K30

BLIND CONTROLLER AND MINI-PROGRAMMER

Engineering Manual

24/02 - Code: ISTR_M_K30-_E_03_--

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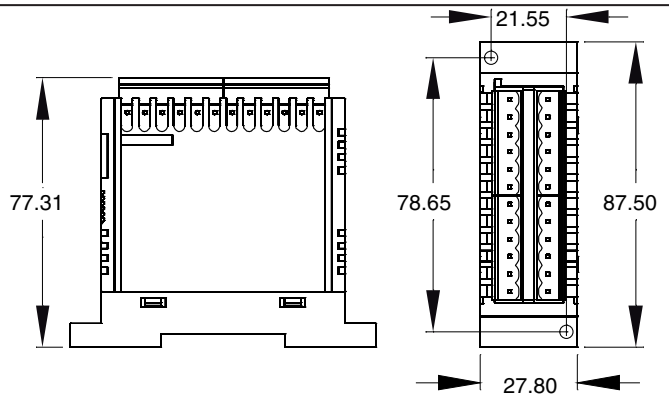
1. OUTLINE DIMENSIONS (mm)

1.1 Mounting requirements

This instrument is intended for permanent installation, for indoor use only, in an electrical panel, specific for a DIN rail mounting. Select a mounting location having the following characteristics:

1. It should be easily accessible;
2. There is minimum vibrations and no impact;
3. There are no corrosive gases;
4. There are no water or other fluid (i.e. condensation);
5. The ambient temperature is in accordance with the operative temperature (0... 50°C);
6. The relative humidity is in accordance with the instrument specifications (20... 85%).

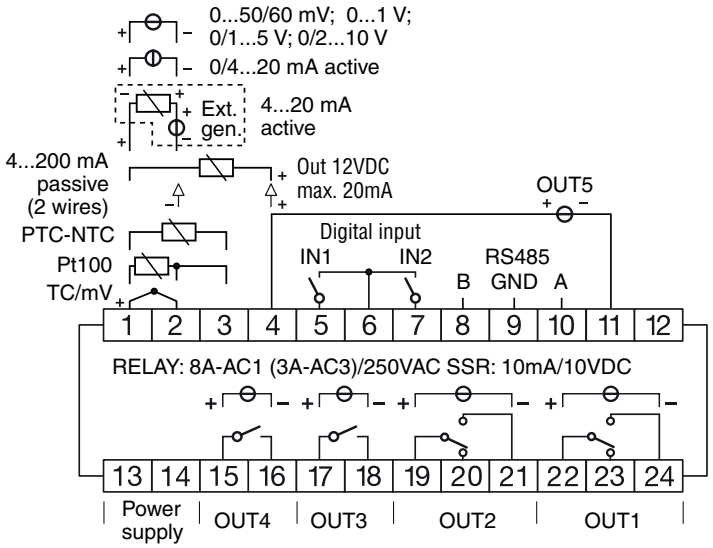
1.2 Dimensions



2. WIRING

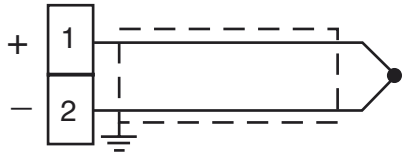
2.1 General notes about wiring

1. Do not run input wires together with power cables;
2. External components (like zener barriers, etc.) connected between sensor and input terminals may cause errors in measurement due to excessive and/ or not balanced line resistance or possible leakage currents.
3. When a shielded cable is used, the protective shield should be connected to ground at one only side.
4. Pay attention to the line resistance, a high line resistance may cause measurement errors.



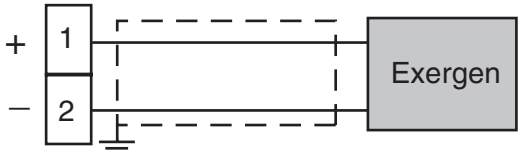
2.2 Inputs

2.2.1 Thermocouple Input



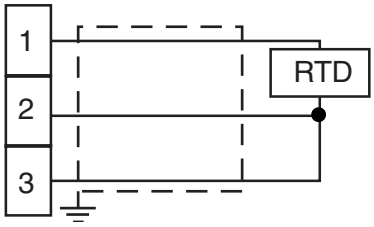
External resistance: 100 Ω max., maximum error 0.5% of span;
Cold junction: Auomatic compensation 0... 50°C;
Cold junction accuracy: 0.1°C/°C after a warm-up of 20 minutes;
Input impedance: > 1 MΩ;
Calibration: According to EN 60584-1.
Note: For TC wiring use proper compensating cable preferable shielded.

2.2.2 Infrared Sensor Input



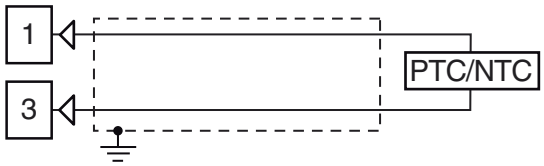
External resistance: Do not care condition;
Cold junction: Automatic compensation 0... 50°C;
Cold junction accuracy: 0.1°C/°C;
Input impedance: > 1 MΩ.

2.2.3 RTD (Pt100) Input



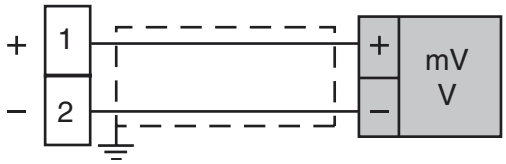
Input circuit: Current injection (135 μA);
Line resistance: Automatic compensation up to 20Ω/wire with maximum error ±0.1% of the input span;
Calibration: According to EN 60751/A2.
Note: The resistance of the 3 wires **must be the same**.

2.2.4 Thermistor Input



Input circuit: Current injection (25 μA);
Line resistance: Not compensated.

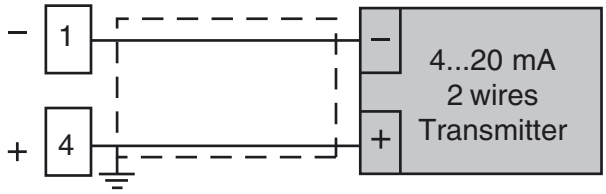
2.2.5 V and mV input



Input impedance: > 1 MΩ;
Accuracy: ±0.5% of Span ±1 digit @ 25°C.

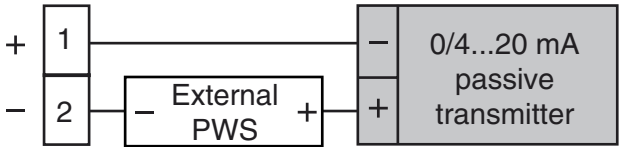
2.2.6 mA input

0/4... 20 mA input wiring for passive transmitter with internal power supply

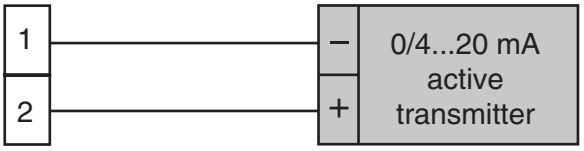


Input impedance: < 51Ω;
Accuracy: 0.5% of Span ±1 digit @ 25°C;
Protection: NOT protected from short-circuits;
Internal auxiliary PWS: 10 VDC (±10%), 20mA max..

0/4... 20 mA input wiring for passive transmitter using an external power supply

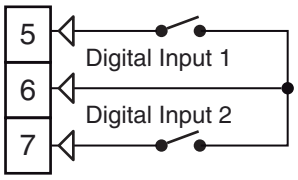


0/4... 20 mA input wiring for active transmitter



2.2.7 Logic Inputs

Digital input controlled by a free of voltage contact



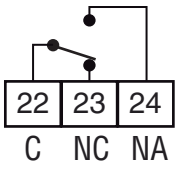
2.3 Outputs

Safety notes:

– To avoid electrical shock, connect power line at last;
– For supply connections use No. 16AWG or larger wires rated for at last 75°C;
– Use copper conductors only;
– SSR outputs are not isolated. A reinforced insulation must be assured by the external solid state relays.

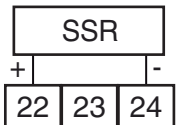
2.3.1 Output 1 (OP1)

Relay Output



Out 1 Contact rating: • 8 A/250 V cosφ = 1;
• 3 A/250 V cosφ = 0.4.
Operational life: 1 x 10^5.

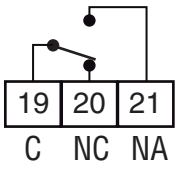
SSR Output



Logic level 0: Vout < 0.5 VDC;
Logic level 1: 12 V ± 20% @ 1 mA;
10 V ± 20% @ 20 mA.

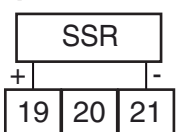
2.3.2 Output 2 (OP2)

Relay Output



Out2 Contact rating: • 8 A /250 V cosφ = 1;
• 3 A /250 V cosφ = 0.4.
Operational life: 1 x 10^5.

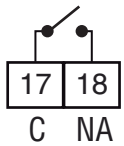
SSR Output



Logic level 0: Vout < 0.5 VDC;
Logic level 1: 12 V ± 20% @ 1 mA;
10 V ± 20% @ 20 mA.

2.3.3 Output 3 (OP3)

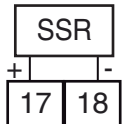
Relay Output



Contact rating: • 5 A /250 V cosφ = 1;
• 1 A /250 V cosφ = 0.4.

Operational life: 1 x 10^5.

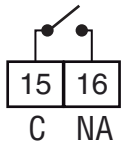
SSR Output



Logic level 0: Vout < 0.5 VDC;
Logic level 1: 12 V ± 20% @ 1 mA;
10 V ± 20% @ 20 mA.

2.3.4 Output 4 (OP4)

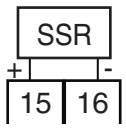
Relay Output



Contact rating: • 5 A /250 V cosφ = 1;
• 1 A /250 V cosφ = 0.4.

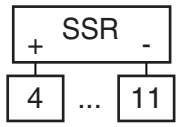
Operational life: 1 x 10^5.

SSR Output



Logic level 0: Vout < 0.5 VDC;
Logic level 1: 12 V ± 20% @ 1 mA;
10 V ± 20% @ 20 mA.

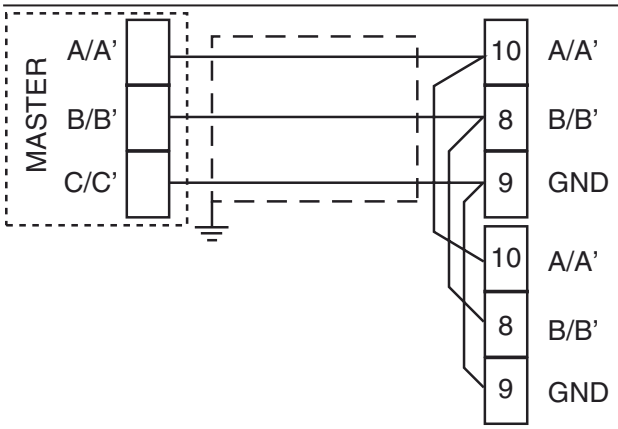
2.3.5 Output 5 (OP5)



Output electrical characteristic: 10mA/10VDC;
Logic level 0: Vout < 0.5 VDC;
Logic level 1: 12 V ± 20% @ 1 mA;
10 V ± 20% @ 20 mA.

Note: This output is not overload protected.

2.4 Serial Interface



Interface type: - Isolated (50 V) RS 485,
- Not isolated TTL;

Voltage levels: According to EIA standard;
Protocol type: MODBUS RTU;
Byte format: 8 bit without parity;
Stop bit: One;
Baud rate: Programmable: 1200... 38400 baud;
Address: Programmable: 1... 255.

Notes: **1.** RS-485 interface allows to connect up to 30 devices with one remote master unit;

2. The cable length must not exceed 1.5 km at 9600 baud;

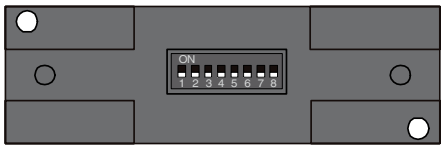
3. Follows the description of the signal sense of the voltage appearing across the interconnection cable as defined by EIA for RS-485.

– The **A** terminal of the generator must be negative with respect to the **B** terminal for a binary 1 (MARK or OFF) state;

– The **A** terminal of the generator must be positive with respect to the **B** terminal for a binary 0 (SPACE or ON)

4. This instrument allows to set serial link parameters (address and baud rate) in two different ways:

– **Programmable parameters:**all the DIP switches present in the back side of the instrument must be set to OFF:



The instrument uses the values programmed in [134] Add and [135] bAud parameters;

– **Fixed parameters:** The DIP switches present in the back side of the instrument must be set according to the following table:

DIP switch	Function
1	Address bit 0
2	Address bit 1
3	Address bit 2
4	Address bit 3
5	Address bit 4
6	Address bit 5
7	Baudrate bit 0
8	Baudrate bit 1

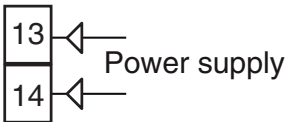
In other words:

– **Address** is a 6 bit binary word and uses a standard codification; e.g.: address 23 will be set by setting to ON the switches 5, 3, 2 and 1 (16 + 4 + 2 + 1 = 23);
– **Baud rate** is a 2 bit binary word but its values is described by the following table

Baud rate	DIP switch 7	DIP switch 8
2400	OFF	OFF
9600	ON	OFF
19200	OFF	ON
38400	ON	ON

Parameters [134] Add and [135] bAud become read only.

2.5 Power supply



Supply voltage: • 100... 240 VAC/DC (±10%), 50... 60 Hz;
• 24 VAC/DC (±10%).

Power consumption: 5VA max..

Notes:
1. Before connecting the instrument to the power line, make sure that line voltage is equal to the voltage shown on the identification label.
2. To avoid electrical shock, connect power line at the end of the wiring procedure.
3. For supply connections use No. 16 AWG or larger wires rated for at last 75°C.
4. Use copper conductors only.
5. The power supply input is NOT fuse protected. Provide a T type 1A, 250 V external fuse.

3. CHARACTERISTICS

3.1 Technical Specifications

Case: Plastic, self-extinguishing degree: V-0 according to UL 94;
Terminals protection: IP 20 according to EN 60070-1;
Installation: Rear panel on DIN rail;
Terminal block: 24-M3 screw terminals (cables with ∅0.64... 1.63 mm or AWG22... AWG14 with connection diagram);
Dimensions: (H x L x D): 75 x 33 x 75.5 mm;
Weight: 180g max.;
Power supply: 100... 240VAC (±10% of the nominal value) or 24 VAC/DC (±10% of the nominal value);
Power consumption: 5 VA max.;
Insulation voltage: 2.3 kV rms according to EN 61010-1;
Sampling time: 130 ms;
Resolution: 30000 counts;
Total accuracy: ±0.5% F.S.V. ±1 digit @ 25°C of ambient temperature;
Common mode rejection: 120 dB at 50/60 Hz;
Normal mode rejection: 60 dB at 50/60 Hz;
Electromagnetic compatibility/safety requirements:
Compliance: EMC directive 2004/108/EC (EN 61326-1), LV directive 2006/95/EC (EN 61010-1);
Installation category: II;
Pollution category: 2;
Temperature drift: It is part of the global accuracy;
Operating temperature: 0... 50°C (32... 122°F);
Storage temperature: -30... +70°C (-22...158°F),
Humidity: 20... 85% RH wit no condensation;
Protections: WATCH DOG (hardware/software) for the automatic restart.

4. HOW TO ORDER

Model
K30 - = Controller
K30T = Controller + timer
K30P = Controller + timer + programmer

Power supply
L = 24 V AC/DC
H = 100 to 240 VAC

Input/2 Digital Inputs (standard)
C = J, K, R, S, T, PT100, 0/12...60 mV
E = J, K, R, S, T, PTC, NTC, 0/12...60 mV
I = 0/4... 20 mA
V = 0... 1 V, 0/1... 5 V, 0/2... 10 V

Out 1/Out 5 SSR (standard)
R = Relay SPDT 8A on resistive load
O = VDC for SSR

Out 2
- = Not available
R = Relay SPDT 8A on resistive load
O = VDC for SSR

Out 3
- = Not available
R = Relay SPST-NO 5A on resistive load
O = VDC for SSR

Out 4
- = Not available
R = Relay SPST-NO 5A on resistive load
O = VDC for SSR

Communication
- = TTL Modbus
S = RS 485 and TTL ModBus

5. CONFIGURATION PROCEDURE

5.1 General notes about K30

K30 is a blind controller (with no display and keyboard) but it is equipped with two serial links.

– The first serial link is an RS485 and it is designed for a standard dialogue with a master unit (a supervisor, an HMI, a PLC, etc.).
– The second serial link (TTL type) is used to dialogue with a remote display. Three different display models are available with 1 or 2 rows - four digits display and a 4 keys keyboard.

All actions can be made by the remote display or the serial link.

– The actions made by serial link are not submitted to time-out or password, have an immediate effect and do not produces any visualization.
– On the contrary, the actions made by remote display (and keyboard) follow the same “strategy” of the front panel instrument of this series.

In the following pages we are going to describe all possible actions that you can do by a remote display.
We have selected the single display type.
The difference between a double row and a single row display is the possibility to see two values at the same time instead of one alternately to the second (e.g. a parameter code alternate to its value).

5.2 Introduction

When the instrument is powered ON, it starts immediately to work according to the parameters values loaded in memory. The instrument behaviour and its performance are governed by the value of the stored parameters.
At the first start up the instrument will use a “default” parameter set (factory parameter set); this set is a generic one (e.g. a TC J input is programmed).
We recommend you to change the operating parameters to suit your application (example: set the correct input sensor, define the control strategy, set alarms, etc.).
To change these parameters you need to enter the **Configuration procedure**.

[6] Unit (Engineering Unit) parameter allows to set the temperature units in accordance with the user needs (°C/°F).
Be careful! Do not change the Engineering Unit during process control as the temperature values inserted by the user (thresholds, limits etc.) are not automatically rescaled by the instrument.

5.2.1 Access levels to the parameter modifications and their password

The instrument has a complete set of parameters. We call it “*configuration parameter set*” (or “*configuration parameters*”).
The access to the configuration parameters is protected by a programmable password (password level 3).
The configuration parameters are divided into groups.
Each group collects all parameters relating to a particular function (e.g.: type of control, alarm, output functions).

Note: The instrument shows only the parameters consistent with the hardware and in accordance with the value previously assigned to parameters (e.g.: **Setting an output as “not used”** the **instrument masks all the the parameters** related to that output).

5.3 Instrument behaviour at Power ON

At Power ON the instrument can start in one of the following mode depending on its configuration:

Auto mode with no program functions:
– The display shows the measured value;
– The decimal point of the less significant digit is OFF;
– The instrument is performing the standard closed loop control.

Manual mode (oPLo):
– The display shows alternately the measured value and the message oPLo;
– The instrument performs **no Automatic control** at all;
– The control output is equal to 0% and can be manually changed using the buttons [▲] and [▼].

Stand by mode (St.bY):
– The display will show alternately the measured value and the message St.bY or od;
– The instrument performs **no control** (the control outputs are OFF);
– The instrument is working as an indicator.

Auto mode with automatic program start up:
The display shows one of the following information:
– The measured value;
– The operative set point (when it is performing a ramp);
– The time of the segment in progress (when it is performing a soak);
– The measured value alternated to the message St.bY;
– The decimal point of the less significant digit is always lit.

We define all the above described conditions as “**Standard Display**”.

5.4 Entering the configuration mode

1. Push the [P] button for more than 3 seconds. The display will show alternately PASS and 0
   Il display visualizzerà alternativamente PASS e 0.
2. Using [▲] and/or [▼] buttons, set the programmed password.

Notes:
1. The factory default password for configuration parameters is 30.
2. The parameter changes are protected by a time out. If no key is pressed for more than 10 s the instrument automatically returns back to the Standard display, the new value of the last selected parameter will be lost and the parameter modification procedure closed. Sometimes can be useful to enter the parameter configuration procedure with no timeout (e.g. the first time an instrument is configured). In this case, use a password equal to the previously set password + 1000 digits (e.g. 1000 + 30 [default] = 1030).
   It is always possible to manually end the parameter configuration procedure (see the next paragraph).
3. During parameter modification the instrument continues performing the control. In certain conditions, when a configuration change can produce a heavy bump to the process, it is advisable to temporarily stop the control procedure during the programming procedure (the control output will be OFF). In this case use a password equal to the previously set password + 2000 digits (e.g. 2000 + 30 [default] = 2030). The control procedure will automatically restart when the configuration procedure will be manually closed.

3. Press the [P] key. If the password is correct the display will show the acronym of the first parameter group preceded by the symbol ⊐.
   In other words the display will show: ⊐ inP.
   The instrument is in configuration mode.

5.5 Exiting the configuration mode

Press the [U] button for more than 5 seconds. The instrument will return to the normal display.

5.6 Keyboard functions during the parameter modification

[U] A short press of the button allows to exit the current parameter group and select a new parameter group.
A long press allows to close the configuration parameter procedure (the instrument returns to the **standard display**).

[P] When the display is showing a group, the key allows to enter in the selected group.
When the display is showing a parameter, the key allows you to store the value shown and go to the next parameter within the same group.

[▲] Allows to increase the value of the selected parameter.

[▼] Allows to decrease the value of the selected parameter.

Note: The group selection is cyclic as well as the selection of the parameters in a group.

5.7 Factory reset - Default parameters loading procedure

Sometimes, e.g. when you reconfigure an instrument previously used for other works or from other people or when you have made too many errors during configuration and you decided to reconfigure the instrument, it is possible to restore the factory configuration.
This action allows you to put the instruent in a defined condition (in the same condition it was at the first Power ON).
The default data are the typical values loaded in the instrument prior to shipping from factory. To load the factory default parameter set, proceed as follows:

4. Press the [P] key for more than 5 seconds;
5. The display will show alternately PASS and 0;
6. Using the [▲] and [▼] keys set the value -48 1;
7. Press the [P] key
8. The instrument turns OFF all the LEDs, then displays the message dFLt; at the end the controller turns ON all the diplay LEDs for 2 seconds and restarts as for a Power-OFF/Power-ON cicle.

The procedure is complete.

Note: The complete list of the default parameter is available in **Appendix A**.

5.8 All configuration parameters

In the following pages we are going to describe all the instrument parameters. However, **the instrument will only show the parameters applicable to its hardware** options in accordance with the specific instrument configuration (i.e.: Setting AL 1t [Alarm 1 type] = **nonE** [not used], all parameters related with the alarm 1 will be skipped).

⊐ inP group - Main and auxiliary input configuration

[2] SEnS - Input type

Available: Always.

Range:
- When the input type code is [C] (see **Order Code**):

J	TC J	(0... 1000°C/32... 1832°F);
crAL	TC K	(0... 1370°C/32... 2498°F);
S	TC S	(0... 1760°C/32... 3200°F);
r	TC R	(0... 1760°C/32... 3200°F);
t	TC T	(0... 400°C/32... 752°F);
ir.J	Exergen IRS J	(0... 1000°C/32... 1832°F);
ir.cA	Exergen IRS K	(0... 1370°C/32... 2498°F);
Pt1	RTD Pt 100	(-200... +850°C/-328... +1562°F);
0.50	0... 50 mV linear;	
0.60	0... 60 mV linear;	
12.60	12... 60 mV linear;	
SEr1	Measure from serial link (strategy 1) (**);	
SEr2	Measure from serial link (strategy 2) (***);	

- When the input type code is [E] :

J	TC J	(0... 1000°C/32... 1832°F);
crAL	TC K	(0... 1370°C/32... 2498°F);
S	TC S	(0... 1760°C/32... 3200°F);
r	TC R	(0... 1760°C/32... 3200°F);
t	TC T	(0... 400°C/32... 752°F);
ir.J	Exergen IRS J	(0... 1000°C/32... 1832°F);
ir.cA	Exergen IRS K	(0... 1370°C/32... 2498°F);
Ptc	PTC KTY81-121	(-55... +150°C/-67... +302°F);
ntc	NTC 103-AT2	(-50... +110°C/-58... +230°F);
0.50	0... 50 mV linear;	
0.60	0... 60 mV linear;	
12.60	12... 60 mV linear;	
SEr1	Measure from serial link (strategy 1) (**);	
SEr2	Measure from serial link (strategy 2) (***);	

- When the input type code is [I] :

0.20	0... 20 mA linear;
4.20	4... 20 mA linear;
SEr1	Measure from serial link (strategy 1) (**);
SEr2	Measure from serial link (strategy 2) (***);

- When the input type code is [V] :

0.1	0... 1 V linear;
0.5	0... 5 V linear;
1.5	1... 5 V linear;
0.10	0... 10 V linear;
2.10	2... 10 V linear;
SEr1	Measure from serial link (strategy 1) (**);
SEr2	Measure from serial link (strategy 2) (***);

(**) SEr1

This mode is designed for PLC interface. It requires that a master writes continuously a “measured” value.

Note: The master MUST send a WRITE command at address 200H or 1H even if the value is the same. If the instrument does NOT receive a write command on one of this two addresses for more than 5 seconds, shows “----” and will operate as for a burnout condition.

(***) SEr2

The previous mode is NOT usable when you use a supervisor or an operator panel. This kind of “master” does NOT “write” a value equal to the previous one. In other words, if the value does not change the master does not write in the specific location. The SEr2 operates as follows:
The instrument looks to the line activity and:

- If a correct line activity is present, considers the master as connected and works with the last received “measured” value.
- If NO activity or a wrong activity is detected for more than 5 seconds, the instrument operate as in presence of a burn out condition.

Notes: **1.** When a TC input is selected and a decimal point is programmed (see the next parameter) the maximum display value appears to be 999.9°C or 999.9°F.

2. Every change of SEnS parameter setting will force the following changes:
[3] dP = 0,
[4] SSc = -1999
[5] FSc = 9999

[3] dP - Decimal point position

Available: Always.
Range: When [2] SenS = Linear input or SEr: 0... 3;
When [2] SenS different from linear input: 0/1.
Note: All changes to the dP parameter setting will produce a change to all the parameters related with it (e.g. :set points, proportional band, etc.).

[4] SSc - Initial scale read-out for linear inputs

Available: When a linear input is selected by [2] SenS.
Range: -1999... 9999.
Notes: **1.** SSc defines, for linear inputs, the value displayed when the instrument measures the minimum measurable value. The instrument displays values up to 5% below the value set for SSc, for it will show an underrange error (uuuu).

