TESCO METERING

OPERATIONS MANUAL

# RF METER

## CATALOG NO. 1120

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THE EASTERN SPECIALTY COMPANY



**Revision: 1.0**

**TESCO – The Eastern Specialty Company**

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# LIMITED WARRANTY & LIMITATION OF LIABILITY

**TESCO** warrants to the original purchaser that it will correct all defects in material and/or workmanship in the Instrument, test equipment or software covered by this warranty (herein called **"PRODUCT"**), provided that TESCO is notified of such defect within the warranty period (set forth below) in accordance with paragraph four of this Warranty.

**WARRANTY PERIOD.** The warranty period shall begin on the date of shipment of the PRODUCT or the date of the issuance of this warranty certificate, whichever is later. If no warranty period is specified below and signed by an authorized DISTRIBUTOR of TESCO, the Warranty Period shall be one (1) year. In no event shall this Warranty remain in effect for more than the stated Warranty Period plus two (2) months after the date of shipment. TESCO's sole obligation and the purchaser's sole remedy under this Warranty is limited to repair or replacement, at TESCO's option, free of charge, F.O.B. TESCO's factory at Bristol, PA of any workmanship and/or part which in TESCO's sole judgment displays evidence of defect. On-site Warranty repairs will be made when in TESCO's judgment the PRODUCT cannot practically be shipped to TESCO's factory. Any modifications, additions or upgrades made to the PRODUCT or control software after this warranty becomes effective shall not extend the term of this warranty.

**COVERAGE.** The warranty set forth above shall be applicable only if the PRODUCT:

1. Is used for the specific purpose for which it was intended;
2. Is operated in accordance with instructions, if any, supplied by TESCO;
3. Has not been modified, neglected, altered, tampered with, vandalized, abused or misused, or subjected to accident, fire, flood or other casualties;
4. Has not been repaired by unauthorized persons;
5. Has not had its serial number altered, defaced or removed;
6. Has not been connected, installed or adjusted other than in accordance with the instructions, if any, furnished by TESCO.

The warranty set forth herein DOES NOT APPLY to defects resulting from ordinary wear, tear and usage, or any cause, similar or dissimilar, not resulting solely from defective material and/or workmanship.

The Warranty set forth herein shall NOT be effective unless:

1. Notice of defect is given to TESCO by phone, fax, email or mail as soon as the defect is discovered.
2. Notice of defect contains the following information: PRODUCT serial number, PRODUCT model number, date of original installation, and an accurate and complete description of the defect including the exact circumstances leading to the defect.
3. The defective PRODUCT or part is returned only upon authorization from TESCO as evidenced by the issuing of a Return Merchandise Authorization (RMA) number, and that the transportation charges are prepaid (except that TESCO may, at its option, appoint a qualified DISTRIBUTOR to make field inspections of the PRODUCT for which purpose the purchaser shall permit such DISTRIBUTOR to enter upon its premises and examine the PRODUCT).
4. The Return Merchandise Authorization (RMA) number is written on the shipping label and all paperwork defective PRODUCT or part.
5. The defective PRODUCT or part is returned in the original packing or packing approved by TESCO

TESCO is not responsible for drayage charges, damages or labor costs incurred in conjunction with failure, removal or reinstallation of any PRODUCT, all of which shall be at the purchaser's expense. TESCO is not responsible for special, incidental or consequential damages, whether resulting from breach of warranty, negligence or any other reason.

TESCO manufactured parts will be available for a minimum period of at least two years after the manufacture of a PRODUCT has been discontinued.

TESCO will provide original purchaser during the Warranty Period, unlimited telephone consulting time for the purpose of PRODUCT trouble shooting/servicing and for the first thirty (30) days of the Warranty Period, unlimited telephone consulting time for the purpose of PRODUCT/software application.

**THE WARRANTY CONTAINED HEREIN IS IN LIEU OF ALL OTHER WARRANTIES AND TESCO MAKES NO OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, WARRANTIES OR CONDITION, DESIGN, MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR ANY OTHER MATTER.**

No other Warranty, express or implied, is authorized by TESCO, and no DISTRIBUTOR of TESCO or any other person has any authority to amend, extend, modify, enlarge or otherwise alter the foregoing warranty and disclaimers in any way whatsoever, except as provided for in an Extended Limited PRODUCT Warranty Agreement.

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# 1.1 Introduction

The TESCO RF Meter combines all the features needed for fast, accurate measurements of electromagnetic fields. This instrument was designed to measure RF, but also could measure electric and magnetic fields.

