Smart Fieldmeter®

Model RFP-04 HF/CE

Users Manual

Meter S.N.:_____ Probe S.N.:_____

LBA Technology is Your Authorized EMCTD LLC Distributor

Congratulations! You purchased the - Smart Fieldmeter®.
Please, read this manual to get the most benefits from this innovative instrument.

Smart Fieldmeter® - Electromagnetic (EM) field monitor combining the major features of the professional quality field monitoring equipment with convenience and simplicity of the multimeter.

Disclaimer

• Use of **Smart Fieldmeter®** for cell phone comparison is meaningful only for the models operating in the same broadcast standard. Evaluation of the SAR (specific absorption rate) requires special techniques, see www.fcc.gov.

• **Smart Fieldmeter®** is not intended to be the primary piece of safety or medical safety equipment.

• Use of **Smart Fieldmeter®** for medical and safety related applications must be done by qualified personnel only. Manufacturer doesn't assume any responsibilities for the results and their consequences.

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1. Description of Smart Fieldmeter®

1.1 Isotropic E probe sensor

E probe sensor is located in plastic enclosure at the end of the nonmetal handle. This sensor uses 3 dipole antennas positioned normal to each other. Signals from each antenna are combined to allow meter to measure the absolute value of the field regardless of the field direction. Therefore, unit always measures the correct value of the E field strength at any probe orientation.

Probe can be mounted on the meter through SMA male connector mating the SMA female connector at the top of the meter, or it can be attached to the meter with flexible cable. In last case the operator has a freedom of moving the probe while meter is positioned for the best view.

Meter can also be mounted on plastic tripod; the same can be done with probe. This is extremely convenient when probe is used with EM filed generating cell (TEM, GTEM) or transmitting antenna.

Probe handle has black non-slip end designating where operator's hand can be positioned without disturbing the probe reading.

1.2. Display

E field strength is displayed in V/m (Volts per meter) by the numerical display with floating decimal point whose position depends on range setting. Display has 3.5 digits and shows numbers from 0000 to 1999. If over-ranged – display shows "1" which means that next higher field range must be selected. At the highest range 600 V/m maximum display reading is limited by the unit design, and there is no over-range indication.

1.3 Range selector

Rotary range selector has 6 positions. There are 4 measurement ranges labeled 2 V/m, 20 V/m, 200 V/m and 600 V/m. Two positions (between 2 V/m and 20 V/m, and between 20 V/m and 200 V/m) are designated for zeroing function – unit performs instant device calibration when going from one range to another. At these zeroing positions display reads zero indicating correct operation (see Auto-zero function).

1.4 Operating modes

Smart Fieldmeter® has three modes of operation: Average, Pulse and Peak.

Operating Mode	Meter Reading	Response Time
Average	RMS (Root Mean Square)	Tav=2 sec
Pulse	0.707xInstant Value	Tp =100 ms
Peak	0.707xPeak Value	Ts=50 ms, Th=14 sec

Tav – Response time of the instrument in Average mode,
Tp - Response time of the instrument in Pulse mode.
Ts - Sample time of the peak detector.
Th - Hold time of the peak detector.

Average is the primary mode of the meter. It offers "slow" response with response time about 2 sec.

Pulse mode allows monitoring of the fast changing fields to view them on the scope or feeding the external fast data logger for the appropriate storage, analysis, and processing or close loop control. It offers "fast" response with response time about 100 ms.

Peak mode allows operator to identify the amplitude modulated and pulsed signals. It can capture changes of the field amplitudes with sample time about 50 ms. Hold time is much longer – 14 sec.

For amplitude modulated signals with crest factor larger than 3 dB Peak mode readings will be higher alerting operator about signal nature. The reading depends on modulation frequency Fmod. For Fmod>100 Hz Peak and Average reading will coincide.

For sinusoidal fields with steady amplitude crest factor (ratio peak to RMS values) equals to 3 dB (1.41), display readings when switched from Average to Pulse or Peak modes will be the same.

