HI–3550

Magnetic Field Monitor
User's Manual

Declaration of Conformity

We,
HOLADAY INDUSTRIES, INC.
14825 MARTIN DRIVE
EDEN PRAIRIE, MN 55344
USA

CE

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.

Manual #600053 10/97 $12.50

Revision Record

Manual #600053
HI–3550 Magnetic Field Monitor

Revision	Description	Date
---	Release	11/93
A	Added CE Label	10/97

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Limited Warranty

Holaday Industries, Inc. warrants each model HI—3550 Magnetic Field Monitor 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 ACCIDENTS ARISING FROM THE USE OF THIS EQUIPMENT.

1.0 DESCRIPTION

Introduction

The model HI—3550 is a compact, lightweight personal magnetic field monitor employing three-axis detection, enabling accurate measurement regardless of field orientation. This instrument provides both instantaneous and time integrated field measurements. A dual alarm function (one for each measurement mode) is also included.

Holaday Industries, Inc. introduced the model HI—3550 in response to demand from researchers and operators working in the strong DC (static) magnetic fields generated by medical diagnostic devices such as MRI's, nuclear fusion experimental devices, metallurgical processes or superconductive magnets. This monitor measures the instantaneous and time integrated exposures to such fields.

Thank you for selecting our model HI—3550 Magnetic Field Monitor. Before using the instrument, please read this manual thoroughly to obtain optimum test results and keep it handy for reference.

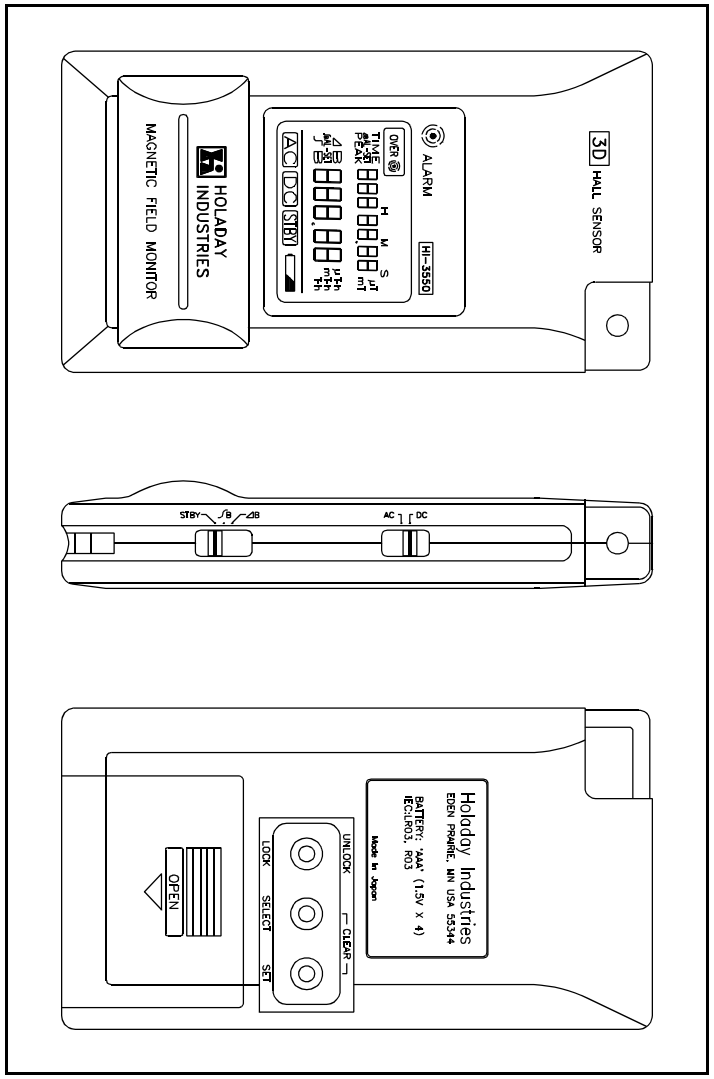

Figure 1
HI—3550 Magnetic
Field Monitor

2.0 SPECIFICATIONS

Target magnetic field: DC (static) magnetic fields; ELF(50/60 Hz) AC magnetic fields

Measuring sensor: InAs Hall Effect Sensor, three-axis (isotropic) response

Measurement range: 0.1 mT to 0.3 T

DC Measurement accuracy:

0.1 mT to 0.5 mT: ± 0.05 mT (24 °C, 50% RH)

