Fieldmaster 3D

Manual PC-V2.0

PC-controlled Version

July 2009

TABLE OF CONTENTS

Preamble

The prerequisite of understanding this manual is to have PC user knowledge. In case you have not had any PC experience, please contact you PC-Dealer or PC-manufacturer.

We do appreciate your feedback! We strive for constant sensor and program control development as well as additional functionalities to maintain our high standard of quality and innovation.

To ensure improvements adapting to user friendly applications, we do count on your feedback; e.g. as additional grid measurements and further documentation options are in planning.

Please send your ideas and suggestions via email to:

> info@rom-elektronik.com

Your input is definitely appreciated and will be implemented if suitable.

Precise comments on errors concerning the program or this manual are welcome.

New program controls and manuals will be avaiable from time to time and can be downloaded free of charge at:

> www.rom-elektronik.com

Miscellaneous

Our Fieldmaster 3D is a cube-shaped sensor for measuring electrical field strengths in low frequence of ca. 10 Hz to 400kHz. Measuring the three orthogonal components (x-, y- and z-component) of the electrical field, calculating the electrical substitute field strength, which complies in most cases[1] with the amount of the electrical field and is being used to assess health hazards.

The isotropic indication of substitute field strength is caused by the geometric construction and the signal processing of the sensor, i.e. independent of direction. Which results in a constant field strength value accuracy of the sensor, independent of its relative alignment to the field. The field distribution and the direction do not have to be known when measuring. The meter is able to detect the field direction because, not only the substitute field strength, but also the x-, y- and z-components are being indicated.

---

[1] The only difference in elliptically polarized electric fields, such as those occur in the vicinity of three-phase cable systems.

The field direction is determined by positioning the cube in a way that the field strength indication will be as low as possible in two axes (e.g. Y- and Z-axis) and as high as possible

in the third axis (X-axis). Causing the field direction to run vertical to the X-plates and is identical with the cube X-axis.

To avoid field disturbance, a distance of at least 2 m from the sensor should be kept.

The resulting field distortion caused by the cube sensor is very low and occurs only within the immediate vicinity (ca. 20 cm) of the cube. The Fieldmaster 3D is not subject to in particularly large strong scale field distortions, which are common when not using potential-free meters. The fiber optic cable (LWL)-supply produces practically no field distortion.

The minor field distortion of the cube, is taken into account and therefore solved by the calibration.

 That is why the cube has great outdoor accuracy (usually < 5% error rate). When measuring close to other objects (distance < 20cm) the field distortion causes an interaction between the sensor and object. Especially, if the object is conductive (e.g. metallic). The interaction always produces excessive field strength readout.

The field strength increase can be estimated when measuring on a surface area of conducting objects (e.g. also human bodies).

At a distance of 2 cm the field strength is ca. 20%. In order to get the correct field strength value when measuring at a distance of 2 cm, ca. 20% have to be deducted from the reading.

For a deeper understanding of the physics of electric fields and in general, measuring with the cube sensor, we do recommend the attendance of a special seminar offered by ROM-Elektronik.

Scope Of Delivery

The following items are included:

- Fieldmaster 3D sensor
- Fiber optic cable
- Tripod bracket
- Charger
- Transportation case
- Manual

Further parts (e.g. a tripod) are available as accessories.
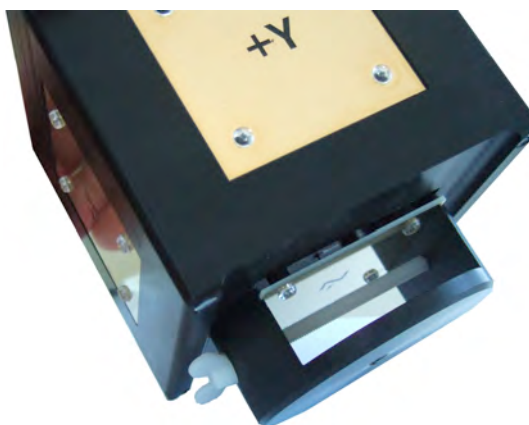
Fieldmaster 3D sensor with tripod bracket

Standard charger

Technical Data

|	
Frequency range:	10 Hz bis >400 kHz
Measurement range:	0,05-20 V/m, 0,5-200 V/m and 5-2000 V/m
Filter:	Low-pass 16 Hz, high pas 50 Hz-400 kHz, 100 Hz-400 kHz, 2 kHz-400 kHz
Maximum sensitivity:	Broad band: ca. 0,05 V/m; with activated filter ca. 0,01V/m
Measurement tolerance:	Basic accuracy ± 5 %; ± 2 % of the final value
Display:	2 LED for „indication" and „on", 5 LED for charger condition; for PC-Software (Windows®)
Ambient temperature:	-10° C to 40° C
Measurements:	110 mm x 110 mm x 110 mm (l x w x h)
Interface:	Optical, serial interface (operation possible via USB-to-serial-adapter), charging socket
Weight:	ca. 600 g
Power supply:	4 pieces NiMH-battery
Maximum operating time:	ca. 8-10 hours (when fully charged)

Subject to technical changes

Initial Application

The Fieldmaster 3D sensor is equipped with a permanently fixed battery supplying it's electricity. The Fieldmaster 3D sensor will be delivered with a fully loaded battery! Nevertheless, the battery should be checked before using the device for the first time. The battery life will be indicated by 5 colored lamps. Each lamp showing the state of 20%.
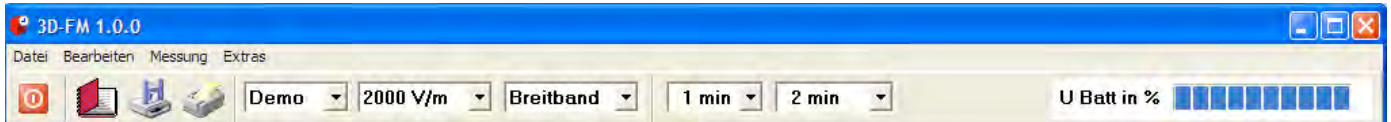
The present state of charge is also shown by the computer software in the upper right corner in the form of a beam.
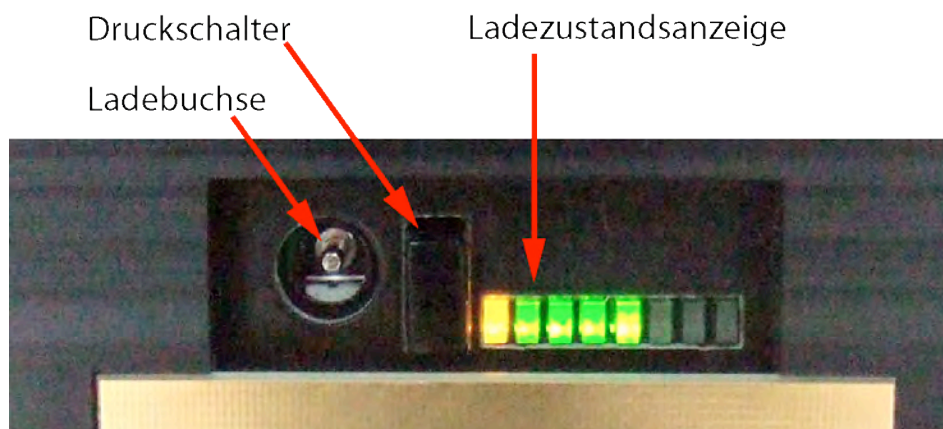
The battery life indication fades out. The operational readiness is shown as a blue light at the right end of the panel.
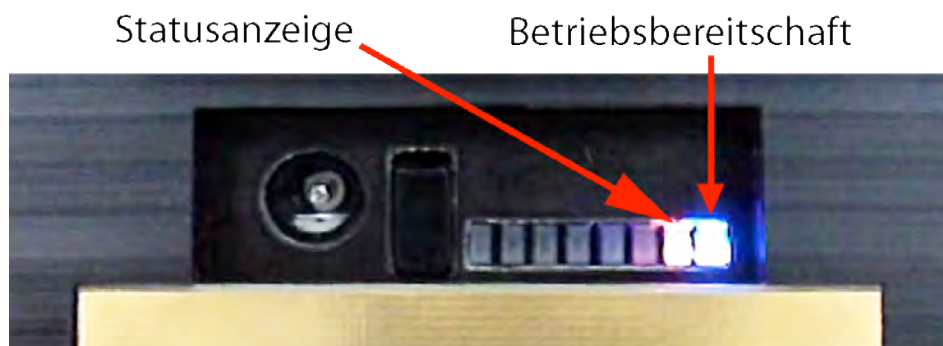
The brightness of the status display depends on the internal condition of the program.

Important Software Information

1. There are many different operating systems and PC-configurations. The program installation and startup works smoothly with most PCs. This cannot be guaranteed in each case. Please do contact ROM-Elektronik, if problems should arise, because in this regard, basically, all issues can be solved.

2. The cube is designed for control via serial interface of the PC. Your PC is only equipped with USB ports? Please contact ROM-Elektronik. There are corresponding adapters, which may require special software adaptation.

3. The program works with a screen resolution of 1024 x 768 pixels. The image fills the entire screen only, if the PC used, works with this screen resolution. If the PC works with a higher resolution, e.g. 1268 x 1024 pixels, the image will not fill the whole computer screen; though the program can be used. Only a part of the image is visible when the PC operates with a lower resolution, such as 800 x 600 pixels; then the program can hardly be used. The PC should be set to a higher resolution.

4. The color display „Hi-Color" or „True-Color" provides the best color quality.

5. The program is very extensive and has several 1000 program components. Despite intensive testing, errors may still occur. If errors are detected, we kindly ask you to send a precise error description to ROM-Elektronik. On the ROM-Elektronik homepage you will find regularly improved versions, which can be downloaded free of charge.

