SERIES P4 · Model P4P

MINIATURE **PANEL METERS**

Section SPECIAL

4/20mA Process | 0/10Vdc Process | °C °F Pt Temperature | °C °F tc Temperature | °C °F NTC Temperature | Resistances

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SPECIAL

MINIATURE PANEL METER **P4P**

Panel meter for process and temperature signals, industrial applications

USER'S MANUAL

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Panel meter for process and temperature signals, in a miniature 48x24mm housing size. Accepts a wide range of process and temperature signals including 4/20mA, 0/10Vdc, resistances, Pt100, Pt500, Pt1000, thermocouples J, K, E, R and S, NTC sensors from 44004 to 44008 and from 44030 to 44034, and a configurable NTC range with configurable R_{25} and ß parameters.

Configurable through '*configuration menu*', with 3 push buttons, accessible behind the front filter, to operate the configuration menu. Includes 1 alarm controlling a transistor output and a front led. Isolated 24Vdc power supply. Does not provide excitation voltage to power the process transducer.

Fast and easy configuration available with the use of predefined configuration codes. Advanced configuration available to customize the configured input signal range, scale the reading, apply filters, etc. '*Password*' function to block non-authorized access to '*configuration menu*'.

Designed for industrial use, with potential integration into a wide range of applications, reduced cost, excellent quality and available customization.

When the marks '*Attention*' or '*Risk of electrical shock*' appear, read the documentation for relevant information about the instrument or about the nature of a risk.

1. How to order

Reference	Description
P4P	Miniature panel meter for process and temperature

2. Material included

The instrument is provided with the following elements:

- 1 x instrument **P4P**
- 1 x plug-in screw terminal
- 1 x quick installation guide

3. Additional information

User's Manual	www.fema.es/docs/5895_P4P_manual_en.pdf
Datasheet	www.fema.es/docs/5897_P4P_datasheet_en.pdf
Quick installation guide	www.fema.es/docs/5899_P4P_installation_en.pdf
CE declaration	www.fema.es/docs/5889_CE-Declaration_P4_en.pdf
Warranty	www.fema.es/docs/4153_Warranty1_en.pdf
Web	www.fema.es/Series_P4

4. Installation and start-up

If this is the first time you are configuring the instrument, below are the steps to follow during a first installation. Read all the manual sections in order to have a full and clear view of the characteristics of the instrument. Do not forget to read the installation precautions at section 16.

1. Connect the power terminals (see section 7.2)
2. Access the configuration system behind the front filter
   - read how to access the configuration system (see section 8.1)
   - read how to operate the instrument (see section 8)
   - choose a predefined configuration code (see section 6)
   - introduce the code at the instrument (see section 12.1)
3. Connect the input terminals (see section 7.3)
4. For process signals, scale the process reading (see section 12.4)
5. For temperature signals, configure the temperature parameters (see section 12.6)
6. If needed, check and configure the display tools (see section 12.7)
7. If needed, connect the transistor output (see section 7.4) and configure the alarm set point (see section 12.3)
8. If needed, check and configure the additional tools available, such as password, '*on error*', etc (see section 12.8).
9. Remove the rear connector, install the instrument in the panel and reconnect the connector.

5. Typical applications

To provide a local reading and '*on/off*' control, in areas with reduced spacing. Accepts signals from standard thermocouples, Pt and Ntc sensors, resistances and process signals.

Notes

- Code '**uSEr**' indicates that a user custom configuration is active, and it does not match any of the listed codes This code is non-selectable, for information only.

Example: select code '**011**' for 0/10 Vdc=0.0/100.0, the instrument reads code '**011**'. Manually configure the input and reading to 0/7 Vdc=0/85.0. As the input does not match a listed code, the instrument reads '**uSEr**'. Changing the reading scale does not affect the '**uSEr**' message, only changing the input signal range.

- Code '**----**' identifies the end of the list, it follows code '**099**' and the list continues with code '**010**'. Select '**----**' to exit the list without applying changes.
- * The '*associated text*' is displayed at power-up, and indicates the actual signal range configured.

6. Predefined configuration codes

Select the desired code for your application, and check the following sections for more information:

- for information on how to activate a code, see section 12.1
- to customize the input signal, see section 12.4

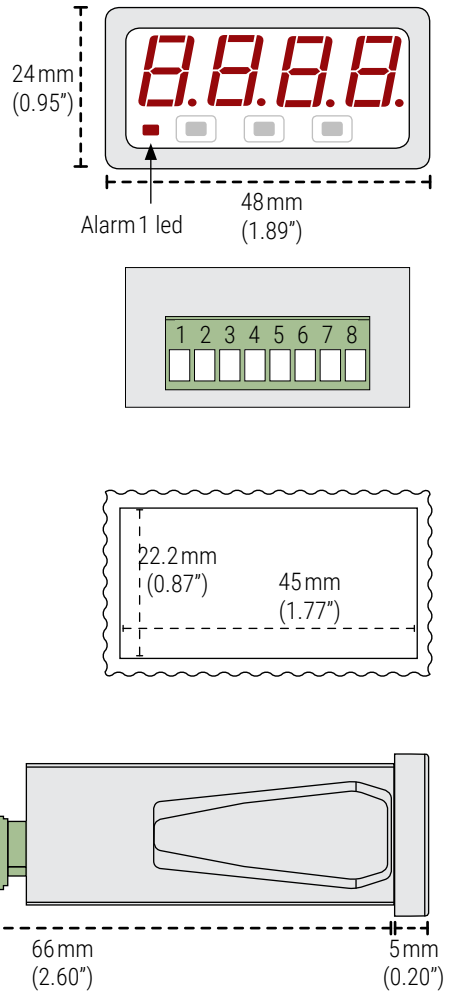
When working with process signals, the INPUT range and READING values are fully configurable through the configuration menu (see section 9.2).

Table 1 | **Predefined configuration codes**

Signal type	Signal range	Configur. code	Default reading	Associated text*	See section
Process	4/20 mA	010	0.0/100.0	420	10.1
	0/10 Vdc	011	0.0/100.0	010	
	reserved	012 to 014			
Pt100 (2 and 3 wires)	-200/850 °C	015	-200.0/850.0	P.100	10.2
Pt500	-200/630 °C	016	-200.0/630.0	P.500	
Pt1000	-200/630 °C	017	-200.0/630.0	P.1k	
	reserved	018 to 019			
Thermoc. J	-200/1200 °C	020	-200/1200	tc.J	10.3
Thermoc. K	-200/1372 °C	021	-200/1372	tc.K	
Thermoc. E	-200/1000 °C	022	-200/1000	tc.E	
Thermoc. R	-50/1768 °C	023	-50/1768	tc.r	
Thermoc. S	-50/1768 °C	024	-50/1768	tc.S	
	reserved	025 to 029			
Ntc	Ntc 44004	030	-80.0/120.0	4004	10.4
	Ntc 44005	031	-80.0/120.0	4005	
	Ntc 44006	032	-70.0/120.0	4006	
	Ntc 44007	033	-80.0/120.0	4007	
	Ntc 44008	034	-40.0/120.0	4008	
	Ntc 44030	035	-80.0/75.0	4030	
	Ntc 44031	036	-70.0/75.0	4031	
	Ntc 44032	037	-40.0/75.0	4032	
	Ntc 44033	038	-80.0/75.0	4033	
	Ntc 44034	039	-80.0/75.0	4034	
	Ntc R_{25}=10K β=3500	040	-50.0/90.0	ntc.2	
	reserved	041 to 044			
Resistance	0/1 KOhm	045	0/1.000	1K	10.5
	0/10 KOhm	046	0/10.00	10K	
	0/100 KOhm	047	0/100.0	100K	
	0/1 MOhm	048	0/1.000	1M	
	reserved	049 to 099			
	(End of list)	**'----'**			
	(Custom selection)	**'uSEr'**			

7. Connections, views and dimensions (mm (*inch*))

7.1 Views and dimensions

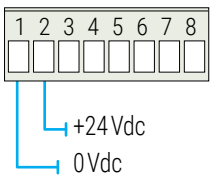


7.2 Power connections

Table 3 | **Power connections**

	Power terminals	
Power	1	2
24 Vdc	- (0 Vdc)	+ (24 Vdc)

Table 5 | **Connections for power**



Fuse - This instrument does not include internal protection fuse. According to security regulation EN 61010-1, add a protection fuse to the power line to act as a disconnection element, easily accessible to the operator and identified as a protection device. Use time-lag fuse, with value : 400 mA

7.3 Signal connections

Table 2 | **Input signal connections**

	Input terminals				
Input signal	3	4	5	6	Section*
4/20 mA (active loop)	mA+ (out)			mA- (in)	10.1
0/10 Vdc	common			+Vdc	10.1
Thermocouples	tc-	tc+			10.3
Ntc	ntc-		ntc+		10.4
Pt100 (3 wires)	pt100-	pt100- (3rd wire)	pt100+		10.2
Pt100 (2 wires)	pt100-	short to terminal 3	pt100+		10.2
Pt500, Pt1000	pt-		pt+		10.2
Resistances	res-		res+		10.5

*More information and connection examples at the indicated sections for each signal type.

