

HI-3000 SERIES
Broadband Isotropic
Field Strength Meter
User's Manual

Declaration of Conformity

We,
HOLADAY INDUSTRIES, INC.
14825 MARTIN DRIVE
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USA



declare in our own responsibility, that the HOLADAY product described in this instruction manual is in compliance with: EN EMC Directive 89/336/EEC, EN50082-1, EN55011

President
HOLADAY INDUSTRIES, INC.

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Broadband Isotropic
Field Strength Meter

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Limited Warranty

Holaday Industries, Inc. warrants each model HI-3000 Series Broadband Isotropic Field Strength Meter to be free from defects in material and workmanship for a period of one year from the date of shipment to the purchaser. This warranty extends to the original purchaser only, and does not apply to the batteries or to any products or parts subject to misuse, neglect, accident, unauthorized service or abnormal conditions of operation.

In the event an instrument covered by this warranty fails, Holaday Industries, Inc. will, without charge, repair and recalibrate the instrument if returned to their factory within one year of the original purchase—provided that Holaday Industries' examination discloses, to its satisfaction, that the product is defective. Holaday Industries, Inc., may, at its option, replace the product in lieu of repair. If the defect was caused by misuse, neglect, accident, unauthorized service or abnormal conditions of operation, repairs will be billed at a nominal cost. In such cases, an estimate will be provided before work is started, if requested by the purchaser.

For warranty service, contact Holaday Industries, Inc. Provide the serial number of the instrument and complete details regarding the failure mode. You will then be given either service information or shipping instructions. Return the instrument to the factory, transportation prepaid. Repairs will be made at the factory and the instrument will be returned to you, transportation prepaid. Holaday Industries, Inc., assumes no responsibility for loss of, or damage to, products in transit.

Warning!

EXTREME CAUTION IS ADVISED WHEN WORKING IN ENVIRONMENTS WHERE HIGH-INTENSITY ELECTROMAGNETIC FIELDS MAY EXIST AND WHERE CONTACT WITH HIGH VOLTAGE OR HIGH CURRENT CIRCUITS OR APPARATUS IS POSSIBLE. ACCIDENTAL CONTACT WITH OBJECTS OR CIRCUITS OPERATING AT HIGH VOLTAGES OR HIGH CURRENTS CAN BE LETHAL! HOLADAY INDUSTRIES, INC. ASSUMES NO LIABILITY FOR ANY DAMAGES OR PERSONAL INJURY WHICH MAY RESULT FROM

1.0 SYSTEM OVERVIEW

The Holaday HI-3000 Series Broadband Isotropic Field Strength Meters are designed primarily for field use to measure both electric and magnetic fields. Each model has unique characteristics optimizing its performance for a particular use. The models in the HI-3000 Series are as follows:

HI-3001

An electric field meter having a wider dynamic range. The GRE and STE electric field probes, standard with this unit, provide measuring capabilities from as low as $10 \text{ V}^2/\text{m}^2$ to $10^7 \text{ V}^2/\text{m}^2$, or 60 dB range. It is possible to add either the CH Magnetic Field probe or the HSE High Sensitivity Electric Field probe to the HI-3001 as an option.

HI-3002

A midline instrument for most general RF field strength measurements where both electric and magnetic fields must be measured. The HI-3002 system includes the STE Electric Field probe and the CH Magnetic Field probe. It is possible to add the LFH Magnetic Field probe to the HI-3002 as an option.

HI-3003

The HI-3003 is a special purpose laboratory instrument usually used in special purpose applications. The unit is unique in providing three meter panel mounted axis selection switches. Any single probe sensing axis or any combination of axes may be selected for field polarization or other special measurements. The IME Electric field probe is standard on the HI-3003, however, any single probe in the Holaday Broadband RF instrumentation line can be installed on the unit.

HI-3004

The HI-3004 is the High Sensitivity Electric Field instrument in the Holaday line. This meter comes standard with the

HSE High Sensitivity Electric Field probe for measurements as low as one (1) Volt/meter full scale. As an option, the STE Electric Field probe can be installed on the HI-3004 to increase the measurement range.

HI-3012

The HI-3012 offers the features of the HI-3002 but with two new probes to meet the new ANSI C95 RF exposure standards for uncontrolled population exposures. The MSE Electric Field probe and the HCH Magnetic Field probe provide sensitivity below 0.05 mW/cm^2 . With capability of measuring equivalent power density levels up to 377 mW/cm^2 , the HI-3012 essentially covers the full ANSI range.

- 1.1 INSTRUMENT DESIGN - The design of the E-field probe is based on the diode-dipole antenna developed by Bowman of NBS [now NIST (National Institute of Science and Technology)], Boulder, Colorado. The use of three mutually orthogonal dipoles provides isotropic response. The total field strength at the probe is displayed, regardless of the field orientation or probe receiving angle. The probes are extremely durable and will withstand overloads of 800% of full scale. Similarly, the magnetic field probes are comprised of three concentric, mutually orthogonal, pickup loops.

The instrumentation package contains the battery pack, electronic circuit boards, analog meter and other front panel features. These include 1) peak hold memory switch, 2) range selector switch, 3) battery status light, 4) over range light, 5) audio output, and 6) recorder output. There is no zero adjust knob, since the instrument has full time automatic zeroing. There is no need to place the probe in a zero field condition in order to zero the meter.

2.0 OPERATING INSTRUCTIONS

2.1 INTRODUCTION - This section contains instructions for the use of the instruments, including an explanation of all the features of the instruments, and information on converting units of measure. Refer to the Appendix sections for information specific to a particular model of broadband meter.

2.2 UNPACKING AND INSPECTION - HI-3000 instruments are shipped in a protective carrying case. The foam insert is designed to provide storage for each component of the system. The white foam block on the instrument handle should be saved and used each time the instrument is transported in the carrying case. Each HI-3000 instrument contains the following:

1 HI-3000 instrumentation package with standard battery pack (14 alkaline C cells) (Nicad battery pack optional)

RF Probe(s) - see the probe selection matrix (figure 1) for the standard probes provided with each unit.

1 Acoustic headset

1 Probe handle and cable assembly, five (5) feet in length. (A 20 foot resistive extension cable is provided standard with the HI-3003 in the place of the cable and handle assembly).

1 User's Manual

Note:

One optional probe can be added to an HI-3000 Broadband Meter.

PROBES MODEL NO.	HSE	GRE	CH	LFH	IME	STE	HCH	MSE
HI-3001	OPT	STD	OPT	OPT		STD		
HI-3001A	OPT	STD	OPT	OPT		STD		
HI-3002			STD	OPT		STD		
HI-3003	OPT	OPT	OPT	OPT	STD	OPT		
HI-3004	STD					OPT		
HI-3005			STD	STD				
HI-3012				OPT			STD	STD

Figure 1

2.3 OPERATING INSTRUCTIONS

NOTE: The probes are individually calibrated to a specific broadband instrument. Do not interchange probes between HI-3000 series instruments.

- 2.3.1 Select the probe for the appropriate field being measured. Insert the probe into the handle and, with light pressure, rotate the probe until the alignment marks meet and the keyway is felt; then fully seat the probe in the handle connector. Secure the probe in the handle by tightening the locking collar.
- 2.3.2 Turn the selector switch to the desired range. The probes are color coded and correspond to the colored scale multipliers selected by the range selector switch on the front panel.

