

®  **HHG-17**

®  **Triaxial ELF**

®  **Milligauss Meter**



**Operator's
Manual**



Servicing USA and Canada: Call OMEGA Toll Free

USA

One Omega Drive, Box 4047
Stamford, CT 06907-0047
Telephone: (203) 359-1660
FAX: (203) 359-7700

Canada

976 Bergar
Laval (Quebec) H7L 5A1
Telephone: (514) 856-6928
FAX: (514) 856-6886

Sales Service: 1-800-826-6342 / 1-800-TC-OMEGASM
Customer Service: 1-800-622-2378 / 1-800-622-BESTSM
Engineering Service: 1-800-872-9436 / 1-800-USA-WHENSM
TELEX: 996404 EASYLINK: 62968934 CABLE OMEGA

Servicing Europe: United Kingdom Sales and Distribution Center

25 Swannington Road, Broughton Astley, Leicestershire
LE9 6TU, England
Telephone: 44 (0455) 285520 FAX: 44 (0455) 283912

The OMEGA Complete Measurement and Control Handbooks & Encyclopedias

- ✓ Temperature
- ✓ Pressure, Strain & Force
- ✓ Flow and Level
- ✓ pH and Conductivity
- ✓ Data Acquisition Systems
- ✓ Electric Heaters
- ✓ Environmental Monitoring and Control



Call for Your FREE Handbook Request Form Today:
(203) 359-RUSH

OPERATING INSTRUCTIONS

HHG-17 Triaxial ELF Milligauss Meter

SECTION 1: GENERAL INFORMATION

The OMEGA® HHG-17 Triaxial ELF Milligauss Meter is a low-cost, hand-held, *triaxial* milligauss meter available for the measurement of Extremely Low Frequency (ELF) magnetic fields. The milligauss meter is a precision instrument useful in making quick, accurate spot field measurements from a variety of ELF sources, including AC power lines, office equipment, video display terminals (VDTs), household appliances, and all types of electrical and electronic equipment.

The milligauss meter uses three internal orthogonal sensors to evaluate and display a wide range of ELF magnetic fields, *independent* of measurement angle. The instrument utilizes a precision analog-to-digital converter and CMOS microprocessor to accurately compute and display the vector magnitude of the *magnetic flux density* in milligauss. The instrument will automatically adjust to the proper scale, yielding a wide dynamic measurement range of 0.1 to 1999 mG with a typical accuracy better than 2%, sufficient for characterizing essentially all electrical and electronic equipment.

Under normal operating conditions the unit will provide 60 hours of continuous use with a standard 9V alkaline battery. A low battery indicator will signal the user when approximately one additional hour of measurement time is available before the battery needs replacing.

The instrument comes complete with a padded, imitation leather carrying case. Optional features include a switchable single-axis mode (to display the individual vector components), analog output, DC (recorder) output, and wideband frequency response.

Note: The term "magnetic field" is used loosely throughout the manual. All references to magnetic field levels in this manual actually refer to the "magnetic flux density," which has (CGS) units of milligauss (mG).

SECTION 2: UNPACKING INSTRUCTIONS

Remove the Packing List and verify that you have received all equipment. If you have any questions about the shipment, please call the OMEGA Customer Service Department at 1-800-622-2378 or (203) 359-1660.

When you receive the shipment, inspect the container and equipment for signs of damage. Note any evidence of rough handling in transit. Immediately report any damage to the shipping agent.

Note: The carrier will not honor damage claims unless all shipping material is saved for inspection. After examining and removing contents, save packing material and carton in the event reshipment is necessary.

SECTION 3: OPERATING INSTRUCTIONS

General. As a result of its inherent 3-axis method of measurement, the HHG-17 Milligauss Meter virtually eliminates the

measurement errors associated with single-axis instruments due to improper instrument orientation. With this milligauss meter, it is virtually impossible to get an erroneous reading of the magnetic field. Inexperienced and non-technical users will benefit from the meter's ease of use, while experienced users will appreciate the ability to make accurate measurements and field surveys quickly and with full confidence.

Turning the Instrument On. To operate the milligauss meter, first flip the ON/OFF switch to the UP position. The instrument will perform a self-test and display -188.8 for approximately two seconds, verifying proper operation. After the power-on sequence has finished, the display will indicate the magnetic field reading in mG.

Operation. Simply bring the instrument into the vicinity of ELF magnetic fields and note the magnetic field level. Upon power-on, the meter is placed in the high-sensitivity mode (0.1 mG resolution) and will remain in that range until the magnetic field exceeds 199.9 mG. At that time, the unit is placed into the low-sensitivity mode, where it will remain as long as the magnetic field stays within the 180-1999 mG range. If the field exceeds the upper limit of 1999 mG, the display will blank, other than leaving a leading "1" in the display, signifying an out-of-range condition. If the level falls below 180 mG, the unit will revert to the high-sensitivity mode.

