♦ PRECISION INSTRUMENTS FOR TEST AND MEASUREMENT ♦

SRX Series

Resistance Standard Operation Manual

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SRX im/April 2010

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WARRANTY

We warrant that this product is free from defects in material and workmanship and, when properly used, will perform in accordance with applicable IET specifications. If within one year after original shipment, it is found not to meet this standard, it will be repaired or, at the option of IET, replaced at no charge when returned to IET. Changes in this product not approved by IET or application of voltages or currents greater than those allowed by the specifications shall void this warranty. IET shall not be liable for any indirect, special, or consequential damages, even if notice has been given to the possibility of such damages.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE.

WARNING

OBSERVE ALL SAFETY RULES
WHEN WORKING WITH HIGH VOLTAGES OR LINE VOLTAGES.

Dangerous voltages may be present inside this instrument. Do not open the case
Refer servicing to qualified personnel

HIGH VOLTAGES MAY BE PRESENT AT THE TERMINALS OF THIS INSTRUMENT

WHENEVER HAZARDOUS VOLTAGES (> 45 V) ARE USED, TAKE ALL MEASURES TO AVOID ACCIDENTAL CONTACT WITH ANY LIVE COMPONENTS.

USE MAXIMUM INSULATION AND MINIMIZE THE USE OF BARE CONDUCTORS WHEN USING THIS INSTRUMENT.

Use extreme caution when working with bare conductors or bus bars.

WHEN WORKING WITH HIGH VOLTAGES, POST WARNING SIGNS AND KEEP UNREQUIRED PERSONNEL SAFELY AWAY.

CAUTION

DO NOT APPLY ANY VOLTAGES OR CURRENTS TO THE TERMINALS OF THIS INSTRUMENT IN EXCESS OF THE MAXIMUM LIMITS INDICATED ON THE FRONT PANEL OR THE OPERATING GUIDE LABEL.

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Figures and Tables

Chapter 1
INTRODUCTION

1.1 Introduction

The SRX Series (Figure 1.1) are stable, laboratory or portable resistance standards. Their ruggedness and small size plus their low temperature coefficient makes the SRX Series ideal for any applications outside of laboratory environment within the temperature range of 18°C to 28°C. Because of the low temperature coefficient, they require no oil-or-temperature bath.

The SRX series units are available in values ranging from 1 mΩ to 100 MΩ, with custom values available, to satisfy any requirement.

To reduce errors caused by temperature changes, the SRX units are built with a low temperature coefficient at 23°C. The binding posts are constructed of low-thermal emf material.

Figure 1-1: SRX Series Resistance Standard

Chapter 2
SPECIFICATIONS

For convenience to the user, the pertinent specifications are given in an **OPERATION GUIDE**, shown in Figures 2-1.