2. It is possible to set an initial scale read-out higher than the full scale read-out in order to obtain a reverse read-out scaling [e.g.: 0 mA = 0 mBar and 20 mA = - 1000 mBar (vacuum)].

[4] SSc - Initial scale read-out for SEr inputs

Available: When SEr1 or SEr2 are selected by [2] SenS.
Range: -1999... 9999.
Notes: **1.** SSc defines the minimum value accepted from serial link.

2. When a value lower than SSc is received, the instrument shows uuuu (underrange).

[5] FSc - Full scale read-out for linear input

Available: When a linear input is selected by [2] SenS.
Range: -1999... 9999
Notes: **1.** FSC allows to define, for linear inputs, the value displayed when the instrument measures the maximum measurable value. The instrument will show a measured value up to 5% higher than [5] FSc value, above it will show an overrange error (oooo).

2. It is possible to set a full scale read-out lower than the initial scale read-out in order to obtain a reverse read-out scaling [e.g. 0 mA = 0 mBar and 20 mA = -1000 mBar (vacuum)].

[5] FSc - Full scale read-out for SEr inputs

Available: When SEr1 or SEr2 are selected by [2] SenS.
Range: -1999... 9999.
Notes: **1.** SSc allows to define the maximum value accepted from serial link.

2. When a value greater than SSc is received, the instrument shows oooo (overerrange).

[6] unit - Engineering unit

Available: When a temperature sensor is selected by [2] SenS parameter.
Range: **°c** Celsius;
°F Fahrenheit.

The instrument does not rescale the temperature values inserted by the user (thresholds, limits etc.).

[7] FiL - Digital filter on the measured value

Available: Always.
Range: oFF (No filter);
0.1... 20.0 s.
Note: This is a first order digital filter applied to the measured value. For this reason its setting influences the measured value, the control action and the alarms behaviour.

[8] inE - Selection of the Sensor Out of Range type that will enable the safety output value

Available: Always.
Range: our When an overrange or an underrange is detected, the output power will be forced to the value of [9] oPE parameter;
or When an overrange is detected, the output power will be forced to the value of [9] oPE parameter;
ur When an underrange is detected, the power output will be forced to the value of [9] oPE parameter.

[9] oPE - Safety output value

Available: Always.
Range: -100... 100% (of the output).
Notes: **1.** When the instrument is programmed as single action control (heat or cool), setting a value outside the available output range, the instrument will use zero value **e.g.:** When heat action only has been programmed, and oPE is equal to -50% (cooling) the instrument will use the zero value.

2. When ON/OFF control is programmed and an out of range is detected, the instrument will perform the safety output value using a fixed cycle time equal to 20 seconds.

[10] diF1 - Digital input 1 function

Available: When the instrument is equipped with digital inputs.
Range: oFF No function;
1 Alarm Reset [status];
2 Alarm acknowledge (ACK) [status];
3 Hold of the measured value [status];
4 Stand by mode of the instrument [status]. When the contact is closed the instrument operates in stand by mode;
5 **HEAt** with **SP1** and **CooL** with **SP2** [status] (see *Note about digital inputs*);
6 Timer Run/Hold/Reset [transition]. A short closure allows to start timer execution and to suspend it while a long closure (longer than 10 seconds) allows to reset the timer;
7 Timer Run [transition] a short closure allows to start timer execution;
8 Timer reset [transition] a short closure allows to reset timer count;
9 Timer run/hold [Status]:
- Contact close = timer RUN;

- Contact open = timer Hold;

10 Program Run [transition]. The 1st closure allows to start program execution but a 2nd closure re-starts the program execution from the beginning;
11 Program Reset [transition]. A contact closure allows to reset program execution;
12 Program Hold [transition]. The 1st closure allows to hold program execution and a 2nd closure continue program execution;
13 Program Run/Hold [status]. When the contact is closed the program is running;
14 Program Run/Reset [status].
- Contact closed - Program run;
- Contact open - Program reset;
15 Instrument in Manual mode (Open Loop)[status];
16 Sequential set point selection [transition] (see "Note about digital inputs");
17 SP1/SP2 selection [status];
18 Binary selection of the set point made by digital input 1 (less significant bit) and digital input 2 (most significant bit) [status];
19 Digital input 1 works in parallel with ▲ key while digital input 2 works in parallel with ▼ key;
20 Timer Run/Reset (status) with block at count-end (needs a Run command from serial port or digital input to restart);
21 Timer Run/Reset (status) with block.

[11] diF2 - Digital input 2 function

Available: When the instrument is equipped with digital inputs.
Range: oFF No function;

1 Alarm Reset [status];
2 Alarm acknowledge (ACK) [status];
3 Hold of the measured value [status];
4 Stand by mode of the instrument [status]. When the contact is closed the instrument operates in stand by mode;
5 **HEAt** with **SP1** and **CooL** with **SP2** [status] (see *Note about digital inputs*);
6 Timer Run/Hold/Reset [transition]. A short closure allows to start timer execution and to suspend it while a long closure (longer than 10 seconds) allows to reset the timer;
7 Timer Run [transition] a short closure allows to start timer execution;
8 Timer reset [transition] a short closure allows to reset timer count;
9 Timer run/hold [Status]:
- Contact close = timer RUN;
- Contact open = timer Hold;
10 Program Run [transition]. The 1st closure allows to start program execution but a 2nd closure re-starts the program execution from the beginning;
11 Program Reset [transition]. A contact closure allows to reset program execution;
12 Program Hold [transition]. The 1st closure allows to hold program execution and a 2nd closure continue program execution;
13 Program Run/Hold [status]. When the contact is closed the program is running;
14 Program Run/Reset [status].
- Contact closed - Program run;
- Contact open - Program reset;
15 Instrument in Manual mode (Open Loop)[status];
16 Sequential set point selection [transition] (see "Note about digital inputs");
17 SP1/SP2 selection [status];
18 Binary selection of the set point made by digital input 1 (less significant bit) and digital input 2 (most significant bit) [status];
19 Digital input 1 works in parallel with ▲ key while digital input 2 works in parallel with ▼ key;
20 Timer Run/Reset (status) with block at count-end (needs a Run command from serial port or digital input to restart);
21 Timer Run/Reset (status) with block.

Notes about the Digital Inputs:

1. When diF1 or diF2 = 5 the instrument operates as follows:
- When the contact is open, the control action is an **heating** action and the active set point is **SP1**;
- When the contact is closed, the control action is a **cooling** action and the active set point is **SP2**.

2. When diF1 = 18, diF2 is forced to 18 cannot perform another additional function.
3. When diF1 = diF2 = 18 the set point selection will be in accordance with the following table:

Digital Input 1	Digital Input 2	Operative Set Point
Off	Off	Set Point 1
On	Off	Set Point 2
Off	On	Set Point 3
On	On	Set Point 4

4. When diF1 = 19, diF2 is forced to 19 cannot perform another additional function.
5. When a option 16 is used, every closure of the logic input increase the value of SPAt (active set point) of one step. The selection is cyclic -> SP1 -> SP2 -> SP3 -> SP4.

OUt group - Output parameters

[12] oiF - Output 1 function

Available: Always.
Range:

nonE	Output not used. With this setting the status of the this output can be driven directly from serial link.
H.rEG	Heating output;
c.rEG	Cooling output;
AL	Alarm output;
t.out	Timer output;
t.HoF	Timer output - OFF when timer in Hold;
P.End	Program **End** indicator;
P.HLd	Program **Hold** indicator;
P. uit	Program **Wait** indicator;
P.run	Program **Run** indicator;
P.Et1	Program Event 1;
P.Et2	Program Event 2;
or.bo	Out-of-range or burn out indicator;
P.FAL	Power failure indicator;
bo.PF	Out-of-range, burn out and Power failure indicator;
diF1	The output repeats the digital input 1 status;
diF2	The output repeats the digital input 2 status;
St.By	Stand By status indicator;
on	Out 1 forced to ON.

Notes: **1.** When two or more outputs are programmed in the same way, these outputs will be driven in parallel.
2. The power failure indicator will be reset when the instrument detects an alarm reset command by

U key, digital input or serial link.

3. When no control output is programmed, all the relative alarm (when present) will be forced to nonE (not used).

[13] o1AL - Alarms linked up with Output 1

Available: When [12] o1F = AL.

Range: 0... 31 with the following rule:

+1 Alarm 1;
+2 Alarm 2;
+4 Alarm 3;
+8 Loop break Alarm;
+16 Sensor break alarm (burn out).

Example 1: Setting 3 (2 + 1) the output will be driven by alarm 1 and 2 (OR condition).

Example 2: Setting 13 (8 + 4 + 1) the output will be driven by alarm 1 + alarm 3 + loop break alarm.

[14] o1Ac - Output 1 Action

Available: When [12] o1F is different from nonE.

Range:

dir Direct action;
rEU Reverse action;
dir.r Direct action with reverse LED indication;
rEU.r Reversed action with reverse LED indication.

Notes:

1. **Direct action:** the output repeats the status of the driven element.
   Example: the output is an alarm output with direct action. When the alarm is ON, the relay will be energized (logic output 1).
2. **Reverse action:** the output status is the opposite of the status of the driven element.
   Example: the output is an alarm output with reverse action. When the alarm is OFF, the relay will be energized (logic output 1). This setting is usually named “fail-safe” and it is generally used in dangerous process in order to generate an alarm when the instrument power supply goes OFF or the internal watchdog starts.

[15] o2F - Output 2 function

Available: When the instrument has the Output 2 option.

Range:

nonE Output not used. With this setting the status of the this output can be driven directly from serial link.
H.rEG Heating output;
c.rEG Cooling output;
AL Alarm output;
t.out Timer output;
t.HoF Timer output - OFF when timer in Hold;
P.End Program **End** indicator;
P.HLd Program **Hold** indicator;
P. uit Program **Wait** indicator;
P.run Program **Run** indicator;
P.Et1 Program Event 1;
P.Et2 Program Event 2;
or.bo Out-of-range or burn out indicator;
P.FAL Power failure indicator;
bo.PF Out-of-range, burn out and Power failure indicator;
diF1 The output repeats the digital input 1 status;
diF2 The output repeats the digital input 2 status;
St.By Stand By status indicator;
on Output 2 forced to ON.

For further details see [12] o1F parameter.

[16] o2AL - Alarms linked up with Output 2

Available: When [15] o2F = AL.

Range: 0... 31 with the following rule:

+1 Alarm 1;
+2 Alarm 2;
+4 Alarm 3;
+8 Loop break Alarm;
+16 Sensor break alarm (burn out).

For further details see [13] o1.AL parameter.

[17] o2Ac - Output 2 Action

Available: When [15] o2F ≠ nonE.

Range:

dir Direct action;
rEU Reverse action;
dir.r Direct action with reverse LED indication;
rEU.r Reversed action with reverse LED indication.

For further details see [14] o1.Ac parameter.

[18] o3F - Output 3 function

Available: When the instrument has the Output 3 option.

Range:

nonE Output not used. With this setting the status of the this output can be driven directly from serial link.
H.rEG Heating output;
c.rEG Cooling output;
AL Alarm output;
t.out Timer output;
t.HoF Timer output - OFF when timer in Hold;
P.End Program **End** indicator;
P.HLd Program **Hold** indicator;
P. uit Program **Wait** indicator;
P.run Program **Run** indicator;
P.Et1 Program Event 1;
P.Et2 Program Event 2;
or.bo Out-of-range or burn out indicator;
P.FAL Power failure indicator;
bo.PF Out-of-range, burn out and Power failure indicator;
diF1 The output repeats the digital input 1 status;
diF2 The output repeats the digital input 2 status;
St.By Stand By status indicator;
on Output 3 forced to ON.

For further details see [12] o1F parameter.

[19] o3AL - Alarms linked up with Output 3

Available: When [18] o3F = AL.

Range: 0... 31 with the following rule:

+1 Alarm 1;
+2 Alarm 2;
+4 Alarm 3;
+8 Loop break Alarm;
+16 Sensor break alarm (burn out).

For further details see [13] o1.AL parameter.

[20] o3Ac - Output 3 Action

Available: When [18] o3F ≠ nonE.

Range:

dir Direct action;
rEU Reverse action;
dir.r Direct action with reverse LED indication;
rEU.r Reversed action with reverse LED indication.

For further details see [14] o1.Ac parameter.

[21] o4F - Output 4 function

Available: When the instrument has the Output 4 option.

Range:

nonE	Output not used. With this setting the status of the this output can be driven directly from serial link.
H.rEG	Heating output;
c.rEG	Cooling output;
AL	Alarm output;
t.out	Timer output;
t.HoF	Timer output - OFF when timer in Hold;
P.End	Program **End** indicator;
P.HLd	Program **Hold** indicator;
P. uit	Program **Wait** indicator;
P.run	Program **Run** indicator;
P.Et1	Program Event 1;
P.Et2	Program Event 2;
or.bo	Out-of-range or burn out indicator;
P.FAL	Power failure indicator;
bo.PF	Out-of-range, burn out and Power failure indicator;
diF1	The output repeats the digital input 1 status;
diF2	The output repeats the digital input 2 status;
St.By	Stand By status indicator;
on	Output 4 forced to ON.

For further details see [12] o1F parameter.

[22] o4AL - Alarms linked up with Output 4

Available: When [21] o4F = AL.

Range: 0... 31 with the following rule:

+1	Alarm 1;
+2	Alarm 2;
+4	Alarm 3;
+8	Loop break Alarm;
+16	Sensor break alarm (burn out).

For further details see [13] o1.AL parameter.

[23] o4Ac - Output 4 Action

Available: When [21] o4F ≠ nonE.

Range:

dir	Direct action;
rEU	Reverse action;
dir.r	Direct action with reverse LED indication;
rEU.r	Reversed action with reverse LED indication.

For further details see [14] o1.Ac parameter.

[24] o5F - Output 5 function

Available: When the instrument has the Output 5 option.

Range:

nonE	Output not used. With this setting the status of the this output can be driven directly from serial link.
H.rEG	Heating output;
c.rEG	Cooling output;
AL	Alarm output;
t.out	Timer output;
t.HoF	Timer output - OFF when timer in Hold;
P.End	Program **End** indicator;
P.HLd	Program **Hold** indicator;
P. uit	Program **Wait** indicator;
P.run	Program **Run** indicator;
P.Et1	Program Event 1;
P.Et2	Program Event 2;
or.bo	Out-of-range or burn out indicator;
P.FAL	Power failure indicator;
bo.PF	Out-of-range, burn out and Power failure indicator;
diF1	The output repeats the digital input 1 status;
diF2	The output repeats the digital input 2 status;
St.By	Stand By status indicator;
on	Output 5 forced to ON.

For further details see [12] o1F parameter.

[25] o5AL - Alarms linked up with Output 5

Available: When [24] o5F = AL.

Range: 0... 31 with the following rule:

+1	Alarm 1;
+2	Alarm 2;
+4	Alarm 3;
+8	Loop break Alarm;
+16	Sensor break alarm (burn out).

For further details see [13] o1.AL parameter.

[26] o5Ac - Output 5 Action

Available: When [24] o5F ≠ nonE.

Range:

dir	Direct action;
rEU	Reverse action;
dir.r	Direct action with reverse LED indication;
rEU.r	Reversed action with reverse LED indication.

For further details see [14] o1.Ac parameter.

AL 1 group - Alarm 1 parameters

[27] AL 1t - Alarm 1 type

Available: Always.

Range:

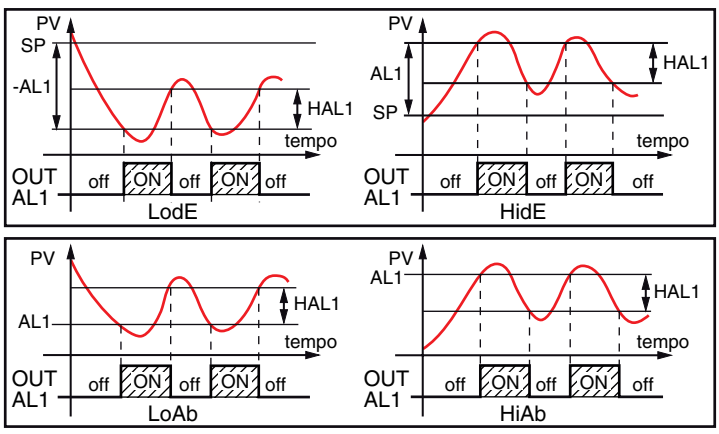
- When one or more outputs are programmed as control output:

nonE	Alarm not used;
LoAb	Absolute low alarm;
HiAb	Absolute high alarm;
LHAb	Absolute band alarm (window alarm);
SE.br	Sensor break;
LodE	Deviation low alarm (relative);
HidE	Deviation high alarm (relative);
LHdE	Relative band alarm.

- When no output is programmed as control output:

nonE	Alarm not used;
LoAb	Absolute low alarm;
HiAb	Absolute high alarm;
LHAb	Absolute band alarm (window alarm);
SE.br	Sensor break.

Notes: **1.** The relative and deviation alarms are “relative” to the operative set point value.



2. The sensor break alarm (SE.br) will be activated when the display shows ----.

[28] Ab 1 - Alarm 1 function

Available: When [27] AL1t ≠ nonE.

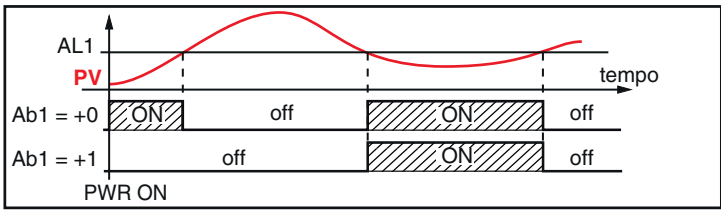
Range: 0... 15 with the following rule:

+1 Not active at power up;
+2 Latched alarm (manual reset);
+4 Acknowledgeable alarm;
+8 Relative alarm not active at set point change.

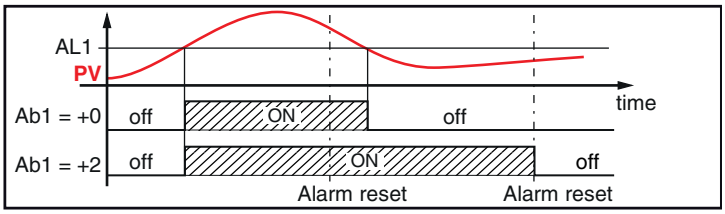
Example: setting Ab1 equal to 5 (1+4) the alarm 1 will be "*Not active at power up*" and "*Acknowledgeable*".

Notes: **1.** The "*Not active at power up*" selection allows to inhibit the alarm function at instrument power up or when the instrument detects a transfer from:
- Manual mode (oPLo) to auto mode
- Stand-by mode to auto mode.

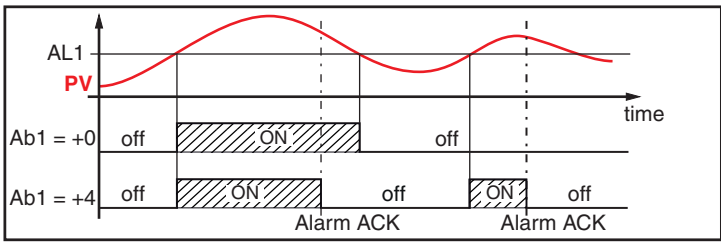
The alarm will be automatically enabled when the measured value reaches, for the first time, the alarm threshold plus or minus the hysteresis (in other words, when the initial alarm condition disappears).



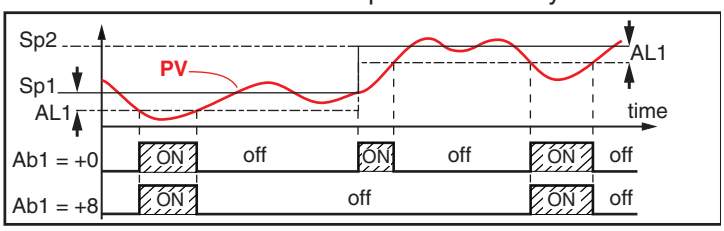
2. A "*Latched alarm*" (manual reset) is an alarm that remains active even if the conditions that generated the alarm no longer persist. Alarm reset can be done only by an external command (U button, digital inputs or serial link).



3. An "*Acknowledgeable*" alarm is an alarm that can be reset even if the conditions that generated the alarm are still present. Alarm acknowledge can be done only by an external command (U button, digital inputs or serial link).



4. A "*Relative alarm not active at set point change*" is an alarm that masks the alarm condition after a set point change until process variable reaches the alarm threshold plus or minus hysteresis.



5. The instrument does not memorize the alarm status in EEPROM. For this reason, the alarm status will be lost if a power down occurs.

[29] AL iL - For High and low alarms AI1L is the low limit of the AL1 threshold - For band alarm AI1 is the low alarm threshold

Available: When [27] AL1t ≠ nonE or [27] AL1t ≠ SEbr.

Range: -1999... [30] AL1H engineering units.

[30] AL iH - For High and low alarms, AL1H is the high limit of the AL1 threshold - For band alarm AL1H is the high alarm threshold

Available: When [27] AL1t ≠ nonE or [27] AL1t ≠ SEbr.

Range: [29] AL1L... 9999 engineering units.

[31] AL 1 - Alarm 1 threshold

Available: When:
- [27] AL1t = LoAb Absolute low alarm;
- [27] AL1t = HiAb Absolute high alarm;
- [27] AL1t = LodE Deviation low alarm (relative);
- [27] AL1t = LidE Deviation high alarm (relative).

Range: [29] AL1L... [30] AL1H engineering units.

[32] HAL 1 - Alarm 1 hysteresis

Available: When [27] AL1t ≠ nonE or [27] AL1t ≠ SEbr.

Range: 1... 9999 in engineering units.

Notes: **1.** The hysteresis value is the difference between the Alarm threshold value and the point the Alarm automatically resets.

2. When the alarm threshold plus or minus the hysteresis is out of input range, the instrument will not be able to reset the alarm.
Example: Input range: 0... 1000 (mBar).
- Set point equal to 900 (mBar);
- Deviation low alarm equal to 50 (mBar);
- Hysteresis equal to 160 (mBar);

the theoretical reset point is
900 - 50 + 160 = 1010 (mBar)
but this value is out of range.
The reset can be made only by turning the instrument OFF, removing the condition wich generated the alarm and turning the instrument ON again.

3. All band alarms use the same hysteresis value for both thresholds.

4. When the hysteresis of a band alarm is bigger than the programmed band, the instrument will not be able to reset the alarm.
Example: Input range: 0... 500 (°C).
- set point equal to 250 (°C);
- relative band alarm;
- Low threshold equal to 10 (°C);
- High threshold equal to 10 (°C);
- Hysteresis equal to 25 (°C).

[33] AL id - Alarm 1 delay

Available: When [27] AL1t ≠ nonE.

Range: From oFF (0) to 9999 seconds.

Note: The alarm goes ON only when the alarm condition persists for a time longer than [33] AL1d time but the reset is immediate.

[34] AL io - Alarm 1 enabling during Stand-by mode and out of range indications

Available: When [27] AL1t ≠ nonE.

Range: 0 Alarm 1 disabled during Stand by and out of range;
1 Alarm 1 enabled in stand by mode;

2 Alarm 1 enabled in out of range condition;
3 Alarm 1 enabled in stand by mode and in out of range condition.

AL2 group - Alarm 2 parameters

[35] AL2t - Alarm 2 type

Available: Always.
Range: • When one or more outputs are programmed as control output:
nonE Alarm not used;
LoAb Absolute low alarm;
HiAb Absolute high alarm;
LHAb Absolute band alarm (window alarm);
SE.br Sensor break;
LodE Deviation low alarm (relative);
HidE Deviation high alarm (relative);
LHdE Relative band alarm.
• When no output is programmed as control output:
nonE Alarm not used;
LoAb Absolute low alarm;
HiAb Absolute high alarm;
LHAb Absolute band alarm (window alarm);
SE.br Sensor break.
Note: The relative alarm are "relative" to the current set point (this may be different to the Target setpoint if you are using the ramp to set point function).

For further details see [27] AL1t parameter.

[36] Ab2 - Alarm 2 function

Available: When [35] AL2t ≠ nonE.
Range: 0... 15 with the following rule:
+1 Not active at power up;
+2 Latched alarm (manual reset);
+4 Acknowledgeable alarm;
+8 Relative alarm not active at set point change.
Example: Setting Ab2 equal to 5 (1 + 4) the alarm 2 will be "*Not active at power up*" and "*Acknowledgeable*".

For further details see [28] Ab1 parameter.

[37] AL2L - For High and low alarms AL2L is the low limit of the AL2 threshold - For band alarm AL2L is the low alarm threshold

Available: When [35] AL2t ≠ nonE or [35] AL2t ≠ SE.br.
Range: From -1999 to [38] AL2H in engineering units.

[38] AL2H - For High and low alarms AL2H is the high limit of the AL2 threshold - For band alarm AL2H isthe high alarm threshold

Available: When [35] AL2t ≠ nonE or [35] AL2t ≠ SE.br.
Range: From [37] AL2L to 9999 in engineering units.

[39] AL2 - Alarm 2 threshold

Available: When:
- [35] AL2t = LoAb Absolute low alarm;
- [35] AL2t = HiAb Absolute high alarm;
- [35] AL2t = LodE Deviation low alarm (relative);
- [35] AL2t = LidE Deviation high alarm (relative).

Range: From [37] AL2L to [38] AL2H in engineering units.

[40] HAL2 - Alarm 2 hysteresis

Available: When [35] AL2t ≠ nonE or [35] AL2t ≠ SE.br.
Range: 1... 9999 in engineering units.
For other details see [32] HAL1 parameter.

[41] AL2d - Alarm 2 delay

Available: When [35] AL2t ≠ nonE.
Range: From oFF (0) to 9999 seconds.
Note: The alarm goes ON only when the alarm condition persist for a time longer than [38] AL2d time but the reset is immediate.

[42] AL2o - Alarm 2 enabling during Stand-by mode and out of range indications

Available: When [35] AL2t ≠ nonE.
Range: 0 Alarm 2 disabled during Stand by and out of range;
1 Alarm 2 enabled in stand by mode;
2 Alarm 2 enabled in out of range condition;
3 Alarm 2 enabled in stand by mode and in out of range condition.

