Pocket RTD and Thermocouple Temperature Meters and Calibrators
TM602 • TM612(A) • TM630(A)
TC621 • TC622(A)

User Manual

WD1017 Rev E
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Palmer Wahl
234 Old Weaverville Road
Asheville, NC 28804
Toll Free 800-421-2853
Phone 828-658-3131
Fax 828-658-0728
www.palmerwahl.com

Warranty

Manufacturer warrants all Wahl TC6XX and TM6XX Series Calibrators distributed by us to be free from defects in material or workmanship under normal use and service. We agree to repair or replace any product listed above which upon examination is revealed to have been defective due to faulty workmanship or material if returned to our factory, transportation charges prepaid, within the product specific warranty period of one (1) year from date of purchase. This warranty does not include does not cover fuses or interchangeable batteries/ cells. This warranty is in lieu of all other warranties, expressed or implied and of all obligations or liabilities on its part for damages including but not limited to normal wear and tear or consequential damages following the use or misuse of this or any instrument sold by the Manufacturer. In addition, if the product is tampered with in any way or calibrated in any way other than by the instructions supplied by Palmer Wahl, it will immediately void the warranty. No agent is authorized to assume, for us, any liability except as set forth above. Freight cost to return item(s) for evaluation, duties and other fees are not covered by the manufacturer.

Product is automatically registered for warranty by serial number at time of purchase. Serial number must remain attached to product upon return.

Product Verification

Each TC6XX-TM6XX unit has been checked mechanically and electrically prior to delivery. The necessary precautions have been taken to ensure it reaches the user without being damaged.
Nonetheless, it is wise to perform a rapid check for any damage which may have occurred during transport. If this is the case, inform the carrier immediately.

The standard accessories included with the units are:

- User manual (available online)
- 4 AA batteries (1.5 V)
- Protection sheath or boot
- Carrying Case (TC6XX only)
- Wrist strap
- Certificate of Conformance
- TC621 includes 1 set of 2 test leads
- TC622A includes 2 sets of 2 test leads

If the product needs to be returned, go to palmerwahl.com and click on: Request an RMA (Return Material Authorization Number) and follow the instructions. You will receive your RMA number via email once your item is received at our facility. If you prefer, call Customer Service at: 1-800-421-2853 for assistance with the RMA process.

Contents

A. GENERAL

A.1 Introduction

The TC6XX-TM6XX Series range is made of 5 temperature measurement and/or calibration devices for thermocouples and resistive sensors. They are especially designed for calibration and maintenance. It makes it possible to measure and to emit electrical measurements and to simulate temperatures both on site as well as in a laboratory.

The TC6XX-TM6XX Series range features a large number of related functions which extend its range of application, including:

- Generation of default values, increases, single or cyclic ramps (for TC621 and TC622).
- Storage of acquisitions and display in the form of tables or trend curves.
- Use of calibrated sensors with their coefficients of correction

A range of improvements facilitates its operation:

- Rapid access to all functions.
- Intuitive user interface.
- 160x160 graphic display
- Connection via 4 mm safety plugs or a miniature flat plug.
- Connection via 4 mm safety plugs or miniature flat plugs for thermocouple temperature calibrators and connection by 4 mm safety plugs or 4-pt circular connector for resistive sensor temperature calibrators.
- Power supply via 4 AA batteries or rechargeable batteries with internal charger (Option).

The units are fitted in an elastomer-sheathed ABS case.

A.2 Definition of the Series

The Series is detailed in the table below:

	Thermocouple measurement	Thermocouple emission	Resistive sensor measurement	Resistive sensor simulation
TC621	X	X		
TC622A			X	X
TM602A	X			
TM612			X	
TM630A	X		X	

A.3 Parts

General characteristics:

- Portable device powered by 4 AA batteries (pack of Ni-MH storage batteries, 1.7 Ah optional).
- Wrist strap for carrying and use on-site
- Graphic liquid crystal display: 160 x 160 pixels.
- Choice of language used for messages and programming of functions, gauges and parameters via 6-key keyboard + 1 navigator.
- Backlit display accessible via a keyboard key, with the possibility of automatic black-out after a specific programmable period of inactivity.
- Housing: ABS case (elastomer-sheath or boot).
- Size: 6.18 x 3.34 x 1.77 in (157 x 85 x 45 mm (without boot).
- Weight: 10.8 ounces (306 g) without boot.
- IP54 tightness in compliance with standard EN 60529

A.4 Directives CE

A.4.1 Conformity with standards

The device complies with the applicable directives in force on the subject of electrical safety (2006/95/CE) as well as on the electromagnetic compatibility of the electrical measuring instruments (2004/108/CE).

These instructions for use contain information and warnings which must be observed by the user to protect the latter against the dangers of electricity, to ensure the safe operation of the device and to protect it against any mishandling which could damage or compromise the safety of use of the device.

A.4.2 Environmental conditions

In accordance with publication CEI 359: operating category I.
Range of application of standards: from 0 to 2,200 m.
Reference temperature range: 23°C ± 5°C, relative humidity: 45% to 75%.
Nominal operating range: -10°C to +50°C, relative humidity: 20% to 80% non-condensing.
Operating range limit: -15°C to +55°C, relative humidity: 10% to 80% (70% at 55°C).
Storage and transport temperature range limit: - 30°C to + 60°C (without the batteries).

A.4.3 Worn devices

Worn electrical devices can pollute the environment. We recommend you refrain from disposing of this device in an ordinary waste bin, but rather that you use the recycling circuits available locally.

A.4.3.1 Waste generated by the device

List of waste classified:

- **16.02.14: Waste originating from electronic equipment:**

→ Printed circuit boards making up the device

- **16.06.02: Batteries and storage battery (dangerous)**

→ Alkaline batteries
→ 3 V lithium battery (CR1225 type)
→ Or Ni-MH batteries (If the unit is equipped with an 12436-01 battery pack)

- **15.01.02: Packaging**

→ ABS plastic and polycarbonate device casing
→ Elastomer sheath or boot

A.4.3.2 Device destruction procedure

Open the device: unscrew the screw on the battery compartment, followed by the 5 screws securing the 2 shells. Separate the 2 shells. Separate the PCB from the upper shell.

With regard to the batteries, you will find them in the battery compartment (see commissioning chapter).

In the case of the pack of batteries, there are 2 contaminants: NI-MH (Nickel-Metal Hybrid) batteries and a PCB. Separate these 2 items.

A.4.4 Instructions

The unit is designed to be used in complete safety if the instructions given in the accompanying documents are followed. Any use apart from those defined, may prejudice the safety of the operator and is therefore dangerous and forbidden.

A.4.5 Making measurements

Measuring wires and leads must be in good condition and must be replaced if their insulation appears defective (insulation cut, burned, etc.).

Never exceed the protection value limits indicated in the specifications.

Before changing function, disconnect the measuring wires from the external circuit. When voltage measurements are being made, even weak ones, keep in mind that the circuits may feature a dangerous voltage for the operator compared to the ground.

Do not make any measurements when the device is linked up to another device using the USB link or when the batteries are being charged.

A.4.6 Unusual faults and stresses

Whenever it is believed that the protection has been damaged, switch off the unit and ensure that it is not used prematurely.
The protection may have been damaged if, for example:

- ✓ There is obvious damage to the unit.
- ✓ The unit is no longer able to make accurate measurements.
- ✓ The unit has been stored under unfavorable conditions.
- ✓ The unit has been subjected to severe stress during transportation.

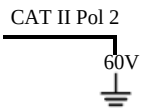
A.4.7 Definitions

A.4.7.1 Definition of the category and degree of pollution

CAT II 60V:
This notion of categories determines the maximum voltage which can be applied to the measuring inputs (it is also referred to as the overvoltage category). For the TC621, the ceiling overvoltage is (DC or AC)

POL 2°:
The notion of pollution determines the clearance between circuits. Degree 2 authorizes temporary conductivity caused by condensation.

A.4.7.2 Table of symbols used

Symbol	Description
	Warning: see accompanying documents
	Earth point
	Complies with European Union directives
	Category II, Pollution 2. Maximum common mode voltage compared with the ground = 60 V
	Do not discard. See chapter Used devices (see section A.3.3)
	Do not discard. See chapter Used devices (see section A.3.3)

A.5 Maintenance

The unit must always be set up according to the instructions in this notice. Any incomplete or poorly executed set up may compromise the safety of the operator.

The responsible authority must ensure on a regular basis that factors affecting safety do not change with time and carry out any necessary preventive work.

Before opening the unit for any maintenance operations, you must ensure that all wires are disconnected from the unit.

Any adjustment, maintenance or repair of an open unit must be avoided as far as possible and, if essential, must be carried out by qualified personnel who are familiar with the risks involved.

B. USING THE INSTRUMENT

In order to use the device with all the safety requirements, all operators must read the paragraph on safety carefully, along with the paragraph below.

B.1 Power-up

B.1.1 Battery replacement

The instrument is supplied with four 1.5V AA batteries. The batteries must be installed in the battery compartment in the back of the instrument. To open the compartment, remove the cover screw. Screw the cover back on after inserting the batteries.
Pay attention to the polarity when installing the batteries as an error could damage the instrument. The polarity is indicated inside the compartment cover.
The figure below illustrates how to open the battery compartment as well as the correct positioning of each battery.

After inserting the dry cells (or NiMH batteries) correctly, press the ON/OFF key to turn ON the product.
To turn the unit off completely, press the ON/OFF key until the "Instrument in power off mode" screen comes up.
Date and hours are saved by a lithium battery.

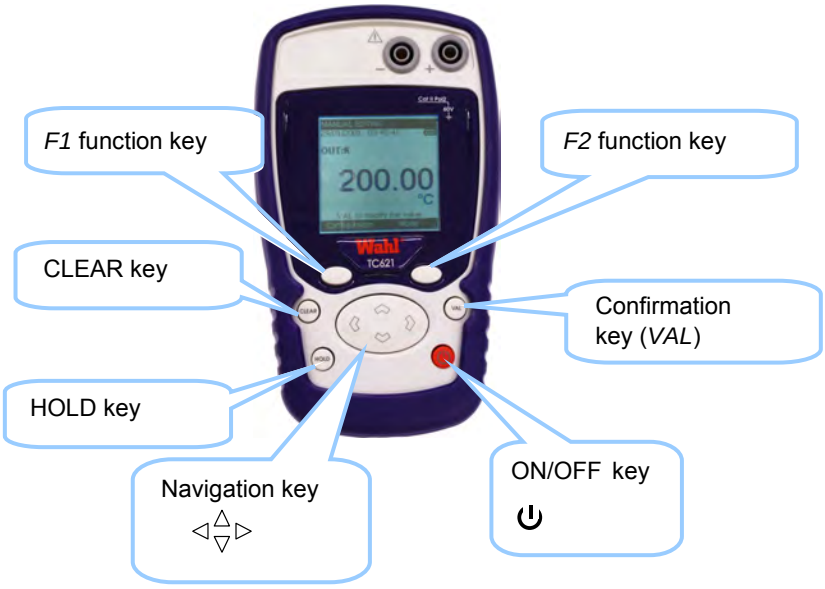
B.1.2 Back-up battery (date and time)

The back-up of the date and time when the unit is powered down is guaranteed by a 3V lithium battery – type CR1225. The battery is located inside the unit and can be accessed by removing the 5 screws on the back of the unit.