6. Suggestions for improvement concerning the program or the cube are appreciated.
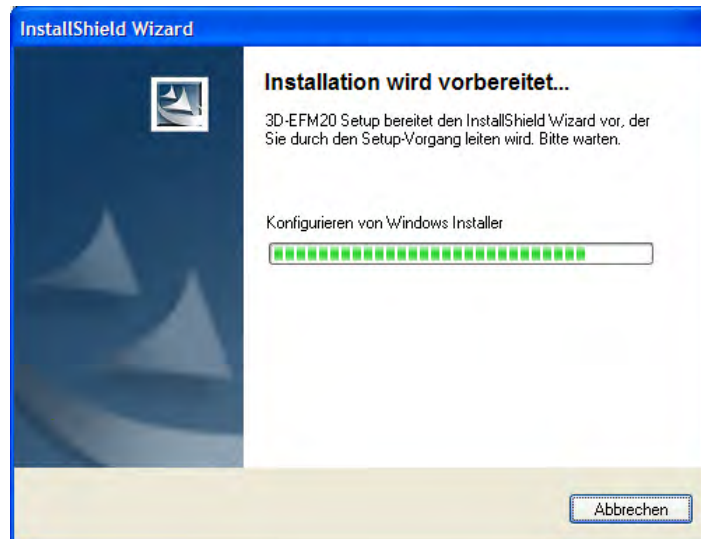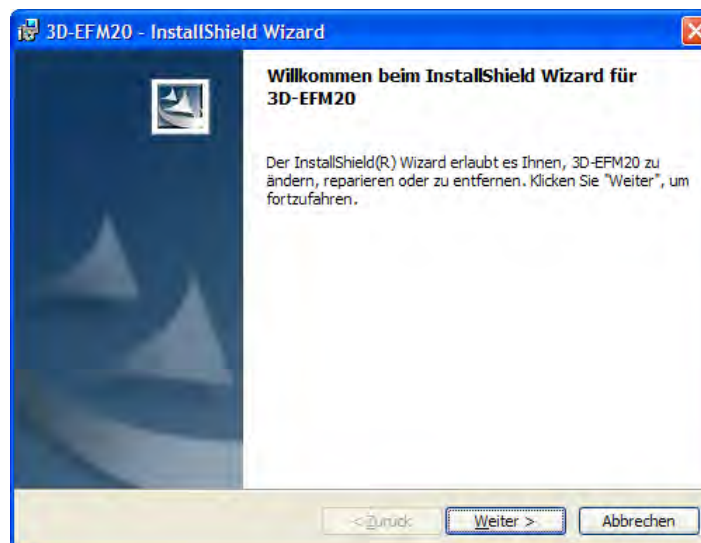
Installation

Please insert the program CD into your computer CD drive and start the installation.

Click on LW:\setup.exe (LW stands for the CD drive letter).

Below you will be guided through each step of the installation.

Installation step 1 (start)

Installation step 2

Continue the installation with step 3 „continue >" and enter you personal data below.

Are you logged in as administrator, you have the choice to set the Fieldmaster 3D software for all users or only for yourself. Click „continue >" to carry on with the installation.

Reference: Was the installation not successful, you need to log in as administrator, if necessary, and repeat the installation.
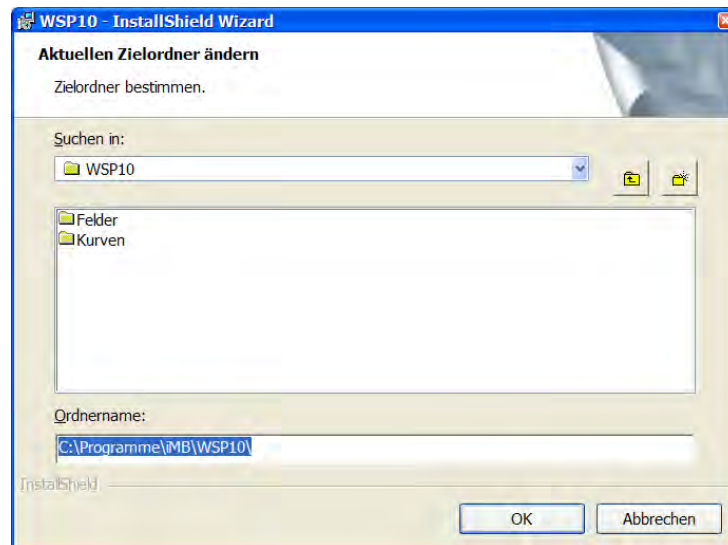

Installation step 3 (personal data)

In step 4 of the installation, you can select a computer directory, in which the Fieldmaster 3D with its subdirectories should be set up. Provided as standard for Fieldmaster 3D is the directory „C:\program\iMB\Fieldmaster 3D". This path is recommended to avoid certain PC configuration problems.
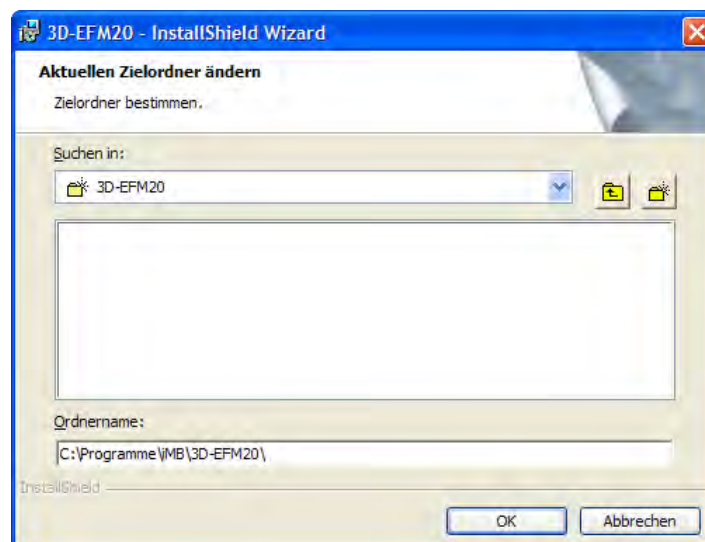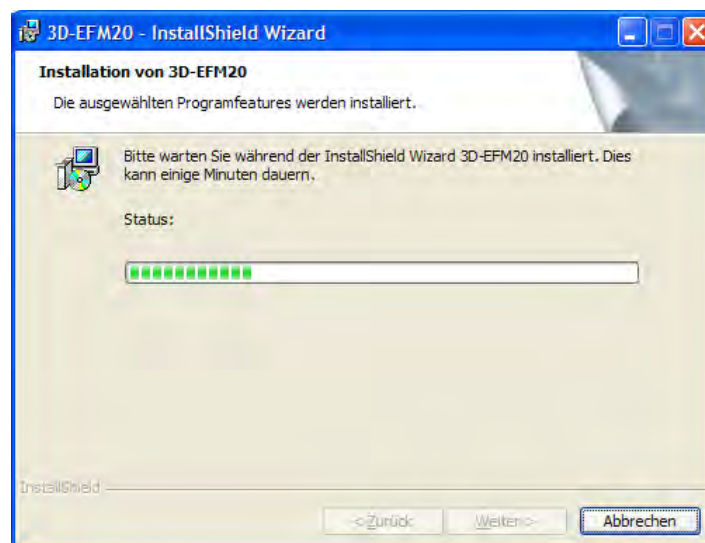

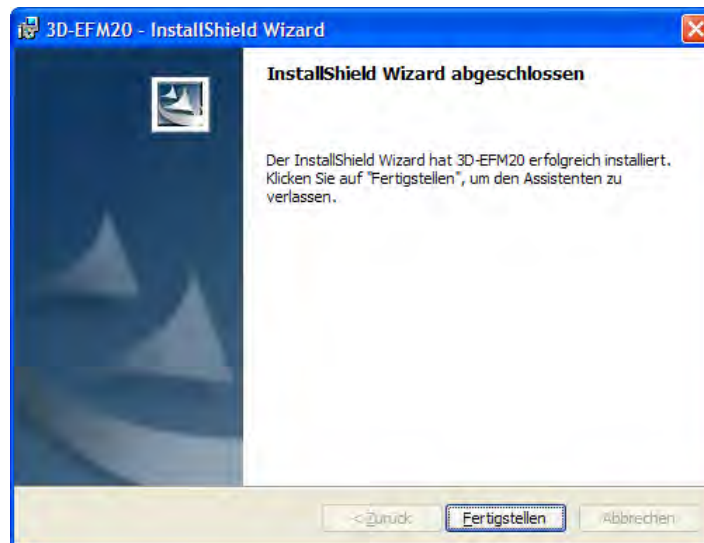**Installation step 4a (destination folder)**

Installation step 4b (change destination folder)

The installation of Fieldmaster 3D continues with <OK> in step 4a and 4b.

Installation step 5 (implementation)

Installation step 6 (completion)

After completing the installation you will find a Fieldmaster 3D-icon on your desktop as well as a program group iMB < Fieldmaster 3D on your task bar.

You can start Fieldmaster 3D with a click on the program icon on your desktop (left illustration) or „start>program>iMB>Fieldmaster 3D" at the program group. A third option is the Explorer, allowing you to start the installation directory „FieldMaster 3D.exe".

The installation program creates the following directory structure:

Main directory:

This is where the program file Fieldmaster 3D.exe, and the configuration files are being saved.

Subdirectory „grid measurement".

The grid measurement files are being stored here.

Subdirectory „program recording".

Here the recording files are being stored up.

Getting Started

Because of the the great variety of PC-configurations the startup may be somewhat time consuming. It is recommended to adhere to the following startup sequence.

