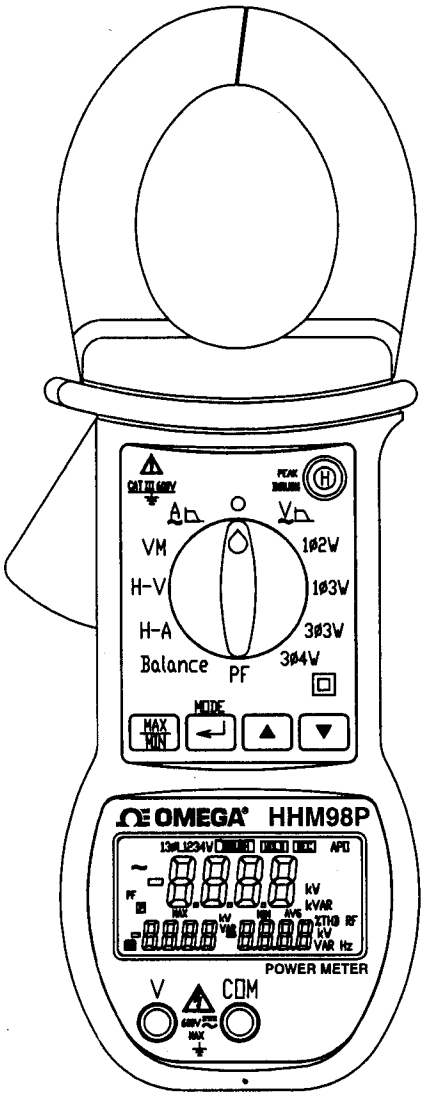
1 YEAR WARRANTY

CE

User's Guide



HHM98P
1000A ac TRMS Clamp On Power Meter

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It is the policy of OMEGA to comply with all worldwide safety and EMC/EMI regulations that apply. OMEGA is constantly pursuing certification of its products to the European New Approach Directives. OMEGA will add the CE mark to every appropriate device upon certification.

SAFETY INFORMATION

⚠ DANGER

- To avoid short circuits and potentially life-threatening hazards, never attach the clamp sensor to a circuit that operates at more than the maximum rated voltage to earth, or over bare conductors.
- Clamp sensor should only be connected to the secondary side of a breaker, so the breaker can prevent an accident if a short circuit occurs. Connections should ever be made to the primary side of a breaker, because unrestricted current flow could cause a serious accident if a short circuit occurs.
- Connect the voltage test lead to the instrument first, and then to the active lines to be measured. Observe the following to avoid electric shock and short circuits:
  When the clamp sensor is opened, do not allow the metal part of the clamp to touch any exposed metal, or to short between two lines, and do not use over bare conductors.

⚠WARNING

- Do not allow the instrument to get wet, and do not take measurements with wet hand. This may cause an electric shock.
- To avoid electric shock when measuring live lines, wear appropriate protective gear, such as insulated rubber gloves, boots and a safety helmet.
- To avoid electric shock when replacing the battery, first disconnect the voltage test lead or clamp from the object to be measured.
- After replacing the battery, replace the cover and screws before using the instrument.
- When replacing the battery, be sure to insert them with the correct polarity. Otherwise, poor performance or damage from battery leakage could result. Replace battery only with the specified type.
- To avoid the possibility of explosion, do not short circuit, disassemble or incinerate batteries.
- Handle and dispose of batteries in accordance with local regulations.

⚠CAUTION

- Do not store or use the instrument where it could be exposed to direct sunlight, high temperature or humidity, or condensation. Under such conditions, the instrument may be damaged and insulation may deteriorate so that it no longer meets specifications.
- Keep the clamp jaws and core slits free from foreign objects, which could interfere with clamping action.

