

Model CB-100

Low-Voltage Capacitance and Insulation Power Factor Test Set



- **Lightweight and portable**
- **100 Hertz test frequency**
- **28 volt test voltage**
- **Test mode selector switch**
- **Direct reading of capacitance and dissipation factor**
- **Perform tests in UST and GST configuration**

DESCRIPTION

The Model CB-100 Low-Voltage Capacitance and Insulation Power Factor Test Set is a self-contained instrument for the accurate measurement of electrical insulation characteristics.

Model CB-100 is an easily balanced, direct-reading bridge designed for testing in the laboratory, shop or substation. Measurements of capacitance are expressed in μF or pF. The dissipation factor, or “power factor” is indicated directly in percent.

The test selector switch allows the operator to conduct up to five tests in both the GST and UST configurations without the need to change the lead connections to the specimen.

APPLICATIONS

Model CB-100 is used for testing a wide variety of electrical insulation including that found in power transformers, circuit breakers and most other substation apparatus. Using test cells or jigs, it can also test insulating liquids and solids.

Capacitance and dissipation factor measurements are used to give an indication of the condition of insulation. Periodic readings on high-voltage electrical equipment are used for trending; to help detect problems in equipment before insulation breakdown occurs.

Model CB-100 uses the transformer ratio arm bridge.

A 28 volt power supply inside the instrument energizes an internal reference capacitor and the insulation under test.

The test currents are balanced using transformer arm taps and precision resistors.

A center-scale null meter indicates when the test set is balanced, and readings are read directly off the instrument dials with no calculation.

Testing in substations and switchyards often results in a precision bridge giving erroneous readings due to influences from nearby energized equipment and high-voltage lines.

Model CB-100 overcomes 60 Hertz interference by shifting the frequency of the bridge output to 100 Hertz. When the null detector is tuned to 100 Hertz, unwanted signals are effectively filtered out and only the desired test current is measured.

Test configurations (UST, GST) can be switched, using a simple selector switch. This allowing complex insulating systems to be tested without changing test connections.

A classic application for Model CB-100 has been in the drying-out process used by transformer manufacturers.

In this process, the transformer is heated under partial vacuum conditions to vaporize and remove moisture from the insulating material, such as paper. Model CB-100 is connected to the transformer during this process.

The dissipation factor of the transformer drops as the paper dries out, typically from 30% to 0.5%. As this occurs, the DF reading of Model CB-100 can be used to determine when to terminate the process. This is done without interrupting the drying-out process.

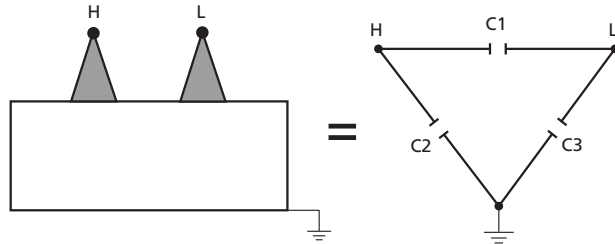
TYPICAL TEST APPLICATIONS

Three-Terminal Equipment

Because it is guarded, Model CB-100 is capable of measuring all components in two- and three-terminal devices, such as the power transformers illustrated below.

Measure the following capacitances without changing leads on the transformer: C1, C2, C3, C1 + C2, C1 + C3.

Four-Terminal Equipment



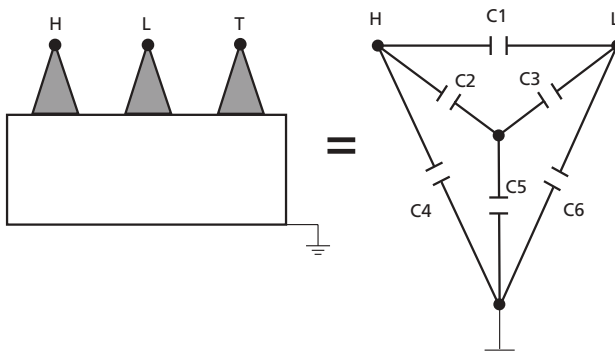
Three-phase, two-winding power transformer and equivalent circuit. All three high-voltage terminals have been connected together to form one high-voltage terminal, and all three low-voltage terminals have been connected together to form one low-voltage terminal.

Model CB-100 can be used to test four-terminal equipment such as transformers with tertiaries and multipole air-blast circuit breakers.

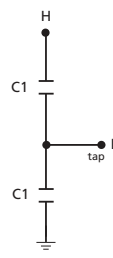
All the associated capacitances can be measured by using a fourth lead and a T-connection at the bridge.

Measure the following capacitances without changing leads on the transformer: C1, C2, C3, C4, C5, C6, C1 + C2, C1 + C3, C2 + C4, C3 + C6, C4 + C5, C5 + C6, C2 + C5, C3 + C5.

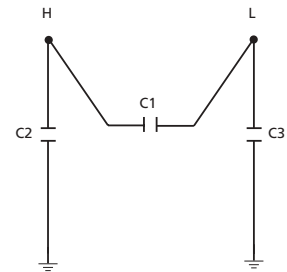
More multiple series/parallel combinations can be measured, such as $C4 + (C1 + C6) = HL-G$.



Typical three-phase, three-winding power transformer and equivalent circuit. The appropriate bushings have been connected together as in the two-winding transformer.



