**Programmable Resistance - Capacitance - Inductance - RTD Decade Substituter**

### PRS-PCS-PLS-PRTD Series

**Features:**
- **All Substitutors**
  - Manual control via thumbwheel switches standard
  - Optional RS-232, Ethernet or IEEE-488 Interfaces
  - 1 to 10 Decades
  - Benchtop or rack mount versions

### RESISTANCE - RTD

**PRS - Programmable Resistance Substituter**
The PRS Series of programmable resistance substituters is a cost-effective solution for a computer-controlled decade box. Ideal for both laboratory and industrial applications requiring highly reliable and automated switching of resistance.

**Features**
- Resistance from 1 mΩ/step to 10 MΩ/step
- Accuracy: ±(0.01% + 15 mΩ) to ±(1% + 70 mΩ)
- Manganin wire for resistance values < 1 Ω/step
- Precision metal film resistors for PRS-200 and PRS-201 for 1 Ω/step and over
- Sealed wirewound non-inductive resistors for PRS-202 for 1 Ω/step to 100 kΩ/step
- Precision metal oxide film resistors for 1 MΩ and higher steps for PRS-202

**PRTD - Programmable RTD Simulator**
- Absolute reading, no "zero" resistance correction required
- Resistance from 4 Ω to 1000 Ω/step
- Resolution: 0.001 Ω

### CAPACITANCE

**Accuracy:** ±(0.02% + 10 mΩ)

**PCS - Programmable Capacitance Substituter**
The PCS Series of programmable capacitance substituters is ideal for both laboratory and industrial applications requiring highly reliable and automated switching of capacitance.

**Features**
- Capacitance from 100 pF to 10 μF/step
- Accuracy: ±(0.5% + 3 pF) to ±(4% + 3 pF)
- 100 pF to 100 nF/Step decades utilize mica capacitors

### INDUCTANCE

**PLS - Programmable Inductance Substituter**
The PLS Series of programmable inductance substituters is ideal for both laboratory and industrial applications requiring highly reliable and automated switching of inductance. The PLS is similar to the IET 1492 Decade Inductor.

**Features**
- Inductance from 1 mH to 1 H/step
- Accuracy: ± 2%
Options and Configurations:

Choice of Performance:
- **PRS-200 Series** - economical 1% accuracy
- **PRS-201 Series** - laboratory 0.1% accuracy
- **PRS-202 Series** - high accuracy to 0.01% and improved stability using wire-wound resistors for 1 Ω/step to 100 kΩ/step for stability of 10 ppm/year. This compares to 50 ppm/year using precision metal film resistors in the PRS 200 and 201.

Wide choice of impedance ranges: resistance, capacitance and inductance of up to 10 decades may be specified. Resistance may range from 1 mΩ to 100 MΩ.

Package Configuration: Convenient standard 19" rack mounting (RM) or more portable benchtop versions, are available. Both single and dual units are available.

Combinations: Dual units can combine any two resistance, capacitance, inductance substituters in one chassis.

Rear Outputs: Single or dual front panel binding posts are standard. Rear binding post outputs are available with option RO.

**PRTD**: Low-resistance models with a fixed minimum resistance setting (4 Ω, or as specified by customer) are suitable for RTD (Resistance Temperature Detector) simulations. This design virtually eliminates the effect of zero resistance and relay contact resistance, providing the specified absolute accuracy over its entire range.

Digital Display (D Option): Shows the remotely programmed or manually set value. This is useful for confirming or monitoring the selected command value, remote or local. This option requires the rack mount RM option.

- **D Digital Display Option**

**Short-Circuit (SC) and Open-Circuit (OC) Options**: Optional short-circuit and open-circuit modes of operation. These states are controlled only in the REMOTE programming mode.

**The Open Circuit OC option** gives the user an open circuit immediately in series with the HI binding post during switching between values. **The Short Circuit SC operation** gives the user a short circuit across the HI and the LO binding posts during switching. The short circuit impedance is very small, <20 mΩ, typically 5 mΩ. This is lower than the regular zero resistance setting. In both these cases, the underlying resistance setting is unaffected and may still be controlled.

**Special Customer Requirements**: High voltage, nonstandard values, high stability, ultra-low temperature coefficient or improved accuracy can be accommodated.

**High-Power Options**: Power dissipation requirements of up to 500 Watts can be accommodated.
Remote Control Options:

IEEE-488: GPIB interface features *IDN? and cal date query, allowing you to improve your instrument and calibration tracking capabilities. GPIB addressing is controlled via DIP switches or commands on the GPIB bus.

RS232: This interface conforms to EIA-STD-RS-530; with a 25 pin DTE interface.

The PRS is a standard DTE device in RS232 mode. Connection to a PC is made via a null-modem cable.

Ethernet: This interface conforms to IEEE 802.3

When equipped with any remote con-

LabVIEW Drivers and Software

LabVIEW instrument drivers are available for units equipped with GPIB or RS232C options. These drivers are written based on the National Instruments instrument template, using VISA handles and standard initialize, configure and query functions.

