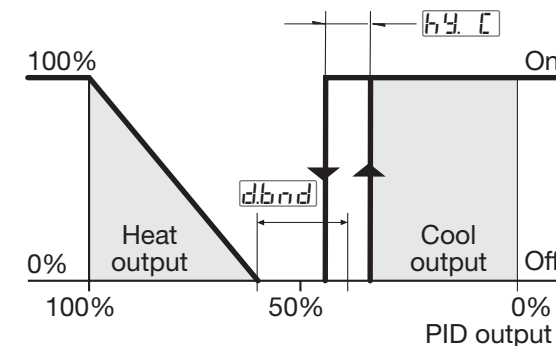


C Cool action adjusting

Example with different relative cool gains



D On-Off Cool action



4.4.3 AUXILIARY PARAMETERS MENU

A 16.9

AL1 alarm hysteresis

A 26.9

AL2 alarm hysteresis

A 36.9

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.

A 1L6

AL1, AL2, AL3 latching
and blocking functions

A 2L6

A 3L6

For each alarm it is possible to select the following functions:

nonE none;

L t c h latching;

b l o c blocking;

L t . b l both latching and blocking.

L t c h

ALARM

ACKNOWLEDGE FUNCTION

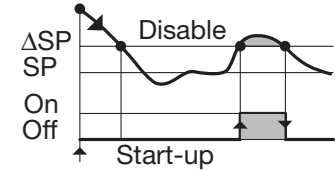
The alarm, once occurred, is presented on the display until to the time of acknowledge. The acknowledge operation consists in pressing any key.

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

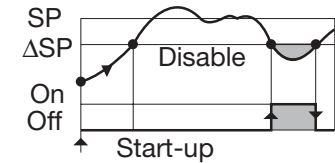
b l o c

START-UP DISABLING

Ramp down



Ramp up



$$\Delta SP \text{ Threshold} = SP \pm \text{range}$$

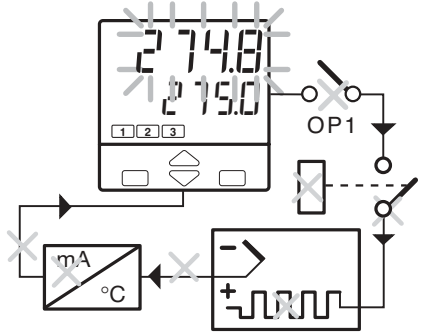
4.4.3 AUXILIARY PARAMETERS MENU

ALARMS WITH LBA (LOOP BREAK ALARM)
AND SENSOR BREAK OPERATION

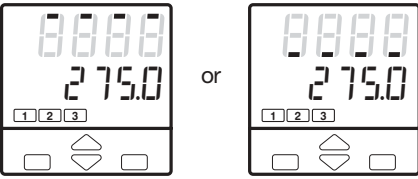
Selecty the code 1 on **O** , **P** or **Q** configuration indexes (see pages 21 or 22). The following parameter is then available:

ELb3 LBA delay

Setting a value between 1 and 9999 s 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.

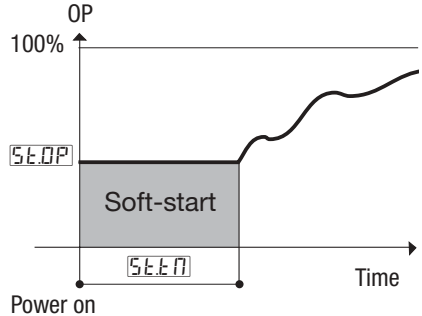
When the cause of the alarm disappears, the alarm status stops.

St.OP Soft-start control output value

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

St.tn Soft-start activation time

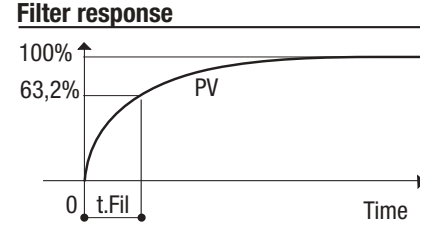
Time duration (starting from the power on) of the Soft-start function.



t.F IL Input filter time constant

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

When this parameter is set to OFF the filter is bypassed.



In.Sh Input shift

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

Addr**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 **OFF** the controller is not communicating.

rtLo**Retransmission low range****rtHi****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 3100-2000
To select these functions use the parameter: (see page 41).

t.No.d**Timer/Start-up operator mode**

⚠ Selecting Timer or Start-up, the Soft-start function is disabled, therefore the parameters **SE.OP and **SE.EN** 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 Start-up function the parameter

“Timer/Start-up operating mode” must be set to **1** (see page 41).

Three parameters are associated to the Start-up function.

t.h.s.u**Start-up hold time**
0...500 min**S.P.S.U****Start-up Setpoint**
(S.P. L...S.P. H)**OP.HS****Control output high limit**

5.0%...100.0%

The Start-up function includes three phases:

1st “**L inG**” - The control output is limited to the **OP.HS**;

2nd “**HoLd**” - The process variable is maintained to the Start-up Setpoint for the time fixed by the parameter **t.h.s.u**;

3rd “**OFF**” - When the **t.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 (**S.P.S.U** - 40 digits), the Start-up function starts again from the “**L inG**” 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:

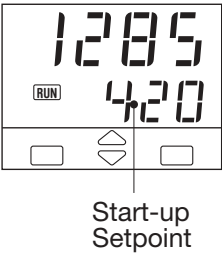
A Start-up Setpoint SP_{SU} lower than the local Setpoint.