The three magnetic field sensors are located inside the instrument just below the LCD display, behind "TRIAxIAL" on the front panel. The display will indicate the magnetic field level at that point in space. Rotation of the instrument will not result in a changing field indication as long as the magnetic field is constant across the dimensions of the internal sensors. Some degree of directionality will be observed in *near fields*, i.e., where the magnetic field level changes rapidly over distances

comparable to the dimensions of the instrument. In *far fields*, where the magnetic field is essentially constant, directionality of the instrument is typically less than 1%.

Battery Replacement. Under normal operating conditions, the unit will provide approximately 60 hours of continuous use using a standard 9V alkaline battery. When the battery level falls below 5.4V, a *low battery indication* (signalled by a minus sign) will be made. Approximately one additional hour of measurement time is available before accuracy will become degraded; however, the battery should be replaced as soon as possible.

Dead Battery: If, when you turn the instrument on, either nothing happens, or the unit behaves in an unpredictable fashion, try replacing the battery. If this solves the problem, it may be that the instrument was left on accidentally for an extended period of time, resulting in a “dead” battery.

Single-Axis Mode: (Option-X01). Units equipped with OPT-X01 have the ability to display the vector components of the magnetic flux density: B_x , B_y , and B_z , in mG.

To activate the single-axis mode, depress the push-button on the top panel firmly until the display blanks, then release. After blanking for approximately one-half second, the display will indicate the x-component of the magnetic field, B_x . Depress the push-button a second time until the display blanks, release, and the display will indicate B_y . Depress the push-button a third time until the display blanks, release, and the display indicates B_z . Depress the push-button once more and the instrument will reset itself and enter the triaxial mode.

Note: The x-sensor is aligned across the meter face, from left to right. The y-sensor alignment is across the meter face, from top to bottom. The z-sensor alignment is through the meter, from front to back.

SECTION 4: CIRCUIT DESCRIPTION

This section describes the function of major circuit elements of the HHG-17. Refer to the block diagram on the following page.

ELF Amplification/Detection Circuitry. Three independent ELF amplifier/detection chains provide DC voltages proportional to the vector components of the rms magnetic field. Each chain consists of an air wound sensing coil, followed by two-stages of AC amplification and filtering. The buffered AC voltage is then converted to a DC voltage by a full-wave rectifier, followed by additional filtering, averaging, and amplification. The resulting DC voltage is scaled to indicate the rms value of the magnetic field.

Analog-to-Digital Conversion. A 4-channel A/D converter converts the analog DC voltages to a 12-bit digital data word. In addition to the x, y, and z components of the magnetic field, the fourth channel of the A/D senses the battery voltage. To reduce current consumption and extend battery life, the A/D is only activated for a small portion of each measurement cycle.

Microprocessor and Support Circuitry. At the heart of the HHG-17 is a CMOS μ P. During each measurement cycle, it initiates a transfer of data from the A/D, computes the vector magnitude of the magnetic field, and transfers the result to the LCD via the display driver. The μ P also senses over and under range conditions, and adjusts the AC amplifier gains accordingly. It also recognizes entry into the single-axis mode (in models equipped with the -X01 option), and thereby displays only the appropriate vector component of the magnetic field. Timing circuitry synchronizes the measurement cycle to repeat every 400 ms.

