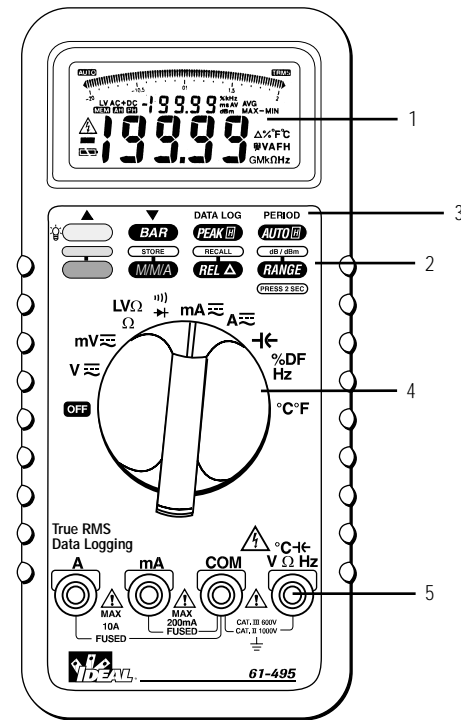
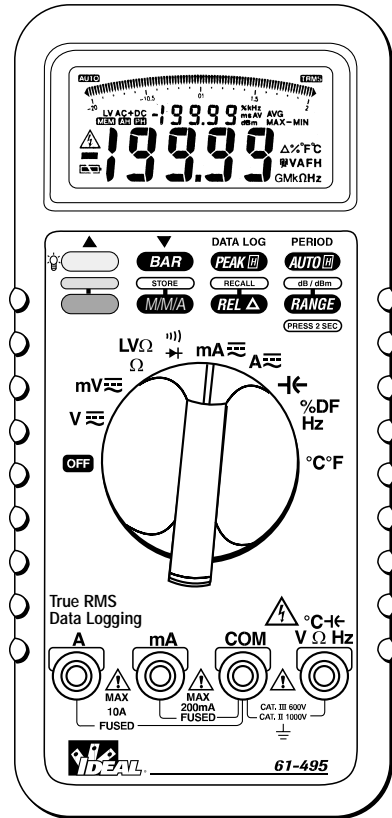




#61-494
#61-495

490 Series Industrial Grade Multimeter



1. LCD Display
2. Function Buttons
3. Data Log Features
4. Rotary Function Switch
5. Input Connectors

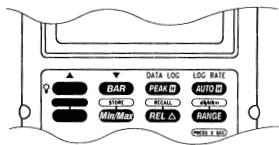
WARNING!

1. DO NOT UNDER ANY CIRCUMSTANCES EXCEED THESE RATINGS:
 - Voltage is not to exceed 1000 Volts.
 - Resistance, Capacitance, Logic and Continuity functions are not to be performed on circuits capable of delivering greater than 600 Volts.
 - Current measurements are not to be performed on circuits capable of delivering greater than 500 Volts

2. To avoid electrical shock hazards and/or damage to the meter:
 - Do not exceed the voltage ratings for the meter. Use caution when measuring voltage.
 - Do not use during electrical storms. AC power sources with inductive loads or electrical storms may result in high voltage. High energy transients can damage meter and present a dangerous shock hazard.
 - Turn off power to the circuit or device being measured before taking resistance and capacitance measurements. Fully discharge all capacitors before measuring.
3. Ensure meter is in proper working order before using. Visually inspect meter for damage. Performing a continuity check can verify proper operation. If the meter reading goes from overload to zero, this typically means the meter is in proper working order.
4. Visually inspect leads for damage before using. Replace if insulation is damaged or leads appear suspect.
5. Never ground yourself when taking electrical measurements. Do not touch exposed metal pipes, outlets, fixtures etc. Keep your body isolated from ground by using dry clothing, rubber shoes, mats, or any other approved insulating material. Keep your fingers behind the finger guards on the probes. Work with others.
6. Before beginning all unknown measurements, set meter to highest possible range.
7. Before breaking a circuit for testing, turn off the power to the circuit. When disconnecting from a circuit, disconnect the hot lead first, then the common lead.
8. Disconnect the meter from the circuit before turning off any indicator, including motors, transformers and solenoids.

Function Buttons

The meter beeps once for every valid key-press, and beeps twice for every invalid key-press.



