AMPROBE®

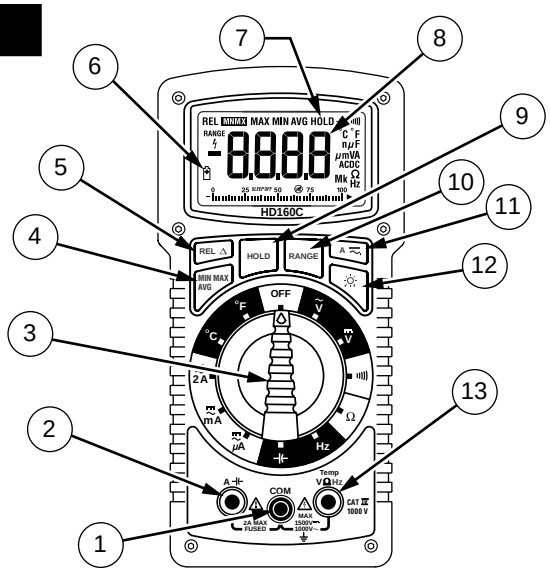
HD160C
Heavy-Duty True-rms Digital Multimeter

User Manual

Limited Warranty and Limitation of Liability

Your Amprobe product will be free from defects in material and workmanship for 1 year from the date of purchase. This warranty does not cover fuses, disposable batteries or damage from accident, neglect, misuse, alteration, contamination, or abnormal conditions of operation or handling. Resellers are not authorized to extend any other warranty on Amprobe's behalf. To obtain service during the warranty period, return the product with proof of purchase to an authorized Amprobe Test Tools Service Center or to an Amprobe dealer or distributor. See Repair Section for details. THIS WARRANTY IS YOUR ONLY REMEDY. ALL OTHER WARRANTIES - WHETHER EXPRESS, IMPLIED OR STAUTORY - INCLUDING IMPLIED WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE OR MERCHANTABILITY, ARE HEREBY DISCLAIMED. MANUFACTURER SHALL NOT BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES OR LOSSES, ARISING FROM ANY CAUSE OR THEORY. Since some states or countries do not allow the exclusion or limitation of an implied warranty or of incidental or consequential damages, this limitation of liability may not apply to you.

HD160C



#	Description
1	COM Input - common or low input for all measurements
2	Current and Capacitance Input
3	Function/Range Selector Switch
4	MIN MAX AVG Button
5	RELative Button
6	Low Battery Indicator
7	Hold Indicator
8	4-Digit LCD with measurement indicators
9	Data HOLD Button
10	RANGE Lock Button
11	AC DC Selection Button for Current Ranges
12	Backlight Button
13	Temperature, Volts, Ohms, and Frequency Input

HD160C
Heavy-Duty True-rms Digital Multimeter

Contents

Symbols

	Battery		Refer to the manual
	Double insulated		Dangerous Voltage
⎓	Direct Current	⏚	Earth Ground
~	Alternating Current		Audible tone
	Fuse	CE	Complies with EU directives
	Conforms to relevant Australian standards.		*Canadian Standards Association*. [**Note**: Canadian and US.]
	Do not dispose of this product as unsorted municipal waste. Contact a qualified recycler for disposal.		

Introduction

The Amprobe® digital multimeter HD160C is a heavy-duty 4-digit, autoranging, AC-coupled True rms measuring instrument that measures voltage, current, resistance, continuity, as well as capacitance, frequency and temperature. It also offers Range Lock, Data Hold, Relative Measurement, Auto Min Max Measurement, a bright backlight, and Auto Power Off to save battery life. The instrument is completely o-ring sealed to pass strict IP-67 ratings for moisture and dust proof. The HD160C also has internal components shock - mounted for drop proof capability. The HD160C meets the highest safety rating of CAT IV 1000 V (1500V DC max).

