

RESISTANCE SYSTEM

PRS-801

User Manual



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PROSTAT® PRS-801 RESITANCE SYSTEM

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I. Introduction & Description



Figure 1: PRS-801 during power up

The PRS-801 Resistance System is capable of precision resistance measurements from 0.1 up to 2.0×10^{14} ohms with an overall measurement tolerance of $\pm 5\%$. Its wide range and close tolerance make it the ideal instrument for measuring resistance to a variety of ESD and general industry specifications. It is operated by microprocessors that control the instrument's measurement process, resistance auto ranging, test voltage selection, electrification periods, and display functions. It can be operated in either fully automatic or manual modes, or a combination of automatic and manual modes.

The PRS-801 is unique in that it stores up to 80 resistance measurements in its non-volatile memory. Its software transfers stored data to Excel® spreadsheets.

Its accuracy is based on its ability to make and process several thousand measurements per second, averaging them until a stable set of eight consecutive measurements, all within 5% of each other are obtained. Typically, measurements at less than 1 ohm are within 5% of tolerance, and those between 1.0 and 1.0×10^{12} ohms are within 0.5% of laboratory references. Measurements from 1.0×10^{12} to less than 2.0×10^{14} ohms are within 5% tolerance using shielded cables, to a maximum of $\frac{1}{4}$ decade deviation from a laboratory reference (<40% tolerance) depending on cables and procedures employed by the operator.

While quite sophisticated in design, the PRS-801 Resistance System is easy to use and extremely helpful in making accurate ESD auditing measurements, or general resistance and continuity checks.

CAUTION

To avoid electrical shock or damage to the PRS-801 Resistance System, read this manual completely before installing batteries or using the instrument.

A. Measurement Applications

The PRS-801 Resistance System is designed to measure resistance characteristics of electrostatic discharge (ESD) control materials and products to current ESD industry standards, including:

Wrist Straps (ANSI/ESD S1.1)
Flooring (ANSI/ESD STM7.1)
ESD CP Grounds (ANSI/ESD S6.1)
Footwear (ANSI/ESD STM9.1)
Equipment (ESD SP10.1)
Material Handling Containers

Garments (ESD STM2.1)
Worksurfaces (ANSI/ESD S4.1)
Carts & Seating (ANSI/ESD STM 12.1)
Workstations
Production Aids & Hand Tools
Packaging (ANSI/ESD STM11.11, ANSI/ESD STM11.12 & ASTM 257), and Other ANSI/S20.20 ESD Program Control Elements

Note: Additional fixtures and electrodes supplied separately are required for many of these measurement.

B. PRS-801 Resistance System Components:

The PRS-801 Resistance System includes the following items:

1. PRS-801 Resistance System Instrument with 2 each 9V alkaline batteries.

IMPORTANT NOTE

Only use alkaline batteries for optimal performance.

2. Two 10-foot leads (PRS-800LB & PRS-800LR) for general audit measurements up to 1.0×10^{12} ohms.
3. One set (PRS-801SSL & PRS-801TVL) high resistance measurement leads, including: one shielded 42 inch sensing lead; and, one 42-inch power lead for precision measurements above 1.0×10^{12} ohms.
4. Prostat Utility Software (PRS-801CSW) enabling data transmission from the PRS-801 to Windows® Excel® spread sheets.
5. One RS-232 output cable (PRS-801CIC) for connection to a nine-pin computer COM port.
6. One heavy duty, black “Bulldog” clip (PRS-801BC)
7. Two Metal Alligator Clips (PSI-870MAC)
8. One Audit Test Bed (PTB-915)
9. One calibration shunt for low range adjustment (PRS-801CC)

Optional accessories are available for the PRS-801 Resistance System. Visit www.prostatcorp.com for additional information.

C. PRS-801 Basic Description & Functions

The PRS-801 Resistance System has several test, display and data logging functions:

1. The PRS-801 six basic measurement modes are described in the following table

MODE	DISPLAYED UNITS	INDICATION	RESIST. RANGE	TEST VOLTS	TEST FUNCTIONS
AUTOMATIC 1 [Default]	1.0EXX IND Ω - T Ω	AUTO	AUTO.	AUTO.	AUTOMATIC RESISTANCE RANGE, TEST VOLTS, ELECTRIFICATION, DISPLAY HOLD SEE TABLE NOTE #1
AUTOMATIC 2	OHMS Ω - T Ω	AUTO	AUTO.	AUTO.	
MANUAL 1 SELECT DECADE	1.0EXX IND Ω - T Ω	MANUAL	MAN	MAN. or AUTO	TEST ONLY; NO DISPLAY HOLD UL= UNDER DECADE LEVEL OL= OVER DECADE LEVEL SEE TABLE NOTE #2
MANUAL 2 SELECT DECADE	OHMS Ω - T Ω	MANUAL	MAN	MAN. or AUTO	
MANUAL/ AUTOMATIC 1 MAY SELECT STARTING DECADE	1.0EXX IND Ω - T Ω	AUTO & MANUAL	MAN. Start AUTO Run	AUTO.	MANUAL SETUP STARTING DECADE, AUTO ADJUST RANGE, TEST VOLTS, ELECTRIFICATION DISPLAY HOLD SEE TABLE NOTE #3
MANUAL/ AUTOMATIC 2 MAY SELECT STARTING DECADE	OHMS Ω - T Ω	AUTO & MANUAL	MAN. Start AUTO Run	AUTO.	

TABLE NOTES:

#1 AUTOMATIC: RESISTANCE RANGES IN AUTO 0.1 Ω TO <2.0E+14 Ω as follows
 @<10V: 0.1 TO <1.0E+04 Ω (0.1 Ω - < 10K Ω)
 @ 10V: 1.0E+04 TO <1.0E+06 Ω (10K Ω - < 1M Ω)
 @100V: 1.0E+06 TO <2.0E+14 Ω (1M Ω - <200T Ω)

#2 MANUAL: RESISTANCE RANGES IN MAN 0.1 Ω TO <2.0E+14 Ω as follows
 @<10V: 0.1 TO <1.0E+05 Ω (0.1 Ω - <100K Ω)
 @ 10V: 1.0E+03 TO <1.0E+09 Ω (1K Ω - <1G Ω)
 @100V: 2.0E+05 TO <2.0E+14 Ω (200K Ω -< 200T Ω)

#3 AUTO-MANUAL: (Same as AUTOMATIC)
 RESISTANCE RANGES IN AUTO-MANUAL 0.1 Ω TO <2.0E+14 Ω as follows
 @<10V: 0.1 TO <1.0E+04 Ω (0.1 Ω - < 10K Ω)
 @ 10V: 1.0E+04 TO <1.0E+06 Ω (10K Ω - < 1M Ω)
 @100V: 1.0E+06 TO <2.0E+14 Ω (1M Ω - <200T Ω)

- The PRS-801 provides three separate test voltages for resistance measurements as indicated in the table, above:

<10 Volts
 10 Volts
 100 Volts

In **AUTOMATIC** and **AUTOMATIC/MANUAL** modes the instrument automatically controls voltage and resistance range based on resistance characteristics of materials being measured. In the **MANUAL** mode the operator may select test voltage and and resistance range. Note that the most efficient mode of operation in **AUTOMATIC/MANUAL** for maximum battery life.

3. The PRS-801 displays resistance Measurements in several ways:

- a. 14 individual operator programmable LED's each representing one order of magnitude from $<10^3$ to $>10^{14}$ ohms. The operator may select from three colors, or **OFF** for each LED, including:

GREEN

RED

YELLOW/ORANGE

OFF (Blank)

- b. The large Liquid Crystal Display (LCD) includes an analog (1 - 10) scale and X1, X10 and X100 multiplier indication for measurement in Ω , $K\Omega$, $M\Omega$, $G\Omega$ and $T\Omega$.
 - c. Digital measurements are provided using integers and Ω , $K\Omega$, $M\Omega$, $G\Omega$, $T\Omega$ indicators, or in exponential format (1.0EXX) with Ω - $T\Omega$ indicators.
4. The PRS-801 includes data logging (storage) capabilities for up to 80 data points when **RECORD** is selected. The instrument will provide access to the memory register, calculate and display Minimum, Maximum and Average of all measurements in the instrument's memory whenever **RECALL** is selected.

Using the Prostat Utility Software, the PRS-801 can transfer all data points stored in its non-volatile memory to a Windows® Excel® computer spreadsheet via its RS-232 port for detailed analysis and record maintenance. (Windows® 95, 98, 2000, ME, XP, Vista, 7, 8 and NT based computer system using an Office Suite® 95, 97, 2000, 2007, 2010 and 2013 Excel® spreadsheet program)

II. Cautions & Warnings

As with any electrical device, use proper safety precautions and safe measurement procedures to avoid personnel shock and arc discharge.

- A. The PRS-801 Resistance System is battery operated and delivers test voltages up to 100 volts.
IMPORTANT: Only use alkaline batteries in the PRS-801.
- B. The instrument is current limited for safety, however, if improperly used it may be capable of delivering an annoying shock to a person touching conductors energized by the PRS-801, particularly at 100 volts.
- C. While current limited, a hazard exists in personnel reaction to a potential shock.
- D. To avoid personnel shock, follow the General Operations instructions at all times. Do not touch energized electrodes or fixtures when power is applied except as specifically described in this and accessory instructions.
- E. Do not operate or store the instrument in damp environments or wet conditions.

CAUTION

Storage or use of this instrument in high humidity, damp or wet conditions may cause damage to the instrument's electronic circuits, effect performance and can increase the possibility of personnel shock or arc discharge.

- F. Do not use the PRS-801 in combustible or explosive environments

WARNING

Improper handling and use of energized circuits may cause arc discharge, which in turn may cause the ignition of combustible materials or fumes. Do not use exposed energized circuits in flammable areas.