1.   Connecting the PC and sensor with the fiber optic cable

2.   Switching on the sensor

3.   Starting the program

4.   Starting measurement

Connecting PC And Sensor

On the PC the 9-pin connector of the fiber optic cable (LWL-cable) is being coupled with the connector for the serial port. Divers USB-RS-232 converters function as well.

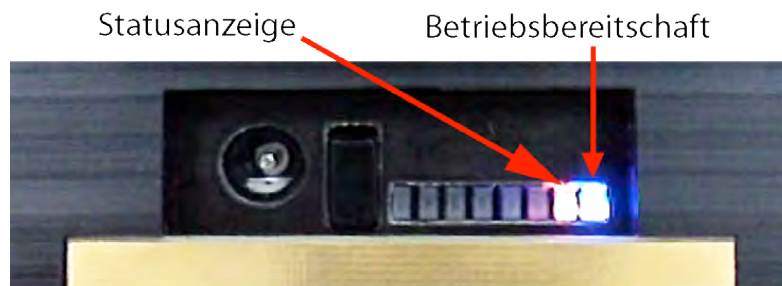On the sensor the other end of the fiber optic cable is plugged into the jack.

A bulge on the plug prevents the connector from being plugged in the wrong way.

Please notice: the plug has to engage with a „click".
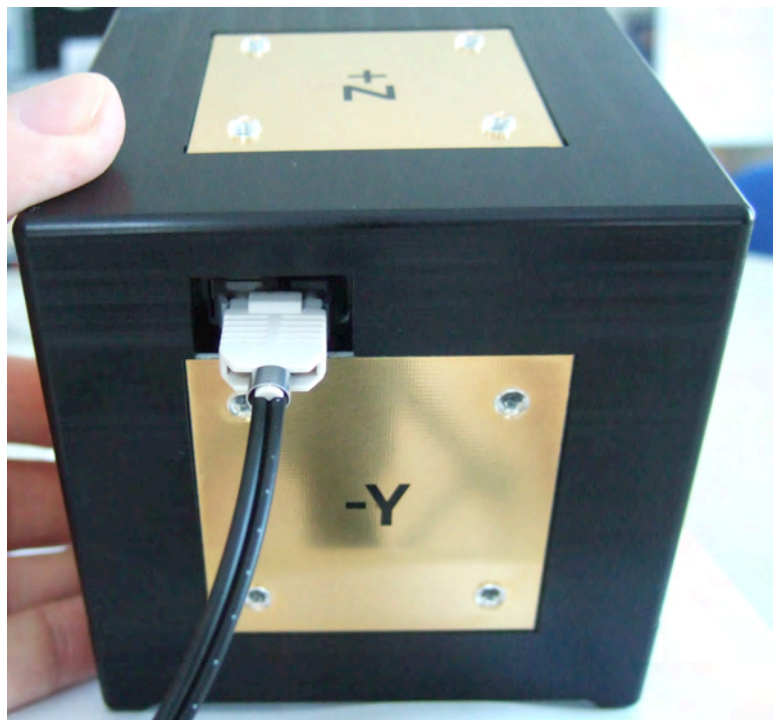
Sensor Switch

Turn on the sensor by pushing the black button (see illustration). Then the blue power-on lamp will flash in regular intervals.

Starting The Program

After starting the program, the startup screen appears (see illustration). The actual program starts after 5 seconds. To avoid waiting, click on the flag icon in the middle ">>>>>continue".


Setting COM-Ports

In most computers the serial port is connected with COM1. If the cube does not work with COM1, another one should be chosen from the list of available COM ports. The program determines all available ports on your system. It is also possible using a USB-to-serial converter to connect the probe to the computer. USB ports are also displayed in the selection list as COM. The setting DEMO only activates a demonstration, while the program will not communicate with the cube.

Using the „Basic Settings Back-up" in the „Tools" menu, the actual COM port will be stored as default configuration. When starting the program again, immediately this COM port is activated by the program. The COM port cannot be changed while running a measurement.
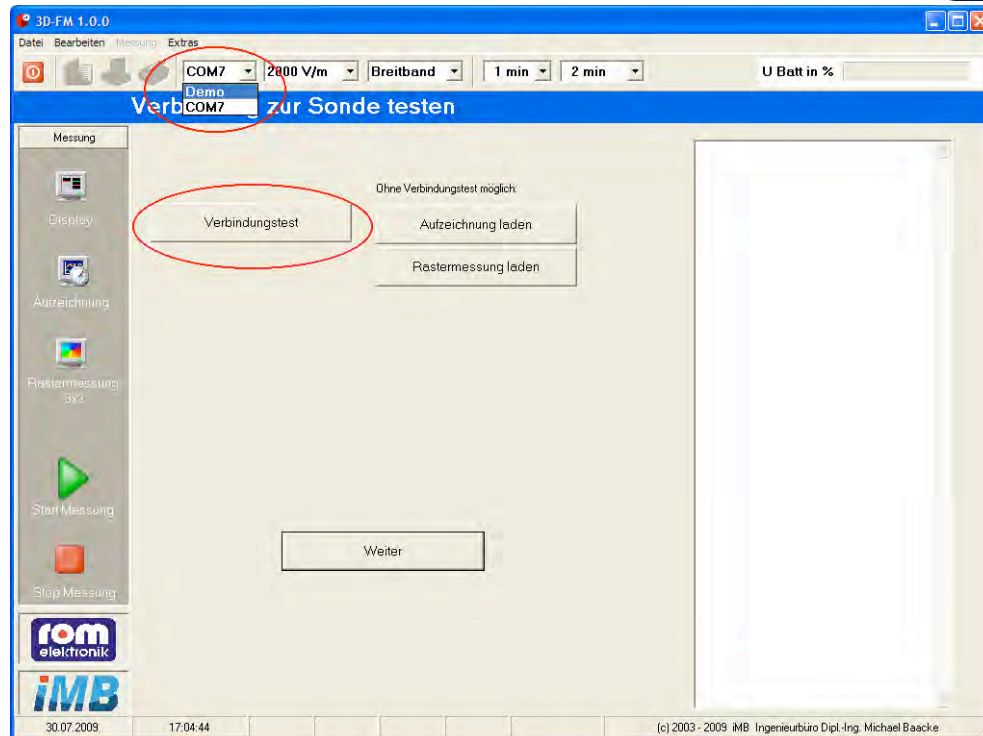
After starting the window „connection-to-the-probe-test" will appear. Before starting the measurements, the connection should be tested. This is the only way to ensure that the measured data is passed on to the program. After clicking the test connection button the calibration factors of the Fieldmaster 3D probe will be read and the screen should show something like this:
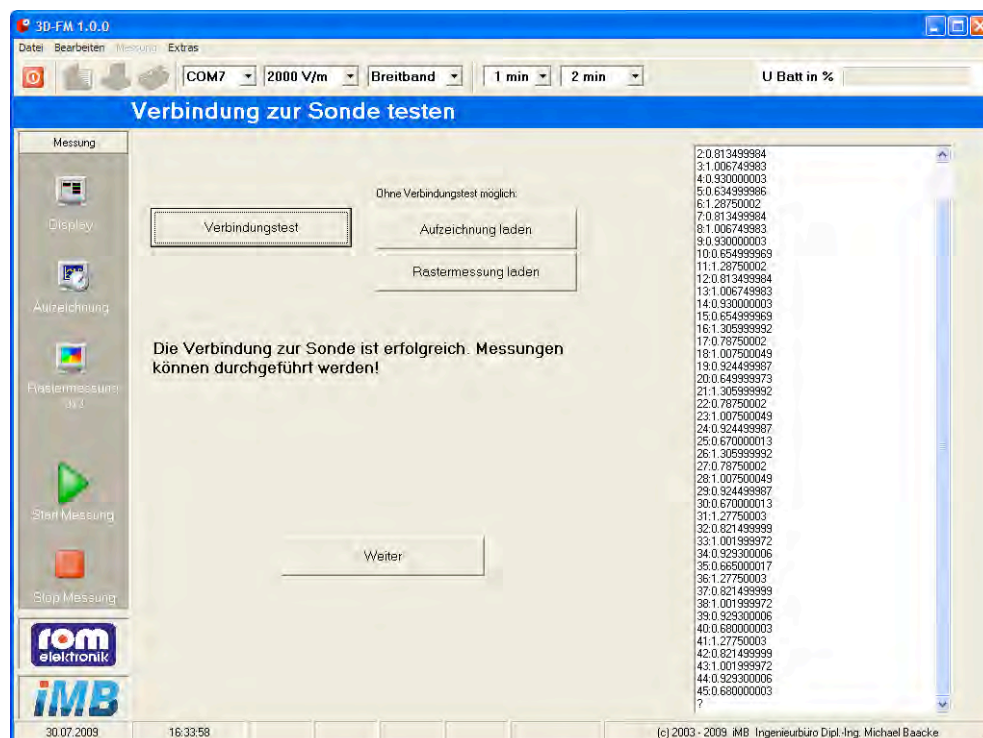
If not, the following messages may appear:

Die Verbindung zur Sonde ist fehlerhaft. Bitte überprüfen Sie die Anschlüsse und schalten die Sonde ein!
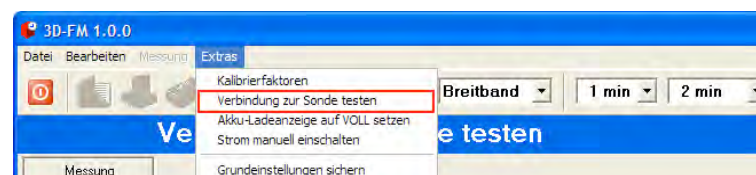
COM1 ist aktiv!

