Projekt Elektronik
Mess- und Regelungstechnik GmbH

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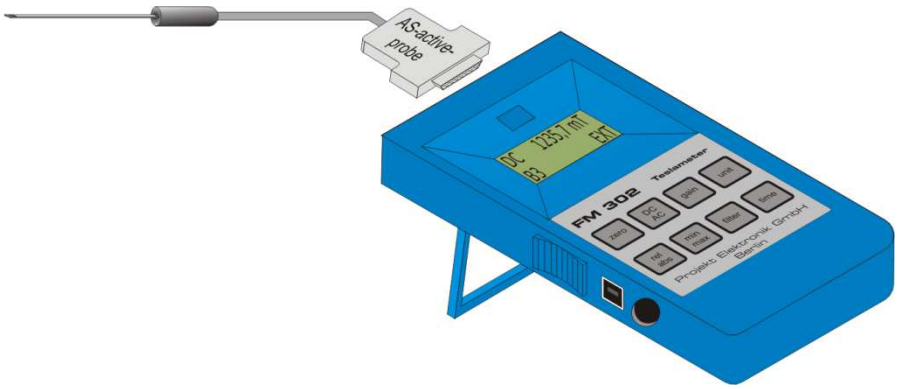
Teslameter FM 302 for AS-active-probes

- **USB interface**
- **Control software with oscilloscope display and data logging capability**
- **4½ digit display DC, RMS: in Tesla, Gauss, A/m, A/cm, Oersted**
- **Polarity display (N / S)**
- **Absolute or relative measurement**
- **Minimal, maximal or absolute max. measurement**
- High precision
- 3 measuring ranges per probe (x1, x10, x100)
- Calibrated probes for µT-, mT- and T- range
- Calibrated analog output: DC – 100 kHz
- Factory calibration certificate with traceability
- Made in Germany

The Teslameter FM 302 is a handy measuring instrument for all AS-active-probes. It measures magnetic fields within a wide range of applications. This includes alternating fields as well as magnetic steady fields. For AC measurements one can either display the mean (DC) or RMS value.



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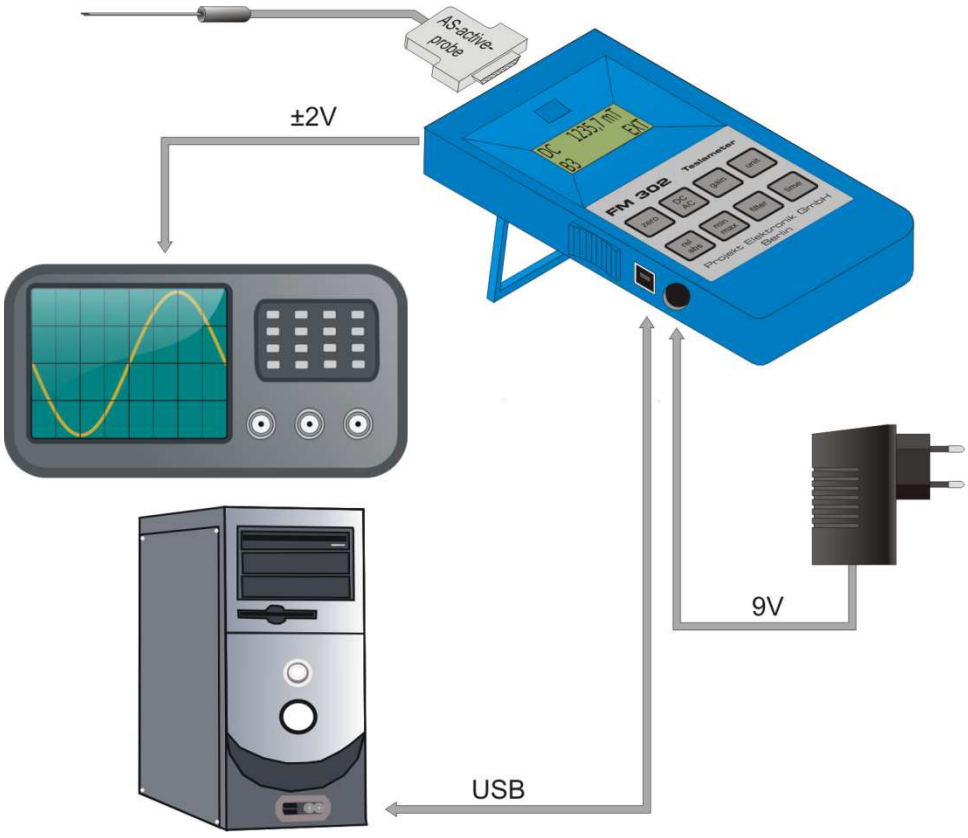
Usage

After plug in the desired probe one can start to measurement immediately without adjustment of zero and scale, since the AS-active-probes are calibrated. Therefore replacing probes for every range can be used at any time.