Backlight Button

- The light button is used to turn the backlight on or off.
- This function is disabled in DATA LOG mode.

BAR Button

- The bar button toggles the analog bar graph between left justified and zero centered.
- Available for DC voltage and current measurements only.
- This function is disabled in DATA LOG mode.

Peak Hold Button

- The peak hold button toggles the peak hold function on or off.
- The beeper sounds when a new minimum or maximum value is detected.

Auto Hold Button

- The auto hold button toggles the auto hold function on or off.
- Place the meter in manual range mode to activate this feature.
- Auto hold is activated when the first stable reading is achieved.
- When activated, the meter beeps when the reading is updated, and it is displayed in the sub-display with **AH** annunciator.
- This function is not available on the 2GΩ range.

Blue Button

- The blue button toggles between the black and blue functions on the dial.



M/M/A Button

- The M/M/A button toggles between the stored minimum, maximum and average values captured during peak hold.
- The MIN/MAX/AVG value is displayed in the sub-display with the appropriate annunciator.
- To escape this function, press the M/M/A button for 2 seconds.
- Pressing the M/M/A button for > 2 seconds prior to entering M/M/A mode enables the store function.



Store Function

- Press the M/M/A button for 72 seconds to enter the store function.
- Pressing the M/M/A key in store mode stores the displayed measurement into the memory.
- Up to 1000 data points can be stored into memory for future analysis.
- When memory is full, the meter will beep twice after each key press.
- Pressing the range button for > 2 seconds exits store mode and returns to normal measurements.

REL Button

- This function displays the differential between the measurement and a stored value.
- The displayed measurement is stored in memory when this function is activated.
- This value is displayed in the sub-display with the  annunciator.
- All new measurements will be subtracted from the stored value, and the difference will be displayed in the main display.
- Pressing the REL  for > 2 seconds enables the recall function.

Recall Function

- In recall mode, use arrow keys,  , above the light and bar buttons to scroll through the stored readings.
- Press and hold the arrow keys to scroll faster (10 data points/second)
- Press the REL button for > 2 seconds to exits recall function and returns to normal measurements.

Range Button

- Pressing the range button for 2 seconds toggles the meter between auto and manual ranging mode.
- When in manual range mode, pressing the button changes the measurement range.
- Pressing the range button while in AC voltage measurements for > 2 seconds enables the dB/dBm function.
- While in dB/dBm mode, pressing the range button toggles between dB and dBm.

dB/dBm Function

- The reading of dB or dBm appears on the secondary display.
- The reference resistance reading for dBm is 600Ω and the reference voltage for dB is 1V.
- Pressing the range button for > 2 seconds exits dB/dBm mode and returns to AC voltage measurements.

Data Log Features

The range button and the M/M/A are the only buttons enabled in data logging mode. All other buttons perform the data logging functions labeled in red directly above the button. The auto power off function is also disabled.

Press the blue button for > 2 seconds to enter data logging mode. Changing the rotary function switch escapes data logging mode without storing data to memory. Pressing the blue button while in data logging mode returns to normal measurements.

Data quantities (61-495): 40K readings form as sequence number on sub-display up to 9999 and each 1/4 scale of bar indicates 10K. (61-494) 6K readings form as sequence number on sub-display up to 6000.

Max pause time: 4095 seconds; exceeding the maximum pause times stores data as 4095 seconds.

Max pause and log rate: 3.6k

▲ ▼ Functions

While in data logging mode, the light button and bar button scroll up and down through the data logging menu selections.

Data Log Functions

Data log-out

- Press the Peak Hold button while in data logging mode enables the data log-out function.
- The first data displayed is the last data point logged in.
- Pressing the ▲ ▼ buttons scrolls up and down through the data.
- Pressing the ▲ ▼ buttons for > 2 seconds scrolls up and down through the data at a rate of 10 data points/seconds, and stops at the reading when the button is released.
- Pressing the M/M/A button while in this mode toggles between the maximum and minimum values logged into memory. Pressing for > 2 seconds escapes.
- Pressing the range button while in this mode toggles the turning points logged-in with "MAX" or "MIN" symbol depending on the comparison from the current reading and the next reading. Press the range key again to escape.

