



P32

Process Calibrator User's Manual



**WD1001
Rev B**

03/26/08

Acknowledgements

Thank you for choosing this Wahl Instruments high accuracy measuring instrument. Wahl has been providing high quality, high accuracy measuring instruments for over 50 years. Because of this, we are able to continue our policy of continuous innovation, which has served our customers so well for the last 50 years. Wahl Instruments encourages your comments and would willingly accept any suggestions from you to help us to perfect our know-how and improve our future products

LIMITED WARRANTY AND LIABILITY

Manufacturer warrants the Model P32 Process Calibrator to be free from defects in material or workmanship under normal use and service for a period of 12 months from date of purchase. The Manufacturer agrees to repair or replace any product, 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 above stated warranty period. 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 consequential damages, following the use or misuse of instruments sold by the Manufacturer. No agent is authorized to assume for Manufacturer any liability except as set forth above.

Unpacking contents

The P32 has been mechanically and electrically verified before shipping. The necessary precautions have been taken for it to reach the user undamaged.

It is nevertheless wise to make a quick check for any damage that might have been incurred in transport. If damage has occurred please contact the carrier immediately and save all packing material.

The following standard accessories are supplied:

- User's manual
- Measurement cables
- Four 1.5V AA batteries
- Wrist-strap
- Rubber Boot

WARRANTY & CALIBRATION REGISTRATION at www.palmerwahl.com/register

Registration is fast and easy. In about a minute you can have your product automatically registered for Warranty Protection and our Calibration Reminder service. Let Palmer Wahl help you protect your investment, and maintain product accuracy and compliance with ISO and other quality standards.

Questions? Call Customer Service
at 1-800-421-2853 or 828-658-3131,
Or email: register@palmerwahl.com

If service or re-certification of your instrument is needed, please contact us via phone, fax or e-mail, for a Return Material Authorization (RMA) number.

If the unit is to be returned, it is preferable to use the original packaging and return with transportation charges prepaid.

Wahl Instruments, Inc.
234 Old Weaverville Road
Asheville, NC 28804 USA

Phone: 800.421.2853
828.658.3131
Fax: 828.658.0728
e-mail: rma@palmerwahl.com
website: www.palmerwahl.com

G.3 "Continuity" function

Maximum rated voltage in common mode: 60 VDC or VAC.

Range	Resolution	Remarks
Continuity	Open/Closed	Considered closed at $Z=[0...1K\Omega]$ and open at $Z=]1K\Omega...∞[$

G.4 Power supply – Battery Life

The P32 is designed to function either with four 1.5V AA batteries or with a 4.8V battery pack.

The following battery life is given for information.

Mode	Voltage & Current measurement	Simulation (20mA/24V)	Standby mode
Battery Life	> 40 hours	> 10 hours	> 95 days

In standby mode (low consumption) the P32 is never completely switched off therefore it keeps all the information stored in memory (times, last configuration, scaling, etc.).

- $R_{in} < 30 \Omega$
- HART compatibility: $R = 250 \Omega \pm 5\%$
- Common mode rejection: $\geq 120 \text{ dB}$ at 50 and 60 Hz.

G.2 "Transmission" function

Maximum rated voltage in common mode: 60 VDC or VAC.

G.2.1 DC voltage

Range	Minimum resolution	Precision/1 year	Measurement range	Remarks
0/10V	1mV	0.015% R + 2mV	0V/+12V	I-out max=10mA (for 10V)
15V	1mV	0.015% R + 2mV	0V/+15V	I-out max=10mA (for 10V) Iout max=8mA (for 15V)

- Temperature coefficient $< 15 \text{ ppm}/^\circ\text{C}$ from 0°C to 18°C and from 28°C to 50°C .
- Rise time: $< 1 \text{ ms}$ (0V to 15V across 1-M Ω load).
- Internal resistance: $\leq 1 \Omega$.
- VLF noise: $< 1 \text{ mV}$ (at $F < 100 \text{ Hz}$).

G.2.2 Direct current

Range	Minimum resolution	Precision / 1 year	Measurement range
0/20mA	1 μA	0.015% R + 2 μA	+500 μA /+24mA
4/20mA	1 μA	0.015% R + 2.6 μA	+3.2mA/+24mA
25mA	1 μA	0.015% R + 2 μA	+500 μA /+25mA

- Temperature coefficient $< 20 \text{ ppm}/^\circ\text{C}$ from 0°C to 18°C and from 28°C to 50°C .
- Rise time: $< 500 \mu\text{S}$ (0 to 20 mA across a 20- Ω load).
- VLF noise: $< 1 \mu\text{A}$ (at $F < 100 \text{ Hz}$).

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A. GENERAL

A.1 Introduction

The P32 is a hand-held process calibrator (conforming to EC standards). It is more particularly intended for calibration and maintenance. It can measure and simulate electrical quantities either on site or in the laboratory. It fulfils voltage and current measuring and simulation functions (DC or LF ramp signals) and a continuity test (on passive loop).

Due to its monitoring (regulation) mechanism in transmission mode, the instrument cannot take measurements and transmit simultaneously.

The P32 features numerous associated functions that extend its range of applications:

- Display of results in accordance with a linear conversion law or not.
- Generation of increments, single or cyclic ramp signals.

Its use is facilitated by a series of improvements:

- Fast access to all the functions.
- Intuitive user interface.
- Graphic display of 160x160 pixels
- Connection by 4-mm safety sockets.
- Powered by 4 AA batteries or a rechargeable battery pack with fast internal charger (Option).

The instrument is enclosed in an ABS casing with a rubber boot.

A.2 The instrument

General characteristics:

- Hand-held instrument powered by 4 AA batteries (1.7 Ah Ni-MH battery pack an option).
- Battery Life: from 12 to 53 hours depending on the functions used.
- Wrist-strap for carrying and on site use.
- Graphic 160 x 160 pixel liquid crystal display (LCD).
- Choice of language for the messages and programming functions, ranges and parameters on 6-key keypad + 1 navigator.
- Display backlighting accessible via the keypad, with the possibility of programming automatic power-off after a given period of inactivity.
- Case material: ABS plastic.
- Dimensions: 6.2 x 3.3 x 1.8 in. (157 x 85 x 45 mm) (without boot).
- Weight: 10.8 oz. (306 g) without boot.
- Sealing IP54 in accordance with standard EN 60529

G. TECHNICAL SPECIFICATIONS

The indicated levels of precision apply at temperatures of +18°C to +28°C, unless otherwise specified, and are expressed in $\pm (n \% R + C)$ where R = Reading and C = Constant expressed in practical units.

They apply to an instrument placed in the reference conditions defined elsewhere, after fifteen minutes of warming up.

The precision includes the precision of the reference standards, the non-linearity, the hysteresis, the repeatability and the long-term stability over the period mentioned.

The specifications are given for a confidence interval of 95%.

G.1 Measurement function

Measuring rate: 15 m/s averaged over 4 measurements
Maximum rated voltage in common mode: 60 VDC or VAC.

G.1.1 DC voltage

Range	Minimum resolution	Precision / 1 year (CI: 95%)	Measurement range
0V	1 mV	0.015% R + 2 mV	-2V/+12V
25V	1 mV	0.015% R + 2 mV	-2/+25V
50V	1 mV	0.015% R + 4 mV	-5V/+50V

- Temperature coefficient < 15 ppm L /°C from 0°C to 18°C and from 28°C to 50°C.
- Series-mode rejection: ≥ 60 dB at 50 and 60 Hz.
- Common mode rejection: ≥ 120 dB at 50 and 60 Hz.