Warnings and Precautions

This instrument is EN61010-1 certified for Cat IV, 1000 V ac/1500 V dc and lower installations. Based on EN61010-1 transient requirements, this product should only be used in installations where transients do not exceed 12,000 volts (a 1.2 μS/50 μS pulse).

- **All inputs are protected against overload conditions up to the limits of each function's stated input protection (see specifications). Never exceed these limits or the ratings marked on the instrument itself.**
- **Exercise extreme caution when: measuring voltage >20 V, current >10 mA, ac power line with inductive loads, ac power line during electrical storms. High voltages can be lethal and high voltage transients may occur at any time.**
- **Operator injury or damage to the multimeter may occur during current measurements if the fuse blows in a circuit with open circuit voltage 1000 V ac/1500 V dc.**

- **Always inspect your DMM, test leads and accessories for signs of damage or abnormality before use. If an abnormal condition exists (broken or damaged test leads, cracked case, display not reading, etc.), do not use. All internal battery and fuse covers are integral to the EN61010-1 Cat IV safety rating and must be in place to avoid potential shock hazards.**
- **When testing for voltage or current, make sure these ranges function correctly. Take a reading of a known voltage or current first.**
- **Never ground yourself when taking measurements. Do not touch exposed metal pipes, outlets, fixtures, etc., which might be at ground potential. Keep your body isolated from ground and never touch exposed wiring, connections, test probe tips, or any live circuit conductors. Do not use the Flex-Strap to attach the meter to your body.**
- **Always measure current in series with the load – NEVER connect the multimeter ACROSS a voltage source. Check fuse first.**
- **Never replace a fuse with one of a different rating.**
- **Do not operate instrument in an explosive atmosphere (flammable gases, fumes, vapor, dust.)**
- **Do not use this or any piece of test equipment without proper training**
- **CRT SERVICE SAFETY REMINDER: A potential danger exists when measuring voltages in the horizontal output and damper stages of CRT equipment. (High voltage transients greater than 8000 V). Refer to your CRT service manual for proper servicing instructions.**

Unpacking and Contents

Your shipping carton should include the HD160C multimeter, a holster with Magna-Grip, one test lead set with alligator clips(one black, one red), one temperature adaptor, one Type K thermocouple probe, one 9 V battery (installed), a hex wrench (held inside holster) and this manual. If any of the items are damaged or missing, immediately return the complete package to the place of purchase for an exchange. The holster/tilt stand provides additional protection of the meter from accidental falls and provides greater ease of use. Both test lead probes can be attached to the holster for storage. One probe can be attached for measurement, holding the meter with probe in one hand and the second probe in the other hand.

Display Symbols and Audible Symbols

ϟ	Dangerous voltage warning (also double beep tone). Indicates input voltages higher than 30 V ac or 60 V dc.
	Low-battery voltage
-	Negative polarity indicator

Overload Condition

Input Overload (highest range in autoranging) is indicated by "OL or –OL" and a continuous tone. Remove test leads from the measurement setup as the input is beyond the range of the meter.

Display Overload (input exceeds the selected range while range is locked) is also indicated by "OL or -OL". Select the next higher range until a value is displayed, or return to autoranging. If overload still exists in the highest range, remove test leads from the measurement setup as input is beyond the range of the meter.

Note: In both instances, overload indication is normal in the ohms and continuity ranges (no sound) when the leads are not connected to anything or when the measured value is higher than the selected resistance range.

Incorrect Input Warning

The meter displays a function error code "Err" when a test lead is placed in the A input jack and the Selector switch is not set to a current or capacitance range. (If the meter is connected to a voltage source with leads connected for current, very high current could result). All current ranges are protected with a fast acting fuse.

Dangerous Voltage Warning

Displayed voltage warning and double-beep warning when input voltages are greater than 30 V ac/60 V dc, ϟ.

Audible Feedback

The meter emits a single beep when a parameter is changed, a "valid" front panel button is pushed, or Auto Min Max values are updated. A double beep indicates a dangerous input voltage (>30 V ac or 60 V dc).

