

HARS-LX Series

Highest-accuracy version of the IET Labs resistance substituters for the most exacting calibration and test applications. The HARS-LX Series features a continuous rheostat as an option.

- No zero subtraction required - Absolute accuracy applies for every setting*
- High accuracy - 20 ppm
- High stability - 5 ppm/yr
- Low temperature coefficient - as low as 3 ppm/°C
- High-performance, solid silver contact switches
- Resistance from 10 mΩ to over 121 MΩ
- 1 mΩ or optional 20 μΩ resolution
- Hermetically sealed, low inductance resistors
- Precise fixed minimum resistance

See also:

- More economical: **HARS-X** or **RS Series**
- Higher power: **HPRS Series**
- Higher resistance: **HRRS Series**
- Higher voltage **HRRS-5kV** and **HRRS-10kV Series**
- RTD simulators: **RTD Series**
- Programmable models: **PRS Series**

MODELS

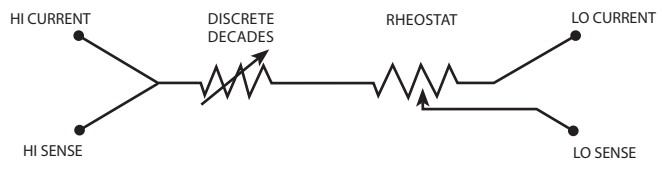


Nine-decade Model with 1 mΩ resolution

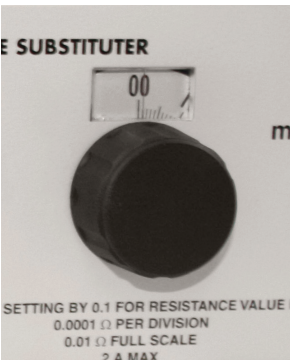


Eleven-decade model with 1 mΩ resolution, offering wide range and high resolution

RHEOSTAT

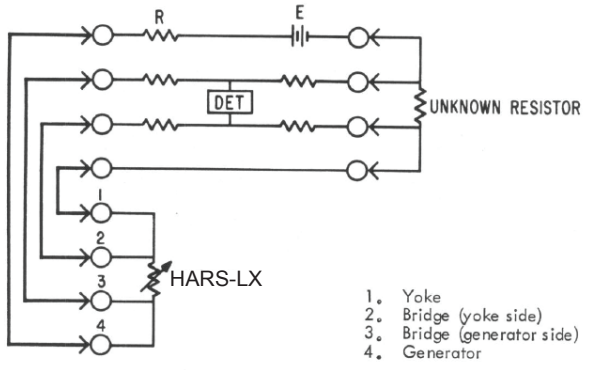


For high-resolution applications, a 10 mΩ rheostat may be added for the lowest step. It is a 0.20 μΩ resolution “decade”. In order to eliminate contact resistance and thermal emf, the HARS-LX integrates the rheostat as shown. In this way, the wiper is in the low potential circuit, which is the high impedance lead. As a result, voltage and contact resistance effects are removed by being effectively added to the input impedance of the measuring instrument.



Three-decade HARS-LX with optional rheostat

KELVIN BRIDGE MEASUREMENT



*Absolute accuracy is accomplished by having a minimum resistance, which includes all contact resistances. No zero subtraction required. Absolute accuracy applies for every setting.