Data Log Functions (continued)

Data log-in

- Press the Peak Hold button for > 2 seconds while in data logging mode enables the data log-in function.
- The meter begins storing data points into memory according to the selected log rate.
- Pressing the Peak hold button while in the mode interrupts data log-in for log-rate resetting. "PAUS" is displayed on the secondary menu while the data flow is interrupted.
- While data is being stored into memory, "-" is shown on the secondary display.
- When 40K data points have been stored, the data log-in stops, the bar is full, the "-" begins blinking, and FULL is displayed on the secondary display.

Log Rate Function

Press the auto hold button while in data logging mode to select the log rate.

Select from 0.5", 1", 10", 30", 60", 120", 180", 240", 300", 360", 480", and 600".

Press the auto hold button to escape and return to data logging mode.

Overload Protection

Function	Overload Protection
VAC & VDC	1000V
AAC & ADC	1A/500V
	10A/500V
Ohms (Ω)	600VAC/600VDC
Diode	600VAC/600VDC
Continuity	600VAC/600VDC

Unit of Measure Multipliers

For your reference, the following symbols are often used to make measurement easier:

Symbol	Verbal	Multiplier
M	mega	x 1,000,000
K	kilo	x 1,000
m	milli	÷ 1,000
μ	micro	÷ 1,000,000

Additional Features

Auto fuse detection: The meter checks the integrity of the internal fuses for the mA and A measurements.

Probe input guard: The meter beeps continuously and displays "ProbE" if a probe is inserted in a current input connector for other measurement functions.

Buzzer: A single beep indicates correct operation; two beeps indicate a warning or error condition.

Peak Hold: ±(0.7% +20) additional error for > 20% of full scale and pulse width greater than 0.5mS; ±(10% +20) additional error for > 50% of full scale on 2V range.

Auto power off: The meter turns itself off within 30 minutes if no controls or settings are changed.

Restore power by switching dial.

Power-up Options: Press button while turning meter on from OFF position.

Light button: Disable backlight auto off

Range button: Turn off buzzer

Blue button: Disable Auto Power Off

Auto H: Set temperature measurement default as °F

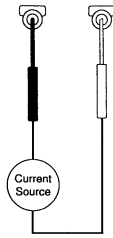
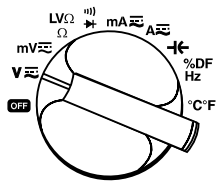
M/M/A: Clear memory area for storage

Voltage Measurements (DC, AC, AC+DC)

DC Voltage	Resolution	Accuracy (61-494)	Accuracy (61-495)
20mV	1μV	±(0.06% +60)	±(0.06% +60)
200mV	10μV	±(0.06% +20)	±(0.06% +20)
2V	100μV	±(0.06% +10)	±(0.06% +10)
20V	1mV	±(0.06% +10)	±(0.06% +10)
200V	10mV		
1000V	100mV		

AC Voltage	Frequency Range	Resolution	Accuracy (61-494)	Accuracy (61-495)
20mV	40 ~ 100Hz	1μV	±(0.7% +80)	±(0.7% +80)
	100 ~ 1kHz		±(1.0% +80)	±(1.0% +80)
	40 ~ 100Hz	10μV	±(0.7% +80)	±(0.7% +80)
200mV	40 ~ 100Hz	10μV	±(0.7% +80)	±(0.7% +80)
	100 ~ 1kHz		±(1.0% +80)	±(1.0% +80)
	40 ~ 100Hz	100μV	±(0.7% +50)	±(0.7% +50)
2V	40 ~ 100Hz	100μV	±(0.7% +50)	±(0.7% +50)
	100 ~ 1kHz		±(1.0% +50)	±(1.0% +50)
	1k ~ 10kHz		±(2.0% +60)	±(2.0% +60)
	10k ~ 20kHz		±(3.0% +70)	±(3.0% +70)
	20k ~ 50kHz		±(5.0% +80)	±(5.0% +80)
	50k ~ 100kHz		±(10.0% +100)	±(10.0% +100)
20V	40 ~ 100Hz	1mV	±(0.7% +50)	±(0.7% +50)
	100 ~ 1kHz		±(1.0% +50)	±(1.0% +50)
	1k ~ 10kHz		±(2.0% +60)	±(2.0% +60)
	10k ~ 20kHz		±(3.0% +70)	±(3.0% +70)
	20k ~ 50kHz		±(5.0% +80)	±(5.0% +80)
	50k ~ 100kHz		±(10.0% +100)	±(10.0% +100)
200V	40 ~ 100Hz	10mV	±(0.7% +50)	±(0.7% +50)
	100 ~ 1kHz		±(1.0% +50)	±(1.0% +50)
	1k ~ 10kHz		±(2.0% +60)	±(2.0% +60)
	10k ~ 20kHz		±(3.0% +70)	±(3.0% +70)
	20k ~ 50kHz		±(5.0% +80)	±(5.0% +80)
	50k ~ 100kHz		±(10.0% +100)	±(10.0% +100)
750V	40 ~ 100Hz	10mV	±(0.7% +50)	±(0.7% +50)
	100 ~ 1kHz		±(1.0% +50)	±(1.0% +50)

