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INSTRUMENTOS DE MEDICIÓN INDUSTRIAL

Medidor de Campo Magnético MP-2000 con sonda de campo transversal P-T4, List Magnetik

LM-MP2000

OPERATION MANUAL

MAGNETIC FIELD METER

MP-2000

Firmware Version 15.1 and up

2022-03

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MP-2000 (2022-03)

INTRODUCTION

We have made every effort to make this operating manual as short and as clear as possible.

Nevertheless, if you should have any questions about operation, please contact our competent service technicians, who are always ready to help. They will be pleased to assist you.

With the magnetic field meter **List-Magnetik MP-2000**, we offer you a first class, high-end product, with externally connectable axial and tangential field probes. With the easy to use device, you can precisely measure magnetic DC and AC fields as well as pulse fields of all kinds. The range of application ranges from the earth's magnetic field to a field strength of 40,000 A/cm, switchable in Gauss/Oersted and Tesla. The built-in data logger, the combined digital and analog display as well as the optional data transfer via USB, allows flexible use.
Especially at high magnetic field strengths, an absolutely interference-free and precise measurement is required. For this reason, a microcontroller digitizes and linearizes the analog measuring signals of the Hall sensor into the probe in the measuring probes of the **MP-2000**.

The fast peak value memory allows measurements in pulse fields from 0.1 milliseconds. In addition, an oscilloscope for the representation of dynamic magnetic fields can be connected via the special probe P-T4A with analog output.

A further advantage is that the probe cable can be plugged in on both sides connects the display unit and the probe and can be easily replaced in the event of a cable break.

The universally applicable MP-2000 tests for residual magnetism, measures magnetic fields of all types and locates stray detectors for crack detection.

The device has six display ranges:

DC field: 0-200 A/cm, 200-10,000 A/cm, 1,000-4,000 kA/m
AC field: 0-200 A/cm, 200-10,000 A/cm, 1,000-4,000 kA/m
(1 A/cm = 0.1 kA/m = 1.256 Gauss (Oersted) = 0.1256 mT)

Display range switching takes place automatically.

Applicable measuring probes:

Measuring range up to 20,000 A/cm
- Axial probes **P-A2** and **P-W2** (angular axial probe)
- Tangential probes **P-T2** and **P-Z2** (flexible reed probe)

Additionally, in measuring range up to 40,000 A/cm
- Axial probe **P-A4**
- Tangential probes **P-T4, P-Z4** and **P-T4A Analog-Output**

A calibration standard is available on request for checking the calibration of the device.

WARNINGS AND HAZARD INFORMATION

List-Magnetik expressly advises that the MP-2000 magnetic field measurement device may only be used for its proper intended purpose: the measurement of magnetic fields. Any other use is impermissible and involves the deliberate involvement of incalculable risks for the device and the operator.

The device operating company must ensure that it is only used by personnel who have access to these operating instructions and who have read and understood them.

The device and the sensor must not be brought into contact with electrical power sources that are not adequately insulated, under any circumstances. Disregard of this warning can result in a fatal hazard for the operator.

Although the device is splash-proof, it is not waterproof. The device must not be submerged in water or other liquids or cleaned with water. If the device comes into contact with a liquid medium, it must be switched off immediately.

Do not use the device in a potentially explosive environment (smoke, gases).
The use of any electrical device, even this battery-operated measurement device, can result in an explosion.

The device must only be opened to replace the battery. Do not carry out any repairs to the electrics yourself. Instead, send the device to us for diagnostics in the event of a fault

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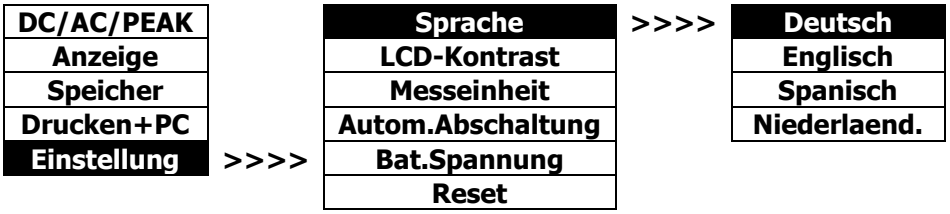
OPERATION WITH MEASURING DUMMY – SAFETY INSTRUCTION

If you are using the MP-2000 with a special measuring dummy instead of a probe for the measurement in a magnetizing system, be sure to observe the following safety instructions:

The complete measuring unit with MP-2000, measuring dummy and connection cable may only be operated behind the closed and locked protection door at the magnetizing coil, according to Performance Level PLe ISO 13849.

QUICK START

- Connect the probe cable to the measuring probe and device.
- Switch on the **MP-2000** with the **ON-OFF** key. Automatic zero balancing takes place when the device is switched on, therefore the probe should not be in a magnetic field when doing so. The last measured value appears briefly on the display, followed by the current measured value.
- To change the language (German is pre-set) press the **MENU** key:



Scroll through the menu using the arrow keys, confirm your selection using the **OK** key.

IMPORTANT NOTES

RETENTION OF STORED VALUES WHEN CHANGING BATTERY

The stored measured values are retained even after switching off the device or storing it without a battery.

POWER SUPPLY

The device is supplied as standard with three 1.5 V (Mignon) batteries. However, it can optionally be powered by three 1.2 V NiCd rechargeable batteries. A suitable charger is available from the factory and is connected to the serial interface.

Charging time: 8 – 10 hours.

The charger can also remain permanently connected!

