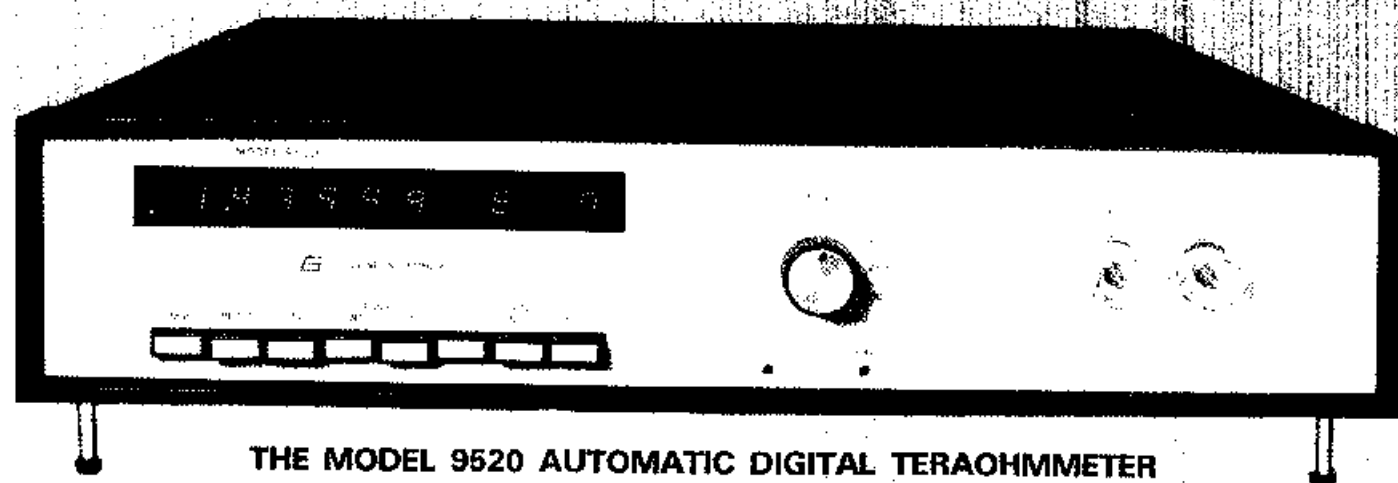


HIGH RESISTANCE TESTING AND MEASUREMENT



THE MODEL 9520 AUTOMATIC DIGITAL TERAOHMMETER

Designed for measurement of high resistance in the range of 10^8 to 10^{16} ohms. This instrument has the highest accuracy commercially available. Yet, because of its simplicity and ease of operation, this instrument is ideally suited for production line testing or incoming inspection of high value wire wound and film resistors, capacitor leakage resistance, microcircuit substrate resistance, transformer winding isolation, nuclear particle detector resistance, semiconductor resistivity, printed circuit board insulation, resistivity of fluids and many more.

GUILDLINE INSTRUMENTS
Modern Electronic Metrology

Measurement validity indicator confirms or qualifies accuracy of reading

Five digit LED display with 100% overranging - auto-ranging from 10^6 to 10^{16} - direct reading in ohms

Automatic blanking of meaningless digits

Only two input connectors for all measurements

All test voltages selected by a single switch

Integration indicator is illuminated during measurement cycle

In-line pushbutton controls for power on/off manual reset; positive/negative test voltage; continuous or single shot measurement mode; rate control - normal (x1, all three buttons out), x10, x100, x10,000

