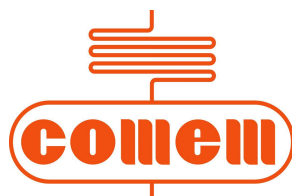


# INSTRUCTION MANUAL



## Heat Monitoring and Control Instrument for Transformers "MB 103" Temperature Control Unit





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# 1. SAFETY

## 1.1 Safety instructions

Make sure that the personnel who install, put into service and operate the “MB 103 Temperature Control Unit”:

- Are technically qualified and competent;
- Fully comply with these assembly instructions.

Improper operation or misuse could endanger:

- Life and limb
- The equipment and other property of the operator

The safety instructions in this manual are shown in three different forms to emphasize the importance of the operation.



### **WARNING**

This information indicates particular danger to life and health. Disregarding such a warning can lead to serious or fatal injury.



### **CAUTION**

This information indicates particular danger to equipment and/or other property of the user. Serious or fatal injury cannot be excluded.



### **NOTE**

These notes give important or specific information concerning the equipment or how to work with the equipment.

## 1.2 Specified applications

The “MB 103” Temperature Control Unit is used in resin or dry type transformers and can also be easily adapted for use in oil transformers.

The “MB 103” Temperature Control Unit uses PT100 temperature probes for constant monitoring of transformer temperature in four points: for example, three on the transformer winding columns and one on the machine's magnetic circuit.

If the transformer fails to function correctly and its temperature rises, the Temperature Control Unit generates an electric alarm signal. If the temperature reaches danger level, the unit generates a second intervention level. This can be connected to a machine stop switch that functions independently of the alarms. A cooling system control program is also implemented in the unit.

### 1.3 Safety notes on equipment operation

The electrical installation must conform to the national safety regulations.  
The MB 103 Temperature Control Unit has double insulation. Earthing is not required.



#### CAUTION

The wires must be fixed properly.



#### CAUTION

The MB 103 Temperature Control Unit must not be installed near sources of electromagnetic interference.

MB 103 conforms to the following standards:

- EN 50081-2: Electromagnetic compatibility - Generic emission standard Part 2: Industrial environment.
- EN 50204: Radiated electromagnetic field from digital radio telephones - Immunity test
- EN 55011: Industrial, scientific and medical equipment - Radio-frequency disturbance characteristics - Limits and methods of measurement.
- EN 61000-3-2: Electromagnetic compatibility (EMC) - Part 3-2: limits - Limits for harmonic current emissions (equipment input current up to and including 16 A per phase).
- EN 61000-6-2: Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity of industrial environments.
- EN 61000-4-2: Electromagnetic compatibility (EMC) - Part 2-4: Environment - Compatibility levels in industrial plants for low-frequency conducted disturbances
- EN 61000-4-4: Electromagnetic compatibility (EMC) - Part 4-4: Testing and measurement techniques - Fast transient immunity test.
- EN 61000-4-5: Electromagnetic compatibility (EMC) - Part 4-5: Testing and measurement techniques - Surge immunity test.
- EN 61000-4-6: Electromagnetic compatibility (EMC). Part 4: Testing and measurement techniques. Section 6: Immunity to conducted disturbances, induced by radio-frequency fields.



#### WARNING

All relevant fire protection regulations must be strictly observed.

## 2. “MB 103” TEMPERATURE CONTROL UNIT TYPE

### 2.1 Drawing

External dimensions (Fig. 1) of the “MB 103” Temperature Control Unit:

