

SEALEY

TA320

**Digital Automotive
Analyser/Insulation
Tester - Hybrid Vehicles**



INTRODUCTION:

Specially designed for hybrid vehicles and conforms to EN61010 CAT III (1000 Volts) and CAT IV (600 Volts). Unlike other multimeters this unit has an insulation test function that allows testing of the insulation of the high voltage wires found on hybrid vehicles. Can be used as a stand-alone device or linked wirelessly with a USB interface to a PC or laptop enabling results to be graphed, saved or printed. Supplied with high voltage probes, thermocouple and wireless USB cable. The unit also has the usual functions expected on a high quality multimeter including true RMS (Root-Mean-Square) and IP67 waterproof rating.

TECHNICAL SPECIFICATION:

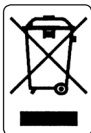
AC Voltage:	400mV, 4V, 40V, 400V, 1000V
DC Voltage:	400mV, 4V, 40V, 400V, 1000V
AC Current:	400 μ A, 4000 μ A, 40mA, 400mA, 10A
DC Current:	400 μ A, 4000 μ A, 40mA, 400mA, 10A
Capacitance:	40nF, 400nF, 4 μ F, 40 μ F, 400 μ F, 4000 μ F, 40mF
Frequency:	40Hz - 10KHz
Duty Cycle:	0.1 - 99.9%
Pulse Width:	100 μ s-100ms
Resistance:	400 Ω , 4k Ω , 40k Ω , 400k Ω , 4M Ω , 40m Ω
Continuity:	<35 Ω
Temperature Range:	-50°C to 1000°C, -58°F to 1832°F
Diode Check:	Yes
Back Light:	Yes
Bar Graph Display:	Yes
Display Hold:	Yes
Auto-Ranging:	Yes
Insulation Test:	125V, 250V, 500V, 1000V
PC Interface:	Yes
Digit Height:	20mm
Auto Power Off:	Yes
Low Battery Indicator:	Yes
Batteries (supplied):	6 x 1.5V AA
Hi-Impact Case:	Yes
Size (L x W x D):	220 x 95 x 56mm
Weight:	700g
PC Compatibility:	Windows 2000, XP, Win7, Vista



Environmental Protection

Recycle unwanted materials instead of disposing of them as waste. All tools, accessories and packaging should be sorted, taken to a recycling centre and disposed of in a manner which is compatible with the environment.

When the product becomes completely unserviceable and disposal, drain off any fluids (if applicable) into approved containers and dispose of the product and the fluids according to local regulations.



WEEE Regulations

Dispose of this product at the end of its working life in compliance with the EU Directive on Waste Electrical and Electronic Equipment (WEEE). When the product is no longer required, it must be disposed of in an environmentally protective way. Contact your local solid waste authority for recycling information.

Battery Removal

This analyser contains 6 AA batteries which must be disposed of in an environmentally appropriate way.

TO REMOVE THE BATTERIES:

- 1) Lift the rear support bracket.
- 2) Remove the four cross-head screws from the battery cover.
- 3) Remove the battery cover.
- 4) Remove the batteries.

Under the Waste Batteries and Accumulators Regulations 2009, Jack Sealey Ltd are required to inform potential purchasers of products containing batteries (as defined within these regulations), that they are registered with Valpak's registered compliance scheme.

Jack Sealey Ltd's Batteries Producer Registration Number (BPRN) is BPRN00705.



IMPORTANT: PLEASE READ THESE INSTRUCTIONS CAREFULLY. NOTE THE SAFE OPERATIONAL REQUIREMENTS, WARNINGS AND CAUTIONS. USE THIS PRODUCT CORRECTLY AND WITH CARE FOR THE PURPOSE FOR WHICH IT IS INTENDED. FAILURE TO DO SO MAY CAUSE DAMAGE AND/OR PERSONAL INJURY AND WILL INVALIDATE THE WARRANTY. PLEASE KEEP INSTRUCTIONS SAFE FOR FUTURE USE.

GENERAL SAFETY PRECAUTIONS.

- ✓ Wear safety eye protection that meets ANSI standards.
- ✓ Operate the vehicle to be tested in a well ventilated area. Exhaust gases are poisonous. If necessary connect the vehicle exhaust to a fume extraction system.
- ✓ Place chocks in front of the drive wheels and never leave the vehicle unattended whilst testing is in progress.
- ✓ Be extra cautious when working in close proximity to the ignition coil, distributor cap, ignition wires and spark plugs. These components create hazardous voltages when the engine is running.
- ✓ Ensure that the handbrake is on and the gearbox is in neutral or 'Park' for automatic transmissions.
- ✓ Keep fire extinguishers nearby that are suitable for petrol/chemical/electrical fires.
- ✓ Keep the analyser clean and in good condition.
- ✓ Remain vigilant when using the code reader on, or near, machinery where there are rotational parts such as belts, pulleys and fans.
- ✓ Remove ill fitting clothing. Remove ties, watches, rings, and other loose jewellery, and contain and/or tie back long hair.
- ✓ Maintain correct balance and footing. Ensure the floor is not slippery and wear non-slip shoes.
- ✓ Keep product surfaces clean and dry.
- ✓ The user shall ensure that test probes are correctly selected in order to prevent danger. Probes shall be selected to ensure that adequate barriers guard against inadvertent hand contact with live conductors under test and that probes have minimal exposed probe tips. Where there is a risk of the probe tip short circuiting with other live conductors under test, it is recommended that the exposed tip length shall not exceed 4mm.
- ✗ **DO NOT** attempt to connect or disconnect any test equipment whilst the ignition is on or the engine is running.
- ✗ **DO NOT** use the analyser if damage is suspected. If suspected damage occurs with the device, have it inspected by qualified service personnel before using it again.
- ✗ **DO NOT** get the analyser wet or use in damp or wet locations or areas where there is condensation.
- ✗ **DO NOT** use the analyser for any purpose other than for which it is designed.
- ✗ **DO NOT** allow untrained persons to use analyser.
- ✗ **DO NOT** use the analyser when you are tired or under the influence of alcohol, drugs or intoxicating medication.
- ✗ **DO NOT** operate in a potentially explosive environment/atmosphere.
- ✗ **WARNING:** The warnings, cautions and instructions discussed in this instruction manual cannot cover all possible conditions and situations that may occur. It must be understood that common sense and caution are factors which cannot be built into this product, but must be applied by the operator.

