



11.1 VOLTAGE (V)

Range (Auto or Manual) (12 ranges 1-2-5 sequence)		0.5V to 2000Vpk (1400V rms)
Scaling Factors		0.001 to 99999
Computation		True rms or rectified mean
Crest Factor		Up to 20
Frequency Range		DC and 0.1Hz to 500kHz
Accuracy (23° ± 5°C) (0.2V - 1000Vrms) (All models)	DC: 45 to 450Hz: 0.1Hz to 500kHz:	±0.05% reading ±0.05% range ± 1mV* ±0.05% reading ±0.05% range ±0.1% reading ±0.05% range ±0.02%/kHz
Effect of Common Mode Voltage	1000Vrms 60Hz: 100Vrms 100kHz:	Less than 20mV Less than 500mV (1V - 002 model)
Maximum Input	Continuous: 1 second:	1500Vpk 5000Vpk
Input Impedance		1 MΩ in parallel with 10pF (all ranges)

11.2 CURRENT (A)

Range (Auto or Manual) (12 ranges 1-2-5 sequences)	INT: EXT:	0.05A to 200Apk (30A rms) 6.25mV to 2.5Vpk (1.5Vrms)
Scaling Factor	INT: EXT:	0.00001 to 99999 0.8uA/mV to 8000A/mV
Computation		True rms or rectified mean
Crest Factor		Up to 20
Frequency Range		DC and 0.1Hz to 500kHz
Accuracy (23° ± 5°C) (20mA to 30Arms) (Std & 001models)	DC: 45 to 450Hz: 0.1Hz to 250kHz: 250 to 500kHz:	±0.05% reading ±0.05% range ± 200μA* ±0.05% reading ±0.05% range ± 100μA ±0.1% reading ±0.05% range ±(kHz x 0.04)% reading ±100μA ±0.1% reading ±0.05% range ±(kHz + 250) x 0.02% reading ±100μA
(002 model) (80mA to 30Arms)	DC: 45 to 450Hz: 0.1Hz to 250kHz: 250 to 500kHz:	±0.05% reading ±0.05% range ± 800μA* ±0.05% reading ±0.05% range ± 100μA ±0.1% reading ±0.05% range ±(kHz x 0.08)% reading ±100μA ±0.1% reading ±0.05% range ±(kHz + 250) x 0.04% reading ±100μA
Effect of Common Mode Voltage	1000Vrms 60Hz: 100Vrms 100kHz:	Less than 2mA rms Less than 20mA rms (50mA - 002 model)
Maximum Input	Continuous: 1 second:	30A rms (must be limited by ext. fuses or CT's) 200A rms

Input Impedance (Std & 001 models)	INT:	12.5m Ω on all ranges
	EXT:	1M Ω in parallel with 100pF (all ranges)
(002 model)	INT:	3.5m Ω on all ranges
	EXT:	20K Ω in parallel with 33pF (all ranges)

(N.B.: The DC accuracy stated is only valid for a unit using the auto-zero facility.)

11.3 POWER (W)

Ranges (Auto or Manual) (144 ranges corresponding to V & A)		25mW to 400kWpk (with scaling to 100,000MW)
Accuracy (23 \pm 5 $^{\circ}$ C, sinewave) (Std & 001 models)	DC:	\pm (A reading x V error) \pm (V reading x A error) \pm 0.04% reading
	45 to 450Hz:	\pm ((A reading x V error) x PF) \pm ((V reading x A error) x PF) \pm (0.04/PF)% reading
	0.1Hz to 250kHz:	\pm ((A reading x V error) x PF) \pm ((V reading x A error) x PF) \pm (kHz x 0.04/PF)% reading
	250 to 500kHz:	\pm ((A reading x V error) x PF) \pm ((V reading x A error) x PF) \pm ((kHz + 750) x 0.01/PF)% reading
	(002 model)	DC:
	45 to 450Hz:	\pm ((A reading x V error) x PF) \pm ((V reading x A error) x PF) \pm (0.04/PF)% reading
	0.1Hz to 250kHz:	\pm ((A reading x V error) x PF) \pm ((V reading x A error) x PF) \pm (kHz x 0.06/PF)% reading
	250 to 500kHz:	\pm ((A reading x V error) x PF) \pm ((V reading x A error) x PF) \pm ((kHz + 1250) x 0.01/PF)% reading
Polarity		+ indicates positive power flow - indicates negative power flow