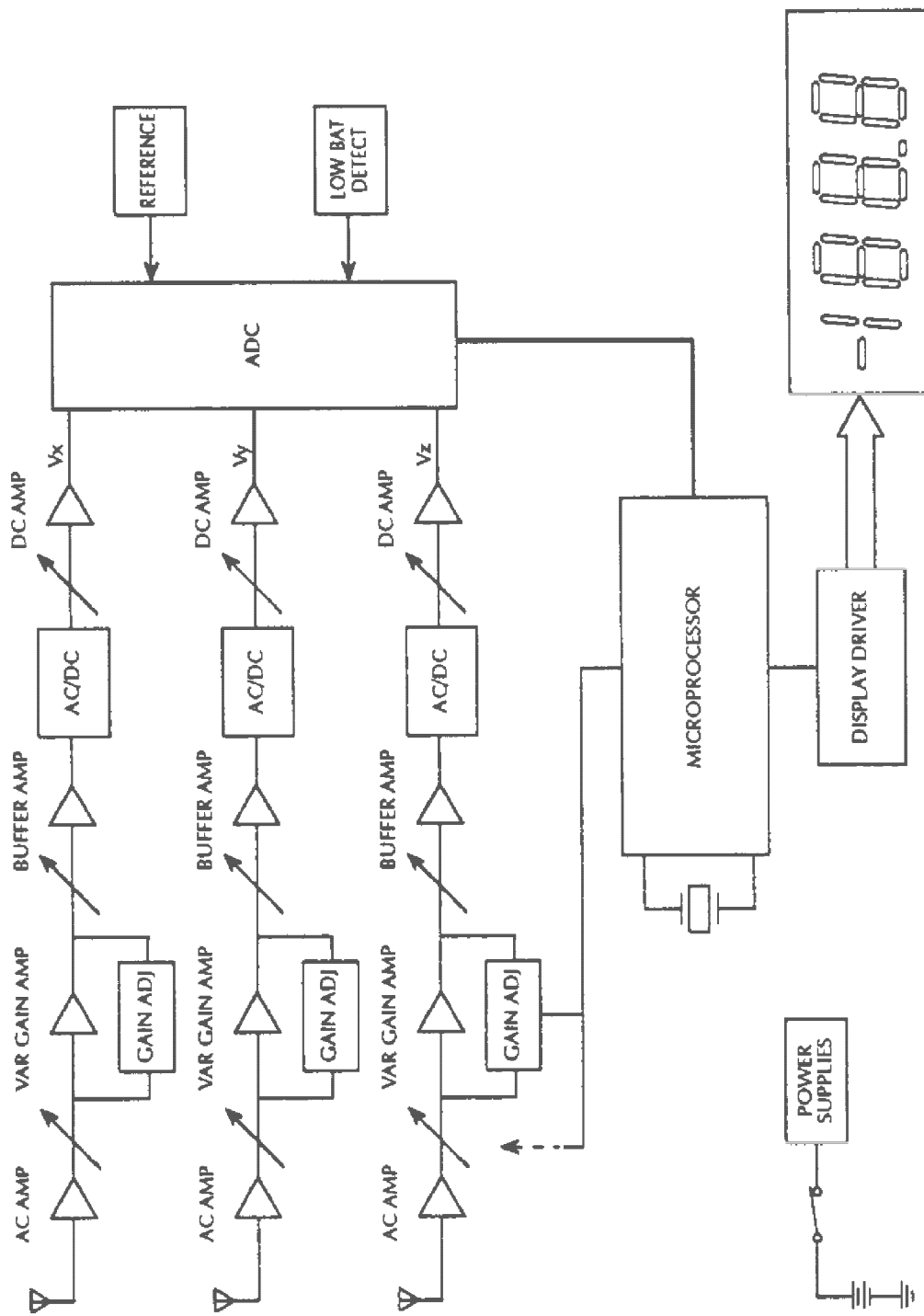


FIGURE 1: Functional Block Diagram of HHG-17

SECTION 5: SPECIFICATIONS

Dynamic Range: 0.1 mG to 1999 mG, rms, autoranging over four decades (20,000:1). 199.9 mG full-scale with 0.1 mG resolution in *high-sensitivity mode*. 1999 mG full-scale with 1 mG resolution in *low-sensitivity mode*.

Accuracy: \pm (1% of rdg + 1 digit) typical. The instrument is average responding, calibrated to an rms sine wave at 60 Hz (50 Hz optional).

Directionality: \pm 1% (typical) for all measurement angles.

Sensor Type: 3 x 750 turns #38 Cu; 0.29" dia. air core.

Frequency Response: essentially flat (\pm 10%) between 40-400 Hz, with cutoff frequencies (-3 dB) of 30/600 Hz. Accuracy is better than \pm 5% between 50-300 Hz for accurate measurement of the 3rd and 5th 60 Hz harmonic. OPTION F20 extends the -3 dB frequencies to 20/2000 Hz.

Environmental: Temperature Range: -10°C to $+50^{\circ}\text{C}$ operating and -20°C to $+85^{\circ}\text{C}$ storage. Relative Humidity: 90% at $+40^{\circ}\text{C}$ operating and 95% up to $+60^{\circ}\text{C}$ storage.

Battery Life/Power Source: 60 hours, typical use (to 5.1V min) using standard 9V alkaline battery. Replace **only** with an alkaline battery (Duracell MN1604 / Eveready 522 / or equivalent).

DC Output (OPT D): 10 mV/mG; 2 volts FS at 200 mG.

Size/Weight: Case dimensions are 5.9"H x 3.2"W x 1.2"D (150mm H x 81mm W x 30mm D) (OPT X01 add 0.5" [12.70mm] to H). Weight approximately 7 oz. (200 g).