Many models and combinations are available; see ORDERING INFORMATION



SPECIFICATIONS

| Resistance per step | Total decade resistance | Max current | Max power | Temperature coefficient (±ppm/°C) | Power coefficient (±ppm/mW) | Accuracy* | Stability (±ppm/yr) | Decade positions | Resistor type |
|-------------------------------------|-------------------------|-------------------------|--------------|-----------------------------------|-----------------------------|------------------|---------------------|---|--|
| | | whichever applies first | | | | | | | |
| 100 µΩ division 20 µΩ resolution | 10 mΩ | 2 A | NA | 20 | 1 | ±(20 ppm+0.5 mΩ) | 20 ppm+0.5 mΩ | Continuous | Rheostat |
| 1 mΩ | 10 mΩ | 2 A | NA | 20 | 1 | | | 11 positions "0"- "10" | Resistance wire |
| 10 mΩ | 100 mΩ | 2 A | NA | 20 | 1 | | | 10 positions "1"- "10" (10 mΩ minimum reading) | |
| 100 mΩ | 1 Ω | 2 A | NA | 20 | 1 | | | 11 positions "0"- "10" (12 positions "0"- "11" for highest decade, where highest decade steps are 1 Ω, 10 Ω, 10 kΩ, 100 kΩ, 1 MΩ, and 10 MΩ.) See Ordering Information section below. | Wirewound hermetically sealed low-inductance |
| 1 Ω | 10 Ω | 1 A | 5 W | 20 | 0.4 | | | | |
| 10 Ω | 100 Ω | 0.33 A | 5 W | 10 | 0.3 | | | | |
| 100 Ω | 1 kΩ | 0.1 A | 5 W | 3 | 0.1 | | | | |
| 1 kΩ | 10 kΩ | 33 mA | 5 W | 3 | 0.1 | | | | |
| 10 kΩ | 100 kΩ | 10 mA | 5 W | 3 | 0.1 | | | | |
| 100 kΩ | 1 MΩ | 3 mA | 2,000 V peak | 3 | 0.1 | | | | |
| 1 MΩ | 10 MΩ | 1 mA | 2,000 V peak | 3 | 0.1 | | | | |
| 10 MΩ | 100 MΩ | 2,000 V peak | | 15 | 0.2 | ±0.02% | 50 ppm | Metal oxide | |
| Wiring and switch resistance | | NA | | 50 µΩ/°C | 0.2 µΩ/W | NA | | | |

*At 23°C "true ohm" measurement, 30-70% RH, absolute reading, SI traceable
No zero subtraction required

Minimum settable resistance:

With this design, absolute accuracy, *without* zero subtraction, is accomplished by having a minimum settable resistance, *which includes all contact and wiring resistances*. Absolute accuracy applies for every setting. The minimum resistance is determined by the lowest resolution of the unit and by internal resistance. See **Ordering Information** for the minimum settable resistance for any model. Minimum settable resistance is implemented by a mechanical stop on one of the decades.

Resistance repeatability:

Better than 100 µΩ, short-term, average value

Leakage Resistance:

>10 GΩ

Environmental Conditions:

Operating Temperature: 0°C to 55°C

Storage Temperature: -40°C to 70°C

Switch Type:

Multiple solid silver contacts; dust-tight diallyl-phthalate body. To allow continuous rotation, a blank position is added on most decades.

Terminals:

Four, 5-way, gold-plated, tellurium-copper binding posts with low thermal emf and low resistance, for four-terminal Kelvin measurements, plus one binding post connected to case for shielding. Rear outputs are available as an option.

Mechanical Information:

| Model | Dimensions | Nominal Weight |
|--------------|---|---------------------|
| 1 decade | 7.7 cm W x 7.7 cm H x 8.4 cm D (3" W x 3" H x 3.3" D) | 0.45 kg (1.0 lb) |
| 3 decades | 37.5 cm W x 8.9 cm H x 10.2 cm D (14.8" W x 3.5" H x 4" D) | 2.0 kg (4.3 lb) |
| 4-5 decades | 43.9 cm W x 8.9 cm H x 10.2 cm D (17.3" W x 3.5" H x 4.0" D) | 2.2 kg (4.8 lb) |
| 6-10 decades | 48.3 cm W x 17.8 cm H x 19.7 cm D (19" W x 7" H x 7.8" D) | 5.1 kg (11 lb) |
| 11 decades | 48.3 cm W x 31 cm H x 19.7 cm D (19" W x 12.3" H x 7.8" D) | 6.6 kg (14 lb) |



