Heat/Cool
temperature controller
$^1/_4$ DIN - 96 x 96
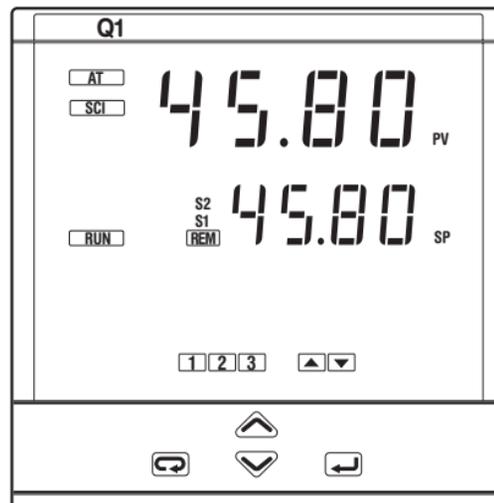
82
S E R I E S

Q1 line

CE

c(UL)us
LISTED

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

Q1 line

CE

CE

**NOTES
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 Comunity 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.

TABLE OF CONTENTS
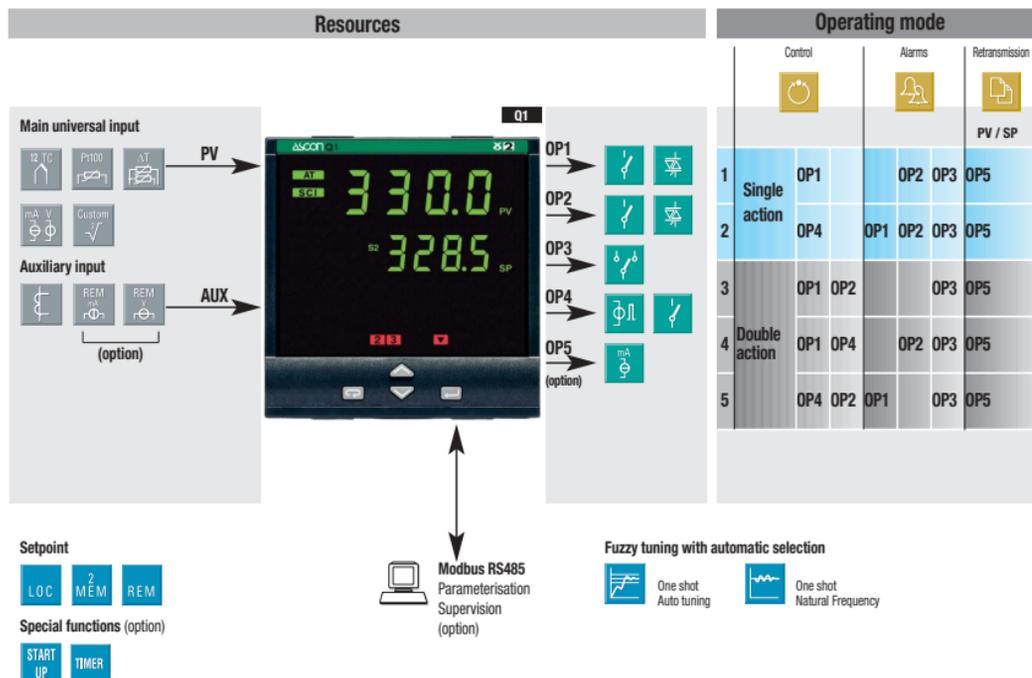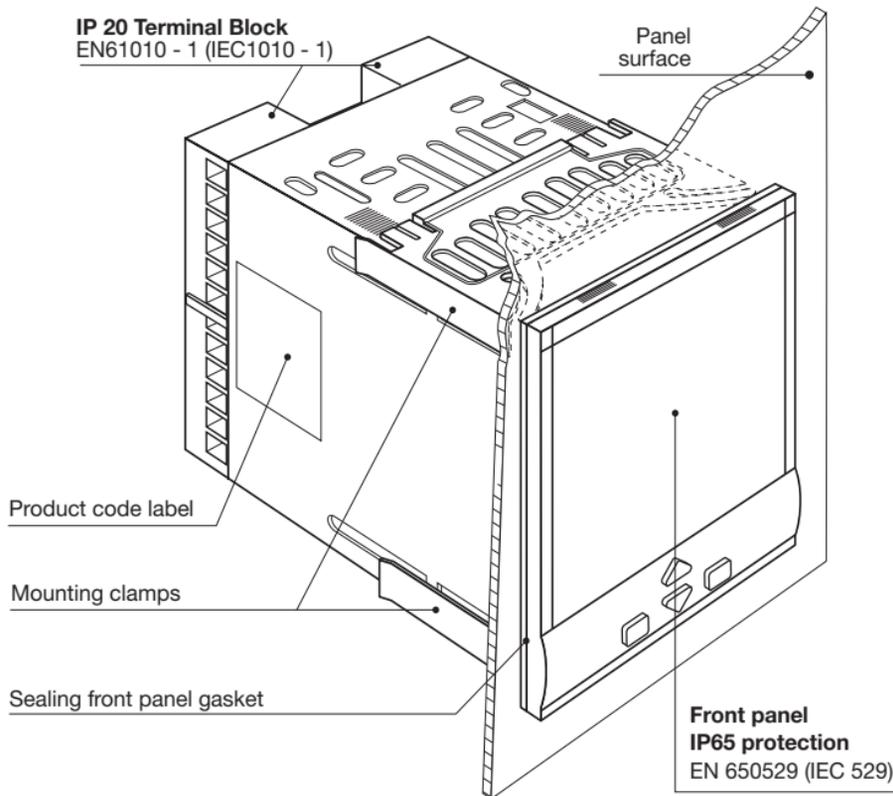
1 ▮ INSTALLATION

1.1 GENERAL DESCRIPTION

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 ⚠CE symbol, related to the European Community directive on electrical protection and electromagnetic compatibility.

⚠CE
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.**

IP 20 Terminal Block
EN61010 - 1 (IEC1010 - 1)

Panel surface

Product code label

Mounting clamps

Sealing front panel gasket

Front panel IP65 protection
EN 650529 (IEC 529)

1.2 DIMENSIONS

96 mm
3.78 in

96 mm
3.78 in

10 mm max.
0.39 in max.

10 mm max.
0.39 in max.

110 mm
4.33 in

1.3 PANEL CUT-OUT

$92^{+0.8}$ mm
$3.62^{+0.031}$ in

113 mm min.
4.45 in min.

$92^{+0.8}$ mm
$3.62^{+0.031}$ in

103 mm min.
4.05 in min.
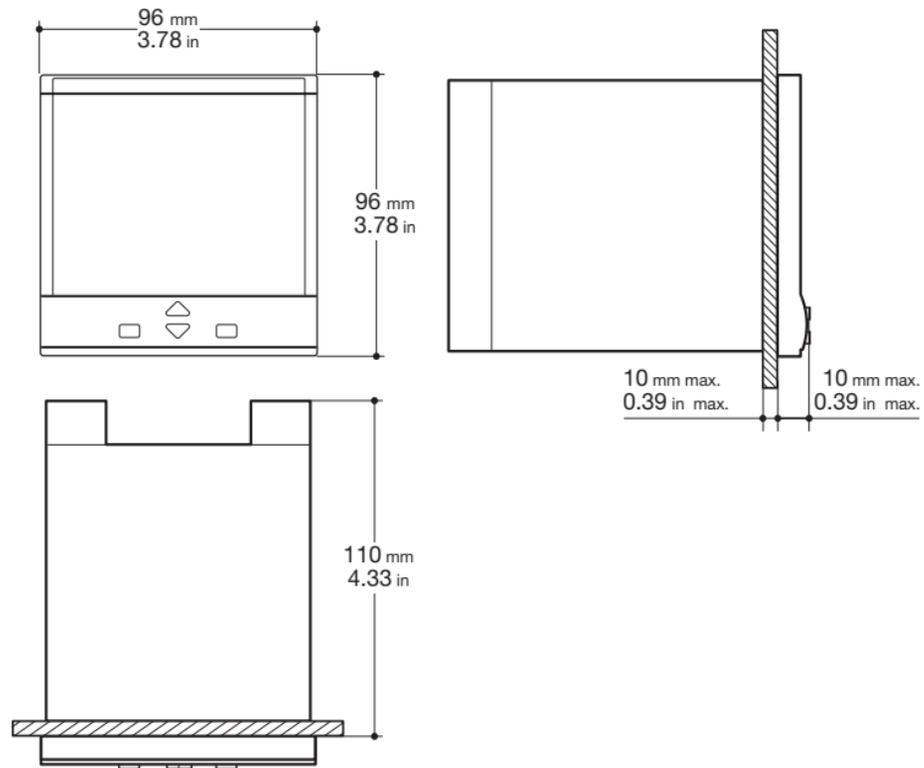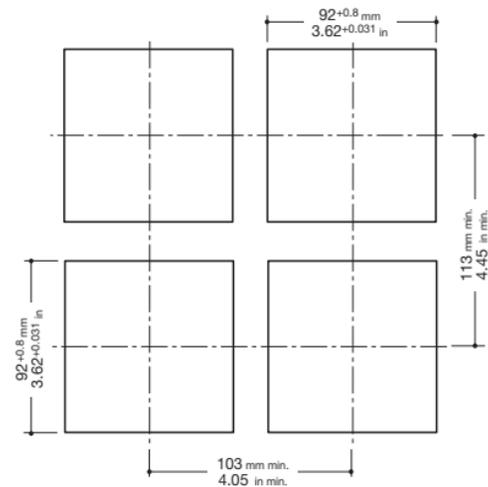
1.4 ENVIRONMENTAL RATINGS ⚠CE

Operating conditions

<u>2000</u> ◢	Altitude up to 2,000 m
▐°C	Temperature 0…50°C
%Rh	Relative humidity 5…95 % non-condensing

Special conditions	**Suggestions**
<u>2000</u> ◢ Altitude > 2,000 m	Use 24Vac supply version
▐°C Temperature >50°C	Use forced air ventilation
%Rh Humidity > 95 %	Warm up
Conducting atmosphere	Use filter

Forbidden Conditions 🚫
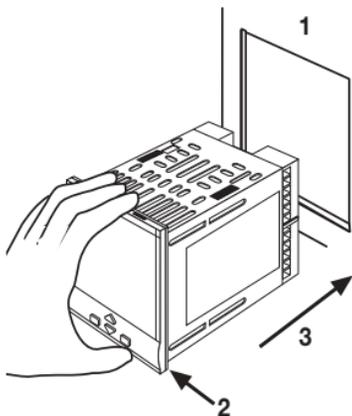
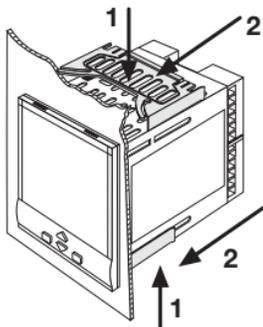|	
Corrosive atmosphere
Explosive atmosphere

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.
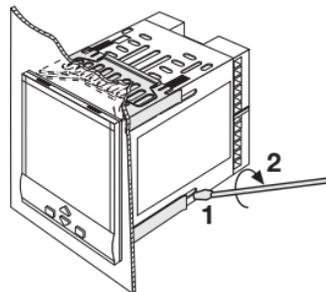
1.5.4 INSTRUMENT UNPLUGGING ⚠CE

1 Push and
2 pull to remove the instrument.
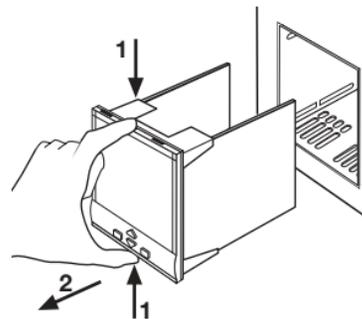
Electrostatic discharges can damage the instrument.
Before removing the instrument the operator must discharge himself to ground.