The “Hold” phase starts when the process variable PV achieves the SP_{SU} (with a tolerance of 1 digit).

B Start-up Setpoint SP_{SU} greater than or equal to the local Setpoint.

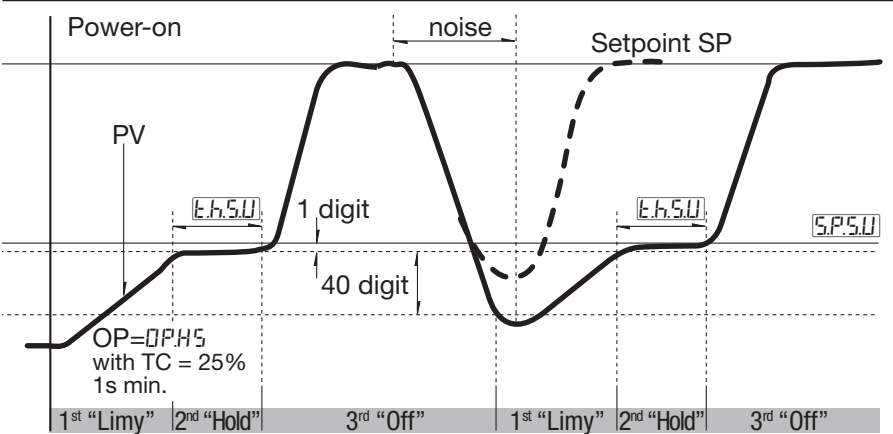
When the process variable PV achieves the local Setpoint (with a tolerance of 1 digit), the Start-up function passes directly to the “Off” phase.

If, at the controller power-on, the process variable PV is greater than the lowest between the SP_{SU} and the working Setpoint, the next phase (“Hold” or “OFF”) will be executed instead of the “Limy” phase.

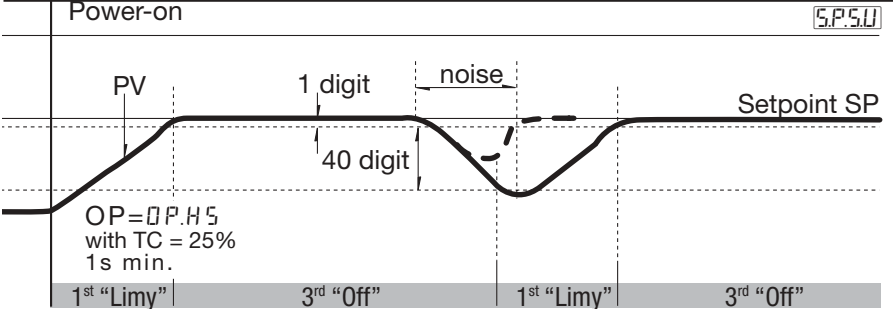


During the “Limy” and “Hold” phases the **RUN** led is on.

A $SP_{SU} < \text{local Setpoint SP}$



B $SP_{SU} \geq \text{Setpoint locale SP}$



4.4.4.2 TIMER FUNCTION (OPTION)

⚠ The Timer can't be 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 **1** 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).

t.No d

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 counting mode		Value
Disabled		0 F F
Start-up function		1
Counting start time	End mode	
When inside the band	Control mode	2
	Output to 0	3
When launched	Control mode	4
	Output to 0	5
When launched. Control disabled	Control mod	6
When launched stand-by Setpoint	Control mod	7

Now the other parameter values can be entered:

t.Ac t

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.

table 2

Time units	Starting mode	[1] OP3 status	Value
Seconds	Manual by keypad	Off	0
		On	1
	Auto at power on [2]	Off	2
		On	3
Minutes	Manual by keypad	Off	4
		On	5
	Auto at power on [2]	Off	6
		On	7

[1] If used by Timer;

[2] Using this selection, manual starting mode is possible too.

t. n e

Timer setting

(1...9,999 s/min.)

5.P.56

Stand-by Setpoint

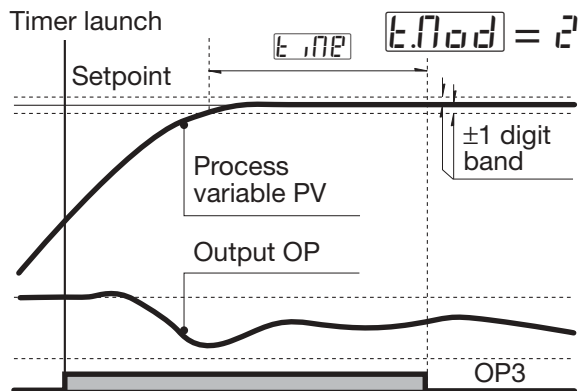
(only for t.No d = 7)
(5.P. L ...5.P. H)