The meter emits a continuous tone in the case of input overload, for continuity measurement when resistance is <40 Ω, and for current measurements, when the A input is used and the current
exceeds 2 A.

Analog Bargraph

The 41 segment analog bargraph indicates the percentage of the range the displayed measurement relates to. The zero segment is lit when the instrument is turned on. Each segment after that equals 2.5 % of range. The 400 mA, 40 MΩ, and Capacitance ranges are limited to 16 segments.
Example: a 500 mV input in the 1 V range (50 %) is represented by 21 segments (50). 400mA (of a theoretical 1000 mA range) = 16 segments (40 %).

Disable Beeper and Auto-Power Off

You can disable the beeper and Auto Power Off by pressing and holding the REL button while turning the meter **ON**.

Measuring Procedures

- Turn instrument on by turning function/range switch away from OFF and selecting the parameter you want to measure.
- This instrument is autoranging on all ranges. It automatically selects the range that gives the best resolution for the measured value. A range can be locked through menu selection (see Button Functions, later in this manual). You can tell which range you are in by the position of the decimal point and the measurement unit displayed.
- When connecting or disconnecting test leads to a circuit, always turn off power to device or circuit being tested and discharge all capacitors.
- Strictly observe the max input limits.
- Do not change functions while test leads are connected to circuit.

Measuring DC Voltage (See Figure 1)

1. Set the Function Switch to $\overline{\tilde{V}}$.
2. If **RANGE** is displayed, press the **RANGE** button to enable auto ranging.
3. Connect the test leads: Red to**Temp** VΩ**Hz**, Black to **COM**
4. Connect the test leads to the circuit test points.
5. Read the display, and, if necessary, correct any overload (OL) conditions.

Measuring AC Voltage - True rms (See Figure 2)

1. Set the Function Switch to $\tilde{V}$.
2. If **RANGE** is displayed, press the **RANGE** button to enable auto ranging.
3. Connect the test leads: Red to **Temp VΩHz**, Black to **COM**
4. Connect the test leads to the circuit test points.
5. Read the display, and, if necessary, correct any overload (OL) conditions.

True rms AC Measurements

Model HD160C is an ac-coupled True rms measuring meter. It measures the True rms value of distorted AC voltage or current signals. The Crest Factor handling capability is shown in Table 1. The Crest Factor is the Peak Voltage divided by the rms voltage.

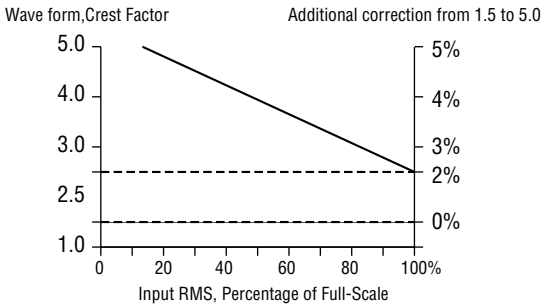


Table 1 - Crest Factor Handling Capability

Note: To accurately measure a DC voltage with an AC component, measure the AC component first with selector switch set to $\tilde{V}$. Note the measurement and range used. Switch to $\overline{\tilde{V}}$, activate Range Lock (see Button Functions later in this manual) and select a range equal to or higher then the $\tilde{V}$ range used previously. Note the measurement. The result is the measured AC Voltage on top of the measured DC component. (Max input is 1500 V dc or 1000 V ac).

Measuring DC Current (See Figure 3)

1. Set the Function Switch to a current function, **µA**, **mA**, or **2A**.
2. If AC is displayed, press the **A⎓≅** button to turn on **DC**.
3. If the 2A function is not selected and **RANGE** is displayed, press the **RANGE** button to enable auto ranging.
4. Connect the test leads: Red to **A⊣⊢**, Black to **COM**.
5. Turn off power to the circuit being measured.
6. Open the circuit (-X-) in which current is to be measured (voltage between this point and ground must not exceed 1500 V dc).
7. Securely connect test leads in series with the load.
8. Turn on power to the circuit being measured.
9. Read the display, and, if necessary, correct any overload (OL or -OL) conditions.

