



LCR METER

4310 4320 4350 43100

Product Specification

Issue B

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1 SPECIFICATION FOR 4300 RANGE

Wayne Kerr Electronics Limited reserves the right to change specification without notice

1.1 Models

The 4300 range consists of the following models:

Model	Minimum measurement frequency	Maximum measurement frequency
4310	20Hz	100kHz
4320	20Hz	200kHz
4350	20Hz	500kHz
43100	20Hz	1MHz

The only difference between the models' specifications is the maximum measurement frequency and the other parameters associated with frequency, such as frequency step size.

1.2 Measurement Parameters

AC Functions

Two parameters can be displayed at the same time as Function 1 and Function 2. Any of the parameters can be selected and displayed on the instrument using the following letter:

Parameter	Letter	Parameter	Letter
Impedance	Z	Phase Angle	A
Capacitance	C	Dissipation Factor	D
Inductance	L	Quality Factor	Q
AC Resistance	R	Conductance	G
Susceptance	B	Reactance	X
Admittance	Y		

The following display formats are available:

Series or Parallel Equivalent Circuit

C, D, L, Q, R, G, B, and X – any combination (both as series or both as parallel)

Polar Form

Z + Phase Angle, Y + Phase Angle

DC Function

DC Resistance (Rdc) - Function 1 only



1.3 Test Conditions

1.3.1 AC Drive

Frequency Range and Points

Model	Frequency Range	Number of frequency points
4310	20Hz to 100kHz	557
4320	20Hz to 200kHz	577
4350	20Hz to 500kHz	637
43100	20Hz to 1MHz	737

Frequency Accuracy

Frequency	Accuracy
20Hz to 495Hz	$\pm 0.0075\%$ (75ppm)
$\geq 500\text{Hz}$	$\pm 0.005\%$ (50ppm)

Frequency Step Size

Frequency	Step Size
20Hz to 1kHz	5Hz
1kHz to 10kHz	50Hz
10kHz to 100kHz	500Hz
100kHz to 1MHz	5kHz

AC Drive Level

AC Drive	Drive Range	Detail	Number of AC Drive levels
Voltage	10mV to 2V	into open circuit	200
Current	100 μ A to 20mA	into short circuit	200

Source Impedance

100 Ω $\pm 1\%$



1.3.2 DC Drive Level (Rdc)

DC Drive	Drive Range	Detail	Number of DC Drive levels
Voltage	1V or 2V	into open circuit	2

1.3.3 DC Bias Voltage

A DC bias voltage derived from an internal or external source can be applied to capacitors during AC measurements.

Internal

DC bias of 2V \pm 5%.

Peak short circuit current <10mA

External

External bias of up to \pm 40V is provided by connecting an external power supply to the rear panel bias terminals. Peak short circuit current < 0.26A

A resettable trip protects the bias circuit against a continuous short circuit.

1.4 Measurement Speeds

There are four selectable speeds for all measurement functions. Selecting slower measurement speed increases reading resolution and reduces measurement noise by averaging.

The fastest measurement time (defined as the time from trigger to end of measurement in bin handler mode) is 20ms, subject to certain measurement conditions.

The following measurement times (includes keyboard scan and display update) are for AC measurements \geq 1kHz and for Rdc.

Speed	Measurement Time	Suggested Application
Maximum	72ms	automatic sorting
Fast	108ms	non-critical measurements
Medium	253ms	improved resolution
Slow	445ms	best resolution and enhanced supply frequency rejection



1.5 Measurement Ranges

Parameter	Range	
R, Z, X	0.01m Ω to >1G Ω	10^{-5} to > $10^9\Omega$
G, Y, B	0.1nS to >2kS	10^{-10} to > 2×10^3 S
L	1nH to >2kH	10^{-9} to > 2×10^3 H
C	0.01pF to >1F	10^{-14} to >1F
D, Q	0.0001 to 9999.9	10^{-4} to 9.9999×10^4
Rdc	0.1m Ω to >100M Ω	10^{-4} to > $10^8\Omega$

1.6 Modes Of Operation

1.6.1 MEASUREMENT

Single and repetitive measurements of any two parameters displayed as Function 1 and Function 2.

Analogue scale with configurable Hi/Lo limits giving PASS/FAIL indication.

1.7 Measurement Connections

4 front panel BNC connectors permit 4-terminal connections with the screens at ground potential.

Terminals withstand connection of charged capacitor up to following limits:

- a capacitor charged to between 50V and 500V with a stored energy of less than 0.25J, either polarity.