Der DEMO-Mode ist aktiv. Der Verbindungstest kann nicht durchgeführt werden!

Bitte stellen Sie einen gültigen COM-Port ein!

By clicking the „Next" button, „Display" pops up automatically.
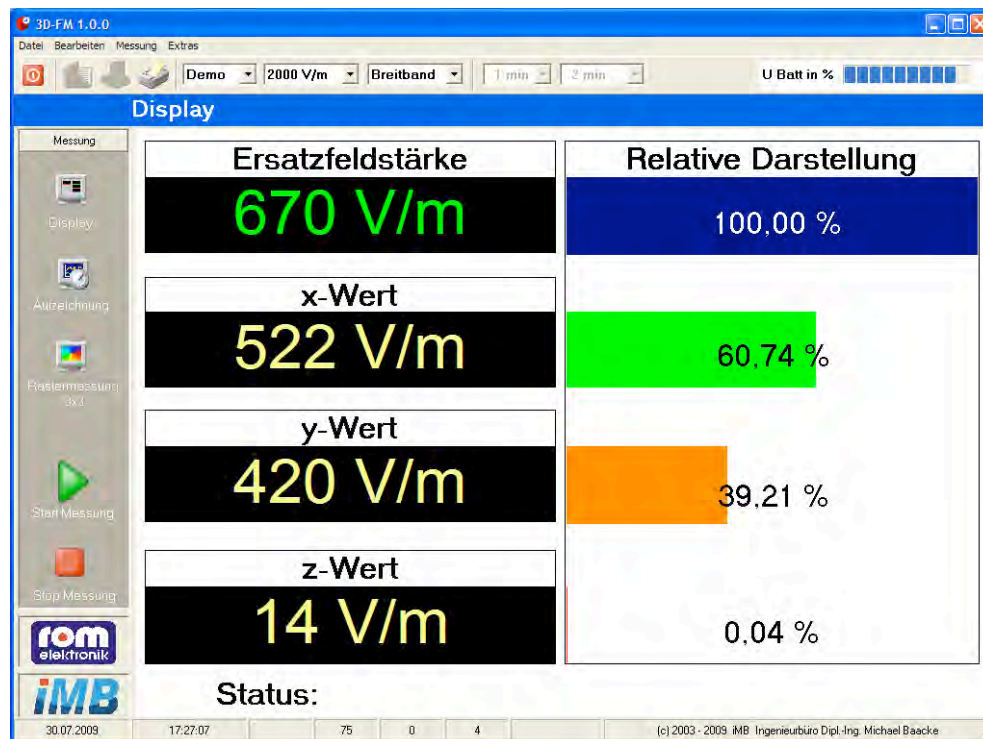
If the connection test was started on the menu „Tools" again, the operation mode, from which the connection test was derived is retained.

Switching Mode Of Operation

At present, there are three operating modes for the sensor:

- Display
- Recording
- Grid measurement 3 x 3

Shift between the operating modes, by clicking on the corresponding icon on the left toolbar.

It is recommended to stop the current measurement by clicking the „Stop measurement" button before choosing a new operating mode.

Sensor Setting
Changing Sensor Settings

The sensor settings are changed with the adjustment panel, which is located above the screen of each operating mode.
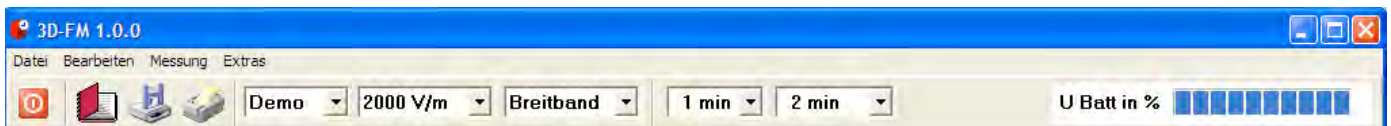
The cube settings cannot be changed during a measurement. To change the cube settings, the measurement has to be ended with the „Stop measurement" button.

Settings can be changed only, when the letters in the preference window show a black color, while the color is grey the settings are blocked and cannot be changed. The settings are blocked during a measurement. The settings may be changed, depending on the operating mode,

The new setting will only be activated after the „Start measurement" button has been activated.

While the cube is performing the measurement, the settings are continually reported to the program. Which shows the cube settings in the status window. If the settings displayed in the status window do not match the settings selected in the setting panel, the cube displays incorrect readings. Which normally (with a functioning cube and intact fiber optic cable) should not be the case.

Nevertheless a sporadic comparison of the set with the displayed status information is recommended.

Setting options in the settings panel:

Connection:	The connection of your computer is set here. When you first start the computer, the first supported COM port will be selected. In case the cube does not function with this setting, simply choose another given COM port.
Measuring range:	Here you may set 20, 200 or 2000 V/m.
Measuring filter:	The sensor filters can be chosen here.
Measured value display:	Here, the time axis of the diagram is scaled on the screen for 2,5 or 10 minutes.
Recording time:	Here, you can set the entire measurement period of 2 minutes to 12 hours. At the end of the recording period, the measurement is automatically ended.

Secure Basic Settings

When starting the program, certain basic settings are predefined.

- Connection
- Measuring range
- Measuring filter
- Mean values for n measurements
- Measurement interval
- Recording time

If you want to have different settings, when starting the program, select the preferred settings, click „Secure basic setting" button in the „Tools" menu. At the next start of the program, the new settings will be established.

Display

In the operating mode „Display", the measured values for the three coordinates x, y and z, as well as the computed substitute field strength is displayed. The cube does not automatically start the measurement process! The measurements are started by clicking on the triangle „Start measurement" button. To stop the measurement click on the square „Stop measurement" button. The measured values of the electric field strength are illustrated separately as large number values on the screen. Simultaneously, the calculated field strength is displayed and on the right the percentages of the x-,y-and z-components on the substitute field strength.

It should be noted that the substitute field strength results from the square and not the linear addition of the single field strengths. The percentages are calculated accordingly.
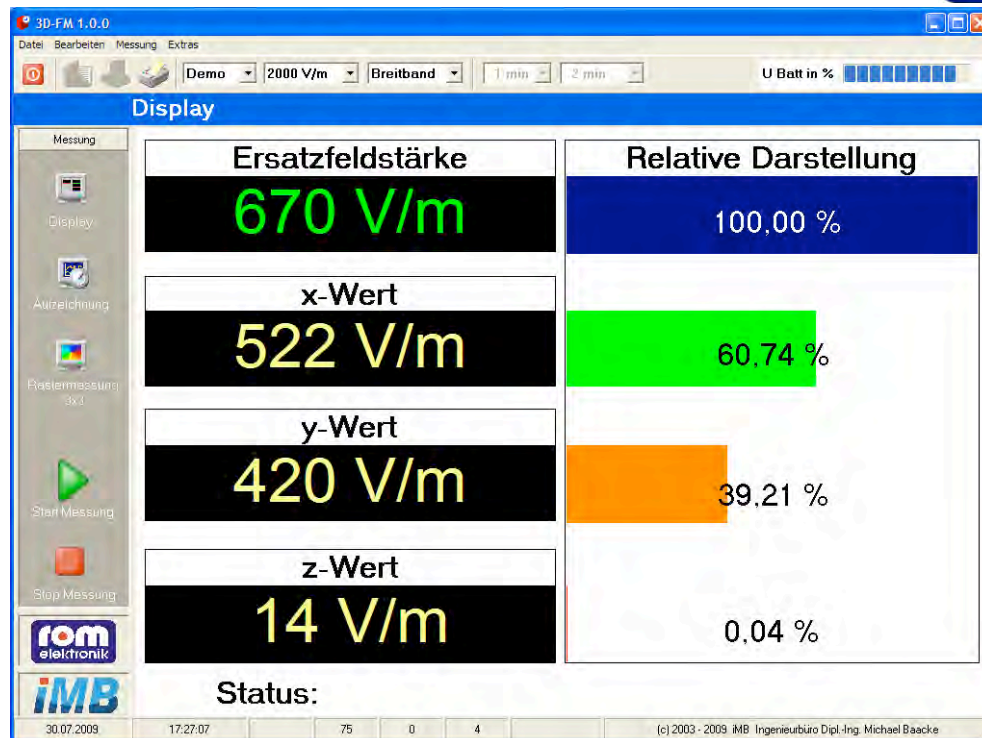
The measuring range and the filter function are adjusted in each operating mode by setting the panel at the top of the screen.
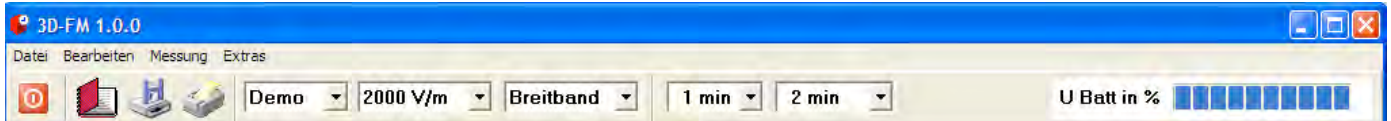

The measurement range and the filter functions can only be set when the measurement is stopped. The cube only takes the new settings when the measurement is started again.

If the field strength of at least one coordinate (x, y, z value) is larger than can be processed in the selected range, the message „OVER FLOW" appears on the display. In this case, the next higher range must be turned on, in order to continue measuring correctly. Just like in all other operating modes, the measurement in the display mode starts by clicking the „Start the measurement" button with the mouse and can be ended with the „Stop measurement" button.

Recording

The recording is used to observe and save the time course respectively fluctuations of the field strength components and the substitute field strength during the measurement.