The RF (Radio/Microwave) setting can detect up to three billion Hz (3 GHz), which lets you gauge radio-wave power, cellular phone equipment, microwave and many types of RF emitting household and industrial equipment. The RF setting detects vertical electric fields parallel to the long axis of the meter. The range of the meter is 10V/m to 1 KV/m (0.026 $mW/cm^2$ to 260 $mW/cm^2$ ) and is frequency-flat from 100 KHz to 2.5 GHz. Accuracy is +/-30%. The RF Meter's primary use is to detect ON-AIR status of transmitters (or to detect concealed transmitters), to check AMI meters, microwave ovens or other microwave equipment for leakage, and to look for RFI sources.

The Radio/Microwave section has a small L-shaped antenna in the front. The signal is amplified and converted to a power density magnitude, calibrated at typical home microwave oven frequency (2 GHz). The RF Meter reads 0 to 1 milliwatt/square centimeter. The resolution at the bottom of the range is 0.01 $mW/cm^2$. A radio wave strength of 0.01 $mW/cm^2$ has 0.006 KV/m and 0.2 milligauss, respectively, of electric and magnetic field (RMS averaged), while a strength of 1 $mW/cm^2$ corresponds to 0.06 KV/m and 2 milligauss. Typical accuracy is within a factor of two. Variations may be caused by reflections off the user's hand and body.

# 1.2 Contacting TESCO

To contact TESCO, call one of the following telephone numbers:

- Technical Support: 215.785.2338
- Calibration/Repair: 215.785.2338

Visit our website at www.tescometering.com or send an email to info@tescometering.com.

To view, print, or download the latest manual supplement, visit www.tescometering.com.

## 1.3 Product Features

- **Fast** and **accurate** measurements
- Measures **RF** and **electric** & **magnetic** fields
- Detects **ON-AIR status** of transmitters (or to detect concealed transmitters)
- Checks AMI meters, microwave ovens or other microwave equipment for leakage
- Looks for **RFI sources**

## 1.4 Specifications

| PARAMETER | | DATA |
|---|---|---|
| **FREQUENCY RANGE** | | 50 MHz - 3000 MHz (3 GHz) |
| **RANGE RESOLUTION** | | 1 $mW/cm^2$ / 0.01 $mW/cm^2$ |
| **ACCURACY** | | 0.5x to 2x of reading |
| **SETTINGS** | **A** | Magnetic Field (0 - 100 milligauss range) |
| | **B** | Magnetic Field (0 - 3 milligauss range) |
| | **C** | Electric Field |
| | **RF** | Radio/microwave ($mW/cm^2$ ) |
| **DIMENSIONS** | **Height** | 5.0 in (129 mm) |
| | **Width** | 2.6 in (67 mm) |
| | **Depth** | 2.4 in (62 mm) |
| **WEIGHT** | | 0.5 lbs (0.226 kg) |
| **BATTERY** | | 9 Volt alkaline (40 hour life) / Low Battery indicator |

## 1.5 Taking Readings


***Figure 1.*** *Proper handling of the device*

Hold the meter as shown (see Figure 1). Do not cover the top of the meter. This prevents your hand from shielding electric fields or microwaves. Normally, the indoor RADIO/MICROWAVE (RF) reading should be near zero in most parts of a home or office and will most certainly be zero if you cup your hand in front of the antenna or place the meter in a metal box.

# 1.6 Measurement Settings

This section introduces the different settings available for measuring the magnetic field, electric field, RF, and high radio/microwave power sources.

## 1.6.1 Magnetic Field

| PARAMETER | VALUE |
|---|---|
| **Maximum range** | 100.0 mG |
| **Resolution** | 0.1 mG |
| **Accuracy** | ±4% |
| **Frequency** | 50 Hz and 60 Hz |

To access different settings, do the following:

**A. Standard (B-S)**

For standard technical magnetic field measurement, turn the knob to the B-S setting.

**B. Weighted (B-W)**

To measure the 60 HZ-equivalent effect of a magnetic field on the human body, turn the knob to the B-W setting and hold the meter at whatever location you want to measure.

## 1.6.2 Electric Field

| PARAMETER | VALUE |
|---|---|
| **Maximum range** | 1000 V/m |
| **Resolution** | 1 V/m |
| **Accuracy** | ±5% |
| **Frequency** | 50 Hz and 60 Hz |

To access different settings, do the following:

**A. Standard (E-S)**

For standard technical electric field measurement, turn the knob to the E-S setting.

