

**INSTRUCTION MANUAL**

**NEAR FIELD  
PROBE SET  
BROADBAND RESPONSE  
MODEL EM-6992**



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**BROADBAND RESPONSE**  
**MODEL EM-6992**

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## **WARRANTY**

**This Model EM-6992 Near Field Probe Set is warranted for a period of 12 months (USA only) from date of shipment against defective materials and workmanship. This warranty is limited to the repair or replacement of defective parts and is void if unauthorized repair or modification is attempted. Repairs for damage due to misuse or abnormal operating conditions will be performed at the factory and will be billed at our commercial hourly rates. Our estimate will be provided before the work is started.**

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## **DESCRIPTION AND USE OF ELECTRO-METRICS MODEL EM-6992 NEAR FIELD PROBE SET**

### **1.0 Description**

The EM-6992 Near Field Probe Set is intended to serve as a versatile aid for diagnostic testing of radiated emissions over a broad range of frequencies from below 100 kHz to above 1 GHz. The probe set consists of three (3) magnetic field probes, two (2) electric field probes, 20 cm extension handle, and custom carrying case. In addition, an optional EM-6990 broadband pre-amplifier is also available (Refer to Paragraph 4.0 for Description/Specifications).

The three magnetic field probes are electrically small (i.e. resonant frequency above 1 GHz) loops of varying sensitivities. The loops are wound within a balanced Faraday shield that reduces their response to electric fields to a negligible factor. Each successively larger loop increases sensitivity (independent of frequency) by approximately 12 to 15 dB. Probes of reduced sensitivity may be of assistance in isolating an emission source more precisely.

A ball probe and a stub probe comprise the two electric field probes. Each probe responds primarily to the electric field component and rejects the magnetic field component.

Type BNC (female) connectors are used as the output connector on all the probes plus the probe extension handle.

## ELECTRO-METRICS EM-6992

While the accompanying typical calibration data assumes that the indicating instrument presents a 50-ohm impedance to the probe and connecting cable, this is by no means mandatory. The high impedance of an RF Voltmeter or oscilloscope may be used with the probes.

When making before-and-after measurements to determine the effectiveness of an attempted EMI solution, some care should be used to ensure that the measurements are repeatable. Of chief importance is the distance from the probe to the item under test. Even small changes in this spacing can yield large variations in amplitude. The E-field probes are also susceptible to measurement variations due to capacitive coupling to external objects such as equipment chassis, human bodies, large metal objects, etc. The H-field probes do not exhibit this effect.

The response of the E-field probes is essentially omnidirectional. The response of the H-field probes is a figure-8 response, typical of a dipole. The primary pickup direction is broadside to the loop, with sharp notches in the pickup pattern in the plane of the loop.

### 2.0 Specifications

Model EM-6993: 6 cm Loop, H-field Sensor.

Connector: BNC, female.

Model EM-6994: 3 cm Loop, H-field Sensor.

Connector: BNC, female.

Model EM-6995: 1 cm Loop, H-field Sensor.

Connector: BNC, female.

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Model EM-6996: 3.5 cm Ball, E-field Sensor.

Connector: BNC, female.

Model EM-6997: 0.3 cm Stub, E-field Sensor.

Connector: BNC, female.

### **3.0 Applications**

The probe set is designed for use with many different indicating instruments such as EMI receivers, spectrum analyzers, oscilloscopes. The selected probe is connected to the indicating device using a 50-ohm coaxial cable (Model EM-1107 or equivalent).

Probe choice is determined by the type of signal under observation, signal strength, and the physical size of the area to be investigated. Comparison of the response to both H-field and E-field probes will provide the user with some idea as to the relative magnitude of the E-field and H-field of each component, thus providing a clue toward solving the emission problem.

The larger probes provide increased sensitivity while the smaller probes permit a more precise location of the emission source.

## **4.0 Optional EM-6990 Broadband Preamplifier**

### **4.1 Description EM-6990**

The EM-6990 Broadband Preamplifier is designed primarily for use with the EM-6992 Probe Set in performing EMI diagnostic testing. The EM-6990 provides a significant improvement in overall measurement sensitivity of the typical spectrum analyzer. Small size and internal rechargeable batteries make the unit suitable for both bench and field testing. An external battery charger is used to recharge the internal batteries.