AL3 group - Alarm 3 parameters

[43] AL3t - Alarm 3 type

Available: Always.
Range: • When one or more outputs are programmed as control output:
nonE Alarm not used;
LoAb Absolute low alarm;
HiAb Absolute high alarm;
LHAb Absolute band alarm (window alarm);
SE.br Sensor break;
LodE Deviation low alarm (relative);
HidE Deviation high alarm (relative);
LHdE Relative band alarm.
• When no output is programmed as control output:
nonE Alarm not used;
LoAb Absolute low alarm;
HiAb Absolute high alarm;
LHAb Absolute band alarm (window alarm);
SE.br Sensor break.
Note: The relative alarm are "relative" to the current set point (this may be different to the Target setpoint if you are using the ramp to set point function).

For further details see [27] AL1t parameter.

[44] Ab3 - Alarm 3 function

Available: When [43] AL3t ≠ nonE.
Range: 0... 15 with the following rule:
+1 Non attivo all'accensione (mascherato);
+2 Allarme memorizzato (riarmo manuale);
+4 Allarme tacitabile;
+8 Allarme relativo non attivo al cambio di Set Point.
Example: Setting Ab3 equal to 5 (1 + 4) the alarm 3 will be "*Not active at power up*" and "*Acknowledgeable*".

For further details see [28] Ab1 parameter.

[45] AL3L - For High and low alarms AL3L is the low limit of the AL3 threshold - For band alarm AL3L is the low alarm threshold

Available: When [43] AL3t ≠ nonE or [43] AL3t ≠ SE.br.
Range: From -1999 to [46] AL3H in engineering units.

[46] AL3H - For High and low alarms AL3H is the high limit of the AL3 threshold - For band alarm AL3H isthe high alarm threshold

Available: When [43] AL3t ≠ nonE or [43] AL3t ≠ SE.br.
Range: From [45] AL3L to 9999 in engineering units.

[47] AL3 - Alarm 3 threshold

Available: When:
- [43] AL3t = LoAb Absolute low alarm;
- [43] AL3t = HiAb Absolute high alarm;
- [43] AL3t = LodE Deviation low alarm (relative);
- [43] AL3t = LidE Deviation high alarm (relative).

Range: From [45] AL3L to [46] AL3H in engineering units.

[48] HAL3 - Alarm 3 hysteresis

Available: When [43] AL3t ≠ nonE or [43] AL3t ≠ SEbr.
Range: 1... 9999 in engineering units.
for other details see [32] HAL1 parameter.

[49] AL3d - Alarm 3 delay

Available: When [43] AL3t ≠ nonE.
Range: From oFF (0) to 9999 seconds.
Note: The alarm goes ON only when the alarm condition persist for a time longer than [49] AL3d time but the reset is immediate.

[50] AL3o -Alarm 3 enabling during Stand-by mode and out of range indications

Available: When [43] AL3t ≠ nonE.
Range: 0 Alarm 3 disabled during Stand by and out of range;
1 Alarm 3 enabled in stand by mode;
2 Alarm 3 enabled in out of range condition;
3 Alarm 3 enabled in stand by mode and in out of range condition.

LbA group - Loop break alarm parameters

General note about LBA alarm

The LBA operate as follows:

When you apply 100 % of the power output to a process, the process variable, after a time due to the process inertia, begins to change in a known direction (increases for an heating action or decreases for a cooling action).

Example: Applying the 100% of the power output to a furnace, the temperature must go up unless one of the component in the loop is faulty (heater, sensor, power supply, fuse, etc...)..

The same philosophy can be applied to the minimum power. In our example, when I turn OFF the power to a furnaces, the temperature must go down, if not the SSR is in short circuit, the valve is jammed, etc..

LBA function is automatically enabled when the PID requires the maximum or the minimum power.

When the process response is slower than the programmed limit the instrument generates an alarm.

Notes:
1. When the instrument is in manual mode, the LBA function is disabled.
2. When LBA alarm is ON the instrument continue to perform the standard control. If the process response come back into the programmed limit, the instrument reset automatically the LBA alarm.
3. This function is available only when the programmed control algorithm is equal to PID (Cont = PID).

[51] LbAt - LBA time

Available: When [55] Cont = PID.
Range: oFF LBA not used;
1... 9999 seconds.

[52] LbSt -ΔT used by LBA during Soft-start

Available: When [51] LbAt ≠ oFF.
Range: oFF Loop break alarm is inhibit during soft start;
1... 9999 in engineering units.

[53] LbAS -ΔT used by loop break alarm (loop break alarm step)

Available: When [51] LbAt ≠ oFF.
Range: 1... 9999 in engineering units.

[54] LbcA - Conditions for LBA enabling

Available: When [51] LbAt ≠ oFF.
Range: uP Enabled when the PID requires the max. power only;
dn Enabled when the PID requires the min. power only;
both Enabled in both condition (when the PID requires the maximum or the minimum power).

LBA application example:

– LbAt (time LBA) = 120 seconds (2 minutes);
– LbAS (delta LBA) = 5°C.

The machine has been designed in order to reach 200°C in 20 minutes (20°C/min).

When the PID demand 100 % power, the instrument starts the time count.

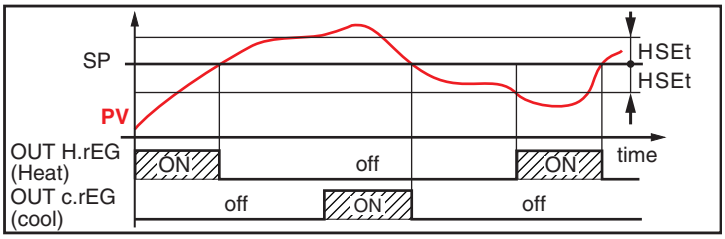
During time count if the measured value increases more than 5°C, the instrument restarts the time count. Otherwise if the measured value does not reach the programmed delta (5°C in 2 minutes) the instrument will generate the alarm.

rEG group - Control parameters

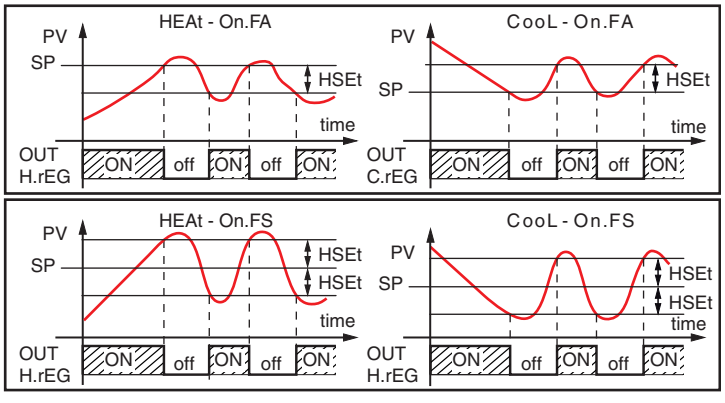
The rEG group will be available only when at least one output is programmed as control output (H.rEG or C.rEG).

[55] cont - Control type

Available: When at least one output is programmed as control output (H.rEG or C.rEG).
Range: • When 2 control actions (heat and cool) are programmed:
Pid PID (heat and cool);
nr Heat/Cool ON/OFF control with neutral zone.



• When one control action (H.rEG **or** c.rEG) is programmed:
Pid PID (heat or cool);
On.FA ON/OFF asymmetric hysteresis;
On.FS ON/OFF symmetric hysteresis.



Notes: 1. ON/OFF control with asymmetric hysteresis:
- OFF when PV ≥ SP;

- ON when PV ≤ (SP - hysteresis).

2. ON/OFF control with symmetrical hysteresis
- OFF when PV ≥ (SP + hysteresis);
- ON when PV ≤ (SP - hysteresis).

[56] AuEo - Auto tune selection

Ascon Tecnologic has developed 3 auto-tune algorithms:

1. The **oscillating auto-tune** is the usual auto-tune and:
- Is more accurate;
- Can start even if PV is close to the set point;
- Can be used even if the set point is close to the ambient temperature.

2. The **FAST auto-tune** is suitable when:
- The process is very slow and you want to be operative in a short time;
- When an high overshoot is not acceptable;
- In multi loop machinery where the fast method reduces the calculation error due to the effect of the other loops.

Note: Fast auto-tune can start only when the measured value (PV) is lower than (SP + 1/2 SP).

3. The **EvoTune** is suitable when:
- There is no information about the process;
- There is no information about the user's ability;
- It is necessary to perform the Autotune calculation independently of the starting conditions (e.g. change of the set point during the execution of the autotune, etc.).

Available: When [55] cont = PId.

Range: -4... 8 dove:

-4	Oscillating auto-tune with automatic restart at power up (after soft start) and after all set point change;
-3	Oscillating auto-tune with manual start;
-2	Oscillating auto-tune with automatic start at 1st power up only;
-1	Oscillating auto-tune with automatic restart at all power ups;
0	Not used;
1	Fast auto tune with automatic restart at all power ups;
2	Fast auto-tune with automatic start at 1st power up only;
3	Fast auto-tune with manual start;
4	Fast auto-tune with automatic restart at power up (after soft start) and after a set point change;
5	EvoTune with automatic restart at all power up;
6	EvoTune with automatic start at 1st power up only;
7	EvoTune with manual start;
8	EvoTune with automatic restart after all set point changes.

Nota: All auto-tune algorithms are inhibited during program execution.

[57] AuEr - Manual start of the auto-tune

Available: When [55] cont = PId.

Range:

oFF	The instrument is not performing the auto-tune;
on	The instrument is performing the auto-tune.

[58] SELF - Self-tune enable

The self-tuning is an adaptive algorithm able to continuously optimize the PID parameter values. This algorithm is specifically designed for all process subjected to big load variation able to change heavily the process response.

Available: When [55] cont = PId.

Range:

OFF	Self-tuning non active;
on	Self-tuning active.

[59] HSEt - Hysteresis of the ON/OFF control

Available: When [55] cont ≠ PID.

Range: 0... 9999 in engineering units.

[60] cPdt - Tempo protezione compressore

Available: When [55] cont = nr.

Range: OFF protection disabled;
1... 9999 seconds.

[61] Pb - Proportional band

Available: When [55] cont = PId and [58] SELF = no.

Range: 1... 9999 in engineering units.

Note: Auto-tune functions calculate this value.

[62] int - Integral time

Available: When [55] cont = PId and [58] SELF = no.

Range: OFF Integral action excluded;
1... 9999 seconds;
inF Integral action excluded.

Note: Auto-tune functions calculate this value.

[63] dEr - Derivative time

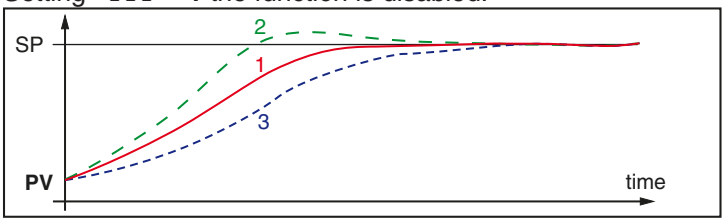
Available: When [55] cont = PId and [58] SELF = no.

Range: oFF Azione derivativa esclusa;
1... 9999 seconds.

Note: Auto-tune functions calculate this value.

[64] Fuoc - Fuzzy overshoot control

This parameter reduces the overshoot usually present at instrument start up or after a set point change and it will be active only in this two cases.
Setting a value between 0.00 and 1.00 it is possible to slow down the instrument action during set point approach.
Setting Fuoc = **1** the function is disabled.



Available: When [55] cont = PId and [58] SELF = no.

Range: 0... 2.00.

Note: Fast auto-tune calculates the Fuoc parameter while the oscillating one sets Fuoc = **0.5**.

[65] HAct - Heating output (H.rEG) actuator

This parameter sets the minimum cycle time of the heating output. It aims to respect the minimum cycle time of a specific actuator in order to assure a long actuator life.

Available: When at list one output has been programmed to be the heating output (H.rEG), [55] cont = PId and [58] SELF = no.

Range:

SSr	Solid state relay output (SSR);
rELY	Relay or contactor;
SLou	Slow actuator (like burners).

Note: Setting:
- **SSr** = No limit is applied to the [66] tcrH parameter and it is pre-set equal to 1 second;
- **rELY** = The [66] tcrH parameter is limited to 20 seconds and [66] tcrH is pre-set equal to 20 seconds;
- **SLou** = The [66] tcrH parameter is limited to 40 seconds and [66] tcrH is pre-set equal to 40 seconds.

[66] tcrH - Cycle time of the heating output

Available: When at least one output has been programmed to be the heating output (H.rEG), [55] cont = P id and [58] SELF = no.

Range:
- When [65] H.Act = SSr: 1.0... 130.0 seconds;
- When [65] H.Act = reLY: 20.0... 130.0 seconds;
- When [65] H.Act = SLou: 40.0... 130.0 seconds.

Note: Auto-tune functions calculate this value, but, when necessary, it can be set manually.

[67] PrAt -Power ratio between heating and cooling action (relative cooling gain)

The instrument uses the same PID parameter set for heat and for cool action but the efficiency of the two actions are usually different.
This parameter allows to define the ratio between the efficiency of the heating system and the efficiency of the cooling one. An example will help us tu explain you the philosophy.
Consider one loop of a plastic extruder.
The working temperature is equal to 250°C.
When you want to increase the temperature from 250 to 270°C (ΔT 20°C) using 100% of the heating power (resistor), you will need 60 seconds.
On the contrary, when you want to decrease the temperature from 250 to 230°C (ΔT 20°C) using 100% of the cooling power (fan), you will need 20 seconds only.
In our example the ratio is equal to 60/20 = 3 ([63] PrAt = 3) and it means that the efficiency of the cooling system is 3 times more efficient of the heating one.

Available: When 2 control actions have been programmed (H.rEG and c.rEG), [55] cont = P id and [58] SELF = no.

Range: 0.01... 99.99.

Note: Auto-tune functions calculate this value.

[68] cAct - Cooling output (C.rEG) actuator

Available: When at list one output has been programmed to be the cooling output (c.rEG), [55] cont = P id and [58] SELF = no.

Range:
SSr Solid state relay output (SSR);
rELY Relay or contactor;
SLou Slow actuator (like compressors).

Note: To have more details, see parameter [65] h.Act.

[69] tcrc - Cycle time of the cooling output

Available: When at list one output has been programmed to be the cooling output (c.rEG), [55] cont = P id and [58] SELF = no.

Range:
- When [68] c.Act = SSr: 1.0... 130.0 s;
- When [68] c.Act = reLY: 20.0... 130.0 s;
- When [68] c.Act = SLou: 40.0... 130.0 s.

Note: Auto-tune functions calculate this value, but, when necessary, it can be set manually.

[70] rS - Manual reset (integral pre-load)

It allows to drastically reduce the undershoot due to a hot restart. When your process is steady, the instrument operates with a steady power output (e.g. 30%).
If a short power down occurs, the process restarts with a process variable close to the set point while the instrument starts with an integral action equal to zero.
Setting a manual reset equal to the average power output (in our example 30 %) the instrument will start with a power output equal to the value it will use at steady state (instead of zero) and the undershoot will become very little (in theory equal to zero).

Available: When [55] cont = P id and [58] SELF = no.

Range: -100.0... 100.0%.

[71] rohL - Minimum power for heating outputs

Available: When at least one output has been programmed to be the heating output (H.rEG) and [55] cont = P id.

Range: From 0 to [72] roh.h (%).

[72] rohh - Maximum power for heating outputs

Available: When at least one output has been programmed to be the heating output (H.rEG) and [55] cont = P id.

Range: From [71] roh.L to 100 (%).

[73] rocL - Minimum power for cooling outputs

Available: When at list one output has been programmed to be the cooling output (c.rEG) and [55] cont = P id.

Range: From 0 to [74] roc.h (%).

[74] roch - Maximum power for cooling output

Available: When at list one output has been programmed to be the cooling output (c.rEG) and [55] cont = P id.

Range: From [73] roc.L to 100 (%).

[75] oPSh -Heating output max. rate of rise

Available: When at least one output has been programmed to be the heating output (H.rEG) and [55] cont = P id.

Range: 1... 50%/s + inF = step transfer.

[76] oPSc -Cooling output max. rate of rise

Available: When at list one output has been programmed to be the cooling output (c.rEG) and [55] cont = P id.

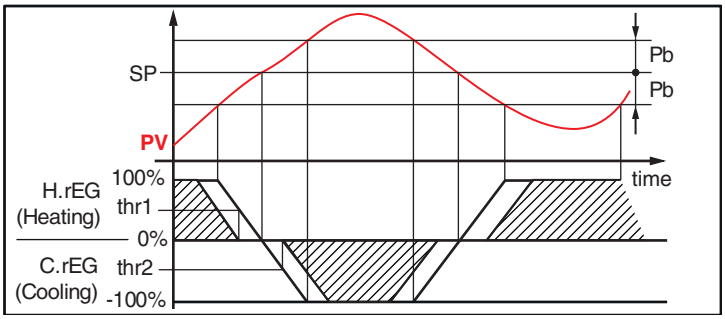
Range: 1... 50%/s + inF = step transfer.

General notes about the SPLIT RANGE function

The use of this function is only possible if the PID control is dual function and can be used to delay or bring forward the intervention of the actuators commanded by the instrument.
Using this function it is therefore possible to optimise the intervention of the two actuators in such a way that their actions do not overlap or so that they overlap so that they obtain the mix of the two actions of the actuators.
Basically, this means setting two power offsets (one for direct action and one for reverse action) that set the beginning of the intervention of the actuator commanded by the output.
The parameters that can be set for this function contained in the group rEG are:

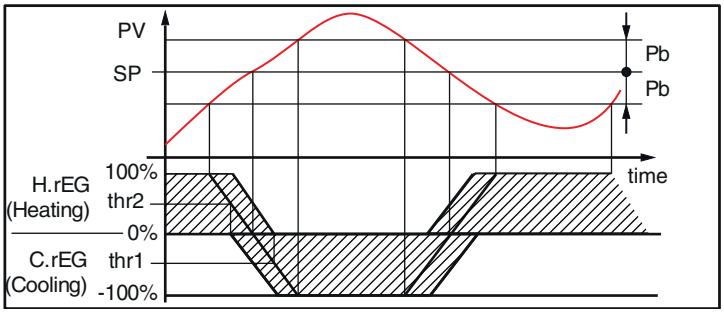
thr1 Power threshold at which output H.rEG begins to operate.
thr2 Power threshold at which output C.rEG begins to operate.

Basically, if one wishes to bring forward the reverse action (H.rEG) and delay the direct action (C.rEG) it is necessary to set positive values on parameter **thr1** and negative values on parameter **thr2**.
In this way, the area within which the two outputs are not activated at the same time is increased.

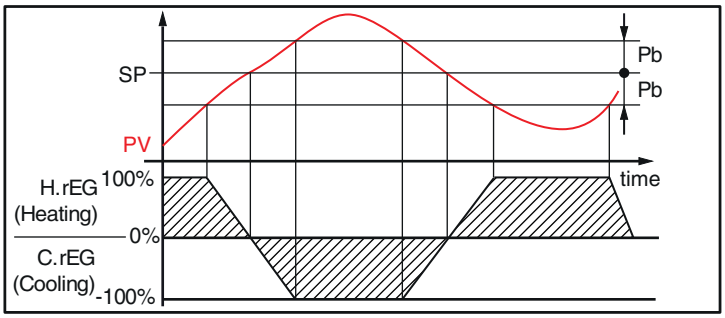


Vice-versa, to extend the reverse action (H.rEG) and bring forward the direct action (C.rEG) it is necessary to set nega-

tive values to parameter **thr1** and positive values to parameter **thr2**.
In this way, the area within which the two outputs are activated at the same time is increased.



The split range function is deactivated by setting **thr1** and **thr2** = 0.



Note: In order to simplify the explanation of the example graphs a dual action control that is only proportional (and therefore with dEr and Int = **OFF**) with PrAt = **1.0** and rS = **0.0** was considered.

[77] thrH - Power threshold at which output H.rEG begins to operate

Available: When two control action are programmed (H.rEG and c.rEG), [55] cont = P Id and [58] SELF = no.
Range: -50... 50%.

[78] thrC - Power threshold at which output C.rEG begins to operate

Available: When two control action are programmed (H.rEG and c.rEG), [55] cont = P Id and [58] SELF = no.
Range: -50... 50%.

[79] od - Delay at power up

Available: When at list one output is programmed as control output.
Range: oFF: Function not used;
0.01... 99.59 hh.mm.
Notes: **1.** This parameter defines the time during which (after a power up) the instrument remains in stand by mode before to start all other function (control, alarms, program, etc.).
2. When a program with automatic start at power up and od function are programmed, the instrument performs od function before to start the program execution.
3. When an auto-tune with automatic start at power up and od function are programmed, the od function will be aborted and auto-tune will start immediately.

[80] StP - Maximum output power used during soft start

Available: When at list one output is programmed as control output and [55] cont = P Id.
Range: -100... 100%.
Notes: **1.** When StP parameter have a **positive** value, the limit will be applied to the **heating** output(s) only.
2. When St.P parameter have a **negative** value, the limit will be applied to the **cooling** output(s) only.
3. When a program with automatic start at power up and soft start function are programmed, the instrument performs both functions at the same time. In other words, the program performs the first ramp, while the requested power is lower than the limit the instrument operates as usual, when the PID requires more then the limit the power output will be limited.
4. The auto-tune function inhibits the soft start function.

[81] SSt - Soft start time

Available: When at list one output is programmed as control output and [55] cont = P Id.
Range: oFF Function not used;
0.01... 7.59 hh.mm;
inF Soft start always active.

[82] SStH - Threshold for soft start disabling

Available: When at list one output is programmed as control output and [55] cont = P Id.
Range: -1999... 9999 in engineering units.
Notes: **1.** When the power limiter have a **positive** value (the limit is applied to the **heating** action) the soft start function will be aborted when the measured value is **greater or equal to** SStH parameter.
2. When the power limiter have a **negative** value (the limit is applied to the **cooling** action) the soft start function will be aborted when the measured value is **lower or equal to** SStH parameter.

2SP group - Set point parameters

The 2SP group will be available only when at least one output is programmed as control output (HrEG or CrEG).

[83] nSP - Number of used set points

Available: When at list one output is programmed as control output.
Range: 1... 4.
Note: Changing the value of this parameter, the instrument operates as follows:
- [90] SPAt parameter will be forced to **SP1**.
- The instrument verifies that all used set points are within the limits programmed by [84] SPLL and [85] SPHL.
- If a set point is out of this range, the instrument forces it to the limit more closed to it.

[84] SPLL - Minimum set point value

Available: When at list one output is programmed as control output.
Range: From -1999 to [85] SPHL in engineering units.
Notes: **1.** Changing the [83] SPLL value, the instrument checks all local set points ([86] SP1, [87] SP2, [88] SP3 and [89] SP4 parameters) and all set points of the program ([104] Pr.S1, [109] Pr.S2, [114] Pr.S3, [119] Pr.S4 parameters);

2. If a Set Point is lower than the minimum value set by [84] SPLL, it is forced to the value of [84] SPLL.

3. A change to [84] SPLL produces the following actions:

- When [91] SP.rt = SP the remote set point will be forced to be equal to the active set point.
- When [91] SP.rt = trim the remote set point will be forced to zero;
- When [91] SP.rt = PErc the remote set point will be forced to zero.

[85] SPHL *- Maximum set point value*

Available: When at list one output is programmed as control output.

Range: From [84] SPLL to 9999 (E.U.).

Note: For other details see [84] SPLL parameter.

[86] SP 1 *- Set Point 1*

Available: When at list one output is programmed as control output.

Range: From [84] SPLL to [85] SPHL (E.U.).

[87] SP 2 *- Set Point 2*

Available: When at list one output is programmed as control output and [83] nSP > 1.

Range: From [84] SPLL to [85] SPHL in engineering units.

[88] SP 3 *- Set Point 3*

Available: When at list one output is programmed as control output and [83] nSP > 2.

Range: From [84] SPLL to [85] SPHL in engineering units.

[89] SP 4 *- Set Point 4*

Available: When at list one output is programmed as control output and [83] nSP = 4.

Range: From [84] SPLL to [85] SPHL in engineering units.

[90] SPAt *- Active Set Point selection*

Available: When at list one output is programmed as control output.

Range: From SP1 to [83] nSP.

Notes: **1.** A [90] SPAt change produces the following actions:

- When [91] SP.rt = SP - the remote set point will be forced to be equal to the active set point;
- When [91] SP.rt = trin - the remote set point will be forced to zero;
- When [91] SP.rt = PErc - the remote set point will be forced to zero;

2. SP2, SP3 and SP4 selection will be shown only if the relative set point is enabled (see [83] nSP parameter).

[91] SP.rt *- Remote Set Point Type*

These instrument will communicate with each other, using RS485 serial interface without a PC. An instrument can be set as a Master while the other are (as usual) Slave units. The Master unit can send his operative set point to the slave units. In this way, for example, it is possible to change simultaneously the set point of 20 instruments by changing the set point of the master unit (e.g. hot runner application).

SP.rt parameter defines how the slaves units will use the value coming from serial link.

The [136] tr.SP [Selection of the value to be retransmitted (Master)] parameter allows to define the value sent by master unit.

Available: When at least one output is e programmed as control output and the serial interface is present.

Range: rSP The value coming from serial link is used as remote set point (RSP);

trin The value coming from serial link will be algebraically added to the local set point selected by SPAt and the sum becomes the operative set point;

PErc The value coming from serial will be scaled on the input range and this value will be used as remote set point.

Note: An [91] SPrt change produces the following actions:

- when [91] SP.rt = rSP - the remote set point will be forced to be equal to the active set point;
- When [91] SP.rt = trin - the remote set point will be forced to zero;
- When [91] SP.rt = PErc - the remote set point will be forced to zero:

Esempio:

A 6 zone reflow-oven for PCB.

The master unit sends its set point value to 5 other zones (slave controllers).

The Slave zones use it as a set point Er in.

The first zone is the master zone and it uses a set point equal to 210°C,

The second zone has a local set point = - 45°;

The third zone has a local set point = - 45°,

The fourth zone has a local set point = - 30°,

The fifth zone has a local set point = + 40°,

The sixth zone has a local set point = + 50°

In this way, the thermal profile will be:

– Master SP = 210°C;

– Second zone SP = 210 -45 = 165°C;

– Third zone SP = 210 - 45 = 165°C;

– Fourt zone SP = 210 - 30 = 180°C;

– Fifth zone SP = 210 + 40 = 250°C;

– Sixth zone SP = 210 + 50 = 260°C.