4.4.4.2 TIMER FUNCTION (OPTION)

TIMER COUNTING MODES

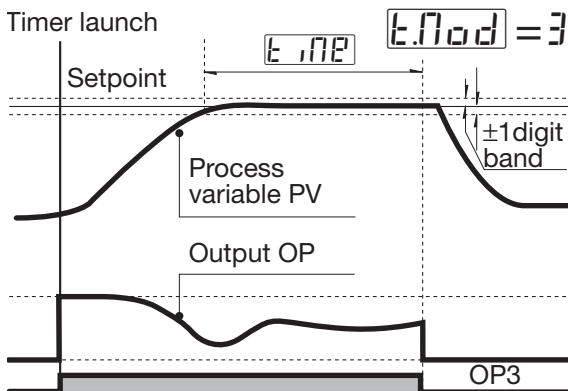
A - Counting start time inside the band, end in control mode.

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



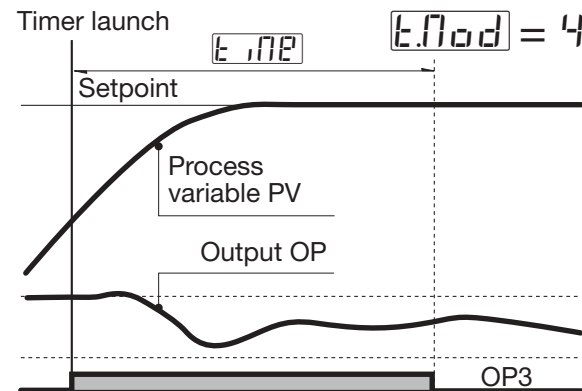
B - Counting start time inside the band, end with control output forced to zero.

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



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.



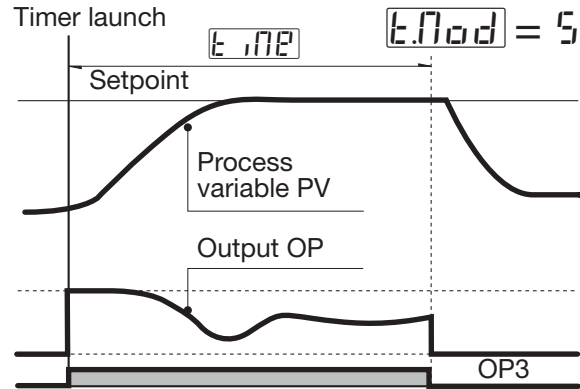
Note:

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

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].

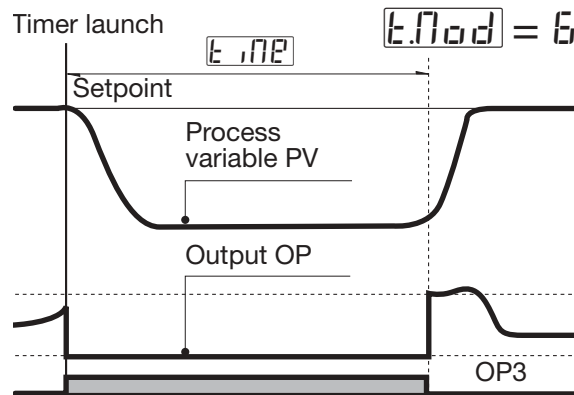


Note:

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

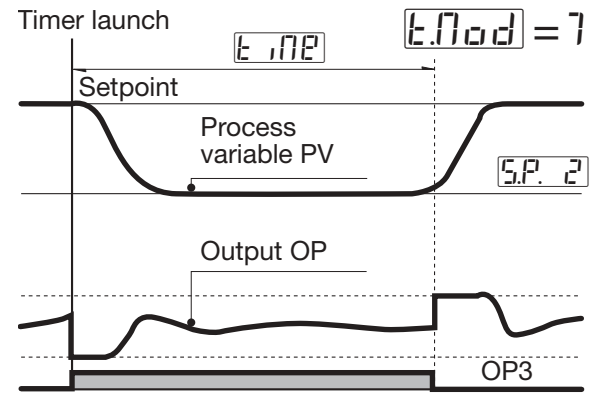
E - No control action during the counting time.

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.



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.

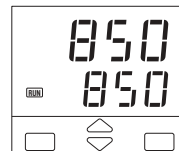
Depending on Timer action $\boxed{t.act}$ selection, when the controller restarts you can have two different situations:

- with automatic mode ($\boxed{t.act} = 2, 3, 6, 7$), the Timer function starts again and the counting time is reinitialised.
- with manual mode ($\boxed{t.act} = 0, 1, 4, 5$), the control output is forced to 0 if $\boxed{t.mod} = 3$ e 5; otherwise the control action restarts using the working Setpoint.

TIMER STARTING

See the Timer starting procedure at page 49.