Thank you for purchasing a Sealey product. Manufactured to a high standard, this product will give you years of trouble free performance, if these instructions are carefully followed and the product is correctly maintained.



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EC DECLARATION OF CONFORMITY

We the sole importers into the UK, hereby declare that the equipment described below

Description and Function: **Digital Automotive Analyser/Insulation Tester - Hybrid Vehicles**.....

Model/Type: **TA320**

Manufacturing Date / Serial number (optional):

Manufacturer's authorised representative within the EC: **Jack Sealey Ltd. Kempson Way, Suffolk Business Park, Bury St. Edmunds, Suffolk, IP32 7AR**

Conforms to the requirements of the following Directives, as indicated.

- | | |
|--|---|
| <input type="checkbox"/> 2006/42/EC Machinery Directive | <input type="checkbox"/> 2000/14/EC Outdoor Noise Emissions Directive |
| <input checked="" type="checkbox"/> 2006/95/EC Low Voltage Directive | <input checked="" type="checkbox"/> 2002/96/EC WEEE Directive |
| <input checked="" type="checkbox"/> 2004/108/EC EMC Directive | <input checked="" type="checkbox"/> 2011/65/EU RoHS Directive |
| <input checked="" type="checkbox"/> 93/68/EEC CE Marking Directive | <input type="checkbox"/> 97/23/EC Pressure Equipment Directive |
| <input type="checkbox"/> 2009/105/EC the Simple Pressure Vessels Directive | |

And the following harmonised standard(s)

BS EN 61010-1:2010 **BS EN 61326-2-1:2013**

BS EN 61010-031:2002+A1:2008

Additional technical standards and specifications (if applicable):

Technical file compiled by: **Jack Sealey Ltd.**

Signed:

Date: **05-Mar-2013**

Place: **Bury St. Edmunds.**

Name: **Tim Thompson**

Position: **Commercial Director**

Being the responsible person appointed by the manufacturer.



Sealey Power Products, Kempson Way,
Suffolk Business Park, Bury St. Edmunds,
Suffolk, IP32 7AR



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Safety Symbols



This symbol adjacent to another symbol, terminal or operating device indicates that the operator must refer to an explanation in the Operating Instructions to avoid personal injury or damage to the meter.

WARNING

This **WARNING** symbol indicates a potentially hazardous situation, which if not avoided, could result in death or serious injury.

CAUTION

This **CAUTION** symbol indicates a potentially hazardous situation, which if not avoided, may result in damage to the product.



This symbol advises the user that the terminal(s) so marked must not be connected to a circuit point at which the voltage with respect to earth ground exceeds (in this case) 1000 VAC or VDC.



This symbol adjacent to one or more terminals identifies them as being associated with ranges that may, in normal use, be subjected to particularly hazardous voltages. For maximum safety, the meter and its test leads should not be handled when these terminals are energized.



This symbol indicates that a device is protected throughout by double insulation or reinforced insulation.

PER IEC1010 OVERVOLTAGE INSTALLATION CATEGORY

OVERVOLTAGE CATEGORY I

Equipment of OVERVOLTAGE CATEGORY I is equipment for connection to circuits in which measures are taken to limit the transient overvoltages to an appropriate low level.

Note – Examples include protected electronic circuits.

OVERVOLTAGE CATEGORY II

Equipment of OVERVOLTAGE CATEGORY II is energy-consuming equipment to be supplied from the fixed installation.

Note – Examples include household, office, and laboratory appliances.

OVERVOLTAGE CATEGORY III

Equipment of OVERVOLTAGE CATEGORY III is equipment in fixed installations.

Note – Examples include switches in the fixed installation and some equipment for industrial use with permanent connection to the fixed installation.

OVERVOLTAGE CATEGORY IV

Equipment of OVERVOLTAGE CATEGORY IV is for use at the origin of the installation.

Note – Examples include electricity meters and primary over-current protection equipment

ELECTRICAL SAFETY PRECAUTIONS

This meter has been designed for safe use, but must be operated with caution. The rules listed below must be carefully followed for safe operation.

1. **NEVER** apply voltage or current to the meter that exceeds the specified maximum:


Input Protection Limits	
Function	Maximum Input
V DC or V AC	1000VDC/AC rms
mA AC/DC	500mA 1000V fast acting fuse
A AC/DC	10A 1000V fast acting fuse (20A for 30 seconds max every 15 minutes)
Frequency, Resistance, Capacitance, Duty Cycle, Diode Test, Continuity	1000VDC/AC rms
Temperature	1000VDC/AC rms
Surge Protection: 8kV peak per IEC 61010	

2. **USE EXTREME CAUTION** when working with high voltages.
3. **DO NOT** measure voltage if the voltage on the "COM" input jack exceeds 1000V above earth ground.
4. **NEVER** connect the meter leads across a voltage source while the function switch is in the current, resistance, or diode mode. Doing so can damage the meter.
5. **ALWAYS** discharge filter capacitors in power supplies and disconnect the power when making resistance or diode tests.
6. **ALWAYS** turn off the power and disconnect the test leads before opening the covers to replace the fuse or batteries.