0.5 mT to 0.3 T: ± 10%

Resolution:

0 - 40 mT: 0.01 mT

40 mT - 0.3 T: 0.5 mT

Measurement update period: 3 seconds

Measurement modes: Instantaneous (with peak hold function) Integrating (mT-hours) Standby (low power consumption)

Alarm function range:

Instantaneous measurement (3 seconds): 0.1 mT to 9999.9 mT

Integrating measurement (60 seconds): 1 mT-h to 999 T-h

Operating Temperature Range: 0 °C to 50 °C

Display: FE Type White liquid crystal

Battery: Size AAA alkaline batteries (4 required)

Battery Life at 8 hours/day continuous use):

measurement of 40 mT or less: 25 days

measurement of 40 mT or more: 15 days

Controls:

Side of case: Field Select Switch (AC,DC) Mode (STBY-IB-)B)

Rear of Case: LOCK/UNLOCK, SELECT, SET, CLEAR (SELECT + SET)

Outside dimensions: 13.2 X 7.35 X 2.0 cm (5.2 X 2.9 X 0.8 in)

Weight: Approximately 150 g (5.3 oz)

Belt Pack: Part #51560038

3.0 UNPACKING AND ACCEPTANCE

Introduction

This section contains information on the procedure for the unpacking and acceptance of the HI—3550.

Unpacking and Acceptance

Step 1. Upon delivery of your order, inspect the shipping container(s) for evidence of damage. Record any damage on the delivery receipt before signing. In case of concealed damage or loss, retain the packing materials for inspection by the carrier.

Step 2. Remove the instrument from its shipping container. Save the boxes and any protective packing materials for future use.

Step 3. Check all materials against the packing list to verify that the equipment received matches that which was ordered. If you find any discrepancies, note them and call Holaday Customer Service for further instructions.

Be sure that you are satisfied with the contents of your order and the condition of your equipment before using the instrument.

4.0 MAINTENANCE

The following user precautions are intended to ensure that your HI—3550 maintains reliable operation over its lifetime.

User Precautions
Do not expose the HI—3550 to direct sunlight or high temperatures for extended periods.

Avoid dropping, bumping, bending or twisting the instrument. Such mistreatment may damage the instrument.

Do not actuate switches or buttons with hard or pointed objects, or press on them with excessive force. Such operation could damage these controls. This may void your warranty.

To clean the instrument case, use a soft dry cloth. Avoid using volatile liquids such as thinner or alcohol, since they will damage the instrument.

NOTE

Holaday Industries is not responsible for any damage that results from disregarding the above precautions.

For maximum battery life, be sure to set the mode switch to STBY when the HI-3550 is not in use.

If the instrument will not be used for extended periods, remove the batteries to avoid damage caused by battery leakage. In case of leakage, wipe away any residue with a cloth before inserting new batteries.

Replacing Batteries

NOTE

All stored data is lost when the batteries are removed.

The HI—3550 is powered by four size AAA batteries. When the batteries need replacing, the battery indicator appears in the lower right corner of the display. When this indicator appears, replace all batteries according to the following procedure:

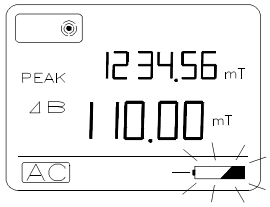

Figure 3
Low Battery Display Flashing

1. Record any integrating measurement data you wish to retain.

2. Switch the instrument to the instantaneous (B) mode.

3. On the back of the case, locate the battery cover and pull it in the direction of the arrow labelled "OPEN".

4. To make battery removal easier, push the battery toward the negative (-) terminal and lift. Remove the old batteries.

5. Insert them according to the diagrams in the inside of the battery compartment. To replace a battery, press it against the terminal spring on the negative terminal,push down and release. Be careful when inserting the batteries, or you may damage the terminal connectors. Replace all four batteries.

6. Immediately after inserting the fourth battery, the display enters the test state (all display indicators are visible) for approximately two seconds. If the test display does not appear, pull out one battery, wait several seconds, then reinsert it.

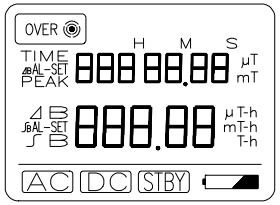

Figure 4
Test Display

NOTE

Make sure that the HI—3550 operates in the instantaneous measurement mode before switching to standby mode. If the unit does not operate properly in this mode, the instrument will not measure accurately.