Measuring AC Current - True rms (See Figure 4)

1. Set the Function Switch to a current function, **µA**, **mA**, or **2A**.
2. If DC is displayed, press the **A⎓≅** button to turn on AC.
3. If the 2A function is not selected and **RANGE** is displayed, press the **RANGE** button to enable auto ranging.
4. Connect the test leads: Red to **A⊣⊢**, Black to **COM**.
5. Turn off power to the circuit being measured.
6. Open the circuit (-X-) in which current is to be measured (voltage between this point and ground must not exceed 1000 V ac).
7. Securely connect test leads in series with the load.
8. Turn on power to the circuit being measured.
9. Read the display, and, if necessary, correct any overload (OL) conditions.

Continuity Test (See Figure 5)

1. Set the Function Switch to).
2. Connect the test leads: Red to **Temp VΩHz**, Black to **COM**.
3. Turn off power to the circuit being measured.
4. Discharge any capacitors that may influence the reading.
5. Connect the test leads across the resistance.
6. Listen for the tone that indicates continuity (< 40 Ω).

When measuring continuity the meter emits a continuous tone when the resistance value falls below 40 Ω.

Resistance Measurement (See Figure 6)

1. Set the Function Switch to Ω.
2. If **RANGE** is displayed, press the **RANGE** button to enable auto ranging.
3. Connect the test leads. Red to **Temp VΩHz**, Black to **COM**.
4. Turn off power to the circuit being measured. Never measure resistance across a voltage source or on a powered circuit.
5. Discharge any capacitors that may influence the reading.
6. Connect the test leads across the resistance.
7. Read the display. If OL appears on the highest range, the resistance is too large to be measured.

Note: When measuring very low resistances, use Relative Measurement to eliminate the test lead resistance (see Button Functions later in this manual).

Measuring Capacitance (See Figure 7)

1. Set the Function Switch to the ⊣⊢ function.
2. If **RANGE** is displayed, press the **RANGE** button to enable auto ranging.
3. Connect the test leads: Red to **COM**, Black to **A**⊣⊢.
4. Turn off power to the circuit being measured.
5. Discharge the capacitor using a 100 kΩ resistor.
6. Free at least one end of the capacitor from the circuit.
7. Connect the test leads across the capacitor. When measuring an electrolytic capacitor match the test lead polarity to the polarity of the capacitor.
8. Read the display.

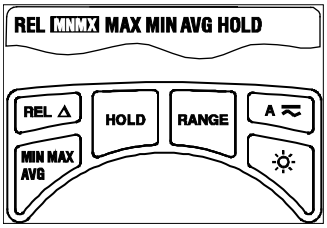
Measuring Frequency (See Figure 8)

1. Set the Function Switch to **Hz**.
2. If **RANGE** is displayed, press the **RANGE** button to enable auto ranging.
3. Connect the test leads: Red to **Temp VΩHz**, Black to **COM**.
4. Connect the test leads to the signal source.
5. Read the display.

Measuring Temperature (See Figure 9)

1. Set the Function Switch to °C or °F.
2. Connect the K-type thermocouple to a TEMP adapter (TA-1A); match the polarity of the adapter to the polarity of the thermocouple.
3. Connect the TEMP adapter to the **Temp** VΩ**Hz** and **COM** inputs.
   Note: The HD160C is compatible with all K-type thermocouples. The K-type bead thermocouple supplied with the meter is not intended for contact with liquids or electrical circuits.
4. Expose the thermocouple to the temperature to be measured.
5. Read the display.

