

With compliments

Helmut Singer Elektronik

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9334A Series

Ultra-Precise "Air" Resistance Standards

Very High Stability Calibration Laboratory Resistance Standards



9334A SERIES FEATURES

- ◆ 12 Month Stabilities Low as 2 ppm
- ◆ Wide Operating Range 18 °C to 28 °C
- ◆ Resistance Range 1 μΩ to 100 GΩ
- ◆ Report of Calibration at 3 Temperatures Points Included
- ◆ ISO 17025 Calibrations Available
- ◆ Compact and Ruggedized
- ◆ Nominal Initial Accuracy < 2 ppm
- ◆ Low Temperature Coefficients
- ◆ Voltage Hysteresis < 0.1 ppm
- ◆ High Power Rating, Low Power Coefficients
- ◆ Guard and Shield Compliant
- ◆ Direct Plug-In Models for Wavetek 1271 & 1281 DMMs
- ◆ 1 GΩ Direct Plug-In for Agilent 3458A & 1 GΩ & 10 GΩ Fluke 8508A DMMs
- ◆ Special Values Available On Request

GUILDLINE INSTRUMENTS 9334A SERIES of Resistance Standards are designed as very high stability calibration laboratory standards for high accuracy resistance calibration in air, without the need for stabilization in a temperature controlled bath.

They can be used as working standards or highly reliable and rugged transportable transfer standards. They are extremely useful for the calibration of resistance ranges of multi-function calibrators and high accuracy DVMs, as well as being used in more classical standards and calibration laboratory applications.

Hysteresis error is typically better than negligible to 0.1 ppm when stressed at three times the maximum voltage, and less than 0.3 ppm over a temperature cycle from 0 °C and 40 °C.

Connections to these resistance standards are by conventional 4-terminal connection up to 1MΩ and two terminal connections for values above 1MΩ. Models 9334AH-1G and the 9334AW-1G are designed to answer a difficult calibration need for owners of the HP/Agilent 3458A and the Wavetek/Datron 1271 & 1281 model DMMs.

The 9334A Series Precision Resistance Standards are available in a wide range of off the shelf and custom values to satisfy demanding applications between 1 μ

Recommended instrument verification at the 1 GΩ & 10 GΩ points (with voltages up to 200V) and typical connection methods make it difficult to obtain very stable readings. These special 9334A's are designed to fit directly into the appropriate DMM's input terminals, without the necessity of external leads and the inherent problems of noise pickup and handle voltages up to 1500V's!

The 9334AH-1G and 9334AH-10G are also specially designed to support the calibration of the Fluke 8508 & Agilent 3458A.

Special values such as 0.25 Ω, 25 Ω, and 200 Ω are available for precision thermometry. Standards available for Quantum Hall Effect applications include 6.4532 kΩ and 12.9064 kΩ. If linearity verification of a long scale DVM is your challenge, 1.9 x cardinal resistance points are available. If you have a special resistance application between 1 μΩ and 100 GΩ, Guildline can supply a precision standard to fulfill your requirement.

For The Ultimate In Resistance Standard Check Out The **6634A TEMPERATURE STABILIZED RESISTANCE STANDARD!**



9334A Series of Precision Air Resistance Standards

The 9334A Series starts with the Low to Ultra-Low Values. The available standard values in this range start at an amazing $1\ \mu\Omega$ and go all the way in decade values to 10 mOhm's. For values less than 1 milliohm, the current (C) Terminals are easily identified by the large black terminals. These terminals can handle currents from 20 Amps all the way up to 100 Amps at a $1\ \mu\Omega$. With their ultra-low drift specifications, just 5 ppm per year for a 10 mOhm, these units are perfect for calibrating precision DC sources such as Transconductance Amplifiers, milli and micro Ohmmeters and precision sources.



There are two levels of specifications for stability for these values. The 1st year stability is the maximum drift specification after the first year of ownership. Then, due to the unique design of these resistance standards, the 2nd year drift is the maximum drift specification for subsequent years of ownership. For example, if you purchased a 1 milliohm model (9334A-1m), after 12 months of use, the next annual recommended calibration should be no more than 15 ppm from initial calibration value. Then for the 2nd year of use, the unit should not drift any more than 10 ppm and will get better with time.

Specifications for Low to Ultra-Low Values

Model (Nominal)	Initial ¹ Tolerance \pm ppm	Stability (\pm ppm) ²		Maximum Limits		Temperature Coefficient \pm ppm/ $^{\circ}$ C	Voltage ⁴ Coefficient \pm ppm/ V_{dc}
		1 st Year ³	2 nd Year or 12 Months	mAmps	Voltage		
9334A-1 μ	500	250	50	100A	0.0001	50	-
9334A-10 μ	200	100	25	50A	0.0005	25	-
9334A-100 μ	50	25	15	20A	0.002	8	-
9334A-0.001	20	15	10	6A	0.006	1.5	-
9334A-0.01	10	10	5	3A	0.03	0.5	-

Mid-Range values start at 100 mOhm and go all the way to 10 MOhm. These are the world's most accurate, 4-terminal Resistance Standards available today. Look at the 1 Ohm and 10 kOhm 12 month stability specification. These resistance values are typical key artifact calibration points. The 9334A-1 Ohm and the 9334A-10kOhm are the only Air resistance standards available today with 1 year specifications that allow a full 4:1 artifact verification of a Fluke 5720. This means no special characterization or 6 month calibration intervals for these values minimizing life cycle and calibration costs. The best in primary drift and other specifications means you are getting the best value for your money!