CHECKING THE BATTERIES OR RECHARGEABLE BATTERIES

The batteries must be replaced or the rechargeable batteries charged up as soon as only 1 bar appears on the battery display when the device is switched on. If the message **Replace batteries** additionally appears on the display then the device switches itself off automatically for protection if the battery voltage is too low. The exact battery voltage can additionally be displayed for checking purposes:

DC/AC/PEAK		**Language**
Display		**LCD-Contrast**
Batch		**Unit**
Print+PC		**Autom.SwitchOff**
Setup	**>>>>**	**Bat.Voltage**
		Reset

The battery voltage should be greater than 3.0 V
Used batteries are special waste and must be disposed of accordingly.

AUTOMATIC POWER-OFF

The device switches itself off automatically 2 minutes after the last measurement if the measured value does not change.

You can deactivate this feature via **Setup** menu.

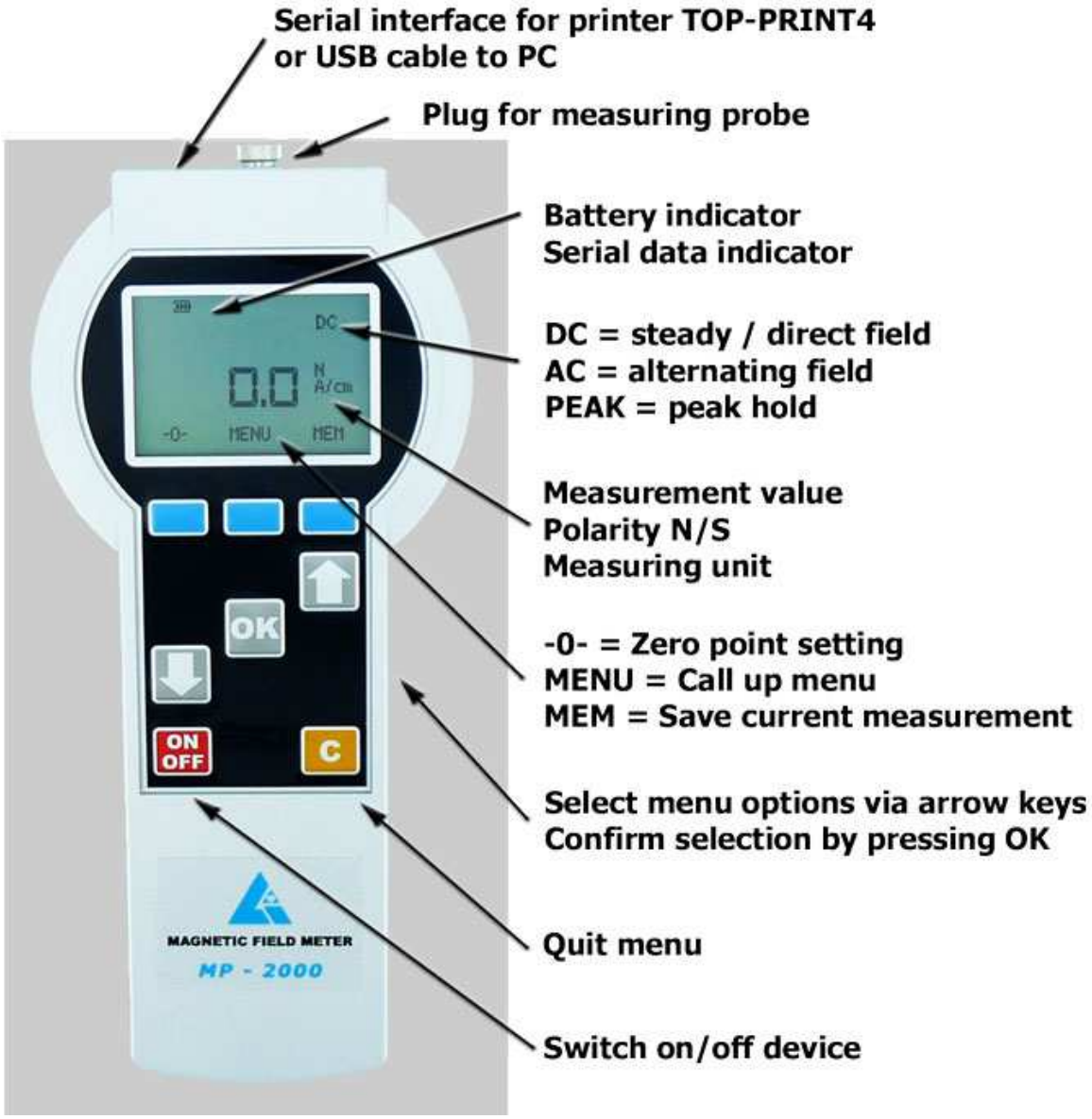
CHANGING THE PROBE

To change the measuring probe, switch off the device first, connect the desired measuring probe to the probe cable and then switch on the device again. If no measuring probe is connected to the device or if the probe cable has no connection to the device, a message is displayed when the device is switched on and the device switches itself off again automatically.

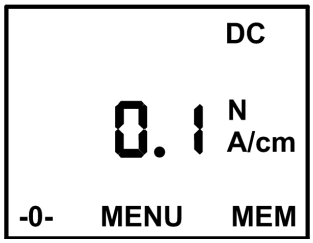
MEASURING RANGE EXCEEDANCE

When exceeding the measuring range, the display shows: **- - - -**

FUNCTIONS OF THE OPERATING KEYS



MENU OPERATION



-0- KEY – ZERO POINT SETTING

Zero-point adjustment takes place after pressing the **-0-** key. The probe must not be in a magnetic field during this time. After the zero balancing is complete the display shows between -0.2 and +0.2, due to the influence of the earth's magnetic field when moving the measuring probe.