7. **NEVER** operate the meter unless the back cover and the battery and fuse covers are in place and fastened securely.

If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

Controls and Jacks

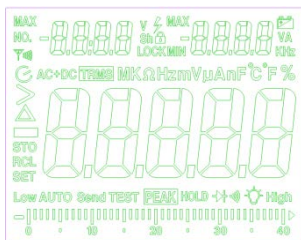
1. 40,000 count LCD display
2. MAX/MIN (-) button
3. STORE(<RECALL) button
4. RANGE(SETUP) button
5. INSULATION TEST button
6. MODE button
7. Function switch
8. mA, μ A and 10A input jacks
9. REL(+) button
10. HOLD(PEAKHOLD>) button
11. EXIT(AC+DC) button
12.  Backlight and RF button
13. Positive input jack
14. COM input jack



Note: Tilt stand and battery compartment are on rear of unit.

Symbols and Annunciators

•)))	Continuity		
▶	Diode test		
⊕	Battery status		
n	nano (10^{-9}) (capacitance)		
μ	micro (10^{-6}) (amps, cap)		
m	milli (10^{-3}) (volts, amps)		
A	Amps		
k	kilo (10^3) (ohms)		
F	Farads (capacitance)		
M	mega (10^6) (ohms)		
Ω	Ohms	PEAK	Peak Hold
Hz	Hertz (frequency)	V	Volts
%	Percent (duty ratio)	REL	Relative
AC	Alternating current	AUTO	Autoranging
DC	Direct current	HOLD	Display hold
$^{\circ}$ F	Degrees Fahrenheit	$^{\circ}$ C	Degrees Centigrade
MAX	Maximum	MIN	Minimum
No.	Serial number	Y	RF transmitter active
S	Second		
	left auxiliary display		
	right auxiliary display		
SET	Set up parameter		
AC+DC	Alternating current + Direct current		
TRMS	True RMS		
STO	Store		
RCL	Recall		
AUTO	Auto Range		
	Timing symbol		
	Backlight		
	Bar graph		



Operating Instructions

WARNING: Risk of electrocution. High-voltage circuits, both AC and DC, are very dangerous and should be measured with great care.

1. ALWAYS turn the function switch to the **OFF** position when the meter is not in use.
2. If “OL” appears in the display during a measurement, the value exceeds the range you have selected. Change to a higher range.

DC VOLTAGE MEASUREMENTS

CAUTION: Do not measure DC voltages if a motor on the circuit is being switched ON or OFF. Large voltage surges may occur that can damage the meter.

1. Set the function switch to the green **VDC** position.
2. Insert the black test lead banana plug into the negative **COM** jack. Insert the red test lead banana plug into the positive **V** jack.
3. Touch the black test probe tip to the negative side of the circuit. Touch the red test probe tip to the positive side of the circuit.
4. Read the voltage in the display.



AC VOLTAGE (FREQUENCY, DUTY CYCLE) MEASUREMENTS

WARNING: Risk of Electrocution. The probe tips may not be long enough to contact the live parts inside some 240V outlets for appliances because the contacts are recessed deep in the outlets. As a result, the reading may show 0 volts when the outlet actually has voltage on it. Make sure the probe tips are touching the metal contacts inside the outlet before assuming that no voltage is present.

CAUTION: Do not measure AC voltages if a motor on the circuit is being switched ON or OFF. Large voltage surges may occur that can damage the meter.

1. Set the function switch to the green **VAC/Hz/%** position.
2. Insert the black test lead banana plug into the negative **COM** jack. Insert red test lead banana plug into the positive **V** jack.
3. Touch the black test probe tip to the neutral side of the circuit. Touch the red test probe tip to the “hot” side of the circuit.
4. Read the voltage in the main display and the frequency in the right auxiliary display
5. Press and hold the **MODE** button 2 second to indicate “Hz”.
6. Read the frequency in the main display.
7. Press the **MODE** button to indicate “%”.
8. Read the % of duty cycle in the main display.
9. Press EXIT for 2 seconds into the function of AC+DC. Test DC and AC True Rms.



MV VOLTAGE MEASUREMENTS

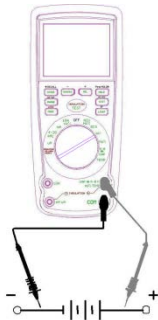
CAUTION: Do not measure mV voltages if a motor on the circuit is being switched ON or OFF. Large voltage surges may occur that can damage the meter.

1. Set the function switch to the green mV position.
2. Press the **MODE** button to indicate “DC”. or “AC”, or in AC range press **EXIT** for two seconds and chose “AC+DC”

Insert the black test lead banana plug into the negative **COM** jack.

Insert the red test lead banana plug into the positive **V** jack.

3. Touch the black test probe tip to the negative side of the circuit.
Touch the red test probe tip to the positive side of the circuit.
4. Read the mV voltage in the display.



DC CURRENT MEASUREMENTS

CAUTION: Do not make 20A current measurements for longer than 30 seconds. Exceeding 30 seconds may cause damage to the meter and/or the test leads.

