NFA 1000

3D Low Frequency
Analyzer
with Data Logger

NFAsoft

Analysis and Configu-
ration Software

Operating Manual
(Version 6.0)

Thank you!

We thank you for the confidence you have shown by buying this product. It allows for a professional analysis of AC electric and AC magnetic fields according to internationally recognized guidelines and the recommendations of the building biology.

In addition to this manual you can watch the tutorial videos on our website concerning the use of this meter.

Contents

This manual is based on the firmware version 47 and NFAsoft version 100.

The firmware and software of the NFA will be continuously improved and made available via e-mail or download from our homepage.

Features not yet implemented, but under development, are printed in GREY in this manual.

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1 Quick Start Guide

The instructions below refer to the factory default settings. They can be customized with the supplied software „NFAsoft".

When you turn on the instrument the LCD will briefly show "batt" and the remaining operation time in the log.-mode with the current capacity of the batteries.

Set all switches to their top position! (Auto, tRMS, M3D and On)

With these settings and the mode button, one can quickly and easily begin the conventional measurement process, without detailed knowledge of the instrument´s features. Primary and secondary measurements can be taken with the help of the mode button. The primary measurement or (3D) unit is indicated by a solid green Unit LED light and the secondary (1D or external) by a quick flashing green Unit LED. The mode button is used to toggle between primary and secondary.

The LCD display will now indicate the isotropic (3D) AC magnetic field strength as the primary measurement. By depressing the 'mode' button you can easily change the display between this and the 1D AC electric field. The coloured frequency LEDs, above the LCD display, indicate the active frequencies, the dominant will be in red. The dominant axis x, y or z is indicated by a red LED on the right of the LCD display.
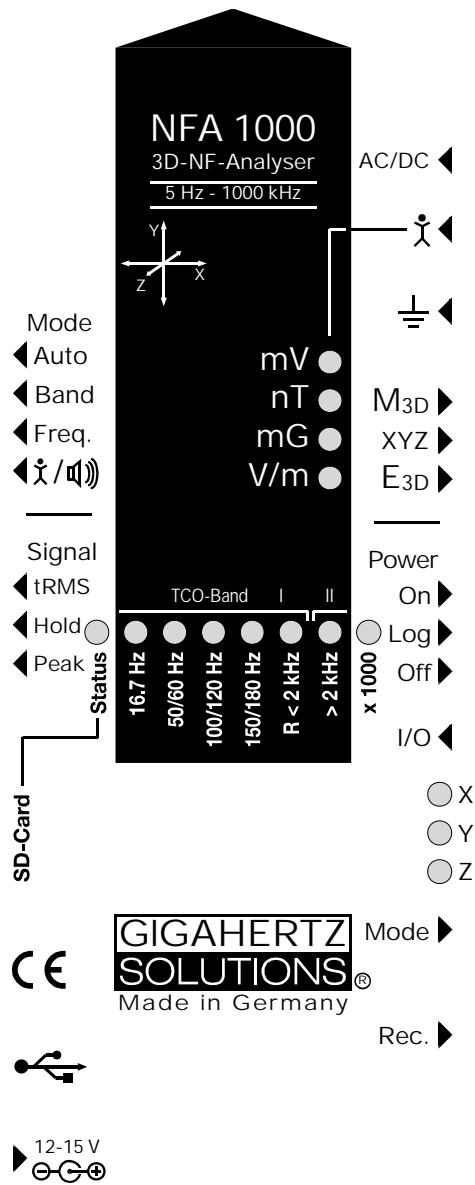
To measure the E-field with ground-reference (1D) simply connect the grounding cable. The NFA detects the attached cable and automatically shows the corresponding AC electric field strengths and frequencies. The E-field measurement will now be displayed as the primary measurement and the 3D magnetic field as the secondary. By depressing the 'mode' button you can easily change the display between this and the 3D magnetic field.

To measure the three dimensional potential-free AC electric field, switch to E3D and hold the instrument by a potential-free rod or support. By clicking the 'mode' button you can swap the display between this and the Z-axis of the AC magnetic field.

Should the meter not do what you expect, please turn to the chapter on frequently asked questions at the end of this manual (Chapter 9)!

Note: For potential-free e-field-measurements the highest accuracy will be reached when used without the yellow silicone holster.

2 NFA 1000 Front Cover

NFA 1000
3D-NF-Analyser
5 Hz - 1000 kHz

Y
Z   X

AC/DC ◀

ⵣ ◀

⏚ ◀

Mode
◀ Auto
◀ Band
◀ Freq.
◀ ⵣ / ◀)))

mV ●
nT ●
mG ●
V/m ●

M3D ▶
XYZ ▶
E3D ▶

Signal
◀ tRMS
◀ Hold
◀ Peak

Status

TCO-Band   I   II

16.7 Hz
50/60 Hz
100/120 Hz
150/180 Hz
R < 2 kHz
> 2 kHz

x 1000

Power
On ▶
Log ▶
Off ▶

I/O ◀

○ X
○ Y
○ Z

SD-Card

GIGAHERTZ
SOLUTIONS ®
Made in Germany

CE

Mode ▶

Rec. ▶

⇜

▶ 12-15 V
⊖–⊙–⊕

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3 LEDs / Display / Audio Signals

3.1   LEDs and Display

The measured value shown on the display ...

 ... is the unit adjacent to the solid green LED (primary measurement).

A flashing LED indicates the unit of the secondary measurement, which can be selected by depressing the "Mode>" button .

In fields of very high magnetic intensity, the value will be displayed in uT (microTesla), indicated by the red LED "X 1000". Also the green LED will then turn red indicating a change of scale. Both LEDs will start flashing red when the measured values are higher than the instrument can display. Similarly, when measuring body voltage, a change from mV to V for higher values is indicated.

Special LCD Display Messages

"Low Batt": The rechargeable battery is low – please charge the battery

"Err.": Short for 'Error'. Indicates an erroneous configuration. This can occur when a grounding cable or mains adapter is connected and potential-free E-field measurement is selected -. Select a different setting!

„----": Instrument is in the process of determining the measurement, or the value is too small to be measured.

„CHAr": Instrument is being charged.
(For technical reasons "FULL" will be shown shortly before this, which is to be ignored)

„FULL": During the charging process, with the mains adaptor connected, this indication means: charging completed, battery loaded. During normal operation, however, "full" means the SD memory card is full.

The time indications iare set up as follows:

„XXXd": XXX days or

„Xd.XX": X days and XX hours or

„XX.XX": XX hours and XX minutes.

„XX.XX": (with blinking dot): XX minutes und XX seconds.

It will be shown upon switching on the NFA and when logging (see chapter 5.4).