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

7

2 ELECTRICAL CONNECTIONS

2.1 TERMINAL BLOCK [1]

24 screw terminals M3	
Option terminals	
Tightening torque 0.5 Nm	
Positive screw-driver PH1	
Negative screw-driver 0.8 x 4 mm	

Rear terminal cover

5.7 mm 0.22 in

Cable size 1 mm² [2]

Terminals
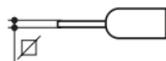
Pin connector ⌀1.4 mm 0.055 in max.	
Fork-shape AMP 165004 Ø5.5 mm - 0.21 in	
Stripped wire L 5.5 mm - 0.21 in	
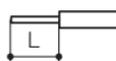
UL note

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

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

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

Conduit for supply and output cables

A = Supply
B = Outputs
C = Analog inputs
D = Analogue output
E = Digital input/output Serial Comm.s

Conduit for low level sensor cables
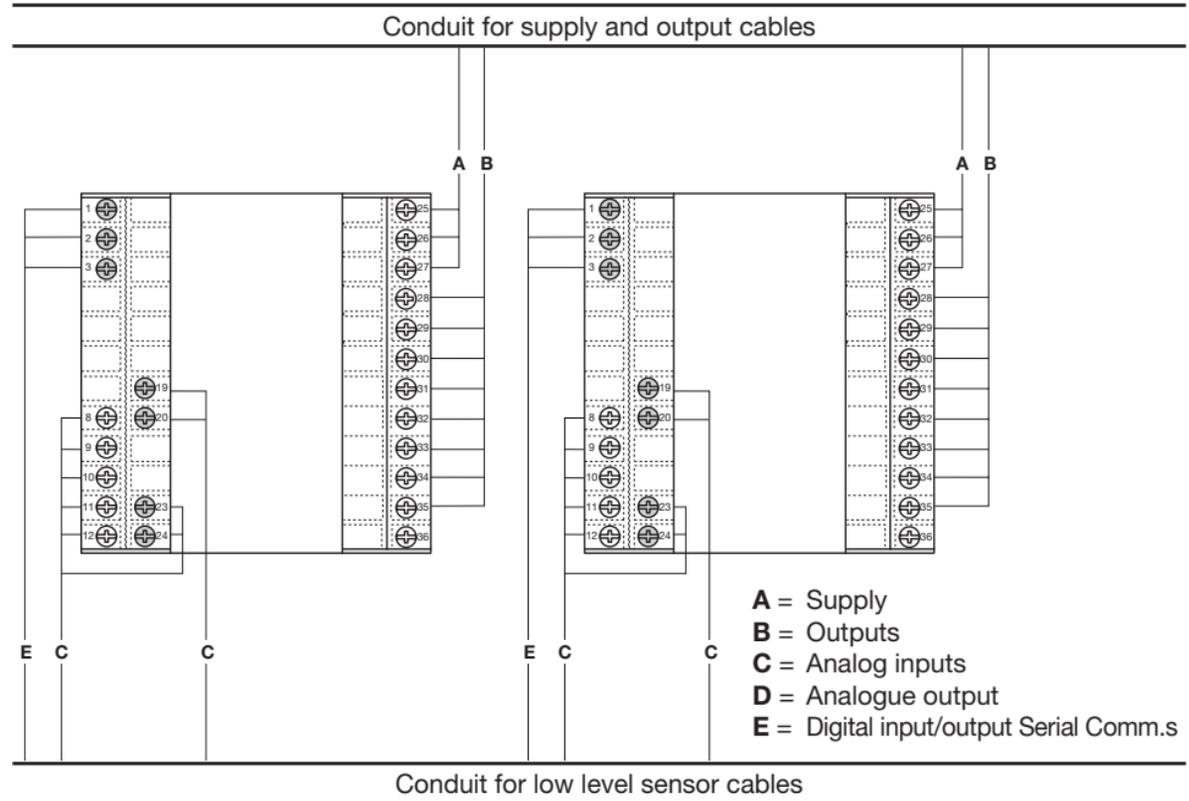
2.3 EXAMPLE OF WIRING DIAGRAM (HEAT / COOL CONTROL)
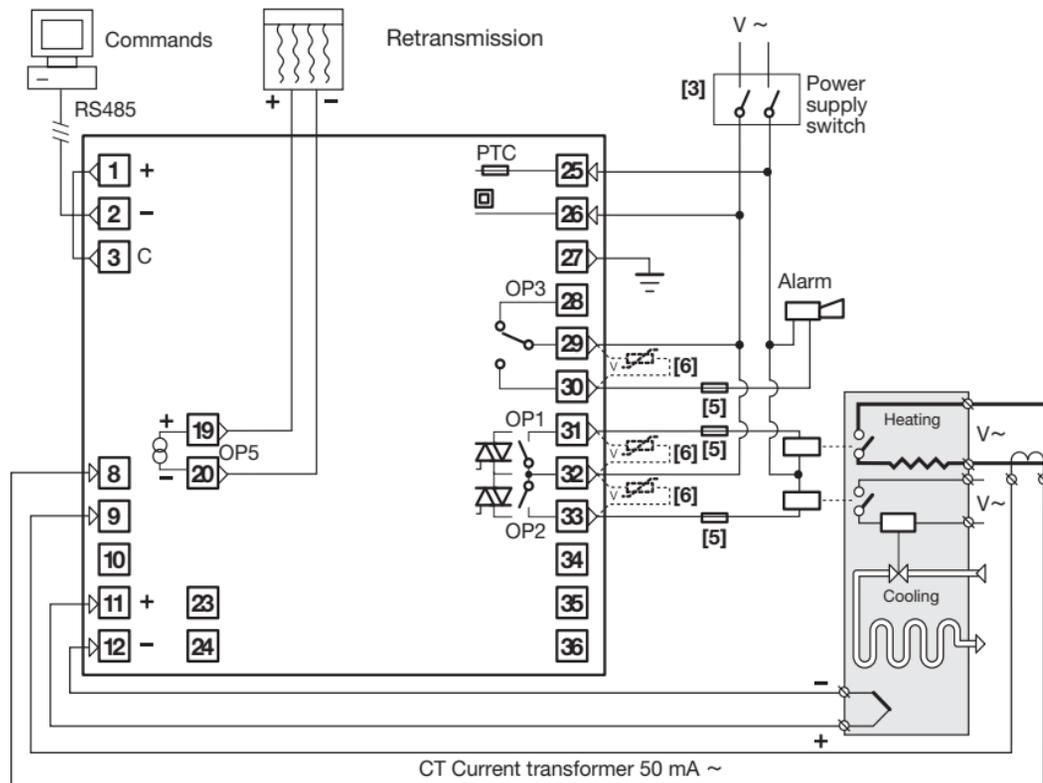
Notes:

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 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 ⚠ CE

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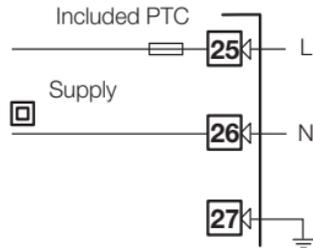
For better protection against noise, it is recommended not to connect the earth clamp provided for civilian installations.

2.3.2 PV CONTROL INPUT

⚠ CE

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.
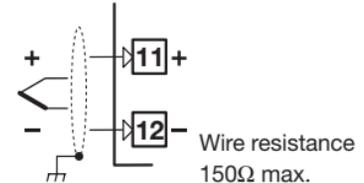
B For Pt100 resistance thermometer

- 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.
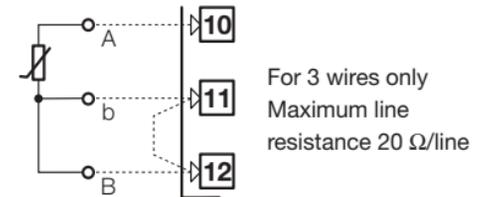
C For ∆T (2x RTD Pt100) Special

⚠ 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.

Wire resistance 150Ω max.

For 3 wires only
Maximum line
resistance 20 Ω/line

Use wires of the same length and 1.5 mm² size.
Maximum line resistance 20 Ω/line

11
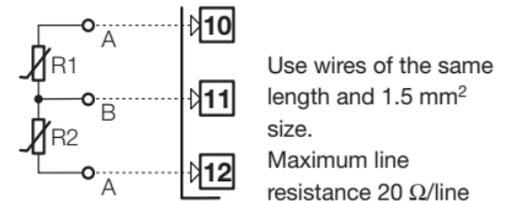
2.3.2 PV CONTROL INPUT ⚠ CE

D   For mA, mV
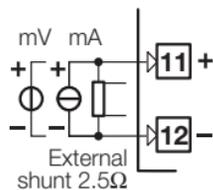
Rj >10MΩ

D1 With 2 wires transducer
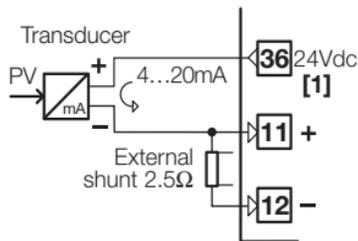
D2 With 3 wires transducer
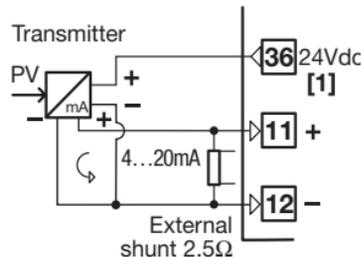
[1] Auxiliary power supply for external transmitter 24Vdc ±20% /30mA max. without short circuit protection.

2.3.3 AUXILIARY INPUT (OPTION) ⚠ CE

A - From Remote Setpoint
Current: 0/4…20mA;
Input resistance: 30Ω;
Voltage: 1…5V, 0…5V, 0…10V;
Input resistence: 300kΩ.
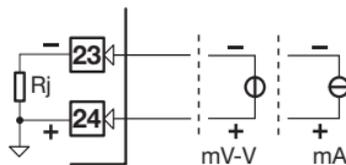
**B- For current transformer CT
    Not isolated**
For the measure of the load current (see page 45).

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

5 watt burden resistor
0.5Ω for 1A secondary transformer coil
0.1Ω for 5A secondary transformer coil
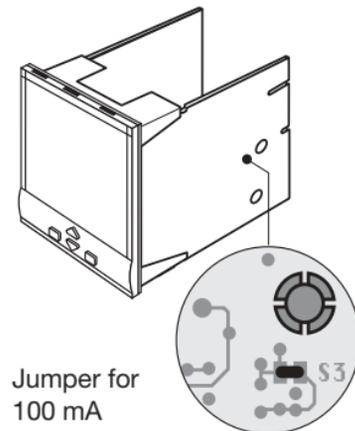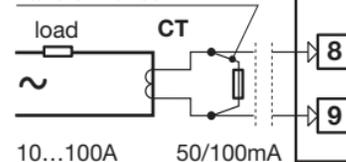
Jumper for 100 mA secondary transformer coil.