MEM KEY – SAVE MEASURED VALUE

After pressing the **MEM** key, the current measured value is saved in the selected memory batch.

MENU KEY

The various functions of the device are controlled via a menu. After switching on the device, press the **MENU** key in order to call up the menu.
The arrow keys are used to select the menu item; the current selection has a black background. The selected menu item is called up via the **OK** key, either a sub-menu or the selected device function appears.
The **C** key is used to quit the device menu; the main menu field is selected with the central blue key.

DC / AC / PEAK SELECTION

DC/AC/PEAK	>>>>	DC Auto Range
Display		DC Low Range
Batch		DC High Range
Print+PC		AC-RMS Auto Range
Setup		Peak Low Range 1
		Peak High Range 2

DC AUTO RANGE

Switch to **DC Auto Range** in order to measure static fields. The probe has an internal measuring range switch at 600 A/cm. For the user, this internal automatic switching has no effect.

The **DC** symbol is shown behind the current measured value on the display.

DC LOW RANGE AND DC HIGH RANGE

The use of the separate ranges below and above the internal measuring range switch at 600 A/cm only makes sense with the analogue output probe P-T4A.

If you are using a non-analogue probe with firmware below version 8.2 (before July 2018), this feature is not available. You will receive the message **Probe not adequate**.

For the P-T4A probe, values from both areas within a measurement series would lead to a wrong representation. If DC Low Range is selected and the range limit is exceeded, the display values are cut off.

The display shows the symbol **DC-Lo** or **DC-Hi** behind the current measured value.

AC-RMS AUTO RANGE

Switch to the **AC-RMS Auto Range** in order to measure alternating fields.

The **AC** symbol is shown behind the current measured value on the display.

In the case of sinusoidal AC fields, the respective effective value (true RMS) is displayed. The respective conversion factors for full-wave and half-wave rectification are given in the DIN standard 54 131 Part 1.

PEAK LOW RANGE (P1) AND PEAK HIGH RANGE (P2)

Switch to the **Peak Low Range**, in former firmware versions known as **P1** range, in order to measure peak fields **less than 600 A/cm** (750 Gauss, 75 mT)**.** The **Peak Lo** symbol is shown behind the current measured value on the display. If the measurement range is exceeded the display shows **- - - -**.

Switch to the **Peak High Range**, in former firmware versions known as **P2** range, in order to measure peak fields of **more than 400 A/cm** (500 Gauss, 50 mT). The **Peak Hi** symbol is shown behind the current measured value on the display. **(PEAK P2** symbol is shown). If no peak value is displayed in the **Peak Hi** mode, this means that the peak value is less 400 A/cm. In this case select the **Peak Low** Range.

If there is already a measured value in the peak value memory and a higher measured value is recorded then the old measured value will be overwritten by the new one. A short acoustic signal is sounded when the measured value is exceeded.

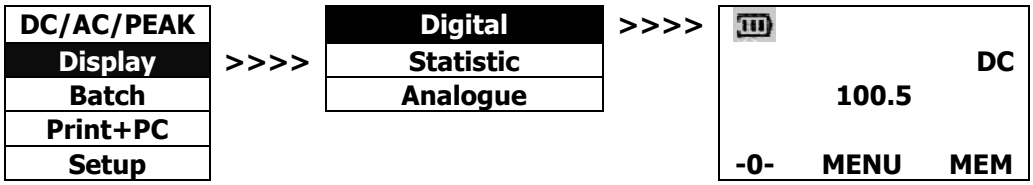
The peak value memory is reset via the **-0-** key.

When measuring AC fields in peak value memory mode the peak value and not the effective value will be saved if the AC field is sinusoidal.

DISPLAY

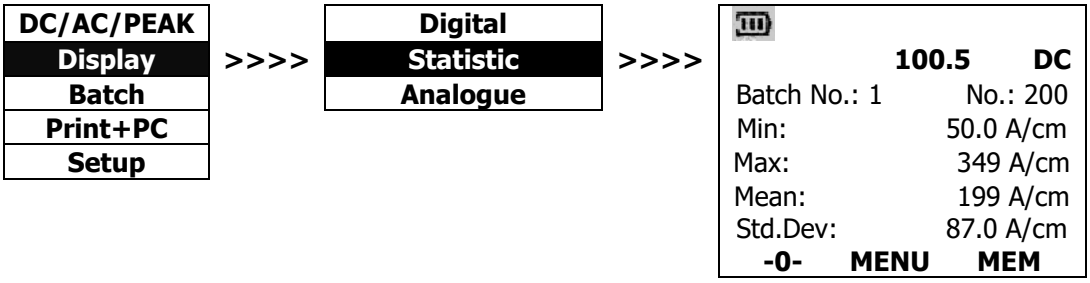
The instrument can display the reading in three ways: Digital, with Statistics, Analog.

DIGITAL



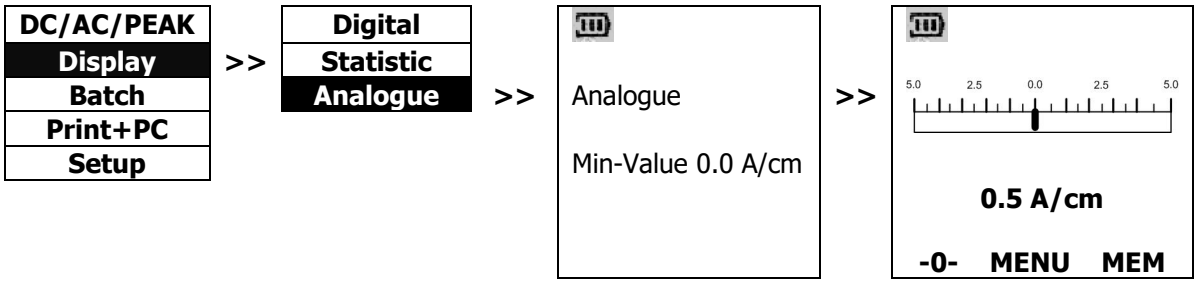
The normal digital display is activated as standard. The current measured value is displayed here.