**B. Weighted (E-W)**

To measure the effect of an electric field on the human body, turn the knob to the E-W setting and hold the meter at the location to be measured.

Your body can easily shield electric fields; the reading is lower if you cover the top surface of the meter with your hand. Also, the presence of your hand at the back of the meter compresses the electric field, making it read somewhat higher than if the meter were suspended from a string or held on a board, away from you. In either case, the true electric field near the meter will be displayed.

The AC Electric Mode uses a metal plate sensor under the top of the meter. Circuitry similar to the magnetic section converts the signals into an electric field strength.

## 1.6.3 Standard Mode and Weighted Mode

The **standard modes** for AC magnetic fields (B-S) and AC electric fields (E-S) will measure fields using a flat frequency response. That is, all frequencies from 40 Hz to 100 kHz (100,000 Hz) are measured with equal sensitivity.

The **weighted modes** for magnetic (B-S) and electric (E-S) fields measure 60 Hz fields with the same sensitivity as the Standard mode. However, weighted modes are more sensitive at frequencies higher than 60 Hz, and from 60 Hz to 500 Hz, sensitivity increases proportional to frequency. That is, 1 milligauss (mG) at 60 Hz will read “1.0” on the display, whereas 1 mG at 120 Hz will read “2.0”.

On Weighted modes, the Field Measurement shows a number proportional to the average electric current induced inside the human body from the fields, and the number is equivalent to the amount of 60 Hz magnetic or electric field that would be required to induce that much current. However, biological reactions generally occur at speeds that are slower than 1000 Hz, so on Weighted modes, the meter is designed to become less and less sensitive at frequencies above 1000 Hz.

## 1.6.4 RF Setting (Radio/Microwave)

| PARAMETER | VALUE |
|---|---|
| **Maximum range** | 12.999 $mW/m^2$ |
| **Resolution** | 0.001 $mW/m^2$ |
| **Accuracy** | ±20% |
| **Frequency** | 1 GHz |

To measure an RF field, turn the knob to the RF setting and point the top of the meter at the potential source, or simply hold the meter vertically (see Figure 1).

Generally, your hand can shield the RF signals, so grip the meter as shown in Figure 1. The RF Mode uses the same plate sensor as the AC Electric Mode. The signal is amplified and converted to a power density magnitude, calibrated at a frequency of 1 GHz (1000 MHz).

When reading RF emitted by digital devices, such as mobile phones and smart meters, the **Peak Measurement** (small numerals in the upper-left of the display) is of more interest than the **Field Measurement** (large numerals at the bottom). The information from the digital RF devices is transmitted in brief packets that occur irregularly (perhaps once per minute with smart meters and several times per second with Wi-Fi transmitters or mobile phones that are in use). The Peak Measurement detects these packets and displays the strongest packet for several seconds before resetting itself.

### 1.6.5 High Radio/Microwave Power Sources

With the setting switched to "RF" and pointing the RF Meter toward the following sources, you can see how high RF sources compare to AMI meters, reading the bottom scale on the display.

Strong sources include:

- Cordless phones, CB, or amateur radio transmitter
- Microwave ovens near door seal. A reading of more than 0.2 $mW/cm^2$ at a distance of six feet suggests a leaking microwave door seal (which should be repaired)

## 1.7 Calibration

The TESCO RF Meters are shipped calibrated to their specification. Recalibration is not required within 10 years; however, if a recalibration certification compliant with ISO 17025 is required, the meter must be certified at least once a year in order to remain in compliance with that standard. Accuracy of the meters is guaranteed to be within the specifications whether or not a certificate is issued.

## 1.8 Changing Battery

| PARAMETER | | VALUE |
|---|---|---|
| **Capacity** | | 9 V |
| **Type** | | alkaline |
| **Battery life** | **With backlight on** | 12 hours |
| | **With backlight off** | 20 hours |

To change the battery:

1. Turn the meter to the "OFF" position.
2. Remove the battery cover by sliding it downward.

3. Tap the battery compartment on the palm of your hand so the battery falls out.
4. Replace/Reconnect the new battery and reassemble.
5. Leave the meter OFF while not in use.

## 1.9 Backlight/Audio Indicator

The TESCO RF Meter has both a backlight and an audio indicator. To turn these functions or on or off, simply use the buttons beneath the battery cover. The batter cover can be removed as described in the above section.