

# MANUAL

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Electrostatic Field Meter EFM 022 (V 5.3)

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## General information on electrostatics

Nowadays ESD<sup>1</sup> is a problem at many workstations, because modern microelectronics<sup>2</sup> 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 build up 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<sup>3</sup> 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 collecting 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 preferred charge.

## Product description

The unit is housed in 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. A 2×12 digit alphanumeric LC display is located at the front of the device.

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

- Conversion of the measured field intensity over the adjusted measurement distance to the charge in Volts
- one button operation
- permanent supervision of the battery voltage with automatic shut-down
- charge plate mode<sup>4</sup>

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<sup>1</sup> electrostatic discharge

<sup>2</sup> integrated circuits

<sup>3</sup> Greek: tribeia = friction

<sup>4</sup> with optional CPS kit

## Specifications

<b>Dimensions (L x W x H):</b>	Approx. 70mm x 122mm x 26mm
<b>Weight:</b>	Approx. 130g
<b>Calibration in parallel plate capacitor:</b>	200mm x 200mm, distance 20mm
<b>Calibration accuracy:</b>	< 5%
<b>Digital/Analogue Converter DAC</b>	Resolution 10Bit
<b>Battery:</b>	9V alkaline or NiMH battery
<b>Operating time:</b>	Approx. 10h with alkaline battery

## Measuring range Voltmeter

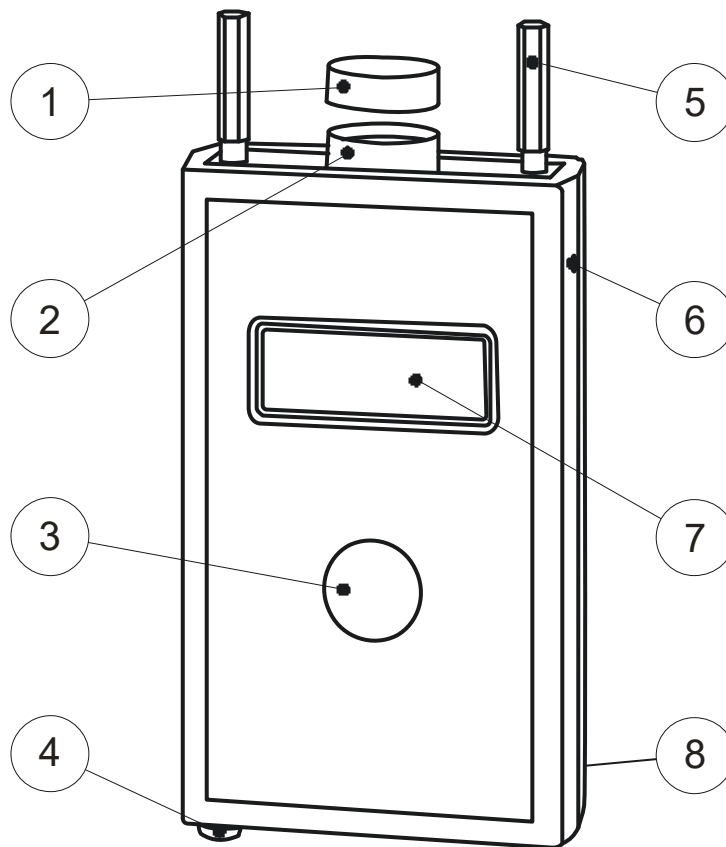
Distance	Measuring range	Max. resolution
1cm	0 ... 10kV	1V
2cm	0 ... 20kV	2V
5cm	0 ... 50kV	5V
10cm	0 ... 100kV	10V
20cm	0 ... 200kV	20V

## Measuring range E-Field Meter

Manual Range	Range with MK 023	Max. resolution
$\pm 20 \text{ kV/m}$	$\pm 200\text{V}$	20V/m
$\pm 200 \text{ kV/m}$	$\pm 2\text{kV}$	200V/m
$\pm 1 \text{ MV/m}$	$*\pm 4\text{kV}$	1kV/m

\* Maximum measuring voltage with MK 023 !