The recording starts when you click the „Start measurement" button. It can be terminated with the „Stop measurement" button manually before reaching the end of the recording time.
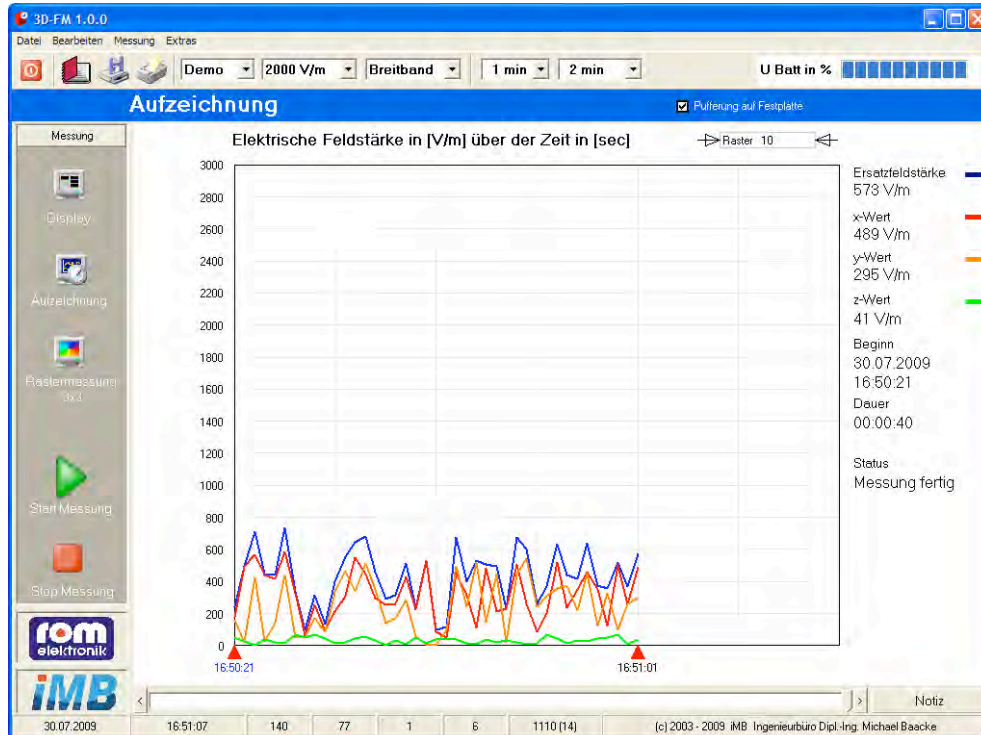
On the right side of the grid the current values are displayed numerically. If the currently set measuring range is exceeded by a component, for this and the substitude field strength, the indication „OVER FLOW" appears.

The status window on the right of the screen display shows the current cube setting. The program sends a query to the cube, which sends its status as a response. During each ongoing measurement it is to be verified that the display matches the status window, with the specifications in the settings panel, at the top of the screen. **If this is not the case[2], the program shows false readings!** The measurement should be stopped and restarted. Perhaps the program must be completely restartet.

The right figure shows the options for the recording duration. The cube has to be charged before starting the reading. **During the charging process the device must not be connected to the cube. This would result in totally wrong readings.**

Except for the entire recording time, the measurement interval and the number of measurements over which the average is calculated (see section 8.1), can be chosen.

---

[2] Normally this should not be the case. But if e.g. the light pulses are not transmitted properly because of a damaged fiber optic cable, such a malfunction may occur.
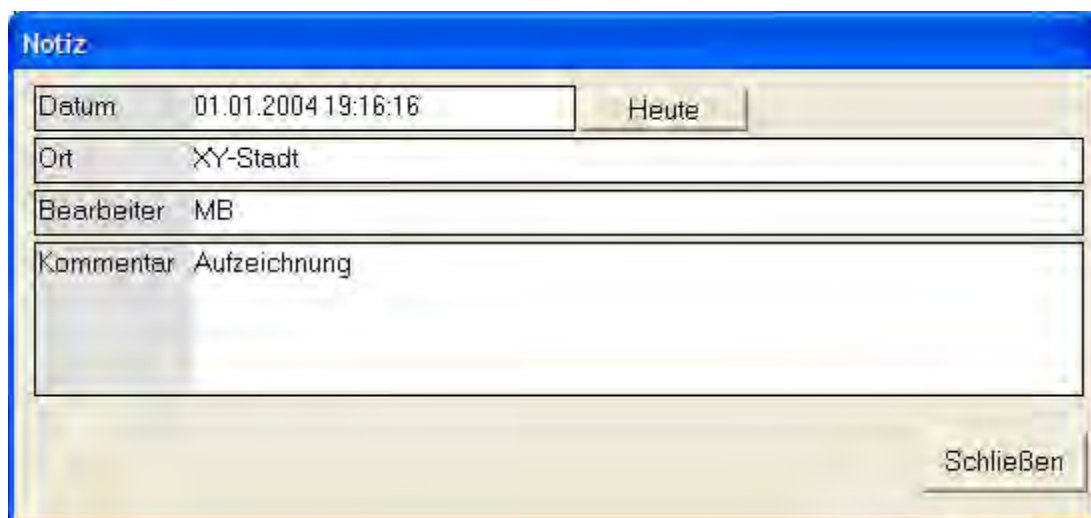
By clicking on the save button, a recording can be saved. An input window „Note" appears, in which details concerning date, location and user can be made, it is also possible to enter comments. **Notice: The use of the return key is not possible within these fields. A line break in the comment field is achieved by inserting spaces.**

The input window „Note" is also available during recording, but has no memory option. The content of the note remains until the start of a new measurement and can therefore be stored even after the current measurement has been ended.

The saving process is completed with opening the „Save measurement" dialogue, and placing of a file name.

The file format is compatible with the Mlog3D software and Microsoft Excel. The recorded data can be further processed in these applications.
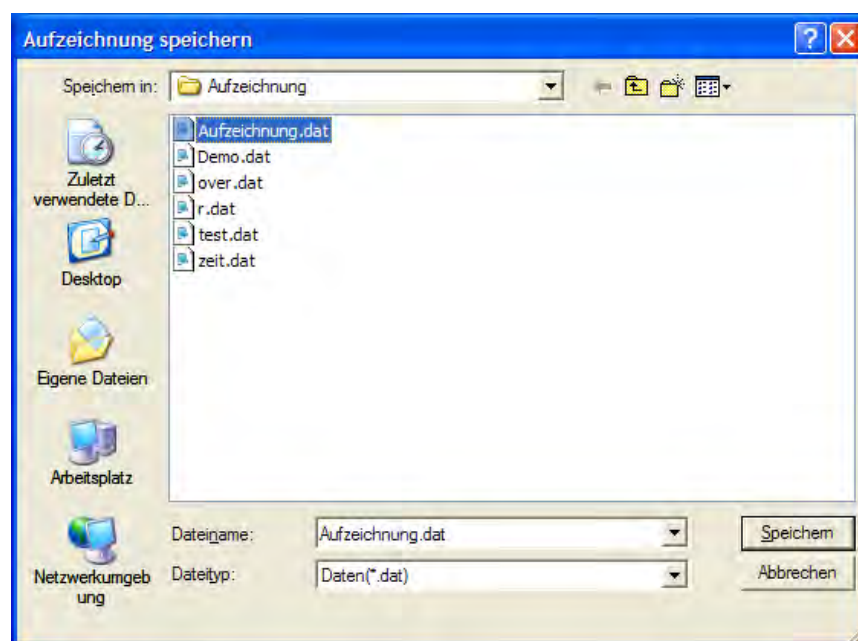
The file is saved in ASCII format and can be edited using any text editor. Missing comments or informations can be added in the editor.

```
Aufzeichnung.dat - Editor

Datei  Bearbeiten  Format  Ansicht  ?

Messung          Aufzeichnung
Software V.      2.0
Datum            06.01.04 13:26:15
Ort              Brunnthal
Bearbeiter       iMB
Kommentar        Test
-----------
Bereich          100 V/m
Intervall        1 sec
Dauer            2 min
Mittelung        1 Wert(e)
Filter           Breitband
-----------
Datum        Zeit            Ersatz   X        Y        Z
06.01.04     13:25:52        42,9     32,3     28,0     3,3
06.01.04     13:25:53        42,3     41,7     7,1      0,0
06.01.04     13:25:54        20,3     17,7     9,8      1,3
06.01.04     13:25:55        46,8     24,9     39,6     1,5
06.01.04     13:25:56        28,7     0,4      28,6     2,4
06.01.04     13:25:57        35,0     0,4      35,0     1,0
06.01.04     13:25:58        31,7     25,8     17,2     6,4
06.01.04     13:25:59        12,6     0,3      12,0     3,6
06.01.04     13:26:00        25,0     18,1     17,2     0,0
06.01.04     13:26:01        29,4     4,8      28,9     1,4
06.01.04     13:26:02        14,6     10,1     9,5      4,7
06.01.04     13:26:03        35,0     3,7      34,4     5,4
06.01.04     13:26:04        16,2     14,4     7,1      1,7

...
...
...
```
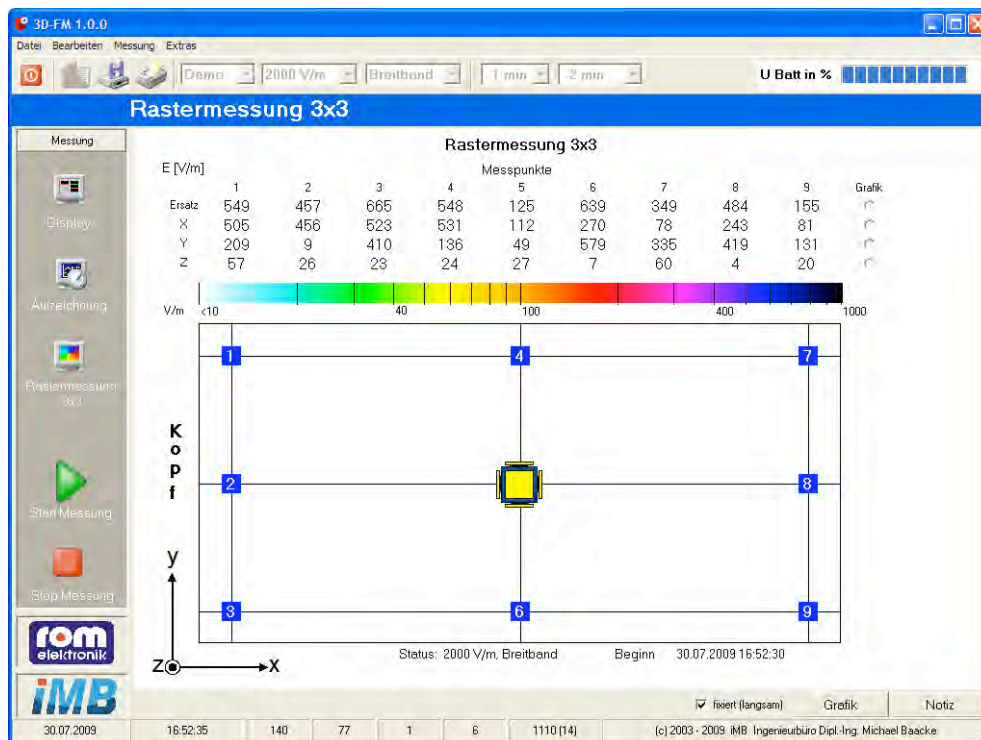
Grid Measurement 3 x 3