G.1.2 Direct current

Range	Minimum resolution	Precision / 1 year (CI : 95%)	Measurement range
0/20mA	1 μ A	0.015% R + 2 μ A	-2 mA/+24 mA
4/20mA	1 μ A	0.015% R + 2,6 μ A	3.2 mA/+24 mA
25mA	1 μ A	0.015% R + 2 μ A	-2 mA/+25 mA

- Temperature coefficient < 20 ppm/°C from 0°C to 18°C and from 28°C to 50°C.
- Possible loop power supply = 24 V \pm 10%.

F. RE-CALIBRATION

In the context of metrological quality monitoring, the user may have to carry out periodic performance verification.

The verification must take the standard metrological precautions into consideration. The following instructions are to be applied.

The operations are carried out under reference conditions, namely:

- Room temperature: $23^{\circ}\text{C} \pm 5^{\circ}\text{C}$.
- Relative humidity: 45% to 75%.

The standards that constitute the measuring chain must be such that the errors at the checkpoints are known and are less than or equal to $\pm 0.008\%$.

If this verification reveals one or more characteristics of the instrument to be outside the tolerances specified in the technical specification chapter, you can:

- Carry out the calibration procedure given in the maintenance document, which requires an instrument whose performance is at least as good as that used for the preceding verification.
- Or contact Wahl Instruments for a Return Material Authorization (RMA) number and return the instrument to the address indicated below for verification and calibration.

Wahl Instruments, Inc.
234 Old Weaverville Road
Asheville, NC 28804
USA

Phone: 800-421-2853 (US only)
(828) 658-3131

Fax: (828) 658-0728

Email: rma@palmerwahl.com

Website: palmerwahl.com

Options:

Reference	Designation
AC 6910	Battery pack + charger
	USB cable + CD-ROM software

A.3 Safety

A.3.1 Compliance with safety standards

The instrument complies with the standards in effect concerning both electrical safety (EN 61010) and electromagnetic compatibility of electrical measuring equipment (EMC: EN61326).

This user's manual contains information and warnings that must be adhered to in order to protect the user against the hazards of electric current, ensure safe operation of the appliance, and protect it against incorrect manipulations that could damage it or be detrimental to its safety of use.

A.3.2 Environmental conditions

Per publication CEI 359: operating category I.

Standards application range, from 0 to 2200 m.

Reference range: $23^{\circ}\text{C} \pm 5^{\circ}\text{C}$, relative humidity: 45% to 75%.

Nominal operating range: -10°C to $+50^{\circ}\text{C}$, relative humidity: 20% to 80% non-condensing.

Extreme operating range: -10°C to $+55^{\circ}\text{C}$, relative humidity: 10% to 80% (70% at 55°C).

Extreme storage and transport range: -30°C to $+60^{\circ}\text{C}$ (without AA batteries or rechargeable battery pack).

A.3.3 Disposal of instrument at end of use

When the instrument reaches the end of useful life we recommend that you dispose of it using the specialized waste disposal channels available in your region, and not the ordinary waste collection service, as the instrument contains elements that are environmental pollutants.

A.3.3.1 Waste produced by the instrument

List of classified waste materials in accordance with the decree published in the Journal Official of April 20, 2002. Decree No. 2002-540.

- **16.02.14: Waste from electronic equipment:**
→ Electronic boards incorporated in the instrument.
- **16.06.02: Cells and batteries (dangerous)**
→ Alkaline batteries (or NI-MH batteries).
- **15.01.02: Packaging**
→ Instrument casing in ABS plastic
→ Rubber Boot

A.3.4 Instrument destruction procedure

To open the instrument: unscrew first the battery compartment cover screw, then the 5 screws fastening the 2 half-shells. Separate the 2 half-shells. Remove the electronic board from the top shell.

The batteries are housed in the battery compartment (see putting into service chapter).

With the battery pack option, there are 2 polluting elements: the NI-MH (Nickel-Metal Hybrid) batteries and an electronic board. Separate the 2 elements.

A.3.5 Instructions

The instrument has been designed to function in complete safety if the instructions given in the accompanying documents are applied. Use of the instrument in any other way can reduce operator safety, and is therefore dangerous and prohibited.

A.3.6 Taking measurements

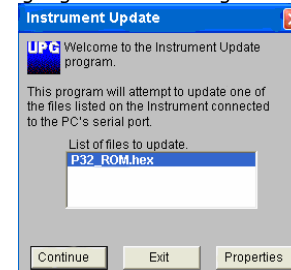
The measuring leads and wires must be in good condition and be replaced if their insulation seems defective (insulation cut, burnt, etc.).

When the instrument is connected to the measuring circuits the terminals can be dangerous, therefore do not place your hands near a terminal, whether used or not.

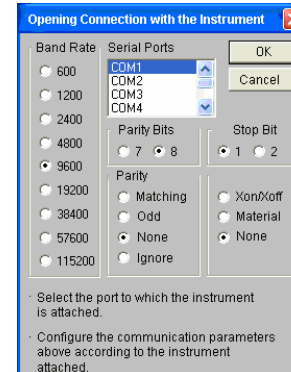
Never exceed the protection limit values indicated in the specifications.

E. SOFTWARE UPDATING

The UPG32 program updates the software. Before starting this program, you have to configure your PC and load the USB driver. These software programs are available on the CD-ROM supplied with the USB cable. After connecting the instrument to the PC (via the USB lead), start the UPG32 program and select the language. The following window is displayed:



- Select the latest software version and click on Continue. Another window opens:



- Check the value 115200 in the Baud rate column.
- Confirm the chosen communication port.
- Configure the communication protocol
 - Data bits: 8
 - Stop bit: 1
 - Parity: None
 - Flow control: None
- Press OK to confirm and start loading the code.
- Wait for the end of loading, then "reboot" the instrument before disconnecting it from the PC.

- Select the **Preferences** field using the navigation keys (↑ and ↓), then confirm.
- Select the **LANGUAGE** field with the **F1** key.
- Using the navigation keys (↑ and ↓) select your language then press **OK** to confirm (if parameter setting is completed or go on to the next field using the F1 key).

D.4 "Maintenance" menu

Not accessible to the user:

Consult WAHL for procedure to follow for maintenance services.

D.5 "About the instrument" menu

In the CONFIGURATION/SETUP/ABOUT menu you can find:

- The reference of the instrument
- The serial number
- The software version
- The name of the company

When the order of size of the measured value is not known, ensure that the starting measurement range is as high as possible, or select automatic range change mode.

Before changing function, disconnect the measuring wires from the external circuit. Remember that when taking even low current and/or voltage measurements that the circuits can carry voltages that, with respect to earth, are hazardous for the operator.

Never take measurements when the instrument is connected to another appliance by the USB link or when charging the batteries (option).

A.3.7 Defects and abnormal stresses

Whenever the level of protection afforded by the instrument is suspected of being impaired, remove it from service and ensure it cannot be put back into service accidentally.

