

M3

For inductive, 1Vpp and TTL probes



USER'S MANUAL

Firmware 2.0



Metro
Rue de la Jonchère
F-74420 Boège

☎ +33 (0) 450 39 08 49
Fax +33 (0) 450 39 08 33
web www.metro-fr.com
E-mail info@metro-fr.com

1. TABLE OF CONTENTS

1.	TABLE OF CONTENTS	2
2.	FOREWORDS	4
3.	INTRODUCTION	5
3.1.	PRODUCT PRESENTATION	5
3.2.	VERSIONS	5
3.3.	CHARACTERISTICS	6
3.3.1.	MAIN TECHNICAL CHARACTERISTICS	6
3.3.2.	DIMENSION AND INSTALLATION	7
3.3.3.	CONTENTS OF THE PACKAGING	8
3.3.4.	OPTIONS	8
3.3.5.	CONNECTORS	11
3.3.5.1.	VERSION FOR INDUCTIVE PROBES	11
3.3.5.2.	VERSION FOR INCREMENTAL PROBES AND ENCODERS	12
3.3.6.	RS232 COMMUNICATION PORT	13
3.3.7.	MINI-USB CONNECTOR	13
3.3.8.	THE 24VDC CONNECTOR (ONLY ON INDUCTIVE AND AIR GAGE VERSION)	14
3.3.9.	THE FOOTSWITCH CONNECTOR	14
4.	GRAPHICAL INTERFACE	15
4.1.	2 MAIN PARTS	15
4.2.	GENERALITIES	16
4.3.	CONFIGURATION WINDOWS	16
4.4.	VIRTUAL KEYBOARD	17
5.	CONFIGURATION OF THE DEVICE AND THE MEASURE	18
5.1.	DEFINITION	19
5.1.1.	PART 1	20
5.1.2.	PART 2	24
5.1.3.	PART 3, CLASS	25
5.1.4.	PART 4, CONTROL LIMIT	27
5.2.	DISPLAY	28
5.3.	SETUP	30
5.3.1.	GENERALITIES	31
5.3.2.	INDUCTIVE PROBE	32
5.3.3.	HEIDENHAIN PROBE (11µA OR VCC)	32
5.3.4.	TTL PROBE WITH HEINDEHAIN PINOUT	33
5.3.5.	M-BUS MODULES	34
5.3.6.	AIR GAGE MB-AG MODULE	39
5.4.	CONFIGURATION	43
5.5.	LOCKING	46
5.6.	MEASURE	48
6.	MEASURING SCREEN	49
6.1.	LATERAL BUTTON FUNCTIONS	49
6.2.	CHOICE OF THE NEEDLE INDICATOR STYLE	52
6.3.	TEMPORARY DYNAMIC MODE	53
6.4.	DISPLAY MODE WITHOUT TOLERANCE	54
7.	USB COMMUNICATION	55

8.	RS232 COMMUNICATION	57
8.1.	COMMANDS.....	57
8.1.1.	GENERALITIES.....	57
8.1.2.	COMMAND LIST	58
8.1.2.1.	WINDOW PART	58
8.1.2.2.	WINDOW DISPLAY	59
8.1.2.3.	WINDOW CONFIGURATION	59
8.1.2.4.	WINDOW « LOCK »	60
8.1.2.5.	MEASURING SCREEN	60
9.	RTU MODBUS process	61
10.	OPTIONAL M-BUS MODULES	64
10.1.	MB-IO MODULE (SEE ALSO CHAP 5.3.5)	64
10.2.	MB-RL MODULE	67
10.3.	MB-TP MODULE – FOR TEMPERATURE COMPENSATION	70
11.	FACTORY RESET	71
12.	FIRMWARE UPDATE	72
13.	EXAMPLES OF PROBE COMBINATIONS	74
13.1.	SIMPLE MEASUREMENTS WITH ONE PROBE	74
13.2.	COMBINED MEASUREMENTS WITH TWO PROBES	74

2. FOREWORDS

ONE YEAR LIMITED GUARANTEE FOR M1 / M3

MANUFACTURER'S RESPONSIBILITY

SPARE PARTS AND LABOUR.

The manufacturer commits himself to pay for repair or replacement costs (labour costs included) during a period of one year as from the date the guarantee came into force. The spare parts can be new or renovated and are guaranteed until the end of the initial guarantee period.

FIRST END-USER COVERAGE.

This guarantee applies only to the first end-user of the product and is not assignable to any other subsequent purchaser or user.

RESTRICTIONS.

Any accessory or expansion item not included in the original factory packaging is not guaranteed.

The present guarantee does not cover: installation or repair costs, damages resulting from circumstances beyond the manufacturer's control like damages following acts of God, misuse, or careless mistake from the user, damages during the transport or due to a wrong installation, use or application, such as any material damage caused by the use of non supplied products, components or accessories. It also does not cover products modified without any written approval from the manufacturer, including electrical or mechanical modification, removal of serial numbers or of the manufacturer's trademarks or of any other identification.

THE SOLE RECOURSE UNDER THIS GUARANTEE SHALL BE THE REPAIR OR THE REPLACEMENT OF DEFECTIVE PARTS AS INDICATED ABOVE. UNDER NO CIRCUMSTANCES THE MANUFACTURER CAN BE HELD LIABLE FOR INDIRECT OR SPECIAL DAMAGES OR FOR DAMAGES RESULTING FROM THE USE OF THE PRODUCT, INCLUDING ANY LOSS OF DATA, BUSINESS OR PROFIT, AND WHETHER THESE DAMAGES CAN BE FORESEEN OR NOT AND WHETHER THEY ARE BASED ON A GUARANTEE VIOLATION OR NOT.

THE PRESENT GUARANTEE REPLACES ANY OTHER EXPRESSED OR IMPLIED GUARANTEE INCLUDING BUT NOT LIMITED TO ANY GUARANTEE OF MARKETING OR ADEQUACY FOR A PARTICULAR USE; AND ALL THESE GUARANTEES ARE EXPRESSLY EXCLUDED AND CANCELLED.

WARNING

The information contained in this booklet can be changed without notice.

The manufacturer makes no warranty whatsoever with respect to the warranties of commercial quality of this product or its suitability to a particular use.

The manufacturer is not responsible for mistakes that could be found in this handbook and also for direct or indirect damage resulting from the equipment, its performances and the use of this product.

It is the responsibility of the user to verify the calibration of the display before measuring and it is advised to check periodically the calibration and measurement performance.

CLEANING

Use a soft cotton cloth slightly soaked with an ethyl alcohol based product.

DO NOT USE the following products: acetone, benzene, toluene and halogens hydrocarbons.



3. INTRODUCTION

3.1. PRODUCT PRESENTATION

The M3 display unit allows making dimensional control using 1 or 2 probes. It is possible to make simple measurement (with one probe), or combined measurement (with 2 probes): sums or differences. It is possible to display 1 or 2 characteristics on the screen and can make static measurement or dynamic (Max, Min, Max-Min...)

The M3 can be connected to a PC thanks to its RS232 or USB connection.

A footswitch can be connected in order to transfer measurements.

3.2. VERSIONS

The following probes can be connected

M3 Reference	Description
13000	2 x TTL probe or encoder : Direct connection of Heidenhain and through adaptor for Magnescale (DK series) and Mitutoyo (LG series)
13010	2 x inductive probes from Metro
13020	2 x incremental probes or encoder from

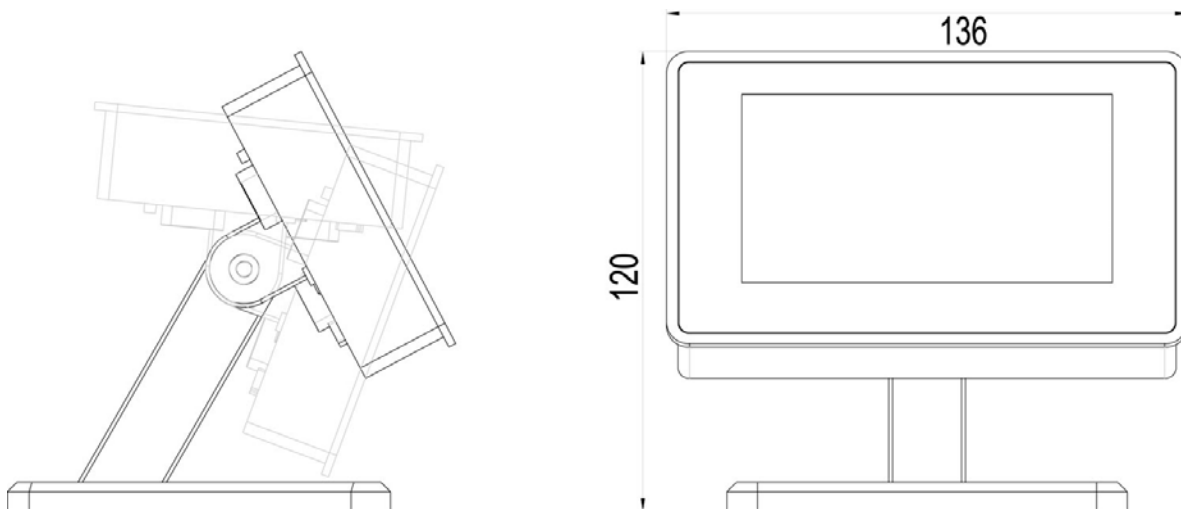
	Heidenhain with a 11µA or 1Vpp output
1301T	2 inductive probe with a Tesa compatibility
1301M	2 x inductive probe from Mahr
1301LVDT	2 x inductive probe from Marposs or Solartron

3.3. CHARACTERISTICS

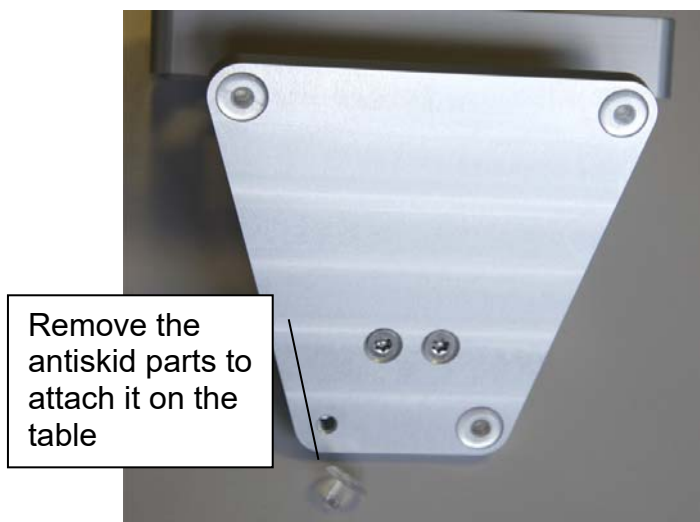
3.3.1. Main technical characteristics

- TFT colour touch screen display 4,3", resolution 480x272.
- Static or dynamic measurements (Max, Min, Max-Min, Average, Median)
- Analogue or digital display
- 2 measurement configurations (2 characteristics)
- Possibility to select automatically the characteristic by moving a probe or by pressing a key.
- Relative or absolute display by pressing a key
- Display resolution (from 1 to 5 decimals)
- Metric (mm or µm) or Imperial (Inches) measurement
- RS232 port for communication with a PC
- USB port for communication and/or power supply
- Optional connection of I/O module
- Measurement transfer by pressing a key, footswitch input or retro-command on the RS232 port.
- Operating temperature : : +15°C to +30°C
- Power supply from 85 to 265 VAC by using the supplied main transformer (or by connecting it directly on your PC USB port.
- Relative humidity : maximum 80%
- Dimensions : width 136 mm, height 120 mm, depth 105 mm
- Mass : 600 grams (700g with the power supply)

3.3.2. Dimension and installation



The M3 is fitted with 4 thread M5 allowing to attach it. To access to these thread it is necessary to remove the 4 antiskid plastic parts.



It is also possible to panel mount the display, with the accessory ref ACS-AFF-001. Be careful not to use longer screw than M4*16.














3.3.3. Contents of the packaging

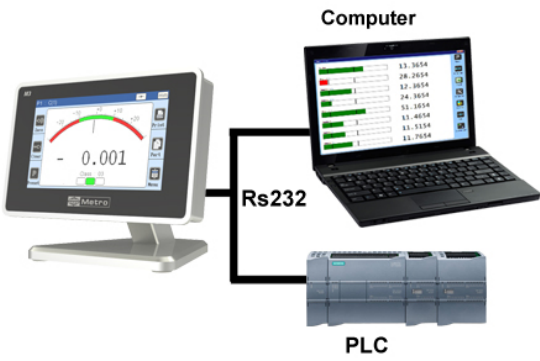






The M3 package includes :


- 1 M3 display mounted on a stand
- 1 USB cable, (length =1.8m) for power supply and/or data transfer
- 1 USB main adaptor for the display power supply. The M3 can also be powered by a computer when connected to it with the USB.
- 1 Mini-CD containing the user manual.

3.3.4. Options

Metro Reference	Description	Picture
18020	Footswitch : This footswitch with a robust construction can be configured in different ways : preset, measurement transmission, start dynamic measurement etc...	
ACS-AFF-001	Accessory for panel mounting. To be installed instead of the stand. 	
MB-IO	This M-Bus module is fitted with 8 input/outputs isolated with opto couplers allowing to get additional functionalities, for example: output for Go/no Go, input for preset or start dynamic measurement... The M-Bus modules are mounted on an aluminum profile allowing to mount them on a standard DIN rail. Up to 4 modules can be mounted	
MB-RL	The optional MB-RL module is fitted with 2 independent relays min and max, free of potential that indicate the position of the measure according to the part tolerances. The module is also fitted with 6 inputs allowing to remote control the display. This MB-RL module is wired exactly like the #24136 optional board for Monocote displays. It allows then to replace a Monocote by a M3 without changing the machine/plc wiring.	

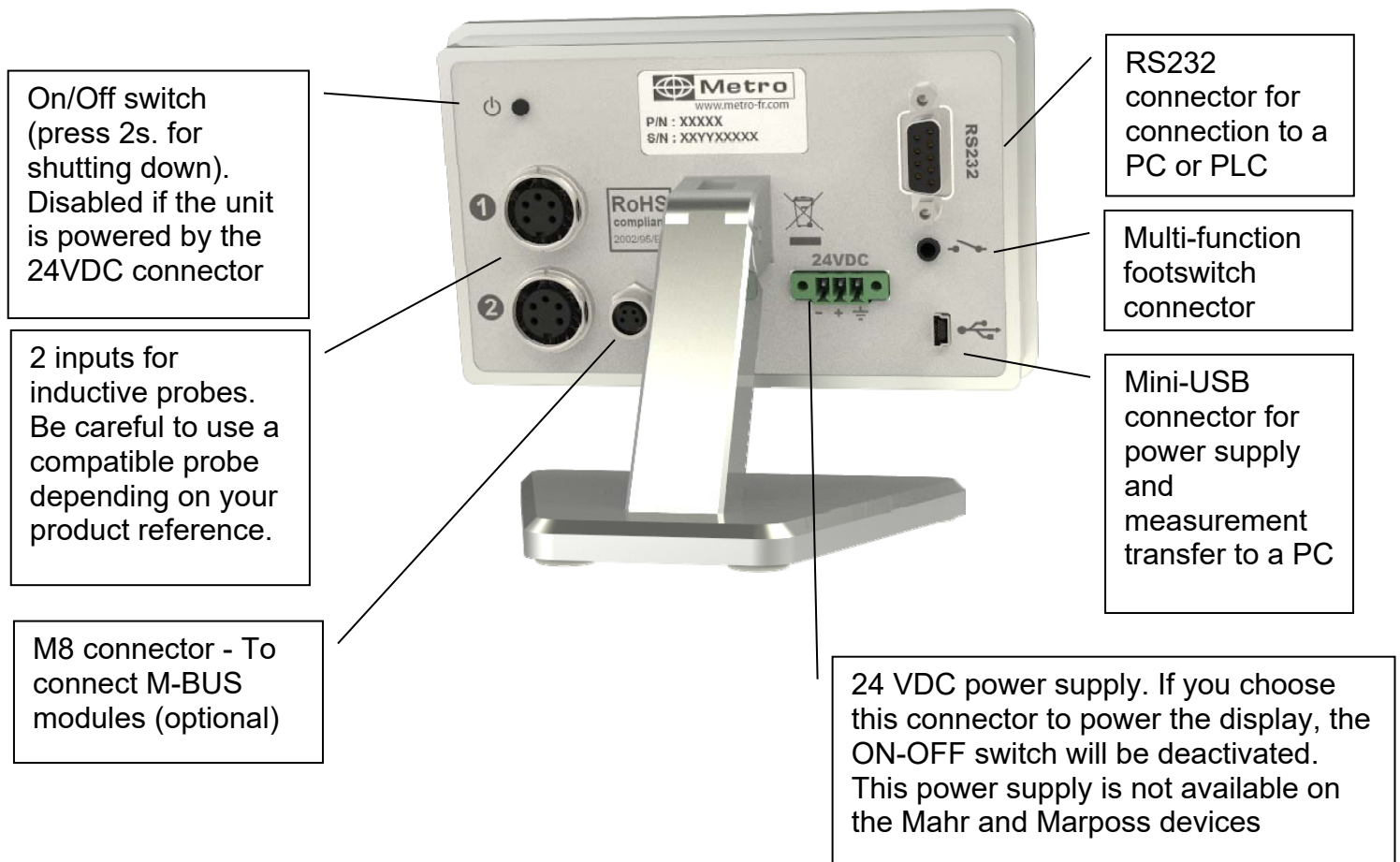
81213-1.5	<p>M-Bus cable for M3 : This cable allows to connect the compatible M-Bus modules on a M3 display unit. Length 1.5m</p> 	
24062	<p>Magnescale probe adapter for M3 TTL : This cable allows to connect 1 Magnescale probe on a M3 (ref 13000) display. It integrates an electronic board that manages the error signal from the Magnescale probes.</p> 	
84100	<p>Heidenhain M23/11μA to D-SUB 15 adapter for M3 11μA/1Vpp : This cable allows to connect 1 Heidenhain probe like MT12 or MT25 with the round M23 connector on a M3 (ref 13020) display.</p> 	

45160	<p>RS232 cable</p> <p>This cable allows to connect a M3 display to a computer.</p> 	
18193	<p>This cable allows to connect a M3 display to a Multiplexer Mux from Metro, and to the DP1 printer from Mitutoyo</p> 	
45173	<p>RS232/USB cable converter :</p> <p>This cable allows a M3 display to communicate with a computer. It creates a virtual COM port on the computer. It is delivered with a driver on a CD.</p> 	
24061	<p>This cable allows to connect 1 Mitutoyo LG probe on a M3 (ref 13000) display.</p>	

ACS-AFF-002 + 45179	<p>Ticket printer</p> <p>Print the displayed values from the M1/M3</p> <p>Require a cable ref 45179 for connecting to the M1/M3</p>	
---------------------	---	--

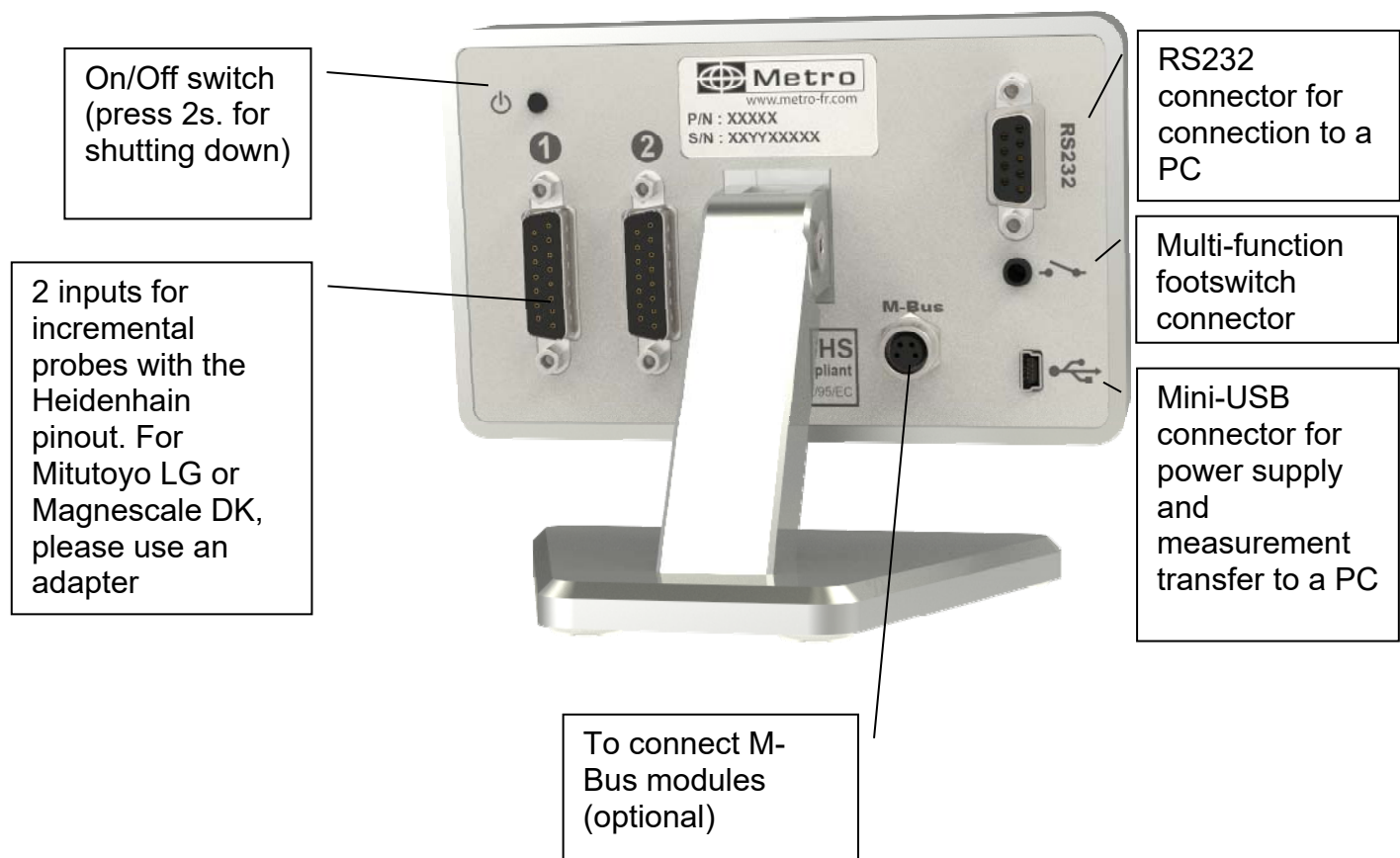
3.3.5. Connectors

3.3.5.1. Version for inductive probes



Note: Metro provides different version for M3 for inductive probes : for Tesa compatible probes, for Mahr, for Metro or for Marposs. Each of these probes has the same DIN-5 connector but is different internally. It is therefore necessary to use the adapted probe depending on your product reference.
You can contact Metro or distributors for any advice about this point.

3.3.5.2. Version for incremental probes and encoders



Note : 2 versions of this unit are available. For sinewave 11 μ A and 1Vpp probes (ref 13020), and for TTL probes (ref 13000).

Please make sure that you are using the right version of M3 depending on the probe you use.

The TTL version allows to connect the Magnescale DK and Mitutoyo LG gages with a cable adapter.

It is possible to connect rotary encoders from different brands. You can contact Metro for any question about this subject.

3.3.6. RS232 communication port

The M3 is fitted with a RS232 port. It allows linking the M3 to PC or an external system. The configuration is as following

9600 bauds, 8 bits, 1 stop bit, no parity

CONNECTOR PINOUT

It is fitted with a SUBD 9 pins female connector.

<i>Pin</i>	<i>Signal</i>	<i>Direction</i>	<i>Description</i>
1			Not used
2	RX	Input	Reception of data
3	TX	Output	Transfer of data
4	IN1	Input	Do no use. Only for firmware update
5	Gnd	-	Ground
6			Not used
7	IN2	Input	Do no use. Only for firmware update
8 & 9			Not used

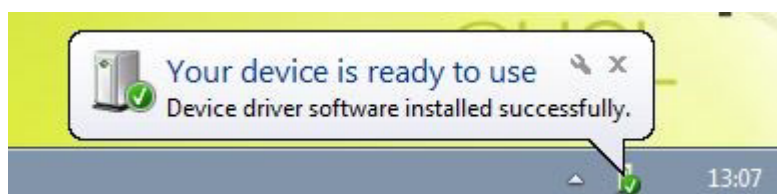
3.3.7. MINI-USB connector

The mini-USB connector has 2 functions

1. Power supply through a wall mounted transformer. This transformer supplies a regulated 5V/1A DC voltage.
2. Measurement transmission. If you connect your M3 to a PC, the PC will detect and install automatically the M3 as a standard USB keyboard with the standard drivers of your operating system (Windows, Mac OS etc..). When you will send the measurement, the value will be written on your PC screen where your cursor is, in the same way as it would have been typed with a keyboard.