7.4 Output connections

Table 4 | **Transistor output connections**

	Output terminals	
Output	7	8
Transistor	collector	emitter

Table 6 | **Transistor output connections**

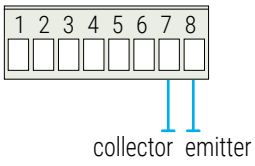
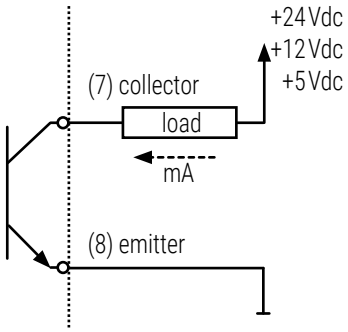


Table 7 | **Detail for transistor output connections**



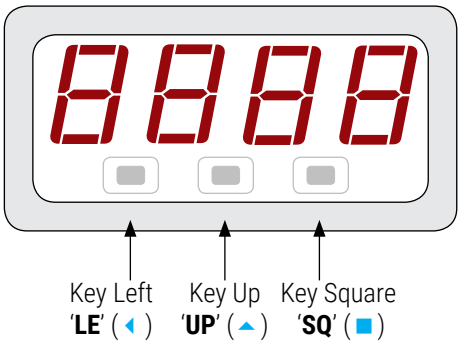
Maximum voltage on transistor terminals : 30 Vdc.
Maximum current through transistor : 30 mA

8. How to operate the instrument

8.1 Configuration system, how to access

The instrument is fully configurable from the 3 push buttons accessible behind the front filter (see Table 8). To remove the front filter, force the front cover to snap out of the body housing, and remove the front filter. Gently push the connection terminals at the back, and the instrument will move to the front, enough to make the keypad accessible.

Table 8 | **CONFIGURATION SYSTEM**



8.2 'Normal mode' of operation

AT POWER-UP

When the power supply is connected, the instrument applies the following start-up sequence :

- the '*display*' shows the firmware code '**b5.xx**'.
- the '*display*' shows the text associated to the configured '*input signal*' (for example: '**tc.J**').
- the instrument is now in '*normal mode*' of operation and the '*display*' reading is according to the input signal and the applied scaling.

FROM 'NORMAL MODE' OF OPERATION

From '*normal mode*' of operation, the operator can access the following functions:

- key '**SQ**' (■) gives access to the '*configuration menu*' (see section 8.3).

8.3 How to operate the 'Configuration menu'

HOW TO ENTER THE 'CONFIGURATION MENU'

With the instrument in '*normal mode*' of operation (see section 8.2), press the '**SQ**' (■) key and maintain for 1 second. The horizontal leds light from bottom to top. When the upper led lights, the instrument enters into the '*configuration menu*'.

When entering the '*configuration menu*', the first menu entry '**Function code**' (**codE**) is displayed. See section 13 for a full view of the '*configuration menu*'.

If the '**SQ**' (■) key is released before entering into the '*configuration menu*', the horizontal leds light downwards from top to bottom, and the instrument returns to '*normal mode*' of operation.

HOW TO OPERATE INSIDE THE 'CONFIGURATION MENU'

Inside the '*configuration menu*', use the front keypad to move through menu entries, parameters, and select configuration values:

- **Key 'SQ'** (■) functions as the '*ENTER*' key. It selects the menu entry currently displayed. At numerical value entries, it validates the number displayed.
- **Key 'UP'** (▴) moves vertically through the different menu entries. At numerical value entries, it modifies the selected digit by increasing its value to 0, 1, 2, 3, 4, 5, 6, 7, 8, 9. The most significant digit has additional values '-' and '-1'.
- **Key 'LE'** (◂) functions as the '*ESCAPE*' key. It leaves the selected menu entry, and eventually, will leave the '*configuration menu*'. When leaving the '*configuration menu*', the changed parameters are activated. At numerical value entries, the **'LE'** (◂) key allows to select the active digit. To modify a numeric value press the '**UP**' (▴) key to increase the value '+1'. Press the **'SQ'** (■) key to validate the value.

WHEN EXITING THE 'CONFIGURATION MENU'

When exiting the '*configuration menu*' without changes (either by '*rollback*' activation or because there are no changes in the configuration), the horizontal leds light down from top to bottom, and the instrument returns to '*normal mode*' of operation.

When exiting the '*configuration menu*' with changes, the display leds light a round shape while the new configuration is stored. When the round shape is finished, a start-up sequence is applied (see section 8.2). After start-up, the new configuration is active and the instrument is in '*normal mode*' of operation.

'ROLLBACK' FUNCTION

If there is no interaction from the operator for 60 seconds, the instrument exits the '*configuration menu*' discarding changes, and returns to '*normal mode*' of operation.

When the operator is inside the '*configuration menu*', the output signal will remain overranged at maximum signal. Additional configurations are available at the '**On SQ**' parameter (see section 12.8).

When the operator exits the '*configuration menu*', the output signal is temporarily set to minimum value for a time <5 seconds, while the instrument restarts.

8.4 'Fast' and 'advanced' configurations

FAST CONFIGURATION

The fastest way to configure the instrument is to activate one of the predefined configuration codes (see section 6).

Access the '*configuration menu*' and enter the '**Function code**' (**codE**) menu entry. The code displayed is the actual input range selected. Select the new code and validate. Selecting a code automatically exits the '*configuration menu*' and activates the new configuration.

For process signals, scale the reading see the '*Process scaling*' section of the '*configuration menu*' (see section 12.4).

ADVANCED CONFIGURATION

Additional configuration parameters are available at the '*configuration menu*'. The operator can customize the input signal and scale the reading to a process value, configure filters, passwords, etc.

See section 12 for a detailed explanation on the '*configuration menu*'.

9. Description of functions

Description of alarm examples, '*field correction*' functions and process scaling examples. You will be addressed to this section for further information, whenever these functions are mentioned in this document.

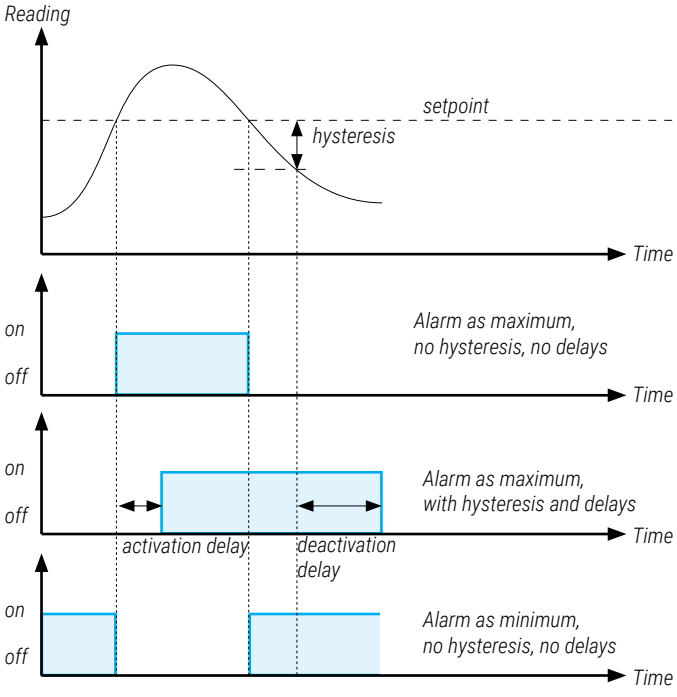
9.1 Alarms

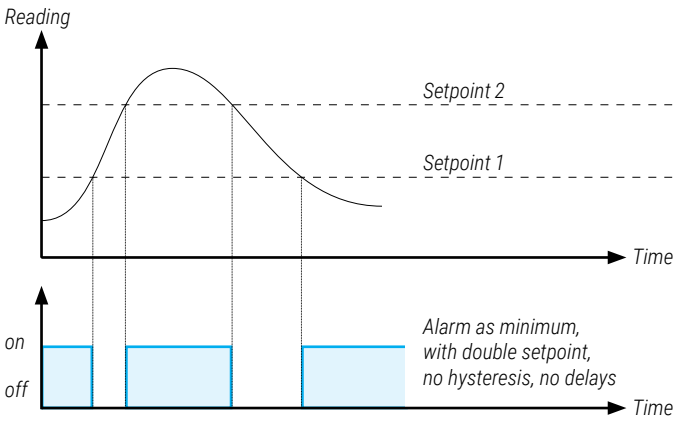
The instrument provides one alarm that controls the state of a transistor output and a front led. The alarm can be configured as a maximum or minimum alarm, with a setpoint, and an hysteresis value. Additionally, a second setpoint for alarm deactivation can be configured.

There are also several functions associated with the activation of the alarm, such as the '*flash*' function that will set the display on flash mode when the alarm is active and activation and deactivation delays.

For more information on the parameters and how to configure the alarm see the '*configuration menu*' at section 12.3.

Below are some graphical examples of the main alarm parameters.





9.2 Process scaling

Process signals can be scaled to read according to your application needs. When selecting a predefined configuration code for process, the default scaling is applied (for example: 4/20 mA=0.0/100.0). Scaling can then be customized to match your application needs.