The protection might have been impaired if, for example:

- ✓ The instrument displays visible damage.
- ✓ The instrument can no longer take precise measurements.
- ✓ The instrument has been stored in unfavorable conditions.
- ✓ The instrument has suffered severe stresses during transport.

A.3.8 Definitions

A.3.8.1 Definition of category and pollution level




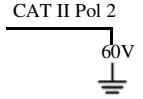
CAT II 60V:

The notion of categories determines the maximum transient voltage that can be applied to the measurement inputs (it is also called overvoltage category). For the P32, the maximum permissible overvoltage is 60V (DC or AC)

POL 2:

The notion of pollution determines the isolation distance between the circuits. Level 2 allows temporary conductivity caused by condensation.

A.3.8.2 Symbols used

Symbol	Meaning
	Caution: see the accompanying documents
	Earth
	Conforms with the European Union directives
	Category II, Pollution 2. Maximum voltage rating with respect to earth=60V

A.4 Maintenance

The instrument must always be reassembled in accordance with the instructions given in this manual. Incomplete or incorrect assembly can jeopardize operator safety.

The authority in charge must regularly check that the safety components have not altered over time and perform all the necessary preventive maintenance operations.

Before opening the instrument for maintenance work, always ensure that all the wires have been disconnected from it.

Work (adjustment, servicing, and repair) on the open instrument must be avoided as much as possible, but if such work is absolutely necessary, it must be performed by qualified personnel that is well aware of the risks involved.

Three types of resolution are then available: high (res=1mV or 1μA), medium (res=10mV or 10μA) and low (res=100mV or 100μA).

- Select the resolution using the navigation keys (↑ and ↓).
- Press **OK** to confirm.

D.3.3 Adjusting the lighting duration

The duration of the lighting can be programmed in the same menu (**CONFIGURATION/SETUP/PREFERENCE**) (manual, 10s or 1mn). A short press on the **ON/OFF** key switches on the lighting for the selected period (10s or 1mn). A second short press restarts the timeout or switches off the lighting in **manual** mode.

- This menu is accessed using key **F1**.
- 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.
- The mode (manual or timed) is selected using the navigation keys (↑ and ↓).
- Press **OK** to confirm.

D.3.4 Adjusting the "key beep"

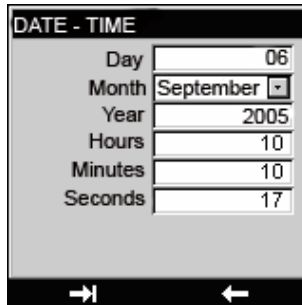
An audio beep can be set in the **CONFIGURATION/SETUP/PREFERENCE** menu to sound each time a key is pressed:

- This menu is accessed using key **F1**.
- 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 Beep** field with the F1 key.
- Using the navigation keys (↑ and ↓) select **ON** or **OFF** mode, then press **OK** to confirm (if parameter setting is completed or go on to the next field using the F1 key).

D.3.5 Adjusting the language

The interface language can be selected to either French or English in the **CONFIGURATION/SETUP/PREFERENCES** menu.

- This menu is accessed using key **F1**.
- Select the **Setup** field using the navigation keys (↑ and ↓), then confirm.



- The various parameters are adjusted using the navigation keys (↑ and ↓).
- Use the navigation keys (← and →) to move from one field to the next.
- Press **VAL** to confirm.

D.3 Adjusting the "preferences"

D.3.1 Adjusting the filtering

When measurements are taken on a noisy loop, the measurements can be filtered to render more stable the value indicated on the display.

- This menu is accessed using key **F1** (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 **F1**.
- Four filtering values are available (OFF, 0.5s, 1s and 2s). The value is selected using the navigation keys (↑ and ↓).
- Press **OK** to confirm.

D.3.2 Adjusting display resolution

The display resolution can be selected from the **CONFIGURATION/ SETUP/ PREFERENCE** menu:

- This menu is accessed using key **F1**.
- 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 key **F1**.

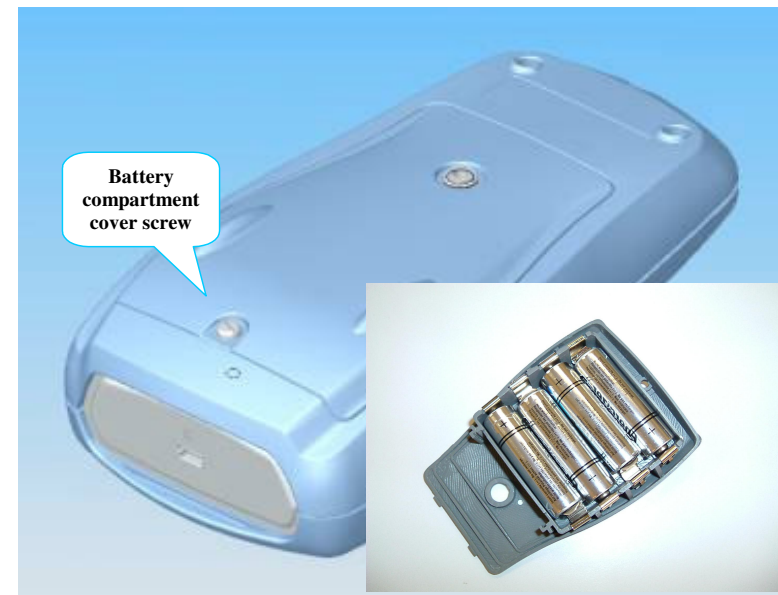
B. USING THE INSTRUMENT

To use the instrument in complete safety, all operators must read attentively the section relating to safety, and this section.

B.1 Putting into service

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, unscrew 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 following figure shows how to open the battery compartment and the direction of installation of each battery.



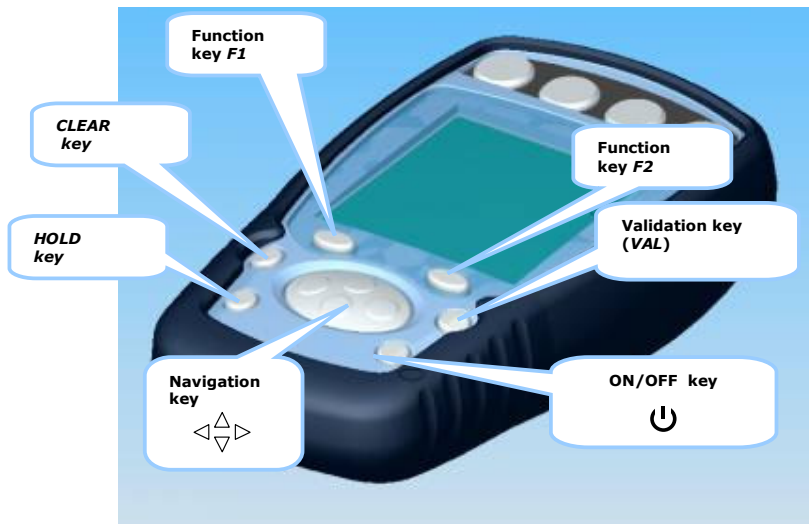
B.1.1 The keypad

The keypad:

- 2 function keys (**F1** and **F2**) for selecting the different menus displayed on the screen.
- The navigator consisting of 4 arrows (up (↑), down (↓), right (→), left (←))
- A cancel key (**CLEAR**).
- A key for switching the instrument and the backlighting on and off (**ON/OFF**).