Due to the increased power consumption (LEDs, sound signal, etc), the remaining battery life in the operating mode "ON" is reduced by up to 30%.
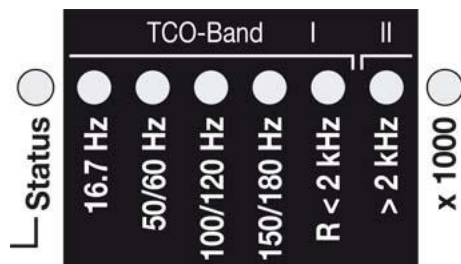
Status and Frequency LEDs

"Status" LED indicates the current mode of operation

"Red" means "instrument is being charged".

"Yellow" means "measurement in progress, NO recording".

"Green" means "measurement in progress WITH recording",
however with the switch set to "log." the "Status"-LED is switched off to extend battery life.

LEDs to indicate the applicable frequency bands:

The frequency-LEDs change their colour in proportion to their contribution to the total field strength. See below for details on LED display modes.

"16.7 Hz": In use for railway lines in some European countries. The reading also includes the 2nd harmonic.

"50/60 Hz"[1]: Mains frequency. The bandwidth only covers individual frequencies of 50 Hz and 60 Hz with their respective lock-in ranges.

"100/120 Hz[2]": This LED indicates the contribution of the second through fifth "even" harmonics. The strongest frequency can be numerically displayed when using "Freq" mode.

"150/180 Hz[2]": This LED indicates the contribution of the third through fifth "uneven" harmonics. The third harmonics will presently be found in many homes and most offices as a significant portion of the total measurement. The frequency of the strongest source can be numerically displayed when using "Freq".

"R < 2kHz": Means "Remainder of frequencies below 2 kHz".
This LED does not show the whole band, but only the sum of all frequencies below 2 kHz which are not covered by the LEDs on the left.

"> 2kHz": Comprises frequencies within the upper TCO-band of 2KHz up to 1 MHz.

"x 1000"-LED

Turns red when the measurement scale increases (see 3.1)

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[1] The NFA automatically detects the mains frequency and adjusts the indication of its harmonics. With "Freq." the actual mains frequency can be determined exactly. The LED's for 16.7 Hz, mains frequency and its harmonics up to 2 kHz have a suitable lock-in range to cover mains fluctuations.

There are two display-modes for the frequency-LEDs:

"Simple/Steady": (= preset) [2]
The red LED represents the strongest frequency , and the yellow LED the second strongest. The green LEDs indicate the total frequency range in the current setting.

"Full Information/Volatile": This makes the LEDs rather unsteady/volatile. (To be configured with NFAsoft)
The proportion of the respective frequency band in relation to the total signal is being displayed. These proportions are shown as follows[3]:

$$\begin{aligned}
\text{RED} &= \text{DOMINANT } (> 50\%) \\
\text{YELLOW} &= \text{MEDIUM } (< 50\%) \\
\text{GREEN} &= \text{SMALL } (< 10\%)
\end{aligned}$$

3.2   Audio Signal

The acoustic signal is always linked to the respective measured value and has a „Geiger Counter" characteristic, i. e. with increasing signal intensity the rattling sound becomes faster.

When the "Mode"-switch is set to „◀⚡/◁))" the volume can be turned louder by depressing the "Mode >"-button and turned down (finally: off) by depressing the „Rec. >"-button, as long as no grounding cable is connected to the instrument.

Please note: For extra-precise measurement requirements turn the acoustic signal volume down or even switch it off completely.
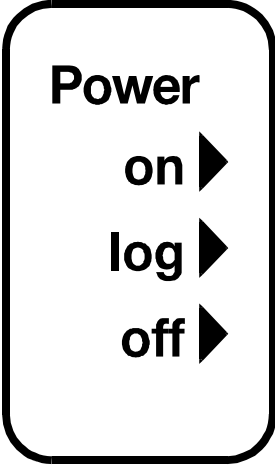
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[2] In order to allow for less fluctuations in this mode an internal high pass filter is switched on. With NFAsoft it can be configurated to 16.7 and 50 Hz. Experience has shown that the best combination for a freehand measurement is a filter set to 16.7 Hz for magnetic fields and to 50 Hz for electric fields. Electric fields of the 16.7 Hz railway line power frequency (in some European countries) are quite rare indoors and can still be evaluated in the "band" mode. They can still be separately evaluated with NFAsoft.
[3] For reasons of user ergonomics frequencies below the nominal display resolution (that is < 0.1 V/m or < 1 nT) are not indicated by an LED-signal but will still be recorded down to the noise level. Hysteresis: 9/12% resp. 45/50%.

4 Switches / Push-Buttons / Connectors

4.1 On / Off switch "Power")

Power
on ▶
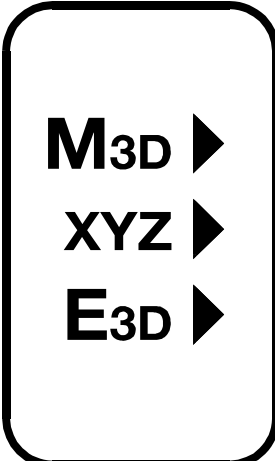**log** ▶
off ▶

on ▶ = Standard Measurement Setting

LEDs and acoustic signal remain <u>activated</u> for manual measurements

log ▶ = Logging / long term recording

All LEDs and the acoustic signal are <u>de</u>activated to save battery life during data logging. This is the mode in which the instrument is most precise.

off ▶ = Device is off

4.2 Field Selection for 3D Measurement

M3D ▶
XYZ ▶
E3D ▶

M3D ▶ = Magnetic field measurement (3D)

The isotropic point or magnetic field sensors are below the „Y" of the coordinate system printed on the meter faceplate. The dominating axis is indicated by a red LED next to the display.

E3D ▶ = Potential-free/floating potential E-field measurement (3D)

The field sensor pairs for the X-, Y- and Z-axis (directions correspond to the imprint) are situated within the meter close to the housing. For a proper measurement the meter has to be set up more than 12 inches away from any metal objects on an insulated "holder" (accessory PM1) or held with an insulated rod (accessory PM4s). Also cables or probes must not be connected during this measurement setting. If an erroneous configuration exists the display will indicate "Err." until the configuration is corrected or the setting is changed to magnetic field measurement. While measuring please maintain a minimum distance of 1 meter. If closer, your presence can influence the measurements.

## XYZ ▶ Display of orthogonal components

In both the M3D and E3D setting the isotropic or 3D field strength is on display. To view the individual components or X, Y and Z axis switch to the "XYZ" setting. By pushing the "Mode >" button one can scroll through each axis and view its corresponding field strength on the display. For details see chapter 4.9.

Where does the field come from? With the instrument in a horizontal position …

- when measuring potential-free electric fields then the sources (sometimes the nearest ground potential) are in the direction of the "dominant" axis indicated.

- when measuring magnetic fields then it is easiest to move the instrument in order to find the direction of the source in the direction of increasing readings. For current-carrying cables X and Y indicate vertical cable path and Z indicates a horizontal cable path.