ORDERING INFORMATION

| Model | Nominal total resistance | No. of decades | Resolution | Minimum settable resistance** |
|-----------------|--------------------------|----------------|------------|-------------------------------|
| HARS-LX-1-0.001 | 10 mΩ | 1 | 1 mΩ | 1 mΩ |
| HARS-LX-1-0.01 | 100 mΩ | 1 | 10 mΩ | 10 mΩ |
| HARS-LX-1-0.1 | 1 Ω | 1 | 100 mΩ | 100 mΩ |
| HARS-LX-1-1 | 11 Ω | 1 | 1 Ω | 1 Ω |
| HARS-LX-1-10 | 110 Ω | 1 | 10 Ω | 10 Ω |
| HARS-LX-1-100 | 1.0 kΩ | 1 | 100 Ω | 100 Ω |
| HARS-LX-1-1k | 10 kΩ | 1 | 1 kΩ | 1 kΩ |
| HARS-LX-1-10k | 110 kΩ | 1 | 10 kΩ | none |
| HARS-LX-1-100k | 1.1 MΩ | 1 | 100 kΩ | none |
| HARS-LX-1-1M | 11 MΩ | 1 | 1 MΩ | none |
| HARS-LX-1-10M | 110 MΩ | 1 | 10 MΩ | none |
| HARS-LX-2-0.001 | 110 mΩ | 2 | 1 mΩ | 2 mΩ |
| HARS-LX-2-0.01 | 1.10 Ω | 2 | 10 mΩ | 10 mΩ |
| HARS-LX-2-0.1 | 12.0 Ω | 2 | 100 mΩ | 100 mΩ |
| HARS-LX-2-1 | 120 Ω | 2 | 1 Ω | 1 Ω |
| HARS-LX-2-10 | 1.10 kΩ | 2 | 10 Ω | 10 Ω |
| HARS-LX-2-100 | 11.0 kΩ | 2 | 100 Ω | 100 Ω |
| HARS-LX-2-1k | 120 kΩ | 2 | 1 kΩ | 1 kΩ |
| HARS-LX-2-10k | 1.20 MΩ | 2 | 10 kΩ | none |
| HARS-LX-2-100k | 12.0 MΩ | 2 | 100 kΩ | none |
| HARS-LX-2-1M | 120 MΩ | 2 | 1 MΩ | none |
| HARS-LX-3-0.001 | 1.110 Ω | 3 | 1 mΩ | * |
| HARS-LX-3-0.01 | 12.10 Ω | 3 | 10 mΩ | 10 mΩ |
| HARS-LX-3-0.1 | 121.0 Ω | 3 | 100 mΩ | 100 mΩ |
| HARS-LX-3-1 | 1.110 kΩ | 3 | 1 Ω | 1 Ω |
| HARS-LX-3-10 | 11.10 kΩ | 3 | 10 Ω | 10 Ω |
| HARS-LX-3-100 | 121.0 kΩ | 3 | 100 Ω | 100 Ω |
| HARS-LX-3-1k | 1.210 MΩ | 3 | 1 kΩ | 1 kΩ |
| HARS-LX-3-10k | 12.10 MΩ | 3 | 10 kΩ | none |
| HARS-LX-3-100k | 121.0 MΩ | 3 | 100 KΩ | none |
| HARS-LX-4-0.001 | 12.110 Ω | 4 | 1 mΩ | * |
| HARS-LX-4-0.01 | 121.10 Ω | 4 | 10 mΩ | 10 mΩ |
| HARS-LX-4-0.1 | 1.111 0 kΩ | 4 | 100 mΩ | 100 mΩ |
| HARS-LX-4-1 | 11.110 kΩ | 4 | 1 Ω | 1 Ω |
| HARS-LX-4-10 | 121.10 kΩ | 4 | 10 Ω | 10 Ω |
| HARS-LX-4-100 | 1.211 0 MΩ | 4 | 100 Ω | 100 Ω |
| HARS-LX-4-1k | 12.110 MΩ | 4 | 1 kΩ | 1 kΩ |
| HARS-LX-4-10k | 121.10 MΩ | 4 | 10 kΩ | none |

