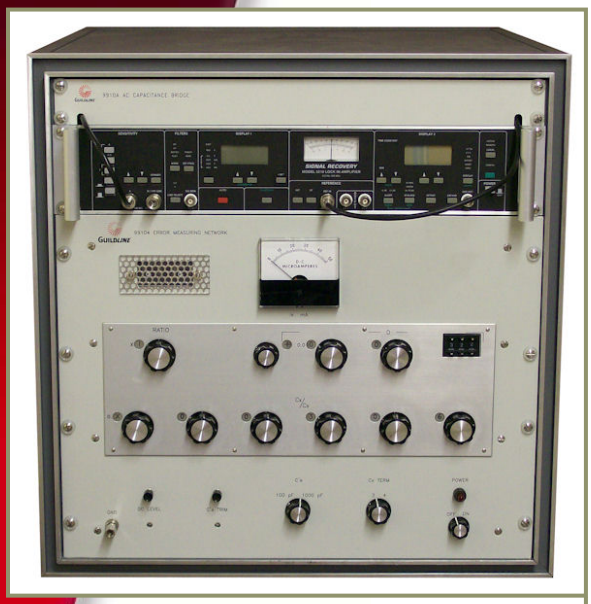
# 9910A

## AC High Voltage Capacitance and Inductance Bridge

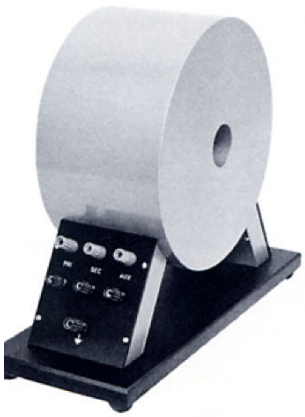
*Still* providing the Most Accurate Capacitance & Inductance Measurements!



### 9910A Model Features

- Better than 15 ppm accuracy, permanent
- Direct reading, six-digit measurements of capacitance from 100 pf to 1000 µF
- Dissipation factor up to 11.1 percent
- 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

View of Optional 9911



**Guildline Instruments Model 9910A High Voltage** Capacitance Bridge is an instrument employing the AC Current Comparator principle.

The Current Comparator principle may be 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.

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 measurement standard has a direct treading 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).

**Optional 9911 Range Extender available for special use in shunt reactor loss measurement and power transformer testing applications!**

Bridge resolution is 1ppm. Capacitance ratio linearity is better than 1ppm, and 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.

An optional Model 9911 Range Extender is available. The 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 a1000:1 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.

Null Detection is accomplished via a dual-phase lock-in amplifier supplied with the 9910A Bridge. The selected amplifier provides:

- Continuous full-scale sensitivity control – this control also includes a sensitivity vernier control, allowing the full scale sensitivity to be set to any value between the calibrated values.
- Unique Walsh Function Demodulators. The modulator multiplies the applied signal by a stepped approximation to the reference sinusoidal waveform.
- Powerful fourth-order signal channel Bandpass, Low Pass or Notch filter
- High Dynamic Reserve
- Two independent line frequency rejection filters
- Up to 130 dB Dynamic Reserve
- Synchronous 15-bit ADC for lower output jitter

### 5210 DUAL-PHASE LOCK-IN AMPLIFIER SPECIFICATIONS

| | | |
|---|---|---|
| Input Mode | Voltage | Single-ended or true differential |
| | Current | Virtual ground |
| Sensitivity | Voltage | 10 nV to 3 V (with output expand) |
| | Current | $10^{-6}$ A/V, $10^{-8}$ A/V Conversion |
| Impedance | Voltage | 100MΩ // 25 pF |
| | Current | 25 W ($10^{-6}$ A/V) |
| Noise | Voltage | 5 nV/√Hz @ 1 kHz |
| | Current | 13 fA/√Hz ($10^{-8}$ A/V) @ 1 kHz |
| CMRR | | 120 dB @ 1 kHz |
| Frequency Response | | 0.5 Hz to 120 kHz |
| Dynamic Reserve | | 130 dB (max) |
| Detection | Phases | 1 |
| | Modes | F, 2F |
| Output | Modes | X, Y (%): X, Y, (V): R, Ø, Noise |
| | Time Constant | 100 µS, 1 ms to 3000 S |
| | Roll-Off | 6 or 12 dB/octave |
| | Voltage | 10V FS |
| | Impedance | 1 kΩ |
| Interface | | RS232, GPIB (IEEE-488) |
| Auxiliary Control | | 4 ADC, 1 DAC |

## 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 | | | | |
| 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 57cmx 56 cm |

| | Capacitance Ratio | Dissipation Factor |
|---|---|---|
| Bridge Resolution (All ranges at rated current) | 1 ppm | 1 ppm |
| Linearity | >1 ppm | 0.1% of reading |
| Accuracy[1] For D factors <0.1% | ±15 ppm | ±15 ppm |
| Accuracy[1] For D factors up to 10% | ±15 ppm (±0.005 x D Factor) | ±1% of reading |

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

## 9910A INDUCTANCE SPECIFICATIONS

Typical ranges according to standard capacitance value $C_s$, Bridge nominal ratio, and Range Extender ratio

| Cs | Bridge Ratio | Range Extender Ratio | Approx Max Inductance for 6 Digit Resolution | Max Inductor Current | Ratio Accuracy[1] |
|---|---|---|---|---|---|
| 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:** 9911 Accuracy not included.

## 9911 RANGE EXTENDER SPECIFICATIONS

| | | |
|---|---|---|
| Maximum Primary Current: | 1000A | |
| Maximum Working Voltage: | 500 V between Secondary & Case | |
| Turns Ratio:: | 1000:1 / 10:1 | |
| Weight Toroid | 33 lbs | 15 kg |

| Bridge Range | Burden | Accuracy |
|---|---|---|
| X1000 | 0.04 Ω | ± 3 ppm |
| X500 | 0.01 Ω | ± 5 ppm |
| X200 | 0.2 Ω | ± 10 ppm |
| X100 | 0.4 Ω | ± 25 ppm |

## 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) |
| | Specify Operating Voltage and Frequency (eg 120V @ 60 Hz) |

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