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MAGNETIC FIELD METER 2000

Operator's Manual

The MFM 2000 is a professional magnetic field instrument

To make the best use of the instrument we recommend that you read this manual carefully.

COMBINOVA MARKETING AB

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Section 1 - INTRODUCTION

1.1 Magnetic Fields from IT equipment
1.2 The Instrument
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The Magnetic Field Meter 2000 (MFM 2000) is a professional instrument designed to measure magnetic fields simultaneously in two frequency bands. Band 1 is from 5 Hz to 2 kHz and band 2 is from 2 kHz to 400 kHz. The MFM 2000 has been developed for self-contained operation with such features as built in rechargeable batteries, LCD touch panel display, PC communication using a USB 2 interface and a large data logging memory. The instrument has a full bandwidth real time dual band spectrum analysis to provide detailed information about the magnetic field.

MFM 2000 is specifically designed to measure magnetic fields according to MPR 2 and TCO testing specifications and is the first instrument to combine dual frequency band testing in one instrument.

1.1 Magnetic Fields from IT equipment

Since the 1980´s the use of IT equipment in offices and at home has increased rapidly. Research findings and user concern about the exposure to low frequency magnetic fields, has led to the development of a number of certification standards including limits for emission of low frequency electric and magnetic fields. The most widely used certification is the TCO certification that started with TCO 92 for video displays and newer certifications like TCO 99, TCO 03 and TCO 06 have been introduced since then. Similar certifications are also present for flat displays, printers, desktop an laptop computers.

All these certifications puts limits on the emission of low frequency magnetic fields. Typical limits for these certifications are 200 nT in band 1 and 25 nT in band 2.

More details about the test methods and certifications are available from TCO Development (www.tcodevelopment.com).

1.2 The Instrument

The MFM 2000 instrument is designed using the latest technology in amplifiers, AD-converters and signal processors to achieve the best measurement performance.

Using the same antenna the instrument covers two frequency ranges, band 1 from 5 Hz-2 kHz and band 2 from 2 kHz-400 kHz. With an innovative concept for signal handling it has a wide dynamic range and still a very good resolution at low magnetic field levels. With dual band spectrum analysis built into the instrument the measurement gives complete information of the different frequency components in the magnetic field.

The user interface is mainly handled by the graphic LCD-display that has a touch panel to select the type of measurement, display settings and to define the parameters controlling measurements and related functions. Two push buttons are used for power ON/OFF and to START measurements.

The instrument has a large memory bank to store test results and to provide possibilities for manual or automatic logging of test results.

External communication to a PC is handled by the built in USB 2 interface and the PC software handles a variety of applications including remote control for laboratory use and handling of logged data.

The built in “smart” battery allows for around 10 hours of operation where mains power is not available. The standard battery charger supplied with the instrument can be used both to charge the battery and also to supply the instrument in laboratory applications.

1.3 Combinova AB – The company behind the product

Magnetic Field Meter 2000 has been developed by Combinova AB. We are also responsible for the manufacturing, marketing and after-sales service of the instrument.

Combinova has been making instruments for magnetic and electric field measurements for the last 20 years. Other products in this product family are:

MFM 3000 - Magnetic Field Meter, wide band 5 Hz – 400 kHz with spectrum analysis and applications for EN 50366 and ICNIRP testing.

EFM 200 – Electric Field Meter for electrostatic and alternating electric fields in two bands 5 Hz – 2 kHz and 2 kHz – 400 kHz.

EFM 100 - Electric Field Meter for alternating electric fields in two bands 5 Hz – 2 kHz and 2 kHz – 400 kHz.

FD 1 – Field Detector for alternating magnetic and electric fields from 20 Hz – 2 kHz.

FD 2 - Field Detector for alternating magnetic and electric fields from 2 kHz – 400 kHz..

FD 3 – Field Dosimeter for logging of alternating magnetic fields from 20 Hz – 2 kHz.

More details about these products are available at www.combinova.se

SECTION 2 – UNPACKING AND INSPECTION

The MFM 2000 is delivered in a specially designed transportation case, which also contains the standard accessories that are used with the instrument.

Open the case and check that the following items have been supplied.