4.3 Sockets for Inputs and Grounding

AC/DC = Combined AC/DC-Input
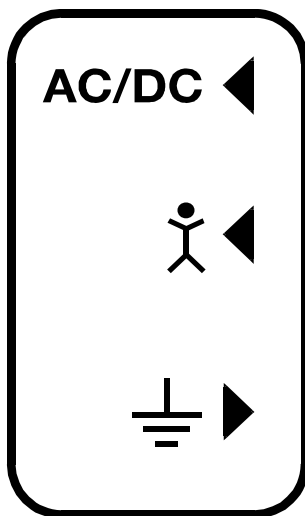
When an external sensor is connected, its signal is automatically displayed in mV and, if so, recorded. For recording, ensure the ("Mode" switch set to "Auto").

AC: A displayed value of 2000 corresponds to "1V$_{peak-peak}$" [4].

DC: +/- 0.1 to 1500 mV, i.e. with an HF59B connected in the coarse measuring range (scaled to 1,5 V DC), the device plots measurement values from 1 to 15,000 µW/m²; the displayed value in mV is 10 times less than the actual reading in µW/m².[5]

It is possible to connect an optionally available magnetostatic and electrostatic sensor (in preparation).

⬥◀ = Input socket for body voltage hand probe

Input for the connection of a hand probe for the measurement of body voltage in mV. The connector is a 4 mm banana jack. For displaying and recording, set the "Mode"-switch to ⬥/◁)) and connect grounding cable.

This is the only input which cannot be recognized automatically (being single-pole).

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[4] Note: The information produced by the frequency decomposition of a demodulated pulsed HF signal produces, of course, no really useful data.
[5] For other measuring ranges just compare the position of the comma and convert accordingly. Readings below 0.1µW/m² cannot be displayed or recorded because of noise-issues.

⏚▶ = Socket for the grounding cable

Allows the connection of a grounding cable for an E-field measurement with reference to ground (in compliance with TCO). This will be detected automatically by the instrument and the display will change to E-field with reference to ground correspondingly.

Socket for the TCO-conformed probe at the front end of the meter

This is for the TCO-conformed probe available as an optional accessory from Gigahertz Solutions.

4.4 Mode = Selection of Measurement Mode
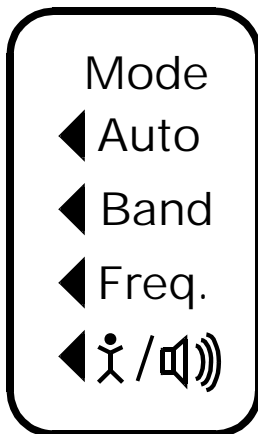
<table>
<tr><td>

Mode
◀ Auto
◀ Band
◀ Freq.
◀ ⅄/🔊

</td><td>

Selects all measurement and display options of the instrument with the field selector switch and the „Mode >" button. Configuration errors will be detected and indicated by "Err." on the display until resolved.

When set to ◀ **Auto** the NFA recognizes probes connected to it, and shows the corresponding values. If an external probe is not connected to the instrument, the selected 3D field type is displayed. By pressing the mode button, you can "toggle" between the primary and secondary display measurements. The secondary measurement field is indicated by a short flashing of the corresponding unit-LED.

</td></tr>
</table>

◀ **Band** = Display of the individual frequency bands

## ◀ **Freq.** = Display of the resp. dominating frequency

Selection of the individual frequency bands is possible by "clicking" the "Mode" button[6]. For more details of this feature or automated scrolling see chapter 4.9.

◀⅄/🔊 = Capacitive body coupling / volume

The signal generated by connecting a hand probe will be displayed in mV in this setting. For proper measurements, the grounding cable must be connected. For volume regulation please see chapter 3.3.

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[6] If the 50 Hz high pass filter has been set with the help of the configuration part of the NFAsoft (maybe even as pre-setting), the 16.7 Hz LED will remain unlit. However, the filter only applies to the display in the "Auto"-mode and to loggings in the "All3D"-channel. The aim is to tranquilize the display. Nevertheless, possible frequency components up to 16.7 Hz can be displayed by using "Band" and "Freq.".

4.5   Evaluation of Signal
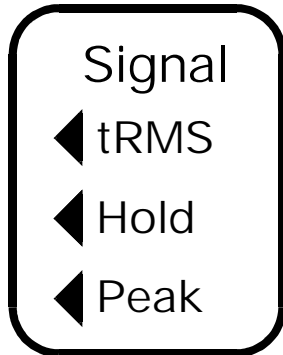
◀ tRMS = true RMS value

tRMS = "true Root Mean Square". The values displayed and recorded can be compared directly to classifications recommended by building biologists.

◀ peak = Peak value

Real peak value measurement: With this setting the meter measures the highest culminating point of the wave[7]. A new measurement feature for building biologists which allows for a more detailed analysis of the LF world in a way which has long since been considered essential in the analysis of high frequencies. This option supplies important information for the evaluation of "Dirty Power" (E-field > 2 kHz).

◀ Hold = retain maximum value

Retains „tRMS" or „Peak" of the signal, depending on the switch position from which „Hold" was chosen. When the signal switch is set to „Hold" only the reading on the display is held, the real time value is still recorded on the SD card, if recording.

4.6   SD Memory Card
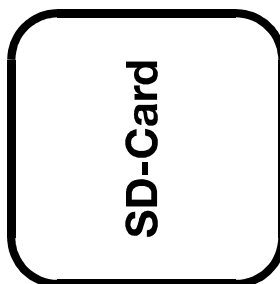
This is the slot for the SD card. To prevent it from being ejected inadvertently slide it in beyond the external surface of the casing until it snaps (use fingernail or pencil, if necessary). To extract it press again to undo the snap mechanism.

The high-speed SD memory card (4 GB, SDHC) supplied with the instrument contains your personal instrument configuration file, NFAsoft software and enough memory to log 10 samples per second for one week.

Your PC will recognize the SD card as an external device when connected by USB cable or slid into a card reading device. It can then be processed with the standard

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[7] Not to be mixed up with the „Hold"-function, which, in case of fluctuating fields „freezes" the highest reading. The resolution of the frequencies during the analysis of the (actually by their nature broadbanded) peak values does not consider phase information that is being a worst-case consideration. Tolerances are much higher than using the tRMS analysis. It cannot be used with the floating potential E-field measurement for the time being.

Windows or Linux functionality. Inserting the SD memory card directly into the card reader of the PC will result in a 40 times faster data transfer than the USB cable[8].

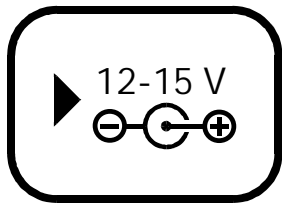Please note: Do not remove the SD memory while the NFA is running!