- G. Do not attempt to measure energized circuits with the PRS-801
- H. Do not use the PRS-801 if it becomes damaged in any way
- I. Only Prostat trained instrument personnel should attempt to service or repair the PRS-801
- J. Other Safety & Operating Considerations
1. This manual displays cautions and warnings alerting the user to hazardous operation and servicing conditions. **CAUTION** or **WARNING** headings throughout this publication flag this information, where appropriate. Follow all caution and warning instructions at all times.
 2. The PRS-801 is a precision instrument and should be operated by experienced personnel familiar with the use and handling of devices containing power supplies.

CAUTION

The PRS-801 Contains Electrostatic Discharge Sensitive (ESDS) components and includes precision alignment of circuit elements. Only Prostat trained and ESD Qualified instrument repair personnel should perform service.



3. The PRS-801 contains Electrostatic Discharge Sensitive (ESDS) components. Qualified personnel should service it only at ESD Controlled workstations. Do not attempt to dismantle the PRS-801 without Prostat's authorization and expert supervision. The instrument contains exceptionally

clean circuits that are aligned and adjusted in a precise manner for optimal operation and accurate performance. Unauthorized opening of the PRS-801 housing will void the instrument's warranty.

WARNING

Unauthorized opening of the PRS-801 case or dismantling in any manner
WILL VOID THE INSTRUMENT'S WARRANTY.

4. Read this manual in its entirety before installing batteries or using the PRS-801.
5. Do not drop or cause unnecessary mechanical shock to your PRS-801 instrument.
6. Store the instrument in a clean, dry environment. Do not expose the instrument to wet, extremely hot or cold conditions.
7. If the unit is stored in a cold environment, allow it to stabilize at room temperature before powering up the unit. This will prevent damage due to condensation that may accumulate on the instrument's circuit boards.

III. Controls, Connections & Indicators

Before operating the PRS-801 instrument become familiar with each control and display function. A thorough understanding of the instrument's operation will make its use a pleasant experience, enhance measurement accuracy, avoid mistakes and prolong the life of the instrument.

PRS-801 CONTROLS:

[1] FUNCTION/ MODE Toggles Through Six Operation Modes

(1) AUTO: (AUTOMATIC) displays data in exponential format 1.0EXX

NOTE: AUTO in exponential format, e.g., 1.3E05, is the Default start up mode when the instrument is turned ON.

(2) AUTO: (AUTOMATIC) displays data in Ω , K Ω , M Ω , G Ω and T Ω . The instrument controls resistance ranges, test voltage and electrification periods in AUTOMATIC mode.



Figure 2: PRS-801 Controls & Display Indicators

(3) MANUAL: displays data in exponential format 1.0EXX

(4) MANUAL: displays data in Ω , K Ω , M Ω , G Ω and T Ω

In **MANUAL**, the operator selects resistance range in single decade increments. Test voltage may be selected by the operator, or allowed to function automatically based on resistance range selected. The operator determines electrification period in seconds (SEC) using the displayed timer in the center of the LCD.

(5) AUTO-MANUAL: displays data in exponential format 1.0EXX

(6) AUTO-MANUAL: displays data in Ω , K Ω , M Ω , G Ω and T Ω

In **AUTO-MANUAL** the operator may select the initial resistance range in decade increments. Once set, the PRS-801 starts the measurement process from the preset resistance decade, rather than re-zeroing itself for each measurement. This feature saves measurement cycle time and extends battery life. In this mode the instrument automatically controls test voltage, range and measurement electrification period.

[2] RESISTANCE RANGE SELECTION

Two Triangular Arrows Buttons, UP (↑) and DOWN (↓), select Resistance Measurement Range in single orders of magnitude while in **MANUAL** or **AUTOMATIC/MANUAL** modes

[3] TEST VOLTS

Manual Selection of <10, 10 or 100 volts in **MANUAL** selects initial test voltage. **MANUAL** Test Voltage & Resistance Limits are as follows:

@<10V: 0.1 to <1.0E+05Ω (0.1Ω - <100KΩ)

@ 10V: 1.0E+03 to <1.0E+09Ω (1KΩ - <1GΩ)

@100V: 2.0E+05 to <2.0E+14Ω (200KΩ - <200TΩ)

NOTE: Optimal minimum measurement in **MANUAL** using 100 volts is 2.0E+05.

[4] RECORD/RECALL

If **REC** is not displayed in the lower left corner of the LCD, pressing **RECORD/RECALL** once turns Memory Register ON [**REC** will then be displayed in LCD]. If **REC** is ON and measurement data is stored in memory, pressing **RECORD/RECALL** once will provide access to the memory register. Pressing **RECORD/RECALL** successively will calculate and sequentially display Minimum [**MIN**], Maximum [**MAX**] and Average [**AVG**] of data stored in the Memory Register. If memory is **ON** and register contains stored data pressing **RECALL** will provide the following information:

First Press RECALL: Provides access to data in Memory

NOTE: **MEM XX** Flashes in LCD indicating number of data points in the register and the last measurement is displayed. Pressing DOWN (↓) and UP (↑) displays other data points and their respective position in the register is shown in the **MEM XX** section of the LCD.

Second Press RECALL: Displays MIN Data Point in Memory

Third Press RECALL: Displays MAX Data Point in Memory

NOTE: When displayed, **OL** [Over Level] indicates a measurement greater than (>) 2.0x10¹⁴ ohms, which is beyond the measurement capability of the PRS-801.

Fourth Press RECALL: Displays **AVG** of all Memory Data Points

NOTE: **OL** [Over Level] measurements [>2.0x10¹⁴ ohms] are not included in displayed average (**AVG**) calculation.

Fifth Press RECALL: Returns System to normal operations

NOTE: If in **RECALL** mode, pressing **RESET** will return the instrument to normal measurement operations.

NOTE

If **RECALL** is not pressed, a fifth time **OOPS** will be displayed in the LCD when **TEST** is next pressed. To Clear **OOPS**, press **RESET**. The instrument will return to normal operations.

- [5] SEND** Transmits data in Memory Register to RS-232 Output Port
- [6] CLEAR** In normal operations **CLEAR** erases data in Memory Register, discards most recent measurement, or turns the **REC** function **OFF** as follows:
- When in any operation mode, and **HOLD** is not displayed, pressing **CLEAR** will erase all data stored in Memory.

NOTE

The process of turning the **REC** function **OFF** will clear the Memory Register of all stored data. Be sure that this is indeed desirable before pressing the **CLEAR** button.

- If a measurement is displayed in **HOLD**, prior to pressing **RESET** button pushing **CLEAR** will discard that held value and will not enter it into Memory. Other data in Memory Register remains intact.
 - If reviewing data in the Memory Register while in the **RECALL** mode, pressing **CLEAR** will discard the displayed data point. Other data in Memory Register remains intact and indexes down one space to replace the discarded data point.
 - When in any operation mode, and **HOLD** is not displayed, pressing **CLEAR** will erase all data stored in the Memory Register. Pressing **OFF** will disable the **REC** mode and the instrument will be de-energized. When powered up again the **REC** mode will remain disabled until **RECORD/RECALL** is pressed once.
- [7] ON/OFF** Turns instrument **ON** for normal operations, performs functional & Battery tests, turns instrument **OFF**.
- [8] BATT. TEST** Displays **GOOD** on LCD if battery provides acceptable voltage for accurate measurements, or displays **Lo** if unacceptable and batteries require replacement.
- [9] RESET** Saves measurement and prepares instrument for next test cycle, i.e., enters measurement into Memory Register if **REC** is **ON**, and clears **HOLD** and the LCD display between measurements.
- [10] TEST** Begins measurement sequence in accordance with selected mode
- [11] BATTERY BUSS CUT OFF** Battery buss cut-off switch is used to isolate the main batteries from the instrument's circuit during battery change, instrument storage and transport.

CAUTION

Switch battery buss to the OFF position before changing batteries to avoid reverse polarity damage to the instrument.

LCD DISPLAY ELEMENTS

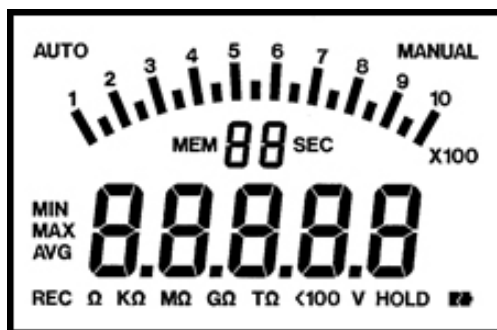
[12] Colored LED's 14 LED's across the top of the PRS-801 indicate measurement order of magnitude in decades from $<10^3$ to $>10^{14}$ ohms. LED's are programmable as described in **PROGRAMMING LED COLORS**.

[13] PRS-801 Liquid Crystal Display (LCD) Elements:

AUTO When ON Indicates instrument in **AUTOMATIC** mode

MANUAL When ON indicates instrument in **MANUAL** mode

When **AUTO** and **MANUAL** are **ON**, indicates instrument is in **AUTO-MANUAL** mode.



Analog Scale & X100 Indicator

The one decade analog scale elements darken to indicate measurement in teger. X1, X10 or X100 darken to indicate the scale multiplier. Combine the Analog indicators with Ω , $K\Omega$, $M\Omega$, $G\Omega$ and $T\Omega$ symbols to obtain an analog measurement.

MEM 00

Provides the number of data points stored in the Memory Register when **REC** is **ON** and instrument is **RESET** in preparation for a new measurement. The Memory Register can store up to 80 data points.

Also identifies a displayed data point's position in the Memory Register when in the **RECALL** mode.