7. When you have confirmed the test display state and proper instantaneous mode operation, reattach the battery cover to the case.

Battery Recommendations
It is recommended that alkaline batteries be used with the HI-3550. Always use four identical batteries (same manufacturer and specification). If this recommendation is not followed, Holaday Industries, Inc. will not be responsible for shortened battery life or other battery-related problems.

Maintenance Recommendations
Any calibration or maintenance task which requires disassembly of this instrument should be performed at the factory. There are no user serviceable components inside the instrument case. Opening or disassembling the instrument case will void the warranty.

Return Procedures
To return your HI—3550 to Holaday, use the following procedure:

1. Briefly describe the problem in writing. Give details regarding observed symptom(s), and whether the problem is constant or intermittent in nature. If you have talked previously to Holaday Customer Service about the problem, provide the date(s), the name of the service representative you spoke with, and the nature of the conversation. Include the serial number of the item being returned.

2. Package the instrument carefully. We recommend using the original box and packing materials. If this is not possible, order new boxes and foam packing from Holaday Industries, Inc.

If the instrument is under warranty, refer to the Limited Warranty at the front of this manual for additional information about your return.

Periodic/Preventive Maintenance

Holaday Industries recommends an annual calibration check of the HI—3550 Magnetic Field Monitor to verify that it is performing within specifications. This calibration check will be performed by Holaday Service Personnel at the factory. Return your instrument(s), using the original packing materials (if possible), to:

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

5.0 DESCRIPTION OF HI—3550 OPERATION

Introduction
This section provides a detailed description of the operation of the HI—3550.

Measurement Cycle
The HI—3550 performs a measurement every three seconds and displays the results on the lower line of the display panel.

Measurement Ranges
The HI—3550 can measure magnetic field strength up to 0.3 T for each of the three axes. Depending on the orientation of each sensing axis with respect to the direction of the magnetic field, it is possible to display the measured value of field intensities greater than 0.3 T.

In the integrating mode, the HI—3550 displays elapsed time on the upper line of the display panel. "H" denotes hours, "M" denotes minutes, and "S" denotes seconds. Integrating time is displayed up to 999 hours, 59 minutes, 59 seconds. When elapsed time exceeds this value, the display rolls over to 0 hours, 00 minutes, 00 seconds, and restarts the count.

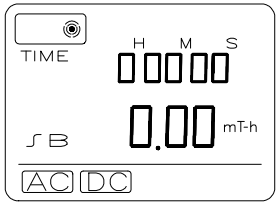

Figure 5
Integrated Time and Integrated Value Cleared

The HI—3550 can display integrated magnetic flux levels of up to 999.99 T-h. Integrated flux levels in excess of this value are not displayed.

5.1 Using the Integrating (IB) Mode

1. Slide the AC-DC (Magnetic Field Selection) switch to select the type of magnetic field to be measured. Set the STBY-IB-) B (Measurement Mode) Switch to IB.

NOTE

Do not perform the next step if you wish to add to previously stored data.

2. Press the SELECT and SET buttons (CLEAR function) on the back of the instrument simultaneously for approximately three seconds to clear the memory of stored integrated time and value.

The alarm settings remain unchanged after the memory is cleared.

Changing the Measurement Mode

Changing from integrating to instantaneous measurement mode will stop the integrating measurement mode while retaining the integrated time and value. After you change the measurement mode, the reading will remain unchanged until one measurement cycle (3 seconds) is completed.

5.2 Using the Instantaneous Measurement ( )B) Mode

Slide the AC-DC (Magnetic Field Selection) switch to select the type of magnetic field to be measured. Set the STBY—)B—IB Switch to)B. The Instantaneous and Peak Hold memory values are cleared, displaying "0.00" for both PEAK and)B. Measurement starts after three seconds.

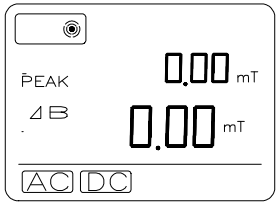

Figure 6
Instantaneous Value and Peak Hold Value Cleared

When a permanent magnet is placed close to the sensor, the measured value will vary depending on which axis is nearest to the magnet. This is normal.

Peak Hold
The model HI—3550 continuously displays the maximum instantaneous value measured since the instrument was last set to the)B mode. This peak value is displayed on the upper line of the display panel.

