M550 Impedance Calibrator

Model M550 Impedance calibrator is designed for calibration of LCR meters. The calibrator consists of several banks of resistance, capacitance and inductance standards of fix decimal values. Total range cover values from 0.1 Ohm to 100 MOhm, 10 pF to 100 µF and 10 µH to 10 H. Calibrator offers four-pair terminal and four terminal coaxial output connectors for calibration of precise and wide range LCR meters, four-terminal and two-terminal non-coaxial output connectors for calibration of simple LCR meters and elder LCR meters.

Basic applicable frequency range is from 20 Hz to 1 MHz in coaxial mode, and to 100 kHz in non-coaxial mode. Calibration memory contains both complex parameters of partial standards. The calibration values can be displayed in wide range of frequently used pairs of complex impedance and admittance. Either parallel or series equivalent model can be selected. The calibrator is equipped with reference positions OPEN and SHORT terminals for easy elimination of test cables influence.

Part of the calibrator is built in level meter of voltage and frequency of test signal which is generated by tested LCR meter during calibration.

M550 calibrator is equipped with large size colour LCD display. It can be controlled either manually from front panel keypad or remotely using GPIB or RS232 interface. M550 is compatible with Meatest automation software CALIBER.

Specification summary

Modes:	4TP four pair terminal	R/L/C coaxial output for coaxial four terminal and four pair terminal applications
	4W four terminal	R/C non-coaxial for four wire applications
	2W two terminal	R/C non-coaxial for two wire applications
Output terminals	4 x BNC connectors for coaxial output (4TP) 4 x banana terminal for non-coaxial output (2W/4W)	
Frequency range	20Hz to 1 MHz	
Reference positions:	SHORT, OPEN	

Resistance

Range	0.1 Ω to 100 MΩ	fix decimal values in 4TP mode
	0.1 Ω to 100 MΩ	fix decimal values in 4W mode
	1 Ω to 10 MΩ	fix decimal values in 2W mode
Deviation to nominal value	0.10 % to 10 % depending on value and mode	
Calibration uncertainty	0.02 % to 1 % at 1 kHz depending on value and mode	
Temperature coefficient	2 to 25 ppm/℃	
Displayed parameter pairs	Z/ɵ, Y/ɵ, Rs/Ls, Rs/Cs, Rp/Cp, Rp/Lp, R/X, G/B	

Capacitance

Range	10 pF to 100 µF	fix decimal values in 4TP mode
	100 pF to 100 µF	fix decimal values in 4W mode
	100 pF to 100 µF	fix decimal values in 2W mode
Deviation to nominal value	< 5%	
Calibration uncertainty	0.05 % to 5 % at 1 kHz depending on value and mode	
Temperature coefficient	30 to 100 ppm/℃	
Displayed parameter pairs	Z/ɵ, Y/ɵ, Cs/D, Cs/Rs, Cp/D, Cp/Rp, Cp/G	

Inductance (simulated in 4TP mode only)

Range	10 µH pF to 10 H	fix decimal values in 4TP mode
Deviation to nominal value	< 15 %	
Calibration uncertainty	0.1 % to 4 % at 1 kHz depending on value and mode	
Temperature coefficient	50 ppm/℃ max.	
Displayed parameter pairs	Z/ɵ, Y/ɵ, Ls/Q, Ls/Rs	

Test level meter

Displayed values	frequency, test voltage, test current
Frequency range	20 Hz to 100 kHz
Test frequency resolution	6 digit
Test frequency accuracy	0.01% +1 ms
Test voltage range	200 mV to 10 V RMS
Test voltage resolution	4 digits
Test voltage accuracy	5 % in range 100 mV – 1 V 2 % in range 1 V – 10 V
Test current range	1 nA to 500 mA
Test current resolution	4 digits

General data

Interface	RS232, GPIB
Reference temperature:	23 +/- 2 ℃, RH < 80%
Operating temperatures:	15 to 30 ℃
Storage temperatures:	-10 to +40 ℃
Power line:	115/230 V – 50/60 Hz
Consumption:	45 VA

Accuracy parameters

4TP Resistance

Nominal value Serial resistance R_s	*1 year stability (typical)*	*Maximal deviation to nominal value at 1 kHz*	*Calibration uncertainty at 1 kHz*	*Temperature coefficient (maximal)*	*Max. test Voltage / Current*	*Max. resistance deviation 100 kHz*
Ω	%	%	%	%/°C	V/mA	%
0.1	0.001	2.00	0.20	0.0050	200 mA	--
1.0	0.001	1.00	0.10	0.0002	100 mA	5.00
10	0.001	0.50	0.05	0.0002	50 mA	0.20
100	0.001	0.10	0.02	0.0002	15 mA	0.03
1k	0.001	0.10	0.02	0.0002	5 V	0.05
10 k	0.001	0.10	0.02	0.0002	15 V	0.03
100 k	0.001	0.10	0.02	0.0002	30 V	0.10
1 M	0.003	0.10	0.03	0.0002	30 V	--
10 M	0.010	0.20	0.05	0.0010	30 V	--
100 M *	0.010	1.00	0.50	0.0050	30 V	--