00 SEC

Display's electrification period required for the measurement when in **TEST** during **AUTOMATIC** and **AUTO-MANUAL** measurement modes. In **MANUAL**, provides continuous measurement timing up to 99 seconds, then restarts at 0 seconds.

MIN

Displayed when **RECALL** button is pushed second time while in **REC** mode. Number displayed when **MIN** is indicated is the Minimum data value in Memory Register.

MAX	Displayed when RECALL button is pushed a third time (sequentially) in REC mode. Number displayed when MAX is indicated is the Maximum data value in Memory Register.
AVG	Displayed when RECALL button is pushed the fourth time (sequentially) in REC mode. Number displayed when AVG is indicated is the Average of all data values in Memory Register that are less than 2.0×10^{14} ohms. (OL's are not included in averaging calculation.) Note: Either the RECALL button must be depressed a fifth time or RESET pressed to return the system to its operational, measurement mode.
REC	Indicates that the Memory Register is ON and is Recording data each time the RESET button is depressed after a TEST measurement.
Ω	Ohms: Indicates measurement between 0.1 and 999 ohms
KΩ	Indicates measurements from 1,000 (1.0×10^3) to 990,000 (9.9×10^5) ohms
MΩ	Indicates measurements from 1,000,000 (1.0×10^6) to 999,000,000 (9.9×10^8) ohms
GΩ	Indicates measurements from 1,000,000,000 (1.0×10^9) to 999,000,000,000 (9.9×10^{10}) ohms
TΩ	Indicates measurements from 1,000,000,000,000 (1.0×10^{12}) to 200,000,000,000,000 (2.0×10^{14}) ohms
<100 V	Indicates <10, 10 or 100 volts being applied as the test voltage.
HOLD	Indicates measurement is complete at the end of a TEST cycle. Holds data point in display until instrument is RESET or CLEAR is depressed.
	Battery indication for low voltage

PRS-801 Connections

[+] Positive Terminal	Power terminal for supplying Test Voltage to fixture or material under test.
[-] Negative Terminal	Sensing Terminal for measurement of current (I) through fixture or material under test.
[14] Instrument Ground Ref.	Used for connecting a Sensing Cable Shield to the instrument's Ground Reference. It is never used to connect the instrument to an earth ground.
[15] RS-232 Output	Transfers data from the Memory Register to an Excel® spreadsheet.

Battery Compartment

Located in lower section of case, opposite LCD display. Holds two 9V-transistor batteries. Two screws secure the battery cover. Note: Use only Long Life Alkaline Batteries. Remove batteries when instrument is not in use for long periods of time.



Figure 3: Opening Battery Compartment



Figure 4: Install 2 each 9V Alkaline Batteries

IV. Battery Installation (See Figures 3 & 4)

For optimal battery life and avoid instrument damage, always replace the batteries with high energy, alkaline batteries. Failure to do so will result in a diminished battery life, measurement error and potential instrument damage that could void the warranty.

The battery caps on the instruments you have purchased are designed to fit snugly. Please follow the directions below for safe replacement of batteries.

- Slide battery bus switch to the **OFF** position (see figure 3).
- Carefully remove the battery cover from the instrument.
- Gently take the batteries from the battery compartment.
- Unwind any battery lead that is wrapped around the top of the battery terminal. Do not pull battery connection leads - this could cause instrument damage.
- Very carefully place a flat head screwdriver between the battery terminals and gently lift the battery cover from the battery.

- F. Properly dispose of any old batteries.
- G. Position the new alkaline battery under the battery cover.
- H. With your thumb, press the terminals in place one at a time.
- I. Carefully wind any excess battery lead around the battery terminal below the cap. To avoid instrument damage, do not pull battery connection leads
- J. Place the batteries back into position with the battery terminal covers facing the lead spurce within the battery case shown in figure 4.
- K. Carefully position the instrument battery cover back into place without force.
- L. Replace the battery cover screws.
- M. Slide battery buss switch to the **ON** position.

Following the above directions for battery replacement will insure that you do not damage the battery covers or wires during this process.

NOTE

It is recommended to measure the voltage of each battery with a multimeter. If the voltage of one battery measures at or below 6.75 volts, replace that battery. If both batteries measure at or below 6.75 volts, replace both batteries.

V. Setup & Calibration

- A. Setting up the PRS-801 for low resistance range calibration
 - 1. Position Battery Buss Cut Off switch to OFF position
 - 2. To install batteries, remove two Phillips locking screws and cover. Attach two Long-Life, Alkaline 9V batteries to the battery connection terminals.
 - 3. Position batteries in compartment with power leads neatly positioned above battery connections. Carefully re-install battery cover and locking screws.

NOTE

Do Not change batteries with the battery buss **ON**. Always switch Battery Buss Cut Off to **OFF** when changing batteries. Should the **ON/OFF** button be depressed during battery change and Battery Bus is **ON** the instrument may lock up and not function properly or be seriously damaged. In this case, simply disconnect the batteries, then re-install with Battery Buss switch in the **OFF** position.

- B. Low Resistance Range (<10 Ohms) Calibration
 - 1. Install the calibration shunt (PRS-801CC) across the Negative (-) and Positive (+) Lead Terminals (Figure 5, below).



Figure 5: Low Resistance Range Calibration Shunt Installation

2. Press the Red **ON/OFF** power button. The instrument display should become energized, each LED will be tested in sequence, and **GOOD** will be displayed in the LCD if the batteries have sufficient test capacity (figure 10).



Figure 6: Low Resistance Range Calibration using Reference Module



Figure 7: Start the Calibration Sequence by pressing RESET then CLEAR within 1/2 Second

3. Allow the instrument circuits to warm-up for a few minutes; approximately 2 - 3 minutes are sufficient, prior to completing the calibration sequence.
4. Press **MODE** once to shift display to ohms mode (Ω).
5. Press the Yellow **RESET**, then the Gray **CLEAR** button within 1/2 second. The message **CAL** will be displayed in the LCD. (See Figure 8)
6. Press the Yellow **RESET** button to complete low range (0.1 to 10 ohm) calibration. The **CAL** message will automatically be cleared when **RESET** is pressed. (See Figure 8)
7. Press the Green **TEST** button. Indicated resistance should be 1.02 (± 0.02) ohms as shown in

Figure 8. Press **RESET** to clear the display. NOTE: If 1.02 (± 0.02) ohms is not displayed, repeat the calibration process.

8. Remove the calibration shunt assembly from the lead terminals
9. The PRS-801 is now ready for wide range measurements from 0.1 to 2.0E+14 Ohms



Figure 8: Complete Calibration Sequence by Pressing RESET. To confirm Calibration, Press TEST to measure the Calibration Shunt resistance. Shunt resistance should display 1.02 Ohms ± 0.02 Ohms

VI. Instrument Operation

A. Overview of PRS-801 Operation & Measurement Test Cycle Sequence

The following 10 points provide a general overview for calibrating and using the PRS-801 for resistance measurements.

1. Slide Battery Buss Cut Off switch to **ON**
2. Press Red **ON/OFF** button once to power up PRS-801
 - a. Instrument performs circuit check, and tests LED's, LCD display, and battery voltage.
 - b. LCD displays **GOOD** if battery voltage suitable for instrument operation; displays **Lo** if batteries require replacement
 - c. Instrument ends startup sequence in default **AUTO**, Exponent Display Mode 1.0EXX
3. Select Function Mode if other than **AUTO**, Exponent Display Mode 1.0EXX is desired by pressing **MODE** button
4. Perform low resistance range calibration after 3 minute instrument warm-up, if desired
 - a. Install Calibration Shunt between positive (+) and negative (-) terminals

- b. Press **RESET** then **CLEAR** within $\frac{1}{2}$ second
 - c. **CAL** is displayed in LCD
 - d. Press **RESET** to calibrate instrument to shunt reference
 - e. Press **TEST** to measure shunt resistance of 1.02 ± 0.02 ohms (Ω)
 - f. Press **RESET** button to prepare instrument for the next measurement
 - g. Repeat calibration procedure if necessary
 - h. Remove Calibration Shunt
5. Carefully connect test leads to positive (+) [Power] and negative (-) [Sensing] terminals. Insert right angle sleeved banana into instrument terminal, press gently while twisting into position.
- a. Standard 10-foot test leads are used for general audit measurements, up to 1.0×10^{12} ohms
 - b. Shielded 42-inch test leads are used for precision applications and bench tests employing special fixtures for measurements up to 2.0×10^{14} ohms.
6. Connect test leads to electrodes, fixture or circuit to be measured
7. Press Green **TEST** button to initiate Automatic measurement Test Cycle
- a. The resistance range is reset to minimum (0.1Ω). It is automatically adjusted in conjunction with the resistance characteristics of the materials under test, based on:
 - (1) Test voltage; and,
 - (2) Current flow.
 - b. Test Voltage is reset to $<10V$ and automatically increased in accordance with the following material resistance characteristics:
 - (1) <10 Volts: 0.1 to less than 1.0×10^4 ohms ($0.1\Omega - <10K\Omega$)
 - (2) 10 Volts: 1.0×10^4 to less than 1.0×10^6 ohms ($10K\Omega - <1M\Omega$)
 - (3) 100 Volts: 1.0×10^6 to 2.0×10^{14} ohms ($1M\Omega - 200T\Omega$)
 - (4) When **OL** is displayed, it mean that the resistance is greater than 2.0×10^{14} ohms
 - c. Electrification period, i.e., the time period during which test voltage is applied to the material under test, is automatically adjusted to the PRS-801's measurement characteristics and industry standards (ANSI/ESD STM11.11). Typical electrification periods are:
 - (1) 2 to 3 Seconds: 0.1 to less than 1.0×10^4 ohms ($0.1\Omega - <10K\Omega$)
 - (2) 2 to 4 Seconds: 1.0×10^4 to less than 1.0×10^6 ohms ($10K\Omega - <1M\Omega$)
 - (3) 7 to 8 Seconds: 1.0×10^6 to $>1.0 \times 10^{12}$ ohms ($1M\Omega - >1T\Omega$)

(4) 15+ Seconds: 1.0×10^{12} to 2.0×10^{14} ohms (1TΩ - 200TΩ)

8. When the PRS-801 displays and holds the final resistance measurement, **HOLD** is indicated in the lower, right corner of the LCD.