Message that appears when the M1/M3 has been correctly installed:



3.3.8. The 24VDC connector (only on inductive and air gage version)

It is advised to use this power supply when the M3 is panel-mounted. Using this power supply instead of the mini-USB will deactivate the ON-OFF switch. Therefore, when the M3 is powered, it will start automatically. This power supply is not available on the Mahr, Marposs compatible devices, and Heidenhain /TTL.



3.3.9. The footswitch connector

This connector is used to connect the Metro footswitch ref 18020. This is a JACK MONO 3.5mm (dry contact)



The footswitch can then be used for several functions: please refer yourself to the chapter 5.4 for further information.

- Transfert the measurement
- Preset
- Start a dynamic measurement
- Zero
- Change the displayed part reference
- Hold (freezes the display) In this case, the button "CLEAR" in the measuring



screen becomes yellow:

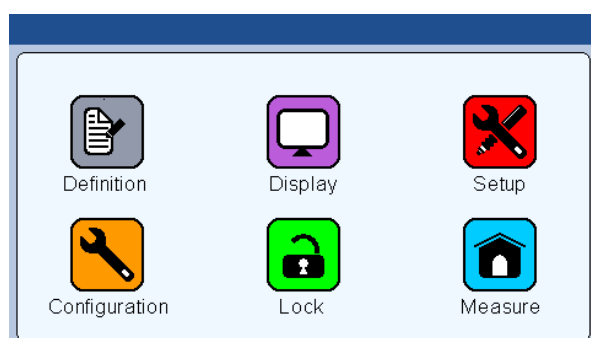
4. GRAPHICAL INTERFACE

The graphical interface of your M3 has been designed to be easy to use and intuitive. This section gives you a preview of the different screens and commands available

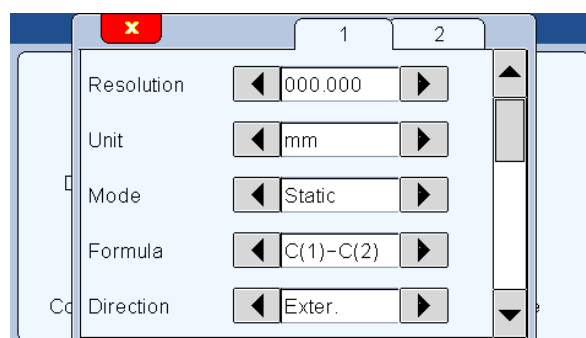
4.1. 2 MAIN PARTS

The graphical interface of your M3 is divided in 2 main parts:

1. A part that allows configuring the device and the measure. It consists of an icon desktop with a few windows.



icon desktop



icon desktop with configuration window

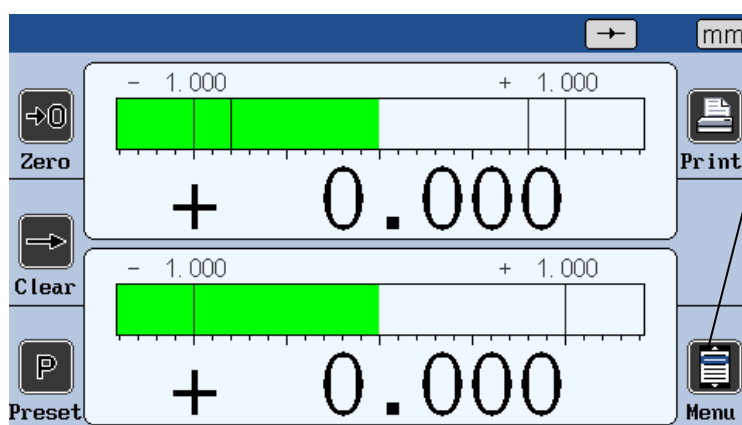


The second part (measuring screen) is called by pressing the **Mesure** button

2. This part allows to see the measurement result and to use them. The M3 starts on this screen. For reaching the configuration screens, press on the



button

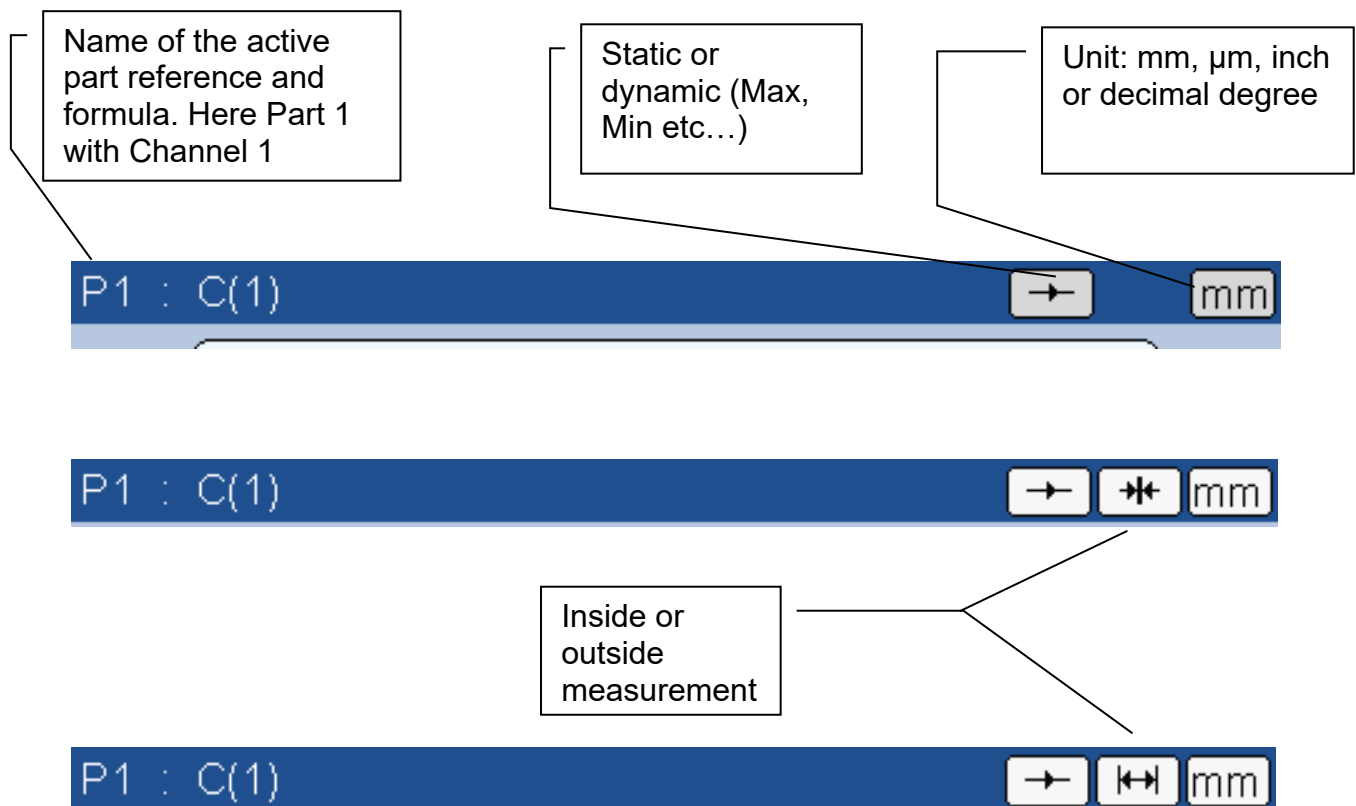


Example of measuring screen

Press on this icon to reach the main icon desktop to configure your device

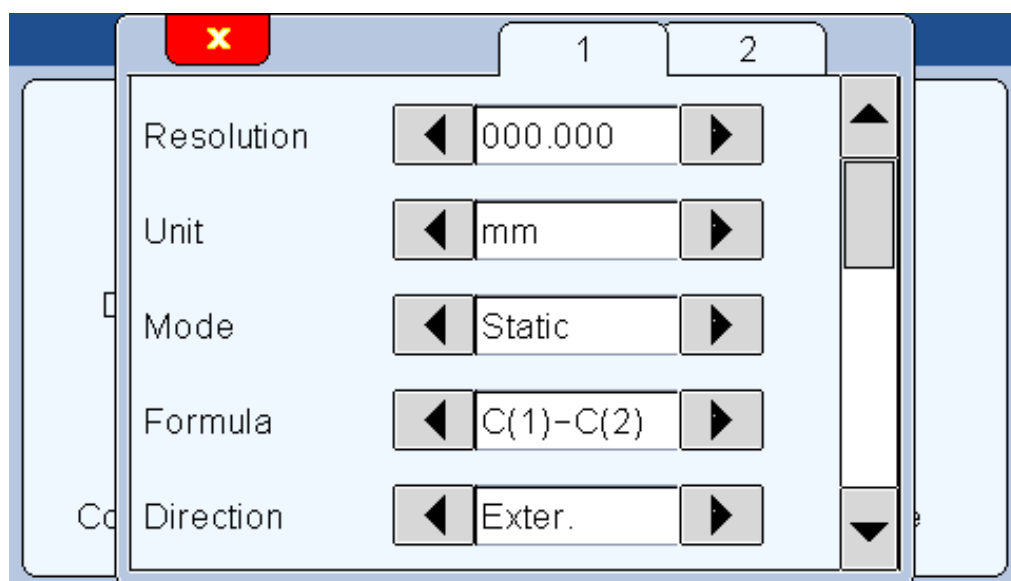
4.2. GENERALITIES

The following information can be seen on the upper part of the screen.



4.3. CONFIGURATION WINDOWS

Configuration windows opens after pressing on the icons of the icon desktop



Example of configuration windows

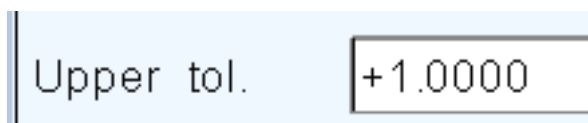
Data are typed by different ways and **are saved after validating while quitting the window.**

Here after are the different ways to input data:

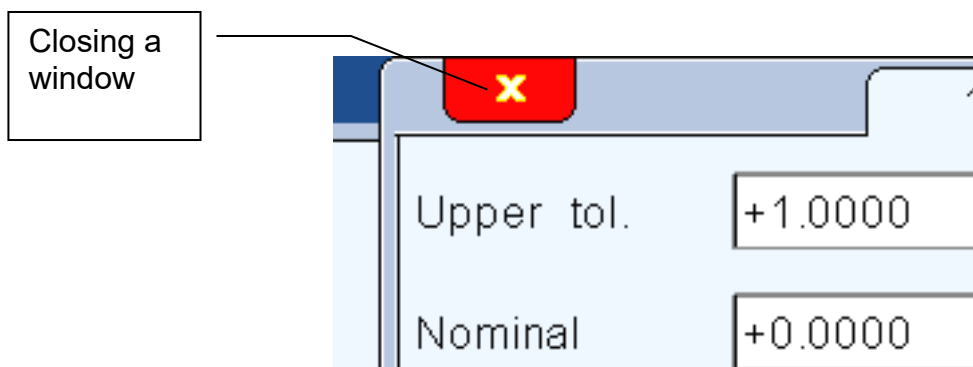
- Multiple selection box. Press on the black arrows to change the pre-defined value.



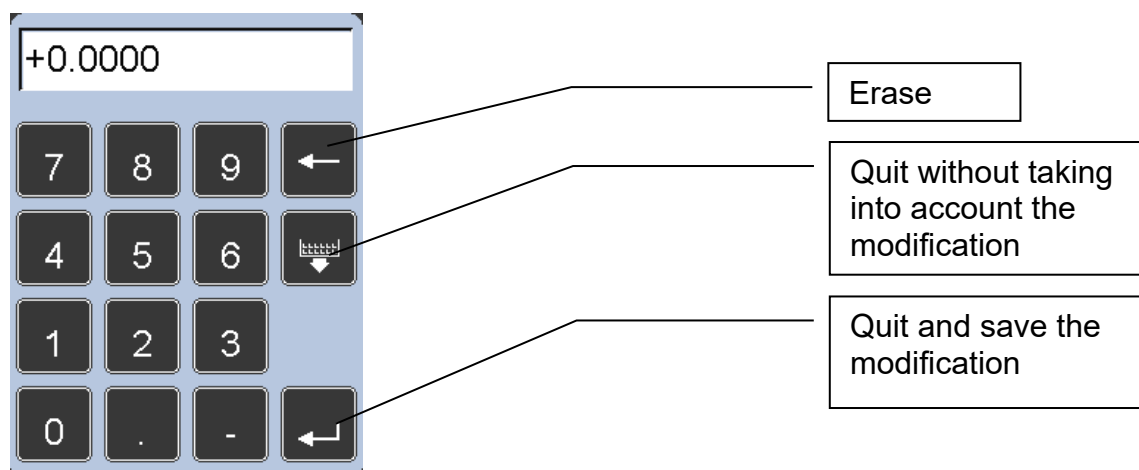
- Edit box. A virtual keyboard appears after clicking on the edit box.



- Closing a window: All the windows can be closed by clicking on the white cross on a red background on the top left corner on each window.



4.4. VIRTUAL KEYBOARD



5. CONFIGURATION OF THE DEVICE AND THE MEASURE

This section describes the different windows that are accessible from the icon desktop.

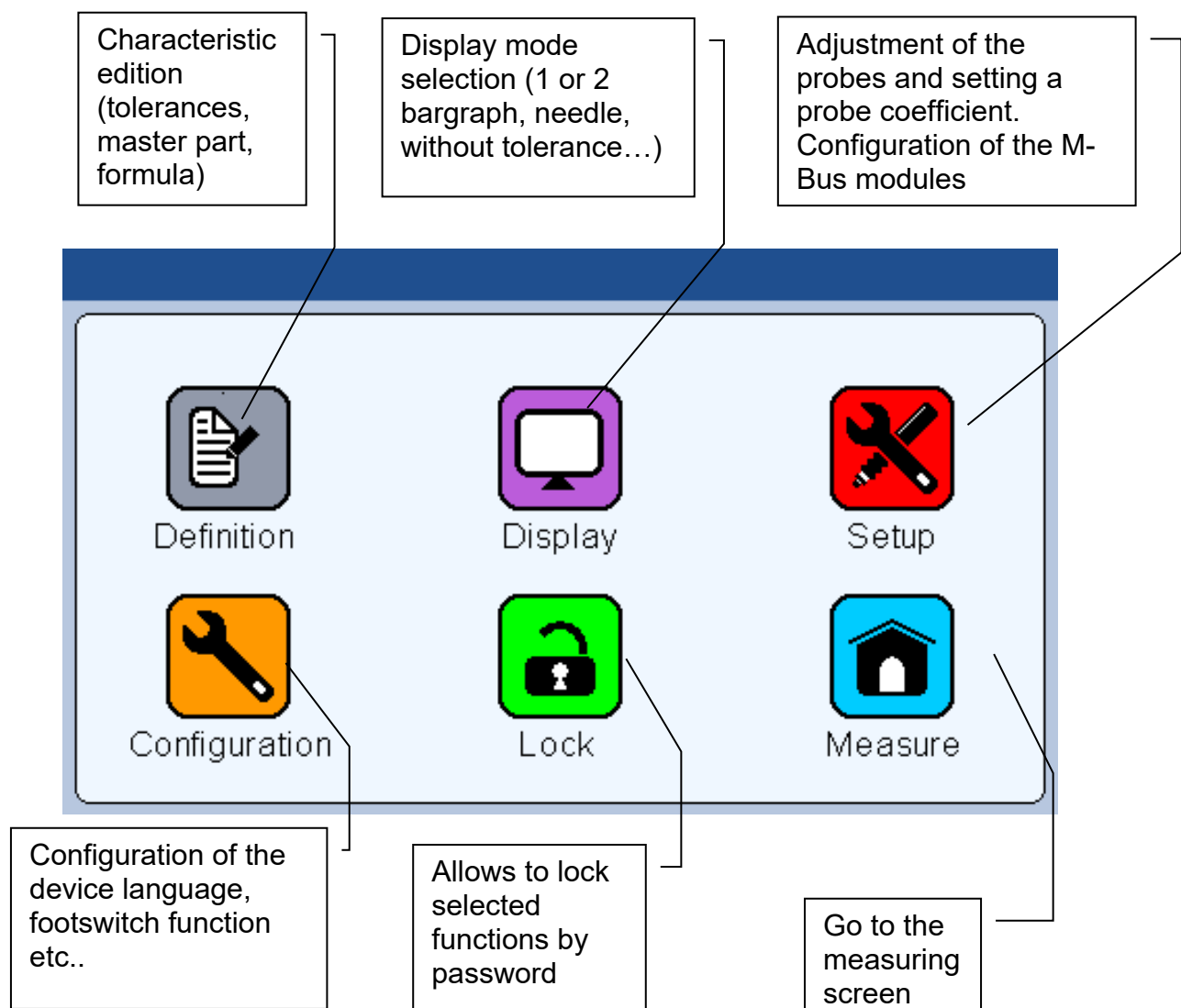
If you are on the measuring screen, you can reach the icon desktop by clicking on the



button.

Your M3 can be entirely configured (language, communication etc...) from this window.

The measure (tolerances, characteristics etc...) is also configured from this window.



The 6 following sections describe the 6 icons of this screen.

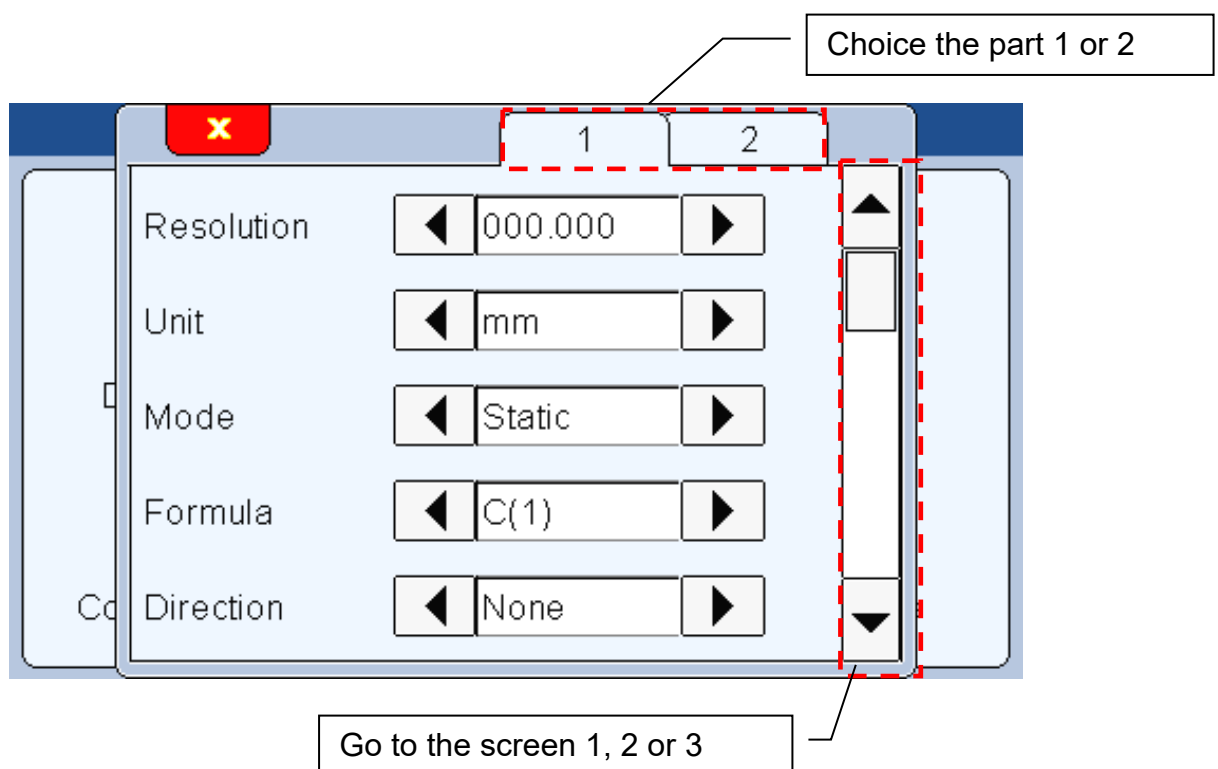
5.1. DEFINITION



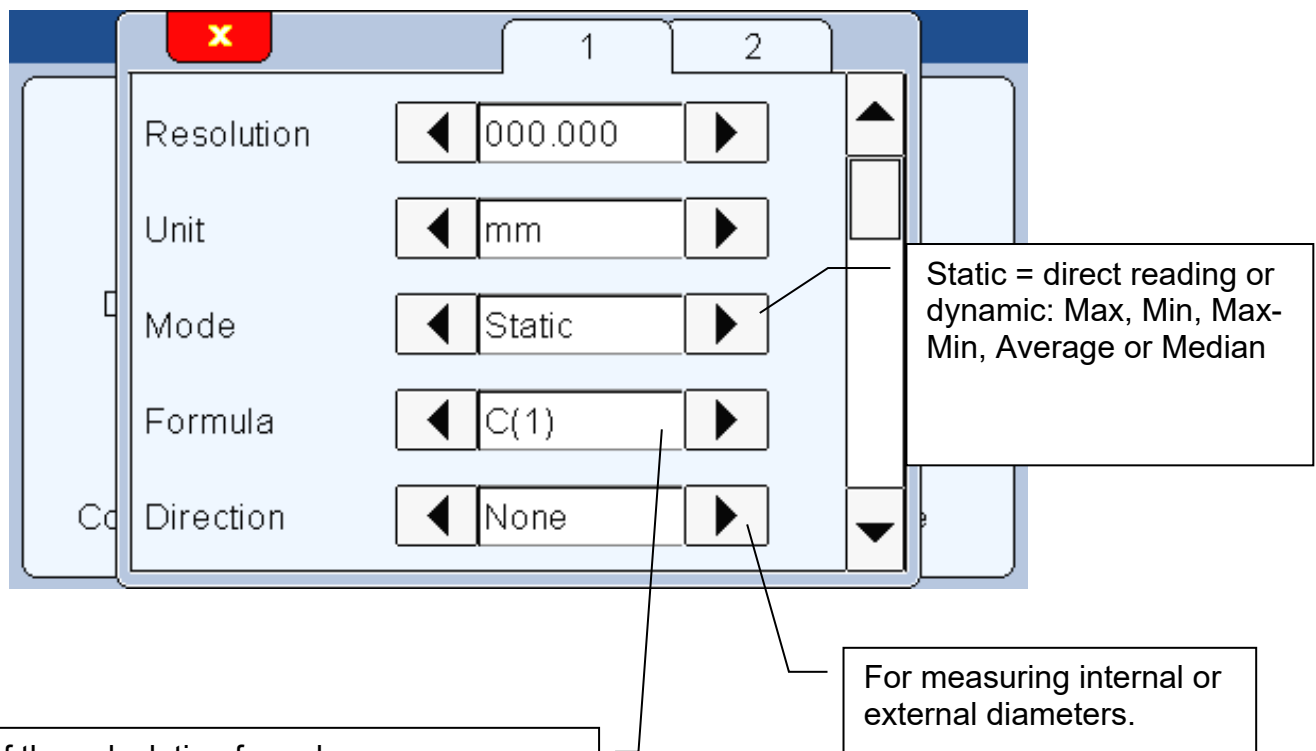
After clicking on this icon, the bellow window appears:

It gives the possibility to define the tolerances, the master, and the nominal value of the characteristic, the resolution of each of the 2 available measurement configurations.

→ This window is divided in 2 parts for the configuration of the 2 measurement configurations.



5.1.1. Part 1



Choice of the calculation formula:

- C(1)
- C(2)
- C(1) + C(2)
- C(1) - C(2)
- -C(1)
- -C(2)
- -C(1)+C(2)
- Cone

« C » means « Channel »

It is possible to give a coefficient for each probe from the menu



Setup

Resolution

000.000 = micron

00.0000 = 0.1 micron

Unit

mm : millimeters

In : inches

Deg = decimal degrees (automatic choice when the formula is set as Taper)

Mode

Static = direct reading: The display is refreshed together with the probe is moving.