Simple periodic calibration with 10^7 ohm standard for all ranges

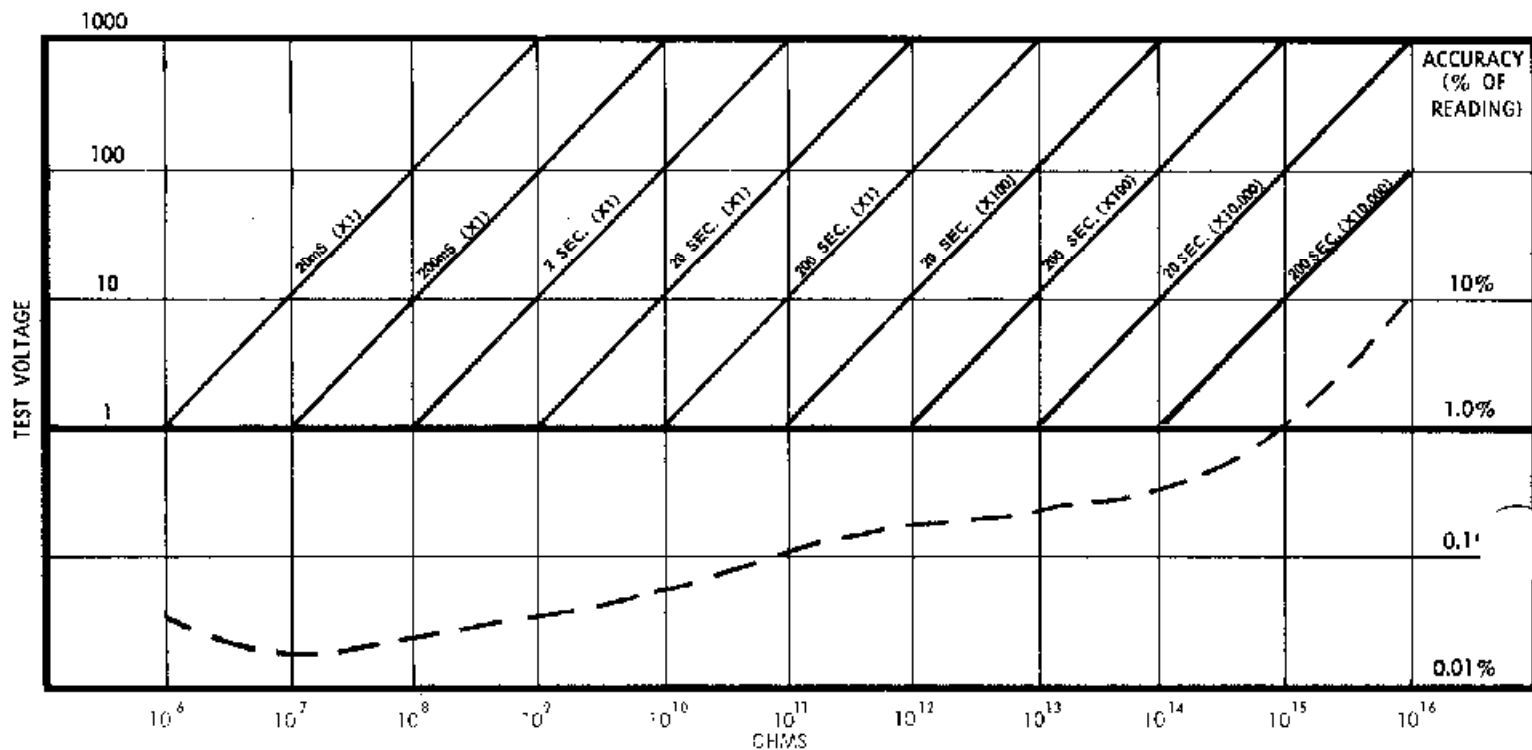
FEATURES

ACCURACY: Highest accuracy commercially available.

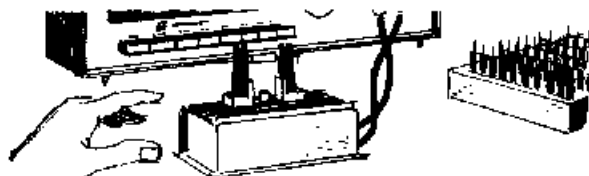
TEST VOLTAGE: Self-contained 0-1000 volt supply. This is the actual voltage appearing across the measured resistance.

GUARDING: Fully guarded input circuit at ground potential.

MEASUREMENT TIME: 10mS to 1000 seconds - dependent on control setting - no manual balancing is required - operation is automatic.