dBm (typical): -15dBm ~ 55dBm (0dBm = 1mW into 600Ω)
 dBm (typical): -80dBV ~ 50dBV = 1VRMS
 Input Impedance: 10MΩ, <100pF
 Overload Protection: 1000VDC, 750VRMS
 AC Conversion Type: AC Coupled, True RMS responding
 AC+DC Volts: Same as ACVRMS +1.00% + 8 digits
 Crest Factor: +1.5% addition error for C.F. from 1.4 ~ 3
 +3.0% addition error for C.F. from 3 ~ 4



To Measure Voltage:

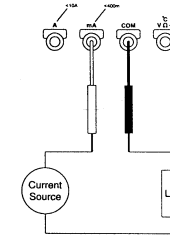
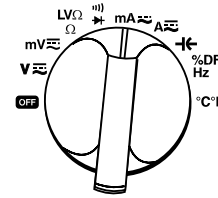
1. Plug the Black test lead into the COM port and the Red test lead into the VΩHz port.
2. Set the rotary switch to either the V or mV position.
3. Push the blue button to choose between DC, AC, or AC+DC measurements.
4. Connect the meter in parallel with the load or circuit.
5. Measure the voltage
6. The AC and AC+DC measurements provide a True RMS measurement.
7. For AC Measurements, the frequency of the measured signal > 20% of full scale is displayed on the secondary display.

Current Measurements (DC, AC, AC+DC)

DC Current Range	Resolution	Accuracy (61-494)	Accuracy (61-495)
20mA	1μA	±(0.3% +40)	±(0.2% +40)
200mA	10μA		
2A	100μA	±(0.3% +40)	±(0.2% +40)
10A	1mA		

AC Current Range	Frequency Range	Resolution	Accuracy (61-494)	Accuracy (61-495)
20mA	40Hz ~ 500Hz	1μA	±(0.8% +50)	±(0.8% +50)
	500Hz ~ 1kHz		±(1.2% +80)	±(1.2% +80)
200mA	40Hz ~ 500Hz	10μA	±(0.8% +50)	±(0.8% +50)
	500Hz ~ 1kHz		±(1.2% +80)	±(1.2% +80)
	1kHz ~ 3kHz		±(2.0% +80)	±(2.0% +80)
2A	40Hz ~ 500Hz	100μA	±(0.8% +50)	±(0.8% +50)
	500Hz ~ 1kHz		±(1.2% +80)	±(1.2% +80)
10A	40Hz ~ 500Hz	1mA	±(0.8% +50)	±(0.8% +50)
	500Hz ~ 1kHz		±(1.2% +80)	±(1.2% +80)
	1kHz ~ 3kHz		±(2.0% +80)	±(2.0% +80)

Voltage Burden: 800mV max. for mA input; 1V max. for A input.
 Input Protection: Equipped with high energy fuse.
 1A, 600V, IR 10kV fuse for mA input
 15A, 600V, IR 100kV fuse for A input.
 AC Conversion Type: AC Coupled, True RMS responding
 AC+DC Volts: Same as ACV RMS +1.00% + 8 digits
 Crest Factor: +1.5% addition error for C.F. from 1.4 ~ 3
 +3.0% addition error for C.F. from 3 ~ 4



To Measure Current:

1. Plug the Black test lead into the COM port and the Red test lead into the mA or A port.
2. Set the rotary switch to either the mA or A position.
3. Push the blue button to choose between DC, AC, or AC+DC measurements.
4. Connect the meter in series with the load or circuit.
5. Measure the current.
6. The AC and AC+DC measurements provide a True RMS measurement.
7. For AC Measurements, the frequency and period of the measured signal are displayed on the secondary displays.