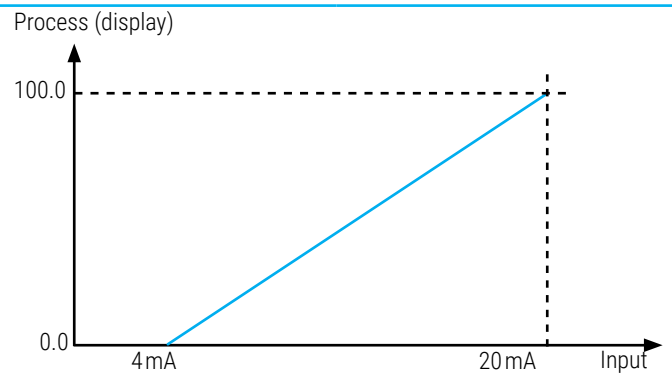
- the '**Input low**' (**In.Lo**) and the '**Process low**' (**Pr.Lo**) parameters define the reading value (the '*process low*' value) associated to a signal value (the '*input low*' value)
- the '**Input high**' (**In.hI**) and the '**Process high**' (**Pr.hI**) parameters define the reading (the '*process high*' value) associated to a signal value (the '*input high*' value)

A straight line is applied between these two configured points, and the scaling of the instrument is defined.

A decimal point can be placed by configuring the '**Decimal point**' (**Pr. dP**) parameter. At the '*Process low*' and '*Process high*' parameters, the configured decimal point is displayed. The decimal point is '*dummy*' and does not carry the process values to the left nor to the right.

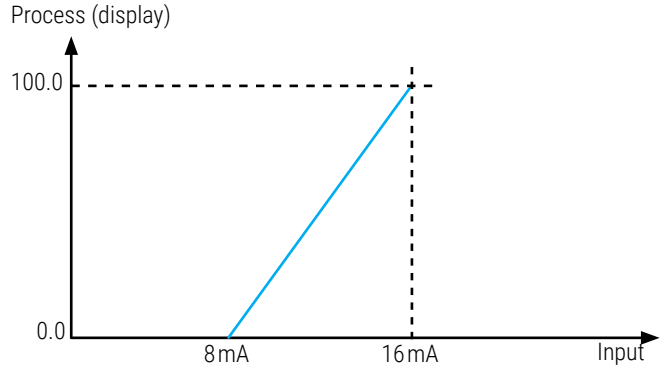
The '*input low*' and the '*input high*' parameters are expressed in 'x.xx' mA or 'x.xx' Vdc according to the configured input signal.

Table 9 | **EXAMPLE FOR CODE '010' (4/20 mA=0.0/100.0)**



Select the predefined code '010 to configure a scaling of 4/20 mA=0.0/100.0. The configured values are as indicated below:	
input_low = 4.00 mA	process_low = 0.0
input_high = 20.00 mA	process_high = 100.0
	process_dp = xxx.x

Table 10 | **EXAMPLE FOR CUSTOM RANGE (8/16 mA=0/100.0)**



Configure a custom scaling of 8/16 mA=0.0/100.0 with the parameters below:	
input_low = 8.00 mA	process_low = 0.0
input_high = 16.00 mA	process_high = 100.0
	process_dp = xxx.x

9. Description of functions (cont.)

9.3 Field corrections for process

Field correction functions can be applied to process signals. They are disabled for temperature signals. Field correction functions are a fast way to correct the configured input signal range, defined at the '*input low*' and '*input high*' parameters of the '*Process scaling*' menu (see section 10.3) to match the actual input signal measured at the input.

- the '**Field correction low**' (**Fc.Lo**) function modifies the '*input low*' parameter of the '*Process scaling*' menu, and places the actual value of the input signal measured at the input.
- the '**Field correction high**' (**Fc.hI**) function modifies the '*input high*' parameter of the '*Process scaling*' menu, and places the actual value of the input signal measured at the input.

While the function is active, and measuring the value, the message remains flashing for 5 seconds. When the measure is completed, the stops flashing and shows '**ok**' . Press any key to return to the '**Fc.Lo**' or '**Fc.hI**' , menu entry.

Example : a pressure transmitter of 0/10 Bar provides a 4/20 mA signal. The meter is configured for 4/20 mA input and 0/10.00 reading. While setting up the system, you realize that although the system is without pressure, the reading of the instrument is at 0.15 Bar. With the help of a milliammeter check the input signal at terminals and get the value of 4.24 mA instead of the expected 4.00 mA. At this point you can either manually change the 'Input low' value from 4.00 mA to 4.24 mA, or apply the 'Field correction low' function to force the instrument to read the input and apply the value to the 'Input low' parameter.

10. Input signals

10.1 Process

MEASURING mA AND Vdc PROCESS SIGNALS

The instrument can be configured to measure 4/20 mA (active loops) and 0/10 Vdc process signals. See connections at 'Table 11'.

PREDEFINED CONFIGURATION CODES

See 'Table 12' for a list of predefined configuration codes. To activate a code see section 12.1.

CUSTOMIZED SCALING

Reading on display can be scaled to the desired process units. Both the input signal values (high and low) and the reading values (high and low) can be configured, additionally to the decimal point position.

To customize the scaling, access the '*Process scaling*' menu (see section 12.4).

MAXIMUM OVERSIGNAL AND PROTECTIONS

'*Maximum oversignal*' is the maximum signal accepted by the instrument. Higher signal values may damage the instrument. Lower signal values are non destructive but may be out of accuracy specifications.

The process inputs are NOT protected against inverted connections.

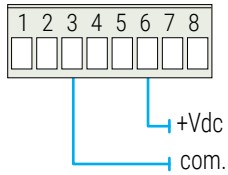
The mA input loop opens if the instrument is powered off.

The milliampere input is protected against over currents, and the instrument automatically opens the loop when currents above >60 mA (approx.) are detected. Error 13 is displayed (see section 15). The instrument tries to reconnect every 1 second.

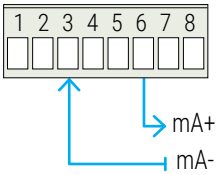
EXCITATION VOLTAGE (VEXC)

The instrument does not provide excitation voltage.

Table 11 | **Connection examples for process signals**



Signal 0/10 Vdc (2 wires)



Signal 4/20 mA (active loop)

Table 12 | **Input signal ranges for process signals**

Input range	Configuration code	Default reading	Accuracy (%FS)	Max. oversignal	Zin
4/20 mA	010	0.0/100.0	<0.15%	1 Adc	V*<1 V
0/10 Vdc	011	0.0/100.0	<0.15%	50 Vdc	2 MOhm

** Voltage drop on terminals <1 Vdc.*

10.2 Pt100 sensors and other Pt

MEASURING TEMPERATURE WITH Pt SENSORS

The instrument can be configured to measure temperature from Pt100, Pt500 and Pt1000 sensors. See connections at 'Table 13'.

PREDEFINED CONFIGURATION CODES

See 'Table 14' for a list of predefined configuration codes. To activate a code see section 12.1.

CUSTOMIZED READING

Resolution is configurable to 1º or 0.1º. Values can be displayed in ºC or in ºF. A manual offset from -999 up to 999 display counts can be manually added to the display (see section 12.6).

SENSOR BREAK DETECTION AND SHORT CIRCUIT DETECTION

The instrument detects the sensor break or short circuit error at the input signals, and displays an error message (see section 15).

Pt100 WITH 2 AND 3 WIRES

The instrument accepts 2 and 3 wire Pt100 sensor. When configured for 3 wires, an automatic compensation of the cable resistance up to 15 Ohms is applied. In both cases, all three terminals must be connected (see Table 13).

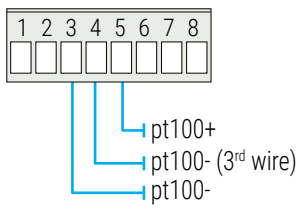
'ALPHA' TEMPERATURE COEFFICIENT

The instrument works with an '*alpha*' value of '0.0385' and can be configured for '0.0390' (see section 12.6). The '*alpha*' parameter is associated to the sensor and depends on the '*pt*' sensor manufacturer.

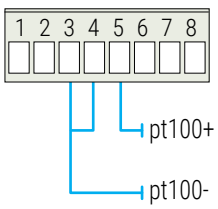
CURRENT THROUGH THE SENSOR

The instrument generates <900 uA through Pt100 sensors and <100 uA through Pt500 and Pt1000 sensors.

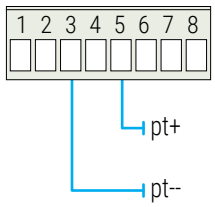
Table 13 | **Connection examples for Pt100 (2 and 3 wires) and Pt500, Pt1000**



Connections for Pt100 (3 wires)



Connections for Pt100 (2 wires)



Connections for Pt500 and Pt1000 (2 wires only)

Table 14 | **Temperature ranges for Pt100, Pt500 and Pt1000**

Sensor	Configuration code	Default reading ºC	Default reading ºF	Total error
Pt100	015	-200.0/850.0 ºC	-328/1562 ºF	<1.5º (up to 200º)
				<3.0º (up to 850º)
Pt500	016	-200.0/630.0 ºC	-328/1166 ºF	<1.5º (up to 400º)
				<3.0º (up to 630º)
Pt1000	017	-200.0/630.0 ºC	-328/1166 ºF	<1.5º (up to 300º)
				<5.0º (up to 630º)

10. Input signals (cont.)

10.3 Thermocouples

MEASURING THERMOCOUPLES

The instrument can be configured to measure temperature from thermocouple sensors J, K, E, R and S. The instrument automatically compensates the thermocouple cold junction. All signals according to ITS90. See connections at 'Table 16'.

PREDEFINED CONFIGURATION CODES

See 'Table 15' for a list of predefined configuration codes. To activate a code see section 12.1.