- MFM 2000 instrument
- Universal Battery Charger
- USB Communication Cable
- Operator's Manual
- Calibration certificate

Inspect the transportation case, the instrument and the accessories for any damage caused during transit. If damage has occurred, please contact the shipping company who delivered your instrument.

IMPORTANT! Complete the warranty form and return a copy to:

Combinova AB
Domkraftsvägen 1
S 197 40 Bro
Sweden

The warranty is only valid when the warranty form has been completed and received by Combinova AB.

NOTE! Before switching on the instrument, read this manual carefully.

Section 3 - OPERATING INSTRUCTIONS

3.1 General Operation
3.2 Battery Charging
3.3 Display
3.4 Parameters
3.5 Measurements

3.1 General Operation

The instrument is operated by the ON-OFF button and the MEASURE button on the front panel. All other settings are handled by menus on the touch panel.

ON-OFF

To turn on the instrument is turned on by pressing the ON-OFF button on the front panel until the display is lit up. After power on a start up display is shown with program versions and some initial tests. The initial tests shown on the display are:

DSP Boot
DSP RAM-Test
DSP Vector Init

When tests are completed it shows the text “Init Ready” and automatically moves to the measurement display selected last time the instrument was used.

To turn off the instrument depress the ON-OFF button for a few seconds and wait for the display to turn off.

The instrument is automatically turned on if the battery charger is connected and cannot be turned off during charging.

MEASURE

The measure button is used to start a single measurement. If the button is depressed until the single measurement is completed a continuous measurement is started and keeps on running until the measure button is depressed again. After stopping a continuous measurement the last result is shown on the display.

Touch panel

The display is also a touch panel where selections and settings in the instrument can be made. The three menus are:

”DISPLAY” menu includes settings for the display of measurement results. Details are described in chapter 3.3.

”PARAMETERS” menu contains all other instrument settings. Details are described in chapter 3.4.

”SAVE X” is a funtcion key that saves the last measurement. X is the number of the results that will be saved when activated. If no measurment has been done or the data is already saved the response when attempting to save is “NO DATA”. Note you cannot save dat from continuous measurements. The memory can handle up to around 7,000 sets of data including results and spectra.

To enter a menu use the touch panel pointer to enter the menu. The available selections are shown when a menu is selected and the text for the current selection is shown inverted (white text on a black background). As soon as a menu is selected a new line of keys will appear at the bottom part of the display. These keys and their functions are:

”UP +” key is used to move up among available selections in the menu or to increase the setting of a variable.

”DOWN –“ key is used to move down among available selections in the menu or to decrease the setting of a variable.

Pointing directly at a selection in a menu is also possible.

”ENTER” key is used to confirm a selection and if there are available sub-menus they will appear after confirming the first selection until all related selections are made.

”CANCEL” key is used to leave a menu without changing of any selections or settings.

3.2 Battery Charging

The MFM 2000 can be operated either from the mains using the battery charger or from the internal rechargeable battery. When having the battery charger connected during measurements make sure the charger is located as far away from the instrument as possible to make sure that the magnetic field from the charger has a minimum influence on the measurement results.

The charging status in percent of full charge of the battery is indicated in battery symbol on the display. Charging of the battery should be done when the charging level drops below 20 %.

Whenever the battery needs charging just connect the battery charger to the instrument. If the instrument is off it will turn on and battery charging will start automatically. The instrument cannot be turned off when the battery charger is connected.

Battery charging cycle is controlled by the firmware in the instrument so there is no risk involved if the battery charger is left connected to the instrument even after the battery has been fully charged. Charging time for an empty battery is around 4 hours.

If the battery is replaced, the charger must be connected to start the instrument and initialize the new battery.