| Model | Nominal total resistance | No. of decades | Resolution | Minimum settable resistance** |
|------------------|--------------------------|----------------|------------|-------------------------------|
| HARS-LX-5-0.001 | 121.110 Ω | 5 | 1 mΩ | * |
| HARS-LX-5-0.01 | 1.111 10 kΩ | 5 | 10 mΩ | 10 mΩ |
| HARS-LX-5-0.1 | 11.111 0 kΩ | 5 | 100 mΩ | 100 mΩ |
| HARS-LX-5-1 | 121.110 kΩ | 5 | 1 Ω | 1 Ω |
| HARS-LX-5-10 | 1.211 10 MΩ | 5 | 10 Ω | 10 Ω |
| HARS-LX-5-100 | 12.111 0 MΩ | 5 | 100 Ω | 100 Ω |
| HARS-LX-5-1k | 121.110 MΩ | 5 | 1 kΩ | 1 kΩ |
| HARS-LX-6-0.001 | 1.111 110 kΩ | 6 | 1 mΩ | * |
| HARS-LX-6-0.01 | 11.111 10 kΩ | 6 | 10 mΩ | 10 mΩ |
| HARS-LX-6-0.1 | 121.111 0 kΩ | 6 | 100 mΩ | 100 mΩ |
| HARS-LX-6-1 | 1.211 110 MΩ | 6 | 1 Ω | 1 Ω |
| HARS-LX-6-10 | 12.111 10 MΩ | 6 | 10 Ω | 10 Ω |
| HARS-LX-6-100 | 121.111 0 MΩ | 6 | 100 Ω | 100 Ω |
| HARS-LX-7-0.001 | 11.111 110 kΩ | 7 | 1 mΩ | * |
| HARS-LX-7-0.01 | 121.111 10 kΩ | 7 | 10 mΩ | 10 mΩ |
| HARS-LX-7-0.1 | 1.211 111 0 MΩ | 7 | 100 mΩ | 100 mΩ |
| HARS-LX-7-1 | 12.111 110 MΩ | 7 | 1 Ω | 1 Ω |
| HARS-LX-7-10 | 121.111 10 MΩ | 7 | 10 Ω | 10 Ω |
| HARS-LX-8-0.001 | 121.111 110 kΩ | 8 | 1 mΩ | * |
| HARS-LX-8-0.01 | 1.211 111 10 MΩ | 8 | 10 mΩ | 10 mΩ |
| HARS-LX-8-0.1 | 12.111 111 0 MΩ | 8 | 100 mΩ | 100 mΩ |
| HARS-LX-8-1 | 121.111 110 MΩ | 8 | 1 Ω | 1 Ω |
| HARS-LX-9-0.001 | 1.211 111 110 MΩ | 9 | 1 mΩ | * |
| HARS-LX-9-0.01 | 12.111 111 10 MΩ | 9 | 10 mΩ | 10 mΩ |
| HARS-LX-9-0.1 | 121.111 111 0 MΩ | 9 | 100 mΩ | 100 mΩ |
| HARS-LX-10-0.001 | 12.111 111 110 MΩ | 10 | 1 mΩ | * |
| HARS-LX-10-0.01 | 121.111 111 10 MΩ | 10 | 10 mΩ | 10 mΩ |
| HARS-LX-11-0.001 | 121.111 111 110 MΩ | 11 | 1 mΩ | * |

Options:

- RH: 10 mΩ rheostat for lowest decades, 20 μΩ resolution
- RO: Rear output binding posts
- RM: Rack-mountable case for standard 19" rack

*Customer Selection

**Minimum settable resistance is determined by a mechanical stop on one of the decades. Absolute accuracy, without zero subtraction, is accomplished by having this minimum resistance, which includes all contact resistances. No zero subtraction required. Absolute accuracy applies for every setting.