Button Functions



Display Backlight Button	Model HD160C has Digi-Glo™ backlighting, one of the best backlights available in the industry. This button turns the backlight on and off. To conserve battery life, backlight will automatically turn off after approximately 60 seconds.
AC DC Mode	Each press alternately selects the AC or DC mode for the current function. The selected mode appears on the display above the button.
RANGE	Locks the currently displayed range. Each subsequent push of the button moves to a higher range. From highest range, the meter returns to the lowest range. The meter functions in the 4000 count mode when range is locked.
HOLD	Freezes the reading present on the LCD at the moment the button is pressed. To use this button feature set up the meter for the type of measurement and range desired. Connect the test leads to the circuit/component to be measured, then press Hold. The LCD reading will freeze and display "HOLD." You may now remove the test leads and the reading will not change until you press Hold again.
REL (Relative Measurements)	The Relative mode displays the difference between the actual reading and a reference value. It may be used with any function or range; however, the range must be set manually. To make a relative measurement first establish a reference value by measuring a value and then pressing the **REL** button after the reading has stabilized. This stores the measured value as the reference and sets the display to zero. The meter subtracts the reference value from subsequent measurements and displays this difference as the relative value. Measurement values greater than the reference value will be positive and values less than the reference value will be negative. To exit the Relative Mode, Press and hold the **REL** button for 2 seconds. Select the proper Range using the RANGE button before enabling the **REL** feature. This function will not autorange.

MIN MAX AVG	The MIN MAX AVG feature reads and updates the display to show the maximum, minimum, or average value measured after you press the **MIN MAX AVG** button. Pressing the **MIN MAX AVG** button for less than 1 second will put the meter into a mode of displaying the maximum, minimum, average, or actual readings. Each time the button is pressed, the meter will cycle to the next display mode as shown in the table below. Press the **MIN MAX AVG** button for more than 2 seconds to disable this feature. Select the proper Range using the **RANGE** button before enabling the MIN MAX AVG feature. This function will not autorange.

Button	Display	Value Displayed
	MAX	Maximum value after feature activated
< 1 second	MIN	Minimum value after feature activated
< 1 second	AVG	Average value after feature is activated
< 1 second		Actual reading, min max being recorded.
> 2 seconds	Exit MIN MAX AVG	Normal measurement, actual reading

Auto-Power Off

In order to save battery life, your multimeter powers down automatically after approximately 30 minutes of inactivity. You can turn it back on by turning the function selector switch to **OFF** and back to a measuring function. The instrument does not power down while in Max MIN AVG mode. You can disable Auto Power Off by pressing and holding the MAX MIN AVG button while turning the meter **ON**.

Safety Test Leads

The test leads provided with your HD160C meter have shrouded banana plugs to eliminate the possibility of shock if the plugs accidentally pull out of the meter while making a measurement. Each set of test leads includes a pair of threaded alligator clips for secure attachment to the probe tips. Replacement part number for Safety test leads is TL1500.

Specifications

General Specifications

Display: 4 digit LCD, 9999 counts, with annunciators, menu features and 41 segment bargraph.

Polarity Indication: Automatic

Input overload indication: OL, -OL.

Low Battery Indication: ; less than 50 hours battery life remain, accuracy is no longer guaranteed

Display Update Rate: 2/sec, nominal; 20/sec for bargraph.

Oper. Temp. 0 °C to +50 °C @ 0 to 75 % R.H.

Storage Temp: -20 °C to 60 °C @ 0 to 80 % RH, battery removed

Altitude: 2000 meters - indoor/outdoor use

Temperature coefficient: 0.1 x (spec. accuracy)/ °C (0 °C to 18 °C and 28 °C to 50 °C)

Fuse: F 2 A/1500 V fuse (8 mm x 65 mm), I.R. 30 kA – Amprobe® p/n FP700

Power: Standard 9-volt battery, NEDA 1604, JIS 006P, IEC 6F22

Auto Power-Down: Meter powers down after approximately 30 minutes of inactivity. Not in Min/Max function.

Battery Life (typical): 150 hours, alkaline. Backlight usage consumes extra power and will decrease battery life significantly. Backlight auto-off after approx. 60 seconds.