One short press switches on the instrument. When in operation, one short press switches the lighting on or off. One long press (2 seconds) switches the instrument to a standby mode (low consumption).

- A validation key (**VAL**).
- A HOLD key allows the temporary stopping of a process (short press). A long press on this key switches from measurement mode to transmission mode and vice versa.

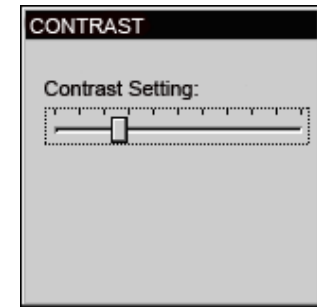
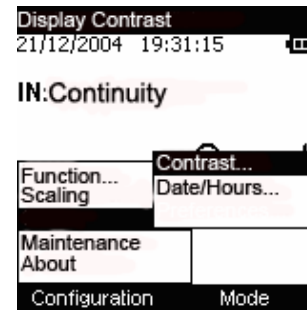


D. PARAMETER SETTINGS

D.1 Adjusting the contrast

The display contrast can be adjusted in the CONFIGURATION/SETUP menu.

- This menu is accessed using key F1.
- Select the **Setup** field using the navigation keys (↑ and ↓), then confirm.
- Select the **Contrast** field using the navigation keys (↑ and ↓), then confirm.
- Increase or reduce the contrast using the navigation keys (← and →).



D.2 Adjusting the date and time

The date and time can be adjusted in the CONFIGURATION/SETUP menu.

- This menu is accessed using key **F1**.
- Select the **Setup** field using the navigation keys (↑ and ↓), then confirm.
- Select the **Date/Time** field using the navigation keys (↑ and ↓), then confirm.

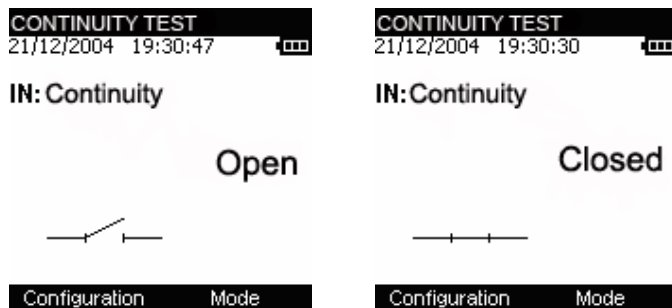
C.1.6 Continuity

CONTINUITY mode is a MEASUREMENT mode applied to the current channel (I+, I- terminals).

It indicates whether the circuit (the loop) is open or closed. The circuit must be resistive with no active elements. The loop shall be considered closed at loop impedances of 0 to 1K Ω , and open at impedances above 1K Ω .

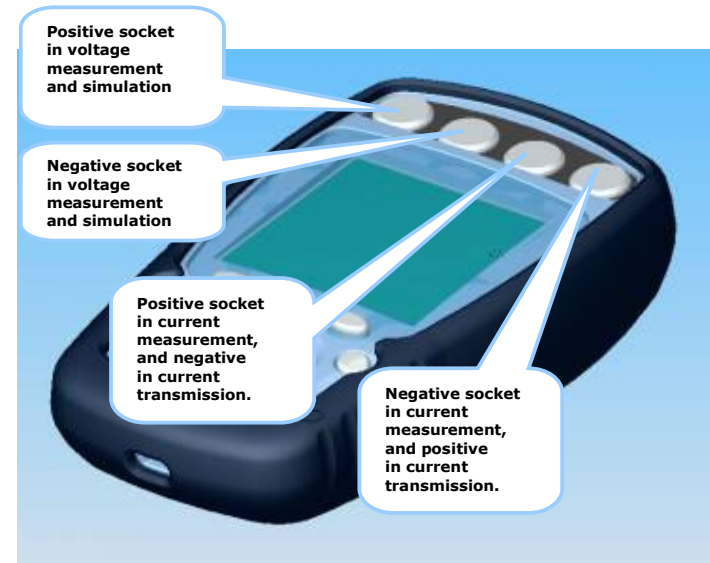
- Select the measurement mode using key **F2 (mode menu)**.
- Using the navigation keys, move down through the menu to the **Measurement** field.
- Press the **OK** key to confirm.
- The type of function (voltage or current or **Continuity**) is selected using key **F1 (configuration menu)**.
- Using the navigation key, go onto the **Function** field and press **OK** to confirm.
- Using the navigation key (\uparrow and \downarrow), select the **Continuity** function and press **OK** to confirm. It is possible to enter the Function field using key **F2** and to select the function with the navigation keys (\uparrow and \downarrow).

Confirming the Continuity function calls up the following screen:

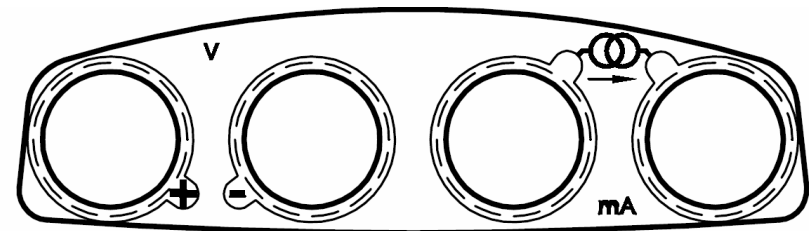


B.1.2 The measurement and simulation terminals

The P32 is equipped with 4 safety sockets (4-mm diameter). Two of these sockets are for voltage measurement and transmission, while the other two are for current measurement and transmission and the continuity test.



The figure below shows the inscription on the sockets of the P32.



B.1.3 The USB connector

The P32 features a USB connector (mini B) for loading new software versions and adjusting the instrument.



Post USB
(mini B connector)

CYCLE RAMP CONFIG.		
Low level	000.00	V
High level	001.00	V
Level Duration	000010	s
Rise	000010	s
Level Duration	000010	s
Falls	000010	s
Repetitions	000001	
Delay	000000	s

The **CONFIGURATION/RAMP** menu is accessed using key **F2**. Caution, it is vital to program the appropriate function mode (**Single Ramp** mode) to access the **CONFIGURATION/RAMP/CYCLIC RAMP** menu.

Use key **F2** to move from one field to the next in the **CONFIGURATION/RAMP/CYCLIC RAMP** menu.

The value is entered using the navigation keys:

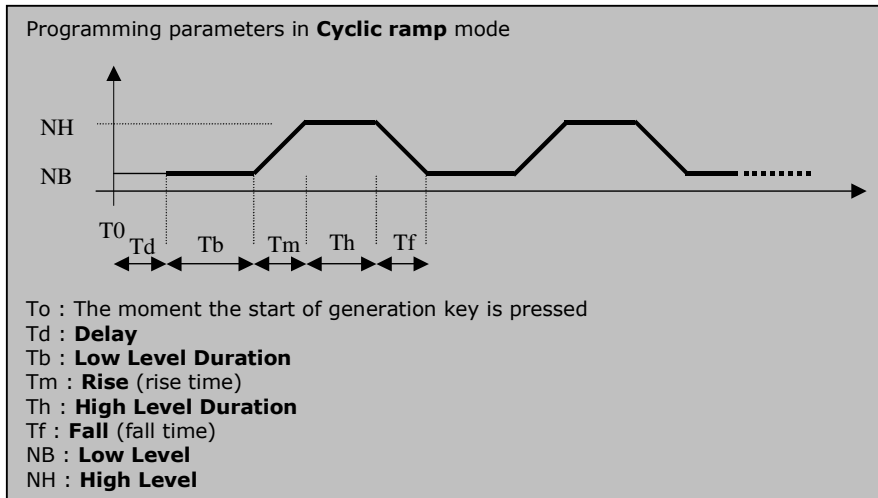
- As a percentage of the range if scaling mode is ON.
- ↑ and ↓ to increment or decrement the value
- ← and → to select the hundreds/tens/units/tenths/hundredths/thousandths.