B.1.3 The keyboard

The keyboard features:

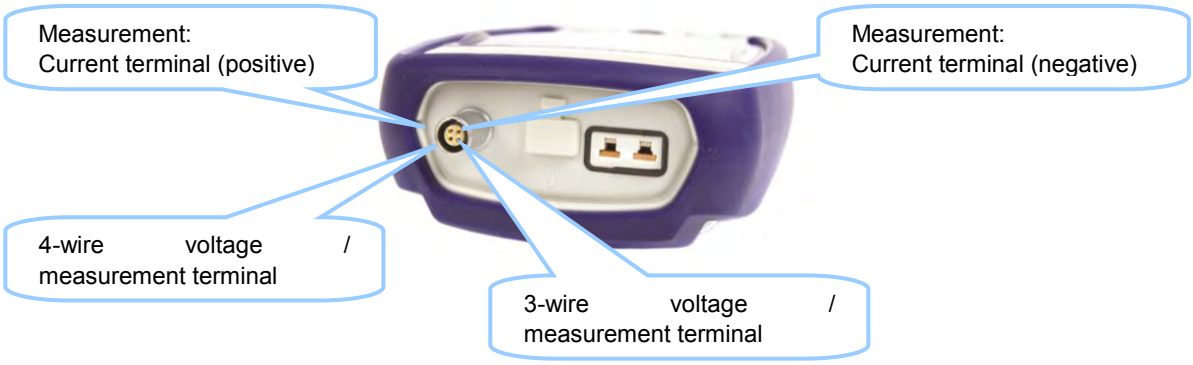
- 2 function keys (**F1** and **F2**) for the selection of the various menus displayed on the screen.
- The navigator, consisting of 4 arrows (up (↑), down (↓), right (→), left (←)
- A clear key (**CLEAR**).
- A device on/off and backlighting on/off key (**ON/OFF**).
- Press briefly to start the device. During operation, press briefly to turn the lighting on or off. Press it longer for 2 seconds to stop the device.
- A validation key (**VAL**).
- A HOLD key allows you to suspend a process temporarily



B.1.4 The measuring and simulation terminals for each device

Both the TC621 and TM602 are fitted with 2 safety bushes (4 mm in diameter) and a miniature flat plug for thermocouples. These connector assemblies are used both in measurement and emission modes (non simultaneous).

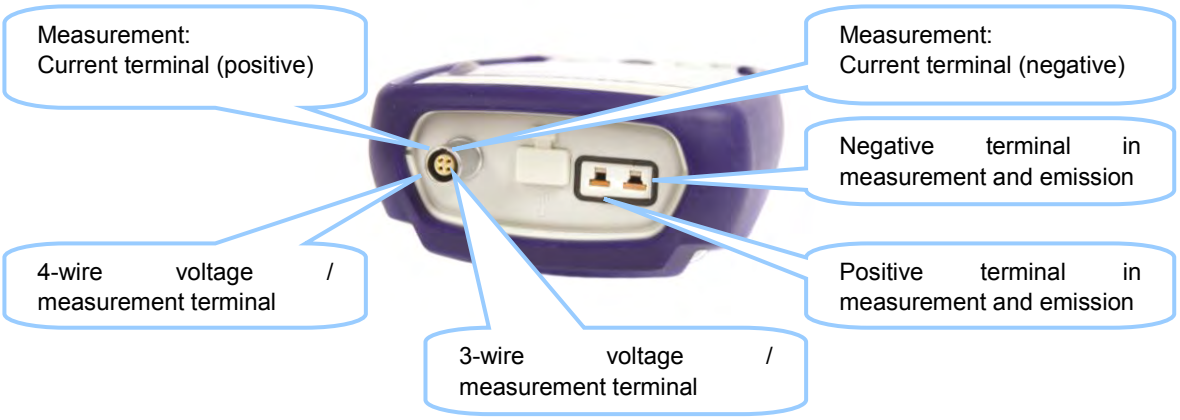
Both the TC622 and TM612 are fitted with 4 safety bushes (4 mm in diameter) and a 4-pt circular connector. These connector assemblies are used both in measurement and emission modes (non simultaneous).



Remark:

When using the unit with resistance testers/simulators, make sure polarities are observed.

The TM630 is fitted with a flat miniature plug for thermocouple and a 4-pt circular connector for resistive sensors.



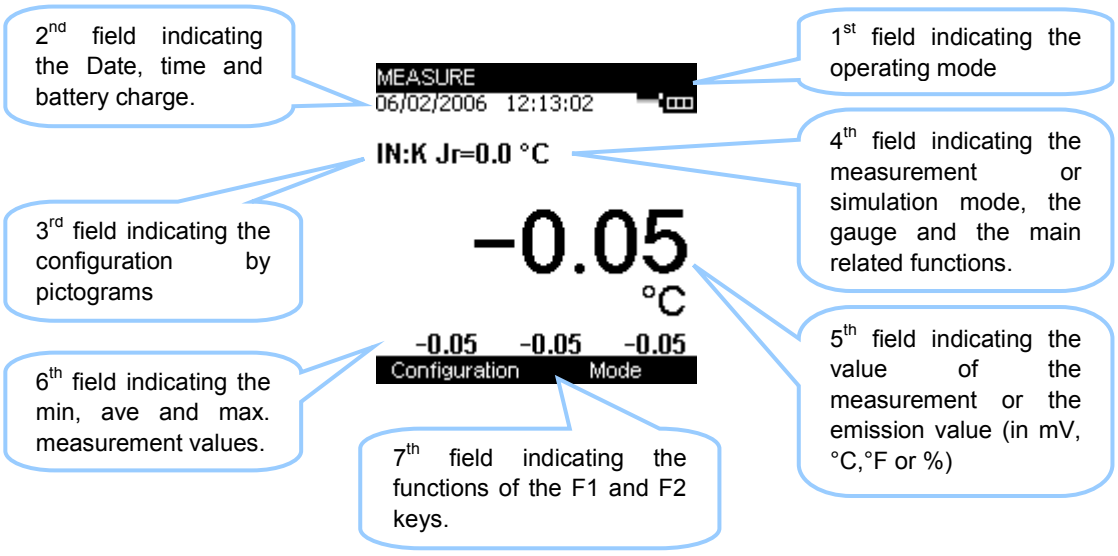
B.1.5 The USB connector

The TC6XX-TM6XX Series range is fitted with a USB connector (mini B) intended for uploading new software versions and device adjustment.

B.1.6 The screen

The TC6XX-TM6XX Series range is fitted with a graphic LCD display with back-lighting. The display resolution is 160 x 160 pixels. In normal operating conditions, the display is divided up into seven horizontal fields:

- The 1st field indicates the operating mode (Measurement or emission).
- The 2nd field indicates the date, time and battery charge.
- The 3rd field is reserved for icons indicating the operating mode (related functions: Scaling, filtering…).
- The 4th field indicates the operating mode, the gauge and certain related functions.
- The 5th field indicates the value of the measurement or of the emission. These values are expressed in mV, Ohm, °C, °F or as a %.
- The 6th field indicates (in measurement mode) the min., average and max. values of the measurement.
- Lastly, the 7th field indicates the functionality of keys **F1** and **F2**.



The table below provides a definition of each pictogram displayed on the screen:

Symbol	Description
	Step increment transmission mode
	Single ramp signal transmission mode
	Cyclic ramp signal transmission mode
	Scaling
	On hold
	Filtering
	%FS (full scale) function
	Error (over-calibration in measurement or error on the value emitted…)
	Incremental mode using the arrows
	Battery life indication
	Acquisition in progress (the value on the right of the pictogram indicates the number of values recorded)

The table below provides a definition of each pictogram of the function keys

Symbol	Description
	Tab key
	Open a drop-down list
	Close a drop-down list
	Delete the selected item
	Clear the selection
	Add the item being edited

B.1.7 Operating modes

There are 2 different operating modes:

- Measurement mode (displayed in mV, Ohm, °C or °F)
- Simulation mode (value displayed in mV, Ohm, °C or °F).

The configuration of the operating mode is done at the extinction of the product.
At power up, the unit automatically switches measurement mode to avoid possible conflicts if the signal had been connected to an external circuit.

The functional and electrical characteristics not to be exceeded are described below:

B.1.7.1 Constant voltage measurement

Gauge	+100mV
Resolution (display)	1 µV or 0.01°
Scope of range:	-10 mV to + 100 mV
Scaling	yes

B.1.7.2 Voltage emission

Gauge	+ 80 mV
Resolution (display)	1 µV or 0.01°
Scope of range:	-9.5 mV to +80 mV
Scaling	yes

B.1.7.3 Electrical characteristics not to be exceeded for "voltage" gauges (TC621, TM630 and TM602)

Function	Gauge	Max Vin	Z load
U measurement	100mV	60 V	
U emission (TC6621)	80mV		1000 Ω min

B.1.7.4 Resistances / temperature measurement (TC622, TM630 and TM612)

Gauge	400 Ohm (for PT100)	3600 Ohm (for PT1000)
Resolution (display)	10 mΩ or 0.01°	100 mΩ or 0.01°
Scope of range:	0 Ω to 400 Ω -220°C to 850°C -364°F to 1562 °F	0 Ω to 3600 Ω -220°C to 760°C -364°F to 1400°F
Scaling	yes	yes

B.1.7.5 Resistance / temperature simulation (TC622)

Gauge	400 Ohm (for PT100)	3500 Ohm (for PT1000)
Resolution (display)	1 mΩ or 0.01°	1 mΩ or 0.01°
Scope of range	0 Ω to 400 Ω -220°C to 850°C -364°F to 1562 °F	0 Ω to 3500 Ω -220°C to 715°C -364°F to 1319°F
Scaling	yes	yes
Measurement current (Continuous)	0.1 mA to 1 mA and 1 mA to 4 mA	0.1mA to 1mA
Measurement current (Pulsed)	0.2 mA to 1 mA and 1 mA to 4 mA	0.2mA to 1mA

B.1.7.6 Electrical characteristics not to be exceeded for "resistance" gauges (TC6622, TM630 and TM612)

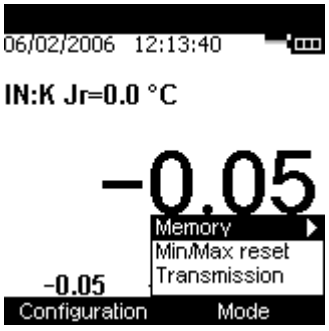
Function	Range	Vin max	Measuring current
Ohm measurement	400 Ω / 3600 Ω	60 V	
Ohm Simulation (TC622 only)	400 Ω / 3500 Ω		5 mA

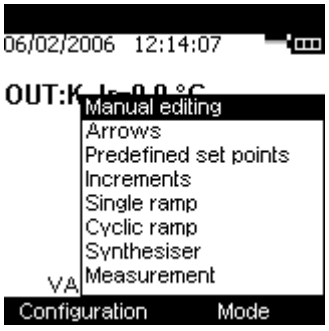
C. PROGRAMMING MODES

C.1 Voltage / resistance or temperature measurement

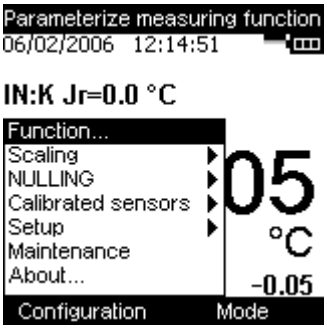
- The choice of measurement or emission mode is made using the **F2** key **(mode** menu**)**.
- Using the navigation keys *(*↑ and ↓*)*, position the cursor in the **Measurement** field going down the menu.
- Confirm your choice using the **VAL** key.

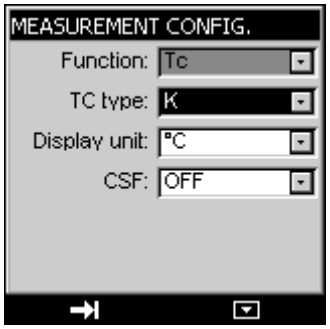
Note that the Measurement mode is the mode selected by default.





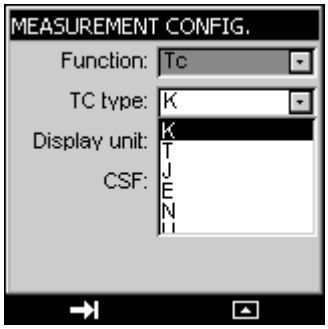
- The function type selection (Thermocouple or resistive sensor type) is made using the **F1** key **(Configuration** menu**)**.
- Using the navigation keys *(*↑ and ↓*)*, position the cursor in the **Function** field.
- Confirm the latter using the **VAL** key.





