

Operating Manual

Teslameter FM 3002-0,1T (low noise)



1. Warnings



Please read this Operating Manual carefully!

To ensure protection of the user and the instrument itself, operation of the Teslameter is permissible only in strict accordance with the Operating Manual.

Observe personal protection rules!



When measuring magnetic fields, consider and observe the regulations concerning potential dangers caused by DC and AC magnetic fields.



The direct influence of magnetic fields may be harmful to one's health (for field strength limits see DIN VDE 0848).



The operation of cardiac pacemakers may be affected.

Examples for sources of potentially hazardous magnetic fields:

- Ultrasonic sources
- Induction heaters and furnaces
- magnetic resonance tomograph
- Medical magnetic fields

For more information see following documents:

- Electromagnetic Compatibility (Elektromagnetische Verträglichkeit), VDE, Vol. 1 to 4
- DIN VDE 0848
- Papers of the Berufsgenossenschaft Energie Textil Elektro Mediengestaltung, Cologne z.B. DGUV Regel 103-013 (BGR B11) – Elektromagnetische Felder



Please read this Operating Manual carefully!

2.1 Minimum Operation Conditions (EMC)



Measurement results may not be valid in the presence of strong RF fields ($>3\text{V/m}$) or burst-signals (pulsed interferences) on the power line.

2.2 ESD



Electrostatic discharges ($>0,5\text{ kV}$) to any of the connectors may damage the measurement instrument. Structural safety measures would affect measurement accuracy due to loss of sensitivity.

2.3 Radioactive Radiation



The sensor is susceptible to radioactive radiation. Exposing the probe to radiation will change the sensitivity of the probe and thus the measured value of the magnetic field.

2.4 Ground Connection / Earthing



When mounting the probe, it should be ensured that no potential difference exists between the protective earths (PE) of the Teslameter FM 3002-0,1T instrument and of the magnet. Otherwise, uncontrollable equalizing currents may flow on the test probe cable and cause substantial damage. In certain situations, the test probe may have to be isolated from the magnet.

2.5 Probe Connection



NEVER connect or disconnect a probe when the unit is switched ON!

2.6 Mechanical Clamping of the Probes



Should it be necessary to clamp the probe down in the area of the protective tube and not at the handle, this MUST NOT be done within the most forward 50 mm of the probe length!

3. Table of Contents

1. Warnings	2
2. Technical Advice	3
2.1 Minimum Operation Conditions (EMC).....	3
2.2 ESD.....	3
2.3 Radioactive Radiation	3
2.4 Ground Connection / Earthing.....	3
2.5 Probe Connection	3
2.6 Mechanical Clamping of the Probes	3
3. Table of Contents	4
4. List of Figures	7
5. Description of the Instrument	8
5.1 General Description	8
5.2 Functional Principle.....	9
5.3 Items Supplied:	9
5.4 Technical Data	10
5.5 Rear Panel Overview	11
5.6 Power ⑤.....	11
5.7 Probes and Probe Connector ①	11
5.8 Ground Connection / Earthing ⑦⑧	12
5.9 Radioactive Radiation	12
5.10 Warm-up	12
5.11 Measuring Range.....	12
5.12 Analog Output ③.....	12
5.13 Zeroing ②.....	13
5.14 Zero Chamber (Option)	13
5.15 Probes.....	13
5.16 Transverse Probe	14
5.17 Axial Probe.....	14
5.18 Polarity of Measured Value	14
5.19 Remark on Precision and Repeatability	15
5.20 Mechanical Clamping of the Probes	15
5.21 Typical Temperature Responses	16
5.22 Power ON ⑥	16
6. Front Operation	17
6.1 Absolute and Relative Measurement: Key “Rel” and Key “Abs” .	17
6.2 Integration Time and Filter: Key “Time” and Key “Filter”	18
6.3 Units: Key “Unit”	18
6.4 Shown Digits: Key “Digits”	19
6.5 Acoustic Feedback.....	19

7. RS232 Interface	20
7.1 General ^④	20
7.2 Configuration of the Interface	20
7.3 Commands.....	21
7.4 Relative	21
7.5 Absolute	21
7.6 Filter	22
7.7 Time or Inttime	22
7.8 Unit.....	22
7.9 Digits	23
7.10 Status or FM Status	23
7.11 Default.....	23
7.12 Externcalibration	24
7.13 Logging	24
7.14 Sound.....	24
7.15 Keys	25
7.16 Version.....	25
7.17 HyperTerminal under Microsoft Windows Vista	25
8. Controlsoftware for FM 3002-0,1T	26
8.1 FM3002Control v 1.0.....	26
8.2 General Description	26
8.3 Installation.....	26
8.4 Usage.....	26
8.5 Uninstall	27
8.6 Source Code	27
9. Maintenance and Warranty	28
9.1 Visual Inspection	28
9.2 Cleaning	28
9.3 Maintenance	28
9.4 Warranty	28
10. Calibration	29
10.1 General	29
10.2 Factory Calibration	29
10.3 Custom Calibration.....	29
11. Customer Service	30
11.1 Repair	30
11.2 Follow-Up Orders.....	30
11.3 Disposal	30
12. EU Declaration of Conformity	31

4. List of Figures

Fig. 1: Teslameter FM 3002-0,1T.....	8
Fig. 2: structural construction of Teslameter FM 3002-0,1T.....	9
Fig. 3: rear panel of the instrument	11
Fig. 4: zero chamber	13
Fig. 5: transverse probe	14
Fig. 6: axial probe	14
Fig. 7: definition of polarity	14
Fig. 8: Trigonometric of the measuring arrangement	15
Fig. 9: typical temperature responses	16
Fig. 10: display with keys	17
Fig. 11: window FM3002Control	26

5. Description of the Instrument



Fig. 1: Teslameter FM 3002-0,1T

5.1 General Description

The Teslameter FM 3002-0,1T is a high-precision and extremely temperature-independent instrument for magnetic flux density measurement.

The display is digital - 7½ digits - and requires no temperature or correction tables which means one can resolve 100 000.00 µT to 0.01 µT. Better accuracy would be possible only by using the proton resonance method (NMR), which is time-consuming and cannot be used in just any situation.