Specifications for Mid-Range Values

Model (Nominal)	Initial ¹ Tolerance \pm ppm	Stability (\pm ppm) ²		Maximum Limits		Temperature Coefficient \pm ppm/ $^{\circ}$ C	Voltage ⁴ Coefficient \pm ppm/ V_{dc}
		1 st Year ³	2 nd Year or 12 Months ³	mAmps	Voltage		
9334A-0.1	5	4	4	1A	0.1	0.3	-
9334A-1	2	2.5	2.5	320	0.32	0.2	-
9334A-10	2	2.5	2.5	100	1	0.2	-
9334A-25	2	2.5	2.5	64	1.6	0.2	-
9334A-100	2	2.5	2.5	32	3.2	0.2	-
9334A-400	2	2.5	2.5	16	6.3	0.2	-
9334A-1k	2	2.5	2.5	10	10	0.2	-
9334A-10k	2	2.0	2.0	3.2	32	0.2	0.01
9334A-100k	3	4	4	1	100	0.3	0.03
9334A-1M	5	4	4	0.32	320	0.3	0.05
9334A-10M	15	5	5	0.1	1000	2.5	0.1

9334A Series of Precision Air Resistance Standards

Available in two-wire configurations, the HIGH VALUE MODELS start at 100 MOhm and continue to 100 GOhm's with the best available specifications today from any commercial "Air" Resistance Standard. Like the low value models, the high value models come with a two-tier stability specification. The 1st year applies only to the first year of ownership, while subsequent years would use the 2nd year drift specification.

All high value models all can handle 1500 Volts. With the best yearly drift specification, the highest voltage handling capability and the very low voltage coefficients, these standards are perfect for calibration of long scale DMM's such as the Fluke 8508 (which can produce up to 200 Volts). They are also the best available solution for calibrating Meg-Ohmmeter, Electrometers and other high resistance applications. No need to worry about overloading these standards.

Specifications for High Values

Model (Nominal)	Initial ¹ Tolerance ± ppm	Stability (± ppm) ²		Maximum Limits		Temperature Coefficient ± ppm/°C	Voltage ⁴ Coefficient ± ppm/V _{dc}
		1 st Year ³	2 nd Year or 12 Months ³	mAmps	Voltage		
9334A-100M	35	20	10	0.015	1500	5	0.2
9334A-1G	50	25	10	0.0015	1500	6	0.3
9334AH-1G	50	25	10	0.0015	1500	6	0.3
9334AW-1G	50	25	10	0.0015	1500	6	0.3
9334A-10G	100	100	20	0.15uA	1500	25	0.5
9334AH-10G	100	100	20	0.15uA	1500	25	0.5
9334A-100G	350	200	50	0.015uA	1500	250	1

Note 1: Nominal initial tolerance is defined as the maximum variation of resistance mean values as initially adjusted at the point of sale.

Note 2: Calibrated in air at 21, 23 and 25 °C referred to the unit of resistance as maintained by the National Research Council of Canada or the National Institute of Standards and Technology, and expressed as a total uncertainty with a coverage factor of k = 2. A traceable report of calibration stating the measured values and uncertainty is provided with each resistor. Calibration Uncertainty can be located on Guildline's Scope of Accreditation.

Note 3: Initial 12 month drift specification is one time specification for first year of ownership only. The initial 12 month drift is higher due to long-term stabilization of precision elements. After the initial 12 months, the 2nd year specification is used as the maximum yearly drift specification.

Note 4: Voltage hysteresis: negligible to < 0.1 ppm. Temperature hysteresis: < 0.3 ppm between 0 °C and 40 °C

Note 5: Special/Custom Values available upon request including 1.9X values.

GENERAL SPECIFICATIONS

Environmental	Temperature	Humidity	Dimensions	Height	Width	Depth	Weight
Operating	18 °C to 28 °C	<70% RH non-condensing	Models ≤ 100μΩ	97 mm 3.8"	124 mm 4.9"	79 mm 3.1"	1.1 kg 2.4 lbs
Storage	-20 °C to 60 °C	15% to 80% RH	Models ≥ 1mΩ	82 mm 3.2"	124 mm 4.9"	79 mm 3.1"	0.6 kg 1.4 lbs

ORDERING INFORMATION

9334A-Model	Resistance Standard (List Ohmic Value For Model)
9334A-X	Customer Specified Value (State Value)
/TM9334A	Technical Manual included at no charge.
/Report	Certificate and Report of Calibration (with data) included
Optional Calibration Services (ISO 17025 Service Available)	
/Temp	Additional Customer Specified Temperature Point (Charge)
/Voltage	Additional Customer Specified Voltage Point (Charge)
/Current	Additional Customer Specified Current Point (Charge)
Precision Low Thermal Leads Are Available – Call and tell us your requirements	

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