- To avoid damage to the instrument, protect if from physical shock when transporting and handling. Be careful to avoid physical shock from dropping. Do not exert excessive pressure on the clamp sensor or attempt to wedge the sensor into a tight spot for measurement.
- This instrument is designed for use indoors. It can be operated at temperatures between 0℃ and 40℃ without degrading safety.
- This instrument is not designed to be entirely water or dust-proof. Do not use it in an especially dusty environment, nor where it might be splashed with liquid. This may cause damage.
- Calibration and repair of this instrument should be performed only under the supervision of qualified technicians knowledgeable about the dangers involved.

Safety symbols

Before using the instrument, be sure to carefully read the following safety notes.

⚠	DANGEROUS VOLTAGE	⚠	SEE EXPLANATION IN MANUAL
~	AC-ALTERNATING CURRENT	⧈	DOUBLE INSULATION (Protection Class II)
⎓	DC-DIRECT CURRENT	⏚	GROUND

SPECIFICATIONS

Display: 4 digit liquid crystal display (LCD) with a maximum reading of 9999.
Over-range: (OL) or (-OL) is displayed.
Low battery indication: The "⊟" is displayed when the battery voltage drops below the operating level.
Measurement rate: 1 times per second, nominal.
Operating Environment: 0°C to 40°C at < 70% R.H.
Storage Temperature: -20°C to 60°C, 0 to 80% R.H. with battery removed from meter.
Accuracy: Stated accuracy at 23°C ± 5°C, 75% R.H.
Temperature Coefficient: 10% of applicable accuracy per °C(5% per °F) outside the range of 18 to 28°C(65°F to 82°F)
Altitude up to 2000m.
Dimensions of conductor: 46.5 Ø mm.
Safety: According to EN61010-1 protection class II over voltage category (CAT III 600V) pollution degree 2.
Power: Single standard 9-volt battery, NEDA 1604, JIS 006P, IEC 6F22.
Battery life: 50 hours typical with carbon-zinc.
Dimensions: 250mm (H) x 100mm (W) x 46mm (D)
Weight: Approx. 375g including battery.
Accessories: One pair test leads, 9V battery (installed).

AC CURRENT (True RMS)

Range: 0.0 to 600.0A
600A to 1000A
Resolution: 0.1A/1A
Accuracy:
±(1.5% rdg + 10dgts) on 50Hz to 60Hz
±(6% rdg + 10dgts) on 45Hz to 400Hz
Effective measurement: 2A to 1000A
Crest Factor: <2.5@ 0 to 100A, <1.5 @ 100 to 1000A
Overload protection: <1200A AC max for 1 minute
Accuracy at the center of CT.

AC VOLTAGE (True RMS)

Range: 0.0 to 600.0V
Resolution: 0.1V
Accuracy:
±(1% rdg + 5dgts) on 20Hz to 100Hz
±(6% rdg + 5dgts) on 100Hz to 400Hz
Input impedance: 1MΩ
Effective measurement: 2V to 600V
Overload protection: 650V AC/DC rms
Crest Factor: <2.3 @ 0 to 50V, <1.8 @ 50 to 600V

PEAK Functions (for ACV, ACA)
Range: 5A to 1000A
5V to 600V
Accuracy: ±(5% rdg + 10dgts) @ 45 to 65Hz

FREQUENCY
Range: 20.0 to 400.0Hz
Resolution: 0.1Hz
Accuracy: ±(0.5% rdg + 5dgts)
Sensitivity:
Voltage > 5 Vrms
Current > 5 Arms on 20Hz to 100Hz
Current > 10 Arms on 100Hz to 400Hz
Overload protection: 650V AC/DC rms

Power Measurement Accuracy

To make sure measuring accuracy, clamp the jaw several times to align the contact surface in place to get the optimal measuring results before you take measurement.
Single phase or three phase load with sine wave input at 50/60 Hz Measurement range:
Effective measurement current range: 4 to 1000A
Effective measurement voltage range: 80 to 600V

Power Factor (PF)
Resolution: 0.001
Accuracy:
±(3.0% rdg + 0.02) at 1.000 > PF ≥ 0.500
±(5.0% rdg + 0.02) at 0.500 > PF ≥ 0.200
±(10.0% rdg + 0.02) at 0.200 > PF ≥ 0