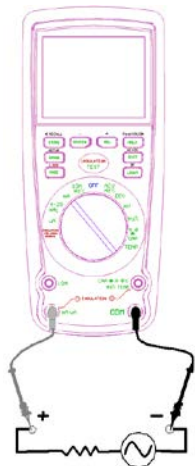
1. Insert the black test lead banana plug into the negative **COM** jack.
2. For current measurements up to $4000\mu\text{A}$ DC, set the function switch to the yellow **μA** position and insert the red test lead banana plug into the **$\mu\text{A}/\text{mA}$** jack.
3. For current measurements up to 400mA DC, set the function switch to the yellow **mA** position and insert the red test lead banana plug into the **$\mu\text{A}/\text{mA}$** jack.
4. For current measurements up to 20A DC, set the function switch to the yellow **$10\text{A}/\text{HZ}/\%$** position and insert the red test lead banana plug into the **10A** jack.
5. Press the **MODE** button to indicate “**DC**” on the display.
6. Remove power from the circuit under test, then open up the circuit at the point where you wish to measure current.
7. Touch the black test probe tip to the negative side of the circuit. Touch the red test probe tip to the positive side of the circuit.
8. Apply power to the circuit.
9. Read the current in the display.



AC CURRENT (FREQUENCY, DUTY CYCLE) MEASUREMENTS

CAUTION: Do not make 20A current measurements for longer than 30 seconds. Exceeding 30 seconds may cause damage to the meter and/or the test leads.


1. Insert the black test lead banana plug into the negative **COM** jack.
2. For current measurements up to $4000\mu\text{A AC}$, set the function switch to the yellow **μA** position and insert the red test lead banana plug into the **$\mu\text{A}/\text{mA}$** jack.
3. For current measurements up to 400mA AC , set the function switch to the yellow **mA** position and insert the red test lead banana plug into the **$\mu\text{A}/\text{mA}$** jack.
4. For current measurements up to 20A AC , set the function switch to the yellow **$10\text{A}/\text{HZ}/\%$** position and insert the red test lead banana plug into the **10A** jack.
5. Press the **MODE** button to indicate "**AC**" on the display.
6. Remove power from the circuit under test, then open up the circuit at the point where you wish to measure current.
7. Touch the black test probe tip to the neutral side of the circuit. Touch the red test probe tip to the "hot" side of the circuit.
8. Apply power to the circuit.
9. Read the current in the display. In the 10AAC range, right auxiliary display frequency.
10. Press and hold the **MODE** button to indicate "**Hz**".
11. Read the frequency in the display.
12. Momentarily press the **MODE** button again to indicate "**%**".



13. Read the % duty cycle in the display.
14. Press and hold the **MODE** button to return to current measurement.
15. Press EXIT for 2 seconds into the function of AC+DC. Test DC and AC True Rms.

RESISTANCE MEASUREMENTS

WARNING: To avoid electric shock, disconnect power to the unit under test and discharge all capacitors before taking any resistance measurements. Remove the batteries and unplug the line cords.

1. Set the function switch to the green **Ω CAP**  position.
2. Insert the black test lead banana plug into the negative **COM** jack. Insert the red test lead banana plug into the positive **Ω** jack.
3. Press the **MODE** button to indicate " **Ω** " on the display.
4. Touch the test probe tips across the circuit or part under test. It is best to disconnect one side of the part under test so the rest of the circuit will not interfere with the resistance reading.
5. Read the resistance in the display.



CONTINUITY CHECK

WARNING: To avoid electric shock, never measure continuity on circuits or wires that have voltage on them.

1. Set the function switch to the green **Ω CAP** $\rightarrow \rightarrow \rightarrow$ position.
2. Insert the black lead banana plug into the negative **COM** jack. Insert the red test lead banana plug into the positive **Ω** jack.
3. Press the **MODE** button to indicate " $\rightarrow \rightarrow \rightarrow$," and " **Ω** " on the display
4. Touch the test probe tips to the circuit or wire you wish to check.
5. If the resistance is less than approximately 35Ω , the audible signal will sound. If the circuit is open, the display will indicate "**OL**".




DIODE TEST

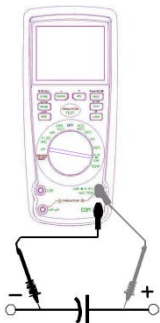
1. Set the function switch to the green **Ω CAP** position.
2. Insert the black test lead banana plug into the negative **COM** jack and the red test lead banana plug into the positive **V** jack.
3. Press the **MODE** button to indicate " \rightarrow " and "**V**" on the display.
4. Touch the test probes to the diode under test. Forward voltage will typically indicate 0.400 to 0.700V. Reverse voltage will indicate "**OL**". Shorted devices will indicate near 0V and an open device will indicate "**OL**" in both polarities.



CAPACITANCE MEASUREMENTS

WARNING: To avoid electric shock, disconnect power to the unit under test and discharge all capacitors before taking any capacitance measurements. Remove the batteries and unplug the line cords.

1. Set the rotary function switch to the green **Ω CAP**  position.
2. Insert the black test lead banana plug into the negative **COM** jack.
3. Insert the red test lead banana plug into the positive **V** jack.
4. Press the **MODE** button to indicate “**F**”
5. Touch the test leads to the capacitor to be tested.
Read the capacitance value in the Display



TEMPERATURE MEASUREMENTS

1. Set the function switch to the green Temp position.
2. Insert the Temperature Probe into the input jacks, making sure to observe the correct polarity.
3. Press the MODE button to indicate “ $^{\circ}$ F” or “ $^{\circ}$ C”
4. Touch the Temperature Probe head to the part whose temperature you wish to measure. Keep the probe touching the part under test until the reading stabilizes (about 30 seconds).
5. Read the temperature in the display.



