MPB S.r.l.
Via Giacomo Peroni 400/402
00131 ROMA (RM)

Tel +39 0641200744
Fax +39 0641200653
info@gruppompb.com
www.gruppompb.com

User Manual

CCM

Contact Current Meter

Updated to Firmware Version:
CCM V1.03

SAFETY NOTES

Read carefully before using the product

MPB works to provide to its customers the best safety conditions available complying with the current safety standards. The instrumentation described in this manual has been produced, tested and left the factory in conditions that fully comply the European standards. To maintain it in safe conditions and ensure the correct use, these general instructions must be fully understood and applied before using the product.

This product is designed for industrial environment and laboratories and should be used by skilled staff only. MPB disclaims responsibility for a different use of the device.

Use the device only after checking the presence and validity of the safety devices (as breakers, differential switches and the validity of grounding)

For safety reason, the *HAND* measure modality has to be done only **after** the *GROUND PLANE* modality which marks a value below regulations limits defined by the 2013/35/EU regulation.

Declaration of Conformity

CE

(in accordance with the Directives: EMC 89/336/EEC and Low Voltage 73/23/EEC)

This is to certify that the product: CCM
(Contact Current Meter)

complies with the following European Standards:
Safety: CEI EN 61010-1 (2001)
EMC: EN 61326-1 (2007)

This product complies with the requirements of the Low Voltage Directive 2006/95/CE, and with the EMC Directive 2004/108/CE.

MPB S.r.l.

Contents

1 General Information **1**
- 1.1 Introduction . . . 2
- 1.2 Descrizione . . . 2
- 1.3 Composition . . . 2
- 1.4 Optional Kit . . . 2
- 1.5 Front . . . 3
- 1.6 Rear . . . 4
- 1.7 Technical Specifications . . . 5

2 Principle of operation **7**
- 2.1 Logic Schema . . . 7
- 2.2 Measures . . . 8
- 2.3 Contact Current . . . 8

3 Usage of CCM **11**
- 3.1 Switch On . . . 11
- 3.2 Standby Screen . . . 12
- 3.3 Hand or GP . . . 12
- 3.4 BANDWIDTH/TOTAL . . . 14
- 3.5 First Run . . . 14
- 3.6 Menu of CCM . . . 16
  - 3.6.1 Regulation limit . . . 16
  - 3.6.2 Beep on press . . . 17
  - 3.6.3 Alarm . . . 17
  - 3.6.4 Auto OFF . . . 17
  - 3.6.5 Date & Time . . . 19
  - 3.6.6 Contrast . . . 19
  - 3.6.7 Clear Data . . . 19

4 Data Download **21**
- 4.1 Connect to PC . . . 21
- 4.2 Data Format . . . 22

Figures List **25**

Chapter 1

General Information

Figure 1.1: CCM

1.1 Introduction

CCM was designed to measure the contact current that may be generated when you touch electrical / electronic equipment, which stays inside an radio frequency field, in a quickly and accurately way.

1.2 Descrizione

CCM (Figure 1.1) is a portable measuring device with more than one measure mode. Depending on yours need, it can measure by means of the *GROUND PLANE* (which is a standard impedance level), or it can works without cable, exploiting the users impedance level through the conductive area on the handle. In the next chapters we will see more deeply this subject.

1.3 Composition

The device come with its special suitcase, containing the "GP" (Ground Plane), a ground wire and a standard resistance.

1.4 Optional Kit

CCM-Kit of calibration, made of:

- CCM-JIG
- standard resistance R45
- RG316 cable (1 mt length) N(M)-sma(M)

1.5 Front

In Figure 1.2 is showed the CCM front panel:

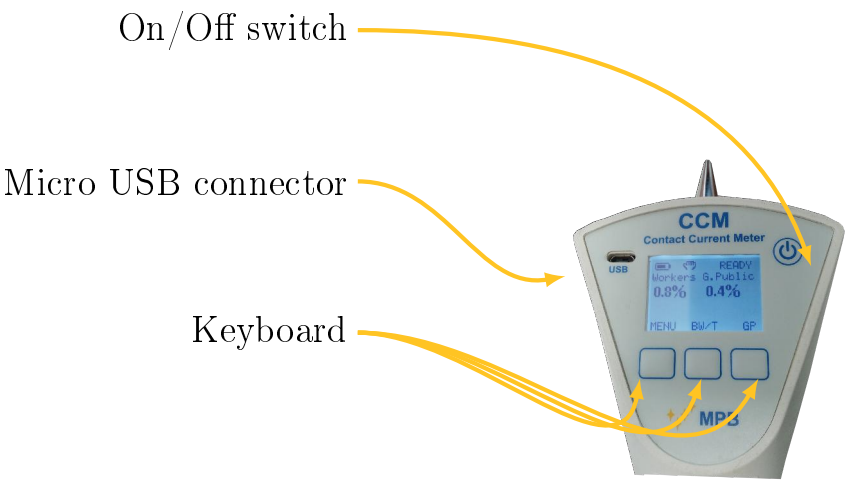

Figure 1.2: CCM front

1.6 Rear

In Figure 1.3 is showed the CCM rear panel:

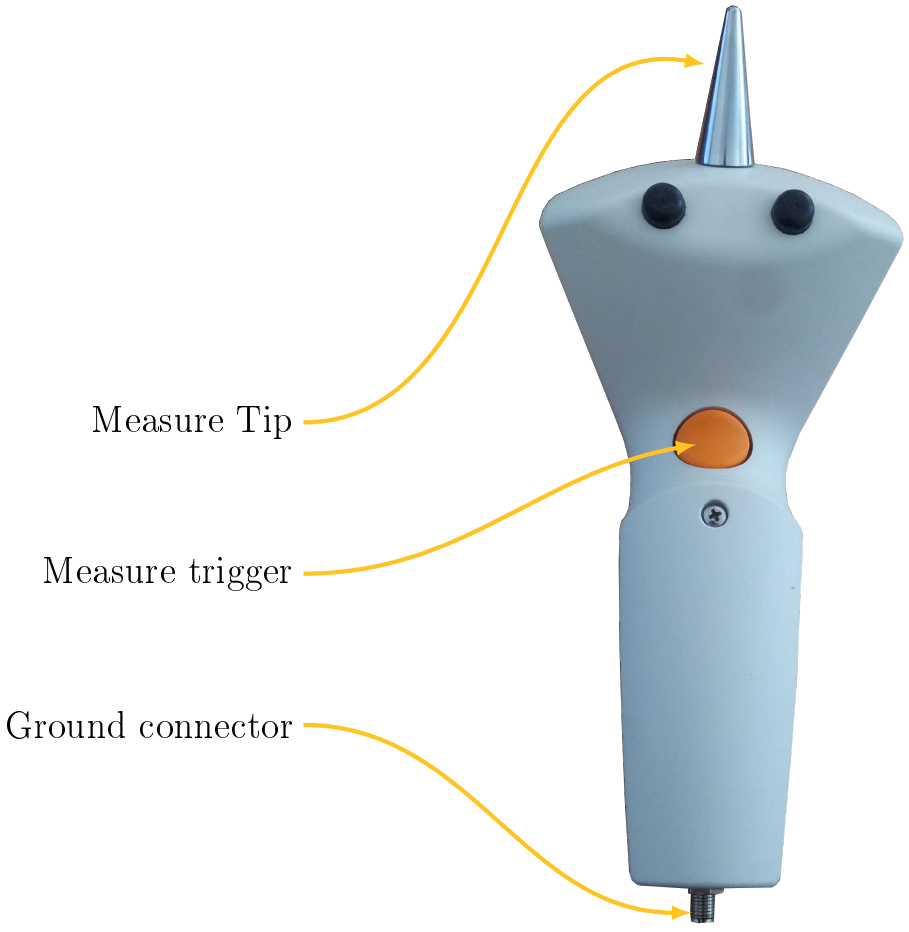

Figure 1.3: CCM rear

1.7 Technical Specifications

Frequency Range	
Low band	40 *Hz* to 2.5 *kHz*
Medium band	2.5 *kHz* to 100 *kHz*
High band	100 *kHz* to 110 *MHz*
Frequency Response	
Low band	$< \pm$ 1 dB
Medium band	$< \pm$ 1.5 dB
High band	$< \pm$ 1.2 dB
Measurement range	
Low Band	
Level range	0.01 to 3 mA (ICNIRP limit 1 mA)
Damage level	100 mA
Resolution	1 nA
Dynamic range @ 500Hz	50 dB
Linearity error @ 500Hz; 0,3...3 mA	$< \pm$ 1 dB
Medium band	
Level range	0 to 300 % (ICNIRP limit 1 to 40 mA)
Damage level	500 %
Resolution	1 nA
Dynamic range @ 10kHz	50 dB
Linearity error @ 10Hz; 10...200 %	$< \pm$ 1 dB
High band	
Level range	0.4 to 120 mA (ICNIRP limit 40 mA)
Damage level	300 mA
Resolution	10 nA
Dynamic range @ 10MHz	50 dB
Linearity error @ 10Mz; 12...120 mA	$< \pm$ 1 dB
Measurement mode	Hand and Ground
Alarm sound	Programmable level
Display	Graphic LCD with led backlight
Detectors	true RMS
Contact tip	Interchangeable
USB Interface	Micro USB connector
Standards	Directive 2004/40/EC
Operating Temperature	+10 °C to +40 °C
Power supply	
Battery	2pcs AA Alkaline
Operation Time	24 hours
Dimension	205 × 90 × 45 mm
Weight	200 g
Recommended calibration interval	24 months
Input signal attenuation over 110 MHz	200 MHz –> 7 dB 300 MHz –> 18 dB 400 MHz –> 31 dB 500 MHz ... 3 GHz –> >45 dB

Chapter 2

Principle of operation

2.1 Logic Schema

The schema showed in Figure 2.1 describe CCM work flow:

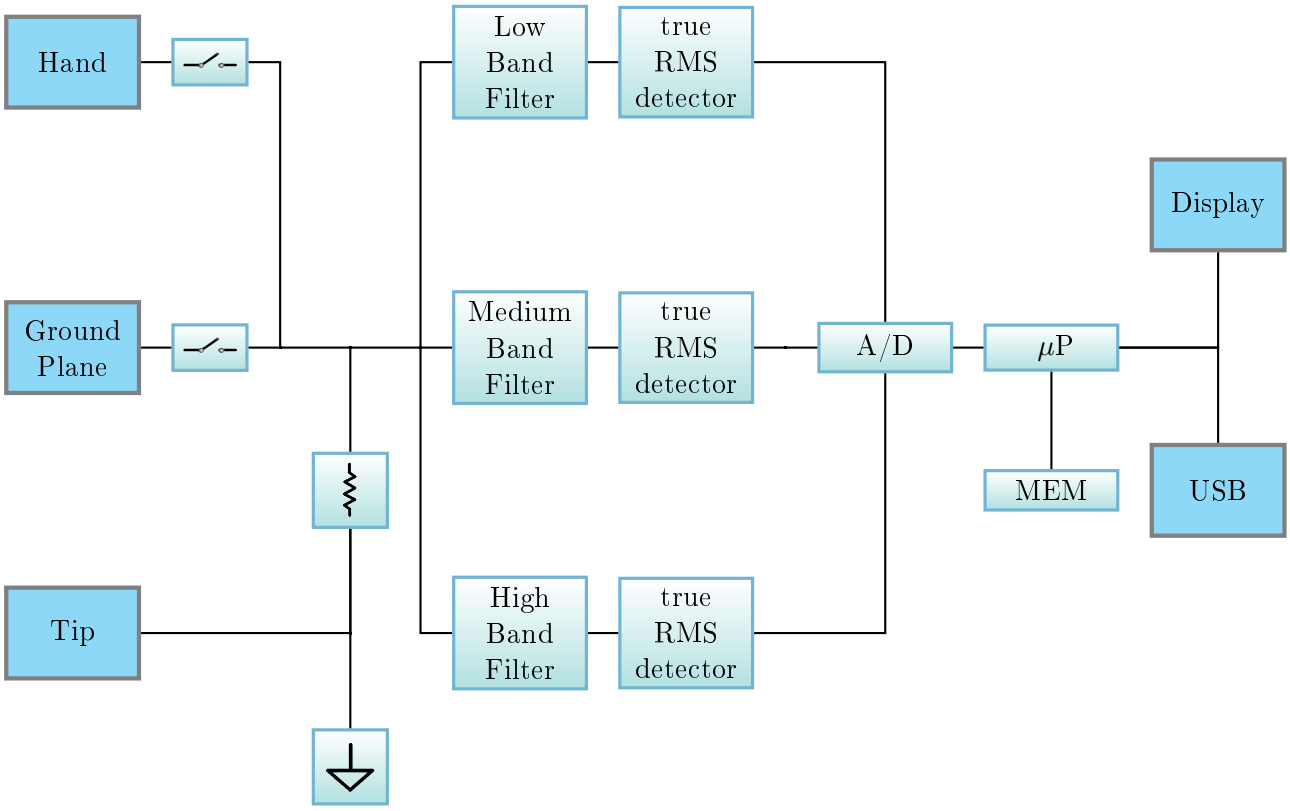

Figure 2.1: CCM Block Diagram

2.2 Measures

The CCM has a digital nature, but it can measure the true RMS (Root Mean Square) value for all analog signals from 40Hz. The RMS value of a waveform signal is equal to a DC current witch provides the same power to the load. The signal is measured by the TIP and pass through the most suitable filter (Low, Medium and High), then arrives at the true RMS detector who gets the value. The equation is the following:

$$e_{rms} = \sqrt{\frac{1}{T}\int_0^T \mathrm{V(t)}^2\,\mathrm{d}t}$$

The actual regulations defines the minimum requirements for the safety of workers and general public in areas of risk, and the limit values for exposure to current contact.

2.3 Contact Current

The current contact happens when a electrical conductor touches another metallic object immersed in an electromagnetic field, and is expressed in Amperes. The moment after the contact, can cause a discharge of currents associated (First attachment of 2013/35/EU). In the workplace, as indeed in the world we live in, the electric and magnetic fields are always present and may have natural or artificial origin. The natural electric fields are, for example, those produced by the accumulation of electric charges during lightning, while the natural magnetic fields are those that are found in nature, such as the terrestrial that orients the compass needle North-South . The electric and magnetic fields are produced by artificial devices and systems, such as electrical equipment or systems for the distribution of electricity.

The electromagnetic field is defined as a physical phenomenon given by the simultaneous existence of an electric field and a magnetic field. Moving away from the source of the electromagnetic field, waves decrease in intensity, it is therefore clear that the intensity is maximum if it comes in contact with the object or with the system which is generating the electromagnetic field. A device with metallic shell if immersed in an electromagnetic field can become a carrier of RF voltage and electrical charge. If you come into contact with the said device without adequate protection, you risk that the RF voltage discharge to ground flowing through the limbs and body. In this case the electrical charges present on the device immersed in the electric field through the operator's body have generated a contact current. An electrical equipment not properly shielded can emit electromagnetic waves. If it comes into contact with the above machinery without adequate protection, even in this case there is a risk that electromagnetic

waves flowing through the limbs and the operator's body to generate a contact current.

Chapter 3

Usage of CCM

3.1 Switch On

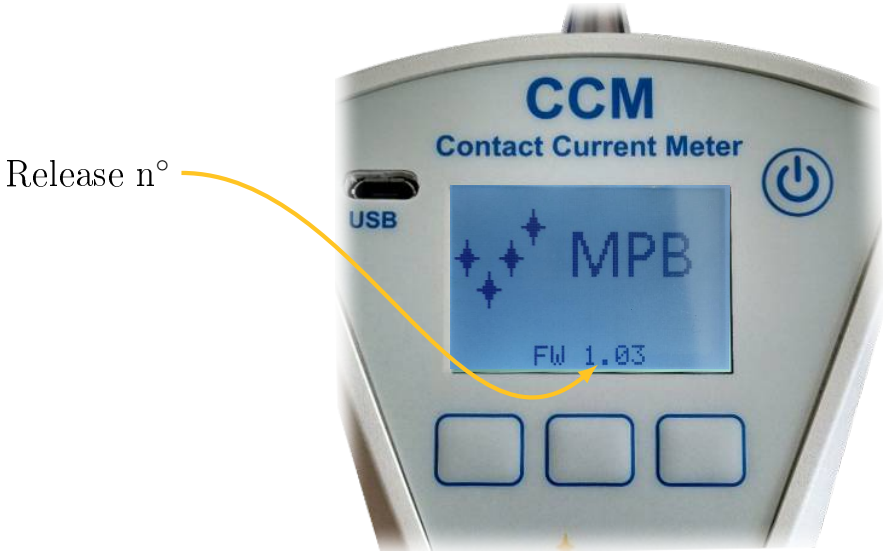

Figure 3.1: turned on CCM

When the CCM is turned on it shows the company logo and the firmware version (Figure 3.1). After a few seconds a warning message will appear (as in Figure 3.2), and users declare to have read this manual and be aware of the risks involved during the current measurement. In case of negative answer (by pressing "DENY"), the device will automatically turn off.