Active Power (kW)
Resolution: 0.01/0.1 kW

Apparent Power (kVA)
Resolution: 0.01/0.1 kVA

Reactive Power (kVAR)
Resolution: 0.01/0.1 kVAR

Note:
1. Active power (kW), apparent power (kVA) and reactive power (kVAR) values obtained by calculation from the measured value of power factor, current and voltage. Power factor (PF): the value of the function is obtained by rounding off, but the micro-processor take the original measuring value to d calculation. There is a certain difference if the readings of the display being used to do further calculations.
2. The resolution of kW and kVAR will vary accompanying the variations of kVA.

Harmonic measurement (Effective in the voltage and current)

Measurement items: Level of each order, percentage of each order and total harmonic distortion (THD-F and THD-R) Measurement range: Fundamental frequency 45Hz to 65Hz Window width: 1 cycle (45Hz to 65Hz)

Date points: 128 points

Window type: Rectangular

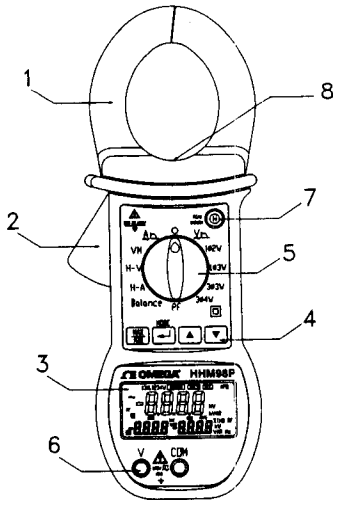
Orders analyzed: Up to 25th

Order	Accuracy
1	±(3.0% rdg + 10dgts)
2 to 6	±(3.5% rdg + 10dgts)
7 to 8	±(4.5% rdg + 10dgts)
9 to 10	±(5.0% rdg + 10dgts)
11 to 15	±(7.0% rdg + 10dgts)
16 to 20	±(10% rdg + 10dgts)
21 to 25	no spec.

Harmonic percentage: ±2dgts. with respect to calculation from each measured value.
Total harmonic distortion ratio: ±2dgts. with respect to calculation from each measured value.

Names of Outer Parts

Front Side:



1. Clamp sensor
To measure current, open the top ends of the clamp sensor by gripping the lever 2. Then position the conductor to be measured at the center of clamp sensor and firmly close the clamp sensor.

2. Lever
Used to open and close the clamp sensor.

3. Display (LCD)

Display	Function
PF	Power Factor indicator
~	Alternating Current indicator
[+−]	Battery low indicator
1Ø 2W	Single-Phase Two-Wire indicator
1Ø 3W	Single-Phase Three-Wire indicator
3Ø 3W	Three-Phase Three -Wire indicator
3Ø 4W	Three -Phase Four-Wire indicator
L1, 2, 3	Measure voltage and current in 1Ø3W, 3Ø3W and 3Ø4W function indicator
INRUSH	INRUSH function indicator
HOLD	Hold measured reading indicator
REC	Record MAX, MIN and AVG indicator
APO	Auto power off indicator
kW	Active power indicator
kVA	Apparent power indicator
kVAR	Reactive power indicator
V	Voltage indicator
A	Current indicator
Hz	Frequency indicator
MAX	Maximum value indicator
MIN	Minimum value indicator
AVG	Average value indictor
P	Peak function indicator
H01	The order of Harmonic
%	Total harmonic distortion ratio
%THD F	Total harmonic distortion ratio-F (as % of Fundamental)
%THD R	Total harmonic distortion ratio-F (as % of rms total)

4. Push buttons
5. Rotary switch
6. Voltage input
7. Hold button
8. Current direction mark
When measuring power, clamp the conductor with the arrow facing the load side.

Button Operation

1. A point of view: This shows the way of changing on Display 1 to 3.

Display 1
Display 2 Display 3

In all range, press "H" button and turn on the meter to disable the APO(Auto Power Off 10 minutes) function.