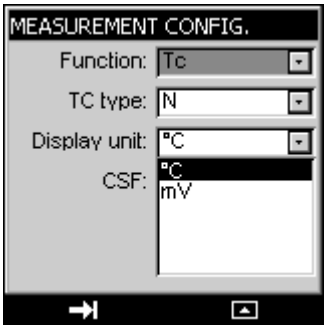
In the **MEASUREMENT CONFIGURATION** menu, position the cursor in the **TC Type** or **Probe** field using the **F1** key.

- Enter the **TC Type** or **Probe** menu using the **F2** key**.**
- Choose the type of thermocouple (**K, T, J…**), using the navigation keys (↑ and ↓) or the type of resistive sensor (PT50, PT100, PT200…).



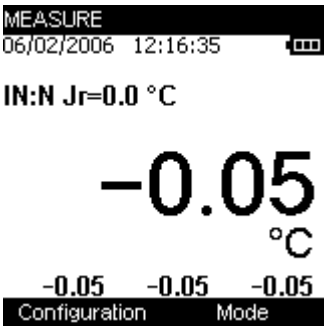
- Press **VAL** to confirm.

- Using the F1 key, define the **Unit** by positioning the cursor on it.
- Enter the menu by pressing **F2**.
- Using the navigation keys *(*↑ and ↓*)*, choose the unit.
- Press **VAL** to confirm.



Attention, the choice of °C or °F is made in the **Setup\Preferences\temp unit** menu.

- Using the F1 key, define the CSF used by positioning the cursor on it (for TC621, TM602 and TM630 units only).
- Enter the menu by pressing **F2**.
- Using the navigation keys (↑ and ↑), choose the CSF (**OFF**: None, **ON**: internal or **programmed**).
- Press **VAL** to confirm.
- Press VAL (again) to confirm the desired function and go back to the measurement screen.



The **Measurement** mode makes it possible to display the Min (bottom left), Average (bottom centre) and Max values (bottom right) from the last **Min/Max Reset** command.

- Access this command by pressing the F2 key.
- Using the navigation keys (↑ and ↑), position the cursor in the **Min/Max Reset** field.
- Confirm the latter using the **VAL** key.

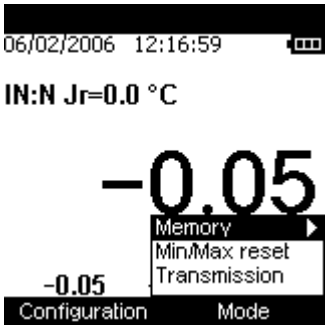
Note:

Following a significant thermal shock, it is advisable to allow the device to stabilize its temperature to use the internal reference junction (CSF) with the utmost precision (TC621, TM602 and TM630 units).

C.2 Voltage / resistance or temperature simulation

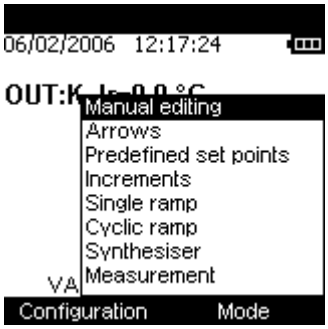
To access the **Emission** mode:

- The choice of **Emission** mode is made using the **F2** key **(mode** menu**)**.
- Using the navigation keys *(*↑ and ↑*)*, position the cursor in the **Emission** field going down the menu.
- Confirm your choice using the **VAL** key.



Once you have confirmed the Emission mode, define the type of generation:

- Continuous (manual or arrows or default editing).
- Incremental (by step or “manual default”).
- By single ramp (only one ramp emitted).
- By cyclic ramp.
- Synthesizer ("automatic default”).



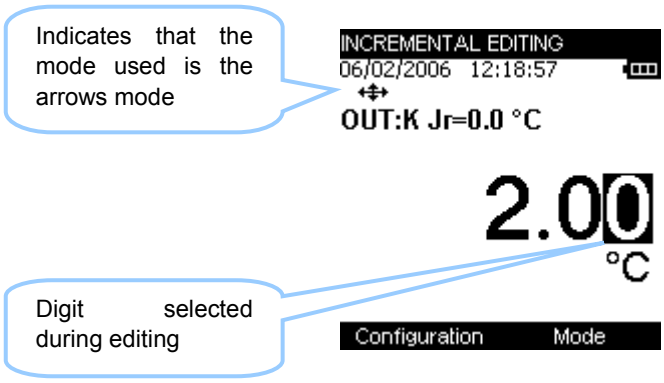
→ Voltage / resistance or temperature generation / manual editing?

- Press the F2 key to display the edit menu.
- Using the navigation keys (↑ and ↓), choose the **Manual edit** mode and confirm (**VAL** key).
- Press **VAL** again and enter your value using the navigation keys:
  - ↑ and ↓ to increase or decrease the value
  - ← and → to select the digit to modify (hundreds/tens/unit/decimal place/hundreds).

Beware: if the Scaling mode is **ON**, the value to edit is expressed in the unit defined, otherwise this value is expressed in Volts or in °C or °F.

→ Voltage / resistance or temperature generation / arrow editing?

- Press the F2 key to display the edit menu.
- Using the navigation keys (↑ and ↑), choose the **Arrows** edit mode and confirm (**VAL** key).
- Use the navigation keys to enter the value:
  - ↑ and ↓ to increase or decrease the value
  - ← and → to select the digit to modify (hundreds/tens/unit/decimal place/hundreds).



→ Voltage / resistance or temperature generation / incremental editing?

- Press the F2 key to display the edit menu.
- Using the navigation keys (↑ and ↑), choose the **INCREASES** mode and confirm (**VAL** key).

The values emitted are those defined in the **CONFIGURATION/RAMP** menu (see the chapter entitled Related functions).

- Using the navigation key (↑), start the automatic increases phase (following the parameters programmed in the **CONFIGURATION/RAMP** menu).
- Using the navigation key (↓), you can decrease automatically starting from the max. programmed voltage (or temperature).
- Using the navigation key (→), you can increase manually the voltage (or temperature) emitted (following the parameters programmed in the **CONFIGURATION/RAMP** menu).
- Using the navigation key (←), you can decrease manually the voltage (or temperature) emitted starting from the max. programmed voltage.

→ Voltage / resistance or temperature generation / single ramp editing?

- Press the F2 key to display the edit menu.
- Using the navigation keys (↑ and ↑), choose the **SINGLE RAMP** mode and confirm (**VAL** key).

The values emitted are those programmed in the **CONFIGURATION/RAMP** menu (see the chapter entitled Related functions).

- Using the navigation key (↑), start the automatic increases phase (following the parameters programmed in the **CONFIGURATION/RAMP** menu).
- Using the navigation key (↓), you can decrease automatically starting from the max. programmed voltage (or temperature).
- Using the navigation key (→), you can increase manually the voltage (or temperature) emitted (following the parameters programmed in the **CONFIGURATION/RAMP** menu).
- Using the navigation key (←), you can decrease manually the voltage emitted starting from the max. programmed voltage (or temperature).

The Hold key allows you to stop generating or to resume it
You can resume the generation of the ramp in step-by-step mode by pressing the navigation keys (← and →) or in automatic generation using the navigation keys (↑ and ↓).

You can delay the emission by a programmable amount of time (in the **CONFIGURATION/RAMP/DELAY** menu**)**

→ Voltage / resistance or temperature generation / cyclic ramp editing?

- Press the F2 key to display the edit menu.
- Using the navigation keys (↑ and ↑), choose the **CYCLIC RAMP** mode and confirm (**VAL** key).

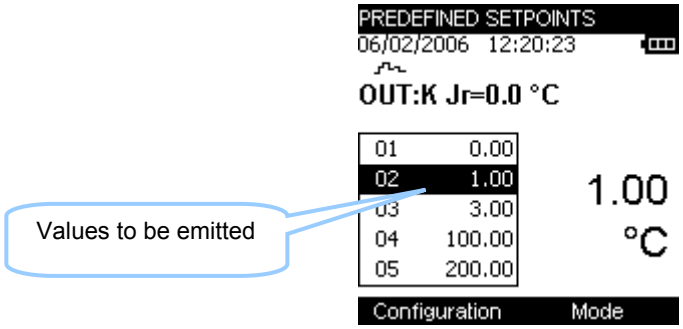
The values emitted are those programmed in the **CONFIGURATION/RAMP** menu (see the chapter entitled Related functions).

- Using the navigation key (↑), start the automatic increases phase (following the parameters programmed in the **CONFIGURATION/RAMP** menu).
- Using the navigation key (↓), you can decrease automatically starting from the max. programmed voltage (or temperature).
- Using the navigation key (→), you can increase manually the voltage (or temperature) emitted (following the parameters programmed in the **CONFIGURATION/RAMP** menu).
- Using the navigation key (←), you can decrease manually the voltage emitted starting from the max. programmed voltage (or temperature).

The Hold key allows you to stop generating or to resume it
You can resume the generation of the ramp in step-by-step mode by pressing the navigation keys (← and ←) or in automatic generation using the navigation keys (← and ←).

→ Voltage or temperature generation / default editing?
The default emission mode is a mode that makes it possible to generate manually the values stored for the synthesizer function.

- Press the F2 key to display the edit menu.
- Using the navigation keys (↑ and ↑), choose the **Default values** mode and confirm (**VAL** key).



- Using the navigation keys (↑ and ↓), select the value that needs to be emitted.
- Confirm using the **VAL** key.

→ Voltage / resistance or temperature generation / synthesizer?

- Press the F2 key to display the edit menu.
- Using the navigation keys (↑ and ↑), choose the **Synthesizer** mode and confirm (**VAL** key).

The values emitted are those programmed in the **CONFIGURATION/Synthesizer** menu (see the chapter entitled Related functions).

- Using the navigation key (↑), start the automatic increases phase (following the parameters programmed in the **CONFIGURATION/Synthesizer** menu).
- Using the navigation key (↓), you can decrease automatically starting from the max. programmed voltage (or temperature).
- Using the navigation key (→), you can increase manually the voltage (or temperature) emitted (following the parameters programmed in the **CONFIGURATION/Synthesizer** menu).
- Using the navigation key (←), you can decrease manually the voltage emitted starting from the max. programmed voltage (or temperature).

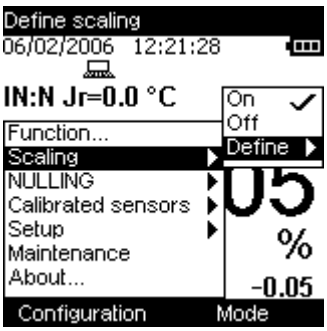
The Hold key allows you to stop generating or to resume it
You can resume the generation of the ramp in step-by-step mode by pressing the navigation keys (← and ←) or in automatic generation using the navigation keys (← and ←).

The configuration of the parameters for the ramps and default values is explained in the chapter entitled “Related Functions”.

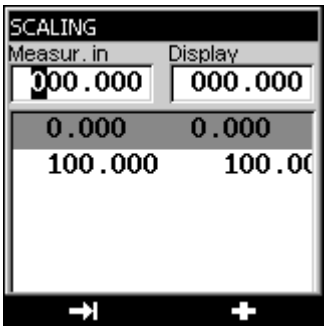
D. RELATED FUNCTIONS

D.1 Scaling

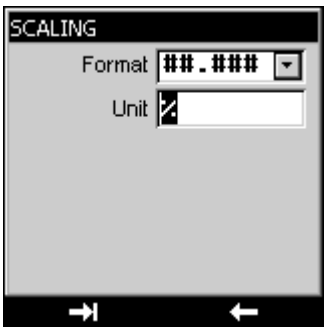
The scale correction function performs conversion operations between the electrical values measured and the physical values converted.
This linearization operation makes it possible to correct partially the errors induced by non-linear sensor/converter systems.
The Scaling function makes it possible to define up to 10 right-segments, i.e. 11 points, in order to approach as much as possible the non-linear response curve, and to make the scale corrections according to each segment.
The pictogram 💻 is displayed on the screen in the active window when the scaling function is enabled.



