

3. SPECIFICATIONS

3.01. MEASUREMENT FEATURES

3.01.01 MEASURING SYSTEM

The 3245 measuring system and soft-key controls are micro-processor based. All selected functions are retained in non-volatile memory when the instrument is powered-down. Keys can be 'locked out' to prevent accidental or unauthorised modification to measurement conditions. Remote triggering of measurement, by contact closure, is possible. Plug-in options are available for interfacing to external equipment such as controllers, printers etc.

3.01.02 MEASUREMENT DISPLAY

A 175mm CRT displays measured values and other user data. Resolution of displayed results is up to five digits depending on measurement accuracy.

3.01.03 MEASUREMENT PREPARATION - TRIMMING

TRIM S/C and TRIM O/C initiate procedures which automatically compensate for residual series impedance and parallel capacitance in the measuring leads, up to 1.25Ω and 50pF maximum. Trim values are retained in non-volatile store.

3.01.04 MEASUREMENT FUNCTIONS

The functions available are:-

L with Q, D or R (Series or parallel equivalent circuit)

C with Q, D or R (Series or parallel equivalent circuit)

Z with θ , Vac/Iac

Rdc

Lm

TRANSFORMER turns-ratio (measured as a voltage ratio)

TRANSFORMER secondary turns (for user specified primary turns)

For non-transformer functions the following modes are also available:-

DEVIATION - Absolute or % deviation from nominal

LIMITS - Absolute or % limits for GO/NO GO testing

BINNING - Sorts into 10 bins, 8 for different values,

1 for MAJOR term rejects, 1 for MINOR term rejects

Sorted results are displayed (with or without a handler)

3.01.05 MEASUREMENT CONDITIONS - ac

Frequency (Hz): A built-in pattern of specific values at

20, 25, 30, 40, 50, 60, 80, 100, 120, 150, 200

The pattern repeats each decade up to 60 kHz, then frequencies of 75, 100, 120, 150, 200 and 300kHz complete the set. When a frequency is keyed-in the system automatically selects the nearest value from the built-in range.

3.01.05 MEASUREMENT CONDITIONS - ac - (Continued)

Drive level: The drive mode (current/voltage) changes automatically, depending on the test impedance. The Z function display includes either the voltage developed across the unknown impedance (current drive selected) or the current through the unknown impedance (voltage drive selected).

1mA - 50mA in 1mA steps) $Z_u \leq 100\Omega$
 50mA - 100mA in 2mA steps)

10mV - 500mV in 10mV steps) $Z_u \geq 100\Omega$
 500mV - 1.0V in 20mV steps)

1V - 2.5V in 50mV steps) $Z_u \geq 800\Omega$
 2.5V - 5.0V in 100mV steps) Subject to 3V maximum at 300kHz

BIAS (dc): Internal supply has a separate on/off control and uses a rear panel mounted safety link. BIAS is always OFF at power-up.*

1mA - 50mA in 1mA steps
 50mA - 100mA in 2mA steps
 100mA - 250mA in 5mA steps
 250mA - 500mA in 10mA steps
 500mA - 1A in 20mA steps

External option 3220 is an alternative dc BIAS source. It provides 200mA to 20A in steps of 100mA, for use with frequencies up to 20kHz. Up to five units may be paralleled with the 3245, replacing the internal BIAS supply.

3.01.06 MEASUREMENT CONDITIONS - dc resistance

The dc drive level depends on the measured value; it is always less than 100mV and 16mA.

3.01.07 MEASUREMENT CONDITIONS - ACCURACIES

Frequency accuracy: $\pm 0.01\%$

Level accuracy - ac

Frequency	O/C Voltage	S/C Current
Range:	Accuracy	Accuracy
30Hz - 120kHz	$\pm 4\%$ $\pm 2mV$	$\pm 5\%$ $\pm 200\mu A$
20Hz - 25Hz)	$\pm 7.5\%$ $\pm 2mV$	$\pm 8.5\%$ $\pm 200\mu A$
150kHz - 200kHz)		
300kHz	$\pm 11.5\%$ $\pm 2mV$	$\pm 12.5\%$ $\pm 200\mu A$

Loading effect: - ac

Maximum change in level occurs at $Z_u = 100\Omega$. For reactive unknown impedances ($Q < 25$) maximum falls in level are voltage 4% and current 3%.