The operating mode „grid measurement 3 x 3" is intended to detect the electric field on a surface that has an aspect ratio of about 2 to1. For this purpose, the cube is sequentially positioned at 9 points of the surface and the respective reading recorded. The graphical representation between the 9 measurement values is interpolated. Depending on the measured field strength values a specific field distribution image results. The larger the field strength differences between the measurement points are, the more colorful the image becomes.


Even in the operating mode „grid measuring 3 x 3" the „Start measurement" button must be clicked first, before readings can be recorded. After starting the measurement, a cube icon appears in position 1. After clicking on the cube icon the reading is entered for position 1 and displayed in the table above.

The cube is being transferred to the next position and the local reading recorded.

As soon as readings are present for all 9 positions, it is possible to generate a field distribution image. Click on the „Graphics" button (right figure). It is also possible to selectively display the field distribution of the individual components of the electric field or the distribution of the substitute field strength. For this purpose, click on one of the four white circular option buttons. This coordinate system in the lower left corner shows the cubes alignment during the reading, so that the cube coordinates match the table data.

The +X-panel must point in the direction of the x-axis and the +Y-panel in the direction of the Y-axis. The +Z-panel must face upward, when measuring a horizontal surface.

Now the result of the grid measurement can be saved.
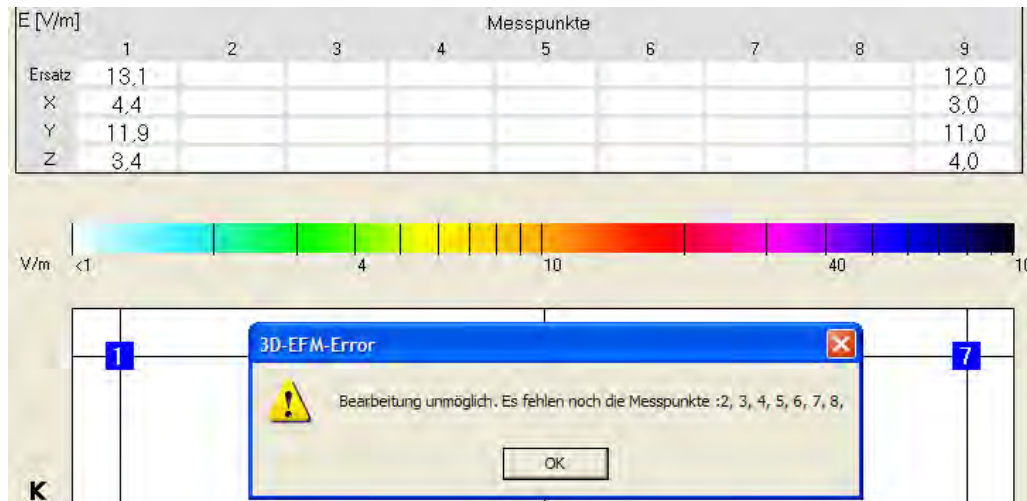
When trying to present an image of an incomplete reading, as well as, when saving an incomplete reading, a warning showing which data points are not assigned values, appears. While the graph is not shown here, however an incomplete measurement can be stored, To finalize the measurement the incomplete measurement is reloaded by the memory medium („Open file (only grid measurement)").

After clicking the „Save measurement" icon a window „Note" opens, in which measurement details of the date, place, user and a comment text can be entered.

Note: The use of the return key is not possible within these fields. A line break in the comment field is achieved by inserting spaces.

The input window „Note" is also available during recording, but does not have a memory option.

The content of the note remains until the start of a new measurement and can therefore be stored even after the current measurement has been ended.

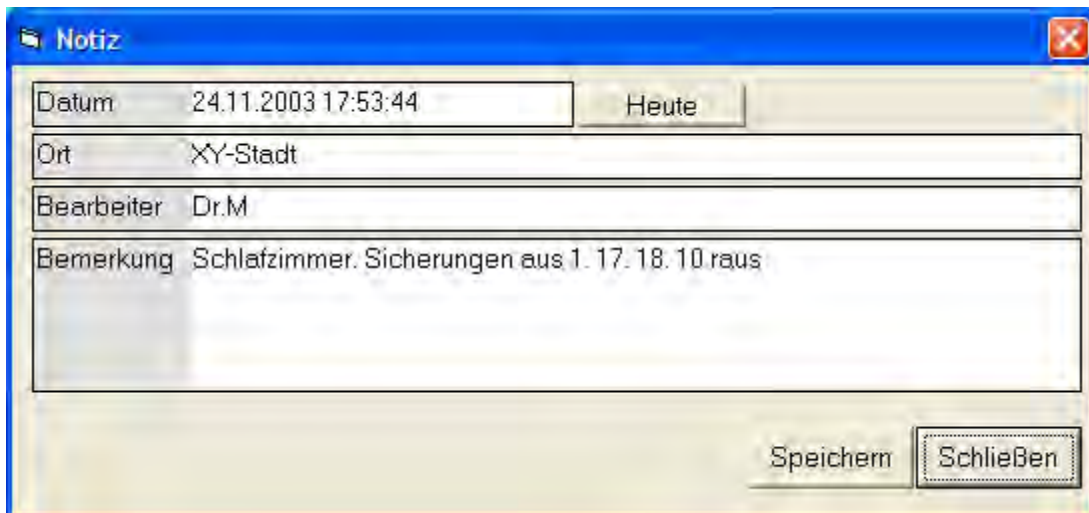The saving process is completed with opening the „Save measurement" dialogue, and placing of a file name.
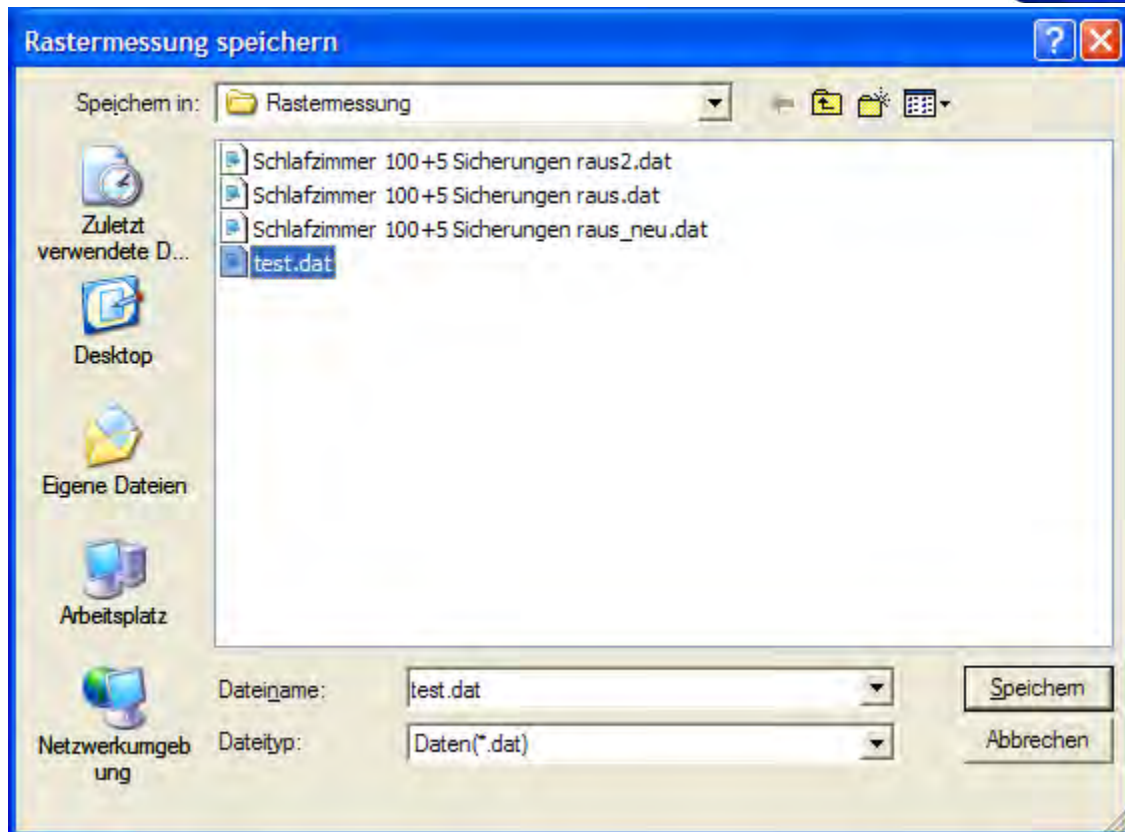
A stored grid measurement can be re-entered. After clicking on the „Open file (only grid measurement)" button a file can be selected in a dialog window.

