M550

Impedance Calibrator

HIGHLIGHTS

- **Automated LCR bridge calibration**
- **Calibration data from 20 Hz to 1 MHz**
- **Four-terminal pair, 4W and 2W configurations**
- **Open, Short and Load compensation**

DESCRIPTION

Model M550 Impedance calibrator is designed for calibration of LCR meters. The calibrator contains stable and temperature independent resistance standards, partial capacitance standards and partial inductance standards simulated by RC T-type passive network. Open and Short reference positions are available to eliminate influence of test cables.

Calibration values of both complex parameters of partial standards are displayed on large LCD screen in preselected pairs of parameters as well as voltage, current and frequency readouts from built-in test signal meter.

Philosophy of M550 is based on remote control and automated calibration. For this reason, the calibrator is equipped with RS-232 and GPIB interfaces and supported in CALIBER/WinQbase automated calibration software.

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SPECIFICATION

Specifications below describe 1-year absolute uncertainty at a confidence interval of 95%, including long-term stability, linearity, load and line regulation and reference standard measurement uncertainty as well as ambient conditions within specified limits.

Resistance

Resistance range summary	0.1 Ω – 100 MΩ in 4TP and 4W mode, 1 Ω – 10 MΩ in 2W mode
Frequency range	20 Hz – 1 MHz
Available parameter pairs	Z/ϴ, Y/ϴ, Rs/Ls, Rs/Cs, Rp/Cp, Rp/Lp, R/X, G/B

Series resistance (Rs) parameter overview

Nominal value	Calibration uncertainty at 1 kHz			1 year typical stability	Tolerance at 1 kHz		Temperature coefficient	Max. voltage / current	
	4TP	4W	2W		4TP	4W		4TP	4W, 2W
100 mΩ	0.20 %	0.50 %	-	0.001 %	2.0 %	2.0 %	50 ppm/K	200 mA	200 mA
1 Ω	0.10 %	0.10 %	5.0 %	0.001 %	1.0 %	1.5 %	2 ppm/K	100 mA	200 mA
10 Ω	0.05 %	0.05 %	0.5 %	0.001 %	0.5 %	1.0 %	2 ppm/K	50 mA	150 mA
100 Ω	0.02 %	0.05 %	0.1 %	0.001 %	0.1 %	1.0 %	2 ppm/K	15 mA	50 mA
1 kΩ	0.02 %	0.02 %	0.1 %	0.001 %	0.1 %	1.0 %	2 ppm/K	5 V	10 V
10 kΩ	0.02 %	0.02 %	0.1 %	0.001 %	0.1 %	1.0 %	2 ppm/K	15 V	30 V
100 kΩ	0.02 %	0.05 %	0.1 %	0.001 %	0.1 %	1.0 %	2 ppm/K	30 V	50 V
1 MΩ	0.03 %	0.20 %	0.2 %	0.003 %	0.1 %	1.0 %	2 ppm/K	30 V	50 V
10 MΩ	0.05 %	0.20 % *1	0.5 %	0.010 %	0.2 %	2.0 % *1	10 ppm/K	30 V	50 V
100 MΩ	0.50 %	1.00 % *1	-	0.010 %	1.0 %	10.0 % *1	25 ppm/K *2	30 V	50 V

*1 At 100 Hz.
*2 50 ppm/K in 4TP mode.

Capacitance

Capacitance range summary	10 pF – 100 µF in 4TP mode, 100 pF – 100 µF otherwise
Frequency range	20 Hz – 1 MHz
Tolerance at 1 kHz	5 % in 4TP mode, 10 % otherwise
Available parameter pairs	Z/ϴ, Y/ϴ, Cs/D, Cs/Rs, Cp/D, Cp/Rp, Cp/G

Parallel capacitance (Cp) parameter overview

Nominal value	Calibration uncertainty at 1 kHz			1 year typical stability		Temperature coefficient		Max. voltage / current	Dissipation factor at 1kHz (4TP, typical)
	4TP	4W	2W	4TP	4W, 2W	4TP	4W, 2W		
10 pF	1.00 %	-	-	0.010 %	-	50 ppm/K	-	30 V	< 0.0020
100 pF	0.10 %	1.0 %	5.0 %	0.010 %	0.015 %	50 ppm/K	500 ppm/K	30 V	< 0.0010
1 nF	0.05 %	0.10 %	1.0 %	0.010 %	0.010 %	50 ppm/K	500 ppm/K	30 V	< 0.0005
10 nF	0.05 %	0.05 %	0.2 %	0.010 %	0.010 %	50 ppm/K	500 ppm/K	30 V	< 0.0005
100 nF	0.05 %	0.05 %	0.2 %	0.010 %	0.010 %	50 ppm/K	500 ppm/K	20 V	< 0.0005
1 µF	0.05 %	0.05 %	0.2 %	0.010 %	0.010 %	250 ppm/K	500 ppm/K	10 V	< 0.0010
10 µF	0.10 %	0.10 %	0.5 %	0.015 %	0.015 %	250 ppm/K	1000 ppm/K	100 mA	< 0.0050
100 µF	0.10 %	0.20 %	1.0 %	0.015 %	0.150 %	250 ppm/K	1000 ppm/K	200 mA	< 0.0200

Inductance *3

Inductance range summary	10 µH – 10 H in 4TP mode
Frequency range	20 Hz – 100 kHz
Tolerance at 1 kHz	15 %
Typical 1-year stability	0.01 %
Temperature coefficient	50 ppm/K
Available parameter pairs	Z/ϴ, Y/ϴ, Ls/Q, Ls/Rs

Series inductance (Ls) parameter overview

Nominal value	Calibration uncertainty at 1 kHz	Max. voltage / current	Typical series resistance Rs
10 µH	0.3 %	50 mA	66 Ω
100 µH	0.2 %	30 mA	200 Ω
1 mH	0.1 %	5 V / 20 mA	660 Ω
10 mH	0.1 %	5 V / 10 mA	660 Ω
100 mH	0.1 %	10 V	2 kΩ
1 H	0.1 %	10 V	20 kΩ
10 H	0.1 %	10 V	20 kΩ

*3 Inductance is simulated in 4TP mode using T-network RC circuit

Test level meter

Frequency measurement	20 Hz – 100 kHz accuracy: 0.01 % + 1 mHz
Voltage measurement	0.2 – 10 V_{rms} accuracy: 2 % above 1V, 5 % otherwise
Current indication	1 nA – 500 mA

GENERAL DATA

Warm-up time	15 minutes
Reference temperature	+21 °C – +25 °C
Operating temperature	+15 °C – +30 °C
Storage temperature	-10 °C – +40 °C
Output terminals	4TP mode: 4 BNC connectors 4W & 2W modes: 4 banana sockets
Max relative humidity	80 %
Power supply	115/230V - 50/60 Hz, 35 VA max
Dimensions (W x H x D)	450 x 150 x 430 mm
Weight	12 kg
Interfaces	RS232, IEEE488

LCR bridge calibration (application)