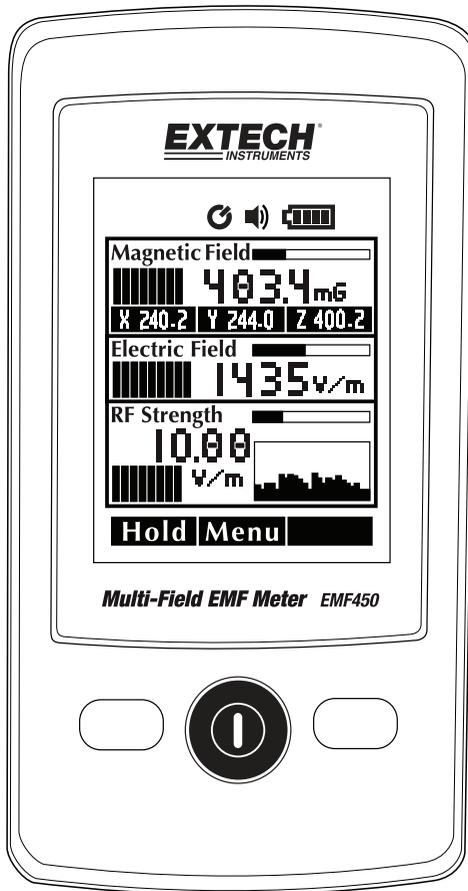


# Multi-Field EMF Meter

Model EMF450



# Safety Information

---



## CAUTIONS

- Before making a measurement, check if the low battery symbol  is shown on the display when the meter is switched on. Replace the battery if the symbol is displayed.
- In the case of prolonged storage, remove the battery from the meter to prevent damage.
- Do not expose this device to direct sunlight or to extreme temperatures and humidity.
- The accuracy and function of the meter may be adversely affected if the specified limits are exceeded or if the meter is handled improperly.
- Clean the device with a soft, dry cloth. Moisture can damage the meter.
- Electric field measurement precautions: Perform tests according to the indicated directions.



## WARNINGS

- Use caution when working in the vicinity of powerful radiation sources.
- Persons with electronic implants (e.g. cardiac pacemakers) should avoid powerful radiation sources.
- Observe all relevant safety regulations.
- Carefully read the operating instructions for equipment generating or conducting electromagnetic energy that will be measured.
- Do not operate near combustible gases or in damp environments.
- Be aware that the field strength in the near vicinity of radiators increases proportionally to the inverse cube of the distance. This means that enormous field strengths can result in the immediate vicinity of small radiation sources (e.g. leaks in waveguides or inductive ovens).
- Field strength measurement devices can underrate pulsed signals, particularly with radar signals, in which case significant measurement errors can result.
- All field strength measuring devices have a limited specified frequency range. Fields with spectral components outside of this frequency range are generally incorrectly evaluated and tend to be underrated. Before using field strength measuring devices be certain that all field components to be measured lie in the specified frequency range of the measuring device.
- For indoor use; Pollution level II
- Operating altitude below 2000' (6562')

# Introduction

---

This meter simultaneously measures and displays Magnetic Field, Electric Field, and RF Strength. The unit of measurement and the measurement types are expressed in units of electrical and magnetic field strength and power density. This meter is ideal for EMF measurements of power lines, electrical appliances, industrial devices, cell phones, base stations, and microwave leakage. This device is shipped fully tested and calibrated and, with proper use, will provide years of reliable service. Please visit our website ([www.extech.com](http://www.extech.com)) to check for the latest version of this User Guide, Product Updates, Product Registration, and Customer Support.

## Features

- Data hold (HOLD)
- Overload display “OL”.
- Brightness options: low-medium-high
- Selectable Auto Power off (APO) Time: 1; 3; 5; 10; 15; 30 minutes
- Key press Sounds / Alarm Sounds: On ; Off  with programmable tone selections
- Information screen shows software version
- Languages: English, Traditional Chinese, Simplified Chinese, Japanese, Spanish
- Magnetic units selection : Gauss (mG) or Tesla ( $\mu\text{T}$ )
- Electric field strength: V/m
- RF Strength Units selection: ( $\mu\text{W}/\text{m}^2 \sim \text{mW}/\text{m}^2$ ) ( $\mu\text{W}/\text{cm}^2$ ) (m V/m  $\sim$  V/m) (mA/m) (dBm).
- Low-Frequency EMF Readings: Individual and aggregated XYZ axial readings: 
- High-frequency EMF Readings
- RF Historical Records; up to 20 groups.
- Low battery indication : HIGH  LOW 
- External USB Power Supply: ”  ”

## Definitions

- **Electromagnetic Radiation**

This meter is used to indicate radiated electromagnetic fields wherever there is a voltage, current, electric (E) or magnetic (H) field. Examples include the electromagnetic fields from radio broadcasting, TV transmitters and power lines.