DISPLAY



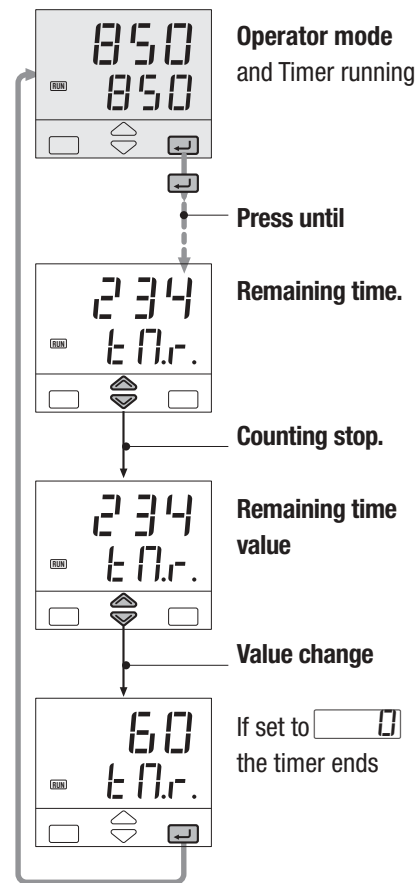
When the Timer is running, the led \boxed{RUN} is on.



When the Timer ends, the Setpoint display shows alternatively the message \boxed{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 it retransmits linearised PV or SP. On configuration (see page 29) it is possible to set:

retr

Output range

0-20 / 4-20

reth

Retransmitted signal

nonP / 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):

reLo

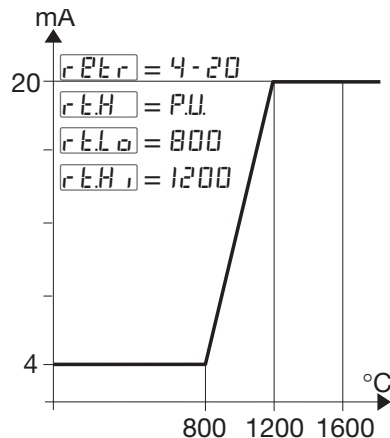
Retransmission low range

reHi

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 **reLo** greater than **reHi**, 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 than 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:

HE.F.5

CT primary high range

OFF / 1...200A

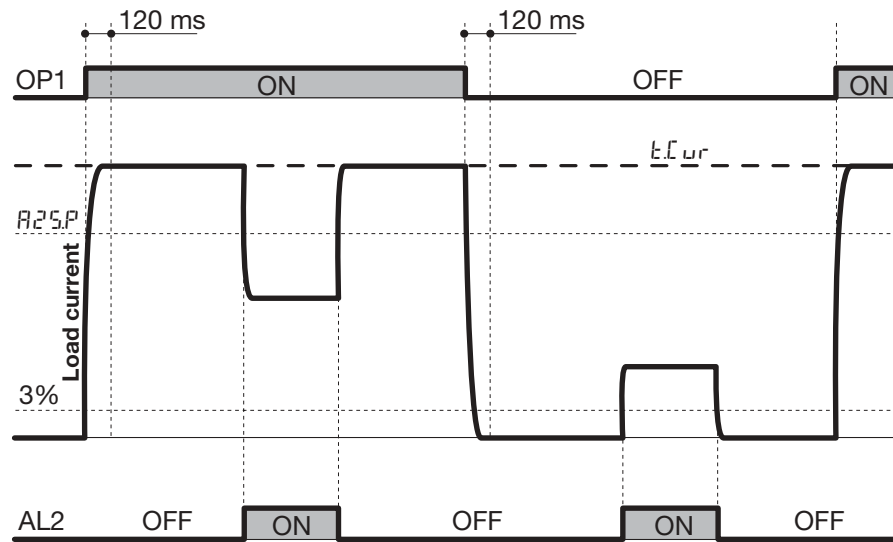
the load current display can be adapted to the transformer characteristics. (OFF means disabled).

During the OFF time the parameter **ELur** 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 **P** = 8, see page 19).