4.7   USB-Socket
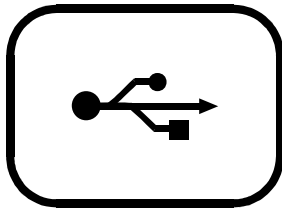
Computer interface connection: Used for meter configuration with NFAsoft. (USB 1.0)

Please connect and disconnect the USB-cable only while the NFA is switched off!

4.8   Charging Socket

For connection to external DC sources

External supply: 12 V battery or 12 V DC power supply unit is sufficient to keep the instrument operational for long term data logging, but will not recharge the battery.

Charging: 15 to 18 V DC battery or AC adaptor is required to charge the instrument.

The instrument comes with an AC adaptor, which can be switched to 12 and 15 V. Euro mains plug! Measurements or recordings parallel to the charging procedure are technically possible, but not specified, therefore not to be recommended.

4.9   „Mode" and „Rec." - Buttons for Navigation and Voice Recording

In connection with the "Mode"-switch and the switch for selecting the field type, the "Mode" and "Rec." keys form part of the many special functions of this device.

They are not needed for a simple measurement of the 3D magnetic field or of the potential-free 3D electric field.

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[8] In order to make use of this speed advantage, your SD card reader needs to be specified „SDHC" which is standard for units built 2008 or later. For older units inexpensive adaptors are available.

Mode ▶ = Change of display mode or "Step ahead"

The configuration of the "Mode"-button is context sensitive.

If the "Mode"-button on the left is on "Auto", the NFA recognizes external probes connected to it, and displays their corresponding values. If a probe is not connected to the instrument, it displays the selected 3D ("primary") field type.

- Press and release the "Mode>" button to switch from the primary to secondary measurement fields. The secondary or background measurement field is indicated by a quick flashing LED corresponding to the unit-LED.

If the "Mode"-button on the left is on "Band" or "Freq.",

- Press and release the "Mode>" button to select the next frequency band (indicated by the corresponding LEDs), and also the axis per band in the "XYZ" mode.

- Press and release the "Mode" and "Rec>" at the same time to display the individual axis one after the other in an infinite loop until one of the buttons is pressed again.

Rec. ▶ = Record an audio note

While this button is pressed, the internal microphone is activated to accept your live comments. The microphone is positioned just over the „rec." button (marked by the hole in the casing lid). It is sufficiently sensitive to pick up audio from a few metres distance.

While the "rec." button is pressed for taking your notes, these will be recorded in a standard WAV file parallelly to logging value recordings. These audio notes will then be directly allocated by NFAsoft to the corresponding recording times in the graphic.

4.10 I/O - Microphone / Headset

- **I/O** ◀ Allows the connection of a mono headset for dictating or listening to the audio analysis.

5 How to Measure and Data-Log
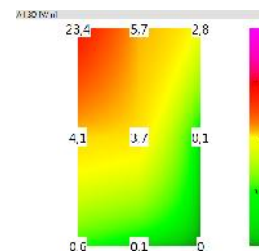
5.1 Measurement

The NFA1000 has two basic measurement modes. One being the conventional method which involves switching the unit on, setting the measurement mode and reading the display. When operating in the conventional mode, the "Status-LED" will be yellow. The other more sophisticated method involves recording information simultaneously from multiple inputs for future analysis. In this mode the "Status-LED" will be green.

In addition, the device is capable of logging all measurement values of all four channels at once (i.e. the three field axis values plus one additional channel). This data is stored onto an SD-card for future analysis. This function can be activated by temporarily switching the "Power" switch to "Log." until the display shows "LXXX" where the "XXX" indicates the log file number recorded on the memory card. When switching the "Power" switch back to "On", the "Status-LED" turns green, thus indicating that logging has started. Please note: When logging with the power switch set to "LOG" and changing a switch (for instance from M3D to E3D), the recording session will be closed and a new log file will begin.

These recordings can be annotated by real-time audio recordings which will be assigned to the respective measurement for replay.

5.2 Guided 9 Point Measurement of Sleeping Areas

For alternating electric fields the guidelines issued by the VDB e.V., Germany, ask for a detailed analysis of the floating-potential electrical field in sleeping areas, specifying nine points (three each in the head-, torso- and foot area, with the outer edge of the instrument located 10 cm off the bed's edge). The NFA in combination with NFAsoft allows for a "guided measurement" in order to efficiently accomplish data collection and evaluation.

Preparation and start of the measurement:

- Use the potential-free rod PM4s or the holder PM1 (stabilized by, for instance, a stiff piece of cardboard or a plywood panel).

- Switch the "Power"-button to "On" and choose „E3D", „Auto" and „tRMS" (choose M3D for magentic fields).

- Press the "Mode"-button until 9Pt is indicated on the LCD and then let go. A beep will indicate the activation of the 9 point measurement.

The NFA guides the user through the nine points by means of short audio signals ("beeps"). These nine points shall always be processed in the same order, head area: left, middle, right, followed by torso area: left, middle, right and finally feet area: left, middle, right.

- The beeps are not time controlled but the NFA will adjust itself to your personal work rhythm by "sensing" whether it is being moved or it is lying still[9]. This way you can finish the nine point measurement within less than a minute or – if you prefer to take it a bit slower – you need not let yourself "be rushed through the measurement by the beeps".

- The algorithm is as follows: after the activation (see above) the NFA "waits patiently" to be moved (… that is being moved to the first measurement position: top left) and it will not beep to confirm the next measurement before the instrument has been left still in that position for a couple of seconds[10] (… In order to pick up a valid measurement). After the beep –and in your speed – you can proceed to the next measurement position[11].

- PLEASE NOTE: In order to support this algorithm move the NFA in a more or less abrupt manner from one measurement position to the next and put it down on the bed's surface with a little impact in order to give the transition movement a clear end[12].

- For analysis of the collected data use NFAsoft.

5.3 Guided 6-Point-Measurement of Working Places

The NFA and the NFAsoft also support the measurement of working places. In this case six measuring positions according to the drawing will be collected. For a selection of the working place measurement on the NFA keep the „Mode" button pressed until „6Pt" is displayed on the LCD. The further procedure follows the instruction of the 9-Point-Measurement in the order: head, elbow, bottom, hands, knees, feet.
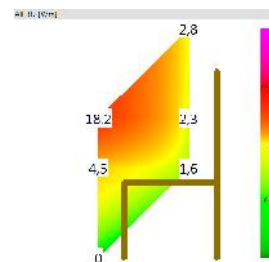
5.4 Long Term Data Logging

The normal approach in building biology is to record only the AC <u>magnetic </u>field, and this as tRMS. Why only the magnetic field? Only AC Magnetic Fields are subject to

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[9] The interval from beep to beep can vary between 3 and up to 20 seconds according to your work rhythm and movement pattern.

[10] This time delay is user-definable with NFAsoft.