Changing the SP of the master unit, all the other slave units will immediately change their operative set point.

[92] SPLr *- Local/remote Set Point Selection*

Available: When at list one output is programmed as control output.

Range: Loc Local set point selected by [90] SPAt;

rEn Remote set point (coming from serial link).

[93] SP.u *- Rate of rise for positive set point change (ramp up)*

Available: When at list one output is programmed as control output.

Range: 0.01... 99.99 units per minute;

inF Ramp disabled (Step transfer).

[94] SP.d *- Rate of rise for negative set point change (ramp down)*

Available: When at list one output is programmed as control output.

Range: 0.01... 99.99 units per minute;

inF Ramp disabled (step transfer).

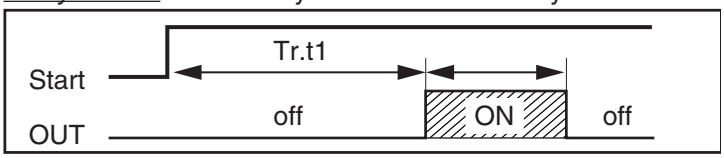
General note about remote set point

When the remote set point (RSP) with trim action is programmed, the local set point range becomes the following: from [84] SPLL+ RSP to [85] SPHL - RSP.

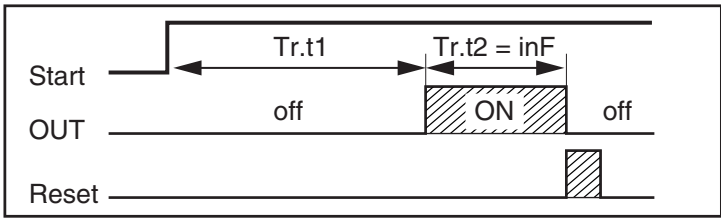
tim group - Timer function parameters

Five timer types are available:

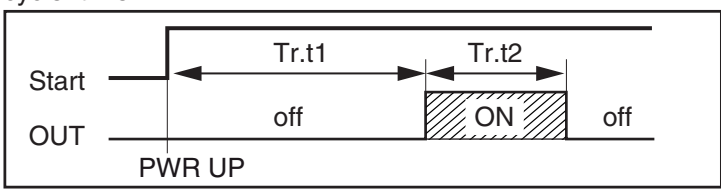
Delayed start with a delay time and a “end of cycle” time.



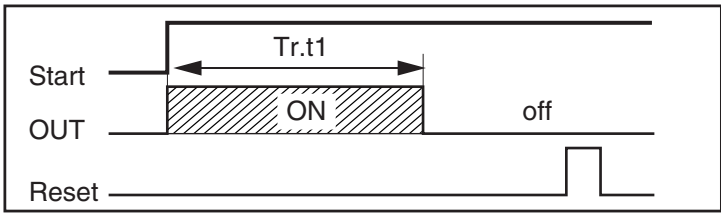
– Setting tr.t2 = **Inf** the timer output remains in ON condition until a reset command is detected.



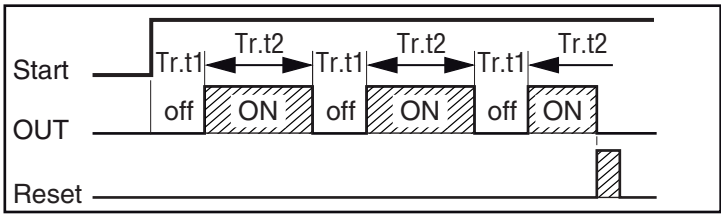
Delayed start at power up with a delay time and a “end of cycle” time.



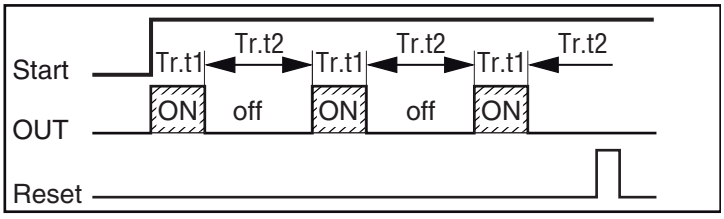
Feed-through



Asymmetrical oscillator with start in OFF



Asymmetrical oscillator with start in ON



Notes: **1.** The instrument can receive the start, hold and reset commands by [U] button, by logic inputs and/or by serial link.

2. An HOLD command can suspend the time count.

[95] tr.F - *Independent timer function*

Available: Always.

Range: nonE Timer not used;
i.d.A Delayed start timer;
i.uP.d Delayed start at power up;
i.d.d Feed-through timer;
i.P.L Asymmetrical oscillator with start in OFF;
i.L.P Asymmetrical oscillator with start in ON.

[96] tr.u - *Timer time unit*

Available: When [95] tr.F ≠ nonE.

Range: hh.nn Hours and minutes;
nn.SS Minutes and seconds;
SSS.d Seconds and tenth of seconds.

Note: When the timer is running, you can see the value of this parameter but you can NOT modify it.

[97] tr.t 1 - *Time 1*

Available: When [95] tr.F ≠ nonE.

Range:
- When [96] tr.u = hh.nn 00.01... 99.59;
- When [96] tr.u = nn.SS 00.01... 99.59;
- When [96] tr.u = SSS.d 000.1... 995.9.

[98] tr.t2 - *Time 2*

Available: When [95] tr.F ≠ nonE.

Range:
- When [96] tr.u = hh.nn: 00.01... 99.59 + inF;
- When [96] tr.u = nn.SS: 00.01... 99.59 + inF;
- When [96] tr.u = SSS.d: 000.1... 995.9 + inF.

Note: Setting [98] tr.t2 = inF, the second time can be stopped by a reset command only.

[99] tr.St - *Timer Status*

Available: When [95] tr.F ≠ nonE.

Range: run Timer Run;
HoLd Timer Hold;
rES Timer reset.

Note: This parameter allows to manage timer execution by a parameter (without digital inputs or [U] button or serial interface).

Pro group - Programmer function parameters

These instruments are able to perform a set point profile compounded of 4 groups of 2 steps (8 step total).

The first step is a ramp (used to reach the desired set point), the second is a soak (on the desired set point).

When a RUN command is detected the instrument aligns the operative set point to the measured value and starts to execute the first ramp.

In addition, each soak is equipped with a wait band which suspends the time count when the measured value goes out of the defined band (guaranteed soak).

Moreover, for each segment it is possible to define the status of two events. An event can drive an output and make an action during one or more specific program steps.

Some additional parameters allow to define the time scale, the automatic RUN conditions and the instrument behaviour at the end of the program.

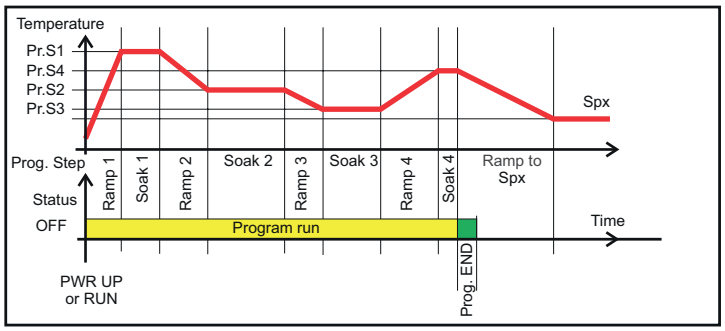
Notes: **1.** All steps can be modified during program execution.

2. During program execution the instrument memorizes the segment currently in use and, by a 30 minutes interval, it stores also the elapsed time of the soaks.

If a power down occurs during program execution, at the next power up the instrument is able to continue the program execution starting from the segment in progress at power down and, if the segment was a soak, it is also capable to restart from the soak time minus the stored elapsed time.

In order to obtain this features, the *[131] dSPu - Status of the instrument at power up* parameter must be set to rSPr (PPAn Group)

If the [131] dSPu parameter is different from rSPr the memorization function is be inhibited.



[100] Pr.F - Programmer action at power up

Available: Always.

Range: nonE Program not used;
S.uP.d Start at power up with a 1st step in stand by;
S.uP.S Start at power up;
u.diG Start at RUN command detection only;
U.dG.d Start at RUN command detection with a 1st step in stand by.

[101] Pr.u - Time unit of the soaks

Available: When [100] Pr.F ≠ nonE.

Range: hh.nn Hours and minutes;
nn.SS Minutes and seconds.;

Note: During program execution, this parameter cannot be modified.

[102] Pr.E - Instrument behaviour at the End of program execution

Available: When [100] Pr.F ≠ nonE.

Range: cnt Continue (the instrument uses the set point of the last soak until a reset command is detected);
SPAt Goes to the set point selected by [90] SPAt parameter;
St.bY Goes in stand by mode.

Notes: **1.** Setting [102] Pr.E = cnt the instrument operates as follows: at program end, it will use the set point of the last soak. When a reset command is detected, it goes to the set point selected by [90] SPAt parameter. The transfer will be a step transfer or a ramp according to the [93] SP.u (max. rate of rise for positive set point change) and [94] SPd (maximum rate of rise for negative set point change).

2. Setting [102] Pr.E = SPAt the instrument goes immediately to the set point selected

3. by [90] SPAt parameter. The transfer will be a step transfer or a ramp according to the [93] SP.u (maximum rate of rise for positive set point change) and [94] SPd (maximum rate of rise for negative set point change).

[103] Pr.Et - Time of the End program indication

Available: When [100] Pr.F ≠ nonE.

Range: oFF Function not used;
00.01... 99.59 minutes and seconds;;
inF indefinitely ON.

Note: Setting [103] Pr.Et = inF the end program indication will go OFF only when a reset command or a new RUN command is detected.

[104] Pr.S1 - Set point of the first soak

Available: When [100] Pr.F ≠ nonE or [100] Pr.F ≠ S.uP.d.

Range: From [81] SPLL to [82] SPHL.

[105] Pr.G1 - Gradient of the first ramp

Available: When [100] Pr.F ≠ nonE or [100] Pr.F ≠ S.uP.d.

Range: 0.1... 999.9 engineering units per minute;
inF Step transfer.

[106] Pr.t1 - Time of the first soak

Available: When [100] Pr.F ≠ nonE.

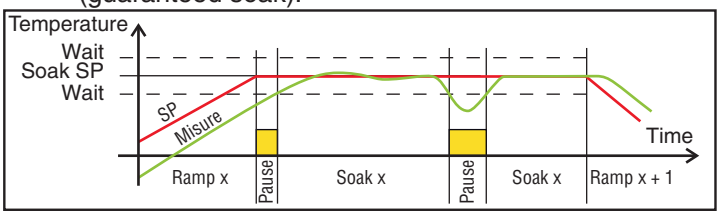
Range: 0.00... 99.59 Soaks time units.

[107] Pr.b1 - Wait band of the first soak

Available: When [100] Pr.F ≠ nonE or [100] Pr.F ≠ S.uP.d.

Range: OFF/1... 9999 in engineering units.

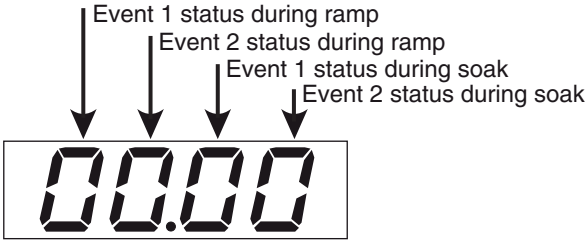
Note: The wait band suspends the time counting when the measured value goes out of the defined band (guaranteed soak).



[108] Pr.E1 - Events of the first group

Available: When [100] Pr.F ≠ nonE or [100] Pr.F ≠ S.uP.d.

Range: 00.00... 11.11 Where:
0 Event OFF;
1 Event ON.



Display	Ramp		Soak	
	Event 1	Event 2	Event 1	Event 2
00.00	off	off	off	off
10.00	on	off	off	off
0 1.00	off	on	off	off
1 1.00	on	on	off	off
00.10	off	off	on	off
10.10	on	off	on	off
0 1.10	off	on	on	off
1 1.10	on	on	on	off
00.01	off	off	off	on
10.01	on	off	off	on
0 1.01	off	on	off	on
1 1.01	on	on	off	on
00.11	off	off	on	on
10.11	on	off	on	on
0 1.11	off	on	on	on
1 1.11	on	on	on	on

[109] Pr.S2 - Set point of the second soak

Available: When [100] Pr.F ≠ nonE.

Range: From [84] SPLL to [85] SPHL;
oFF Program end.

Note: It is not necessary to configure all steps. Using for example 2 groups only, it is sufficient to set the set point of the third group equal to OFF. The instrument will mask all the following parameters of the programmer.

[110] Pr.G2 - Gradient of the second ramp

Available: When [100] Pr.F ≠ nonE and [109] Pr.S2 ≠ oFF.
Range: 0.1... 999.9 engineering units per minute;
inF Step transfer.

[111] Pr.t2 - Time of the second soak

Available: When [100] Pr.F ≠ nonE and [109] Pr.S2 ≠ oFF.
Range: 0.00... 99.59 soaks time units.

[112] Pr.b2 - Wait band of the second soak

Available: When [100] Pr.F ≠ nonE and [109] Pr.S2 ≠ oFF.
Range: OFF/1... 9999 in engineering units.
Note: For more details see [107] Pr.b1 parameter.

[113] Pr.E2 - Events of the second group

Available: When [100] Pr.F ≠ nonE and [109] Pr.S2 ≠ oFF.
Range: 00.00... 11.11 where:
0 Event OFF;
1 Event ON.
Note: For more details see [108] Pr.E1 parameter.

[114] Pr.S3 - Set point of the third soak

Available: When [100] Pr.F ≠ nonE and [109] Pr.S2 ≠ oFF.
Range: From [84] SPLL to [85] SPHL;
oFF Program end.
Note: For more details see [109] Pr.S2 parameter.

[115] Pr.G3 - Gradient of the third ramp

Available: When [100] Pr.F ≠ nonE, [109] Pr.S2 ≠ oFF and [114] Pr.S3 ≠ oFF.
Range: 0.1... 999.9 engineering units per minute;
inF Step transfer.

[116] Pr.t3 - Time of the third soak

Available: When [100] Pr.F ≠ nonE, [109] Pr.S2 ≠ oFF and [114] Pr.S3 ≠ oFF.
Range: 0.00... 99.59 soaks time units.

[117] Pr.b3 - Wait band of the third soak

Available: When [100] Pr.F ≠ nonE, [109] Pr.S2 ≠ oFF and [114] Pr.S3 ≠ oFF.
Range: OFF/1... 9999 in engineering units.
Note: For more details see [107] Pr.b1 parameter.

[118] Pr.E3 - Events of the third group

Available: When [100] Pr.F ≠ nonE, [109] Pr.S2 ≠ oFF and [114] Pr.S3 ≠ oFF.
Range: 00.00... 11.11 where:
0 Event OFF;
1 Event ON.
Note: For more details see [108] Pr.E1 parameter.

[119] Pr.S4 - Set point of the fourth soak

Available: When [100] Pr.F ≠ nonE, [109] Pr.S2 ≠ oFF and [114] Pr.S3 ≠ oFF.
Range: From [84] SPLL to [85] SPHL;
oFF Program end.
Note: For more details see [109] Pr.S2 parameter.

[120] Pr.G4 - Gradient of the fourth ramp

Available: When [100] Pr.F ≠ nonE, [109] Pr.S2 ≠ oFF, [114] Pr.S3 ≠ oFF and [119] Pr.S4 ≠ oFF.
Range: 0.1... 999.9 engineering units per minute;
inF Step transfer.

[121] Pr.t4 - Time of the fouth soak

Available: When [100] Pr.F ≠ nonE, [109] Pr.S2 ≠ oFF, [114] Pr.S3 ≠ oFF and [119] Pr.S4 ≠ oFF.
Range: 0.00... 99.59 soaks time units.

[122] Pr.b4 - Wait band of the fourth soak

Available: When [100] Pr.F ≠ nonE, [109] Pr.S2 ≠ oFF, [114] Pr.S3 ≠ oFF and [119] Pr.S4 ≠ oFF.
Range: OFF/1... 9999 in engineering units.
Note: For more details see [107] Pr.b1 parameter.

[123] Pr.E4 - Events of the fourth group

Available: When [100] Pr.F ≠ nonE, [109] Pr.S2 ≠ oFF, [114] Pr.S3 ≠ oFF and [119] Pr.S4 ≠ oFF.
Range: 00.00... 11.11 dove:
0 Event OFF;
1 Event ON.
Note: For more details see [108] Pr.E1 parameter.

[124] Pr.St - Prgram status

Available: When [100] Pr.F ≠ nonE.
Range: run Program in Run;
HoLd Program in Hold;
rES Program in Reset.
Note: This parameter allows to manage program execution by a parameter(with no need for logic inputs, etc.).

3PAn group - Operator HMI parameters

[125] PAS2 - PLevel 2 password: Limited access level

Available: Always.
Range: oFF Level 2 not protected by password (as level 1 = Operator level);
1... 999 Level 2 password.

[126] PAS3 - Level 3 password: configuration level

Available: Always.
Range: 3... 999 Level 3 password.
Note: Setting [125] PAS2 equal to [126] PAS3, the level 2 will be masked.

[127] uSrb - [U] button function during RUN TIME

Available: Always.
Range: nonE No function;
tunE Auto-tune/self-tune enabling. A single press (longer than 1 second) starts the auto-tune.
oPLo Manual mode. The first pressure puts the instrument in manual mode (oPLo) while a second one puts the instrument in Auto mode;
AAc Alarm reset;
ASi Alarm acknowledge;
chSP Sequential set point selection (note);
St.by Stand by mode. The first press puts the instrument in stand by mode while a second one puts the instrument in Auto mode;
Str.t Timer run/hold/reset (note);
P.run Program run (note);
P.rES Program reset (note);
P.r.H.r Program run/hold/reset (note).

Notes:
1. When "*Sequential set point selection*" is used, every stroke of the [U] button (longer than 1 s) increases the value of SPAt (active set point) of one step. The selection is cyclic:
-> SP1 -> SP2 -> SP3 -> SP4.
2. When a new set point is selected using the [U] key, the display shows for 2 s the acronym of the new set point (e.g. SP2);
3. When "*Sequential set point selection*" is used, the number of set points selectable is limited by [80] nSP;
4. When "*Timer run/hold/reset*" is selected, a short

[U] key press starts/stops(hold) timer count while a long press (longer than 10 s) resets the timer;

5. When "*Program run*" is selected, the 1st [U] key press starts the program execution but a 2nd press restarts the program execution from the beginning;
6. When "*Program reset*" is selected, a short [U] key press allows to reset the program execution;
7. When "*Program run/hold/reset*" is selected, a short [U] key press starts/s,tops (Hold) program execution while a long press (longer than 10 s) resets the program.

[128] dISP - Display management

Available: Always.

Note: As there is only 1 display, any setting (except nonE) hides the process temperature.

Range:
- nonE Standard display;
- Pou Power output;
- SPF Final set point;
- Spo Operative set point;
- AL1 Alarm 1 threshold;
- AL2 Alarm 2 threshold;
- AL3 Alarm 3 threshold;
- Pr.tu - During a soak, the instrument shows the elapsed time of the soak,
  - During a ramp the display shows the operative set point. At the end of program execution, the instrument shows P.End message alternated with the measured value,
  - When no program is running, the instrument shows the standard display;
- Pr.td - During a soak, the instrument will show the remaining time of the soak (count down),
  - During a ramp the display shows the operative set point. At the end of program execution, the instrument shows P.End message alternated with the measured value,
  - When no program is running, the instrument shows the standard display;
- P.t.tu When the programmer is running, the display shows the total elapsed time. At the end of program execution, the instrument shows P.End message alternated with the measured value;
- P.t.td When the programmer is running, the display shows the total remaining time (count down). At the end of program execution, the instrument shows P.End message alternated with the measured value;
- ti.uP When the timer is running, the display shows the timer counting up. At count the end, the instrument shows t.End message alternated with the measured value;
- ti.du When the timer is running, the display shows the timer counting down. At count the end, the instrument shows P.End message alternated with the measured value;
- PErc Percent of the power output used during soft start (when the soft start time = inF, the limit is ever active and it can be used also when ON/OFF control is selected).

[129] rdE - Bar-graph deviation

Available: Always.

Range: oFF Bar-graph not used;
1... 9999 In engineering units.

[130] F ILd - Filter on the displayed value

Available: Always.

Range: oFF Filter disabled;
0.1... 20.0 in engineering units.

Note: This is a *window filter* related to the set point; it is applied to the displayed value only and it have no effect on the other instrument functions (control, alarms, etc.).

[131] dSPu - Instrument status at power up

Available: Always.

Range:
- AS.Pr Starts in the same way it was prior to the power down;
- Auto Starts in Auto mode;
- oP.0 Starts in manual mode with a power output equal to zero;
- St.bY Starts in stand-by mode.

[132] oPr.E - Operative modes enabling

Available: Always.

Range:
- ALL All modes will be selectable by parameter [133] oPEr;
- Au.oP Auto and manual (oPLo) mode only will be selectableby parameter [133] oPEr;
- Au.Sb Auto and Stand-by modes only will be selectable by parameter [133] oPEr.

Notes:
1. When you change the value of [132] oPr.E, the instrument forces [133] oPEr = AutO;
2. During program execution the instrument stores the segment currently in use and, by a 30 minutes interval, it stores also the elapsed time of the soaks. If a power down occurs during program execution, at the next power up the instrument is able to continue the program execution starting from the segment in progress at power down and, if the segment was a soak, it is also capable to restart from the soak time minus stored the elapsed time.
   In order to obtain this features, the [131] dSPu - (*Status of the instrument at power up*) parameter must be set to ASPr. If [131] dSPu ≠ AS.Pr the storing function will be inhibited.

[133] oPEr - Operative mode selection

Available: Always.

Range:
- When [132] oPr.E = ALL:
  - Auto Auto Mode;
  - oPLo Manual Mode;
  - St.bY Stand by Mode.
- When [132] oPr.E = Au.oP:
  - Auto Auto Mode;
  - oPLo Manual Mode.
- When [132] oPr.E = Au.Sb:
  - Auto Auto Mode;
  - St.bY Stand by Mode.

SEr group - Serial interface parameters

[134] Add - Instrument address

Available: Always.
Range: oFF Serial interface not used;
1... 254 Instrument address.

[135] bAud - Baud rate

Available: When [134] Add ≠ oFF.
Range: 1200 1200 baud;
2400 2400 baud;
9600 9600 baud;
19.2 19200 baud;
38.4 38400 baud.

[136] trSP - Selection of the variable to be retransmitted (Master)

Available: When [134] Add ≠ oFF.
Range: nonE Retransmission not used (the instrument is a slave);
rSP The instrument becomes a Master and retransmits the operative set point;
PErc The instrument becomes a Master and retransmits the power output.

Note: For more details see [91] SP.rt (remote set point type) parameter.

COn group - Consumption parameters

[137] CotY - Measurement type

Available: Always.
Range: oFF Not used;
1 Instantaneous power (kW);
2 Power consumption (kW/h);
3 Energy used during program execution. The measure starts from zero when a program starts and stops at the end of the program. A new program execution resets the value;
4 Total worked days with threshold (number of hours the instrument is turned ON divided for 24);
5 Total worked hours with threshold (number of hours that the instrument is turned ON).

Note: Items **4** and **5** are an internal counter for machine service inspection intervals. It works every time the instrument is turned ON. When the count reaches the programmed threshold, the display shows alternately the standard display and the message r.iSP (requested Inspection). The count reset can be done only by changing the threshold value.

[138] UoLt - Nominal Voltage of the load

Available: When [137] Co.tY = 1 or [137] Co.tY = 2 or [137] Co.tY = 3.
Range: 1... 9999 (V).

[139] cur - Nominal Current of the load

Available: When [137] Co.tY = 1 or [137] Co.tY = 2 or [137] Co.tY = 3.
Range: 1... 999 (A).

[140] hJob - Maintenance interval (tot.d/tot.H threshold)

Available: When [137] Co.tY = 4 or [137] Co.tY = 5.
Range: oFF Threshold not used;
1... 999 Days;
1... 999 Hours.

CAL group - User Calibration parameters

This function allows to calibrate the complete measuring chain and to compensate the errors due to:
– Sensor location;
– Sensor class (sensor errors);
– Instrument accuracy.

[141] AL.P - Adjust Low Point

Available: Always.
Range: From -1999 to (AH.P - 10) in engineering units.
Note: The minimum difference between the value of parameters AL.P and AH.P is 10 engineering units.

[142] AL.o - Adjust Low Offset

Available: Always.
Range: -300... +300 in engineering units.

[143] AH.P - Adjust High Point

Available: Always.
Range: From (AL.P + 10) to 9999 in engineering units.
Note: The minimum difference between AL.P and AH.P is equal to 10 Engineering Units.

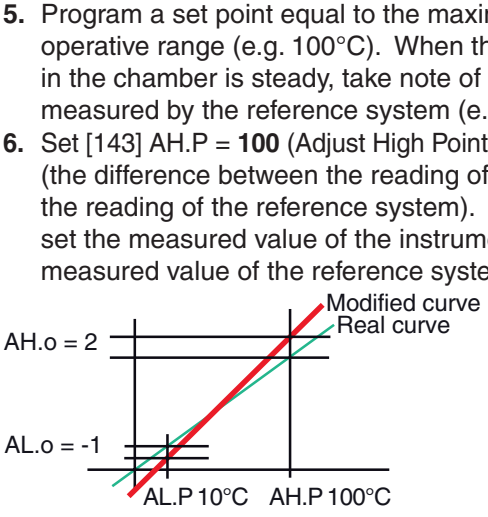
[144] AH.o - Adjust High Offset

Available: Always.
Range: -300... 300 in engineering units.

Example:

Climatic chamber with an operative range of: 10... 100°C.

1. Insert in the chamber a reference sensor connected with a reference instrument (usually a calibrator);
2. Start the control of the instrument, and program a set point equal to the minimum value of the operative range (e.g. 10°C);
3. When the temperature in the chamber is steady, take note of the temperature measured by the reference system (e.g. 9°C).
4. Set [141] AL.P = **10** (Adjust Low Point) and [142] ALo = **-1** (the difference between the reading of the instrument and the reading of the reference system). Note that after this set the measured value of the instrument is equal to the measured value of the reference system.
5. Program a set point equal to the maximum value of the operative range (e.g. 100°C). When the temperature in the chamber is steady, take note of the temperature measured by the reference system (e.g. 98°C).
6. Set [143] AH.P = **100** (Adjust High Point) and [144] ALo = **+2** (the difference between the reading of the instrument and the reading of the reference system). Note that after this set the measured value of the instrument is equal to the measured value of the reference system.