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 $\boxed{N}$ (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 ⚠CE

Fuse
OP1 [1]
31
32
Coil of the heat load contactor
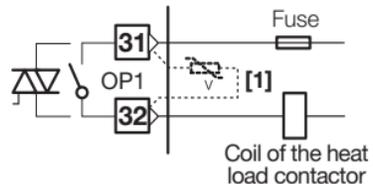
2.3.5-C SINGLE ACTION ANALOGUE OUTPUT ⚠CE

Fuse
OP1 [1]
31
32
Coil of the heat load contactor

Fuse
OP2 [1]
32
33
Coil of the cool load contactor
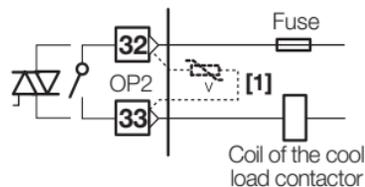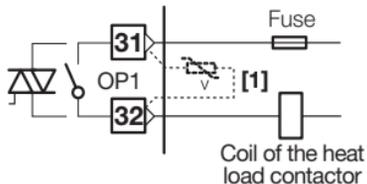
2.3.5-B SINGLE ACTION SSR DRIVE CONTROL OUTPUT ⚠CE

Static Relay
[2] ⊓ OP4
− 34
+ 35
Load
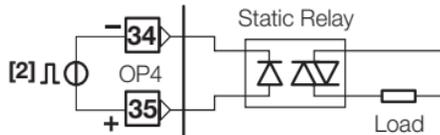
2.3.5-D DOUBLE ACTION RELAY (TRIAC)/RELAY (TRIAC) CONTROL OUTPUT ⚠CE

Fuse
OP1 [1]
31
32
Coil of the heat load contactor

Static Relay
[2] ⊓ OP4
− 34
+ 35
Cool Load
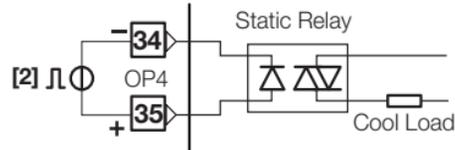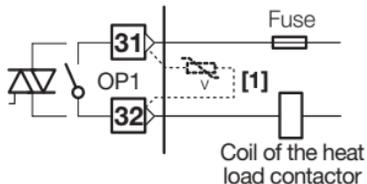
2.3.5-E DOUBLE ACTION RELAY (TRIAC)/SSR DRIVE CONTROL OUTPUT ⚠CE

Static Relay
[2] ⊓ OP4
− 34
+ 35
Heat Load

Fuse
OP2 [1]
32
33
Coil of the cool load contactor
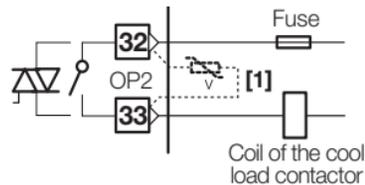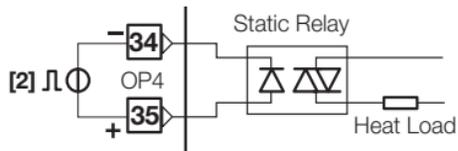
2.3.6 ALARM OUTPUTS

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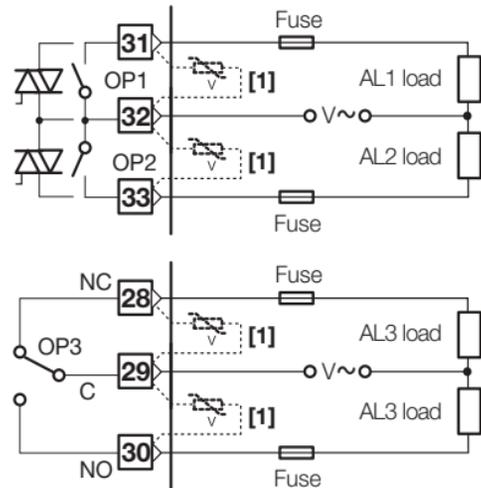
Notes:

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

2.3.7 OP5 ANALOGUE RETRANSMISSION OUTPUT (OPTION)
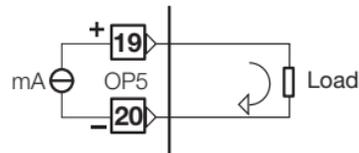
For PV/SP retransmission only:
• Galvanic isolation: 500Vac/1 min;
• 0/4…20mA, (750Ω or 15Vdc max.).

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

2.3.8 SERIAL COMMUNICATIONS (OPTION)
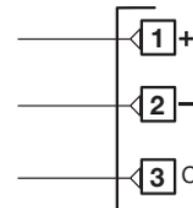
• Galvanic isolation: 500Vac/1 min; Compliance to the EIA RS485 standard for Modbus/Jbus;
• Setting dip switches.

15
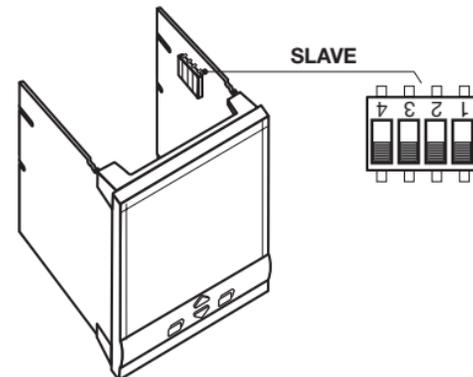
3 ■ PRODUCT CODING

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

Configuration code (software)

Basic product code (hardware)

Instrument label

```
P/N   : Q1-3150-0000
CONF  : 0320-2301
S/N   : A0A-9909/0013
V~(L-N) : 100÷240V 50/60 Hz - 4W
```
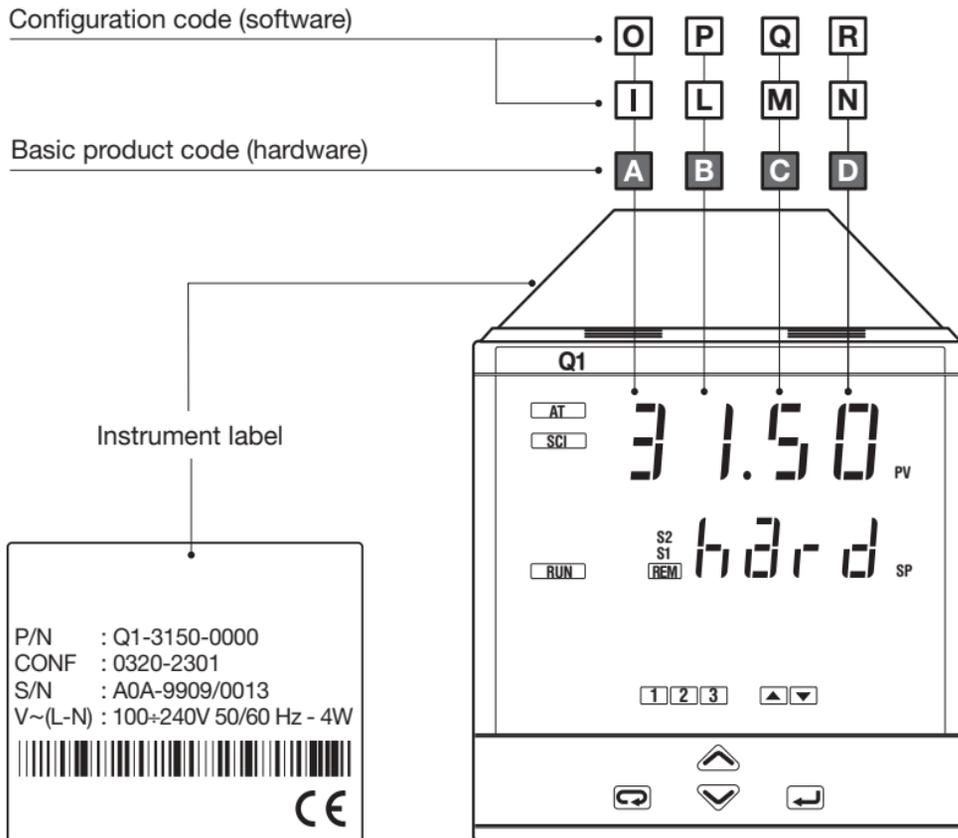
3.1 MODEL CODE

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
Analogue output + Remote Setpoint	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)
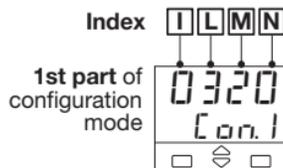
Index | I | L | M | N |

1st part of configuration mode

```
0320
 Con.1
□ ⇕ □
```

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.

Index | O | P | Q | R |

2nd part of configuration mode

```
2301
 Con.2
□ ⇕ □
```
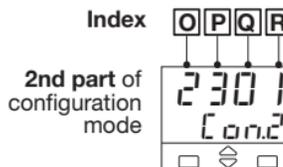
E.g.: Enter code 2301 to choose:
- AL1 absolute, active high;
- AL2 absolute, active low;
- AL3 Used by Timer;
- Local + 2 Stored Setpoints with tracking function.

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

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

[3] Only possible whether "Output configuration" $\boxed{N}$ = 0 or 1 and $Ht.F.5.$ 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

PV control input
in engineering units

Over range

Under range

SP operating Setpoint
(Local/Remote or Stored)

Alarm status LEDs (red)

1 AL1 ON
2 AL2 ON
3 AL3 ON

Control output LEDs (red)
▲ OP1/OP4 ON - ▼ OP2/OP4 OFF

Entry key for selection and value setting confirmation

Menu access

Setpoint setting
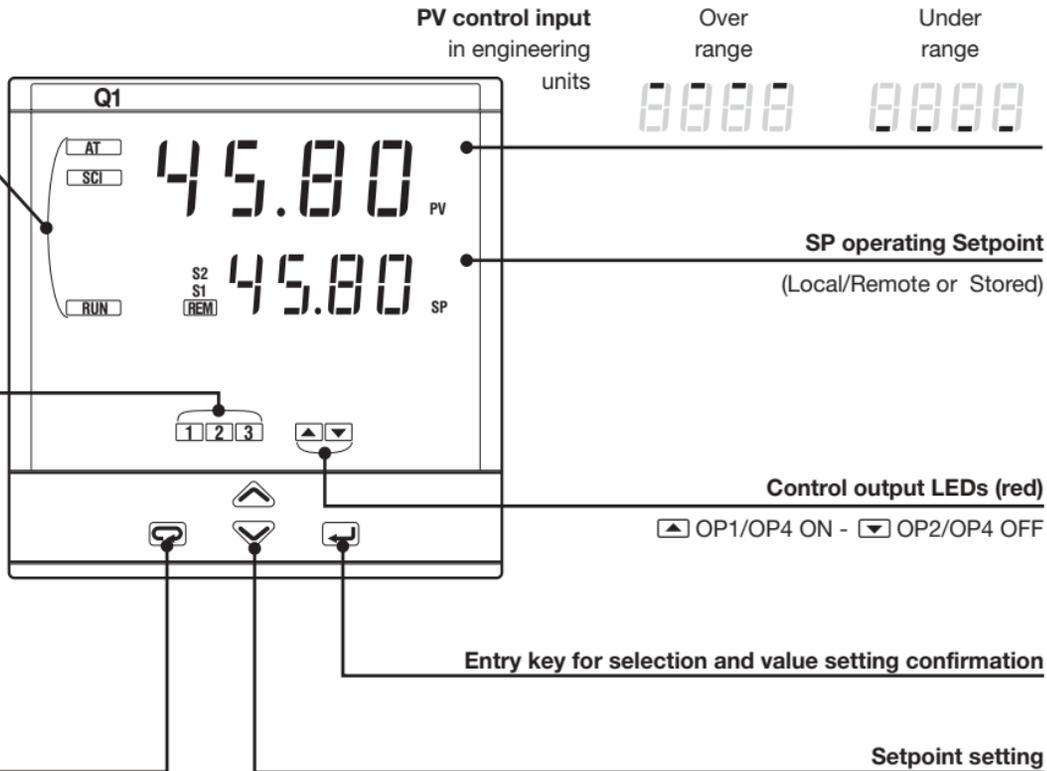
4.1.2 KEYS FUNCTIONS AND DISPLAY IN PROGRAMMING MODE

⚠
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 è 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.