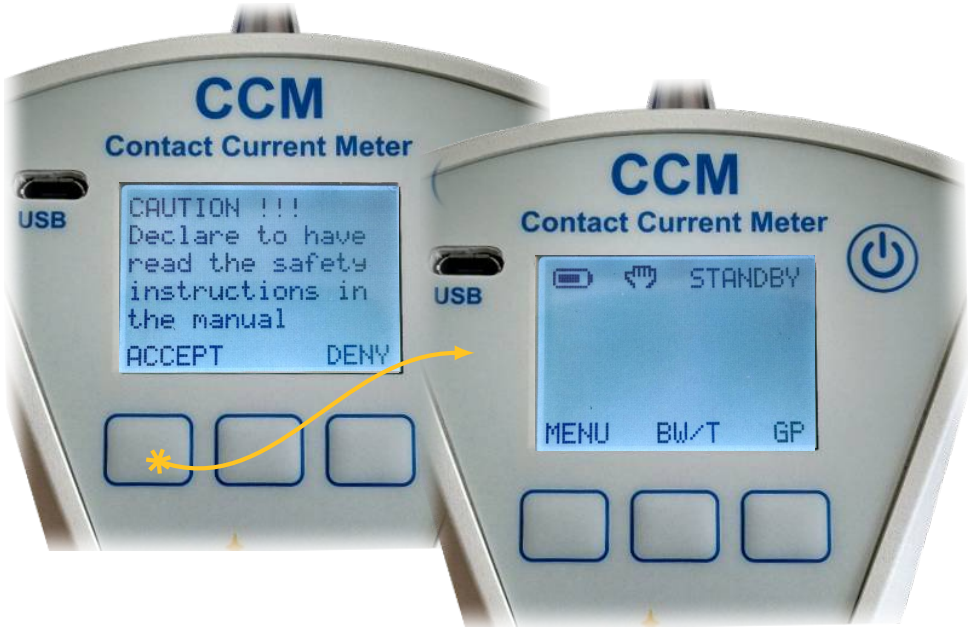

Figure 3.2: menu of CCM

Once you accept the terms of use, the device will remain in the state of *STANDBY* until the operator presses the Trigger to make a measurement.

3.2 Standby Screen

In Figure 3.3 is showed the standby screen. Focusing the high part of display:

- *Battery* indicator.
- The *Measure Modality* points witch kind of circuit is selected, and (we'll see deeply in next chapter) there are two different Modality:

HAND for measures that use the body resistance of the operator as a reference.

GP (or *GROUND PLANE*) for measures relating to the metal plate supplied with an standardized impedance reference.

- The *State* indicates to the user if the device is ready to make a measurement or not.

3.3 Hand or GP

In the main screen, the right key (marked with *GP* or *HAND*) allows to choose which circuit used for the measurement that follows (Figure 3.4). It's a good

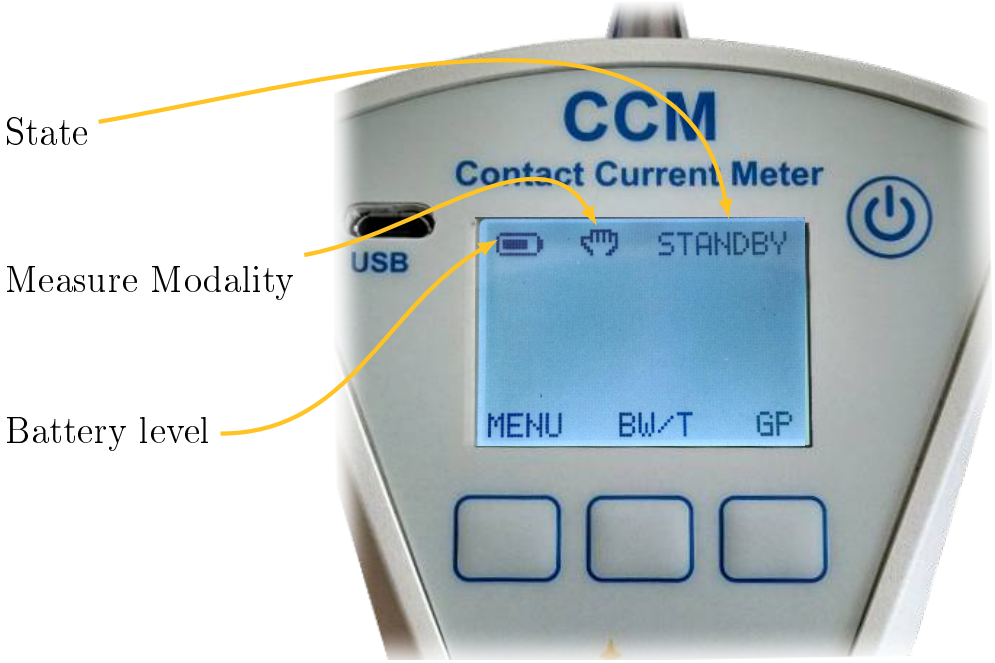

Figure 3.3: First Run

practice measure with the Ground Plane **before** doing the *HAND* measures (in extreme cases a high current may drain simply on the ground). In the *Hand* measurement the CCM will take account of the real value of the impedance of the human body.

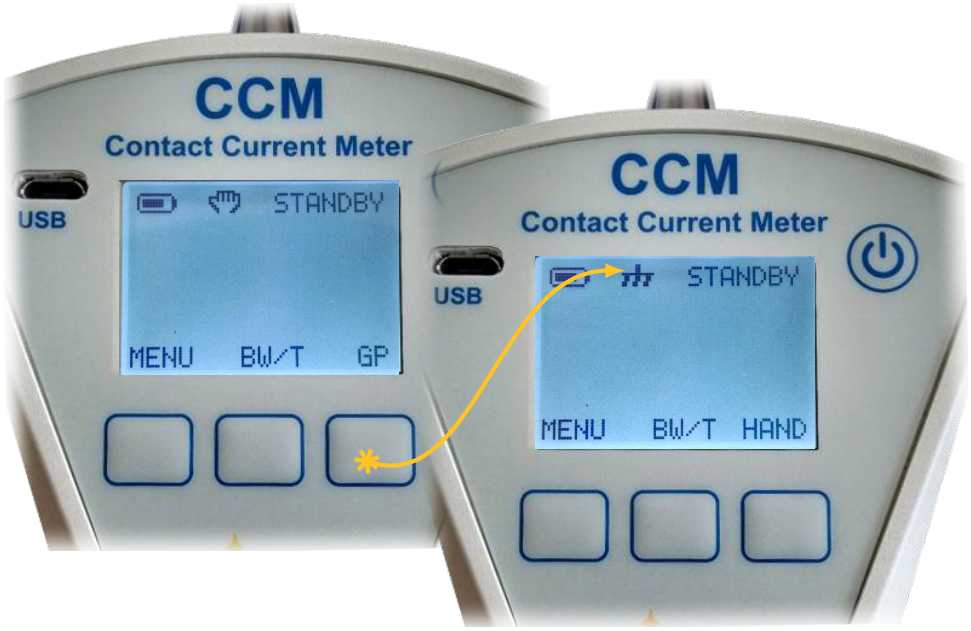

Figure 3.4: Hand or GP

3.4 BANDWIDTH/TOTAL

Central key, marked with *BW/T*, allows to choose the visualization mode:

BANDWIDTH Display of measurement divided by bands (or selective), with the end result in mA.