- **Electric Field Strength**

This is a field vector quantity that represents the force (F) on an infinitesimal unit positive test charge (q) at a point divided by that charge. Electric field strength is expressed in units of volts per meter (V/m). Use the units of electric field strength for measurements in near-field power measurements.

- **Magnetic field strength (H)**

This is a field vector that is equal to the magnetic flux density divided by the permeability of the medium. Magnetic field strength is expressed in units of amperes per meter (A/m). This measurement is for near-field power measurements.

- **Power density (S)**

Power per unit area in the direction of propagation; usually expressed in units of watts per square meter (W/m<sup>2</sup>) or, for convenience, milli-watts per square centimeter (mW/cm<sup>2</sup>).

- **The characteristic of electromagnetic fields**

Electromagnetic fields propagate as waves and travel at the speed of light (c). The wavelength is proportional to the frequency.

$$\lambda \text{ (wavelength)} = \frac{c \text{ (speed of light)}}{f \text{ (frequency)}}$$

Near-field is assumed if the distance to the field source is less than three wavelengths. For far-fields, the distance is more than three wavelengths. In the near-field, the ratio of electric field strength (E) and magnetic field strength (H) is not constant, so measure each separately. In the far-field, however, it is enough to measure one field quantity, and compute the other accordingly.

## Descriptions

### Front Panel Description

1. 2.4" Color TFT display (240\*320 resolution)
2. Select and Down button
3. Power and Menu button
4. Mini USB interface jack
5. Hold and Enter button
6. Battery compartment cover and measurement chart on back of meter

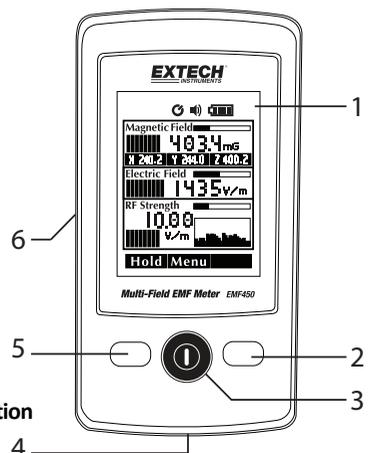


Figure 1 – Meter Description

## Display description

1. Data Hold
2. Auto power off (APO)
3. Audible alert
4. Battery status
5. USB power
6. Magnetic Field bargraph
7. Magnetic Field digital reading
8. XYZ axes values
9. Electric Field bargraph
10. Electrical Field digital reading
11. RF strength bargraph
12. RF strength histogram display
13. Select
14. Menu
15. Hold / Enter
16. RF electronic field color alert\*
17. RF strength digital reading
18. RF Strength indication area
19. LF Electrical field color alert\*
20. Electrical field indication area
21. LF electromagnetic field color alert\*
22. Magnetic field indication area

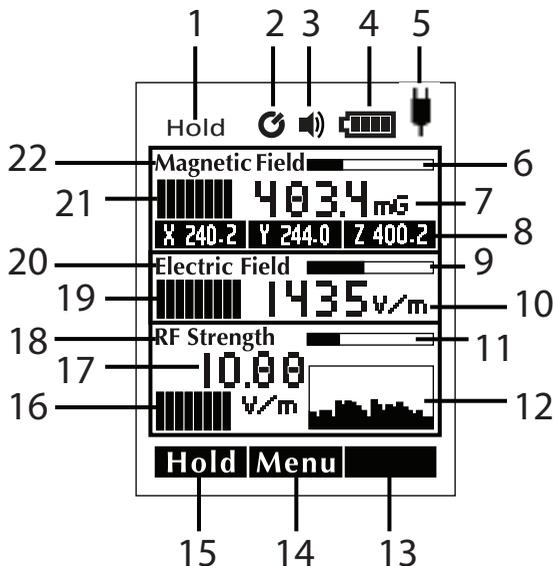


Figure 2 – Display Description

\***Color Coded Alert Table** (for reference purpose only) see items 16, 19, and 21 above.