[11] After the beep the NFA will wait up to 20 seconds for a movement

[12]This way the NFA can distinguish more reliably whether it is in motion or kept still. If you use the potential-free rod PM4s then try not to move the instrument after you have "hit" the measurement point, if you use a holder then withdraw quickly to a minimum distance of 1.5 m and keep still there in order to avoid movement-induced "pseudo-fields".

large fluctuations, as they depend on the actual current flow which is variable. The interval for recording data is set to 10 data sets/sec..

Initiating Long Term Logging of the Meter

For a long term recording of several hours or days, set the "Power" switch to "Log". In this mode the LEDs and the sound are turned off to extend the battery life. The recording will start automatically after some seconds. The display will show the log-file number ("L999"), the elapsed time of recording as well as the remaining time of use in an infinite loop until the battery is empty or the SD-card full. For information on the display format please see chapter 3.2.

The instrument records all data corresponding to its field selection switch. If the field selection switch is set for M3D and the AC/DC socket is not connected, the fourth channel will record the "Y" axis of the potential-free E-field. If an HF analyzer is connected to the AC/DC socket, its output will be recorded automatically on channel 4.

"Locking" of the Instrument

„Locking" ensures that the instrument exclusively executes the predefined tasks, when left at the customer's place for long-term recordings. To lock, remove the SD memory card from the instrument after predefining the measurement settings, set its micro switch on the top left of the SD-card to „lock" or „write protect" and reinsert it. Note: The data will still be recorded!

IMPORTANT: Don't forget to unlock the SD memory card afterwards!

6 Power Supply

6.1 Internal Rechargeable Battery

The instrument features high performance Lithium Ion rechargeable batteries (2 x 3.7 V). When fully charged, they will last for up to 36 hours of continuous data logging[13].

6.2 Charging

To charge the battery set the AC adapter switch to 15 Volts. If the device is switched off while charging, the display will show "CHAr" and the potential runtime of the instrument with the current capacity status in an infinite loop. Measurements or recordings during the charging process are technically possible, but not specified, and therefore not recommendable.

With a completely discharged battery only about one hour of charging time is sufficient to operate the instrument for a couple of hours. To achieve the maximum operation time, charging will take 12 to 15 hours. If the full capacity is reached the instrument stops charging automatically and will show "FULL" on the LCD

6.3 External Power Supply

Switch the AC adaptor to 12 Volts. With a 32 GB SD card and an external power supply (AC adaptor) you can continuously log at full speed for over two months.

Longterm recordings of the 3D magnetic field and the AC entry can also be done using external power from an AC adapter. In this case, the adapter should be placed as far as possible from the instrument and turned in such a way that the resulting magnetic field is as low as possible, as it can influence the readings.[14]

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[13] Please note that Li-Ion batteries, even when treated with care, will lose some of their original capacity within one or two years and their typical life expectancy is 250-500 complete charge cycles. In this case please always replace both batteries. For initialisation of the indication of the remaining battery life of the instrument please fully unload and recharge the instrument once. If possible store in a cool place..

[14] To determine the emission created by the AC adapter at the location of the NFA, proceed as follows:

- Place the instrument and adaptor into their measurement location

- Plug the AC adapter into the wall and to the NFA. Wait until the readings on the display stabilize.

- Disconnect the adapter from the NFA without changing its position and orientation; wait for the display to stabilize.

This procedure will also be logged, and should be marked with an audio note. This will be accessible when evaluating the logged data on the PC. Now potential disturbances can be noted on each axis and corrections be made, if necessary.

6.4 Operation from a Standard 9 V Alkaline Battery

If you run out of battery power while measuring, one can temporarily operate the NFA from a standard 9 V alkaline battery. To change the battery, remove the NFA from its protective holster, and open the battery compartment. Carefully pull off the cables of the integrated lithium ion batteries from the PCB-connector and remove the batteries. Make sure to remember their exact position, as they are tight! The plugs are keyed so they cannot be connected incorrectly. Connect the 9 V alkaline battery to the battery clip, insert it into the meter, and close the lid.

DO NOT TRY TO CHARGE A 9 VOLT BATTERY, whether rechargeable or alkaline, INSIDE THE METER!

7 „NFAsoft"

The provided software allows ...

- for the analysis of the data logged by the NFA

- for the configuration of the NFA according to your preferences and habits.

A double-click on the program-icon 👁 opens the window shown on the left. Here you can chose between the tool for the analysis of the data 〽 and the tool for the user-specific configuration of your NFA 🔧 .

The software is subject to continuous upgrade. The most current revision can always be found for download on our homepage.

System requirements

NFAsoft is compatible with Windows XP and above, or LINUX. NFAsoft requires no installation – just double-click and start!

In some cases, it might be necessary to temporarily disable your anti-virus software. Anti-virus software may interpret NFAsoft as a threat and hence might disable or even erase it. It may me necessary to repeat this when a upgraded version of NFAsoft is loaded. NFAsoft can be loaded and executed directly form the SD memory card through a card reader or through the USB interface cable. The NFA is supplied with a „Class 6 SDHC"-SD memory card (appropriate readers have been available since 2008, adapters are available for older computers).

7.1 Data Analysis: File Types

A click on the button 〽 opens the program and a Windows-box for file selection. The following file types are available (the consecutive numbering is independent from the file type)

- LOG00001.TXT   log file (long time recording)

- LOG00002.9PM   9-Point-Measurement (sleeping area)

- LOG00003.6PM   6-Point-Measurement (workplace)

- REC00004.WAV   audio file (recorded note).

7.2 Data Analysis: Longterm Recordings

Double click the appropriate log file for analysis. For longterm-recordings the following window will open: (check capter 7.2 for 9 point measurements)
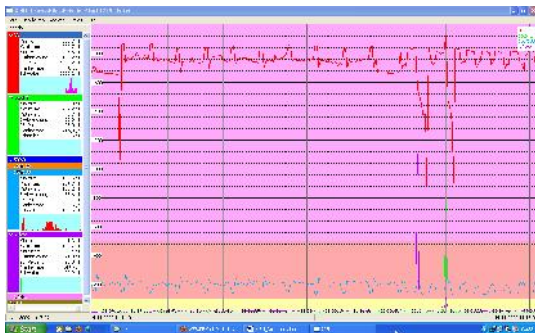
- The far left column labelled "Channels" displays statistic evaluations of the plot on the right (in real-time)

- The large area on the right shows the plot of the collected data over time.

- The "x" (horizontal) axis of the plotted data is the time scale and the "y" (vertical) axis shows the units of measurement corresponding to the field of measurement.

Plotted Data Window

Units of measurement appear on the corresponding channel window on the left and are not indicated on the y-axis. The different plots are colour coded. This allows for different channels to be shown simultaneously.

The x-axis indicates the time span. The figures at the left and the right end of the grey status line show the times of start and end of the logging period.

If the status line is mouse clicked, the window on the right will appear. Here one can enter a preferred time span to view. The time span can also be selected in the "View" menu.

The colouring scheme of the plot corresponds to the standards for building biology measurements (SBM2008): Green for "no concern". Yellow for "slight concern". Red for "severe concern". Purple for "extreme concern".