Display refresh rate is 2 times per second, so fast-changing fields can be monitored only through remote monitor output. For slow varying fields with time constants much greater than 0.5 s. display readings and remote monitor output readings are numerically the same (decimal point, though, depends on the range setting).

1.5 Auto-zero function

Smart Fieldmeter® incorporates a unique auto-zero function that eliminates the errors caused by temperature variations and components aging. It is being done automatically during normal usage even in the presence of the strong EM fields.

Auto zero function has two modes of activation:
1 - Every time when unit is turned on (at any range).
2 - Every time when range selector gets by zeroing position
(there are two zeroing positions of the range selector, see 1.3).

LED "Ready" light provides visual indication of auto-zero function by going off for 2 sec. when display reads zero and restoring normal operation after "Ready" light turns on again.

1.6 Low battery indicator

When power switch is turned on, LED "Ready" light turns on indicating that device is ready for use. When 9V battery voltage goes below 7.2V (deep discharge) LED light goes permanently off indicating that battery needs replacement. Instrument keeps the accuracy at any battery voltage till LED light is on.

1.7 Remote monitor

Remote monitor output allows data be taken with the external DC voltmeter. When DC voltmeter with 200-400 mV range is used (1 MEG impedance) – reading of the display and external voltmeter coincide (except decimal point). Therefore remote monitor output allows direct proportional reading according to the following table:

Range	Remote monitor output voltage	Display reading
2 V/m	200 mV (3 V/m - 300 mV)	2 V/m
20 V/m	200 mV (30 V/m - 300 mV)	20 V/m
200 V/m	200 mV (300 V/m – 300 mV)	200 V/m
600 V/m	60 mV*	600 V/m*

* Exact maximum field displayed by the unit is specified for each one individually.

Unit is supplied with remote monitor cable having 3.5mm stereo plug at one end and standard dual banana plug at another. Cable has special design providing EM decoupling between Smart Fieldmeter® and external DC voltmeter reducing the measurement errors.

Remote monitor output must be used with battery-operated multimeter or differential probes (for scopes or data loggers).
In no case there should be load between the remote monitor output and instrument case (this will affect the readings).

Devices that can be connected to the remote monitor output:
- DMM (multimeter) with battery power (floating).
- Optically isolated DMM and data acquisition cards.
- Differential voltage probes.

Optically isolated devices are the best to use in case of data logging into PC.
Unit can be supplied with appropriate DMM with IR isolated RS232 output (optional).

1.8 Tripod Mounting

There is a standard ¼"-20 nut located at the back of the unit for tripod mounting. This gives the user multiple possibilities to position meter with different E probe sensor orientation or to hold it in hand at a distance to reduce measurement errors caused by the EM effects of operator body.

Unit is supplied with nonmetallic portable tripod, which can perform all these functions. The simplest way to put meter on tripod – first, arrange the tripod for a desired position, secure the lock, and then attach the unit and tighten ¼"-20 screw. If meter body interferes with screw knob, rotate the unit by 90 degrees to allow knob free rotation.

Probe also can be mounted on tripod for remote field monitoring. To install probe on tripod use the nylon clip supplied with unit. Remove the stock black screw from the tripod, install the supplied thumbwheel screw and secure the probe in clip with nut.

In order to get an accurate field strength reading – keep all conductive parts (including cables, meter itself, operator hands, etc.) away from the probe.

2. Handling and Maintenance

In spite of the rugged design this instrument requires gentle and responsible handling. Please, use the following practices when using this instrument:

- **Use only when probe and meter are completely dry.**

- Do not immerse into water, neither leave under the rain or snow uncovered. If wet – open the bottom cover, remove and disconnect the battery and allow instrument to dry for 24 hours in dry ventilated place before use.

- Instrument is supplied in hard case with padded insert – use it for storage and transportation.

- **When connecting or disconnecting the probe from the meter apply gentle force. Do not over-tighten the probe connector.**

- In rough environments – use probe connected to the meter through the cable.

- Do not try to open the top meter cover or probe enclosure – there are no user serviceable parts inside.