The PRS-801 is processor controlled to obtain hundreds of measurements per second, and to make rapid adjustments in resistance range and test voltage as necessary. It will display the resistance measurement of the material under test based on the following criteria:

- a. A digital numeric display is the averaged result of eight (8) individual, consecutive measurements, each within $\pm 5\%$ of each other.
- b. The display is continuously recalculated and updated during the measurement's electrification period.
- c. The final displayed measurement is the averaged result of the last eight (8) individual, consecutive measurements, each within $\pm 5\%$, at the end of the electrification period.
- d. If the material or test conditions vary such that eight consecutive measurements, each within $\pm 5\%$ of each other cannot be obtained, the PRS-801 will extend the electrification period until the measurement criteria are met; or,
- e. The electrification period will automatically be terminated and the most recent averaged result of eight (8) individual, consecutive measurements will be displayed and held. NOTE: Several material measurements that vary greater than 15 to 20 percent of each other typically indicate inconsistencies in the material or test conditions.

9. To save the displayed measurement in the Memory Register and prepare the PRS-801 for the next measurement, press the Yellow **RESET** button. Pressing **RESET** causes three functions:
 - a. Enters (saves) last measurement into Memory Register

NOTE

REC must be displayed in the lower, left corner of the LCD in order to enter the measurement in the Memory Register. If **REC** is not displayed, press **RECORD/RECALL** once, then press **RESET** to save the data.

- b. Increases LCD displayed number of data points in the Memory Register (**MEM**) by one, e.g., MEM 02
 - c. Returns the PRS-801 to its last function mode in preparation for the next measurement
10. To make several measurements, simply press **TEST** to obtain the next measurement, and then **RESET** to save it. Repeat the **TEST** and **RESET** process for each measurement.

NOTE

Be sure to press **RESET** after your last measurement to save it in your Memory Register before turning the PRS-801 OFF. If the instrument is turned **OFF** before pressing **RESET** the last measurement will be lost.

Good Measurement Practices, specific Operational Procedures and descriptions of functional modes are covered in detail, below.

B. Good Measurement Practices

Several factors will affect precision resistance measurements. Most practitioners are aware of the importance of using care when handling instruments, proper use of connections, lead resistance, grounding, and the impact of electrical or electrostatic fields on their equipment.

As with most very precise instruments, the PRS-801 circuits and its cables are sensitive to the effects of electromagnetic and electrostatic fields. These effects are minimized by instrument and test lead design. However, good measurement practices should be exercised at all times to ensure accuracy and repeatability. Follow the recommendations below to obtain optimal performance from the PRS-801.

1. Instrument handling and preparation

- a. Do not drop or cause mechanical shock to your instrument
- b. Store the instrument in a clean, dry environment. Do not expose the instrument to wet, extremely hot or cold conditions.
- c. If the unit is stored in a cold environment, allow it to stabilize at room temperature before powering up the unit.
- d. Be sure fresh batteries are installed when beginning an extensive measurement sequence. Periodically check the condition of your alkaline batteries by pressing **BATT. TEST**. If **Lo** is indicated, replace your batteries.

OPERATIONAL NOTE

Low voltage Batteries will affect measurement accuracy.

- e. When making resistance measurements below 10 ohms, perform The Low Range Calibration Procedure. Repeat the procedure to confirm the instrument's response.
- f. During resistance measurements, stand back, away from the instrument to avoid body capacitance or fields from effecting instrument accuracy.
- g. To avoid body fields from interfering with instrument accuracy, wear a wrist strap attached to a tested ESD ground to dissipate body charges.

WARNING

To prevent electrical shock, Do Not Touch energized circuits, leads or fixtures while grounded.

Use pre-tested ground connections meeting local safety codes for personnel earth grounding. Refer to National Electrical Codes and ESD Association Standard S6.1 Grounding for information and procedures. Only qualified personnel should conduct ground test measurements.

2. Use only Prostat test leads, cables and accessories supplied with the PRS-801. Be sure that leads are properly connected to their respective terminals as described below.
 - a. The 10-foot general measurement leads are custom made of high quality, silicon rubber for maximum insulation properties and measurement accuracy. These leads are intended for general measurements up to 10^{12} ohm range. Shielding is not incorporated in the 10-foot lead construction.
 - (1) When installed in the PRS-801 terminals, be sure the right angle sheathed banana connections are fully inserted and positively seated for full terminal contact.

NOTE

Do not apply excessive force when mounting leads on the terminals to prevent deformation or damage to the terminal circuit board.

- (2) The straight, retractable-sheathed banana plugs are intended for connection to measurement electrodes, fixtures or clip accessories.
- (3) The red lead should be installed in the positive (+) terminal and the black lead in the negative (-) terminals
- b. The 42-inch shielded cable and power lead are designed to minimize the effect of lead impedance on measurement accuracy, and to provide additional shielding from electromagnetic and electrostatic fields in the environment. These test leads provide excellent performance for measurements up to 2.0×10^{14} ohms. They should be used whenever best accuracy is required.
 - (1) The shielded cable assembly must be installed with its Black right angle sheathed banana fitting in the negative (-) sensing terminal
 - (2) The shielded cable assembly's green, male banana must be inserted in the Instrument Ground Reference receptacle located at the lower end of the PRS-801 case.
 - (3) The Red 42-inch power lead must be connected to the instrument's positive (+) terminal.

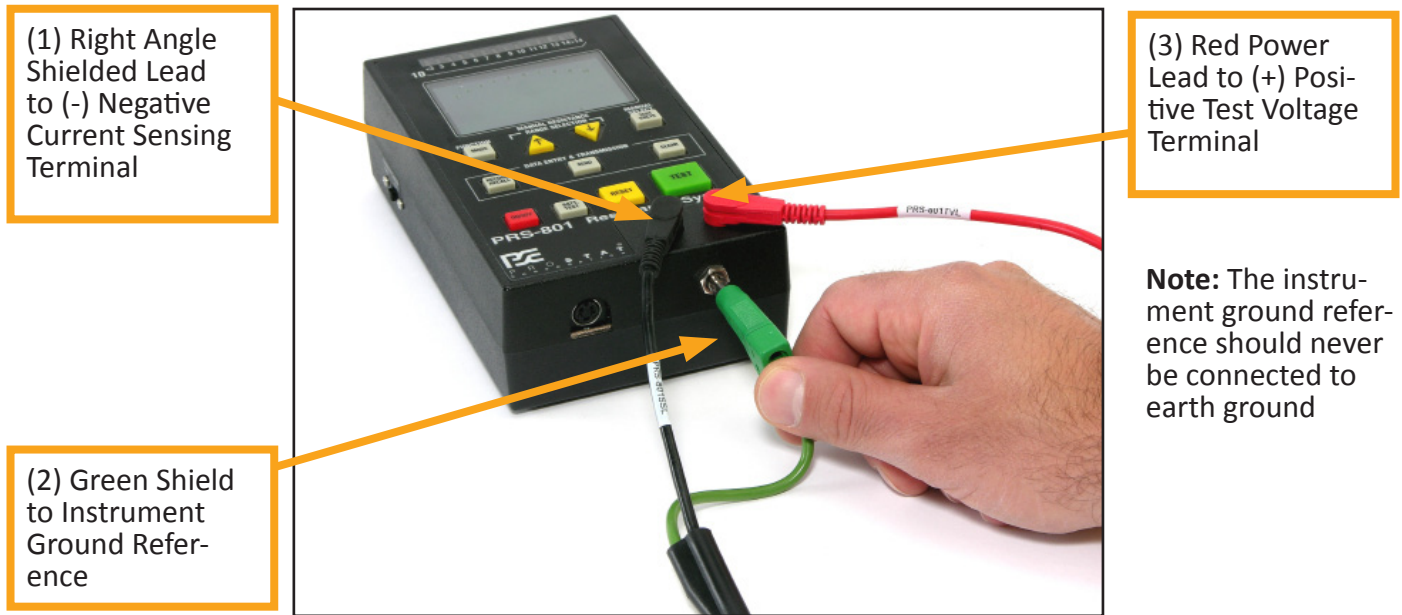


Figure 9: Shielded Lead Set Connections

3. When making measurements in the manufacturing environment, move the instrument and test leads away from power cables and heavy electrical equipment to prevent electromagnetic interference.
4. If groundable fixtures are employed for material measurements:
 - a. When using 10-foot leads, attach an auxiliary lead from the fixture to the instrument ground reference.
 - b. When using the shielded cable assembly, attach the shield's green, male banana to the fixture ground. A separate ESD earth ground may also be employed in laboratory bench top testing situations.
5. Prior to making precision measurements, allow the PRS-801 to warm-up for 3 minutes, then perform the Low Resistance Calibration procedure. If several measurements are to be made, periodically check the instrument's calibration using the supplied calibration shunt.