The original valid readings and saved settings of the measuring range and measuring filters will be saved automatically on the screen. After loading the measurement values the graphics can be created.

Loading an incomplete measurement (at least one grid point is not occupied with a measurement value and has not been set on zero in the editor), the drawing of graphics will not be possible. After clicking on the graphic button, the corresponding error message is displayed, but subsequently the measurement grid is re-activated, the missing and already acquired measuring points can be approached so measured values may be stored again.

The file format is crucial and pictured in the following figure.

The file is saved in ASCII format and read again. As long as the formats are observed the file can be read and modified. This opens the possibility to complete missing data points or comments outside of Field Master 3D. Measurements with previous versions of Fieldmaster 3D20 can be adapted to the existing format (set to zero of previously non-existing grid points). The file is saved in ASCII format and read again.

Note: When making any changes to the ASCII file, only use the editor (Windows-Editor or Note-pad). Changes with Excel can thus change the file thru special characters (TABs) that, when transmitting in Fieldmaster 3D, the measurement ranges and filter displays no longer match.
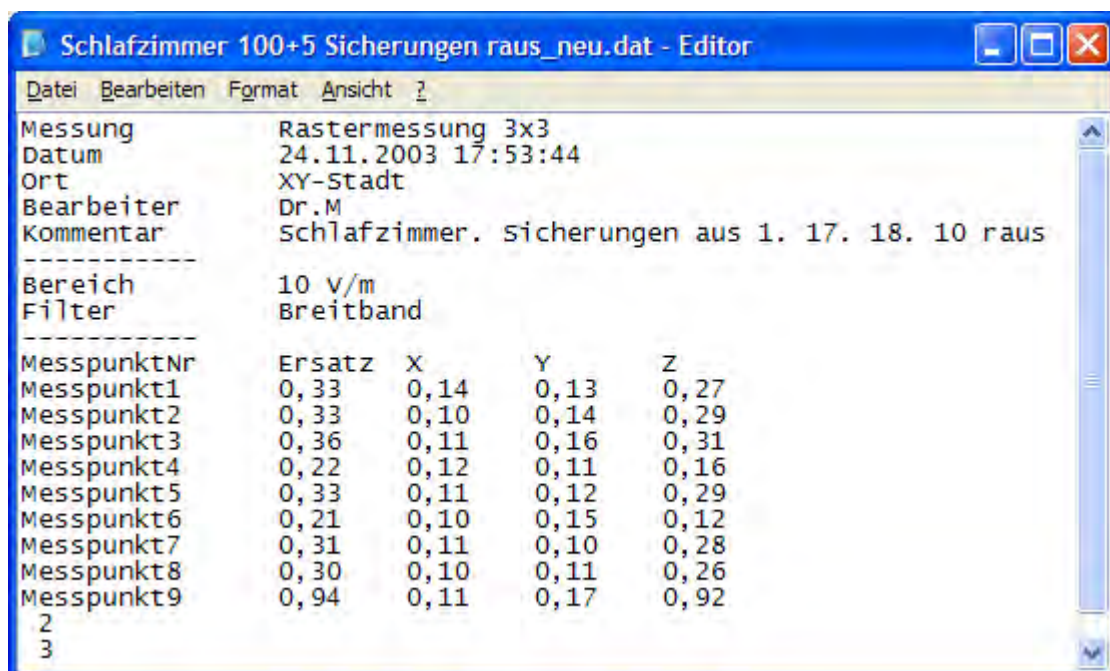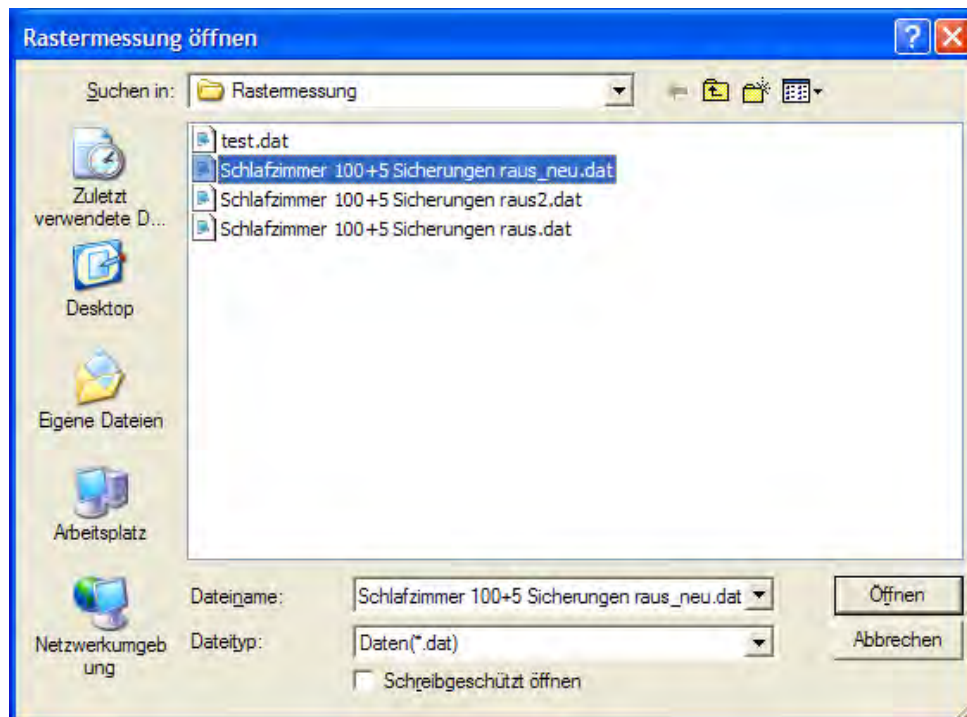
Measurement Documentation

The program is continually being optimized.

The current options are described below.

Direct Saving To A Word Document

Choosing this option, a word document should be opened before starting the cube control program.

After starting the cube control program, a screen snapshot can be taken anytime by pressing the keyboard combination[3] „alt print" and saved in the computer buffer memory. Following by pressing the button „Minimize" the cube control program (pictured right) is moved to the task bar and the Word document activated. With the key combination „Ctrl V" the image from the computer buffer is copied into the Word document and can be edited there.

An ongoing measurement continues even if the cube control program has been „minimized".

Another possibility is, to only impart the relevant screen portion, important for the measurement, into the buffer memory. For this purpose the „Copy" button is clicked in the pull down menu „Edit". After that, the buffer contents are in turn taken into a Word document by „Ctrl V".

Only one computer buffer exists. Every time a graphic is written to the buffer, it will be overwrite the existing graphics, which therefore will be lost, if they were not taken into a Word document beforehand.

Memory Function

In the operating mode „recording" and „grid measurement", individual measurement results can be saved in a file and loaded again later in the grid measurement. As explained in previous chapters, when using this function, the results must not directly be taken into a Word document.

The acquisition of several measurements into a Word document takes place, when sequentially loading the results and transferring each one with „Alt pressure" and Ctrl V" into a Word document.

---

[3] Simultaneouly pressing the keys „Alt" and „Print"

Calibration Factors

The Fieldmaster 3D sensor stores its calibration factors. The software runs a connection test on the 45 sensor calibration factors.

Since it is difficult to describe the E-field calibration, the matter is not being explained in this manual[4]. In the calibration, the field quality should always be inspected with special calibration equipment.
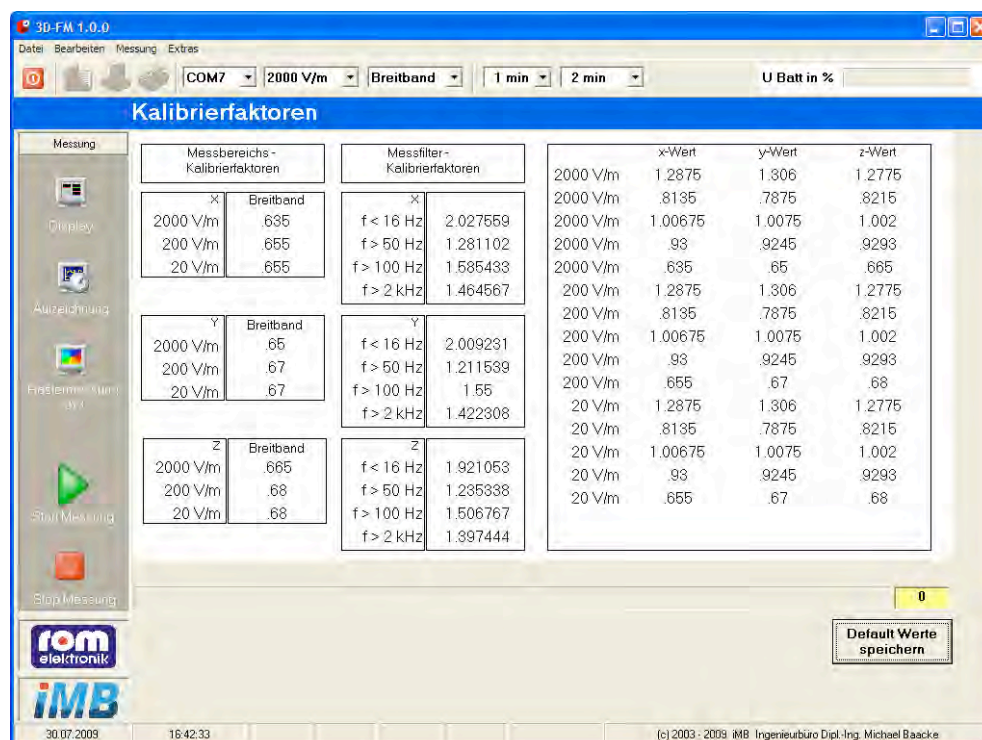
 Basically, the cube calibration factors can be changed. By keyboard each calibration factor can be corrected manually. The software then uses the modified calibration factors. By applying „Save Defaults" the changed values can be restored in the Fieldmaster 3D sensor and remain there until amended again.

