

1616 Precision Capacitance Bridge

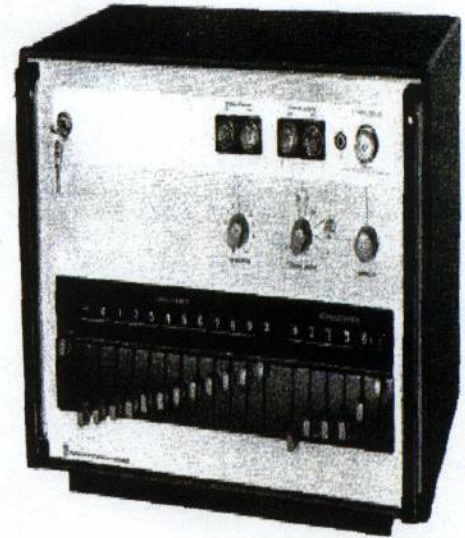
The heart of precision. The 1616 is the heart of the 1621 Capacitance-Measuring Assembly. The bridge is also available separately for use where oscillator and detector are on hand or in applications in which they must be specialized for a unique need.

The 1616 employs a transformer ratio-arm bridge with which unbalances as small as 0.1 aF (10^{-7} pF) and 100 aS (10^{-10} μ S) can be resolved. Detection of such small unbalances is aided by ratio-transformer voltage capabilities up to 160 volts at 1 kHz and by range switching that disconnects the unused internal standards in order to reduce shunt capacitance across the detector input.

For thermal stability in precision intercomparisons, eight of the twelve internal capacitance standards are mounted in an insulated compartment to reduce the effects of ambient temperature changes. Misreading the values at balance is virtually impossible due to direct-reading lever switches that control the balance for both capacitance and conductance. Panel layout is unusually neat—only the unknown capacitor and, if desired, and external standard for comparison measurements are connected to the front panel; the oscillator and detector are connected to the rear as are the BCD data-output channels.

- 10^{-7} pF to 10 μ F - 12 digital readout
- 10^{-10} μ S to 1000 μ S - 5 digital readout
- 10 Hz to 100 kHz

- up to 150-V input from oscillator
- 3-terminal measurements
- coaxial measurements



Model 1616 Precision Capacitance Bridge

SPECIFICATIONS

Capacitance measurement, 3-terminal; DECADES: 12. RANGE: 0.1 aF to 1 μ F (10^{-19} to 10^{-6} F). ACCURACY: ± 10 ppm, when most-significant decade is 1, 10, or 100 pF per step; otherwise, and at other frequencies, accuracy is $\pm[50\text{ppm} + (0.5 + 20 C_{\mu\text{F}})(f_{\text{kHz}} \text{ ppm} + (f_{\text{kHz}}) \text{ aF})]$. Capacitance, 2-terminal: Same as above, except as follows. RANGE: One additional decade, to 10 μ F (10^{-19} to 10^{-5} F).

Conductance measurement, 3-terminal: DECADES: 5 (virtually extended to 11 by G multiplier). RANGE: 100 aS to 100 μ S (10^{-16} to 10^{-4} S). ACCURACY: $\pm(0.1\% + 1 \text{ step in least significant decade})$. There is a small reduction in conductance accuracy at frequencies other than 1 kHz. RESIDUAL C (across conductance standards): $\pm(<0.03 \text{ pF})$.

Conductance, 2-terminal: Same as above, except as follows: RANGE: One additional decade, to 1000 μ S (10^{-16} to 10^{-3} S).

Multipliers: FOR 3-TERM: X1, X10; FOR 2-TERM: X1, X10, X100; affect both C and G. FOR CONDUCTANCE ONLY: X1, X10⁻¹, ... X10⁻⁶ (7 positions). Effects of these multipliers are included in the specified ranges.

Frequency: 10 Hz to 100 kHz.

Standards: CAPACITANCE; Air dielectric with TC $< +20$ ppm/°C and D < 10 ppm for 8 lowest decades; Invarf, air dielectric with TC of $+3 \pm 1$ ppm/°C and D < 10 ppm for 3 middle decades; mica dielectric with TC of 20 ± 10 ppm/°C and D < 200 ppm for 2 highest decades. ADJUSTMENTS for all capacitance standards available through key-locked door on panel. THERMAL LAG: C standards for first 8 decades mounted in an insulated compartment with a thermal time constant of 6 h (time required for compartment interior to reach 63% of ambient change).

CONDUCTANCE: Metal-film resistors in T networks with small phase angles.

Comparison: Terminals provided to connect external standard for comparison measurements; 13-position panel switch multiplies standard by -0.1, 0 ... +1.

Input: The smaller of 160 f_{kHz} or 350 V rms can be applied to the bridge transformer at the GENERATOR terminal without waveform distortion; 500 V rms max, depending on conductance range, when GENERATOR and DETECTOR connections are interchanged.

Interface: GR900[®] locking coaxial connector on panel to connect 2-terminal unknowns, 2 gold-plated GR900[®] locking coaxial connectors on panel to connect 3-terminal unknowns and 2 to connect external standard. DATA OUTPUT; 50-pin and 36-pin type 57 connectors on rear provide connection to 8-4-2-1 weighted BCD contacts (rated at 28 V, 1 A) on each switch for capacitance and conductance values respectively. OSCILLATOR and DETECTOR: Connect to rear BNC connectors.

Required: OSCILLATOR: GR 1316 recommended. DETECTOR: GR 1238 recommended. The 1616 Bridge is available with this oscillator and detector as the 1621 Capacitance-Measuring Assembly.

Available: 1316 OSCILLATOR, 1268 DETECTOR, a broad line of capacitance and resistance standards, and coaxial cables for connection of unknowns and standards.

* Accuracy stated as fraction of measured value, for these conditions; frequency, 1 kHz, except as noted, temperature, $23^\circ \pm 1^\circ\text{C}$; humidity, $<50\% \text{RH}$.

^t Registered trademark of the Carpenter Steel Co. National stock numbers are listed at the back of the catalog.

Mechanical: Bench or rack model. DIMENSIONS:

Bench: 35.1 cm H x 50.2 cm W x 32.7 cm D (13.81" x 19.75" x 12.88")

Rack: 31.0 cm H x 48.3 cm W x 26.8 cm D (12.22" x 19" x 10.56")

WEIGHT: Bench, 26 kg (57 lb) net, 32 kg (69 lb) shipping; rack, 23 kg (49 lb) net, 28 kg (61 lb) shipping.

Ordering: 1616-9700 Bench Model
1616-9701 Rack Model