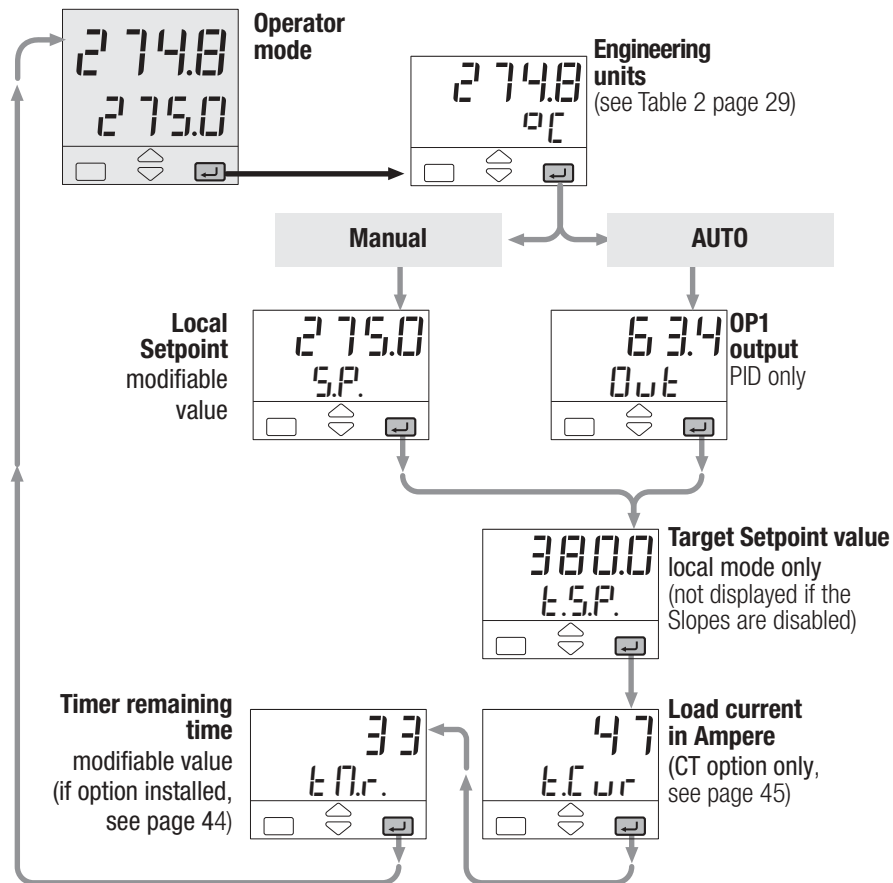
SERIAL COMMUNICATIONS

Prot Communication
protocol
Modbus/Modbus

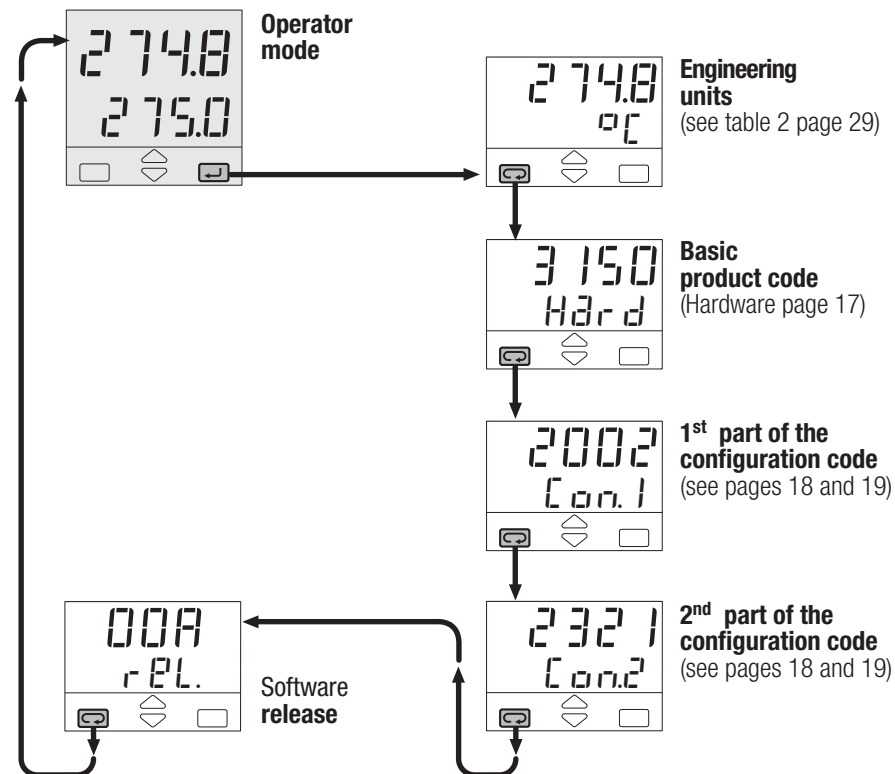
baud Baud rate
1200/2400
4800/9600

DISPLAYS

5.1 OF THE PROCESS VARIABLES



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

see page 49

- Setpoint modification;
- Timer start;
- Local/remote selection;
- Stored Setpoint display;
- Keypad lock;
- Outputs lock.

6.2 SERIAL COMMUNICATIONS

see the manual on this topic

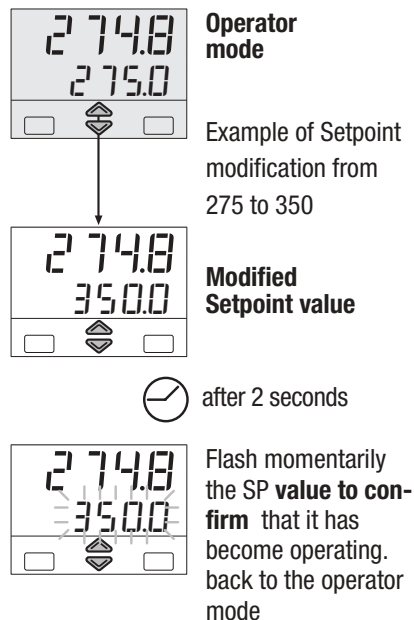


6.1 KEYPAD COMMANDS

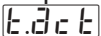
6.1.1 SETPOINT MODIFICATION

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.