	Magnetic Fields	Electrical Fields	RF Strength
<b>Low</b>	0~10.00mG	0~500V/m	0~0.99W/m <sup>2</sup> (0.59V/m)
<b>Medium</b>	10.01~100mG	501~1000V/m	1~9.99 W/m <sup>2</sup> (1.9V/m)
<b>High</b>	101~2000mG	>1001V/m	>10 W/m <sup>2</sup> (>2V/m)

Note: Alarm beeper sounds when readings enter the red region.

### Conversions

1W/m<sup>2</sup> = 0.1mW/Cm<sup>2</sup> = 100μW/Cm<sup>2</sup>.    1mW/m<sup>2</sup> = 0.1μW/Cm<sup>2</sup>

# Operation

## Power ON/OFF

1. Press the power button to power the meter. The display will show the main measurement screen. If the meter does not power on, check that the batteries are installed correctly and are fresh (see battery installation/replacement section later in this guide). The EM450 can also be powered from a USB port.
2. Press and hold the Power button for 3 seconds to power off the meter.

## External USB power supply

An  icon is displayed when an external USB power supply is connected to the meter's USB jack on the bottom of the meter. Voltage specification is 4.7~5.2VDC with current greater than or equal to 500mA. USB cables should not reach over the top rim of the buttons during testing since the EMF450 will recognize this cable as an antenna causing the readings to be inaccurate.

## Data hold (HOLD)

Press the HOLD button to freeze the current readings on the display. The HOLD display icon will appear when this mode is active. To release the data press the HOLD button again.

## Electric Field Measurements

The EM450 measures the electric field (Electrical Power) in the atmosphere of the sensor's surroundings. The sensor orientation is printed on the back of the meter.

Perform all tests according to the indicated direction of the electric field sensor.  
Hold the meter at the bottom and at arm's length, as shown in Figure 3.

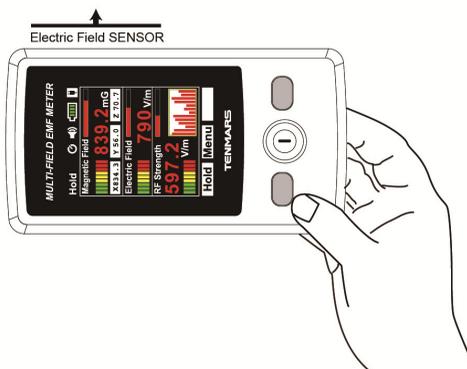


Figure 3 – Orienting the meter for Electrical Field Measurements

## Low Frequency EMF Readings (Magnetic field)

Point the front section of the meter toward the desired electromagnetic field to take a measurement. The meter simultaneously displays the electromagnetic field readings of individual (XYZ) and the aggregated Magnetic field readings.

$$B = \sqrt{B_x^2 + B_y^2 + B_z^2}$$

The aggregated calculation equation is expressed as:

Due to environment related magnetic field factors, this electromagnetic field (EMF) meter may display a reading of under 0.50mG prior to testing. This is caused by the magnetic noise in the environment, rather than meter failure.

The Magnetic and Electric field will also display a warning indicator (Good/Normal/Warning).

**Important:** If the sensor is moved quickly, excessive field strength values will be displayed which do not reflect the actual field conditions. This effect is caused by electrostatic charges.

### Measurement considerations:

1. Hold the meter at arm's length.
2. Point the front face of the meter toward the source of power.
3. Hold the meter steady during the measurement.
4. Make several measurements at various locations in the work place or other areas of interest. This is particularly important if the field conditions are unknown.
5. Pay special attention to measuring the neighboring vicinity for possible radiation sources. Apart from active sources, those components connected to a source may also act as radiators.

For example, the cables used in diathermy equipment may also radiate electromagnetic energy.

Note that metallic objects within the field may locally concentrate or amplify the field from a distant source.

## RF strength meter readings

Point the front face of the meter toward the desired RF field to take a measurement.

The RF signal strength will be displayed with the units of measure set from the menu mode.

The RF strength portion of the display will also show a RF strength history histogram and a warning indicator (Good/Normal/Warning) based on the measured value.

### Measurement considerations:

1. Hold the meter at arm's length.
2. Point the front face of the meter toward the source of power.
3. Hold the meter steady during the measurement.