To clear the peak hold value:
1) change to any other mode
2) change the magnetic field selection (AC or DC).

Peak Hold Display Range
The HI—3550 is capable of displaying a maximum peak hold value of 3546.37 mT; the maximum instantaneous

value that can be displayed is 3.54 T. These readings are also displayed for any measured field strength exceeding these values.

5.3 Changing the Target Magnetic Fields

To change the target magnetic field while measuring, slide the AC-DC switch to the desired position.

NOTE

Be very careful to select the appropriate setting (AC or DC) for the magnetic field being measured. Incorrect settings can increase the error or uncertainty of the displayed value by up to 10%.

5.4 Using the Stand-by (STBY) Mode

To stop measuring, change the measurement mode to STBY. Selecting STBY reduces power consumption and prolongs battery life. All stored integrated field data is saved in STBY mode. For practical purposes, the STBY mode is the "OFF" condition of the instrument. If the instrument will not be used for a considerable period, remove the batteries.

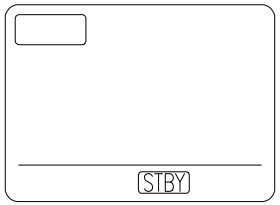

Figure 7
Stand-by Mode

5.5 Alarm Function

Selecting the Alarm Mode

1. Slide the Measurement Mode switch to STBY.
2. Press LOCK button for approximately three seconds to shift to the alarm set mode. The alarm display will be indicated on the LCD readout.

Activating/Deactivating the Alarm

When the alarm set mode is initiated, the word OVER appears and the alarm symbol blinks (upper left corner of the display).

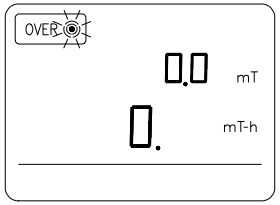

Figure 8
Ready for Alarm ON/OFF Setting

The alarm is toggled on and off each time you press the SET button. When the alarm symbol blinks, the alarm is on; when it disappears, the alarm is off. When deactivated, no alarm sounds even if an alarm value has been programmed.

Setting the Instantaneous Alarm Value

1. After the alarm set mode is activated, press the SELECT button. The alarm set symbol is visible, the word OVER disappears and both the)B AL-SET indicator and the instantaneous measurement units (mT) appear. In addition, the most significant digit of the instantaneous measurement value is blinking.

The instrument is now ready to be set to the desired alarm value for the instantaneous measurement mode.

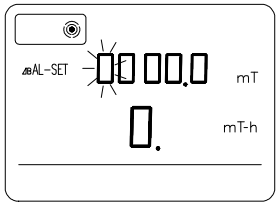

Figure 9
Instantaneous Measurement Alarm Value
Flashing Ready to Set

2. Each time the SET button is pressed, the value of the selected digit increments by one (1). Press SET until the selected digit indicates the desired value.

3. Each time you press the SELECT button, the digit to be programmed advances to the right. Proceed in this manner, setting each individual digit, to set the exact alarm value desired.

NOTE

When you proceed to step 4, the)B AL-SET mark goes out and the leading zeros of the instantaneous alarm value are suppressed. For example, 0050.0 is displayed as 50.0.

4. After you have programmed all digits of the alarm value, pressing the SELECT button will switch the instrument into the integrated alarm units-of-measure programming mode. The IB AL-SET indicator and the digits to be programmed appear on the lower line of the display, and the integrating unit of measure

symbol blinks. Pressing the SET button now toggles the units of measure between mT-h and T-h (milliTesla-hours and Tesla-hours).

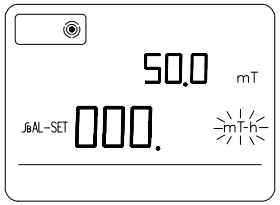

Figure 10
Leading Zeros Suppressed

Setting the Integrating Alarm Value

1. After you have set the alarm value unit of measure for integrating measurement (see step 4, above), press the SELECT button. The most significant digit of the integrated alarm value blinks.

2. Each time the SET button is pressed, the value of this digit increments by one (1). Press SET until the selected digit indicates the desired value.

3. Each time you press SELECT button, the digit to be programmed advances to the right. Proceed in this manner, setting each individual digit, to set the exact alarm value desired.

4. After you have programmed all digits of the alarm value, pressing the SELECT button again returns the instrument to the alarm ON/OFF state (see "Activating/Deactivating the Alarm").