As a speciality, the FM 3002-0,1T has not only a highly accurate and stable display but also an enhanced-accuracy analog output, which makes possible the use of the instrument as a high-accuracy measuring transducer.

Several correction processes, some of which intervene up to 20,000 times per second, are used to take into account and correct the non-linearities and the complex temperature dependencies of the Hall element in each individual probe.

Each instrument can be shipped ex works including the individual correction data of any two probes (transverse or axial) so that two different probes can be used on it by simply plugging them out and in. The transverse and axial probes both have the same accuracy of typ. 0.05 % of reading \pm 0.05 % of range with a temperature coefficient of 5 ppm/K (<0.0005 %/K) at 25 °C.

Optional a probe extension cord up to 27 m is available. This can be plugged between probe and device, if a larger distance between measured object and measuring instrument have to be covered. The influence of the probe extension cord to the measured value is very low. An additional calibration is not necessary. However we recommend to omit the application of a probe extension cord where possible. With optimal accuracy and low electromagnetic susceptibility in mind it is more appropriate to extend the analog output or the RS232 interface.

Nuclear magnetic resonance (NMR) is used as a reference standard.

Outstanding performance data like these establish the FM 3002-0,1T as a top-of-the-class measuring instrument. Each unit is shipped with a factory calibration certificate stating traceability to national reference standards. Re-calibration is recommended in one-year intervals.

The FM 3002-0,1T has a 2 HE-19" housing. As desktop version it is equipped with stands, as rack version it comes without stand but with mounting brackets.

5. Description of the Instrument

5.2 Functional Principle

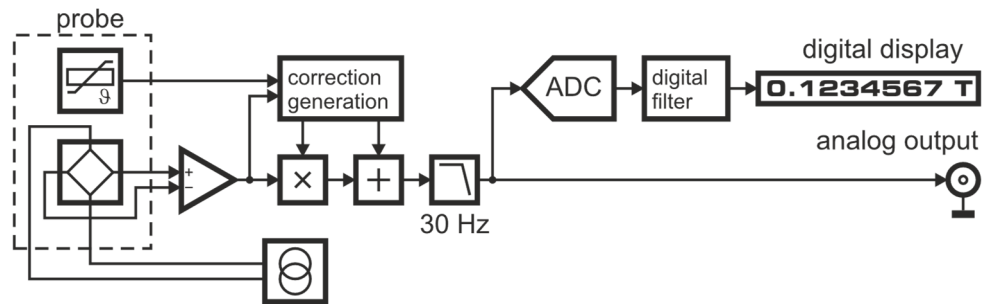


Fig. 2: structural construction of Teslameter FM 3002-0,1T

The graphic shows the simplified structural construction of the Teslameter FM 3002-0,1T. To achieve the outstanding accuracy of the device a multitude of parameters is incorporated. In the graphic thereof are only shown the measurement of the probe temperature and the actual value of the probe signal.

The generated corrections directly affect to the analog signal path. This principle offers considerable advances against solely digital correction techniques. At solely digital correction techniques first the probe signal is digitized with an analog-to-digital converter, corrected at the digital level and then again putted out as an analog signal via a digital-to-analog converter. Due to the restricted resolution of the converter it is inevitable that steps occur in the output signal. In contrast the Teslameter FM 3002 with its principle generates a continuous signal response.

The analog output of the Teslameter FM 3002-0,1T is directly feed from the corrected signal and therefor provides full correction and yet a bandwidth of 30 Hz.

Eventually the corrected high precision analog output is sampled with a high-resolution analog-to-digital converter. Out of it the values for the digital display and the serial port are obtained. The settings for integration time and filter affect only the digital path. The program for relative measurement is also generated in the digital path. The analog output is not affected by these settings.

5.3 Items Supplied:

- | | | | |
|---|-------------------------|---|---------------------------------|
| 1 | Teslameter FM 3002-0,1T | 1 | factory calibration certificate |
| 1 | probe in a probe case | 1 | operating manual |
| 1 | power cord | 1 | CD with software examples |
| 1 | RS 232 cable 10 m | 1 | zero chamber (option) |
| | | 1 | probe extension cord (option) |

5. Description of the Instrument

5.4 Technical Data

Range: 0 to ± 100 mT	± 1.0 V $\pm 100\,000.00$ μ T	analog output 7½-digit display
Non-linearity (incl. probe) (at 23 °C; 20 mT – 100 mT)	≤ 0.05 % of reading ± 0.05 % of range	
Resolution (display)	0.01 μ T (1/10 000 000)	
Temperature coefficient instrument	≤ 5 ppm/K (0.0005 %/K)	
Temperature coefficient probe at 25 °C probe T; A	≤ 5 ppm/K (0.0005 %/K)	
Zero drift	≤ 2 μ T/K	
Long-time stability	≤ 0.1 %/year (typ. 0.05 %/year)	
Bandwidth	0 – 30 Hz (-3 dB) analog output DC display	
Noise	≤ 0.15 μ T _{eff} (1.5 mG _{eff}) (0,1 Hz – 1 Hz; 50 s)	
Display units	μ T, mT, T, G, kG	
Measuring time	0.1 s to 5 s	
Probe size	9 x 2.5 x 200 mm \varnothing 8 x 200 mm 2.80 m	transverse probe T 1 axial probe A 1 probe cable
Effective area	1.5 mm x 3.0 mm \varnothing 0.8 mm	transverse probe axial probe
Operation temperature	+10 °C to +40 °C	
Storage temperature	-20 °C to +50 °C	
Relative humidity	70 % at +35 °C	
Size housing (<i>W x H x D</i>)	449 x 104 x 320 mm 483 x 89 x 320 mm	desktop version 19" rack version
Power	115 V, 230 V ± 10 % / 50 Hz – 60 Hz / 20 VA	
Pollution	2 under IEC664	
Protection	Class I	
Weight	4.50 kg	
Probe Extension Cord additional error	$\pm (10$ μ T + 10 ppm) (cord length 15 m)	

Technical data are subject to change without prior notice!