Parameter value

Parameter mnemonic

**Entry key for selection
and value setting confirmation**

Value modification

Access to the menu for:

Parameter setting
Configuration

4 - Operations
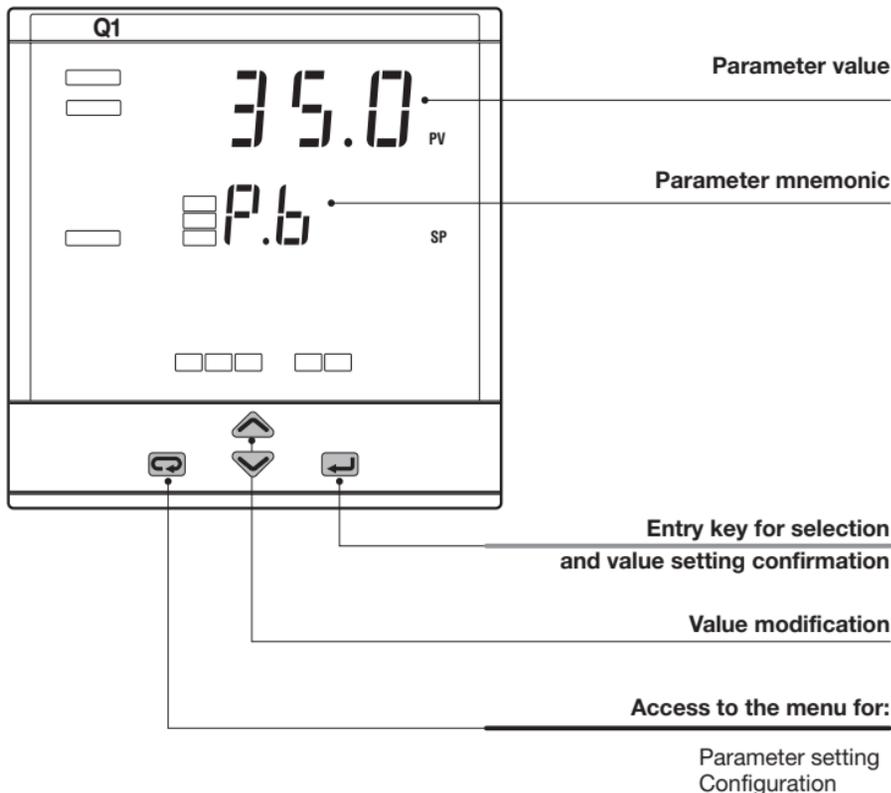
4.2 PARAMETER SETTING

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

Operator mode working Setpoint displayed

Local Setpoint display

Lower

Setpoint modification

Raise

⏱ after 2 s

Setpoint entry The operation is acknowledged by one flash of the display.
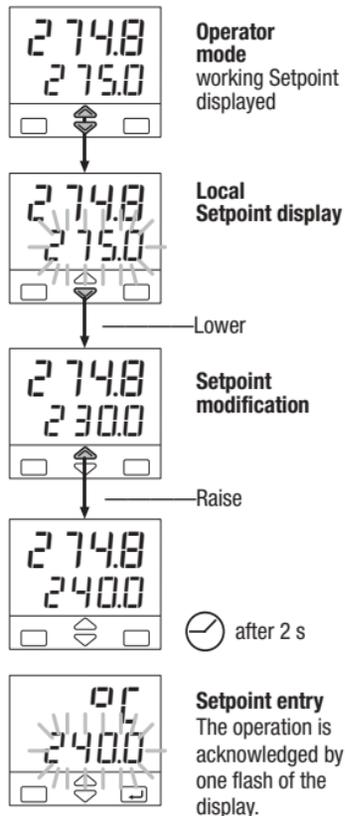
4.2.2 MNEMONIC CODES SETTING

(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.

Engineering Units:

Degree Centigrade

Degree Fahrenheit

Degree Centigrade

Degree Fahrenheit

no units defined

Ph

23
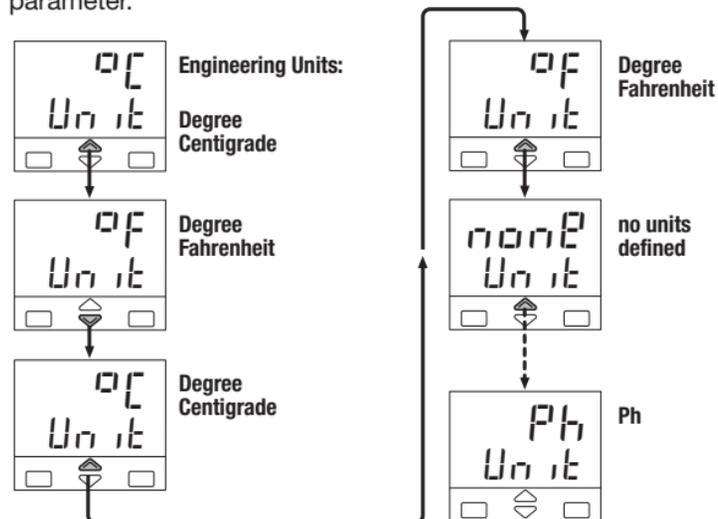
4.3 PARAMETERISATION - MAIN MENU
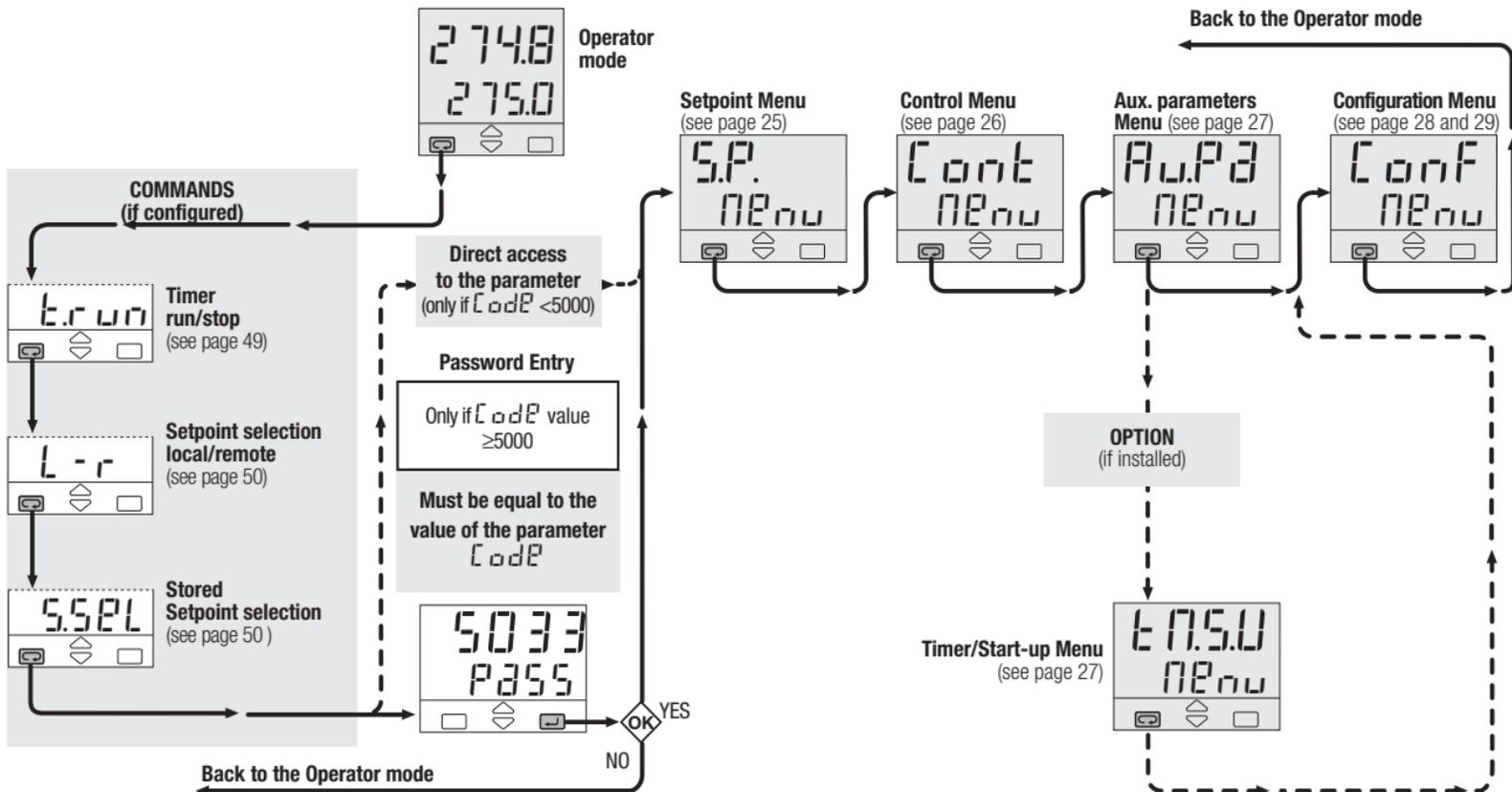
4.3.1 PARAMETERISATION - SETPOINT MENU

Menu Setpoint

0 [A 15.P]	**AL1 alarm threshold** [1] (see page 30)
0 [A 25.P]	**AL2 alarm threshold** [1] (see page 30)
0 [A 35.P]	**AL3 alarm threshold** [1] (see page 30)
OFF [SL. u]	**Setpoint ramp up** OFF /0.1…999.9 digit/min
OFF [SL. d]	**Setpoint ramp down** OFF /0.1…999.9 digit/min

L.range [S.P. L] **Setpoint low limit** low range…S.P. H

H.range [S.P. H] **Setpoint high limit** S.P. L …High range

LOCAL, REMOTE, PROGRAMM. configuration index **R** = 0, 3, 6

LOCAL, + 2 STORED. configuration index **R** = 1, 2

.... [S.P. 1] **1st stored Setpoint**

.... [S.P. 2] **1nd stored Setpoint**

LOCAL OR REMOTE WITH TRIM. configuration index **R** = 4, 5

100 [r t io] **Ratio Setpoint**

0 [b iAS] **Remote Setpoint bias**

Note

[1] It is not presented if the controller has been configured with alarm n° 2 not active or of sensor break type. Digit O/P of the configuration code is assigned to 0 or 1.