Current accuracy - dc BIAS: $\pm 2.5\%$, $\pm 0.25mA$

* New safety features: see Chapter 8, page F:2.

3.01.08 MEASUREMENT RANGES, ACCURACY and RESOLUTION

Range matching to measured items is automatic unless inhibited by HOLD. If HOLD is selected, a RANGE ERROR message shows when a change of range could produce better measurement accuracy.

Seven ac impedance ranges are available.

Range No.	Impedance Coverage	Maximum Level
1	<1.25 Ω	100mA
2	<10 Ω	100mA
3	>10 Ω	1V
4	>80 Ω	5V
5	>640 Ω	5V
6	>5k12 Ω	5V
7	>41k Ω	5V

Notes: Maximum level at 300kHz is 3V.

Range 7 is unavailable above 60kHz.

At <250mV range 7 is unavailable; also range 6 is unavailable above 60kHz.

At >25mA range 1 is unavailable.

Two dc resistance ranges are available.

Range	Resistance coverage	Maximum Level
Normal	>2 Ω	100mV or 2mA
Low	<2 Ω	100mV or 16mA

On all ranges, accuracy and resolution depend on the specific test conditions and impedance being measured. The basic ac measurement accuracy is $\pm 0.1\%$. This applies, assuming proper trim, to any component with an impedance between 0.16 and 330k in the frequency range 100Hz to 5kHz, normal speed, for levels of 250mV to 5V or 100mA, no dc BIAS applied. Figures 3 - 5 show inductance accuracies with other drive conditions. Accuracy changes obtained from these charts apply equally to Q and D measurements. Except where stated, the standard conditions above apply to the following accuracy ranges. All resolution figures improve by 2:1 with SLOW selected.

Inductance:

Resolution: 0.5nH at 10kHz and above				
Accuracy:	Frequency	Max.Value	Min.Value	
$\pm 0.1\%*$	100Hz	500H	250 μ H	
	1kHz	50H	25 μ H	
	10kHz	5H	4 μ H	
$\pm 0.5\%*$	100Hz	4000H	25 μ H	
	1kHz	400H	2.5 μ H	
	10kHz	40H	0.6 μ H	
	40kHz	1.8H	0.6 μ H	
$\pm 1\%*$	10kHz	60H	0.3 μ H	
	50kHz	2.5H	0.6 μ H	
	100kHz	40mH	0.9 μ H	

Q-Factor:

Maximum display with $\pm 5\%$ resolution: $Q = 1300$

Accuracy: $\pm 0.1(Q + 1/Q)\%$

* When $Q > 10$. If $Q < 10$, multiply accuracy figures by $(1 + 1/Q)$.

3.01.08 MEASUREMENT RANGES, ACCURACY and RESOLUTION (Continued)

Capacitance:	Resolution: 0.01pF at 10kHz			
	Accuracy:	Frequency	Max.Value	Min.Value
	$\pm 0.1\%*$	100Hz	10mF	5nF
		1kHz	1mF	500pF
		10kHz	50μF	50pF
Dissipation Factor:	Resolution: 0.0002			
	Accuracy: 0.001(1+D ²)			
Impedance/ac Resistance:	Resistance: 0.02mΩ			
	Accuracy:	Frequency	Range	
	$\pm 0.1\%**$	100Hz - 5kHz	0.16Ω to 330kΩ	
		5kHz - 10kHz	0.33Ω to 330kΩ	
Phase Angle:	Resolution: 0.1°			
	Accuracy: $\pm 0.2^\circ$			
Turns Ratio (as a voltage ratio)	Accuracy: $\pm 0.1\%$ over range 1:100 to 100:1			
dc Resistance:	Resolution: 0.2mΩ			
	Accuracy: $\pm 0.5\%$ in range 0.2Ω to 5kΩ			

3.01.09 MEASUREMENT REPETITION SELECTION

Measurement sequence is free-running or single shot; selection is by soft-keys, see figure 12. Single shot measurements are triggered by front panel button or remote contact closure.

Measurement speed: The reading rate affects the accuracy and resolution; choices, at 1 kHz ac drive, are:-

Normal	3/sec	} approximately
Fast speed (reduced accuracy)	8/sec	
Slow speed (improved resolution)	1/sec	

At the fast speed setting, line frequency rejection worsens and basic accuracy worsens by 5:1, subject to adequate supply screening.