NOTE! **The battery is a smart battery with its own electronics and no other type of battery can be used with the instrument.**

3.3 Display

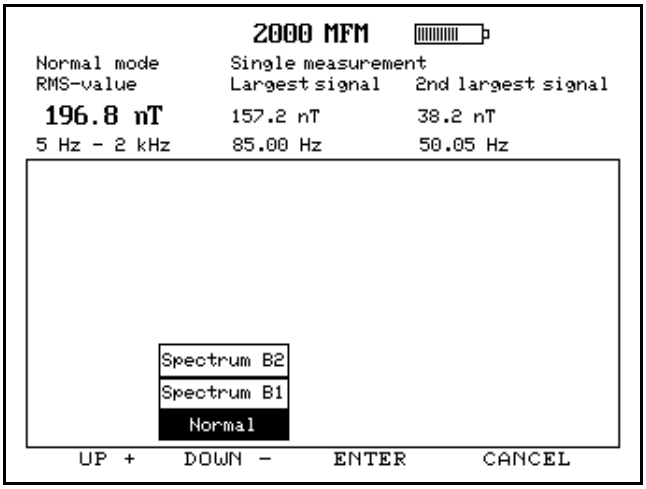
The MFM 2000 uses a touch panel for all operator settings and selections.

To calibrate the coordinates on the touch screen keep the “MEASURE” button depressed at power on until you to get into the calibration function.

A screen with a square in the upper left and another square in the lower right corner will appear. Mark the upper left corner with the pointer and keep it there until the instructions on screen asks you to mark the lower right corner. Keep the pointer on the square until the screen reports calibration ready. Wait for the saving of calibration data.

The instrument will automatically return to the measurements after the calibration is completed. This calibration procedure can be repeated at any time if the positions of different screen selections are changing.

In the “Display” menu you can select to show the results either with the “Normal” numerical result display or “Spectrum” graphical display where there is a choice to either show the spectrum for band 1 “Spectrum B1” or the spectrum for band 2 “Spectrum B2” together with the numerical results. After a measurement you can select the other spectrum to get details for both bands related to the same measurement.



In the normal numerical display of results the total result in each band together with the largest signal in each band is shown.
In the graphical displays with spectrum the total result, the largest and second largest signal shown is related to the spectrum shown on the display.

3.4 Parameters

In the “Parameter” menu you can set the light and contrast of the display to optimize the readability of the display. How to use the menu keys is described in chapter 3.1 General operation.

3.5 Measurements

Before making a measurement on a test object it is important to measure the background emission to make sure it is low enough not to influence the test results.

Background fields are normally added to the field from a test object according to the formula:

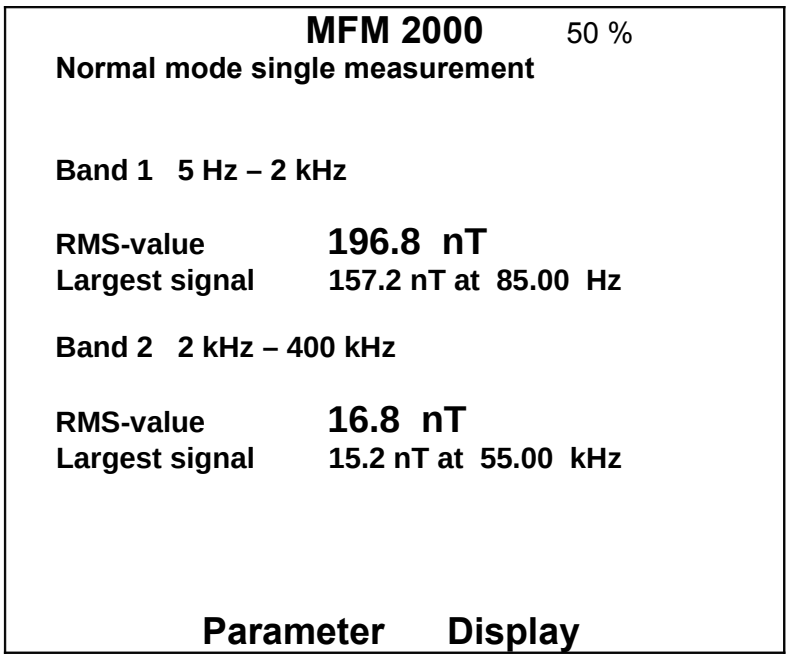
$$B_{measured}^2 = B_{test\ object}^2 + B_{background}^2$$

$B_{measured}$ is the measurement result.
$B_{test\ object}$ is the emitted field from the test object.
$B_{background}$ is the background field.