5. When you return to the alarm ON/OFF, the IB AL-SET mark will go out and, as before, the leading

zeros of the integrating measurement alarm value will be suppressed.

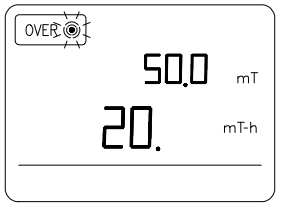

Figure 11
Leading Zeros Suppressed
Ready for Alarm ON/OFF Setting Again

Changing the Alarm Settings

1. In the alarm set mode, press the SELECT button to move to the value or unit you wish to change.

2. Press the SET button to program the desired value or unit.

Ending Alarm Set Mode

When you have completed setting the alarms, press the LOCK button for approximately three seconds. The instrument returns to the stand-by mode, and the alarm set mode is terminated. Switching directly to the instantaneous or integrating measurement mode will also terminate the alarm set mode automatically.

Alarm Indicators by Measurement Mode

When alarm values are programmed for both integrating and instantaneous measurement modes, and the alarm is ON:

a. In the integrating measurement mode, the IB AL-SET,) B AL-SET, and alarm indicators are visible.
b. In the instantaneous measurement mode, only the

alarm indicator is visible.

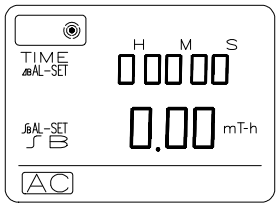

Figure 12
Integrating Mode Display
with Both Alarms Set and ON

When an alarm value is programmed only for the integrating measurement mode and the alarm is ON:

a. In the integrating measurement mode, only the alarm indicator is visible.
b. In the instantaneous measurement mode, no alarm indications are visible.

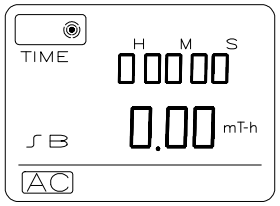

Figure 13
Integrating Mode Display
with Only Integrating Alarm Set and ON

When an alarm value is programmed only for the instantaneous measurement mode and the alarm is ON:

a. In the integrating measurement mode, both the

)B AL-SET and the alarm indicators are visible.

b. In the instantaneous measurement mode only the alarm indicator is visible.

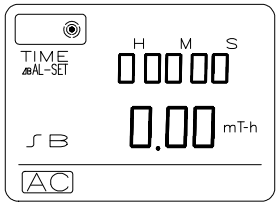

Figure 14
Integrating Mode Display
with Only Instantaneous Alarm Set and ON

When alarm values are programmed for both the integrating and instantaneous measurement modes but the alarm is OFF, or when the alarm is ON but alarm values for both the integrating and instantaneous measurement values are set to 0.0 mT:

None of the IB AL-SET,)B AL-SET or alarm indicators are visible.

In the stand-by mode, only the STBY indicator is visible.

Alarm

The instantaneous alarm signal is generated in both the instantaneous and integrating measurement modes. **The integrating alarm signal is produced only in the integrating measurement mode.**

The instantaneous alarm signal occurs 8 times per second for a duration of three seconds. The integrating alarm signal occurs once per second for a duration of 60 seconds.

When the instantaneous alarm setting overlaps the integrating alarm setting, the instantaneous alarm is given priority. After the instantaneous alarm stops, the integrating alarm follows immediately.

Stopping the Integrating Mode Alarm

If desired, the integrating mode alarm can be interrupted manually prior to the end of the default duration (60 seconds). The operator can stop the alarm by pressing the LOCK, SELECT, or SET buttons, or by switching measurement modes. When the alarm is interrupted in this manner, the OVER indicator appears. The integrating alarm will not operate again until it is reset.

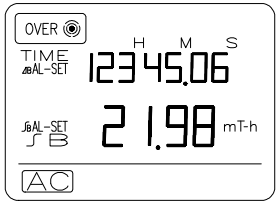

Figure 15
OVER is Displayed

NOTE

When the instantaneous and integrating alarm values are set to 0.0 mT, the alarm will not sound even if it is activated.

Clearing a Manually Interrupted Alarm

Pressing the SELECT and SET buttons simultaneously for approximately three seconds clears the memory of integrated time and value. The alarm is reset automatically.

When you modify the integrating mode alarm value, the

alarm will also be reset automatically.

When the alarm is reset, the OVER indicator disappears.

-- NOTES --

-- NOTES --