At the Slow speed setting, line frequency rejection is enhanced and all resolutions improve by 2:1.

With Normal or Fast settings, speed slows progressively below 300Hz to about 1.6/second at 20Hz.

* When $D < 0.1$. If $D > 0.1$, multiply accuracy figure by $(1 + D)$.

** When $Q < 0.1$ ($D > 10$). For loss resistance of an inductor, multiply accuracy figure by $(1 + Q)$. For loss resistance of a capacitor, multiply accuracy figure by $(1 + 1/D)$.

3.01.10 MEASUREMENT TERMINALS

Four BNC connectors provide 2, 3 and 4 terminal connections. Lead connection diagrams are available on the crt display. As a safety feature, measurement terminals are internally protected against accidental connection of charged capacitors and inductor back emf.

Single-pole Remote Triggering Contacts connect to the 3245 via a 3.5mm jack-socket mounted below the front panel trigger button, see figure 1. Contact current is mA only; neither side is grounded.

An external link - suitable for 1A current - is necessary for use of the internal BIAS supply. Terminals are on the rear panel, see figure 32.

3.02 ANCILLARY FEATURES

3.02.01 NON-VOLATILE MEMORY

The non-volatile memory is powered by a lithium battery with a service life exceeding 10 years. The parameters retained are:-

TRIM
MAIN INDEX mode selection
FREQUENCY
DRIVE (ac, dc)
BIAS level (But on re-powering, BIAS will be OFF)
MAJOR TERM)Measurement
MINOR TERM)parameters
AUTO-RANGE or RANGE-HOLD
Selected Range (In RANGE-HOLD)
SINGLE-SHOT/REPETITIVE
SPEED
LIMITS
BIN SET DATA
BIN COUNT DATA
Parity checking at power-up ensures that non-volatile data is valid

3.02.02 ACCESSORIES

1. Type 1605 - Four-terminal leads terminated with Kelvin clips.
2. Type 1505 - Four-terminal leads terminated with Crocodile clips. These may also be used for connection to 3- or 2-terminal networks and transformers.
3. Type 1005 - Component fixture unit, suitable for both radial and axial components.
4. Rack Mounting Kit - 2 mounting brackets and screws. Part number 25539

Standard shipment: The 3245 analyzer plus accessories 1605 and 1505.

3.02.03 OPTIONS (See also Appendices)

Various options for interconnection to other equipments are available. All are accessed on the back panel.

1. 3220 dc Extension (20Amp). Comprises a separate unit of the same physical dimensions as the 3245. Up to five units may be stacked as a BIAS source (currents to 100Amp) replacing the internal 1Amp dc source. Operationally the analyzer and soft-keys control the units. All 3245 measurement functions are available up to 20kHz.*
2. RS232C interface - provides:-
 Serial output of measurement data conforming to RS232C format to, for example, a printer.
3. GPIB interface - is implemented to the IEEE standard 488 (1980) (basic Talker and Listener) - and provides either:-
 (i) Full remote control of all functions including data entry and read-out, or
 (ii) Automatic output of measurement data to, for example, a printer.
4. Analogue output - provides one or two analogue outputs corresponding to selected measurement functions.*
5. Binning Handler Interface - provides connections to automatic component handlers.

3.02.04 TEMPERATURE RANGE

Storage	-40°C to +70°C	-40°F to +158°F
Operating	0°C to +40°C	+32°F to +104°F
Full Accuracy	+10°C to +30°C	+50°F to +86°F

3.02.05 SUPPLY VOLTAGE

115V ±10% or 230V ±10% ac only (Must be correctly selected)

Power consumption 70VA nominal. The instrument may be converted for 50Hz or 60Hz operation by means of an internal wire link. (If this is not set correctly the instrument will continue to operate but not to full specified accuracy.)

3.02.06 DIMENSIONS

Width:	443mm	17.5in
Height (including feet):	195mm	7.5in
Depth (overall):	470mm	18.5in
Weight:	16kg	35lbs

3.02.07 DISCLAIMER

In step with rapidly developing technology the Company is continually improving its products and therefore reserves the right at any time to alter specifications or designs without prior notice.

* New safety features: see Chapter 8, page F:2.