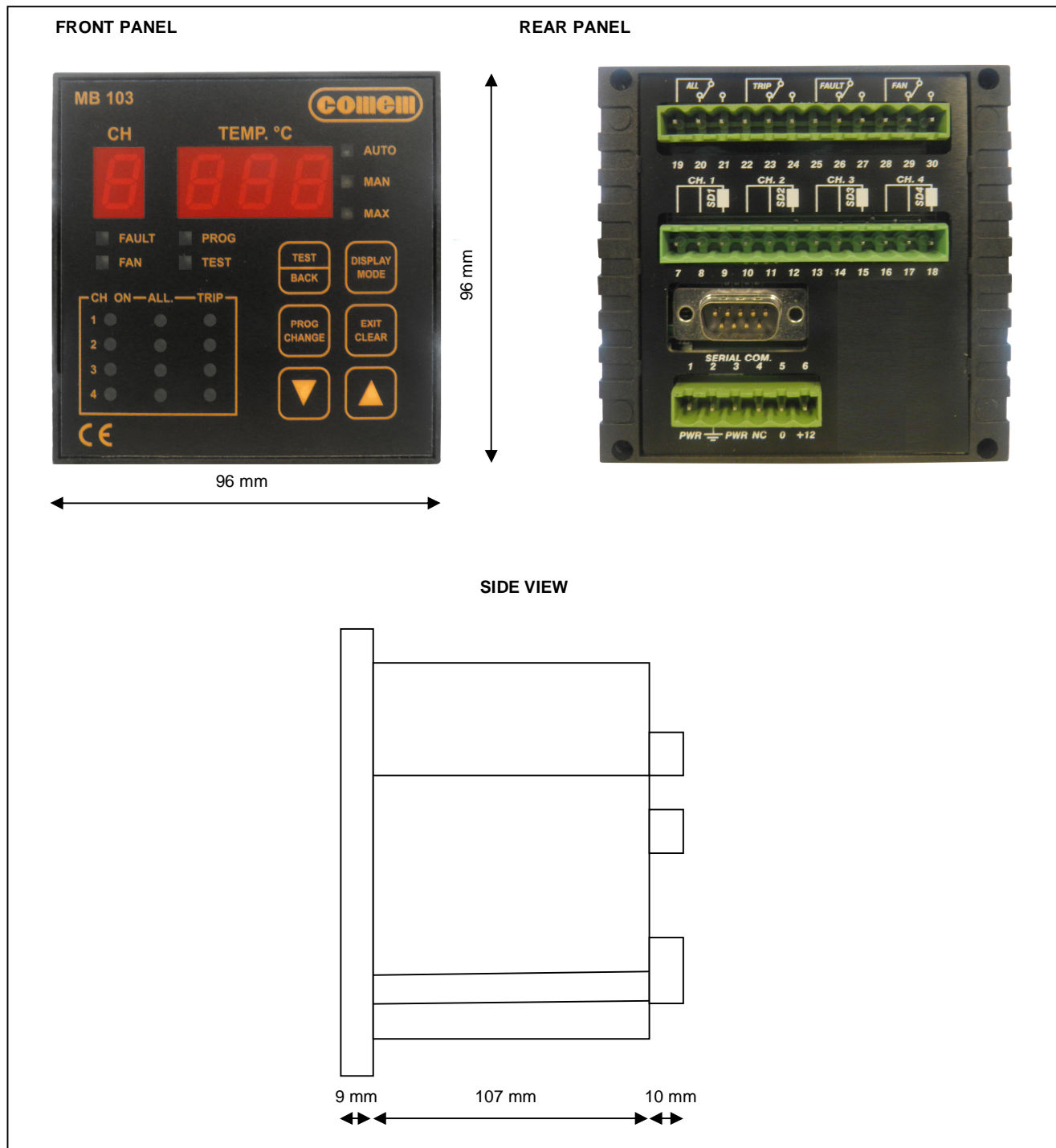


Fig. 1

## 2.2 Hardware characteristics

- Container: self-extinguishing ABS  
Dimensions: box 170 mm x 110 mm x 105 mm (DIN 43700)
- Front panel: self-extinguishing Exon  
Dimensions: 96 mm x 96 mm
- Weight: 0.5 kg
- Display:  
Temperature: 3 numbers, each with 7 segments  
Channel: 7 segments
- LEDs 19 signals
- Terminal board: withdrawable and polarized, in accordance with IEC 998-1 and IEC 998-2-1
- Climatic category 40/11021 according to IEC
- Power supply: universal, range 24-220 V  $\pm$  10% in DC or AC at 50 Hz  $\pm$  2% frequency or 12V in DC
- Operating temperature: -20°C +60°C
- Inputs: 4 PT100 (or PTC) resistance thermometers, range from -10°C to 200°C
- Outputs: 4 relays with 5 A contacts, 250 V A.C.
- Memory: EEPROM with data retention for more than 10 years
- Precision:  $\pm$  1% of full-scale value + 1 digit
- Insulation: Double galvanic insulation between power supply, microprocessor and temperature probes (2500 V test voltage)
- Humidity: 90% without condensation
- Consumption: 4 VA
- Construction in accordance with  $\text{C}\text{E}$  regulations