5. Description of the Instrument

5.5 Rear Panel Overview

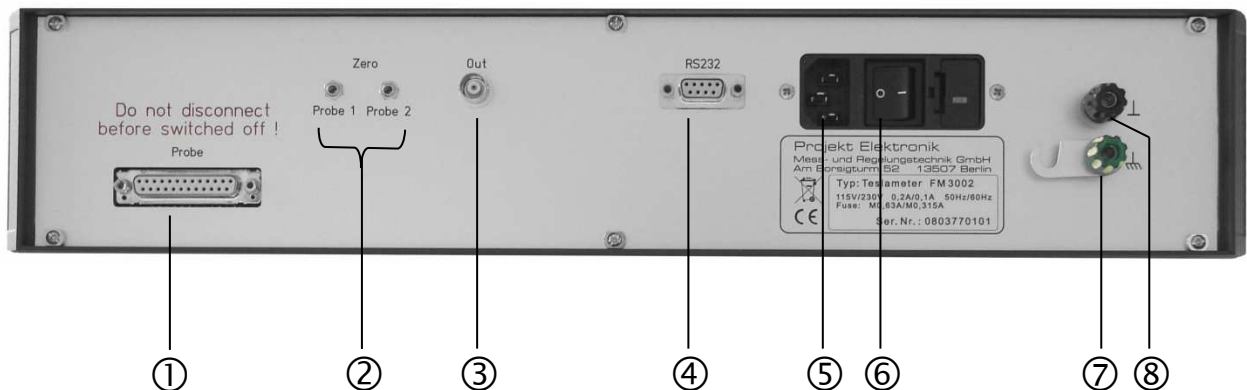


Fig. 3: rear panel of the instrument

- | | |
|-----------------------------|------------------------------|
| ① probe connector | ⑤ mains socket |
| ② zero point trimmer 'Zero' | ⑥ power switch |
| ③ analog output | ⑦ connector protective earth |
| ④ RS232 connector | ⑧ connector analog ground |

5.6 Power ⑤

The FM 3002-0,1T is operated on 230 V or 115 V AC power.

The operating voltage is selected by plugging the corresponding fuse adaptor into the power outlet. The selected voltage will be displayed in the fuse adaptor as being 230 V or 115 V. Instrument operation is possible with both 50 Hz and 60 Hz.

The fuse holder on the power switch houses two medium-blow 0.315 A / 250 V fuses (M 0.315/250). For 115 V operation, the fuses should be replaced by medium-blow 0.63 A units.

If operating the mains switch does not result in the digital display lighting up, these fuses should be checked.

5.7 Probes and Probe Connector ①

Two probes of any kind (axial and/or transverse) can be provided for each Teslameter unit.

Each probe is marked at its plug end with the serial number of the associated instrument (nameplate on the rear panel of the FM 3002-0,1T); in situations where several FM 3002-0,1T are used, this ensures the use of each together with the correct probe only.

The 25-position probe plug is plugged into the 25-position receptacle "Probe" and the two retaining screws in the plug are tightened.



NEVER connect or disconnect a probe when the unit is switched ON!

5. Description of the Instrument

5.8 Ground Connection / Earthing ⑦⑧

The PE (protective earth) conductor of the power supply is connected to the instrument case.
The analog ground is connected to PE through $1 \text{ MOhm} \parallel 22 \text{ nF}$.
The voltage between PE and analog ground must not exceed $\pm 39 \text{ V}$.
Two terminals (black for analog ground and yellow-green for PE) enable the analog ground to be connected directly to PE.



When mounting the probe, it should be ensured that no potential difference exists between the protective earths (PE) of the Teslameter instrument and of the magnet. Otherwise, uncontrollable equalizing currents may flow on the test probe cable and cause substantial damage. In certain situations, the test probe may have to be isolated from the magnet.

5.9 Radioactive Radiation



The sensor in the probe of the Teslameter FM 3002-0,1T is a hall element. This sensor is susceptible to radioactive radiation. There is some shielding through the brass material of the probe. But exposing the probe to radiation will change the sensitivity of the probe and thus the measured value of the magnetic field.

5.10 Warm-up

Several components must have reached their rated operating temperature before the instrument reaches its full accuracy and temperature stability.

Almost all performance data specified will be met approx. 10 min after power turn-on.

For highly accurate repeatable measurements with a $< 100 \mu\text{T}$ tolerance, a warm-up phase of approx. 30 min should be observed.

5.11 Measuring Range

The measuring range is $\pm 100 \text{ mT}$.

Exceeding the display range of approx. $\pm 230 \text{ mT}$ causes the message "!OVERLOAD!" to appear on the display.

The measuring range of the FM 3002-0,1T is specified to have an accuracy of $\pm 0.05 \%$ of reading up to 100 mT and of $\pm 0.05 \%$ of the range (100 mT).

For flux densities higher than 100 mT , the displayed value or output voltage is still proportional, although with a higher error of approx. $1 - 3 \%$.

5.12 Analog Output ③

The analog output "out" (BNC female connector on the rear panel) offers a highly accurate, stable, low-noise voltage signal highly proportional to the value of the measured flux density with the relation $1.000\,000\,0 \text{ V} \equiv 100.000\,00 \text{ mT}$.

This voltage can be used as flux density value in field control or for analog field scanning and detection.

The output is short-circuit proof with an internal impedance $< 1 \text{ Ohm}$.

To take advantage of the high accuracy ($\pm 0.05 \%$ of reading $\pm 0.05 \%$ of range), the input impedance of the connected evaluation electronics should be $> 20 \text{ kOhm}$.

The bandwidth of the output signal is limited to 30 Hz (-3 dB).

5. Description of the Instrument

The analog output is independent on relative measurement. It provides the instantaneous absolute flux density value at any time.

5.13 Zeroing ②

The highly stable electronics of the FM 3002-0,1T and the many probe data it has stored in memory ensure a zero setting which is precise and stable and easily repeatable.

Still, the zero setting should be checked and reset, if necessary, after some time.

To this end, the probe is introduced in a zero chamber; the instrument will show whether the zero setting should be readjusted.

This can be done - for each of probes 1 and 2 separately - by means of the "zero" slotted trimmer potentiometer on the rear panel of the FM 3002-0,1T.

The zero setting should be checked also whenever the probe is changed.

Zeroing should not be carried out before an approx. 30 min warm-up period has elapsed.