If one selects two channels with different units, the SBM colour scheme of the plot's background will be the one corresponding to the unit of the selected (= bold) channel. It will be bold for the one and regular for the other, equalling the markings in the "Statistics/Channels" window.

Navigation within the Plotted Data

Navigation within the plotted data can easily done with a mouse and its scroll wheel. Move the mouse pointer into the data plot. The scale of the x-axis will be

- zoomed in when scrolling up or by using the „Up Arrow", zoomed out when scrolling down or by using the „Down Arrow"

- centered around the clock time indicated by the position of the mouse

The data area can be repositioned on the x-axis by a left mouse click hold and drag left or right. One can also use the "right" and "left" arrows of the keyboard. Zooming of the time on the x-axis can also be achieved via the View Menu.

Scaling of the y-axis is done automatically by default but can be adjusted manually if desired through the View menu under "Y-Scale". You can also adapt the scaling of the y-axis manually via the menu (under "View / Scale").

Listening to the Audio Notes

Audio notes dictated during measurement or long-term recordings are shown in the diagram directly at the corresponding point of dictation. Simply click them in order to listen to the information recorded. The audio notes will be played back by the audio player of your computer. The grey bar on the top will show the file name and a level preview.
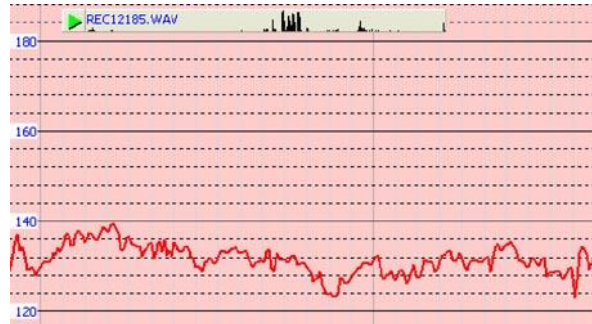
The audio files (.wav) will only be displayed in the diagram when they are stored in the same folder as the LOG-file and they are not renamed.

Insert Comments directly into the Diagram

Areas of special interest can be commented directly in the plotted data. Simply position your mouse, right click and enter your comments in the comment window. When you click Ok, the comment will be embedded into the data, marking an event or section of interest. .

Program Window "Statistics Channels"

To display the data of a particular channel, click the triangle to the left of the channel.

If multiple channels are open, an additional click on the channel information will bold the channels plotted data and its statistical data.

The top five values are standard statistical values[15]. The numerical value "Edges per hour" is used to analyse the number of steeply rising edges, spikes, peaks, pulses, sharp bursts or high frequency transients of the field. The edge thresholds can be defined in the Channel menu under Set edge criteria. This is an experimental function. PLEASE NOTE: If the 50 Hz high pass filter has been set with the help of the configuration part of NFAsoft (maybe even as pre-setting), this only applies to the channels "All3D", "AllX", "AllY", and "AllZ". Nevertheless, possible frequency components at 16.7 Hz will also be recorded in the correspondent channel. In this case the sum of the frequency specific channels may well be higher than that of "All3D".

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[15] The 95th percentile is calculated heuristically. If the possible deviation exceeds 10%, it will be noted in parenthesis after the figure in absolute terms.

The light-blue field underneath the statistical channel data represents the frequency distribution of the measured intensities of the specific channel („Histogram"). It is self-scaling and can be interpreted as follows:

- On the left side of the x-axis a formula calculates and plots how often the minimum value has occurred in a given time interval, and similarly on the right side for the maximum value.

- The higher point marks the measured intensity - found most often. The lower points indicate a specific value measured very seldomly.

Menu

Edit

"Copy all": Copies the plotted data area as well as the drop-down of the "Statistics/Channels" section into the buffer – from here it can be inserted directly into your measurement protocol at any point of your choice. This is similar to a screen shot.

All other edit options are self explanatory.

View

"Edge Display"
Choose the menu option View/Edge Display to activate the edge display. The edge display option will help find important field strength flucutations. Steep edges are marked in the diagram in the colour corresponding to each channel – the marked channel will be bolded, the others won't. This way you will always have an overview of what's going on in the other channels, even if your focal point is, for instance, the 3D-value. The threshold value for an edge display can be defined in the menu opiton "Channel/Set edge crieteria".

"Set Times"
Choose the "Set Times" option to scale the graphic to a defined time segment.

"Y-Scale"

- Automatic – The y-axis will be scaled automatically to give the best display of the area selected for analysis.

- Manual – The y-axis scaling can be manually controlled in this mode. Allows for and will assist in analyzing small values (e.g. those over 2 kHz) overshadowed by other very strong field intensities.

„All" – zooms out the x-axis and displays the complete data set on the data plot. The keyboard "A" keys can alternatively be used.

Use the arrow-keys to take over the functions of the mouse.

Channel

Set Edge Criteria (experimental!)

This feature is new and its intention is to facilitate professionals the dicussion and analysis of "dirty electricity" beyond today's definition. Activate "Edge Dispay" in the menu option "View" to use this function.

This function allows you to define a threshold value with which a spike can be marked directly in the "Edge Display" of the plot. This threshold can be selected individually for every channel. Standard values have been pre-selected as defaults.
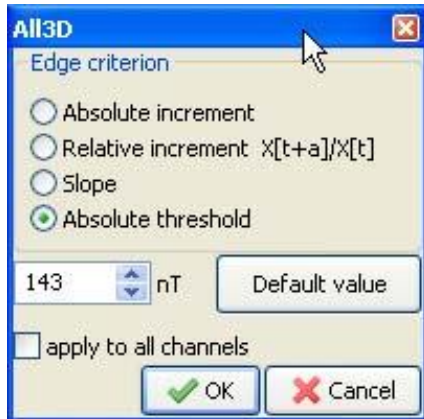
When clicking „Set edge criteria" the following window opens. Description:

Absolute increment = Marks a rise of measured field intensity between adjacent points of time by a user defined absolute increment level in V/m, mG or nT

Relative steepness = Marks a rise of measured field intensity between adjacent points in time by a user defined factor or multiple.

Slope = Marks a rise of measured field intensity between adjacent points in time by a user defined slope rate in V/m, mG or nT per second. This is independent of the measuring intervals. A hypothetical interval of 1 second would give that increment. This permits to compare results recorded with different recording intervals.

Absolute threshold = Marks a rise of measured field intensity between adjacent points in time by a user defined threshold level in V/m, mG or nT. Any rise beyond this absolute threshold value will be marked.

The selected edge criteria will be graphically displayed on the top of the plotted data section and will appear numerically in the field channel statistical data section under edges per hour for that particular time span. All edge markings displayed appear in real time and allow for a quick visual analysis.

When clicking the „ok" button, the selected criteria and the set value will be transferred into the statistical values of the channel. When re-accessing the menu option "Set edge criteria", the pre-set values will again be displayed (under construction).