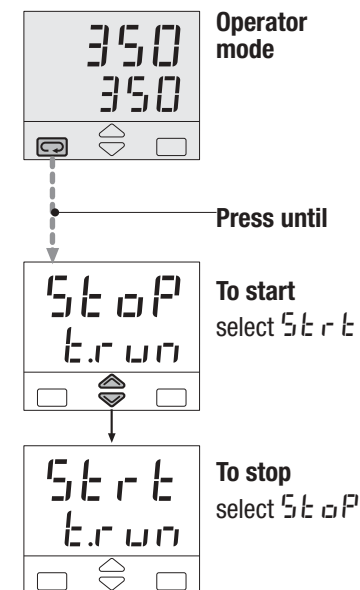


6.1.2 TIMER STARTING (option)

Depending on the Timer action  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:

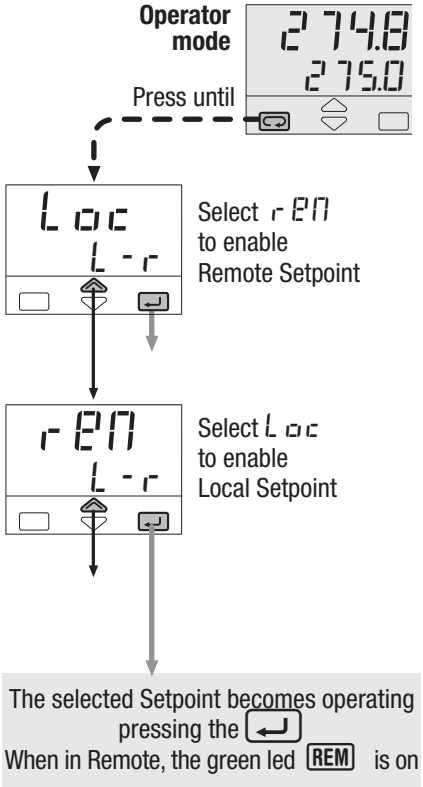


Press the key  to confirm

6.1 KEYPAD COMMANDS

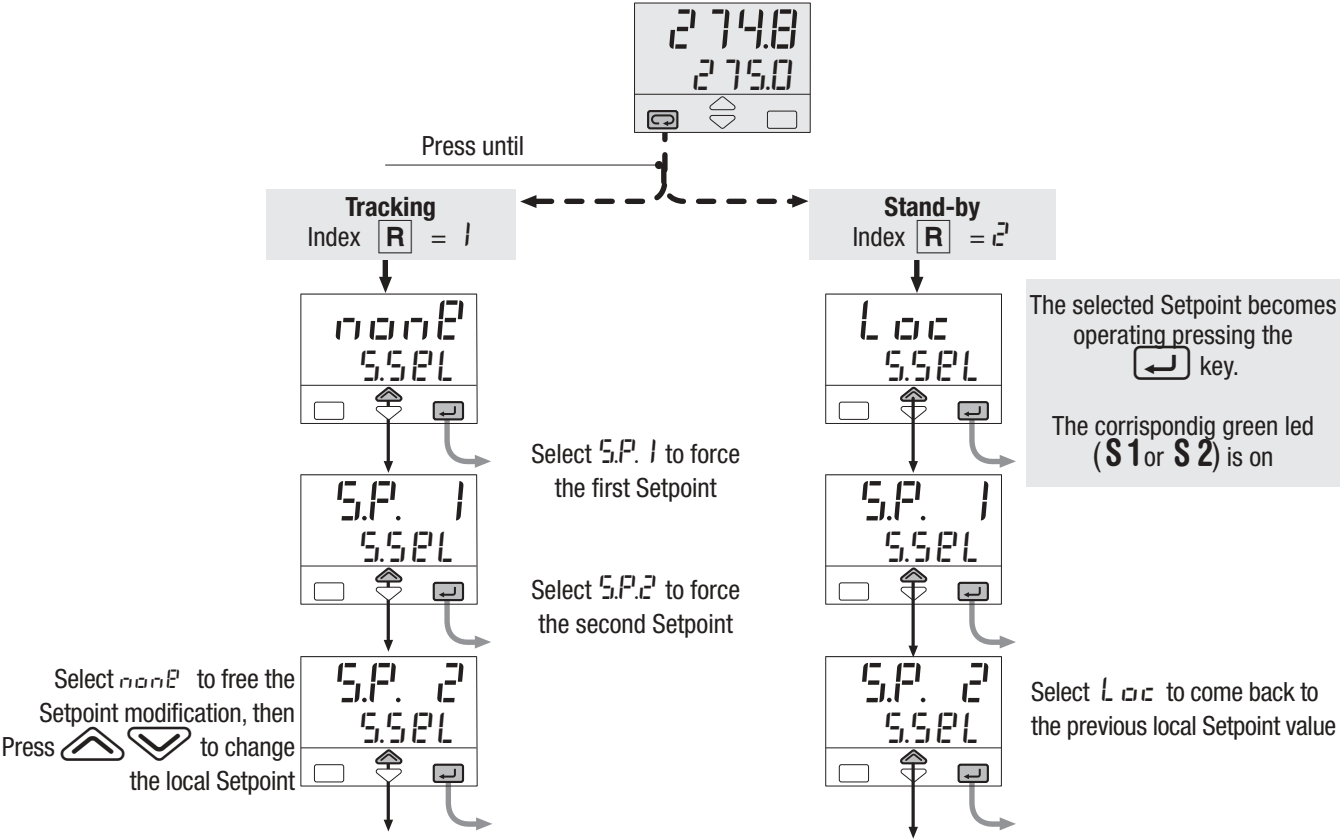
6.1.3 LOC/ REM SELECTION

configuration index **R** = 4 or 5)