⚠ Warning

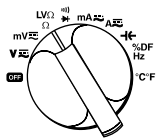
Limit large current measurements (10~20A to 30 seconds, and **allow two minutes of cooling between readings.** Do not connect to circuits with >600V.

Resistance and Low Voltage Resistance Measurements (Ohms)

Resistance Range	Resolution	Accuracy (61-494)	Accuracy (61-495)
200Ω	10mΩ	±(0.3% +30)	±(0.3% +30)
2kΩ	100mΩ		
20kΩ	1Ω		
200kΩ	10Ω		
2MΩ	100Ω	±(0.3% +50)	±(0.3% +50)
20MΩ	1kΩ	±(5.0% +50)	±(5.0% +50)
200MΩ	10kΩ	±(5.0% +20)	±(5.0% +20)
2GΩ	100kΩ	±(5.0% +8)	±(5.0% +8)

Low Voltage Resistance Range	Resolution	Accuracy (61-494)	Accuracy (61-495)
2kΩ	100mΩ	±(0.6% +20)	±(0.6% +30)
20kΩ	1Ω		
200kΩ	10Ω		
2MΩ	100Ω	±(0.6% +50)	±(0.6% +50)
20MΩ	1kΩ	±(7.0% +50)	±(7.0% +50)
200MΩ	10kΩ	±(7.0% +20)	±(7.0% +20)

Open circuit voltage: 3.3V
 Open circuit low voltage: 0.6V
 Input protection: 600V rms



To Measure Resistance:

1. Turn the power off to the circuit or device that is to be measured and discharge all capacitors before attempting a measurement.
2. Plug the Black test lead into the COM port and the Red test lead into the VΩHz port.
3. Set the rotary switch to the Ω LV Ω position.
4. Press the blue button to choose between Ω and LVΩ.

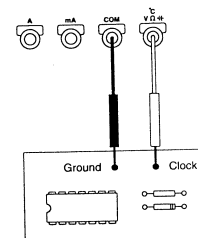
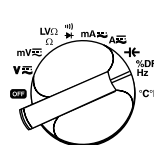
LV setting reduces the maximum test voltage level to about 0.5V to avoid turning on semiconductor devices.

Frequency and Duty Factor Measurements

Frequency Range	Resolution	Accuracy (61-494)	Accuracy (61-495)
20Hz	0.001Hz	±(0.01% +50)	±(0.01% +50)
200Hz	0.01Hz		
2kHz	0.1Hz	±(0.01% +10)	±(0.01% +10)
20kHz	1Hz		
200kHz	10Hz		
1MHz	100Hz		

Duty Factor	Resolution	Accuracy (61-494)	Accuracy (61-495)
20% ~ 80%	0.1%	+6 digits	+6 digits

Sensitivity: 0.5Vp-p for 15Hz ~ 1MHz
 1Vp-p for 1 MHz ~ 4MHz
 Min. frequency: 5Hz
 Input protection: 600V rms



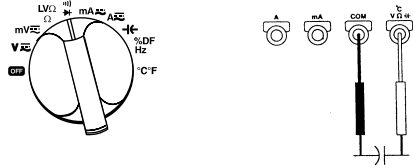
To Measure Frequency:

1. Plug the black test lead into the COM port and the red test lead into the VΩHz port.
2. Set the rotary switch to the Hz %DF position.
3. For duty factor, push the blue button until % is shown on the main display, and Hz is shown in the upper right secondary display.
4. Connect the meter in parallel with the load or circuit.
5. Measure frequency or duty factor.