The most important steps of the configuration procedure are completed. In order to exit from configuration parameter procedure, proceed as follows:
– Press the [U] key;
– Press the [U] key for more than 10 s;
The instrument will returns to the *standard display*.

PAth group - Other parameters

[160] SCFA - Serial communications malfunction (RS485 only)

Available: Always.

Range: 0 None (behavior like the current one);
1 Reset of the outputs driven via serial interface;
2 Reset of the whole instrument, restarts as programmed with dSPu;
3 The instrument switches to StbY, resets the outputs driven via the serial interface and remains in stand by until a specific command is received (from TTL keyboard, logic contact or serial interface);
4 The instrument switches to **Stby**, resets the outputs driven via the serial interface but automatically returns to the previous mode (auto, man or stand by) in case of resuming communication. If the instrument receives a specific command (from TTL keyboard or from logic contact) before the serial communication resumes, the instrument will switch to the requested mode forgetting the mode it had before the automatic standby;
5 The instrument switches to **Stby**, performs a reset of the whole instrument, restarts as programmed with dSPu (if dSPu = ASPr the instrument restarts in **Stby** and waits for a specific command from the TTL keyboard, from digital input or from serial interafce). **Note:** resuming serial communication does not change the status;
6 The instrument stores the state before the communication fails, performs a total reset but restarts in **forced STBY** to automatically return to the previous mode (auto, man or stand by) when communication resumes. If the instrument receives a specific command (from TTL keyboard or logic contact) before the serial communication resumes, the instrument will switch to the requested mode, forgetting the mode it had before the automatic standby.

Note: When oPrE = AuoP, parameter FcSA allows to choose only modes: **0**, **1**, **2**.

6. PARAMETERS PROMOTION

Another important step of the instrument configuration is due to the possibility to create a custom HMI (interface) in order to make the instrument easy to use for the operator and comfortable for the assistance.
By a special procedure, named *promotion*, the OEM can create two parameter subsets.

- The first one is the *limited access* level. This subset is protected by the password programmed by [125] PAS2.
- The last subset is the *Operator* set (Level1).
  This level si NOT password protected

Notes: **1.** The *limited access* parameters are collected in a list.
2. The sequence of the *limited access* parameters is programmable and can be made according to the user needs.
3. The parameter sequence of the operator level is the same programmed for *limited access* level but only specified parameters can be displayed and modified. This set must be create according to the user requirements.

6.1 Parameter promotion procedure

The limited access parameter set is a list, so that, before to start promotion procedure, we suggest to operate as follows:

1. Prepare the exact parameter list you want to make accessible for limited access.
2. Number the desired parameters in the same sequence you want to have in the limited access.
3. Define which of the selected parameters will be available also at Operator level.

Example: I would like to obtain the following limited access list:

- OPEr Operative mode selection
- SP1 First set point;
- SP2 Second set point;
- SPAt Set point selection;
- AL1 Alarm 1 threshold;
- AL2 Alarm 2 threshold;
- Pb Proportional band;
- Int Integral time;
- dEr Derivative time;
- Aut.r Manual start of the auto-tune.

But I want that the operator can change: the operative mode, the SP1 value and the AL1 value.
In this case the promotion will be the following:

Parameter	Promotion	Limited access	Operator
- OPEr -	o 1	OPEr	OPEr
- SP1 -	o 2	SP1	SP1
- SP2 -	A 3	SP2	
- SPAt -	A 4	SPAt	
- AL1 -	o 5	AL1	AL1
- AL2 -	A 6	AL2	
- Pb -	A 7	Pb	
- Int -	A 8	Int	
- dEr -	A 9	dEr	
- Aut.r -	A 10	Aut.r	

Now, proceed as follows:

1. Press the [P] key for more than 3 seconds.
The display will alternately show PASS and 0.
2. By [▲] and [▼] keys set a password equal to -81.

3. Press the [P] key. The instrument will show the acronym of the first configuration parameter group ⁊ inP.
4. Press [U] key to select the group of the first parameter of your list (e.g. ⁊ inP).
5. Press [U] key to select the first parameter of your list.
6. The instrument will show alternately: the acronym of the parameter and his current promotion level. The promotion level is defined by a letter followed by a number.
   The letter can be:
   - "c" Means that this parameter is **NOT promoted** and it is present only in configuration. In this case the number is forced to zero.
   - "A" Means that this parameter **has been promoted** to the *limited access level*. The number indicates the position in the *limited access* list.
   - "o" Means that the parameter **has been promoted** to the *Operator level* and therefore it will be visible both at *Operator level* and at *limited access level*.

   The number indicates the position in the *limited access* list.
7. Using the [▲] and [▼] keys assign to the selected parameter the desired position.
   Note: Setting a value different thwn "0", the letter "c" will change automatically to "A" and the parameter is automatically promoted to the *limited access level*.
8. In order to modify the level from limited access to operator and vice-versa, press the [U] key and, maintaining the pressure, press [▲] key. The letter will change from "A" to "o" and vice versa.
9. Select, with the [▲] and [▼] keys, the second parameter that you want to add to the *limited access* level and repeat steps **6**, **7** and **8**.
10. Repeat steps **6**, **7** and **8** until the list has been completed.
11. When you need to exit from promotion procedure, press [U] key and maintain the pressure for more than 10 s.

The instrument returns to the *standard display*.

Note: Setting the same number to 2 parameter, the instrument uses only the last programmed parameter in that position.

Example: in the previous example, I have set for SP2 a promotion value equal to A3. If now I set for SP3 a promotion value equal to o3, the *Limited Access list* and the *Operator list* becomes:

Parameter	Promotion	Limited access	Operator
- OPEr -	o 1	OPEr	OPEr
- SP1 -	o 2	SP1	SP1
- SP3 -	o 3	SP3	SP3
- SPAt -	A 4	SPAt	
- AL1 -	o 5	AL1	AL1
.....			

7. OPERATING MODES

As we said at paragraph 5.1, when the instrument is powered ON, it starts immediately to work according to the parameters values stored in the controller.
In other words, the instrument has one status only, the "run time" status.
During "run time" we can force the instrument to operate in three different modes: Automatic mode, Manual mode or Stand by mode.

- In Automatic mode the instrument drives automatically the control outputs according to the parameters value set and the setpoint/measured value.
- In Manual mode the instrument shows the measured value and allows the user to manually set the control output power. No Automatic action is made.
- In stand-by mode the instrument operates as an indicator. It shows the measured value (PV) and forces the control outputs to zero.

As we have seen, it is always possible to modify the value assigned to a parameter independently from the operative mode selected.

7.1 How to enter the "Operator level"

The instrument is showing the *standard display*.

1. Press the [P] key;
2. The instrument will alternately show the acronym of the first parameter promoted to this level and its value.
3. Using the [▲] and [▼] keys assign to this parameter the desired value.
4. Press the [P] key in order to store the new value and go to the next parameter.
5. When you want to return to the *standard display* press the [U] key for more than 5 seconds.

Note: The parameter changes of the Operator level is subject to a time out. If no buttons are pressed for more than 10 s, the instrument returns to the *standard display* and the new value of the last selected parameter will be lost.

7.2 How to enter the "Limited Access Level"

The instrument is showing the *standard display*.

1. Press the [P] key for more than 5 seconds,
   The display will alternately show PASS and 0.
2. By [▲] and [▼] keys set the value assigned to [114] PAS2 parameter (Password of level 2);

Notes:
1. The factory default password for configuration parameters is equal to 20.
2. All parameter modifications are protected by a time-out. If no buttons are pressed for more than 10 seconds the instrument automatically returns to the *Standard display*, the new value of the last selected parameter is lost and the parameter modification procedure is closed.
   If it is necessary to to remove the time out (e.g. for the first configuration of an instrument) use a password equal to 1000 plus the programmed password (e.g.: 1000 + 20 [default] = 1020). It is always possible to manually End the parameter configuration procedure (see below).

3. During parameter changes the instrument continues to perform the control. In certain conditions (e.g. when a

parameter change can produces a heavy bump to the process) it is advisable to temporarily stop the controller from controlling during the programming procedure (its control output will be OFF). A password equal to 2000 + the programmed value (e.g. 2000 + 20 = 2020) will switch the control out off during configuration.
The control will restart automatically when the parameter modification procedure will be manually ended.

4. Press the [P] key;
5. The instrument will alternately show the acronym of the first parameter promoted to this level and its value.
6. [▲] and [▼] keys assign to this parameter the desired value.
7. Press the [P] key in order to store the new value and go to the next parameter.
8. When you want to return to the *standard display* press the [U] key for more than 5 seconds.

7.3 How to see but not modify the "Limited Access Parameters"

Sometimes it is necessary to give to the operator the possibility to see the value assigned to the parameter promoted in the *Limited Access level* but it is important that all changes are made by autorized personnel only.
In this cases, proceed as follows:

1. Press the [P] key for more than 5 seconds,
   The display will alternately show PASS and 0.
2. By [▲] and [▼] keys set the number -181 insted of the programmed password.
3. Press the [P] key;
4. The instrument will alternately show the acronym of the first parameter promoted to the level 2 and its value;
5. Using the [P] key it is possible to see the value assigned to all parameter present in level 2 but it <u>will not be possible</u> to modify it;
6. It is possible to return to the*standard display* by pressing the [U] key for more than 3 seconds or by pressing no keys for more than 10 s.

7.4 Automatic Mode

7.4.1 Keyboard function when the instrument is in Auto mode

[U] Performs the action programmed by [127] uSrb ([U] key function during RUN TIME) parameter.
[P] Allows to enter the parameters modification procedure.
[▲] Allows to display the *Additional information* (see below).
[▼] Allows to start the *Direct set points modification* function (see below).

7.4.2 Direct set point modification

This function allows to quickly modify the set point value selected by [79] SPAt (selection of the active Set point) or to the set point of the segment group (of the programmer) currently in progress.
While the instrument shows the *Standard display*.

1. Press the [▼] key. The display will alternately show the acronym of the selected set point (e.g. SP2) and its value;
   Note: When the programmer is running, the instrument will show the set point of the group currently in use (e.g. if the instrument is performing the soak 3 the instrument will show [114] Pr.S3).
2. Using [▲] and [▼] keys set the desired value to this parameter;
3. Press no keys for more than 5 s or press the [P] key. In both cases the instrument stores the new value and returns to the *Standard display*.

Note: If the set point in use has not been promoted to *Operator level*, the instrument allows to see the value but not to modify it.

7.4.3 Additional information

This instrument is able to show you some additional information that can help you to manage your system.
The additional information is related to how the instrument is programmed, hence in many cases, only part of this information is available.

1. While the instrument is showing the *Standard display* press the [▲] key. The display will show "H" or "c" followed by a number. This value is the current power output applied to the process. The "H" indicates that the action is a Heating action while the "c" indicates that the action is a Cooling action.
2. Press the [▲] key again. When the programmer is running the instrument will show the segment currently performed and the Event status as shown below:

   r 1.00

   Where the first character can be "r" for a ramp or "S" for a soak, the next digit show the number of the segment (e.g. S3 means Soak number 3) and the two Less Significant Digits (LSd) show the status of the two event (the LSD is the Event 2).
3. Press the [▲] key again. When the programmer is running the instrument will show the theoretical remaining time to the end of the program preceded by a "P" letter:

   P04.3

4. Press the [▲] key again. When the wattmeter function is running the instrument will show "U" followed by the measured energy.
   Note: The energy calculation will be in accordance with the [137] Co.tY parameter setting.
5. Press the [▲] key again. When the *Worked time count* is running the instrument will show "d" for days or "h" for hours followed by the measured time.
6. Press the [▲] key again. The instrument returns to the *Standard display*.

Note: The additional information visualization is subject to a time out. If no buttons are pressed for more than 10 s the instrument automatically returns to the *Standard display*.

7.4.4 The programmer function

In chapter 5 we have described all parameters related with the programmer and their action during program execution. In this paragraph we will give you some additional information and some application examples.

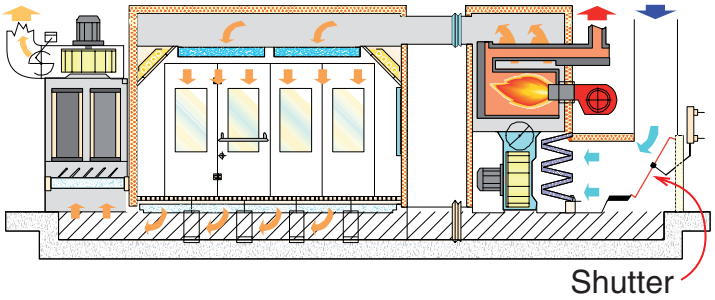
Note: The LSD decimal point is used to show the programmer status independently from the displayed value selected by [114] diSP (Display management).

The relations between the programmer status and the LED are the following:

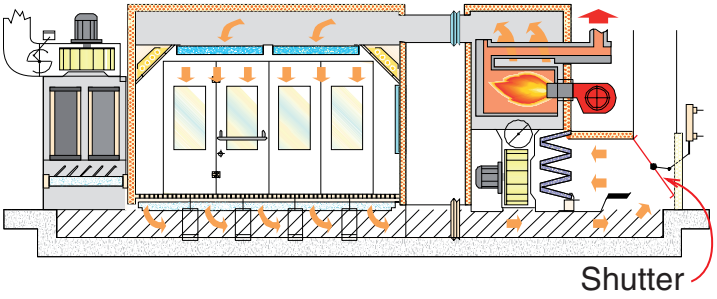
- Program in RUN - the LED is steady ON;
- Program in Hold - the LED The LED flashes fast;
- Program in Wait - il LED flashes slow;
- Program in End or Reset - the LED is OFF.

Application Example 1: Spray Paint Drying Booth

When the operator is inside the booth to paint a car, the internal temperature must be 20°C and the air, used for booth ventilation, comes from outside.



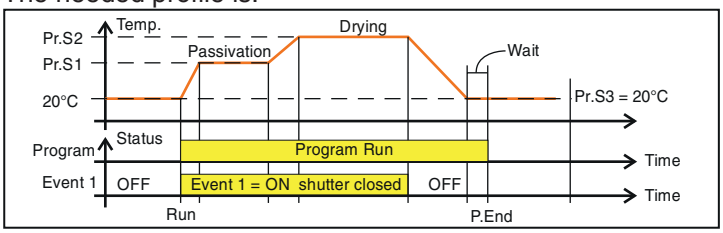
During the passivation and drying phases, the operator is out of the booth and the system closes the shutter of the air and recycles the internal air in order to reduce the power consumption.



When the drying time is finished, before the operator is allowed to enter into the boot, you must be sure that:

1. The air in the booth has been refreshed;
2. The temperature is lower than a limit.

The needed profile is:



Out 1 = H.rEG (heating output);

Out 2 = P.Et1 (program event 1);

Out 3 = P.run (program running);

Pr.E1e Pr.E2 = 10.10 (event 1 goes ON during ramp 1, soak 1, ramp 2 and soak 2).

While the program is running the door is locked.

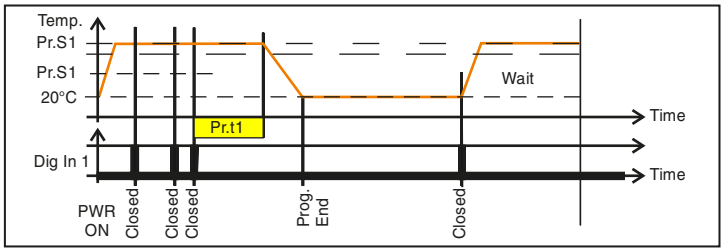
Application Example 2: Edge banding machine with glue tank (for wood)

At the working temperature the hot melt quickly oxidizes and runs down from the “dispenser”.

For this reason, when the machine does not work for a certain time, it is suitable to move the temperature of the dispenser to a lower value to idle. In this cases the configuration is the following:

– Out 1 = h.reg (heating output);
– Out 2 = AL (alarm used to disable the dragger);
– diF.1 = P.run (digital input 1 used for run/restart the Program);
– Pr.F = S.uP.S (program starts at power up);
– Pr.E = cnt (Instrument behaviour at program execution end = continue).

Connect a proximity switch to Digital Input 1 for panel detection.



If a new panel is detected before the end of the first soak time, the program restarts and the set point remains equal to Pr.S1.

If no panel is detected, the instrument goes to Pr.S2 (idle temperature) and remains there until a new panel arrives.

The detection of a new panel brings the instrument back to operating at the working temperature (Pr.S1).

7.5 Manual mode

When manual mode is selected the display will show alternately the measured value and the message “oPLo”.

When manual control is selected, the instrument starts to operate with the same power output as the last supplied by the automatic mode and can be modified using the ▲/▼ keys.

In case of ON/OFF control, 0% corresponds to the deactivated output while any value different from **0** corresponds to the activated output.

As in the case of visualization, the programmable values range from H 100 (100% output power with reverse action) to C 100 (100% output power with direct action).

Notes:

1. During manual mode, the absolute alarms are operative while the relative alarms are disabled.
2. Setting the manual mode during program execution, the program will be aborted.
3. Setting the manual mode during self-tune execution, the self-tune function will be aborted.
4. During manual mode, all functions not related with the control (wattmeter, indipendent timer, “worked time”, etc.) continue to operate normally.

7.6 Stand-by mode

This operative mode also deactivates the automatic control but forces the control output to zero.

In this mode the instrument operates as an indicator.

When stand by mode is selected the display will show alternately the measured value and the message “ StbY.

Notes:

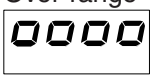
1. During stand by mode, the relative alarms are disabled while the absolute alarms are operative or not according to the AL❑o (Alarm ❑ enabling during Stand-by mode) parameter setting.
2. Setting the stand by mode during program execution, the program will be aborted.
3. Setting the stand by mode during self-tune execution, the self- tune function will be aborted.
4. During stand by mode, all functions not related with the control (wattmeter, indipendent timer, “worked time”, etc.) continue to operate normally.
5. When the instrument is swapped from stand by to auto modes, the instrument will start automatically the alarm masking, and the soft start functions.

8. ERROR MESSGES

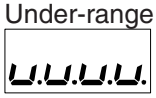
8.1 Out of Range signals

The display shows the **OVER-RANGE** and **UNDER-RANGE** conditions with the following indications:

Over-range



Under-range



The sensor break will be pointed out as an out of range:

Note: When an over-range/under-range is detected, the alarms operate as in presence of the maximum or the minimum measurable value respectively.

To check the *Out of span Error condition* proceed as follows:

1. Make sure that the input signal is in accordance with the instrument configuration.
1. Otherwise, modify the input configuration (see Chapter 5);
2. If no errors are detected, send the instrument to your supplier to be checked.

8.2 List of possible errors

Errore	Descrizione
ErAt	Fast Auto-tune doews not start. The measure value is too close to the set point. Press the [P] key in order to delete the error message.
noAt	Auto-tune not finished within 12 hours.
ErEP	ossible problem of the instrument memory. The messages desappears automatically. When the error continues, send the instrument to your supplier.

9. GENERAL NOTES

9.1 Proper use

Every possible use not described in this manual must be considered as a improper use.

This instrument is in compliance with EN 61010-1 "*Safety requirements for electrical equipment for measurement, control and laboratory use*"; for this reason it could not be used as a safety equipment.

Whenever a failure or a malfunction of the control device may cause dangerous situations for persons, thing or animals, please remember that the plant has to be equipped with additional safety devices.

Ascon Tecnologic S.r.l. and its legal representatives do not assume any responsibility for any damage to people, things or animals deriving from violation, wrong or improper use or in any case not in compliance with the instrument features.

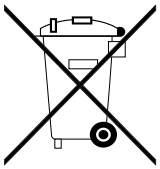
9.2 Maintenance

This instrument does not requires periodical recalibration and it have no consumable parts so that no particular maintenance is required.

Sometimes it is advisable to clean the instrument.

1. **SWITCH THE EQUIPMENT OFF** (power supply, relay output, etc.).
2. Using a vacuum cleaner or a compressed air jet (max. 3 kg/cm^2) remove all deposits of dust and dirt which may be present on the case and on the internal circuits being careful not to damage the electronic components.
3. To clean external plastic or rubber parts use only a cloth moistened with:
   - Ethyl Alcohol (pure or denatured) [C_2H_5OH] or
   - Isopropyl Alcohol (pure or denatured) [$(CH_3)_2CHOH$] or
   - Water (H_2O).
4. Make sure that there are no loose terminals.
5. Before turning ON the instrument make sure it is perfectly dry.
6. Apply the power supply to the instrument.

9.3 Disposal



The appliance (or the product) must be disposed of separately in compliance with the local standards in force on waste disposal.

10. WARRANTY AND REPAIRS

This product is under warranty against manufacturing defects or faulty materials that are found within 18 months from delivery date. The warranty is limited to repairs or to the replacement of the instrument.
The tampering of the instrument or an improper use of the product will bring about the immediate withdrawal of the warranty effects.
In the event of a faulty instrument, either within the period of warranty, or further to its expiry, please contact our sales department to obtain authorisation for sending the instrument to our company.
The faulty product must be shipped to Ascon Tecnologic with a detailed description of the faults found, without any fees or charge for Ascon Tecnologic, except in the event of alternative agreements.

11. ACCESSORIES

The instrument has a lateral socket into which a special tool can be inserted.

This tool, named A01, allows:
– To store a complete instrument configuration and to use it for other instruments.
– To transfer a complete instrument configuration to a PC or from a PC to an instrument
– To transfer from a PC to an instrument a complete instrument configuration
– To transfer a configuration from an A01 to another one.
– To test serial interface of the instruments and to help the OEM during machine start up.

Note: When the instrument is powered by the A01 key, the outputs are NOT supplied and the instrument can show the ouLd (Out 4 Overload) indication.

Appendix A
List of the available parameters

As for the previous parts of the manual, the parameter labels are indicated as if an indicator with a single display were connected to the instrument (via the TTL port).

2 inP group - Inputs parameters

no.	Par.	Description	Dec.	Range	Default	Vis. Promo.
1	HcFG	Parameter available by serial link. It shows the current hardware.	0	TC/RTD TC/PTC Current Voltage	According to the HW	Not displayed
2	SEnS	Sensor selection (according to the HW)				A-4
		TC, Pt100 input	0	J, crAL, S , r, t, ir.J, ir.cA, Pt1, 0.50 (mV), 0.60 (mV), 12.60 (mV), Ser1, SEr2	J	
		TC, PTC, NTC input		J, crAL, S , r, t, Ir.J, Ir.cA, Ptc, ntc, 0.50 (mV), 0.60 (mV), 12.60 (mV), Ser1, SEr2	Ptc	
		I input		0.20 (mA), 4.20 (mA), Ser1, SEr2	4.20	
		V input		0.5(V), 1.5(V), 0.10(V), 2.10(V), 0.1 (V), Ser1, SEr2	0.10	
3	dP	Decimal figures	0	0 ÷ 3	0	A-5
4	SSc	Initial scale readout	dP	From -1999 to FSC (E.U.)	-1999	A-6
5	FSc	Final scale readout	dP	From SSc to 9999 (E.U.)	9999	A-7
6	un it	Engineering unit	0	°C or °F	0 = °C	A-8
7	F iL	Digital filter on the measured value	1	0 oFF 0.1 ÷ 20.0 (s)	1.0	C-0
8	inE	Selection of the Sensor Out of Range type that will enable the safety output value	0	or Over-range ur Under-range our Over and Under	our	C-0
9	oPE	Safety output value	0	-100 ÷ 100 (%)	0	C-0
10	diF1	Digital input 1 function	0	oFF No function 1 Alarm Reset 2 Alarm acknowledge (ACK) 3 Hold of the measured value 4 Stand by mode 5 HEAt with SP1 and CooL with “SP2” 6 Timer run/hold/reset [transition] 7 Timer run [transition] 8 Timer reset [transition] 9 Timer run/hold [Status] 10 Program run 11 Program reset 12 Program hold 13 Program run/hold 14 Program run/reset 15 Instrument in Manual model 16 Sequential set point selection 17 SP1/SP2 selection 18 Set point Binary selection 19 Digital inputs in parallel to ▲/▼ keys 20 Timer RUN/Reset with lock at count end 21 Timer RUN/Reset without lock at count end	nonE	A-13
11	diF2	Digital input 2 function	0		nonE	A-14