Note: The temperature probe is fitted with a type K mini connector. A mini connector to banana connector adaptor is supplied for connection to the input banana jacks.

FREQUENCY (DUTY CYCLE) MEASUREMENTS (ELECTRONIC)

1. Set the rotary function switch to the green **Hz/%** position.
2. Insert the black lead banana plug into the negative **COM** jack and the red test lead banana plug into the positive **Hz** jack.
3. Touch the test probe tips to the circuit under test.
4. Read the frequency on the display.
5. Press the **MODE** button to indicate “%”.
6. Read the % duty cycle in the display.



% 4 – 20mA MEASUREMENTS

1. Set up and connect as described for DC mA measurements.
2. Set the rotary function switch to the **4-20mA%** position.
3. The meter will display loop current as a % with 0mA=-25%, 4mA=0%, 20mA=100%, and 24mA=125%.

INSULATION RESISTANCE MEASUREMENTS

- a) Set the rotary function switch to the **INSULATION** position and Press the **RANGE** button to chose one of the voltages displayed in the top left corner.
- b) Connect two testing lines to the item to be tested.
- c) Push down and hold the “TEST” button or press the “LOCK” key first and then the “TEST” button, if there is any static electricity present in the item being tested and its voltage is over 30V, it will fail and no high-voltage testing will occur, “>30V” will display on the LCD, the symbol “ ⚡ ” flashes, and the buzzer will sound. Otherwise it will enter into the formal testing process and the high-voltage will show on the primary display, the insulation resistance in MΩ is indicated in-phase with the analog bar; on the top right corner display, the

tested insulation voltage in V (DC) is indicated, the symbol “ ⚡ ” flashes and the buzzer will sound.

d) Releasing the “TEST” button or pushing down the “TEST” button in the “LOCK “ status will exit from the “LOCK” status and shut-off the testing voltage, simultaneously the resistance value indicated in the primary display will be held, and the top right corner display will still show the status of the insulation voltage for the item tested.

Turning the function switch to off or pressing the **EXIT** button will exit from the testing procedure during the process.

POWER TOOLS AND SMALL APPLIANCES

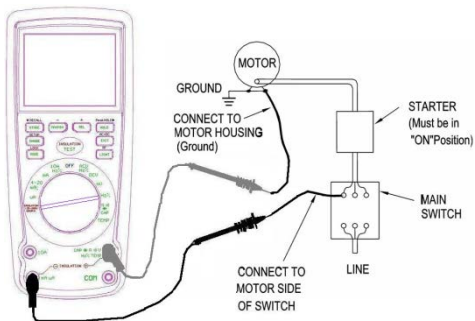
This test would also apply to other similar equipment that has a line cord. For double insulated power tools, the megohmmeter lead shown connected to the housing would be connected to some metal part of the tool (e.g. chuck, blade).

Note: The switch of the device must be in the “ON” position and the main power should be disconnected.

MOTORS

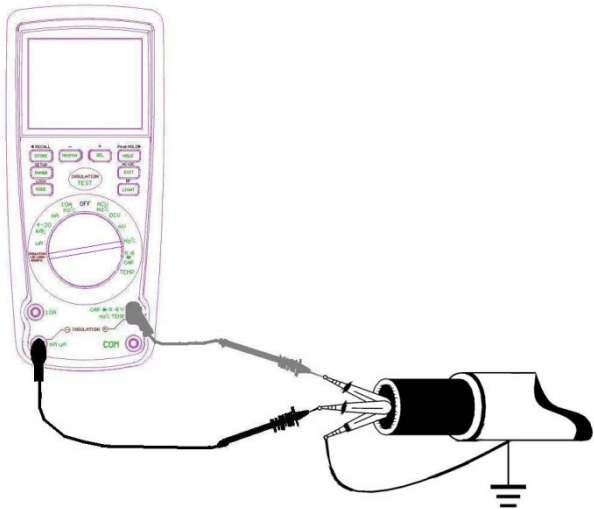
AC-Disconnect the motor from the line by disconnecting the wires at the motor terminals or by opening the main switch. If the main switch is used and the motor also has a starter then the starter must be held, by some means, in the “ON” position. In the latter case, the measured resistance will include the resistance of the motor, wire and all other components between the motor and the main switch. If a weakness is indicated, the motor and other components should be checked individually. If the motor is disconnected at the motor terminals, connect one megohmmeter lead to the grounded motor housing and the other lead to one of the motor leads. DC - Disconnect the motor from the line. To test the brush rigging, field coils and armature

connect one megohmmeter lead to the grounded motor housing and the other lead to the brush on the commutator. If the resistance measurement indicates a weakness, raise the brushes off the commutator and separately test the armature, field coils and brush rigging by connecting one megohmmeter lead to each of them individually, leaving the other connected to the grounded motor housing. The above also applies to DC Generators.



CABLES

Disconnect the cable from the line. Also disconnect opposite end to avoid errors due to leakage from other equipment. Check each conductor to ground and /or lead sheath by connecting one megohmmeter lead to a ground and /or lead sheath and the other megohmmeter lead to each of the conductors in turn. Check insulation resistance between conductors by connecting megohmmeter leads to conductors in pairs.



