

HARS-X Series

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Tight tolerance laboratory grade decade substituters, for applications requiring a cost effective high performance resistance decade box.

- Resistance from 1 mΩ to 111 MΩ
- Excellent stability - 10 ppm/yr, 25 ppm/ 3 yrs
- Wide choice - single through 11 decade units
- High accuracy - 0.01% (100 ppm)
- Very low zero resistance: <1 mΩ per decade
- High performance solid silver alloy switches
- Low temperature coefficient - 5 ppm/°C
- Noninductive or low inductance resistors

- Rack mounting available
- Special and custom configurations available



6 Decade HARS-X High Accuracy Resistance Substituter

- See HRRS Series for higher resistance
- See HPRS Series for higher power
- See HARS-L Series for higher accuracy
- See RTD Series for RTD simulators
- See PRS Series for programmable models

SPECIFICATIONS

Resistance per Step	Total Decade Resistance	Stability (±ppm/year)	Long Term Stability (±ppm/3 years)	Temperature Coefficient (±ppm/°C)	Max. Power (W/step)	Maximum current (per decade)	Maximum voltage (per step)
1 mΩ	10 mΩ	100	700	50	0.04	8 A	5 mV
10 mΩ	100 mΩ	50	350	20	0.2	4 A	40 mV
100 mΩ	1 Ω	30	50	20	0.25	1.6 A	0.16 V
1 Ω	10 Ω	10	25	20	0.6	0.8 A	0.8 V
10 Ω	100 Ω	10	25	15	0.6	0.25 A	2.5 V
100 Ω	1 kΩ	10	25	5	0.6	80 mA	8 V
1 kΩ	10 kΩ	10	25	5	0.5	23 mA	23 V
10 kΩ	100 kΩ	10	25	5	0.5	7 mA	70 V
100 kΩ	1 MΩ	10	25	5	0.5*	2.3* mA	230 V*
1 MΩ	10 MΩ	10	25	10	0.5*	0.7* mA	700 V*
10 MΩ	100 MΩ	50	40	10	0.1*	0.1* mA	1000 V*

* Subject to maximum of 2000 V to case.

Accuracy: After subtraction of zero resistance, at 23°C; traceable to SI.

- HARS-L: ± 20 ppm (see p 17)
- HARS-Z: ±(50 ppm + 1 mΩ)
- HARS-X: ±(0.01% + 2 mΩ); ±0.03% for 10 MΩ steps.
- HARS-Q: ±(0.02% + 2 mΩ); ±0.05% for 10 MΩ steps.
- HARS-A: ±(0.05% + 2 mΩ); ±0.1% for 10 MΩ steps.
- HARS-B: ±(0.1% + 4 mΩ); ±1% for 10 MΩ steps.

Zero Resistance: <1 mΩ per decade, at dc; slightly higher for 7-10 decades; for HARS-X version; (<4 mΩ per decade for HARS-A and HARS-B)

Maximum Voltage to Case: 2000 V peak.

Operating Environment: +10 to 40°C, <80% RH.

Switch Type: 11 positions; "0"- "10"; multiple solid silver alloy contacts.

Switch Capacitance: <4 pF per switch.

Terminals: Low-thermal-emf beryllium-copper binding posts with standard 3/4 inch spacing, plus shield terminal; connections from the rear of the instrument are available with RO option.

Mechanical:

Model	Dimensions	Weight
1 decade	7.7 cm W x 7.7 cm H x 8.4 cm D (3" x 3" x 3.3")	0.45 kg (1.0 lb)
2-3 decades	31 cm W x 8.9 cm H x 10.2 cm D (12.2" x 3.5" x 4")	1.7 kg (3.8 lb)
4-5 decades	37.5 cm W x 8.9 cm H x 10.2 cm D	2.0 kg (4.3 lb)
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 (11.2 lb)
10 decades		5.3 kg (11.7 lb)
11 decades		5.4 kg (11.9 lb)



IET LABS, INC. in the GenRad Tradition

534 Main Street, Westbury, NY 11590

IET cat/HARSX p1/02-24-06

www.ietlabs.com
TEL: (516) 334-5959 • (800) 899-8438 • FAX: (516) 334-5988

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SINGLE DECADE UNITS

Single decade units are available with resistance as low as 1 mΩ per step to as high as 10 MΩ per step. These units satisfy many system applications requiring only a single decade while maintaining all the quality features of the HARS series.

Each decade is enclosed in an aluminum case which can serve as a shield.

It may be panel mounted and integrated with additional units to form potentiometer circuits or other configurations.