Select HF-Unit
This function will only be displayed when selecting „CH 4"in the „Channels" window and the data recorded in this channel are those of an external input device such as an HF-Analyser (and are therefore recorded in mV). Upon selection of this point of the menu the following window will open up for a selection of the HF-Analyser settings during the recording period.
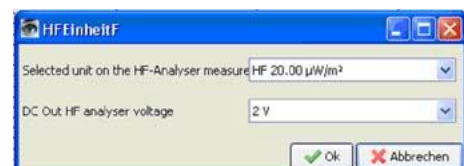
nT <> mG
This function allows to subsequently convert a chosen channel's data from milli-Gauss to nanoTesla and vice versa.

Convert Units

This function can be used to display whichever values recorded via the AC/DC input port directly in its original unit. This way, an HF-recording can be shown either in µW/m² or V/m. A new channel will autmatically be generated, thus avoiding any potential loss of data.

More help to be provided in future revisions.

Rename or Delete Channel
Allows for a renaming or deleting of the marked channel.

Summarise Channels
The plotted channels (selected on the left) will be added up ("square sum") and added as a new channel. The sum of 100/120 Hz, 150/180 Hz, R<2kHz and >2kHz are considered to be the relevant paramter for the evaluation of "dirty electricity".

Extras

The first two items in the dropdown menu have been explained already.

Create KML-File

Required as a plugin for the connection of GPS-data, NFA logs and Google Earth (currently in beta level). Please ask for the current manual by e-mail.

7.3 Data-Analysis:
9-Point-Measurement / 6-Point Measurement

For a graphical illustration of recorded 9-Point-Measurement please double-click the respective file with the extension ".9PM". The illustration is frequency specific. Please note that the readings of the channels X, Y and Z as well as "All CH4" are dependent on the position of the instrument and that the graphical illustration is for orientation purposes only. "Edit" in the menu offers you the possibility to copy the illustrations into your report, also individually. The evaluation of the 6-Point-Measurement is done analogous to the 9-Point-Measurement.

7.4 User-specific Configuration of the NFA

This part of NFAsoft allows for a customized user definable configuration of the NFA. The configurations will be made available in the "CONFIG.NFA" file of your NFA. The new settings are automatically loaded by the NFA upon its next start when saved on the SD memory card.

Several customized pre-settings for NFAsoft can be defined allowing a quick access. Simply select the settings as required and activate the button "save as pre-setting for NFAsoft". All pre-settings are stored in the file "NFAsoft.ini" and are available for NFAsoft provided that this file is in the same folder.
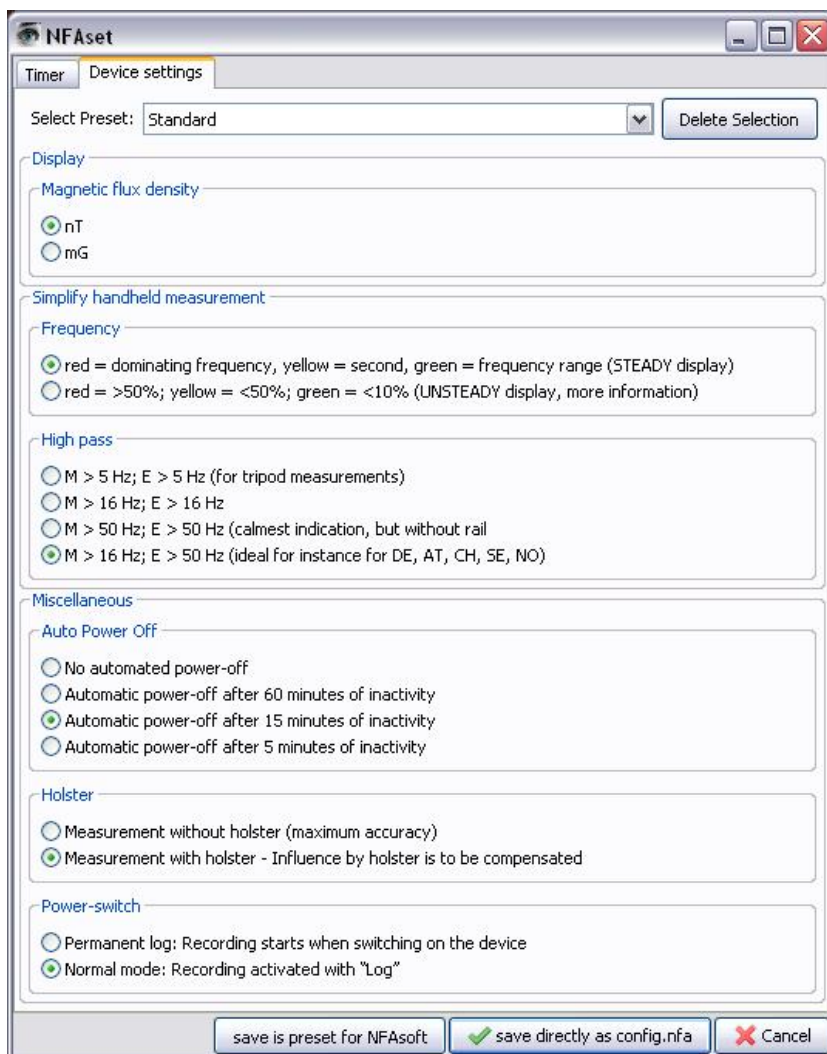
For a synchronisation of the time, the SD-card in the meter should be connected to your computer via USB-cable. The synchronisation will either take place automatically once "CONFIG.NFA" is recorded onto the SD-card, or else the manually entered time is applied at that very moment.

If the high pass is set at 50 Hz, this only refers to the broad band reading or recording as it reduces the influence of movement induced field components. For full information, the frequency components of sinusoidal waves at exactly 16.7 Hz are still recorded separately and can be shown with the help of the NFAsoft.

If the filter is set, it is therefore not unusual for the summary indication "All3D" to be smaller than the indication for 16.7 Hz, as the signal components at 16.7 Hz are not integrated in the total sum of "All3D". Furthermore, the signals of the different frequencies are added up quadratically, which in turn means that the result of simply adding the individual signals will also differ from the sum of "All3D".

(For more information on this matter see chapter 9)

8 Firmware-Update

The file: "firmware.nfa" is the meter's operating system stored in its internal memory[16]. As known from computer programmes, this software is subject to continuous improvements and upgrade, and can be updated as follows:

Procedure for the Update:

Copy the new "firmware.nfa" file onto your SD memory card. If need be, overwrite any old versions as only one "firmware.nfa" file should be on the card. It should not be renamed.

Lock your SD memory card byswitching the small switch on left side of the card to "lock".

Insert SD card into your powered-off NFA.

Turn on your NFA. The display will show "CodE", the frequency LEDs will gradually change from green to red during the update process. Then all LEDs will turn off except for the status LED. As soon as the status LED is green, the update process is completed.