By default there are no AS-active-probes included in delivery. They have to be ordered separately.

The Teslameter FM 302 permits the fast adaptation to different measuring tasks by simply plugging in one of the AS-active-probes. Depending on the type of the AS-active-probe one can measure fields from a few nano Tesla up to 12 Tesla. Further information can be found in the data sheet of the AS-active-probes.



Attention should be paid to the fact that at the device a connection exists between GND and cable shield. Also at the probe there is a connection between GND, cable shield and plug housing. At brass probes this is also connected to GND. Possibly an isolated installation of the probe and the plug may be necessary to prevent an unintended connection between measuring ground and protective earth.

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Top Hat Rail Adapter (Option)

Optionally the Teslameter FM 302 can be equipped with a top hat rail adapter. Thus the device can be fixed on a top hat rail. For release the locking bar has to be pulled up with a screw driver.

The top hat rail adapter is screwed to the back of the Teslameter FM 302. Therefore the usage of the stand is no longer possible.

Supply

Battery: The Teslameter FM 302 is powered with a 9 V battery. With that the operation time is >20 hours. The actual time among other things depends on the used AS-active-probe.

Power Adapter: Additionally, the supply can be provided with an external 9 V power adapter. A suitable external 9 V plug-in power supply unit is available as an optional accessory for the Teslameter FM 302.

USB: If the Teslameter FM 302 is connected to a computer via the USB-interface then this is also used to supply the device.

Control

Key Pad: The Teslameter FM 302 offers numerous functions, which may be controlled directly via keypad.

USB: The USB interface permits to read the current measured value and to control the device with all and some more options as available via the keypad.

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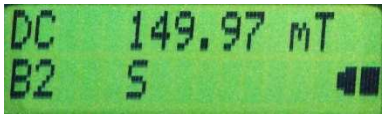
Measuring Time: The measuring time of the display can set between 0.1 s and 5 s (via keypad) or 25.5 s (via USB).

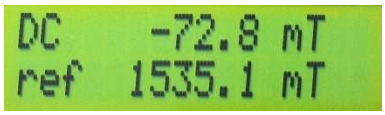
Filter: Additionally, a further digital filtering of the displayed values with a settable filter length between 2 and 64 values may be activated.

Unit: The unit of the displayed values can be switched between Tesla, Gauss, A/m, A/cm and Oersted.

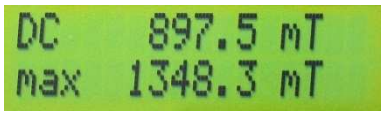
Polarity: Furthermore, it is displayed if there is a north pole or south pole under the probe.

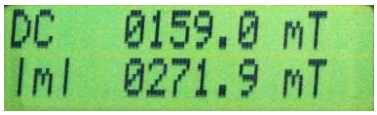


Relative Measurement: With the function relative measurement the measured values may be displayed referenced to a settable reference value. As reference value the current measured value can be set via keypad or USB command. The USB command additionally allows to set an arbitrary reference value.



Min-/Max-Measurement: In addition to the currently measured value the device can save and display the minimal, maximal or absolute maximal measured value.





Zero Adjustment: An exact zero adjustment can be done with a zero chamber and by calling the zero function. See our application note “PE012 Zero Chamber - Zero Point Adjustment”

Switch of Sensitivity

The internal amplifier of the FM 302 offers the sensitivity ranges x1, x10 and x100 which influences the display and also the analog output. Thus also small measured values are presentable reliably.

Table 1 shows the resulting measuring ranges and Table 2 the transfer factors for the analog output.

Calibrated Analog Output

An additional feature is the calibrated analog output of the device, which can be used for displaying magnetic impulses in the µs-range (oscilloscope), measured value capturing and field based closed-loop-control. The output signal is produced on the analog level from the calibrated signal of the connected AS-active-probe. Therefore the analog output offers undistorted the full precision and the full bandwidth of teslameter and probe. The analog output is not subject to the restrictions which exist for signals that are generated by digital to analog converters.