2. In Voltage measurements and Current measurements range. Method of measurement by active filter.

2.1 Max / Min button:
Press this button to trigger maximum and minimum values and calculates average value of measurement record. Press this button more than 2 seconds to exit this function.

2.2 ↵ button: Disabled.

2.3 ▲ and ▼ button: Disabled.

2.4 H / PEAK / INRUSH button:
Press this button to trigger HOLD, PEAK and INRUSH function (in voltage range INRUSH function is disabled).

3. In 1Ø 2W range

3.1 Max / Min button:
Press this button to trigger maximum and minimum values and calculates average value of measurement record. Press this button more than 2 seconds to exit this function.

3.2 ↵ button: Disabled.

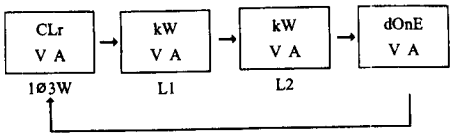
3.3 ▲ and ▼ button:
Press this button to change view parameters.
V, A, kW, kVAR and kVA.

3.4 H / PEAK / INRUSH button:
Press this button to trigger the HOLD function.
The PEAK and INRUSH function is disabled.

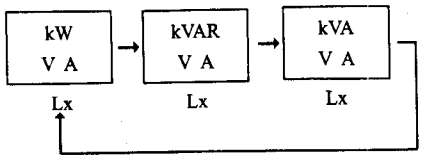
4. In 1Ø 3W range

4.1 Max / Min button: Disabled.

4.2 ↵ button:
Press this button to into save data function.



4.3 ▲ and ▼ button:
Press this button to change view parameters.
V, A, kW, kVA and kVAR of Lx.

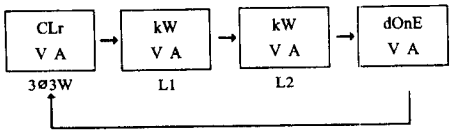


4.4 H / PEAK / INRUSH button:
Press this button to trigger the HOLD function.
The PEAK and INRUSH function is disabled.

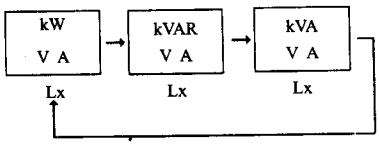
5. In 3Ø 3W range

5.1 Max / Min button: Disabled

5.2 ↵ button:
Press this button to into save data function.



5.3 ▲ and ▼ button:
Press this button to change view parameters.
kW, kVA R and kVA of Lx(R or S or T).

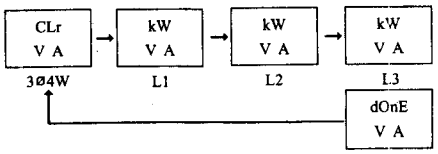


5.4 H / PEAK / INRUSH button:
Press this button to trigger the HOLD function.
The PEAK and INRUSH function is disabled.

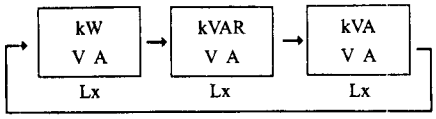
6. In 3Ø 4W range

6.1 Max / Min button: Disabled.

6.2 ↵ button:
Press this button to into save data function.



6.3 ▲ and ▼ button:
Press this button to change view parameters.
kW, kVA R and kVA of Lx(R or S or T).



6.4 H / PEAK / INRUSH button:
Press this button to trigger the HOLD function.
The PEAK and INRUSH function is disabled.

7. In PF (Power Factor) range

7.1 Max / Min button:
Press this button to trigger maximum and minimum values and calculates average value of measurement record. Press this button more than 2 seconds to exit this function.

7.2 ▲ and ▼ button: Disabled.

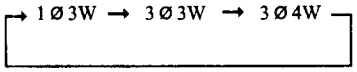
7.3 ↵ button: Disabled.