CUSTOMIZED READING

Resolution is configurable to 1º or 0.1º. Temperature values can be displayed in ºC or in ºF. A manual offset from -999 up to 999 display counts can be manually added to the display (see section 12.6).

SENSOR BREAK DETECTION AND SHORT CIRCUIT DETECTION

The instrument detects the sensor break or short circuit error at the input signals, and displays an error message (see section 15).

MAXIMUM OVERSIGNAL

Maximum oversignal for thermocouple inputs is 1 Vdc. Higher voltage inputs can be destructive.

TOTAL ERROR

The '*total error*' indicated contains both the measurement error and the cold junction error.

10.4 NTC sensors

MEASURING NTC SENSORS

The instrument can be configured to measure temperature from common NTC sensors. Accepts standard NTC models 44004, 44005, 44006, 44007, 44008, 44030, 44031, 44032, 44033 and 44034. See connections at 'Table 17'.

An independent range exists for NTC sensors characterized by its R_{25} and β parameters. Configurable R_{25} values from 1.0 KOhm to 30.0 KOhm, and β values from 3000 to 4000. This type of NTC can read signals from 30 Ohms and up to 2.5 MOhms.

PREDEFINED CONFIGURATION CODES

See 'Table 18' for a list of predefined configuration codes. To activate a code see section 12.1.

CUSTOMIZED READING

Resolution is configurable to 1º or 0.1º. Temperature values can be displayed in ºC or in ºF. A manual offset from -999 up to 999 display counts can be manually added to the display (see section 12.6).

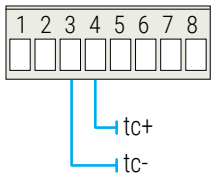
SENSOR BREAK DETECTION

The instrument detects the sensor break and displays an error message (see section 15).

CURRENT THROUGH THE SENSOR

The instrument generates <150 uA through the NTC sensors, with a power dissipation of <10 uW.

Table 16 | **Connection examples for thermocouples**



For a correct measurement of thermocouple signals, always use compensated cable between the instrument and the thermocouple.

Table 17 | **Connection examples for NTC signals**

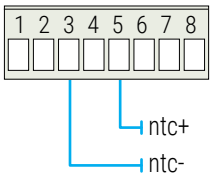


Table 15 | **Temperature ranges for thermocouples**

Sensor	Configuration code	Default reading ºC	Default reading ºF	Total error
Tc. J	020	-200/1200 ºC	-328/2192 ºF	<1.5º (>0º)
				<6.0º (<0º)
Tc. K	021	-200/1372 ºC	-328/2501 ºF	<3.0º (>0º)
				<7.0º (<0º)
Tc. E	022	-200/1000 ºC	-328/1832 ºF	<1.5º (<800º)
				<4.0º (<1000º)
Tc. R	023	-50/1768 ºC	-58/3214 ºF	<3.0º (>700º)
				<4.0º (<700º)
Tc. S	024	-50/1768 ºC	-58/3214 ºF	<3.0º (>350º)
				<4.0º (<350º)

Table 18 | **Input signal ranges for NTC sensors**

Sensor	Configuration code	Default reading ºC	Default reading ºF	Total error
Ntc 44004	030	-80.0/120.0	-112.0/248.0 ºF	<1.0º
Ntc 44005	031	-80.0/120.0	-112.0/248.0 ºF	<1.0º
Ntc 44006	032	-70.0/120.0	-94.0/248.0 ºF	<0.8º
Ntc 44007	033	-80.0/120.0	-112.0/248.0 ºF	<1.0º
Ntc 44008	034	-40.0/120.0	--40.0/248.0 ºF	<0.8º
Ntc 44030	035	-80.0/75.0	-112.0/167.0 ºF	<0.8º
Ntc 44031	036	-70.0/75.0	-94.0/167.0 ºF	<0.8º
Ntc 44032	037	-40.0/75.0	-40-80.0/167.0 ºF	<0.8º
Ntc 44033	038	-80.0/75.0	-112.0/167.0 ºF	<1.0º
Ntc 44034	039	-80.0/75.0	-112.0/167.0 ºF	<0.8º
Ntc R_{25}=10K, β=3500	040	-50.0/90.0	-58.0/194.0 ºF	<1.0º

10. Input signals (cont.)

10.5 Resistances

MEASURING RESISTANCES

The instrument can be configured to measure resistance signals with ranges from 1 KOhm up to 1 MOhm. Measurement uses 2 wires. See connections at 'Table 19'.

PREDEFINED CONFIGURATION CODES

See 'Table 20' for a list of predefined configuration codes. To activate a code see section 12.1.

CUSTOMIZED SCALING

Resistance measurement is direct and reading is not scalable.

SENSOR BREAK DETECTION

The instrument detects the sensor break and displays an error message (see section 15).

CURRENT THROUGH THE SENSOR

The instrument generates a fixed current to measure the resistance values (see Tabla 20).

MAXIMUM OVERSIGNAL AND PROTECTIONS

Active signals are not to be connected to the resistance input terminals. Maximum active input is 3 Vdc. Higher voltage inputs will be internally shorted and can be destructive.

Table 19 | **Connection examples for resistance signals**

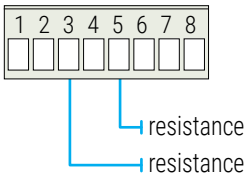


Table 20 | **Input signal ranges for resistances**

Input range	Configuration code	Default reading	Accuracy (%FS)	Current on resistance	Max. overvoltage
0/1 KOhm	045	0/1.000	<0.7 %	167 uA	3 Vdc
0/10 KOhm	046	0/10.00	<0.7 %	45 uA	3 Vdc
0/100 KOhm	047	0/100.0	<0.7 %	4.5 uA	3 Vdc
0/1 MOhm	048	0/1.000	<2.5 %	1 uA	3 Vdc

11. Technical specifications

DISPLAY	
digits	4
color	red
type	7 segment led
digit height	10 mm
max. reading	9999
min. reading	-1999
decimal point positions	x.x.x.x
display refresh	3 refresh / second
overrange	see '*errors*' and '*messages*' at section 15
underrange	see '*errors*' and '*messages*' at section 15
INPUT SIGNAL RANGES	
process	4/20 mA, 0/10 Vdc no excitation voltage provided (see section 10.1)
thermocouples	J, K, E, R and S conforming to ITS-90 (see section 10.3)
'Pt' sensors	Pt100 (2 wires and 3 wires) Pt500, Pt1000 (2 wires) (see section 10.2)
'NTC' sensors	(see section 10.4)
resistances	ranges from 0/1 KOhm up to 0/1 MOhm (see section 10.5)
ACCURACY AT 25 ºC	
	see for each type of signal at section 10
THERMAL DRIFT	
process mA, Vdc	±100 ppm/ºC (F.S.)
thermocouples, Pt	±150 ppm/ºC (F.S.)
resistances	±0.4 %/ºC (F.S.)
thermocouple CJC	±0.05 ºC/ºC
STEP RESPONSE	
Typical response values to reach 99% of the reading value, as a response to a 100% step at the signal input. Indicated values are typical values, as tasks performed in parallel with the acquisition can affect the response time.	
mA, Vdc	<0.8 seconds
Pt100	<1.0 seconds
thermocouple	<2.5 seconds
Ntc, resistances	<0.8 seconds
OUTPUT	
type	transistor
configuration	open collector
max. voltage on terminals	30 Vdc
max. current through terminals	30 mA
CONFIGURATION SYSTEM	
push buttons	accessible at the front of the instrument, behind the front filter
configuration	'*configuration menu*' and '*predefined codes*'
POWER SUPPLY	
voltage range	24 Vdc ±10%
consumption	<1.0 W
power wires	0.13 mm^2 to 1.3 mm^2 (AWG26 to AWG16)
overvoltage category	II

ISOLATION	
power	1000 Vdc
input Vs output	500 Vdc
ENVIRONMENTAL	
IP protection	IP40
impact protection	IK06
operation temperature	from 0 to +50 ºC
storage temperature	from -20 to +70 ºC
'*warm-up*' time	15 minutes
relative humidity	0 to 95% non condensing
altitude	up to 2000 meters
MECHANICAL	
front size	48 x 24 mm
mounting	panel mount
panel cut-out	45 x 22.2 mm
connections	plug-in screw terminal (pitch 3.81 mm)
housing material	polyamide V0
front filter material	polycarbonate
weight	<100 grams
total deep	71 mm
deep from panel	66 mm (including terminal)
packaging	95 x 85 x 43 mm, cardboard

12. Configuration menu

12.1 Function codes

The fastest way to configure the instrument, is to select a predefined configuration code (see section 6). At the '**Configuration code**' (**codE**) parameter use keys '**UP**' (▲) and '**LE**' (◀) to move up and down through the list of codes. Locate the desired code, and press '**SQ**' (■). The instrument stores the new configuration, applies a '*power-up*' routine and returns to the '*normal mode*' of operation (see section 8.2).

To leave the the '**Function code**' (**codE**) menu, select a valid code, or press '**----**' to return to the previous menu without changes.

When entering the '**Function code**' (**codE**) parameter, the active '*configuration code*' is displayed. If the actual configuration does not match any of the configuration codes, code '**uSEr**' is displayed.

Custom scaling of display can be configured at the '*Process scaling*' section of the '*configuration menu*' (see section 12.4).