- **Do not use the instrument near AC lines or high voltage sources, because its reading may be offset and there is a safety risk for the operator (!).**

- To clean the meter and probe use soft tissue wetted with water or mild household glass cleaner (weak ammonia solution). Do not use the solvents that may damage the plastic parts of the meter.

- If there is ever a need to clean the probe connector – use cotton swab wetted with alcohol. Let it dry before connecting to the meter.

3. Measurement Hints

Operation of the unit is as simple as using the multimeter. In order to get the best accuracy of measurements few things should be noted:

- Keep unit calibrated. We recommend calibration once a year in our NIST traceable EMC Test Lab.

- To get the best accuracy take reading always in the 10%-100% of maximum value on each range. If reading is too small (less than 10%) - switch to more sensitive range.

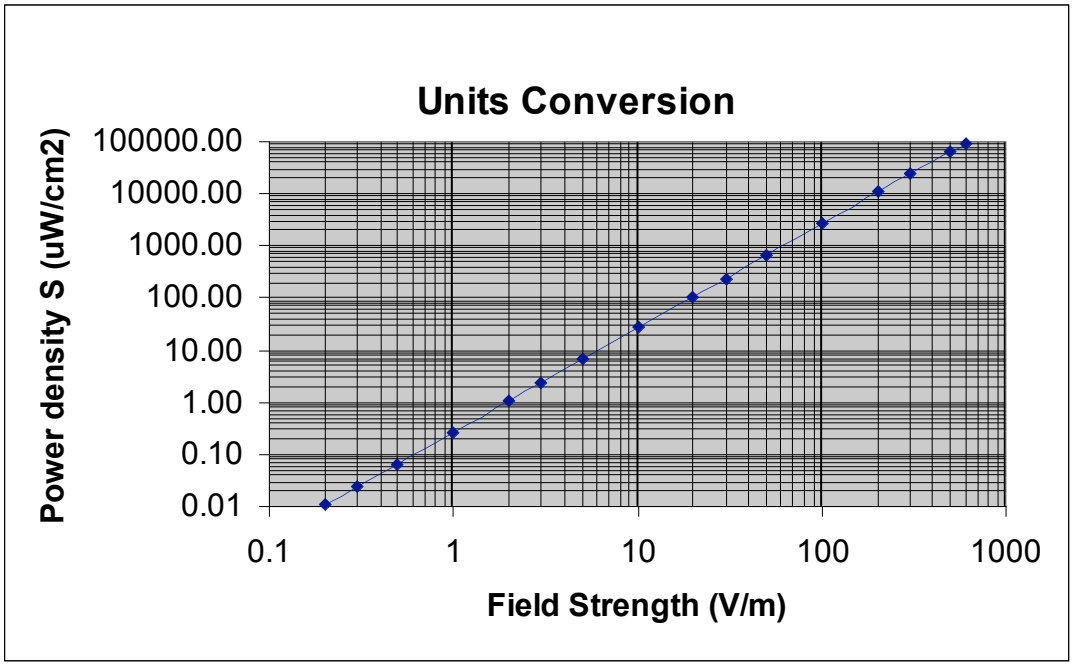
- Wider single scale dynamic range can be achieved by using remote monitor output: at 2 V/m (0.2-30 V/m), at 20 V/m (2-30 V/m). For fields higher than 100 V/m use 600 V/m range.

- Use tripod – it eliminates the effects of your body and meter on electromagnetic field. If EM fields are strong and/or measurements are done in the EMC cell or screen room, connect the supplied cable to the remote monitor output and read the field from external DC voltmeter.

- Meter is calibrated to display the E field strength in V/m, which correspond to RMS (Root Mean Square). For E fields less than 60 V/m reading doesn't depend on wave shape (sine, square, AM modulated, etc.). For fields higher than 60 V/m meter reading scales with peak value of the field, therefore some correction may be needed if dealing with AM modulated signals or making measurements in multi-signal environment.

- Every unit has its maximum displayed field specified on Smart Fieldmeter Linearity page for every unit (typically, about 500 V/m for standard unit, and 700 V/m for UL variant). Instrument will tolerate the higher fields but be aware, that there is no maximum limit overload indication.