STATISTIC



When the statistics display is activated the current measured value is displayed at the top and the statistical parameters are additionally displayed.

ANALOGUE



After activating the analogue display the start of the measuring range is input first (min. value), after which the analogue display is shown in the center on the display with the preselected start of the measuring range. The maximum measuring range value is automatically adjusted according to the size of the current measured value.

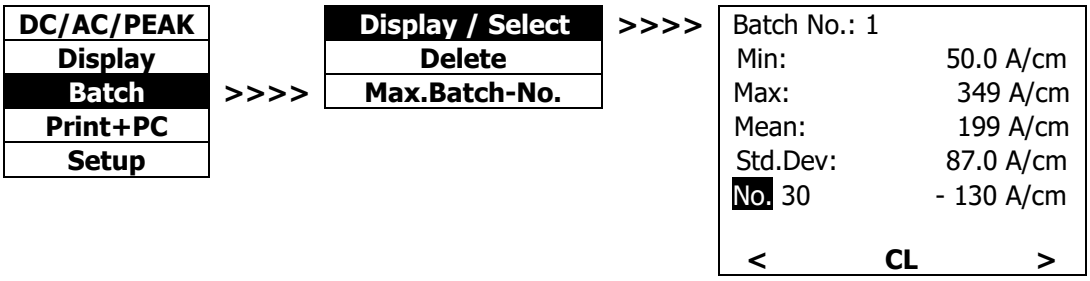
BATCH

The **MP–2000** contains a maximum of 100 different application batches for saving and statistical evaluation of object-related series of measurements.

A total up to 10,000 measurements can be stored. The maximum number of measurements per application batch depends on the set number of batches.

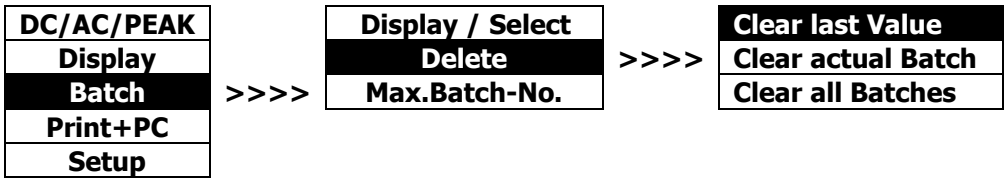
First you should select the number of batches needed. Then activate the current batch number in the menu Display/Select, where the measurement values are to be stored.

DISPLAY / SELECT



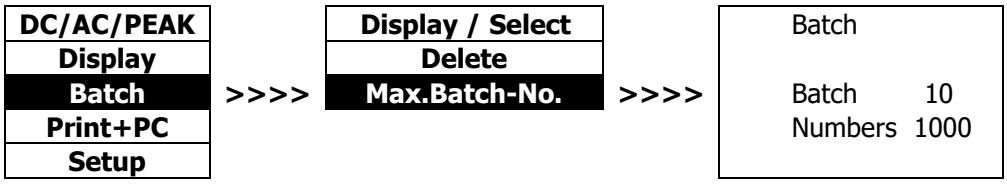
The memory contents are displayed or the current batch is selected here. Also, any measured value in the batch can be deleted here, upon which the statistics will be automatically updated.
Any measured value can be selected using the arrow keys (measured value no. has a black background) and the selected measured value is deleted using the center blue key if required. The batch number is selected using the left and right blue keys.

DELETE



Here you can delete either the last measured value from the current batch, all stored measured values in the currently set batch or all measured values in all batches.

MAX. BATCH NO.



After selecting a maximum number of batches, the maximum number of measured values that can be saved per batch is displayed.

PRINT + PC

In this menu item, you can send stored measurement data via the serial interface, either to the printer **TOP-PRINT4** or to the **PC**. Both cables are plugged in the same connector.

In addition, there is a possibility to send the current measured value to the **PC** every 0.5 seconds, for the evaluation of measurement curves. If the printer is connected instead, the values will be printed continuously.

TRANSMIT TO PC

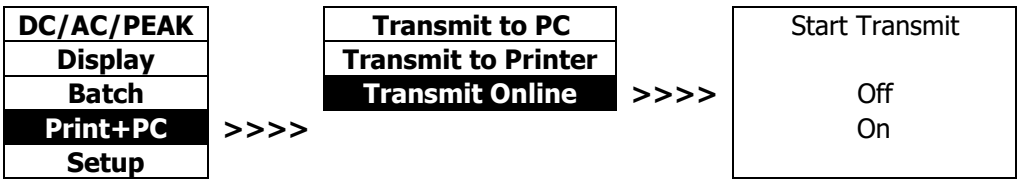
This function is only used to supply the data application TRANSFER.
The applications TRANSFER-EXCEL and STAT6 don't work any longer with firmware version 15.1 and up. To transfer data to PC, switch to the data transfer application M**P-2000 TRANSFER** at https://www.list-magnetik.com/software

Send the statistical evaluation and measured values from the current batch to the PC via the USB wireless interface and the serial interface. First, you need to start the data transfer in the PC software.