Press **OK** to save the parameters.

Press **CLEAR** to quit the menu without saving.

→ Cyclic ramp signal configuration?

The figure below shows the type of cyclic ramp signal that can be generated along with its parameters:



The **LOW Level and HIGH level** are given:

- As a percentage of the range if scaling mode is ON.
- In volts or mA if the scaling mode is OFF and depending on the type of quantity transmitted (voltage or current transmission).

The **Low Level Duration, Rise, High Level Duration, Fall and Delay** times are given in seconds and are limited to a maximum of 1000s.

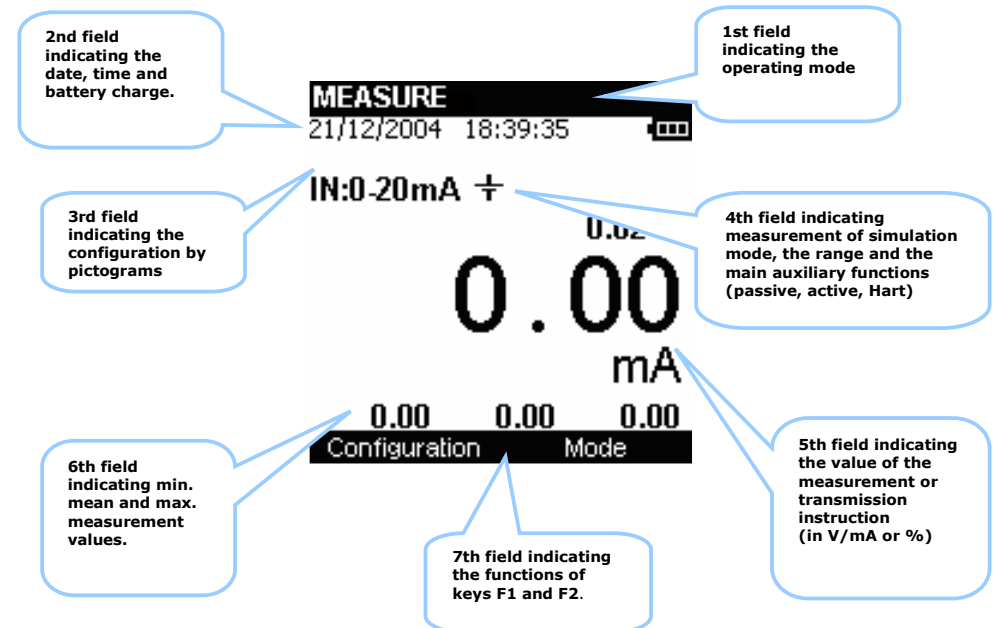
The **Repetitions** field gives the number of ramp signals to be generated. There can be a maximum of 1000 repetitions.

B.1.4 Screen

The P32 has a backlit graphic liquid crystal display (LCD), with a resolution of 160 x 160 pixels.

In normal operation, the display is divided into seven horizontal fields:

- The 1st field indicates the mode of operation (Measurement, transmission or continuity).
- The 2nd field indicates the date, time and battery charge.
- The 3rd field is reserved for the icons indicating the mode of operation (auxiliary functions: Scaling, filtering, etc.).
- The 4th indicates the mode of operation, the range, and certain auxiliary functions (scale, passive or active mode, Hart, etc.).
- The 5th field indicates the measured or transmitted value. The measured quantities are indicated in V, mA or %.
- The 6th field gives (in measurement mode) the minimum, mean and maximum values of the measurement.
- The 7th field indicates the functionality of keys **F1** and **F2**.



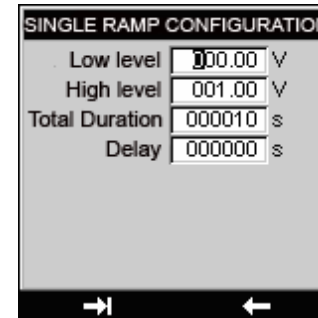
The following table gives the meaning of the pictograms that appear on the screen:

Symbol	Description
	Step increment transmission mode
	Single ramp signal transmission mode
	Cyclic ramp signal transmission mode
	Scaling
	Hold
	Quadratic scale
	Filtering
	%FS (full scale) function
	Valve test
	Warning: the P32 is in error condition (range exceeded (1)...etc)
	Incremental mode using the arrows
	Passive mode (the instrument delivers a +24V source to the sensor)
	Active mode (the instrument delivers no voltage source)
	Hart mode
	Caution: The current source cannot deliver the current demanded (unlooping probable).
	Caution: The voltage source cannot deliver the voltage demanded (output current probably too high).

Note 1:

When the range is exceeded (limits determined in the next chapter), the following pictogram appears and the measurement display (5th field) indicates:

- : ---- if the measured value is below the low limit.
- + : ---- if the measured value is above the high limit.



The **CONFIGURATION/RAMP** menu is accessed using key **F2**.

Important: The appropriate function mode (**INCREMENTS** mode) must have been programmed in order to access the **CONFIGURATION/RAMP/SINGLE** menu.

Use key **F2** to move from one field to the next in the **CONFIGURATION/RAMP/SINGLE** menu.

The value is entered using the navigation keys:

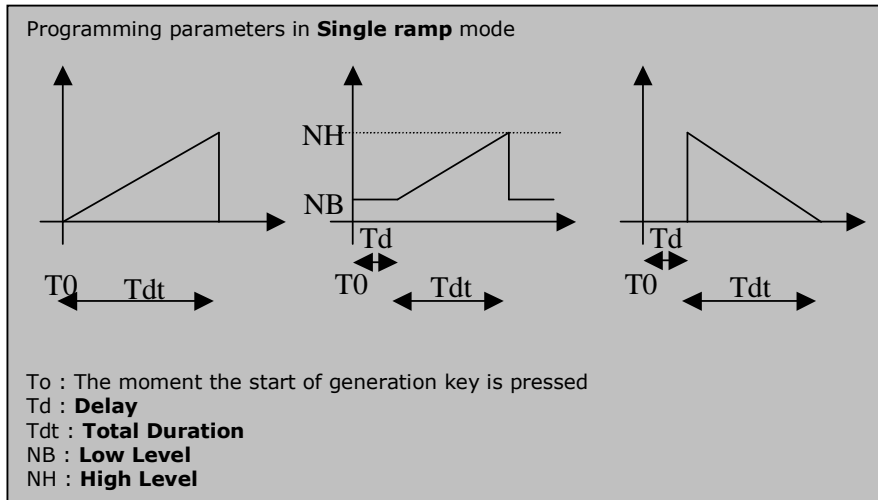
- As a percentage of the range if scaling mode is ON.
- ↑ and ↓ to increment or decrement the value
- ← and → to select the hundreds/tens/units/tenths/hundredths/thousandths.