SPECIFICATIONS

Nominal Value	Model Number	Adjustment to Nominal	Calibration Uncertainty	Stability per year	Temperature coefficient	Power coefficient	Max power	Max voltage	Max Current
0.001 Ω	SRX-0.001	200 ppm	200 ppm	50 ppm	20 ppm/°C	0.1 ppm/mW	0.2 W	0.015 V	14 A
0.0019 Ω	SRX-0.0019	200 ppm	200 ppm	50 ppm	20 ppm/°C	0.1 ppm/mW	0.38 W	0.03 V	14 A
0.002 Ω	SRX-0.002	200 ppm	200 ppm	50 ppm	20 ppm/°C	0.1 ppm/mW	0.2 W	0.02 V	10 A
0.01 Ω	SRX-0.01	200 ppm	100 ppm	50 ppm	20 ppm/°C	0.1 ppm/mW	2 W	0.15 V	14 A
0.019 Ω	SRX-0.019	200 ppm	100 ppm	50 ppm	20 ppm/°C	0.1 ppm/mW	3.8 W	0.3 V	14 A
0.1 Ω	SRX-0.1	200 ppm	20 ppm	50 ppm	20 ppm/°C	0.1 ppm/mW	1 W	0.3 V	3 A
0.19 Ω	SRX-0.19	200 ppm	20 ppm	50 ppm	20 ppm/°C	0.1 ppm/mW	1.7 W	0.6 V	3 A
1 Ω	SRX-1	20 ppm	10 ppm	20 ppm	10 ppm/°C	0.5 ppm/mW	0.25 W	0.5 V	0.5 A
1.9 Ω	SRX-1.9	20 ppm	10 ppm	20 ppm	10 ppm/°C	0.5 ppm/mW	0.25 W	0.7 V	0.36 A
10 Ω	SRX-10	10 ppm	5 ppm	10 ppm	3 ppm/°C	0.15 ppm/mW	0.1 W	1 V	0.1 A
19 Ω	SRX-19	10 ppm	5 ppm	10 ppm	3 ppm/°C	0.15 ppm/mW	0.1 W	0.7 V	70 mA
50 Ω	SRX-50	10 ppm	5 ppm	10 ppm	1 ppm/°C	0.05 ppm/mW	0.1 W	2.3 V	45 mA
100 Ω	SRX-100	10 ppm	5 ppm	10 ppm	1 ppm/°C	0.05 ppm/mW	0.1 W	3 V	30 mA
190 Ω	SRX-190	10 ppm	5 ppm	10 ppm	1 ppm/°C	0.05 ppm/mW	0.1 W	4.4 V	23 mA
1 kΩ	SRX-1k	10 ppm	2 ppm	10 ppm	1 ppm/°C	0.05 ppm/mW	0.1 W	10 V	10 mA
1.9 kΩ	SRX-1.9k	10 ppm	2 ppm	10 ppm	1 ppm/°C	0.05 ppm/mW	0.1 W	14 V	7 mA
10 kΩ	SRX-10k	10 ppm	2 ppm	10 ppm	1 ppm/°C	0.05 ppm/mW	0.1 W	30 V	3 mA
19 kΩ	SRX-19k	10 ppm	2 ppm	10 ppm	1 ppm/°C	0.05 ppm/mW	0.1 W	43 V	2.2 mA
100 kΩ	SRX-100k	10 ppm	2 ppm	10 ppm	1 ppm/°C	0.05 ppm/mW	0.1 W	100 V	1 mA
190 kΩ	SRX-190k	10 ppm	2 ppm	10 ppm	1 ppm/°C	0.05 ppm/mW	0.1 W	140 V	0.7 mA
1 MΩ	SRX-1M	20 ppm	5 ppm	15 ppm	3 ppm/°C	0.15 ppm/mW	0.1 W	316 V	0.3 mA
1.9 MΩ	SRX-1.9M	20 ppm	5 ppm	15 ppm	3 ppm/°C	0.15 ppm/mW	0.1 W	440 V	0.23 mA
10 MΩ	SRX-10M	20 ppm	10 ppm	20 ppm	5 ppm/°C	0.25 ppm/mW	0.1 W	2000 V	0.1 mA
19 MΩ	SRX-19M	20 ppm	10 ppm	20 ppm	5 ppm/°C	0.7 ppm/mW	0.05 W	5000 V	50 µA
100 MΩ	SRX-100M	50 ppm	15 ppm	20 ppm	5 ppm/°C	1.2 ppm/mW	0.01 W	5000 V	10 µA

Table 2-1: SRX Specifications

Calibration Conditions:

At 23°C, low power, traceable to SI

Terminals:

Gold-plated, tellurium-copper, low-thermal-emf binding posts on standard 3/4 inch spacing. A **GROUND** terminal is provided on all units.

≤190 kΩ: four 5-way binding posts for 4-terminal measurement

≥1 MΩ: two 5-way binding posts

100 MΩ has a **GUARD** *terminal*

Transit Case:

Optional **Model SRC-100** lightweight transit case with handle, suitable for transporting and storing two units. The case provides mechanical protection and insulation from temperature changes during transportation or shipping.