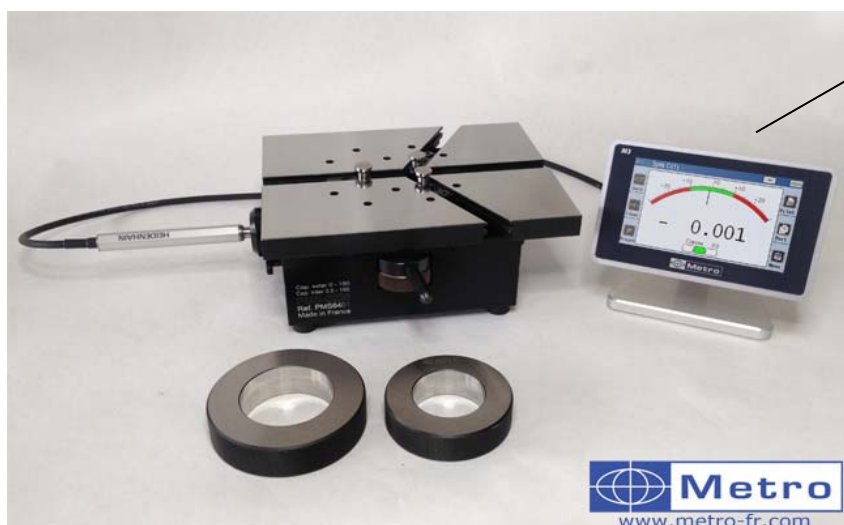
Dynamic : The following mode starts after pressing on the “clear” button of the measuring screen (or through a I/O or footswitch command)

- Max
- Min
- Max-Min
- Average
- Median = $(\text{max} + \text{min}) / 2$

Calcul formula

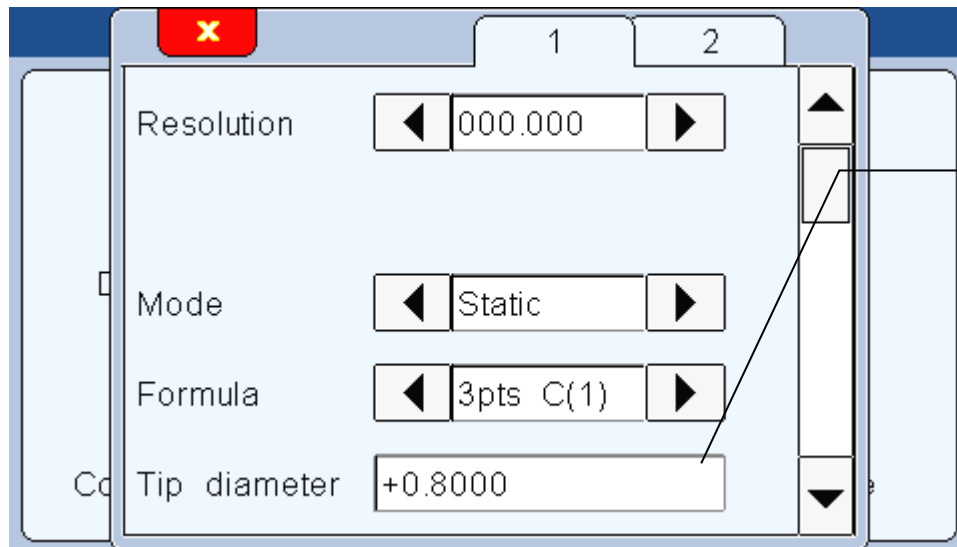
Calcul formula: 3 points (only on the Heidenhain)

This mode allows to measure internal or external diameter of a cylindrical part. The part is blocked on a 3 points table.



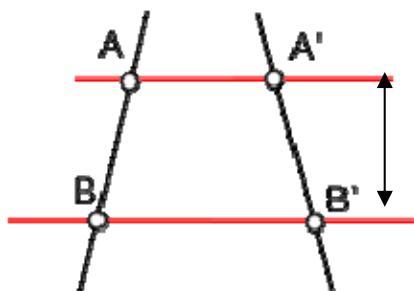
On this table 3 points, 2 points are fixes and the third one moves to constrain the part and measure its diameter

For this kind of measurement, a new option appears: "Tip diameter"

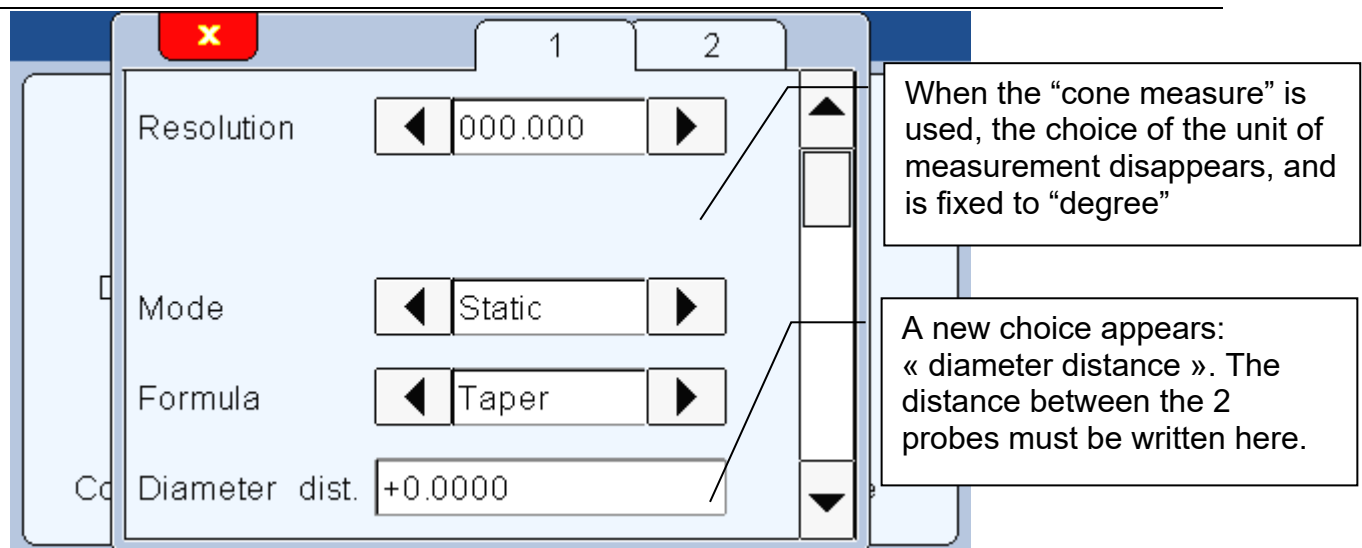


Calcul formula: Cone

This mode is used to calculate an angle of a cone.



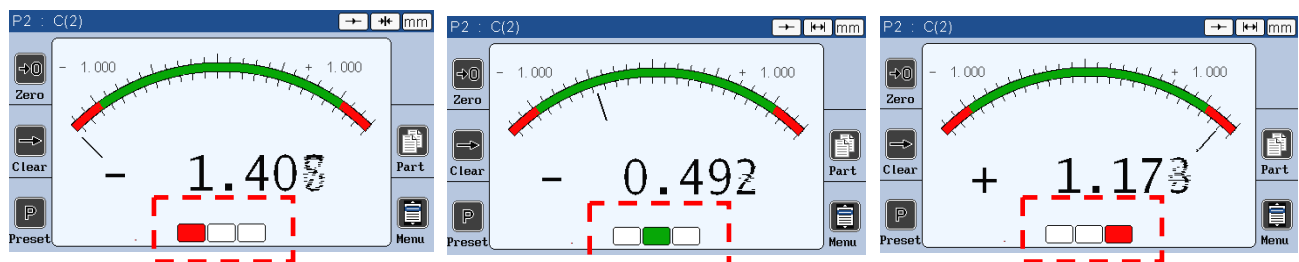
To measure the angle, 2 probes are compulsory, and must be placed to different diameter of the cone. The distance between each diameter has to be entered on the parameters.



Direction of measurement

Direction: none

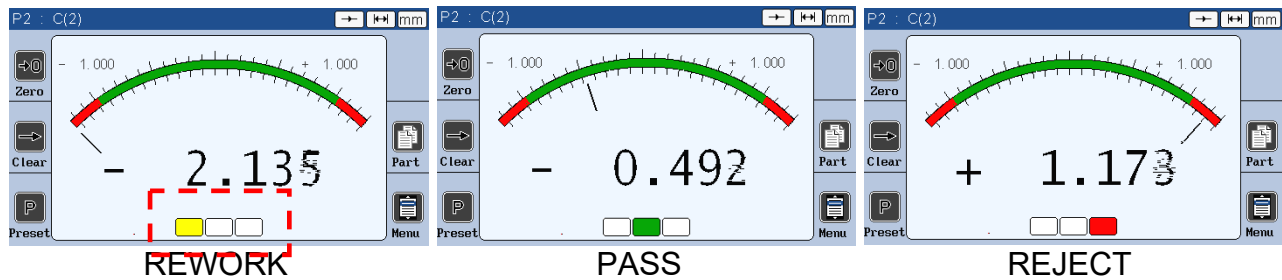
With this direction of measurement, any measure outside of the tolerance limits will appear in red. All the good measure will be in green.



Direction: Internal diameter

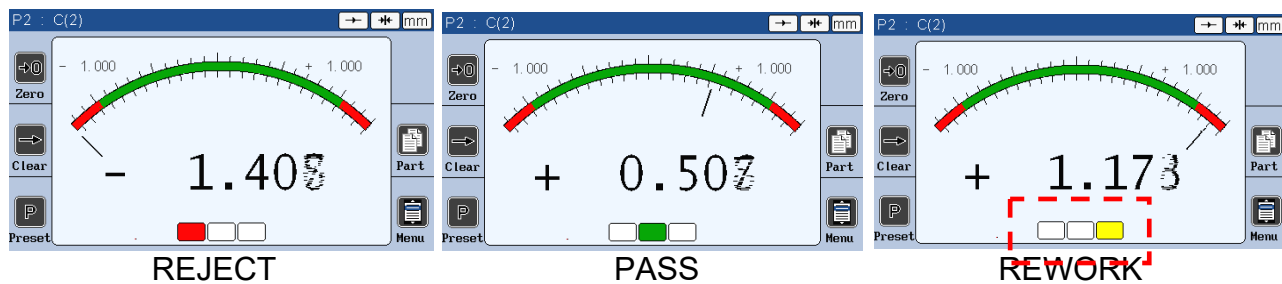
The direction of measurement is used to measure internal or external diameters. The difference between these two modes is that according to the part, the part might still be rework. For example, the size of a bore in a part: if the bore is too big, there is no way to rework the characteristics of the bore to make it fit in the tolerance interval. However, if the bore is too small, it can still be increased, and then the part could fit in the tolerance interval. In this case, the internal diameter is used, as on the pictures below.

On the measuring screen, a yellow indicator shows when the part is too small (so possible to rework), and a red indicator if the part is too big (rejected)



Direction: External diameter

The opposite phenomena happens for the external diameter.



5.1.2. Part 2

This screen allows to set tolerances and the characteristics (nominal and master)

Just press on the corresponding edit box to input the needed values

The tolerances must be set relatively from the nominal value

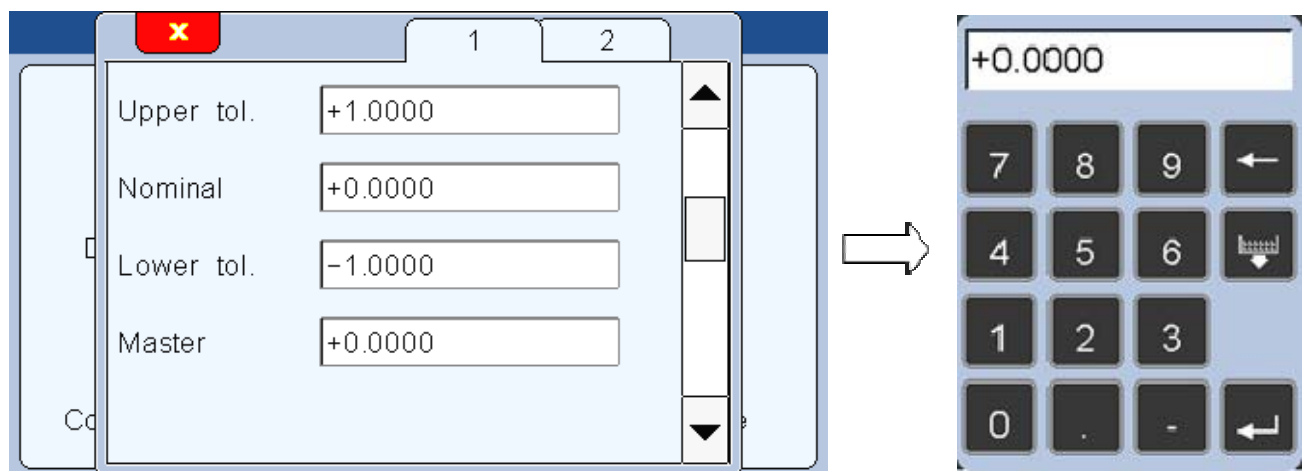
Example : diameter 8mm +/-20μm

→ upper tol : 0.020

→ nominal : 8

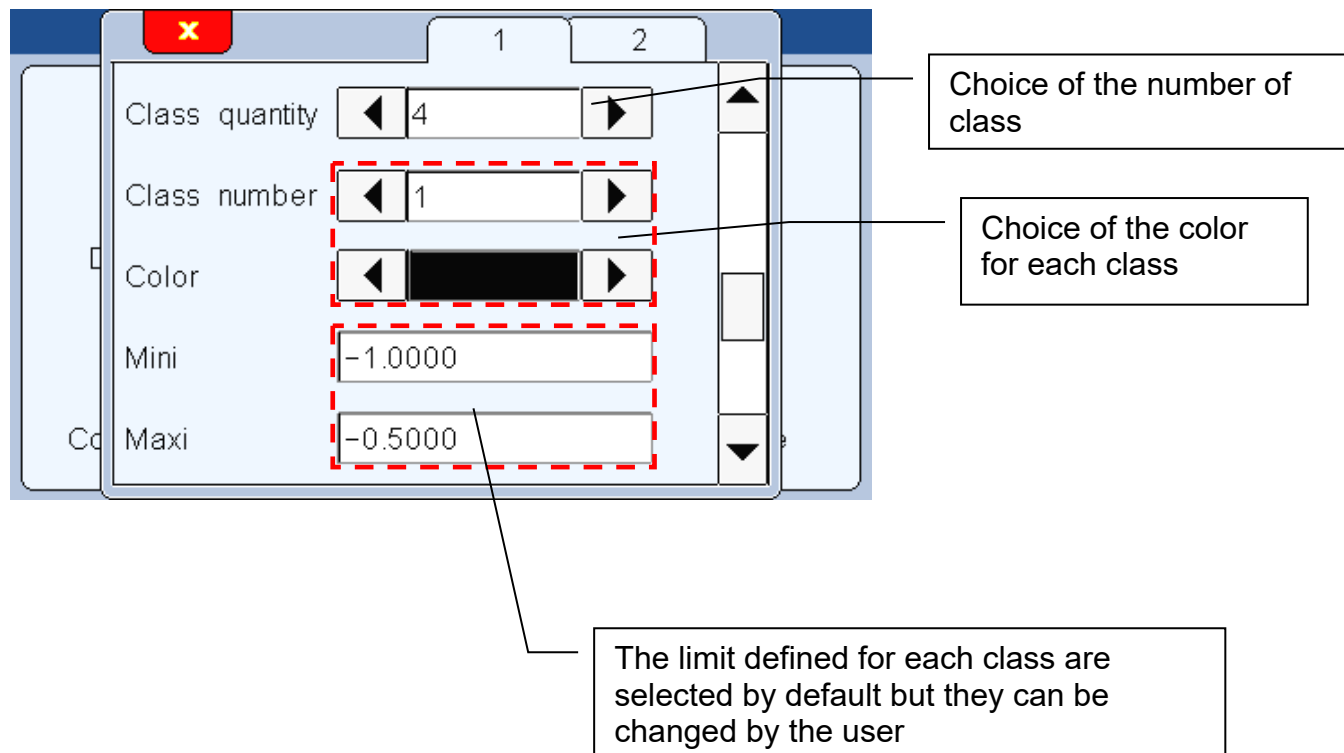
→ lower tol :-0.020

→ master : real value according to the calibration certificate.



5.1.3. Part 3, class

This screen allows to set up a sorting of the part according to their size. Up to 16 class can be programmed



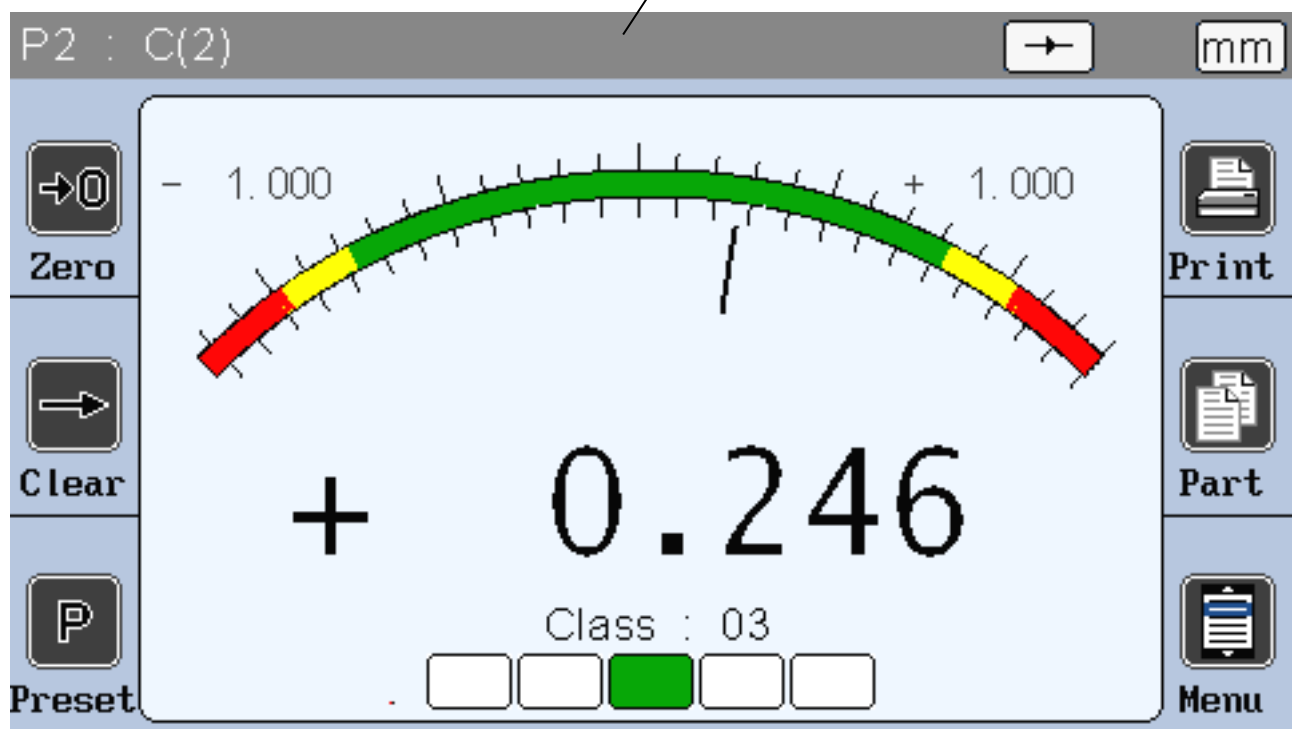
The class has an important utility, because it allows the user to sort the parts according to their position in the tolerance interval. The top bar of the display, which is normally blue is grey on the picture bellow, because grey is the color which was defined for this interval of measurement. Thanks to the color code, the user can easily sort the parts according to the color of the display.

The screenshot shows the Metro M3 setup screen with two tabs, 1 and 2. Tab 1 is active. The screen displays the following parameters:

- Class quantity: 4
- Class number: 3
- Color: Grey (indicated by a grey bar)
- Mini: +0.0000
- Maxi: +0.5000

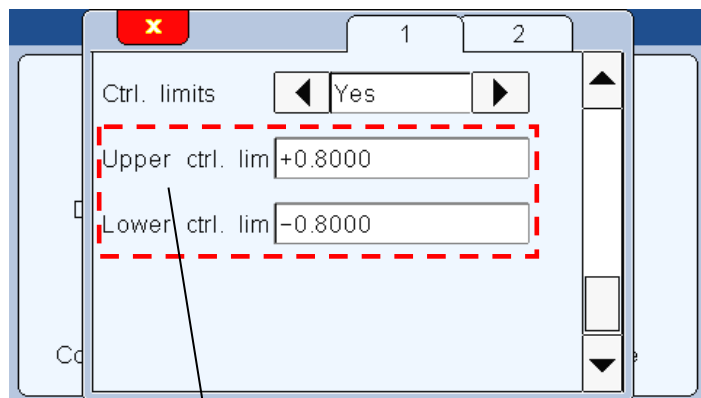
A red 'X' icon is visible in the top left corner of the setup window. A line points from the 'Color' parameter to the main display screen below.

Grey color because of the class parameters.



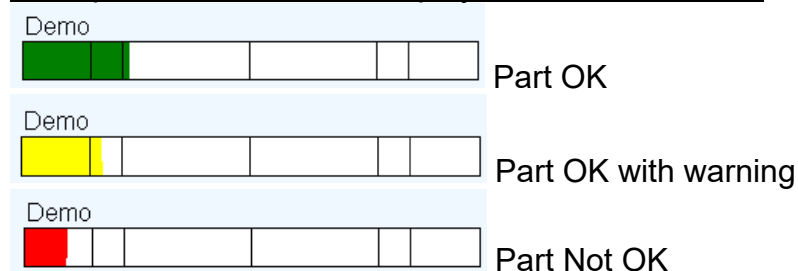
5.1.4. Part 4, control limit

This screen allows to display or not the control limits (warnings) and to define them. Control limits are warnings that inform the user if the measure becomes too close to the tolerances limits. (Yellow colour on the bargraph)



This part is hidden if « no » has been selected

Example of characteristic displayed with control limits

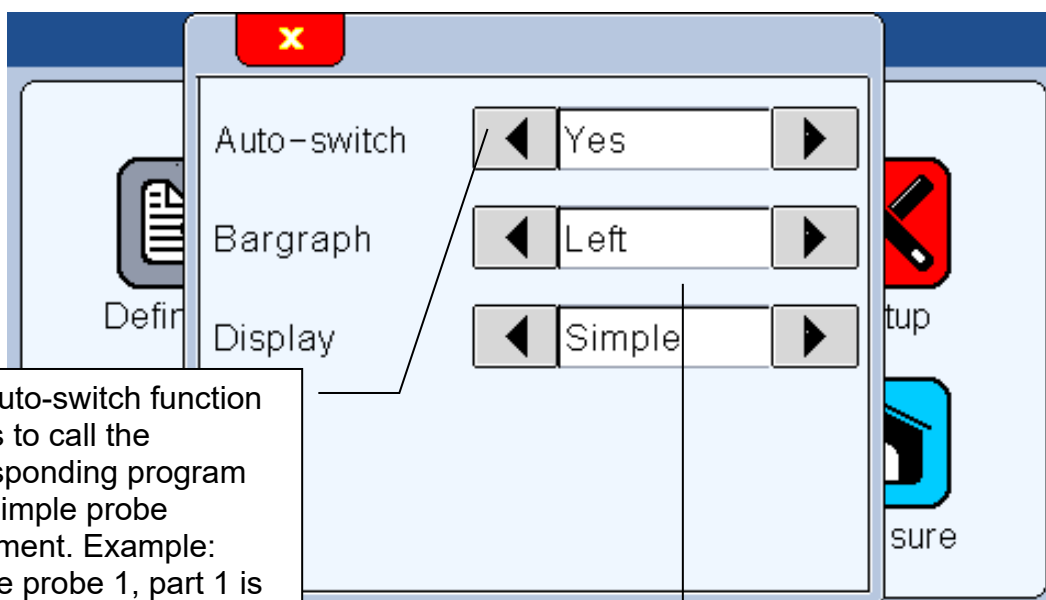


5.2. DISPLAY



After clicking on this button, the below window appears.