To aid the user in operating the PRS/PCS/PLS, two "Keyboard" Controller programs - the easiest way to control GPIB or RS232 devices without writing a program - are available from IET. This Keyboard programs automatically finds your device at start-up and it lets you enter just the data that you want to send to the device. This program works with ICS and National Instruments GPIB cards.

For example; the PRS-202-IEEE has a least significant digit value of 1 mΩ and a remote logic maximum of 12 command decades. To set a value of 50,000.045 Ω, the command string would be:

SOURCe:DATA 000050000045

The PRS-201 & PRS-202 RS-232 has a least significant digit value of 0.1 Ω and a remote logic maximum of 10 command decades. To set a value of 2,500.8 Ω, the command string would be:

SOURCe:DATA 0000025008

To control functionality, the PRS front panel switch determines if REMOTE mode is enabled. Regardless of remote control type, setting the front panel switch to the LOCAL position always disables the remote control "set" value.


The remote output value is set by sending a ‘SOURCe:DATA’ command followed by a string that represents the digits as they would be selected using the thumbwheels. Leading and trailing zeros are required to set each decade properly; the decimal point is not used.
## SPECIFICATIONS

**User interface**: Front panel switch selects REMOTE (Optional: IEEE-488, Ethernet or RS-232 interface) or LOCAL (front-panel thumbwheel) operation.

**Accuracy**: The accuracy shown in the chart below applies after subtraction of the "zero setting" residual impedance.

**Accuracy (PRTD)**: The absolute accuracy indicated below applies without requiring subtraction of "zero setting" residual impedance.

**Min. setting (PRTD)**: 4 Ω or customer specified.

**Thermal emf**: < 15 μV; < 10 μV, typical.

**Terminals**:
Four low-emf, gold-plated, tellurium-copper 5-way binding posts are used for HI and LO terminal pairs for CURRENT and SENSE. GND binding post is connected to the case, to the chassis ground and to the earth ground. Rear outputs are available with the RO option.

**Switching time**: < 4 ms per change; < 7 ms for ≤0.05% units.

**Power requirements**: 90 - 264 Vac, 47 - 63 Hz, 30 Watts Max.

### Dimensions
- Bench model: 22 cm W x 12 cm H x 24 cm D (8.5" x 4.44" x 9.25")
- Rack model: Panel: 48.3 cm W x 13.2 cm H (19" x 5.2"); behind panel: 42.7 cm W x 12.4 cm H x 31.5 cm D (16.8" x 5.2" x 12.4"); in front of panel: 3.8 cm (1.5").

**Weight**: Bench model: 2.0 kg (4.5 lb); Rack model: 4.5 kg (10 lb); Dual rack mount model: 6.4 kg (14 lb); weight specifications are nominal.

**Remote Control Options**:
- IEEE: GPIB standard 24 pin connector, conforms to IEEE-488.2; SCPI 1994.0 command set; Hardware or software configurable addressing range of 0 to 30.
- RS232: 25 pin male DTE interface conforms to EIA-STD-RS-530; SCPI 1994.0 command set; data rates from 300 to 115200 bps.
- Ethernet: IEEE 802.3 compliant, Speeds 10 BaseT (10 Mbs) and 100 BaseT (100 Mb/s), IP Address Static or DHCP, Factory setting 192.168.1.254 static

