QS series

Semi-Automatic C, L & tanδ / cosφ High Precision Measuring Bridge

The measuring system type **QS30A** is designed for determining the capacitance and dielectric dissipation factor of liquid and solid insulants, cables, capacitors, line transformers, generators, motors, bushings etc. Furthermore it can also be used for power loss measurement on shunt reactors or similar apparatus. This system is suitable for both low and high voltage measurement at line frequency.

QS30A is a basic apparatus. The main bridge uses the principle of current comparator and data process by computer. It is a high voltage bridge having high precision, high stability, easy operation and large applications.

This measuring equipment has been specially developed to maximize efficiency in production and quality control environments. Its outstanding accuracy also makes it suitable for laboratory and research applications.

This bridge can also measure inductance and value Q of reactor. QS30A range expander (optional purchase) can enlarge the capacitance ratio from 1000:1 to 106:1.

Features

Semi-Automatic measurements with indication of the following values:

- Test specimen capacitance C_X
- Dissipation Factor tanδ, Power Factor pF (cosφ)
- Inductance LX, Quality Factor QF
- Real Power P, Apparent Power S, Reactive Power Q
- Test specimen current Ix
- Test Frequency f
- Test Voltage as Peak, RMS or Peak/√2

Benefits

- Bridge balancing is independent of test frequency
- Not influenced by ambient humidity
- The computer inside this apparatus can measure and process the data automatically
- Display directly capacitance, tgδ, measuring voltage and current of standard capacitor（Icn）on the panel
- Print the measured results
- Built-in protection against electrical insulation failure of the test object and against stray electrical fields
- Large measuring range for capacitance, dissipation factor tanδ and inductance

QS30A-1 Current transformer（measuring range expander）

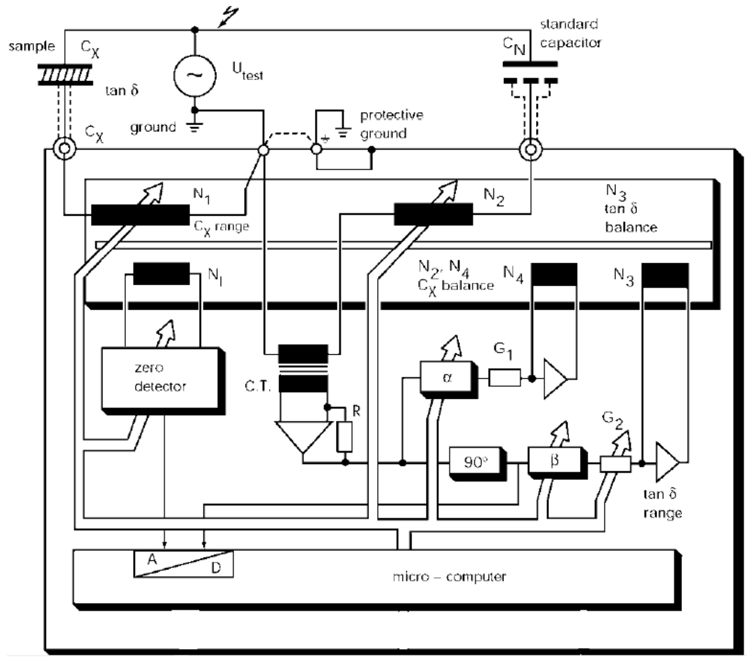
Construction

This bridge is in a metal box and its zero-indicator is at the place suitable for inspecting by eyes. The sensitivity-adjusting switch is on the side of the meter wheel. The bridge body is under the zero-indicator. The capacitance ratio adjusting switch and the tgδ value adjusting switch are fixed on the panel. The display windows of capacitance, tgδ and test voltage of measured sample are between main bridge body and zero-indicator. On the side of main bridge body is presetting panel of capacitance. The circular current comparator of bridge body is installed in a magnet-shielded box. Its circular iron core is made of extra-magnetic material wound into ring shape, and has excellent anti-interference against the internal and external magnetic field and has very high precision ratio difference and angle difference. The main operational amplifier, the lead compensation amplifier and the microprocessor are all installed in a metal-shielded box in the body cabinet. The bridge uses the switch power supply as its operating power, it has a large operation range and installed also in a metal-shielded box.

The socket connecting the standard capacitor and measured sample is on the back of this apparatus. There are totally two earthed terminals on the front and back. The external connection is shielded cable. The capacitor cabinet is electrostatic shielding type to prevent from interference.

Principle of Measurement

In the bridge method, the capacitance CX to be measured is compared to a standard capacitor CN by means of a differential current transformer. Its two primary windings N1 and N2 constitute the lower bridge arms of the CX and CN side respectively.
The secondary winding of the differential current transformer forms the indicator winding N1, which is connected to the null detector. The auxiliary windings N4 and N3 provide fine balancing of CX (β).



Inverse magnetic fluxes are induced in the core by the two primary windings. Their difference causes a current flow in the indicator winding. This current is zero when the bridge is balanced i.e. when the two magnetic fluxes are equal in phase and magnitude.

Control of the reference parameters (number of turns, fine balance current, tanδ, balance current, measurement range) is achieved by the microcomputer based upon data supplied by the zero detectors. At the end of the balancing cycle the actual values for CX tan and test voltage are calculated from the reference parameters and displayed.

Technical Specifications

System

Standard capacitor	C_N = 0…1999.9 pF
C_N (permitted values)	Larger values limited only by IC_N max = 15 mA
Max. Test object Capacitance	C_X max = 1099.99 x C_N

Test Voltage

Range	50 V…0.99 MV typically.
Max. Test voltage	$U_{max} = \frac{I_{CNmax}}{2 \cdot \pi \cdot f \cdot C_N}$, I_{CNmax} = 15 mA
Resolution	0.1KV
Accuracy	0.5%

Test Frequency （QS30C）

Range	45…60 Hz
Resolution	0.1 Hz
Accuracy	± 0.2 %

Test Current

Up to 15 Amps, extension with Current transformer （measuring range expander）(QS30A-1)

Range

Capacitance (manual range selection)

Range	0.1…1099.99 x C_N
Resolution	5 significant digits
Accuracy	0.05%

Dissipation Factor tanδ

Range	Resolution
0.00000…0.00999	1 x 10^{-6}
0.0100…0.0999	1 x 10^{-4}
0.100…0.999	1 x 10^{-3}
1.00…9.99	1 x 10^{-2}
Accuracy:	±0.5% of the reading ± 0.005%

Stated accuracy is based on the following test conditions:

Current in standard capacitor IC_N
31μA < IC_N < 15 mA
Test specimen current IC_X
31 μ A < IC_X < 15 A

Environmental Conditions

Temperature range: 5…45°C
Humidity range: <95% rel. humidity, non condensing

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