### 2.2.1 Front panel

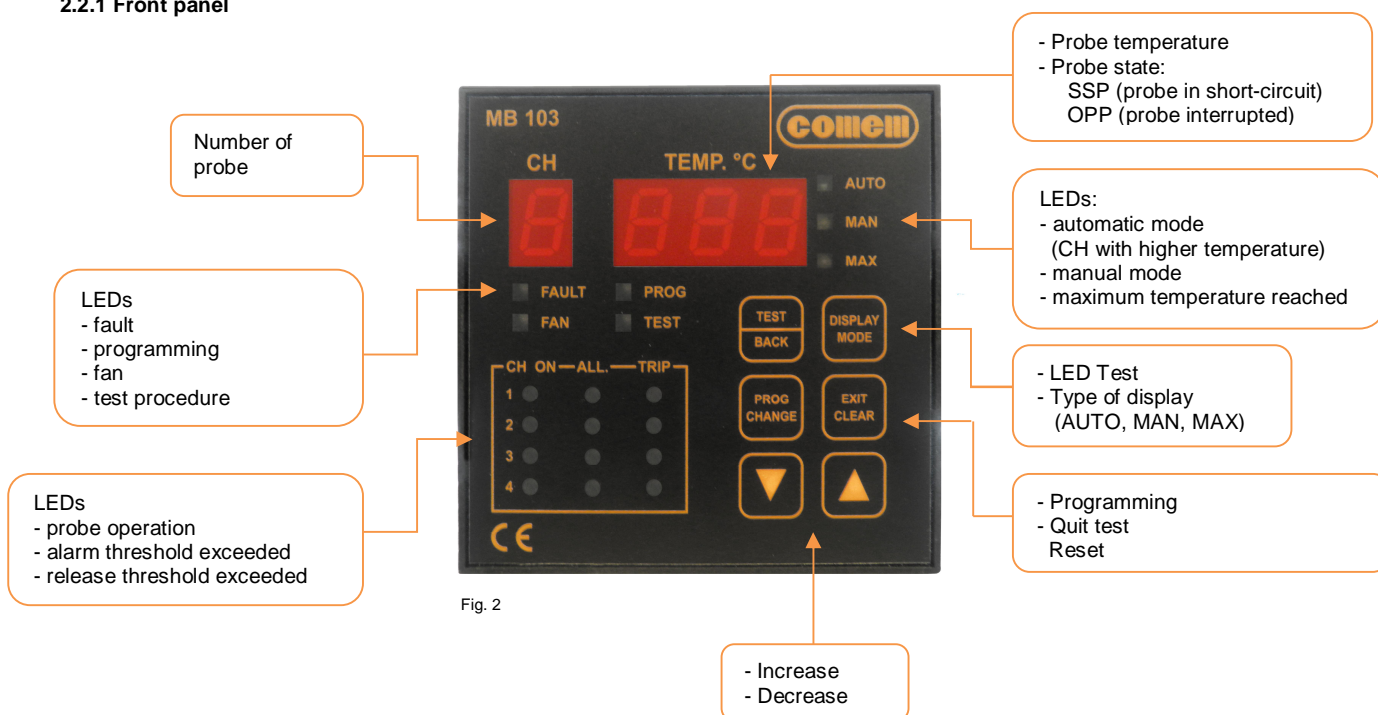


Fig. 2

## 2.2.2 Rear panel

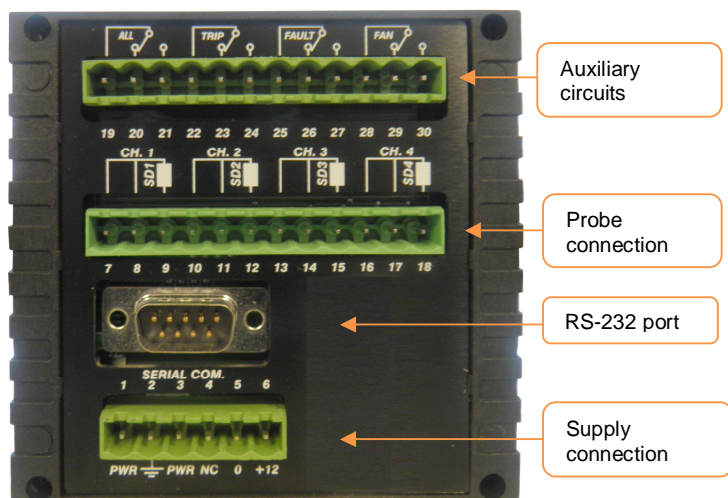


Fig. 3

### Power supply

Terminal number	Input	Description of operation
1	PWR	From 24 to 220V AC to DC universal power supply with +/- 10% variations allowed
2	Earth	Must be connected using cable at least 1.5 mm in section
3	PWR	From 24 to 220V AC to DC universal power supply with +/- 10% variations allowed
4		Terminal not connected
5	0	Input for 12V DC power supply
6	+12	Input for 12V DC power supply

### Probe inputs (PT100)

Terminal number	Input	Description of operation
7 - 8	SD1PF	Probe 1 cold pole input
9	SD1PC	Probe 1 hot pole input
10 - 11	SD2PF	Probe 2 cold pole input
12	SD2PC	Probe 2 hot pole input
13 - 14	SD3PF	Probe 3 cold pole input
15	SD3PC	Probe 3 hot pole input
16 - 17	SD4PF	Probe 4 cold pole input
18	SD4PC	Probe 4 hot pole input

### Auxiliary circuits

Terminal number	Input	Description of operation
19	ALL1 - C	Terminals of ALARM circuit
20	ALL1 - NC	
21	ALL1 - NA	
22	ALL2 - C	Terminals of RELEASE circuit
23	ALL2 - NC	
24	ALL2 - NA	
25	FAULT - C	Terminals of FAULT circuit
26	FAULT - NC	
27	FAULT - NA	
28	FAN - C	Terminals of VENTILATION circuit
29	FAN - NC	
30	FAN - NA	



## 2.3 Main characteristics

System programmed directly from the front panel.

Each channel can be selected independently.

Automatic display of max. temperature and relative channels.

Software configuration for controlling inputs and outputs.

Maximum temperature memorized for each channel.

Relay test command.

Programmable ventilation settings.

Up to four channels during activation.

Two thresholds: one alarm threshold and one release threshold with change-over contacts.

Automatic probe fault indicator with change-over contact.

## 2.4 Operation

The software immediately detects, saves and signals any temperature irregularities in the automatic mode.

The entire programming procedure controls both the requests and data entered in the smart mode.

The Temperature Control Unit settings are standard factory values that can be modified as required. The alarm threshold is 140°C with release at 160°C and ventilation excluded.

The 19 LEDs on the display allow the MB 103 unit to clearly signal and handle information concerning the temperature situation.

## 2.5 Temperature display

The Temperature Control Unit always switches on in the automatic mode.

To change the display, press



: when the key is pressed, the operating mode of the instrument changes in sequence: "AUTO", "MAN" and "MAX"

AUTO: Automatic operation

Both the maximum temperature and the channel this measurement comes from are displayed in the automatic operation mode.


MAN: Manual operation


The temperature of each sensor is displayed in real time in the manual operation mode. The arrow keys are used to scroll the active channels.

MAX: Maximum operation

The maximum temperature reached by each probe is displayed in the maximum operation mode. The arrow keys are used to scroll the active channels.

## 2.6 Programming

Press the  key for 3 seconds to program.

The  "PROG" LED will light up on the instrument panel and the letter "S" followed by a number will appear on the display.

Use the arrow keys to re-program the operating mode of the unit as shown in the table below.

The table contains four pre-defined profiles for programming the active channels and a fifth profile.