5.14 Zero Chamber (Option)

Optional a zero chamber is attainable for our instruments.

The zero chamber is a one side closed pipe of good magnetic shielding metal to shield the existing outer field. That is at least the earth magnetic field. In addition there may be other interfering fields from the environment. In real world shielding may not be 100 %. A small residual magnetic field remains inside of the zero chamber.



Fig. 4: zero chamber

5.15 Probes

Two different types of probe are offered: an axial probe and a transverse probe .

The connecting cable comes with a length of 2.80 m. Lengths up to 25 m are possible on demand.

Lengths greater than 2.80 m do not affect the accuracy and temperature specifications as the instrument will be calibrated with the longer cable, so that the same high precision can be guaranteed.

5. Description of the Instrument

5.16 Transverse Probe

Dimensions (mm): $L = 200$ $D = 9.0$ $C = 2.5$ $A = 4 \pm 1$
Active area (mm): 1.5×3.0

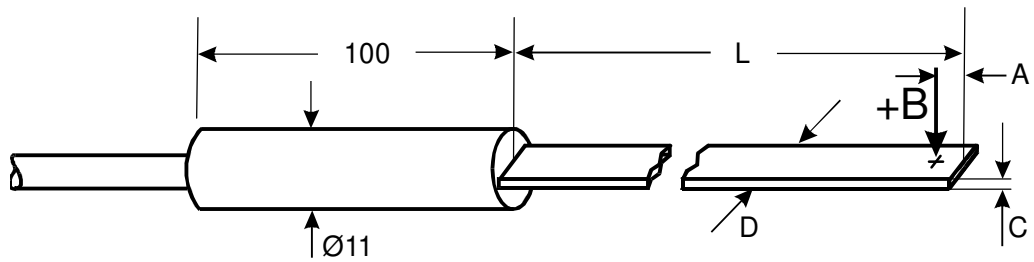


Fig. 5: transverse probe

5.17 Axial Probe

Dimensions (mm): $L = 200$ $D = 8.0$ $A = 2 \pm 0.5$
Active area (mm): $\varnothing 0.8$

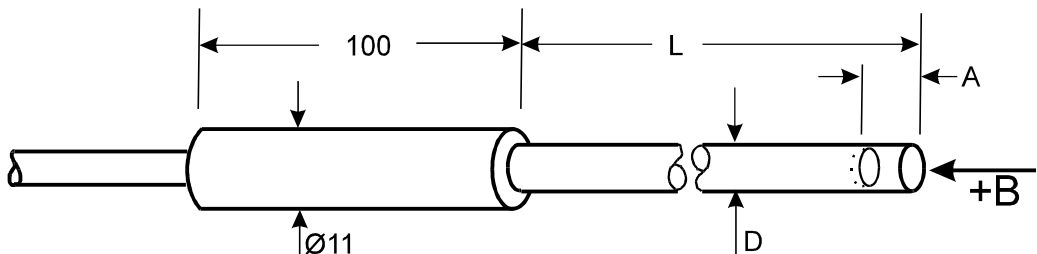


Fig. 6: axial probe

5.18 Polarity of Measured Value

On the transverse probes, the center of the active area is marked by a „+“ symbol. On Axial Probes, that center lies on the central probe axis.

If the magnetic flux density vector enters the measuring probe through the „+“ symbol, the value displayed will be positive (Fig. 7: *definition of polarity*). As memory hook one can think about an arrow, which when seen from behind is a cross. Positive indicated values mean the field is in the direction of the arrow.

For transverse probes, the reading at the analog output and on the display relates to a vector entering the probe at 90° to the surface of the probe profile.

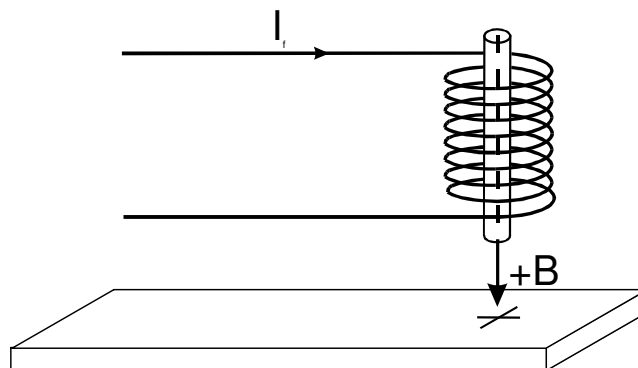


Fig. 7: definition of polarity

5. Description of the Instrument

5.19 Remark on Precision and Repeatability

The flux density is a vector. To measure the exact value, the probe has to be positioned exactly perpendicular to the flux direction. If the lines of magnetic force do not enter the Hall element at right angle, the displayed value results from the true magnetic flux density according to the following relation:

$$B = B_{\max} \cdot \cos \alpha$$

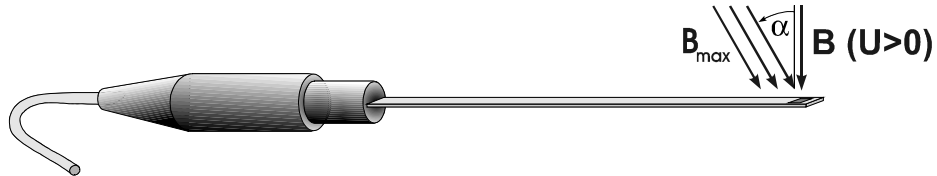


Fig. 8: Trigonometric of the measuring arrangement

For example to measure a flux of 1 T with precision of 0.1 μ T the deviation of the angle have to be less than two arc minutes. For illustration: On a rotation with radius 100 mm this relates to a distance of only 0.3 mm.

The repeatability of the measurement extremely depends on the quality of the mechanical clamping of the probe.

The main reason to use a high-precision teslameter is not the absolute precision rather than the long term stability and the reliability in differential measurement.

5.20 Mechanical Clamping of the Probes

Transverse and axial probes are housed in a protective brass tube so as to maximize the protection for the Hall element.



Should it be necessary to clamp the probe down in the area of the protective tube and not at the handle, this **MUST NOT** be done within the most forward 50 mm of the probe length!

