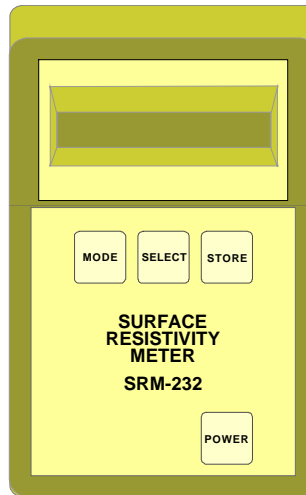


# *Sheet Resistance Meter*

*Model SRM – 232*



## *Operator's Guide*

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## 1.0 System Overview

The SRM-232 is a small hand-held device used for measuring sheet resistance in Ohms-per-square. It utilizes a 4-point probe to perform the measurement. Precise resistance measurements can easily be made throughout the range of the instrument. Additional features of the meter are:

- Internal Data Storage of 127 measurements. (Data resides in non-volatile memory)
- An RS-232 output interface allowing data flow to an external device.
- Internal Calibration adjustment.

## 1.1 Unit Specifications

### SRM-232-10

- Measurement Range - 0.000 – 9.999  $\Omega$ /square (minimum)
- Resolution - 0.004  $\Omega$ /square
- Accuracy - 0.01  $\Omega$ /square @ 1.00  $\Omega$ /square

### SRM-232-100

- Measurement Range - 0.00 - 95.00  $\Omega$ /square (minimum)
- Resolution - 0.04  $\Omega$ /square
- Accuracy - 0.07  $\Omega$ /square @ 10.00  $\Omega$ /square

### SRM-232-1000

- Measurement Range - 0 - 1000  $\Omega$ /square (minimum)
- Resolution - 0.4  $\Omega$ /square
- Accuracy - 0.7  $\Omega$ /square @ 100.0  $\Omega$ /square

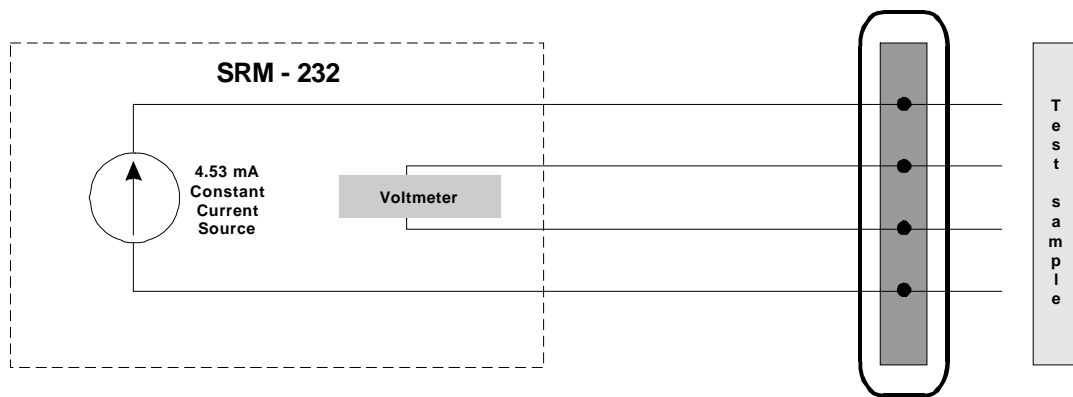
### SRM-232-2000

- Measurement Range - 0 - 2000  $\Omega$ /square (minimum)
- Resolution - 0.8  $\Omega$ /square
- Accuracy - 1.4  $\Omega$ /square @ 1000.0  $\Omega$ /square

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- Power Requirement - 9 VDC internal alkaline battery
  - Constant Current Source - 4.53 mA, +/- 0.02 mA
  - RS-232 Interface - 9600 baud rate, 1 Start bit, 1 Stop bit, No parity
  - Auto Turn Off - Approx. 1 minute after last keystroke
  - Low Battery Detect - At approx. 7.5 VDC

## 1.2 Theory of Operation

The SRM-232 operates by passing a calibrated constant current source of 4.53 mA through the two outer tips of the 4-point probe (see diagram below). This current develops a voltage across the **two** inner probe tips, which is directly proportional to the sheet resistance being measured. The measurement results are then displayed on the 16 digit LCD front panel display.



