

## AC HIGH VOLTAGE CAPACITANCE AND INDUCTANCE BRIDGE

*Still* providing the Most Accurate Capacitance & Inductance Measurements!



**Guildline Instruments 9910A High Voltage Capacitance Bridge** is a measurement standard employing the AC Current Comparator principle. The Current Comparator principle is applied to the measurement of ratio and dissipation factors of high voltage capacitors in a similar manner to the classical Schering Bridge but with greatly improved accuracy and resolution.

The Model 9910A High Voltage Capacitance and Inductance Bridge brings the superior accuracy of the Current Comparator to those applications too stringent or demanding for conventional Schering Bridges. Referred to an external gas-filled standard capacitor, accuracy and resolution are better than 15 ppm. The instrument is ideally suitable for low-cost, high voltage, power cable measurements.

**AN OPTIONAL 9911 RANGE EXTENDER IS AVAILABLE FOR SPECIAL USE IN SHUNT REACTOR LOSS MEASUREMENT AND POWER TRANSFORMER TESTING APPLICATIONS!**

### FEATURES

- Better than 15 ppm accuracy, permanent
- Direct reading, six-digit measurements of capacitance from 100 pF to 1000  $\mu$ F
- Dissipation factor up to 11.1 percent
- Working Voltage to 50 kV with 9911
- Safe to operate, even into Megavolt region
- Bridge components remain at ground potential
- Ideal for measuring low-loss, high voltage, power cables, insulators, transformers, P.F. correction capacitors and reactors

This makes the 9910A a unique and versatile instrument for a wide range of applications including cable testing, corona loss measurements, insulator and dielectric testing, inductance measurements, potential transformer error measurements, shunt reactor loss measurements and power transformer testing.

This High Voltage Capacitance and Inductance Standard has a direct reading capacitance ratio of 0 to 1.111,110 in steps of 0.000,001 (1 ppm). The 9910A has a direct reading dissipation range of -0.110999 to +0.110999 in steps of 0.000,001 (1 ppm).

Bridge resolution is 1 ppm. Capacitance ratio linearity is better than 1 ppm, uncertainty / accuracy is < 15 ppm, fixed permanently. Accuracy essentially depends on turns ratio only. Measurements may be safely made into the megavolt region, as bridge components remain at or near ground potential.

# 9910A High Voltage Capacitance and Inductance Bridge

The model 9910A High Voltage Capacitance and Inductance Bridge is housed in a durable metal cabinet. There is a 3U space allocated at the top of the cabinet to install a null detector so that it is positioned at eye level. The null detector is an optional item. The null detector provided by Guildline is a digital dual phase lock-in amplifier. A 1.3 Vrms reference signal synchronized to the line frequency is provided on the input transformer section of the 9910A which can be used as the reference input of the lock-in amplifier.

The 9910A Bridge is located below the detector with the capacitance ratio and dissipation dials dominating the front panel. The bridge comparator toroid is mounted at the rear of the cabinet within a magnetic shield. The feedback and lead compensation amplifiers are within a magnetic shielded box. The connectors and ground terminals for connection to the standard and unknown capacitors are on the back.

Extensive use is made of shielded cables. Critical areas are magnetically shielded, and the cabinet is fabricated with steel material that acts as an electrostatic shield to avoid stray pick-up. A separate, optional 9911A Range Extender (i.e. compensated current transformer) is available of circular construction with a center hole for feed through turns. The internal windings are brought out to terminals mounted on the base plate. Note that the High Voltage Source required for excitation of the Capacitance or Inductance being measured is not supplied with the 9910A.

The optional 9911 is used to extend the range of the 9910A and for special use in shunt reactor loss measurement and power transformer testing applications. Constructed in two parts – toroid and primary bar, the model 9911 is a two-stage transformer with a 1000:1 ratio that can be extended to 1,000,000:1.

A 1000 pF standard can then be used to measure capacitance values up to 1000 μF. Maximum accuracy of the range extender is 3 ppm with bridge range at 1000:1 ratio.