Pout group - Outputs parameters

no.	Par.	Description	Dec.	Range	Default	Vis. Promo.
12	o1F	Out 1 function	0	NonE Output not used H.rEG Heating output c.rEG Cooling output AL Alarm output t.out Timer output t.HoF Timer out -OFF in hold P.End Program end indicator P.HLd Program hold indicator P. uit Program wait indicator P.run Program run indicator P.Et1 Program Event 1 P.Et2 Program Event 2 or.bo Out-of-range or burn out indicator P.FAL Power failure indicator bo.PF Out-of-range, burn out and Power failure indicator diF.1 The output repeats the digital input 1 status diF.2 The output repeats the digital input 2 status St.bY Stand by status indicator on Out 1 forced to ON	H.reg	A-16
13	o1AL	Alarms linked to out1	0	0 ÷ 31 +1 Alarm 1 +2 Alarm 2 +4 Alarm 3 +8 Loop break alarm +16 Sensor Break	AL1	A-17
14	o1Ac	Out 1 action	0	dir Direct action rEU Reverse action dir.r Direct with reversed LED ReU.r Reverse with reversed LED	dir	C-0
15	o2F	Out 2 function	0	NonE Output not used H.rEG Heating output c.rEG Cooling output AL Alarm output t.out Timer output t.HoF Timer out -OFF in hold P.End Program end indicator P.HLd Program hold indicator P. uit Program wait indicator P.run Program run indicator P.Et1 Program Event 1 P.Et2 Program Event 2 or.bo Out-of-range or burn out indicator P.FAL Power failure indicator bo.PF Out-of-range, burn out and Power failure indicator diF.1 The output repeats the digital input 1 status diF.2 The output repeats the digital input 2 status St.bY Stand by status indicator on Out 2 forced to ON	AL	A-19
16	o2AL	Alarms linked to out2	0	0 ÷ 31 +1 Alarm 1 +2 Alarm 2 +4 Alarm 3 +8 Loop break alarm +16 Sensor Break	AL1	A-20
17	o2Ac	Out 2 action	0	dir Direct action rEU Reverse action dir.r Direct with reversed LED ReU.r Reverse with reversed LED	dir	C-0
18	o3F	Out 3 function	0	NonE Output not used H.rEG Heating output c.rEG Cooling output AL Alarm output t.out Timer output t.HoF Timer out -OFF in hold P.End Program end indicator P.HLd Program hold indicator P. uit Program wait indicator P.run Program run indicator P.Et1 Program Event 1 P.Et2 Program Event 2 or.bo Out-of-range or burn out indicator P.FAL Power failure indicator bo.PF Out-of-range, burn out and Power failure indicator diF.1 The output repeats the digital input 1 status diF.2 The output repeats the digital input 2 status St.bY Stand by status indicator on Out 3 forced to ON	AL	A-22

no.	Par.	Description	Dec.	Range	Default	Vis. Promo.
19	o3AL	Alarms linked to out3	0	0 ÷ 31 +1 Alarm 1 +2 Alarm 2 +4 Alarm 3 +8 Loop break alarm +16 Sensor Break	AL2	A-23
20	o3Ac	Out 3 action	0	dir Direct action rEU Reverse action dir.r Direct with reversed LED ReU.r Reverse with reversed LED	dir	C-0
21	o4F	Out 4 function	0	NonE Output not used H.rEG Heating output c.rEG Cooling output AL Alarm output t.out Timer output t.HoF Timer out -OFF in hold P.End Program end indicator P.HLd Program hold indicator P. uit Program wait indicator P.run Program run indicator P.Et1 Program Event 1 P.Et2 Program Event 2 or.bo Out-of-range or burn out indicator P.FAL Power failure indicator bo.PF Out-of-range, burn out and Power failure indicator diF.1 The output repeats the digital input 1 status diF.2 The output repeats the digital input 2 status St.bY Stand by status indicator on Out 4 forced to ON	AL	A-24
22	o4AL	Alarms linked to out4	0	0 ÷ 31 +1 Alarm 1 +2 Alarm 2 +4 Alarm 3 +8 Loop break alarm +16 Sensor Break	AL2	A-25
23	o4Ac	Out 4 action	0	dir Direct action rEU Reverse action dir.r Direct with reversed LED ReU.r Reverse with reversed LED	dir	C-0
24	o5F	Out 5 function	0	NonE Output not used H.rEG Heating output c.rEG Cooling output AL Alarm output t.out Timer output t.HoF Timer out -OFF in hold P.End Program end indicator P.HLd Program hold indicator P. uit Program wait indicator P.run Program run indicator P.Et1 Program Event 1 P.Et2 Program Event 2 or.bo Out-of-range or burn out indicator P.FAL Power failure indicator bo.PF Out-of-range, burn out and Power failure indicator diF.1 The output repeats the digital input 1 status diF.2 The output repeats the digital input 2 status St.bY Stand by status indicator on Out 5 forced to ON	AL	C-0
25	o5AL	Alarms linked to out5	0	0 ÷ 31 +1 Alarm 1 +2 Alarm 2 +4 Alarm 3 +8 Loop break alarm +16 Sensor Break	AL2	C-0
26	o5Ac	Out 5 action	0	dir Direct action rEU Reverse action dir.r Direct with reversed LED ReU.r Reverse with reversed LED	dir	C-0

PAL 1 group - Alarm 1 parameters

no.	Par.	Description	Dec.	Range	Default	Vis. Promo.
27	AL 1t	Alarm 1 type	0	nonE Alarm not used LoAb Absolute low alarm HiAb Absolute high alarm LHAb Absolute band alarm SE.br Sensor Break LodE Deviation low alarm (relative) HidE Deviation high alarm (relative) LHdE Relative band alarm	LoAb	A-47
28	Ab 1	Alarm 1 function	0	0 ÷ 15 +1 Not active at power up +2 Latched alarm (manual reset) +4 Acknowledgeable alarm +8 Relative alarm not active at set point changes	0	C-0
29	AL 1L	- For High and low alarms, AL1L is the low limit of the AL1 threshold - For band alarm, AL1L is low alarm threshold	dP	From -1999 to AL1H (E.U.)	-1999	A-48
30	AL 1H	- For High and low alarms, AL1H is the high limit of the AL1 threshold - For band alarm, AL1H is high alarm threshold	dP	From AL1L to 9999 (E.U.)	9999	A-49
31	AL 1	AL1 threshold	dP	From AL1L to AL1H (E.U.)	0	A-50
32	HAL 1	AL1 hysteresis	dP	1 ÷ 9999 (E.U.)	1	A-51
33	AL 1d	AL1 delay	dP	0 oFF 1 ÷ 9999 (s)	oFF	C-0
34	AL 1o	Alarm 1 enabling during Stand-by mode and out of range conditions	0	0 AL1 disabled in Stand by and out of range 1 AL1 enabled in stand by mode 2 AL1 enabled in out of range condition 3 AL1 enabled in stand by and overrange	no	C-0

PAL 2 group - Alarm 2 parameters

no.	Par.	Description	Dec.	Range	Default	Vis. Promo.
35	AL2t	Alarm 2 type	0	nonE Alarm not used LoAb Absolute low alarm HiAb Absolute high alarm LHAb Absolute band alarm SE.br Sensor Break LodE Deviation low alarm (relative) HidE Deviation high alarm (relative) LHdE Relative band alarm	LoAb	A-54
36	Ab2	Alarm 2 function	0	0 ÷ 15 +1 Not active at power up +2 Latched alarm (manual reset) +4 Acknowledgeable alarm +8 Relative alarm not active at set point changes	0	C-0
37	AL2L	- For High and low alarms, AL2L is the low limit of the AL2 threshold - For band alarm, AL2L is low alarm threshold	dP	From -1999 to AL2H (E.U.)	-1999	A-56
38	AL2H	- For High and low alarms, AL2H is the high limit of the AL2 threshold - For band alarm, AL2H is high alarm threshold	dP	From AL2L to 9999 (E.U.)	9999	A-57
39	AL2	AL2 threshold	dP	From AL2L to AL2H (E.U.)	0	A-58
40	HAL2	AL2 hysteresis	dP	1 ÷ 9999 (E.U.)	1	A-59
41	AL2d	AL2 delay	dP	0 oFF 1 ÷ 9999 (s)	oFF	C-0
42	AL2o	Alarm 2 enabling during Stand-by mode and out of range conditions	0	0 AL2 disabled in Stand by and out of range 1 AL2 enabled in stand by mode 2 AL2 enabled in out of range condition 3 AL2 enabled in stand by and overrange	no	C-0

AL3 group - Alarm 3 parameters

no.	Par.	Description	Dec.	Range	Default	Vis. Promo.
43	AL3t	Alarm 3 type	0	nonE Alarm not used LoAb Absolute low alarm HiAb Absolute high alarm LHAb Absolute band alarm SE.br Sensor Break LodE Deviation low alarm (relative) HidE Deviation high alarm (relative) LHdE Relative band alarm	LoAb	A-47
44	Ab3	Alarm 3 function	0	0 ÷ 15 +1 Not active at power up +2 Latched alarm (manual reset) +4 Acknowledgeable alarm +8 Relative alarm not active at set point changes	0	C-0
45	AL3L	- For High and low alarms, AL3L is the low limit of the AL3 threshold - For band alarm, AL3L is low alarm threshold	dP	From -1999 to AL3H (E.U.)	-1999	A-48
46	AL3H	- For High and low alarms, AL3H is the high limit of the AL3 threshold - For band alarm, AL3H is high alarm threshold	dP	From AL3L to 9999 (E.U.)	9999	A-49
47	AL3	AL3 threshold	dP	From AL3L to AL3H (E.U.)	0	A-50
48	HAL3	AL3 hysteresis	dP	1 ÷ 9999 (E.U.)	1	A-51
49	AL3d	AL3 delay	dP	0 oFF 1 ÷ 9999 (s)	oFF	C-0
50	AL3o	Alarm 3 enabling during Stand-by mode and out of range conditions	0	0 AL3 disabled in Stand by and out of range 1 AL3 enabled in stand by mode 2 AL3 enabled in out of range condition 3 AL3 enabled in stand by and overrange	no	C-0

LbA group - Loop Break Alarm parameters

no.	Par.	Description	Dec.	Range	Default	Vis. Promo.
51	LbAt	LBA time	0	0 oFF 1 ÷ to 9999 (s)	oFF	C-0
52	Lb5t	Delta measure used by LBA during Soft start.	dP	0 oFF 1 ÷ 9999 (E.U.)	10	C-0
53	LbAS	Delta measure used by LBA	dP	1 ÷ 9999 (E.U.)	20	C-0
54	LbcA	Condition for LBA enabling	0	uP Active when Pout = 100% dn Active when Pout = -100% both Active in both cases	both	C-0

PrEG group - Temperature control parameters

no.	Par.	Description	Dec.	Range	Default	Vis. Promo.
55	cont	Control type	0	Pid PID (heat and/or cool) On.FA ON/OFF asymmetric hysteresis On.FS ON/OFF symmetric hysteresis nr Heat/Cool ON/OFF control with neutral zone	Pid	A-25
56	Auto	Autotuning selection (this parameter is shown only if cont = Pid)	0	-4 Oscillating auto-tune with automatic restart at power up and after a set point change -3 Oscillating auto-tune with manual start -2 Oscillating -tune with auto-matic start at the first power up only -1 Oscillating auto-tune with auto-matic restart at every power up 0 Not used 1 FAST auto-tune with automatic restart at every power up 2 FAST auto-tune with automatic start at the first power up only 3 FAST auto-tune with manual start 4 FAST auto-tune with automatic restart at power up and after a set point change 5 EVO auto-tune with automatic restart at every power up 6 EVO auto-tune with automatic start at the first power up only 7 EVO auto-tune with manual start 8 EVO auto-tune with automatic restart at power up and after a set point change	2	C-0
57	Autr	Manual start of the Autotune	0	oFF Not active on Active	oFF	A-26
58	SELF	Self tuning enabling	0	oFF The instrument performs no self-tune on The instrument performs the self-tune	no	C-0
59	HSEt	Hysteresis of the ON/OFF control	dP	0 ÷ 9999 (E.U.)	1	A-27
60	cPdt	Time for compressor protection	0	0 oFF 1 ÷ 9999 (s)	oFF	C-0
61	Pb	Proportional band	dP	0 ÷ 9999 (E.U.)	50	A-28
62	int	Integral time	0	0 oFF 1 ÷ 9999 (s)	200	A-29
63	dEr	Derivative time	0	0 oFF 1 ÷ 9999 (s)	50	A-30
64	Fuoc	Fuzzy overshoot control	2	0.00 ÷ 2.00	0.50	A-31
65	HAct	Heating output actuator	0	SSr SSR rELY Relay SLou Slow actuators	SSr	A-32
66	tcrH	Heating output cycle time	1	0.1 ÷ 130.0 (s)	20.0	C-0
67	PrAt	Power ratio between heating/cooling action	2	0.01 ÷ 99.99	1.00	A-34
68	cAct	Cooling output actuator	0	SSr SSR rELY Relay SLou Slow actuators	SSr	A-35
69	tcrc	Cooling output cycle time	1	0.1 ÷ 130.0 (s)	20.0	C-0
70	rS	Manual reset (Integral pre-load)	1	-100.0 ÷ +100.0 (%)	0.0	C-0
71	roHL	Minimum power for heating output		From 0 to [72] roh.h (%)	0	
72	roHH	Maximum power for heating output		From [71] roh.L to 100 (%)	100	
73	rocL	Minimum power for cooling output		From 0 to [74] roc.h (%)	0	
74	rocH	Maximum power for cooling output		From [73] roc.L to 100 (%)	100	
75	OPSH	Heating output max. rate of rise		1 ÷ 50 (%/s) inF Step transfer	inF	
76	OPSc	Cooling output max. rate of rise		1 ÷ 50 (%/s) inF Step transfer	inF	
77	thrH	Power threshold at which H.rEG output starts working		-50 ÷ +50 (%)	0	
78	thrc	Power threshold at which C.rEG output starts working		-50 ÷ +50 (%)	0	
79	od	Delay at power up	2	0 oFF 0.01 ÷ 99.59 (hh.mm)	oFF	C-0
80	SLP	Maximum power output used during soft start	0	-100 ÷ 100 (%)	0	C-0
81	SSt	Soft start time	2	0 oFF 0.01 ÷ 8.00(hh.mm) inF No limit	oFF	C-0
82	SStH	Threshold for soft start disabling	dP	-1999 ÷ +9999 (E.U.)	9999	C-0

SSP group - Set Points parameters

no.	Par.	Description	Dec.	Range	Default	Vis. Promo.
83	nSP	Number of used set points	0	1 ÷ 4	1	A-38
84	SPLL	Minimum set point value	dP	From -1999 to SPHL	-1999	A-39
85	SPHL	Maximum set point value	dP	From SPLL to 9999	9999	A-40
86	SP 1	Set point 1	dP	From SPLL to SPLH	0	O-41
87	SP 2	Set point 2	dP	From SPLL to SPLH	0	O-42
88	SP 3	Set point 3	dP	From SPLL to SPLH	0	O-43
89	SP 4	Set point 4	dP	From SPL to SPLH	0	O-44
90	SPAt	Selection of the active set point	0	From 1 (SP 1) to nSP	1	O-45
91	SP.rt	Remote set point type	0	RSP The value coming from serial link is used as remote set point trin The value will be added to the local set point selected by SPAt and the sum becomes the operative set point PErc The value will be scaled on the input range and this value will be used as remote set point	trin	C-0
92	SPLr	Local/remote set point selection	0	Loc Local rEn Remote	Loc	C-0
93	SPu	Rate of rise for POSITIVE set point change	2	0.01 ÷ 100.00 Engineering units per minute inF Step transfer	inF	C-0
94	SPd	Rate of rise for NEGATIVE set point change	2	0.01 ÷ 100.00 Engineering units per minute inF Step transfer	inF	C-0

tim group - Timer parameters

no.	Par.	Description	Dec.	Range	Default	Vis. Promo.
95	tr.F	Independent timer function	0	NonE Timer not used i.d.A Delayed start timer i.uP.d Delayed start at power up i.d.d Feed-through timer i.P.L Asymmetrical oscillator with start OFF i.L.P Asymmetrical oscillator with start ON	nonE	A-62
96	tr.u	Timer unit	0	hh.nn Hours and minutes (0) nn.SS Minutes and seconds (1) SSS.d Second and tenth of seconds (2)	nn.SS	A-63
97	tr.t1	Time 1	2	When tr.u < 2: 0.01 ÷ 99.59	1.00	A-64
			1	When tr.u = 2: 0.1 ÷ 995.9		
98	tr.t2	Time 2	2	When tr.u < 2: 00.00 oFF 0.01 ÷ 99.59 inF Stopped by reset command	1.00	A-65
			1	When tr.u = 2: 00.0 oFF 0.1 ÷ 995.9 inF Stopped by reset command		
99	tr.St	Timer status	0	rES Timer reset run Timer run HoLd Timer hold	rES	C-0

SPrG group - Programmer parameters

no.	Par.	Description	Dec.	Range	Default	Vis. Promo.
100	Pr.F	Program action at power up	0	nonE Programmer not used S.uP.d Start at power up with a first step in stand-by S.uP.S Start at power up u.diG Start at Run command detection only u.dG.d Start at Run command with a first step in stand-by	nonE	A-67
101	Pr.u	Time unit of the soaks	2	hh.nn Hours and minutes nn.SS Minutes and seconds	hh.nn	A-68
102	Pr.E	Instrument behaviour at the end of the program execution	0	cnt Continue SPAt Go to the set point selected by SPAt St.by Go to stand-by mode	SPAt	A-71

no.	Par.	Description	Dec.	Range	Default	Vis. Promo.
103	Pr.Et	Time of the end program indication	2	0.00 oFF 0.01 ÷100.00 minutes and seconds inF Goes oFF at reset or run command	oFF	A-72
104	Pr.S1	Set point of the first soak	dP	From SPLL to SPHL	0	A-73
105	Pr.G1	Gradient of the first ramp	1	0.1 ÷ 1000.0 Engineering Unit/minute inF Step transfer	inF	A-74
106	Pr.t1	Time of the first soak	2	0.00 ÷ 99.59	0.10	A-75
107	Pr.b1	Wait band of the first soak	dP	0 oFF 1 ÷ 9999 (E.U.)	oFF	A-76
108	Pr.E1	Events of the first group	2	00.00 ÷ 11.11	00.00	C-0
109	Pr.S2	Set point of the second soak	dP	OFF or from SPLL to SPHL	0	A-78
110	Pr.G2	Gradient of the second ramp	1	0.1 ÷ 1000.0 Engineering Unit/minute inF Step transfer	inF	A-79
111	Pr.t2	Time of the second soak	2	0.00 ÷ 99.59	0.10	A-80
112	Pr.b2	Wait band of the second soak	dP	0 oFF 1 ÷ 9999 (E.U.)	oFF	A-81
113	Pr.E2	Events of the second group	2.	00.00 ÷ 11.11	00.00	C-0
114	Pr.S3	Set point of the third soak	dP	OFF or from SPLL to SPHL	0	A-83
115	Pr.G3	Gradient of the third ramp	1	0.1 ÷ 1000.0 Engineering Unit/minute inF Step transfer	inF	A-84
116	Pr.t3	Time of the third soak	2	0.00 ÷ 99.59	0.10	A-85
117	Pr.b3	Wait band of the third soak	dP	0 oFF 1 ÷ 9999 (E.U.)	oFF	A-86
118	Pr.E3	Events of the third group	0	00.00 ÷ 11.11	00.00	C-0
119	Pr.S4	Set point of the fourth soak	dP	OFF or from SPLL to SPHL	0	A-88
120	Pr.G4	Gradient of the fourth ramp	1	0.1 ÷ 1000.0 Engineering Unit/minute inF Step transfer	inF	A-89
121	Pr.t4	Time of the fourth soak	2	0.00 ÷ 99.59	0.10	A-90
122	Pr.b4	Wait band of the fourth soak	dP	0 oFF 1 ÷ 9999 (E.U.)	oFF	A-91
123	Pr.E4	Events of the fourth group	0	00.00 ÷ 11.11	00.00	C-0
124	Pr.St	Program status	0	rES Program reset run Program start HoLd Program hold	0	C-0

PAn group - Operator interface (HMI) parameters

no.	Par.	Description	Dec.	Range	Default	Vis. Promo.
125	PAS2	Password level 2	0	0 oFF 1 ÷ 999	20	A-93
126	PAS3	Password level 3	0	1 ÷ 999	30	C-0
127	uSrb	[U] button function during run time	0	nonE Not used tunE Starts auto tuning functions oPLo Manual mode (OPLO) AAc Alarm reset ASi Alarm acknowledge chSP Sequential set point selection St.by Stand-by mode Str.t Run/hold/reset timer P.run Program start P.rES program reset P.r.H.r Run/hold/reset program	nonE	A-94
128	diSP	Display management	0	nonE Standard display Pou Power output SPF Final set point Spo Operative set point AL1 Alarm 1 threshold AL2 Alarm 2 threshold AL3 Alarm 3 threshold Pr.tu Program time up Pr.td Program time down P.t.tu Program total time up P.t.td Program total time down ti.uP Timer time up ti.du Timer time down Perc Percent of the power output during soft start	nonE	A-95
129	RdE	Bargraph deviation	dP	0 oFF 1 ÷ 9999	2	A-96
130	FiLd	Filter on the displayed value	1	0 oFF 1 ÷ 20.0	oFF	C-0

no.	Par.	Description	Dec.	Range	Default	Vis. Promo.
131	dSPu	Status of the instrument at power up	0	AS.Pr Starts as it was prior to the power down Auto Starts in Auto mode oP.0 Starts in manual mode with power output = 0 St.bY Starts in stand-by mode	AS.Pr	C-0
132	oPrE	Operative mode enabling	0	ALL All Au.oP Auto or manual (oPLo) only Au.Sb Auto and Stand by only	ALL	C-0
133	oPEr	Operative mode selection	0	Auto Automatic oPLo Manual St.by Stand-by	Auto	O-1

SEr group - Serial Interface parameters

no.	Par.	Description	Dec.	Range	Default	Vis. Promo.
134	Add	Address	0	0 oFF 1 ÷ 254	1	C-0
135	bAud	Baud rate	0	1200 (bit/s) 2400 (bit/s) 9600 (bit/s) 19.2 (kbit/s) 38.4 (kbit/s)	9600	C-0
136	trSP	Selection of the value to be retransmitted (Master)	0	nonE Not used rSP Operative set point PErc Current power output (%)	nonE	C-0

Pcon group - Wattmeter parameters

no.	Par.	Description	Dec.	Range	Default	Vis. Promo.
137	coty	Measurement type	0	0 OFF = Not used 1 Instantaneous (kW) 2 Power consumption (kW/h) 3 Energy used during program execution 4 Total worked days with threshold 5 Total worked hours with threshold	nonE	A-97
138	UoLt	Nominal voltage of the load	0	1 ÷ 999 (Volt)	230	A-98
139	cur	Nominal current of the load	0	1 ÷ 999 (A)	10	A-99
140	hJob	Threshold of the worked hours/days	0	0 oFF 1 ÷ 9999	oFF	A-100

PcAL group - User Calibration parameters

no.	Par.	Description	Dec.	Range	Default	Vis. Promo.
141	ALP	Adjust low Point	dP	From -1999 to AH.P-10 (E.U.)	0	A-9
142	ALo	Adjust low Offset	dP	-300 ÷ 300 (E.U.)	0	A-10
143	AHP	Adjust High Point	dP	From A.L.P +10 to 9999 (E.U.)	9999	A-11
144	AHo	Adjust High Offset	dP	-300 ÷ 300 (E.U.)	0	A-12

PotH group - Other parameters

no.	Par.	Description	Dec.	Range	Default	Vis. Promo.
160	ScFA	Serial communication malfunction (RS485 only)	dP	0 None (behavior like the current one); 1 Reset of the outputs driven via serial interface; 2 Reset of the whole instrument, restarts as programmed with dSPu; 3 The instrument switches to Stby, resets the outputs driven via the serial interface and remains in stand by until a specific command is received (from TTL keyboard, logic contact or serial interface); 4 The instrument switches to Stby, resets the outputs driven via the serial interface but automatically returns to the previous mode (auto, man or stand by) in case of resuming communication. If the instrument receives a specific command (from TTL keyboard or from logic contact) before the serial communication resumes, the instrument will switch to the requested mode forgetting the mode it had before the automatic standby; 5 The instrument switches to Stby, performs a reset of the whole instrument, restarts as programmed with dSPu (if dSPu = AS.Pr the instrument restarts in Stby and waits for a specific command from the TTL keyboard, from digital input or from serial interafce). Note: resuming serial communication does not change the status; 6 The instrument stores the state before the communication fails, performs a total reset but restarts in “forced STBY” to automatically return to the previous mode (auto, man or stand by) when communication resumes. If the instrument receives a specific command (from TTL keyboard or logic contact) before the serial communication resumes, the instrument will switch to the requested mode, forgetting the mode it had before the automatic standby.	0	C-0

Appendix B

B. K30 COMMUNICATIONS PROTOCOL

B.1 Preface

Tecnologic uses ModBUS® RTU communication protocol. It is a royalty free protocol and it is easy to implement. For ModBus RTU a vast literature is available also in internet. Herafter some common characteristics:

– The ModBus protocol represent all data in hexadecimal format.
– Each communication string finishes with a checksum type CRC (Cyclic Redundancy Check).
– Each device in a line must have a different address.
– The protocol allows only one master and up to 255 slaves.
– Only the Master unit can start the transmission sending the address of the calling device and the command to execute.
– Only the unit having the called device address will answer to the master.

The transmission characteristics are usually programmable:

– Device address: 1 ÷ 255;
– Baud rate: bit per second;
– Byte format:
    - 1 start bit;
    - 8 data bits
– 2 final bits composed as follows:
    - 1 parity bit (even or odd);
    - 1 stop bit;

    or
    - no parity bit;
    - 2 stop bits.

The K30 allows to configure:

– Address (1 ÷ 254);
– Baud rate (1200/2400/9600/19200/38400).

The byte format is fixed : 8 bits without parity and 1 stop bit.

This document is intended to describe the K30 controllers using the MODBUS protocol in their communications capability and is mainly directed to technicians, system integrators and software developers.

B.2 Physical connection

B.2.1 Interface

K series controllers are provided with a RS485 serial communication interface, insulated so that any problem arising from ground potential is removed.

While at rest, the instruments are in a receive condition and are revert to transmission after a correct message has been decoded that matches the configured address.

B.2.2 Line

The instruments are equipped with 2 terminals named A and B.

The connection between the devices must carried on in parallel, i.e. all A terminals have to be connected between them so as B terminals. A termination resistor of 120Ω is required to maintain the quiescent condition on the line.

Adopted baud rates range from 1200 to 38400 baud, that is very satisfactory for application performance, yet very slow for RS485 interface. This fact allows the wiring of the line with a medium quality twisted pair cable: total capacity of the line should not exceed 200 nF.

The line length can be up to 1000 meters.