Press **OK** to save the parameters.

Press **CLEAR** to quit the menu without saving.

→ Single ramp signal configuration?

The figure below shows the type of single ramp that can be generated along with its parameters:



The **LOW Level and HIGH level** are given:

- As a percentage of the range if scaling mode is ON.
- In volts or mA if the scaling mode is OFF and depending on the type of quantity transmitted (voltage or current transmission).

The **Total Duration** corresponds to the incremental time it takes to go from **Low Level to High Level** (and vice versa with decremental). 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.

B.1.5 Starting (after powering on)

At powering up (insertion of the AA batteries or battery pack), the instrument automatically starts functioning (loading of the software into memory). It is recommended not to connect the instrument to any external circuits during this period.

To avoid any signal conflicts, the instrument then enters measurement mode.

B.1.6 Operating modes

There are 5 main operating modes:

- Voltage measurement,
- Current measurement,
- Voltage transmission,
- Current transmission,
- Continuity test.

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

B.1.6.1 DC voltage measurement

The following ranges are available:

Range	0/10V (Process)	25V	50V
Resolution (display)	1mV (or 10mV or 100mV)	1mV (or 10mV or 100mV)	1mV (or 10mV or 100mV)
Extent of the range	-2V to +12V	-2V to +25V	-5V to 50V

B.1.6.2 Current measurement

Range	0-20mA (Process)	4-20mA (Process)	25mA
Resolution (display)	1μA (or 10μA or 100μA)	1μA (or 10μA or 100μA)	1μA (or 10μA or 100μA)
Extent of range	-6mA to +24 mA	3.2mA to +24 mA	-6mA to +25 mA
Loop supply	YES	YES	YES
Scale	Linear or quadratic	Linear or quadratic	Linear

B.1.6.3 Voltage transmission

The following ranges are available:

Range	0/10V	15V
Resolution (display)	1mV (or 10mV or 100mV)	1mV (or 10mV or 100mV)
Extent of range	0V to +12V	0V to +15V
Mode	Continuous, increments, or ramp	Continuous, increments, or ramp

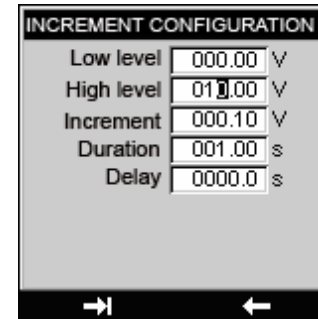
B.1.6.4 Current transmission

The following ranges are available:

Range	0/20 mA	4/20 mA	25 mA
Resolution (display)	1 μ A (or 10 μ A or 100 μ A)	1 μ A (or 10 μ A or 100 μ A)	1 μ A (or 10 μ A or 100 μ A)
Extent of the range	+100 μ A to +24mA (1)	+3.2mA to +24mA	+100 μ A to 25 mA (1)
Mode	Continuous, increments, ramp or predefined (valve, %FS), linear or quadratic scale	Continuous, increments, ramp or predefined (valve, %FS), linear or quadratic scale	Continuous, increments or ramp.

Note 1: Caution, a residual current of about 100 μ A may be detected in the loop in spite of a setpoint value of 0 mA.

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 key **F2** to move from one field to the next

The value is entered using the navigation keys:

- As a percentage of the range if scaling mode is ON.
- \uparrow and \downarrow to increment or decrement the value
- \leftarrow and \rightarrow to select the hundreds/tens/units/tenths/hundredths/thousandths.

Press **OK** to save the parameters.

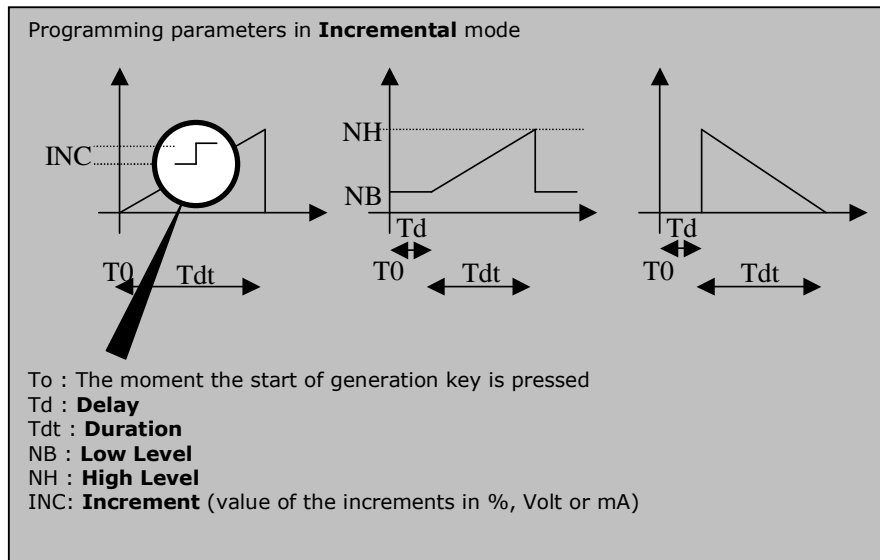
Press **CLEAR** to quit the menu without saving.

C.1.5 Ramp signal generation configuration

The CONFIGURATION/RAMP menu is used for the generation of incremental, single or cyclic ramp signals in both voltage and current.

→ Incremental ramp signal configuration?

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



The **LOW Level and HIGH level** are given:

- As a percentage of the range if scaling mode is ON.
- In volts or mA if the scaling mode is OFF and depending on the type of quantity transmitted (voltage or current transmission).

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

B.1.6.5 Continuity

Range	Continuity
Resolution	Open/Closed: Considered closed for $Z=[0...1K\Omega \pm 10\%]$ and open for $Z=]1K\Omega \pm 10\% ... \infty[$

The loop to be tested is connected through the current channel. Caution, the tested loop must be resistive and passive

B.1.6.6 Maximum permissible electrical characteristics (values not to be exceeded)

Function	Range	Vin max	Iout max	Z load
V measurement	0/10V 25V 50V	60V - -		
V transmission	0/10V 15V		10 mA 8 mA	1000 Ω min 2000 Ω min
I measurement	0/20 mA 4/20mA 25mA	60V - -		
I transmission	0/20 mA 4/20mA 25mA		24 mA - 25 mA	1000 Ω max at 20mA - -
Continuity		60V		

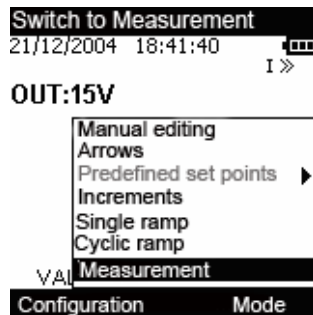
These 5 operating modes are explained in the following chapters (chapter C).