4TP Capacitance

Nominal value Parallel capacitance C_p	*1 year stability (typical)*	*Maximal deviation to nominal value at 1 kHz*	*Calibration uncertainty at 1 kHz*	*Temperature coefficient (maximal)*	*Dissipation factor at 1kHz (typical)*	*Max. Voltage / Current*	*Typ. capacitance deviation 100 kHz*
F	%	%	%	%/°C	-	V/mA	%
10 p	0.010	0.5 pF	1.00	0.005	< 0.0020	30V	-0.10
100 p	0.010	5	0.10	0.005	< 0.0010	30V	-0.02
1 n	0.010	5	0.05	0.005	< 0.0005	30V	0.00
10 n	0.010	5	0.05	0.005	< 0.0005	30V	+0.01
100 n	0.010	5	0.05	0.005	< 0.0005	20V	+0.03
1 µ	0.010	5	0.05	0.005	< 0.0010	10V	+0.20
10 µ	0.015	5	0.10	0.010	< 0.0050	100mA	--
100 µ	0.015	5	0.10	0.010	< 0.0200	200 mA	--

4TP Inductance

Nominal value Serial inductance L_s	*1 year stability (typical)*	*Maximal deviation to nominal value at 1 kHz*	*Calibration uncertainty at 1 kHz*	*Temperature coefficient (maximal)*	*Serial resistance R_s (typical)*	*Max. Voltage / Current*	*Typ. inductance deviation 100 kHz*
H	%	%	%	%/°C	Ω	V/mA	%
10 µ	0.01	15	0.30	0.005	66	50 mA	0.10
100 µ	0.01	15	0.20	0.005	200	30 mA	0.10
1 m	0.01	15	0.10	0.005	660	5 V / 20 mA	0.10
10 m	0.01	15	0.10	0.005	660	5 V / 10 mA	0.10
100 m	0.01	15	0.10	0.005	2 000	10 V	4.00
1	0.01	15	0.10	0.005	20 000	10 V	--
10	0.01	15	0.10	0.005	20 000	10 V	--

4W and 2W Resistance

Nominal value Serial resistance R_s	*1 year stability (typical)*	*Max. test Voltage / Current*	*Temperature coefficient (maximal)*	*4W mode Maximal deviation to nominal value at 1 kHz*	*4W mode Calibration uncertainty at 1 kHz*	*2W mode Calibration uncertainty at 1 kHz*
Ω	%	V/mA	%/°C	%	%	%
0.1	0.001	200 mA	0.0050	2.0	0.50	--
1.0	0.001	500 mA	0.0002	1.5	0.10	5.0
10	0.001	150 mA	0.0002	1.0	0.05	0.5
100	0.001	50 mA	0.0002	1.0	0.05	0.1
1k	0.001	10 V	0.0002	1.0	0.02	0.1
10 k	0.001	30 V	0.0002	1.0	0.02	0.1
100 k	0.001	50 V	0.0002	1.0	0.05	0.1
1 M	0.003	50 V	0.0002	1.0	0.20	0.2
10 M	0.010	50 V	0.0010	2.0 at 100 Hz	0.2 at 100 Hz	0.5
100 M	0.010	50 V	0.0025	10.0 at 100 Hz	1.0 at 100 hz	--

4W and 2W Capacitance

Nominal value Parallel capacitance C_p	*1 year stability (typical)*	*Temperature coefficient (maximal)*	*Max. Voltage Current*	*4W mode maximal deviation to nominal value at 1 kHz*	*4W mode Calibration uncertainty at 1 kHz*	*2W mode Calibration uncertainty at 1 kHz*
F	%	%/°C	V/mA	%	%	**%**
100 p	0.015	0.050	30V	10	1.0	5.0
1 n	0.010	0.010	30V	10	0.10	1.0
10 n	0.010	0.050	30V	10	0.05	0.2
100 n	0.010	0.050	20V	10	0.05	0.2
1 µ	0.010	0.050	10V	10	0.05	0.2
10 µ	0.015	0.010	100mA	10	0.10	0.5
100 µ	0.150	0.010	200 mA	10	0.20	1.0

Automation of LCR meter calibration
M550 Impedance calibrator application combines precise and frequency independent partial standards of electric resistance, capacitance and inductance in one housing. It enables both manual and remote control and it is effective tool for manual or automatic adjustments, verifications and calibrations of various types of LCR meters. In 4TP mode the calibrator enables verification of LCR meter in frequency range up to 1 MHz. It offers calibration values either with or without test lead length correction.

Long term stability and comfortness
Exellent long term stability and low temperature coefficient guarantee minimum time shift of calibration values in wide working conditions. Large color front panel display shows calibration values of currently selected partial standard and calibration uncertjainty as well. Test level meter can be activated manully offering calibration of test signal voltage and frequency. According to measured frequency calibrator can display calibration values at the measured frequency.

Recalibration procedure
M550 calibration menu offers comfortable recalibration of the calibration data. Two basic method are implemented to make recalibration easier. *Full recalibration* enables access to all stored complex calibration values of all partial standards in spot frequencies. In this way modification of frequency characteristics is fully accessible. *Offset recalibration* simplify process of recalibration to modifying main parameter at 1 kHz frequency only. Difference against the previous calibration value is automatically projected to all spot frequencies.

Correction mode
Calibration data in 4TP mode can be displayed either with or without applied OPEN, SHORT and LOAD correction. OPEN and SHORT corrections enables compensation of test leads residual parameters.

Inductance standards
Inductance standards are available in 4TP coaxial mode only. All partial inductance standards are simulated using passive T type RC network. They can be applied for calibration of LCR meters working on auto-balancing principle. Inductance standards do not contain any wirewound components.