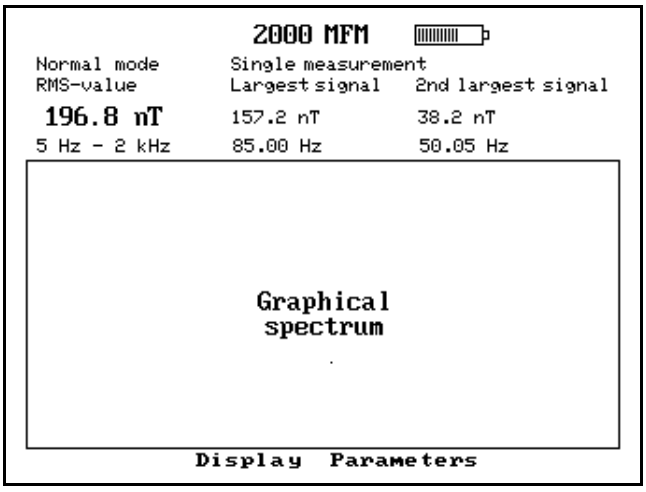
Note! This formula cannot be used to compensate for a too high background field, because other interactions between the test object fields and the background fields can occur.

Test results are shown in nT with one decimal until the field is larger than 999 nT. Higher fields are shown in µT with two decimals.

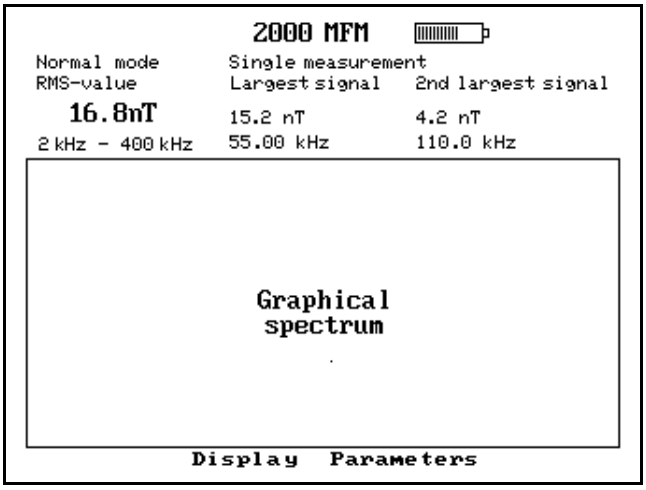
After making a measurement the normal mode display shows the total results in band 1 and band 2 together with the largest signal in each band.



Results including a spectrum for each band can also be selected. The corresponding display showing results in band 1:



For results in band 2 the spectrum display will be:

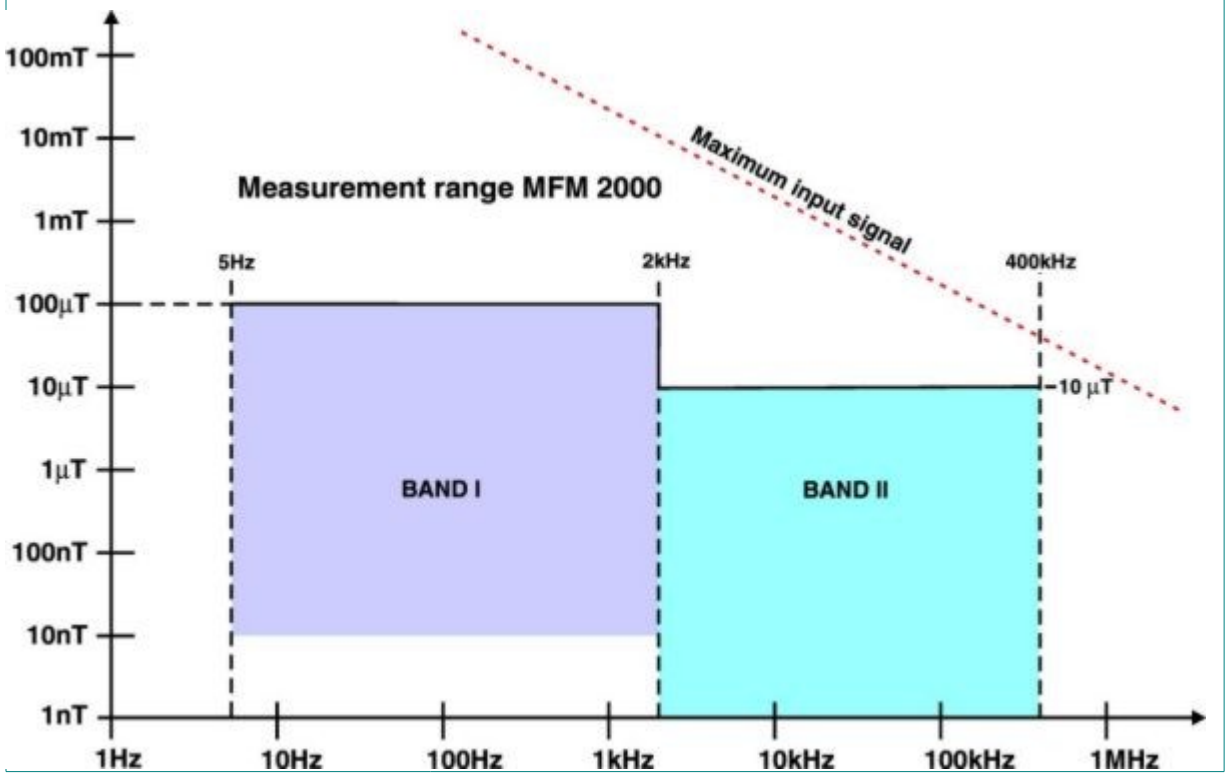


Note that the display showing a spectrum also includes the largest and second largest signal in each band.

After a measurement you can select the different display options to look in more detail at the spectrum and result in each frequency band for the last measurement.

Section 4 – SPECIFICATIONS

Specifications are given at the temperature Tamb = 23 ± 5 °C.
Specifications subject to change without notice.

ALTERNATING MAGNETIC FIELDS				
Antenna system	3-axis, concentric, orthogonal. Coil area 100 cm²			
Frequency range	5Hz - 2000 Hz (Band I) and 2 kHz - 400 kHz (Band II)			
Frequency response:	Band I:	at 5 Hz -3 dB	and below	5 Hz >80 dB/octave
		at 2 kHz -3dB	and above	2 kHz >40 dB/octave
	Band II:	at 2 kHz -3dB	and below	2 kHz >80 dB/octave
		at 400 kHz -3dB	and above	400 kHz >40 dB/octave
Measurement range				
Accuracy Band I:	±(1% of reading +2 nT)			
Accuracy Band II:	±(1% of reading +0.2 nT)			
Measurement rates	1 s single measurements and continuous measurements			

MISCELLANEOUS	
Display	Graphical 5,7" LCD display, with touch panel
Parameter storage	Instrument parameters and corrections are stored in a non-volatile memory
Result memory	64 Mbit
Power	Smart Lithium ion battery, 10.8 V and 4.8 Ah. Universal battery charger 90-250 V, 45 – 65 Hz
Communication	USB 2 interface for PC communication
Operating temperature	10°C to +50°C.
Operating humidity	10 - 85%.
Dimensions	400 x 110 x 190 mm (LxWxH)
Weight	Instrument weight 2.5 kg.
Environment protection	IP 53

WARRANTY FORM for MFM 2000

Customer :

Customer address :

Delivery date :
Warranty period :
Serial number :
Program version :

The warranty includes material and labour cost for service and repair, but not transportation costs in any direction. If new program versions become available during the warranty period a free update is also included. A condition for the warranty is that a correctly filled in copy of the warranty form is sent to Combinova AB.

Note: Always return the instrument in its own transportation case.

WARRANTY FORM for MFM 2000 (customer copy)

Customer :

Customer address :

Delivery date :
Warranty period :
Serial number :
Program version :

The warranty includes material and labour cost for service and repair, but not transportation costs in any direction. If new program versions become available during the warranty period a free update is also included. A condition for the warranty is that a correctly filled in copy of the warranty form is sent to Combinova AB.

Note: Always return the instrument in its own transportation case.

If service is required the instrument should be sent to :

Combinova AB
Domkraftsvägen 1
S-197 40 Bro
SWEDEN