These Transportable Resistance Standards are designed for precision applications. Their accuracy, stability, and low temperature coefficient make them ideal for precise laboratory comparisons without critical environmental controls. For maximum accuracy, these standards offer users a temperature-correction chart and a built-in RTD temperature sensor to measure internal temperature.

**Features**
- Resistance values of 100 Ω, 1000 Ω, or 10000 Ω
- High accuracy
- High stability - <0.5 ppm/year
- Low temperature coefficient -- <0.1 ppm/°C
- Built-in temperature sensor and temperature-correction chart
- Oil-filled, hermetically sealed, custom resistors
- Increased-stability option (DC) is available to be used in an oil-bath

**Temperature coefficient comparison between a typical SR-102 unit and a typical 100 Ω resistance standard**

<table>
<thead>
<tr>
<th>Temperature (°C)</th>
<th>SR-102 Standard</th>
<th>100 Ω Resistance Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>±1 ppm</td>
<td>±0.1 ppm</td>
</tr>
<tr>
<td>10</td>
<td>±0.5 ppm</td>
<td>±0.2 ppm</td>
</tr>
<tr>
<td>20</td>
<td>±0.7 ppm</td>
<td>±0.3 ppm</td>
</tr>
<tr>
<td>30</td>
<td>±0.9 ppm</td>
<td>±0.4 ppm</td>
</tr>
<tr>
<td>40</td>
<td>±1.1 ppm</td>
<td>±0.5 ppm</td>
</tr>
<tr>
<td>50</td>
<td>±1.3 ppm</td>
<td>±0.6 ppm</td>
</tr>
</tbody>
</table>

**SPECIFICATIONS**

**Stability**
- First 2 years: ±1 ppm/year
- Thereafter: ±0.5 ppm/year

**Temperature coefficient**
- Temperature coefficient ($\alpha$):
  - $<0.1$ ppm/°C at 23°C
- 1/2 rate of TC change ($\beta$):
  - $<0.03$ ppm/°C from 18°C to 28°C

**Power coefficient**
- $<1$ ppm/W

**Adjustment to nominal**
- SR102, SR103, SR104: ±1 ppm

**Max voltage**
- 500 V peak to case

**Power rating**
- 1 W (Momentary 100 W overloads will not cause failure)

**Insulation resistance**
- All terminals maintain a minimum 10$^{12}$ Ω to ground

**Internal temperature sensor**
- 100 Ω, 1 kΩ, or 10 kΩ resistor with 1,000 ppm/°C temperature coefficient.
- Integral thermometer well is provided for calibration

**Hermetic sealing**
- The hermetically sealed resistors are additionally hermetically sealed in an oil filled can with metal-to-glass seals to improve stability. The resistance changes $<0.1$ ppm with normal atmospheric pressure and humidity changes.

**Pressure effects**
- No pressure effects under normal atmospheric changes.

**Connection terminals**
- Five-terminal construction, four-terminal resistor with ground intercept for the standard and temperature resistor.

**Thermal emf**
- Thermal emf at the terminals does not exceed $±0.1$ μV under normal conditions.

**Thermal lagging**
- Thermal lagging time constant is 1 hour minimum (1-1/e of total change in one hour).

**Dielectric soakage effect**
- The resistance stabilizes to within 0.1 ppm of final value within 5 seconds with 1 V applied to the resistor.

**Current reversal**
- With the reversal of the current through the resistor, the resistance value changes less than $±0.1$ ppm.

**Shock effects**
- The resistance changes is $<0.2$ ppm when subjected to 2 drops three-foot drops to a concrete floor on each of the 3 mutually perpendicular faces (6 drops total).
SAMPLE TEMPERATURE CORRECTION CHART

SR-104 RESISTANCE STANDARD

CONSULT INSTRUCTION MANUAL FOR PROPER INSTRUMENT OPERATION

Temp. (°C) Res. (kΩ) Dev. from Nominal (ppm)
18.0 10.009 587 0.39
18.5 10.009 587 0.29
19.0 10.009 587 0.19
19.5 10.009 587 0.09
20.0 10.009 587 0.00
20.5 10.009 587 -0.09
21.0 10.009 587 -0.19
21.5 10.009 587 -0.29
22.0 10.009 587 -0.39
22.5 10.009 587 -0.49
23.0 10.009 587 -0.59
23.5 10.009 587 -0.69
24.0 10.009 587 -0.79
24.5 10.009 587 -0.89
25.0 10.009 587 -0.99
25.5 10.009 587 -1.09
26.0 10.009 587 -1.19
26.5 10.009 587 -1.29
27.0 10.009 587 -1.39
27.5 10.009 587 -1.49
28.0 10.009 587 -1.59

Temperature of standard resistor expressed as percentage change of Temperature Sensor Resistance (R_s) at temperature T from (R_{23}) 9,999,589 kΩ, e.g. if R_s = 10,009,588 is 0.1% above R_{23}, the resistance of the standard = 10,000 004 11 kΩ, (may also be obtained from the formula or the temperature chart)

Temperature Sensor Resistance (R_s)

R_{23} (sensor resistance at 23 °C) = 9,999,589 kΩ
Deviation from nominal value = -0.004 1% at 23 °C
T = 10,000 002 96 kΩ

Model: SR-104  SN: J1-1041623
By: JOS  Date: 15-Nov-2010

MECHANICAL INFORMATION

Dimensions
Regular
25.4 cm x 20.6 cm x 31.1 cm (10” x 8.1” x 12.25”)
Deleted case (DC) version
12.7 cm x 8.9 cm x 17.8 cm (5.0” x 3.5” x 7.0”)

Weight
Regular
4.8 kg (10.5 lb)
Deleted case (DC) version
1.8 kg (4.0 lb)

ORDERING INFORMATION

Optional:
For deleted case version add -DC at the end of the part number.

OPTIONAL EXTERNAL OIL BATH

This optional version can further enhance the short-term stability of the resistance standard. It comes without the insulated case, so that it may be used in an external oil bath that provides additional temperature stability. This version is called Deleted Case (DC).

When the standards are used in an oil bath, the resistance elements maintain a constant temperature, providing outstanding short-term stability, which is especially important when making Quantum-Hall-Effect measurements.

Each unit includes:
• Built-in temperature sensor
• Temperature correction chart
• Instruction manual
• ISO/IEC 17025 calibration certificate