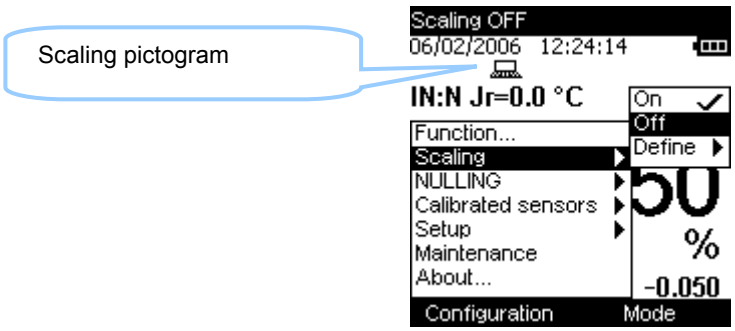
The **Define/list of points** menu makes it possible to program up to 10 lines of 2 values: X and Y= f(X).
In measurement mode: X = Value measured and Y = Value Displayed.
In emission mode: X = Value displayed and Y = Value emitted.
The lines entered are sorted according to the X in increasing order, to scale an X-value, the device seeks the 2 lines n and m=n+1 which frame it, and extrapolates linearly: Y = Yn + (X-Xn) x (Ym-Yn)/(Xm-Xn)
Use the function keys to edit the points:
To add a line: enter X and Y, then enable the ✚ function key.
To select a line in a list, use the Up and Down navigation keys.
To delete a selected line, use the ✂ key.
To move from one field to the next, use the ⇥ key.



The **Define/parameters** menu makes it possible to define the format (Number of digits displayed) and unit.



Once the parameters have been set, the scaling is automatically enabled. To disable it, enter the **Configuration/Scaling** menu, select **OFF** and confirm by pressing the **VAL** key.

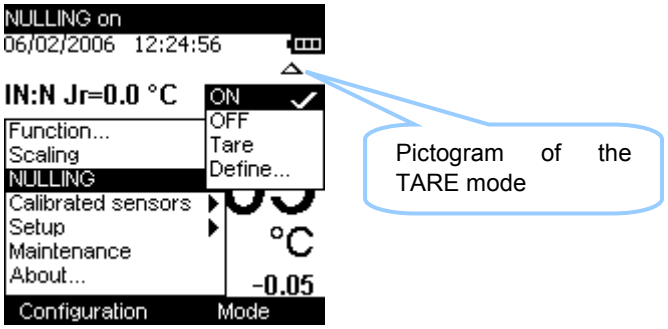


Remarks:
The parameters and scaling points are saved when turning the unit off.

Beware, when changing functions (thermocouple or resistive sensor) or units, scaling goes OFF. The data defined in the point lists are then erroneous.

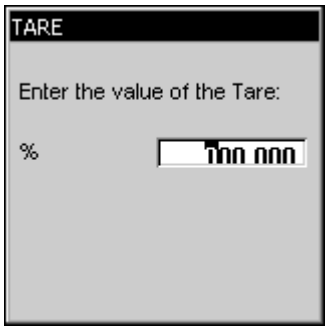
D.2 Differential measurements

The relative measurement function available on the device makes it possible to cancel a constant or spurious value via programming.
When the relative measurement function is enabled, the symbol △ is displayed on the measurement screen.



The **NULL/define** menu makes it possible to program the value of the Tare (positive or negative). This value is obtained from the measurements:

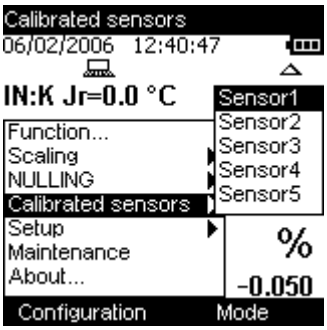
Value Displayed = Value measured – Value of the Tare



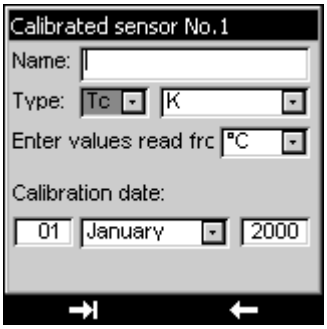
D.3 Calibrated sensors

The calibrated sensors function of the device makes it possible to use sensors, the calibration (correction) coefficients of which are taken into consideration by the device during measurement.

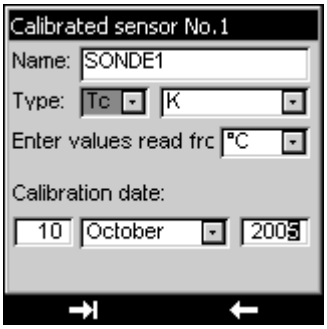
- Using the F1 key, enter the Configuration menu.
- Select the **Calibrated Sensors** function, followed by one of the 5 available sensors.



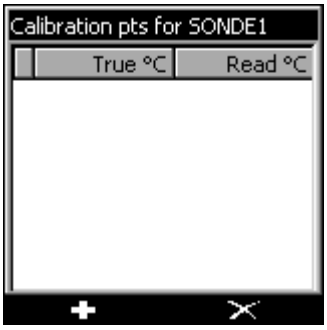
- Confirm (**VAL** key).



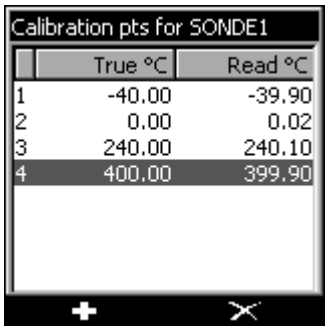
- Enter the sensor information fields. Use the F1 function key ( ) to move from one field to the next.



- Confirm your choice using the **VAL** key.



- To add a value in the table of calibration points, use the keys, enter the calibration points (real value and value read) then confirm using the VAL key.
- Repeat this operation for all the calibration points (maximum of 4).



To delete a line, select it then use the ✂ key.
To edit a line, select it then use the navigation key (→) to make editing possible.

- Confirm using the **VAL** key to return to the measurement screen.

Remarks:
1 to 4 calibration points can be entered per sensor.
These calibration points are used to compute a degree 0 to 3 c(T) polynomial, giving the voltage (or resistance) correction of the sensor at temperature T.

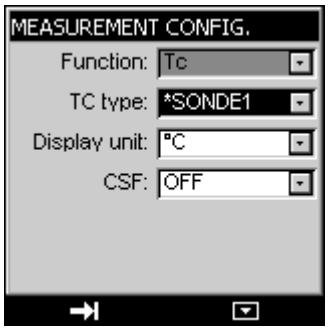
In the special case where a single calibration is indicated, the behavior differs according to whether the sensor is a thermocouple or a thermometer resistance:

- In the case of a thermocouple, the correction is a fixed voltage difference.
- In the case of a resistive sensor, the correction made is a correction of R0.

The sensors declared thus are added to the list of thermocouple types (or sensor types) proposed in the settings dialog box of the measurement function. They appear at the top of the list, before standard sensors, and their description is preceded by the '*' character denoting a calibrated sensor.

To ensure the measurements are made using the calibration coefficients defined earlier, go to the **configuration/function** menu.

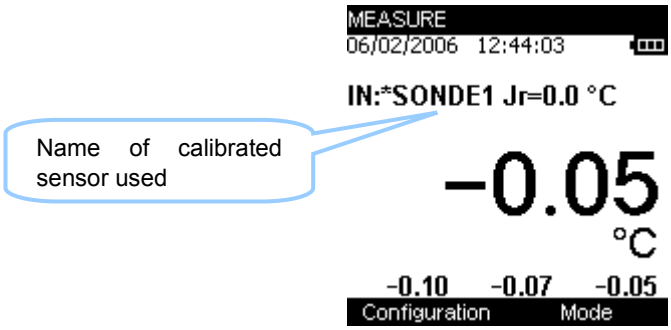
- In the **thermocouple** field, select sensor1 (PROBE1-SENSOR1 below).



Note: the Calibrated sensors are at the top of the list and their name is preceded by a *.

- Confirm the latter using the **VAL** key.

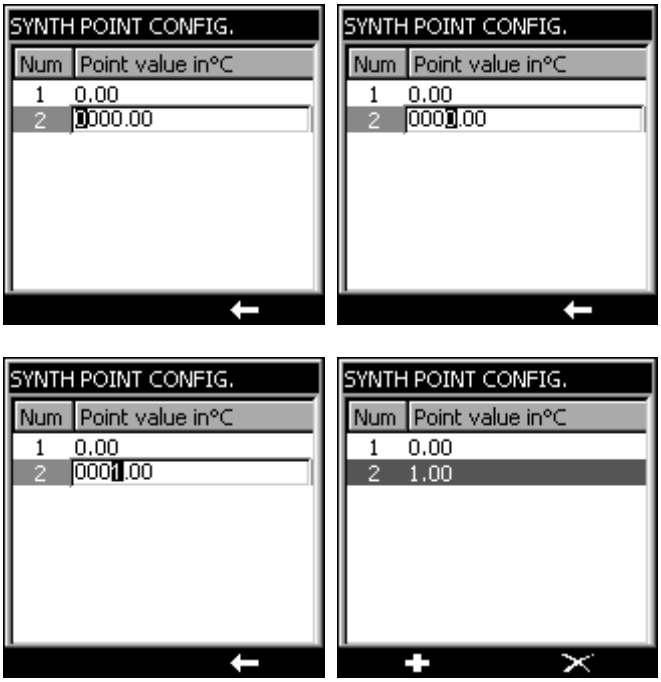
The chosen calibrated sensor is displayed in the measurement screen.



D.4 Configuration of default value points

The configuration of default value points is performed in the **configuration/Points** menu, obviously providing the **default values** mode has been confirmed.

- Using the F1 key, select the **configuration/Points** menu.
- Confirm using the **VAL** key.
- Using the F1 key ( ) add a new value line to the table.
- Using the navigation keys (← and →), select the digit that requires editing.
- Using the navigation keys (↑ and ↑), increase the value of the selected digit.
- Confirm the line using the **VAL** key.



You can edit a value already recorded:

- Using the navigation keys (↑ and ↑), select the line requiring editing.
- Press the navigation key (→) to make editing possible.

You can delete a value already recorded:

- Using the navigation keys (↑ and ↑), select the line requiring deleting.
- Press the key to delete the line.

Notes:
A maximum of 100 values can be entered.

This table of values is also used for the Synthesizer mode; consequently all changes to this table entail a change to the synthesizer values.

D.5 Storage of acquisitions in progress

The TC621 is designed to store 10,000 values in one or more acquisition bursts.

- Using the F2 key, enter the Mode menu.
- Select the **Memory** function.
- Confirm using the **VAL** key.

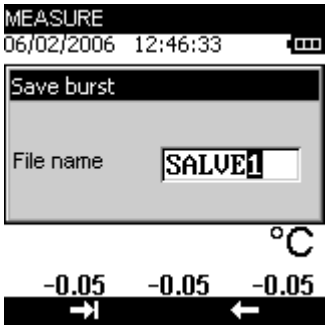
The drop-down list displays the following functions:

REC.MEASUREMENT:
Enable the triggering of an acquisition on a case-by-case basis.

If an acquisition has already been opened, then the following screen is displayed:

If you wish to save it, press the F2 key (YES) to confirm.

- You are then requested to enter the name of a file. Using the navigation keys (↑ and ↓), scroll down the letters.
- Using the navigation keys (← and →), move the cursor by one position.
- Using the F2 key(⇤), you can delete the characters entered



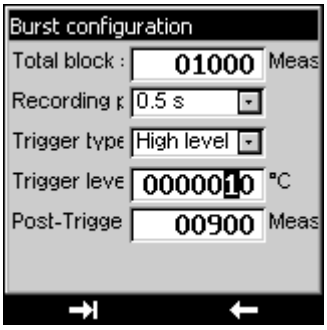
- Once you have entered the file name, confirm by pressing the **VAL** key.