Do not switch the meter off during the update process!

Before applying the new firmware, don't forget to unlock the SD-card!

Which is the active firmware on your NFA?

Press the "Mode"-button while switching on the meter, and you will be shown the currently active firmware version for a short period of time.

The NFA always has two firmware versions in its memory. In order to switch from one version to the other, press the "Mode" and the "Rec."-button simultaneously.

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[16]

Please differentiate: With „NFAsoft" one can configure the firmware, with these user settings being stored in the file „CONFIG.NFA". This has nothing to do with the firmware-update described above.

9 What if… (FAQ)

Answers to frequently asked questions regarding the NFA1000

Make sure you're always using the most current firmware version!

The device does not react when trying to switch or press a key

Unlock SD-card! (Push micro switch on the left of the card upwards)

Restart: All switches up – switch off – switch on.

There is no recording (status LED does not turn green)

Insert or unlock SD-card! (Push micro switch on the left of the card upwards)

No long-term recording over several hours or days possible

Solution 1: Update your firmware.

Solution 2: There is a file system error on your SD-card. In this case, save the "good" files and re-format your SD-card ("quick format" or simple deletion is not enough).

Note: Windows XP does NOT format the SD memory cards according to the standard (Vista or Windows 7 are ok). XP-users may use the following link to download a standard-conformed formatter:
http://www.sdcard.org/consumers/formatter_3/SDFormatterEN2905.zip

No E-field measurement against ground potential are possible

The field type switch must be switched to "M3D". Now you will automatically be shown the E-field vs. Ground potential once you insert the grounding cable. Please see the "quick start guide" at the beginning of this manual for further information.

The meter has four measurement channels which always work simoultaneously. Three of them are needed for the 3D measurement, the fourth channel can be used for any other required measurement task

The meter turns off after quarter of an hour

NFAsoft allows you to change the interval for the auto-power-off feature. (Auto-power-off is deactivated while recording!)

The sum of the frequency specific channels is higher than the value of "All3D"

> The signals of the different frequencies are added up quadratically (square root out of the sum of squares), which means that a simple addition of the individual signals will result in a higher value than the sum of "All3D".
> For example, if you take 500 nT at 16.7 Hz plus 1000 nT at 50 Hz, a simple addition will amount to 1500 nT, whereas the quadratical addition (= "All3D") will amount to only 1118 nT.

The 16.7 Hz LED is off although measurements with "Band" or "Freq." show values in this frequency

> If the 50 Hz high pass filter has been set with the help of the configuration part of NFAsoft (maybe even as pre-setting), the 16.7 Hz LED will remain unlit. However, the filter only applies to the DISPLAY in the "Auto" mode and to recordings made in the "All3D" channel. The aim is to tranquilize the display. Nevertheless, the device may well identify possible frequency components at 16.7 Hz when using "Band" and "Freq.".

NFAsoft is showing measurement values at 16.7 Hz inspite of the 50 Hz high pass filter being set
and
The sum of the 16.7 Hz channel and the other channels is higher than the value of "All3D"

> If the 50 Hz high pass filter has been set with the help of the configuration part of NFAsoft (maybe even as pre-setting), this only applies to the channels "All3D", "AllX", "AllY", and "AllZ". Nevertheless, possible frequency components at 16.7 Hz will also be recorded in the correspondent channel. In this case the sum of the frequency specific channels may well be higher than that of "All3D".

The NFA was configurated according to customer requirements with NFAsoft, but when restarting, NFAsoft shows the original settings

> The "CONFIG.NFA" file on the SD-card transfers user-specific configurations to the NFA. NFAsoft can write this file, but not read it. Therefore you cannot use NFAsoft to check the configuration of the NFA, but only to instal new configurations.
>
> You can save frequently used configurations as presets to a dropdown menu in NFAsoft.

What is the purpose of the individual files and where are they
saved?

"CONFIG.NFA" -> user configurations of the NFA-> SD-card

"NFAsoft.ini" -> Presettings for NFAsoft -> same folder as
NFAsoft

"FIRMWARE.NFA" -> operating system of the NFA -> SD-card

9-Point-Measurement of the electric field ("E3D")…

… in an (almost) field-free area: the indication of the dominant
frequency is unpredictable.

In fields of minimal values the indication of the dominant fre-
quency is a matter of pure stochastic

… in an (almost) field-free area we still have a reading
on the display

The function "Peak" does not work in combination with "E3D"
and a recording (the recording process onto the SD-card
causes periodic peaks of 10-20 V/m).

When using a telescopic rod, a reading may well be caused by
either movement-induced fields or alternating electrostatic
fields from your contact with the rod.

Solution: The configuration part of NFAsoft allows to set the
high pass filter at 16 Hz or 50 Hz. This will suppress most of
these "pseudo fields", the 50 Hz filter of course more so than
the 16 Hz filter. In areas where the 16.7 Hz frequency is <u>not</u>
used for traction power you should choose the 50 Hz filter.

… in an (almost) field-free area and using the equipment holder
PM1 the evaluation with NFAsoft still shows high values at usually
only one point, especially in the "R<2k" channel which does not
usually show up during a "normal" measurement

This is nearly always a matter of "pseudo fields" caused by
movements or electrostatics in the area of the meter (for in-
stance by the person moving away from the measurement
device). Please check chapter 5.2 for more details on the con-
duction of a proper measurement avoiingd this effect.
These pseudo-readings can, if need be, be deleted from the graph by opening the
9PM-file with a text editor and replacing the odd value by "0.0".

The grounding cable plug slips out of the jack, or there is a loose connection

The plug is inserted too far into the isolating material, so there is no connection

Solution: Hold on to the middle part of the contact on the plug with a tong, and screw back the isolation material

WRONG

Correct

Streaks and "scratches" on the display foil?

In order to assure a high resolution potential free measurement of the E-field, a highly sensitive foil of a vapour deposited metal layer has had to be mounted onto the display. Unfortunately, scratches and streaks cannot be completely avoided.

There are very many small TXT-files on the SD-card?

Solution 1: You have activated the function "permanent logging", which causes the meter to log not only when switched to "Log". This option will cause a new file to be started each time the meter is switched on, and each time you switch from one mode to the other.

Solution 2: There is a file system error on your SD-card. In this case, save the "good" files and re-format your SD-card ("quick format" or simple deletion is not enough).
Note: Windows XP does NOT format the SD memory cards according to the standard (Vista or Windows 7 are ok). XP-users may use the following link to download a standard-conformed formatter:
http://www.sdcard.org/consumers/formatter_3/SDFormatterEN2905.zip

An existing audio note it is not shown in the diagram window of NFAsoft.

The audio files (.wav) will only be displayed in the diagram when they are stored in the same folder as the LOG-file and they are not renamed.

Thank you for reading this data sheet.

For pricing or for further information, please contact us at our UK Office, using the details below.

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