11.4 APPARENT POWER (VA)

Ranges (Auto or Manual) (144 ranges corresponding to V & A)		25mVA to 400kVApk (with scaling to 100,000MVA)
Accuracy	0.1Hz to 500kHz:	\pm ((A reading x V error) x PF)

(23±5°C, sinewave)
(All models)

$\pm((V \text{ reading} \times A \text{ error}) \times PF)$

11.5 REACTIVE POWER (VAR)

Ranges (Auto or Manual)
(144 ranges corresponding to V & A)

25mVAR to 400kVARpk
(with scaling to 100,000MVAR)

Accuracy
(23±5°C, sinewave)
(Std & 001 models)

45 to 450Hz:

$\pm((A \text{ reading} \times V \text{ error}) \times (1 - PF^2)^{0.5})$
 $\pm((V \text{ reading} \times A \text{ error}) \times (1 - PF^2)^{0.5})$
 $\pm((0.04/(1 - PF^2)^{0.5})\% \text{ reading})$

0.1Hz to 250kHz:

$\pm((A \text{ reading} \times V \text{ error}) \times (1 - PF^2)^{0.5})$
 $\pm((V \text{ reading} \times A \text{ error}) \times (1 - PF^2)^{0.5})$
 $\pm((0.04/(1 - PF^2)^{0.5})\% \text{ reading})$

250 to 500kHz:

$\pm((A \text{ reading} \times V \text{ error}) \times (1 - PF^2)^{0.5})$
 $\pm((V \text{ reading} \times A \text{ error}) \times (1 - PF^2)^{0.5})$
 $\pm((\text{kHz} + 750) \times ((0.01/(1 - PF^2)^{0.5})\% \text{ reading}))$

(002 model)

45 to 450Hz:

$\pm((A \text{ reading} \times V \text{ error}) \times (1 - PF^2)^{0.5})$
 $\pm((V \text{ reading} \times A \text{ error}) \times (1 - PF^2)^{0.5})$
 $\pm((0.04/(1 - PF^2)^{0.5})\% \text{ reading})$

0.1Hz to 250kHz:

$\pm((A \text{ reading} \times V \text{ error}) \times (1 - PF^2)^{0.5})$
 $\pm((V \text{ reading} \times A \text{ error}) \times (1 - PF^2)^{0.5})$
 $\pm((0.06/(1 - PF^2)^{0.5})\% \text{ reading})$

250 to 500kHz:

$\pm((A \text{ reading} \times V \text{ error}) \times (1 - PF^2)^{0.5})$
 $\pm((V \text{ reading} \times A \text{ error}) \times (1 - PF^2)^{0.5})$
 $\pm((\text{kHz} + 1250) \times ((0.01/(1 - PF^2)^{0.5})\% \text{ reading}))$

Polarity

+ indicates positive power flow
- indicates negative power flow

11.6 POWER FACTOR (PF)

Range
Accuracy (23 ± 5°C)
(All models)
Polarity

0.000 to ±1.000
 $\pm 0.002 \pm (\text{kHz} \times 0.001/PF)$

+ indicates leading PF
- indicates lagging PF

11.7 CREST FACTOR (CF)

Range
Basic Accuracy
(23 ± 5°C)
(All models)

1.000 to 19.999

Voltage Crest Factor: $\pm 0.1\% \text{ reading} \pm (0.05/\text{range}) \pm 0.02$
Current Crest Factor: $\pm 0.1\% \text{ reading} \pm (0.01/\text{range}) \pm 0.01$

11.8 INRUSH CURRENT

Range		0.1A to 200A _{pk} (with scaling to 20MA)
Accuracy (23 ± 5°C)		2% of selected range
Sampling Interval	1Ø 2 wire:	3.6 µS
(All models)	1Ø 3 wire/3Ø 3 wire:	6.8 µS
	3Ø 4 wire:	10 µS

11.9 IMPEDANCE

Range		0.0001Ω to 9.999 MΩ
Accuracy (23 ± 5°C)	45 to 450Hz:	±0.5% reading
(All models)	0.1 to 500kHz:	±0.5% reading ± (kHz x 0.05/PF)% reading