This window allows to define if 1 or 2 measure are displayed on the screen and on which format (needle = galva, horizontal bargraph or value only).



The auto-switch function allows to call the corresponding program by a simple probe movement. Example:

- Move probe 1, part 1 is displayed.
- Move probe 2, part 2 is displayed.

Left : simple and double

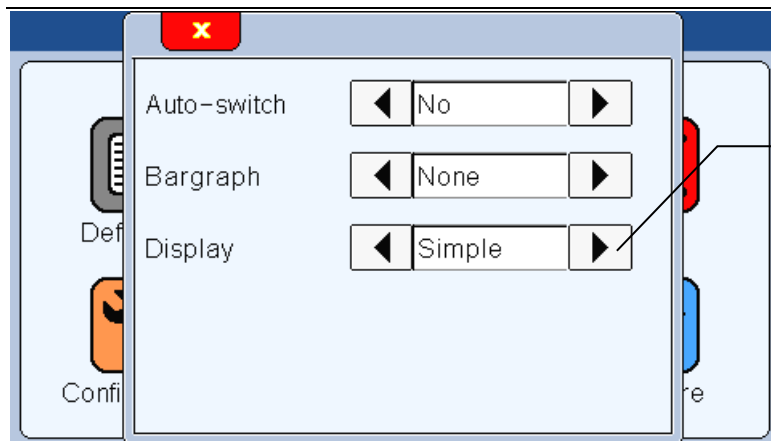


Galva :

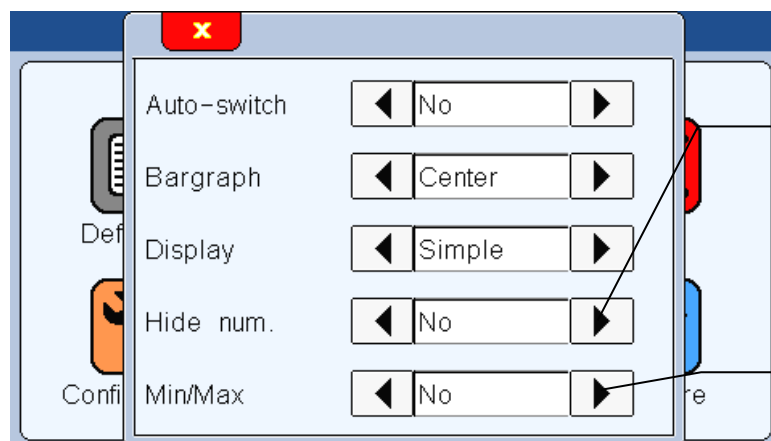


None : simple and double



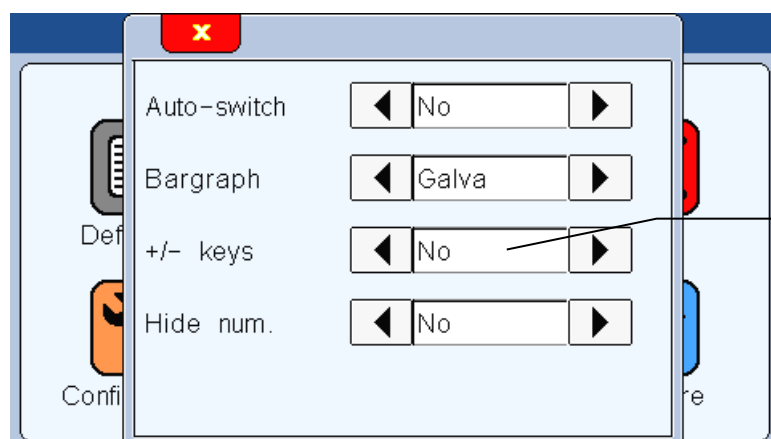
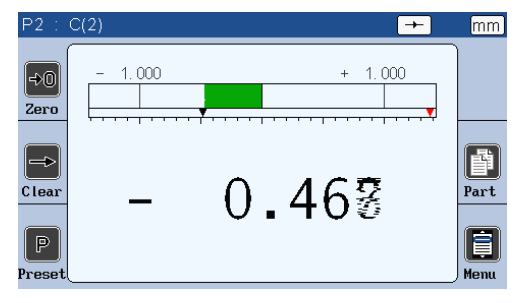
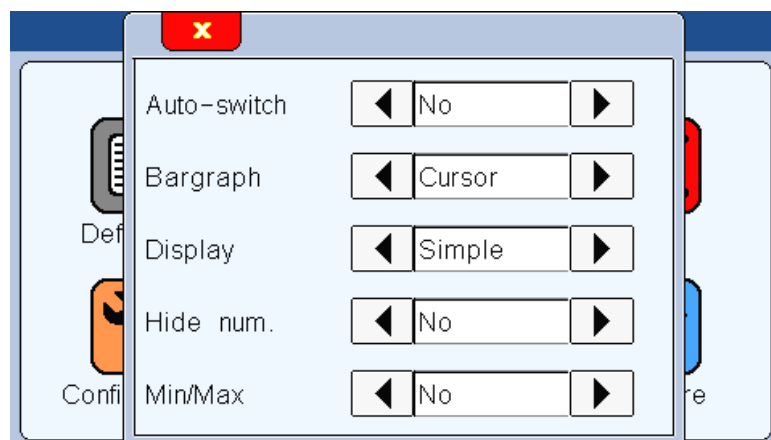


Allows to display 2 probe on the measuring screen (except in GALVA mode)



Allows to remove the value of the measurement on the measuring screen, only the bargraph appears.

Displays small indicators (triangles) on the measuring screen to show the maximum and minimum value measured



Allows to move the needle like with the screw on an old analogue display.

5.3. SETUP



After clicking on this button, the below window appears (for an inductive probe)

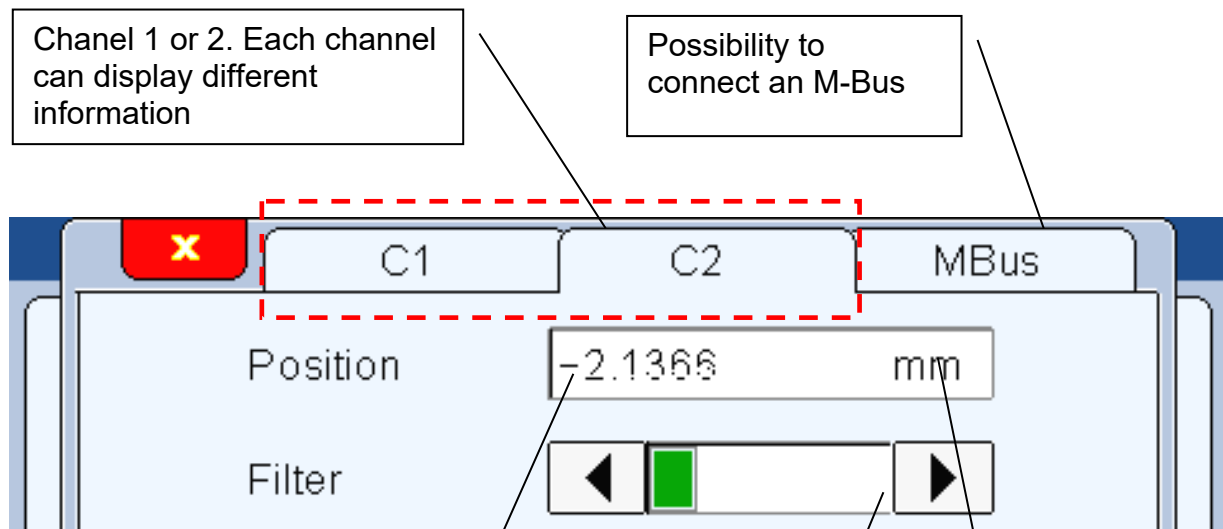
The Setup window for an inductive probe displays the following settings:

Parameter	Value	Unit
Position	-2.1366	mm
Filter	Slider control (green bar)	
Coefficient	+1.0000	

On this screen, some information are normalized for all the probes, and some other are specialized for each type of probe.

5.3.1. Generalities

The following screen is displayed whatever your probe is. The different options are:



Channel 1 or 2. Each channel can display different information

Possibility to connect an M-Bus

Allows to know the electrical position of the probe in order to adjust it on its fixture.
It is recommended to adjust the inductive probes close to their « electrical zero »

Allows to slow down the refresh frequency of the display (**running average**). It can be useful to limit the blinking of the last digit, and for runout measurement on large parts.

The unit of measurement is always displayed here, but it can change depending on the probe.

In addition to this general information, some more options are displayed and depends on the concerned probe.

5.3.2. Inductive probe

The following information are focused on inductive probes.

Position: +0.0087 mm

Filter: [Slider with green bar]

Coefficient: +1.0000

It is recommended to adjust the inductive probes close to their « electrical zero »

Allow to affect a coefficient to the measured value of the probe.

5.3.3. Heidenhain probe (11 μ A or Vcc)

The following information are focused on Heidenhain probes.

Position: +0.0010 mm

Coefficient: +1.0000

Refmark: [Dropdown menu with 'Oui' selected]

Pas: 20

Interpolation: [Slider with '20' selected]

An indicator inside the probe allow to re-calibrate by its own at the half of the measuring range when this option is activated

Interpolation, see the description bellow

Step, see the description bellow

In the case of Heidenhain (11µA or 1Vpp) probes, 3 additional lines appear:

Ref Mark, Step and interpolation. You have to set the correct value for having a correct measurement.

- The step defines the grating period of the probe's glass scale. The different values are defined on the following table :

Type of probe	Step
Specto (ST) 12 or 30	20 µm
Metro (MT) 12XX or 25XX	2 µm
Metro (MT) 60 or 101	10 µm
Certo (CT)	2 µm

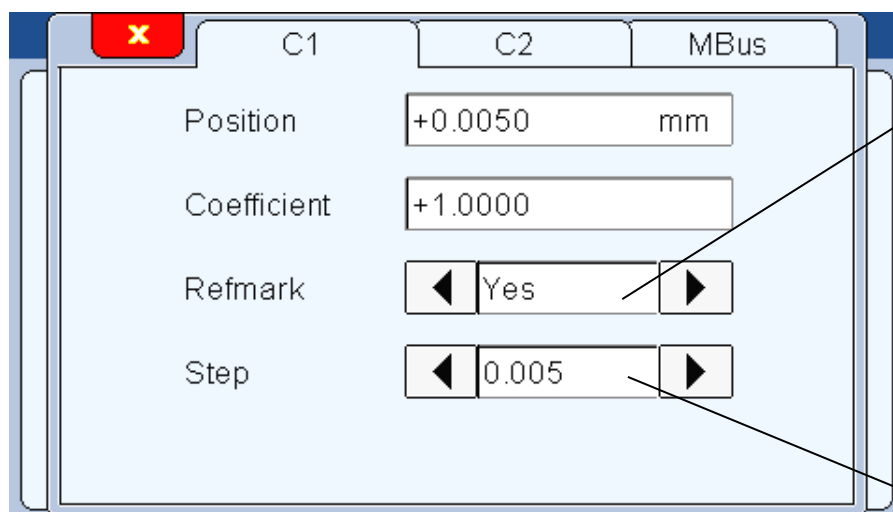
- The interpolation defines the division rate of the glass scale, and therefore the measurement precision :

Example for a probe type Heidenhain Specto ST12 :

The glass scale of this probe is engraved with a step of 20µm, therefore if the interpolation is set at 200, you will have a resolution of $20/200 = 1/10$ µm.

5.3.4. TTL probe with Heindehain pinout

The following information are focused on TTL probes (or Magnescale or Mitutoyo)



An indicator inside the probe allow to re-calibrate by its own at the half of the measuring range when this option is activated

Step, resolution

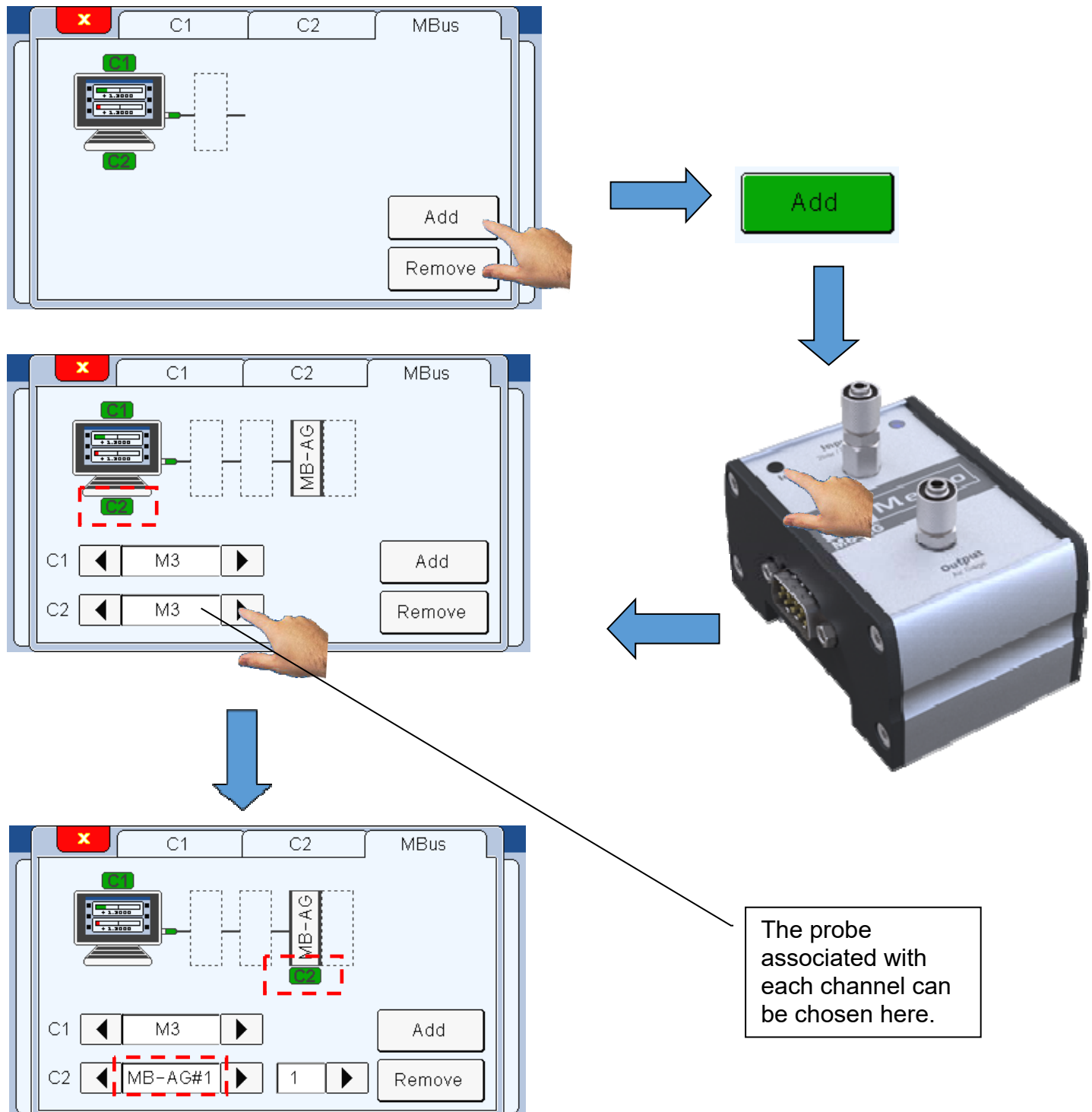
5.3.5. M-Bus modules

External M-Bus modules can be connected to the M3 thanks to the following screen. It allows to mix 2 different probes on the same display with the multiplexer modules, or to use inside/outside modules.

Multiplexer modules

The same process is made to connect all the multiplexer modules

Example M3 inductive with MB-AG module (for air gage) on the channel 2.



After being connected, A Multiplexer module must be configured from the C1 or C2 pages of the setup menu (according to the channel with witch the probe is linked). Please refer to the example for each probe, chapter 5.3 to 5.3.6 for air gage.



MB-2S module,
Heidenhain



MB-2T module,
TTL



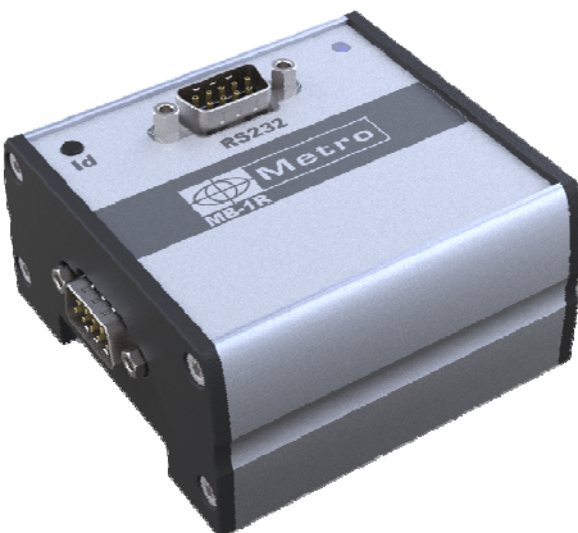
MB-AG Module
Air Gage



MB-8I Module
Inductif



MB-4D Module
Port Mitutoyo

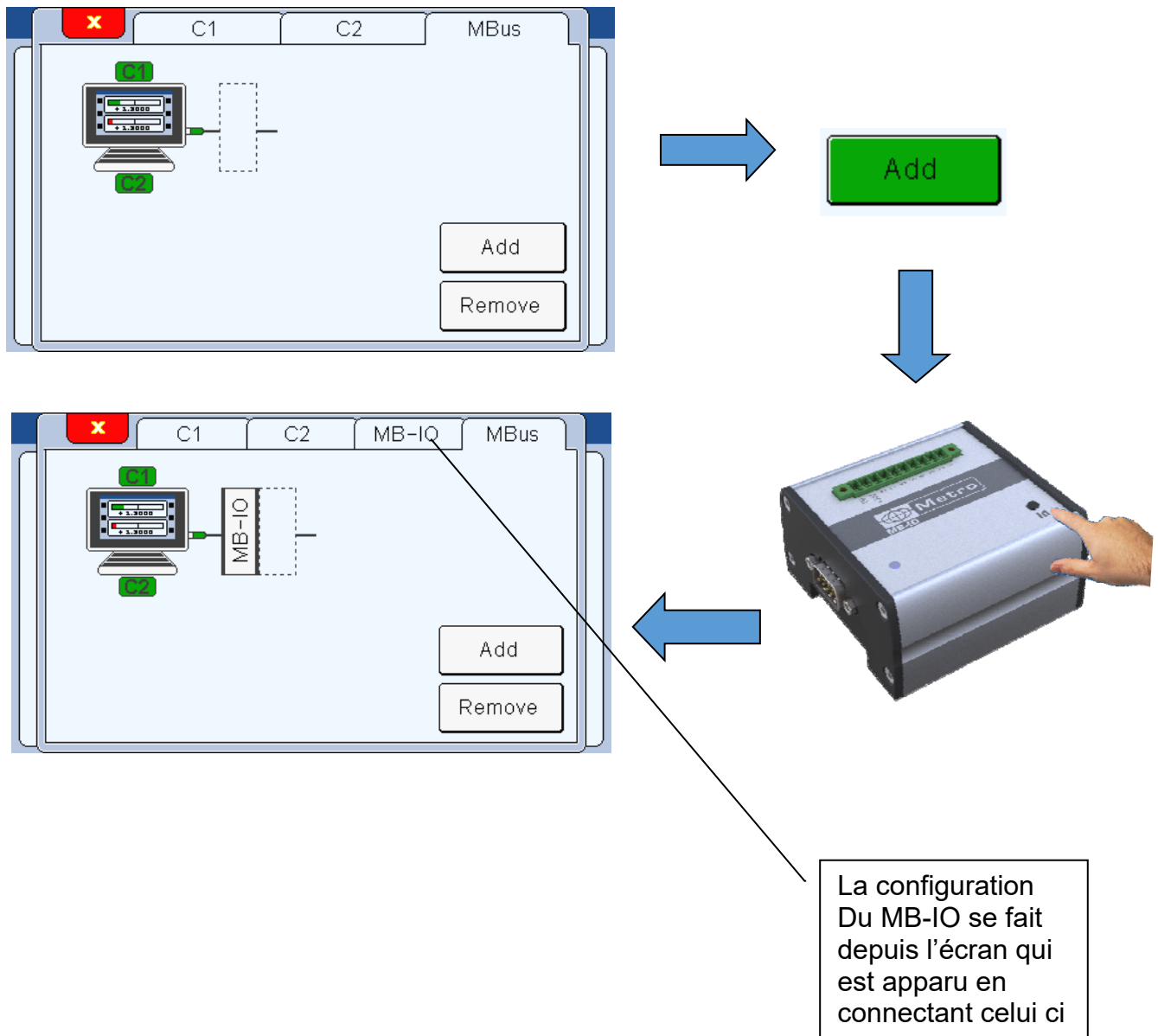


MB-1R Module
Port RS232

Input/output modules (see also chap. 10)

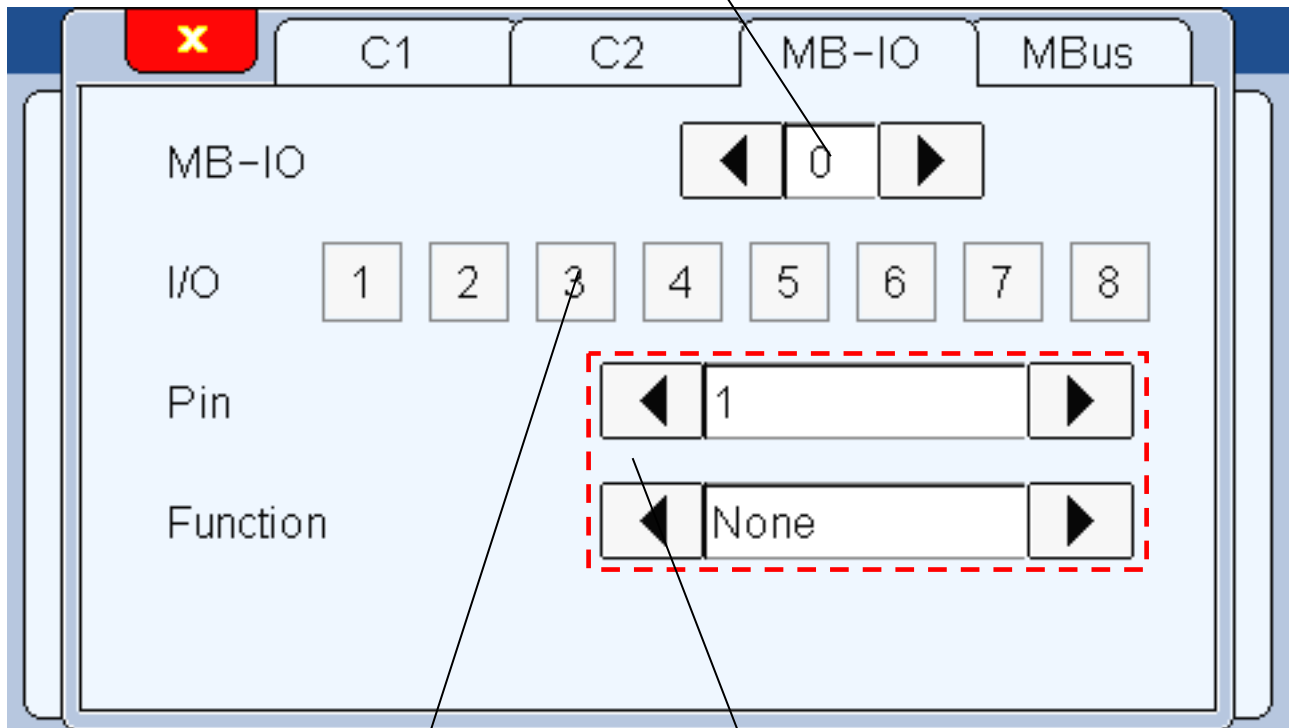
The connection of an input/output module is made with the same way than a multiplexer

Example: connection of a MB-IO module on the inductive M3.



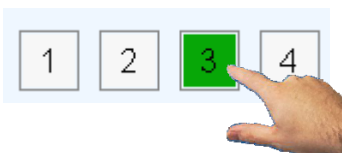
The different options for the MB-IO configuration are displayed bellow.

The number of the MB-IO is written here and can be changed if more than one is connected



These buttons are used to output a 24VDC signal on specific port of the MB-IO to check the installation.