### Table: Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>PRS-200</th>
<th>PRS-201</th>
<th>PRS-200W</th>
<th>PRS-201W</th>
<th>PRS-202</th>
<th>PRS-202W</th>
<th>PRTD</th>
<th>PCS-300</th>
<th>PCS-301</th>
<th>PLS-400</th>
<th>PLS-400A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>Resistance</td>
<td>Precision Resistance</td>
<td>Wide-Range Resistance</td>
<td>Wide-Range Precision Resistance</td>
<td>High-Precision Resistance</td>
<td>Wide-Range High-Precision Resistance</td>
<td>Precision Absolute-Value Resistance</td>
<td>Precision Capacitance</td>
<td>Wide-Range Capacitance</td>
<td>Wide-Range Inductance</td>
<td>Inductance</td>
</tr>
<tr>
<td>Accuracy</td>
<td>1% +70 mΩ</td>
<td>0.1%+ 30 mΩ</td>
<td>1%+ 70 mΩ</td>
<td>0.1%+ 30 mΩ</td>
<td>0.05% + 15 mΩ (0.01% optional)</td>
<td>.05% + 10 mΩ</td>
<td>4% + 5 pF</td>
<td>1% + 3 pF</td>
<td>2%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Decades</td>
<td>7</td>
<td>9</td>
<td>7</td>
<td>9</td>
<td>6 or more</td>
<td>6</td>
<td>4</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Range</td>
<td>0 - 9,999,999 Ω</td>
<td>0 - 9,000,000 Ω</td>
<td>0 - 9,999,999.9 Ω</td>
<td>0 - 9,999,999 Ω</td>
<td>4-10,003.99 Ω</td>
<td>0 - 9,999 Ω</td>
<td>0 - 9,999 H</td>
<td>0 - 999 mH</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resolution</td>
<td>1 Ω</td>
<td>0.1 Ω</td>
<td>1 Ω</td>
<td>0.1 Ω</td>
<td>0.01 or 0.001 Ω</td>
<td>100 pF</td>
<td>100 pF</td>
<td>100 pF</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type of Components</td>
<td>Resistance wire for 0.1 Ω steps and under</td>
<td>Precision metal film for 1 Ω steps and over</td>
<td>Resistance wire for 0.1 Ω steps and under</td>
<td>Wirewound, sealed non-inductive resistors for 1 Ω to 100 kΩ steps *; Precision metal-oxide film resistors for 1 MΩ steps and over</td>
<td>100-900 pF: Mica 0.001-0.009 µF: Polystyrene 0.01-0.9 µF: Polycarbonate 1-9 µF: Polyester 10-90 µF: Polarized tantalum</td>
<td></td>
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<tr>
<td>Max. Load</td>
<td>0.5 A, 200 V (dc + ac peak), 0.2 W/step, 2 W unit, whichever applies first.</td>
<td>3 A, 200 V (dc + ac peak), 0.5 W/step, 4.5 W/unit, whichever applies first.</td>
<td>100 V (20 V for 10-100 µF)</td>
<td></td>
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<td></td>
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<tr>
<td>Residual Impedance</td>
<td>&lt;450 mΩ</td>
<td>&lt;800 mΩ</td>
<td>&lt;100 mΩ</td>
<td>&lt;140 mΩ typ. &lt;100 mΩ</td>
<td>Absolute Value</td>
<td>7 pF, typ. higher with Rear Output</td>
<td>&lt;1 µH</td>
<td></td>
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</tr>
</tbody>
</table>

* PRS with accuracy of 0.1% to 4% use precision metal film resistors for 1 Ω steps and over
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**PRS-PCS-PLS-PRTD Series**

### ORDERING INFORMATION

**STANDARD MODELS**

- **PRS-200**: Programmable Resistance Substituter
- **PRS-201**: Programmable Precision Resistance Substituter
- **PRS-200W**: Programmable Wide-Range Resistance Substituter
- **PRS-201W**: Programmable Wide-Range Precision Resistance Substituter
- **PRS-202**: Programmable High-Precision Resistance Substituter
- **PRS-202W**: Programmable Wide-Range, High-Precision, Resistance Substituter
- **PCS-300**: Programmable Capacitance Substituter
- **PCS-301**: Programmable Precision Capacitance Substituter
- **PLS-400**: Programmable Inductance Substituter
- **PLS-400A**: Programmable Inductance Substituter
- **PRTD Models**: Programmable RTD Simulator

**OTHER OPTIONS**

- **RM Option**: Rack mount
- **RMK Option**: Rack mount Kit
- **RO Option**: Rear output
- **D Option**: Digital display of programmed value
- **SC Option**: Short circuit option
- **OC Option**: Open circuit option
- **HP**: Custom high power specifications

**GPIB CABLES**

- **CBL-488-1**: 1 meter IEEE-488 cable

### INTERFACE OPTIONS

- IEEE Option: IEEE-488.2 Interface
- RS232 Option: Serial interface
- Ethernet Option: Ethernet IEEE 802.3

### CONFIGURATION

In order to satisfy any unique requirements for programmable substituters, generate a part number from the table below.

**PRS - B - 5 - .1 - IEEE - -RM - RO-SC-OC-D**

**No. of Units**
- Single: 1
- Dual: 2

**Type of Substituter**
- PRS: Resistance
- PCS: Capacitance
- PLS: Inductance
- PRTD: RTD Simulator

**Tolerance**

- X: 0.01% + 15 mΩ
- Y: 0.05% + 15 mΩ
- Z: 0.1% + 30 mΩ
- A: 0.15% + 30 mΩ
- B: 0.05% + 30 mΩ
- F: 1% + 70 mΩ
- G: 2% + 70 mΩ
- H: 4% + 70 mΩ

**No. of Decades**
- 1 to 10

**Impedance per Step for Lowest Decade**
- 0.001 Ω to 10 MΩ
- 100 pF to 100 μF

**Interface Options**
- IEEE: IEEE-488.2
- RS232: Serial 232/485
- Ethernet: IEEE 802.3

**Custom V, I and P Rating**
- Custom: Specify maximum required voltage, current and power.
- i.e. 3A/200V/250W

**Custom V, I and P Rating**

**Other Options**

- **RM**: Rack mount option
- RO: Rear outputs
- D: Digital Display
- SC: Short Circuit
- OC: Open Circuit
- HP: High Power

(i.e.: 0 - 9.999.9 Ω, 0.1%, 5 decades, 0.1 Ω steps, rack mounted PRS with IEEE-488 remote control, rear outputs, short circuit and open circuit operation, and digital display)