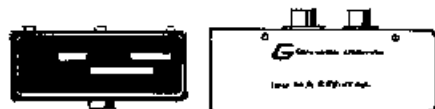
APPLICATIONS



Production line testing or incoming inspection of high value resistors, quickly and automatically.



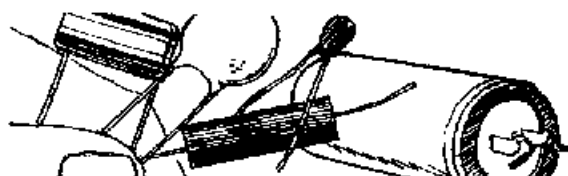
Calibration of Electrometers and Picoampere Sources, by direct measurement of input resistance.



A high resistance standard of unequalled accuracy above 10^{12} ohms — invaluable in the standards laboratory for the calibration or intercomparison of fixed standards.



Semiconductor substrate and surface resistivity, printed circuit board insulation, FET input resistance.



Measurement of capacitor leakage resistances, open circuit reed switch resistance.



Resistivity of fluids, photosensitive paper, insulating tapes and materials.



Insulation resistance and voltage breakdown of single or multi conductor cables.



Voltage coefficient of resistance from 1 to 1000 volts — quickly and simply.

THEORY OF OPERATION

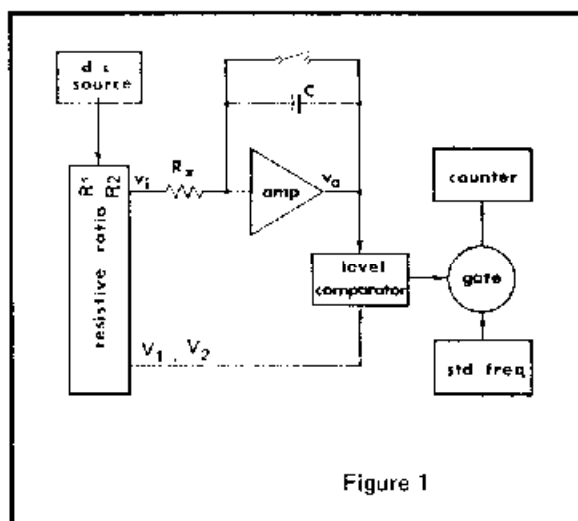


Figure 1

The basic block diagram of the system is shown in Figure 1 where R_x denotes the high resistance under test. Operation is based upon an analog integration technique employing a high quality, solid state electrometer and a feedback capacitor C .

The integration process is initiated by opening the switch across C . Shortly thereafter a timing gate opens for an interval (Δt) between coincidence of the output voltage V_o with two references V_1 and V_2 .

A simplified expression for the unknown is given by

$$R_x = \frac{\Delta t}{C} \cdot \frac{V_i}{-\Delta V} \quad \text{where } \Delta V = V_2 - V_1$$

With the circuit as depicted in Figure 1, the term $\frac{V_i}{-\Delta V}$ can be replaced by the ratio of two resistances R_1 and R_2 , and R_x can be read out digitally.

$$\text{Thus } R_x = \left[\frac{R_1}{R_2} \cdot \frac{1}{fC} \right] \bar{N}$$

where \bar{N} is the mean of registered counts in the digital counter for reversed d.c. determinations and f is the standard frequency in Hz.

The above description is oversimplified in the interests of brevity. A complete treatment is found in "An Accurate, Semiautomatic Technique of Measuring High Resistance" by Dr. S. Hoi Tsao, (proceedings of the 1967 IEEE International Conference) available on request from Guildline Instruments.

SPECIFICATIONS

RANGE: Auto-ranging from 10^6 through 10^{16} ohms.

ACCURACY: As tabulated below. Traceable to NBS or NRC. Based on the mean of reversed DC readings at a current of no less than one picoampere.