5. Description of the Instrument

5.21 Typical Temperature Responses

Fig. 9 shows the typical error, that is caused by temperature dependency of the probe at 12 °C and 25 °C.

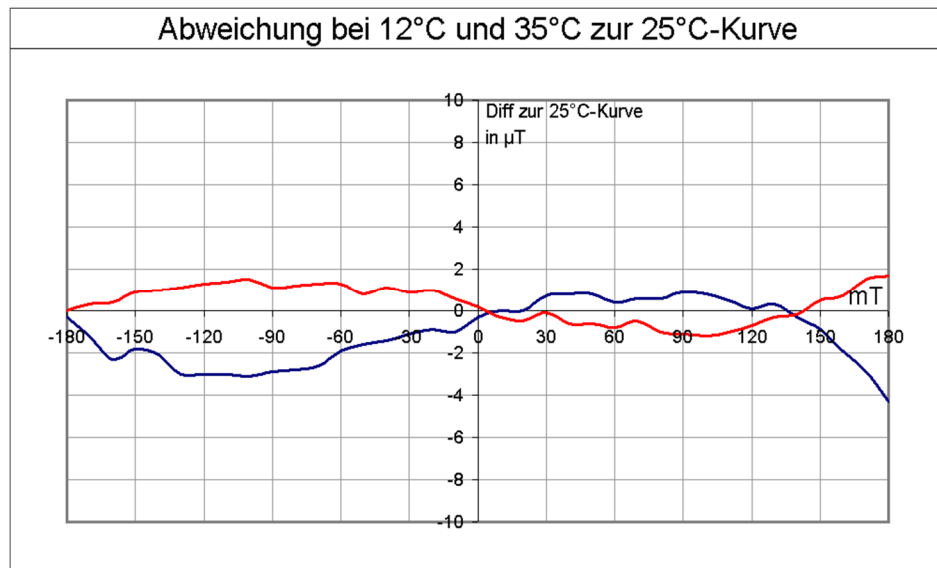


Fig. 9: typical temperature responses

5.22 Power ON ©

After the probe has been plugged in, the instrument can be turned ON using the power switch on the rear panel. The digital display lights up.

With the probe located in a space with a magnetic field of a magnitude equivalent to the Earth's magnetic field (approx. $\pm 50 \mu\text{T}$), the display will show that.

6. Front Operation

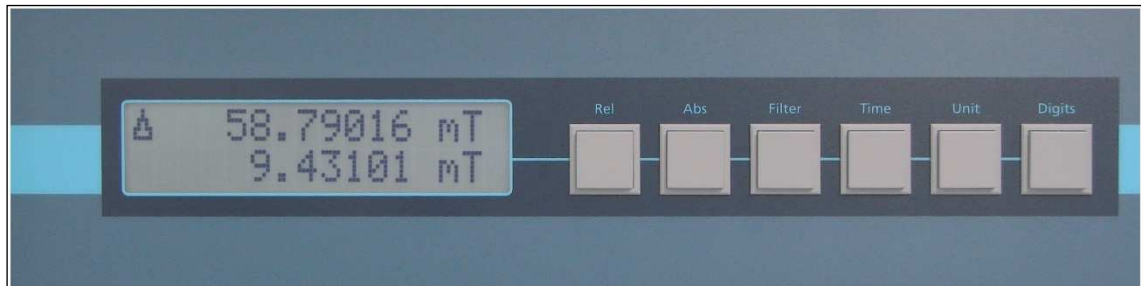


Fig. 10: display with keys

The display shows the magnetic flux as number and unit. Different settings allow the variable adjustment to varying measurement tasks.

6.1 Absolute and Relative Measurement: Key “Rel” and Key “Abs”

After power-on the unit is in absolute mode. Positive and negative values will be displayed. See also chapter 5.18 Polarity of Measured Value.

The upper display row shows the true flux density measured by the probe. By pressing the key “Abs” one can switch to absolute mode at every time.

By pressing the key “Rel” the actual absolute value is saved as reference and showed at the lower part of the display. At the upper part the relative value referred to the saved reference value is shown marked with “ Δ ”.

relative value = actual absolute value – reference value

Pressing “Rel” again sets the actual absolute value as new reference value (lower display line).

See also chapter 7 RS232 Interface for other possibilities of relative and absolute measurement.

The relative mode has no effect on the analog output of the FM 3002-0,1T. The analog output always provides the actual absolute value.

6. Front Operation

6.2 Integration Time and Filter: Key “Time” and Key “Filter”

The key “Time” sets the integration time. According to that the refresh rate of the display is set, which means that after expiration of the integration time a new value is displayed.

The internal sampling rate is 10 Hz.

With the key “Time” one can choose the integration times from the below-mentioned table. Out of it results the number of samples used for averaging.

TIME	100 ms	200 ms	500 ms	1 s	2 s	5 s
averaged Samples	1 (off)	2	5	10	20	50

A short key press shows the actual integration time at the display. With successive presses the integration time is raised cyclically. Every successive press has to be done within 0.8 s or it will be taken again as a first press.

The key “Filter” allows the filtering about a selectable number of values. Therefor a built-in digital filter is used. The table shows the selectable filter lengths.

FILTER	1	2	4	8	16	32	64
--------	---	---	---	---	----	----	----

After a fast change of flux it is advisable to wait Filter x Time before using the measured value.

A short key press shows the actual filter length at the display. With successive presses the filter length is raised cyclically. Every successive press has to be done within 0.8 s or it will be taken again as a first press.

See also chapter 7 RS232 Interface for other possibilities of setting integration time and filter length..

6.3 Units: Key “Unit”

The key “Unit” sets the unit for the displayed values. The table shows the selectable units.

UNIT	μ T	mT	T	Gs	kGs
------	---------	----	---	----	-----

Every key press selects cyclically the next unit.

Exception: see chapter 6.4

See also chapter 7 RS232 Interface for other possibilities of setting integration time and filter length.

6. Front Operation

6.4 Shown Digits: Key “Digits”

The key “Digits” allows to hide decimal places which will be replaced by an underscore. Here the value is rounded mathematically correct. The use of this function does not interfere with the precision of the FM 3002-0,1T in any way. It is only a reading simplification.