AUTORANGING/MANUAL RANGE SELECTION

When the meter is first turned on, it automatically goes into AutoRanging. This automatically selects the best range for the measurements being made and is generally the best mode for most measurements. For measurement situations requiring that a range be manually selected, perform the following:

1. Press the **RANGE** key. The “**AUTO**” display indicator will turn off.
2. Press the **RANGE** key to step through the available ranges until you select the range you want.
3. To exit the Manual Ranging mode and return to Autoranging, press **EXIT**

Note: Manual ranging does not apply for the Temperature functions.

MAX/MIN

1. Press the **MAX/MIN** key to activate the MAX/MIN recording mode. The display icon “**MAX**” will appear. The meter left auxiliary display will display and hold the maximum reading and will update only when a new “max” occurs. The display icon “**MIN**” will appear. The right auxiliary display meter will display and hold the minimum reading and will update only when a new “min” occurs.
2. To exit MAX/MIN mode press **EXIT**


RELATIVE MODE

The relative measurement feature allows you to make measurements relative to a stored reference value. A reference voltage, current, etc. can be stored and measurements made in comparison to that value. The displayed value is the difference between the reference value and the measured value. **Note:** Relative mode does not operate in the 4-20mA function.

1. Perform the measurement as described in the operating instructions.
2. Press the **REL** button to store the reading in the display and the “**REL**” indicator will appear on the display.

3. Left auxiliary display shows the margin of initial value and the current value.
Right auxiliary display shows the initial reading. Main displays the reading after REL TEST.
4. Press the **EXIT** button to exit the relative mode.

Display Backlight

Press the  key to turn the backlight on. The backlight will automatically turn off after SET time. Press the **EXIT** button to exit the **backlight on** mode.

HOLD

The hold function freezes the reading in the display. Press the **HOLD** key momentarily to activate or to exit the **HOLD** function.

PEAK HOLD

The Peak Hold function captures the peak AC or DC voltage or current. The meter can capture negative or positive peaks as fast as 1 millisecond in duration. Momentarily press the **PEAK** button, "**PEAK**" and "**MAX**" will display in **left auxiliary display**. "**MIN**" will display in **right auxiliary display**. The meter will update the display each time a lower negative peak occurs. **Press the EXIT button to exit the PEAK HOLD mode**. Auto Power Off feature will be disabled automatically in this mode.

DATA STORAGE

1. Set the function switch to the measurement function desired.
2. Press the **STORE** button to access the recording interval time set up function.
3. The auxiliary display on the left indicates 0000 S, which is the recording sample rate; use the **+** & **-** buttons to select the desired sample rate (0 to 255 seconds)
4. Set the sample rate to 0000 S for manual recording. In this mode, each press of the **STORE** button will save one measurement reading.

5. Set the sample rate (from 1 to 255 S) for automatic recording. In this mode, pressing the **STORE** button will start data recording at the programmed sample rate.
6. The auxiliary display on the left indicates the current storage location (0000 to 9999). New measurements will begin storing into the next available location.
7. Press and hold the **STORE** button for 2 seconds to enter the RECALL mode or press **EXIT** to return to the normal operating mode.


DATA STORAGE RECALL

1. Press and hold the **STORE** button for two seconds (if not already done as instructed in step 7 in the above procedure) to enter the RECALL function.
2. The auxiliary display on the left will show XXXX (current storage location). The auxiliary display on the right will show XXXX (number of storage locations used).
3. Use the **+** and **-** buttons to navigate the storage locations. The value for the selected location is indicated in the main display.
4. Press the **EXIT** button to end the recall session.

CLEAR ALL DATA

1. From the OFF position, press and hold the RANGE button while turning the function switch to any on position
2. Release the RANGE button. The memory has been cleared

PC WIRELESS COMMUNICATION

1. Install and launch the PC software (refer to the HELP utility contained in the software for more details)
2. Press and Hold the backlight/USB button for two seconds to enter RF wireless transmit mode
3. The RF icon  will appear on the display
4. When communication is established, the RF icon on the display will blink and the LED indicator on the receiver will blink
5. Once per second, the data will be displayed on the PC screen (plotted on the graph and inserted to the data list)
6. Hold the backlight button for two seconds to exit the RF wireless transmit mode

SENDING STORED DATA TO THE PC

1. Launch the PC software
2. Press the STORE button for two seconds to enter into data RECALL function.
3. Press the HOLD button for two seconds. The RF transmit icon will flash while the stored data is sent to the PC

NOTE: Refer to the HELP utility included in the supplied software program for in-depth software instructions.

SETUP

1. Press and Hold the RANGE/SETUP button for two seconds to enter the SET function. The first of five settable functions will appear.
2. Press the RANGE button to step through the functions
 - a: Alarm High limit buzzer alarm OFF or Value
 - b: Alarm Low limit buzzer alarm OFF or Value
 - c: Auto power off time OFF, 10 to 30 sec
 - d: Button beeper ON/OFF
 - e: Back light time OFF, 10 to 30 sec
3. Use the +, -, ◀ and ▶ buttons to select and change conditions and digits.

4. Press the RANGE/SETUP button until the meter returns to the normal display to exit this mode.


ALARM LIMITS

1. Press and Hold the SETUP button for two seconds to enter the High Limit function.
2. Press the ► button to select a digit for adjustment
3. Press the + or – button to adjust the value of the digit
4. Press the ◀ button to turn the alarm OFF.
5. Press the SETUP button and repeat the procedure to set the low limit
6. Press the SETUP button to step through the other functions and return to the normal operating mode.
7. The meter will “beep” if the measured value is greater than the high limit or lower than the low limit.