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class	ranges factors with Teslameter FM 302 range x1, x10, x100								
High(1):	x1	20,000 T	200,00	kG	200,00	kOe	15,915	MA/m	159,15	kA/cm
	x10	2000,0 mT	20,000	kG	20,000	kOe	1591,5	kA/m	15,915	kA/cm
	x100	200,00 mT	2000,0	G	2000,0	Oe	159,15	kA/m	1591,5	A/cm
Normal:	x1	2000,0 mT	20,000	kG	20,000	kOe	1591,5	kA/m	15,915	kA/cm
	x10	200,00 mT	2000,0	G	2000,0	Oe	159,15	kA/m	1591,5	A/cm
	x100	20,000 mT	200,00	G	200,00	Oe	15,915	kA/m	159,15	A/cm
Low:	x1	200,00 mT	2000,0	G	2000,0	Oe	159,15	kA/m	1591,5	A/cm
	x10	20,000 mT	200,00	G	200,00	Oe	15,915	kA/m	159,15	A/cm
	x100	2,0000 mT	20,000	G	20,000	Oe	1,5915	kA/m	15,915	A/cm
Ultralow:	x1	200,00 µT	2,0000	G	2,0000	Oe	159,15	A/m	1,5915	A/cm
	x10	20,000 µT	200,00	mG	200,00	Oe	15,915	A/m	159,15	mA/cm
	x100	2,0000 µT	20,000	mG	20,000	mOe	1,5915	A/m	15,915	mA/cm

Table 1

class	transfer factors with Teslameter FM 302 range x1, x10, x100
High(1):	x1 2 V / 20 T x10 2 V / 2 T x100 2 V / 0,2 T
Normal:	x1 2 V / 2000 mT x10 2 V / 200 mT x100 2 V / 20 mT
Low:	x1 2 V / 200 mT x10 2 V / 20 mT x100 2 V / 2 mT
Ultralow:	x1 2 V / 200 µT x10 2 V / 20 µT x100 2 V / 2 µT

Table 2

(1) calibrated up to 12 T

Units
- T – Tesla
- G – Gauss
- Oe – Oersted
- A/m – Ampere per Meter
- A/cm – Ampere per Centimeter

For conversion of magnetic units see our application note “PE005 – Magnetic units of measurement and their conversion”.

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Use With Strong Steady Magnetic Fields

The Teslameter FM 302 with its AS-active-probes is not disturbed in its function by stronger magnetic fields. The device works reliable even at a DC field of 350 mT. Neither the actual measurement nor the communication with the computer is interfered.

It has just to be considered the occurring action of force of the device. The main reasons are the battery and the probe connector.

USB Inteface

The USB interface of the Teslameter FM 302 is realized with the FT232R USB-to-serial converter.

That means, that the Teslameter FM 302 creates a virtual serial port after it has been connected to a PC. For communication every ordinary terminal program is suited. The control takes place text oriented which makes it easy to integrate the Teslameter into existing environments.

The necessary USB driver can be found at the CD which is included in delivery (see page 10). With Windows (since Windows 7) as well as with Linux (since Kernel 2.6.31) the necessary drivers are already delivered with the operating system. The newest drivers can be found at the homepage of FTDI under the menu Drivers – VCP Drivers (http://www.ftdichip.com/Drivers/VCP.htm).

The following table lists the available commands. A full-length documentation of the commands can be found in the operating manual which is included in delivery (see page 10). It can also be downloaded from our website https://www.projekt-elektronik.com/.

Command	Function
amax	switch to absolute maximal measurement
absolute	switch to absolute measurement
maximum	switch to maximum measurement
minimum	switch to minimum measurement
relative	switch to relative measurement
coupling	switch between DC and AC measurement
gain	switch sensitivity
zero	set/reset offset compensation
range	read current measurement range
logging	read measured value single/multiple/continuous
inttime	set measurement time
filter	set filter length
digits	blind out decimal
unit	set display unit
keys	lock/unlock keypad
sound	switch on/off acoustic feedback
fmstatus	read current settings
default	reset instrument to factory configuration
serial	read serial number
version	read firmware version