- 2.3.3 The "Battery" indicator LED will blink when the unit is turned on and the batteries are good. When the battery voltage drops below a safe operating level, the LED will light steadily and will not blink. The battery pack consists of 14 C cells and will provide approximately 30 hours of continuous use or up to 40 hours of intermittent use.
- 2.3.4 Operate the Peak Hold switch to clear the memory. There is no zero adjust since the unit has automatic, full-time self-zeroing capability.
- 2.3.5 The memory is active any time the instrument is on, continually being updated with the highest reading observed. The memory reading can be called for at any time by operating the peak hold switch. The reading obtained will be the highest reading observed since the last switch operation. Releasing the switch automatically clears and zeros the memory. The time constant of the memory circuit is much faster than the circuits driving the analog meter and the recorder output, which enables the memory to capture a higher peak reading on a fast rise time pulse. Therefore, the memory reading may appear higher than the meter needle indication. Since a time-averaged signal is important in making safety measurements, the actual meter indication or recorder output will usually provide a more suitable reading.
- 2.3.6 The "Over Range" LED will light should any of the following conditions occur: a) the integrated signal is greater than full scale, b) the peak of any amplitude modulation is greater than the top of the diode shaping ROM, c) any common mode signal is present which is large enough to cause the front end amplifier to malfunction. An audible alarm will also be heard through the headset when any of these conditions occur. In the event of any over range condition

simply switch to the next higher range. The meter, of course, will automatically re-zero itself.

- 2.3.7 On the lower left of the front panel there is a port for driving the headset. The repetition rate of the ticking sound is proportional to the meter reading and allows the operator to listen for the high field region while observing the probe location.
- 2.3.8 On the left side of the front panel there is a BNC recorder output jack. The signal available at this port is calibrated to one volt for full scale indication. The source impedance is 5K ohms.
- 2.3.9 Although it is recommended that the unit be turned OFF to change probes, no damage will occur if the unit is on while changing probes. While handling probes, it is important to eliminate the possibility of static discharge to the probe connector while the probe is not plugged in.

2.4 UNITS OF MEASURE - The analog meter on HI-3000 instruments generally displays $|FSU|^2$ which means field strength units squared. When using an E-field probe, the units are V^2/m^2 and when using an H-field probe, the units are A^2/m^2 . Refer to the Appendix for special information on the HI-3001A, the HI-3003, and the HI-3004. The HI-3001A and the HI-3004 display in units of Volts/meter (V/m) and the HI-3003 displays in mW/cm^2 .

In the far-field region (distances greater than several wave lengths from an RF source), the E and H fields are in phase and vary predictably with distance from the source, creating a uniform plane wave condition. The ratio of E/H is constant and has the value of 377 ohms which is termed the impedance of free space.

In the near-field region both the E and H field strengths vary greatly with small changes in distance from the source, and the ratio of E/H is not constant. Therefore, the standards have been written specifying the measurement of both Electric and Magnetic fields. Each must be measured independently regardless of the units of measure displayed on the meter. For measuring fields at frequencies above 300 MHz, an assumption of near field conditions is made and only the electric field component of the EM field is measured. It is generally not feasible to measure free space magnetic fields above 300 MHz.

In the far field, the power density can be calculated from either the E or the H field by using 377 ohms, the impedance of free space, as follows:

$$\frac{E^2}{377} = \text{power density (W/m}^2\text{)}$$

$$H^2 \times 377 = \text{power density (W/m}^2\text{)}$$

Converting W/M² to mW/cm², these equations become:

$$\frac{E^2}{3770} = \text{power density (mW/cm}^2\text{)}$$

$$H^2 \times 37.7 = \text{power density (mW/cm}^2\text{)}$$

2.5 EXPOSURE GUIDELINES

- 2.5.1 In the United States, the most commonly applied standard for RF exposure is the ANSI C95.1-1982 (American National Standards Institute). This standard is in the process of being revised and a "Final-Final" draft is in circulation. For your information, summary information on both the 1982 version and the proposed "1991 Revision" are included in Appendix 9.

Refer to your National Standards Organization or contact Holaday Industries, Inc. for information on standards in other countries.

3.0 MAINTENANCE

3.1 INTRODUCTION - This section contains instructions for routine maintenance and minor fault isolation.

3.2 BATTERY STATUS - If the battery status LED is glowing steady, the batteries must be replaced or recharged (see below).

3.3 REPLACING BATTERIES

3.3.1 Standard Battery Pack - The standard battery pack consists of 14 alkaline C cells. The battery holder is fastened to the bottom of the inner instrumentation housing. Unsnap the four latches holding the outer instrumentation housing and remove it. Holding the meter upside down, slide off the retaining strap and remove old batteries. Replace batteries, observing the polarity as shown in the bottom of the battery holder. Slide the retainer back into place. Replace the outer instrumentation housing taking care not to pinch the wires or battery clips.

NOTE: If there are more than one meter present, note that the serial number is written on the battery cover and the serial label is on the outside can. Care must be used not to mix them up.

3.3.2 Rechargeable NiCad Option - The NiCad battery pack is also composed of 14 C size cells. It can be recharged by plugging in the charger which is supplied with this option. The meter normally cannot be operated while recharging the batteries. The charger operates on either 115 or 220 VAC, 50/60Hz. See the battery charger manual for the voltage selection procedure. The NiCd battery charger requires 24 hours to recharge a fully discharged battery.

The NiCad battery pack is in the bottom of the outer instrumentation housing. If it becomes necessary to replace the NiCad pack, unsnap the four latches holding the outer instrumentation case and remove it. Lift out the NiCad pack and disconnect the two leads coming from it. One lead has an in-line connector and the other an in-line fuse holder. Insert the new battery pack and reconnect both leads. Replace the inner housing, being careful not to pinch any wires.

- 3.4 UNIT COMPLETELY DEAD - If the battery status LED does not light or blink when the selector switch is turned on, the battery voltage is too low, or the fuse is open. Refer to 3.3 to open the unit for access to the fuse. If the fuse is good, the batteries should be replaced or recharged. If the fuse is open, check for pinched or shorted wires or defective connections. Replace the fuse (3ag, 1/2 amp, slow blow). If the fuse blows again, the unit should be returned to the factory for repair.

CAUTION: The latches which hold the outer instrumentation case can exert considerable force. Make certain the case is properly fitted to the front panel before securing latches or the front panel will become deformed. In addition to possible mechanical damage, the effectivity of the RFI seal may be lost.

4.0 SYSTEM DESCRIPTION

4.1 INTRODUCTION - The HI-3000 is a portable, rugged, easy-to-use instrument with a wide dynamic range. It employs an internal digital memory to capture the highest reading observed for display, when desired, on the unit's analog meter. It also has automatic full-time zeroing of the meter to eliminate the effects of offset, noise pickup, and drift while measurements are being made.

4.2 INSTRUMENTATION OVERVIEW - The front panel controls of the HI-3000 are relatively simple (see figure 2). Most prominent is the range selector switch. There are four ranges for E-field readings and four ranges for H-field readings. The four ranges are selected by the rotary range selector switch. The analog meter displays the reading in field strength units squared. The analog signal is also available at the recorder output jack, which is calibrated for one volt output for full-scale meter deflection. The output is also converted to an audio signal, which is a ticking sound proportional to meter deflection. LED indicators show over range conditions and battery status. The momentary switch labeled peak hold is used to recall the highest reading from the memory.

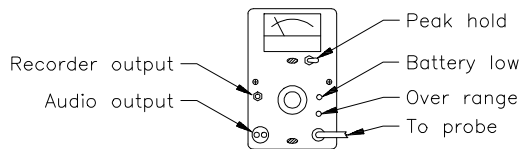


Figure 2

4.3 ELECTRONICS PACKAGE - The electronics package consists of three circuit boards: the front panel board, the digital board and the analog board (see figure 3).

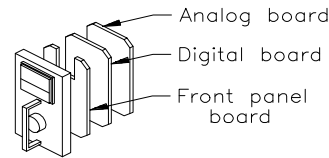


Figure 3

Contained on the front panel board are three switching power supplies, the meter driver, a battery low indicator driver and sense circuits, and audio and recorder output driver circuits. The digital board contains the circuitry which sums the three orthogonal channels and also contains the stored curve reconstruction circuit necessary to reconstruct the field present at the antenna. The analog board contains the necessary multiplexing and scaling circuits required to condition the signal for conversion to a digital word by the A/D converter, which is also contained on the analog board.

The entire unit is powered by a single voltage battery pack consisting of 14 alkaline batteries. An optional rechargeable NiCad battery pack is also available.

4.4 SIGNAL FLOW - The operation of the HI-3000 series broadband meters can best be understood by following a signal through the meter.