- To convert the electric field strength E (V/m) into power density S (uW/cm^2) use formula: $S=E^2/3.77$. To calculate the value of the magnetic field H (far field region) use the relationship: E/H=377 Ohm. For convenience, the following table represents the conversion for working range of Smart Fieldmeter®:



4. External AC Fields

Smart Fieldmeter is designed to be immune to the moderate external AC fields of the 50/60 Hz line frequency. In case of harsh environment with strong AC fields the following tips will reduce the measurement errors:

- Use the Average mode of operation.
- Use the least sensitive range (20 V/m in stead of 2 V/m, and so on.)
- When operated near metal objects, like in TEM cell, for example - connect the metal case of the meter (tripod mounting nut) to the TEM cell metal ground. This will eliminate the parasitic AC currents caused by the equipment power lines.
- Use only optically isolated devices connected to the meter remote monitor output (see 1.7).
- **Do not connect meter metal case to any AC power lines or ungrounded metal objects due to the risk of electric shock (!).**

5. Battery Replacement

9V Battery is located under the bottom cover – it must be replaced when low battery indicator (green LED) goes off permanently.

To replace the battery - remove 4 bottom screws, pull out the battery, disconnect the old one from the connector and reconnect a new one keeping correct polarity. Install battery into the unit and then secure the bottom cover with 4 screws. Longest life is achieved with standard alkaline battery reaching about 100 hours of continuous operation.

6. Specification
Meter RFP-04

- Portable EM field meter (E-Field) with detachable isotropic probe.
- Wide dynamic range: 0.01 - 2000 V/m (depending on the probe).
- Resolution (at range): 0.01 V/m (2 V/m and 20 V/m),
  0.1 V/m (200 V/m), 1 V/m (600 V/m).
- Broad frequency range: At least 0.1 MHz-18 GHz (defined by the probe).
- Probe directivity: Omni directional (Isotropic probe).
- Ranges (V/m, full scale): 2, 20, 200, 600 (no overload indicator).
- Calibration accuracy: +/- 0.5 dB (at reference levels).
- Linearity deviation: +/- 1.5 dB (any range 10-150% of full scale).
  Typically +/- 1 dB.
- Probes frequency response: +/- 1 dB typically, with correction factors.
- Probes rotational isotropicity: +/- 0.5 dB, typically (at 100 MHz, 1.9 GHz).
- Operating modes: Average, Pulse and Peak.
- Reading: RMS (root mean square) in all modes:
  Average: RMS (Averaged over Tav).
  Pulse: 0.707 x Instant Value (Averaged over Tp).
  Peak: 0.707 x Peak Value (Averaged over Ts).
- Response times for different operating modes:
  Average (Slow Response): Tav (averaging slow time)=2 sec.
  Pulse (Fast Response): Tp (averaging fast time)=100 ms.
  Peak (Peak Response): Ts (sample time)=50 ms, Th(hold time)=14 sec.
- Auto zeroing (automatic and/or user activated) operates even at strong EM fields, and eliminates temperature induced offset errors.
- Display: LCD 3.5 Digits, with over-range feature.
- Remote monitor: Special 1.8 m (6 ft.) cable (supplied with unit) allows remote output monitoring by data logger, scope or voltmeter.
- PC data streaming allows fast data transfer (120 samples/sec.) through PCLK-01 - optional AC/RF decoupled DAQ box to serial RS232 port.
- Data logging allows the use of portable battery operated data loggers for data storage and PC transfer at a later time.
- Design: rugged metal hand held enclosure. Probe is mounted on nonmetal handle and can be removed for cable operation at a distance.
- Standard tripod mount (1/4”-20) for meter, probe clip and nonmetal portable tripod are provided.
- Operating temperature: 5 C° to 40° C, RH 10%-90%, non-condensing.
- Temperature error: <0.08 dB/°C (range 2 V/m), <0.05 dB/°C (other ranges)
  This parameter is defined by the probe.
- Dimensions: Meter (hxwxd) 130x80x30 mm., 5x3.125x1.25 inch,
  Probe (LxD) 230x58 mm, 9.0x2.25 inch.