Equivalent circuit of a bushing with capacitor tap



Equivalent circuit of a single oil-filled circuit breaker

Other Examples

Simple oil-filled circuit breakers and bushings with a capacitor tap also can be tested with Model CB-100. The equivalent circuits are similar to that of the two-winding and the three-winding transformers described above, as are the components that can be measured.

FEATURES AND BENEFITS

- **Lightweight and portable:** The bridge is ideal for field and shop use, weighing only 14 lb (6.5 kg).
- **100 Hertz test frequency:** This allows accurate power system measurements to be made without interference problems from nearby equipment. The operating frequency is close enough to the power frequency that test results are not affected.
- **28 volt test voltage:** This low test voltage makes the instrument extremely safe to operate even by untrained personnel, making certain safety precautions unnecessary.
- **Test selector switch:** A five-position switch is provided to allow changing test modes between GST, GST-Guard and UST. Connections are changed internally, eliminating the need to move leads for every test.
- **Direct reading:** Capacitance and dissipation factor are read directly from the instrument. No calculations are required. Capacitance is expressed in pF or μF , and dissipation factor is in percent.
- **High resolution of reading:** 0.01% on capacitance and 0.001% on dissipation factor allow low values of capacitance and dissipation factor to be accurately measured.
- **Comprehensive instruction manual:** This provides detailed operating instructions, describes suggested analysis of results with typical test values and gives service and maintenance procedures.
- **Accessories:** A complete range of accessories to extend the testing capability and application of the instrument is available.
- **Test cells:** Several test cells are available for testing liquid and solid insulation in both the field and the laboratory, allowing a complete analysis to be performed on oil-filled equipment and verification of specifications of insulating materials.

- **Calibrator:** To verify proper operation of the bridge, a CB-CHEK™ calibrator is supplied to check all functions of Model CB-100.
- **Range extender:** For testing insulation with a capacitance greater than 1.2 μF , a range extension adapter is available. This enables Model CB-100 to test large capacitors, long cables and generators.

SPECIFICATIONS

Bridge Circuit

Transformer ratio arm bridge

Capacitance

12 multipliers are used to allow measurements from less than 20 pF to 1.2 μF .

Accuracy: $\pm 0.25\%$ of range ± 4 pF

Dissipation Factor (Power Factor)

Range	Accuracy	Resolution
0-1%	± 0.03	0.001%
1-10%	± 0.3	0.01%
10-20%	± 0.5	0.01%
20-30%	± 1.0	0.01%

Detector

Synchronous, tuned and phase-sensitive null detector

Test Voltage

28 V, 100 Hz for 60 Hz test set

28 V, 80 Hz for 50 Hz test set

Measurements

The instrument measures the following combinations:

UST C_{H-L} (ungrounded specimen test, HI to LO)

GST C_{H-G} (grounded specimen test, HI to ground, LO guard)

GST C_{L-G} (grounded specimen test, LO to ground, HI guard)

GST $C_{H-G} + C_{H-L}$ (grounded specimen test, HI to ground, plus HI to LO)

GST $C_{L-G} + C_{L-H}$ (grounded specimen test, LO to ground, plus LO to HI)

Power (specify one)

120 V, 60 Hz, 5 VA or 240 V, 50 Hz, 5 VA

or 220 V, 60 Hz, 5 VA

CB-CHEK™

Designed to verify the proper calibration and operation of Model CB-100. The unit provides a capacitance and dissipation factor constant for each of the five test modes.

Dimensions

2.5 H x 2.2 W x 2.3 D in.

64 H x 70 W x 57 D mm

Weight

0.5 lb (0.2 kg)

Dimensions

Instrument

10.3 H x 11.3 W x 8.5 D in.

262 H x 287 W x 216 D mm

Case

13 H x 22 W x 12 D in.

330 H x 560 W x 305 D mm

Leads

One 6.6 ft (2 m) power cord, one 33 ft (10 m) grounded lead, two 33 ft (10 m) coaxial measuring leads

Weight

Instrument: 14 lb (6.5 kg)

Shipping: 36 lb (16.5 kg)

Optional Accessory

Range Extension Adapter

A range extension adapter extends the measuring range of Model CB-100 for testing large capacitor banks and long cables. Four available range multipliers extend the range of the test set to up to 480 μF .

If purchased separately, Model CB-100 and the range extension adapter need to be calibrated together for best accuracy and performance.

Range Multipliers: 4, 25, 100 and 400, allowing Model CB-100 to measure up to 4.8, 30, 120 and 480 μF respectively

Dimensions

5 H x 6 W x 4 D in.

(125 H x 150 W x 100 D mm)

Weight

3.2 lb (1.4 kg)

ORDERING INFORMATION

Item (Qty)	Cat. No.	Item	Cat. No.
Model CB-100			
120 V, 60 Hz	810130	Optional Accessories	
240 V, 50 Hz	810130-1	Range extension adapter	
220 V, 60 Hz	810130-2	For 120 volt, 60 Hz operation	810132
Model CB-100 for 120 V, 60 Hz complete with range extension adapter	810130-3	For 240 volt, 50 Hz operation	810132-1
Model CB-100 for 240 V, 50 Hz complete with range extension adapter	810130-4	Lead sets	
Model CB-100 for 220 V, 60 Hz complete with range extension adapter	810130-5	3.3 ft (1 m)	810136-2
		59.4 ft (18 m)	810136-3
Included Accessories			
Lead set, 33 ft (10 m)	810136		
Line cord, ac	17032		
Transport case	MC803		
CB-CHEK Calibrator	810133		
Instruction manual	AVTM810130		