Each unit consists of low inductance resistors in series, with a high performance solid silver alloy contact switch.



Single Decade HARS-X Unit

ORDERING INFORMATION

Model* (0.01% Accuracy)	Total Res. (Ω)	No. of Decades	Resolution (Ω)
HARS-X-1-0.001	0.01	1	0.001
HARS-X-1-0.01	0.1	1	0.01
HARS-X-1-0.1	1	1	0.1
HARS-X-1-1	10	1	1
HARS-X-1-10	100	1	10
HARS-X-1-100	1 k	1	100
HARS-X-1-1K	10 k	1	1 k
HARS-X-1-10K	100 k	1	10 k
HARS-X-1-100K	1 M	1	100 k
HARS-X-1-1M	10 M	1	1 M
HARS-X-1-10M	100 M	1	10 M
HARS-X-2-0.001	0.11	2	0.001
HARS-X-2-0.01	1.1	2	0.01
HARS-X-2-0.1	11	2	0.1
HARS-X-2-1	110	2	1
HARS-X-2-10	1.1 k	2	10
HARS-X-2-100	11 k	2	100
HARS-X-2-1K	110 k	2	1 k
HARS-X-2-10K	1.1 M	2	10 k
HARS-X-2-100K	11 M	2	100 k
HARS-X-2-1M	110 M	2	1 M
HARS-X-3-0.001	1.11	3	0.001
HARS-X-3-0.01	11.1	3	0.01
HARS-X-3-0.1	111	3	0.1
HARS-X-3-1	1.11 k	3	1
HARS-X-3-10	11.1 k	3	10
HARS-X-3-100	111 k	3	100
HARS-X-3-1K	1.11 M	3	1 k
HARS-X-3-10K	11.1 M	3	10 k
HARS-X-3-100K	111 M	3	100 k
HARS-X-4-0.001	11.11	4	0.001
HARS-X-4-0.01	111.1	4	0.01
HARS-X-4-0.1	1.111 k	4	0.1
HARS-X-4-1	11.11 k	4	1

Model* (0.01% Accuracy)	Total Res. (Ω)	No. of Decades	Resolution (Ω)
HARS-X-4-10	111.1 k	4	10
HARS-X-4-100	1.111 M	4	100
HARS-X-4-1K	11.11 M	4	1 k
HARS-X-4-10K	111.1 M	4	10 k
HARS-X-5-0.001	111.11	5	0.001
HARS-X-5-0.01	1.1111 k	5	0.01
HARS-X-5-0.1	11.111 k	5	0.1
HARS-X-5-1	111.11 k	5	1
HARS-X-5-10	1.1111 M	5	10
HARS-X-5-100	11.111 M	5	100
HARS-X-5-1K	111.11 M	5	1 k
HARS-X-6-0.001	1.111 11 k	6	0.001
HARS-X-6-0.01	11.1111 k	6	0.01
HARS-X-6-0.1	111.111 k	6	0.1
HARS-X-6-1	1.111 11 M	6	1
HARS-X-6-10	11.1111 M	6	10
HARS-X-6-100	111.111 M	6	100
HARS-X-7-0.001	11.111 11 k	7	0.001
HARS-X-7-0.01	111.1111 k	7	0.01
HARS-X-7-0.1	1.111 111 M	7	0.1
HARS-X-7-1	11.111 11 M	7	1
HARS-X-7-10	111.1111 M	7	10
HARS-X-8-0.001	111.111 11 k	8	0.001
HARS-X-8-0.01	1.111 111 M	8	0.01
HARS-X-8-0.1	11.111 11 M	8	0.1
HARS-X-8-1	111.111 11 M	8	1
HARS-X-9-0.001	1.111 111 11 M	9	0.001
HARS-X-9-0.01	11.111 111 1 M	9	0.01
HARS-X-9-0.1	111.111 111 M	9	0.1
HARS-X-10-0.001	11.111 111 11 M	10	0.001
HARS-X-10-0.01	111.111 111 1 M	10	0.01
HARS-X-11-0.001	111.111 111 11 M	11	0.001

* For less exacting applications, more economical tolerances are available:

- use "A" for "X" in part number for 0.05% basic accuracy, in lieu of .01%
- use "Q" for "X" in part number for 0.02% basic accuracy, in lieu of .01%
- use "B" for "X" in part number for 0.1% basic accuracy, in lieu of .01%

OPTIONS

- RM Rack mountable case for standard 19" rack
- K Kelvin type 4-terminal binding posts
- RO Rear output binding posts