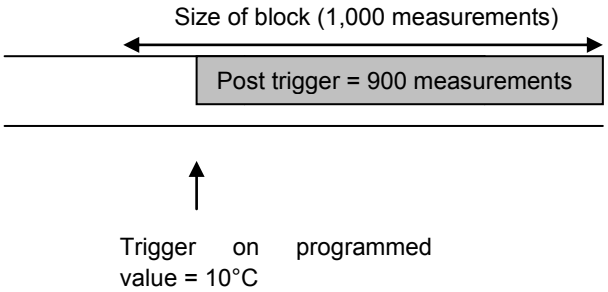
RUN:
Launches the storage of data following the parameters set in the “parameters” function. The pictogram is displayed on the measurement screen

STOP:
Stops the storage in progress.

PARAMETERS:
Allows you to define:
the size of the acquisition (max 10,000 values),
the sampling period from 0.5 S to 30 Min,
and the type of trigger (None, low level, high level).

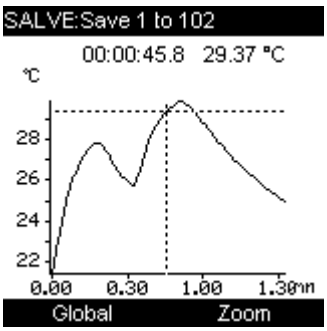
If you have selected a low level or high level trigger, you must define the trigger level and the number of data to record after this trigger (Post-trigger).



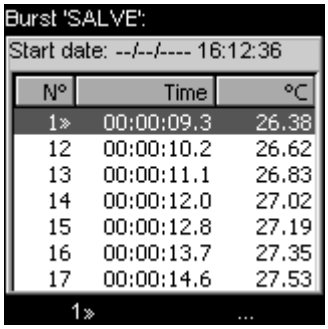


Display burst:
You can display the burst in the form of a table of values or a trend curve.

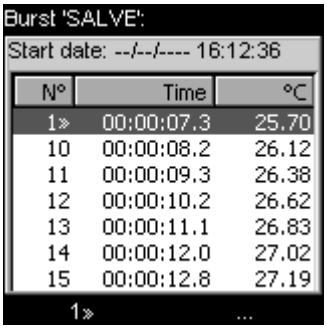
At this level, it is possible to:
- display the trend curve entirely: press the F2 key (GRAPH).

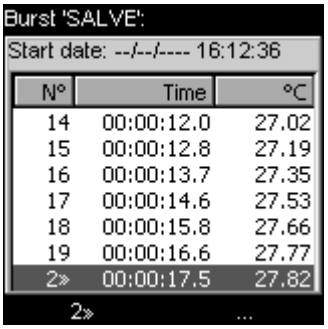


- or place markers so as to display in the form of a graph all the values included between these 2 markers. To do so, press the F2 key (…).



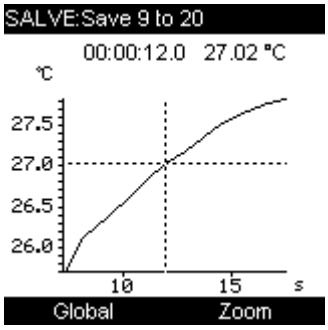
- Using the navigation keys (↑ and ↓), move the cursor to the value to be marked “value 1” and press the F1 key (1>>).
- For the second marker, press the F2 key (…) and using the navigation keys (↑ and ↓), move the cursor to the value to be marked “value 2” and press the F1 key (2>>).



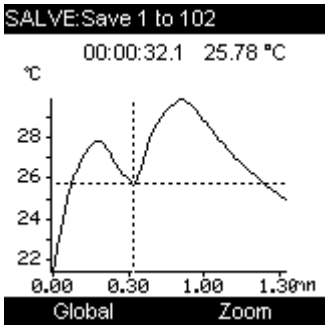


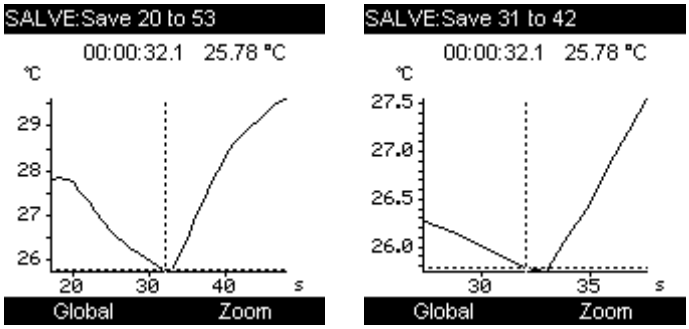
In this particular example, the graph will display values included between positions 10 and 20.

- Press the F2 key twice (…), to reach the **GRAPH** function, then press F2 to confirm.



At this level, you can display the whole curve or a zoom around the cursor. The cursor is moved using the navigation keys (← and →)

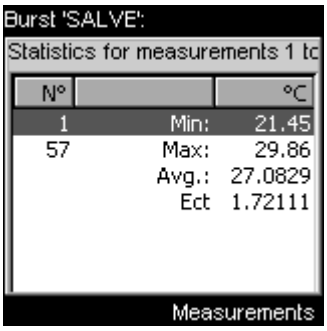




- Press **CLEAR** to return to the table of values.

At this level, you can find out some statistics on the measurements made (Min, Max, Avg and Std. Dev.

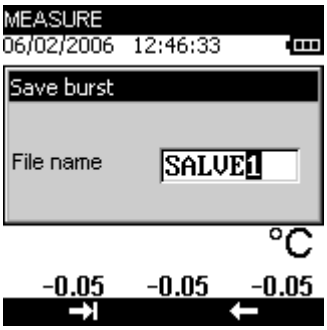
- Press the F2 key three times (…) followed by the F1 key (STAT).



- Press F2 (measurements) to return to the table of values.
- Press **CLEAR** to quit the storage function.

Record burst:
This function makes it possible to record the burst in the memory.

- You are then requested to enter the name of a file. Using the navigation keys (↑ and ↑), scroll down the letters.
- Using the navigation keys (← and →), move the cursor by one position.
- Using the F2 key(⬅), you can delete the characters entered



- Once you have entered the file name, confirm by pressing the **VAL** key.

Open burst:
Allows you to choose a burst among many and to open it to display the values. At this level, you can obtain information on the acquisition burst, such as the number of measurements, the date of acquisition, the sensor used, etc.

New free burst:
Allows you to start a new acquisition burst. If a burst is under way, you will be requested to save it.

Burst management:
Allows you to display all the bursts recorded. At this level, you can delete one or all bursts.

Statistics:
Allows you to find out the number of bursts recorded, the number of bytes free as well as the number of measurements which can be recorded.

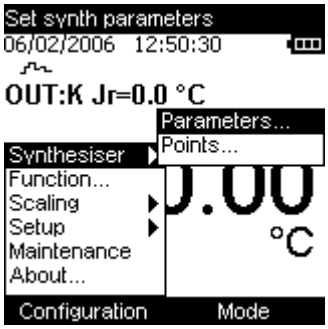
D.5.1 Synthesizer configuration

D.5.1.1 Configuration of synthesizer points

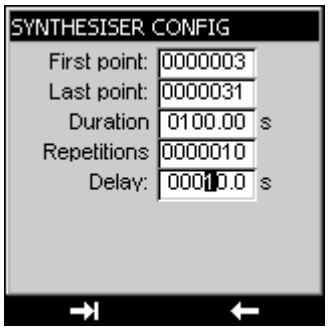
The configuration of the synthesizer points is identical to that of the default values.

D.5.1.2 Configuration of synthesizer parameters

The configuration of the synthesizer parameters is performed in the **configuration/Synthesizer/Parameters** menu, obviously providing the Synthesizer mode has been confirmed.
Warning: The values (points) must be recorded first.



- Once you have selected the C**onfiguration/Synthesizer/Parameters** menu, confirm by pressing the **VAL** key.



This screen allows you to configure the emission:

First point:
This is the 1st point to be emitted. It is not necessarily the 1st point in the table of values.

Last point:
This is the last point to be emitted. It is not necessarily the last point in the table of values but this point number must be below the number of points recorded.
Should this not be the case, it will be impossible to record the configuration of the synthesizer parameters

Duration:
This is the amount of time required for the emission of all the points that need to be emitted (Last point - first point).

Repetition:
This is the number of cycles that need to be performed.

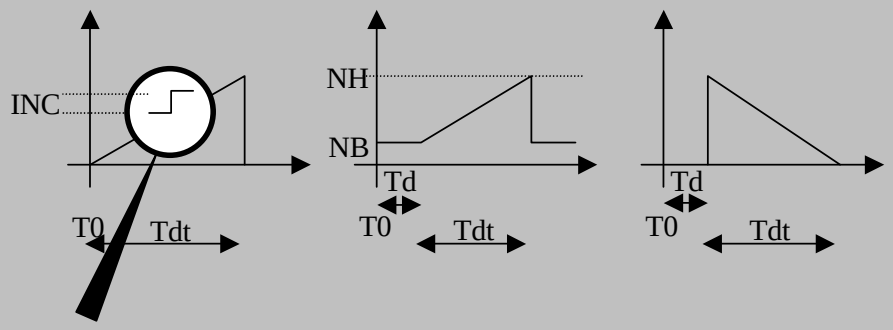
Time frame:
This is the time lapse between 2 repetitions.

D.5.2 Configuration of the ramp generation

The CONFIGURATION/RAMP menu is used for the generation of incremental, single or cyclic ramp signals.

→ Incremental ramp signal configuration?
The figure below illustrates the type of single ramp that can be generated and their parameters:

Programming parameters in **Increases** mode



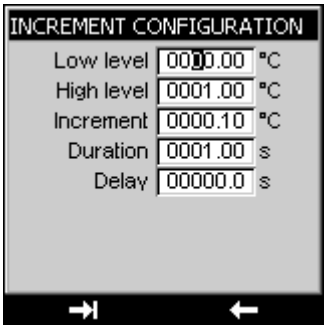
To : time pressing the generation start key
Td : Time frame
Tdt : Duration
NB : Low Level
NH : High Level
INC: **Increment** (value of the increments as a %, in mVolt, °C or °F)

The **LOW level** and **HIGH level** levels are expressed:

- As a percentage of the range if the scaling mode is ON.
- In mVolt or in temperature units if the scaling mode is OFF and according to the type of value emitted (voltage or temperature emission).

The **Duration** corresponds to the incrementation time it takes to go from **Low Level** to **High Level** (and vice versa with decrementation). It is given in seconds and is limited to a maximum of 1000s.

The **Delay** corresponds to the timeout that can be programmed between the moment the start of transmission key is pressed and the actual start of generation. It is given in seconds and is limited to a maximum of 1000s.



- Use the **F2** key to move to the next field.

Use the navigation keys to enter the value:

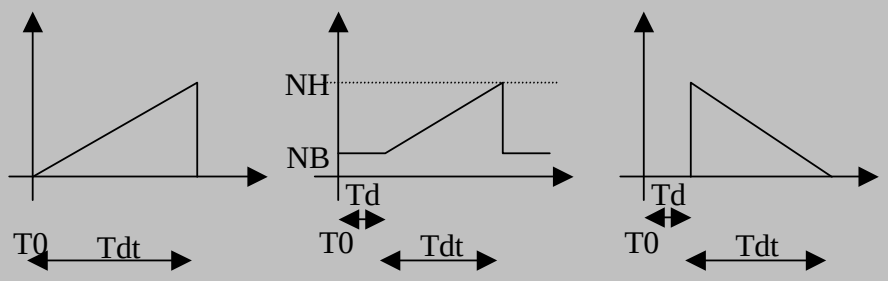
- As a percentage of the gauge if the scaling mode is ON.
- and ↓ to increase or decrease the value
- And → to choose the hundreds/tens/units/decimal place/hundreds/thousands.

