

◆ PRECISION INSTRUMENTS FOR TEST AND MEASUREMENT ◆

HPRS SERIES
**High-Power Decade
Resistance Substituter**
User and Service Manual

Copyright © 2001 IET Labs, Inc.

HPRS im/December 2001



IET LABS, INC.

534 Main Street, Westbury, NY 11590

www.ietlabs.com

TEL: (516) 334-5959 • (800) 899-8438 • FAX: (516) 334-5988

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.

Contents

WARRANTY	iii
Contents	iv
Figures and Tables	v
WARNING	vi
CAUTION	vi
Chapter 1	
INTRODUCTION	1
Chapter 2	
SPECIFICATIONS	2
Chapter 3	
INSTALLATION	4
3.1 Initial Inspection	4
3.2 Installation	4
3.3 Storage	4
Chapter 4	
OPERATION	5
4.1. Connection	5
4.1.1 General Considerations	5
4.1.2 Electrical Considerations	5
4.2 Dial Setting	5
4.3 Environmental Conditions	5
Chapter 5	
MAINTENANCE	6
5.1 Preventive Maintenance	6
5.2 Verificaiton of Performance	6
5.2.1 Calibration Interval	6
5.2.2 General Considerations	6
5.2.3 Procedure	6
5.3 Schematic and Replacement Parts	7
5.4 Troubleshooting	7
5.5 Disassembly, Component Replacement, and Reassembly	7
5.5.1 Disassembly	7
5.5.2 Component Replacement	7
5.5.3 Reassembly	7
5.6 Customer Service	7
5.7 Instrument Return	7

Figures and Tables

Figure 1.1	HPRS Series High-Power Decade Resistance Substituter	1
Figure 2.1	Typical Operating Guide Affixed to Unit	2
Figure 5.1	HPRS Series Schematic Diagram	9



WARNING



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

ELECTRICAL SHOCK HAZARD. DO NOT OPEN CASE.
REFER SERVICING TO QUALIFIED PERSONNEL.

HIGH VOLTAGE MAY BE PRESENT WITH HIGH VOLTAGE OPTIONS.

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.

REMOVE POWER WHEN HANDLING UNIT.

POST WARNING SIGNS AND KEEP 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.

CASE MAY BECOME HOT
WHEN HIGH POWER IS APPLIED

Chapter 1

INTRODUCTION

The High-Power Decade Resistance Substituter (**HPRS**) Series is a family of instruments offering a broad choice of high-power, excellent-performance resistance sources (Figure 1.1). High-power resistors are made available without sacrificing other electrical properties. Any number of decades is available in a choice of two accuracies.

The **HPRS** Series employs state-of-the-art precision resistors of various types for high accuracy, high stability, and low temperature and power coefficients-of-resistance.

The standard models offer a choice of three to nine decades. The panels are clearly labeled showing the step size and maximum voltage and current limitations for each decade.

With a resolution as low as 1 m Ω and a maximum resistance of 10 M Ω , the **HPRS** Series may be used as a general purpose substituter as well as a high-power load for testing power supplies and for other high-power applications.

Applications include calibration of meters and instruments. **HPRS** instruments are useful development

tools wherever precise resistances with high-power handling capacity are required.

The HPRS series complements the HRRS and HARS series, providing resistance steps as low as 1 m Ω . The units may be rack-mounted to serve as components in measurement and control systems.

This series is part of a family of resistance substituters suited to fill many engineering and testing needs. Consult IET for:

High power substituters - up to 400 W

High resistance substituters - to 1 T Ω

RTD simulators

Laboratory-standard-grade substituters - to 1 ppm accuracy

Programmable substituters - IEEE-488 or BCD.



Figure 1.1. HPRS Series High-Power Decade Resistance Substituter

Chapter 2

SPECIFICATIONS

For convenience to the user, the pertinent specifications are given in an **OPERATING GUIDE**, shown in Figure 2.1, affixed to the case of the instrument.

SPECIFICATIONS

Decade Total (Ω)	Resistance per step	Max.* Current per decade (A)	Max.* Power per step (W)	Temperature Coefficient (ppm/°C)
0.01	1 mΩ	6	0.036	90
0.1	10 mΩ	6	0.36	90
1.0	100 mΩ	6	3.6	90
10	1 Ω	5	25	50
100	10 Ω	1.5	25	50
1 k	100 Ω	0.5	25	50
10 k	1 kΩ	0.15	25 [†]	50
100 k	10 kΩ	0.05 [†]	25 [†]	50
1 M	100 kΩ	V limit [†]	V limit [†] 20	
10 M	1 MΩ	V limit [†]	V limit [†] 10	

* Subject to 250 W max. per unit.