Optional 9911

## Specifications (1 Year)

9910A CAPACITANCE SPECIFICATIONS					
Direct-Reading Capacitance:		(1:1 nominal ratio), 1.111,110 in steps of 0.000,001 (1 ppm)			
Direct Reading Dissipation Factor:		-0.110999 to +0.110999 in steps of 0.000,001 (1 ppm)			
Capacitance Decade Scaling Ratios:		1000, 500, 200, 100, 50, 10, 5, 2 and 1 to 1			
Current Rating:		Max bridge current through 10 mA through standard capacitor. Current through the measured capacitor is dependent on the capacitance ratio and is not the limiting factor			
		Capacitance Ratio		Dissipation Factor	
Bridge Resolution (All ranges at rated current)		1 ppm		1 ppm	
Linearity		>1 ppm		0.1% of reading	
Accuracy <sup>1</sup> For D factors <0.1%		±15 ppm		±15 ppm	
Accuracy <sup>1</sup> For D factors up to 10%		±15 ppm (±0.005 × D Factor)		±1% of reading	
Power Requirements:		120 V, 60 Hz, 150 W		240 V, 50 Hz, 150 W	
				Specify at Time of Order	
Weight:		140 lbs	64.3 kgs	Dimensions	20" W x 22.5"D x 22" H
				51 cm x 57cm x 56 cm	

**Note 1:** All ranges – capacitance dials at maximum

# 9910A High Voltage Capacitance and Inductance Bridge

## 9910A INDUCTANCE SPECIFICATIONS <sup>1</sup>

C <sub>s</sub>	Bridge Ratio	Range Extender Ratio	≈Max Inductance for 1 ppm Resolution	Max Inductor Current	Ratio Accuracy <sup>2</sup>
1000 pF	100:1	10:1	7 H	10 A	± 15 ppm
1000 pF	1000:1	1000:1	7 mH	1000 A	± 15 ppm
100 pF	100:1	10:1	70 H	10 A	± 15 ppm
100 pF	1000:1	1000:1	70 mH	1000 A	± 15 ppm

**Note 1:** Typical ranges according to standard capacitance value C<sub>s</sub>, Bridge nominal ratio, and Range Extender ratio

**Note 1:** 9911 Accuracy not included.

## OPTIONAL DUAL-PHASE LOCK-IN AMPLIFIER SIGNAL CHANNEL SPECIFICATIONS

Voltage Input	Single-ended or differential	Sensitivity	2 nV to 1 V
Current Input	10 <sup>6</sup> or 10 <sup>8</sup> V/A		
Input Impedance	Voltage	10MΩ + 25 pF, AC or DC Coupled	
	Current	1 kΩ to virtual ground	
Gain Accuracy	±1% (±0.2% typical)		
Input Noise (typical)	6 nV/√Hz @ 1 kHz		
	0.13 pA/√Hz @ 1 kHz (10 <sup>6</sup> V/A)		
	0.013 pA/√Hz @ 100 Hz (10 <sup>8</sup> V/A)		
Line Filters	50/60 Hz and 100/120 Hz (Q=4)		
CMRR	100 dB to 10 kHz decreasing by 6 db/octave above 10 kHz		
Harmonic Distortion	-80 dB		
Dynamic Reserve	100 dB (with no signal filters)		
Stability	< 5 ppm/°C		
Interface	RS232, GPIB (IEEE-488.2)		

## OPTIONAL 9911 RANGE EXTENDER SPECIFICATIONS

Maximum Primary Current:	1000A		Bridge Range	Burden	Accuracy
Maximum Working Voltage:	50 kV				
Turns Ratio:	1000:1 / 10:1		X1000	0.04 Ω	± 3 ppm
Weight Primary Bar	45 lbs	20.5 kg	X500	0.01 Ω	± 5 ppm
	Weight Toroid	130 lbs	59 kg	X200	0.2 Ω
X100				0.4 Ω	± 25 ppm

# 9910A High Voltage Capacitance and Inductance Bridge

## Unparalleled Support

Guildline Instruments provides an **industry leading two-year warranty** on this device. We know that the 9910A and associated options **will work for you** out of the box and in the future... and we back it up.

ORDERING INFORMATION	
9910A	AC High Voltage Capacitance and Inductance Bridge
/60Hz	60 Hz Test Frequency
/50Hz	50 Hz Test Frequency
/Dual	50 and 60 Hz Test Frequencies
/TM	Technical Manual (Included)
/ND	Null Detector / Lock In Amplifier
9911A	Range Extender
Specify Operating Voltage and Frequency (eg 120V @ 60 Hz)	

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