RANGE IN OHMS	ACCURACY (of reading)	DISPLAY RESOLUTION† (of full scale)	RANGE IN OHMS	ACCURACY (of reading)	DISPLAY RESOLUTION† (of full scale)
10^6	$\pm 0.05\%$	0.01%	10^{11}	$\pm 0.1\%$	0.01%
10^7	$\pm 0.025\%$	0.001%	10^{12}	$\pm 0.2\%$	0.01%
10^8	$\pm 0.035\%$	0.001%	10^{13}	$\pm 0.3\%$	0.01%
10^9	$\pm 0.05\%$	0.001%	$*10^{14}$	$\pm 0.5\%$	0.1%
10^{10}	$\pm 0.07\%$	0.01%	$*10^{15}$	$\pm 1\%$	0.1%
			$*10^{16}$	$\pm 10\%$	1%

* These accuracies are inferred from the basic linearity of the instrument.

† Meaningful resolution approximately four times accuracy.

AMBIENT CONDITIONS: 15 to 30°C, at not greater than 50% R.H.

DISPLAY: 5 digit LED display with 100% overranging plus index digits

MEASUREMENT VALIDITY INDICATORS: A LED is automatically illuminated if the integration time is going to exceed approximately 200 seconds. This cautions the operator that the reading may be outside the accuracy specification. If the integration time is less than 10 milliseconds the entire display is blanked out.

Another LED is illuminated while the instrument is actually integrating.

MEASUREMENT TIME: 20mS - 200 seconds nominal rated accuracy.

10mS to 20mS and 200 seconds to 1000 seconds with some degradation.

TEST VOLTAGE: 1, 2.5, 5, 10, 25, 50, 100, 250, 500, 1000 volts selected by front panel switch. NOTE: This is actual voltage appearing across the measured resistance. Ranges above 100 volts are offered as an option.

SET ZERO: Adjustment for user convenience - allows equalization of reversed readings - does not effect accuracy.

CALIBRATION: Adjustment for periodic calibration.

PUSH BUTTON CONTROLS (left to right): Power on/off; reset; positive/negative test volts; continuous mode; single shot mode; rate control - normal (x1 all buttons out) x10, x100, x10,000.

NOTE: The rate is selected in conjunction with the required test voltage to give the most convenient measurement time according to the measured resistor value.

OUTPUT CONNECTORS: General Radio Type 874.

DIMENSIONS: Standard 19" width, 3 1/2" height, and 18" depth (48.3 x 8.9 x 45.6 cm). 30 pounds (13.6 kg).

POWER REQUIREMENTS: 115/230 volts. 50/60 Hz. 50 watts.
Specifications subject to change without notice.

OPTIONS

- 01 **EXTENDED TEST VOLTAGE RANGE:** 250, 500, and 1000 volts.
- 02 **BCD OUTPUT:** Providing 1248 output from rear connector.
- 03 **BENCH MOUNTING:** for Model 9520 Terachmmeter or Model 95202 Oven.

ACCESSORIES

- 95201 **TEMPERATURE EQUALIZING CHAMBER:** A shielded and draft free environment for samples under test. This assembly simply plugs into the Model 9520 and a hinged lid gives access to the internal connectors.
- 95202 **TEMPERATURE CONTROLLED OVEN:** Choice of preset temperatures of 25, 28 or 30°C to an accuracy of $\pm 0.1^\circ\text{C}$ allows highest accuracy measurements. Standard 19" rack mountable.

95203 **TERMINAL CONVERSION ASSEMBLY:** Converts from the G.R. Type 874 connector to a banana plug, BNC or standard resistor connection as specified. The latter is an adjustable three-pin banana plug arrangement which is common to many high resistance standards.

95204 **REMOTE CABLE ASSEMBLY:** A pair of cables terminated at both ends with G.R. Type 874 connectors, 18" or 60" length as specified.

95205 **CAPACITOR LEAKAGE ADAPTOR:** A shielded enclosure to eliminate noise problems associated with the measurement of dielectric absorption of capacitors.

NOTE: Special test fixtures, probes and cables can be supplied for most applications, prices on request.



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INC.**

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represented by