6.1.4 STORED SETPOINTS SELECTION

(configuration index **R** = 1 or 2)

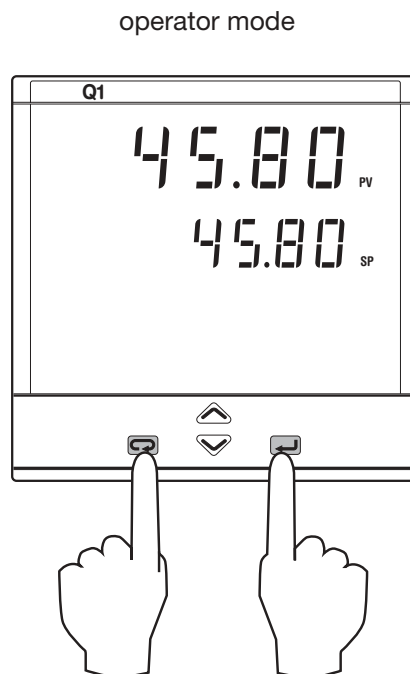


6.1.5 KEYPAD LOCK

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.



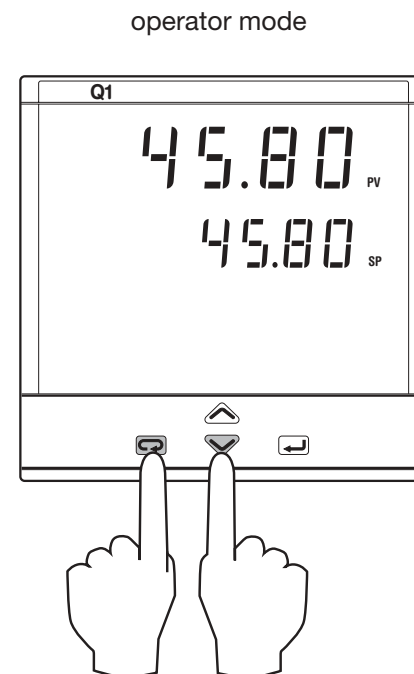
Press simultaneously
for 2 seconds

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 **OFF** 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.



Press simultaneously
for 2 seconds

7 TECHNICAL SPECIFICATIONS

Features (at 25°C environmental temp.)	Description		
Total configurability (see chapter 3.2 page 18 chapter 4.3.5 page 28)	From keypad or serial communication the user selects: <ul style="list-style-type: none"> - the type of input - the type of control algorithm - the type of output - 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: 1...30 seconds	
	Accuracy	0.25% ± 1 digits for temperature sensors 0.1% ± 1 digits (for mV and mA)	Between 100...240Vac the error is minimal
	Resistance thermometer (for ΔT : R1+R2 must be <320 Ω)	Pt100 Ω at 0°C (IEC 751) °C/°F selectable	2 or 3 wires connection Burnout (with any combination) Max. wire Res: 20 Ω max. (3 wires) Input drift: 0.35°C/10°C T _{env.} <0.35°C/10 Ω Wire Res.
	Thermocouple	L,J,T,K,S, R, B, N, E, W3, W5 (IEC 584) R _j >10M Ω °C/°F selectable	Internal cold junction compensation con NTC Error 1°C/20°C $\pm 0.5^\circ\text{C}$ Burnout Max. wire Res.: 150 Ω max. Input drift: <2 $\mu\text{V}/^\circ\text{C}$ T _{env.} <5 μV /10 Ω Wire Res.
	DC input (current)	4...20mA, 0...20mA with external shunt 2.5 Ω R _j >10M Ω	Burnout. Engineering units Conf. decimal point position Init. Scale -999...9,999
	DC input (voltage)	10...50mV, 0...50mV R _j >10M Ω	Full Scale -999...9,999 (min. range of 100 digits) Input drift: <0.1%/20°C T _{env.}

Features (at 25°C environmental temp.)		Description						
Auxiliary inputs	Remote Setpoint (option) Not isolated accuracy 0.1%	Current 0/4...20mA Rj = 30Ω	Bias in engineering units and ±range Ratio from -9.99...+99.99 Local + Remote Setpoint					
		Voltage 1...5/0...5/0...10V Rj = 300KΩ						
	CT current transformer (see pages12 and 45)	50 or 100 mA input hardware selectable	Current visualisation 1...200A 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	OP3 -Relay	OP5 -Analogue
			OP4 - SSR drive/Relay		OP1 -Relay/Triac	OP2 -Relay/Triac	OP3 -Relay	OP5 -Analogue
		Double action Heat / Cool	OP1 -Relay/Triac	OP2 -Relay/Triac			OP3 -Relay	OP5 -Analogue
			OP1 -Relay/Triac	OP4 - SSR drive/Relay		OP2 -Relay/Triac	OP3 -Relay	OP5 -Analogue
			OP4 - SSR drive/Relay	OP2 -Relay/Triac	OP1 -Relay/Triac		OP3 -Relay	OP5 -Analogue