### **4.2 EM-6990 Specifications**

#### **4.2.1 Electrical**

Gain:	25 dB, typical.
Bandwidth (@ -3 dB):	1199.995 MHz.
Frequency Range:	5 kHz-1200 MHz.
Noise Figure:	6 dB.
1 dB Compression Point:	-1 dBm.
Power Source:	4 rechargeable "N" cells. (1.2 VDC nickel cadmium)
Operating Time (approx.):	15 hours between recharging.
Recharge Time:	14-16 hours.
Input/Output Connectors:	BNC, female.



Battery Charger:	2 Options available: 1) 110 VAC, 50/60 Hz 2) 220 VAC, 50/60 Hz
Charge/Power Jack:	Size: Inside Diameter: 2.1 mm Outside Diameter: 5.5 mm.

**NOTE**

The rechargeable nickel cadmium batteries can be replaced by 4 commonly available **NON-RE-CHARGEABLE** Alkaline "N" cells that increase the operating time to approximately 100 hours.

Operating Temperature: -20°C to 60°C.

**4.2.2 Mechanical**

Length:	76 mm (3")
Width:	89 mm (3.5")
Height:	44.5 mm (1.75")
Weight:	230 g (10 ounces)

### 4.3 EM-6990 Operating Instructions

The EM-6990 Preamplifier is normally inserted in line between the probe being used and the receiving device (e.g. spectrum analyzer, oscilloscope, etc). The typical gain of the preamplifier is approximately 25 dB producing a significant increase in the overall sensitivity of the typical spectrum analyzer.

Operation of the Preamplifier is controlled by a slide switch located on the side of the unit next to the external charger jack.

#### **CAUTION**

**The POSITION of the ON/OFF slide switch PROVIDES THE ONLY INDICATION whether the EM-6990 Preamplifier IS OPERATING. To conserve battery life, always turn off the preamplifier when not in use.**

### 4.4 Description EM-6990 Battery Power Supply

The internal battery of the EM-6990 consists of four (4) 150 mA-hour 1.2 VDC nickel cadmium "N" cells. The fully charged batteries will operate the Preamplifier for approximately 15 hours. It will fully recharge after such usage in 14 to 16 hours.

For longer operating times, the nickel cadmium “N” cells can be replaced by 4 commonly available **NON-RECHARGEABLE** Alkaline “N” cells that increase the operating time to approximately 100 hours.

**WARNING**

*DO NOT attempt to RE-CHARGE ALKALINE cells. The cells may rupture and cause severe damage to the amplifier.*

**4.4.1 Charging The Battery**

To recharge the internal batteries, turn off the EM-6990 and connect the external battery charger to the **CHARGER JACK** located on the side of the unit.

**NOTE**

To maximize the recharge rate, the unit should not be operated while connected to the external charger. In addition, operation while connected to the external charger could cause ground loops and noise problems.

Two battery charger options are available:

1) 110 VAC, 50/60 Hz

2) 220 VAC, 50/60 Hz

After the batteries have been recharged, remove the external charger. The unit is now ready for use.

Storage or operation of the nickel cadmium battery cells at or near the upper temperature limit (60°C) will significantly reduce the number of battery charge/discharge cycles.

In addition, operation of nickel cadmium battery cells at low temperatures (<-20°C) will limit their operational life.

#### **4.4.2 Replacing The Battery Cells**

To replace the battery cells:

- a. Turn off the EM-6990.
- b. Remove the eight (8) screws (#0-80 x 3/16 FLAT HD) from the edge of the top cover.
- c. Carefully remove the old cells from the holders.
- d. Replacement cells:

#### **RECHARGEABLE**

NICKEL CADMIUM:

Panasonic P-15N

Radio Shack 23-121

SPC BRN-N

**NON-RECHARGEABLE**

**ALKALINE:**

Radio Shack 23-030  
Eveready E90  
Ray-O-Vac 81C  
Durcell MN 9100

- e. Carefully insert the new cells into the holders, ensuring that the cells are placed with respect to the required polarity.
- f. Check the inserted cells to ensure that no shorting of the battery terminals or wiring has occurred.
- g. Replace the top cover and screws carefully. Ensure that no wires are trapped/pinched between the cover and case.

## 5.0 Typical Calibration Chart H-Field Probes

The calibration chart of Page 11 shows typical antenna calibration data for the three (3) H-Field probes supplied with the EM-6992 Probe Set.