Duty factor is the percentage of the signal that is high

Capacitance Measurements

Range	Resolution	Accuracy (61-494)	Accuracy (61-495)
4nF	1pF	$\pm(1.9\% + 10)$	$\pm(1.5\% + 10)$
40nF	10pF		
400nF	100pF	$\pm(1.4\% + 5)$	$\pm(0.9\% + 5)$
4 μ F	1nF		
40 μ F	10nF	$\pm(1.7\% + 5)$	$\pm(1.2\% + 5)$
400 μ F	100nF		
4mF	1 μ F	$\pm(2.0\% + 5)$	$\pm(1.5\% + 5)$
10mF	10 μ F		



To Measure Capacitance:

1. Turn the power off to the circuit or device that is to be measured and discharge all capacitors before attempting a measurement.
2. Plug the Black test lead into the COM port and the Red test lead into the VΩHz port.
3. Set the rotary switch to the **C** position.
4. Measure capacitance.

Temperature Measurements

Temperature Range	Resolution	Accuracy (61-494)	Accuracy (61-495)
-200°C ~ -100°C	0.1°C	$\pm(0.1\% + 6^\circ\text{C})$	$\pm(0.1\% + 60\text{C})$
-100°C ~ 1200°C	1°C	$\pm(0.1\% + 3^\circ\text{C})$	$\pm(0.1\% + 30\text{C})$

To Measure Temperature

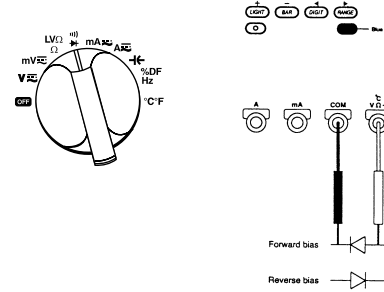
1. Plug the temperature probe and adapter into the COM the VΩHz port.
2. Set the rotary switch to the °C °F position.
3. For correct reading, ensure that the device being tested contains no voltage.
4. Press the blue button to chose between a °C or °F display.

Multiply the accuracy by 2 for °F

Input protection: 600V rms

Note: The readings <360°C on 1°C resolution range when settled as manual range, display reads "Er" to change to lower range for best measurements.

Diode Testing



Diode Check:

To ensure a proper functioning diode, the meter will develop a voltage across the component from a test current. The diode test function allows measurements of forward voltage drops across diode and transistor junctions.

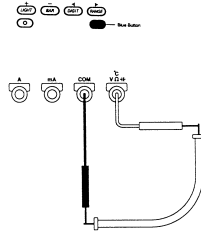
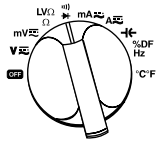
1. Turn off power to the device or circuit that is being tested and discharge all capacitors.
2. Plug the Black test lead into the COM port and the Red test lead into the VΩHz port.
3. Set the rotary switch to the **D** position.
4. Press the blue button until **D** is shown on the display
5. Connect the test leads to the diode.

Forward bias: Good = 0.4 to 0.9V
Bad = 0 or $\geq 2.0\text{V}$

Reverse bias: Good = OL
Bad = <2.0V

Test current: 1.1mA (typical)
Open circuit voltage: 3.3VDC (max)
Input Protection: 600V rms

Continuity Check



To Verify Continuity:

A continuity test ensures that all circuit connections are intact.

1. Plug the Black test lead into the COM port and the Red test lead into the VΩHz port.
2. Set the rotary switch to the 1) position.
3. Press the blue button until 1) is shown in the display.
4. Connect the test leads to the circuit to be measured. The buzzer will sound if the resistance of the circuit measured is lower than 50Ω .

Continuity threshold: Approx. 50Ω

Continuity Indicator: 2kHz tone buzzer

Input protection: 600V rms

General Specifications

Stated accuracies are at $23^{\circ}\text{C} \pm 5^{\circ}\text{C}$ at less than 80% RH and without battery indicator displayed.

LCD display digits:	4-1/2 or 3-3/4
Bargraph segments:	42 segment graph
Display count	20,000 or 4,000
Numeric update rate:	2 times/sec (20,000 count)
Bargraph:	20 times/sec
Polarity display:	Automatic
Overrange display:	OL is displayed
Low voltage indicator:	1) is indicator
Automatic power-off time:	Automatic backlit off = 15 minutes
Power source	One 9V dry cell battery
Maximum input voltage:	1000V (750VAC) Cat II between V and COM
Maximum floatin voltage:	1000V (750VAC) Cat II between any terminal and earth ground
Maximum input current:	200mA between mA and COM 10A continuous between A and COM (20A for 30 seconds)
Maximum open circuit	600V between A and COM and
Voltage (current inputs):	between mA and COM
Overload protection mA	1A (600V) fast blow fuse connector:
A connector:	15A (600V) fast blow fuse