Every key press hides one more decimal place up to a maximum of four places.

example with 0,12345678 T:

key press	display
0	0.12345678 T
1	0.1234568_ T
2	0.123457__ T
3	0.12346___ T
4	0.1235____ T
5	0.12345678 T
...	...

The use of the key “Digits” has an anomaly. To avoid misunderstandings only decimal places can be blinded out. If there are not enough decimal places the error message “More decimal places needed” is displayed.

Double-pressing results in the next possible selection. The same applies to the key “Unit”.

See also chapter 7 RS232 Interface for hiding the decimal places.

6.5 Acoustic Feedback

Every new setting is acknowledged acoustically by a two-tone. At an error message the feedback is a disharmonic tone.

See also chapter 7 RS232 Interface for switching acoustic feedback on and off

7. RS232 Interface

7.1 General ④

All functions to be served at the key-pad can be controlled remotely via the RS232 interface. Furthermore, there are extended and additional commands.

Every ordinary terminal or terminal program can be used to communicate with the FM 3002-0,1T. The control is text-oriented thereby it can be easily integrated in existing environments.

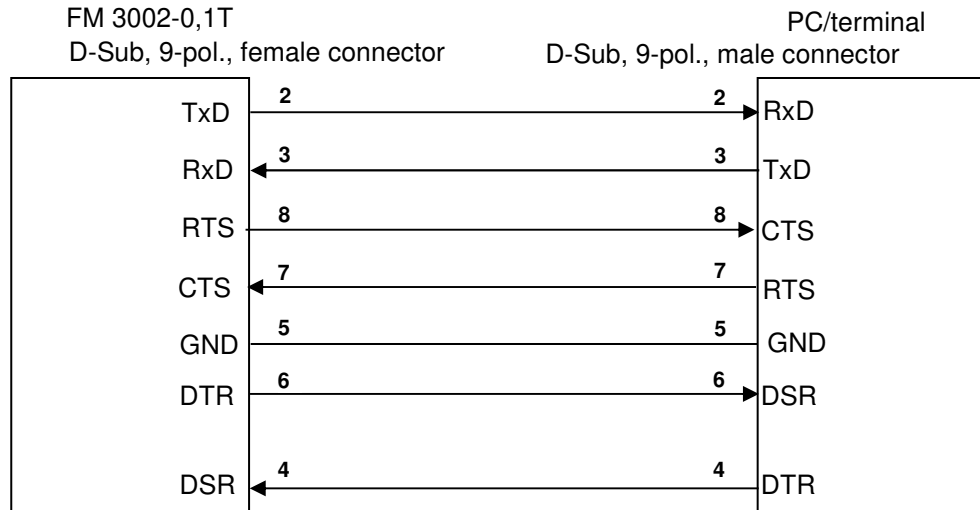
The terminal program should use a font which contains the "μ"-sign for display. Unfortunately HyperTerminal under Microsoft Windows does not do that by default. Here the font should be switched to Courier New or Fixedsys.

7.2 Configuration of the Interface

For communicating with the FM 3002-0,1T, the RS232 interface should be configured as follows:

baudrate	9600
databits	8
parity	none
stopbits	1
flow control	none

To connect the FM 3002-0,1T with an IBM-compatible PC a serial cable (1:1) has to be used. Important are only the lines TXD, RXD and GND. The other lines are not used.



Common USB to RS232 converter have the correct pinout and can be used without further add-on. Due to the great variety of offered converters a general functioning guarantee cannot be given.

7. RS232 Interface

7.3 Commands

The FM 3002-0,1T has a simple command structure consisting of the command name followed by one optional parameter. Command and parameter are separated by a space. Supplementary whitespaces will be tolerated. Every command line is finished with a newline character (LF/10d/0Ah). A preceding carriage-return character (CR/13d/0Ch) will be tolerated too.

All commands (but not the parameters) may be abbreviated as long as they are distinguishable. The commands are not case-sensitive.

typographic convention of the examples:

normal script - output FM 3002-0,1T
bold script - input user
[] - optional-brackets; brackets are not entered

7.4 Relative

command:	relative [reference]
without parameter:	switches to relative measurement and uses the actual measured value as reference (equal to pressing the "Rel" key)
with parameter:	switches to relative measurement and uses the given number as reference (interpreted as a multiple of 0.01 μT)
parameter:	- 25000000 reference 25000000

example:

```
> rel
display is relative, reference = 1234.5  $\mu\text{T}$ 
>
```

```
> rel 12345678
display is relative, reference = 1234567.8  $\mu\text{T}$ 
>
```

7.5 Absolute

command:	absolute
without parameter:	switches to absolute measurement (equal to pressing the "Abs" key)

example:

```
> abs
display is absolute
>
```

7. RS232 Interface

7.6 Filter

command:	filter [taps]
without parameter:	shows the actual filter length (equal to pressing the "Filter" key once)
with parameter:	sets the filter length to the given length
parameter:	1 taps 64

example:

```
> filter
filter is 10
>
```

```
> filter 8
filter is 8
>
```

7.7 Time or Inttime

command:	time [time]
	inttime [time]
without parameter:	shows the actual integration time in milliseconds (equal to pressing the "Time" key once)
with parameter:	sets the integration time to the given value (interpreted as ms, rounded to a multiple of 100 ms)
parameter:	100 time 25500

example:

```
> time
integration time is 100 ms
>
```

```
> time 1500
integration time is 1500 ms
>
```

7.8 Unit

command:	unit [unit]
without parameter:	shows the actual unit
with parameter:	sets the display unit to the given unit
parameter:	μ T, uT, mmT, mT, T, G, Gs, kG, kGs

example:

```
> unit
unit is mT
>
```

```
> unit kG
unit is kGs
>
```

7. RS232 Interface

7.9 Digits

command:	digits [digits]
without parameter:	shows the number of hidden decimal places
with parameter:	hides the give number of decimal places
parameter:	0 digits 4

example:

```
> dig
0 decimal places blinded out
>
```

```
> dig 3
3 decimal places blinded out
>
```