B.3 Communication protocol

The protocol adopted by K30 is a subset of the widely used MODBUS (JBUS, AEG Schneider Automation, Inc. registered trademark) protocol, so that connections are easy for many commercial PLCs and supervisory programs.
The MODBUS® RTU communication protocol requires that only the unit selected as the master can start communication.
Slave units can only transmit after receiving a request from the master.
The generic format for the transmission between master and slave is the following:

Data	Data number of bytes
Slave Address	1
Function code	1
Data	n
Checksum (CRC-16) (lower byte)	1
Checksum (CRC-16) (higher byte)	1

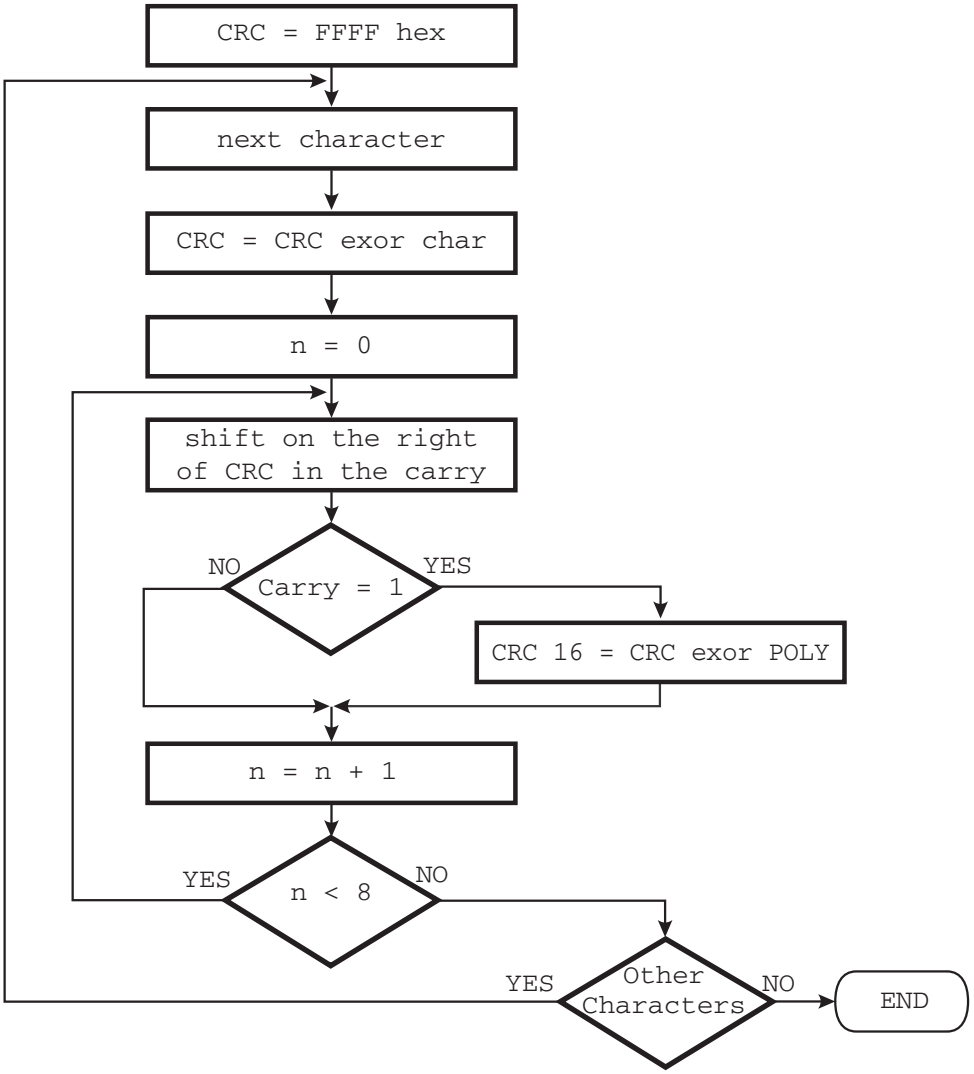
The MODBUS® RTU communication protocol provides that the end of a message is determined when the interval in the transmission of two successive characters is greater than 3.5 T.U. (Time Unit = Time required to transmit a character).
Given the latency times associated with current supervision devices and their operating systems, it is very difficult to calculate the silence time with precision.
The function codes of the communication protocol implemented on the K30 device foresee messages with a fixed length, the end of the message is therefore determined by the count of characters. For the start of the response, a fixed delay will be respected that can cover the period of silence required by the various baud rate configurations.

B.4 Cyclic redundancy check (CRC-16 Cyclic Redundancy Check)

CRC-16 is a check word that allows to verify the integrity of a message. All messages, sent or received, has in the two last characters the CRC check word.
The CRC-16 value is calculated by the transmitting device. This value is appended to the message. The receiving device recalculates the CRC-16 obviously excluding the last two characters of the message, then compares the received CRC-16 with the calculated CRC-16: the two values must be equal.
CRC-16 calculation procedure:

1. Initialize the word (16 bit) used to store the CRC-16 with the value 0xFFFF;
2. Perform an exclusive OR (XOR) between the first byte of the message and the lower part of CRC-16 putting the result in CRC-16;
3. Shift the CRC-16 one position to the right, towards the least significant bit. By inserting the zero value in the most significant bit. Examine the least significant bit;
4. If = 0: Repeat step 3 (move to another position),
   If = 1: Carry out an exclusive OR (XOR) between the CRC-16 and the polynomial value 0xA001;
5. Repeat steps 3 and 4 until 8 moves have been made. At this point an entire byte will have been processed;
6. Repeat the procedure from step 2 to step 5 for the next bytes of the message.
7. The final content of the CRC-16 word is the value of CRC-16.

The lower part of the word containing the CRC-16 (16 bytes) is always transmitted first and then the upper part.
The CRC-16 calculation algorithm can be schematized as follows:



The Poly [polynomial adopted by MODBUS RTU (JBUS)] values 0xA001.
Follows a subrutine written in “C” language able to calculate the CTC-16.

```
/* ----------------------------------------------------------------
crc_16   CRC-16 calculation

Input:
   buffer:  character string on which CRC is calculated
   length:  string length in bytes

Output:  crc_16
---------------------------------------------------------------- */
unsigned int crc_16 (unsigned char *buffer, unsigned int length)
{
      unsigned int i, j, temp_bit, temp_int, crc;
      crc = 0xFFFF;
      for (i = 0; i < length; i++ ){
            temp_int = (unsigned char) *buffer++;
            crc ^= temp_int;
            for ( j = 0; j < 8; j++ ) {
                  temp_bit = crc & 0x0001;
                  crc >>= 1;
                  if ( temp_bit != 0 )
                        crc ^= 0xA001;
            }
      }
      return (crc);
}
```

Note: All numerical values in the format 0x. ÷ are expressed in hexadecimal format.

10.1 Function Codes

The ModBUS® RTU protocol provides a complete set of function codes capable of allowing the supervisor to interact perfectly with the devices connected to it.
These commands, able to cover the most diverse and generic needs, can however make the code that must necessarily be implemented on the devices heavy.
For this reason Ascon Tecnologic has decided to use a small subset of the function codes of the ModBUS® RTU protocol to communicate with devices of the K30 family:

Function Code 3 **Multiple reading (maximum 16 consecutive addresses);**
Function Code 6 **Writing of a single address;**
Function Code 16 **Multiple writing (maximum 16 consecutive addresses).**

The correct use of these two function codes allows the remote master to carry out the control and supervision function completely, being able to read and modify any information present in the slave device.

10.1.1 Function code 3: read multiple registers (maximum 16 registers for K30)

This function code is used by the master to read a group of sequential registers present in the slave.

Master request	
Data	Byte
Slave address (1-255)	1
Function code (3)	1
First register address (MSB = Most Significant Byte)	1
First register address (LSB = Less Significant Byte)	1
Number of requested registers (MSB)	1
Number of requested registers (LSB)	1
CRC-16 (LSB)	1
CRC-16 (MSB)	1

Slave reply	
Data	Byte
Slave address (1-255)	1
Function code (3)	1
Byte number (n)	1
Data(s)	n
CRC-16 (LSB)	1
CRC-16 (MSB)	1

In the Data field the values of the requested registers are presented in word format [2 bytes]: the first byte represent the MSB (Most Significant Byte) while the second one represent the LSB (Less Significant Byte). This mode will be the same for all the requested locations.
Example: The master requires to the address 1 slave the value contained in 2 consecutive addresses [locations 25 and 26 (0x19 and 0x1A)].

Master request	
Data	Byte (Hex)
Indirizzo slave (1-254)	01
Codice funzione (3)	03
Primo indirizzo richiesto (parte alta)	00
Primo indirizzo richiesto (parte bassa)	19
Numero indirizzi richiesti (parte alta)	00
Numero indirizzi richiesti (parte bassa)	02
CRC-16 (parte bassa)	15
CRC-16 (parte alta)	CC

Slave reply	
Data	Byte (Hex)
Indirizzo slave (1-254)	01
Codice funzione (3)	03
Numero byte (n)	04
Primo dato (parte alta)	00
Primo dato (parte bassa)	0A
Secondo dato (parte alta)	00
Secondo dato (parte bassa)	14
CRC-16 (parte bassa)	DA
CRC-16 (parte alta)	3E

The slave replay means:
The value of the location 25 = 10 (0x000A hexadecimal);
The value of the location 26 = 20 (0x0014 hexadecimal).

10.1.2 Function code 6: write a single word (one location)

This function code is used by the master to write a value to a single address.

Master request	
Data	Byte
Slave address (1 ÷ 255)	1
Function code (6)	1
Register address (MSB)	1
Register address (LSB)	1
Value to write (MSB)	1
Value to write (LSB)	1
CRC-16 (MSB)	1
CRC-16 (LSB)	1

Slave reply	
Data	Byte
Slave address (1 ÷ 255)	1
Function code (6)	1
Register address (MSB)	1
Register address (LSB)	1
Written value (MSB)	1
Written value (LSB)	1
CRC-16 (MSB)	1
CRC-16 (LSB)	1

Example: The master unit asks to slave at address 1 to write the value 10 (0x0A) at the memory location 770 (0x302).

Master request	
Data	Byte (Hex)
Slave address (1 ÷ 255)	01
Function code (6)	06
Register address (MSB)	03
Register address (LSB)	02
Value to write (MSB)	00
Value to write (LSB)	0A
CRC-16 (MSB)	A8
CRC-16 (LSB)	49

Slave reply	
Data	Byte (Hex)
Slave address (1 ÷ 255)	01
Function code (6)	06
Register address (MSB)	03
Register address (LSB)	02
Written value (MSB)	00
Written value (LSB)	0A
CRC-16 (MSB)	A8
CRC-16 (LSB)	49

10.1.3 Function code 16: preset multiple registers (maximum 16 registers for K30)

This function code allows to preset 16 registers at a time.

Master request	
Data	Byte
Slave address (1 ÷ 255)	1
Function code (16)	1
First register address (MSB)	1
First register address (LSB)	1
Number of requested registers (MSB)	1
Number of requested registers (LSB)	1
Byte count	1
Values	n
CRC-16 (LSB)	1
CRC-16 (MSB)	1

Slave reply	
Data	Byte
Slave address (1 ÷ 255)	1
Function code (16)	1
First register address (MSB)	1
First register address (LSB)	1
Number of written registers (MSB)	1
Number of written registers (LSB)	1
CRC-16 (LSB)	1
CRC-16 (MSB)	1

Example: The master unit requires to the slave 1 to write the values 100 (0x64) and 200 (oxC8) at registers 10314 (0x284A) and 10315 (0x284B).

Master request	
Data	Byte (Hex)
Slave address (1 ÷ 255)	01
Function code (16)	10
First register address (MSB)	28
First register address (LSB)	4A
Number of requested registers (MSB)	00
Number of requested registers (LSB)	02
Byte count	4
Value 1 (MSB)	00
Value 1 (LSB)	64
Value 2 (MSB)	00
Value 2 ((LSB)	C8
CRC-16 (LSB)	C9
CRC-16 (MSB)	A8

Slave reply	
Data	Byte (Hex)
Slave address (1 ÷ 255)	01
Function code (16)	10
First register address (MSB)	28
First register address (LSB)	4A
Number of written registers (MSB)	00
Number of written registers (LSB)	02
CRC-16 (LSB)	69
CRC-16 (MSB)	BE

10.1.4 The exception reply

K 30 instruments reply with an exception when the request is formally correct, but cannot be satisfied standing particular situations; the reply contains a code indicating the cause of the missing regular reply, the frame is:

Exception request	
Data	Byte
Slave address (1 ÷ 255)	1
Function code (3 or 6 +0x80)	1
Error code	1
CRC-16 (LSB)	1
CRC-16 (MSB)	1

K 30 adopts a subset of MODBUS RTU (JBUS) exception code:

Exception request	
Error code	Data
1	Unknown function code
2	Invalid memory address
3	Invalid data field
6	Data not ready (Controller not ready)

10.1.5 Note

Error code 6

The instrument sends an exception response with error code 6:

- Upon a request to read or write an address not available in the current configuration.
- To a read or write request that comes when the instrument is in the parameter display/programming phase.

Data format

The data can represent the value of a quantity (eg: measured variable) or a choice within a list (eg: unit of measurement C/°F). Both are encoded as integers and represented by word. A word consists of 2 bytes. The information is transferred using a word of which the first byte transmitted represents the most significant part.
The “2’s complement” format is used for the transmission of negative values.
Examples:

- The value 2046 (7FE in hexadecimal) is transmitted as 0x7, 0xFE;
- The value -1250 (2’s complement = FB1E in hexadecimal) is transmitted as 0xFB, 0x1E.

Decimals

Due to the characteristics of the protocol, the decimal point cannot appear in the data transmitted. The attribution of the decimal point must therefore take place outside the communication protocol. For addresses that represent values with a fixed decimal established in advance, refer to the technical specifications and/or the user manual. For addresses that represent values with variable decimal, the address of the parameter that determines the number is specified in the relative table.

Writing addresses

The value sent by the master in writing must be within the limits set for the corresponding address. Otherwise, the limit value that has been exceeded is automatically stored instead of the value sent.

Performance

After receiving a valid request, a K30 instrument prepares the response and sends it to the master station, according to the methods specified below:
Between the end of reception and the beginning of transmission, a minimum time of three characters is guaranteed to allow the line to be switched. An online silence time of 20 ms is required to recover abnormal conditions or incorrect messages: this means that the time between two consecutive characters of the same message must be less than 20 ms.

10.2 Address map

The devices of the K30 family use only word addresses, divided as follows:

Initial address		Final address		Meaning
Hex	Dec.	Hex	Dec.	
1	1	13	21	Group of variables common to all new Ascon Tecnologic instruments: numerical values and states calculated and dynamically updated. Available in reading and writing
200	512	250	592	Compatibility variables common to all Ascon Tecnologic devices prior to K30: numerical values and states calculated and dynamically updated. Available in reading and writing
280	640	31E	798	Configuration parameters Available in reading and writing
2800	10240	289E	10398	Repetition for compatibility with all Ascon Tecnologic devices prior to K30 of the configuration parameters (280-31B): numerical and symbolic values. Available in reading and writing

10.3 Variables comunes

no.	Address		Description	Dec.	R/W
	Hex.	Dec.			
1A	1	1	**PV: Measured value** **Note:** When a measuring error is detected the instrument sends: -10000 Underrange 10000 Overrange 10001 Overflow of the A/D converter 10003 Variable not available	dP	r/w
2A	2	2	**Number of decimal digits of the measured value**		r
3A	3	3	**Operative set point** (value)	dP	r
4A	4	4	**Power output** **Range:** -10000 ÷ 10000 (%) **Note:** This parameter is always writable but it will be active only when the instrument operates in Manual mode.	2	r/w
5A	5	5	**Active set point selection** **Range:** 0 SP 1 1 SP 2 2 SP 3 3 SP 4	0	r/w
6A	6	6	**SP 1** **Range:** SPLL ÷ SPLH	dP	r/w
7A	7	7	**SP 2** **Range:** SPLL ÷ SPLH	dP	r/w
8A	8	8	**SP 3** **Range:** SPLL ÷ SPLH	dP	r/w
9A	9	9	**SP 4** **Range:** SPLL ÷ SPLH	dP	r/w
10A	A	10	**Alarms status** Bit-managed word: **Range:** bit 0 Alarm 1 status bit 1 Alarm 2 status bit 2 Alarm 3 status bit 3 ÷ 8 RESERVED bit 9 LBA status bit 10 Power failure indicator bit 11 Generic error bit 12 ÷ 15 RESERVED	0	r
11A	B	11	**Outputs status** (physical outputs) Bit-managed word: **Range:** bit 0 Out1 status bit 1 Out2 status bit 3 Out3 status bit 4 Out4 status bit 5 Out5 status bit 6 ÷ 15 RESERVED **Note:** When an output is driven by serial link, the relative bit will remain equal to 0	0	r
12A	C	12	**Controller status** Bit-managed word: **Range:** bit 0 Automatic bit 1 Manual bit 2 Standby bit 3 Remote Set point (temporary) used bit 4 Auto-tuning active bit 5 Self tuning active bit 6 RESERVED bit 7 Timer running bit 8 Soft start running bit 9 Ramp for set point change (up or down) running bit 10 Delay at start up (▫◿) running bit 11 Program running bit 12 Measure status (0 = OK; 1 = error). bit 13 ÷ 15 RESERVED	0	r
13A	D	13	**Alarms reset** **Range:** 0 Not reset 1 Reset	0	r/w
14A	E	14	**Alarms acknowledge** **Range:** 0 Not acknowledged 1 Acknowledged	0	r/w
15A	F	15	**Controller mode** **Range:** 0 Automatic 1 Manual 2 Stand-by	0	r/w
16A	10	16	**Remote set point (Temporary set point)**(from serial link) **Range:** SPLL ÷ SPLH **Note:** The remote set point is stored in RAM	dP	r/w

no.	Address		Description	Dec.	R/W
	Hex.	Dec.			
17A	11	17	**Autotuning activation** **Range:** 0 Not activated 1 Activated	0	r/w
18A	12	18	**Power output used when a measuring error is detected** **Range:** -100 ÷ +100 **Note:** This value is stored in RAM	0	r/w
19A	13	19	**Default parameters loading** 481 Default parameter loading	0	r/ w
20A	14	20	**Parameters table identification code** **Range:** 0 ÷ 65535 **Note:** The word is composed by two parts: Low byte – Version of the parameter table High byte - Version of the family protocoll	0	r
21A	15	21	**Instrument identification code** 11 K30	0	r

10.4 Group of variables compatible with the old Tecnologic instruments

no.	Address		Description	Dec.	R/W
	Hex.	Dec.			
1B	0200	512	**PV: Measured value** As Modbus address 1	dp	r
2B	0201	513	**Number of decimal digits of the measured value** As Modbus address 2	0	r
3B	0202	514	**Power output** As Modbus address 4	2	r
4B	0203	515	**Power output of the heating output** **Range:** 0 ÷ 10000 (%)	2	r
5B	0204	516	**Power output of the cooling output** **Range:** 0 ÷ 10000 (%)	2	r
6B	0205	517	**Alarm 1 status** **Range:** 0 OFF 1 ON	0	r
7B	0206	518	**Alarm 2 status** **Range:** 0 OFF 1 ON	0	r
8B	0207	519	**Alarm 3 status** **Range:** 0 OFF 1 ON	0	r
9B	0208	520	**Operative set point** As Modbus address 3		
10B	020A	522	**LBA status** **Range:** 0 OFF 1 ON	0	r
11B	020F	527	**Control status** **Range:** 0 Automatic 1 Manual 2 Standby 3 Tuning	0	r/w
12B	0224	548	**Status/remote control of Out1** **Range:** 0 OFF 1 ON **Note:** Parameter writable when Out1 is not used by the controller (o1F = nonE). This parameter is stored in RAM	0	r/w
13B	0225	549	**Status/remote control of the Output 2** **Range:** 0 OFF 1 ON **Note:** Parameter writable when Out2 is not used by the controller (o2F = nonE). This parameter is stored in RAM	0	r/w
14B	0226	550	**Status/remote control of the Output 3** **Range:** 0 OFF 1 ON **Note:** Parameter writable when Out3 is not used by the controller (o3F = nonE). This parameter is stored in RAM	0	r/w
15B	0227	551	**Status/remote control of the Output 4** **Range:** 0 OFF 1 ON **Note:** Parameter writable when Out4 is not used by the controller (o4F = nonE). This parameter is stored in RAM	0	r/w

no.	Address		Description	Dec.	R/W
	Hex.	Dec.			
16B	228	552	**Status/remote control of the Output 5** **Range:** 0 OFF 1 ON **Note:** Parameter writable when Out5 is not used by the controller (o5F = nonE). This parameter is stored in RAM	0	r/w
17B	0240	576	**Digital input 1 status** **Range:** 0 OFF 1 ON **Note:** The digital input 1 status can be read from the serial port even if the input is not used by the controller.	0	r/w
18B	0241	577	**Digital input 2 status** **Range:** 0 OFF 1 ON **Note:** The digital input 2 status can be read from the serial port even if the input is not used by the controller.	0	r/w
19B	0244	580	**Program status** **Range:** 0 Not configured 1 Reset (not running) 2 Run 3 Hold 4 Wait 5 End 6 Hold + Wait 7 Continue	0	r/w
20B	0245	581	**Timer status** **Range:** 0 Not configured 1 Reset 2 Run 3 Hold 4 End	0	r/w
21B	0246	582	**Program step in execution** **Range:** 0 Program not active 1 Ramp step 1 2 Soak step 1 2 Ramp step 2 4 Soak step 2 5 Ramp step 3 6 Soak step 3 7 Ramp step 4 8 Soak step 4 9 END	0	r
22B	0247	583	**Remaining time to the program end** **Range:** 0 ÷ 65535 (**Minutes** if Pru=hh.mm the, **Seconds** if Pru=mm.ss) **Note:** When the program is not running this parameter returns zero.	2	r
23B	248	584	**Program events status** **Range:** 0 E1 = 0 E2 = 0 1 E1 = 1 E2 = 0 2 E1 = 0 E2 = 1 3 E1 = 1 E2 = 1	0	r
24B	249	585	**Remaining time to the timer end** **Range:** 0 ÷ 65535 (**Hours** when Tru=hh.mm, **Minutes** when Tru=mm.ss)	2	r
			Range: 0 ÷ 9959 (**Tenth of seconds** when Tru = SSS.d) **Note:** When the timer is not active this parameter returns zero.	1	r
25B	24A	586	**Wattmeter**: The meaning of this parameter is defined by the CO.ty parameter setting. **Range:** 0 CO.ty = 0FF 1 CO.ty = 1 = kW 2 CO.ty = 2 = kWh 3 CO.ty = 3 = Energy used during program execution (kWh) 4 CO.ty = 4 = Worked days 5 CO.ty = 5 = Worked hours	0	r
26B	24B	587	**Time necessary to execute the first ramp of the program** **Range:** 0 ÷ 65535 (**Minutes** if Pru = hh.mm, **Seconds** if Pru = mm.ss)	0	r
27B	250	592	**Power output when the instrument is in manual mode** **Range:** -10000 ÷ 10000 (%)	2	r/w

10.5 Parameters configuration

3 inP group - Inputs parameters

no.	Par.	Address Hex.	Address Dec.	Description	Values	Dec.	R/W
1	HcFG	280 2800	640 10240	**Built in Hardware**	0 TC/RTD 1 TC/PTC 2 Current 3 Volt	0	r
2	SEnS	281 2801	641 10241	**Input type (a**ccording to “Built in HW”)		0	r/w
				TC, Pt100 input (C)	0 = J, 1 = crAL, 2 = S, 3 = r, 4 = t, 5 = ir.J, 6 = ir.cA, 7 = Pt1, 8 = 0.50 (mV), 9 = 0.60 (mV), 10 = 12.60 (mV), 11 = SEr1, 12 = SEr2		
				TC, PTC, NTC (E)	0 = J, 1 = crAL, 2 = S ,3 = r, 4 = t, 5 = ir.J, 6 = ir.cA, 7 = Ptc, 8 = ntc, 9 = 0.50 (mV), 10 = 0.60 (mV), 11 = 12.60 (mV), 11 = SEr1, 12 = SEr2		
				Current input (I)	0 = 0.20 (mA), 1 = 4.20 (mA), 11 = SEr1, 12 = SEr2		
				Voltage input (V)	0 = 0.1 (V) 1 = 0.5 (V), 2 = 1.5 (V), 3 = 0.10 (V), 4 = 2.10(V), 11 = SEr1, 12 = SEr2		
3	dP	282 2802	642 10242	**Decimal digits for linear inputs and SEr**	0 ÷ 3	0	r/w
				Decimal digits for TC, RTD, PTC, NTC	0/1		
4	SSc	283 2803	643 10243	**Initial scale readout for linear inputs**	-1999 ÷ FSC (E.U.)	dP	r/w
5	FSc	284 2804	644 10244	**Full scale readout for linear inputs**	SSC ÷ 9999 (E.U.)	dP	r/w
6	unit	285 2805	645 10245	**Engineering unit**	0 C °C 1 F °F	0	r/w
7	FiL	286 2806	646 10246	**Digital input filter** **Note:** This filter affects the control, the retrasmission and the alarm actions	0 oFF 1 ÷ 200	1	r/w
8	inE	287 2807	647 10247	**Behavior in case of Out of Range**	0 our Over-range and Under-range 1 or Over-range 2 ur Under-range	0	r/w
9	oPE	288 2808	648 10248	**Output power in case of out of range**	-100 ÷ 100 (%)	0	r/w
10	diF1	289 2809	649 10249	**Digital input 1 function** **Note:** The digital input status is available even if the input is “not used”	0 OFF = not used 1 Alarm Reset 2 Alarm acknowledge (ACK) 3 Hold of the measured value 4 Stand by mode 5 HEAt with SP1 and CooL with “SP2” 6 Timer run/hold/reset [transition] 7 Timer run [transition] 8 Timer reset [transition] 9 Timer run/hold [Status] 10 Program run 11 Program reset 12 Program hold 13 Program run/hold 14 Program run/reset 15 Instrument in Manual mode 16 Sequential set point selection 17 SP1 / SP2 selection 18 Set point Binary selection 19 Digital inputs in parallel to ▲/▼ keys 20 Timer RUN/Reset with lock at count end 21 Timer RUN/Reset without lock at count end	0	r/w
11	diF2	28A 280A	650 10250	**Digital input 2 function** **Note:** The digital input status is available even if the input is “not used”		0	r/w