Dimensions, without holster (H x W x D): 200 x102 x59 mm (7.9 in x 4. 0 in x 2.3 in)

Weight (incl. battery): 642 g (22 oz)

Accessories: Heavy Duty Test leads with threaded alligator clips, battery (installed), hex wrench (inside holster), Holster with Magne-Grip strap, Type K thermocouple probe (TP255A), Temperature Adaptor (TA-1A) and User Manual.

Case material: Reinforced, high-impact, fire retardant thermoplastic

Safety: Meets EN 61010-1 Cat IV -1500 V dc or 1000 V ac. Class II. EN 60529:IP67

EMC: Meets EN 61326-1

CE EMC: This product complies with requirements of the following European Community Directives: 89/336/EEC (Electromagnetic Compatibility) and 73/23/EEC (Low Voltage) as amended by 93/68/EEC (CE Marking). However, electrical noise or intense electromagnetic fields in the vicinity of the equipment may disturb the measurement circuit. Measuring instruments will also respond to unwanted signals that may be present within the measurement circuit. Users should exercise care and take appropriate precautions to avoid misleading results when making measurements in the presence of electronic interference.

Electrical Specifications

Accuracy at 23 °C ± 5 °C, <75 % RH, guaranteed for one year.

DC Volts

Ranges: 1000 mV, 10 V, 100 V, 1500 V

Resolution: 0.1 mV in 1000 mV range:

Accuracy: ±(0.1 % rdg + 5 dgt)

Input Impedance: 10 MΩ

CMRR: >120 dB up to 1500 V dc

NMRR: >60 dB at 50 or 60 Hz

OL Protection: 1500 V dc or 1000 V ac rms.

Transient protection: 12 kV impulse (1.2 μS/50 μS) based on EN 61010-1:2001 impulse requirement for at CAT IV 1000 V/1500V dc product. This product should not be used in installations where transients exceed 12 kV.

AC Volts True rms

Ranges: 1000 mV, 10 V, 100 V, 1000 V

Resolution: 0.1 mV in 1000 mV range

Accuracy:

1000 mV (45 Hz to 400 Hz)
±(1.2 % rdg + 10 dgt)

10 V, 100 V (45 Hz to 500 Hz)
±(1.2 % rdg + 10 dgt)

10 V, 100 V (500 Hz to 2 kHz)
±(2.0 % rdg + 10 dgt)

1000 V (45 Hz to 1 kHz)
±(2.0 % rdg + 10 dgt)

Input Impedance: 10 MΩ

Conversion type: True rms, ac coupled 5 % to 100 % of range

Crest factor: ≤ 3

OL Protection: 1500 V dc or 1000 V ac rms

Transient protection: 12 kV impulse (1.2 μS/50 μS) based on EN 61010-1:2001 impulse requirement for at CAT IV 1000 V product. This product should not be used in installations where transients exceed 12 kV

DC Current

Ranges: 100 μA, 1000 μA, 10mA, 100mA, 400mA, 2A (Auto/Manual ranging)

Resolution: 0.01μA in 100 μA range

Accuracy:

100 μA range; ± (0.5% rdg + 10 dgts)

1000 μA to 400 mA ranges: ± (0.5% rdg + 5 dgts)

2 A ±(1.5% rdg + 10 dgts)range

Input protection: 2 A/1500 V fast blow ceramic fuse 8×65 mm on A input , FP700

Burden voltage: μA range of 1 mV/1 μA, mA range of 10 mV/1 mA, 2A range of 500 mV/1A, 500 mV max. (2 V max. on 1000 μA, 100 mA, 400 mA, 2 A ranges)

AC Current True rms

Ranges: 100 μA, 1000 μA, 10 mA, 100 mA, 400 mA, 2 A

Resolution: 0.01 μA in 100 μA range

Accuracy(45 Hz to 1kHz):

100 μA to 100 mA: ± (1.5 % + 10 dgts)

400 mA: ± (2.0 % + 10 dgts)

2 A: ± (2.5 % + 20 dgts)

Voltage burden: see DC Current

Conversion type: True rms ac coupled 10 to 100% of range

Crest factor: ≤ 3

OL protection: see DC Current.