† Subject to 1000 V (dc + ac peak) max.

Accuracy:

Option C: ±(0.5% + 20 mΩ) after zero subtraction.

Option F: ±(1.0% + 20 mΩ) after zero subtraction.

Type of Resistor: Resistance wire for 0.1 Ω and under; film power resistors for 1 Ω to 100 kΩ steps; low inductance wirewound resistors for 1 MΩ steps.

Terminals: Two five way binding posts and one ground post electrically connected to case.

Model	Dimensions	Weight
6 decades	43.9 cm W x 8.9 cm H x 10.2 cm D (17.3" x 3.5" x 4")	2.2 kg (4.8 lb)
7 decades		2.4 kg (5.3 lb)
8 decades		2.6 kg (5.7 lb)
9 decades	48.3 cm W x 17.8 cm H x 19.7 cm D (19.0 x 7.0 x 7.8")	5.1 kg (11.2lb)

ORDERING INFORMATION

Model* (1% Accuracy)	Total Resistance (Ω)	No. of Decades	Resolution (Ω)
HPRS-F-3-0.001	1	3	0.001
HPRS-F-3-0.01	10	3	0.01
HPRS-F-3-0.1	100	3	0.1
HPRS-F-3-1	1 k	3	10
HPRS-F-3-10	10 k	3	10
HPRS-F-3-100	100 k	3	100
HPRS-F-3-1K	1 M	3	1 k
HPRS-F-3-10K	10 M	3	10 k
HPRS-F-4-0.001	10	4	0.001
HPRS-F-4-0.01	100	4	0.01
HPRS-F-4-0.1	1 k	4	0.1
HPRS-F-4-1	10 k	4	1
HPRS-F-4-10	100 k	4	10
HPRS-F-4-100	1 M	4	100
HPRS-F-4-1K	10 M	4	1 k
HPRS-F-5-0.001	100	5	0.001
HPRS-F-5-0.01	1 k	5	0.01
HPRS-F-5-0.1	10 k	5	0.1

*For 0.5% accuracy substitute "C" for "F" in the part number.

Model* (1% Accuracy)	Total Resistance (Ω)	No. of Decades	Resolution (Ω)
HPRS-F-5-1	100 k	5	1
HPRS-F-5-10	1 M	5	10
HPRS-F-5-100	10 M	5	100
HPRS-F-6-0.001	1 k	6	0.001
HPRS-F-6-0.01	10 k	6	0.01
HPRS-F-6-0.1	100 k	6	0.1
HPRS-F-6-1(HPRS-150)	1 M	6	1
HPRS-F-6-10	10 M	6	10
HPRS-F-7-0.001	10 k	7	0.001
HPRS-F-7-0.01	100 k	7	0.01
HPRS-F-7-0.1(HPRS-200)	1 M	7	0.1
HPRS-F-7-1	10 M	7	1
HPRS-F-8-0.001	100 k	8	0.001
HPRS-F-8-0.01	1 M	8	0.01
HPRS-F-8-0.1(HPRS-200W)	10 M	8	0.1
HPRS-F-9-0.001	1 M	9	0.001
HPRS-F-9-0.01	10 M	9	0.01

OPTIONS

- RM Rack mountable case for standard 19" rack
- Programmable Version See PRS Series

HPRS SERIES HIGH POWER DECADE RESISTANCE SUBSTITUTER

CONSULT INSTRUCTION MANUAL FOR PROPER INSTRUMENT OPERATION

Decade Total (Ω)	Resistance per step	Max.* Current per decade (A)	Max.* Power per step (W)	Temperature Coefficient (ppm/ $^{\circ}$ C)
.009	1 m Ω	6	0.036	50
.09	10 m Ω	6	0.36	50
.9	100 m Ω	6	3.6	20
9	1 Ω	5	25	50
90	10 Ω	1.5	25	50
900	100 Ω	0.5	25	50
9 k	1 k Ω	0.15	25 [†]	50
90 k	10 k Ω	0.05 [†]	25 [†]	50
900 k	100 k Ω	V limit [†]	V limit [†]	20
9 M	1 M Ω	V limit [†]	V limit [†]	10

* Subject to 250 W max. per unit.

† Subject to 1000 V (dc + ac peak) max.