At the opposite, if you input a 24VDC on a terminal, the corresponding button becomes green.



The function of each port of the MB-IO can be set with this 2 menus. The first one is for the number of the Pin, the second one defines the associated function

The different functions available for the MB-IO are listed below:

- Transfer : (Input) Transfer the measure to the computer (need a USB or RS232 link)
- Preset : (Input) set the current measured value to the master value
- Zero : (Input) set the current measured value to 0 (relative mode)

-
- Clear : (Input) reset the 0 mode (come back to absolute mode)
 - Init dyn : (Input) start a dynamic measure
 - Characteristic status : (output) output a signal if the characteristics are ok
 - Ctrl limit - : (output) output a signal if the part is in the lower control limit
 - Ctrl limit + : (output) output a signal if the part is in the upper control limit
 - - No Go : (output) output a signal if the part is out of the lower tolerance limit
 - + No Go : (output) output a signal if the part is out of the upper tolerance limit
 - Part status: (output) output a signal if the whole part (the 2 probes) respects the tolerance limit.
 - Class : (output) output a signal if the part is in the selected class
 - Hold: (Input) freeze the screen to display the previous measure as long as the input signal stay.
 - Characteristic : (output) changes the displayed screen in the measuring screen

5.3.6. Air gage MB-AG module

The following information are focused on air gage modules and probes.

After being connected and linked to a channel thanks to the MBus menu (channel 1 in the example bellow), the probe must be parametrized. To make it, the corresponding channel screen must be check.

The air gage's probe menu needs a calibration before doing the measurement.



Air gage
(MB-AG)
module

X C1 C2 MBus

Position **bar**

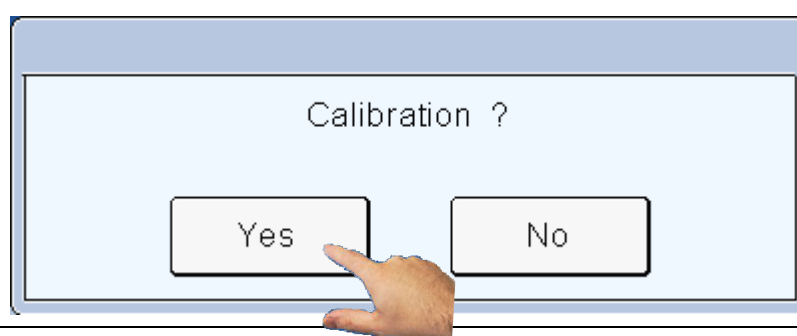
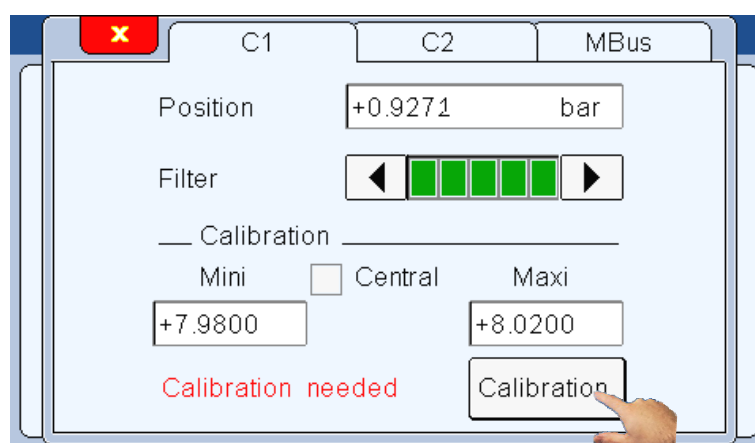
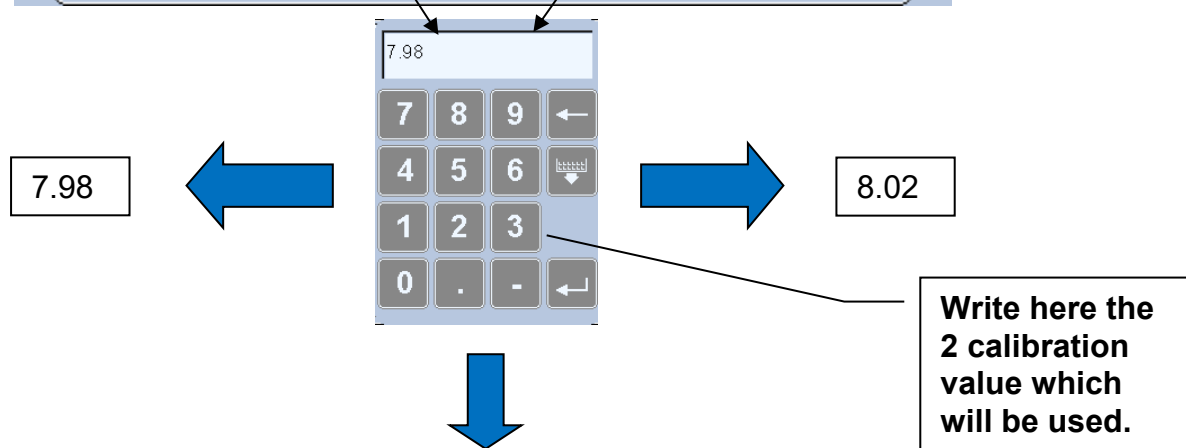
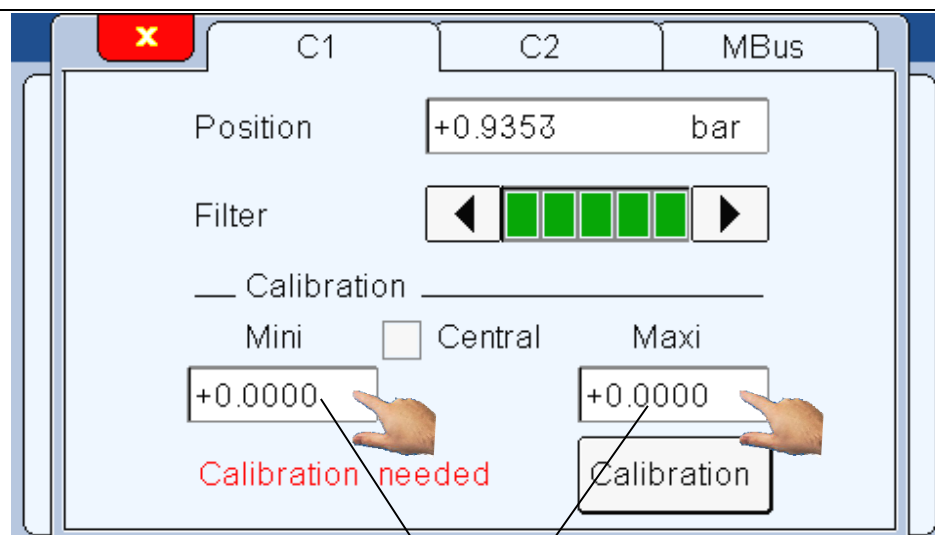
Filter

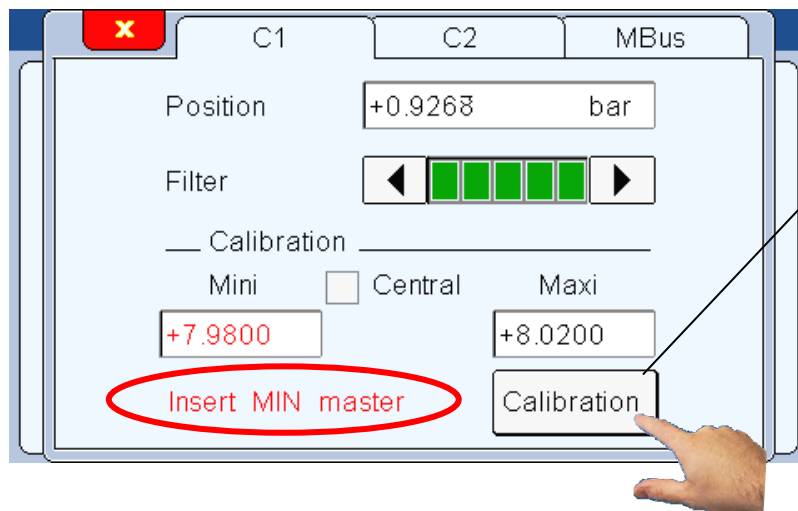
___ Calibration ___

Mini Central ☐ Maxi

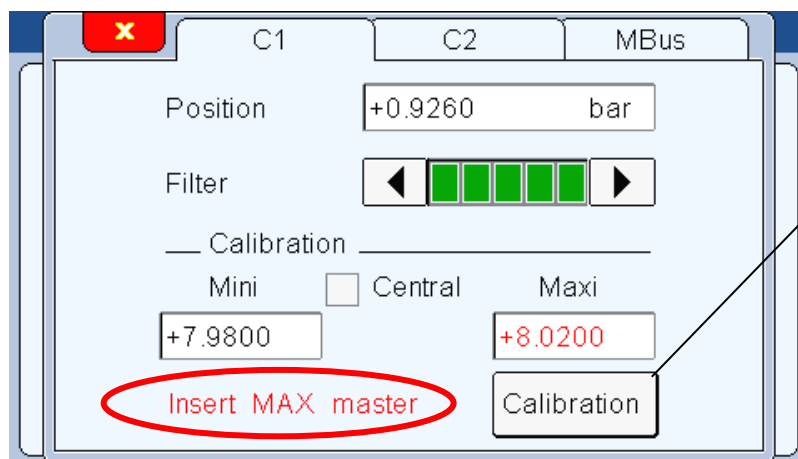
Calibration needed

Must be
calibrated

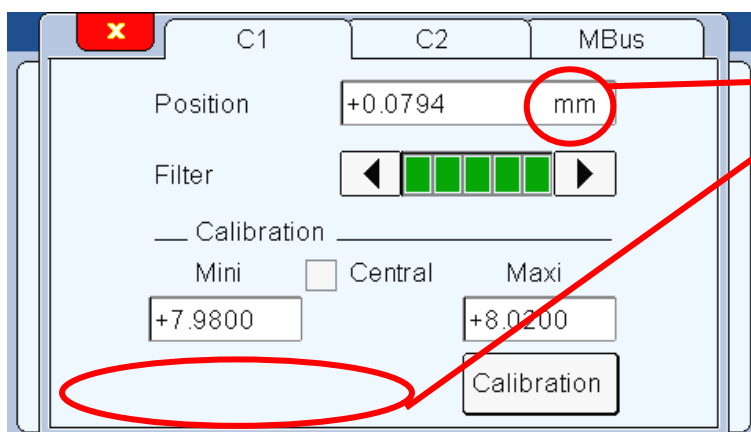




After placing the min master, push « calibration »

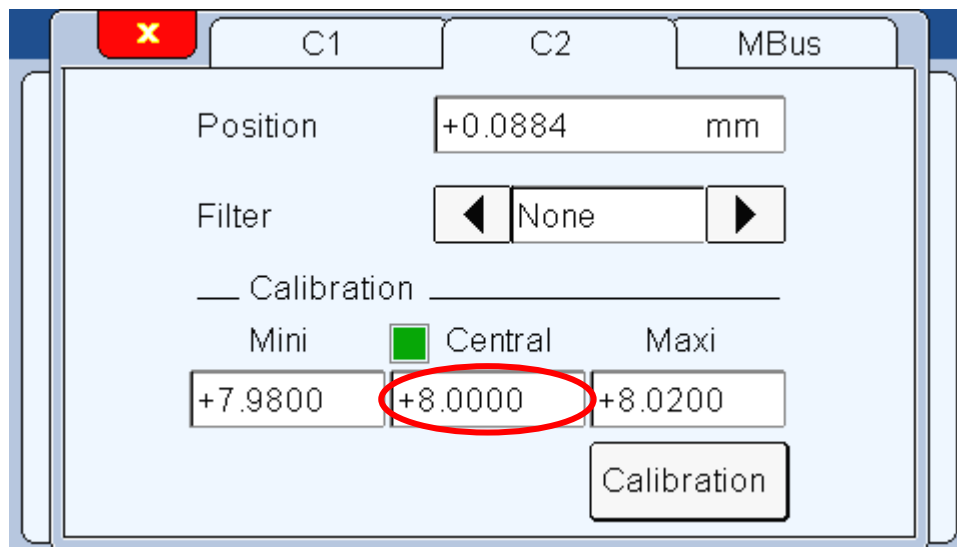


The same manipulation is done here, but with the max master, and the final push on « calibration »



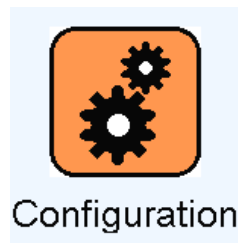
The probe is now calibrated

There is also the possibility to use 3 points to calibrate the measure. When the button “central” is selected, a third master point is asked. The calibration process stay the same, with one manipulation added.

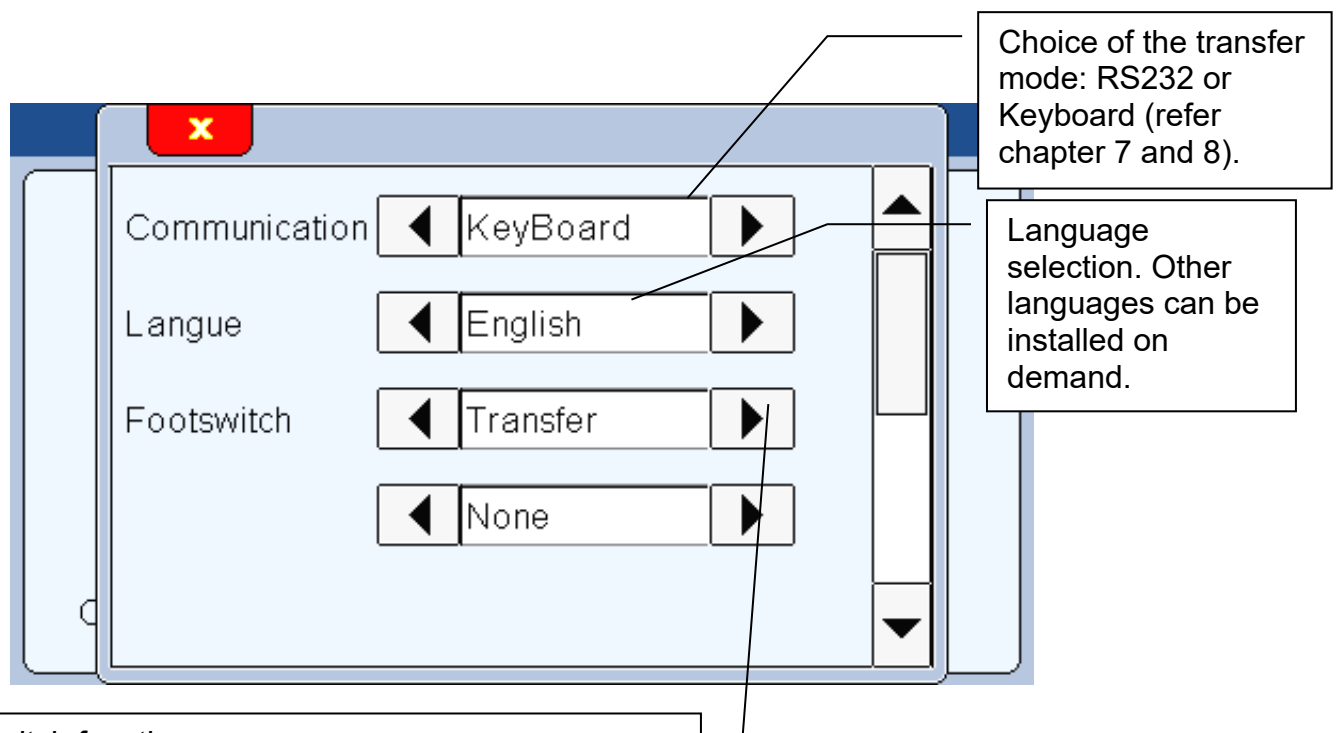


When the Module is linked to the M3, a diode on the module lights itself in violet. When the module/probe is calibrated, the diode becomes blue.

5.4. CONFIGURATION

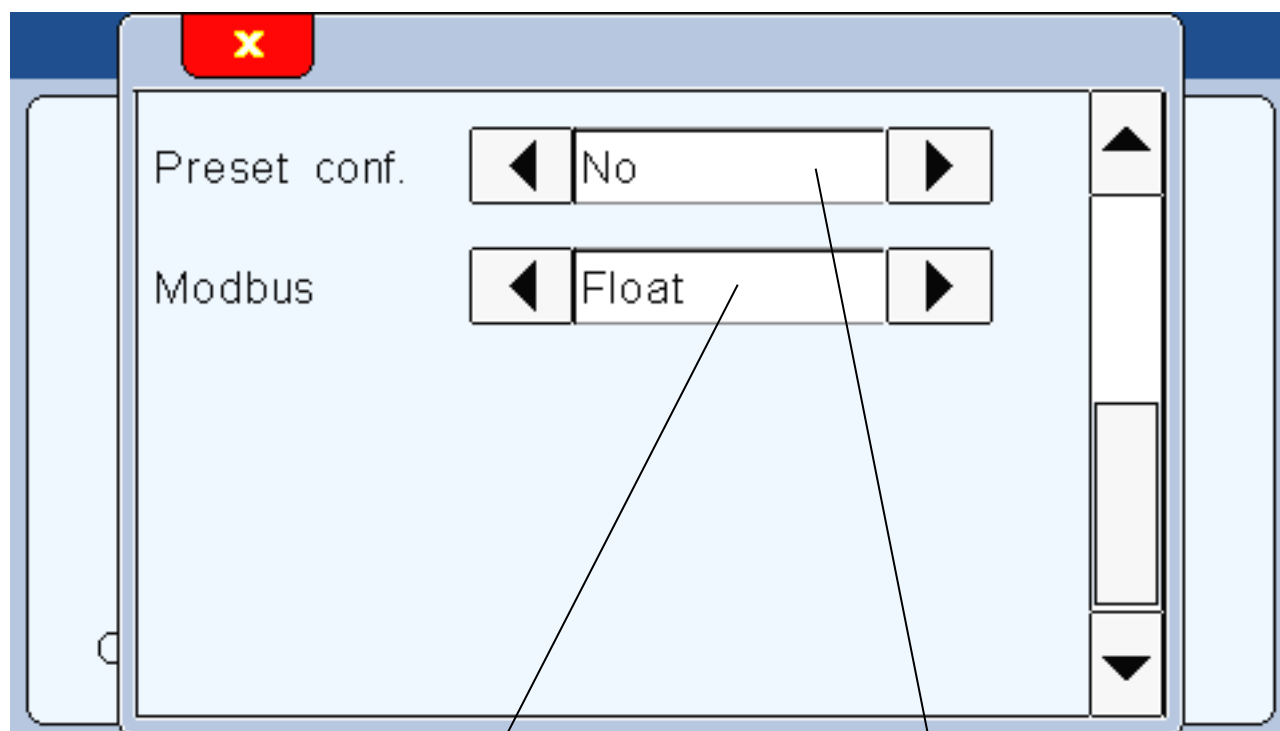
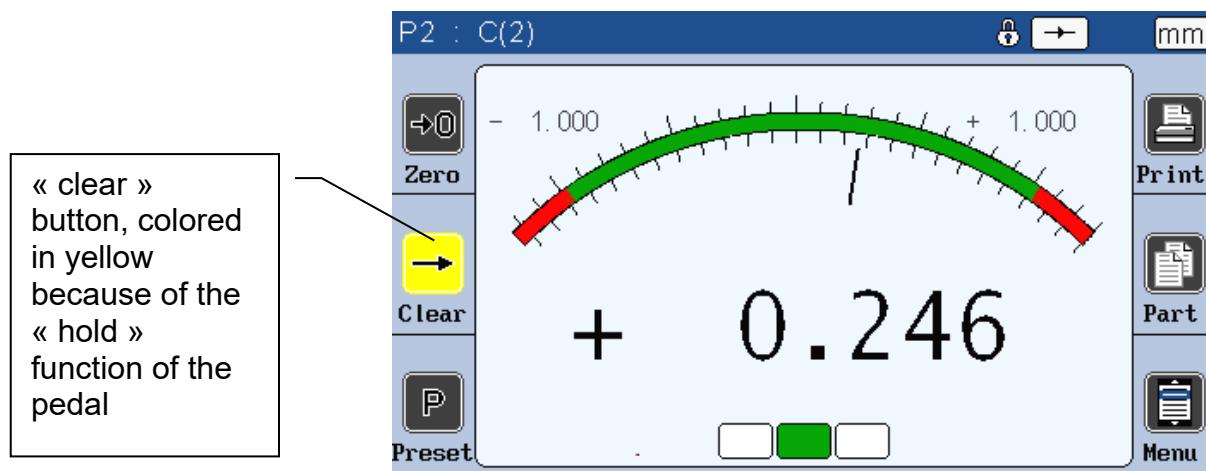


After clicking on this button, the below window appears. This window allows configuring the communication settings of your M3



The communication modes are detailed chapter 7 and 8

The “clear” icon is yellow while the hold function is activated:



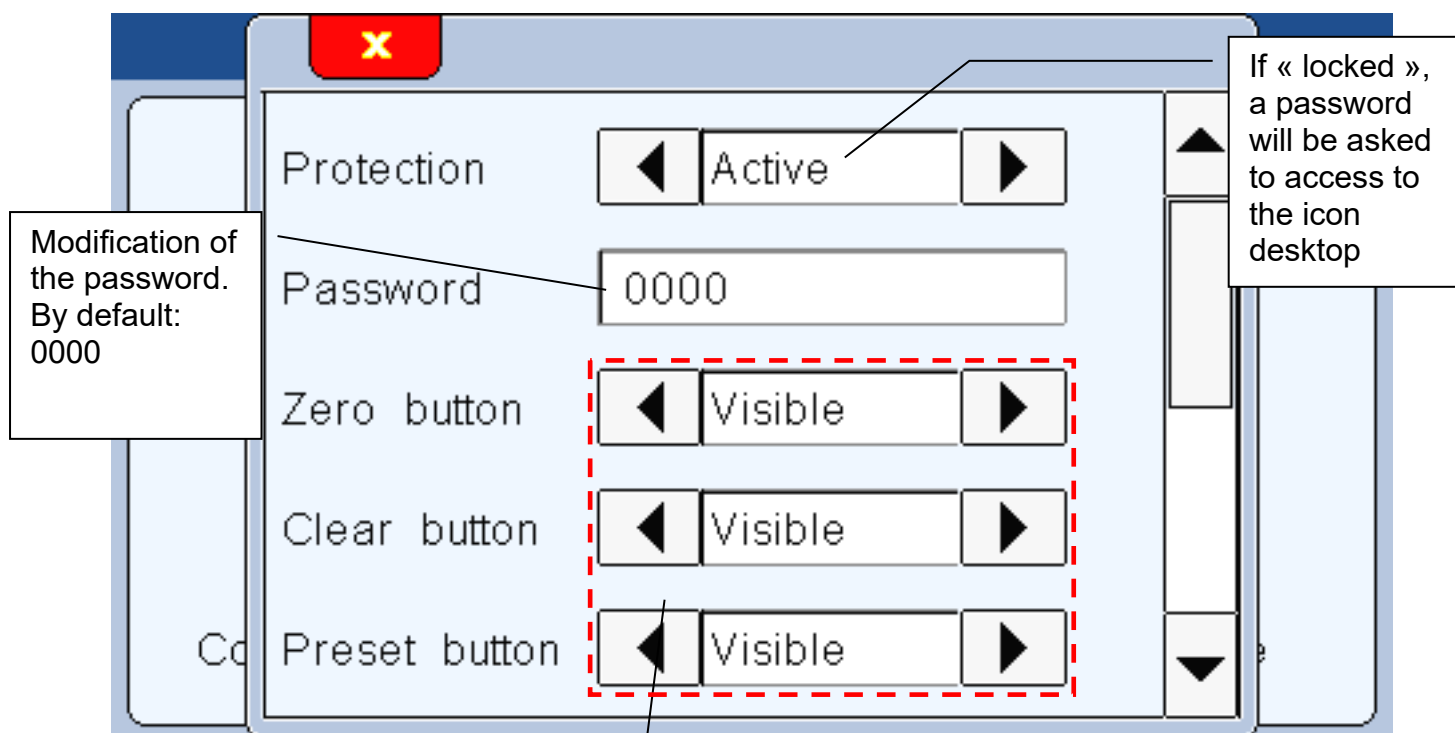
Defines the register format for the MODBUS RTU protocol. Float, or integer.