1.8 Accuracy

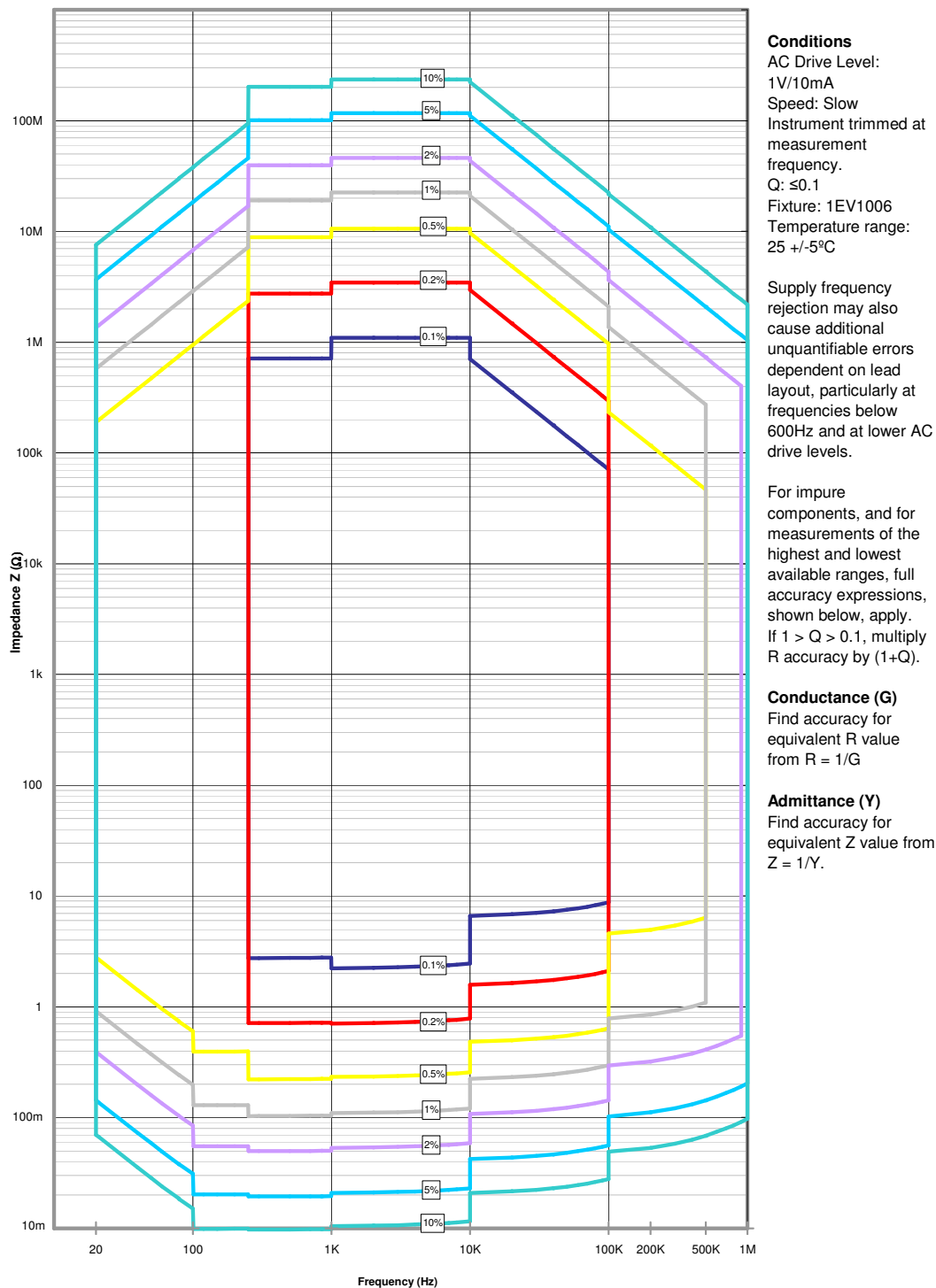
Iso-accuracy charts define the specified accuracies, over the available frequency band and impedance range. All curves assume that Slow measurement speed is used, that the instrument has been trimmed at the frequency used for measurements, that factory calibration is valid and that the component under test is pure.

For above and below the ranges indicated in the following charts, the accuracy degrades linearly with increasing/decreasing DUT value.



1.8.1 R / G / Y / Z* Accuracy Chart

4300 Impedance Measurement Accuracy





1.8.2 Rdc Accuracy

Resistance Range	Accuracy
10 Ω to 1M Ω	$\pm 0.2\%$

1.9 General

1.9.1 AC Input

Parameter	Specification
Voltage	90 to 264V AC autoranging
Frequency	45 to 63Hz
Power	15W max
Input fuse rating	1.6A T HRC The input fuse is in the fuse holder drawer integral to the IEC input connector.