Profile	Setting			
	Active channels		Channels with active ventilation	
	CH1, CH2 and CH3	CH 4	CH1, CH2 and CH3	CH4
S 0	YES	NO	NO	-
S 1	YES	YES	YES	YES
S 2	YES	YES	NO	NO
S 3	YES	NO	YES	-
S 4	Each channel can be activated as well as the relative ventilation			

**NOTE**

For profiles 0, 1, 2 and 3, the settings include one single alarm threshold and one single release threshold common to all activated channels.

The ventilation setting (profiles 1 and 3) will also have common thresholds.

Profile 4 is useful when maximum flexibility is required since any combination of active channels can be selected, while activation of the alarm and release thresholds and ventilation can be set for these channels independently.

Once the required operating profile has been selected, it must be confirmed by pressing the  key.

Programming proceeds with a request for entry of the alarm and release thresholds and, for the profiles concerned, entry of the ventilation activation and deactivation thresholds as shown in the table.



Display request sequence	Profile	Description
A nnn	0,1,2,3	Setting of the alarm threshold common to the channels activated by profile selection (see previous table)
t nnn	0,1,2,3	Setting of the trip threshold common to the channels activated by profile selection (see previous table)
L nnn	1,3	Setting of the ventilation stop threshold common to the channels activated by profile selection (see previous table)
H nnn	1,3	Setting of the ventilation start threshold common to the channels activated by profile selection (see previous table)



**NOTE**

Confirmation of “nnn” can be displayed at any moment by pressing the key.

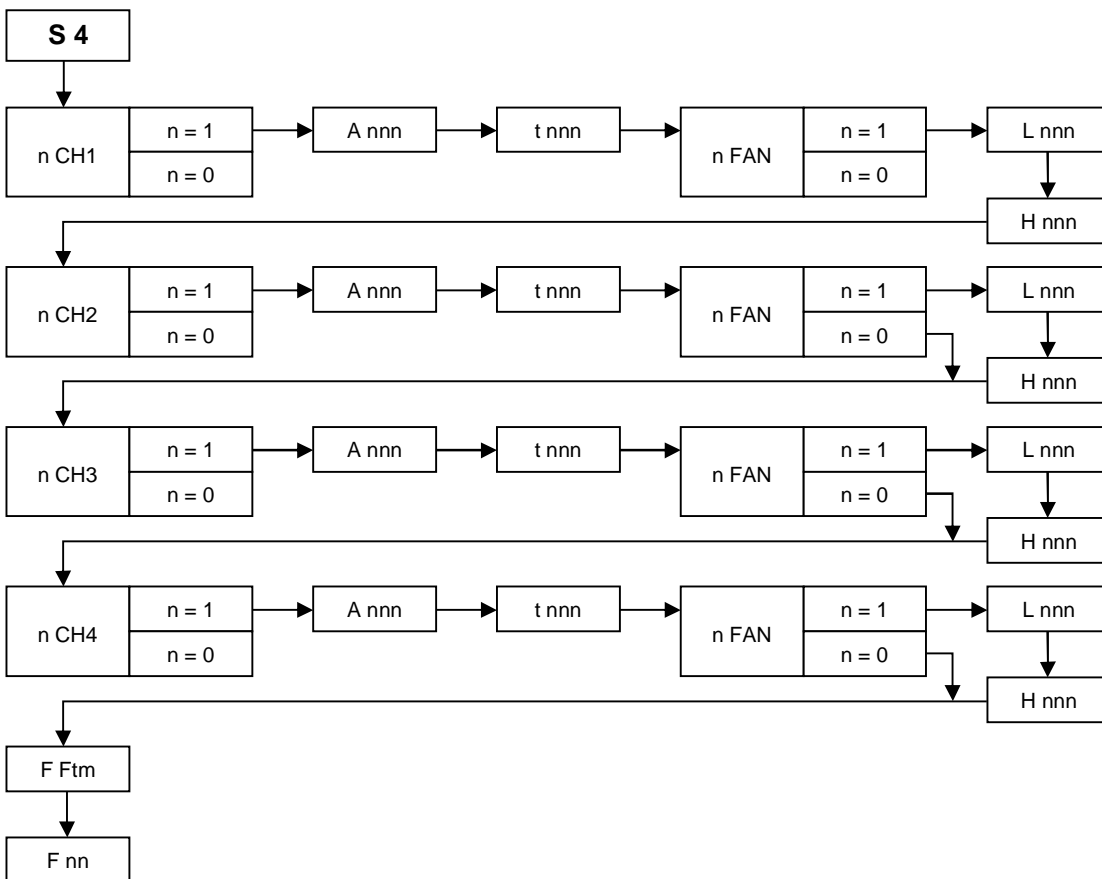
Use the arrow keys to make changes.

Use profile **S 4** for maximum freedom when making the settings.

Select **S 4** and press the **PROG CHANGE** key for each confirmation.

if this option has been selected, programming will follow the Flow-Chart below (consult the previous note when changing and confirming the “n” and “nnn” values):

**2.6.1 S4 profile**



**NOTE**


Entry of a value other than zero for the **F FtM** parameter, under the **F nn** item, specifies a time interval in hours after which ventilation will function for 5 minutes, regardless of the temperature present.

This function is available even when ventilation has not been applied to any of the active channels.

Each channel can have different values for each threshold and ventilation control can occur with any combination of channels.



### CAUTION

To restore the factory settings, access the programming mode and press the  key for a few seconds.


Do not confirm the last step if you wish to quit the programming mode without saving the changes made to the thresholds.  
Quitting will occur automatically after about 1 minute.

## 2.7 Correct operation checks

The unit features two test levels to ensure that the switchboard is reliable and the state signaled correctly.

