1. TECHNICAL SPECIFICATIONS

Accuracy is calculated as: ±[%reading + (no. of digits) * resolution] at 23°C, <80%RH

AC TRMS VOLTAGE

Range (V)	Resolution (V)	Accuracy
15 ÷ 460	1	±(3.0% rdg + 2dgt)

FREQUENCY

Range (Hz)	Resolution (Hz)	Accuracy
47.50 ÷ 52.50 / 57.00 ÷ 63.00	1	±(0.1% rdg + 1dgt)

CONTINUITY OF PROTECTION CONDUCTORS WITH 200mA

Range (Ω)	Resolution (Ω)	Accuracy
0.00 ÷ 9.99	0.01	±(5.0% rdg + 3dgt)
10.0 ÷ 99.9	0.1	
100 ÷ 1999	1	

Test current: >200mA DC up to 5Ω (test leads included)
Test current generated: 1mA resolution, range 0 ÷ 250mA
Open-circuit voltage: 4 < V_0 < 24VDC
Safety protection: error message for input voltage >10V

INSULATION RESISTANCE

DC test voltage (V)	Range (MΩ)	Resolution (MΩ)	Accuracy
50	0.01 ÷ 9.99	0.01	±(2.0% rdg + 2dgt)
	10.0 ÷ 49.9	0.1	
	50.0 ÷ 99.9		±(5.0% rdg + 2dgt)
100	0.01 ÷ 9.99	0.01	±(2.0% rdg + 2dgt)
	10.0 ÷ 99.9	0.1	
	100 ÷ 199	1	±(5.0% rdg + 2dgt)
250	0.01 ÷ 9.99	0.01	±(2.0% rdg + 2dgt)
	10.0 ÷ 99.9	0.1	
	100 ÷ 249	1	
	250 ÷ 499		±(5.0% rdg + 2dgt)
500	0.01 ÷ 9.99	0.01	±(2.0% rdg + 2dgt)
	10.0 ÷ 199.9	0.1	
	200 ÷ 499	1	
	500 ÷ 999		±(5.0% rdg + 2dgt)
1000	0.01 ÷ 9.99	0.01	±(2.0% rdg + 2dgt)
	10.0 ÷ 199.9	0.1	
	200 ÷ 999	1	
	1000 ÷ 1999		±(5.0% rdg + 2dgt)

Open-circuit voltage: rated test voltage -0% +10%
Rated measuring current: >1mA with 1kΩ x Vnom (50V, 100V, 250V, 1000V), >2.2mA with 230kΩ @ 500V
Short-circuit current: <6.0mA for each test voltage
Safety protection: error message for input voltage >30V

LINE/LOOP IMPEDANCE P-P, P-N, P-PE – TT/TN SYSTEMS

Range (Ω)	Resolution (Ω) (*)	Accuracy
0.01 ÷ 19.99	0.01	±(5.0% rdg + 3dgt)
20.0 ÷ 199.9	0.1	

(*) 0.1mΩ in range 0.1 ÷ 199.9 mΩ (by using the optional accessory IMP57)

Maximum test current: 3.31A (at 265V); 5.71A (at 457V)
P-N/P-P Test voltage: (100V ÷265V) / (100V÷460V); 50/60Hz ±5%
Protection types: MCB (B, C, D, K), Fuse (aM, gG, BS882-2,BS88-3, BS3036, BS1362)

TEST ON RCD PROTECTION (MOLDED-CASE TYPE)

Differential protection type (RCD): AC(∿),A/F(⩙),B/B+(⎓), CCID (∿,⎓ - USA country),General (G), Selective (S)

Single -phase systems (L-N-PE)

Voltage range L-PE, L-N: 100V ÷265V RCD type AC, A/F, B/B+ and CCID (IΔN ≤100mA)
190V ÷265V RCD type B/B+ (IΔN = 300mA)

Voltage range N-PE: <10V

Split-phase systems (phase delay VL1-PE, VL2-PE = 180° or phase delay VL1-PE, VL2-PE = 120°)

Voltage range L1-PE, L1-L2: 100V ÷265V RCD type AC, A/F, B/B+ and CCID (IΔN ≤100mA)

Voltage range L2-PE: 0V÷265V RCD type AC, A/F
0V÷min[(VL1-PE-100V) and (VL1-L2-100V), RCD type B/B+ (IΔN ≤100mA)

