

Model HI-1801

Microwave Survey Meter

User Manual



 **ETS-LINDGREN**[®]
An ESCO Technologies Company

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**Revision Record | HI-1801 Microwave Survey Meter, MANUAL
Part #H-600041, Rev. C**

Revision	Description	Date
	Initial Release	February, 1990
A	Revised, Reformatted	March, 1999
B	Update branding: revised to meet Style Guide specifications; PIB included with release	October, 2012
C	Update introduction, calibration method, and electrical specifications, and formatting.	April, 2016

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Notes, Cautions, and Warnings



Note: Denotes helpful information intended to provide tips for better use of the product.



Caution: Denotes a hazard. Failure to follow instructions could result in minor personal injury and/or property damage. Included text gives proper procedures.



Warning: Denotes a hazard. Failure to follow instructions could result in SEVERE personal injury and/or property damage. Included text gives proper procedures.



Note: See the ETS-Lindgren *Product Information Bulletin* for safety, regulatory, and other product marking information.

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1.0 Introduction

The **ETS-Lindgren Model HI-1801 Microwave Survey Meter** is a rugged, compact, portable instrument that is virtually immune to failure caused by excessive fields or physical abuse. This instrument is acceptable to the US Government Center for Devices and Radiological Health (FDA/CDRH) and to all major microwave oven manufacturers for testing ovens in use and after repair.

This easy to use meter, and the step-by-step instructions in this manual will enable you to easily and accurately measure leakage from your microwave oven.

Microwave leakage (electromagnetic fields) is detected by an array of eight hot carrier diodes housed in the large end of the plastic probe. This antenna array has the unique feature of being able to sum microwave electric fields of any polarization in a plane perpendicular to the axis of the probe. The antenna lobe (effective measuring area) is also very broad, making the instrument easy to use when measuring leakage around an oven door. The spacer cone is designed to provide 5 cm spacing from the tip of the probe to the center of the array.



The HI-1801 must be used with the spacer cone in place. Using the instrument without the cone will result in reading errors and may damage the unit.

Calibration Method

Each meter is calibrated by placing the probe in a CW (continuous wave) 2450 MHz electromagnetic field. The source feeds an anechoic chamber through a section of waveguide terminating in a slot radiator. Calibration is performed at a level of 5 mW/cm² and a standard temperature of 75° F.

The calibration is also checked at 1 mW/cm². The accuracy of the field is determined by comparing with an LCR (local calibration reference) which is traceable to NIST (National Institute of Standards and Technology) through FDA / CDRH (Food and Drug Administration / Center for Devices and Radiological Health).

Standard Configuration

The Model HI-1801 Microwave Survey Meter includes:

- Survey meter including probe with spacer cone
- 600 mL Beaker
- Two 9 Volt Alkaline Batteries
- Fitted carrying case

Optional Items

- Spacer Cover Kit

ETS-Lindgren Product Information Bulletin

See the ETS-Lindgren *Product Information Bulletin* included with your shipment for the following:

- Warranty information
- Safety, regulatory, and other product marking information
- Steps to receive your shipment
- Steps to return a component for service
- ETS-Lindgren calibration service
- ETS-Lindgren contact information

2.0 Maintenance



Before performing any maintenance, follow the safety information in the ETS-Lindgren *Product Information Bulletin* included with your shipment.



Maintenance of the HI-1801 Microwave Survey Meter is limited to external components such as cables or connectors. If you have any questions concerning maintenance, contact ETS-Lindgren Customer Service.

Maintenance Recommendations

The only maintenance that is required is the replacement of the batteries or the spacer cone.

BATTERY REPLACEMENT



Always replace both batteries when batteries are in need of replacement.



1. Move the selector switch to the **OFF** position.

2. Remove the two screws that hold the instrument cover in place.
3. Remove the foam block that holds the batteries then remove the batteries.
4. Replace the batteries and re-insert the foam block. Replace and tighten the two screws that hold the instrument cover in place.
5. Make sure the **LOW BATT** indicator light is not on indicating the batteries are fully charged.

SPACER CONE REPLACEMENT



Do not use the HI-1801 without the spacer cone in position. To maintain stated instrument accuracy, only use spacer cones provided by ETS-Lindgren.

The spacer cone must be replaced when worn or contaminated. A polystyrene cone shield provides protection for the relatively soft material of the cone.

1. Remove the old cone by pulling straight up and off the end of the probe.
2. Slip a new cover on, being sure the cover is fully seated on the probe.

Annual Calibration

It is recommended that the Model HI-1801 Microwave Survey Meter be recalibrated every 12 months. See the *Product Information Bulletin* included with your shipment for information on ETS-Lindgren calibration services.

Replacement and Optional Parts



ETS-Lindgren may substitute a similar part or new part number with the same functionality for another part/part number. Contact ETS-Lindgren for questions about part numbers and ordering parts.