The first level is dedicated to the front panel signaling LEDs, while the other checks to make sure that the command relay functions properly.

## 2.8 Signal tests


Press the  on the control panel to find out whether there are any faulty components.

All 19 LEDs and the display segments will light up for 2 seconds.

## 2.9 Zeroing procedure

Resetting the re-entered fault signal.


If a probe is faulty, the Temperature Control Unit indicates:

- release relay "Fault"
- the "alarm", "trip" and "fault" LEDs come on 
- the fault channel is displayed
- an error message is displayed alongside the fault channel:

SSP: probe short-circuited


OPP: probe interrupted

If the fault is intermittent (as in the case of faulty cables), the faulty sensor can be safely identified when the release signal returns since the LED continues to flash.

To reset the fault signal, press  for two seconds until the **FLt** signal appears on the display.

The fault signal reset function can be used in both the automatic and manual modes.

How to reset the maximum temperatures detected:

The function allowing the detected maximum temperatures to be reset is only available in the maximum log display mode (  "MAX").

This function allows the maximum logs to be reset to the current temperature values.

To reset, press  for two seconds until the **rES** signal appears on the display.

### 2.9.1 Factory settings

Parameters to enter	Message displayed	Set value
Instrument state	S n	0 (channels 1, 2, 3 active with ventilation excluded)
Alarm temperature	A nnn	140
Release temperature	t nnn	160
Ventilation Start value	H nnn	100
Ventilation Stop value	L nnn	90

### 3. INSTALLATION

The MB 103 Temperature Control Unit must be installed inside the switchboard compartment and then fixed in place with the fastening components and screws provided.

Connect the power supply (universal power supply 24V – 220V AC/DC or 12V DC).

Connect the probes to the relative connection.

Connect the auxiliary circuits (alarm, trip, fault, fan) to the electrical connections.



#### WARNING

The instrument reads up to PT 100 probes.

Dust, humidity and corrosive gases should be avoided. Keep away from heat sources. The maximum operating temperature of the instrument is 60 °C.

### 4. CONNECTION

#### 4.1 Power supply



#### WARNING

The power supply is universal: 24V - 220V AC/DC or 12V DC

#### 4.2 Inputs



#### WARNING


Up to four PT100 resistance thermometers

#### 4.3 Relay tests

The operation test for all the relays can be performed via the menu.

Press the  for about 2 seconds until the  "TEST" LED comes on.

Press again to test the other relays.

Press  to quit the relay test menu (see table below).

Display	State	Description
n ALL	n = 0 Deactivated	Alarm relay test
	n = 1 Activated	
n trP	n = 0 Deactivated	Trip relay test
	n = 1 Activated	
n FLt	n = 0 Deactivated	Fault relay test (Inversion of the logic that allows faults to be signaled if the supply is locked can be considered)
	n = 1 Activated	
n Fan	n = 0 Deactivated	Ventilation relay test
	n = 1 Activated	

## 5. OPERATION AND MAINTENANCE

### 5.1 Starting

Power the terminals to start the MB 103 Temperature Control Unit.



#### CAUTION

If possible, group all parts of the instrument in a separate area from the relay powering section.

Do not install the following components in the same switchboard: high power teleswitches, counters, relays, thyristors and, especially, phase displacement units, motors, etc.).

Before applying the MB 103 Temperature Control Unit, wait for the equipment to reach room temperature (at least 1 hour).

### 5.2 Maintenance

Always perform the following inspections on the dehydrator during scheduled maintenance of the transformer:

- Check the operation of the LEDs.
- Check the operation of the display.
- Check the failure contact.

### 5.3 Fault monitoring

Fault	Cause	Solution
The instrument fails to switch on	Faulty power supply	Check connection
	Power supply protected	Remove protection and restore voltage
Fault alarm activated	Sensors faulty or wrongly connected	Check and/or invert connections between faulty and operating probes
Temperature indicated by instrument is wrong for one or more probes	Faulty probes	Check Ohm value of probe with connections disconnected
Probes are connected correctly but "Fault" LED comes on	Fault is intermittent	See: Resetting the re-entered fault signal (section 2.9)
The instrument is affected by disturbance	Probes are not shielded or shield is not connected	Connect probes to shield and earth, but only on instrument side.

If the fault is not mentioned above, please contact:

Comem  
 S.R. 11 Signolo, 22  
 36054 Montebello Vicentino (VI) - Italy  
 Tel +039 0444 449311 E-mail: [infocomem@it.abb.com](mailto:infocomem@it.abb.com)

### 5.4 Movement, transport and storage



All MB 103 Temperature Control Units are shipped inside a cardboard box on a pallet to facilitate transport and storage.

As soon as the MB 103 Temperature Control Unit is received, the customer must perform the following operations:

- examine the outer surface of the packaging to make sure it is intact;
- check that there are no breakages.

If damage is discovered, please contact Comem and provide the data in the shipping list together with the serial number of the instrument.

Comem  
 S.R. 11 Signolo, 22  
 36054 Montebello Vicentino (VI) - Italy  
 Tel +039 0444 449311 E-mail: [infocomem@it.abb.com](mailto:infocomem@it.abb.com)

The MB 103 Temperature Control Unit must be stored in a dry place at temperatures from -20°C to 40°C.

## 6. SOFTWARE

### 6.1 Introduction

The software allows the parameters and temperatures detected by the MB 103 in real time to be displayed. Create a *Log File* where all the data can be stored.

### 6.2 Installation

To install the program used by the MB 103 Temperature Control Unit, insert the CD into the PC drive and wait until for the installation procedure autorun.