- Press **VAL** to save the parameters.

- To quit the menu without saving, press **CLEAR**.

→ Single ramp signal configuration?
The figure below shows the type of single ramp that can be generated along with its parameters:

Programming parameters in **Single Ramp** mode



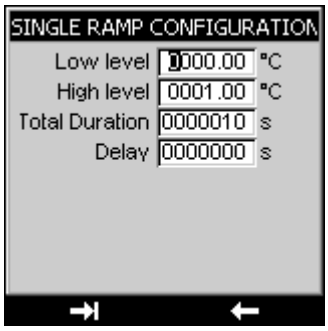
To : time pressing the generation start key
Tdt : Total Duration
Tdt : Total Time
NB : Low Level

The **LOW level** and **HIGH level** levels are expressed:

- As a percentage of the range if the scaling mode is ON.
- In Volt or in temperature units if the scaling mode is OFF and according to the type of value emitted (voltage or temperature emission).

The **Total Duration** corresponds to the incrementation time it takes to go from **Low Level** to **High Level** (and vice versa with decrementation). It is given in seconds and is limited to a maximum of 1000s.

The **Time frame** corresponds to the amount of time you can have between pressing the emission start key and the actual starting of generation. It is expressed in seconds and the max time is limited to 1000s.



Use the **F2** key to access the **CONFIGURATION/RAMP** menu. Attention: the appropriate function mode must be programmed (**INCREASES** mode) to access the **CONFIGURATION/RAMP/SINGLE** menu.

In the **CONFIGURATION/RAMP/SINGLE** menu, use the **F2** key to go to the next field.

Use the navigation keys to enter the value:

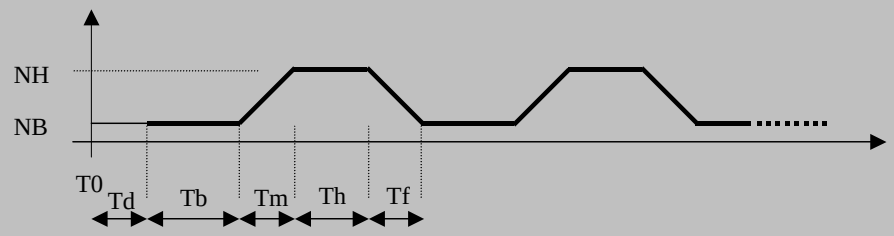
- As a percentage of the gauge if the scaling mode is ON.
- and ↓ to increase or decrease the value
- And → to choose the hundreds/tens/units/decimal place/hundreds/thousands.

- Press **VAL** to save the parameters.

- To quit the menu without saving, press **CLEAR**.

→ Cyclic ramp configuration?
The figure below illustrates the type of single ramp that can be generated and their parameters:

Programming parameters in **Cyclic ramp** mode



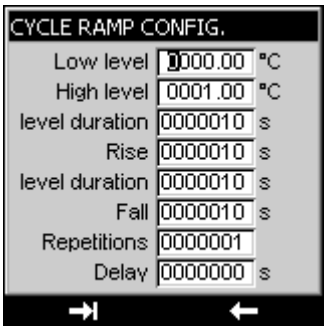
To : time pressing generation start key
Td : Time frame
Tb : Low duration
Tm : **Rise** (rise time)
Th : High duration
Tf : **Drop** (drop time)
NB : Low Level

The **LOW level** and **HIGH level** levels are expressed:

- As a percentage of the gauge if the scaling mode is ON.
- In Volt or in temperature units if the scaling mode is OFF and according to the type of value emitted (voltage or temperature emission).

The **Low Duration**, **Rise**, **High Duration**, **Drop** and **Time frame** durations are expressed in seconds. The max duration is limited to 1000s.

The **Repetitions** field indicates the number of ramps that need to be generated. The number of repetitions is limited to 1000.



Use the **F2** key to access the **CONFIGURATION/RAMP** menu. Attention: the appropriate function mode must be programmed (**Single Ramp** mode) to access the **CONFIGURATION/RAMP/CYCLIC RAMP** menu.

In the **CONFIGURATION/RAMP/CYCLIC RAMP** menu, use the **F2** key to go to the next field.

Use the navigation keys to enter the value:

- As a percentage of the gauge if the scaling mode is ON.
- and ↓ to increase or decrease the value
- And → to choose the hundreds/tens/units/decimal place/hundreds/thousands.

- Press **VAL** to save the parameters.

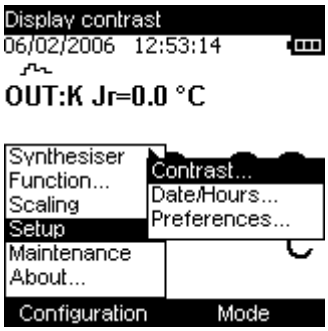
- To quit the menu without saving, press **CLEAR**.

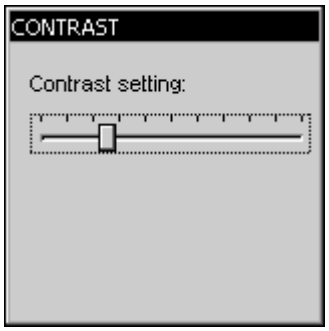
E. PARAMETER SETTINGS

E.1 Contrast adjustment

In the CONFIGURATION/SETUP menu, you can adjust the display contrast.

- Access this menu using the F1 key.
- Select the **Setup** field using the navigation keys (↑ and ↓), then confirm.
- Select the **Contrast** field using the navigation keys (↑ and ↑), then confirm.
- Using the navigation keys (← and →), increase or decrease the contrast as required.





E.2 Date and time setting

In the CONFIGURATION/SETUP menu, you can set the time and date.

- Access this menu using the F1 key.
- Select the **Setup** field using the navigation keys (↑ and ↑), then confirm.
- Select the **Date/Time** field using the navigation keys (↑ and ↑), then confirm.

- Use the navigation keys (↑ and ↓) to increase the various parameters.
- Use the navigation keys (← and →) to go to the next field.
- Press **VAL** to confirm.

E.3 "Preferences" setting

E.3.1 Filtering setting

In the event of noisy measurements, you can filter the latter to make the value displayed on the screen more stable.

- Access this menu using the **F1** key (configuration menu).
- Select the **Setup** field using the navigation keys (↑ and ↑), then confirm.
- Select the **Preferences** field using the navigation keys (↑ and ↑), then confirm.
- Select the **Filtering** field by pressing the F1 key.
- Four filtering values are available (OFF, 0.5s, 1s and 2s). Select these values using the navigation keys (↑ and ↓).
- Confirm by pressing the VAL key.

E.3.2 Display resolution setting

In the **CONFIGURATION/SETUP/PREFERENCE** menu, you can select the desired display resolution:

- Access this menu using the **F1** key.
- Select the **Setup** field using the navigation keys (↑ and ↑), then confirm.
- Select the **Preferences** field using the navigation keys (↑ and ↑), then confirm.
- Select the **Resolution** field by pressing the F1 key.
- Three types of resolution are available: high (res=1µV), medium (res=10µV) and low (res=100µV).
- Select this resolution using the navigation keys (↑ and ↑).
- Confirm by pressing the VAL key.

E.3.3 Lighting duration setting

In the same menu (**CONFIGURATION/SETUP/PREFERENCE**), you can control the duration of the lighting (manual, 10s or 1min). Press the **ON/OFF** key briefly to turn on the lighting for the selected duration (10s or 1min). Press it again briefly to start the timing or to turn off the lighting in the case of the **manual** mode.

- Access this menu using the **F1** key.
- Select the **Setup** field using the navigation keys (↑ and ↑), then confirm.
- Select the **Preferences** field using the navigation keys (↑ and ↑), then confirm.
- Select the **Lighting** field by pressing the F1 key.
- Choose the manual or timed mode using the navigation keys (↑ and ↓).
- Confirm by pressing the VAL key.

E.3.4 "Key beeping" setting

In the **CONFIGURATION/SETUP/PREFERENCE** menu, you can emit a beeping sound every time a key is pressed:

- Access this menu using the F1 key.
- Select the **Setup** field using the navigation keys (↑ and ↑), then confirm.
- Select the **Preferences** field using the navigation keys (↑ and ↑), then confirm.
- Select the **Key Beeping** field using the F1 key.
- Using the navigation keys (↑ and ↓), select the **ON** or **OFF** mode then confirm by pressing the VAL key (if the parameter settings are completed or go to the next field using the F1 key).

E.3.5 Language setting

In the **CONFIGURATION/SETUP/PREFERENCES** menu, the interface language can be selected from French, English, German, Italian or Spanish.

- Access this menu using the F1 key.
- Select the **Setup** field using the navigation keys (↑ and ↑), then confirm.
- Select the **Preferences** field using the navigation keys (↑ and ↑), then confirm.
- Select the **LANGUAGE** field using the F1 key.
- Using the navigation keys (↑ and ↑), select your desired language then confirm by pressing the VAL key (if the parameter settings are completed or go to the next field using the F1 key).

E.3.6 Temperature unit setting

In the **CONFIGURATION/SETUP/PREFERENCES** menu, you can choose the temperature unit that will be displayed.

- Access this menu using the F1 key.
- Select the **Setup** field using the navigation keys (↑ and ↑), then confirm.
- Select the **Preferences** field using the navigation keys (↑ and ↑), then confirm.
- Select the **TEMP unit** field using the F1 key.
- Using the navigation keys (↑ and ↓), select the desired unit, then confirm by pressing the VAL key.

E.4 "Maintenance" menu

As part of the follow-up on measurement quality, the user may be asked to perform a regular check of the performance levels.

This check must take into consideration the customary measurement precautions. The following instructions should be followed.

Any handling operations should be performed in the following reference conditions:

- Temperature of the room: 23°C ± 1°C.
- Relative humidity: 45 % to 75 %.

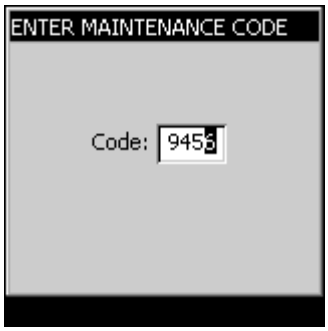
Following this check, should the user find that one or more characteristics of the device are outside the tolerances specified in chapter **E**, said user may:

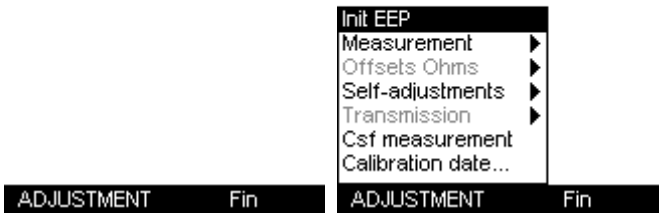
- Either proceed with the appropriate adjustment, according to the following procedure, which requires equipment which features at least the same performance levels as the one used for the previous check.
- Or return the device to Palmer Wahl.

Palmer Wahl
234 Old Weaverville Road
Asheville, NC 28804
Ph.: 800-421-2853 (US only) 828-658-3131
Fax: 828-658-0728
Email: info@palmerwahl.com
www.palmerwahl.com

E.4.1 Adjustment from the Maintenance menu

The instrument may be adjusted using an instrument with a precision of more than 50 ppm.
To adjust the device, go to the **Configuration\Maintenance** menu, enter the password 9456 and then press the **VAL** key.