The equivalent circuit of the antenna system can be seen in figure 4. It should be noted that the antenna and diode assembly is simply a short dipole terminated by a diode detector. The 0.4 pf capacitances represent the equivalent capacitance of the short dipole antenna. The diode in this case is modeled as an ideal diode. The 10,000 ohm resistances represent that section of the high resistance feed system that occurs before any distributed capacitance is associated with the feed system. The 6 pf capacitance represents a lumped element model of the distributed

capacitance of the high resistance feed line. The 1 megohm resistances are the series resistances of the high impedance lines and the 60 pf capacitance is the capacitance found in the multiple conductor shielded line. The 10 megohm resistances are the input impedances of the differential amplifier. The entire feed system therefore looks like a peak detector followed by a low pass filter. This low pass filter has a cutoff frequency of approximately 400 Hz.

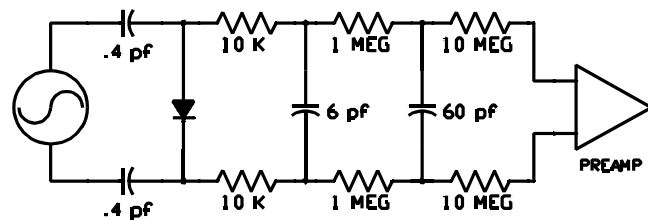


Figure 4

Each element of the feed system is connected to a preamplifier. The preamplifiers are differential input, matched and zeroed (see figure 5), and drive a multiplexer which takes the individual channels and assigns a time slice to them (see figure 6).

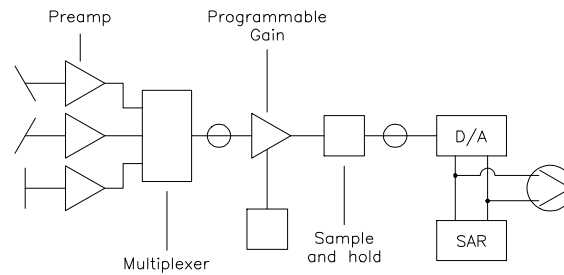


Figure 5

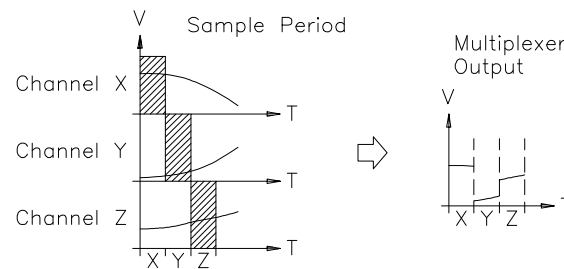


Figure 6

The sampling rate for this multiplexer is approximately 30 KHz, giving each preamplifier a sample rate of approximately 8 KHz. Figure 7 is a graph representing the time sliced input signal X,Y,Z. The multiplexer then feeds a programmable gain section. The gain is selected via MOSFET switches controlled by the front panel rotary range switch. The programmable gain stage then drives a sample and hold circuit. The sample and hold merely samples the incoming signal at a prescribed time and holds it until the next sample is updated (see figure 7).

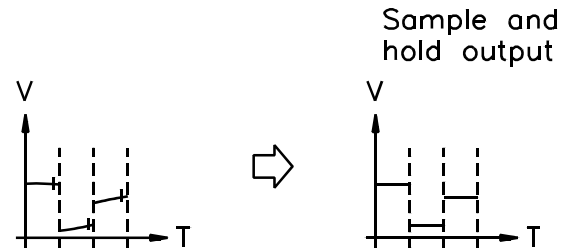


Figure 7

The sample and hold feeds the analog to digital converter. The output of the analog to digital converter now drives the digital board (see figure 8).

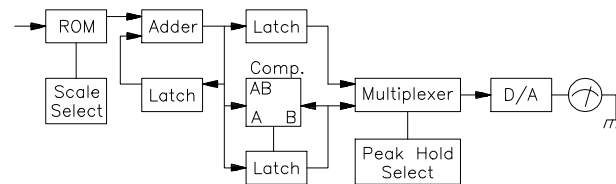


Figure 8

The data coming from the analog board forms a digital word whose value is proportional to the diode output voltage. This, when applied as an address to the ROM, defines a unique location in the ROM, due to the monotonic nature of the diode transfer curve. The ROM itself contains numbers which represent the field strength necessary to generate that diode output level. Therefore, the ROM output yields a true representation of the field strength of each of the three orthogonal components. It should be noted that in order for the ROM to accommodate a 100% modulated signal, the ROM has to convert values up to 400% of the full scale value. These field strength values then go into an adder section. The adder section is

composed of an adder and a latch, comprising a bite wide serial adder. Figure 9 is representative of the sequence in which the additions occur. Upon sampling channel X, the latch is initially cleared. X is then converted by the ROM and applied to the A input of the adder. Since the output latch is initially cleared and is applied to B input, the sum port of the adder contains only X.

	ROM Input	ROM Output	Adder Output	Adder Latch	Sum Latch
1	X	X*	X*	-0-	$(X + Y + Z)^{T-1}$
2	Y	Y*	$X^* + Y^*$	X*	"
3	Z	Z*	$X^* + Y^* + Z^*$	$X^* + Y^*$	"
4)	0	0	0	$(X + Y + Z)^T$
5	X	X*	X*	0	"
6	Y	Y*	$X^* + Y^*$	X*	"

* - Value after SCR

Figure 9

This is stored in the latch. Y is now applied to input A and the output of the latch, which contains X, is applied to the B input. Therefore, the sum contains X plus Y. This is continued one more iteration so that the sum of the adder contains X plus Y plus Z. At this point, since the ROM contained the square of the field strength in each of the three coordinates, as defined by the diode output, the sum of the adder contains a number representing the space power density. This number is then latched in an output latch found directly to right of the adder.

The two boxes directly below the output latch labeled comparator and peak hold latch make up the peak hold function. The output of the adder is applied to the A input of the comparator and the latch labeled peak hold latch is applied to the B input of the comparator. When the incoming signal on A is greater than the signal on B, $A > B$ output will go high thus latching the new incoming signal. Therefore the latch contains the word which is representative of the maximum signal received by the meter. The multiplexer found to the right of these latches simply selects the current output latch or the peak hold latch. The multiplexer drives a digital to analog converter which converts the digital word back into an analog signal for driving the meter movement and the recorder output. It should be noted, however, that the peak hold function captures only the modulation envelope that is passed by the probe input transmission line. Since the transmission line has a rolloff of 400 Hz, the peak hold will see a modulation envelope as filtered by a single pole 400 Hz low-pass filter. The analog meter on the other hand has a rolloff characteristic of approximately 1 Hz. Therefore it is possible that the actual modulation envelope may be higher than the analog meter deflection.

- 4.5 AUTOMATIC ZERO - This feature eliminates the need for a zero adjustment and eliminates temperature drift problems associated with other available instrumentation. The automatic full time zero also allows the operator to use the meter immediately upon turning it on. Also, it is not necessary to remove the meter to a "ZERO FIELD" environment to check its zeroing.

The operation of the automatic zeroing can be seen in figure 10.

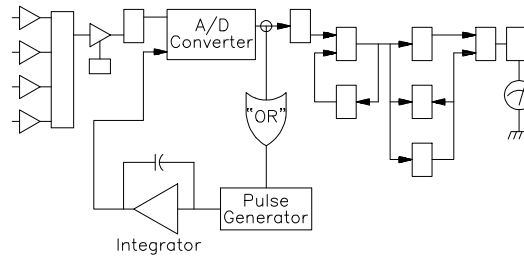


Figure 10

Included in the meter is a fourth channel called the redundant channel. This channel is identical to the other three channels except that instead of being driven by a dipole diode element, it is terminated in the probe head by a carbon resistor simulating the zero bias impedance of the Schottky Barrier diode in series with the high resistance feed line. It is also subjected to the same temperature variations as the high resistance feed lines of the other three channels.