---

[4] The description is given in a later version of this manual.

Care And Maintenance

The gilded panels may be gently cleansed with a soft cloth, moistened with window cleaner. It is important to ensure that no cleaning fluid gets on or into the housing.

The built-in batteries should be replaced circa every 2 - 3 years. As seen in the past, aggressive chemicals can leak from old batteries. This can result in serious sensor damage. After a battery change, a test of the function and calibration should be performed.

A more frequent calibration is not necessary, according to experience. The measurement accuracy firstly depends on the geometry of the cube, which does not change by normal usage. Under no circumstances should the fiber optic cable be stepped on or nipped off. The fiber optic cable is highly sensitive. When it is crushed or damaged, the light pulses can no longer be transmitted. In this case, a replacement must be purchased.

Under no circumstances should the fiber optic cable be stepped on or nipped off.

Battery Charging

Der Fieldmaster 3D sensor comes with a load balancing. Which means that the charge and discharge are constantly set off against each other, resulting in an indication of the batter charge. For charging the battery, the charger is being plugged into a power outlet and the charger plug is plugged into the charging socket of the Fieldmaster 3D sensor. The charger has a red control light, that illuminates when the charging current flows.

Please make sure that the Fieldmaster 3D sensor is turned OFF during charging, otherwise a charging of the battery is not guaranteed.
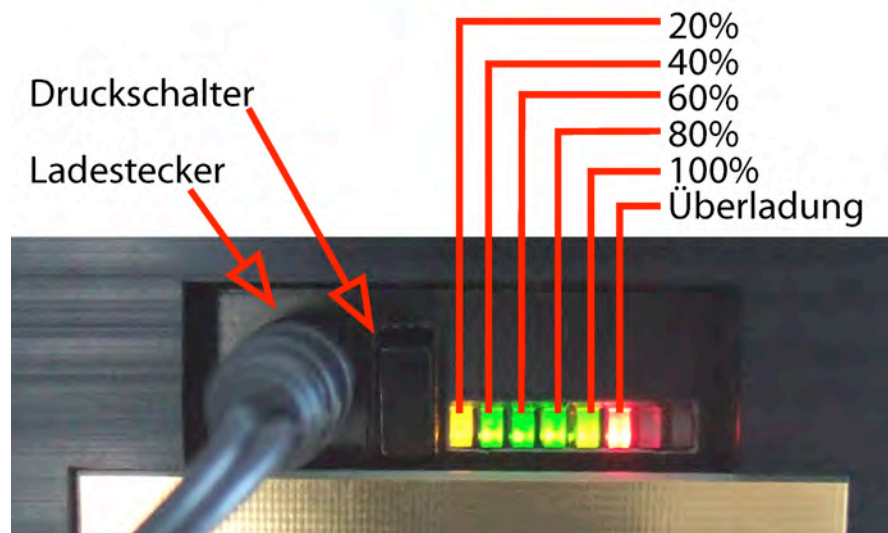
During charging, the battery indictor lamps light up. An overload is indicated by the red „Overload" light. To avoid overloading, the charging should be stopped.

In time, an aging of the battery occurs inevitably. Which can be noticed by the shortened operating time of the Fieldmaster 3D. This may also be notice by the discrepancy in the charge indicator. The software provides the ability to recalibrate the battery indicator. To ensure that the battery of the Fieldmaster 3D sensor is fully charged, the charging process takes ca. 20 hours or more. Finally, via software, the battery charging indicator is set to FULL.
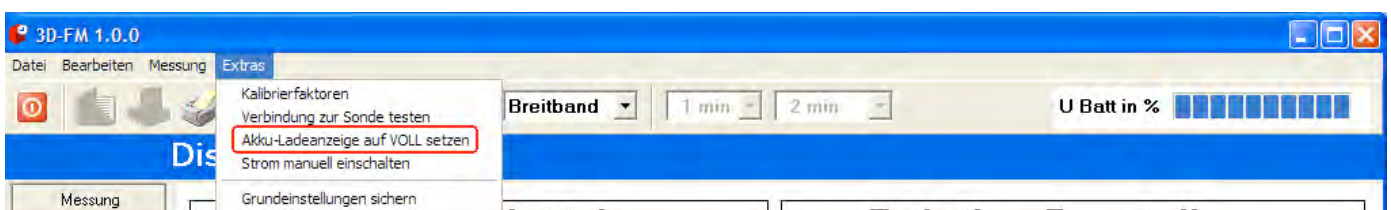
An almost empty battery is indicated by flashing of the 20% lamp. In that case the Fieldmaster 3D sensor should be loaded immediately.

Optionally, a „smart" charger is available. The battery will then be charged in a short time and also has the ability to discharge the battery so that defined loading is possible (Reduction of the memory effect).

Tips And Troubleshooting

Generally, based on the information in this chapter, most problems with the Fieldmaster 3D sensor can be solved quickly.

A common mistake is, impaired or lack of communication between Fieldmaster 3D sensor and the PC. This may be caused by:

1. wrong COM port choice: please carefully check the selected COM port and if necessary provide the correct COM port . Often, a missing or incorrectly installed driver for a USB serial converter is the cause.

2. additional communication software: there are third-party software that permanently blocks all available COM ports. For example synchronization software for cell phone synchronization. Please deactivate or uninstall this software.

3. plugs on Fieldmaster 3D sensor are not plugged in correctly. The sensor plug should engage with a „click".

4. Fieldmaster 3D sensor: additionally to the function indicator (flashing blue light), also the communication can be tested. For this purpose, turn off the Fieldmaster 3D sensor and disconnect the fiber optic connector. Now take a look at the plug connections. When turned on, a short red flashing should be seen in the left, grey connector. This flashing is only seen during or shortly after switching and may have to be repeated several times.

kurzes, rotes Blinken beim Einschalten

5. If the fiber optic converter (PC side) does not work: the fiber optic converter function is to be checked the same way as with the sensor. For this purpose, start the software and after choosing the correct COM port, click on the connecting test button several times, looking into the white plug. A red flash on a wire within the plug must appear.
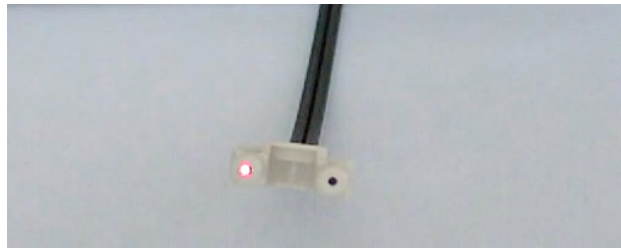
**Red flashing fiber optic plug during the connection test**

6. Fiber optic cable or fiber optic converter partially unplugged. This often happens when carelessly handling the fiber optic cable. Please make sure that the fiber optic cable is set flush both the plug and the fiber optic converter. If a re-assembly on the fiber optic converter should be necessary, please take the following steps:

Fiber Optic Converter Assembly

The connection of the plastic optical fiber cable with the converter requires no special tools.

- The fiber optic cable is cut as square as possible with a sharp knife to the desired length and at the end of the cable, cut into single wires over a length of about 2 cm.
- The locking lever of the fiber optic connector on top of the converter is being pulled in the direction of the SUB-D connector and the separated ends of the fiber optic duplex inserted in the fiber optic cable socket of the interface.
- By releasing the locking lever the fiber optic cable is fixed within the transducer.
- The connection can be detached by pulling the two locking levers to the top of the connector housing in the direction of the SUB-D connector and then taking out the fiber optic cable from the fiber optic connectors.

The arrows on top of the transducer housing identify the location of the emitter and receiver lines. The transmission of data is done with visible light, so during the flow of data, the sending cable can be identified easily.
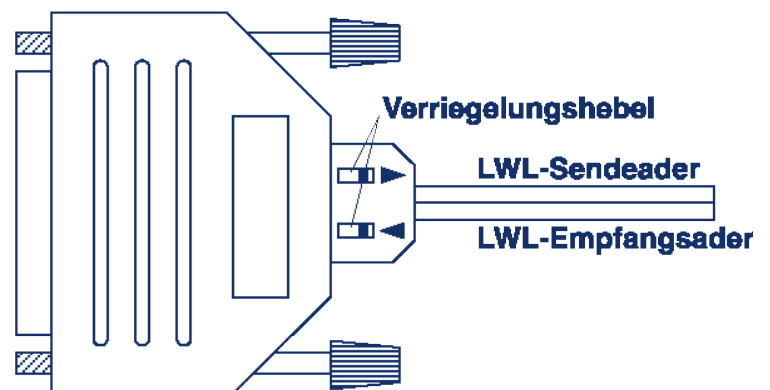
1. Fieldmaster 3D sensor does not function.
   The battery is probably completely empty! Turn off the Fieldmaster 3D sensor and reload it with the charger. It may take some time before the 20% lamp lights up.