## Caption



- 1 Cover cap
- 2 Modulator system
- 3 Button «function/on»
- 4 Grounding jack

- 5 Spacer
- 6 Zero point trimmer
- 7 Alphanumeric LCD display
- 8 Battery case (on the back)

## Operating instructions

### 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!*

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### Application Areas

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

### Button Features

On	Press «function/on» 1 time briefly
Hold	Press «function/on» 1 time briefly to switch on or off
Distance	Press «function/on» until „change cm“ appears Press «function/on» 1 time briefly to change to a new distance or to CPS mode, wait approx. 2s to select the displayed function
Aus	Press «function/on» 2 times in quick succession

### Initiation

By pressing the «function/on» button on the front panel the device is switched on. By pressing the «function/on» button twice in normal operation the device is switched off.

**The black cover cap (1) on the modulator system must be removed before measuring!**

If the «function/on» button is not pressed for about 3.5 min, the device switches off to save power and to prevent discharge of the accumulator.

### Hold

The device has a hold function to freeze the current measuring value. By pressing the «function/on» one time the value measured at that time remains in the display. The upper line shows „Hold“ and in the bottom line the result is displayed. By pressing the «function/on» button again the hold function is switched off and the current result is displayed.

## Measurement ranges

After switching the device on the distance selected is at 2cm. If you want to measure with that distance<sup>5</sup> you just have to place the device 2cm in front of the object to be measured. For most cases this distance is ideal because charges up to 20kV can be measured (see specifications). Also there are cases in which the measuring distance should be changed. In case of very high charges or very rough surfaces the distance should be increased. In case of very low charges the smallest distance (1cm) should be selected.

When the instrument switches off in the E-Field Meter Mode, it switches on in this Modus with the last selected Range.

## E-Field Meter Measurement

The unit can display the E-Field strength directly. By “change distance” (see downsize) select the E-Field Meter Mode. In this Mode it’s possible to select the following ranges  $\pm 20\text{KV/m}$ ,  $\pm 200\text{kV/m}$  or  $\pm 1\text{MV/m}$ . To change the ranges press the «function/on» key briefly. The range changes as follows:



In this Mode there is no automatic range change. That’s why the analogue interface  $\pm 1\text{V}$  is now active.

## Max. Value

The unit display in the “Max. Value” Mode is in the upper row with the maximum positive (right) and negative (left) Value. The “Hold” Function is in this case out of order. By briefly pressing the «function/on» key the maximum values will be errased and this function will start again.

With a mounted voltage measuring head MK 023 you can do a walking test !

By measuring an area, you can see the maximum pos. and neg. Charge on that.

By alternating fields (> 200ms) you can also see the maximums.

## Max. Value

To measure the discharge time of an ionizer you need the Charge Plate Set CPS 022.

For further information read the CPS 022 manual.

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<sup>5</sup> According to the spacers

### Changing the measurement distance

Press «function/on» until the lower line shows „change distance“ (approx. 2 sec). In the upper line the current distance is shown in cm. By pressing «function/on» the distance can be changed in the following order:



To select the displayed value wait (without pressing «function/on») until the current measurement value is displayed in the bottom line. In the upper line the new distance is displayed. Continue measuring using the new distance. The distance is measured from the plate behind the modulator blade. The plate is located 6.4mm in front of the devices front plane.

*\*After switching the device off and then back on the standard 2cm distance is always selected*

\* Not when "E-Field Mode" is selected

The electrostatic field meter measures the direct voltage field strength. Over the selected distance the field strength is converted to the charge on the object:

$$\text{displayed value [V]} = \text{field strength [V/m]} \times \text{distance [m]}$$

Example:

With a distance of 10cm and a displayed value of 1000V the field strength is:

$$E = 1.000V / 0,1m = 10.000 V/m$$

### Spacers

The shipment includes 2 spacers for the measurement distance 2cm. Those can be screwed in the front plate.

### Measurement with mounted voltage measuring head MK 023

With the mounted measuring head you get a Volt Meter up to 4kV with an

**Input impedance > 10<sup>15</sup> Ohm.**

The measure head must be mounted on the front of the modulator system. First remove the black spacers, then screw the metal spacers in. On top of this, screw in the measure head.

Select at the instrument by "change cm" the 1cm distance. Now the correct measure voltage is shown in the display.

**Important !** The maximum measuring voltage is ±4kV !

By higher voltage you get a flash in the head Mk023 because of the dimension.