The redundant channel feeds a preamp which is matched to the other three preamps. It is then fed into the same multiplexer and analog gain path as the other three channels. Therefore any drifts associated with the programmed gain stage, sample and hold stage and multiplexer are also contained in the fourth redundant channel with the absence of signals due to the diode-dipole-antenna system. This fourth channel is allocated a time slice and is presented to the analog to digital conversion.

The output of the analog to digital converter is a digital word which represents only the amount of signal which is due to common mode pickup and drifts of the different gain stages. This word should ideally be equal to zero with any word other than zero representing an unwanted noise or drift. If a value other than zero occurs, an integrator is charged up which subtracts this offset. Thus, a closed loop

has been generated which subtracts analog zero shifts and gain shifts from the remaining three channels.

The only circuits prone to zero shifts are the analog circuits. The digital circuits following do not drift. The drifts associated with the final digital to analog converter are insignificant compared to the signal levels present. Therefore, the entire meter is protected against zero drift and temperature variation drift.

An auto-zeroing technique of this nature yields a zeroing signal that oscillates about true zero at 1/2 the sample rate of the instrument. Step sizes correspond to the amount of charge the integrator acquires during one correction interval, and the slope at which the integrator can charge determines the maximum slope the automatic zeroing circuit can follow (see figure 11). This rate of change is many times faster than the temperature and zero drifts, making the zero very stable and accurate during use. When the instrument is first turned on, however, or when changing scales, large offsets may be introduced which may take a second or two for the auto-zero circuit to correct.

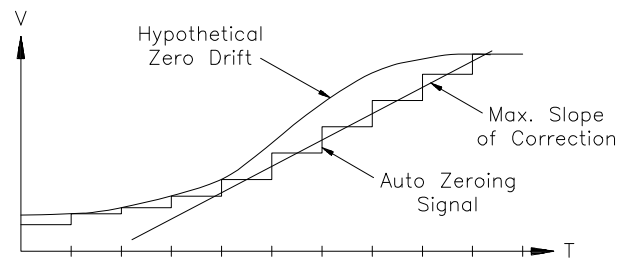


Figure 11

- 4.6 ERRORS - Errors associated with the HI-3000 series meters are generated primarily by two sources. The first is the instrumentation electronics itself and the second is associated with the limitations of the sensing probe.

Those errors caused by the instrumentation electronics section of the HI-3000 are primarily due to non-linearities in the analog to digital and the digital to analog converters, the look-up ROM, and the analog meter movement itself. The maximum total error of the electronics package is about three percent. Errors associated with the limitations of the probe fall into three categories; those of the frequency response of the antenna, modulation response errors and multiple frequency detection errors.

The out-of-band response of the electric field probes exhibits a fairly sharp rolloff. The high end response drops due to the selective loading of the dipole and the diode package characteristics. The low frequency rolloff is predominantly controlled by the shunt capacitance of the diode and the stray capacitance associated with the initial section of the high resistance feed lines. At frequencies near the low end of the response band feed lines are not sufficiently transparent and act as an unwanted antenna (see section 7.1). Similarly, the frequency response of the magnetic field probes are dropping at frequencies below the lower limit. At frequencies above the upper limit, however, the response of the magnetic field probes exhibits out-of-band resonances, causing the response to rise sharply.

Below 1.0 MHz, any electrical unbalance of the feed lines or capacitive coupling to electrodes supporting the electric field being measured can cause false readings. It is important that the user of any instrument having high input impedances associated with the detection system, such as the HI-3000, be aware of the general spectrum of the fields being measured. A prime example of this would be the attempt to measure the low frequency electromagnetic radiation of a CRT with the HI-3000. A CRT generates a

substantial field at about 15 KHz with a decaying spectrum content to about 100 KHz. These signals can induce voltages into the detection system via the feed lines rather than the antennas and hence it is impossible to correlate the reading of the instrument with a meaningful calibration. The same may be said about the case where measurements are attempted in the presence of extremely high 60 Hz fields such as would be found under very high voltage transmission lines (see section 7.1).

A second error occurs in the form of modulation error. As was noted earlier, the detected signals are fed to the instrumentation package by means of high resistance lines. These lines and the associated distributed capacitance form a low-pass filter between the detection element and the signal shaping circuit. Because the associated circuits following the detection diode cannot follow the instantaneous RF signal, the input to the look-up table will be different from the ideal and the corresponding output will, in general, be lower for the peaks and higher for the valleys. This will result in slight errors for low levels of modulation below 400 Hz and significant errors for 100 percent modulation at higher modulation frequencies. Table 1 shows the comparison of 100 percent sinusoidal modulation to a pure cw case.

Table 1: Modulation Errors

<u>Modulation Frequency (Hz)</u>	<u>Meter Error (db)</u>
20	+0.61
50	+0.51
100	+0.51
200	+0.31
500	0.00
1000	-0.11
2000	-0.22
5000	0.00
10000	+0.61

Note: All modulations are 100% sinusoid

It should be noted that the HI-3000 series broadband meters were designed specifically to measure electric and magnetic fields associated with industrial and communication uses as opposed to the low duty cycle, short pulse modulation of microwave radar systems.

The third form of error associated with the antenna-detector system occurs when two or more nearly equal strength signals, whose frequencies are in the detection band of the instrument, are imposed on the antenna. This error occurs because the signals are summed by a detection element which is not, except for relatively low level signals, a square law detector. Instead, the diode along with its R-C circuit acts very much as a peak detector relying on the look-up ROM to restore square law characteristics over most of the upper dynamic range of the instrument. The typical transfer characteristic of the family of diodes used in the 3000 series instruments is shown in figure 12.

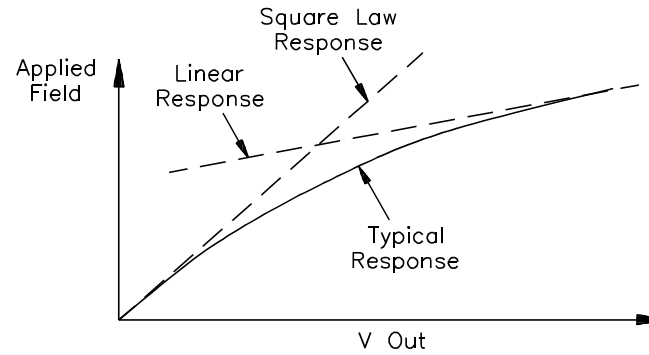


Figure 12

The instrument will therefore read higher than true. This is shown by a simple example as follows. Assume that there are two electric fields impinging on the probe. Let the amplitude of these fields be A1 and A2 accordingly. It can be seen that the effective power density is proportional to A1 squared plus A2 squared, ie., the sum of the squares of the fields at the point of reception (equation 1A). If we assume that diode detector elements of the probe are operating in the purely linear region of the diode's curve and the squaring is done after the two signals are summed, it can be seen that equation 1B represents the formulation of the effective power density. Equation 1C compares equation 1A and 1B and it can be seen that $(2 \times A1 \times A2) / (A1^2 + A2^2)$ is the error term.

$$(1A) \quad A1^2 + A2^2$$

$$(1B) \quad (A1 + A2)^2 = A1^2 + 2A1A2 + A2^2$$

$$(1C) \quad \frac{(A1^2 + 2A1A2 + A2^2) - (A1^2 + A2^2)}{A1^2 + A2^2} = \frac{2A1A2}{A1^2 + A2^2}$$

This error term approaches 1 as $A1 = A2$. Therefore, with the probe exposed to two equal signals falling in the nondispersive region of the frequency response curve of the antenna and if the diode is acting as a peak detector in the ideally linear region of the diode curve, the instrument would theoretically yield a +3 db error. In a careful evaluation using a TEM cell, the Environmental Protection Agency (EPA) Electromagnetics Branch, Las Vegas, has measured this effect for the case of two and three equal electric fields. These results are compared to the idealized worse case using the assumptions previously discussed (table 2).