Dimensions:

8.6 cm H x 10.5 cm W x 12.7 cm D (3.4” x 4.15” x 5”)

Weight:

0.73 kg (1.6 lb)

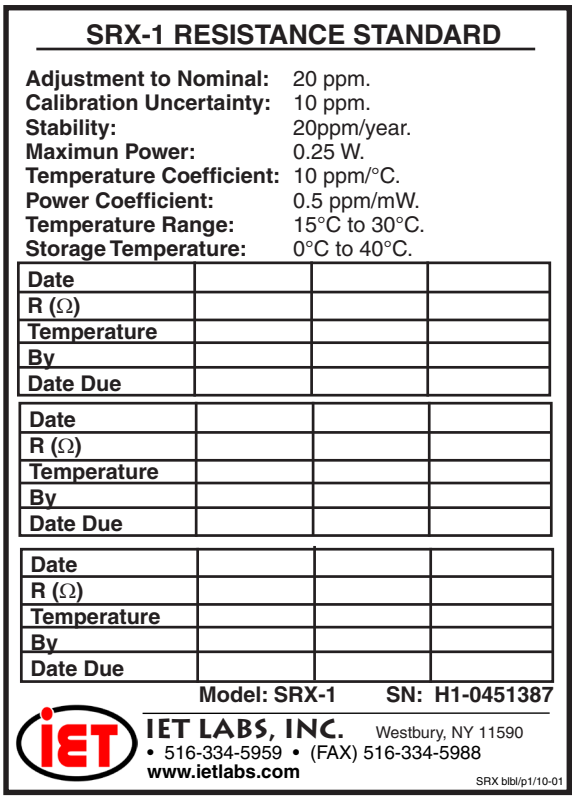


Figure 2-1: Sample label affixed to unit

Chapter 3
OPERATION

3.1 Initial Inspection and Setup

This instrument was carefully inspected before shipment. It should be in proper electrical and mechanical order upon receipt.

An **OPERATION GUIDE** is attached to the case of the instrument to provide ready reference to specifications.

3.2 Connections

The SRX series has three different types of connections listed below.

3.2.1 Connections for values ≤190 kΩ

Values ≤190 kΩ have four insulated low thermal emf binding posts for four-terminal measurements as shown in Figure 3-1. The fifth binding post **GND** is connected to the case. For high-resistance models (e.g. >10 kΩ) two-terminal measurements may be made by shorting **HI** to **HI** and **LO** to **LO**, preferably with shorting links or other substantial means.

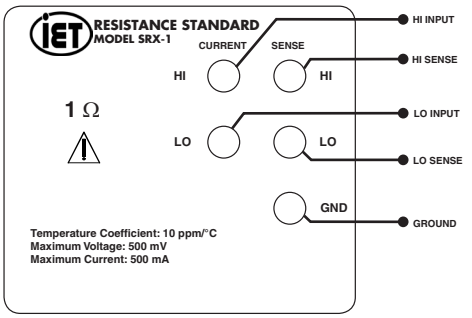


Figure 3-1: Connections for values ≤190 kΩ

Binding Post	Function
CURRENT HI	Current input from source (e.g. ohmmeter)
CURRENT LO	Current return to source (e.g. ohmmeter)
SENSE HI	Measurement point for a four-wire ohmmeter
SENSE LO	Measurement point for a four-wire ohmmeter
GND	Guard or shield

Table 3-1: Connections for values ≤190 kΩ

3.2.2 Connections for values > 190 kΩ and <100 MΩ

Values > 190 kΩ and <100 MΩ have two insulated, low thermal emf binding posts for two-terminal measurements as shown in Figure 3-2. The third binding post **GND** is connected to the case.

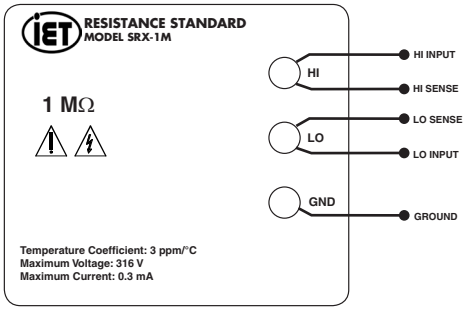


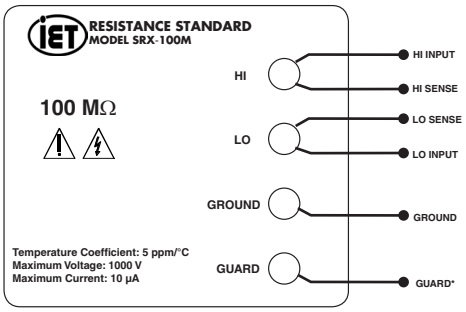
Figure 3-2: Connections for values > 190 kΩ and <100 MΩ