TOTAL Overall view of the value measured in percentage compared to the ICNIRP limit.

This appear as in Figure 3.5. The *Low band Filter* starts at 40 Hz to 2.5 kHz (IC bound = 1 mA), and the *High band Filter* start at 0.1 MHz to 110 MHz (IC bound = 40 mA). The value of the contact current in the range of frequencies ranging from 2.5 kHz to 100 kHz is determined for the difference between the total value and the respective values of the LF and HF bands. for this reason it is suggested to perform the measurement while "displaying" Total and then check in BW at what frequency range there was any limit to be exceeded.

3.5 First Run

At power on (or if it's been more than a minute since the last measurement) the CCM is in *STANBY* mode. By pressing the trigger the device performs a test to verify the effectiveness of the selected relay switching and active the *WAIT*

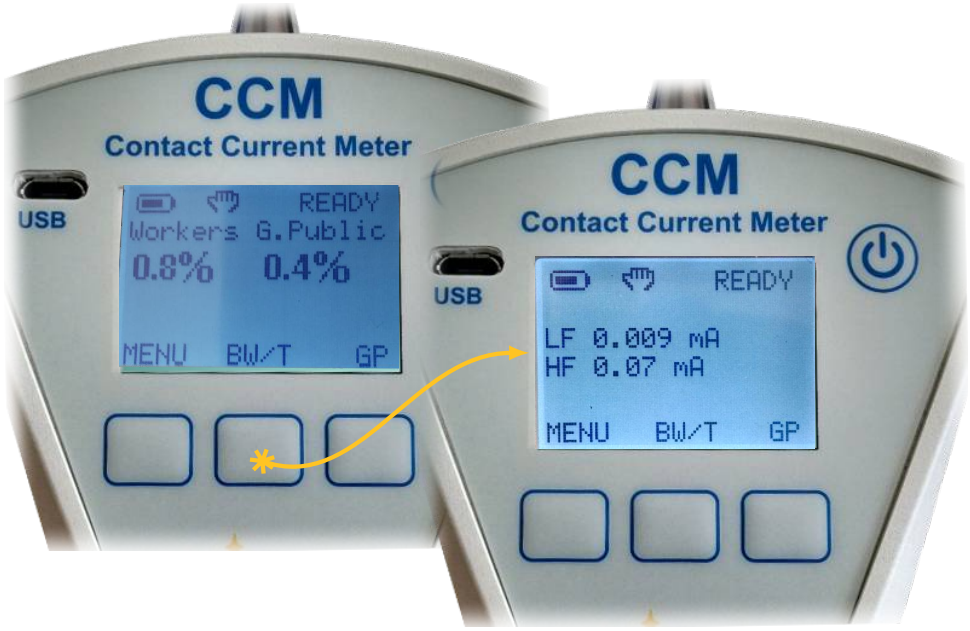

Figure 3.5: BW/T

mode which points that the device is preparing itself to make measures. If the test on the actual switching of the relay has been successful, the message *READY* is shown, otherwise it will shows *ERROR xx*, where *xx* is the error code. The operator before pressing again the trigger will have to await the appearance of *READY* on the screen (Figure 3.6). From this moment the device is ready to perform the test in real-time.

Figure 3.6: Ready for measuring

Before carrying out the measurement, follow the instructions below:

- *Bring the status of the instrument from STANDBY to READY pressing the trigger. Only after viewing the status of READY (without pressing the trigger again) touch the equipment under test with the tip and only after establishing contact press the trigger to start the measurement. You can perform single or consequential measurements.*
- *With each new measurement, the operator will be warned by an acoustic signal (if enabled) and, simultaneously, by a greater display illumination. All measures are automatically stored automatically by the CCM.*
- *In both modes the measuring tip of the CCM must never be detached from the equipment under test.*

3.6 Menu of CCM

The next part of the manual shows sequentially the possible configurations of the device.

3.6.1 Regulation limit

From the standby screen, by pressing the *MENU* key, you will reach the screen showed in Figure 3.7