7.10 Status or FM Status

command:	status
	fmstatus
without parameter:	prints out a list of the actual settings

example:

```
> STATUS
FM3002 status
-----
serial no. is 0801770101
filter is 1
integration time is 1000 ms
unit is  $\mu$ T
0 decimal places blinded out
sound is on
keys are unlocked
offset = -76755
slope = 23702056
factory calibration active
>
```

7.11 Default

command:	default
without parameter:	resets the instrument to factory settings (exemption: settings for slope and offset are conserved)

example:

```
> default
factory settings restored
>
```

7. RS232 Interface

7.12 Externalcalibration

command:	externalcalibration [{on/off}]
without parameter:	shows if the factory calibration or an (external) custom calibration is active; these influences only the display, not the analog output
with parameter:	switches the (external) custom calibration on or off (factory calibration active); these influences only the display, not the analog output

example:

```
> ext  
factory calibration active  
>
```

```
> externalcalibration on  
external calibration active  
>
```

7.13 Logging

command:	logging [number]
without parameter:	switches between deactivated logging and permanent logging
with parameter:	returns the give number of measured values; may be aborted through log without parameter
parameter:	1 number 65534

example:

```
> log 2  
logging 2 records  
1.3068753 kGs  
1.3068780 kGs  
>
```

7.14 Sound

command:	sound [{on/off}]
without parameter:	shows the actual setting of acoustic feedback
with parameter:	switches acoustic feedback on or off
parameter:	on, off

example:

```
> sound  
sound is on  
>
```

```
> sound off  
sound is off  
>
```


7. RS232 Interface

7.15 Keys

command:	keys [{on/off}]
without parameter:	shows if the front keys are locked or not
with parameter:	switches the lock of the front keys on or off; after cycling power, the front keys are unlocked
parameter:	on, off

example:

```
> keys  
keys are unlocked  
>
```

```
> keys off  
keys are locked  
>
```

7.16 Version

command:	version
without parameter:	shows the version of the software

example:

```
> ver  
V1.3, built May 28 2008, 21:41:29  
>
```

7.17 HyperTerminal under Microsoft Windows Vista

HyperTerminal as part of the past Windows versions should be one of the widest used terminal programs. For Windows Vista Microsoft writes now: „HyperTerminal is not part of Windows anymore“. Therefore it remains only the possibility to switch to one of the numerous alternatives.

examples:

Putty
HTerm

8. Controlsoftware for FM 3002-0,1T

8.1 FM3002Control v 1.0

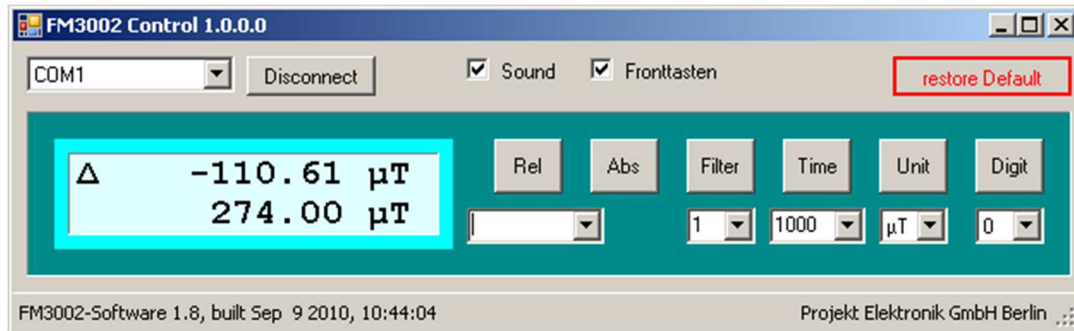


Fig. 11: window FM3002Control

8.2 General Description

The software FM3002Control is used to demonstrate the control of a FM 3002-0,1T via serial interface. It allows to test the different functions of the instrument.

The software runs on all platforms wherefore the Microsoft .NET Framework 3.5 is available. Actual (September 2008) that are Windows XP, Windows Vista, Windows Server 2003 and Windows Server 2008.

Detailed information can be found at <http://msdn.microsoft.com/en-us/library/bb882520.aspx>

The supplied source code illustrates the control of the instrument by software and can be used as a base for developing an own software.

All in all the software is designed as a demo. The use in productive environment is done at one's own risk.

8.3 Installation

The software FM3002Control is supplied with a ClickOnce-Installation. Therefore run setup.exe in the Setup directory on the CD. The installation runs autonomous and finally starts FM3002Control.

To run the software the Microsoft .NET Framework 3.5 is necessary. If it is not installed at the computer, the installation-routine will do that too.

During the installation an entry at the Start-menu is created, so one can start the software later via Start → Program → Projekt Elektronik GmbH → FM3002Control.

8.4 Usage

To use the software FM3002Control, the FM 3002-0,1T has to be connected to the serial port of the PC.

After the start of FM3002Control choose the correct port to where the FM 3002-0,1T is connected in the upper left dropdown-box. Now press "Connect" to establish the connection. If the connection is successfully established the remaining controls are enabled. The actual set parameters of the FM 3002-0,1T are read out and the dropdown-boxes are preset to these parameter-values. Moreover the version of the internal firmware of the FM 3002-0,1T is printed in the status-bar.

8. Controlsoftware for FM 3002-0,1T

The user-interface of FM3002Control is primarily built after the front of the FM 3002-0,1T and is only adapted to the extended possibilities of the serial interface commands.

The display-area shows the same as the display of the instrument. Because the software has to wait for the measured values with longer measuring times the software can react lazily.

In the dropdown-box under the buttons the corresponding parameter is chosen. Therefore one of the predefined values can be chosen or where permitted one can enter any other value (in the boundaries of permitted range). By pressing the button, the setting is send to the FM 3002-0,1T. For the exact function and the value-range see the operating manual of the FM 3002-0,1T.

In the upper part of the window, the acoustic feedback and the lock of the front-keys can switched on and off. With "restore Default" the FM 3002-0,1T can be reset to the factory values. For details see here the operating manual of the FM 3002-0,1T, too.

8.5 Uninstall

FM3002Control can be uninstalled under Start → Settings → Control Panel → Add or Remove Programs.

8.6 Source Code

FM3002Control has been developed with Visual Basic 2008 Express. The source code is at the CD in the directory Source. It can be used as base to develop own software or to integrate into existing environments.