Table 3

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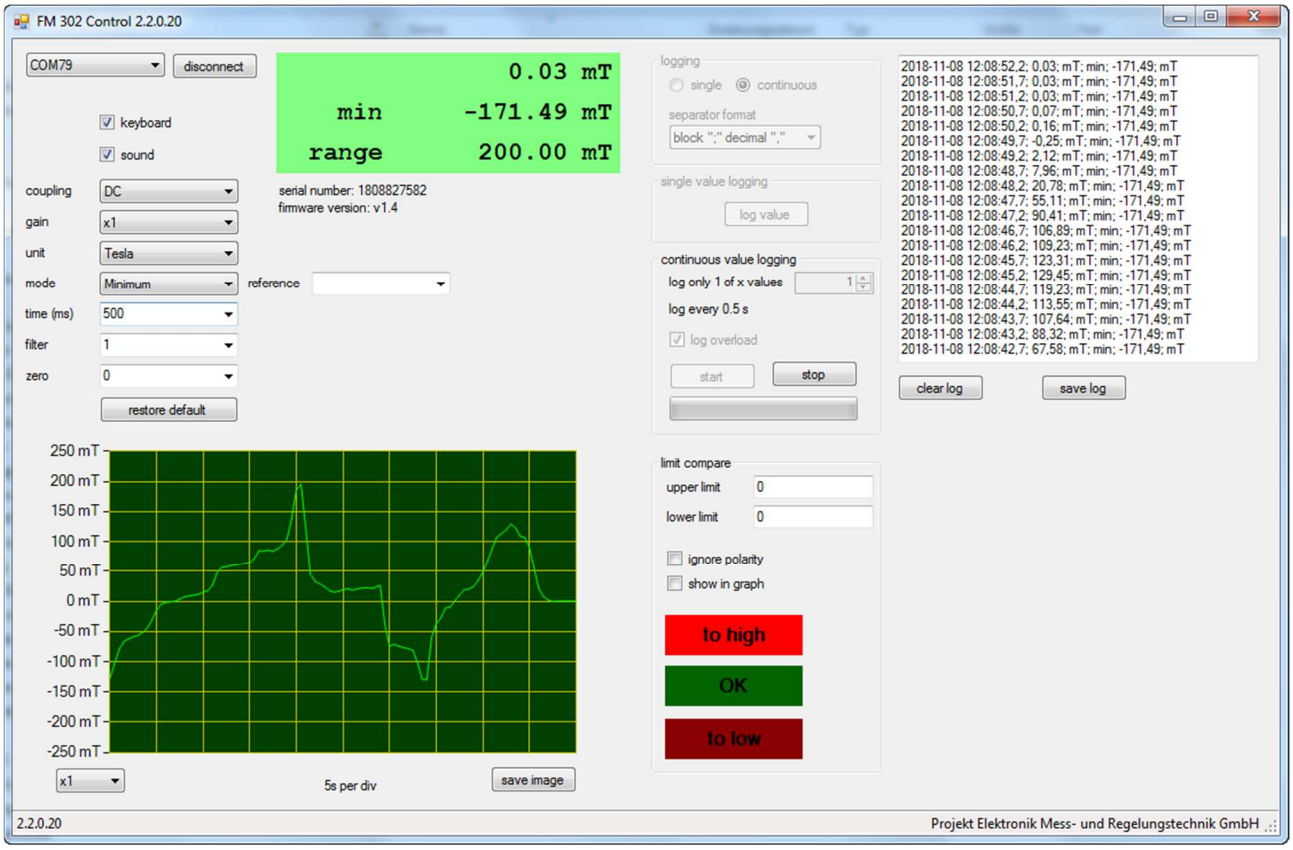
Control Software for Teslameter FM 302



Included in the delivery is a control software for the Teslameter FM 302. This software permits to make all settings of the Teslameter FM 302 via the PC. For this, the software not only allows the settings possible via the keypad of the device but makes available the whole range of functions available via the commands of the USB-Interface.

Current Measured Value:
indicated like at the display of the FM 302

Current Measurement Range

Oscilloscope-like Display
x1, x10, x100, x1000
possibility to save in different graphic formats

Logging of Measured Values
as single values or continuously
save with time-stamp, comma or semicolon separated

Limit Comparator Function
enter upper and lower limit
signals “to low”, “OK”, “to high”

A full-length documentation of the software can be found in the operating manual which is included in delivery (see page 10). It can also be downloaded from our website https://www.projekt-elektronik.com/.