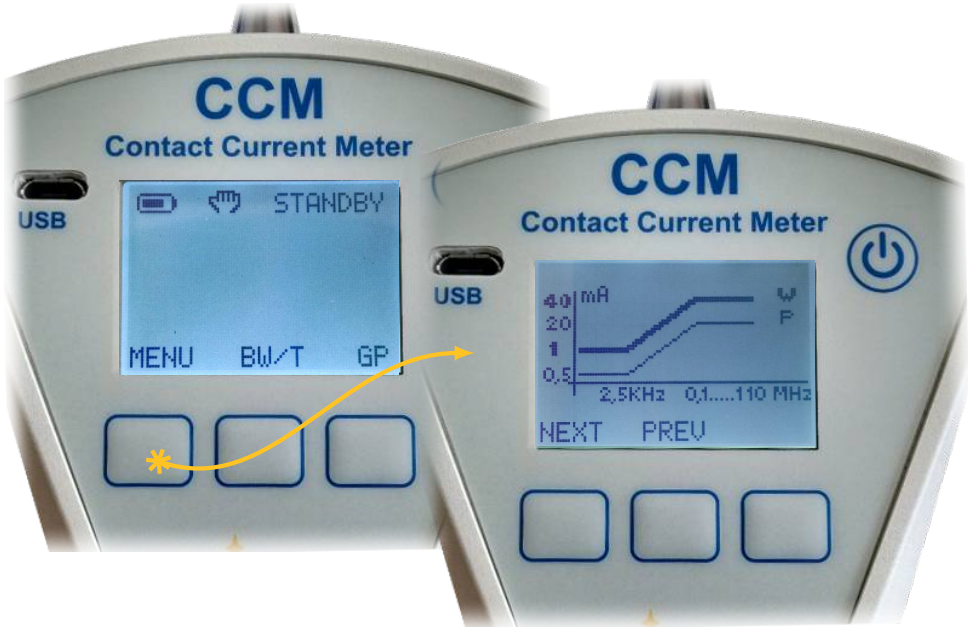

Figure 3.7: Limit

This screen is intended as a reminder for the user, since it expresses the limit values for which the CCM is designed.

3.6.2 Beep on press

The second page of the menu allows you to enable or disable the beep every time you press a key. To change this setting to access the page with the key *SET*, as in Figure 3.8.

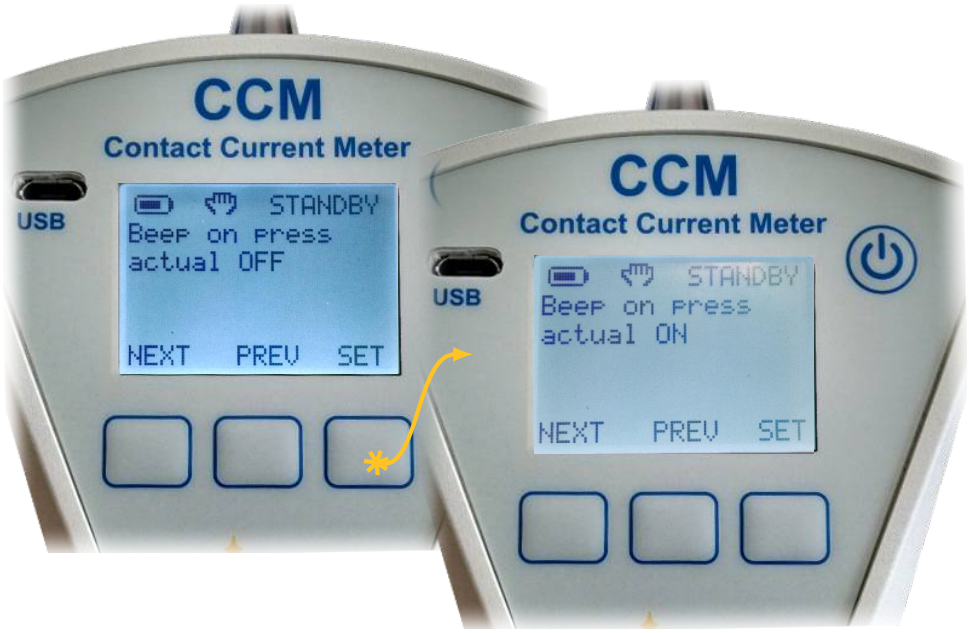

Figure 3.8: Beep on press

3.6.3 Alarm

Continuing in the menu (always using the *NEXT* key) the third page is displayed on the alarm. In this case when pressing the *SET* key (as showed in Figure 3.9).By default the alarm is disabled, when pressing the *UP* key value is incremented by 5 % until it reaches the maximum warning threshold of 300 %.

that the percentage value is parametric with respect to the frequency of the input signal, based on the graph shown on the first page of the menu (Chapter 3.6.1).

3.6.4 Auto OFF

This settings determines how long the device must idle before shutdown. This is the fourth page of the menu, and in Figure 3.10 you can see how, on this page, the left and center change their behavior.