C. Operation in AUTOMATIC Modes

The PRS-801 was designed to simplify measurement standards and general rules for making wide range resistance measurements. The PRS-801's **AUTOMATIC** mode controls the critical aspects of Test Voltage, Resistance Range, and Electrification Period to meet ESDA Standard ANSI/ESD STM11.11 Surface Resistance, and other requirements. Most measurements can be performed in AUTOMATIC, which has two function modes:

AUTO Mode 1: Auto Exponential Display 1.0EXX plus Ω indicators

AUTO Mode 2: Auto Display in Ω , K Ω , M Ω , G Ω and T Ω indicators

AUTO Mode 1 is the default functional mode when the PRS-801 is powered up. To change to AUTO Mode 2, simply press the MODE button once. The **AUTOMATIC** modes are used in measurements where the following attributes are desired:

- Automatic Test Voltage selection and control from 0.01 to 100 volts
- Automatic resistance scale control from 0.1 ohm to 2.0×10^{14} ohms (200 TΩ)
- Automatic Electrification Period timing based on the instrument's measurement capabilities and industry standards for measurement of ESD controlled materials.

In AUTOMATIC Modes, the PRS-801 performs the following functions during the Measurement Test Cycle once the **TEST** button is pressed:

1. Resets the **RESISTANCE RANGE** to minimum, i.e., 0.1Ω
2. Sets **TEST VOLTAGE** to <10 volts (millivolts), and applies initial voltage to material under test
3. Resets the **ELECTRIFICATION PERIOD** timer to 0 seconds, then starts timer
4. During Measurement Test Cycle:
 - a. Automatically adjusts **RESISTANCE RANGE** in accordance with material resistive characteristics
 - b. Automatically adjusts **TEST VOLTAGE** in accordance with material resistive characteristics and industry standards
 - c. Automatically adjusts **ELECTRIFICATION PERIOD** in accordance with material resistive characteristics and industry standards
5. At completion of Test Cycle, displays and **HOLDS** final resistance measurement, test voltage, order of magnitude (LED), analog scale & multiplier, and electrification time at end of electrification period.

D. General Automatic Mode Procedures

1. Attach the desired test leads to the fixture, electrodes or points to be measured

NOTE

The standard Prostat 10 foot test leads are intended for measurements up to the 10^{12} ohm range. The shielded test leads are intended for precision measurements above 1.0×10^{14} ohms.

2. Slide the Battery Buss Cut Off to the **ON** position. This connects the 9V batteries to the instrument's circuitry.

NOTE

Slide the Battery Buss Cut Off to the **OFF** position when the instrument is not in use, particularly during storage and transport to prevent unintentional instrument power up, and during battery replacement.



3. Press the Red **ON/OFF** button to power up the instrument.
4. The instrument will conduct a self-test, check its LCD display and LED lights, and test the batteries. If Batteries are acceptable **GOOD** will be displayed in the LCD (Figure 10).



Figure 10: PRS-801 Power Up tests display circuits, LED indicators and batteries

5. **AUTO** is displayed in the LCD.
 - a. The default Mode for the PRS-801 is Automatic Resistance Measurement in exponential format (1.0EXX).
 - b. If measurements are to be displayed in Ohms press the Gray **MODE** button once.
 6. If **REC** is not displayed in the lower left corner of the Liquid Crystal Display (LCD), press Gray **RECORD/RECALL** button once to display **REC** in LCD. This activates the Memory Register, enabling data storage.
 7. Press the Green **TEST** button to begin the **AUTOMATIC** measurement sequence. The instrument will automatically set the resistance range to 0.1 Ohms (1.0E-01), and select <10 volts to be applied to the Positive (+) Lead Terminal. The electrification timer will start counting seconds.
- E. Measurements Less than 10,000 ohms ($<1.0 \times 10^4$ ohms):
1. When the resistance measurement is less than 1.0×10^4 ohms, test voltage will remain at <10V, the resistance range will be adjusted automatically and a stable resistance measurement will be obtained within 2.0 to 3.0 seconds.
 2. Once a stable measurement is confirmed and displayed by the instrument, **HOLD** will be energized in the LCD and the electrification timer will stop.
 3. An LED corresponding to the measurement's order of magnitude will be energized

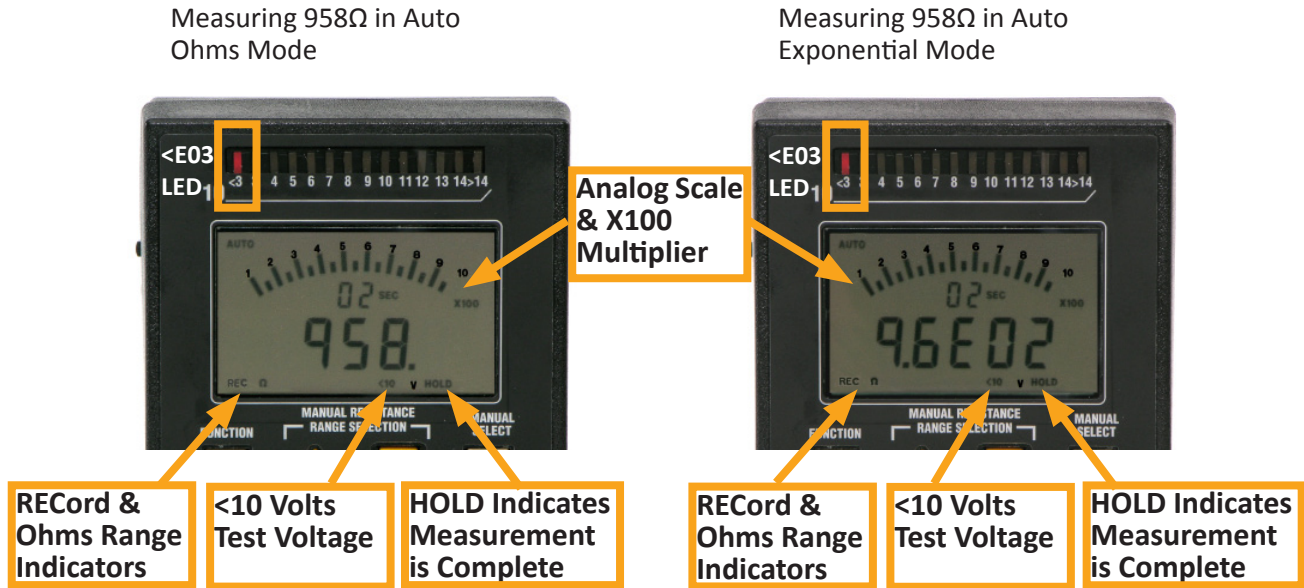


Figure 11: Comparing PRS-801 Display in Automatic Ohms Mode and Automatic Exponential Mode after the same low resistance measurement.

F. Measurements from 1.0×10^4 to less than 1.0×10^6 ohms:

1. When the resistance measurement is greater than 1.0×10^4 ohms test voltage will automatically be increased to 10 volts, and the resistance range will be adjusted as necessary.
2. A stable resistance measurement will be obtained within 2.0 to 4.0 seconds.
3. Once a stable measurement is confirmed and displayed, **HOLD** will be energized in the LCD and the electrification timer will stop.
4. An LED indicating the measurement's order of magnitude will be energized

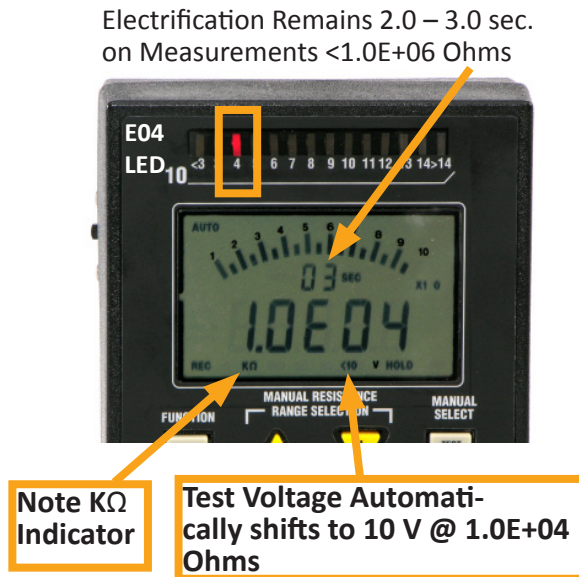


Figure 12: Test Voltage at 10 Volts from 1.0×10^4 to $<1.0 \times 10^6$ Ohms in Auto

G. Measurements from 1.0×10^6 to less than 1.0×10^{12} ohms:

1. When the resistance measurement is greater than 1.0×10^6 ohms the test voltage will automatically be increased to 100 volts, and electrification (Test Period) is automatically adjusted to >7.5 seconds.
2. Unless there are variations in the material or object being measured, a stable resistance measurement will be obtained in approximately 8.0 seconds.

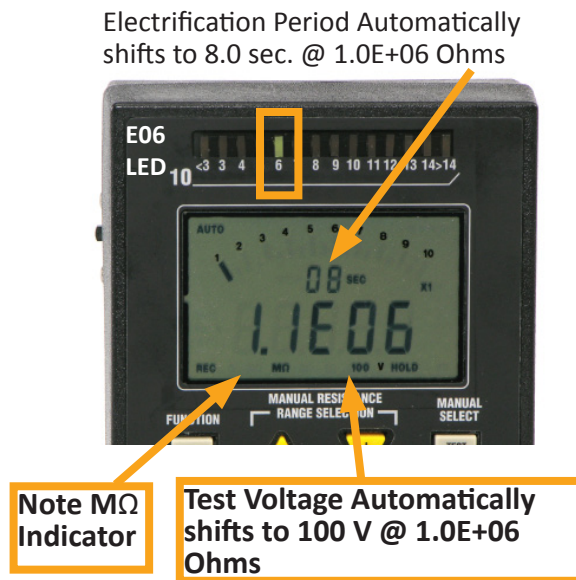


Figure 13: Test Voltage at 100 Volts from 1.0×10^6 to 1.0×10^{14} Ohms in Auto

NOTE

The PRS-801 can obtain an accurate resistance measurement within 2.5 seconds up to 1.0×10^{12} ohms, depending on material characteristics. An additional 5.0 seconds of electrification is applied in accordance with ESD Association S11.11 Surface Resistance Standard.