TRANSMIT TO PRINTER

Send the statistical evaluation and measured values from the current batch to the printer **TOP-PRINT4** via the USB wireless interface and the serial interface. **Older printer models (MEGA-PRINT, TOP-PRINT) will not be served with this firmware version 7.1 and up.**

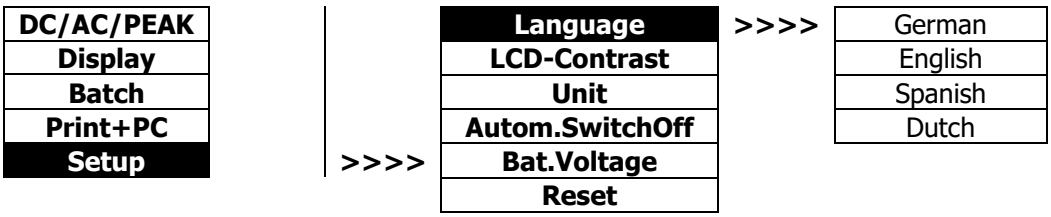
TRANSMIT ONLINE



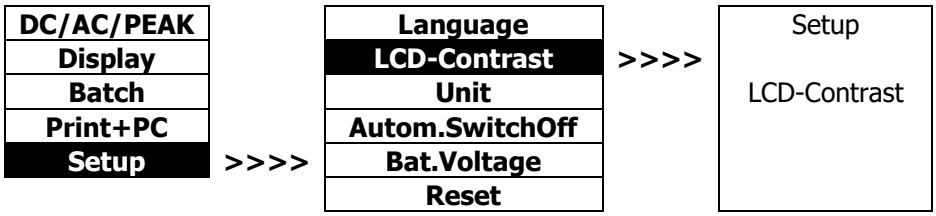
If this function is activated, the current measured value will be sent via the serial interface twice a second, **if it is more than 0.8 A/cm or 1 Gauss.**

SETUP

SELECT LANGUAGE

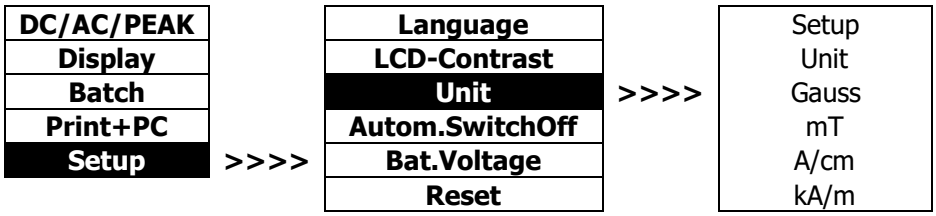


ADJUST LCD-CONTRAST



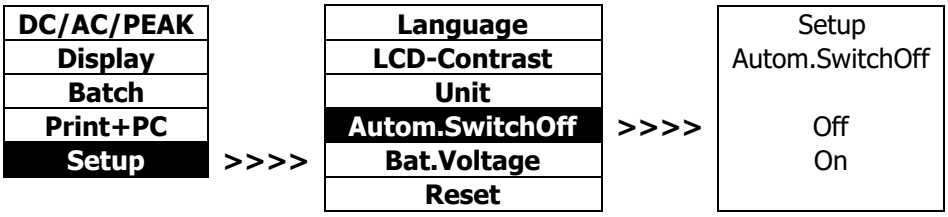
The adjusting of the contrast is done with the arrow keys.

SELECT MEASURING UNIT (Gauss – mT – A/cm – kA/m)



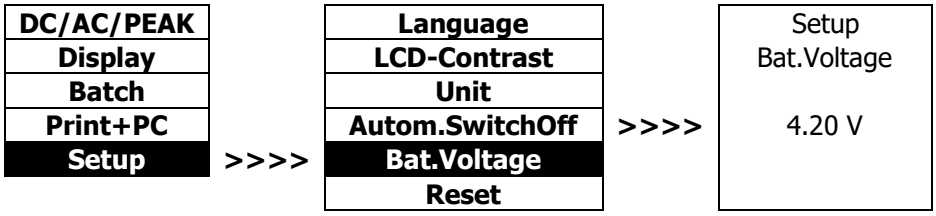
Conversion: 1 A/cm = 0.1 kA/m = 1.256 Gauss/Oersted = 0.1256 mT

AUTOMATIC SWITCH-OFF



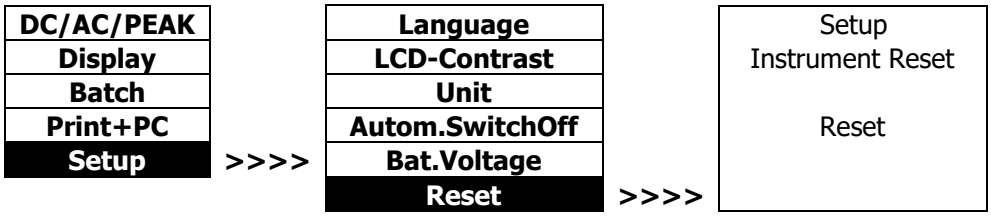
The device will automatically turn off 2 minutes after the last measurement if no measurement value change occurs. This automatic is pre-set. It can be deactivated e.g. when the device is used in a production line.

DISPLAY BATTERY VOLTAGE



The battery voltage should be more than 3.0 V.

RESET



Reset returns all device settings to the factory settings. This function should be used if settings have been changed and the device does not work properly, or if the calibration of the probe does not work properly.