9. Maintenance and Warranty

9.1 Visual Inspection

Be sure before taking readings that the probe cable, the probe, the housing and the power chord are undamaged and in a proper and safe condition.

Check the cables for breakage or chafing.

9.2 Cleaning

Do not use a strong cleaner on the instrument.

Clean the instrument with a soft cloth moistened slightly with soap suds or methylated spirits.

9.3 Maintenance

There are no parts inside the device, which have to be serviced by the operator.

9.4 Warranty

Projekt Elektronik Mess- und Regelungstechnik GmbH warrants for a period of two years after delivery that the device will function dependably.

Warranty repairs occurring within this period will be carried out free of charge.

Violation of the rules set forth in this Operating Manual voids any warranty claims. No responsibility will be assumed for damage resulting from such actions.



The opening of or willful damage to the instrument will void any and all warranty claims!

Great care should be used when using movable magnets, as the Hall element will be destroyed when it strikes a pole surface!

10. Calibration

10.1 General

Loosely seen the FM 3002-0,1T consists of two parts. The first part is the analog signal processing which also provides the signal for the analog output at the rear panel. The second part is the digital display and interface unit which converts the analog signal.

At the analog part only the offset can be adjusted with the corresponding potentiometer at the rear panel of the FM 3002-0,1T. An extended calibration can only be done by the manufacturer.

10.2 Factory Calibration

As manufacturer we recommend the regular calibration (approx. once a year, depending on usage). For this instrument, we have the necessary test equipment and the confirmation of the traceability to national standards (PTB). The confirmation is given with a factory calibration certificate.

10.3 Custom Calibration

There is the possibility of a custom calibration of the digital part. Therefore the commands externalcalibration on/off, slope and offset are available.

If desired we will send you a detailed instruction.

11. Customer Service

11.1 Repair

For repairs send the instrument to the following address:

Projekt Elektronik Mess- und Regelungstechnik GmbH
Am Borsigturm 54
13507 Berlin / Germany

Tel. +49 30 43032240
Fax +49 30 43032243

11.2 Follow-Up Orders

Follow-up orders can be placed at Projekt Elektronik Mess- und Regelungstechnik GmbH by letter, telephone, fax or e-mail stating the name of the item.

11.3 Disposal

Should disposal of the instrument be necessary, it can be returned to

Projekt Elektronik Mess- und Regelungstechnik GmbH
Am Borsigturm 54
13507 Berlin / Germany

freight/postage prepaid, together with a declaration of assignment.

12. EU Declaration of Conformity

EU Declaration of Conformity

Name of manufacturer	Projekt Elektronik Mess- und Regelungstechnik GmbH
Manufacturer's address	Am Borsigturm 54 D - 13507 Berlin Germany Tel. +49 30 43032240 Fax +49 30 43032243 http://www.projekt-elektronik.com Email: info@projekt-elektronik.com
declares that this product	
Product name	Teslameter FM 3002-0,1T
Model number	F770
Short description	The Teslameter FM 3002-0,1T is a measuring instrument for the measurement of the magnetic flow density.
following the regulations of the EMC guidelines	2014 / 30 / EU
the low voltage guideline	2014 / 35 / EU
and RoHS directive	2011 / 65 / EU
complies with the following standards and/or standardizing documents	EN 61326-1:2013 EN 61010-1:2010
Supplemental information	As to the restrictions regarding EN 61000-4-3, see also Minimum Operation Conditions (EMC) page 3
Berlin, 18. July 2016	Dipl.-Ing. Hartmut Heinze Managing Director / CE Coordinator

13. Index

A

Abs..... 17
absolute 21
absolute measurement 17, 21
AC magnetic fields 2
acoustic feedback 19, 24
active area 10, 14
analog ground 11, 12
analog output 8, 9, 11, 12, 17, 24
axial probe 10, 13, 14

B

bandwidth 9, 10, 12

C

calibration 8, 24, 29
clamping 3, 15
cleaning 28
commands 21
configuration 20
construction 9
control software 26
custom calibration 24, 29
customer service 30

D

damage 3, 12, 28
damage resulting 28
DC magnetic fields 2
decimal places 19, 23
declaration of conformity 31
default 23
digits 19, 23
dimension 10, 14
discharges 3
display range 12
display units 10
disposal 30

E

earth magnetic field 13
earthing 12
effective area 10, 14
ESD 3
external calibration 24, 29

F

factory calibration 29
factory calibration certificate 8, 9, 29
factory settings 23
filter 9, 18, 22
filter length 9, 18
fm status 23
follow-up order 30
front operation 17

functional principle 9

G

ground connection 12

H

Hall element 15, 28
humidity 10
HyperTerminal 20, 25

I

integration time 9, 18
interface 8, 20
interface cable 20
internal resistance 12
inttime 22
items supplied 9

K

keys 17, 20, 25

L

list of figures 7
lock keys 25
logging 24
long-time stability 10

M

magnetic fields 2
mains socket 11
maintenance 28
measuring instrument 3, 8
measuring range 12
measuring time 10
measuring units 18
Microsoft Windows Vista 25

N

NMR 8
noise 10
non-linearity 10

O

operation temperature 10
overload 12

P

polarity 14
pollution 10
power 10, 11
power on 16
probe 13
probe cable 10, 13
probe case 9
probe connector 3, 11
probe extension cord 8, 9, 10

probe ponnector 11
probe size 10, 14
protection 10
protective earth 11, 12

R

rack version 8
radiation 3, 12
radioactive radiation 3, 12
range 10, 12
rear panel 11
Rel 17
relative 21
relative humidity 10
relative measurement 9, 13, 17, 21
repair 30
repeatability 12, 13, 15
resolution 8, 10
RS232 interface 8, 11, 20
RS232 parameters 20

S

sampling rate 18
size 10
sound 19, 24
status 23
switch on 11

T

table of contents 4
technical data 10
temperature coefficient 10
temperature response 16
time 9, 18, 22
transverse probe 10, 13, 14

U

unit 18, 22
USB 20

V

version 25
visual inspection 28

W

warm-up 12, 13
warnings 2
warranty 28
weight 10

Z

zero chamber 9, 11, 13
zero drift 10
zeroing 13