25

4.3.2 PARAMETERISATION - CONTROL MENU

Control Menu

PID Algorithm | **On-Off Algorithm**

Control output hysteresis 0.1…10.0% sc.

h.y. — **Control output hysteresis** 0.1…10.0% sc.

tun.E — **Tune run/stop** Strt / StoP

P.b. — **Proportional band** 0.5...999.9 of span

t.i. — **Integral time** OFF /0.1…100.0 min

t.d. — **Derivative time** OFF /0.01…10.00 min

O.C. — **Overshoot control** 0.01…1.00

M.rES — **Manual reset** (only with integral time = OFF) 0.0...100.0% output

d.Err — **Error dead band** OFF /0.1…10.0 digit

t.c. — **Cycle time** (Time proportioning only) 1…200 seconds

OP.H — **Control output high limit** 10.0…100.0%

S.Out — **Output safety value** 0.0…100.0% (-100.0…100.0% for Heat / Cool)

Heat / Cool Algorithm

d.bnd — **Dead band** -10.0…10.0%

r.C.G.a — **Cool relative gain** 0.1…10.0

t.c. C — **Cool cycle time** (heat/cool time proportioning only) 1…200 seconds

OP.HC — **Cool control output high limit** (PID only) 10.0…100.0%

h.y. C — **Cool output hysteresis** (On-Off only) 0.1...10.0% sc

Back to the **tun.E** parameter

26

4.3.3 PARAMETERISATION - AUXILIARY PARAMETERS MENU

Display	Description
Au.PA NEnu	Auxiliary parameters Menu
0.5 — A1hy	AL1 hysteresis 0.1…10.0% of span
nonE — A1Lb	Alarm latching and blocking functions nonE / Ltch bLoc / Lt.bL
	AL2 and AL3 parameters
OFF — t.Lbd	LBA delay (see page 38) OFF = sensor break 1…9999 s LBA
0.5 — St.OP	Soft-start output value (t.Mod =OFF only) OFF / 0.1…100.0%

Back to the **A1hy** parameter

Display	Description
1 — St.tN	Soft-start activation time (only if St.OP different than OFF) 1…9999 s
OFF — t.F iL	Filter time constant OFF / 1…30 s
OFF — In.Sh	Input shift OFF /-60…60 digit
1 — Addr	Communication address (if option installed) OFF / 1…247
L. range — rt.Lo.	Retransmission low range (only if installed) whole range
H. range — rt.hi	Retransmission high range (only if installed) whole range

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

Display	Description
tN.S.U NEnu	Timer and Start-up Menu
t.Mod	Timer/Start-up operating mode (see table 1 page 41)

TIMER FUNCTION (only with AL3 enabled)

Display	Description
OFF — t.Act	Timer Action (only if t.Mod not equal to OFF or to 1) (see table page 41)
0.5 — t.iNE	Timer setting 1…9999 s or min
0 — S.P.Sb	Stand-by Setpoint (only if t.Mod =7) SP. L …SP. H

START-UP FUNCTION (only if t.Mod = 1)

Display	Description
1 — t.h.S.U	Hold time 0…500 min
0 — S.P.S.U	Start-up Setpoint SP. L …SP. H
100.0 — OP.HS	Output high limit during Start-up 5.0…100.0%

Back to the **t.Mod** parameter

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:

```
9999
Con.1
```
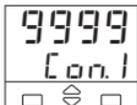
Until the configuration code is set correctly, the controller remains in stand-by with input and output deactivated.

**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)**

Index ┃I┃**L**┃**M**┃**N**┃
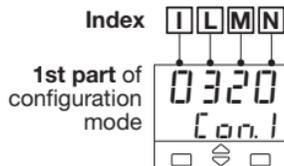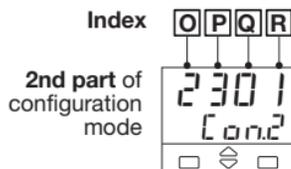
1st part of configuration mode

```
0320
Con.1
```

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.

Index ┃**O**┃**P**┃**Q**┃**R**┃

2nd part of configuration mode

```
2301
Con.2
```

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.

```
ConF
MEnu
```

Password Entry

Only if $CodE$ value <5000 (33 default from factory)

Must be equal to the value of the parameter $CodE$

```
33
PASS
```

NO ⟵ ◇OK◇ ⟶ YES

Back to Operator mode
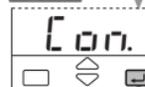
```
OFF
Con.1
```
Entry of digits I - L - M - N of the configuration code (chapter 3.2 pages 18, 19)
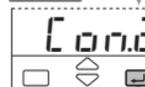
```
OFF
Con.2
```
Entry of digits O - P - Q - R of the configuration code (chapter 3.2 pages 19, 20)
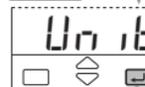
```
nonE
Unit
```
IL1 digital input function (see table 1)

LINEAR SCALE ONLY

N° of decimals 0…3

Low range -999…9999 (min 100 digit)

High range -999…9999 (min 100 digit)

REMOTE SETPOINT (if configured)

Remote Setpoint input (see table 2)

CT (only on proportional output other than the servomotor)

CT primary high range Off/1…200 A

SERIAL COM. OPTION (if installed)

Communication protocol Π.bu5 / Jbu5

Baud rate 1200/2400 4800/9600

ANALOGUE OUTPUT OPTION OP5 (if installed)

Analogue control output range 0-20/4-20 mA

Control output selection PU /5P.

Password 0…9999 33 default from factory

Back to the Con.1 parameter

Table 1 Engineering units

un it	
Value	Description
°C	degree centigrade
°F	degree Fahrenheit
nonP	none
nU	mV
U	Volt
nA	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::
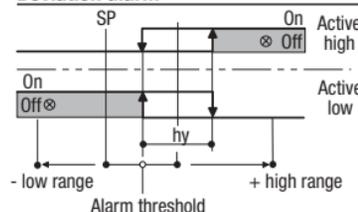
- **A** the type and the operating condition of the alarm;
- **B** the functionality of the alarm acknowledgement (latching) $\boxed{Ltch}$ (see page 37);
- **C** the start-up disabling (blocking) $\boxed{bLoc}$ (see page 37);
- **D** Loop break or sensor break (see page 38).

A ALARM TYPE AND OPERATION CONDITIONS

Absolute alarm (full scale)
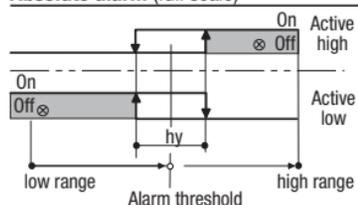
Deviation alarm

Band alarm
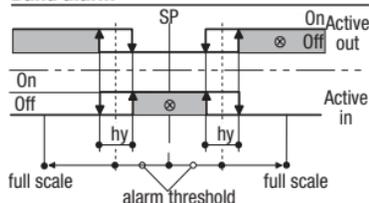
$\boxed{A1S.P}$ **AL1 alarm threshold**
$\boxed{A2S.P}$ **AL2 alarm threshold**
$\boxed{A3S.P}$ **AL3 alarm threshold**

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 occures, the display will shows the red leds $\boxed{1}$, $\boxed{2}$ or $\boxed{3}$, respectively on.

$\boxed{5L. \; \sqcup}$ **Setpoint ramp up**

$\boxed{5L. \; d}$ **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.
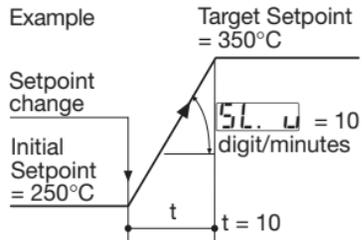
Otherwise, the Setpoint value is reached according to the configured rate of change.

The new Setpoint value is called "Target Setpoint". It can be displayed by means the parameter $\boxed{t.5.P.}$

(see procedure at page 47).

When Remote Setpoint is configured, we suggest to disable $\boxed{5L. \; \sqcup}$ and $\boxed{5L. \; d}$ parameters OFF.

Example

Target Setpoint = 350°C

Setpoint change

Initial Setpoint = 250°C

$\boxed{5L. \; \sqcup}$ = 10 digit/minutes

t = 10

$\boxed{5.P. \; L}$ **Setpoint low limit**

$\boxed{5.P. \; H}$ **Setpoint high limit**

Low / high limit of the Setpoint value.

$\boxed{5.P. \; 1}$ **1st stored Setpoint**

$\boxed{5.P. \; 2}$ **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 $\boxed{R}$ = 1 (tracking), the previous Local Setpoint value will be lost, when the stored Setpoint is selected.

If index $\boxed{R}$ = 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.
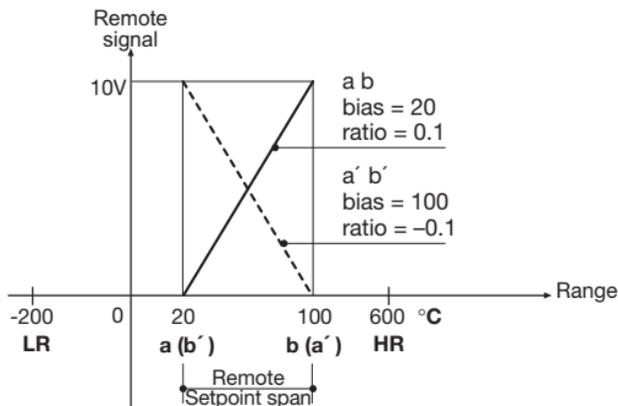
4.4.1 SETPOINT MENU

$\boxed{r\ t\ \ \ \ \imath\sqsubset}$ **Remote Setpoint Ratio**

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

$\boxed{b\ \ \imath\overline{d}\,\overline{S}}$ **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


```
Remote
signal

10V ┤        ┌────────────  a b
    │   ╲   ╱              bias = 20
    │    ╲ ╱               ratio = 0.1
    │     ╳
    │    ╱ ╲               a´ b´
    │   ╱   ╲              bias = 100
    └──┴─────┴──────┴──→ Range  ratio = –0.1
  -200  0  20    100   600 °C
   LR      a (b´) b (a´)  HR
            └─────────┘
             Remote
            Setpoint span
```

PV = process variable
LR = PV low limit
HR = PV high limit
SR = Remote Setpoint
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:

$b\ \imath\overline{d}\,\overline{S}$ = starting point = a

$r\ t\ \imath\sqsubset = \dfrac{b - a}{HR - LR}$

Example:
$b\ \imath\overline{d}\,\overline{S}$ = 20
$r\ t\ \imath\sqsubset =$

$\dfrac{100 - 20}{600 - (-200)} = \dfrac{80}{800} = 0.1$

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

$b\,id5$ = starting point = a´

$rt\,io = \dfrac{b´ - a´}{HR - LR}$

Example:
$b\,id5$ = 100
$rt\,io =$

$\dfrac{20 - 100}{600 - (-200)} = \dfrac{-80}{800} = -0.1$

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

Setpoint type $L\,oc.t$
(configuration index $\boxed{R} = 4$)
$SP = SL + (rt\,io \bullet REM) + b\,id5$