3. Once a stable measurement is confirmed and displayed by the instrument, **HOLD** will be energized in the LCD and the electrification timer will stop.
4. An LED corresponding to the measurement's order of magnitude will be energized

H. Measurements from 1.0×10^{12} to 2.0×10^{14} ohms:

1. When the resistance measurement is greater than 1.0×10^{12} ohms, the test voltage will remain at 100 volts and the instrument will continue to automatically adjust the resistance range.
2. The instrument's ELECTRIFICATION PERIOD is extended to a minimum of 15 seconds. Typically, a stable measurement will be obtained in 15.0 to 20.0 seconds.
3. Once a stable measurement is confirmed and displayed by the instrument, **HOLD** will be dis-

played in the LCD and the electrification timer will stop.

4. An LED corresponding to the measurement's order of magnitude will be energized

I. Measurements Greater Than 2.0×10^{14} ohms:

1. If the measurement is greater than 2.0×10^{14} ohms, the test voltage will remain at 100 volts and the resistance range will be adjusted until the upper range is exceeded.
2. **OL** (Over Level) will be displayed in the LCD, and the >14 LED will be energized.
3. Once the instrument confirms a stable measurement, if any, **HOLD** will be displayed in the LCD and the electrification timer will stop. If a stable measurement cannot be obtained at this range **OL** will be displayed.

J. Resistance Measurements in **MANUAL MODE** of Operation

To select **MANUAL** in either Exponential (Mode 3) or Ohms (Mode 4) Display, use the **FUNCTION MODE** button to toggle through choices. Manual is used for a variety of applications where one desires to override Automatic functions:

- Measurement series where magnitude is in a defined decade and test voltage is fixed.
- When an extended electrification period may be desired
- Manual selection of test voltage for measurements not used with Automatic settings

The following summarizes **MANUAL MODE** Operations and assumes test leads are installed

1. Slide Battery Buss Cut Off switch to **ON** position
2. Press Red **ON/OFF** button once to power up the instrument.
3. Select **MANUAL MODE** by pressing the **MODE** button until **MANUAL** appears in the LCD.
 - a. Pressing **MODE** button two (2) times selects **MANUAL** Exponential display (1.0EXX)
 - b. Pressing the **MODE** button three (3) times selects **MANUAL** display in Ohms.
4. Set **RESISTANCE RANGE SELECTION** using the UP (↑) and DOWN (↓) arrow keys.
 - a. Range selection is made in one-decade increments and indicated with colored LED's.
 - b. For resistance ranges below <E3, use the LCD displayed decimal point (.) as a guide for setting the desired decade. The <3 LED will be illuminated.
5. Set test voltage by pressing **MANUAL SELECT TEST VOLTS** button until the desired voltage is displayed in lower right portion of LCD, i.e., <10, 10 or 100 Volts. **MANUAL** Test Voltage & Resistance Limits are defined below.

IMPORTANT: Exceeding these limits may affect measurement accuracy.

<10V: 0.1 to $<1.0 \times 10^5$ ohms

(0.1Ω - < 100KΩ)

10V: 1.0×10^3 to $<1.0 \times 10^9$ ohms (1K Ω - < 1G Ω)

100V: 2.0×10^5 to 2.0×10^{14} ohms (200K Ω - 200T Ω)

NOTE

If a test voltage is not manually selected, test voltage control will default to Automatic Mode limits, switching higher or lower in accordance with resistance range selection.

6. Press **TEST** to begin the Measurement Test Cycle.
 - a. The instrument will:
 - (1) Apply and display the selected Test Voltage, or automatically default to and display the appropriate voltage for the selected resistance decade
 - (2) Self adjust the measurement resistance range to the selected decade
 - (3) Start the electrification period timer
 - b. If resistance is within the selected decade, the measurement and the electrification time will be displayed continuously in the LCD.
 - c. Pressing **RESET** will stop the Measurement Test Cycle, and simultaneously:
 - (1) Turn Test Voltage power supply OFF
 - (2) Save the displayed measurement in the Memory Register
 - (3) Add one data point to the MEM XX counter and display total number of data points in the Memory Register, e.g., MEM 05
 - (4) Prepare the instrument for the next measurement using the same Manual settings.
 - (5) Pressing **TEST** will start a new Measurement Test Cycle
7. If the resistance you are measuring is higher than the selected decade, **OL** (Over Level) will be displayed. To move the selected resistance range up to a higher decade:
 - a. Press **RESET** once to stop the Test Cycle. This does not add **OL** to Memory.
 - b. Press **MANUAL RESISTANCE RANGE SELECTION** up arrow ($\uparrow$) to select the desired decade; the appropriate LED will illuminate indicating the current selection
 - c. Press **TEST** to restart the Test Cycle
 - d. Repeat the **RESET**, Resistance Range adjustment and TEST sequence until a stable measurement is displayed
8. If the resistance is lower than the selected decade, **UL** (Under Level) will be displayed. To move the selected resistance range down to a lower decade:

- a. Press **RESET** once to stop the Test Cycle. This does not add **UL** to Memory.
- b. Press MANUAL RESISTANCE RANGE SELECTION down arrow (↓) to select the desired decade; the appropriate LED will illuminate indicating the current selection
- c. Press **TEST** to restart the Test Cycle
- d. Repeat the **RESET**, Resistance Range adjustment and **TEST** sequence until a stable measurement is displayed

K. Resistance Measurements in the **AUTOMATIC/MANUAL** MODE of OPERATION

To select **AUTOMATIC/MANUAL** in either Exponential (Mode 5) or Ohms (Mode 6) Display, use the **FUNCTION MODE** button to toggle through choices. **AUTOMATIC/MANUAL** is used for a variety of applications where one desires to reduce Measurement Test Cycle time by overriding Automatic reset-to-minimum functions. It is intended for applications where:

- Multiple Measurements where magnitude is expected within a range of two or three decades, and test voltage must vary with actual resistance measurements.
- When **AUTOMATIC** electrification period and Test Voltage control must be maintained to current industry (and Automatic Mode) settings

This mode prevents the PRS-801 from resetting the Test Voltage and Resistance Range to Minimum at the beginning of each Measurement Test Cycle. In this mode, measurements start at the resistance range selected by the operator, and its commensurate Test Voltage, or the value of the last measurement. Otherwise, it is used similar to the **AUTOMATIC** Mode.

The following summarizes **AUTOMATIC/MANUAL** Mode Operations and assumes that test leads are properly connected.

1. Slide Battery Buss Cut Off switch to **ON** position
2. Press Red **ON/OFF** button once to power up the instrument.
3. Select **AUTOMATIC/MANUAL MODE** by pressing the **MODE** select button until **AUTO** and **MANUAL** appear in the LCD display.
 - a. Pressing the **MODE** button four (4) times selects **AUTOMATIC/MANUAL** Exponential display (1.0EXX).
 - b. Pressing the **MODE** button five (5) times selects **AUTOMATIC/MANUAL** display in Ohms.
4. Set RESISTANCE RANGE SELECTION using the UP (↑) and DOWN (↓) arrow keys.
 - a. Range selection is made in one-decade increments and indicated with illuminated LED's.
 - b. For resistance ranges below <E03, use the LCD displayed decimal point (.) for setting the desired decade. The <3 LED will be illuminated.
5. Press the Green **TEST** button to begin the **AUTOMATIC/MANUAL** Measurement Cycle.

- a. The instrument will automatically start the Test Cycle from the selected resistance range decade.
- b. Initial Test Voltage for the selected resistance decade will be applied. For example if the 10^6 ohms decade was selected, initial Test Voltage will be 100 Volts.
- c. At this point the PRS-801's **AUTOMATIC** Mode takes control of the Measurement Test Cycle:
 - (1) Automatically re-adjusts **RESISTANCE RANGE** in accordance with material resistive characteristics
 - (2) Automatically re-adjusts **TEST VOLTAGE** in accordance with material resistive characteristics and industry standards
 - (3) Automatically re-adjusts **ELECTRIFICATION PERIOD** in accordance with material resistive characteristics and industry standards
 - (4) At completion of Test Cycle, displays and **HOLDS** final resistance measurement, test voltage, order of magnitude (LED), analog scale & multiplier, and electrification time at end of electrification period.

L. CHANGING LED INDICATOR COLORS

Either the operator or the Supervisor can program this handy feature in the field. The programmable LED colors are GREEN, RED, YELLOW/ORANGE, or OFF (Blank). The 14 LED colors can be changed as follows:

1. Press the Yellow **RESET** button, and within ½ second press the gray **RECORD/RECALL** button. The LCD will display **SETUP**.
2. Use the UP (↑) arrow key to toggle through all LED lights until the <3 LED is illuminated.
3. Press the DOWN (↓) arrow key to toggle through the color selection. Once the color desired is illuminated for that LED, press the UP (↑) arrow key to move to the next LED.
4. The next LED will assume the same color as selected for the previous LED. If this is acceptable, press the UP (↑) arrow key to move to the next LED, otherwise press the DOWN (↓) arrow key to select the desired color.
5. Repeat the Move (↑) and Color Select (↓) until all LED's from are the desired colors.
6. Press SEND to save the new LED color program. The program is stored in non-volatile memory and will not change unless reprogrammed.

M. The Memory Register: Data Logging, Calculation & Transmission

As previously described, the PRS-801 Resistance System will acquire and store up to 80 measurements, or data points, in its Memory Register when Record (REC) is activated. The data in memory can be reviewed for its minimum, maximum and average values, or transmitted to a Windows® 95, 98, 2000, ME, XP, Vista, 7, 8 and NT based computer system using an Office Suite® 95, 97, 2000, 2007 and 2010 Excel® spreadsheet program.