C. PROGRAMMING THE MODES

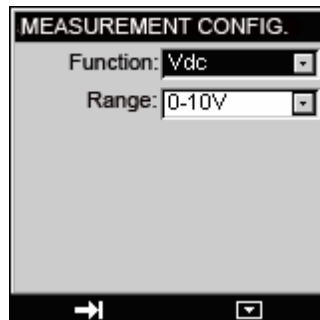
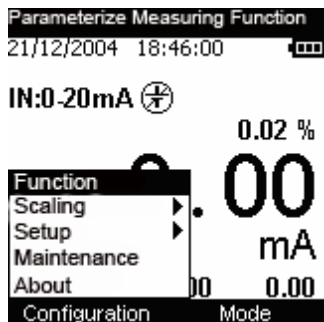
C.1.1 Voltage (DC) measurement

- Measurement or transmission mode is selected using key **F2 (mode menu)**.
- Using the navigation keys (↑ and ↓), move down through the menu to the **Measurement** field.
- Press **VAL** to confirm.

It should be noted that Measurement mode is the mode selected by default.



- The type of function (voltage or current) is selected using key **F1 (Configuration menu)**.
- Using the navigation key (↑ and ↓), go onto the **Function** field
- Press **VAL** to confirm.



→ Voltage or current generation / cyclic ramp editing?

- Press key F2 to display the edit menu.
- Using the navigation keys (↑ and ↓), select **CYCLIC RAMP** editing mode and confirm (**OK** key).

The value displayed is that programmed in the **CONFIGURATION/RAMP** menu (see next chapter).

- Using the navigation key (↑), start the automatic incrementing phase (according to the parameters programmed in the **CONFIGURATION/RAMP** menu).
- The voltage can be automatically decremented from the programmed maximum value using the navigation key (↓).
- The transmitted voltage can be manually incremented (according to the parameters programmed in the **CONFIGURATION/RAMP** menu) using the navigation key (→).
- The transmitted voltage can be manually decremented from the maximum programmed value using the navigation key (←).

Ramp generation can be stopped by pressing the navigation keys (← and →) and automatic generation restarted with the navigation keys (↑ and ↓).

The Hold key allows generation to be stopped and restarted

→ Current generation/predefined editing/valve test?

Valve test transmission mode is a mode that transmits predefined current values (3.8; 4; 4.2; 8; 19; 20 and 21mA).

- Press key F2 to display the edit menu.
- Using the navigation keys (↑ and ↓), select **Predefined setpoints** mode and confirm (**OK** key).
- Using the navigation keys (↑ and ↓), select **Valve test** mode and confirm (**OK** key).

A transmission screen is displayed with a setpoint value of 3.8 mA.

- Press the navigation keys (← and →) to increment or decrement the setpoint value.

→ Current generation / predefined editing/% FS?

The "% FS" (percentage of full scale) transmission mode transmits predefined current values: 0%, 25%, 50%, 75% and 100%.

- Press key F2 to display the edit menu.
- Using the navigation keys (↑ and ↓), select **Predefined setpoints** mode and confirm (**OK** key).
- Using the navigation keys (↑ and ↓), select **%FS** mode and confirm (**OK** key).

A transmission screen is displayed with a setpoint value of 0.00%.

- Press the navigation keys (← and →) to increment or decrement the setpoint value.

→ Voltage or current generation // incremental editing?

- Press key F2 to display the edit menu.
- Using the navigation keys (↑ and ↓), select the **INCREMENTS** editing mode and confirm (**OK** key).

The value displayed is that programmed in the **CONFIGURATION/RAMP** menu (see next chapter).

- Using the navigation key (↑), start the automatic incrementing phase (according to the parameters programmed in the **CONFIGURATION/RAMP** menu).
- The voltage can be automatically decremented from the programmed maximum value using the navigation key (↓).
- The transmitted voltage can be manually incremented (according to the parameters programmed in the **CONFIGURATION/RAMP** menu) using the navigation key (→).
- The transmitted voltage can be manually decremented from the maximum programmed value using the navigation key (←).

→ Voltage or current generation / single ramp editing?

- Press key F2 to display the edit menu.
- Using the navigation keys (↑ and ↓), select **SINGLE RAMP** editing mode and confirm (**OK** key).

The value displayed is that programmed in the **CONFIGURATION/RAMP** menu (see next chapter).

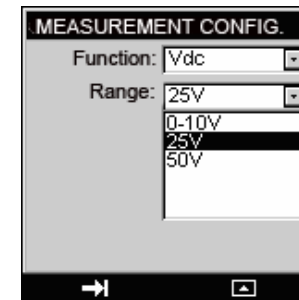
- Using the navigation key (↑), start the automatic incrementing phase (according to the parameters programmed in the **CONFIGURATION/RAMP** menu).
- The voltage can be automatically decremented from the programmed maximum value using the navigation key (↓).
- The transmitted voltage can be manually incremented (according to the parameters programmed in the **CONFIGURATION/RAMP** menu) using the navigation key (→).
- The transmitted voltage can be manually decremented from the maximum programmed value using the navigation key (←).

Ramp generation can be stopped by pressing the navigation keys (← and →) and automatic generation restarted with the navigation keys (↑ and ↓). The Hold key allows generation to be stopped and restarted

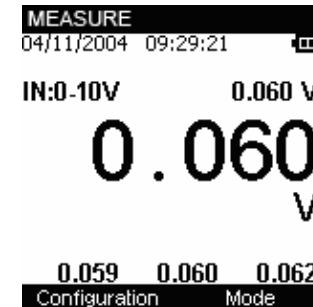
Transmission can be delayed by a programmable length of time (in the **CONFIGURATION/RAMP/DELAY** menu)

In the **MEASUREMENT CONFIGURATION** menu, go onto the **Function** field using the **F1** key.

- Go into the **Function** menu by pressing **F2**.
- Select the type of function (**Vdc**) using the navigation keys.
- Press **VAL** to confirm.
- Using key F1, go onto **Range** to define it.
- Go into the menu by pressing **F2**.
- Select the range using the navigation keys.
- Press **VAL** to confirm (the range).



- Press **VAL** again to confirm the desired function and call up the measurement screen.



Measurement mode provides for display of the Minimum (bottom left), Mean (bottom center) and Maximum (bottom right) values since the last **Min/Max Reset** command

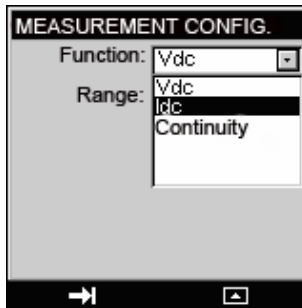
- This command is accessed through key F2.
- Using the navigation key, go onto the **Min/Max Reset** field
- Press **VAL** to confirm.

C.1.2 Current (DC) measurement

- Measurement or transmission mode is selected using key **F2 (mode menu)**.
- Using the navigation keys, go onto the **Measurement** field.
- Press **VAL** to confirm.

It should be noted that Measurement mode is the mode selected by default.

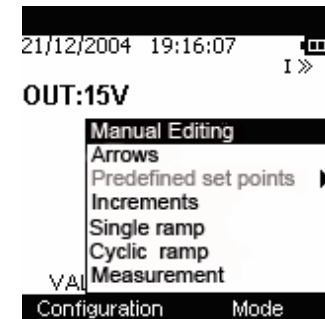
- The type of function (voltage or current) and the range are selected using key **F1 (Configuration menu)**.
- Using the navigation key, go onto the **Function** field.
- Press **VAL** to confirm.
- In the **MEASUREMENT CONFIGURATION** menu, go onto the **Function** field using key **F1**.
- Go into the **Function** menu by pressing **F2**.
- Select the type of function (**Idc**) using the navigation keys (**↑** and **↓**).