Table 2: Multiple Frequency Errors

Meter Reading (V/M) ²	Ideal Reading (V/M) ²	Meter Error (db) ²
48	40	+0.79
460	400	+0.61
6000	4000	+1.76

Note: F1 = 1 MHz, F2 = 100 MHz, both of equal amplitude

It can be seen that the experimental results are far less severe than that predicted by the simplistic worse case calculations. This is explained for the most part by the fact that the diode does, in fact, operate over a characteristic curve which does approximate square law response at the low field levels and never reaches the pure linear region. It should be noted that, in a practical sense, one would rarely find nearly equal multiple frequency fields in health and safety measurements and any resulting error would be positive in nature. This would prevent errors of the type which might underestimate field strengths. Again, if the user does observe measurement levels approaching the recommended maximum exposure, care must be taken to consider the spectrum of the fields being measured.

5.0 SPECIFICATIONS

5.1 SYSTEM CHARACTERISTICS

- 5.1.1 Full-time automatic zero! Even while performing measurements.
- 5.1.2 Peak hold memory circuit
- 5.1.3 LED indicators for overload and battery status.
- 5.1.4 Audio output, ticking rate is proportional to meter deflection.
- 5.1.5 Recorder output, 0-1 volt corresponding to meter deflection.
- 5.1.6 Instrumentation readout in field strength units (FSU) squared.
- 5.1.7 Operates on 14 C size batteries.
- 5.1.8 Size (instrumentation package): 8-1/8" x 5-1/8" x 4-7/8".
- 5.1.9 Weight: 6.5 pounds
- 5.1.10 Total length of probe and handle (with probe inserted): 30 inches.
- 5.1.11 Overload: can withstand CW signal to 800% of full scale of maximum probe range.

6.0 WARRANTY SERVICE

6.1 LIMITED WARRANTY - Holaday Industries, Inc. warrants each HI-3000 series Isotropic Broadband Field Strength Meter to be free from defects in material and workmanship under normal use and service for a period of one (1) year from date of shipment. This warranty extends to the original purchaser only. This warranty does not apply to fuses, batteries, or any products or parts that have been subject to misuse, neglect, accident, or abnormal conditions of operation.

In the event of instrument failure covered by this warranty, Holaday Industries, Inc. will repair and recalibrate the instrument if returned to their factory within one (1) year of original purchase, provided the warrantor's examination discloses to its satisfaction that the product was defective. The warrantor may, at its option, replace the product in lieu of repair. With regard to any instrument returned within the warranty period, said repairs or replacement will be made without charge. If the defect was caused by misuse, neglect, accident, or abnormal conditions of operation, repairs will be billed at nominal cost. In such a case, an estimate will be submitted before work is started, if requested.

6.2 INSTRUCTIONS IN CASE OF DEFECT

- 6.2.1 Notify Holaday Industries, Inc. giving full details of the difficulty, and include the serial number of the instrument. On receipt of this information, service data or shipping instructions will be forwarded to you.
- 6.2.2 On receipt of the shipping instructions, forward the instrument, transportation prepaid to:

**Holiday Industries Inc.
Attn. Service Department
14825 Martin Drive
Eden Prairie, MN USA 55344**

Repairs will be made at the factory and the instrument returned to you, transportation prepaid.

- 6.3 CLAIM FOR DAMAGE IN SHIPMENT TO ORIGINAL PURCHASER - The instrument should be thoroughly inspected immediately upon delivery to the purchaser. All material should be checked against the enclosed packing list. Holiday Industries, Inc. cannot be responsible for shortages against the packing list unless a claim is filed with the carrier immediately. To obtain a quotation to repair shipping damage, contact Holiday Industries, Inc. Final claim and negotiations with the carrier must be completed by the customer.

7.0 TECHNICAL NOTES

7.1 LOW FREQUENCY MEASUREMENTS - When measuring electric fields, special procedures must be followed to maximize the accuracy of measurements near the low frequency end of the instrument response band. Even though the feed lines from the probe are as transparent to RF as possible, they may act as an unwanted antenna, especially at frequencies below approximately 3 MHz.

When making electric field measurements at these frequencies, such as around AM broadcast towers, it is possible to minimize unwanted pickup by placing the probe handle perpendicular to the field orientation and carefully coiling the probe cord in the same plane as the probe handle. Also, the probe should be kept well away from the body or any object which could cause reflections or re-radiation to be picked up by the probe. This scattering of reflection can cause falsely high readings. It is recommended that the instrument be placed on a non-conducting support, such as a wooden stepladder or stand. Back away from the instrument until the reading stabilizes. The meter scale is easily read from several feet away.

See figure 13 for one suggested method of measurement near an AM broadcast tower.

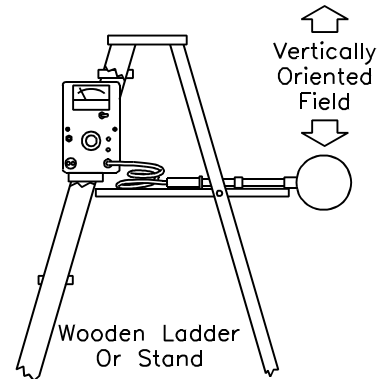


Figure 13

7.2 MRI MEASUREMENTS - Measuring RF field strengths near MRI (Magnetic Resonance Imaging or Nuclear Magnetic Resonance) units requires special care. This is due to the extremely strong static (dc) magnetic fields present near the unit during operation. The concern is in regard to interference or even damage to the meter unit itself rather than to the probe.

For this reason, it is strongly recommended that an extension cable be used to connect the probe to the meter unit. The extension cable should be at least 10 feet long. In this manner, it is possible to measure the RF fields generated by the system while locating the meter unit a safe distance away.

7.3 HIGH STANDING WAVES - In high field areas with high standing waves or high reflections, high currents may be induced in the probe cable and handle. In such areas, it may be advisable to use a resistive cable such as are provided in the Holaday Industries extension cables. Contact Holaday Industries for further information.

APPENDIX 1

HI-3001

The HI-3001 is a broadband electric field strength meter. With two electric field probes, it provides a wide dynamic range of E field measurements. It is especially useful for measurements above 300 MHz where magnetic field measurements are not generally necessary. An auxiliary range is available for the addition of an accessory probe. The accessory probe may be either the HSE high sensitivity electric field probe or the CH magnetic field probe. The meter scale is calibrated in field strength units squared [FSU]².

The fourth range of the HI-3001 is an auxiliary range not used by the two standard electric field probes. One additional probe can be used with the HI-3001 and used on the auxiliary (**AUX**) ranges. The two most sensitive range of the auxiliary probe can be used with the HI-3001. An attenuator is provided with the additional probe to provide the second range. To use the first (most sensitive) range of the additional probe, connect it directly to the meter in the normal manner. To use the second range of the additional probe, connect the probe to the attenuator and the attenuator to the probe handle. This effectively reduces the sensitivity of the additional probe by a factor of 10. Do **NOT** use the attenuator with either the GRE or the STE probes.

The optional HI-3001A version is calibrated in Volts/meter. The meter scale on the HI-3001A is non-linear in that the pointer deflection is proportional to the square of the electric field. The scale graduations are in Volts/meter. This factor is especially important when using the Recorder Output signal. The 0-1 VDC signal from the Recorder Output receptacle is proportional to meter pointer deflection. A displayed or Recorder Output Signal value is proportional to Volt²/meter². To obtain a value in

volts/meter, the square root of the indicated value must be calculated. Please refer to the following example:

Recorder Output	V^2/m^2	V/m
1.0 Volts	100	10.0 Full Scale
0.9	90	9.5
0.8	80	8.9
0.7	70	8.4
0.6	60	7.7
0.5	50	7.1
0.4	40	6.3
0.3	30	5.5
0.2	20	4.5
0.1	10	3.2

Electric Field Probes For the HI-3001

PROBE SPECIFICATION, **STE** E-FIELD PROBE

(Red)

Range 1 $10^5 \text{ V}^2/\text{m}^2$ Full ScaleRange 2 $10^6 \text{ V}^2/\text{m}^2$ Full ScaleRange 3 $10^7 \text{ V}^2/\text{m}^2$ Full ScaleFrequency Response: 0.5 MHz to 5 GHz \pm 2 dbIsotropy: \pm 0.5 dbCalibration Accuracy: \pm 0.5 db
(at calibration frequencies)PROBE SPECIFICATION, **GRE** E-FIELD PROBE

(Green)

Range 1 $10^2 \text{ V}^2/\text{m}^2$ Full ScaleRange 2 $10^3 \text{ V}^2/\text{m}^2$ Full ScaleRange 3 $10^4 \text{ V}^2/\text{m}^2$ Full ScaleFrequency Response: 0.5 MHz to 5 GHz \pm 2 dbIsotropy: \pm 0.5 dbCalibration Accuracy: \pm 0.5 db
(at calibration frequencies)

APPENDIX 2

HI-3002

The HI-3002 Broadband Field Strength meter is a general purpose broadband field strength meter for measuring electric and magnetic fields to current ANSI guidelines.