Rated tripping currents (IΔN): 5mA, 6mA,10mA, 20mA, 30mA, 100mA, 300mA, 500mA, 650mA, 1000mA

Frequency: 50/60Hz ± 5%

RCD tripping current (for General RCDs only)

Type RCD	IΔN	Range IΔN (mA)	Resolution (mA)	Accuracy
CCID	5mA, 20mA	(0.2 ÷ 1.3) $I_{\Delta N}$	$0.1I_{\Delta N}$	- 0%, +10%$I_{\Delta N}$
AC, A/F, B/B+	6mA,10mA	(0.2 ÷ 1.1) $I_{\Delta N}$		
AC, A/F, B/B+	30mA ≤IΔN ≤300mA			- 0%, +5%$I_{\Delta N}$
AC, A/F	500mA ≤IΔN ≤650mA			

Measurement RCD tripping time – TT/TN systems

	x 1/2		x 1		x 5		AUTO			AUTO+	
\	G	S	G	S	G	S	G	S	G S	G	S
5mA	AC A/F B/B+ CCID		999						310		
6mA	AC 999 A/F 999 B/B+ 999 CCID	999 999 999	999 999 999	999 999 999	50 50	150 150	✓ ✓	✓ ✓	310 310 310	✓ ✓	
10mA	AC 999 A/F 999 B/B+ 999 CCID	999 999 999	999 999 999	999 999 999	50 50	150 150	✓ ✓	✓ ✓	310 310 310	✓ ✓	
20mA	AC A/F B/B+ CCID		999						310		
30mA	AC 999 A/F 999 B/B+ 999 CCID	999 999 999	999 999 999	999 999 999	50 50	150 150	✓ ✓	✓ ✓	310 310 310	✓ ✓	
100mA	AC 999 A/F 999 B/B+ 999 CCID	999 999 999	999 999 999	999 999 999	50 50	150 150	✓ ✓	✓ ✓	310 310 310		
300mA	AC 999 A/F 999 B/B+ 999 CCID	999 999 999	999 999 999	999 999 999	50 50	150 150	✓ ✓	✓ ✓	310 310 310		
500mA 650mA	AC 999 A/F 999 B/B+ CCID	999 999	999 999	999 999	50	150	✓	✓	310 310		
1000mA	AC 999 A/F 999 B/B+ CCID	999 999	999 999								

Table with duration of tripping time measurement [ms] - Resolution: 1ms, Accuracy:±(2.0%reading + 2digits)

Measurement RCD tripping time – IT systems

	x 1/2		x 1		x 5		AUTO				AUTO+	
	\	G	S	G	S	G	S	G	S	G	S	G	S
6mA	AC	999	999	999	999	50	150	✓	✓	310		✓	
10mA	A/F	999	999	999	999	50	150	✓	✓	310		✓	
30mA	B/B+	999	999	999	999					310			
100mA	AC	999	999	999	999	50	150	✓	✓	310			
300mA	A/F	999	999	999	999	50	150	✓	✓	310			
	B/B+	999	999	999	999					310			
500mA	AC	999	999	999	999	50	150	✓		310			
650mA	A/F	999	999	999	999			✓		310			
	B/B+												
1000mA	AC	999	999	999	999								
	A/F	999	999	999	999								
	B/B+												

Table with duration of tripping time measurement [ms] - Resolution: 1ms, Accuracy:±(2.0%reading + 2digits)

TEST ON RCD TYPE DD PROTECTION

Differential protection type (RCD): DD type (compliance with IEC62955 guideline), General (G)
Single -phase systems (L-N-PE)
Voltage range L-PE, L-N: 100V ÷265V
Voltage range N-PE: <10V
Split-phase systems (phase delay VL1-PE, VL2-PE = 180° or phase delay VL1-PE, VL2-PE = 120°)
Voltage range L1-PE, L1-L2: 100V ÷265V
Voltage range L2-PE: 0V÷min[(VL1-PE-100V) and (VL1-L2-100V)]
Rated tripping currents (IΔN): 6Ma
Frequency: 50/60Hz ± 5%

Tripping current – (RCD DD type General)

RCD type	IΔN	Range (mA)	Resolution (mA)	Accuracy
DD	6mA	(0.2 ÷ 1.1) $I_{\Delta N}$	≤ 0.1$I_{\Delta N}$	- 0%, +10%$I_{\Delta N}$

Tripping time – (RCD DD type General)

RCD type	IΔN	Range (ms)	Resolution (ms)	Accuracy
DD	6mA	10000	1	±(2.0% rdg + 2dgt)