1. To Activate the Record Mode press the gray **RECORD/RECALL** button once. **REC** will be displayed in the lower left corner of the instrument's LCD display.
2. To Review Data in the Memory Register press the **RECORD/RECALL** button four times, as follows:
 - a. 1st Press **RECORD/RECALL**: Provides access to data points in the Memory Register
 - (1) Use UP (↑) and DOWN (↓) arrow keys to scroll through data.
 - (2) You may select a data point and eliminate it by pressing **CLEAR**. All other stored data will shift one slot in the register to replace deleted data.
 - (3) Min, Max and Average of remaining data in Memory will be recalculated.
 - (4) Press **RECORD/RECALL** to proceed, or **RESET** to exit Memory Register and return to normal operations.

OPERATIONAL NOTE

You may return the instrument to normal operations from the **RECORD/RECALL** mode at any time by pressing **RESET**.

- b. 2nd Press **RECORD/RECALL**: LCD Displays **MIN** and the lowest recorded resistance value saved in the Memory Register
- c. 3rd Press **RECORD/RECALL**: Displays **MAX** and the highest recorded resistance value saved in the Memory Register

NOTE

When displayed, **OL** (Over Level) indicates a measurement greater than ($>$) 2.0×10^{14} ohms, beyond the measurement capability of the PRS-801

- d. 4th Press **RECORD/RECALL**: Displays **AVG** and the average of all recorded resistance values saved in the Memory Register

NOTE

OL (Over Level) measurements greater than ($>$) 2.0×10^{14} ohms are not included in displayed average (**AVG**) calculation. **AVG** is the calculated average of all resistance values less than ($<$) 2.0×10^{14} ohms, rounded to the first decimal point.

- e. 5th Press **RECORD/RECALL**: Returns PRS-801 System to normal operations

NOTE

If **RECALL** is not pressed, a fifth time **OOPS** will be displayed in the LCD when **TEST** is next pressed. To Clear **OOPS**, press **RESET**. The instrument will return to normal operations.

3. Installing the Prostat Utility Software on your computer

The Prostat Utility Software is included with the PRS-801. Properly installed, the Utility Software allows data stored in the PRS-801 Memory Register to be transmitted to your computer and inserted in an Excel spreadsheet. In effect, the connectivity program performs a standard “cut and paste” function in Excel. It is compatible with all Windows/Office Suites 95, and later Excel versions. (Includes Windows® 95, 98, 2000, ME, XP, Vista, 7, 8 and NT based computer system using an Office Suite® 95, 97, 2000, 2007, 2010 and 2013 Excel® spreadsheet program)

NOTE

Cable connections to your computer should be made with the computer shutdown. You may wish to connect your PRS-801 cable to your computer's COM Port before starting your computer and running the Prostat Utility Software.

Install the Prostat Utility Software as follows:

- a. Insert the Utility Software CD-ROM into your CD-ROM Drive.
- b. Open the CD-ROM Drive folder in your windows program
- c. Double click on **SETUP.EXE**
- d. Follow the instructions on the screen

If you do not have a CD-ROM Drive, you can download the utility Software from our website at www.prostatcorp.com.

4. To Start Utility Software with Excel, follow this instruction sequence:

- a. Assuming you started your machine in Windows, and no other programs are presently running, start your **EXCEL** program.
- b. Once a blank worksheet is displayed, MINIMIZE your Excel program

BACKUP TEXT FILE

The Backup Data File and Backup Data File Entry Description sub-windows are helpful for backing up all data transferred from the PRS-801 to the computer. It allows entering brief notes into a PROSTAT backup *.txt file associated with each set of data, or single entries. The Backup Text File identifies, dates, and time-stamps each data transfer event.

Enter a description in the Backup Data File Entry Description sub-window and that note will be included in the backup *.txt file each time data is transferred, until the description is changed. Thus, several measurements transfer to your computer, and your backup file will identify those measurements. For example, “WORKSTATION #43” will be appended to each backup entry in the text file. Once you begin measurements at WORKSTATION #44, you can change the description such that your backup data is correctly annotated. You can change the Backup Data File Entry Description anytime you wish before closing the file, and use as many entries as you need. The file will accumulate and maintain all your entries until you clear the file by clicking, Clear Backup Data File.

Location for the backup files can be found here:

32-bit versions of Windows: *C:\Program Files\Prostat*
64-bit versions of Windows: *C:\Users\[Name]\AppData\Local\VirtualStore\Program Files (x86)\Prostat*

- c. Select **START, PROGRAMS, PROSTAT**, or Click the **PROSTAT** icon to start the Utility Software.
- d. You will see a PROSTAT “**OK**” panel. Click on **OK**.
- e. The Utility Software operating window and menu will come up. It stays in the foreground (in front).
- f. Setup the PROSTAT – Excel Connection for your computer as follows
 - (1) Click **Setup**
 - (2) Click **Com Port**
 - (3) Select the computer Com Port to which the PROSTAT data transmission cable is connected 1, 2, 3 or 4
 - (4) Select Number of Measurements and click on 80. In lower left corner of Prostat Window “N.M. = 80” will appear.
- g. MAXIMIZE your Excel program. You are ready to transfer information from the PRS-801 to your Excel spreadsheet. Use the blank sheet or select a file for data entry, or create a standard data format to meet your measurement needs

5. Bulk Data Transfer from PRS-801 to Excel Spreadsheet

To transfer data from your PRS-801 to your Excel spreadsheet carefully connect the RS-232 output cable to the PRS-801. [This assumes you have connected the cable to the desired COM port on your computer before starting your computer.] Start your computer and activate your Windows Excel and Prostat Utility Software as described above.

- a. Position the Utility Software Window at a convenient position over the Excel spreadsheet, such as in the lower right hand corner of your screen.
- b. On the Utility Software Menu Click on **SETUP**, and confirm your Com Port number and NUMBER OF MEASUREMENTS selected is 80, or more
- c. Position the cursor in the cell where you want the data to start filling in the spreadsheet.
- d. Select “**Horizontal**” or “**Vertical**” fill format, Confirm the cursor position, if necessary
- e. Click on **CLEAR BACKUP DATA FILE** to give yourself a clean backup slate.
- f. Enter any information you wish for identifying the backup data in the Utility Software window, CURRENT MEASUREMENT DESCRIPTION
- g. Press **SEND** on the PRS-801
- h. Note the number of measurements sent from the PRS-801 (number shown in display as “**MEM**”) should match MEASUREMENTS RECEIVED in the Utility Software window.
- i. Click on the **CONNECT** button in the Utility Software Window.
- j. Data will fill in the spreadsheet.

6. Single Data Point Transfer & Automatic Cell Entry

To transfer individual data points as they are obtained by the PRS-801 use the Auto Connect Data Transfer feature. It allows you to enter data on a measurement-by-measurement basis and fills each spreadsheet cell in sequence, either horizontally or vertically. It saves time and many key-strokes. This is particularly helpful for pre-constructed Excel measurement formats used for routine quality control, audits and other applications where all data must be documented.

- a. Clear the PRS-801 memory
- b. Select **AUTO CONNECT** in the Utility Software Window
- c. Select **HORIZONTAL** or **VERTICAL FILL**
- d. Check the current cell position in Excel and click on **OK**
- e. Make your first measurement and press **RESET** on the PRS-801. This saves the data point in the memory register. The LCD will display **MEM 01**
- f. Press **SEND** to transfer the single data point to the spreadsheet. It will fill the selected cursor location.
- g. Press **CLEAR** on the PRS-801 to eliminate the first measurement from its memory.
- h. Press **TEST** to obtain the next measurement, **RESET** to enter it in memory and **SEND** to transfer it to the spreadsheet. Note that the next cell automatically fills. Repeat this sequence for as many measurements as you desire.

NOTE: The Excel cursor remains in the first cell selected in Auto Connect mode. Subsequent cells will automatically fill until the program is reset to the bulk mode, or another Auto Connect series is initiated.

IDENTIFYING COMPUTER “NOISE” PROBLEMS

Should your computer COM PORT generate “noise” (electrical interference), it will affect the accuracy of the PRS-801 at resistance ranges above $1\text{G}\Omega$ (10^9 ohms). To determine if noise is a problem, simply compare two high resistance measurements. Make one with the PRS-801 connected to your computer, and the same measurement without connection to your computer. They should be almost identical, within $\pm 25\%$ of each other, if computer electrical interference is not a problem.

While typically not a concern, if electrical noise is a problem simply make all your measurements without being connected to the computer. Save your data in the PRS-801's Memory Register, then connect and transfer the data after each measurement set is completed (bulk download).

7. To Turn the Recording Mode (**REC**) **OFF**, perform the following sequence:

- a. With the unit ON, press **CLEAR**
- b. Then press the Red **ON/OFF** button to turn the instrument OFF
- c. Press the Red ON/OFF button to power up the instrument
- d. Note that **REC** is no longer displayed in the lower, left corner of the LCD

VII. Instrument Maintenance

A. Calibration & Repair

1. Instrument Calibration should be performed annually
2. Only Prostat Corporation or their authorized instrument laboratory should perform PRS-801 calibration or repair.
3. Before shipping your instrument to Prostat Corporation for service, contact Prostat calibration & customer service for a Return Material Authorization (RMA) tracking number by the following means: See WARRANTY INFORMATION, below, for further instructions.

B. General Handling & Maintenance

1. Cleaning

- a. Wipe case and LCD with clean, low linting damp cloth
- b. Do not use solvents for cleaning case or LCD

2. Handling

- a. Store the instrument in a clean, dry environment. Do not expose the instrument to wet, extremely hot or cold conditions.
- b. Do not drop or cause mechanical shock to your instrument
- c. If the unit is stored in a cold environment, allow it to stabilize at room temperature before powering up the unit.
- d. Remove batteries before storing the instrument for long periods.
- e. Be sure fresh alkaline batteries are installed when beginning an extensive measurement sequence. Periodically check the condition of your batteries by pressing **BATT. TEST**. If **Lo** is indicated, replace your batteries.

