MANUAL

Electrostatic Field Meter EFM 120

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General information on electrostatics

Nowadays ESD[1] is a problem at many workstations, because modern microelectronics[2] is easily destroyed by the sequels of ESD. Other branches of industry like e.g. telecommunications-, plastics-, and explosive material industry are also heavily affected by ESD.

ESD causes losses of time as well as high financial losses and can endanger the human health. Charges of over 10000 Volts can emerge on people, clothes, materials and equipment. Devices that are sensitive to electrostatics can be damaged by electrostatic discharges of less than 100 Volts. Charges of 3000 Volts and more can cause sparks. In endangered areas that can cause explosions.

Origin of electrostatic charge

Triboelectricity[3] is caused by attrition of different materials. Electrons are transferred from one material to the other. As electrons are charged negative the material that releases electrons is charged positive. The material admitting electrons is charged negative. There are different ways to avoid or to discharge electrostatic charges. But to find an effective and reasonable solution first of all the emergence, amount and polarity of the charge have to be found. Our devices are suitable for that purpose and for the supervision of favored charge.

Product description

The unit is housed into an EMV plastic enclosure. The influence electrode is star shaped. In front of it in a small distance apart a rotating grounded modulation propeller with the same shape as the electrode is located. The influence electrode is enclosed by a ring electrode system that is used as mechanical shield for the propeller wheel and the sensor plate. Measurement values are displayed with a 21 digit LED bargraph.

The device has an integrated micro computer with the following functions:

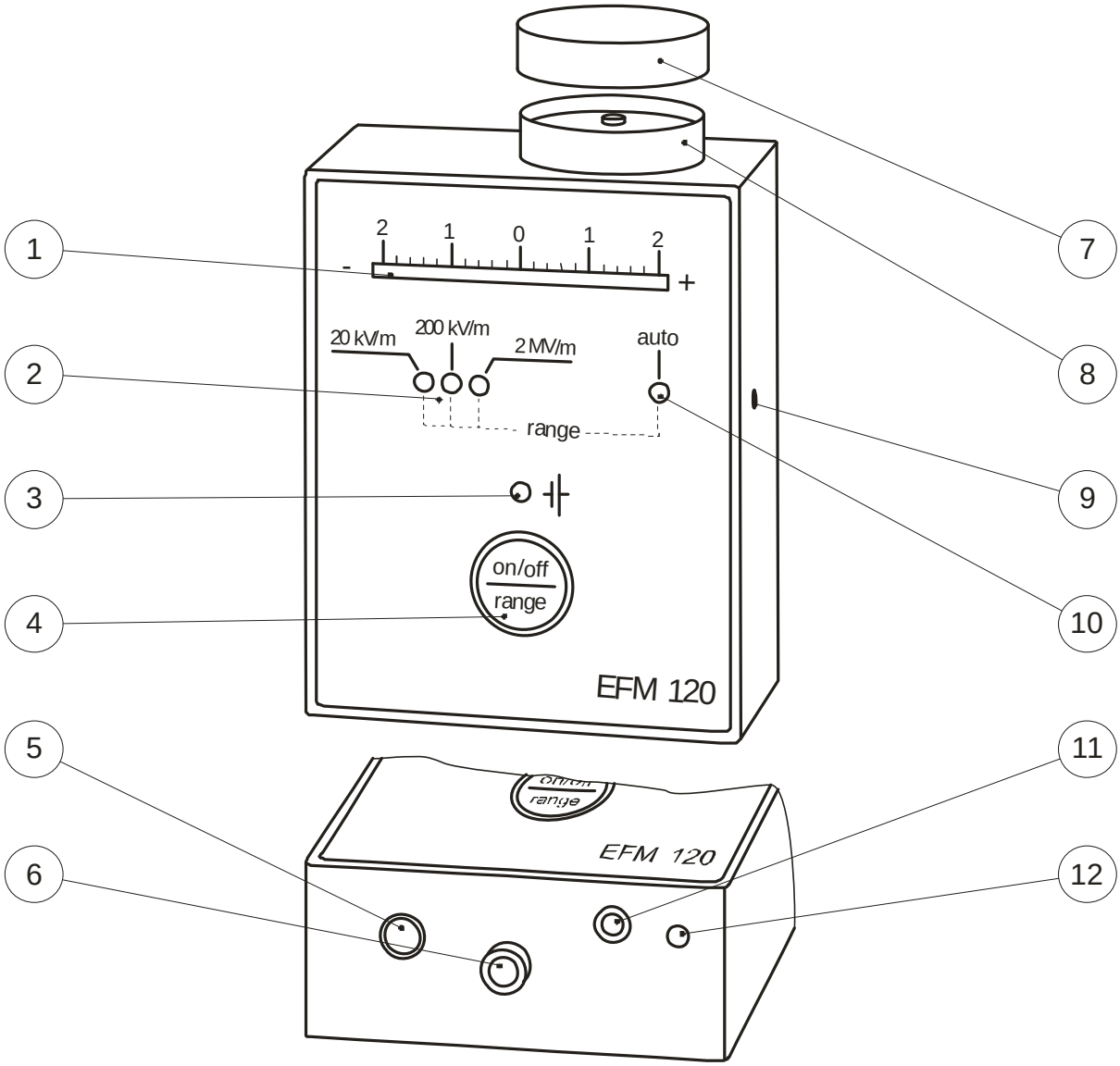
- Automatic functional check on powering on
- One button operation
- Permanent supervision of the battery voltage with automatic shut-down