General Specifications

V connector:

1100 Vp A \sim V --- AC+DC

850 Vp mA \sim mV --- AC+DC

LV Ω \cdot 1) --- Hz% DF $^{\circ}\text{C}^{\circ}\text{F}$

Temperature coefficient:

0.1 X (Spec. Accuracy) per $^{\circ}\text{C}$, $<18^{\circ}\text{C}$ or $>28^{\circ}\text{C}$

Battery Life:

100 hours typical (alkaline)

Physical Characteristics

Dimensions:

200mm x 90mm x 42mm

Weight (w/battery):

0.4Kg

Weight (w/holster):

0.6Kg

Environmental Characteristics

Temperature Operating:

0 to $+50^{\circ}\text{C}$

Temperature Non-Operating:

-20 to $+60^{\circ}\text{C}$

Humidity (Operating):

$<80\%$ R.H.

Altitude (Operating):

2,222m (7290 ft.)

Altitude (Non-Operating):

12,300m (40354 ft.)

Vibration & Shock (Operating):

MIL-T-28800E Type II Class 5

2.66g RMS, 5 to 500 Hz,

3 axes, (10 min. each)

Dust/Water Protection IP Rating:

IP 64

Certifications & Compliances

Safety:

Designed to IEC 1010-1, UL3111 and CSA

Specifications Input Rating:

1000VDC Category II

600VDC Category III

750VAC Category II

600VAC Category III

Overvoltage Category:

Cat III: Distribution level mains, fixed installations

Cat II: Local level mains, appliances, portable equipment

Cat I: Signal level, special equipment or parts of equipment, telecommunication, electronics

Pollution Degree 2:

Do not operate in environments where conductive pollutants may be present.



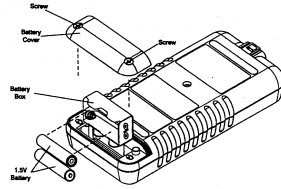
Warning

To avoid electrical shock, remove test lead before opening the cover. Repairs or servicing not covered in this manual should only be performed by qualified personnel.

Maintenance

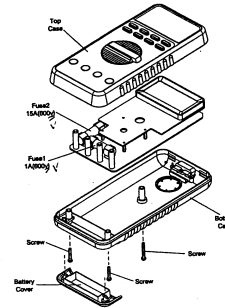
Battery Installation or Replacement:

1. The #61-492 is powered by one 9 volt battery.
2. Remove the test leads from the front terminals and turn the meter off.
3. Remove the screw from the battery cover and lift to remove.
4. Replace batteries.
5. Make sure the battery box leads do not become pinched between the case and battery cover before replacing the battery cover and screw.



Fuse Replacement

1. Remove the test leads from the front terminals and turn the meter off.
2. Remove the screw from the battery cover and lift to remove.
3. Remove the battery.
4. Remove the three screws connecting the top and bottom cases of the meter.
5. Separate the top case and PCB of the meter.
6. Replace the fuse (Fuse 1 or Fuse 2)
7. Re-assemble the top case and PCB of the meter
8. Assemble the top case, PCB and bottom case of the meter.
9. Re-install the battery and battery cover.



Lifetime Limited Warranty

This meter is warranted to the original purchaser against defects in material or workmanship for the lifetime of the meter. During this warranty period, IDEAL INDUSTRIES, INC. will, at its option, replace or repair the defective unit, subject to verification of the defect or malfunction.

This warranty does not apply to defects resulting from abuse, neglect, accident, unauthorized repair, alteration, or unreasonable use of the instrument.

Any implied warranties arising out of the sale of an IDEAL product, including but not limited to implied warranties of merchantability and fitness for a particular purpose, are limited to the above. The manufacturer shall not be liable for loss of use of the instrument or other incidental or consequential damages, expenses, or economic loss, or for any claim or claims for such damage, expenses or economic loss.

State laws vary, so the above limitations or exclusions may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

IDEAL INDUSTRIES, INC.

Sycamore, IL 60178, U.S.A.

800-304-3578 Customer Assistance

www.testersandmeters.com

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