7.4 H / PEAK / INRUSH button:
Press this button to trigger the HOLD function.
The PEAK and INRUSH function is disabled.

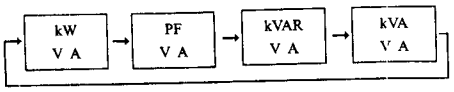
8. In Balance range

8.1 Max / Min button:
Press this button to trigger maximum and minimum values and calculates average value of measurement record. Press this button more than 2 seconds to exit this function.

8.2 MODE button: To select 1Ø 3W, 3Ø 3W and 3Ø 4W balanced load.



8.3 ▲ and ▼ button:
Press this button to change view parameters.
V, A, kW, PF, kVA R and kVA of total.

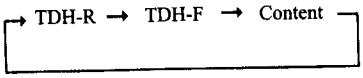


8.4 H / PEAK / INRUSH button:
Press this button to trigger the HOLD function.
The PEAK and INRUSH function is disabled.

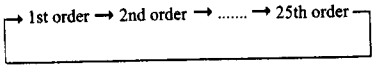
9. In H-A (Harmonics of Current) and H-V (Harmonics of Voltage) range

9.1 Max / Min button: Disabled.

9.2 MODE button:
Switch between the total harmonic distortion ratio (THD-R, THD-F) and harmonic percentage from one to another, as needed, by pressing the MODE button.



9.3 ▲ and ▼ button:
Press this button to select the order of harmonics to be measured.



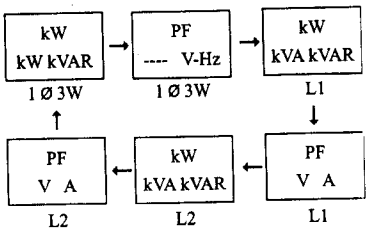
9.4 H / PEAK / INRUSH button:
Press this button to trigger the HOLD function.
The PEAK and INRUSH function is disabled.

10. In VM (View Memory) range

10.1 Max / Min button: Disabled.

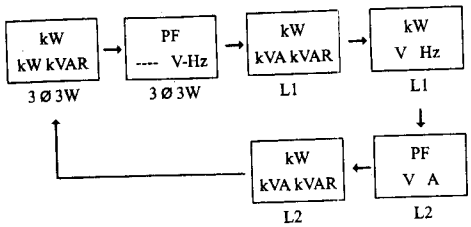
10.2 ↵ button: Disabled.

10.3 ▲ and ▼ button:
When the data is saved of 1Ø 3W, press this button to change view parameters.
- kW, kVA, kVAR, PF and V-Hz of 1Ø 3W.
- kW, kVA, kVAR, PF, V and A of L1.
- kW, kVA, kVAR, PF, V and A of L2.



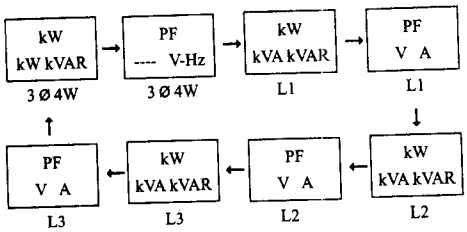
When the data is saved of 3Ø3W, press this button view.

- kW, kVA, kVAR, PF and V-Hz of 3Ø3W.
- kW, kVA, kVAR, PF, V and A of L1.
- kW, kVA, kVAR, PF, V and A of L2.



When the data is saved of 3Ø4W, press this button view.

- kW, kVA, kVAR, PF, V and A of 3Ø4W.
- kW, kVA, kVAR, PF, V and A of L1.
- kW, kVA, kVAR, PF, V and A of L2.
- kW, kVA, kVAR, PF, V and A of L3.



10.4 H / PEAK / INRUSH button: Disabled.

Measurement Procedure

1. Voltage measurement

Place rotary switch at position "V" and refer to Fig 1.
When only measuring voltage, the clamp sensor needs not be clamped.

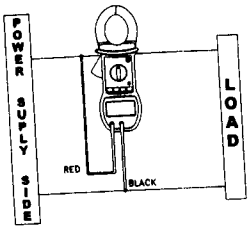


Fig 1.