- Weight: Meter 225 g., 0.5 lb; Probe 100 g., 0.2 lb.
- Battery life: 100 hr. with user replaceable 9V battery (included). Low battery indicator.
- Calibration: Every unit is individually calibrated for absolute test levels and linearity at specified frequencies. NIST/UK NPL traceable Calibration certificate is supplied with each unit.
- Accessories: Smart Fieldmeter® comes in a hard carrying case and includes the RFP-04 HF/CE Meter with installed battery, Isotropic Probe together with probe cable, remote monitor cable, tripod, probe clip and product documentation.

Note: This Specification may be changed without notice due to continuous improvement of the design and manufacturing process.

7. Meter/Probe Selection Table

Probe: PI-03	**3 MHz - 18 GHz**	**0.8 – 800* V/m**	
Probe: PI-02	**2 MHz - 12.5 GHz**	**0.5 – 800* V/m**	
Probe: PI-01	**0.2 MHz - 3 GHz**	**0.2 – 500* V/m**	
Probe: PI-01V	**900 -1900 MHz. Dual GSM band.**	**0.4 – 400* V/m**	
Probe: PI-01E	**0.1 MHz - 6 GHz**	**0.3 – 500* V/m**	

* Exact maximum field limit is specified for every unit.

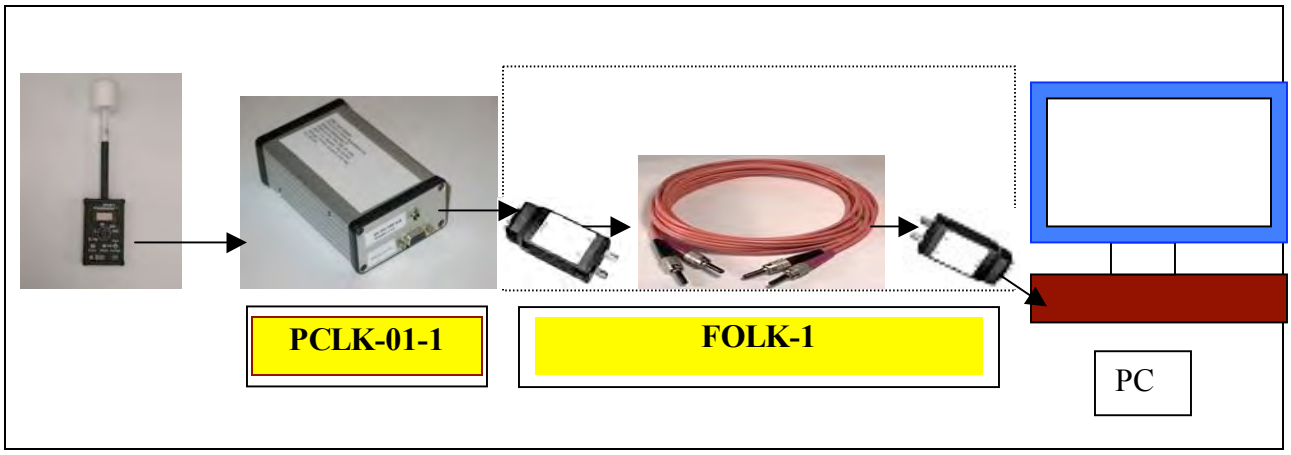
The probes below require a Smart Fieldmeter® Digital meter: Model RFP-05			
Probe: PI-H1 Magnetic Field	500 KHz - 50 MHz	0.05 – 20A/m	
Probe: PI-03P Pulsed Electric Field	100 MHz-18 GHz	70 -1400 V/m. RF pulse width > 1 us.	