APPLICABLE MEASURING PROBES

Measuring range up to 20,000 A/cm

Axial probes **P-A2** and **P-W2** (angular axial probe)

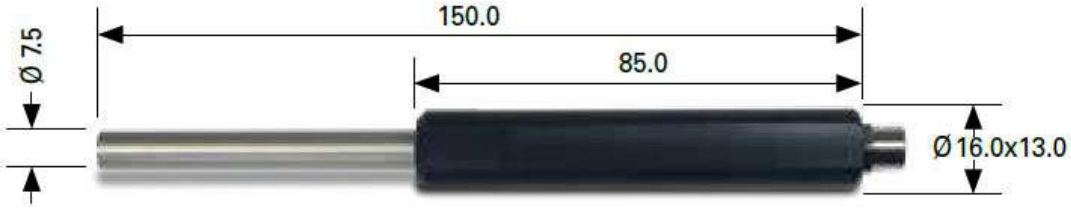
Tangential probes **P-T2** and **P-Z2** (flexible reed probe)

Additionally, in measuring range up to 40,000 A/cm

Axial probe **P-A4**

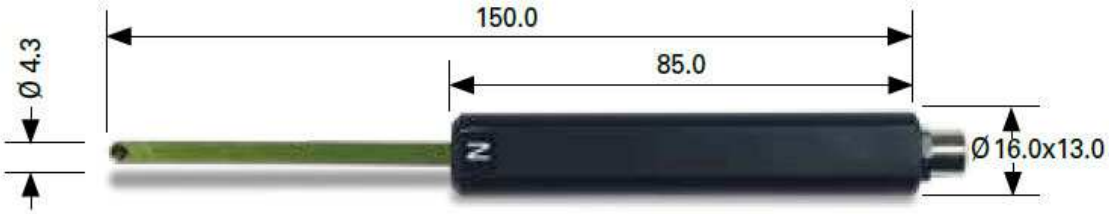
Tangential probes **P-T4, P-Z4** and **P-T4A Analog-Output**

Axial Field Probe P-A2/A4:



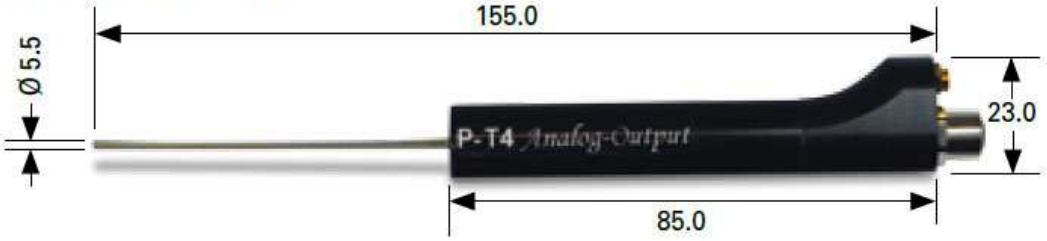
Tangential Field Probe P-T2/T4: 1.7 mm thickness

Flexible Reed Probe P-Z2/P-Z4: 0.9 mm thickness



Angular Axial Probe P-W2:

Tangential Field Probe P-T4A:



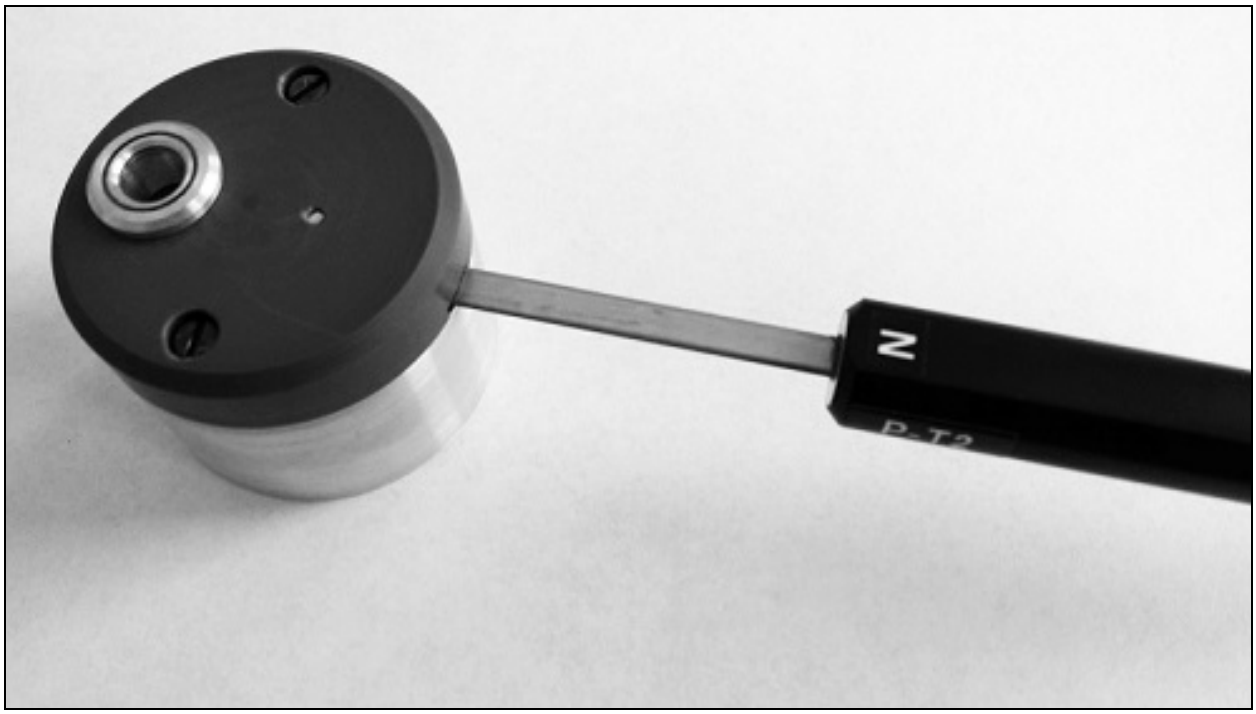
CHECKING MP-2000 WITH CALIBRATION STANDARD

It is not necessary to calibrate the device. The measuring probes are pre-calibrated and are interchangeable.