VIII. Warranty Information

A. Prostat Corporation Warranty

Prostat Corporation expressly warrants that for a period of one (1) year from the date of purchase, that Prostat instruments will be free from defects in material (parts) and workmanship (labor). If Prostat receives notice of such defect during the warranty period, Prostat will replace at its expense such parts that it determines to be defective. Any defective part must be returned to Prostat postage prepaid with proof of purchase date.

Warranty Exclusions – THE FOREGOING EXPRESS WARRANTY IS MADE IN LIEU OF ALL OTHER PRODUCT WARRANTIES, EXPRESS AND IMPLIED, INCLUDING MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, WHICH ARE SPECIFICALLY DISCLAIMED. The express warranty will not apply to defects or damage due to accidents, neglect, misuse, alterations, operator error, or failure to properly maintain, clean, or repair products. Limit of Liability – in no event will Prostat or any seller be responsible or liable for special, incidental, or consequential losses or damages, under any legal theory including but not limited to contract, negligence, or strict liability.

Fulfillment by Prostat of its express warranty obligations described above will be purchaser's exclusive remedy and will be Prostat's and seller's limit of liability for any breach of warranty or otherwise.

B. Shipping of Warranty Returns

1. Obtain a Return Materials Authorization (RMA) number and shipping address from Prostat customer service. Pack the instrument carefully and ship it prepaid and insured to the proper destination provided by Prostat's customer service department.
2. For detailed shipping instructions and Return Materials Authorization (RMA), contact:

Prostat Corporation
1072 Tower Lane
Bensenville, IL 60106
Telephone: (630) 238-8883 or (855) 782-8421
Website: prostatcorp.com/rma

C. Shipping Non-Warranty Items

1. Any Prostat product returned for non-warranty repair or calibration requires a Return Materials Authorization (RMA) number and should be packaged and shipped as described above, and as directed by Prostat's customer service department.
2. The following information must be included with the returned product:
 - a. Description of the problem
 - b. Customer's Purchase Order Number & Prostat's Materials Authorization (RMA) number
 - c. Name, telephone number and fax number of individual contact who can provide more information regarding the problem and related application(s).
 - d. Complete return address.

PRS-801 Resistance System Specifications

Range:	Resistance from <0.1 (1.0E-1) Ohms to 200 Tera ohms (2.0E+14 ohms). Maximum Resistivity with S11.11 concentric ring 2.0E+15 ohms/square	
Test Voltages:	Automatic mode Default:	<0.01 to 10 volts Variable 1.0E-1 to 1.0E+4 Ohms Constant Voltage 10 volts $\pm$ <0.2 volts 1.0E+4 to 1.0E+6 Ohms At 10 & 100 Volts 100 volts $\pm$ <2.0 volts 1.0E+6 to 2.0E+14 Ohms
	Manual Mode:	<0.01 to 10 volts Variable 1.0E-1 to 1.0E+5 Ohms 10 volts $\pm$ <0.2 volts 1.0E+3 to 1.0E+9 Ohms 100 volts $\pm$ <2.0 volts 2.0E+5 to 2.0E+14 Ohms
Normal Accuracy:	Overall: +_ <5% at ambient conditions (at 23°C and 30% Rh). Approximate Range Tolerances: 1.0E-1 to 1.0E+1 ohms: $\pm$ 5% Corrected for Test Lead Resistance 4.0E+1 to 1.0E+12 ohms: $\pm$ 2.0% with 10-foot Test Leads 1.0E+12 to 2.0E+14 ohms: $\pm$ 40% or $\pm$ 0.25 Decade using Grounded, Shielded Leads	
Display:	Multi-function 2-5/8" x 1-5/8" Liquid Crystal Display with 0.5" digit height. Displays 3-1/2 digits in Ohms, or 1.0EXX in exponential format. Ohms Display indicators: Ω , K Ω , M Ω , G Ω and T Ω . Includes 19-segment analog scale (1-10 with 0.5 indication) with x1, x10, & x100 multipliers. Number of Data Points in Memory (0 – 80). Automatic Electrification Time (seconds), or Time required to Manually obtain steady state measurement. Displays data HOLD, BATTERY status, MIN, MAX, AVG, REC and Test Voltage (<10, 10, or 100 V)	
LED Indicators:	14 Color Programmable LED's from <10 ³ to >10 ¹⁴ ohms. Colors (RED, GREEN, YELLOW/ORANGE, or Blank/OFF) may be programmed in SETUP mode.	
Timer Memory:	Times measurements In Seconds up to 99 seconds (Displayed on LCD) Register stores up to 80 data points (MEM # Displayed after RESET)	
RS-232 Output:	Digital format: Exponential Power followed by Integer.	
Response & Electrification:	Response from >0.1 to <1.0E06 Ohms: <2.0 seconds Average Measurement Period from 0.1 ohms to 1.0E12 Ohms 2.5 Seconds. Calculated Electrification Period per ESD S11.11, 7.5 second 0.1 ohms to 10E+12 Ohms. Programmed Electrification >1.0E+12 Ohms: 15.0+ seconds	
Power:	Two 9-VDC alkaline batteries. Nominal battery life 25 hours in AUTOMATIC mode, approximately 40 hours in AUTOMATIC/MANUAL mode.	
Dimensions:	4.0" wide x 6.0" long x 2.0" deep.	
Weight:	22 ounces, with batteries	
Open Circuit Current (I):	<4ma @ 100 Volts	
Usage:	Designed for Intermittent use. Not intended for continuous use or production applications.	

PRS-801 Instrument Controls

FUNCTION/ MODE Toggles Through Six (6) Operation Modes:

MODE	DISPLAYED UNITS	INDICATION	RESIST. RANGE	TEST VOLTS	TEST FUNCTIONS
AUTOMATIC 1 [Default]	1.0EXX IND Ω - T Ω	AUTO	AUTO.	AUTO.	AUTOMATIC RESISTANCE RANGE, TEST VOLTS, ELECTRIFICATION, DISPLAY HOLD SEE TABLE NOTE #1
AUTOMATIC 2	OHMS Ω - T Ω	AUTO	AUTO.	AUTO.	
MANUAL 1 SELECT DECADE	1.0EXX IND Ω - T Ω	MANUAL	MAN	MAN. or AUTO	TEST ONLY; NO DISPLAY HOLD UL= UNDER DECADE LEVEL OL= OVER DECADE LEVEL SEE TABLE NOTE #2
MANUAL 2 SELECT DECADE	OHMS Ω - T Ω	MANUAL	MAN	MAN. or AUTO	
MANUAL/ AUTOMATIC 1 MAY SELECT STARTING DECADE	1.0EXX IND Ω - T Ω	AUTO & MANUAL	MAN. Start AUTO Run	AUTO.	MANUAL SETUP STARTING DECADE, AUTO ADJUST RANGE, TEST VOLTS, ELECTRIFICATION DISPLAY HOLD SEE TABLE NOTE #3
MANUAL/ AUTOMATIC 2 MAY SELECT STARTING DECADE	OHMS Ω - T Ω	AUTO & MANUAL	MAN. Start AUTO Run	AUTO.	

TABLE NOTES:

- #1 AUTOMATIC:** RESISTANCE RANGES IN AUTO 0.1 Ω TO <2.0E+14 Ω as follows
 @<10V: 0.1 TO <1.0E+04 Ω (0.1 Ω - < 10K Ω)
 @ 10V: 1.0E+04 TO <1.0E+06 Ω (10K Ω - < 1M Ω)
 @100V: 1.0E+06 TO <2.0E+14 Ω (1M Ω - <200T Ω)
- #2 MANUAL:** RESISTANCE RANGES IN MAN 0.1 Ω TO <2.0E+14 Ω as follows
 @<10V: 0.1 TO <1.0E+05 Ω (0.1 Ω - <100K Ω)
 @ 10V: 1.0E+03 TO <1.0E+09 Ω (1K Ω - <1G Ω)
 @100V: 2.0E+05 TO <2.0E+14 Ω (200K Ω -< 200T Ω)
- #3 AUTO-MANUAL:** (Same as AUTOMATIC)
 RESISTANCE RANGES IN AUTO-MANUAL 0.1 Ω TO <2.0E+14 Ω as follows
 @<10V: 0.1 TO <1.0E+04 Ω (0.1 Ω - < 10K Ω)
 @ 10V: 1.0E+04 TO <1.0E+06 Ω (10K Ω - < 1M Ω)
 @100V: 1.0E+06 TO <2.0E+14 Ω (1M Ω - <200T Ω)

Resistance Range Select. 2 Triangular button Arrows: UP ($\uparrow$) and DOWN ($\downarrow$). Select Resistance Range in single decades in Manual and Automatic/Manual modes

Test Volts Manual Selection of <10, 10 or 100 volts in Manual Mode

Record/ Recall Turns Memory Register ON if OFF. Provides access to all data in Memory Regis-

ter. Calculates and Displays Minimum, Maximum and Average of data stored in Memory Register.

Send	Transmits data in Memory Register to RS-232 Output Port or USB
Clear	Erases data in Memory Register; if in HOLD mode, discards most recent Held Value
ON/OFF	Power-up, perform functional & Battery tests, Power-down if ON.
Batt. Test	Displays GOOD on LCD if acceptable voltage or Lo if unacceptable
Reset	Enters (saves) data into Memory Register, Clears HOLD and Display.
Test	Begins measurement sequence.
Battery Buss Cut Off	ON/OFF Switch isolates batteries from instrument circuits for storage & transport

NOTES

NOTES

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