Resistance

Ranges:1000 Ω, 10 kΩ, 100 kΩ, 1000 kΩ, 10 MΩ, 40 MΩ

Resolution: 0.1 Ω in 1000 Ω range

Accuracy:
1000 Ω to 1000 KΩ ranges: ±(0.5 % rdg +8 dgts);

10 MΩ range: ± (1.0 % rdg +10 dgts)

40 MΩ range: ± (2.0 % rdg +10 dgts)

Overload protection, all ranges: 1500 V dc or 1000 V ac rms

Continuity Test

Audible indication: Less than 40 Ω

Response time: 100 ms

Overload protection:1500 V dc or 1000 V ac rms

Capacitance

Ranges: 40 ηF, 400 ηF, 4 μF, 40 μF, 400 uF (3999 counts) (Auto/Manual ranging)

Resolution: 0.01 ηF

Accuracy: ±(3.0% rdg +10dgts) on 40 ηF, 400 μF ranges

±(3.0% rdg +5dgts) on 400 ηF to 40 μF ranges

Test voltange: < 1 V

Test Frequency: 1.3 Hz on 40 ηF to 40 μF ranges; 0.7 Hz on 400 μF range

Overload protection: 1500 V dc or 1000 V ac rms

Temperature

Ranges: -20 °C ~ 1300 °C (-4° F ~ 2372 °F) 3999 counts

Resolution: 1 °C, 1 °F

Accuracy: ±(2.0% rdg +4 °C) -20 °C ~ 10 °C

±(1.0% rdg +3 °C)10 °C ~ 200 °C

±(2.0% rdg + 2 °C) 200 °C ~ 1300 °C

±(2.0% rdg + 8 °F) -4 °F ~ 50 °F

±(1.0% rdg + 6 °F) 50° F ~ 400 °F

±(2.0% rdg +4 °F)400 °F ~2372 °F

Overload protection: 1500 V dc or 1000 V ac rms

Frequency

Ranges: 100Hz, 1000Hz, 10kHz, 100kHz, 1000kHz, 10MHz

Resolution: 0.01 Hz on 100 Hz range

Accuracy: ±(0.1% rdg + 5 dgts)

Sensitivity:
3 Hz to 1 MHz: >2.5 V ac rms;

1MHz to 10MHz: >2.5V ac rms, <5V ac rms

Minimum input range:

100 Hz range >3 Hz;

1000 Hz range >30 Hz

Minimum pulse width: > 25 ns

Duty cycle limits: > 30 % and < 70 %

Overload protection: 1500 V dc or 1000 V ac rms

Optional Accessories

TL1500 Test Leads with Alligator Clips

CT235A 1000 A ac/dc Clamp

CT237A 200 A ac/dc Current Clamp

CT238A 20 A ac/dc Current Clamp

VC221B Padded Vinyl Case. Fits meter & holster.

DC205C Deluxe Hard-Shell Carry Case

DC207C Large Deluxe Hard-Shell Carry Case with extra space for accessories

HV231-10A High Voltage Probe

FP 700 Replacement Fuse, 2 A/1500 V

TA-1A K-type thermocouple, temperature adapter.

Maintenance and Repair

If there appears to be a malfunction during the operation of the meter, the following steps should be performed in order to isolate the cause of the problem:

1. Check the battery.
2. Review the operating instructions for possible mistakes in operating procedure.
3. Inspect and test the test leads for a broken or intermittent connection.
4. Inspect and test the fuses. See Battery/Fuse Replacement for additional information.