*Figure 1.1 SRM-232 Functional Block Diagram*

## 2.0 Hardware Features

The SRM-232 has two main hardware feature areas (See Figure 2.1 for locations):

- 16 Digit LCD Display
- Front Panel Keypad
- Top Connectivity Panel

### 2.1 Front Panel Keypad

The **Front Panel Keypad** has four function buttons (See Figure 2.1 for locations):

- **MODE** Button
- **SELECT** Button
- **STORE** Button
- **POWER** Button

#### 2.1.1 MODE Button

Pressing this button will allow the user to scroll through the SRM-232'S four modes of operation:

(See Section 3.0 for a description of these Modes of Operation)

- Measure
- Calibrate
- Clear Memory
- Transfer Data

### 2.1.2 SELECT Button

Pressing this button will allow the user to enter the Mode of Operation that is currently displayed on the LCD Display.

### 2.1.3 STORE Button

Pressing this button will save the displayed resistivity measurement to the SRM-232's internal memory. The display value is also transmitted, via the RS-232 interface, each time the STORE Button is depressed. This save and transmit function is only active when the unit is in the MEASURE Mode. The unit will beep after a successful storage of the measurement is completed.

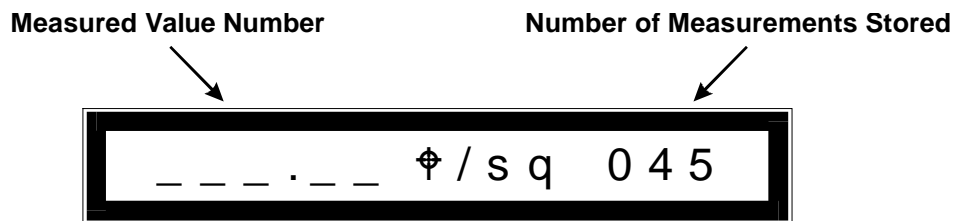
### 2.1.4 POWER Button

This button is used to turn the SRM-232 ON. Please note that this button will **ONLY** turn the unit ON and can not be used to turn the unit OFF. The Auto Turn Off function will turn the unit OFF after one minute of non-use.

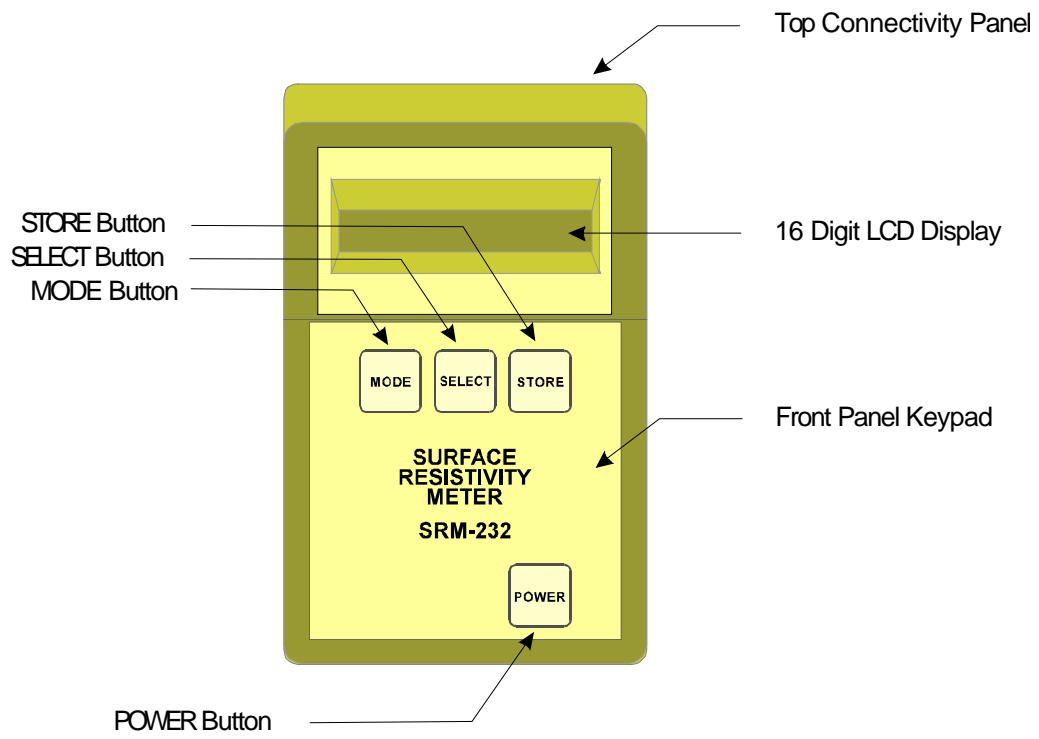
## 3.0 Modes of Operation

### 3.1 Measure Mode

This is the primary mode of operation for the SRM-232. Once the Measure Mode has been selected, the unit's LCD will display:



The SRM-232 will display a valid resistivity measurement once the unit has sensed that an adequate current is flowing in the outer two tips of the 4-point probe. Firmly pressing the 4-point probe to the surface to be measured, will activate the current source and a measurement will be taken and displayed.