After a few minutes, if the autorun fails to appear, run the “Setup” program by means of “Computer resources” or “Explore resources”.



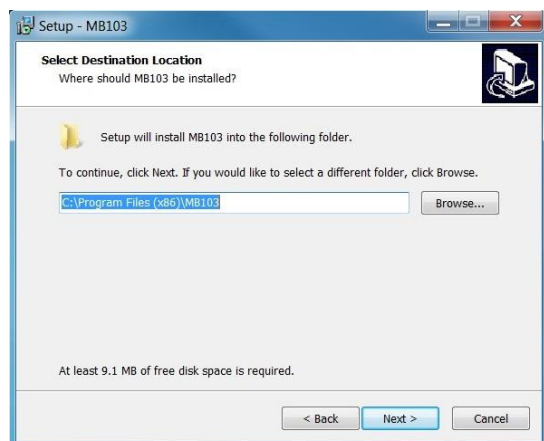
Select the installation language then press OK. (fig. 1)

Fig. 1



Click on “Next”. (fig. 2)

Fig. 2



Press “Browse”; (fig. 3)

Select the destination location of the installation and press “OK”; (fig. 4)

Click on “Next”. (fig. 3)

Fig. 3

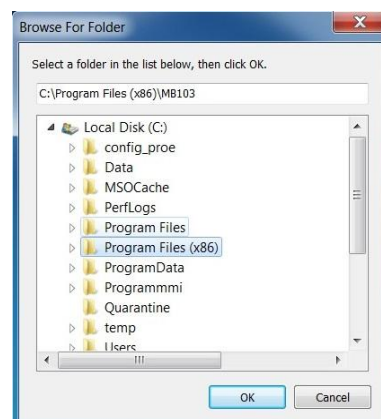


Fig. 4



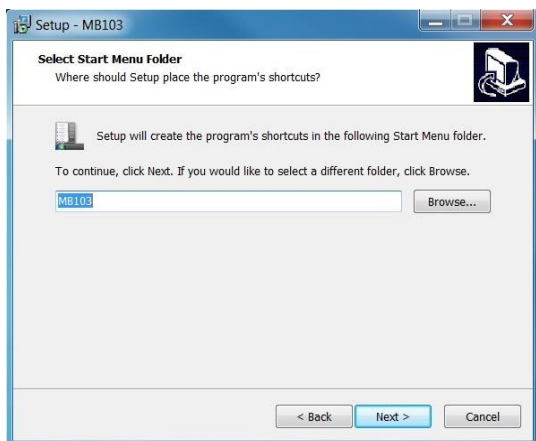


Fig. 5

Click on "Next".  
(fig. 5) and (fig. 6)



Fig. 6

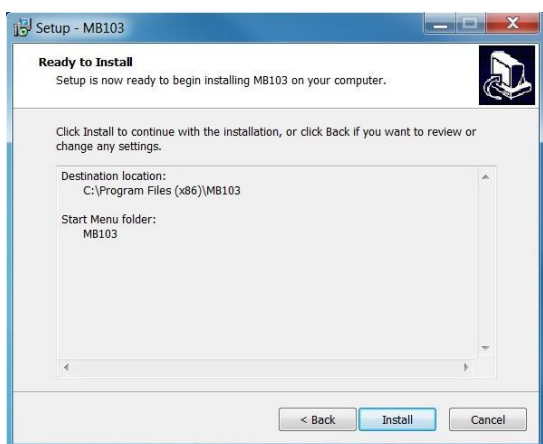


Fig. 7

Click on "Install".  
(fig. 7)

then on "Finish".  
(fig. 8)



Fig. 8

The installation procedure has now terminated.

### 6.3 Use

Once the program has been installed, click on the start Menu: "Start – Programs – MB 103" to run the software.

the following page will appear:

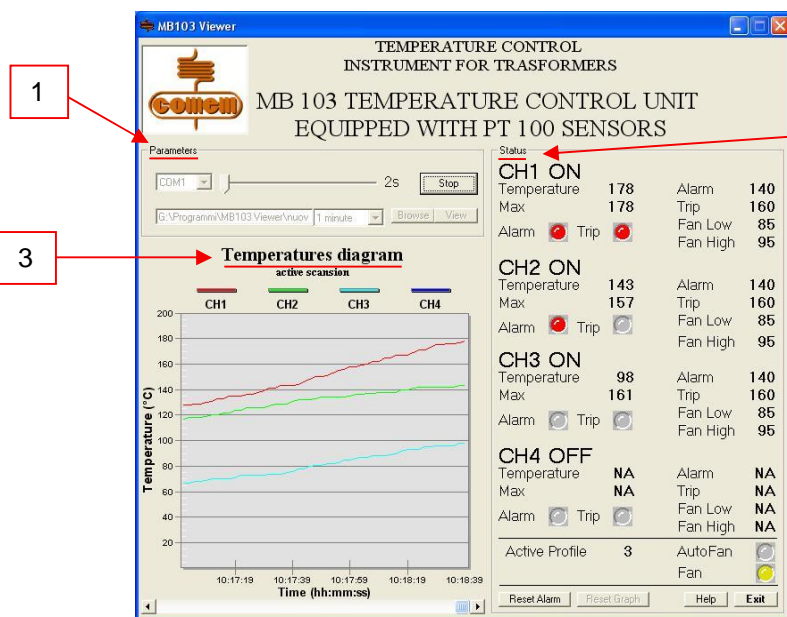


Fig. 9

The initial window (fig. 9) is divided into 3 parts:

1. Parameters
2. Status
3. Temperatures diagram

### 6.3.1 Parameters

In the Parameters area (fig. 10) you can:

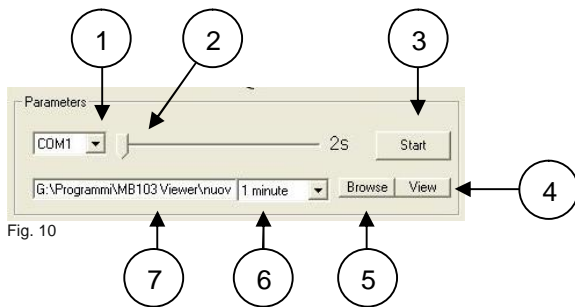


Fig. 10

- 1) choose which RS 232 to enable: COM1 or COM2;
- 2) establish the graph sampling time (minimum 2s and maximum 600s);
- 3) start acquiring data with "Start" or stop data acquisition with "Stop";
- 4) display the *Log File* with the "View" button;
- 5) create the *Log File* with the "Browse" button;
- 6) select the *Log File* sampling time interval from the pull-down menu;
- 7) view the storage path of the *Log File*.

The data acquired during the scanning process are stored in the **Log File**.

The file has a ".csv" type of extension so that it can be consulted using the most widely used spreadsheets (Microsoft Excel, Calc). In view of the limited number of lines (about 65,500), the program eliminates the oldest data and maintains the most recent ones.

For this reason, the software has been designed to regulate the sampling time interval so as to maintain the most significant data for the user in its memory (tab. 1).

Sampling time interval	Historical data
1 minute	45 days
2 minutes	3 months
6 minutes	9 months
9 minutes	13 months
10 minutes	15 months

Tab. 1

Once data acquisition has been stopped by pressing the "Stop" button, the *Log File* can be consulted by pressing "View". If the required spreadsheet is not displayed, the program must be defined by using "Open with" in "Explore resources" or "Computer resources" and clicking on *Log File* with the right key of the mouse (fig. 11).

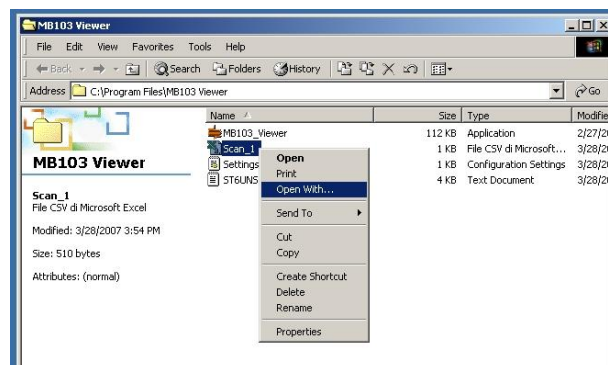


Fig. 11

To display the *Log File* correctly, open the required file from “Explore resources” or “Computer resources” and then save with the normally used spreadsheet extension, using “Save as”.

For example, Microsoft Excel uses extension “.xls” (*fig. 12*).

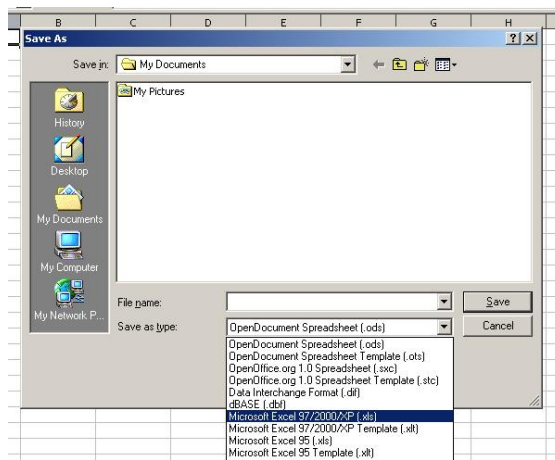
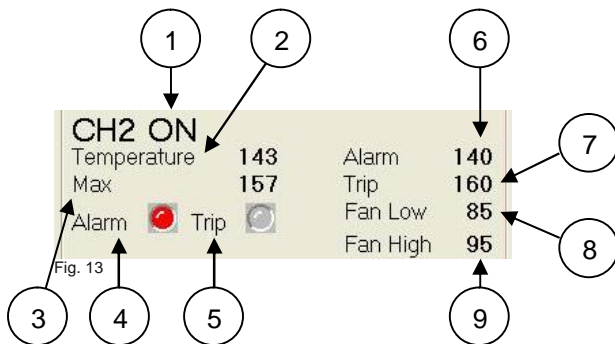


Fig. 12

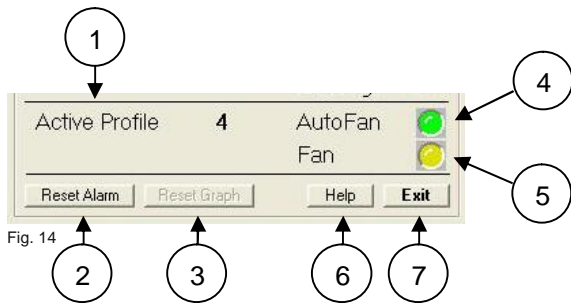
### 6.3.2 Status

Status (*fig. 13*) allows you to view the settings of the MB 103:



- ON will appear if the temperature detection channel 1) is activated, otherwise OFF will appear.
- The following information is displayed for each active channel:
  - 2) the instantaneous temperature value;
  - 3) the maximum temperature value memorized by the unit;
  - 4) the alarm state: GREY is not active, RED if active;
  - 5) the trip state: GREY is not active, RED if active;
  - 6) the trip temperature of the alarm;
  - 7) the trip temperature of the release;
  - 8) the ventilation deactivation temperature;
  - 9) the ventilation activation temperature;
- The letters NA will appear on a level with the *Temperature* 2), *Max* 3), *Alarm* 6), *Trip* 7), *Fan Low* 8), *Fan High* 9) values if not all channels are active.