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Technical Data for Teslameter FM 302 (without AS-active-probes)

Measuring modes	DC / AC (RMS)
Ranges	3 ranges per probe, see Table 1 at page 5 or the data sheet of the AS-active-probes sensitivity x1, x10, x100
Bandwidth (-3 dB)	DC: DC – ≥100 kHz AC: <5 Hz – ≥100 kHz depends also on the used probe
Measurement uncertainty DC	in x1: <0,1 % ±2 Digit (at 23 °C ±1 °C) in x10: <0,1 % ±5 Digit (at 23 °C ±1 °C) in x100: <0,1 % ±20 Digit (at 23 °C ±1 °C) offset adjustable with zero-function
Adjustable offset	±4500 digit at most sensitive range (x100)
Measurement uncertainty RMS	16.7 Hz: ≤-0.3 dB 50 Hz: ≤ -0.1 dB with level ≥5 % of range, sine wave, at 23 °C ±1 °C
Temperature coefficient	max. ±0.01 %/K, typ. <±0.003 %/K
Zero drift	max. ±3 digit/K, typ. ±1 digit/K (DC) at most sensitive range
Input resistance	10 kΩ ±0.1 %
Operation	keypad with 8 keys USB interface
Operation temperature	+5 °C to +50 °C
Storage temperature	-10 °C to +50 °C
max. relative humidity	70 % at +35 °C
Operation in magnetic field	undisturbed up to at least 350 mT observe action of force!
Power	9 V battery 400 mAh alkaline battery, life time >20 h, depending on probe type, jack for 9 V power adapter 9 V DC, 40 mA, minus at inner port USB interface (low power device)

LCD display:

Display	4½ digit two-line LCD-display
Display range	±25100 digit
Resolution	$^{1}/_{20,000}$ of each measurement range of the probe (e.g. 0.1 mT at a range of 2 T)
Measuring modes	mean value (DC) true effective value (AC / true RMS)
Polarity	sign (in DC) N(orth pole) or S(outh pole) (in DC)
Measuring modes	absolute measurement relative measurement minimal, maximal. absolute maximal measurement
Display unit	Tesla, Gauss, Oersted, A/m, A/cm
Update rate	given by measuring time
Rise time RMS meas.	typ. 0.3 s
Measuring time	settable 0.1 s (10 Hz) to 5 s (via keypad) or 25.5 s (via USB interface)
Digital filter	moving average filter with settable filter length of 1 to 64 values

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Analog output:

Output voltage	±2.7 V
Factor	±2 V per full scale of range of probe (e.g. range 2 T → factor 1 V/T) see also Table 2 at page 5
Bandwidth (-3 dB)	DC: DC – ≥100 kHz AC: <5 Hz – ≥100 kHz depends also on the used probe
Rise time	<2 µs
Output connector	BNC
Output impedance	47 Ω

USB interface:

Connector	USB-B-jack
Standard	USB 1.1 / USB 2.0 compatible
Driver	Windows, Linux, Mac
PC interface	creates a virtual serial port control via ASCII commands (see Table 3 at page 6)

Control software on CD:

Control possibilities	whole range of functions available via the USB interface
Measured value display	current measured value as number with unit value of set measuring mode as number with unit oscilloscope like display limit comparator
Oscilloscope display	last 100 measured values display range as given by probe and sensitivity setting x1, x10, x100, x1000s
Saving format	as JPEG, PNG, BMP, TIFF, GIF or EMF image
Data logging	single values by key press or continuously automated
Log format	comma separated and period as decimal point (CSV) semicolon separated and comma as decimal point time stamp with 0.1 s resolution, measured value, unit
Limit comparator	with lower and upper limit display if measured value below, between or above limits possibility to ignore polarity display of the limits in oscilloscope display
System requirements	Windows with .NET Framework 4.0 available (Windows XP and later) .NET Framework 4.0 (installed with control software)
Source code	Visual Basic 2010 Express project

Dimension:

Length	166 mm (without connected plugs)
Width	88 mm (without connected plugs)
Thickness	31 mm
Weight	225 g (without 9 V battery) 271 g (with 9 V battery)

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AS-active-probe not included in delivery

To use the Teslameter FM 302 at least one AS-active-probe is needed.

Because of the many different possible measuring tasks, by default there is no AS-active-probe included in delivery of the Teslameter FM 302.

Please order one or more AS-active-probes separately and in accordance with your requirements.

Detailed information about our versatile program of AS-active-probes can be found in their separate data sheet.

included in delivery of Teslameter FM 302:

- Teslameter FM 302
- case
- 1,8 m USB cord
- operating manual
- CD with drivers and control software
- factory calibration certificate
- replacement battery

Options:

- 9 V power adapter
- top hat rail adapter fixed to the device (see page 3)