AC+DC

In all the measuring mode VAC, mV(AC), 10A(AC), mA(AC), μ A(AC), press button EXIT for 2 seconds to enter into AC+DC testing. The precision is the same as AC measure. LCD shows AC+DC signal. Press button EXIT to exit.

LOW BATTERY INDICATION

When the  icon appears alone in the display, the batteries should be replaced.

Maintenance

WARNING: To avoid electric shock, disconnect the test leads from any source of voltage before removing the back cover or the battery or fuse covers.

WARNING: To avoid electric shock, do not operate your meter until the battery and fuse covers are in place and fastened securely.

This Meter is designed to provide years of dependable service, if the following care instructions are performed:

1. **KEEP THE METER DRY.** If it gets wet, wipe it dry immediately.
2. **USE AND STORE THE METER IN NORMAL TEMPERATURES.** Temperature extremes can shorten the life of the electronic parts and distort or melt plastic parts.
3. **HANDLE THE METER GENTLY AND CAREFULLY.** Dropping it can damage the electronic parts or the case.
4. **KEEP THE METER CLEAN.** Wipe the case occasionally with a damp cloth. DO NOT use chemicals, cleaning solvents, or detergents.
5. **USE ONLY NEW BATTERIES OF THE RECOMMENDED SIZE AND TYPE.** Remove old batteries so they do not leak and damage the unit.
6. **IF THE METER IS TO BE STORED FOR A LONG PERIOD OF TIME,** the batteries should be removed to prevent damage to the unit.

BATTERY INSTALLATION

WARNING: To avoid electric shock, disconnect the test leads from any source of voltage before removing the battery cover.

1. Turn power off and disconnect the test leads from the meter.
2. Open the rear battery cover by removing 4 screws using a cross head screwdriver.

3. Insert the batteries into battery holder, observing the correct polarity.
4. Put the battery cover back in place. Secure with the screws.

WARNING: To avoid electric shock, do not operate the meter until the battery cover is in place and fastened securely.

NOTE: If your meter does not work properly, check the fuses and batteries to make sure that they are still good and that they are properly inserted.

REPLACING THE FUSES

WARNING: To avoid electric shock, disconnect the test leads from any source of voltage before removing the meter cover.

1. Disconnect the test leads from the meter.
2. Remove the protective rubber holster.
3. Remove the battery cover (4 screws) and the batteries.
4. Remove the six screws securing the rear cover.
5. Gently remove the old fuse and install the new fuse into the holder.
6. Always use a fuse of the proper size and value (0.5A/1000V fast blow for the 400mA range, 10A/1000V fast blow for the 20A range).
7. Replace and secure the rear cover, battery and battery cover.

WARNING: To avoid electric shock, do not operate your meter until the fuse cover is in place and fastened securely.

Specifications

Function	Range	Resolution	Accuracy
DC Voltage	400mV	0.01mV	± (0.06% reading + 4digits)
	4V	0.0001V	
	40V	0.001V	
	400V	0.01V	
	1000V	0.1V	± (0.1% reading + 5digits)
AC Voltage			50 to 1000Hz
	400mV	0.1mV	± (1.0% reading + 7digits)
	4V	0.001V	
	40V	0.01V	± (1.0% reading + 5 digits)
	400V	0.1V	
	1000V	1V	
AC+DCVoltage	400mV	0.1mV	± (1.0% reading + 7digits) (50/60HZ)
	4V	0.001V	
	40V	0.01V	
	400V	0.1V	
	1000V	1V	
All AC voltage ranges are specified from 5% of range to 100% of range			
DC Current	400μA	0.01μA	± (1.0% reading + 3 digits)
	4000μA	0.1μA	
	40mA	0.001mA	
	400mA	0.01mA	
	10A	0.001A	

	(20A: 30 sec max with reduced accuracy)		
AC Current	400 μ A	0.1 μ A	\pm (1.5% reading + 7 digits) (50 to 1000Hz)
	4000 μ A	1 μ A	
	40mA	0.01mA	
	400mA	0.1mA	
	10A	0.01A	
AC+DCCurrent	400 μ A	0.1 μ A	\pm (1.5% reading + 7 digits) (50/60HZ)
	4000 μ A	1 μ A	
	40mA	0.01mA	
	400mA	0.1mA	
	10A	0.01A	
	(20A: 30 sec max with reduced accuracy)		
All AC current ranges are specified from 5% of range to 100% of range			

NOTE: Accuracy is stated at 65°F to 83°F (18°C to 28°C) and less than 75% RH.

AC switch according to the calibration of sine wave. It generally increase \pm (2% reading + 2% full scale) if non sine wave in the wave crest less than 3.0.