[1] electrostatic discharge
[2] integrated circuits
[3] Greek: tribeia = friction

Specifications

Dimensions (L x B x H):	Approx. 80mm x 100mm x 40mm
Weight:	Approx. 380g
Calibration in a plate capacitor:	285mm x 285mm, distance 100mm
Calibration accuracy:	< 2,5%
Output voltage	±1V
Internal resistance	>1kΩ
Power supply	Integrated battery / charger 230V 50Hz
Battery:	NiMH storage battery pack 7,2V 350mAh
Operating time:	Min. 4h in battery mode
Measurement ranges	±20kV/m, ±200kV/m, ±2MV/m

Legend



1 LED bargraph
2 Range indicator LEDs
3 Battery charge indicator
4 «on/off/range» button
5 Charge socket
6 Grounding socket
7 Protective cap
8 Modulator system
9 Buzzer
10 Automatic LED
11 Recorder output
12 Zero point trimmer

Manual

Measuring principle

The electrostatic field meter is a parametric amplifier. The electric field influences a current proportional to the electrostatic field. The current is amplified and measured with a selective amplifier. No energy is taken from the field over time means.

No radioactive matters are used!

Application Areas

Detection and *Control* of electrostatic fields resp. charges, *measuring* of electric charges, electrostatic charges, very high-resistance voltage sources, very low currents or high resistances.

Initiation

By pressing the «function/on/range» button on the front panel the device is switched on. By holding the «function/on» button pressed until the device buzzes, the EFM 120 is switched off.

The protective cap on the modulator system has to be removed before measuring!

Measurement Range Switching / Automatic Mode

The device has 3 manual measurement ranges and an automatic mode. Switching is performed by pressing the «on/off/range» button briefly while the unit is switched on.

After switching on the most sensitive range (± 20kV/m manual) is selected. After pressing the button, the range switches to ± 200 kV/m and to ± 2MV/m after pressing again.

If the button is pressed in ± 2MV/m mode, the EFM 120 switches to automatic mode. This indicated by the automatic indicator LED. In automatic mode the device selects the optimal measurement range and displays it by LEDs.

Each time the button is pressed, the measurement range is changed in the following order:

Measurement Range Exceeding

If the measurement rang is exceeded in manual mode, the outer two LEDs will flash on the side were the exceeding takes place (+ or -). In addition an audio warning resounds. In this case a higher range has to be selected.

In automatic mode the device switches to the next higher measurement range when the range is exceeded. If highest range is already selected, the outer LEDs start flashing next on the side where the exceeding took place (+ or -). Additionally an audio alert resounds. In this case the distance to the object to be measured has to be increased.

If the measured value falls below 10% of the range's maximum value the EFM 120 switches to a lower range if possible.