A precision calibration standard with **180 A/cm** is optionally available in order to check the device with a measuring probe.

Tangential field probe:

Insert the probe with the lettering N = north pole pointing upwards into the slot of the calibration standard until the probe latches at the front. Compare the displayed value with the value of the calibration standard.



Axial field probe:

Insert the probe vertically into the cut-out with the red recess of the calibration standard and rotate it until the maximum value is displayed. Compare the displayed value with that of the calibration standard.

Flexible reed probe:

With the precision calibration standard, it is not possible to check the flexible reed probe. In the slot for the tangential probe, it can even be damaged.

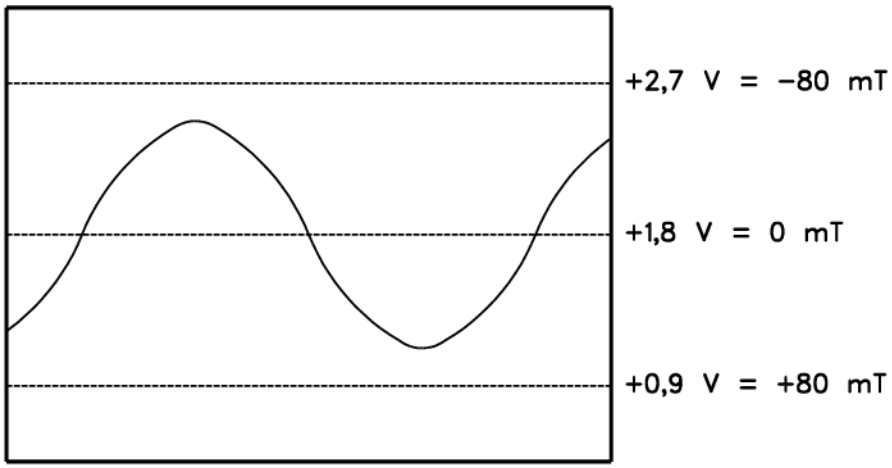
Instead, you can obtain a calibration standard with positioning point, which unfortunately works less accurately, but does not damage the probe.

USING THE ANALOG PROBE P-T4A ANALOG-OUTPUT

The P-T4A Analog-Output analog probe works like a normal tangential probe P-T4. Like the P-T4, it can measure up to 40,000 A / cm (approx. 5,000 mT) and can be checked with the precision calibration standard.

In addition, it offers an analog output that is connected to an oscilloscope. An additional BNC cable is included.

If you have connected the probe to the oscilloscope, you must set the zero line to + 1.80 V. The positive and negative values of the magnetic field measurement are then displayed in the range between + 0.90 V and + 2.70 V.



Depending on the measuring range (low / high), the magnetic field strengths are shown in this table converted into voltage values:

Measuring range		***Output***
DC Low Range / Peak Low Range		
Min -80 mT	=	+2,70 V
Threshold -0,1 mT		
0 mT	=	+1,80 V
Threshold +0,1 mT		
Max +80 mT	=	+0,90 V
DC High Range / Peak High Range		
-5140 mT	=	+2,70 V
Threshold -1 mT		
0 mT	=	+1,80 V
Threshold +1 mT		
+5140 mT	=	+0,90 V

TECHNICAL DATA

Measuring units:	A/cm - kA/m – Gauss (Oe) - Tesla switchable (1 A/cm = 0.1 kA/m = 1.256 Gauss = 1.256 Oersted = 0.1256 mT)
Applicable measuring probes:	Axial probes P-A2, P-W2 and P-A4, Tangential probes P-T2, P-T4, P-Z2, P-Z4, P-T4A.
Measuring range DC:	0-40,000 A/cm
Measuring range AC:	20-40,000 A/cm
Accuracy:	in the homogeneous field ± 1 A/cm up to 50 A/cm, ± 2 % of measured value from 50 A/cm, ± 3 % of measured value from 20,000 A/cm
Resolution:	0-200 A/cm: 0.1 A/cm, > 200 A/cm: 1 A/cm, > 10,000 A/cm: 10 A/cm
Frequency range AC:	10 Hz - 5 kHz
Peak Hold:	with impulse duration >= 0.0001 s
Display:	Graphic display with additional analog display of measured values
Multilingual menu navigation:	German / English / Spanish / Dutch
Data logger:	10,000 measurements, divisible into 100 Batches
Statistics:	Count / Maximum / Minimum / Average / Standard deviation
Interface:	RS232 interface with USB cable for communication with PC and printer
Power supply:	3x 1.5 V AA Mignon
Operating time:	approx. 50 hours
Dimensions:	200 x 95 x 41 mm
Weight:	265 g with batteries
Warranty:	12 months on the device, 3 months on the probe

OPTIONAL

TOP-PRINT4 THERMAL DATA PRINTER

Small, battery powered printer for measurement values and statistics.

Technical data

Printing method:	Thermal printer
Characters/line:	32
Transfer speed:	38400 baud
Interface:	Bluetooth class 2 and Serial
Paper:	Thermal paper 57 mm wide – max. 10 m long
Power supply:	Li-Io rechargeable battery (approx. 60 hours of operation)
Dimensions:	100 x 75 x 45 mm
Weight	210 g

Operating instructions

1. Connect the printer cable to the left USB port (**COM**) at the printer.
2. Connect the printer cable to the device (serial port next to the probe).
3. Insert paper roll.
4. Switch on printer (is it already charged? See below).
5. Switch on the device.