Pout group - Outputs parameters

no.	Par.	Address		Description	Values	Dec.	R/W
		Hex.	Dec.				
12	o1F	28B 280B	651 10251	**Out 1 function**	0 nonE Output not used 1 H.rEG Heating output 2 c.rEG Cooling output 3 AL Alarm output 4 t.out Timer output 5 t.HoF out -OFF in hold 6 P. End Program end 7 P.HLd Program Hold 8 P.uit Program wait 9 P.run Program Run 10 P.Et1 Program Event 1 11 P.Et2 Program Event 2 12 or.bo Over-range &burnout 13 P.FaL Power failure 14 bo.PF Burnout & power Fail 15 diF1 The output repeats the DI1 status 16 diF2 The output repeats the DI2 status 17 St.bY Instrument in stand by mode 18 ON Out1 forced to ON	0	r/w
13	o1AL	28C 280C	652 10252	**Alarms linked to out1**	0 ÷ 15 +1 Alarm 1 +2 Alarm 2 +4 Alarm 3 +8 Loop break alarm +16 Sensor Break	0	r/w
14	o1Ac	28D 280D	653 10253	**Out 1 action**	0 dir Direct 1 rEV Reversed 2 dir.r Direct with reversed LED 3 rev.r Reversed with reversed LED	0	r/w
15	o2F	28E 280E	654 10254	**Out 2 function**	See o1.F	0	r/w
16	o2AL	28F 280F	655 10255	**Alarms linked to out 2**	See o1.AL	0	r/w
17	o2Ac	290 2810	656 10256	**Out 2 action**	See o1Ac	0	r/w
18	o3F	291 2811	657 10257	**Out 3 function**	See o1.F	0	r/w
19	o3AL	292 2812	658 10258	**Alarms linked to out 3**	See o1.AL	0	r/w
20	o3Ac	293 2813	659 10259	**Out 3 action**	See o1Ac	0	r/w
21	o4F	294 2814	660 10260	**Out 4 function**	See o1.F	0	r/w
22	o4AL	295 2815	661 10261	**Alarms linked to out 4**	See o1.AL	0	r/w
23	o4Ac	296 2816	662 10262	**Out 4 action**	See o1Ac	0	r/w
24	o5F	297 2817	663 10263	**Out 5 function**	See o1.F	0	r/w
25	o5AL	298 2818	664 10264	**Alarms linked to out 5**	See o1.AL	0	r/w
26	o5Ac	299 2819	665 10265	**Out 5 action**	See o1Ac	0	r/w

PAL 1 group - Alarm 1 parameters

no.	Par.	Address		Description	Values	Dec.	R/W
		Hex.	Dec.				
27	AL 1t	29A 281A	666 10266	**Alarm 1 type**	0 nonE 1 LoAb Absolute low alarm 2 HiAb Absolute high alarm 3 LHAb Absolute band alarm 4 SE.br Sensor Break 5 LodE Deviation low alarm 6 HidE Deviation high alarm 7 LHdE Band alarm	0	r/w
28	Ab 1	29B 281B	667 10267	**Alarm 1 function**	0 ÷ 15 +0 No function +1 Not active at power up +2 Latched alarm +4 Alarm +8 Alarm masked after a set point change	0	r/w
29	AL 1L	29C 281C	668 10268	**For High and low alarms AL1L is the low limit of the AL1 threshold For band alarm AL1L is low alarm threshold**	From -1999 to AL1H (E.U.)	dP	r/w
30	AL 1H	29D 281D	669 10269	**For High and low alarms AL1H is the high limit of the AL1 threshold For band alarm AL1H is high alarm threshold**	From AL1L to 9999 (E.U.)	dP	r/w
31	AL 1	29E 281E	670 10270	**Alarm 1 threshold**	From Al1L to Al1H (E.U.)	dP	r/w
32	HAL 1	29F 281F	671 10271	**Alarm 1 hysteresis**	0 oFF 1 ÷ 9999 (E.U.)	dP	r/w
33	AL 1d	2A0 2820	672 10272	**Alarm 1 delay**	0 oFF 1 ÷ 9999 (s)	0	r/w
34	AL 1o	2A1 2821	673 10273	**Alarm 1 operation in stand-by, over and under range**	0 AL1 disabled during Stand by and out of range 1 AL1 enabled in stand by mode 2 AL1 enabled in out of range condition 3 AL1 enabled in stand by, over and under range	0	r/w

PAL 2 group - Alarm 2 parameters

no.	Par.	Address		Description	Values	Dec.	R/W
		Hex.	Dec.				
35	AL2t	2A2 2822	674 10274	**Alarm 2 type**	0 nonE 1 LoAb Absolute low alarm 2 HiAb Absolute high alarm 3 LHAb Absolute band alarm 4 SE.br Sensor Break 5 LodE Deviation low alarm 6 HidE Deviation high alarm 7 LHdE Band alarm	0	r/w
36	Ab2	2A3 2823	675 10275	**Alarm 2 function**	0 ÷ 15 +0 No function +1 Not active at power up +2 Latched alarm +4 Alarm +8 Alarm masked after a set point change	0	r/w
37	AL2L	2A4 2824	676 10276	**For High and low alarms AL2L is the low limit of the AL2 threshold For band alarm AL2L is low alarm threshold**	From -1999 AL2H (E.U.)	dP	r/w
38	AL2H	2A5 2825	677 10277	**For High and low alarms AL2H is the high limit of the AL2 threshold For band alarm AL2H is high alarm threshold**	From AL2L 9999 (E.U.)	dP	r/w
39	AL2	2A6 2826	678 10278	**Alarm 2 threshold**	From AL2L AL2H (E.U.)	dP	r/w
40	HAL2	2A7 2827	679 10279	**Alarm 2 hysteresis**	0 oFF 1 ÷ 9999 (E.U.)	dP	r/w
41	AL2d	2A8 2828	680 10280	**Alarm 2 delay**	0 oFF 1 ÷ 9999 (s)	0	r/w
42	AL2o	2A9 2829	681 10281	**Alarm 2 operation in stand-by, over and under range**	0 AL2 disabled during Stand by and out of range 1 AL2 enabled in stand by mode 2 AL2 enabled in out of range condition 3 AL2 enabled in stand by, over and under range	0	r/w

AL3 group - Alarm 3 parameters

no.	Par.	Address Hex.	Address Dec.	Description	Values	Dec.	R/W
43	AL3t	2AA 282A	682 10282	**Alarm 3 type**	0 nonE 1 LoAb Absolute low alarm 2 HiAb Absolute high alarm 3 LHAb Absolute band alarm 4 SE.br Sensor Break 5 LodE Deviation low alarm 6 HidE Deviation high alarm 7 LHdE Band alarm	0	r/w
44	Ab3	2AB 282B	683 10283	**Alarm 3 function**	0 ÷ 15 +0 No function +1 Not active at power up +2 Latched alarm +4 Alarm +8 Alarm masked after a set point change	0	r/w
45	AL3L	2AC 282C	684 10284	**For High and low alarms AL3L is the low limit of the AL3 threshold For band alarm AL3L is low alarm threshold**	From -1999 to AL3H (E.U.)	dP	r/w
46	AL3H	2AD 282D	685 10285	**For High and low alarms AL3H is the high limit of the AL3 threshold For band alarm AL3H is high alarm threshold**	From AL3L to 9999 (E.U.)	dP	r/w
47	AL3	2AE 282E	686 10286	**Alarm 3 threshold**	From AL3L to AL3H (E.U.)	dP	r/w
48	HAL3	2AF 282F	687 10287	**Alarm 3 hysteresis**	0 oFF 1 ÷ 9999 (E.U.)	dP	r/w
49	AL3d	2B0 2830	688 10288	**Alarm 3 delay**	0 oFF 1 ÷ 9999 (s)	0	r/w
50	AL3o	2B1 2831	689 10289	**Alarm 3 operation in stand-by, over and under range**	0 AL3 disabled during Stand by and out of range 1 AL3 enabled in stand by mode 2 AL3 enabled in out of range condition 3 AL3 enabled in stand by, over and under range	0	r/w

LbA group - Loop Break Alarm (LBA) parameters

no.	Par.	Address Hex.	Address Dec.	Description	Values	Dec.	R/W
51	LbAt	2B2 2832	690 10290	**Loop break alarm time**	0 oFF 1 ÷ 9999 (s)	0	r/w
52	LbSt	2B3 2833	691 10291	**Δt used by LBA during Soft start**	0 oFF 1 ÷ 9999 (E.U.)	dP	r/w
53	LbAS	2B4 2834	692 10292	**Δt used by LBA**	0 oFF 1 ÷ 9999 (E.U.)	dP	r/w
54	LbcA	2B5 2835	693 10293	**Condition for LBA enabling**	0 uP Active when Pout = 100% 1 dn Active when Pout = -100% 2 both Active in both cases	0	r/w

rEG group - Temperature control parameters

no.	Par.	Address Hex.	Address Dec.	Description	Values	Dec.	R/W
55	cont	2B6 2836	694 10294	**Control type (**When heating **and** cooling outputs are programmed)	0 Pid PID control 1 nr neutral zone On/OFF	0	r/w
				Control type (When heating **or** cooling outputs are programmed)	0 Pid PID control 1 On.FA asymmetrical ON/OFF 2 On.FS symmetrical ON/OFF		

no.	Par.	Address		Description	Values	Dec.	R/W
		Hex.	Dec.				
56	AUto	2B7 2837	695 10295	**Auto tune selection**	-4 Oscillating auto-tune with automatic restart at power up and after a set point change -3 Oscillating auto-tune with manual start -2 Oscillating -tune with automatic start at 1st power up -1 Oscillating auto-tune with automatic restart at all power ups 0 Not used 1 FAST auto-tune with automatic restart at all power ups 2 FAST auto-tune with automatic start at 1st power up 3 FAST auto-tune with manual start 4 FAST auto-tune with automatic restart at power up and after a set point change 5 EVO auto-tune with automatic restart at all power ups 6 EVO auto-tune with automatic start at 1st power up 7 EVO auto-tune with manual start 8 EVO auto-tune with automatic restart at power up and after a set point change	0	r/w
57	AUtr	2B8 2838	696 10296	**Manual start of the auto-tune** **Note: r/w** in auto-tune with manual start, **r** in all other cases	0 oFF Auto-tune tuning disabled 1 on Auto-tune tuning enabled	0	r/w
58	SELF	2B9 2839	697 10297	**Self-tuning enabling**	0 no Self tuning disabled 1 YES Self tuning enabled	0	r/w
59	HSEt	2BA 283A	698 10298	**Hysteresis of the ON/OFF control**	0 ÷ 9999 (E.U.)	dp	r/w
60	cPdt	2BB 283B	699 10299	**Time for compressor protection**	0 oFF 1 ÷ 9999 (s)	0	r/W
61	Pb	2BC 283C	700 10300	**Proportional band**	1 ÷ 9999 (E.U.)	dp	r/w
62	int	2BD 283D	701 10301	**Integral time**	0 oFF 1 ÷ 9999 (s)(10000 = inF)	0	r/w
63	dEr	2BE 283E	702 10302	**Derivative time**	0 oFF 1 ÷ 9999 (s)	0	r/w
64	Fuoc	2BF 283F	703 10303	**Fuzzy overshoot control**	0 ÷ 200	2	r/w
65	HAct	2C0 2840	704 10304	**Heating output actuator**	0 SSr SSR 1 rEly Relay 2 Slou Slow actuators	0	r/w
66	tcrH	2C1 2841	705 10305	**Heating output cycle time**	0 oFF 1 ÷ 1300 (s)	1	r/w
67	PrAt	2C2 2842	706 10306	**Power ratio between heating and cooling action**	1 ÷ 9999	2	r/w
68	cAct	2C3 2843	707 10307	**Cooling output actuator**	0 SSr SSR 1 rEly Relay 2 Slou Slow actuators	1	r/w
69	tcrc	2C4 2844	708 10308	**Cooling output cycle time**	0 oFF 1 ÷ 1300 (s)	1	r/w
70	rS	2C5 2845	709 10309	**Manual reset** (pre-load Integral action)	-1000 ÷ +1000 (%)	1	r/w
71	rohL	2C6 2846	710 10310	**Min. power for heating outputs**	From 0 to roh.h (%)	0	r/w
72	rohH	2C7 2847	711 10311	**Max. power for heating outputs**	From roh.L to 100 (%)	0	r/w
73	rocL	2C8 2848	712 10312	**Min. power for cooling outputs**	From 0 to roc.h (%)	0	r/w
74	rocH	2C9 2849	713 10313	**Max. power for cooling outputs**	From roc.L to 100 (%)	0	r/w
75	oPSh	2CA 284A	714 10314	**Heating output max rate of rise**	1 ÷ 50 (%/s) 51 inF Step transfer	0	r/w
76	oPSC	2CB 284B	715 10315	**Cooling output max rate of rise**	1 ÷ 50 (%/s) 51 inF Step transfer	0	r/w
77	thrh	2CC 284C	716 10316	**Power threshold at which output H.rEG begins to operate**	-50 ÷ +50%	0	r/w
78	thrc	2CD 284D	717 10317	**Power threshold at which output C.rEG begins to operate**	-50 ÷ +50%	0	r/w
79	od	2CE 284E	718 10318	**Delay at power up**	0 oFF 1 ÷ 9959 (hh.min)	2	r/w
80	St.P	2CF 284F	719 10319	**Max. power output used during soft start**	-100 ÷ +100 (%)	0	r/w
81	SSt	2D0 2850	720 10320	**Soft start time**	0 oFF 1 ÷ 799 (h.min) (800 = inF = no time limit)	2	r/w
82	SSth	2D1 2851	721 10321	**Threshold for soft start disabling**	0 oFF -2000 ÷ 9999 (E.U.)	dP	r/w

SP group - Set Points parameters

no.	Par.	Address		Description	Values	Dec.	R/W
		Hex.	Dec.				
83	nSP	2D2 2852	722 10322	**Number of available set points**	1 ÷ 4	0	r/w
84	SPLL	2D3 2853	723 10323	**Minimum set point value**	From -1999 to SPHL (E.U.)	dP	r/w
85	SPHL	2D4 2854	724 10324	**Maximum set point value**	From SPLL to 9999 (E.U.)	dP	r/w
86	SP 1	2D5 2855	725 10325	**Set point 1**	From SPLL to SPLH (E.U.)	dP	r/w
87	SP 2	2D6 2856	726 10326	**Set point 2**	From SPLL to SPLH (E.U.)	dP	r/w
88	SP 3	2D7 2857	727 10327	**Set point 3**	From SPLL to SPLH (E.U.)	dP	r/w
89	SP 4	2D8 2858	728 10328	**Set point 4**	From SPLL to SPLH (E.U.)	dP	r/w
90	SPAt	2D9 2859	729 10329	**Active set point selection**	0 SP 1 1 SP 2 2 SP 3 3 SP 4	0	r/w
91	SP.rt	2DA 285A	730 10330	**Remote set point type**	0 rSP The value coming from serial link is used as remote set point (RSP). 1 trin The value coming from serial link will be algebraically added to the local set point selected by SPAt and the sum becomes the operative set point 2 PErc The value coming from serial will be scaled on the input range and this value will be used as remote set point	0	r/w
92	SPLr	2DB 285B	731 10331	**Local/remote set point selection**	0 Loc Local 1 rEn Remote	0	r/w
93	SP.u	2DC 285C	732 10332	**Rate of rise for positive set point change (ramp up)**	1 ÷ 9999 units per minute 10000 inF Step transfer	2	r/w
94	SP.d	2DD 285D	733 10333	**Rate of rise for negative set point change (ramp down)**	1 ÷ 9999 units per minute 10000 inF Step transfer	2	r/w

tim group - Timer parameters

no.	Par.	Address		Description	Values	Dec.	R/W
		Hex.	Dec.				
95	tr.F	2DE 285E	734 10334	**Independent timer function**	0 nonE Timer not used 1 i.d.A Delayed start timer 2 i.uP.d Delayed start at power up 3 i.d.d Feed-through timer 4 i.P.L Asymmetrical oscillator with OFF start 5 i.L.P Asymmetrical oscillator with ON start	0	r/w
96	tr.u	2DF 285F	735 10335	**Time unit of the timer**	0 hh.nn Hours and minutes 1 nn.SS Minutes and seconds 2 SSS.d seconds and thenth of seconds	0	r/w
97	tr.t 1	2E0 2860	736 10336	**Time 1**	1 ÷ 9959 (hh.min) when tr.u = **0** 1 ÷ 9959 (mm.ss) when tr.u = **1**	2	r/w
					1 ÷ 9959 (tenth of second) when tr.u = **2**	1	
98	tr.t2	2E1 2861	737 10337	**Time 2** inF = Stopped by reset command	1 ÷ 9959 (inF) (hh.min) tr.u = **0** 1 ÷ 9959 (inF) (mm.ss) tr.u = **1**	2	r/w
					1 ÷ 9959 (inF) (1/10 s) when tr.u = **2**	1	
99	tr.St	2E2 2862	738 10338	**Timer status**	0 rES 1 run 2 HoLd	0	r/w

PrG group - Programmer parameters

no.	Par.	Address		Description	Values	Dec.	R/W
		Hex.	Dec.				
100	PrF	2E3 2863	739 10339	**Programmer action at power up**	0 nonE Program not used 1 S.uP.d Start at power up with a first step in stand by 2 S.uP.S Start at power up 3 u.diG Start at RUN command detection only 4 U.dG.d Start at RUN command detection with a first step in stand by	0	r/w
101	Pru	2E4 2864	740 10340	**Soaks time unit**	0 hh.nn hours and minutes 1 nn.SS minutes and seconds	0	r/w
102	PrE	2E5 2865	741 10341	**Instrument behaviour at End of the program execution**	0 cnt Continue (uses the set point of the last soak until a reset command is detected) 1 SPAt Go to the set point selected by [79] SPAt 2 St.bY Go in stand by mode.	0	r/w
103	PrEt	2E6 2866	742 10342	**Time of "end program" indication**	0 oFF Not used 1 ÷ 9959 (mm.ss) 10000 inF End program indication goes oFF at Reset or Run command	2	r/w
104	Pr.S1	2E7 2867	743 10343	**Set point of the first soak**	From SPLL to SPHL (E.U.) -8000 Program END	dP	r/w
105	PrG1	2E8 2868	744 10344	**Gradient of the first ramp**	1 ÷ 9999 Engineering Unit/minute 10000 inF Step transfer	1	r/w
106	Prt1	2E9 2869	745 10345	**Time of the first soak**	0 ÷ 9959 (soaks time unit)	2	r/w
107	Prb1	2EA 286A	746 10346	**Wait band of the first soak**	0 oFF 1 ÷ 9999 (E.U.)	0	r/w
108	PrE1	2EB 286B	747 10347	**Event of the first group**	00.00 ÷ 11.11 (binary)(0: Event OFF, 1: Event ON)	2	r/w
109	Pr.S2	2EC 286C	748 10348	**Set point of the second soak**	From SPLL to SPHL (E.U.) -8000 Program END	dP	r/w
110	PrG2	2ED 286D	749 10349	**Gradient of the second ramp**	1 ÷ 9999 Engineering Unit/minute 10000 inF Step transfer	1	r/w
111	Prt2	2EE 286E	750 10350	**Time of the second soak**	0 ÷ 9959 (soaks time unit)	2	r/w
112	Prb2	2EF 286F	751 10351	**Wait band of the second soak**	0 oFF 1 ÷ 9999 (E.U.)	0	r/w
113	PrE2	2F0 2870	752 10352	**Event of the second group**	00.00 ÷ 11.11 (binary)(0: Event OFF, 1: Event ON)	2	r/w
114	Pr.S3	2F1 2871	753 10353	**Set point of the third soak**	From SPLL to SPHL (E.U.) -8000 Program END	dP	r/w
115	PrG3	2F2 2872	754 10354	**Gradient of the third ramp**	1 ÷ 9999 Engineering Unit/minute 10000 inF Step transfer	1	r/w
116	Prt3	2F3 2873	755 10355	**Time of the third soak**	0 ÷ 9959 (soaks time unit)	2	r/w
117	Prb3	2F4 2874	756 10356	**Wait band of the third soak**	0 oFF 1 ÷ 9999 (E.U.)	0	r/w
118	PrE3	2F5 2875	757 10357	**Events of the third group**	00.00 ÷ 11.11 (binary)(0: Event OFF, 1: Event ON)	2	r/w
119	Pr.S4	2F6 2876	758 10358	**Set point of the fourth soak**	From SPLL to SPHL (E.U.) -8000 Program END	dP	r/w
120	PrG4	2F7 2877	759 10359	**Gradient of the fourth ramp**	1 ÷ 9999 Engineering Unit/minute 10000 inF Step transfer	1	r/w
121	Prt4	2F8 2878	760 10360	**Time of the fourth soak**	0 ÷ 9959 (soaks time unit)	2	r/w
122	Prb4	2F9 2879	761 10361	**Wait band of the fourth soak**	0 oFF 1 ÷ 9999 (E.U.)	0	r/w
123	PrE4	2FA 287A	762 10362	**Events of the fourth group**	00.00 ÷ 11.11 (binary)(0: Event OFF, 1: Event ON)	2	r/w
124	Pr.St	2FB 287B	763 10363	**Program status**	0 rES 1 run 2 HoLd	0	r/w

PAn group - Operator interface (HMI) parameters

no.	Par.	Address		Description	Values	Dec.	R/W
		Hex.	Dec.				
125	PAS2	2FC 287C	764 10364	**Level 2 password: Assistance**	0 oFF 1 ÷ 999	0	r/w
126	PAS3	2FD 287D	765 10365	**Level 3 password: Configuration**	0 ÷ 999	0	r/w
127	uSrb	2FE 287E	766 10366	**[U] key function during run time**	0 nonE No function 1 tunE Auto-tune/self-tune enable 2 oPLo Manual mode 3 AAc Alarm reset 4 ASi Alarm acknowledge 5 chSP Sequential set point selection 6 St.by Stand by mode 7 Str.t Timer run/hold/reset 8 P.run Program run 9 P.rES Program reset 10 P.r.H.r Program run/hold/reset	0	r/w
128	diSP	2FF 287F	767 10367	**Display management**	0 nonE Standard display 1 Pou Power output 2 SPF Final set point 3 SPo Set point 4 AL1 1 threshold 5 AL2 2 threshold 6 AL3 3 threshold 7 Pr.tu Increasing time count of the current soak 8 Pr.td Decreasing time count of the current soak 9 P.t.tu Increasing time count of the total program time 10 P.t.td Decreasing time count of the total program time 11 ti.uP Increasing time of the timer 12 ti.du Decreasing time of the timer 13 Perc % of the power output used during soft start		r/w
129	AdE	300 2880	768 10368	**Bargraph deviation**	0 oFF 1 ÷ 9999 (E.U.)	Dp	r/w
130	FiLd	301 2881	769 10369	**Digital filter on the displayed value**	0 oFF 1 ÷ 9999	1	r/w
131	dSPu	302 2882	770 10370	**Status of the instrument at power up**	0 AS.Pr In the same way it was prior to the power down. 1 Auto Starts in AUTO mode 2 oP.o Starts in Manual mode with a power out equal to 0 3 StbY Starts in stand-by mode	0	r/w
132	oPrE	303 2883	771 10371	**Operative modes enabling**	0 ALL All 1 Au.oP Only Auto and Man. 2 Au.Sb Only Auto and Stand-by	0	r/w
133	oPEr	304 2884	772 10372	**Operative mode selection**	0 Auto Auto 1 oPLo Manual 2 StbY stand by	0	r/w

SEr group - Serial Interface parameters

no.	Par.	Address		Description	Values	Dec.	R/W
		Hex.	Dec.				
134	Add	305 2885	773 10373	**Instrument address**	0 oFF 1 ÷ 254	0	r/w
135	bAud	306 2886	774 10374	**Baud rate**	0 2400 baud 1 9600 baud 2 19200 baud 3 38400 baud	0	r/w
136	trSP	307 2887	775 10375	**Remote set point retransmission**	0 Not used 1 Operative Set point 2 Control output percent	0	r/w

PCon group - Wattmeter parameters

no.	Par.	Address		Description	Values	Dec.	R/W
		Hex.	Dec.				
137	coty	308 2888	776 10376	**Measurement type**	0 Off - not used 1 Istantaneous power (kW) 2 Power consumption (kW/h) 3 Power consumption during program run 4 Worked days 5 Worked hours	0	r/w
138	uoLt	309 2889	777 10377	**Nominal voltage**	1 ÷ 999 (Volt)	0	r/w
139	cur	30A 288A	778 10378	**Nominal current**	1 ÷ 9999 (A)	0	r/w
140	HJob	30B 288B	779 10379	**Threshold of the worked days/hours**	0 oFF 1 ÷ 9999	0	r/w

PcAL group - User Calibration parameters

no.	Par.	Address		Description	Values	Dec.	R/W
		Hex.	Dec.				
141	ALP	30C 288C	780 10380	**Adjust low point**	From -1999 to A.H.P-10 (E.U.)	dP	r/w
142	ALo	30D 288D	781 10381	**Adjust low offset**	-300 ÷ +300 (E.U.)	dP	r/w
143	AHP	30E 288E	782 10382	**Adjust high point**	From A.L.P+10 to 9999 (E.U.)	dP	r/w
144	AHo	30F 288F	783 10383	**Adjust high offset**	-300 ÷ +300 (E.U.)	dP	r/w

SYS group - System parameters

no.	Par.	Address		Description	Values	Dec.	R/W
		Hex.	Dec.				
145	ESL	310 2890	784 10384	**Lower limit of the measurement for probe error generation**	1999 ÷ ES.H (E.U.)		
146	ESH	311 2891	785 10385	**Higher limit of the measurement for probe error generation**	ES.L ÷ 9999 (E.U.)		
147	AtL	312 2892	786 10386	**Set point % value for soft start interruption and autotuning launch**	20 ÷ 100 (%)		
148	cPb	313 2893	787 10387	**Proportional band action correction**	1 ÷ 1000		
149	c.int	314 2894	788 10388	**Integral action correction**	1 ÷ 1000		
150	cdEr	315 2895	789 10389	**Derivative action correction**	1 ÷ 1000		
151	ctcr	316 2896	790 10390	**tcr correction**	1 ÷ 1000		
152	oSPb	317 2897	791 10391	**Proportional band oscillation**	1 ÷ 1000		
153	OSt.A	318 2898	792 10392	**Power amplitude**	1 ÷ 1000		
154	A	319 2899	793 10393	**Calculated oscillation amplitude**	0 ÷ 9999		
155	t	31A 289A	794 10394	**Oscilltion amplitude**	0 ÷ 9999		
156	tAu	31B 289B	795 10395	**Time constant for the auto-tuning calculation**	-1999 ÷ 9999		
157	ndEr	31C 289C	796 10396	**Filter value on the PID derivative**	1 ÷ 200		
158	t.Amb	31D 289D	797 10397	**Ambient temperature**	-1999 ÷ +9999		
159	tSd2	31E 289E	798 10398	**Minimum ΔT (SP - PV) above which it is possible to start FAST autotuning for normalized signals**	0.0 ÷ 100.0% of the measuring range [default: 5.0%]		

PotH group - Other parameters

no.	Par.	Address		Description	Values	Dec.	R/W
		Hex.	Dec.				
160	ScFA	31F 289F	799 10399	**Serial communication malfunction (RS485 only)**	0 ÷ 6	dP	r/w

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