12.2 Input range

At the '**Input signal**' (**InP**) menu entry, select the input signal to be measured. Input signals available are grouped by process, thermocouples, pt sensors, ntc sensors and resistances.

If you have already selected a configuration code (see section 12.1), the input signal has been already selected and there is no need to manually select the '**Input range**' (**InP**) parameter again.

At the '**Process**' (**Proc**) parameter select '**420**' for 4/20 mA or '**010**' for 0/10 Vdc signal input.

At the '**Thermocouples**' (**tc**) parameter select from the available thermocouples J, K, E, R and S.

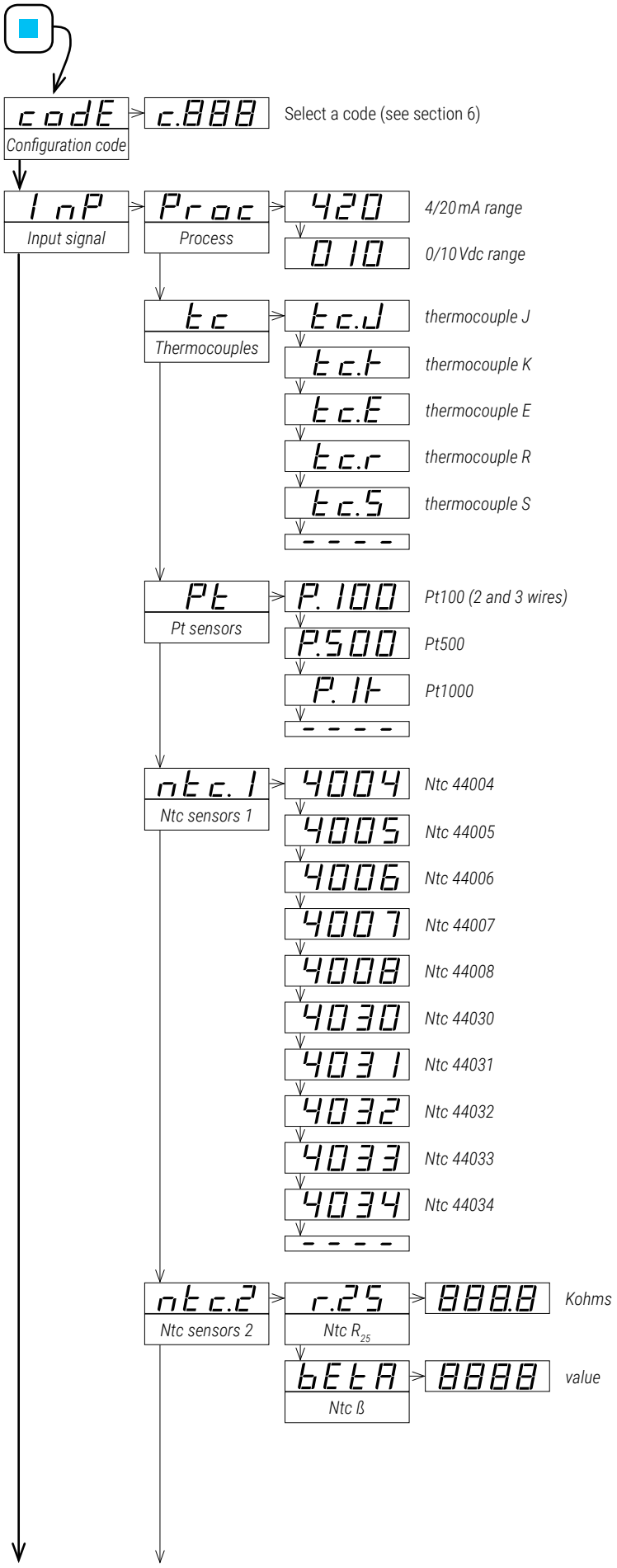
At the '**Pt sensors**' (**Pt**) parameter select from the available pt sensors Pt100 (2 and 3 wires), Pt500 or Pt1000. For 2 or 3 wires Pt100 sensors, see section 10.2 for specific connections.

At the '**Ntc sensors 1**' (**ntc.1**) parameter select from the available Ntc sensors. Only the last part of the Ntc name is displayed. For example, the '**Ntc 44004**' is designated with '**4004**' and the first '4' is missing. The same applies to Ntc sensors 44004 to 44009 and 44030 to 44034. For non-standard Ntc sensors, characterized with R_{25} and ß parameters, see the '**Ntc sensors 2**' (**ntc.2**) below.

At the '**Ntc sensors 2**' (**ntc.2**) menu configure the input to read from an ntc sensor, characterized by the R_{25} and ß parameters. At the '**Ntc R_{25}**' (**r.25**) parameter configure the resistance at 25 degrees of the ntc sensor, in KOhms, with accepted values from 1.0 KOhms and 30.0 KOhms. At the '**Ntc ß** ' (**BEtA**) parameter configure the value fo the 'ß' parameter of the ntc sensor, with accepted values between 3000 and 4000.

At the '**Resistances**' (**rES**) parameter select from the available resistance ranges.

Input signal ranges are also accessible as predefined '*configuration codes*' (see section 6). The predefined '*configuration codes*' also define a default scaling for the reading.



12. Configuration menu (cont.)

12.3 Alarms

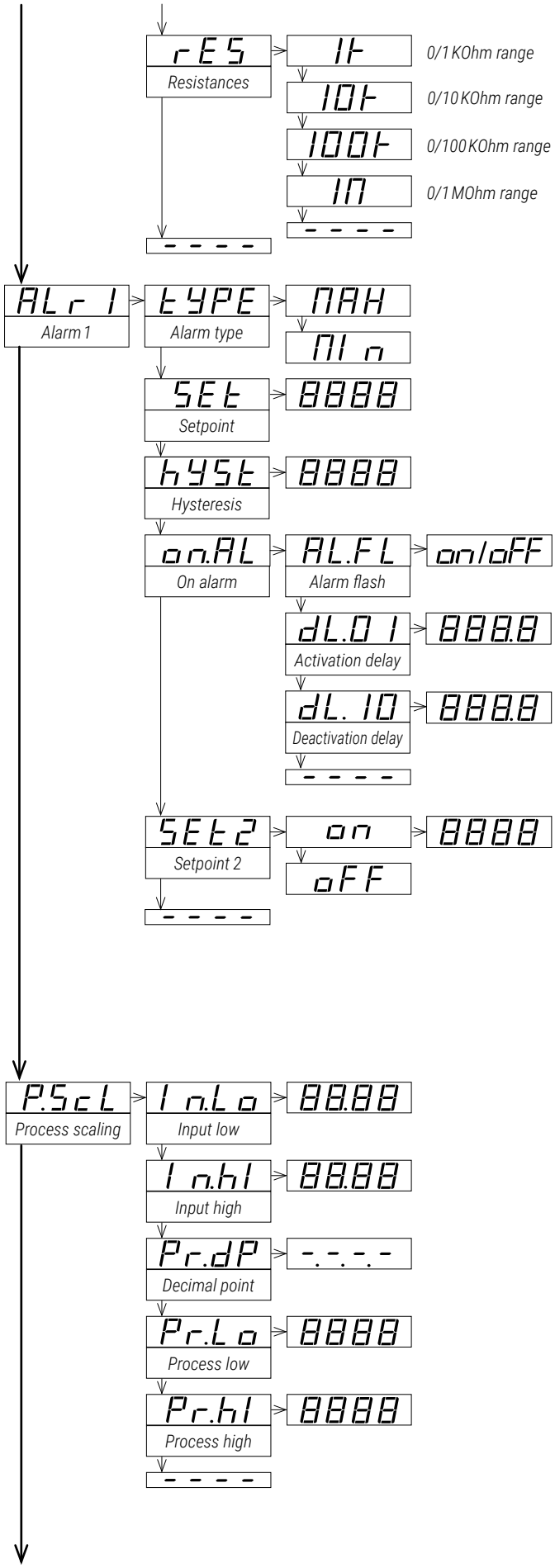
At the '**Alarm 1**' (**ALr1**) menu entry, configure the alarm. The alarm controls a front led and a transistor output. More information on alarms at section 9.1

- at the '**Alarm type**' (**TypE**) parameter select alarm as as a maximum (**MAX**) or as a minimum (**MIn**). The maximum type alarm (or minimum type) activates when the display value is higher (or lower) than the setpoint value.
- at the '**Setpoint**' (**SEt**) parameter enter the value for the alarm activation point. Values from -1999 up to 9999.
- at the '**Hysteresis**' (**hySt**) parameter configure the hysteresis value. The hysteresis applies to the deactivation process of the alarm. Values from -1999 up to 9999. The alarm deactivates when the reading has passed the setpoint value plus the hysteresis value. Hysteresis helps to avoid repetitive switching of the alarm relays, due to fluctuating input signals around the setpoint.
- at the '**On alarm**' (**on.AL**) menu there is a set of functions related to the activation of the alarm.
  - at the '**Alarm flash**' (**AL.FL**) parameter configure to '**on**' to activate the flash on display when the alarm is active. The display reading value and then front alarm led will flash while the alarm is active.
  - at the '**Activation delay**' (**dEL.01**) parameter configure the time delay to apply before alarm activation. The activation delay starts counting when the setpoint value is passed. Values from 0.0 to 99.9 seconds.
  - at the '**Deactivation delay**' (**dL.10**) parameter configure the delay to apply before alarm deactivation. The deactivation delay starts counting when the setpoint value plus the hysteresis value, is passed. Value from 0.0 to 99.9 seconds.
- at the '**Setpoint 2**' (**SEt2**) parameter configure a second setpoint '*window alarms*'. Configure '**Setpoint 2**' (**SEt2**) to '**on**' and then configure the desired value for the second setpoint. The second setpoint must always be higher in value than the first setpoint.