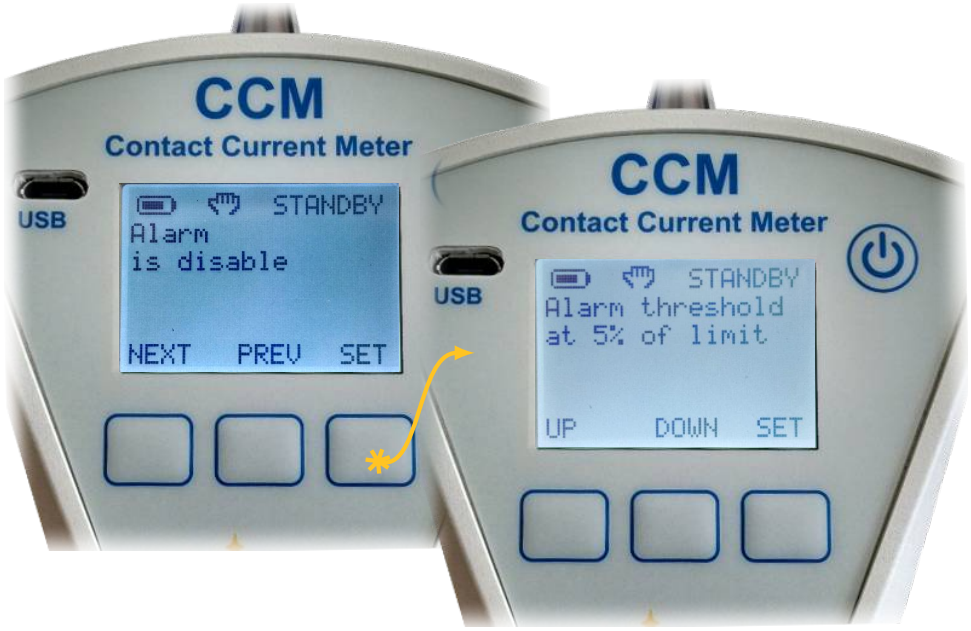

Figure 3.9: Alarm

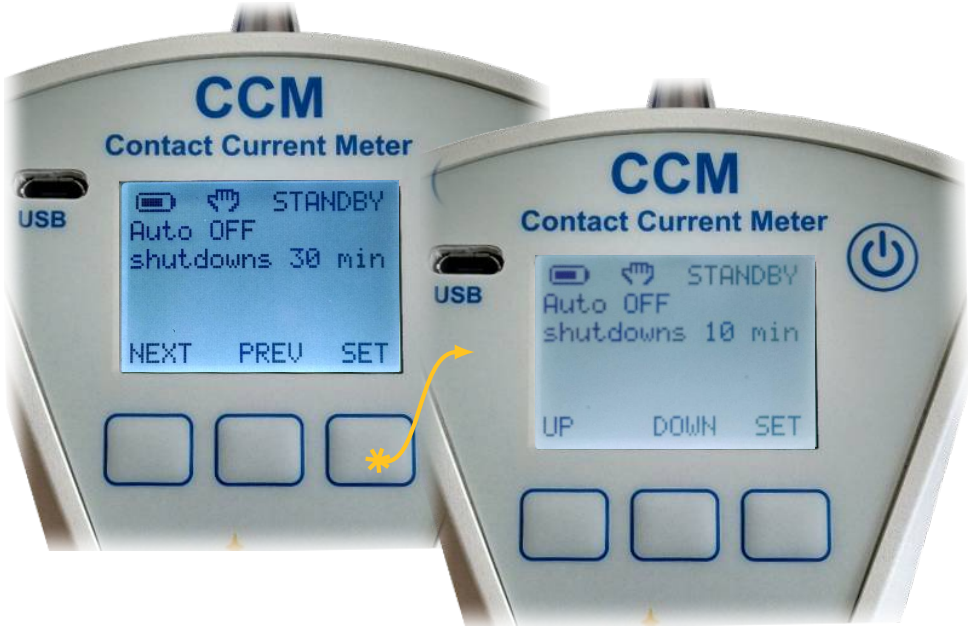

Figure 3.10: Auto Off

The possible values for this setting range starts with 10 minutes and come to a maximum of 60 minutes (with a 10 minutes span). You cannot disable this option for energy savings.

3.6.5 Date & Time

The fifth menu item allows you to change the date and time of the device (Figure 3.11). It is important that this information is correct, because as the results of measurement in the downloaded data (csv file generated by the device) are associated with the day and time of measures.

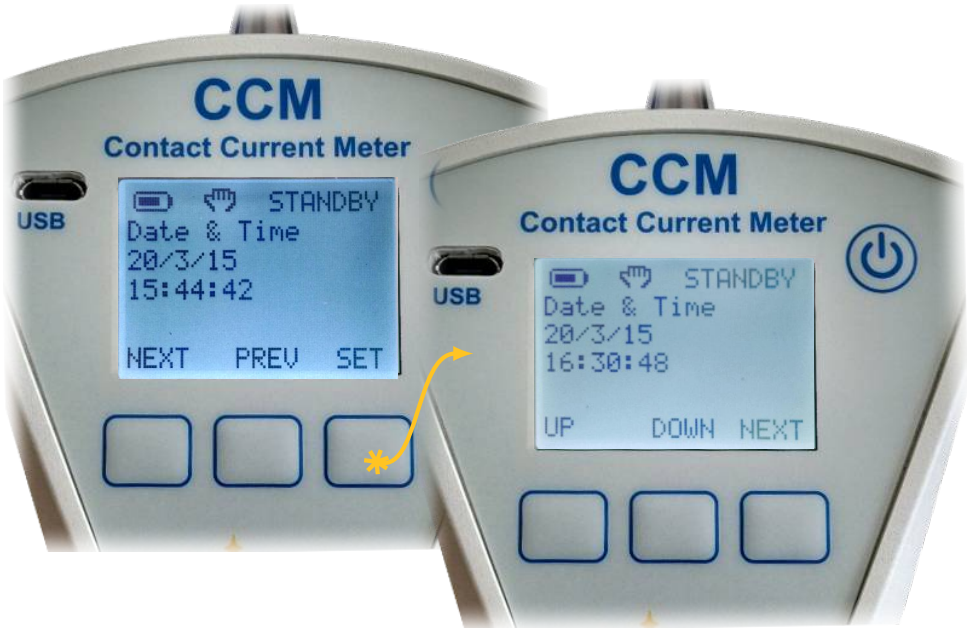

Figure 3.11: Date & Time

The changes of the fields are carried out using the buttons *UP* and *DOWN*, and will follow the sequential order of the day, month, year, hours, minutes and seconds.

3.6.6 Contrast

The sixth page of the menu (Figure 3.12) allows you to change the contrast of the LCD using the same keys, *UP* and *DOWN*. By default this is set to an intermediate value.

3.6.7 Clear Data

In this menu, the operator has the ability to delete all the data stored in the internal memory. In the event that have remained of the measures from the last work session is possible to free the memory without the aid of a PC. The Figure 3.13 shows how to achieve this functionality