Function	Range	Resolution	Accuracy
Resistance	400 Ω	0.01 Ω	\pm (0.3% reading + 9 digits)
	4k Ω	0.0001k Ω	\pm (0.3% reading + 4 digits)
	40k Ω	0.001k Ω	
	400k Ω	0.01k Ω	
	4M Ω	0.001M Ω	
	40M Ω	0.001M Ω	\pm (2.0% reading + 10 digits)


Capacitance	40nF	0.001nF	± (3.5% reading + 40 digits)
	400nF	0.01nF	
	4μF	0.0001μF	± (3.5% reading + 10 digits)
	40μF	0.001μF	
	400μF	0.01μF	
	4000μF	0.1μF	± (5% reading + 10 digits)
	40mF	0.001mF	
Frequency (electronic)	40Hz	0.001Hz	± (0.1% reading + 1 digits)
	400Hz	0.01Hz	
	4kHz	0.0001kHz	
	40kHz	0.001kHz	
	400kHz	0.01kHz	
	4MHz	0.0001MHz	
	40MHz	0.001MHz	
	100MHz	0.01MHz	Not specified
Sensitivity: 0.8V rms min. @ 20% to 80% duty cycle and <100kHz; 5Vrms min @ 20% to 80% duty cycle and > 100kHz.			
Frequency (electrical)	40.00Hz-10KHz	0.01Hz - 0.001KHz	± (0.5% reading)
	Sensitivity:2Vrms		
Duty Cycle	0.1 to 99.90%	0.01%	± (1.2% reading + 2 digits)
	Pulse width: 100μs - 100ms, Frequency: 5Hz to 150kHz		
Temp (type-K)	-50 to 1200°C	0.1°C	±(1.0% reading + 2.5°C)
	-58 to 2192°F	0.1°F	±(1.0% reading +4.5°F) (probe accuracy not included)
4-20mA%	-25 to 125%	0.01%	±50 digits
	0mA=-25%, 4mA=0%, 20mA=100%, 24mA=125%		

Meg OHMS

Terminal Voltage	Range	Resolution	Accuracy	Test Current	Short circuit current
125V(0%~+10%)	0.125~4.000 MΩ	0.001MΩ	$\pm(2\%+10)$	1mA @load1 25kΩ	≤1mA
	4.001~40.00 MΩ	0.01MΩ	$\pm(2\%+10)$		
	40.01~400.0 MΩ	0.1MΩ	$\pm(4\%+5)$		
	400.1~4000 MΩ	1MΩ	$\pm(5\%+5)$		
250V(0%~+10%)	0.250~4.000 MΩ	0.001MΩ	$\pm(2\%+10)$	1mA @load2 50kΩ	≤1mA
	4.001~40.00 MΩ	0.01MΩ	$\pm(2\%+10)$		
	40.01~400.0 MΩ	0.1MΩ	$\pm(3\%+5)$		
	400.1~4000 MΩ	1MΩ	$\pm(4\%+5)$		
500V(0%~+10%)	0.500~4.000 MΩ	0.001MΩ	$\pm(2\%+10)$	1mA @load5 00kΩ	≤1mA
	4.001~40.00 MΩ	0.01MΩ	$\pm(2\%+10)$		
	40.01~400.0 MΩ	0.1MΩ	$\pm(2\%+5)$		
	400.1~4000 MΩ	1MΩ	$\pm(4\%+5)$		
1000V(0%~+10%)	1.000~4.000 MΩ	0.001MΩ	$\pm(3\%+10)$	1mA @load1 MΩ	≤1mA
	4.001~40.00 MΩ	0.01MΩ	$\pm(2\%+10)$		
	40.01~400.0 MΩ	0.1MΩ	$\pm(2\%+5)$		
	400.1~4000 MΩ	1MΩ	$\pm(4\%+5)$		

Note: Accuracy specifications consist of two elements:

- (% reading) – This is the accuracy of the measurement circuit.
- (+ digits) – This is the accuracy of the analog to digital converter.

Store capacitance	2000
Enclosure	Double molded, waterproof
Shock (Drop Test)	6.5 feet (2 meters)
Diode Test	Test current of 0.9mA maximum, open circuit voltage 2.8V DC typical
Continuity Check	Audible signal will sound if the resistance is less than 35Ω (approx.), test current <0.35mA
Peak	Captures peaks >1ms
Temperature Sensor	Requires type K thermocouple
Input Impedance	>10MΩ VDC & >9MΩ VAC
AC Response	True rms
AC True RMS:	The term stands for “Root-Mean-Square,” which represents the method of calculation of the voltage or current value. Average responding multimeters are calibrated to read correctly only on sine waves and they will read inaccurately on non-sine wave or distorted signals. True rms meters read accurately on either type of signal.
ACV Bandwidth	50Hz to 1000Hz
Crest Factor	≤3 at full scale up to 500V, decreasing linearly to ≤1.5 at 1000V
Display	40,000 count backlit liquid crystal with bargraph
Overrange indication	“OL” is displayed
Auto Power Off	15 minutes (approximately) with disable feature
Polarity	Automatic (no indication for positive); Minus (-) sign for negative
Measurement Rate	2 times per second, nominal
Low Battery Indication	“  ” is displayed if battery voltage drops below operating voltage

Battery	6 x AA batteries
Fuses	mA, μ A ranges; 0.5A/1000V ceramic fast blow A range; 10A/1000V ceramic fast blow
Operating Temperature	41°F to 104°F (5°C to 40°C)
Storage Temperature	-4°F to 140°F (-20°C to 60°C)
Operating Humidity	Max 80% up to 87°F (31°C) decreasing linearly to 50% at 104°F (40°C)
Storage Humidity	<80%
Operating Altitude	7000ft. (2000metres) maximum.
Safety	This meter is intended for origin of installation use and protected, against the user, by double insulation per EN61010-1 and IEC61010-1 2 nd Edition (2001) to Category IV 600V and Category III 1000V; Pollution Degree 2. The meter also meets UL 61010-1, 2 nd Edition (2004), CAN/CSA C22.2 No. 61010-1 2 nd Edition (2004), and UL 61010B-2-031, 1 st Edition (2003)