12.4 Process scaling

At the '**Process scaling**' (**P.ScL**) menu, configure the input and display values to properly scale the reading to your application needs (see section 9.2).

- at the '**Input low**' (**In.Lo**) parameter configure the low input signal value.
- at the '**Input high**' (**In.hI**) parameter configure the high input signal value.
- at the '**Decimal point**' (**Pr.dP**) parameter configure the position of the decimal point.
- at the '**Process low**' (**Pr.Lo**) parameter configure the reading value associated to the low input signal value.
- at the '**Process high**' (**Pr.hI**) parameter configure the reading value associated to the high input signal value.



12. Configuration menu (cont.)

12.5 Field correction

At the '**Field correction**' (**F.cor**) menu, there is access to the '*field correction*' functions (see section 9.3).

- select the '**Field correction low**' (**Fc.Lo**) to modify the '*input low*' parameter of the '*Process scaling*' menu, with the actual value of the input signal measured at the input.
- select the '**Field correction high**' (**Fc.hI**) to modify the '*input high*' parameter of the '*Process scaling*' menu, with the actual value of the input signal measured at the input.

12.6 Temperature tools

At the '**Temperature tools**' (**t.tlS**) menu, configure parameters associated with the measurement of temperature sensors (Pt sensors, thermocouples and Ntc).

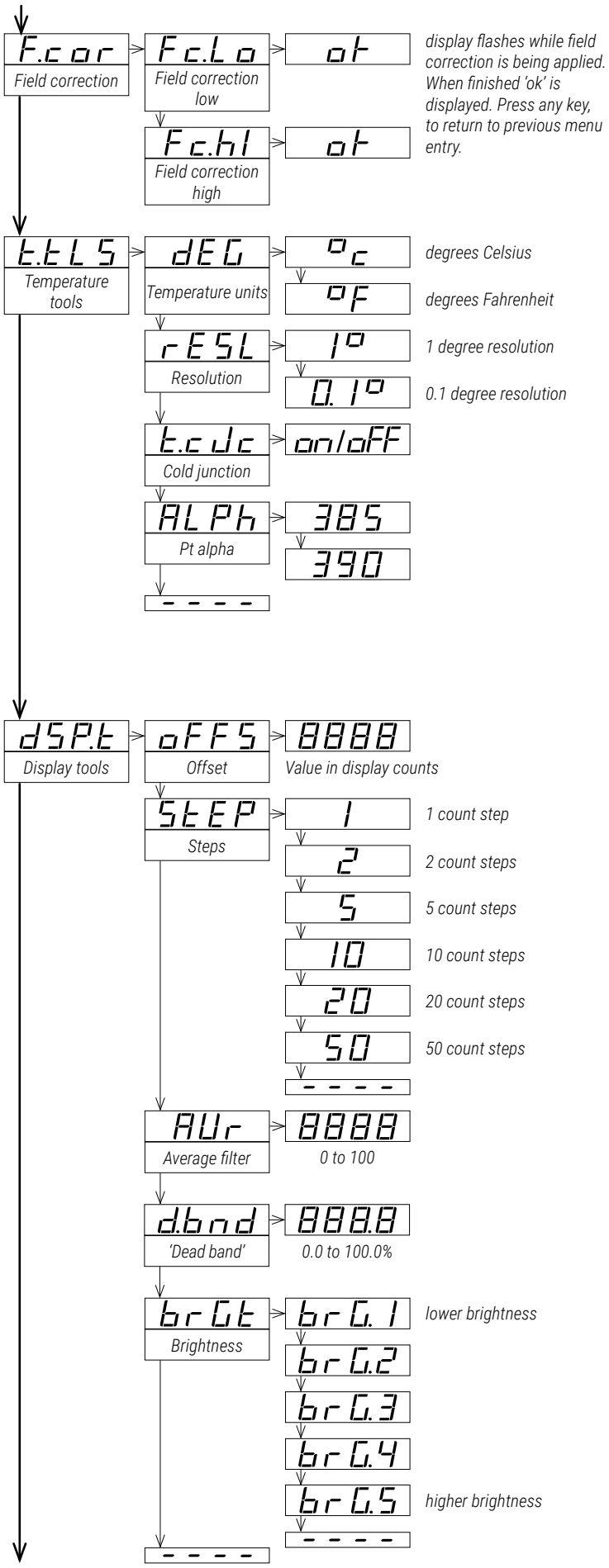
- at the '**Temperature units**' (**dEG**) parameter select the temperature units of the temperature. Values available are '**Degrees Celsius**' (**ºC**) or '**Degrees Fahrenheit**' (**ºF**).
- at the '**Resolution**' (**rESL**) parameter configure the resolution for the temperature readings, between 1º and 0.1º.
- at the '**Cold junction**' (**t.cJc**) parameter configure if the cold junction of the thermocouple is compensated by the instrument (**on**, default option) or the compensation is disabled (**oFF**). This parameter applies only to thermocouple sensors.
- at the '**Pt alpha**' (**ALPh**) parameter select '**385**' if your Pt sensor has a temperature coefficient of 0.00385 ºC, or select '**390**' if your Pt sensor has a temperature coefficient of 0.00390 ºC. This parameter applies only to Pt sensors (Pt100, Pt500, Pt1000).

12.7 Display tools

At the '**Display tools**' (**DSP.t**) menu, there is access to a set of functions that affect the display, and are independent of the input signal configured.

- at the '**Offset**' (**Pr.oF**) parameter configure the number of counts to add to the reading. Value from -999 to -999.

  Example : to manually compensate for wire resistance in resistance measurements, or to manually correct for fixed errors in temperature sensors.
- at the '**Steps**' (**StEP**) parameter, select a number of counts. The reading changes in steps according to the configured number of counts.
- at the '**Average filter**' (**AVr**) parameter, configure the recursive filter to be applied to the measured input signal. The filter can be used to reduce oscillations on noisy signals. Configure the filter strength between '0' and '100'. The filter is stronger with higher values. Increasing the strength of the filter slows the response speed of the instrument. Value '0' disables the filter.
- at the '**Dead band**' (**d.bnd**) parameter set a value between '0.0'% and '100.0'%. This is a percentage of the '*input high*' parameter configured at the '*Process scaling*' section. Input signals below this value, are treated as a '0'. This parameter applies to process signals, and it is disabled for temperature ranges (thermocouples, Pt, Ntc) and resistances.



12. Configuration menu (cont.)

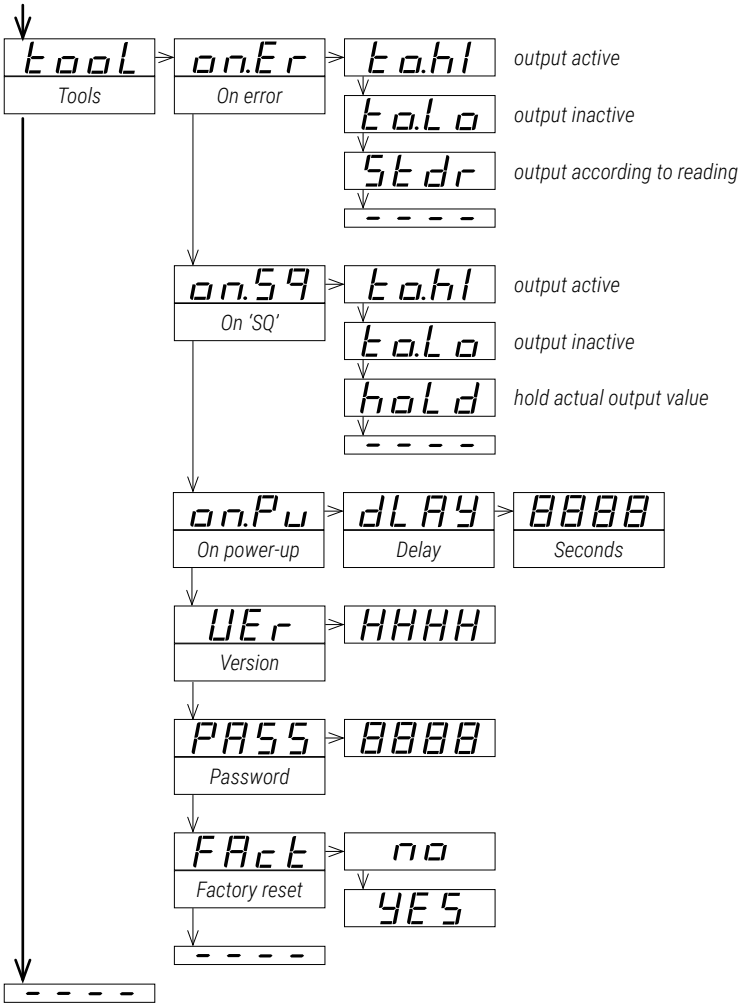
Example : instrument configured with code '011' (0/10 Vdc = 0/100.0). Configure the 'Dead band' parameter to '5.0' to set a dead band value of 0.50 Vdc. All signals below 0.50 Vdc will be treated as 0 Vdc, and the reading will be 0.0.