Ask a confirmation of preset when the preset is done from the measuring screen

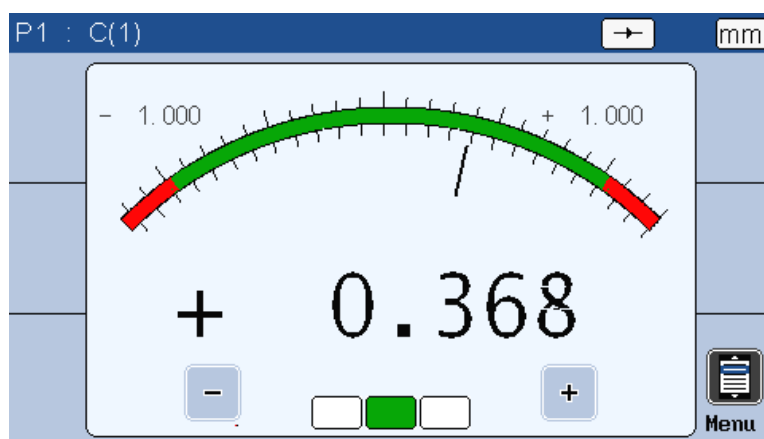
5.5. LOCKING



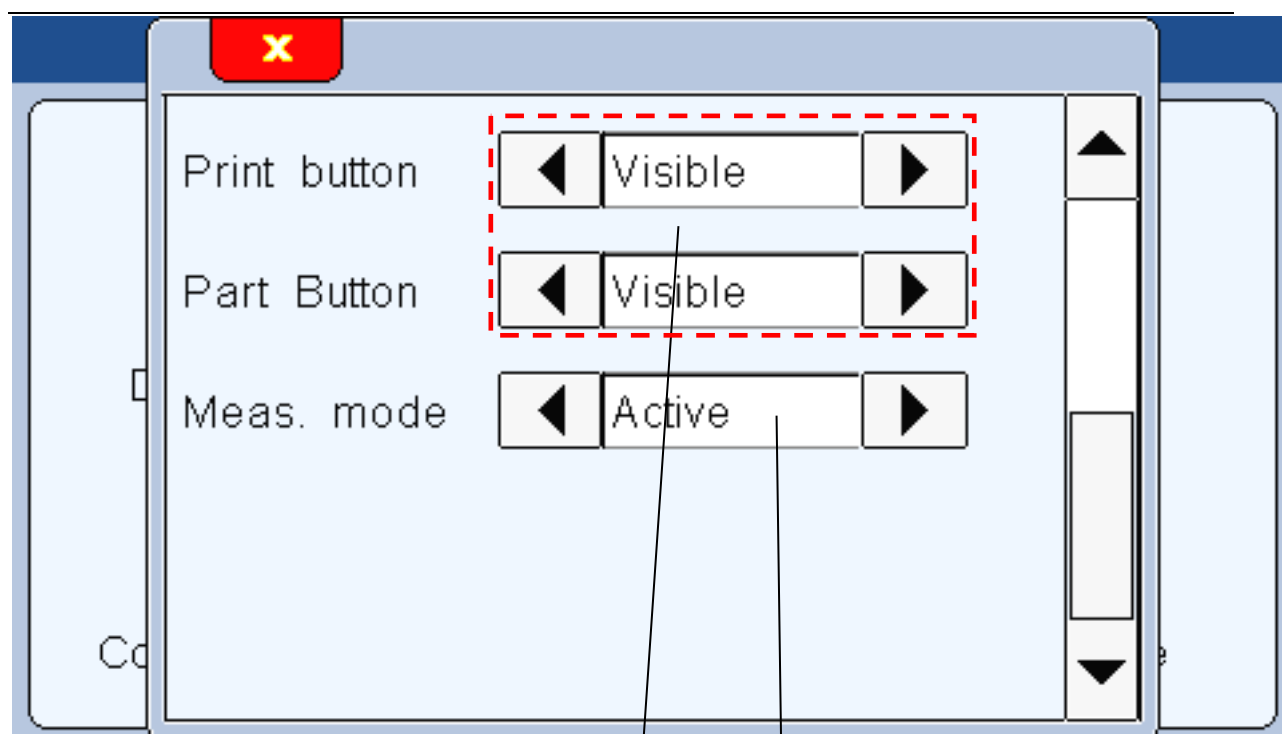
After clicking on this button, the below window appears.
This screen allows to lock by password some functions of the M3



Allows to remove the corresponding buttons from the measuring screen. It is recommended to remove the button to make the interface as easy as possible for the user



Example of a measuring screen without all the buttons.



Allows to remove the corresponding buttons from the measuring screen.

Allows to lock the measuring mode (maxi, mini, maxi-mini, average...)



5.6. MEASURE



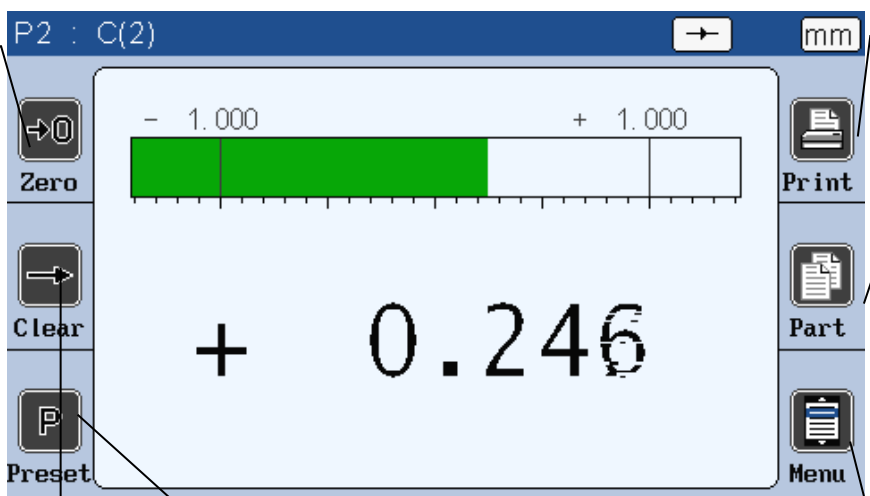
After clicking on this button, the measuring screen appears.
Please read the chapter 6 for the presentation of the measuring screen.

6. MEASURING SCREEN

The M3 starts on this screen.

The measuring screen allows seeing the characteristics of the part that has to be controlled. A needle/bargraph indicator allows seeing the characteristic in function of the tolerance of the part (see chap. 4.1 for tolerances modification).

6.1. LATERAL BUTTON FUNCTIONS




The screenshot shows the M3 measuring screen with the following elements:

- Top Bar:** Displays "P2 : C(2)" and a unit "mm".
- Central Display:** Shows a bargraph with a green bar and a numerical value "+ 0.246". Tolerance limits "- 1.000" and "+ 1.000" are also shown.
- Left Side Buttons:**
 - Zero:** A button with a red square icon containing a white "→0".
 - Clear:** A button with a green square icon containing a white right-pointing arrow.
 - Preset:** A button with a black square icon containing a white "P".
- Right Side Buttons:**
 - Print:** A button with a printer icon.
 - Part:** A button with a document icon.
 - Menu:** A button with a list icon.

Callout boxes provide detailed functions for these buttons:

- Absolute or relative mode (allows to make a « zéro » at a defined position. If the relative mode is selected, the button become red)** (points to the Zero button).
- To come back to the absolute mode, press on the « Preset » button** (points to the Preset button).
- Start dynamic measurement (Min, Max...) clear the zero function**
This icon can become yellow in case of a hold function (refer to 3.3.9, the footswitch connector) (points to the Zero button).
- Calibration/Preset. After pressing this button, the displayed value will take the master value. It is possible to ask a confirmation windows from the menu "LOCK".** (points to the Preset button).
- Measurement transfert (RS232 or USB)** (points to the Print button).
- Change manually the active part (part 1 or part 2)** (points to the Part button).
- Go to the icon desktop** (points to the Menu button).

When they are pushed, the button becomes green for one second:



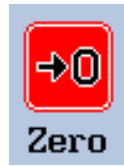
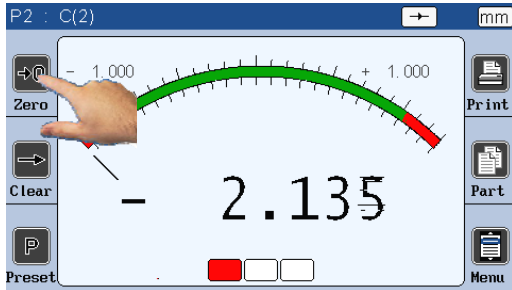
When they are pushed, the button becomes green for one second:

Zero :

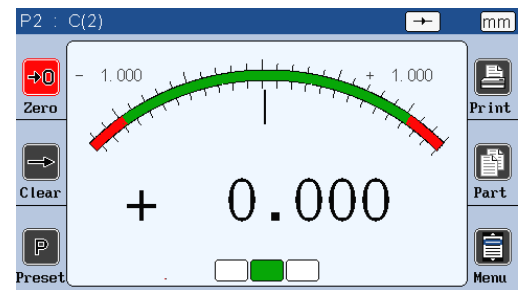


Zero

This button is used to set the current measured value to 0, it's the relative mode



Zero

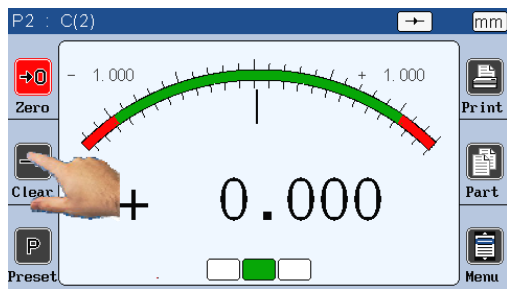


Clear :

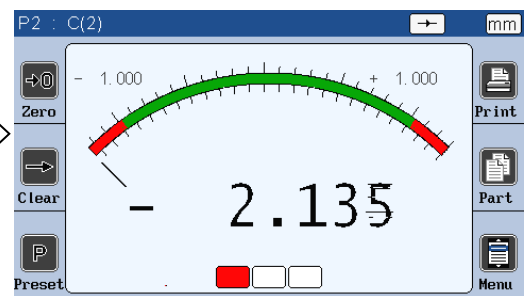


Clear

This button allows to cancel the zero button, and to switch again to absolute mode



Clear

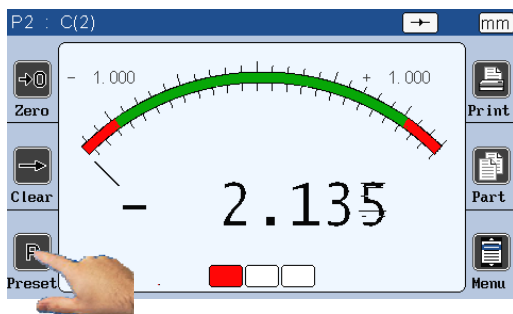


Preset :



Preset

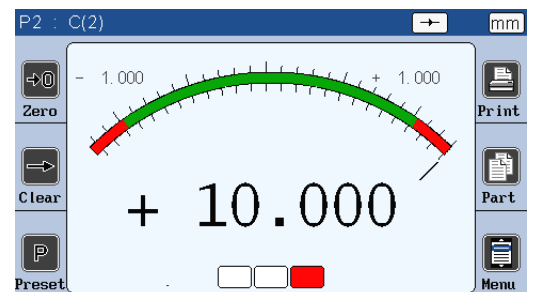
This button allows to set the current measure value to the master value



Preset

Master

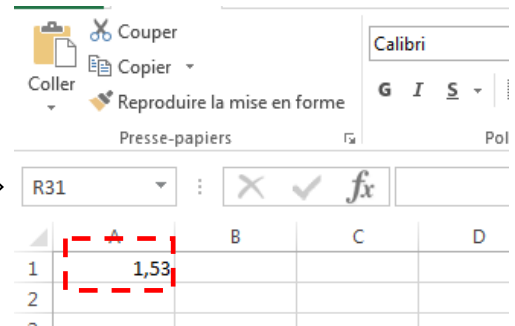
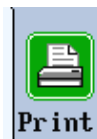
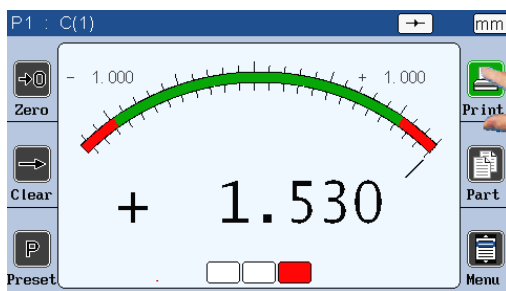
+10.0000



Print ;



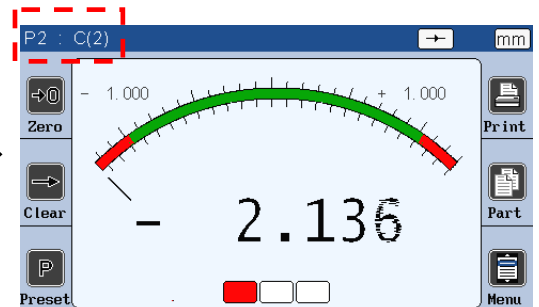
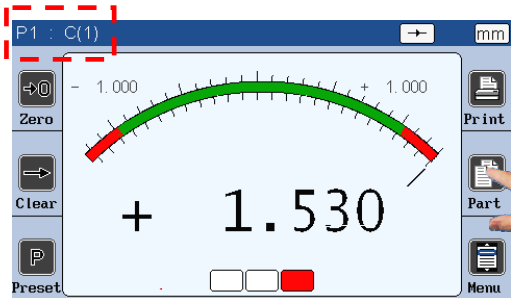
The print function allows to transfer the measured value to a computer.



Part :

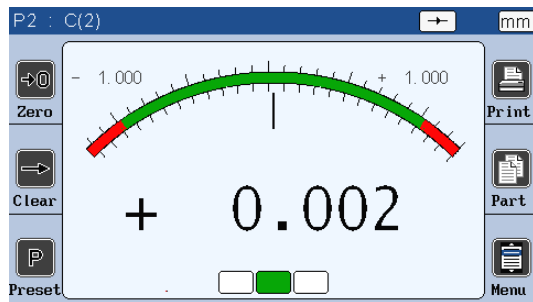


This function is used to change the displayed part

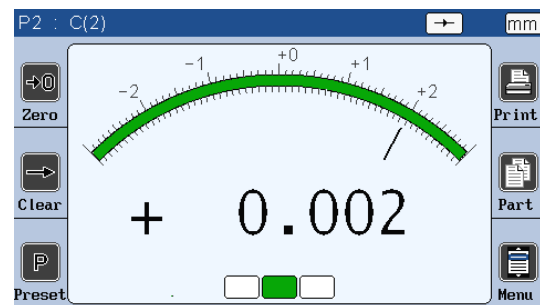


6.2. Choice of the needle indicator style

If the M3 is configured with the needle indicator (mode Galva, see chap. 5.2), it is possible to change manually the type of scale.



Automatic

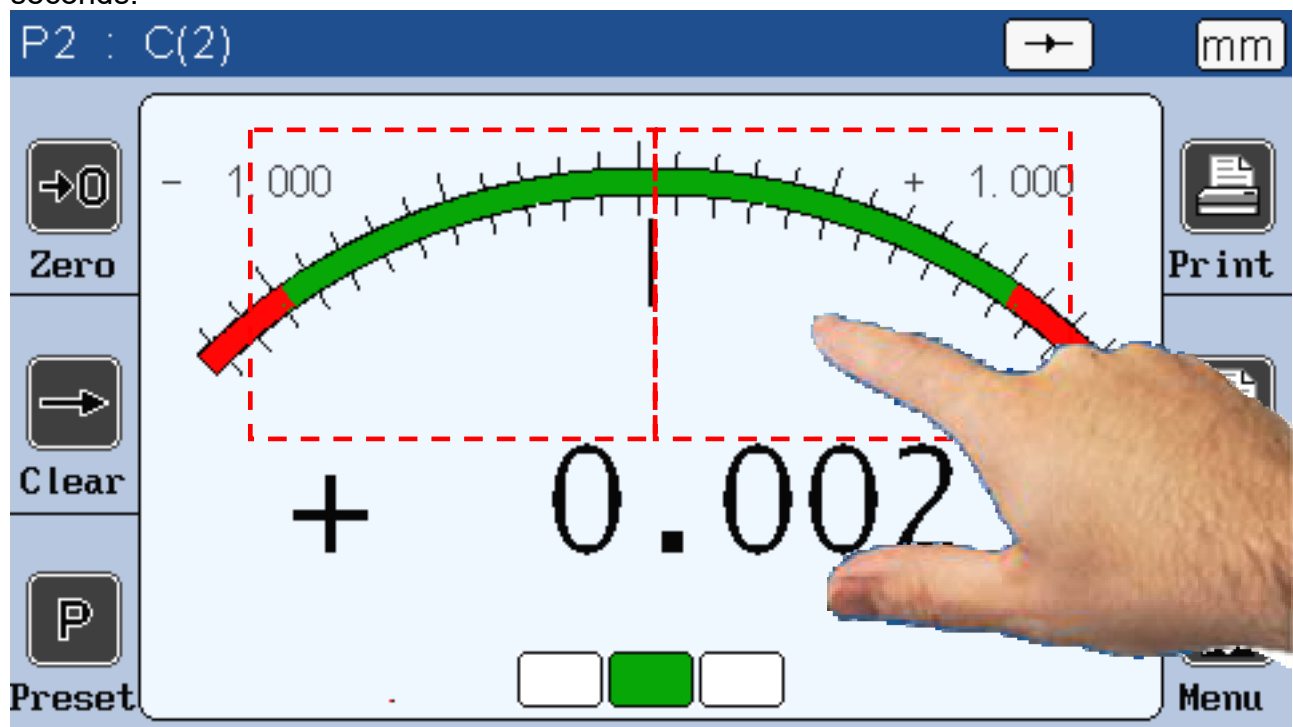


Manual

The automatic needle scale adapts automatically with the part tolerances.

The manual needle has fixed scales and allows to use the +/- option (see chap 5.2)

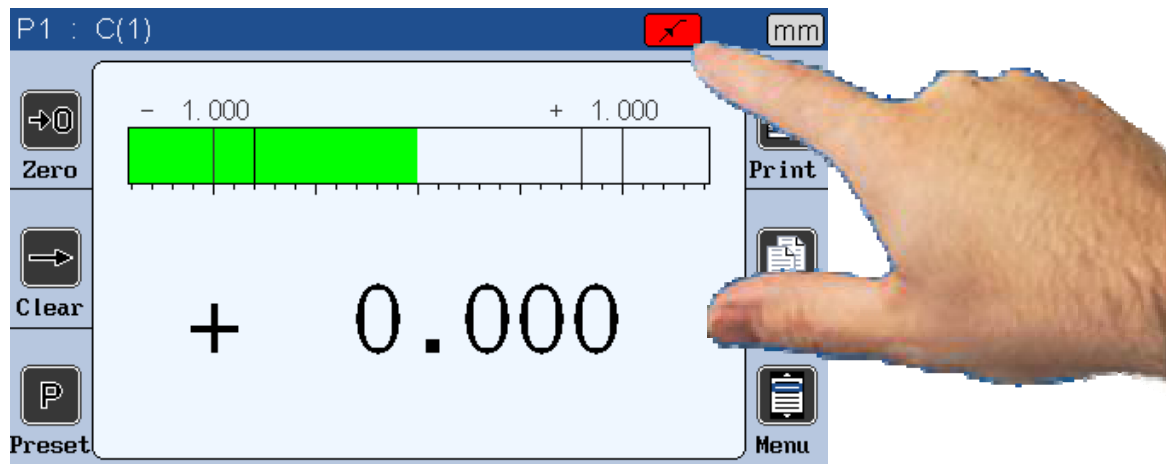
You can change the scale type by touching the area as on the picture bellow during 2 seconds.









6.3. Temporary dynamic mode

As explained on the chapter 5.1, the characteristic is defined either as « static » (direct) or « dynamic » (Max, Min ...)

If a characteristic has been adjusted as static, it is nevertheless possible to change temporarily to a dynamic mode, directly from the measuring screen.



To change the measuring mode, press on the icon as shown on the above picture.

-  Static
-  Max
-  Min
-  Max-Min
-  Average (adapté pour une mesure automatique)
-  Median The displayed value is calculated with the formula $(MAX-MIN)/2$.



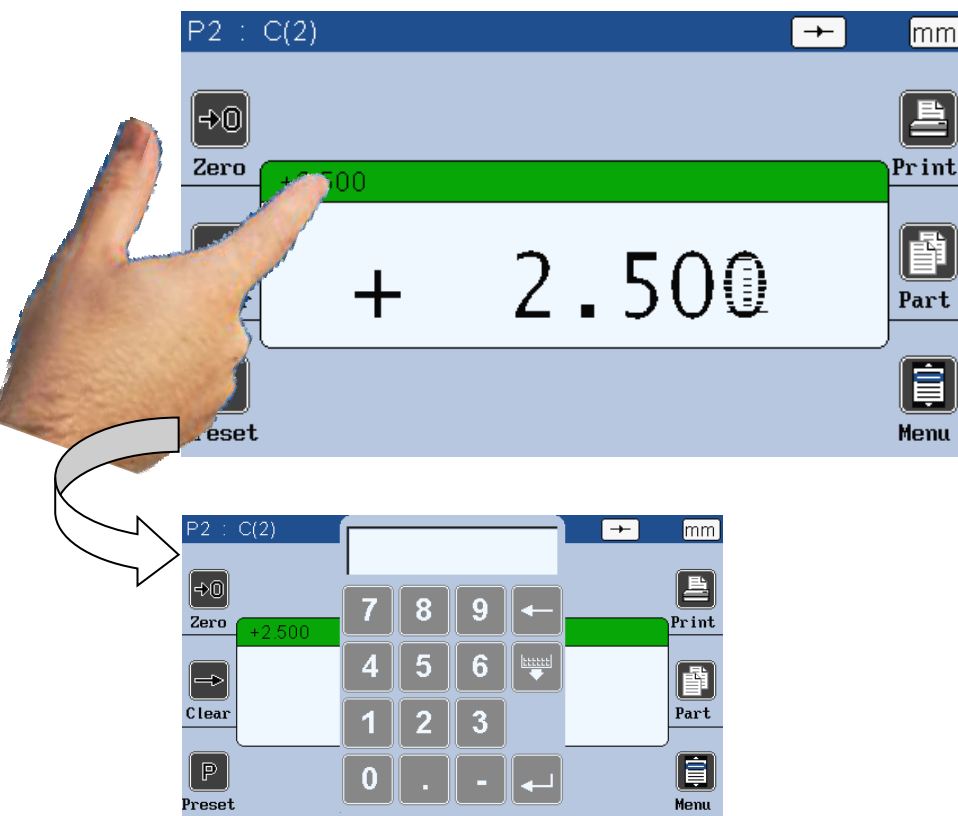
When a dynamic mode has been selected, press on the **Clear** button or on the footswitch (if configured as « init dyn » (see chap 5.4) to start recording.

6.4. Display mode without tolerance

This display mode is very adapted to be used with incremental probes like Heidenhain.

This mode (see chap. 5.2) allows to display only the numerical value, without tolerance indication.

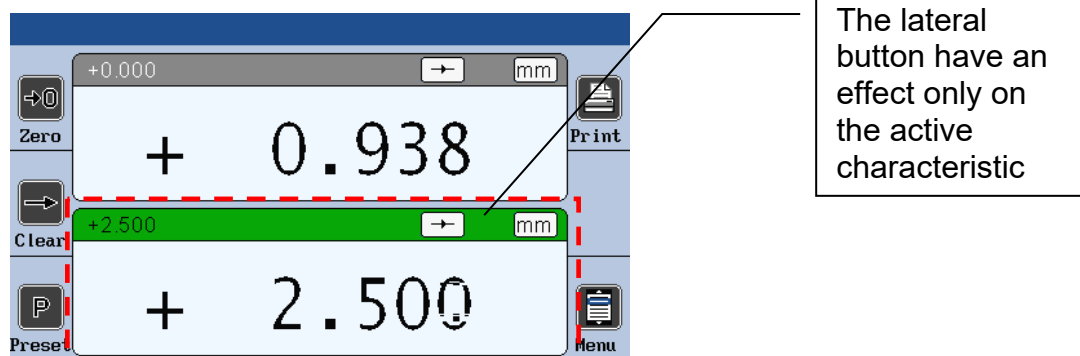
It is also possible to change the preset value (calibration) directly from this screen. Press on the value as shown on the below picture, an input the new value with the keyboard.