Display

The measured value display is a 21 digit LED bargraph with zero point (green LED). The measured value is displayed by 10 LEDs for each polarity. Due to the smooth transition, the scale-reading precision is about 5%.

Recorder Output

On the rear side of the device a recorder output with jack bush for the connection of an external recorder or voltmeter is located. The output voltage is ±1V proportional to the electric field strength measured. The metering precision is ±2.5% in a homogeneous field.

Battery Supervision

The device has an integrated battery supervision function. If the battery voltage falls below 6.8V, the "⊣⊢" LED lights. By falling below 6.5V the device buzzes (a long beep followed by a short one). To prevent total discharge of the battery the device is automatically powered off. In this case the battery has to be loaded with the shipped charger for about 12-14h.

Grounding

The device has to be grounded properly to measure the amount and the polarity of an electrostatic field. For that purpose the device has to be connected to ground by using the grounding jack (4). Grounding the device by a grounded person (e.g. over conductive shoes or wrist strap) touching the grounding jack suffices under most circumstances.

Zero Point Adjustment

Under normal circumstances a zero point adjustment is not necessary. If green led does not light while the modulator system is screened (e.g. mounted cover cap) the zero point can be adjusted using the trimmer (12) on the right side of the device.

Electric Field Strength

For measuring the electric field strength at first the protective cap has to be removed. Afterwards the electro static field meter has to be adjusted with the modulator system parallel to the object to be measured.

The distance between the EFM 120 and the object to be measured must be kept constant, as the distance is for the voltage calculation. The measured field strength is displayed in kV/m.

The charge in Volt is obtained by multiplying the displayed value with the distance in meters.

For example: The distance d between the object and the device is 5cm and the measured field strength E is 1,6kV/m, the surface potential U is calculated as follows::

$$pontential = strength \times distance$$

$$U = E \times d = 1600V/m \times 0,05m = 80V$$

Please pay attention to use correct units. To avoid this problem we recommend using SI units.

Voltage Metering with MK11

With the optional voltage gauge head MK11 voltages up to ±2kV can be measured with an internal resistance R_i >10^{15}Ω. For high voltage measurements the guidelines of the European standard EN 10100 need to be considered.

The voltage gauge head has to be mounted on the modulator system of the static meter for measurements. As the internal teflonized field plate is located in a distance of 1cm to the modulator field plate, the following measurement ranges are obtained:

- ±200V
- ±2kV

Measurements up to ±20kV are not realizable due to potential spark formation in this range.

The generated linear voltmeter has the following outstanding properties:

Input capacitance:	approx. 5pF
Input resistance:	>10^{16}Ω with appropriate gauge head

Maintenance

The modulator system or parts of it must not be touched. Those parts have to be protected of dust, isolating impurity layers, color- or paint haze and condensate. If required the modulator system can be cleaned with ethyl alcohol and a lint-free cotton cloth.

NiMH Storage Battery

Even if the device is not used for longer terms, the battery has to be charged after 6 month to prevent total discharge. If the battery cannot be charged anymore, the battery must be changed. For that purpose the device has to be sent to the manufacturer.

Warranty

We provide a 24 month warranty in case of proper application according to the manual. Excluded of the guarantee are: The battery resp. the accumulator, damage by electric shock, wrong grounding and mechanical damage of the device. The guarantee expires if the device was opened.

Scope of Delivery

The basic equipment of the electrostatic field meter includes the following components:

- Carrying case
- Electro static field meter
- Charger
- Phone jack for the recorder output
- Grounding spiral cable
- Manual
- Declaration of factory calibration

Optional available:

- Voltage gauge head MK11-S1 with banana jack
- Voltage gauge head MK11-S2 with BNC connector

Warning Notices

- The electrostatic field meter must not be opened. By opening the guarantee expires.
- The electrostatic field meter must not be used in explosive areas. No admission for explosive areas!
- If high charges are possible the electrostatic field meter must be grounded. An adequate distance must be kept.
- Flashovers on the modulator system must be avoided!
- The use of the device in power plants or comparable areas is prohibited!
- The device can not measure alternating fields > 1Hz!

Calibration

A check of the measurement values is recommended annually.