• at the '**Brightness**' (**brGt**) parameter, select the brightness intensity of the display. Adapt the instrument to environments with higher or lower brightness or adapt the intensity to other meters in the area.

12.8 'Tools' menu

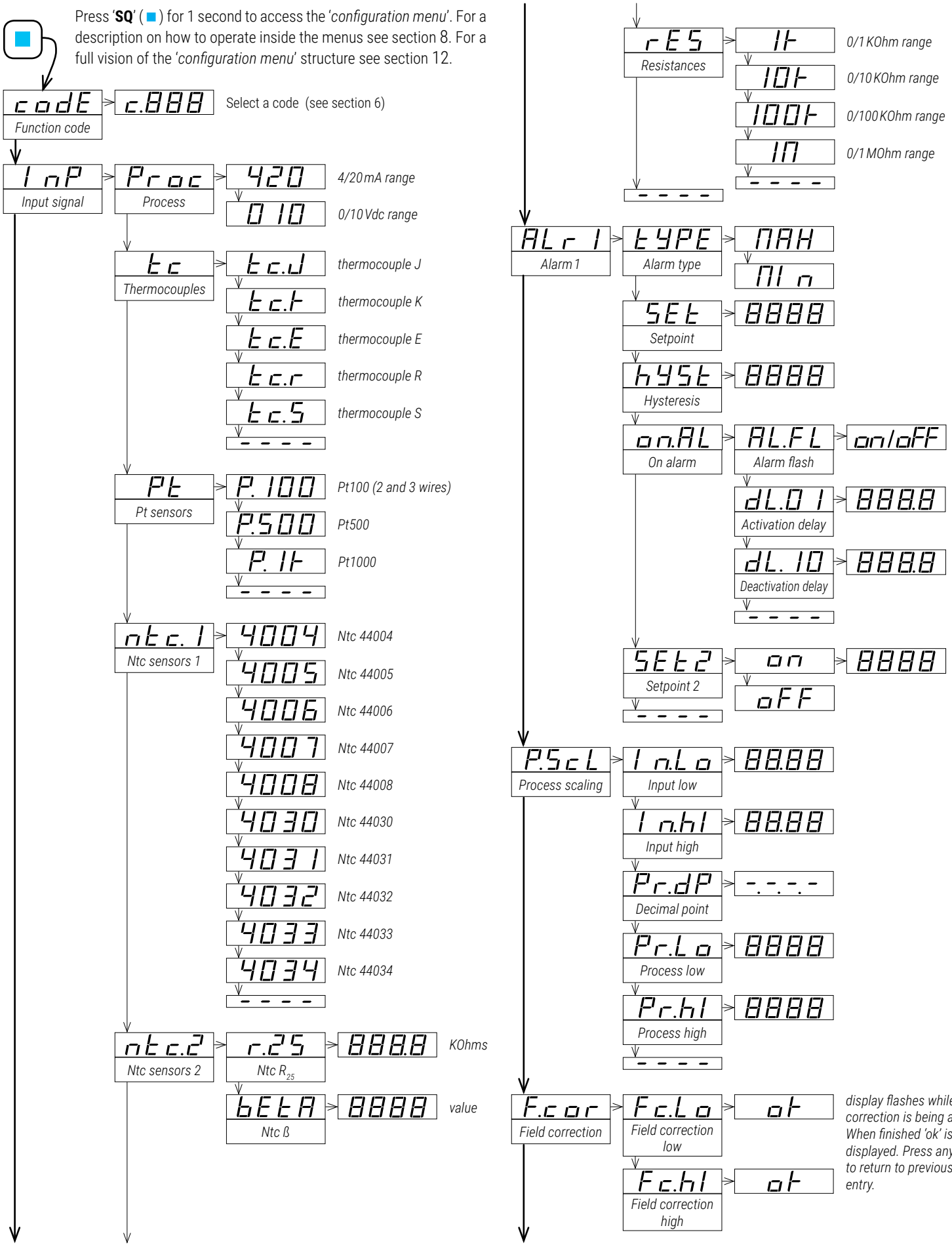
The '**Tools'** (**tooL**) menu groups several functions that are related to the general working of the instrument.

- at the '**On error**' (**on.Er**) parameter, configure the behavior of the output signals, in case of error at the input signal (see section 15).
  - select '**Output to high**' (**to.hI**) to force the transistor output to active state.
  - select '**Output to low**' (**to.Lo**) to force the transistor output to inactive state.
  - select '**Standard display**' (**Stdr**) to active the transistor output in case of input signal overrange, and to inactivate the transistor output in case of input signal underrange.
- at the '**On 'SQ'**' (**on.Sq**) parameter, configure the behavior of the output signals when the operator is inside '*configuration menu*' (see section 8.3).
  - select '**Output to high**' (**to.hI**) to force the transistor output to active state.
  - select '**Output to low**' (**to.Lo**) to force the transistor output to inactive state.
  - select '**Hold output**' (**hoLd**) to maintain the state of the transistor while the operator remains inside '*configuration menu*'.
- at the '**On power-up**' (**on.Pu**) menu, configure the functions to execute at power-up, after a power loss. It does not apply at a restart due to changes in the configuration.
  - at the '**Delay**' (**dLAY**) parameter, configure a number of seconds between 0 and 255. The normal start up of the instrument is delayed for the configured time. The displays indicated '**dLAY**' and outputs remain in the same state as when the instrument was not powered. After the configured time has elapsed, the instrument goes into '*normal mode*' of operation.
- the '**Version**' (**VEr**) parameter informs about the firmware version running in the instrument.
- at the '**Password**' (**PASS**) parameter define a 4 digit code to block access to the '*configuration menu*'. Activate the password to prevent access to the instrument configuration by non authorized personnel. To activate the '*Password*' function enter a code and validate. The password will be requested when accessing the '*configuration menu*'. To deactivate the password, set the password value to '**0000**'.
- at the '**Factory reset**' (**FAct**) parameter select '**yes**' to activate the default factory configuration (see section 14 for a list of factory default parameters).

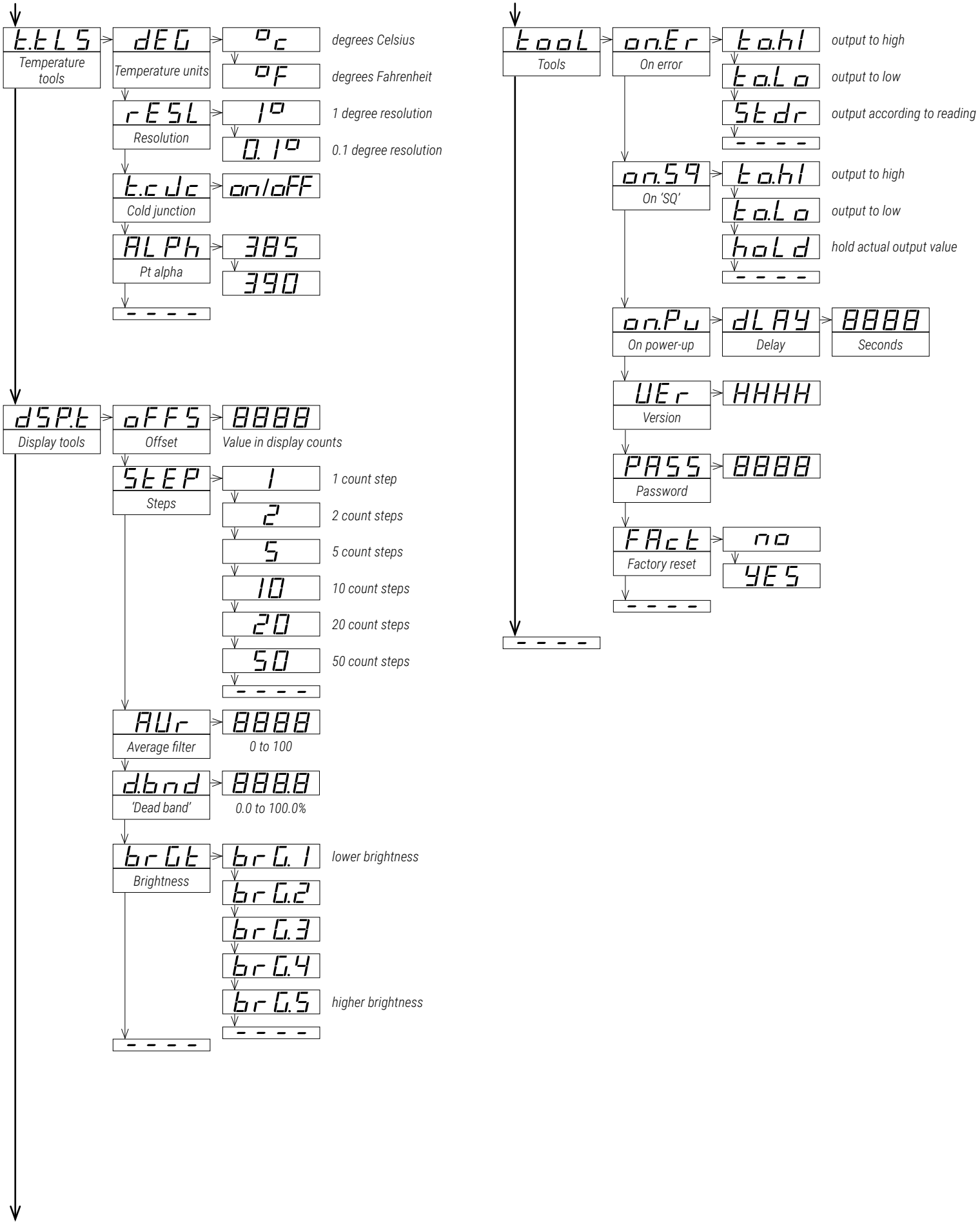


13. Full configuration menu

Press '**SQ**' (■) for 1 second to access the '*configuration menu*'. For a description on how to operate inside the menus see section 8. For a full vision of the '*configuration menu*' structure see section 12.