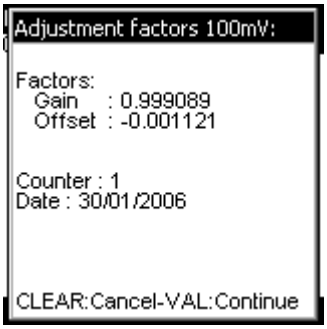


Using the **F1** function key, open the menu to access the following functions:

Init EEP:
Allows you to initialize part of the EEPROM (Calibrated Sensors Coefficient)

Example of a thermocouple calibrator:

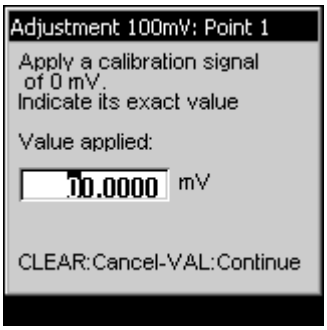
Measurement:
Allows you to access the gauge adjustment function (stated as 100 mV).



The 1st screen indicates the gain and offset correction value found for the adjustment of this gauge. The counter indicates the number of adjustments the device has undergone with the date of the last adjustment.

To perform an adjustment:

- Press the **VAL** key.

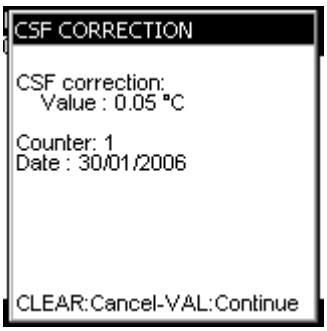


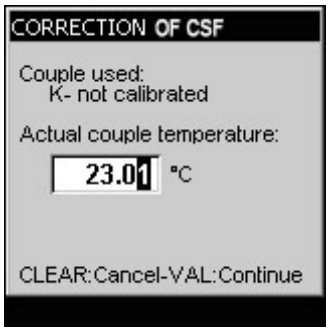
The adjustment is performed in 2 points, around 0V and 100 mV. Apply the calibration signal every time it is requested, and enter the value of this calibration signal in the “Value Applied” field.

- Confirm each step using the **VAL** key.

Auto Adjustment:
This function allows you to adjust the emission from the product’s internal measurement gauge. This procedure takes several tens of seconds.

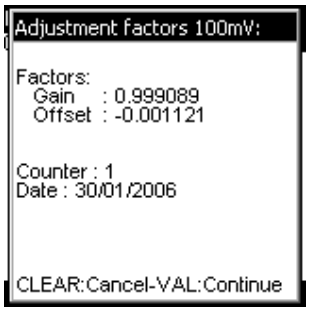
Measurement CSF:
This function allows you to adjust the Cold Junction Compensation (French abbreviation, CSF). You need to know precisely what the temperature of the reference thermocouple used is, and the latter must be a type K thermocouple.





Example of a resistive sensor calibrator

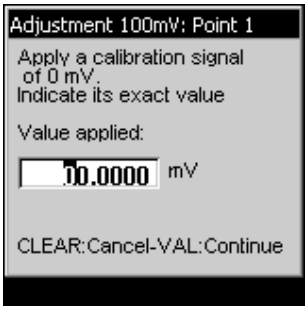
Measurement:
Allows you to access the gauge adjustment functions.



The 1st screen indicates the gain and offset correction value found for the adjustment of this gauge. The counter indicates the number of adjustments the device has undergone with the date of the last adjustment.

To perform an adjustment:

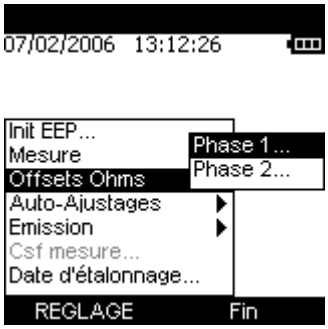
- Press the **VAL** key.



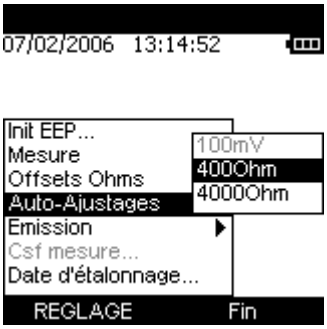
The adjustment is performed in 2 points, around 010 Ohm and 300 Ohm. Apply the calibration resistance every time it is requested, and enter the value of this calibration in the “Value Applied” field.

- Confirm each step using the **VAL** key.

Offset ohms:
This function allows you to adjust the offset ohms in the measurement and simulation channel. Two steps are to be carried out in sequence, following the instructions



Auto Adjustment:
This function allows you to adjust the emission from the product's internal measurement gauge. This procedure takes several tens of seconds and shall be carried out for the 2 gauges (400 Ohm and 3500 Ohm).



Emission:
This function allows you to adjust the emission more finely according to the output connector assembly used and the transmitter's measurement current. This adjustment is to be carried out for the 2 gauges (400 Ohm and 3500 Ohm).

Calibration date:
Should the device undergo calibration, you can enter the date of this calibration and the certificate reference number.

E.5 "About the instrument" menu

In the **Configuration/Setup/About** menu, you can find out:

- The instrument part number
- The Serial number
- The software version
- The name of the company

F. SOFTWARE UPDATE

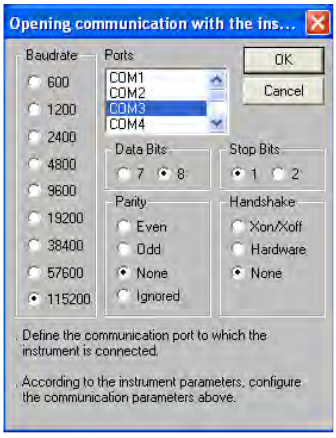
To find out which version of firmware is installed in your unit, use the **Configuration** → **About** menu.

To check for Firmware updates, contact Palmer Wahl Customer Service at (800) 421-2853, (828) 658-3131 or email info@palmerwahl.com.

To update the firmware, proceed as follows:

1. If necessary, install on the PC the USB driver for communication with Wahl Instruments. Contact Customer Service.
2. Disconnect the leads connected to the measurement and simulation terminals.
3. Connect the instrument to the PC using the USB lead.
4. Download and run the firmware update program.
5. Select the language then the file containing the firmware and download in the first stage.

6. Choose the communication parameters that match the parameters of the TC621. The communication port used is a virtual port which does not correspond to a physical port on your computer. The other parameters to be selected are defined in the diagram below.



7. Confirm the update by pressing “OK” and wait for the firmware to load into the unit.

G. TECHNICAL SPECIFICATIONS

The precision expressions mentioned herein apply from + 18°C to + 28°C, unless otherwise specified, and are expressed in ± (n % L + C) where R = Reading and C = Constant expressed in practical units, for a confidence interval of 95%.

They apply to a device positioned in the reference conditions defined below:
Prior power-up of the device for temperature adjustment for 10 minutes

Following a significant thermal shock, it is advisable to allow the device to stabilize its temperature to use the internal reference junction (CSF) with the utmost precision.

The precision includes the precision of the reference calibrations, the non-linearity, hysteresis, repetitiveness and long-term stability over the time period mentioned.

G.1 Thermocouple measurement function

Rated maximum voltage in common mode: 60 VDC or VAC.

G.1.1 Constant voltage (TC621,TM602 and TM630)

The voltage measurement is made by configuring the device as follows:

Thermocouple: indifferent.
Unit: mV.
CSF: OFF.

Gauge	Scope of measurement	Resolution (min)	Precision / 1 year
100 mV	-10 mV to 100mV	1 µV	0.020% R + 3 µV

- Temperature coefficient < 10 ppm R /°C from 0°C to 18°C and from 28°C to 50°C.
- Rin = 1 MΩ ±1%

G.1.2 Temperature by Thermocouples (TC621,TM602 and TM630).

Type of sensors:
- Standardized in accordance with CEI 584-1/1995 (Thermocouples K, T, J, E, S, B, N)
- In accordance with Din 43710 (Thermocouples U and L)
- In accordance with the HOSKINS table (Thermocouple C)
- In accordance with the ENGELHARD table (Platinum Thermocouple).
- Standardized in accordance with ASTM E 988-96 /2002 (Thermocouple D W3Re/W25Re)
- Standardized in accordance with ASTM E 1751-00 /2000 (Thermocouple G W/W26Re)

Sensor	Scope of measurement	Resolution	Precision / 1 year
K	- 250 to - 200°C - 200 to - 120°C - 120 to - 50°C - 50 to + 1372°C	0.1° 0.1° 0.05° 0.05°	0.90°C 0.3°C 0.02 % R + 0.12°C 0.02 % R +0.11°C
T	- 250 to - 200°C - 200 to - 50°C - 50 to + 400°C	0.1° 0.05° 0.05°	0.80°C 0.25°C 0.02 % R +0.09°C
J	- 210 to - 200°C - 200 to - 120°C - 120 to + 60°C + 60 to + 1200°C	0.05° 0.05° 0.05° 0.05°	0.30°C 0.25°C 0.020 % R + 0.11°C 0.020 % R + 0.09°C
E	- 250 to - 200°C - 200 to - 100°C - 100 to + 450°C + 450 to + 1000°C	0.1° 0.05° 0.05° 0.05°	0.55°C 0.20°C 0.020 % R + 0.07°C 0.020 % R + 0.05°C
R	- 50 to + 150°C + 150 to + 550°C + 550 to + 1768°C	0.1° 0.1° 0.1°	0.95°C 0.40°C 0.020 % R + 0.30°C
S	- 50 to + 150°C + 150 to + 550°C + 550 to + 1768°C	0.1° 0.1° 0.1°	0.85°C 0.020 % R + 0.4°C 0.020 % R + 0.3°C
B	+ 400 to + 900°C + 900 to + 1820°C	0.1° 0.1°	0.95°C 0.50°C
U	- 200 to - 100°C - 100 to + 600°C	0.05° 0.05°	0.35°C 0.20°C
L	- 200 to - 100°C - 100 to + 900°C	0.05° 0.05°	0.30°C 0.20°C
C	- 20 to + 900°C + 900 to + 2310°C	0.1° 0.1°	0.30°C 0.020 % R+ 0.15°C
N	- 240 to - 190°C - 190 to - 110°C - 110 to – 0°C + 0 to + 1300°C	0.1° 0.1° 0.05° 0.05°	0.60°C 0.25°C 0.15°C 0.020 % R + 0.07°C
Platinum	- 100 to + 1400°C	0.05°	0.3°C
Mo	0 to + 1375°C	0.05°	0.020 %L + 0.10°C
NiMo/NiCo	- 50 to + 1410°C	0.05°	0.020 %L + 0.35°C
D	+ 0 to + 310°C + 310 to + 1000°C + 1000 to + 1800°C + 1800 to + 2000°C + 2000 to + 2315°C	0.1° 0.05° 0.05° 0.05° 0.05°	0.40°C 0.40°C 0.025 % R +0.15°C 0.030 % R +0.10°C 0.05 % R
G	+ 0 to + 100°C + 100 to + 300°C + 300 to + 1100°C + 1100 to + 1800°C + 1800 to + 2315°C	0.5° 0.2° 0.05° 0.05° 0.05°	2.5°C 0.6°C 0.3°C 0.5°C 0.85°C

The precision is guaranteed for a reference junction (JR) at 0°C.
With the use of the internal JR (except for thermocouple B). add an additional uncertainty of 0.3°C to 0°C. For the other temperatures. it is a good idea to take into consideration the sensitivity of the thermocouple at the temperature (T) considered. namely an additional uncertainty of 0.3°C*S(0°C)/S(T).

- Temperature coefficient: < 10% of precision/°C from 0°C to 18°C and from 28°C to 50°C.
- You can, except for thermocouple B. choose the location of the reference junction by programming it on the keyboard:
  - external at 0°C.
  - Internal (temperature compensation at the device terminals).
  - By programming the temperature.

G.2 Thermocouple emission function (TC621)

Rated maximum voltage in common mode: 60 VDC or VAC.

G.2.1 Constant voltage

The voltage emission is made by configuring the device as follows:

Thermocouple: indifferent.
Unit: mV.
CSF: OFF.