Three typical calibration data plots are shown:

Upper Plot: 1 cm Loop,

Middle Plot: 3 cm Loop,

Lower Plot: 6 cm Loop.

The Y-axis is denoted in  $\text{dB}(\text{Sm}^{-1})$ .

The X-axis is denoted in Frequency (MHz).

$\text{dB}(\text{Sm}^{-1}) = \text{dB above 1 Siemens/meter.}$

Add  $\text{dB}(\text{Sm}^{-1})$  to meter reading in  $\text{dB}(\mu\text{V})$  to obtain dB Siemens.

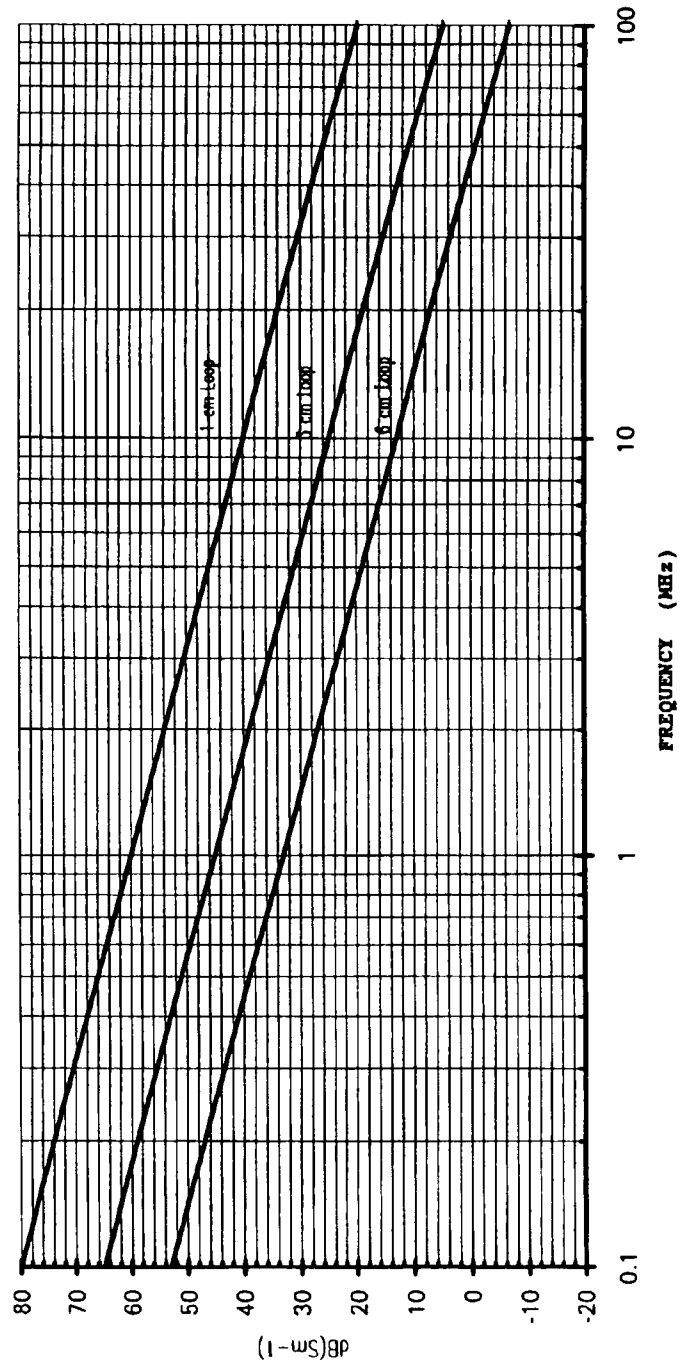
$\text{dB}(\text{Sm}^{-1}) = \text{dB}(\mu\text{A/m}).$

$\text{dB}(\text{Sm}^{-1}) + 51.5 \text{ dB} = \text{dB}(\mu\text{V/m})(\text{Far Field}).$

$\text{dB Siemens} + 2 \text{ dB} = \text{dB}(\text{pT}).$

$\text{dB Siemens} - 158 \text{ dB} = \text{dB gauss.}$

## TYPICAL CALIBRATION H-FIELD PROBES



(EM6992-11)

ELECTRO-METRICS EM-6992

**NOTES**



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