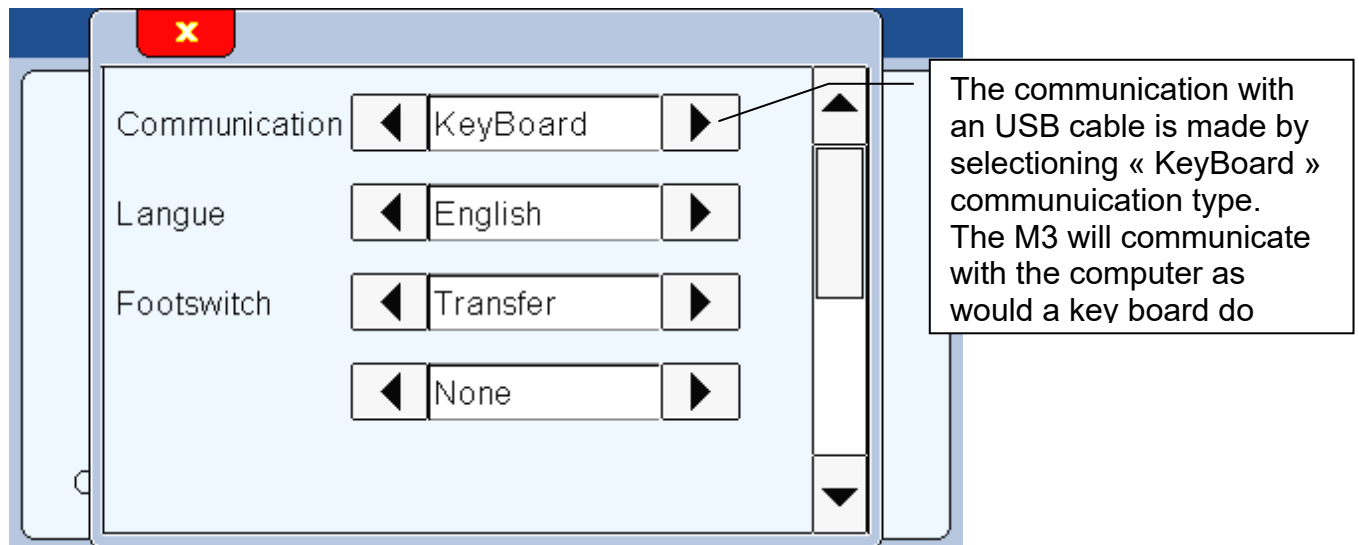
If the double display mode is selected, the 2 characteristics can move together, but only 1 is active.

The lateral buttons have an effect only on the active characteristic.

For selecting the active characteristic, press on it and the top of the box will become green.



7. USB COMMUNICATION



If you select the “Keyboard/USB” communication, the M3 will be detected has a keyboard when connected to a computer, without installing a specific driver or software.

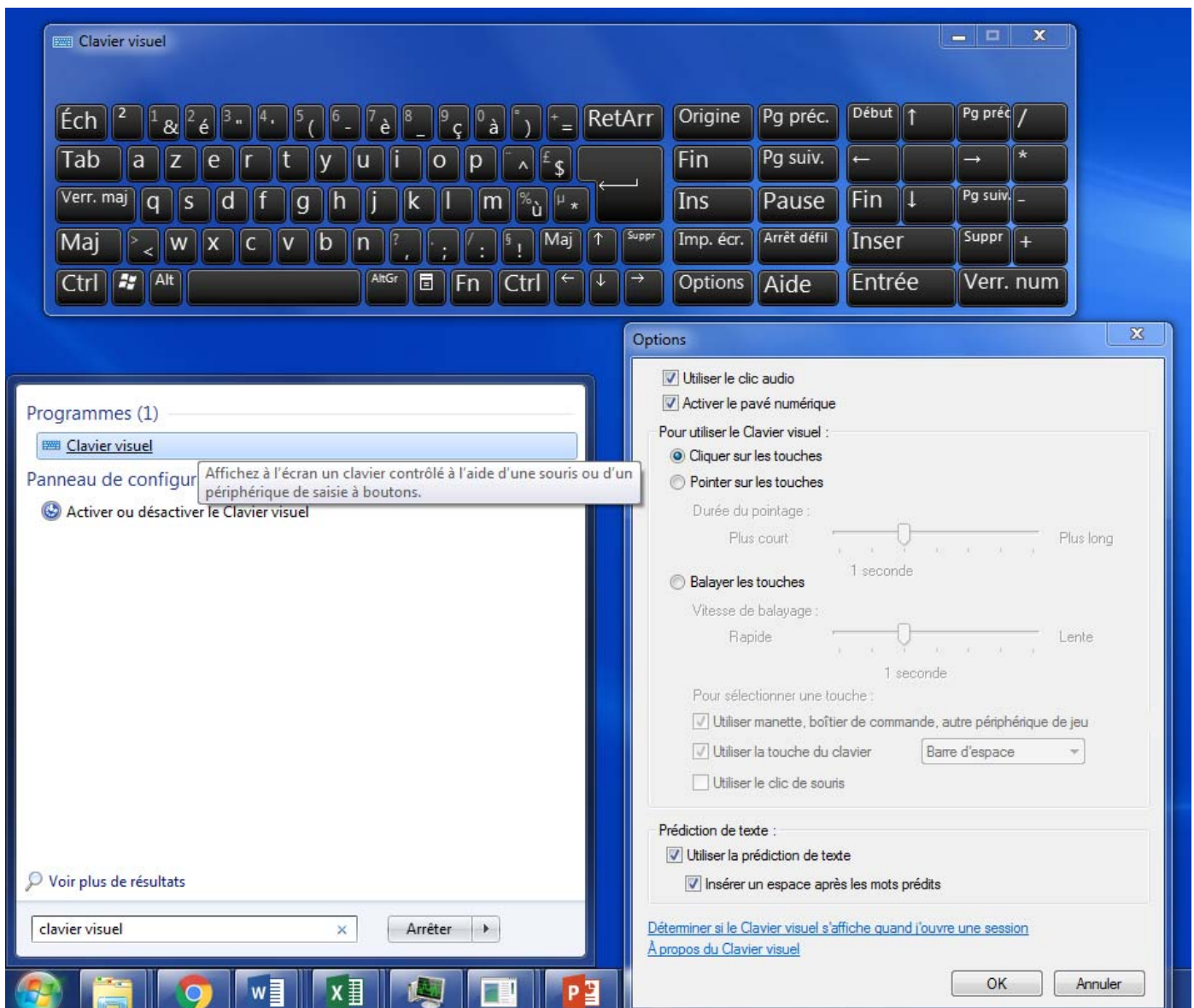
Then when you transfer the measure (with screen, through IO or footswitch), the displayed value will appear on your PC when your cursor is. (For example on an Excel cell), in the same way than you would have typed with your standard keyboard.



1	5,13	
2	5,09	
3	5,07	
4	5,06	
5	5,16	
6	5,12	
7	5,19	

Example of a table completed by the M3

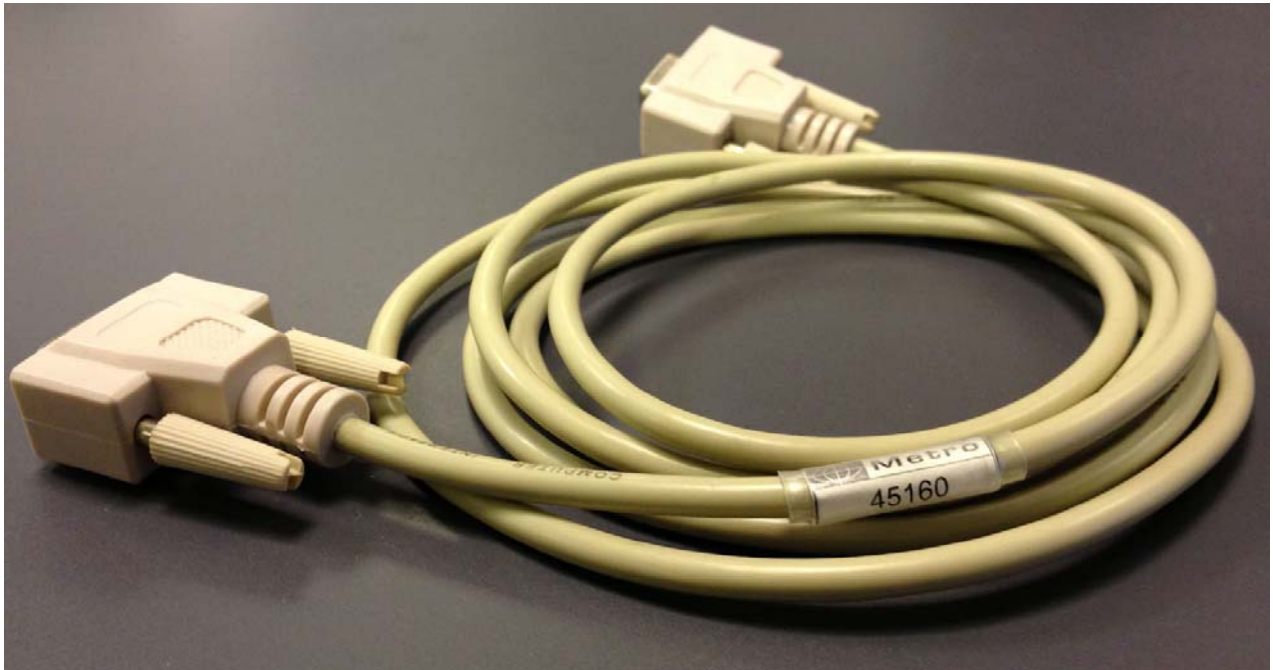
A problem appears sometimes while the data is transferring with a USB cable. The M3 display acts like a keyboard, so, in order to write numbers, the “num lock” key must be activated. If your keyboard doesn’t have the “num lock” key, you can still find it by writing “visual keyboard” in the windows search bar, and activate it. If even there the “num lock” key doesn’t appear, the option key allows to access to a menu from which you can activate the “num lock”.



8. RS232 COMMUNICATION

The M3 can communicate with an ASCII protocol allowing to master and configure all the functions.

For connecting the M3 to a PC or a PLC, you must use a cable Metro ref 45160, sold separately.



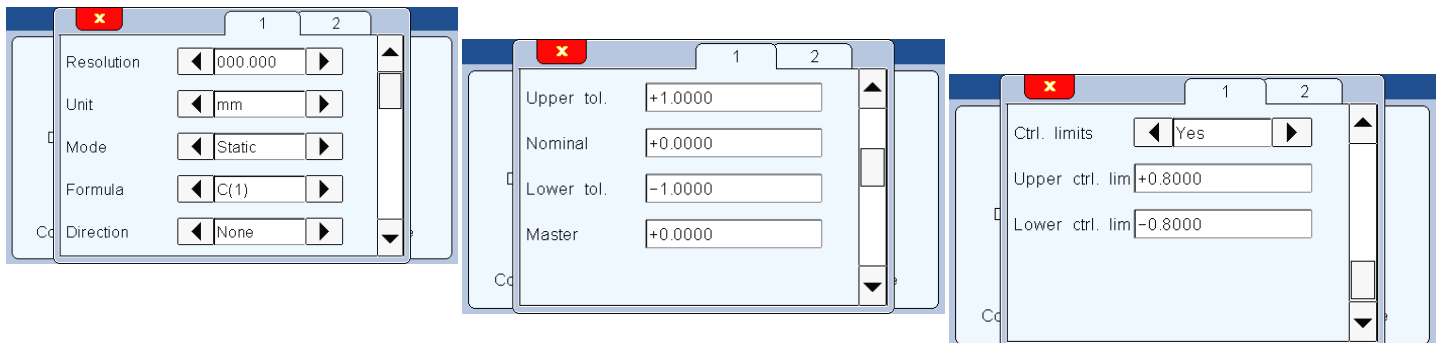
8.1. Commands

8.1.1. Generalities

All the commands must be ended by a « CR » character. (ASCII code 13/ \$0D).
The commands can be sent grouped by separating with a «;» (max 500 characters).
The display is refreshed only once after reception of the « CR » character.

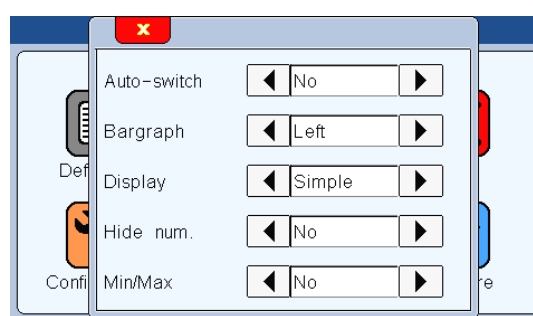
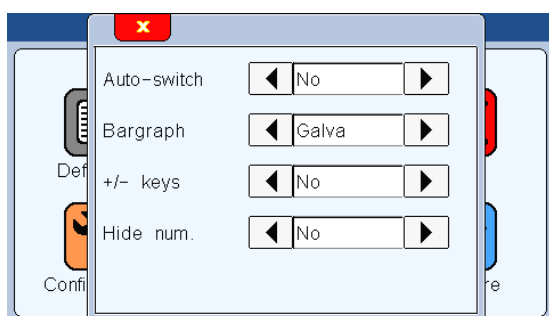
8.1.2. Command list

8.1.2.1. Window PART



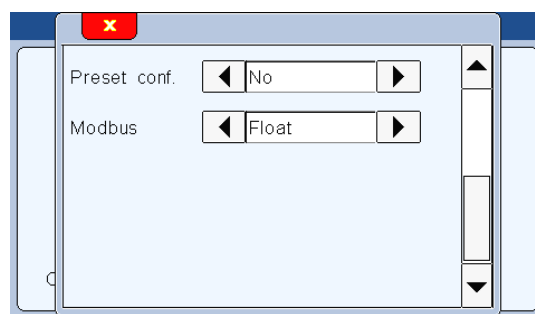
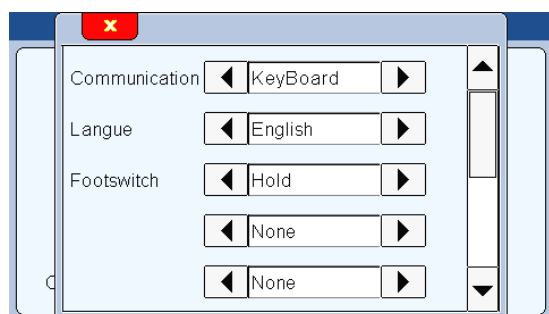
Window « Part »		(Command by characteristic with "n" = 1 or 2 (number of the characteristic))	
Rubric	Read. command	Write command	Comment
Resolution	nRES?	nRES=x	x=1 to 5 (number of decimals)
Unit	nUNIT?	nUNIT=x	x=0(mm) x=1 (inch) x=2 (µm)
Dynamic mode	nDYN?	nDYN=x	x=0 (static) x=1 (maxi) x=2 (mini) x=3 (maxi-mini) x=4 (average) x=5 (median)
Formula	nFM?	nFM=x	x=0 (C1) x=1 (C2) x=2 (-C1) x=3 (-C2) x=4 (C1+C2) x=5 (C1-C2) x=6 (-C1+C2) x=7 (-C1-C2)
Direction	nDIR?	nDIR=x	x=0 (sans) x=1 (internal) x=2 (external)
Upper tolerance	nUT?	nUT=seee.ddddd	
Nominal	nNM?	nNM=seee.ddddd	
Lower tolerance	nLT?	nLT=seee.ddddd	
Master	nMT?	nMT=seee.ddddd	
Activate control limits	nLIMIT?	nLIMIT=x	x=0 (inactive) x=1 (active)
Upper control limit	nUCL?	nUCL=seee.ddddd	
Lower control limit	nLCL?	nLCL=seee.ddddd	
Reference	nREF?	nREF=xxxxxxx	xxxxxxx = part ref

8.1.2.2. Window DISPLAY



Window "display"			
Rubric	Read. command	Write command	Comment
Auto switch	AUTO?	AUTO=x	x=0 (manual)
			x=1 (auto)
Bargraph	BAR?	BAR=x	x=0 (horiz. Bar origin left)
			x=1 (horiz. Bar origin center)
			x=2 (needle)
			x=3 (non = value only, no tolerance)
Display	DISPL?	DISPL=x	x=1 (display 1 characteristic on the screen)
			x=2 (display 2 characteristics on the screen)

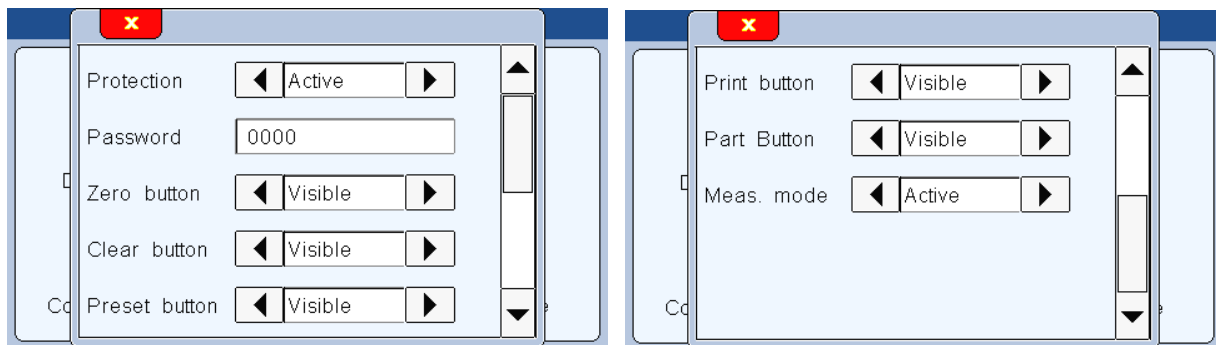
8.1.2.3. Window CONFIGURATION



Window "Configuration"			
Rubric	Read. command	Write command	Comment
Transfert	PRINT?	PRINT=x	x=0 (USB)
			x=1 (RS232)
Langue	LANG?	LANG=x	x=0 (French)
			x=1 (English)
			x=2 (German)
			x=3 (Spain)
			x=4 (Italian)
			x=5 (Hungarian)
			x=6 (Czech)
			x=7 (Swedish)
			x=8 (Portugaise)
Footswitch	FOOT?	FOOT=x	x=0 (Print)
			x=1 (Preset) → calibration
			x=2 (Zero)
			x=3 (change Part reference)

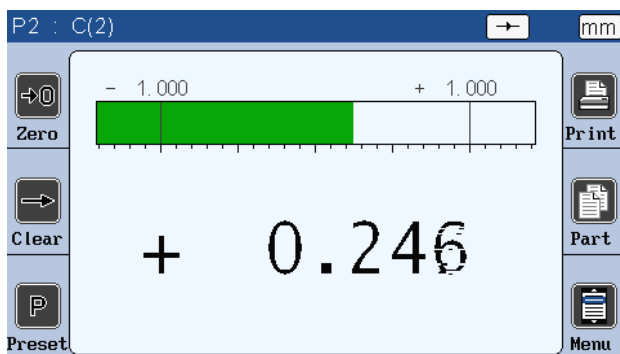
x=4 (start dynamic measurement)

8.1.2.4. Window « Lock »



Window "Lock"			
Rubric	Read. command	Write command	Comment
Protection	LOCK?	LOCK	Lock
		UNLOCK	Unlock
Code	PASS?	PASS=xxxxxx	xxxxxx = password with 6 figures

8.1.2.5. Measuring screen



Measuring screen			
Rubric	Read. command	Write command	Comment
Zero		ZERO	Zero relative
Clear		CLR	Start dynamic measurement
Preset		PRESET	Calibration
Print		?	Measurement transfert : If 1 characteristic mode, transfert the value with the format : +000.00000<CR> If double characteristic mode, transfert the value with format : +000.00000,+000.00000<CR>
		1	Transfert the characteristic 1, format = +000.00000<CR>
		2	Transfert the characteristic 2, format = +000.00000<CR>
Part		G1	Part 1
		G2	Part 2
M3 power off		OFF	Shut down the M3

9. RTU MODBUS process

This process allows to connect the M3 to an compatible and programmable automate. This process allows to control all the functionality of the M3 thanks to a lot of register. A maximum of 256 register can be read.



Example of a RTU Modbus communication with an automate Pro-Face. This example can be download from our website www.metro-fr.com

Trame Modbus RTU

Adr	Code	Data	CRC16
-----	------	------	-------

Address: always equal to 1

Code: the M3 supports codes « 3 » by reading and « 16 » by written

Data: 1 to 256 register

CRC16: verification code on 2 octets

The following functionality are available:

- Reading of the position of 2 probes
- Instant reading of the value of 2 characteristic
- Preset
- Reading / programing of the tolerances, of the master value, the formula...

Register are compounded by one or a couple of 16 bits words.

Function	Address	Size (word)	Value
Preset (W)	0	1	1
Start a dynamic measure (W)	1	1	1
Active programm (R/W)	4	1	0 ou 1
Life word (change each 100ms) (R)	6	1	0 ou 1
Stop	7	1	1
Active M3	8	1	1 = measure

			0 = Menus
--	--	--	-----------

Register by characteristic: from 100 to 188 for the characteristic 1 and from 200 to 288 for the characteristic 2

Formula (R/W)	100	1	0 = C1 1 = C2 2 = -C1 3 = -C2 4 = C1 + C2 5 = C1 - C2 6 = -C1 + C2 7 = -C1 - C2
Maxi of a dynamical cote (R)	101	2	
Mini of a dynamical cote (R)	103	2	
Lower control limit (R/W)	105	2	
Upper control limit (R/W)	107	2	
Active class	109	1	1 à 16
Unit	110	1	0 = mm 1 = inch 2 = μm
Control limit activated	111	1	0 = no 1 = yes
resolution	112	1	1 to 5 (decimal)
State of the characteristic	113	1	0 = good 1 = < Mini 2 = > Maxi 3 = < lower ctrl limit 4 = > upper ctrl limit
Type of the characteristic	114	1	0 = Static 1 = Maxi 2 = Mini 3 = Maxi-Mini 4 = average 5 = Median
Nominal	115	2	
Lower tolerance	117	2	
Upper tolerance	119	2	
Master value	121	2	
Measure	123	2	Displayed value
Mini class 1	126	2	
Mini class 2	128	2	
Mini class 3	130	2	
Mini class 4	132	2	
Mini class 5	134	2	
Mini class 6	136	2	
Mini class 7	138	2	
Mini class 8	140	2	
Mini class 9	142	2	
Mini class 10	144	2	
Mini class 11	146	2	

Mini class 12	148	2	
Mini class 13	150	2	
Mini class 14	152	2	
Mini class 15	154	2	
Mini class 16	156	2	
Maxi class 1	158	2	
Maxi class 2	160	2	
Maxi class 3	162	2	
Maxi class 4	164	2	
Maxi class 5	166	2	
Maxi class 6	168	2	
Maxi class 7	170	2	
Maxi class 8	172	2	
Maxi class 9	174	2	
Maxi class 10	176	2	
Maxi class 11	178	2	
Maxi class 12	180	2	
Maxi class 13	182	2	
Maxi class 14	184	2	
Maxi class 15	186	2	
Maxi class 16	188	2	

probe 1	7000	2	
probe 2	7002	2	

10. OPTIONAL M-BUS MODULES

10.1. MB-IO Module (see also chap 5.3.5)

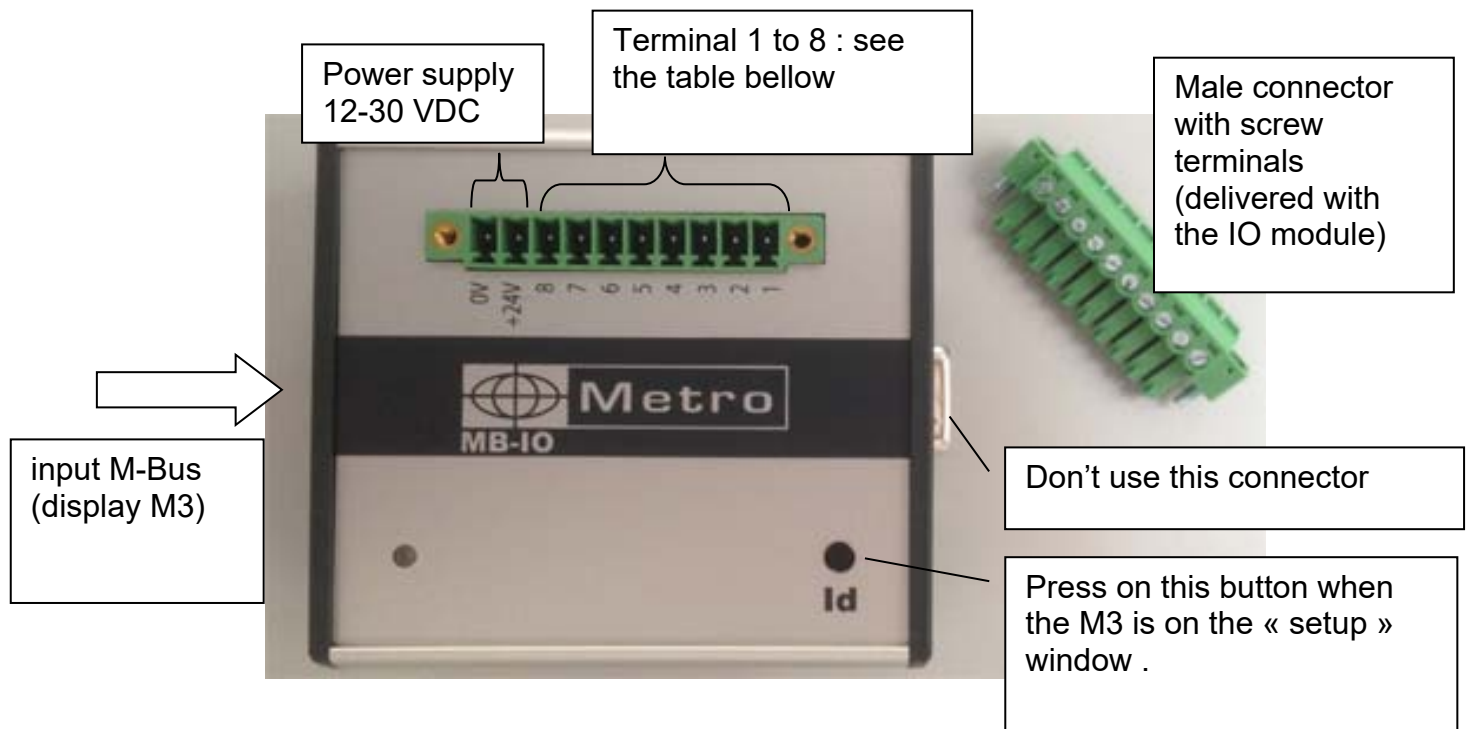
As an option, it is possible to connect up to 4 M-Bus modules with 8 inputs/output isolated by opto-coupler. (ref MB-IO)

The 8 outputs are similar to the « open collector PNP » type. They can be used with an external power supply 12 to 30 VDC maximum. The maximal output current drained by each output is 50mA

The 8 inputs represent a 2.2kOhms load connected to the 0 volt.