## Menu Settings

1. Momentarily, press the center MENU key to enter the main menu.
2. Press the right SELECT key to cycle through the list.
3. Press the left ENTER key to enter the selected option.
4. Use the right SELECT key to choose the desired setting.
5. Press the left ENTER key to confirm the setting, the meter will exit the menu unless there are more settings required for the given parameter (as in the SOUND setting); in which case continue using the keys in the same manner as described in this section.
6. From the Main Menu screen (Figure 4), the MENU key can be used to exit the Main Menu.



Figure 4 – Main Menu Option Screen

<b>Brightness:</b>	Low, Middle, High
<b>Magnetic unit:</b>	Gauss/mG, Tesla/ $\mu$ T (Used for testing Electrical power (50/60Hz))
<b>RF strength unit:</b>	$\mu$ W/m <sup>2</sup> -mW/m <sup>2</sup> , $\mu$ W/cm <sup>2</sup> , mV/m-V/m, mA/m, and dBm (Used for testing RF energy from 50MHz to 3.5GHz)
<b>Language:</b>	English, Traditional Chinese, Simplified Chinese, Japanese, Spanish
<b>Power OFF (Auto):</b>	NO (OFF), 1, 3, 5, 10, 15, 30 (minutes). Factory default is 5 minutes.
<b>Sound:</b>	Enable/Disable when 'enable' is selected, the keys/alarm sound menu will open.
<b>Keys:</b>	3 options (1, 2, or 3) represent alternate keystroke sounds.
<b>Alarm:</b>	3 options (1, 2, or 3) represent alternate alarm sounds.
<b>Information:</b>	Displays the software version

# Battery Installation and Replacement

---

## Battery Installation

Remove the rear battery cover and insert three (3) 1.5V AAA batteries observing correct polarity.

Figure 5 Battery Installation



## Battery Replacement

The battery status icon shows low energy  when the battery voltage drops below the operating level. See installation instructions above for battery insertion.



Never dispose of used batteries or rechargeable batteries in household waste. As consumers, users are legally required to take used batteries to appropriate collection sites, the retail store where the batteries were purchased, or wherever batteries are sold.

**Disposal:** Do not dispose of this instrument in household waste. The user is obligated to take end-of-life devices to a designated collection point for the disposal of electrical and electronic equipment.

### Other Battery Safety Reminders

- Never dispose of batteries in a fire. Batteries may explode or leak.
- Never mix battery types. Always install new batteries of the same type.

## Specifications

---

### Sensor Type: LF - Magnetic Fields

Range:	20mG /200mG /2000mG, 2 $\mu$ T /20 $\mu$ T /200 $\mu$ T
Display resolution:	0.02/0.1/1
Frequency range:	50/60Hz
Accuracy:	$\pm$ (15% + 100 digits)

### Sensor Type: LF- Electric Field Sensor

Range:	50V/m to 2000V/m
Display resolution:	1V/m
Frequency range:	50/60Hz
Accuracy:	$\pm$ (7% + 50 digits)

### Sensor Type: RF Strength

Range:	0.02 $\mu$ W/m <sup>2</sup> to 554.6mW/m <sup>2</sup> 0.02 $\mu$ W/cm <sup>2</sup> to 55.4 $\mu$ W/cm <sup>2</sup> 36.1mV/m to 14.46V/m 0.02mA/m to 38.35mA/m -51dB to 16dBm
Display resolution:	0.02 $\mu$ W/m <sup>2</sup> , 0.2 $\mu$ A/m, 0.2mV/m, 0.002 $\mu$ W/cm <sup>2</sup> , 2dB
Frequency range:	50MHz to 3.5GHz
Accuracy:	$\pm$ 2dB at 2.45GHz

---

Display:	4 digits Triple color TFT display
Sample rate:	6 seconds
Sensors:	Triple axes (XYZ) RF and ELF and Electric field sensor
Over range condition:	The EM450 is equipped with three individual aerial sensors to measure EMF. Overload indication (OL) applies to all three axes (X, Y, and Z)
Battery:	Three (3) 1.5V alkaline batteries
Battery Life:	Approx. 8 hours
Alarm:	Beeps when readings are in the red display region
Operating temperature and RH%:	5°C~40°C (41°F ~104°F); < 80%RH
Storage temperature and RH%:	-10°C to 60°C (14°F ~140°F); < 70%RH
Weight:	Approx. 120g (4.2 oz.)
Dimensions:	115 x 60 x 21mm (4.5 x 2.4 x 0.08")

**Copyright © 2015 FLIR Systems, Inc.**

All rights reserved including the right of reproduction in whole or in part in any form

**www.extech.com**