1.9.2 Display

High contrast black and white LCD module 3.8" 1/4VGA (320 x 240 pixels) with CPL back lighting.

1.9.3 Remote Control

Can be controlled using RS232C or GPIB IEEE-488.2 (SCPI 1992.0) interfaces.

1.9.4 Remote Trigger

Rear panel BNC with internal pull-up, operates on logic low or contact closure.

1.9.5 Mechanical

Parameter	Specification
Height	104mm (4.1")
Width	322mm (12.7")
Depth	285mm (11.2")
Weight	3kg (6.6lbs)



1.10 Environmental Conditions

This equipment is intended for indoor use only in a non-explosive and non-corrosive atmosphere.

1.10.1 Temperature Range

Parameter	Specification
Storage	-40°C to +70°C
Operating	0°C to 40°C
Normal accuracy	18°C to 28°C ⁽¹⁾

⁽¹⁾ See section 1.8—Accuracy Chart for full specification.

1.10.2 Relative Humidity

Up to 80% non-condensing.

1.10.3 Altitude

Up to 2000m.

1.10.4 Installation Category

II in accordance with IEC664.

1.10.5 Pollution Degree

2 (mainly non-conductive).

1.10.6 Safety

Complies with the requirements of EN61010-1.

1.10.7 EMC

Complies with EN61326 for emissions and immunity.



2 THEORY REFERENCE

2.1 Abbreviations

B	Susceptance (= 1/X)	R	Resistance
C	Capacitance	X	Reactance
D	Dissipation factor (tan δ)	Y	Admittance (= 1/Z)
E	Voltage	Z	Impedance
G	Conductance (= 1/R)	ω	$2\pi \times$ frequency
I	Current		
L	Inductance		Subscript s (s) = series
Q	Quality (magnification) factor		Subscript p (p) = parallel

2.2 Formulae

$$Z = \frac{E}{I} \quad (\text{all terms complex})$$

$$Y = \frac{I}{E} = \frac{1}{Z}$$

$$Z_s = R + jX = R + j\omega L = R - \frac{j}{\omega C}$$

$$|Z_s| = \sqrt{(R^2 + X^2)}$$

$$|Z_p| = \frac{RX}{\sqrt{(R^2 + X^2)}}$$

$$Y_p = G + jB = G + j\omega C = G - \frac{j}{\omega L}$$

$$|Y_p| = \sqrt{(G^2 + B^2)}$$

$$|Y_s| = \frac{GB}{\sqrt{(G^2 + B^2)}}$$

$$\text{where} \quad X_L = \omega L \quad X_C = \frac{1}{\omega C} \quad B_C = \omega C \quad B_L = \frac{1}{\omega L}$$

$$Q = \frac{\omega L_s}{R_s} = \frac{1}{\omega C_s R_s} \quad (\text{series R, L, C values})$$

$$Q = \frac{R_p}{\omega L_p} = \omega C_p R_p \quad (\text{parallel R, L, C values})$$



$$D = \frac{G_p}{\omega C_p} = \omega L_p G_p \quad (\text{parallel G, L, C values})$$

$$D = \frac{R_s}{\omega L_s} = \omega C_s R_s \quad (\text{series R, L, C values})$$

Note : The value $Q = \frac{1}{D}$ is constant regardless of series/parallel convention

2.3 Series/Parallel Conversions

$$R_s = \frac{R_p}{(1+Q^2)}$$

$$R_p = R_s(1+Q^2)$$

$$C_s = C_p(1+D^2)$$

$$C_p = \frac{C_s}{(1+D^2)}$$

$$L_s = \frac{L_p}{\left(1+\frac{1}{Q^2}\right)}$$

$$L_p = L_s\left(1+\frac{1}{Q^2}\right)$$

Conversions using the above formulae will be valid only at the test frequency.

2.4 Polar Derivations

$$R_s = |Z| \cos\theta$$

$$G_p = |Y| \cos\theta$$

$$X_s = |Z| \sin\theta$$

$$B_p = |Y| \sin\theta$$

Note that, by convention, +ve angle indicates an inductive impedance or capacitive admittance.

If capacitance is measured as inductance, the L value will be -ve.

If inductance is measured as capacitance, the C value will be -ve.

$D = \tan \delta$ where $\delta = (90 - \theta)^\circ$ admittance measurement.

$Q = \frac{1}{\tan \delta}$ where $\delta = (90 - \theta)^\circ$ impedance measurement.