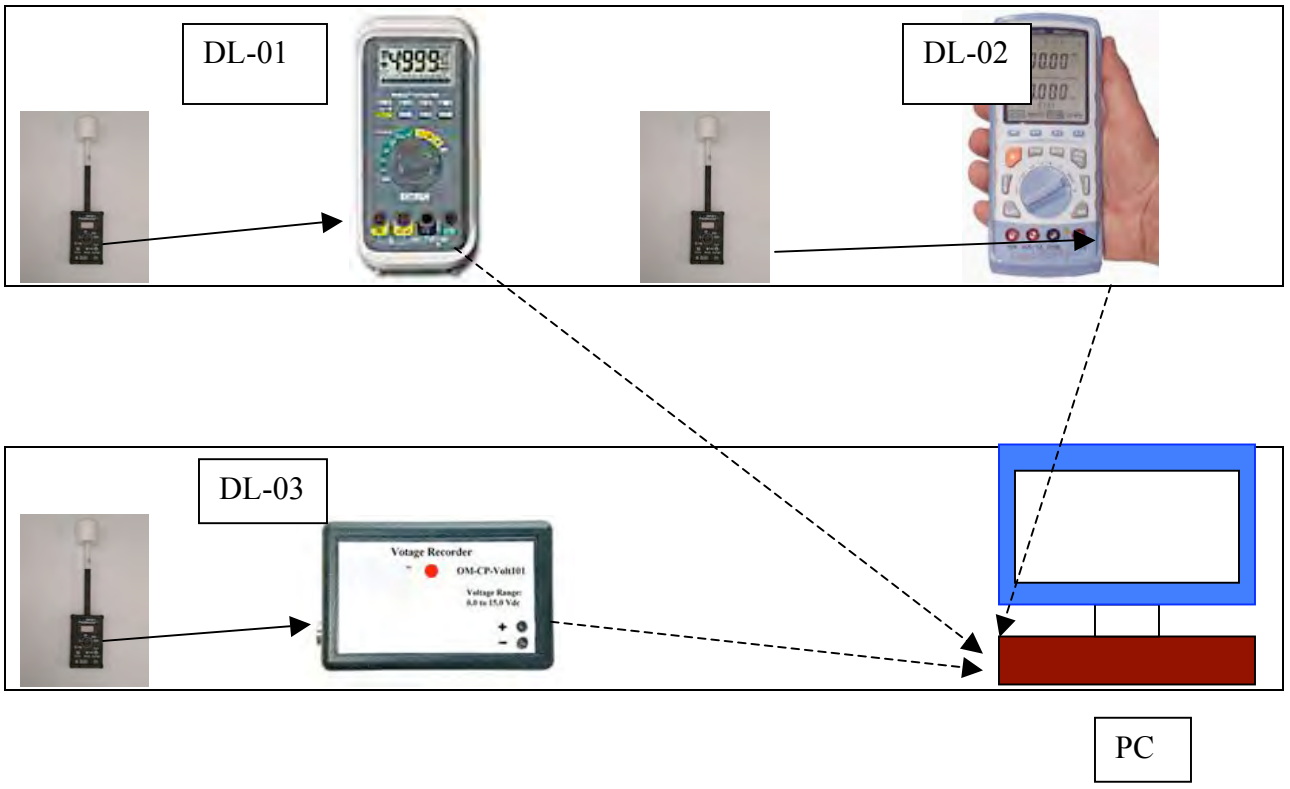
8. Accessories Selection Table

Name	Description	Notes
Cable: Probe - Meter	SMA/SMA 4-6 ft.	Stocked, standard
Cable: Remote Monitor.	3.5 mm/dual banana, 6 ft long.	Stocked, special
Tripod	6" Nonmetal tripod	Stocked, standard.
PCLK-01-1	PC Link Kit. (120 samp./sec). RS232 isolated serial data link for Smart Fieldmeter unit with isolating input module and free display software.	Low cost PC link kit wire solution.
FOLK-01	Fiber Optic Link Kit. Includes two RS232/Optic converters and 10-meter (30 ') bi-line fiber optic cable. Requires PCLK-01-1.	PC link kit fiber optic solution. One converter connects to PCLK- 01-1 RS232 output; another - directly into PC RS232 port.
DL-01	Portable data logging DMM with PC link (20 samp./sec).	DMM with optically decoupled RS232 link
DL-02	Portable data logging DMM with PC link (1 samp./sec). Memory 33-100 samples.	DMM with optically decoupled RS232 link. Memory – user activated.
DL-03	Portable data logger with 8,000 memory samples. Variable sampling rate from sec. to days.	RS 232 output. Memory recording – continuous.
FC-01	Portable frequency counter with frequency range 30 MHz- 2.8 GHz.	Capable of measuring the pulsed GSM and cell phone signals with RF pulse duration longer than 250 usec.