## Display

The display is a double-spaced alphanumeric LCD display with 12 digits in each row (2 x 12). In the upper line the selected distance is displayed in cm. In the bottom line the measured charge is displayed in Volt. From 999V on the display changes to kV display. The displayed value is always triple-digit:

Examples:



If „overflow! “ is displayed, the distance has to be increased.

## Battery Monitoring

The device has permanent battery voltage monitoring. By undercutting a battery voltage of 7.6V the upper line displays: „Low Battery!“. In that case the 9V battery has to be charged or renewed. By undercutting 7.1V the display shows “auto off” for about 2s and the device powers off to prevent further damage.

### Attention:

Use only Rechargeable 9V – NiMH Batteries or Alkaline Batteries!

Batteries must be charged out of the device in a suitable battery charger. Please pay attention to the manufacturers instructions! Used batteries can be returned to us or must be disposed of professionally.

## 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.

## 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.

## Zero Point

Under normal circumstances a zero point adjustment is not necessary. If the device does not show  $U=000V$  while the modulator system is screened (e.g. mounted cover cap) the zero point can be adjusted using the trimmer (6) on the right side of the device. The last digit of the display may be ignored as that error is smaller than the admissible tolerance.

## Guarantee Items

We provide a 24 month guarantee in the 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.

## Battery Replacement

When „Low Battery“ appears in the display the 9V battery must be charged (NiMH battery) or renewed (alkaline). For this, the device must be turned, and the battery compartment must be opened by sliding down. The battery must be taken out and the battery clip pulled off. The clip needs to be plugged to the new battery and put back with the battery into the device. Finally, the battery compartment should be closed again.

## Waste disposal

**Batteries and accumulators are not allowed in the household waste!**

Every consumer must by law, dispose of all batteries and accumulators at a municipal or commercial collection center, free of charge. Thereby, the disposal will be environmentally friendly.

Batteries and accumulators are marked with the following symbol:



This crossed out garbage bin means that you may not dispose of batteries and accumulators in the household waste. Under this sign you may also find sometimes, in addition, the following abbreviations related to the materials contents:  
Pb = lead, Cd = cadmium and Hg = mercury.

**Electrical and electronic equipment are not allowed in the household waste!**

When the equipment is not used anymore, every consumer must by law, separate the equipment from the household waste and bring it to a municipal collection center. Old electrical equipment is accepted there free of charge. This will ensure that the old equipment is handled by experts and it will avoid negative impact on the environment. Electrical equipment is marked with the following symbol:



The black bar under the crossed out garbage bin indicates that the equipment was put into circulation after August 13, 2005.

### Scope of Delivery (only EFM 022 ZBS)

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

- ESD transport case with conductive foam interior
- Electrostatic field meter
- 2× 9V NiMH accumulators
- Plug-in charger
- Grounding spiral cable with alligator clip
- Manual on a USB - card
- Certificate of calibration

### Optionally accessories :



#### CPS 022 Charge Plate Set

To test air ionization systems by measuring the discharge time

#### EFM 023 It has the same function as the EFM 022 with an additional

analogue interface  $\pm 1V$

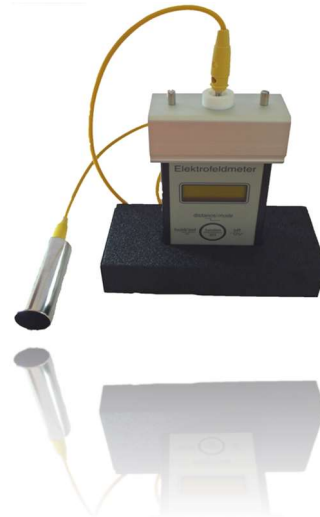
It is possible to upgrade an EFM 022 to an EFM 023 !

Together with our USB – Analogue/Digital Converter UAC 110 you can connect the instrument to a personal computer to save, change and display the results.



#### UAC 110 A/D – Converter with Input range $\pm 1V$

Inclusive connection cable and Software KL\_ReadOut



### **MK 023** -measuring head-

up to  $\pm 4\text{kV}$

Head to measure DC-Voltage with an  
Input impedance from  $10^{16}$  Ohm

**VMS 022** – Volt Meter Set-  
with MK 023, hand electrode  
and silicon cable  
to do a walking test

### **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  $> 1\text{Hz}$ !

### **Calibration**

A check of the measurement values is recommended annually.