Observe all safety rules when working with high voltages or line voltages. Connect the (G) terminal to earth ground in order to maintain the case at a safe voltage. Whenever hazardous voltages (>45 V) are used, take all measures to avoid accidental contact with any live components: a) Use maximum insulation and minimize the use of bare conductors. b) Remove power when adjusting switches. c) Post warning signs and keep personnel safely away.

Resistor Type: Resistance wire for 0.1 Ω steps and under; power film resistors for 1 Ω through 10 k Ω steps; wirewound and metal-film resistors for 100 k Ω steps; wirewound or film resistors for 1 M Ω steps and over.

Accuracy:

HPRS-F Series: \pm (1% + 20 m Ω) after subtraction of zero resistance,
HPRS-C Series: \pm (0.5% + 20 m Ω) after subtraction of zero resistance at 23 $^{\circ}$ C; traceable to NIST.

Terminals:

Two five way binding posts and one ground post electrically connected to case.



**CAUTION
CASE MAY BE HOT UNDER POWER**

MODEL:

SN:



IET LABS, INC. • 534 Main Street, Westbury, NY 11590 • (800) 899-8438 • (516) 334-5959 •
 CAGE CODE: 62015 www.ietlabs.com

HPRSLBLp1/HPRS-gen1/62%/08-00

Figure 2.1. Typical Operating Guide Affixed to Unit

Chapter 3

INSTALLATION

3.1 Initial Inspection

IET instruments receive a careful mechanical and electrical inspection before shipment. Upon receipt, verify that the contents are intact and as ordered. The instrument should then be given a visual and operational inspection.

If any shipping damage is found, contact the carrier and IET Labs. If any operational problems are encountered, contact IET Labs and refer to the warranty at the beginning of this manual. IET Labs will work with you until you are satisfied that your instrument is operating to fulfill the needs of your applications.

Save all original packing material for convenience in case shipping of the instrument should become necessary.

3.2 Installation

For a rack-mounted model, installation in a 19-inch rack may be made using the slots in the rack mounting ears. A mounting location that does not expose the unit to excessive heat is recommended.

For bench models, no installation as such is required, because this instrument series is not powered. Since it is a high-accuracy instrument, bench space should be provided that will not expose it to abuse and keep it protected from temperature extremes and contaminants.

3.3 Storage

If this instrument is to be stored for any lengthy period of time, it should be sealed in plastic and stored in a dry location. It should not be subjected to temperature extremes beyond the specifications. Extended exposure to such temperatures can result in an irreversible change in resistance, and require repair and/or recalibration

Chapter 4

OPERATION

4.1. Connection



4.1.1 General Considerations

The HPRS Series Decade unit provides three terminals labeled **H** (high), **L** (low), and **G** (ground.) The **H** and **L** terminals are connected to the ends of the resistor being set. the **G** terminal is connected to the case. The **G** terminal may be used as a guard or shield terminal. It may also be connected using a shorting link to either terminal to allow two-terminal as opposed to three-terminal measurement. See Figure 5.1.

In order to make proper use of the full performance capabilities of the HPRS unit, especially if low resistance or high power are important, take care in connecting to the terminals of the decade box.

In order to keep contact resistance to a minimum, make the most substantial and secure connection to the binding posts. They accept banana plugs, telephone tips, spade lugs, alligator clips, and bare wire. The largest or heaviest mating connection should be made, and, where applicable, the binding post should be securely tightened.

4.1.2 Electrical Considerations

As a good safety practice, the case should be grounded using the **G** terminal.

Since high voltages may be present, it is important to observe all precautions and safety rules.

CONNECT THE G (GND) TERMINAL TO EARTH OR OTHER SUITABLE GROUND IN ORDER TO MAINTAIN THE CASE AT A SAFE VOLTAGE.

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.

- REMOVE POWER WHEN SETTING SWITCHES.

- EXERCISE CARE WHEN HANDLING UNIT. CASE - ESPECIALLY REAR AND BOTTOM - MAY BECOME HOT IF HIGH POWER IS APPLIED FOR AN EXTENDED PERIOD.

- POST WARNING SIGNS AND KEEP PERSONNEL SAFELY AWAY.

4.2 Dial Setting

Whenever the dials are used for positions 0-9, the resulting resistance is simply read from the panel dial setting directly. Both the decimal point and the steps are clearly marked on the panel.

4.3 Environmental Conditions

For optimal accuracy, the decade box should be used in an environment near 23°C and <50% RH. It should be allowed to stabilize at those conditions for at least two hours after any significant temperature variation.