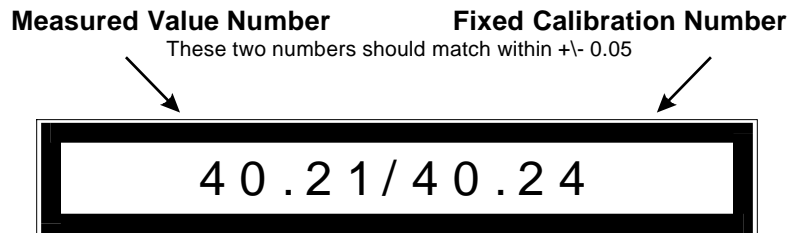


**Figure 2.1 SRM-232 Physical Layout**

### 3.2 Calibrate Mode

This is used to ensure the proper calibration of the unit when in normal use. To verify the unit's calibration, enter the Calibration Mode by pressing the MODE Button until the word 'Calibrate' is displayed. Then press the SELECT Button, to enter the Calibrate Mode of operation. Next, press the 4-point probe firmly on a test sample with a resistivity between 0 - 95  $\Omega$ /square. Two numbers will be displayed (See Figure 3.1). The number on the right side of the display is a calibration figure derived specifically for that specific SRM-232 in use. The number on the left side of the display is the actual measured value. With the probe pressed on a test sample, the two numbers should match one another by  $\pm 0.05$ . If the displayed value, left side, is not within specification, the user can adjust the displayed value via the Current Adjust Potentiometer located on the Top Connectivity Panel between the RS-232 and the 4-point probe connections (See Figure 4.1 for location).

*Figure 3.1 Sample Calibration Number Display*

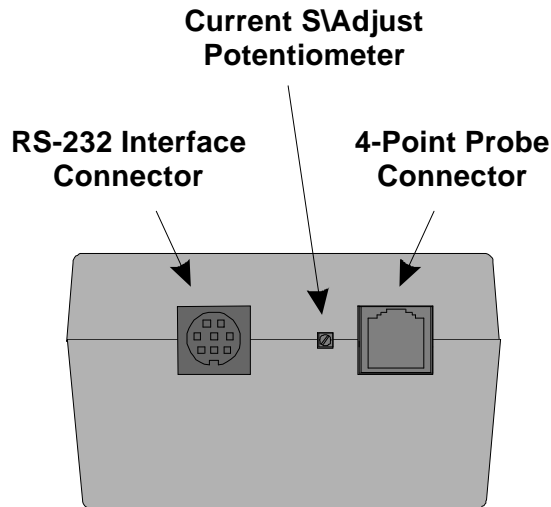


### 3.3 Transfer Data

This is used to dump the SRM-232's internally stored resistivity measurements to an external device via the RS-232 interface. The SELECT key will start the actual data transfer. The unit can store up to 127 resistivity measurements. The format of the data dump is: 9600 baud, 1 Start bit, 1 Stop bit, No parity and no handshaking. The unit will beep, once the data transfer is completed.

### 3.4 Clear Memory

This is used to "delete" all of the stored measurements in the SRM-232's internal memory. Make certain you no longer require access to the internally stored measurements before selecting this function.



*Figure 4.1 Top Connectivity Panel*

## 4.0 Hardware Connections

### 4.1 4-Point Probe

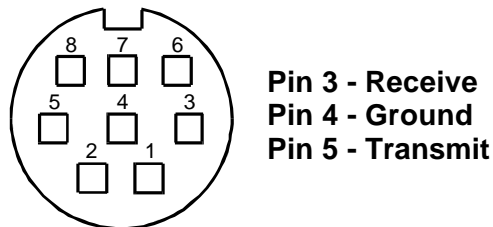
The 4-Point probe assembly connects to the SRM-232 via an 8 pin telephone style connector on the Top Connectivity Connector. Be certain that the connector is properly positioned and in place before making measurements.

### 4.2 Current Adjust Potentiometer

The unit's internal 4.53 mA constant current source can be adjusted via the small opening shown above. Refer to the Calibration Section for the Calibration procedure.

### 4.3 RS-232 Interface Connector

External device may be used to transfer data from the SRM-232. A mini-DIN style connector is provided for use. Figure 4.2, below, indicates the pin-out of this connector.



*Figure 4.2 RS-232 Connector Pin-out*