Features (at 25°C environmental temp.)	Description	
Control mode	Algorithm	PID with overshoot control or On-off - PID with valve drive algorithm, for controlling motorised positioners
	Proportional band (P)	0.5...999.9%
	Integral time (I)	0.1...100.0 min
	Derivative time (D)	0.01...10.00 min
	Error dead band	0.1...10.0 digit
	Overshoot control	0.01...1.00
	Manual reset	0.0...100.0%
	Cycle time (Time proportional only)	1...200 s
	Control output high limit	10.0...100.0%
	Soft-start output value	0.1...100.0%
	Output safety value	0.0...100.0% (-100.0...100.0% for Heat / Cool)
	Control output hysteresis	0.1...10.0%
	Dead band	-10.0...10.0%
	Relative cool gain	0.1...10.0
	Cycle time (Time proportional only)	1...200 s
	Control output high limit	10.0...100.0%
	Cool output hysteresis	0.1...10.0%

Features (at 25°C environmental temp.)	Description					
OP1-OP2 outputs	SPST Relay N.O., 2A/250Vac (4A/120Vac) for resistive load Triac, 1A/250Vac for resistive load					
OP3 output	SPDT relay N.O., 2A/250Vac (4A/120Vac) for resistive load					
OP4 output	SSR drive: 0/5Vdc, ±10% 30mA max. - SPST Relay N.O., 2A/250Vac (4A/120Vac) for resistive load					
OP5 analogue output (option)	Control or PV/SP retransmission	Galvanic isolation: 500 Vac/1 min Resolution 12 bit (0.025%) Accuracy: 0.1 %		In current: 0/4...20mA, 750Ω / 15V max.		
AL1 - AL2 - AL3 alarms	Hysteresis 0.1...10.0% c.s.					
	Action	Active high	Action type	Deviation threshold	±range	
		Active low		Band threshold	0...range	
				Absolute threshold	whole range	
		Special functions	Sensor break, heater break alarm			
			Acknowledge (latching), activation inhibit (blocking)			
	Connected to Timer or program (if options installed)					
Setpoint	Local		Up and down ramps 0.1...999.9 digit/min (OFF=0) Low limit: from low range to high limit High limit: from low limit to high range			
	Local					
	Local and Remote	If option installed				
	Local with trim					
	Remote with trim					

Features (at 25°C environmental temp.)	Description		
Special functions (option)	Timer (see page 41)	Automatic start at the power on, manual start by keypad, Digital inputs or serial comm.s	
		Setting time:	1...9,999 s/min
		Stand-by Setpoint:	from Setpoint low limit to Setpoint high limit
	Start-up (see page 39)	Start-up Setpoint:	from Setpoint low limit to Setpoint high limit
		Hold time:	0... 500 min
		Control output high limit: 5.0...100.0%	
Fuzzy-Tuning one shoot	The controller selects automatically the best method according to the process conditions		Step response
			Natural frequency
Serial comm. (option)	RS485 isolated, Modbus/Jbus protocol, 1,200; 2,400; 4,800; 9,600 bit/s 3 wires		
Auxiliary Supply	+24Vdc $\pm 20\%$ 30mA max. - for external transmitter supply		
Operational safety	Measure input	Detection of out of range/short circuit/sensor break with automatic activation of safety strategies and alerts on display	
	Control output	Safety value: -100%...100%	
	Parameters	Parameter and configuration data are stored in a non volatile memory for an unlimited time	
	Access protection	Password to access the configuration and parameters data, keypad lock, outputs lock	
General characteristics	Power supply (PTC protected)	100...240Vac (-15...+10%) 50/60 Hz or 24Vac (-25...+12%) 50/60Hz e 24Vdc (-15...+25%)	Power consumption 4W max.
	Safety	Compliance to EN61010-1 (IEC 1010 – 1), installation class 2 (2.5kV) pollution class 2, instrument class II	
	Electromagnetic compatibility	Compliance to the CE standards (see page 2)	
	UL and cUL approval	File 176452	
	Protection EN60529 (IEC529)	IP65 front panel	
	Dimensions	1/4 DIN - 96 x 96, depth 110 mm, weight 470 g approx.	



WARRANTY

We warrant that the products will be free from defects in material and workmanship for 18 months from the date of delivery.

The warranty above shall not apply for any failure caused by the use of the product not in line with the instructions reported on this manual.

ICONS TABLE

Main universal input	
	Thermocouple
	RTD (Pt100)
	Delta Temp (2x RTD)
	mA and mV
	Custom
	Frequency
Auxiliary input	
	Current transformer
	mA Remote setpoint
	Volt Remote setpoint
	Feedback potentiometer

Digital input	
	Isolated contact
	NPN open collector
	TTL open collector
Setpoint	
	Local
	Stand-by
	Keypad lock
	Outputs lock
	Start-up function
	Timer function
	Memorized
	Remote
	Setpoint programmer

Digital input connected functions	
	Auto/Manual
	Run, Hold, Reset and program selection
	PV hold
	Setpoint slopes inhibition
Output	
	SPST Relay
	Triac
	SPDT Relay
	mA
	mA mV
	Logic