The HI-3002 is supplied with one E-field probe and one H-field probe. The E-field probe covers the range from 10^3 to 10^7 V²/m² and the H-field probe covers the range from 0.01 to 100 A²/m².

An LFH Low Frequency Magnetic Field probe may be added as an option to the HI-3002. This probe extends the frequency range for magnetic field measurements down to 500 KHz. When using the LFH probe with the HI-3002, the readings must be multiplied by the correction factor listed on the probe. For example, when reading on range 1 using the LFH probe with a correction factor of 8.7, a reading of 5 on the meter scale would be multiplied by the range multiplier (0.01) to obtain a reading of 0.05. This is multiplied by the probe correction factor to obtain a reading of 0.44 A²/m². See Appendix 8 for the LFH probe specifications.

The following table shows the full-scale readings of each range in terms of effective power density:

PROBE	RANGE	$ FSU ^2$	PWEPD* (mW/cm ²)
CH (H Field) Green	1	0.1 A ² /m ²	3.77
	2	1.0 A ² /m ²	37.7
	3	10.0 A ² /m ²	377
	4	100.0 A ² /m ²	3770
STE(E Field) Red	1	10 ⁴ V ² /m ²	2.65
	2	10 ⁵ V ² /m ²	26.5
	3	10 ⁶ V ² /m ²	265
	4	10 ⁷ V ² /m ²	2653

Note: * Plane Wave Equivalent Power Density

APPENDIX 3

HI-3003

The HI-3003 is specially configured primarily for laboratory and research use. This model also is chosen for customized configurations using special probes and/or special meter scale calibration. The standard configuration of the HI-3003 includes a single IME electric field probe and has a scale calibrated in mW/cm^2 . A 6 meter (20 foot) probe extension cable is also standard as is an internal NiCad battery pack and external battery charger. The HI-3003 can be custom configured with any of the Holaday broadband probes.

A unique feature of the HI-3003 is the set of three axis selection switches on the front panel. This feature allows the selection of any combination of sensor elements to provide the signal displayed on the meter. The meter normally sums the signals from all three of the orthogonal probe sensing elements to provide an isotropic measurement of the electromagnetic field present. In some situations, it is helpful to separately measure the field polarization along one or more of the sensing axes.

In normal operation, all three axis switches are in the UP or ON position. To measure using only a single axis, leave the selected axis switch ON and turn the other two switches OFF (DOWN).

To align a sensor with a horizontally or vertically polarized field, the probe handle must be positioned at the "analytical" angle. This is the angle that the diagonal of a cube makes with the horizontal plane (35.3°). When the probe axis, (probe handle), is oriented at this angle, the three sensing elements will be successively oriented in horizontal and vertical directions as the probe handle is rotated about its axis. Refer to figure 14 for further information.

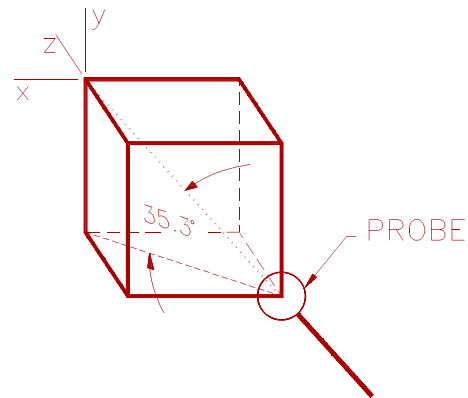


Figure 14

ELECTRIC FIELD PROBE for the Model HI-3003

PROBE SPECIFICATION, IME E-FIELD PROBE

Range 1 2 mW/cm² Full Scale

Range 2 10 mW/cm² Full Scale

Range 3 20 mW/cm² Full Scale

Range 4 100 mW/cm² Full Scale

Frequency Response: 0.5 - 1000 MHz ± 2 db

Isotropy: ± 0.5 db

Calibration Accuracy: ± 0.5 db
(at calibration frequencies)

APPENDIX 4

HI-3004

The HI-3004 Isotropic Broadband Field Strength Meter is designed primarily to measure low level fields for EMI/EMC studies. The meter scale on the HI-3004 is calibrated in Volts/meter. It is important to note that the scale is non-linear. The meter pointer deflection is proportional to field strength units squared (Volts²/meter²). The Recorder Output on the HI-3004 provides a 0-1 VDC signal proportional to meter deflection, i.e., the output signal is proportional to the square of the reading in Volts/meter. To use the output readings as Volts/meter, it is necessary to take the square root of the value and then multiply by the proper scaling factor.

The probe/handle can be secured to the instrument case by seating the red handle grip in the clamp on the side of the meter case. The clamp can be rotated to various probe orientations by pulling the locking pin and rotating the holder to the desired position. This allows for convenient one-hand operation or for stationary, unattended operation.

When the lowest (most sensitive) range is selected, an indication may occur when no field is present, especially if the cable is flexed, due to the high gain necessary on this range. Care must generally be taken when moving the probe cable to avoid indication artifacts due to the movement.

For maximum accuracy, the HI-3004 should be allowed to "warm up" for at least five (5) minutes after turning the selector switch ON before using.

The HSE High Sensitivity Electric Field probe is standard with the HI-3004. The STE Electric Field probe is available as an option.

ELECTRIC FIELD PROBES for the Model HI-3004

PROBE SPECIFICATION, HSE E-FIELD PROBE

(Blue)

Range 1 1 V/m Full Scale

Range 2 3 V/m Full Scale

Range 3 10 V/m Full Scale

Range 4 30 V/m Full Scale

Frequency Response: 0.5 - 1500 MHz \pm 2 dbIsotropy: \pm 0.5 dbCalibration Accuracy: \pm 0.5 db
(at calibration frequencies)PROBE SPECIFICATION, STE E-FIELD PROBE

(OPTIONAL Red)

Range 1 100 V/m Full Scale

Range 2 300 V/m Full Scale

Range 3 1000 V/m Full Scale

Range 4 3000 V/m Full Scale

Frequency Response: 0.5 MHz to 5 GHz \pm 2 dbIsotropy: \pm 0.5 dbCalibration Accuracy: \pm 0.5 db
(at calibration frequencies)

APPENDIX 5

HI-3005

The HI-3005 is designed specifically for magnetic field measurements. With two magnetic field probes, the system will measure magnetic fields over a frequency range from 0.3 to 300 MHz.

The HI-3005 readout includes a set of three axis selection switches on the front panel. This feature allows the selection of any combination of sensor elements to provide the signal displayed on the meter. The meter normally sums the signals from all three of the orthogonal probe sensing elements to provide an isotropic measurement of the RF magnetic field present. In some situations, it is helpful to separately measure the field polarization along one or more of the sensing axes.

In normal operation, all three axis switches are in the UP or ON position. To measure using only a single axis, leave the selected axis switch ON and turn the other two switches OFF (DOWN).

To align a sensor with a horizontally or vertically polarized field, the probe handle must be positioned at the "analytical" angle. This is the angle that the diagonal of a cube makes with the horizontal plane (54.7°). When the probe axis, (probe handle), is oriented at this angle, the three sensing elements will be successively oriented in horizontal and vertical directions as the probe handle is rotated about its axis. Refer to appendix 3, figure 14 for further information.