Gauge	Scope of measurement	Resolution (min)	Precision / 1 year
80 mV	-9.5 mV / 80 mV	1 µV	0.020% R + 3 µV

- Temperature coefficient < 10 ppm R /°C from 0°C to 18°C and from 28°C to 50 °C.
- Internal resistance: ≤ 1 Ω.

G.2.2 Temperature by Thermocouple

Type of sensors:
- Standardized in accordance with CEI 584-1/1995 (Thermocouples K. T. J. E. S. B. N).
- In accordance with Din 43710 (Thermocouples U and L).
- In accordance with the HOSKINS table (Thermocouple C).
- In accordance with the ENGELHARD table (Platinum Thermocouple).
- Standardized in accordance with ASTM E 988-96 /2002 (Thermocouple D W3Re/W25Re)
- Standardized in accordance with ASTM E 1751-00 /2000 (Thermocouple G W/W26Re)

Sensor	Scope of measurement	Resolution	Precision / 1 year
K	- 240 to - 50°C - 50 to + 120°C +120 to + 1372°C	0.1° 0.1° 0.05°	0.80°C 0.30°C 0.020 % R + 0.11°C
T	- 240 to - 100°C - 100 to - 40°C - 40 to + 400°C	0.1° 0.05° 0.05°	0.50°C 0.25°C 0.020 % R + 0.10°C
J	- 210 to +50°C + 50 to + 500°C + 500 to + 1200°C	0.05° 0.05° 0.05°	0.35°C 0.020 % R + 0.11°C 0.020 % R + 0.09°C
E	- 240 to - 100°C - 100 to + 40°C + 40 to + 1000°C	0.1° 0.1° 0.05°	0.55°C 0.20°C 0.020 % R + 0.06°C
R	- 50 to + 350°C + 350 to + 900°C + 900 to + 1768°C	0.1° 0.1° 0.1°	0.95°C 0.5°C 0.020 % R + 0.30°C
S	- 50 to + 350°C + 350 to + 900°C + 900 to + 1768°C	0.1° 0.1° 0.1°	0.90°C 0.020 % R + 0.40°C 0.020 % R + 0.30°C
B	+ 400 to + 850°C + 850 to + 1820°C	0.1° 0.1°	0.95°C 0.50°C
U	- 200 to - 70°C - 70 to + 600°C	0.05° 0.05°	0.35°C 0.20°C
L	- 200 to - 70°C - 70 to + 900°	0.05° 0.05°	0.30°C 0.25°C
C	- 20 to + 900°C + 900 to + 2310°C	0.1° 0.1°	0.35°C 0.020 % R+ 0.15°C
N	- 240 to + 10°C + 10 to + 250°C + 250 to + 1300°C	0.1° 0.1° 0.05°	0.90C 0.20°C 0.020 % R + 0.09°C
Platinum	- 100 to + 1400°C	0.05°	0.35°C
Mo	+ 0 to + 1375°C	0.05°	0.25°C
NiMo/NiCo	- 50 to + 1 410°C	0.05°	0.020 % L + 0.35°C
D	+ 0 to + 310°C + 310 to + 1000°C + 1000 to + 1800°C + 1800 to + 2000°C + 2000 to + 2315°C	0.1° 0.05° 0.05° 0.05° 0.05°	0.40°C 0.40°C 0.025 % R +0.15°C 0.030 % R +0.10°C 0.05 % R
G	+ 0 to + 100°C + 100 to + 300°C + 300 to + 1100°C + 1100 to + 1800°C + 1800 to + 2315°C	0.1° 0.1° 0.05° 0.05° 0.05°	2.5°C 0.6°C 0.3°C 0.5°C 0.85°C

The precision is guaranteed for a reference junction (JR) at 0°C.
With the use of the internal JR (except for thermocouple B). add an additional uncertainty of 0.3°C to 0°C. For the other temperatures. it is a good idea to take into consideration the sensitivity of the thermocouple at the temperature (T) considered. namely an additional uncertainty of 0.3°C*S(0°C)/S(T).

- Temperature coefficient: < 10 % of precision/°C from 0°C to 18°C and from 28°C to 50°C.
- You can, except for thermocouple B. choose the location of the reference junction by programming it on the keyboard:
    - external at 0°C.
    - Internal (temperature compensation at the device terminals).
    - By programming the temperature.

G.3 Resistive sensor measurement function

Rated maximum voltage in common mode: 60 VDC or VAC.

G.3.1 Resistance (TC622, TM612 and TM630)

The resistance measurement function is obtained by configuring the device as follows:

Sensor: PT100 and Unit: Ohm for the 400 Ohm gauge.
Sensor: PT1000 and Unit: Ohm for the 3600 Ohm gauge.

Gauge	Scope of measurement	Resolution (min)	Precision / 1 year
400 Ohm	0 Ω to 400 Ω	10 mΩ	0.012% R + 10 mΩ
3600 Ohm	0 Ω to 3600 Ω	100 mΩ	0.012% R +100 mΩ

- Temperature coefficient < 10 ppm R/°C from 0°C to 18°C and from 28°C to 50°C.
- Automatic wiring diagram detection: 2 wires. 3 wires or 4 wires.
- In the 2-wire assembly, the measurement includes the line resistances.
- In the 3-wire assembly, add the line resistances imbalance.

G.3.2 Temperature by resistive sensors (TC622, TM612 and TM630)

Sensor	Scope of measurement	Resolution	Precision / 1 year
Pt 50 (α = 3851)	- 220°C + 850°C	0.01°	0.012 % R + 0.06°C
Pt 100 (α = 3851)	- 220°C + 850°C	0.01°	0.012 % R + 0.05°C
Pt 100 (α = 3916)	- 200°C + 510°C	0.01°	0.012 % R + 0.05°C
Pt 100 (α = 3926)	- 210°C + 850°C	0.01°	0.012 % R + 0.05°C
Pt 200 (α = 3851)	- 220°C + 1200°C	0.01°	0.012 % R + 0.12°C
Pt 500 (α = 3851)	- 220°C + 1200°C	0.01°	0.012 % R + 0.07°C
Pt 1000 (α = 3851)	- 220°C + 760°C	0.01°	0.012 % R + 0.05°C
Ni 100 (α = 618)	- 60°C + 180°C	0.01°	0.012 % R + 0.03°C
Ni 120 (α = 672)	- 40°C + 205°C	0.01°	0.012 % R + 0.03°C
Ni 1000 (α = 618)	- 60°C + 180°C	0.01°	0.012 % R + 0.03°C
Cu 10 (α = 427)	- 70°C + 150°C	0.01°	0.012 % R + 0.18°C
Cu 50 (α = 428)	- 50°C + 150°C	0.01°	0.012 % R + 0.06°C

For negative temperatures. use the value displayed L and not its absolute value.
Temperature coefficient: < 10 % of precision/°C from 0°C to 18°C and from 28°C to 50°C.
The above precision is given for a 4-wire connection to the temperature sensor.
You should also take into consideration the actual error of the temperature sensor used. as well as the conditions of its setup.

- Pt 50 ohm, 100 ohm, 200 ohm, 500 ohm, 1000 ohm with α = 3851 in accordance with publication IEC 751/1995
- Pt 100 ohm with α = 3916 in accordance with publication JIS C 1604/1989
- Pt 100 ohm with α = 3926 in accordance with publication EIT90
- Ni 100 ohm, 1000 ohm with α = 618 in accordance with publication DIN 43760
- Ni 120 ohm with α = 672 in accordance with publication MIL-T-24388C
- Cu 10 ohm with α = 427 in accordance with publication MINCO 16/9

G.4 Resistive sensor simulation function (TC622)

G.4.1 Resistance

The resistance simulation function is obtained by configuring the device as follows:

Sensor: PT100 and Unit: Ohm for the 400 Ohm gauge.
Sensor: PT1000 and Unit: Ohm for the 3500 Ohm gauge.

Gauge	Scope of measurement	Resolution (min)	Current range	Precision / 1 year
400 Ohm – 1mA (Direct current)	0 Ω to 400 Ω	1 mΩ	0.1 mA to 1 mA	0.012% R + 30 mΩ
400 Ohm – 1mA (pulsed current)	0 Ω to 400 Ω	1 mΩ	0.2 mA to 1 mA	0.012% R + 80 mΩ
400 Ohm – 4mA (Direct current)	0 Ω to 400 Ω	1 mΩ	1 mA to 4 mA	0.012% R + 30 mΩ
400 Ohm – 4mA (pulsed current)	0 Ω to 400 Ω	1 mΩ	1 mA to 4 mA	0.012% R + 80 mΩ
3500 Ohm (Direct current)	0 Ω to 3500 Ω	10 mΩ	0.1 mA to 1 mA	0.012% R + 300 mΩ
3500 Ohm (pulsed current)	0 Ω to 3500 Ω	10 mΩ	0.2 mA to 1 mA	0.012% R +8 00 mΩ

- Temperature coefficient: Direct current 10 ppm R/°C ; Pulsed current < 20 ppm Gauge/°C from 0°C to 18°C and from 28°C to 50°C.
- The above precision is given for a 4-wire connection to the gauge.
- You should also take into consideration the actual error of the temperature sensor used. as well as the conditions of its setup.
- Settling time: < 5 ms in "pulsed current" mode.

G.4.2 Temperature by resistive sensors

Sensor	Scope of measurement	Resolution	Precision / 1 year
Pt 50 (α = 3851)	- 220°C + 850°C	0.01°	0.012 % R + 0.18°C
Pt 100 (α = 3851)	- 220°C + 850°C	0.01°	0.012 % R + 0.12°C
Pt 100 (α = 3916)	- 200°C + 510°C	0.01°	0.012 % R + 0.12°C
Pt 100 (α = 3926)	- 210°C + 850°C	0.01°	0.012 % R + 0.12°C
Pt 200 (α = 3851)	- 220°C + 1200°C	0.01°	0.012 % R + 0.33°C
Pt 500 (α = 3851)	- 220°C + 1200°C	0.01°	0.012 % R + 0.18°C
Pt 1000 (α = 3851)	- 220°C + 730°C	0.01°	0.012 % R + 0.08°C
Ni 100 (α = 618)	- 60°C + 180°C	0.01°	0.012 % R + 0.08°C
Ni 120 (α = 672)	- 40°C + 205°C	0.01°	0.012 % R + 0.08°C
Ni 1000 (α = 618)	- 60°C + 180°C	0.01°	0.012 % R + 0.08°C
Cu 10 (α = 427)	- 70°C + 150°C	0.01°	0.012 % R + 0.10°C
Cu 50 (α = 428)	- 50°C + 150°C	0.01°	0.012 % R + 0.15°C

For negative temperatures. use the value displayed L and not its absolute value.
Temperature coefficient: < 10 % of precision/°C from 0°C to 18°C and from 28°C to 50°C.
The above precision is given for a 4-wire connection to the gauge.
You should also take into consideration the actual error of the temperature sensor used. as well as the conditions of its setup.
These specifications are given for a measurement current of 0.1 mA to 1mA in direct current mode.

- Pt 50 ohm, 100 ohm, 200 ohm, 500 ohm, 1000 ohm with α = 3851 in accordance with publication IEC 751/1995
- Pt 100 ohm with α = 3916 in accordance with publication JIS C 1604/1989
- Pt 100 ohm with α = 3926 in accordance with publication EIT90
- Ni 100 ohm, 1000 ohm with α = 618 in accordance with publication DIN 43760
- Ni 120 ohm with α = 672 in accordance with publication MIL-T-24388C
- Cu 10 ohm with α = 427 in accordance with publication MINCO 16/9

For calibration, service or technical support, contact:
Palmer Wahl
234 Old Weaverville Road
Asheville, NC 28804
Ph.: 800-421-2853 (US only) 828-658-3131
Fax: 828-658-0728
Email: info@palmerwahl.com
www.palmerwahl.com

Palmer Wahl
BEYOND THE SCALE
234 Old Weaverville Road, Asheville, NC 28804
800-421-2853 • 828-658-3131 • 828-658-0728
www.palmerwahl.com
info@palmerwahl.com

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1
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