11.10 FREQUENCY

Range	Internal Source:	5Hz to 1MHz
	External Source:	0.1Hz to 1MHz
Accuracy (23 ± 5°C)		±0.1%
(All models)		

11.11 HARMONIC ANALYSIS

Range		DC and fundamental to 99th harmonic for voltage and current. Max Harmonic = 1MHz
Accuracy (23 ± 5°C)		
(All models)	Voltage Fundamental:	±0.1% reading ±0.1% range ±(kHz ^F x 0.02)% reading
(Std & 001 models)	Current Fundamental:	±0.1% reading ±0.1% range ±(kHz ^F x 0.04)% reading ± 100 µA
(002 model)	Current Fundamental:	±0.1% reading ±0.1% range ±(kHz ^F x 0.08) % reading ± 100 µA
(All Models)	Harmonic:	±((kHz ^H x 0.05) + 0.1) % fundamental
	THD ¹ :	±((kHz ^F x 0.01) + 0.2) % fundamental

(N.B.: kHz^F - Frequency of Fundamental component in kHz.)

(N.B.: kHz^H - Frequency of Harmonic component in kHz.)

(N.B.: ¹ - Specification using Harmonic series formula with dc excluded.)

11.12 INTEGRATOR

Range	0.001 Whr to 100,000MWhr
Integration Interval	1 Second
Elapsed Time Display	7 Digit, Floating Decimal Point

11.13 BANDWIDTH

A low bandpass filter is applied at power-up. It can be deselected using the BANDWIDTH key.

Unfiltered Bandwidth	DC to 500kHz:	
Filtered Bandwidth: (Std & 001 models)	DC to 25kHz:	(Specified Accuracies Achieved to 12.5kHz)
(002 model)	DC to 5kHz:	(Specified Accuracies Achieved to 2.5kHz)

11.14 CHART RECORDER OUTPUTS

Functions	All except Peaks, Harmonics and Inrush Current
Number of Outputs	8
Output Levels	0 to +5V; 5mA max
Update Rate	0.5 seconds

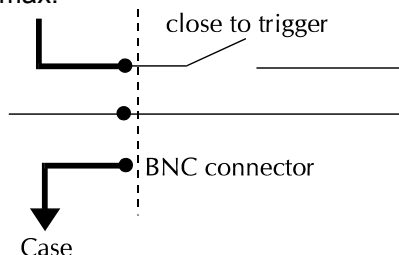
11.15 EXTERNAL FREQUENCY SOURCE

Input	1 to 10Vrms 0.1Hz - 1MHz 10k Ω input impedance
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(N.B.: Negative inputs see a reverse diode - very high impedance.)

11.16 EXTERNAL TRIGGER INPUT

Closed switch to pass 5mA max.



11.17 OPERATING TEMPERATURE AND HUMIDITY

Temperature	5° to 40°C
Humidity	10% to 80% RH non condensing

11.18 DIELECTRIC STRENGTH

Input to Case	4kV AC 50/60Hz for 1 minute
Inputs to Power Supply	4kV AC 50/60Hz for 1 minute
Input to Input	2kV AC 50/60Hz for 1 minute
Power Supply to Case	2.9kV DC for 1 minute

11.19 POWER SOURCE

AC Input Voltage	100 to 220V \pm 20% (48 to 440Hz)
Protection	Fuse 20mm 1AT
Consumption	30W, 50VA max

11.20 DIMENSIONS AND WEIGHT

Dimensions	420mm (W) 129mm (H) 406mm (D)
Weight	9kg

11.21 AUXILIARY INPUTS A AND B (TORQUE AND SPEED)

Pulse	Ext. Frequency Input: 0.5Hz - 1kHz High Frequency: 100 Hz - 1MHz
Bipolar Input	0 - 1V DC (software selectable) 0 - 10V DC (software selectable)
Type	BNC rear panel connector
Accuracy	0.1% reading \pm 0.1% range \pm 10mV
Input Impedance	20k Ω over the normal operating range.

(N.B.: All stated accuracies are based upon a minimum **AVERAGING DEPTH** setting of 8.
The default on power-up is 16.)