9. Data Streaming and Data Logging Options

Low cost PCLK-01-1 wire or
PCLK-01-1 with FOLK-01 fiber optic solution.





10. Limited Warranty

The manufacturer (EMC Test Design, LLC) warrants the product to be free from defects in material and workmanship under normal use and service for the period of 1 (one) year from the date of purchase. This warranty extends only to the original buyer or end use customer of a manufacturer-authorized distributor.

Manufacturer's warranty obligation is limited, at manufacturer's option, to refund of the purchase price, or free of charge repair or replacement of a defective product, which is returned to an authorized distributor or manufacturer within the warranty period.

Manufacturer authorized distributors have no authority to extend the warranty on behalf of the manufacturer.

To obtain the warranty service, contact your authorized distributor. Buyer pays for the insured shipping of the unit to be returned or serviced. Manufacturer doesn't assume any risk for damage in transit. Following the warranty repair, the product will be returned to the buyer, transportation prepaid.

If manufacturer determines that the failure was caused by misuse, negligence, accident or abnormal condition of operation and handling, manufacturer will provide an estimate of the repair costs and obtain authorization before commencing the work. Following repair, the product will be returned to the buyer, transportation prepaid, after customer has paid for the repair and return transportation charges.

The typical examples of product abuse which void the warranty are: broken probe or probe mount connector, damaged display, etc. We will void the warranty if product has been opened (except the bottom battery compartment), altered or repaired by unauthorized personnel.

This warranty is purchaser's sole and exclusive remedy and is in lieu of all other warranties, expressed or implied, including but not limited to any implied warranty or merchantability or fitness for a particular purpose.

EMC Test Design shall not be liable for any special, indirect, incidental or consequential damages or losses, including loss of data, whether arising from breach of warranty or based on contract, tort, reliance or any other theory.

The limitations and exclusions of the warranty may not be applicable to every buyer depending on the laws of the land of residence.

Buyer has the rights to return the unit within 14 (fourteen) days from the date of purchase using the insured prepaid carrier, in mint condition in undamaged original package with all accessories and documentation for replacement or refund. In case of refund the restocking fee of 10% will be charged.

11. Technical Support

To purchase the additional units, accessories, get technical support or warranty service, buyer should contact the authorized distributor or manufacturer by e-mail (preferred) or phone. The manufacturer e-mail is: exid@emctd.com (check our web site www.emctd.com for the most up to date information).

Buyer should supply the following information:
- Buyer's name, company name and contact information.
- Distributor's name, and contact information.
- Date of purchase.
- Serial numbers of the meter and probe.
- Accurate description of the issues.

Also indicate the general details of your application:

1. Which application do you use Smart Fieldmeter® for?
EMC, Field Survey, Communication, Industrial, other (please, specify).
2. What is typical frequency range of fields that you measure?
0.1-1 MHz, 1 MHz - 1 GHz, 1-3 GHz, 3-6 GHz, 6-12.5 GHz, 12.5-18 GHz.
3. What is typical field strength range of your measurements?
0.2-2 V/m, 2-20 V/m, 20-100 V/m, 100-300 V/m, >300 V/m.
4. Do you use PC to log the test data? If yes, what kind of data logging equipment do you use?
5. Which features of the Smart Fieldmeter® are the most important for you?
6. Which features of the Smart Fieldmeter® you would like to change (add)?

Your answers will be used in full confidentiality with only one purpose – to make the Smart Fieldmeter® better.

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