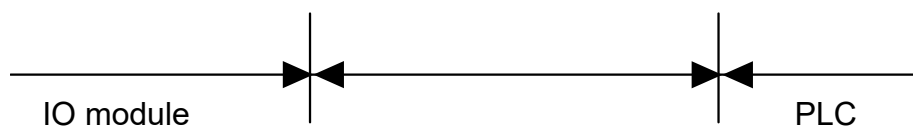
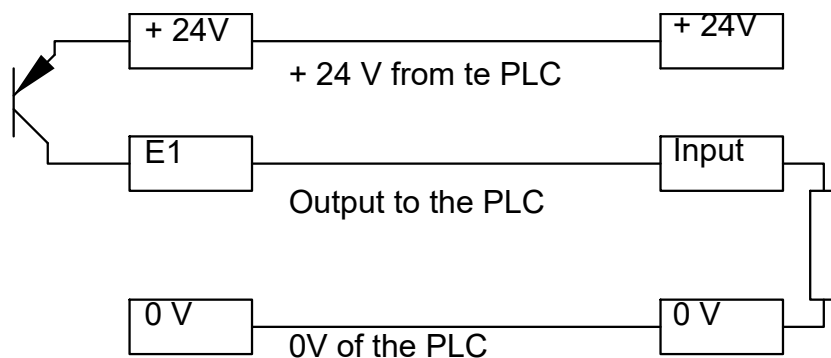
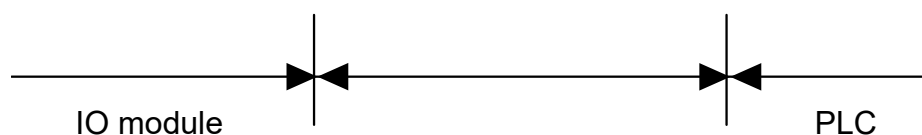
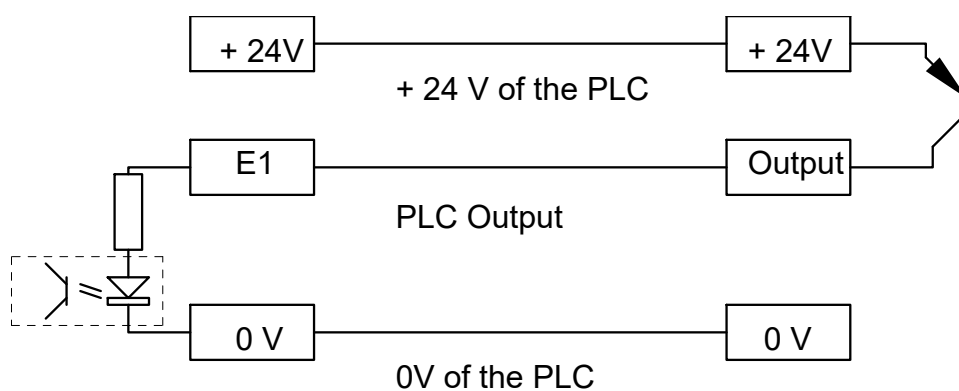
Refer to the chapter 5.3 (setup) to connect a MB-IO module



List of available functions :

Transfer	Print, transfer the measured value
Preset	Set the display value to the master value
Zero	Set the display value to 0
Clear	Reset the dynamical measure
Init Dyn	Start a dynamical measure
State characteristic	Output a signal if the characteristic is in the tolerance
Lower control limit	Output a signal if the part is in the lower control limit
Upper control limit	Output a signal if the part is in the upper control limit
Out Tol -	Output a signal if the part is out lower tolerance
Out Tol +	Output a signal if the part is out upper tolerance
Part status	Output a signal if the part is in the tolerances
Class	Output a signal on a defined port for each class
Stop	Hold the measure
characteristic	Change the displayed characteristic

Connection example between a M3 and a PLC



10.2. MB-RL Module

Please refer to the chapter 5.3 (Setup) to connect an M-Bus module

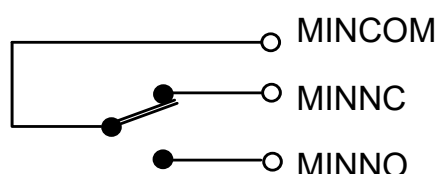


The MB-RL module has been designed for retrofitting old Monocote displays equipped with the optional relay board.

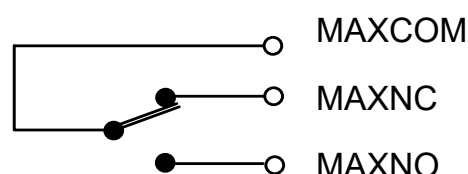


The external M-bus module has the same pinout (SUBD-15) than the relay board of the Monocote display, so there is no need to change the wiring of the existing installation.

The MB-RL has two independent and isolated relays indicating the position of the displayed measurement by comparison with the tolerances. Each relay provides a contact that is normally open in case the measurement is within the tolerances (MINNO and MAXNO) and a contact that is normally closed (MINNC and MAXNC). The commons of each relay (MINCOM and MAXCOM) are independent, so that the user is as free as possible.



RELAIS TOLERANCE MINI



RELAIS TOLERANCE MAXI

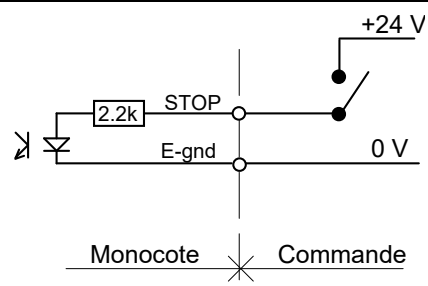
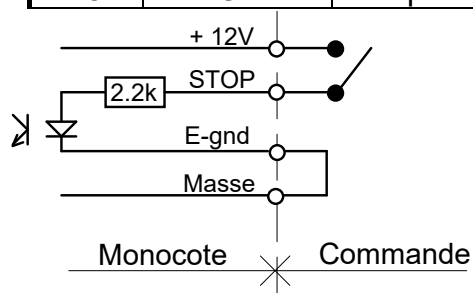
Four inputs isolated by opto-couplers enable to operate the M3 by remote control. They are active at the logical level 1 (+12 to + 24 Volts) that must be maintained at 1 for 50 milliseconds minimum. The command is effective when the input comes back to zero, except for the input STOP that stays active as long as the logical level 1 (+12 to + 24 Volts) is maintained.

- **INITDYN** : This input controls the initialisation of memories for the dynamic measurement. It must be used every time the dynamic measurement starts, when the part to be measured is already in place under the probes. This command has the same function as the button "CLEAR" of the measuring screen.
- **STOP** : This input stops the measurement (and freezes the screen) as long as it is maintained at the logical level 1.
- **ZERO** : This input controls the zero reset of the display. The display then indicates the variations of the measurement in comparison with this origin. This command has the same function as the button "ZERO" of the measuring screen
- **PRINT** : This input controls the sending onto the communication port of the displayed measured value. This command has the same function as the button "PRINT" of the measuring screen
- **PRESET** : External command of calibration according the selected working mode. This command has the same function as the button "PRESET" of the measuring screen

SUB D connector (15 pins) : pin assignment

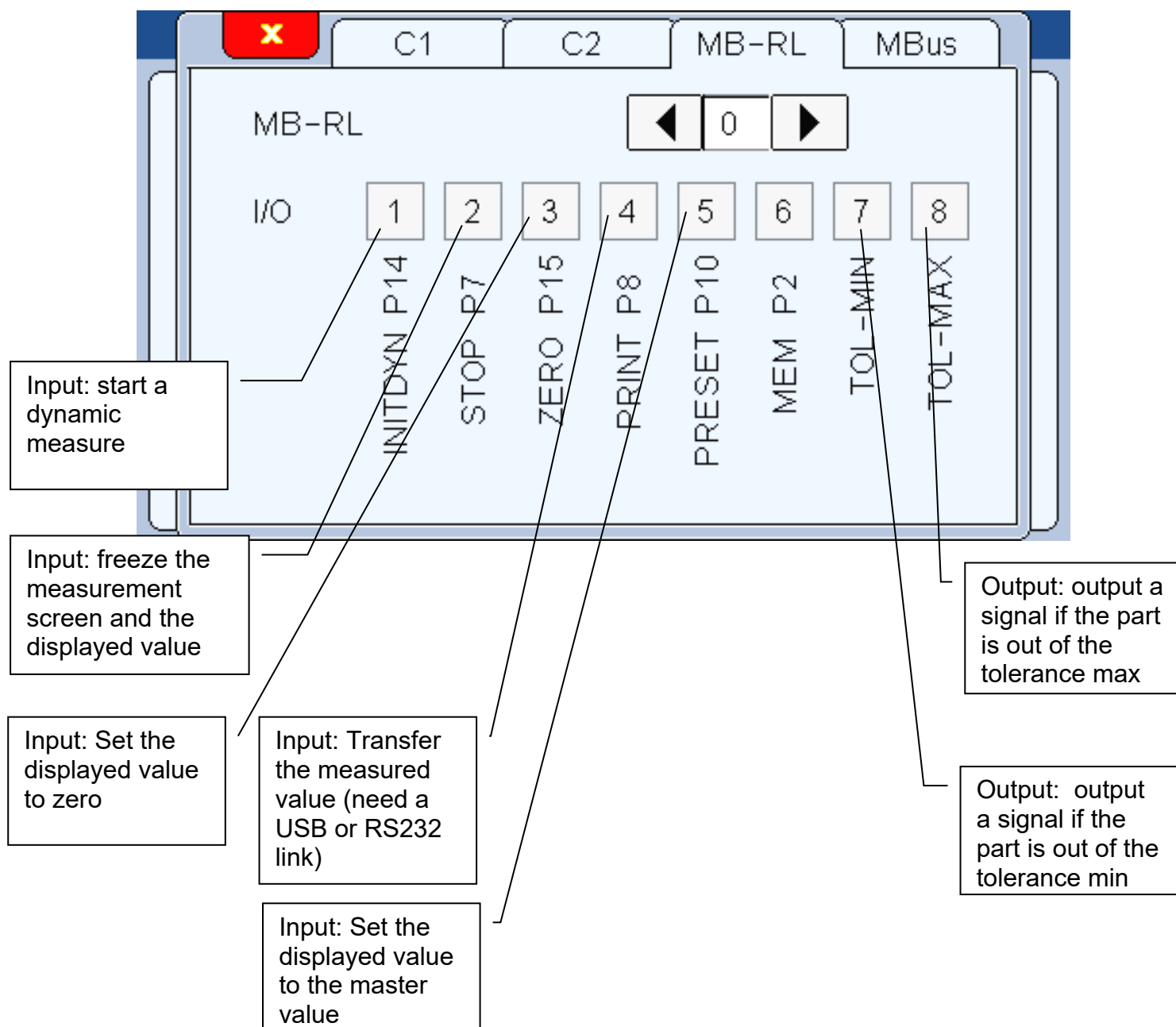
Borne	Signal	Sens	Description
1	+5 V	output	Power supply to activate the inputs
2	Not connected		

3	MINNC	-	Mini tolerance relay contact 1A 48V
4	MINCOM	-	Common of mini tolerance contacts
5	MINNO	-	Mini tolerance relay contact 1A 48V
6	E_GND		Input ground
7	STOP	input	Command for Stop mode
8	PRINT	input	Command for measurement transfer
9	Ground	-	Supply ground
10	PRESET	input	External calibration command
11	MAXNC	-	Maxi tolerance relay contact 1A 48V
12	MAXCOM	-	Common of maxi tolerance contacts
13	MAXNO	-	Maxi tolerance relay contact 1A 48V
14	INIDYN	input	Command for measurement initialisation
15	ZERO	input	Command for display reset to zero



Command example: with internal supply (not isolated) and with an external supply (isolated).

The following screen appears on the M8 when a MB-RL is connected. There is a function for each of the 8 ports, and these functions can't be changed.



10.3. MB-TP Module – for temperature compensation

Using this module allows to use a special firmware version.
A special hardware with the Type K thermocouple integrated is also available.
Please contact Metro for further information.

11. FACTORY RESET

This function allows to come back to the factory setting.

Warning: At the end of this procedure, all the parameters of your M3 will be reset (tolerances, masters, formulas...)

To Reset the M3 to its factory settings, please follow the process below.

- 1 – Shut down the M3
- 2 – Start the M3
- 3 – When the splash screen appears, press on the Metro logo
- 4 – A desktop with 3 icons appear.
 - 4a – Press on « initialization »
 - 4b – Confirm YES or cancel NO
- 5 – Press Home to come back to the measuring screen

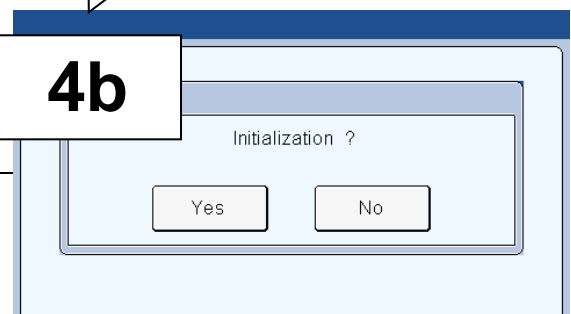
3



4a



4b



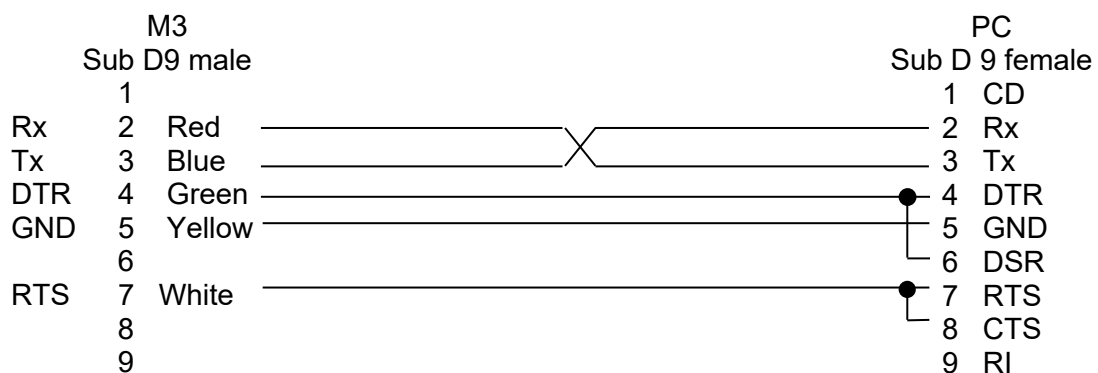
12. FIRMWARE UPDATE

It is possible to update the M3 firmware

For this you need a RS232 cable ref 18060.

It is possible to use a RS232/USB convertor if your computer is not equipped with a serial port.

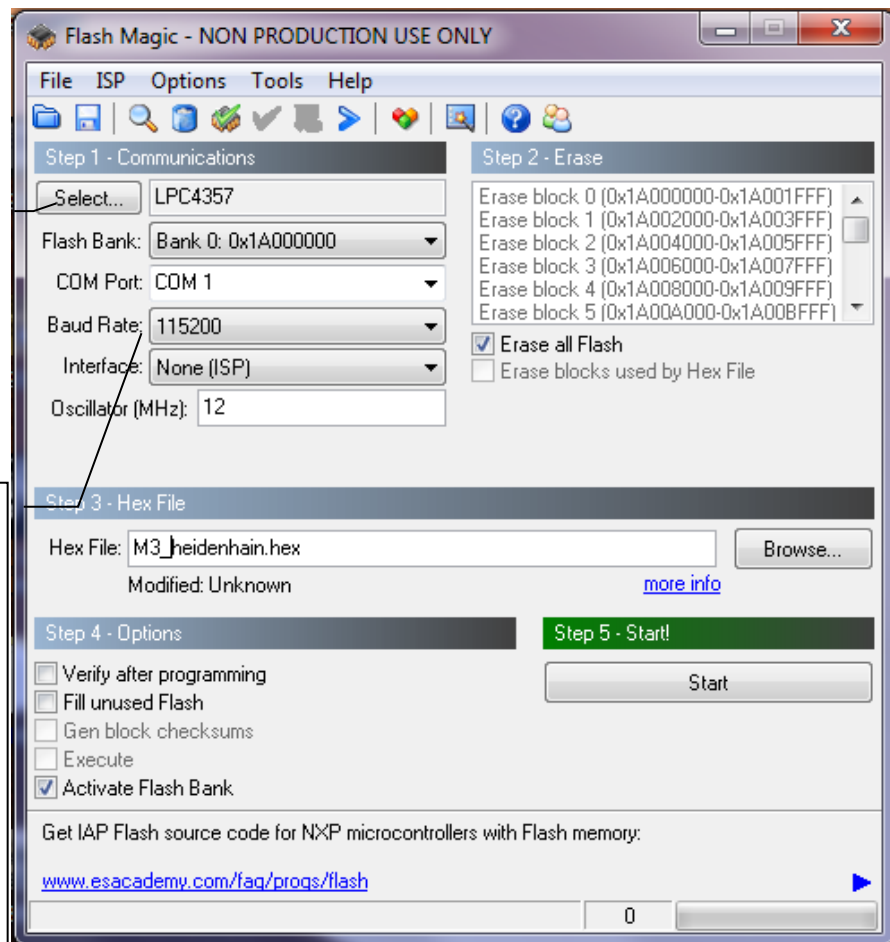
If you do not have a Metro cable ref 18060, you can make your own cable by following this schematic



The firmware update requires to use the « flash magic » software that can be download (free) from this address:

www.flashmagictools.com

After installation, please configure the software on the following way:



The LPC4357 can be found on the “ARM Cortex” category after clicking on « Select ».

If you are connected directly on a serial port, you can use the baud rate 115200bauds. If you use a USB/RS232 convertor, use 38400 bauds.

Procedure:

- 1 – Connect the M3 with the cable Metro ref 18060 to the computer
- 2 – Start the M3
- 3 – Configure the flash magic software according to the above picture.
- 4 – Click on “Start”

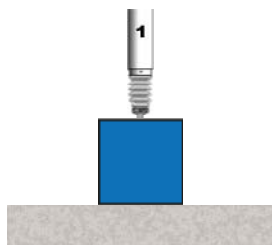
It takes from 2 to 5 min depending on the Baud rate selected. During the update, the screen becomes blurred.

5- The M3 restart automatically when it is finished.

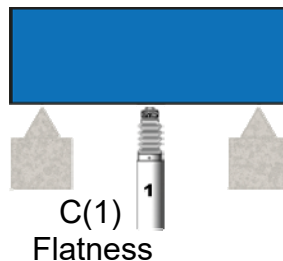
6- Reset the M3 by following the procedure on the chapter 11.

13. EXAMPLES OF PROBE COMBINATIONS

13.1. SIMPLE MEASUREMENTS WITH ONE PROBE

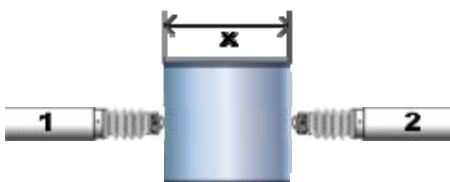


C(1)
Thickness

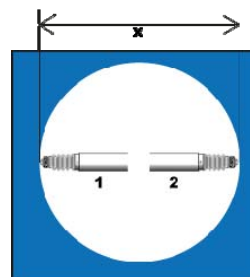


C(1)
Flatness

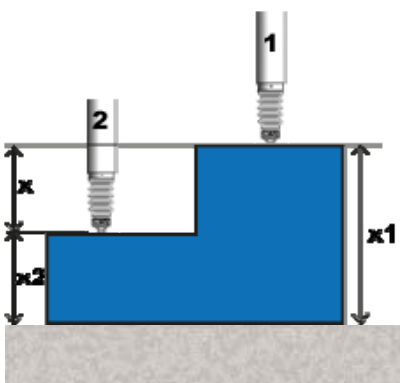
13.2. COMBINED MEASUREMENTS WITH TWO PROBES



C(1) + C(2)
Thickness or external diameter

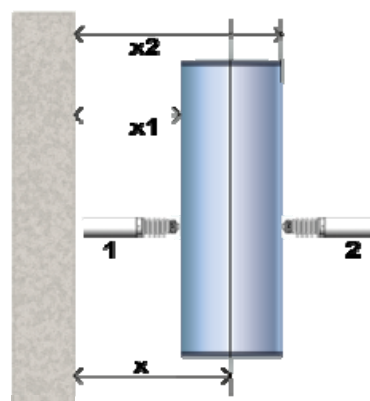


-C(1) - C(2)
Width or internal diameter



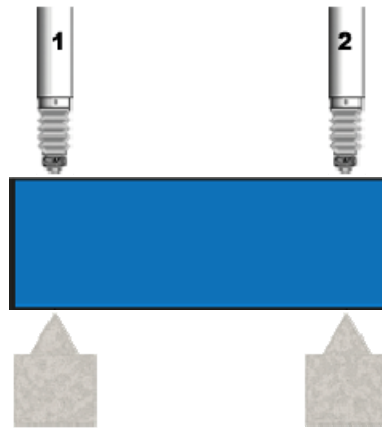
$$\begin{aligned} X1 &= C(1) \\ X2 &= C(2) \\ X &= C(1) - C(2) \end{aligned}$$

Thrust



$$\begin{aligned} X1 &= -C(1) \\ X2 &= C(2) \\ X &= -0.5 \cdot C(1) + 0.5 \cdot C(2) \end{aligned}$$

Position



Parallelism

$$X = C(1) - C(2)$$