Following are the part numbers for ordering replacement or optional parts for the model HI-1801 Microwave Survey Meter.

Part Description	Part Number
Spacer Cover Kit (10 Cones and 20 Shields)	H-540013
600 mL Plastic Beaker	H-44600MLP
Carrying Case	H-51FPC6506B

Service Procedures

For the steps to return a system or system component to ETS-Lindgren for service, see the *Product Information Bulletin* included with your shipment.

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3.0 Specifications

Electrical Specifications

Frequency	2450 MHz (± 50 MHz)
Power Range	1-10 mW/cm ²
Accuracy	± 1 dB
Response Time	Full scale within 3 seconds
Overload Capacity	Continuous 2.0 W/cm ²

Physical Specifications

Dimensions	5.3 x 4.3 x 10.5 cm (2.09 x 1.7 x 4.13 in)
Probe Length	30.5 cm (12 in)
Cable Length	1.0 m (3.3 ft)
Spacer Cover	5cm (1.97 in)
Shipping Weight	1.81 kg (4 lbs)

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4.0 Operation



Before operating any components, follow the safety information in the ETS-Lindgren *Product Information Bulletin* included with your shipment.



Do not attempt to operate a microwave oven with:

- Any object caught in the door
- A door that does not close properly
- A damaged door hinge, latch or sealing surface



Do not use the HI-1801 without the spacer cone in position.

The areas where leakage is likely to occur are around the door seal, the window, and at ventilation louvers or vents. A damaged or improperly installed magnetron mounting gasket may cause leakage in the control panel area of the oven.

Accuracy

The accuracy of the ETS-Lindgren Model HI-1801 Microwave Survey Meter is within ± 1 db (+25%, -20%) when used according to these instructions:

1. Always use a clean spacer cover. Accuracy will be affected by wear of the cover and by dirt and metallic particles which may become imbedded in the EPS (expanded polystyrene) foam. If the cover is damaged, contact Customer Service for a replacement.
2. Hold the instrument case at approximately 45°. The balance of the meter movement causes the needle to move slightly when held horizontally (flat) or vertically (upright). The meter is calibrated while at an angle of 45° and if it is used at that angle, no additional error will be introduced.

3. The normal operating temperature range is between 60° and 90° F (15° and 32° C). If used outside this range, an additional error will be introduced. This error can be approximated as -0.1% per Fahrenheit degree. The negative temperature coefficient means that the instrument reads high at lower temperatures and low at higher temperatures.
4. The parameters which affect the accuracy of this instrument are listed along with the error contribution of each in the following table.

Parameter	Error (dB)
Calibration	Precision--±0.09 Accuracy--±0.13
Nonlinearity and AM response	±0.17
Near Field vs. Far Field	±0.29
Receiving Pattern	-0.11
Temperature Response	±0.06
Frequency Response*	±0.04
Polarization*	±0.21
RFI*	±0.04
Drift*	±0.04
Total	+0.96/-0.81

*Errors combined in RMS manner

Preparing the Oven



Do not attempt to operate a microwave oven with:

- **Any object caught in the door.**
- **A door that does not close properly**
- **A damaged door, hinge, latch or sealing surface.**

1. Make sure that the oven is clean and that there is no buildup of dirt around the door seal area.
2. Inspect the door and sealing surfaces, the hinge, and the latch for damage or a loose fit.
3. Make sure the oven is set for full power.
4. In order to make an accurate leakage measurement, you must use the specified water load. Fill the beaker to a level of 275 mL with cool tap water and place it in the center of the oven.
5. Set the oven timer for approximately three minutes. If your test takes longer than this, the water may boil. If the water boils, pour it out and refill using 275 mL of cool tap water.



If the timer is set longer than three minutes, the water may boil. If the water does boil, carefully remove the beaker and pour out the water. Once the beaker has cooled, refill with 275 mL of cool tap water.

Preparing the Meter



1. Remove the meter from the carrying case. Make sure the spacer cover is intact and firmly seated on the probe. Check the cover for signs of wear or contamination; replace if worn or contaminated.
2. The ON/OFF switch must be moved to either the “ON” or the “CHECK” position to operate the unit. The “PWR” light will come on when the ON/OFF button is held in either position and the instrument is operating.
3. Turn the ON/OFF switch to either the ON or the CHECK position. The “LOW BATT” light will come on if the batteries need to be replaced. Replace the batteries before continuing. See the Maintenance section for battery replacement instructions.
4. While operating the ON/OFF switch in the “ON/10 MW” position, use the large knob to adjust the meter to a ZERO indication.



The probe must be in a zero microwave field with no RF energy present for accurate zeroing.

CHECK FEATURE

The control switch has two positions, an “ON/10 MW” position and a “CHECK” position. The “ON/10 MW” position is used for testing microwave ovens in the normal manner. In the “CHECK” position, the meter will respond to very low levels of leakage and will assure you that the instrument is responding to microwave energy allowing you to check the operation of the instrument at any time including while testing the microwave oven.