WARRANTY

OMEGA warrants this unit to be free of defects in materials and workmanship and to give satisfactory service for a period of **13 months** from date of purchase. OMEGA Warranty adds an additional one (1) month grace period to the normal **one (1) year product warranty** to cover handling and shipping time. This ensures that our customers receive maximum coverage on each product. If the unit should malfunction, it must be returned to the factory for evaluation. Our Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective it will be repaired or replaced at no charge. However, this WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of being damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components which wear or which are damaged by misuse are not warranted. These include contact points, fuses, and triacs.

We are glad to offer suggestions on the use of our various products. Nevertheless, OMEGA only warrants that the parts manufactured by it will be as specified and free of defects.

OMEGA MAKES NO OTHER WARRANTIES OR REPRESENTATIONS OF ANY KIND WHATSOEVER, EXPRESSED OR IMPLIED, EXCEPT THAT OF TITLE AND ALL IMPLIED WARRANTIES INCLUDING ANY WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED.

LIMITATION OF LIABILITY: The remedies of buyer set forth herein are exclusive and the total liability of OMEGA with respect to this order, whether based on contract, warranty, negligence, indemnification, strict liability or otherwise, shall not exceed the purchase price of the component upon which liability is based. In no event shall OMEGA be liable for consequential, incidental or special damages.

Every precaution for accuracy has been taken in the preparation of this manual; however, OMEGA ENGINEERING, INC. neither assumes responsibility for any omissions or errors that may appear nor assumes liability for any damages that result from the use of the products in accordance with the information contained in the manual.

SPECIAL CONDITION: Should this equipment be used in or with any nuclear installation or activity, buyer will indemnify OMEGA and hold OMEGA harmless from any liability or damage whatsoever arising out of the use of the equipment in such a manner.

RETURN REQUESTS / INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA ENGINEERING Customer Service Department. Call toll free in the USA and Canada: 1-800-622-2378, FAX: 203-359-7811; International: 203-359-1660, FAX: 203-359-7807.

BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, YOU MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OUR CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

FOR **WARRANTY** RETURNS, please have the following information available **BEFORE** contacting OMEGA:

1. P.O. number under which the product was **PURCHASED**,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems you are having with the product.

FOR **NON-WARRANTY** REPAIRS OR **CALIBRATION**, consult OMEGA for current repair/calibration charges.

Have the following information available **BEFORE** contacting OMEGA:

1. P.O. number to cover the **COST** of the repair/calibration,
2. Model and serial number of product, and
3. Repair instructions and/or specific problems you are having with the product.

OMEGA's policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering.

OMEGA is a registered trademark of OMEGA ENGINEERING, INC.

© Copyright 1994 OMEGA ENGINEERING, INC. All rights reserved. This documentation may not be copied, photocopied, reproduced, translated, or reduced to any electronic medium or machine-readable form, in whole or in part, without prior written consent of OMEGA ENGINEERING, INC.

OMEGA... Your Source for Process Measurement and Control

TEMPERATURE

- ☑ Thermocouple, RTD & Thermistor Probes, Connectors, Panels & Assemblies
- ☑ Wire: Thermocouple, RTD & Thermistor
- ☑ Calibrators & Ice Point References
- ☑ Recorders, Controllers & Process Monitors
- ☑ Infrared Pyrometers

PRESSURE/STRAIN FORCE

- ☑ Transducers & Strain Gages
- ☑ Load Cells & Pressure Gauges
- ☑ Displacement Transducers
- ☑ Instrumentation & Accessories

FLOW/LEVEL

- ☑ Rotameters, Gas Mass Flowmeters & Flow Computers
- ☑ Air Velocity Indicators
- ☑ Turbine/Paddlewheel Systems
- ☑ Totalizers & Batch Controllers

pH/CONDUCTIVITY

- ☑ pH Electrodes, Testers & Accessories
- ☑ Benchtop/Laboratory Meters
- ☑ Controllers, Calibrators, Simulators & Pumps
- ☑ Industrial pH & Conductivity Equipment

DATA ACQUISITION

- ☑ Data Acquisition and Engineering Software
- ☑ Communications-Based Acquisition Systems
- ☑ Plug-in Cards for Apple, IBM & Compatibles
- ☑ Datalogging Systems
- ☑ Recorders, Printers & Plotters

HEATERS

- ☑ Heating Cable
- ☑ Cartridge & Strip Heaters
- ☑ Immersion & Band Heaters
- ☑ Flexible Heaters
- ☑ Laboratory Heaters

ENVIRONMENTAL MONITORING AND CONTROL

- ☑ Metering & Control Instrumentation
- ☑ Refractometers
- ☑ Pumps & Tubing
- ☑ Air, Soil & Water Monitors
- ☑ Industrial Water & Wastewater Treatment
- ☑ pH, Conductivity & Dissolved Oxygen Instruments