14. Full configuration menu (cont.)



14. Factory default parameters

Function code (**codE**)	10	
Input range (**InP**)	4/20 mA	
Alarm 1 (**ALr1**)		
Alarm type (**tYPE**)	maximum	
Setpoint (**SEt**)	100.0	
Hysteresis (**hYSt**)	1	
On alarm (**on.AL**)		
Alarm flash (**AL.FL**)	on	
Activation delay (**dL.01**)	0.0	
Deactivation delay (**dL.10**)	0.0	
Setpoint 2	off	
Process scaling (**P.ScL**)		
Input low (**In.Lo**)	4.00	(mA)
Input high (**In.hI**)	20.00	(mA)
Process decimal point (**Pr.dP**)	---.-	
Process low (**Pr.Lo**)	0.0	
Process high (**Pr.hI**)	100.0	
Temperature tools (**t.tLS**)		
Temperature units (**dEG**)	°c	
Resolution (**rESL**)	1°	
Cold junction (**t.cJc**)	on	
Pt alpha (**ALPh**)	385	
Display tools (**dSP.t**)		
Offset (**oFFS**)	0	
Steps (**StEP**)	1	
Average filter (**AVr**)	0	
Dead band (**d.bnd**)	0.0	
Brightness (**brGt**)	3	
Tools (**tooL**)		
On error (**on.Er**)	to.hI	(output active)
On '*SQ*' (**on.Sq**)	to.hI	(output active)
On power-up (**on.Pu**)		
Delay (**dLAY**)	0	
Password (**PASS**)	0000	(disabled)

RESET TO DEFAULT FACTORY PARAMETERS

To recover the instrument to default factory parameters, enter into '*configuration menu*' and go to '*Tools*' / '*Factory reset*' and select '*yes*'.

- access the '*configuration menu*' (press key '**SQ**' (■) for 1 second)
- press key '**UP**' (▲) to locate '*tools*' and press '**SQ**' (■)
- press key '**UP**' (▲) to locate '*Factory reset*' (**FAct**)and press '**SQ**' (■)
- value '*no*' appears on display
- press key '**UP**' (▲) and '*Yes*' appears on display
- press key '**SQ**' (■) to apply the factory reset
  - the leds light a round shape while the new configuration is applied
  - the start up message appears ('**420**')
  - the actual signal input value is displayed
- the instrument is in '*normal mode*' of operation

15. Error codes and messages

In case of error, the error code is shown flashing on the digits. The error code remains active on display until the problem that caused the error is solved. In case of multiple error codes, solve the first problem to see the next active error code. The error code is not visible inside '*configuration mode*'.

While on error, the instrument can be configured to 'overrange' or to 'underrange' or to act as per the specific error. See the '**On error**' (**on.Er**) parameter at section 12.8.

Table 21 | **Error codes**

Error	Description
'**Er.01**'	Password error. The password code entered is not correct.
'**Er.02**'	Input hardware overrange. The input signal is higher than the maximum signal that can be measured.
'**Er.03**'	Input hardware underrange. The input signal is lower than the minimum signal that can be measured.
'**Er.06**'	Display overrange. The display value should be higher than the maximum value that can be displayed.
'**Er.07**'	Display underrange. The display value should be lower than the minimum value that can be displayed.
'**Er.08**'	Scaled input slope not valid. The values for '*Input low*' (**In.Lo**) and '*Input high*' (**In.hI**) can not be the same. Enter a different value to validate the parameter (see section 12.4).
'**Er.10**'	Scaled process display slope not valid. The values for '*Process low*' (**Pr.Lo**) and '*Process high*' (**Pr.hI**) can not be the same. Enter a different value to validate the parameter (see section 12.4).
'**Er.11**'	Short circuit error. The input signal detects a short circuit. Applies to 4/20 mA and resistive temperature sensors (Pt100, Ntc, ...).
'**Er.12**'	Sensor break. Thermocouple open. Ntc connection open. Pt100 3rd wire connected to Pt+ or Pt100 open.
'**Er.13**'	Overload at the 4/20 mA input. The input signal detected is higher than 60 mA, and the instrument has opened the circuit. The instrument tries to reconnect every 1 second.
'**Er.14**'	The third wire of the Pt100 is open (not connected, broken, or third wire resistance is higher than 15 Ohms). Short-circuit terminals 3 and 4 to overlook the third wire.

Messages do not affect the output signal, and do not trigger the '**On error**' (**on.Er**) function.

Table 22 | **Messages**

Message	Description
'**-nA-**'	Function not available. For the actual configuration, the function is not available.
'*flash*'	Display flashes because of the '*on alarm*' parameter configuration, does not activate any error.

16. Precautions on installation

Check the documentation when you find this symbol, to know the nature of a potential danger and actions to prevent it.

Risk of electrical shock. Instrument terminals can be connected to dangerous voltage.

Instrument protected with double isolation. No earth connection required.

Instrument conforms to CE rules and regulations.

This instrument has been designed and verified conforming to the 61010-1 CE Security Regulation, for industrial applications. Installation of this instrument must be performed by qualified personnel only. This manual contains the appropriate information for the installation. Using the instrument in ways not specified by the manufacturer may lead to a reduction of the specified protection level. Disconnect the instrument from all external circuits before starting any maintenance and/or installation action.

The instrument does not have a general switch and will start operation as soon as power is connected. The instrument does not have protection fuse, the fuse must be added during installation.

The instrument is designed to be panel mounted, inside a closed cabinet, protected from direct impacts. An appropriate ventilation of the instrument must be assured. Do not expose the instrument to excess of humidity. Maintain clean by using a humid rag and do NOT use abrasive products such as alcohols, solvents, etc. General recommendations for electrical installations apply, and for proper functionality we recommend : if possible, install the instrument far from electrical noise or magnetic field generators such as power relays, electrical motors, speed variators, ... If possible, do not install along the same conduits power cables (power, motor controllers, electrovalves, ...) together with signal and/or control cables. The use of shielded cables is recommended to prevent the coupling of environmental electromagnetic noise, connected to earth only one cable end side. Before proceeding to the power connection, verify that the voltage level available matches the power levels indicated in the label on the instrument. In case of fire, disconnect the instrument from the power line, fire alarm according to local rules, disconnect the air conditioning, attack fire with carbonic snow, never with water.

17. Warranty

This instrument is warranted against all manufacturing defects for a period of 36 months, as requested by the European legislation. This warranty does not apply in case of misuse or accident, and the scope of the warranty is limited to repair of the instrument, not being the manufacturer responsible for additional damages or additional costs. Within the warranty period and after examination by the manufacturer, the unit will be repaired or substituted when found to be defective.

Extended warranty available at (see section 3)

18. CE declaration of conformity

Manufacturer	FEMA ELECTRÓNICA, S.A. Altimira 14 - Pol. Ind. Santiga E08210 - Barberà del Vallès BARCELONA - SPAIN www.fema.es - info@fema.es
Products	**P4P**

The manufacturer declares that the instruments indicated comply with the directives and rules indicated below.

Electromagnetic compatibility directive 2014/30/EU
Low voltage directive 2014/35/EU
ROHS directive 2015/863/EU
WEEE directive 2012/19/EU

Security rules EN-61010-1

Instrument	Fixed, Permanently connected
Pollution degree	1 and 2 (without condensation)
Isolation	Double

Electromagnetic compatibility rules EN-61326-1

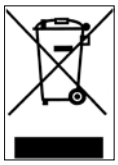
EM environment	Industrial*

**(note: for conformity with 610004-5, do not power directly from a 'DC distribution network', instead power from DC power supply).*

CISPR 11	Instrument Class A & Class B Group 1

For a detailed declaration see section 3.

Barberà del Vallès, January 2024
Xavier Juncà - Product Manager



According to directive 2012/19/EU, electronic equipment must be recycled in a selective and controlled way at the end of its useful life.

FEMA

INSTRUMENTATION FOR INDUSTRIAL AUTOMATION

PANEL METERS . SIGNAL CONVERTERS. LARGE FORMAT

DIGITAL PANEL METERS
Section Industrial

SIGNAL CONVERTERS
Section Industrial

LARGE DISPLAYS
Section Industrial

PANEL METERS . LOW COST
Section OEM

CONVERTERS . ISOLATORS
Section OEM

LARGE DISPLAYS
Section Special

SPECIAL INSTRUMENTS
Section Special

DATA ACQUISITION
Section Industrial

'CUSTOMIZED' INSTRUMENTS

FEMA ELECTRÓNICA

FEMA ELECTRÓNICA, S.A.
Altimira 14 (T14 N2) - Pol. Ind. Santiga
E08210 Barberà del Vallès
BARCELONA - SPAIN
info@fema.es
www.fema.es