Meter readings in the “CHECK” mode have no significance; the only purpose of this mode is to verify proper meter function..

1. Hold the ON/OFF switch in the CHECK position and use the large knob to adjust the meter to an indication between 0 and 1. Note that the probe must be in zero microwave field with no RF energy present.
2. Holding the ON/OFF switch in the CHECK position and the oven operating, move the probe over the door and door gap surfaces of the oven. In the CHECK mode, the sensitivity of the HI-1801 is increased from five to ten fold.

Making a Measurement

Turn the oven on and proceed with the leakage measurement.

1. Hold the probe by the red handle in one hand and hold the meter in the other hand, with the ON/OFF switch in the “ON/10 MW” position.
2. Place the tip of the spacer cover against the oven surface, with the probe handle perpendicular to the surface. While testing, hold the meter away from the oven to minimize the possible RF pickup directly from the oven to the meter case.
3. Move the probe slowly, about one inch per second, keeping the cover tip in contact with the oven and the probe handle straight.
4. Once you have checked all around the door edges, around and across the window, and at any louvers or vents, return to the spot where you noticed the highest reading before.

5. Hold the probe in place over this spot for at least five seconds and watch for the highest needle indication. The reading you obtain is the maximum leakage of your oven.

What the Measurement Means

The FDA/CDRH (Food and Drug Administration/Center for Devices and Radiological Health) has established the following requirements concerning microwave oven leakage:

- The power density (leakage) emitted by a microwave oven shall not exceed 1 mW/cm² measured prior to acquisition by a purchaser, and thereafter 5 mW/cm².
- The 5 mW/cm² measurement is mid-scale on the 10 mW range. However, many ovens leak so little that you may notice only a small indication. This actual value is sometimes as low as 0.1 or 0.2 mW/cm².
- If the oven leakage exceeds 5 mW/cm², you should contact a service agency recommended by the oven manufacturer, or contact the manufacturer directly. This oven must be repaired to comply with the CDRH safety guidelines.

You may wish to write down for future reference the leakage level, and the model number and serial number of the meter used to make the measurement. Be sure to note the calibration due date of the instrument; for assurance of accurate readings, the microwave survey meter should have been calibrated within the last 12 months.

Appendix A: Warranty



See the *Product Information Bulletin* included with your shipment for the complete ETS-Lindgren warranty for your HI-1801 Microwave Survey Meter.

DURATION OF WARRANTIES FOR HI-1801 MICROWAVE SURVEY METER

All product warranties, except the warranty of title, and all remedies for warranty failures are limited to one year.

Product Warranted	Duration of Warranty Period
HI-1801 Microwave Survey Meter	1 Year

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Appendix B: EC Declaration of Conformity



Declaration of Conformity

We, ETS-Lindgren, L.P., 1301 Arrow Point Drive, Cedar Park, TX, 78613, USA, declare under sole responsibility that the:

Model/Part Number: HI-1801

Model/Part Name: Microwave Survey Meter

Date of Declaration:

Affirmation Date: 04 June, 2009

to which this declaration relates, meets the requirements and is in conformity with the relevant EC Directives listed below using the relevant section(s) of the following EC harmonized standards and other normative documents;

Applicable Directive(s):

Electromagnetic Compatibility Directive (EMC), 89/336/EEC and its amending directives

Applicable harmonized standard(s) and/or normative document(s):

CISPR 11:1990 Industrial, Scientific and Medical (ISM) Radio-Frequency equipment- Electromagnetic disturbance characteristics- Li measurement

CISPR 22:1993 Information Technology Equipment - Radio Disturbance Characteristics - Limits and Methods of Measurement

EN 50082-1:1992 Electromagnetic compatibility - Generic immunity standard Part 1: Residential, commercial and light industry

EN 55011:1991- Group 1 Class B, Limits and methods of measurement of radio disturbance characteristics of industrial, scientific, a frequency equipment

EN 55022:1994 Limits and methods of measurement of radio disturbance characteristics of information technology equipment

FCC Part 15: Radio Frequency Devices, Subpart B - Unintentional Radiators

Authorized Signatories:

ETS-Lindgren L.P.
Bryan Saylor, General Manager

ETS-Lindgren L.P.
James C. Psencik, Vice President of Engineering

The authorizing signatures on this Declaration of Conformity document authorizes ETS-Lindgren, L.P. to affix the CE mark to the indicated product. CE marks placed on these products will be distinct and visible. Other marks or inscriptions liable to be mistaken with the CE mark will not be affixed to these products.

ETS-Lindgren, L.P. has ensured that technical documentation shall remain available on premises for inspection and validation purposes for a period ending at least 10 years after the last product has been manufactured.

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