Magnetic Field Probes for the HI-3005:

PROBE SPECIFICATION, CH H-FIELD PROBE

(Green)

Range 1	0.1 A ² /m ²	Full Scale
Range 2	1.0 A ² /m ²	Full Scale
Range 3	10.0 A ² /m ²	Full Scale
Range 4	100.0 A ² /m ²	Full Scale

Frequency Response: 5 MHz to 300 MHz ± 2 db

Isotropy: ± 0.5 db

Calibration Accuracy: ± 0.5 db
(at calibration frequencies)

PROBE SPECIFICATION, LFH H-FIELD PROBE

(Black)

Range 1	1.0 A ² /m ²	Full Scale
Range 2	10.0 A ² /m ²	Full Scale
Range 3	100.0 A ² /m ²	Full Scale
Range 4	1000.0 A ² /m ²	Full Scale

Frequency Response: 0.3 MHz to 10 MHz ± 2 db

Isotropy: ± 0.5 db

Calibration Accuracy: ± 0.5 db
(at calibration frequencies)

APPENDIX 6

HI-3012

The HI-3012 Broadband Field Strength meter is a general purpose broadband field strength meter for measuring electric and magnetic fields to the proposed revision to the ANSI MPE's (maximum permissible exposures). It is anticipated that this revised standard will be issued in late 1991.

The HI-3012 is supplied with two new field sensing probes. The MSE E-field probe provides a 10X increase in sensitivity over the STE probe to measure to the 0.2 mW/cm² MPE for uncontrolled exposures. This probe covers the range from 10² to 10⁶ V²/m² (10 to 1000 Volts/meter).

The HCH H-field probe also provides an additional 10X increase in sensitivity over the CH probe to measure to the reduced MPE's for uncontrolled exposures. This probe covers the range from 0.001 to 10 A²/m² (.03 to 3.16 Amps/meter).

An optional **LFH** probe may be added to the HI-3012. The LFH probe is calibrated over the existing HCH ranges. A calibration factor is provided with the probe and readings on the HCH ranges must be multiplied by the calibration factor to provide actual values.

On special order, the HI-3012 may have its magnetic field scales (**H Field**) calibrated primarily to the optional **LFH** probe. In this case, the measurement range of the LFH probe can be extended up to **1,000 A²/m²** full scale on range 4. The full scale values on ranges 1, 2, and 3 are 1.0, 10.0, and 100.0 A²/m² respectively. A calibration factor of 100 is applied in converting the meter/range readings to the actual values measured with the LFH probe.

When the HI-3012 is calibrated in this manner, the sensitivity of the **HCH** probe is reduced proportionately and a calibration factor is supplied for this probe also. The calibration factor is approximately 5. This factor may vary significantly from the nominal value and may vary from range to range.

The following table shows the **Full-scale** readings of each range in terms of effective power density:

PROBE	RANGE	$ FSU ^2$	PWEPD* (mW/cm ²)
HCH (H Field) Orange	1	0.01 A ² /m ²	.377
	2	0.1 A ² /m ²	3.77
	3	1.0 A ² /m ²	37.7
	4	10.0 A ² /m ²	377.0
MSE (E Field) Green	1	10 ³ V ² /m ²	0.265
	2	10 ⁴ V ² /m ²	2.65
	3	10 ⁵ V ² /m ²	26.5
	4	10 ⁶ V ² /m ²	265

Note: * Plane Wave Equivalent Power Density

APPENDIX 7

ELECTRIC FIELD PROBES

PROBE SPECIFICATION, **STE** E-FIELD PROBE
(Red)

Range 1	$10^4 \text{ V}^2/\text{m}^2$	Full Scale
Range 2	$10^5 \text{ V}^2/\text{m}^2$	Full Scale
Range 3	$10^6 \text{ V}^2/\text{m}^2$	Full Scale
Range 4	$10^7 \text{ V}^2/\text{m}^2$	Full Scale

Frequency Response: 0.5 MHz to 5 GHz \pm 2 db
1 MHz to 1 GHz \pm 1 db

Isotropy: \pm 0.5 db

Calibration Accuracy: \pm 0.5 db
(at calibration frequencies)

PROBE SPECIFICATION, **GRE** E-FIELD PROBE
(Green HI-3001)

Range 1	$10^2 \text{ V}^2/\text{m}^2$	Full Scale
Range 2	$10^3 \text{ V}^2/\text{m}^2$	Full Scale
Range 3	$10^4 \text{ V}^2/\text{m}^2$	Full Scale

Frequency Response: 0.5 MHz to 5 GHz \pm 2 db

Isotropy: \pm 0.5 db

Calibration Accuracy: + 0.5 db
(at calibration frequencies)

PROBE SPECIFICATION, MSE E-FIELD PROBE

(Green - HI-3012)

Range 1 $10^3 \text{ V}^2/\text{m}^2$ Full ScaleRange 2 $10^4 \text{ V}^2/\text{m}^2$ Full ScaleRange 3 $10^5 \text{ V}^2/\text{m}^2$ Full ScaleRange 4 $10^6 \text{ V}^2/\text{m}^2$ Full ScaleFrequency Response: 0.5 MHz to 5 GHz \pm 2 dbIsotropy: \pm 0.5 dbCalibration Accuracy: \pm 0.5 db
(at calibration frequencies)**PROBE SPECIFICATION, IME E-FIELD PROBE**Range 1 $2 \text{ mW}/\text{cm}^2$ Full ScaleRange 2 $10 \text{ mW}/\text{cm}^2$ Full ScaleRange 3 $20 \text{ mW}/\text{cm}^2$ Full ScaleRange 4 $100 \text{ mW}/\text{cm}^2$ Full ScaleFrequency Response: 0.5 - 1000 MHz \pm 2 dbIsotropy: \pm 0.5 dbCalibration Accuracy: \pm 0.5 db
(at calibration frequencies)

PROBE SPECIFICATION, HSE E-FIELD PROBE

(Blue)

Range 1	1 Volt/meter	Full Scale AUX Range A*
---------	--------------	----------------------------

Range 2	3 Volts/meter	Full Scale AUX Probe B*
---------	---------------	----------------------------

Range 3	10 Volts/meter	Full Scale
---------	----------------	------------

Range 4	30 Volts/meter	Full Scale
---------	----------------	------------

* When used with the HI-3001 (Range B - with attenuator).

Frequency Response: 0.5 - 1500 MHz \pm 2 db

Isotropy: \pm 0.5 db

Calibration Accuracy: \pm 0.5 db
(at calibration frequencies)

APPENDIX 8

MAGNETIC FIELD PROBES

PROBE SPECIFICATION, CH H-FIELD PROBE

(Green - HI-3002)

(Yellow - HI-3001)

Range 1 0.1 A²/m² Full ScaleRange 2 1.0 A²/m² Full ScaleRange 3 10.0 A²/m² Full ScaleRange 4 100.0 A²/m² Full Scale

Frequency Response: 5 MHz to 300 MHz ± 2 db

Isotropy: ± 0.5 db

Calibration Accuracy: ± 0.5 db
(at calibration frequencies)

PROBE SPECIFICATION, HCH H-FIELD PROBE
(Orange HI-3012)

Range 1 0.01 A²/m² Full Scale

Range 2 0.10 A²/m² Full Scale

Range 3 1.0 A²/m² Full Scale

Range 4 10.0 A²/m² Full Scale

Frequency Response: 5 MHz to 300 MHz ± 2 db

Isotropy: ± 0.5 db

Calibration Accuracy: ± 0.5 db
(at calibration frequencies)

PROBE SPECIFICATION, LFH H-FIELD PROBE
(Black)

HI-3005 / HI-3002*

Range 1 1.0 A²/m² Full Scale

Range 2 10.0 A²/m² Full Scale

Range 3 100.0 A²/m² Full Scale

Range 4 1000.0 A²/m² Full Scale

Frequency Response: 0.3 MHz to 10 MHz ± 2 db

Isotropy: ± 0.5 db

Calibration Accuracy: ± 0.5 db
(at calibration frequencies)

PROBE SPECIFICATION, LFH H-FIELD PROBE

(Black)