Setpoint type $r\,Ent$
(configuration index $\boxed{R} = 5$)
$SP = REM + (rt\,io \bullet SL) + b\,id5$

SIGN = Remote signal percentage
SPAN = HR-LR

$REM = \dfrac{SIGN * SPAN}{100}$

Examples:
Local Setpoint (SL) with an external Trim with multiplying coeff. of 1/10:
Setpoint type = $L\,oc.t$
$rt\,io$ = 0.1
$b\,id5$ = 0

Remote Setpoint (SR) with an internal Trim with multiplying coeff. of 1/5:
Setpoint type = $r\,Ent$
$rt\,io$ = 0.2
$b\,id5$ = 0

Remote Setpoint range equal to the Input range:
Setpoint type = $L\,oc.t$
$rt\,io$ = 1
$b\,id5$ = LR
SL = 0

4.4.2 CONTROL MENU
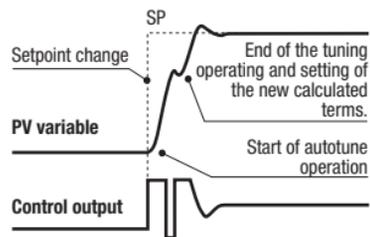
$t\,u\,n\,E$	Run Tune

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.
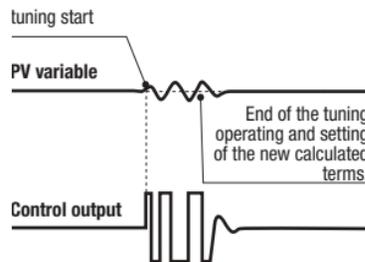
This type is selected when, at

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 $\boxed{AT}$ 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 $\boxed{AT}$ becomes off.
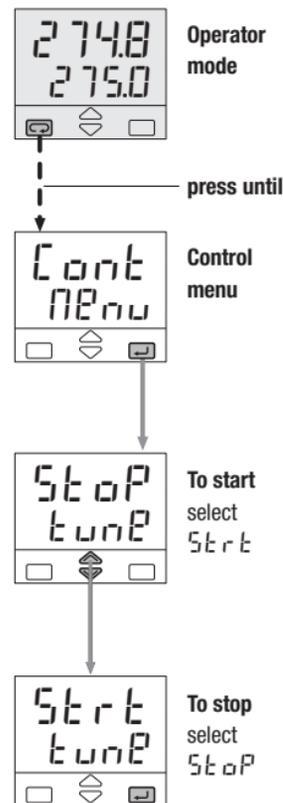
P.b.	**Proportional band**

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.

Π.r ES	**Manual Reset**

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

d.Err	**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.

S.Out	**Output Safety Value**

Output Value in case of input anomaly

hy.	**Control output hysteresis**
hy. C	**Cool output hysteresis**
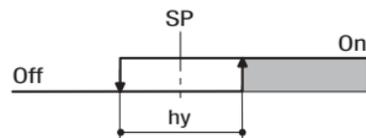
Control or alarm output hysteresis span, set in % of the full scale.

35

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 $\boxed{d.bnd}$ is the zone where it is possible to separate or overlap the Heat and Cool actions.
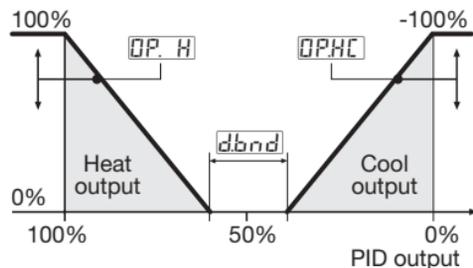
The Cool action can be adjusted using the relative cool gain parameter $\boxed{r.C.Gd}$.

To limit the Heat and Cool outputs the parameters $\boxed{OP.\ H}$ and $\boxed{OP.HC}$ can be used.

When there is an overlap, the displayed output $\boxed{OUt}$ shows the algebric sum of the Heat and Cool outputs.
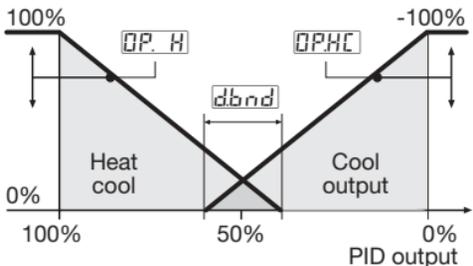
A   Heat /Cool actions separated
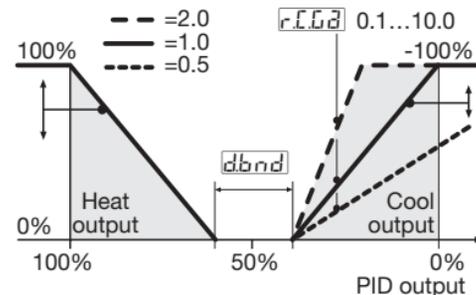Insert positive $\boxed{d.bnd}$ value (0…10%)

B   Heat /Cool actions overlapped
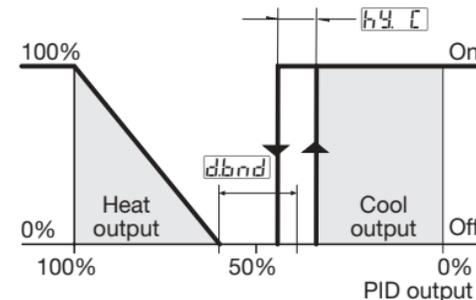Insert negative $\boxed{d.bnd}$ value (-10…0%)

C   Cool action adjusting
Example with different relative cool gains

D   On-Off Cool action

4.4.3 AUXILIARY PARAMETERS MENU

| $A1hy$ | **AL1 alarm hysteresis** |

| $A2hy$ | **AL2 alarm hysteresis** |

| $A3hy$ | **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.

| $A1L.b$ | **AL1, AL2, AL3 latching and blocking functions** |

| $A2L.b$ | |

| $A3L.b$ | |

For each alarm it is possible to select the following functions:
$nonE$ none;
$Ltch$ latching;
$bLoc$ blocking;
$Lt.bL$ both latching and blocking.
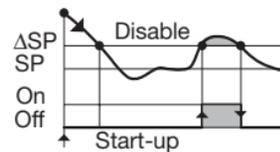
$Ltch$ ALARM ACKNOWLEDGE FUNCTION

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.
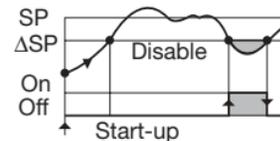
$bLoc$ START-UP DISABLING

Ramp down

Ramp up

ΔSP Threshold = SP $\pm$ range

4.4.3 AUXILIARY PARAMETERS MENU

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

Selecy the code 1 on $\boxed{O}$, $\boxed{P}$ or $\boxed{Q}$ configuration indexes (see pages 21 or 22). The following parameter is then available:

$\boxed{\text{t.L b d}}$ **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:
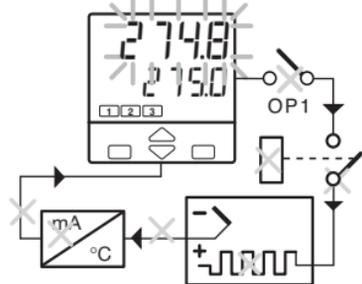
Setting OFF the alarm works as Sensor break with immediate action.

This condition is shown by means the red led of the selected alarm as well as:
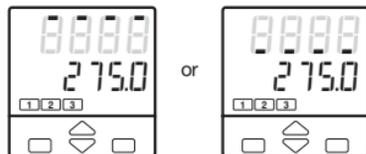
Note [1] In case of sensor break, condition, the alarm action is immediate.

$\boxed{\text{5t.0P}}$ **Soft-start control output value**

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

$\boxed{\text{5t.t n}}$ **Soft-start activation time**

Time duration (starting from the power on) of the Soft-start function.
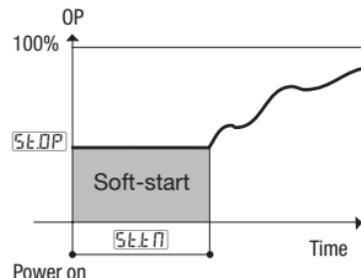
$\boxed{\text{t.F iL}}$ **Input filter time constant**

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

When this parameter is set to 0FF the filter is bypassed.

Filter response
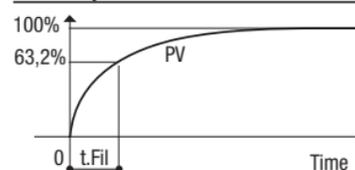
$\boxed{\text{In.Sh}}$ **Input shift**

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

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

$\boxed{Addr}$ **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.

$\boxed{r\,t.Lo}$ **Retransmission low range**
$\boxed{r\,t.Hi}$ **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 $\boxed{E}$ must be **2** (see page 19).

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

$\boxed{t.Mod}$ **Timer/Start-up operator mode**

⚠ **Selecting Timer or Start-up, the Soft-start function is disabled, therefore the parameters $\boxed{St.OP}$ and $\boxed{St.tN}$ 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 $\boxed{\quad 1}$ (see page 41).
Three parameters are associated to the Start-up function.

$\boxed{t.h.S.U}$ **Start-up hold time** 0…500 min

$\boxed{S.P.S.U}$ **Start-up Setpoint** (SP. L…SP. H)

$\boxed{OP.HS}$ **Control output high limit** 5.0%…100.0%

The Start-up function includes three phases:

1st "$Lin\,y$" - The control output is limited to the $\boxed{OP.HS}$;

2nd "$Hold$" - The process variable is maintained to the Start-up Setpoint for the time fixed by the parameter $\boxed{t.h.S.U}$;

3rd "OFF" - When the $\boxed{t.h.S.U}$ 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 ($\boxed{S.P.S.U}$ - 40 digits), the Start-up function starts again from the "$Lin\,y$" phase.

39

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** $\boxed{5.P.5U}$ **lower than the local Setpoint.**

The "$HoLd$" phase starts when the process variable PV achieves the $\boxed{5.P.5U}$ (with a tolerance of 1 digit).

B **Start-up Setpoint** $\boxed{5.P.5U}$ **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 $\boxed{5.P.5U}$ and the working Setpoint , the next phase ("$HoLd$" or "OFF") will be executed instead of the "$Lin9$" phase.

Start-up Setpoint

During the "$Lin9$" and "$HoLd$" phases the $\boxed{RUN}$ led is on.