2. Current measurement

Place rotary switch at position "A" and refer to Fig 2.
When only measuring current, the orientation of the clamp sensor is irrelevant.
Moreover, the voltage test lead need not be connected to the meter.

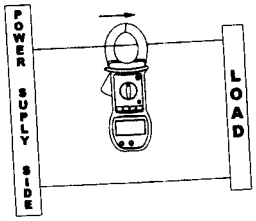


Fig 2.

3. 1Ø 2W measurement

Place rotary switch at position "1Ø 2W" and refer to Button Operation 3. and to Fig 3.

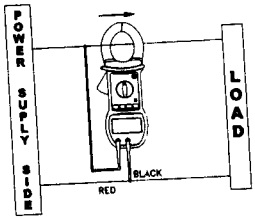


Fig 3.

4. 1Ø 3W measurement

Balanced or Unbalanced load measurement

Place rotary switch at position "1Ø 3W" and refer to the Button Operation 4. and Fig 4.

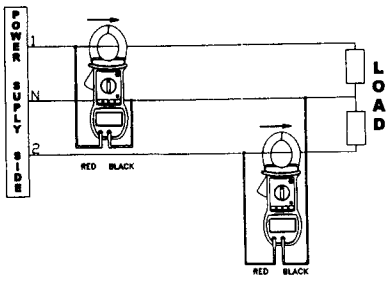


Fig 4.

Balanced load measurement

Place rotary switch at position "Balance" and refer to the Operation 8. and Fig 5.

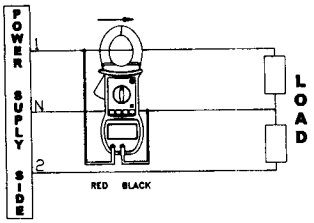


Fig 5.

5. 3Ø 3W measurement

Balanced or Unbalanced load measurement

Place rotary switch at position "3Ø 3W" and refer to the Button Operation 5. and refer to Fig 6.

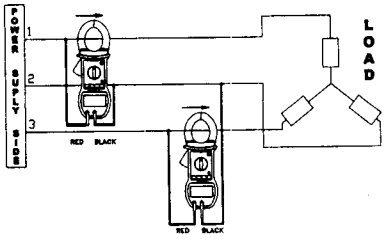


Fig 6.

Balanced load measurement
Place rotary switch at position "Balance" and refer to the Operation 8. and Fig 7.

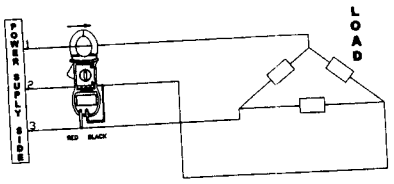


Fig 7.

6. 3Ø 4W measurement

Balanced or Unbalanced load measurement
Place rotary switch at position "3Ø4W" and refer to the Button Operation 6. and refer to Fig 8.

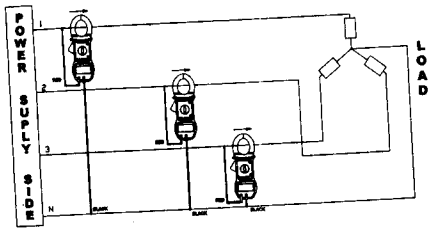


Fig 8.

Balanced load measurement
Place rotary switch at position "Balance" and refer to the Operation 8. and Fig 9.

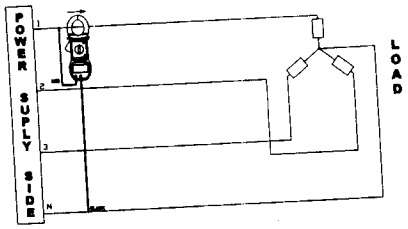


Fig 9.

7. INRUSH current Function Button

In "INRUSH" current function, the Meter takes a large number of samples precisely at the beginning of the starting current for a 100-millisecond period and then digitally filters and processes the samples to calculate the actual staring current.