- Press **VAL** to confirm.

→ The navigation keys can be used to make a shortcut. In the **MEASUREMENT CONFIGURATION** menu, go onto the **Function** field using key **F1**:

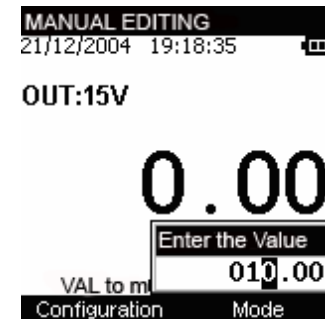
- Select the type of function (**Idc**) using the navigation keys (**↑** and **↓**),



→ Voltage or current generation / manual editing?

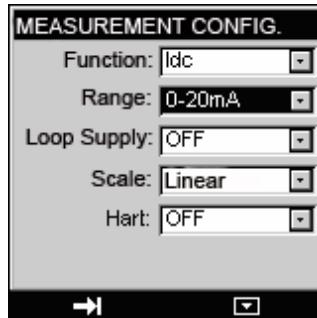
- Press key **F2** to display the edit menu.
- Using the navigation keys (**↑** and **↓**), select the **Manual editing** mode and confirm (**OK** key).
- Press **OK** again and enter your value using the navigation keys:
 - **↑** and **↓** to increment or decrement the value
 - **←** and **→** to select the hundreds/tens/units/tenths/hundredths.

Caution: if the Scaling mode is **ON**, the value to be edited is %, otherwise this value is in volts, and in this case the hundreds unit does not exist.



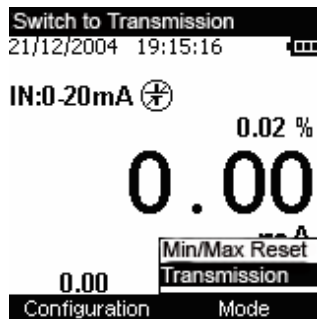
→ Voltage or current generation / editing using the arrows?

- Press key **F2** to display the edit menu.
- Using the navigation keys (**↑** and **↓**), select the **Arrows** editing mode and confirm (**OK** key).
- The value is entered using the navigation keys:
 - **↑** and **↓** to increment or decrement the value
 - **←** and **→** to select the tens/units/tenths/hundredths/thousandths.



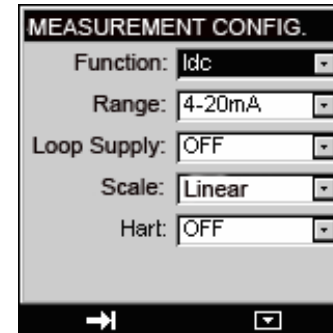
C.1.4 Voltage or current (DC) transmission

- Transmission mode is selected using key **F2 (mode menu)**.
- Using the navigation keys (\uparrow and \downarrow), move down through the menu to the **Transmission** field.
- Press **VAL** to confirm.

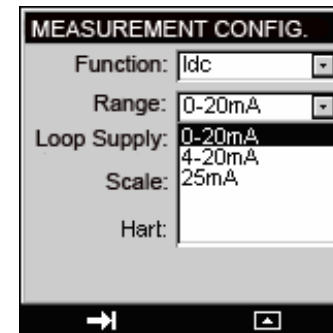


After confirming Transmission mode, the type of generation must be defined:

- Continuous (manual or incremental (arrows) editing).
- Incremental (in steps).
- Single ramp (only one ramp signal transmitted).
- Cyclic ramp.



- Using key **F1**, go onto the **Range** field and define the **Range**.
- Go into the menu by pressing **F2**.
- Select the range using the navigation keys (0/20mA, 4/20mA or 25mA).



- Press **VAL** to confirm (the range).

→ The navigation keys can be used to make a shortcut. In the **MEASUREMENT CONFIGURATION** menu, go onto the **Range** field using the **F1** key:

- Select the range directly using the navigation keys (\uparrow and \downarrow),

→ Other configuration parameters can be defined at this level, such as the current loop supply, the type of scale and Hart compatibility. These parameters are defined in the next chapter.

- Press **VAL** (again) to confirm the desired function and call up the measurement screen.

Measurement mode provides for display of the Minimum (bottom left), Mean (bottom center) and Maximum (bottom right) values since the last **Min/Max Reset** command.

- This command is accessed through key F2.
- Using the navigation key, go onto the **Min/Max Reset** field
- Press **VAL** to confirm.

C.1.3 Current measurement / auxiliary functions

Auxiliary functions can be defined for all the ranges. Examples include:

- Supply of a +24 voltage to the sensors or not → Passive or active mode
- Linear or quadratic scale (for process ranges only).
- Hart compatibility (for process ranges only).

After selecting the Function and Range, the auxiliary functions described above must be defined.

→ passive or active mode?

- Using key F1, go onto the **Loop Supply** field.
- Using the navigation keys (**↑** and **↓**), select the mode **ON** or **OFF** (Passive or Active).

This active or passive mode also concerns the Hart mode.

→ Scale?

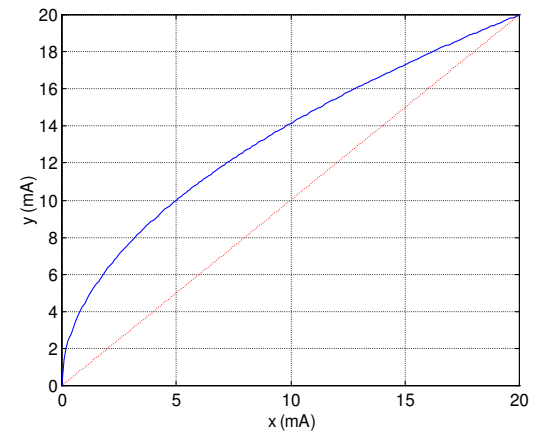
- Using key F1, go onto the **Scale** field.
- Using the navigation keys (**↑** and **↓**), select **Linear** or **Quadratic** mode.

When quadratic scaling is activated, the P32 takes the square root of its input and displays the result as a percentage. For example, if the P32 is connected to the output of a differential pressure transmitter it displays a result proportional to the flow.

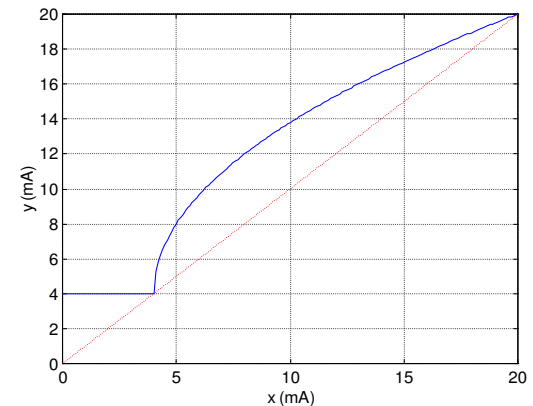
If the input current x varies between a and b , scaling complies with the formula below:

$$y = a + (b - a) \sqrt{\frac{(x - a)}{(b - a)}}$$

The scaling curve for the 0-20mA range is as follows:



The scaling curve for the 4-20mA range is as follows:



→ Hart?

- Using key F1, go onto the **Hart** field.
- Using the navigation keys (**↑** and **↓**), select the mode **ON** or **OFF**.