A $\boxed{5.P.5U}$ **< local Setpoint SP**
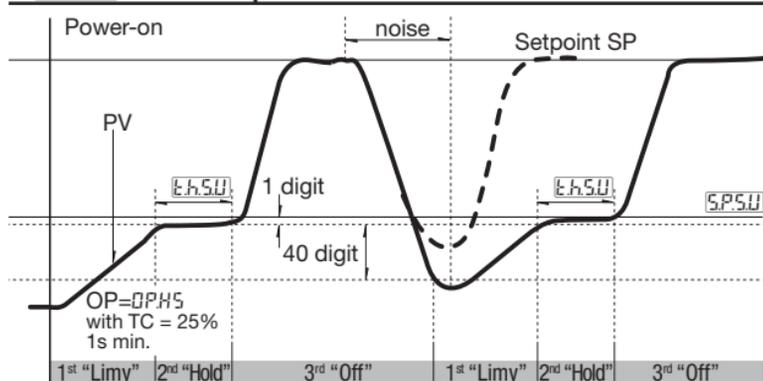
B $\boxed{5.P.5U}$ $\geq$ **Setpoint locale SP**
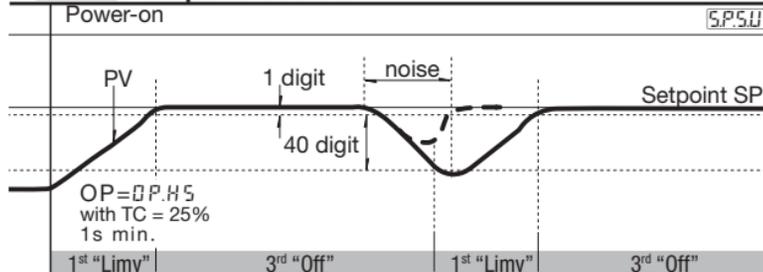
4.4.4.2 TIMER FUNCTION (OPTION)

⚠ **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 *0* 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.Mod` **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		*OFF*
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.Act` **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.ime` **Timer setting**

(1…9,999 s/min.)

`S.P.Sb` **Stand-by Setpoint**

(only for *t.Mod* = 7)
(*SP.L …SP.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.
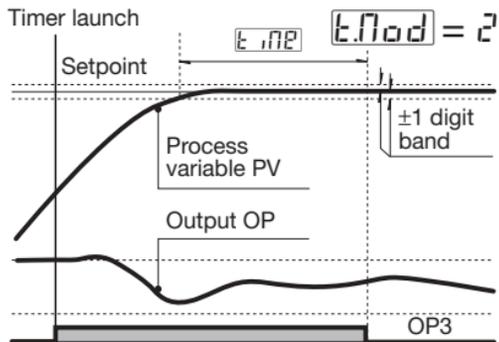
B - Counting start time inside the band, end with control output forced to zero.

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].

Note:
[1] When the Timer is not running the control output is forced to zero, also before the Timer launch
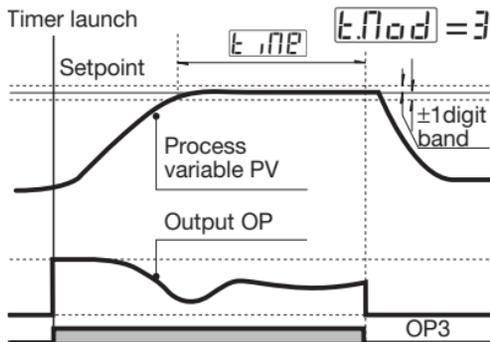
C - Counting start time = timer launch time, end in control mode.

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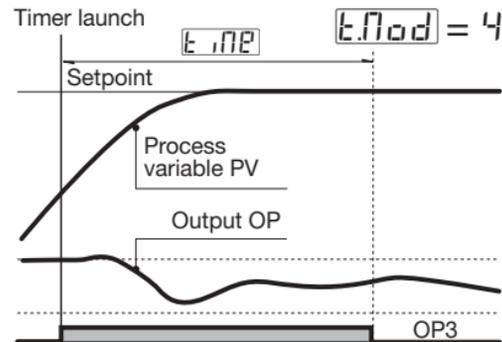
TIMER COUNTING MODES

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].

Timer launch $\boxed{E\,\Pi E}$ $\boxed{E.\Pi o d} = 5$

Setpoint

Process variable PV

Output OP

OP3

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.

Timer launch $\boxed{E\,\Pi E}$ $\boxed{E.\Pi o d} = 6$

Setpoint

Process variable PV

Output OP

OP3
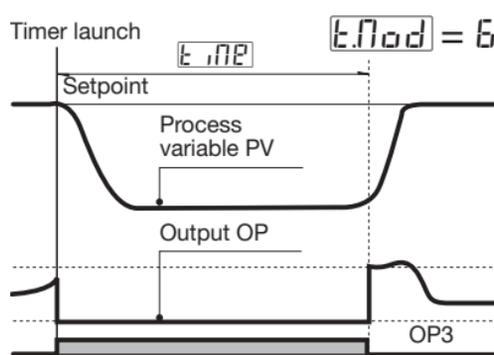
F - Control action with stand-by Setpoint during the counting time

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.

Timer launch $\boxed{E\,\Pi E}$ $\boxed{E.\Pi o d} = 7$

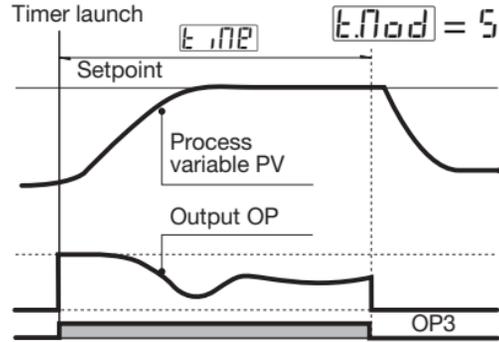Setpoint

Process variable PV

$\boxed{5.P.\ 2}$

Output OP

OP3

Note:
[1] When the Timer is not running the control output is forced to zero, also before the Timer launch.
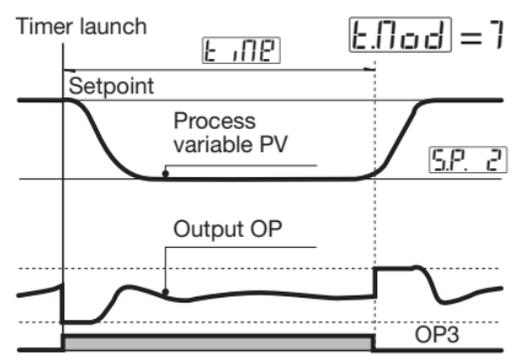
4.4.4.2 TIMER FUNCTION (OPTION)

POWER FAILURE

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

Depending on Timer action $\boxed{t.\bar{d}ct}$ selection, when the controller restarts you can have two different situations:
- with automatic mode ($\boxed{t.\bar{d}ct}$ = $2,3,6,7$), the Timer function starts again and the counting time is reinitialised.
- with manual mode ($\boxed{t.\bar{d}ct}$ = $0,1,4,5$), the control output is forced to zero, if $\boxed{t\Pi od}$ = 3 e 5; otherwise the control action restarts using the working Setpoint.

TIMER STARTING

See the Timer starting procedure at page 49.

DISPLAY

```
    850
■    850
□  ⇕  □
```

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

```
    850
    End
□  ⇕  □
```

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.

Operator mode and Timer running

Press until

Remaining time.

Counting stop.

Remaining time value

Value change

If set to ☐ the timer ends
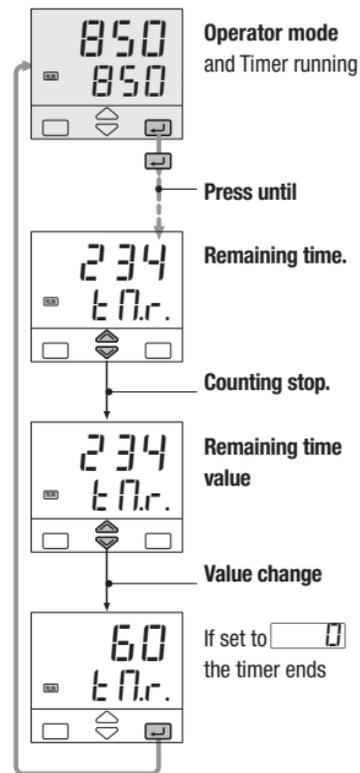
4.4.5 CONFIGURATION MENU

RETRANSMISSION

When OP5 output is present it retransmits linearised PV or SP. On configuration (see page 29) it is possible to set:

$\boxed{r\,\mathcal{C}t\,r}$ **Output range**
$0 - 20 / 4 - 20$

$\boxed{r\,t\,H}$ **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):

$\boxed{r\,t.L\,o}$ **Retransmission low range**

$\boxed{r\,t.H\,i}$ **Retransmission high range**

Example:
- T/C S, range 0…1600°C;
- Output range, 4…20 mA;
- Retransmitted signal PV on 800…1200°C range.
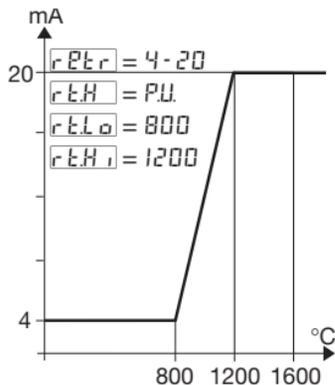
With $r\,t.L\,o$ greater than $r\,t.h\,i$ it is possible to obtain a reverse scale.

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:

$\boxed{Ht.F.S}$ **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 $\boxed{t.Cur}$ latches the last on time current value.

4.4.5 CONFIGURATION MENU

CURRENT TRANSFORMER INPUT

SERIAL COMMUNICATIONS

Example:
CT input on OP1, alarm on AL2 during on time (configuration digit $\boxed{P}$ = 8, see page 19).
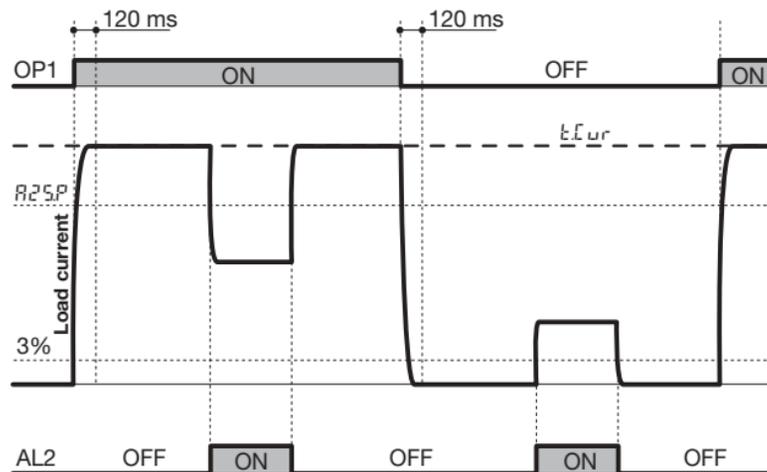
| $\boxed{Pr\ ot}$ | **Communication protocol** $\Pi.bu5/J.bu5$ |