1. Place rotary switch at position "Ah".
2. Press the "INRUSH" button three times before the in rush current measurement and display was show "----" and the "INRUSH" is displayed.
3. Press the trigger to open transformer jaws and clam onto one conductor only, and turn on the motor.
4. Read the INRUSH current directly from display. Press and hold down the "INRUSH" button and turn on the meter to disable/enable the APO mode.

8. Operation Expressions

INRUSH The meter takes a large number of samples precisely at the beginning of the starting current for a 100-millisecond period and then digitally filters and processes the samples to calculate the actual staring current.

kW (kilo) Active Power
The average power dissipated (also called real power).

kVA (kilo) Volt Amps
Apparent power: a value that the Tester calculates by multiplying the rms value for current by the rms value for voltage.

kVAR (kilo) Volt Amps Reactive
The reactive power component of the fundamental frequency.

PF Power Factor
Ratio of active power to apparent power (including all harmonics). True power factor for all loads, linear and non-linear.

$$PF = \frac{\text{Activepower}}{\text{Apparentpower}} = \frac{kW}{kVA}$$

% THD-F Total Harmonic Distortion (as % of Fundamental)
Defines amount of harmonic distortion as a percentage of the waveform at the fundamental frequency.

$$\%THD-F = \frac{\text{rms of harmonice(less fundamental)}}{\text{rms of fundamental}} = \frac{\sqrt{\sum_{k=2}^{25} I_k^2}}{I_1} X100\%$$

% THD-R Total Harmonic Distortion (as % of rms total)
Defines amount of harmonic distortion as a percentage of the waveform at all frequencies.

$$\%THD-R=\frac{\text{rmsof harmonice (less fundamenta l)}}{\text{totalrms}}$$

$$=\frac{\sqrt{\sum_{k=2}^{25} I_k^2}}{I_{rms}}X100\%$$

% THD Total Harmonic Distortion ratio.

$$\%THD-k_{th}=\frac{\text{rms of } k_{th}}{\text{rms of fundamental}}$$

$$=\frac{I_{th}}{I_1}$$

MAINTENANCE

WARNING
Remove test leads before changing battery
or performing any servicing.

Battery Replacement
Power is supplied by a 9 volt battery. (NEDA 1604, IEC 6F22). The "⊟" appears on the LCD display when replacement is needed. To replace the battery, remove the two screws from the back of the meter and lift off the battery cover. Remove the battery from battery contacts.

Cleaning
Periodically wipe the case with a damp cloth and detergent, do not use abrasives or solvents.

WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of **13 months** from date of purchase. OMEGA's 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 OMEGA's customers receive maximum coverage on each product.

If the unit malfunctions, it must be returned to the factory for evaluation. OMEGA's 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. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of having been 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 are not warranted, including but not limited to contact points, fuses, and triacs.

OMEGA is pleased to offer suggestions on the use of its various products. However, OMEGA neither assumes responsibility for any omissions or errors nor assumes liability for any damages that result from the use of its products in accordance with information provided by OMEGA, either verbal or written. OMEGA warrants only 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, EXPRESS 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 purchaser 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.

CONDITIONS: Equipment sold by OMEGA is not intended to be used, nor shall it be used: (1) as a "Basic Component" under 10 CFR 21 (NRC), used in or with any nuclear installation or activity; or (2) in medical applications or used on humans. Should any Product(s) be used in or with any nuclear installation or activity, medical application, used on humans, or misused in any way, OMEGA assumes no responsibility as set forth in our basic WARRANTY/DISCLAIMER language, and, additionally, purchaser will indemnify OMEGA and hold OMEGA harmless from any liability or damage whatsoever arising out of the use of the Product(s) in such a manner.

RETURN REQUESTS/INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S 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.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

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

1. Purchase Order 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 relative to the product.

FOR **NON-WARRANTY** REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:

1. Purchase Order number to cover the COST of the repair,
2. Model and serial number of the product, and
3. Repair instructions and/or specific problems relative to 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.

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