Except for the replacement of the battery or fuse, or test probes, repair of the multimeter should be performed only by a Factory Authorized Service Center or by other qualified instrument service personnel. The front panel and case can be cleaned with a mild solution of detergent and water. Apply sparingly with a soft cloth and allow to dry completely before using. Do not use aromatic hydrocarbons or chlorinated solvents for cleaning.

Battery/Fuse Replacement (Figure 10)

⚠⚠Warning

To prevent electrical shock or meter damage, disconnect the meter's test leads from any circuit and the meter then turn the meter off before removing the rear case cover.

PRECAUTIONS

- The hex head case screws each have a washer and gasket integral to the meter's water/dust-proof integrity. Upon opening, be sure these are retained and replaced when closing.
- Prying the rear case cover off with a knife or screwdriver is not recommended as this may damage the case rim flanging and/or gasket thereby destroying the water/dust-proof integrity.
- The fuse cover is integral to the EN 61010-1 Cat IV safety rating and must be replaced to avoid potential shock hazards.
- Battery or fuse replacement should be performed in a clean environment and with appropriate care taken to avoid contaminating the meter's interior components.
- There are no user serviceable parts or components on the circuit boards. Disassembly beyond the instructions list below for battery and/or fuse replacement will void all warranties.

BATTERY REPLACEMENT

Disconnect the test leads, turn off the meter and remove the holster. Remove the 4 hex head battery cover screws from the rear case cover using the 2 mm hex wrench as Shown in Figure 10. Replace the battery with a NEDA type1604 or equivalent 9V alkaline battery. Make sure the battery compartment seal is in good condition and properly aligned before replacing the cover and screws.

FUSE REPLACEMENT

The fuse is located under the protective cover. Disconnect the test leads, turn off the meter and remove the holster. Remove the six hex head screws in the face plate using the 2 mm hex wrench mounted in holster. Remove the rear case cover carefully and place the front of the

meter face down on a clean padded surface. Lift off cover and carefully remove the fuse by gently prying under the fuse. Pry out the large fuse by placing a small flat screwdriver under the fuse's center using the circuit board edge toward the bottom of the meter as a fulcrum. Do NOT use the gasket as a fulcrum point as this could permanently disfigure the gasket.

⚠⚠ Warning

Use only the same size and type fuse specified. Use of higher amperage or lower voltage or different type fuses could result in shock, injury and/or damage to the meter. Replacement fuse is:

2 A/1500 V fast blow ceramic size 8 x 65 mm. Amprobe® p/n: FP700.

CLOSING THE BATTERY COMPARTMENT

After fuse replacement, replace the fuse cover and the rear case cover; be careful not to bend or pinch the case rim gasket. Re-install the six hex-head screws with a gasket and washer and tighten securely with an even amount of torque on each. Do NOT over tighten as this may strip case threading. Turn on the meter and test operation. If working normally replace the holster.

Repair Information

All test tools returned for warranty or non-warranty repair or for calibration should be accompanied by the following: your name, company's name, address, telephone number, and proof of purchase. Additionally, please include a brief description of the problem or the service requested and include the test leads with the meter. Non-warranty repair or replacement charges should be remitted in the form of a check, a money order, credit card with expiration date, or a purchase order made payable to Amprobe® Test Tools.

In-Warranty Repairs and Replacement – All Countries

Please read the warranty statement and check your battery before requesting repair. During the warranty period any defective test tool can be returned to your Amprobe® Test Tools distributor for an exchange for the same or like product. Additionally, in the United States and Canada In-Warranty repair and replacement units can also be sent to an Amprobe® Test Tools Service Center (see below for address). **Non-Warranty Repairs and Replacement – US and Canada**

Non-warranty repairs in the United States and Canada should be sent to an Amprobe® Test Tools Service Center. Call Amprobe® Test Tools or inquire at your point of purchase for current repair and replacement rates.

Non-Warranty Repairs and Replacement – Europe

European non-warranty units can be replaced by your Amprobe® Test Tools distributor for a nominal charge.

*(Correspondence only – no repair or replacement available from this address. European customers please contact your distributor.)