Binding Post	Function
HI	Input from source (e.g. ohmmeter)
LO	Measurement point
GND	Guard or shield

Table 3-2: Connections for values > 190 kΩ and <100 MΩ

3.2.3 Connections for values ≥100 MΩ

Values ≥100 MΩ have two insulated, low thermal emf binding posts for two-terminal measurements as shown in Figure 3-3. The third binding post, labeled **GROUND**, is connected to the case. The fourth binding post, labeled **GUARD**, is connected to an internal case that contains the resistor.



If no* **GUARD *point exists on the measuring instrument, it may be connected to* **GROUND**.

Figure 3-3: Connections for values ≥100 MΩ

Binding Post	Function
HI	Input from source (e.g. ohmmeter)
LO	Measurement point
GROUND	Shield
GUARD	Interrupts leakage from the internal resistor to the case and other components of the unit

Table 3-3: Connections for values ≥100 MΩ

3.3 Thermal emf Considerations

High-quality, gold-plated, tellurium-copper binding posts serve to minimize the thermal emf effects which would artificially reflect a change in dc resistance measurements. All other conductors within the instrument, as well as the solder used, contain no metals or junctions that could contribute to thermal emf problems.

There nevertheless may be some minute thermal emf generated at the test leads where they contact the gold banana jacks. This voltage will also be eliminated if a meter with so called "True Ohm" capability is used. Otherwise the generated emf may represent itself as a false component of the dc resistance measurement.

Always use low emf test leads when working with SRX models. In particular, avoid brass or steel conductors.

3.4 Environmental Conditions

3.4.1 Operating Temperature

For optimal accuracy, SRX Models should be used in an environment of 23°C. They should be allowed to stabilize at those temperatures after any significant temperature variation.

3.4.2 Storage Temperature

The SRX Series should be maintained within the storage temperature range of 0°C to 40°C to retain its accuracy within the specified limits.

3.5 Shipping and Handling

The SRX Series should not be exposed to any excessive shock or temperature extremes. The option SRC-100, a lightweight transit case capable of storing two SRX units, is recommended for shipping or transporting the models.

Chapter 4
MAINTENANCE

4.1 Maintainability and Reliability

It is possible to maintain SRX units indefinitely. They are reliable due to their closed, rugged design and sealed resistors. The units are resistant to electromagnetic interference (EMI) because of their metal enclosure.

4.2 Preventive Maintenance

Keep the SRX units in a clean environment. This will help prevent possible contamination.

The front panel may be cleaned to eliminate any leakage paths from near or around the binding posts. To clean the front panel:

Wipe the front panel clean using alcohol and a lint-free cloth.

4.3 Calibration

The SRX units may be employed as stand-alone instruments or as an integral components of a system. If used as part of a system, they should be calibrated as part of the overall system to provide an optimum system calibration.

If an SRX model is employed as a stand-alone device, the following should be observed:

- Calibration Interval
- General Considerations
- Required Equipment
- Calibration Procedure

4.3.1 Calibration Interval

The recommended SRX Series calibration interval is twelve (12) months.

If the instrument is used to transfer resistance values only, recalibration is not required, assuming that there has been no drastic change of value.

4.3.2 General Considerations

Before starting the calibration procedure, you need to consider the following:

- Calibration environment should be 23°C and less than 50% relative humidity.
- Test instruments should be sufficiently more accurate than the SRX unit, and/or the uncertainty of the measurement instrumentation has to be considered in the calibration Test Uncertainty Ratio (TUR).
- The testing equipment and the SRX unit should stabilize at laboratory conditions for at least 24 hours.
- Kelvin type 4-wire test leads should be used to obtain accurate low resistance measurements.
- Steps should be taken to minimize thermal emf effects, such as using a meter with “True Ohm” capacity.
- Accepted metrology practices should be followed.