| $\boxed{baud}$ | **Baud rate** $1200/2400$ $4800/9600$ |

5 DISPLAYS

5.1 OF THE PROCESS VARIABLES
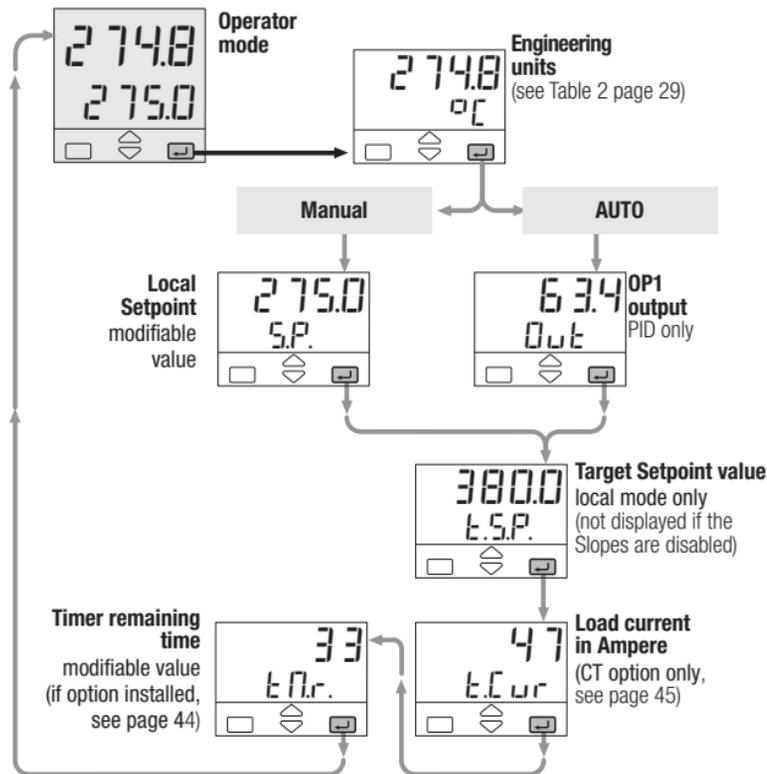
5.2 OF THE CONFIGURATION CODES
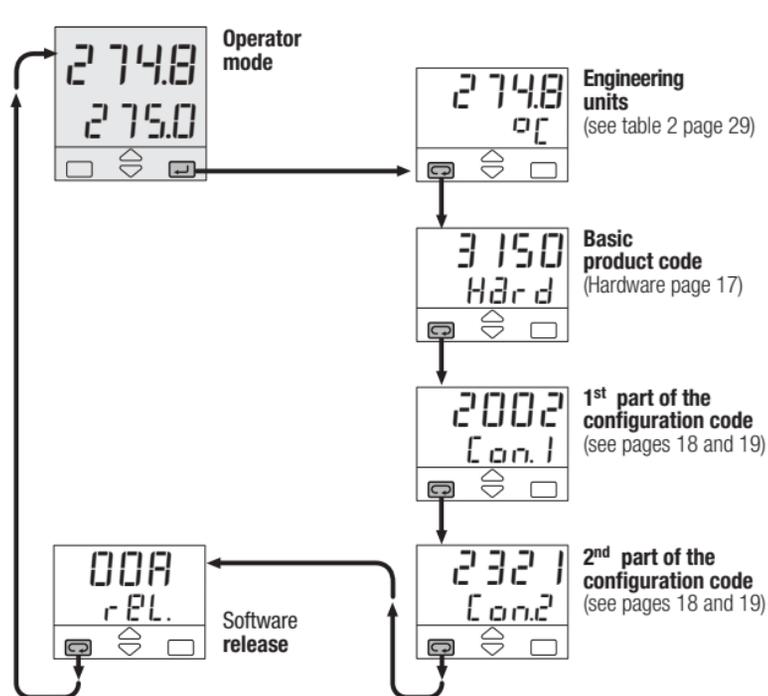
6 COMMANDS COMMANDS TO THE CONTROLLER AND OPERATING PHASES

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.

Operator mode

Example of Setpoint modification from 275 to 350

Modified Setpoint value

after 2 seconds

Flash momentarily the SP **value to confirm** that it has become operating. back to the operator mode
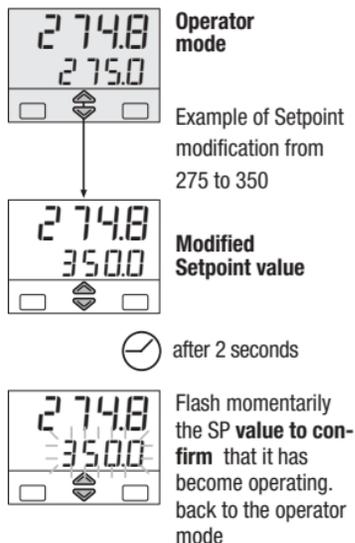
6.1.2   TIMER STARTING (option)

Depending on the Timer action $t.act$ 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:

Operator mode

Press until

To start
select $Strt$

To stop
select $StoP$
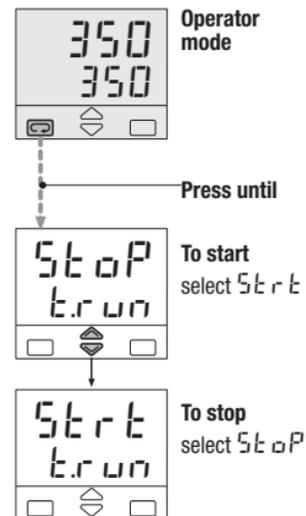
Press the key ⏎ to confirm

6.1 KEYPAD COMMANDS

6.1.3 LOC/ REM SELECTION
configuration index $\boxed{R}$ = 4 or 5)
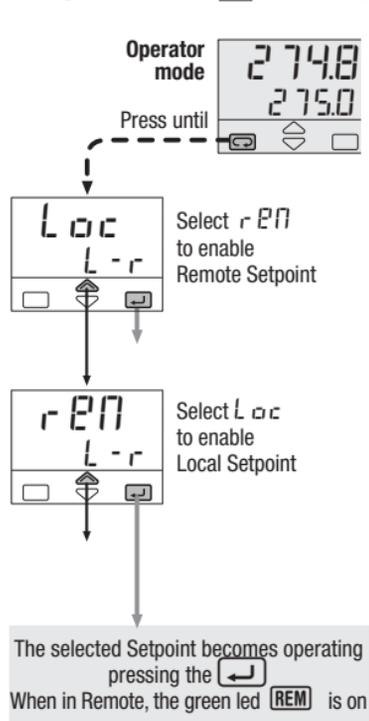
6.1.4 STORED SETPOINTS SELECTION
(configuration index $\boxed{R}$ = 1 or 2)

Operator mode
```
2 74.8
2 75.0
```
Press until

$L\ o\ c$
$L\ \text{-}\ r$
Select $r\ E\Pi$ to enable Remote Setpoint

$r\ E\Pi$
$L\ \text{-}\ r$
Select $L\ o\ c$ to enable Local Setpoint

The selected Setpoint becomes operating pressing the ⏎
When in Remote, the green led REM is on

```
2 74.8
2 75.0
```
Press until

Tracking
Index $\boxed{R}$ = 1

Stand-by
Index $\boxed{R}$ = 2

$n o n E$
$S.S.P L$

$L\ o\ c$
$S.S.P L$
The selected Setpoint becomes operating pressing the ⏎ key.
The corrisponding green led (**S 1** or **S 2**) is on

$S.P.\ 1$
$S.S.P L$
Select $S.P.\ 1$ to force the first Setpoint

$S.P.\ 1$
$S.S.P L$

Select $S.P.2$ to force the second Setpoint

Select $n o n E$ to free the Setpoint modification, then Press ⏝⏝ to change the local Setpoint

$S.P.\ 2$
$S.S.P L$

$S.P.\ 2$
$S.S.P L$
Select $L\ o\ c$ to come back to the previous local Setpoint value

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.

operator mode

```
Q1
    45.80  PV
    45.80  SP
```

Press simultaneously
for 2 seconds
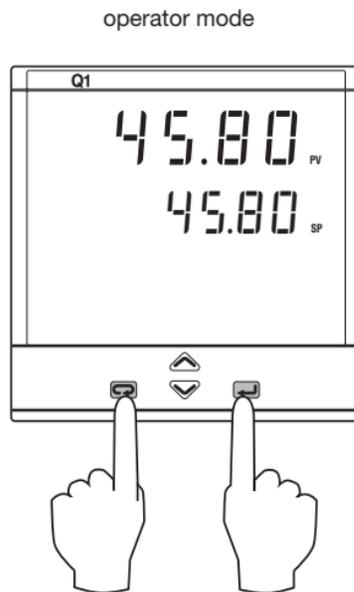
6.1.6 OUTPUTS LOCK

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.

operator mode

```
Q1
    45.80  PV
    45.80  SP
```

Press simultaneously
for 2 seconds
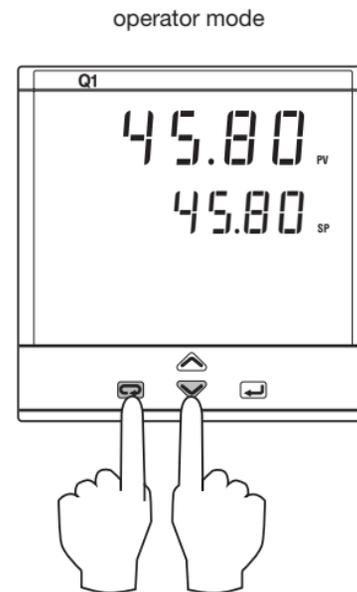
7 TECHNICAL SPECIFICATIONS

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: - 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 ∆T: R1+R2 must be <320Ω)	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) Input drift: 0.35°C/10°C T$_{env.}$ <0.35°C/10Ω 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	Max. wire Res.: 150Ω max. Input drift: <2µV/°C T$_{env.}$ <5µV/10Ω Wire Res.
	DC input (current)	4…20mA, 0...20mA with external shunt 2.5Ω Rj >10MΩ	Burnout. Engineering units Conf. decimal point position Init. Scale -999…9,999 Full Scale -999…9,999 (min. range of 100 digits)	Input drift: <0.1%/20°C T$_{env.}$
	DC input (voltage)	10…50mV, 0...50mV Rj >10MΩ		

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			Control output		AL1 alarm	AL2 alarm	AL3 alarm	Retransmiss.
Operating mode and Outputs	1 single or double action PID loop or On/Off with 1, 2 or 3 alarms	Single action	**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	$OFF = 0$
	Derivative time (D)	0.01…10.00 min	
	Error dead band	0.1…10.0 digit	
	Overshoot control	0.01…1.00	Single action PID algorithm
	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%	$OFF = 0$
	Output safety value	0.0…100.0% (-100.0…100.0% for Heat / Cool)	
	Control output hysteresis	0.1…10.0%	On-Off algorithm
	Dead band	-10.0…10.0%	Double action PID algorithm (Heat / Cool) with overlap
	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
				Band threshold	0…range
		Active low		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 ±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 3 years 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.

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■ ICONS TABLE

Main universal input	
TC	Thermocouple
Pt100	RTD (Pt100)
ΔT	Delta Temp (2x RTD)
mA V	mA and mV
Custom	Custom
Hz	Frequency

Auxiliary input	
	Current transformer
REM mA	mA Remote setpoint
REM V	Volt Remote setpoint
POT.	Feedback potentiometer

Digital input	
	Isolated contact
	NPN open collector
	TTL open collector

Setpoint	
LOC	Local
STAND BY	Stand-by
	Keypad lock
	Outputs lock
START UP	Start-up function
TIMER	Timer function
MEM	Memorized
REM	Remote
	Setpoint programmer

Digital input connected functions	
	Auto/Manual
RUN	Run, Hold, Reset and program selection
HOLD PV	PV hold
SP SLOPE	Setpoint slopes inhibition

Output	
	SPST Relay
	Triac
	SPDT Relay
mA	mA
mA V	mA mV
	Logic