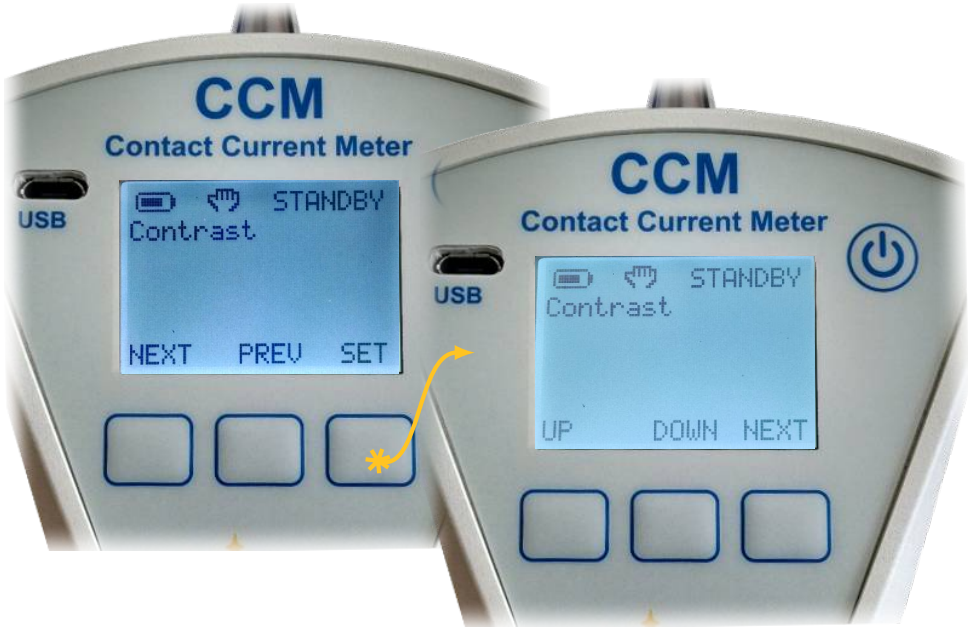

Figure 3.12: Contrast

Figure 3.13: Clear Data

Chapter 4

Data Download

4.1 Connect to PC

The downloading operation of the data has been designed aiming to the speed and simplicity of use. The data generated by the CCM are saved in **csv** (comma separated value), or a text file with separators value. This allows you to read, edit and process the data downloaded via various software including *MS Excel*.

When you connect your device, it must be turned on. At the first connection, via the USB-MicroUSB cable supplied with the instrument, the CCM will be seen by the PC as a mass storage device (Figure 4.1). For this reason there is no need for special drivers, because drivers will be self-installed by *Windows* OS and data will be ready for use.

Figure 4.1: Installing

If your PC has autoplay enabled the next window that appears will be the one to go to the new device (Figure 4.2), otherwise it can be accessed by opening "My Computer" and selecting the device marked **MPB (CCM)**

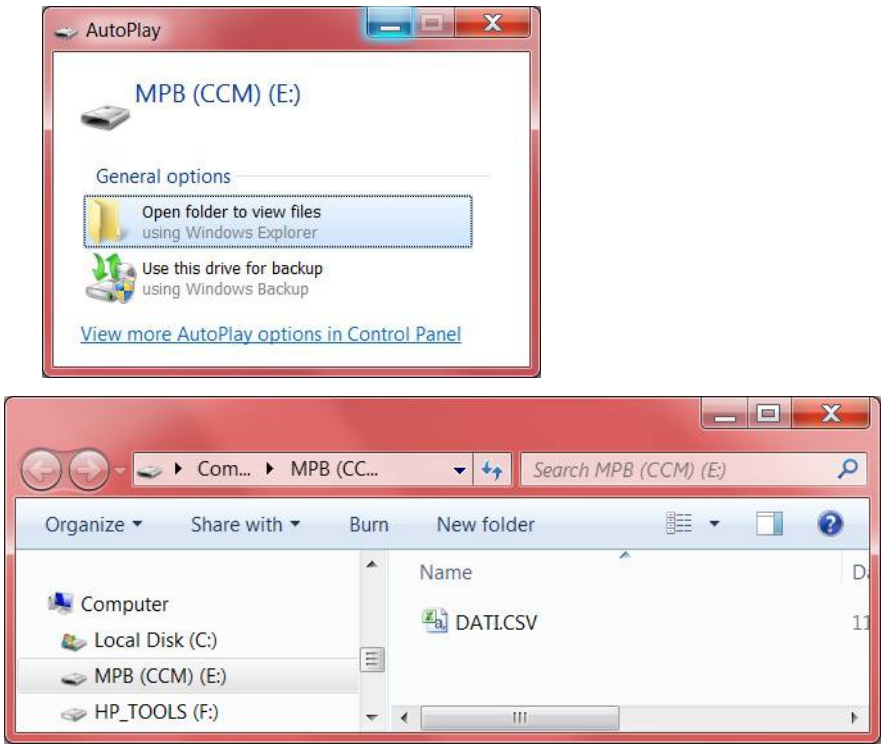

Figure 4.2: Access Data

4.2 Data Format

From time to time you make the measures, the device appends into *DATA.csv* file, generated with all information about a measure. Going into more detail, the data recorded are so ordered:

- Date & Time
- Measure Total value (expressed in %).
- Value in *mA* from Low Filter.
- Value in *mA* from High Filter.
- Circuit modality (*HAND* or *GP*).

To correctly display the date and time format to enter is hh:mm:ss.

To correctly display of the acquired values: the decimal separator is the "." (point), and the digit grouping symbol is a "," (comma)

In case of visualization problem, change the "Region and International" settings in the control panel

This file, opened with *MS Excel* will appear as in Figure 4.3

MPB CCM FW 1.03					
date time	Workers	G.Public	LF	HF	Input
GG/MM/AAAA hh:mm:ss	%	%	mA	mA	from
05/11/2015 12:55	1.0	0.5	0.010	0.07	hand
05/11/2015 12:55	3.3	1.6	0.033	0.07	hand
05/11/2015 12:55	1.0	0.5	0.010	0.07	hand
05/11/2015 12:55	4.9	2.4	0.049	0.07	hand
05/11/2015 12:55	1.0	0.5	0.010	0.07	hand
05/11/2015 12:55	4.4	2.2	0.044	0.07	hand
05/11/2015 12:55	0.9	0.4	0.009	0.07	hand
05/11/2015 12:55	5.0	2.5	0.050	0.07	hand
05/11/2015 12:55	1.0	0.5	0.010	0.07	hand

Figure 4.3: Data dump

List of Figures

1.1 CCM 1
1.2 CCM front 3
1.3 CCM rear 4

2.1 CCM Block Diagram 7

3.1 turned on CCM 11
3.2 menu of CCM 12
3.3 First Run 13
3.4 Hand or GP 14
3.5 BW/T 15
3.6 Ready for measuring 15
3.7 Limit 16
3.8 Beep on press 17
3.9 Alarm 18
3.10 Auto Off 18
3.11 Date & Time 19
3.12 Contrast 20
3.13 Clear Data 20

4.1 Installing 21
4.2 Access Data 22
4.3 Data dump 23