HI-3012*

Range 1 0.2 A²/m² Full ScaleRange 2 2.0 A²/m² Full ScaleRange 3 20.0 A²/m² Full ScaleRange 4 200.0 A²/m² Full Scale

Frequency Response: 0.3 MHz to 10 MHz ± 2 db

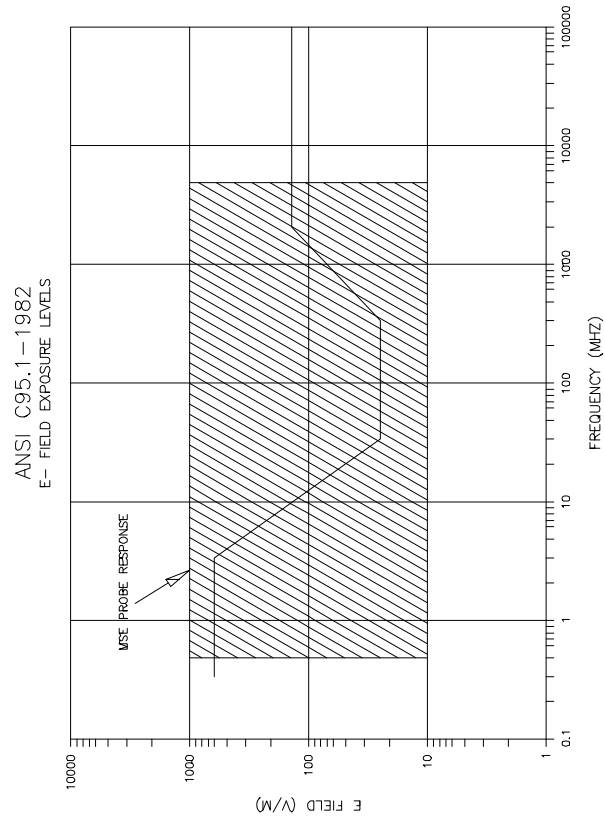
Isotropy: ± 0.5 db

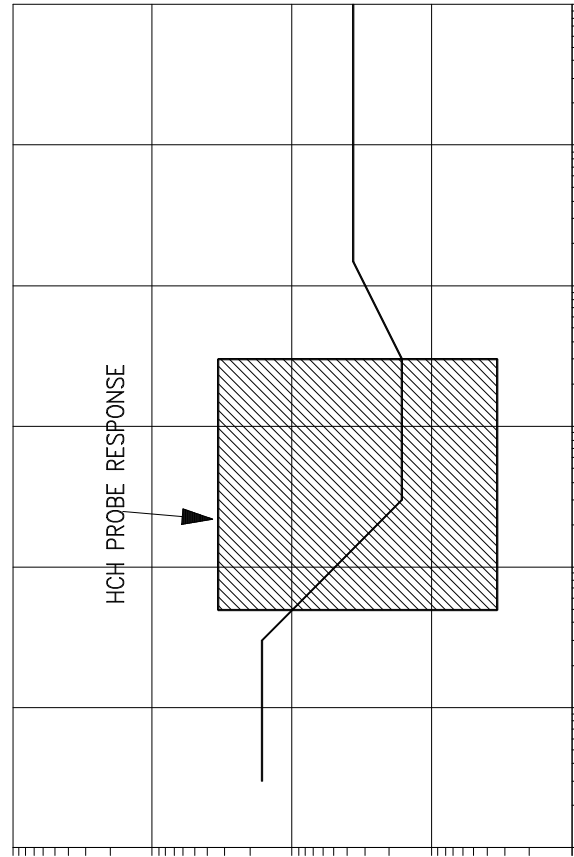
Calibration Accuracy: ± 0.5 db
(at calibration frequencies)

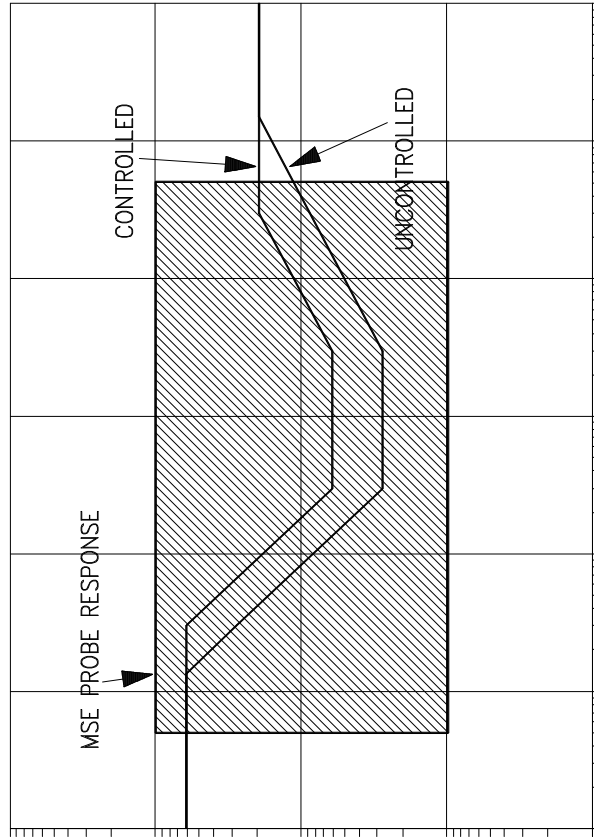
* When used with the HI-3002 and HI-3012, the **LFH** Probe is calibrated to the standard H field probe ranges and a calibration factor applied. The full scale values listed are approximate and the actual values may vary by up to 20% from those listed.

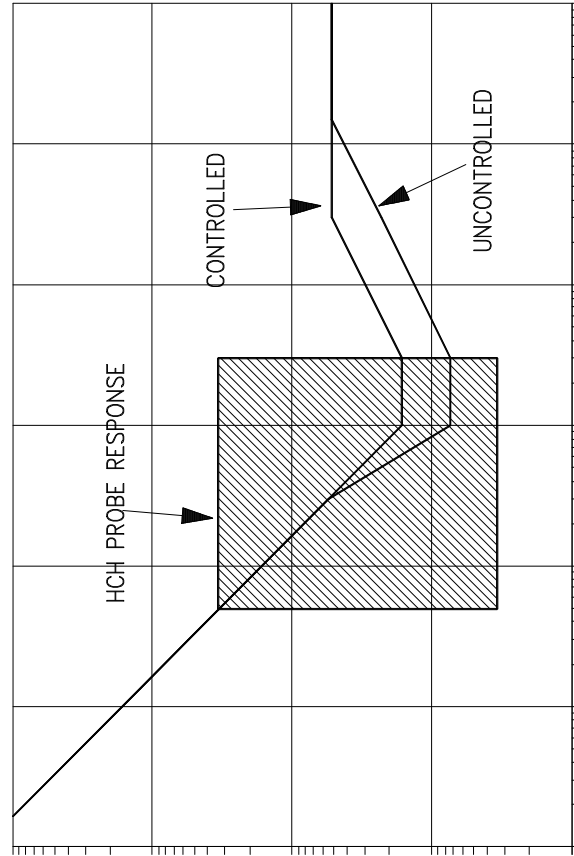
APPENDIX 9

ANSI Standards









ACCESSORIES

Description	Part No.
Alkaline Batteries (Qty. 14)	30MN1400
NiCad Battery Pack	30490310
NiCad Battery Charge Assembly	HI-3101A
Heavy Duty Carry Case	490988
Replacement Handle and Cable Assembly	490333
Probe Extension Cable	490939
Probe Spacer 13 cm and 14 cm	491002
Fiber Optic Link	HI-3113
Datalogger HI-3320	
Printer (use with HI-3320)	46DPU-411
Back Pack	445000SX

RECORD OF SERIAL NUMBERS

Meter

Model Number _____

Serial Number _____

Date Placed in Service _____

Probe

Model Number _____

Serial Number _____

Model Number _____

Serial Number _____

Model Number _____

Serial Number _____

Model Number _____

Serial Number _____

Model Number _____

Serial Number _____

--NOTES--