The following information appears in the lower part of the Status area (fig. 14):



- 1) the active profile;
- 2) the "Reset Alarm" key: deletes the active alarms if pressed;
- 3) the "Reset Graph" key: deletes the data shown in the graph (Fig. 15)
- 4) the visual AutoFan indication: GREEN if on, GREY if off;
- 5) the visual F indication: YELLOW if on, GREY if off;
- 6) the "Help" key to access help online;
- 7) the "Exit" key to quit the program.

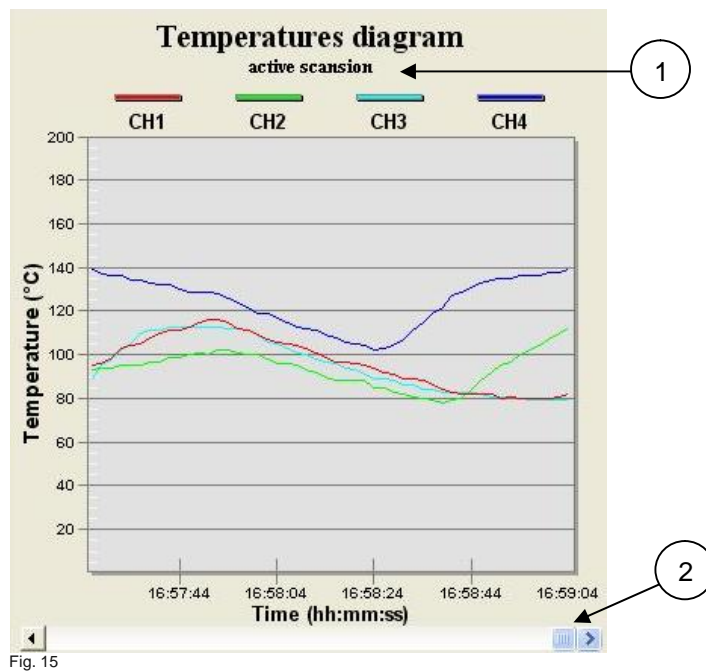


**NOTE**

If the *Active Profile* is number 4 and ventilation is activated (with *Fan* YELLOW in colour), then *AutoFan* will be GREEN.

**6.3.3 Temperature diagram**

The temperature trend detected over time can be viewed in the Temperatures diagram (fig.15):



Use the Scroll bar (1) to move the x-coordinates so as to display the instants prior to the displayed times. Press "m" on the keyboard to zoom the graph area. Press "Esc" to go back to the main page.

The words "active scanning" (2) will appear if acquisition is activated, otherwise the message will be "no active scanning".

Click with the right key of the mouse when on the graph area to display the dialog window and change the parameters (fig. 16).

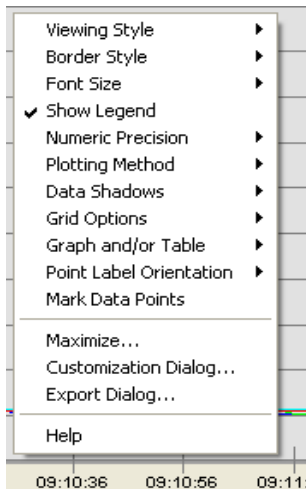


Fig. 16

The main functions are as follows:

- *Viewing Style*: to change the colours of the graph area;
- *Show Legend*: enabled if graph legend is ticked;
- *Plotting Method*: allows you to choose the mode with which the temperatures on the graph are displayed (histograms, lines, dots, etc...);
- *Maximize*: zooms the graph area;
- *Customization Dialog*: allows you to access a dialog mask (fig. 17), where you can:
  - enable or disable the channels displayed in the graph area (**Subsets**)
  - change the number of points shown in the graph area (**Points**)
  - change the scale of the y-coordinates (linear or logarithmic) and the temperature range (**Axis**)
  - change the colours and types of lines and points (**Style**)

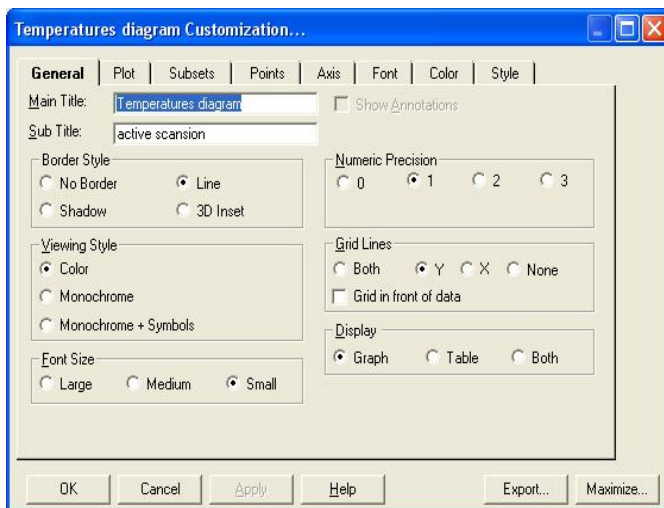


Fig. 17