Charging the built-in Li-Io rechargeable battery

When delivered new the Li-Io rechargeable battery in the TOP-PRINT4 must be charged up before first-time use. The rechargeable battery is charged up with the mains charger supplied. The cable from the mains charger is plugged into the connection socket on the right-hand side. **The charging time should be at least 4 hours.** The blue LED blinks during the charging process; it lights steadily when the battery is fully charged. The charger then switches automatically to maintenance charging mode. The capacity of the rechargeable battery is sufficient for approx. 60 hours of operation.

Notes on operation

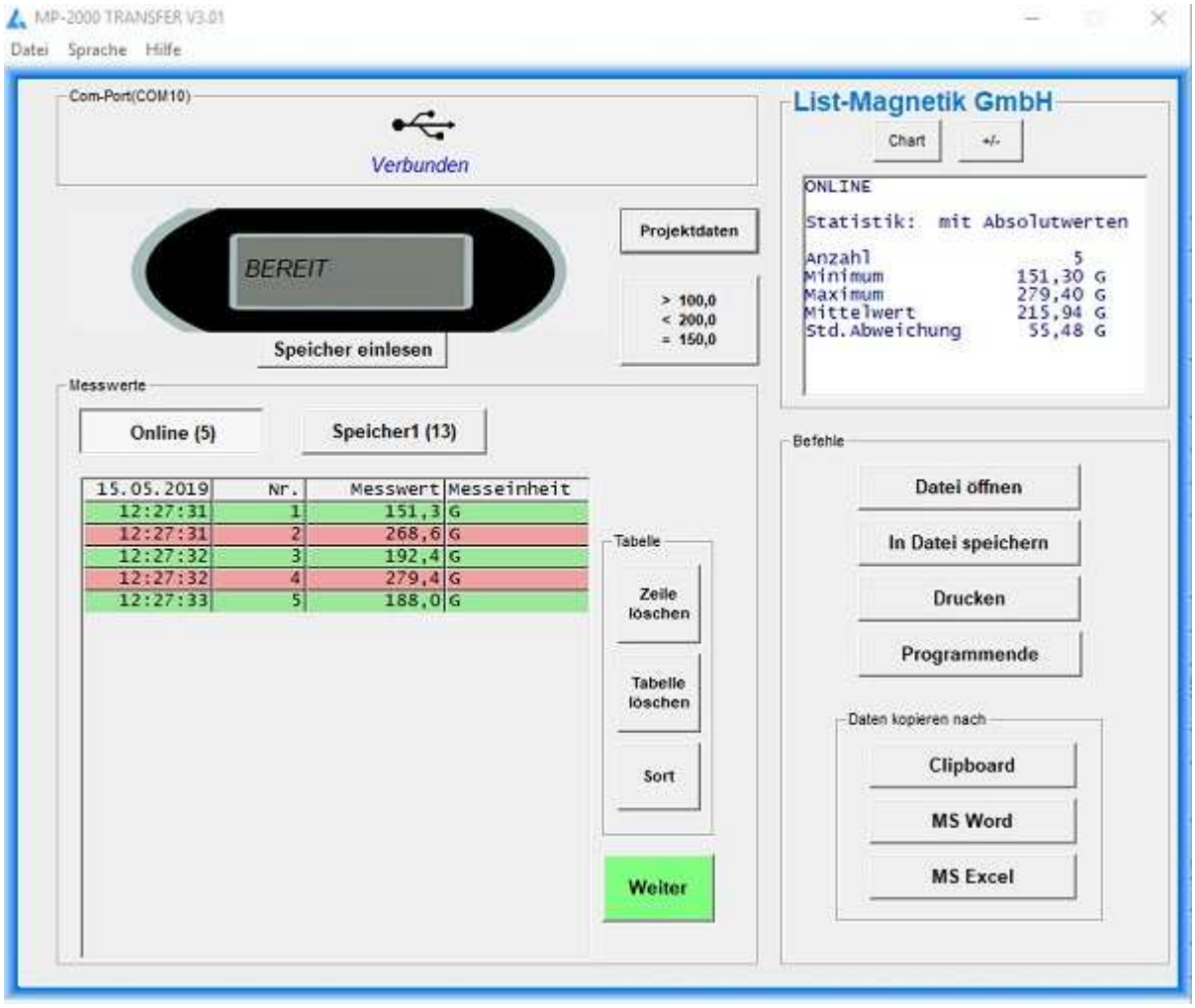
1. The paper is manually transported using the **Feed** button. After completion of the printout the paper strip is transported out of the housing by pressing this button and can then be cut off cleanly.
2. Faulty printout: The **TOP-PRINT4** must be charged up again if individual lines of the printout are not printed correctly.
3. Inserting a new paper roll: Open the cover, Insert the paper roll, pull out the end of the paper, Close the cover.

AVAILABLE APPLICATIONS

MP-2000 TRANSFER

On www.list-magnetik.com, in the category **Applications** you may obtain the free of charge data transfer application **MP-2000 TRANSFER**, to transfer measurement data to your PC.

With MP-2000 TRANSFER, you can measure online or read the device's memory, you can evaluate the data statistically or visualize as chart. You can print the results or hand over the data to applications like Microsoft Word and Microsoft Excel.



TRANSFER

- free download from our website www.list-magnetik.com
- easy to handle transfer program to display measurement values as text

  This software reads the data into a file and displays it.

  The free **TRANSFER** software for the transmission of data to the PC or laptop can be downloaded from www.list-magnetik.com category **Applications.**

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