FIRST FAULT CURRENT – IT SYSTEMS

Range (mA)	Resolution (mA)	Accuracy
0.1 ÷ 0.9	0.1	±(5.0% rdg + 1dgt)
1 ÷ 999	1	±(5.0% rdg + 3dgt)

Limit contact voltage (ULIM) : 25V, 50V

OVERALL EARTH RESISTANCE WITHOUT RCD TRIPPING

Voltage range P-PE, P-N: 100V ÷ 265V
Voltage range N-PE: <10V
Frequency: 50/60Hz ± 5%

Overall earth resistance in systems with Neutral (3-wire) – (30mA or higher RCD)

Range (Ω)	Resolution (Ω)	Accuracy
0.05 ÷ 9.99	0.01	± (5.0% rdg + 8dgt)
10.0 ÷ 199.9	0.1	

Overall earth resistance in systems with Neutral (3-wire) – (6mA and 10mA RCD)

Range (Ω)	Resolution (Ω)	Accuracy
0.05 ÷ 9.99	0.01	± (5.0% rdg + 30dgt)
10.0 ÷ 199.9	0.1	

Overall earth resistance in systems withot Neutral (2-wire) – (30mA or higher RCD)

Range (Ω)	Resolution (Ω)	Accuracy
0.05 ÷ 9.99	0.01	± (5.0% rdg + 8dgt)
10.0 ÷ 99.9	0.1	
100 ÷ 1999	1	

Overall earth resistance in systems withou Neutral (2-wire) – (6mA and 10mA RCD)

Range (Ω)	Resolution (Ω)	Accuracy
0.05 ÷ 9.99	0.01	± (5.0% rdg + 30dgt)
10.0 ÷ 99.9	0.1	
100 ÷ 1999	1	

Contact voltage

Range [V]	Resolution [V]	Accuracy
0 ÷ Ut LIM	0.1	-0%, +(5.0%rdg + 3V)

PHASE ROTATION WITH 1 TEST LEAD

Voltage range P-N, P-PE[V]	Frequency range
100 ÷ 265	50Hz/60Hz ± 5%

Measurement is only carried out by direct contact with metal live parts (**not on insulation sheath**)

VOLTAGE DROP ON LINES (ΔV%)

Range [%]	Resolution [%]	Accuracy
0.0 ÷ 100.0	0.1	±(10.0%rdg + 4dgt)

ENVIRONMENTAL PARAMETERS (AUX)

Parameters	Range	Resolution	Accuracy
°C (Air)	-20.0°C ÷ 60.0°C	0.1 °C	±(2.0%rdg+2dgt)
°F (Air)	-4.0°F ÷ 140.0°F	0.1 °F	
Relative humidity [%RH]	0.0% ÷ 100.0%RH	0.1%HR	
DC Voltage	-1999.9mV ÷ -1.0mV 1.0mV ÷ 1999.9mV	0.1mV	
illuminance [Lux]	0.01Lux ÷ 20.00 Lux	0.01Lux	
	1Lux ÷ 2kLux	1Lux	
	1.00kLux ÷ 20.00kLux	0.01kLux	

Values lower to ±1mVDC are zeroed; Values lower to 0.1mVAC are zeroed

DC CURRENT WITH TRANSDUCER CLAMP (In1 input – STD clamp)

Range [mV]	Resolution [mV]	Accuracy
-1999.9 ÷ -1.0	0.1	±(5.0%rdg + 2dgt)
1.0 ÷ 1999.9		

Values lower to ±1mVDC are zeroed

AC TRMS CURRENT WITH TRANSDUCER CLAMP (In1 input – STD clamp)

Range [mV]	Frequenza [Hz]	Resolution [mV]	Accuracy
1.0 ÷ 2999.9	50/60Hz ±5%	0.1	±(5.0%rdg + 2dgt)

Values lower to 1mVAC are zeroed ; Max crest factor: 3

DC/AC TRMS CURRENT WITH TRANSDUCER CLAMP (In1 input – STD clamp)

FS clamp / Output ratio	Measurement range	Resolution
1A/1V AC	0.1mA ÷ 999.9mA AC	0.1mA AC
5A/1V AC	0.001A ÷ 4.999A AC	0.001A AC
10A/1V AC/DC	0.001A ÷ 9.999A AC/DC	0.001A AC/DC
30A/3V AC	0.01A ÷ 29.99A AC	0.01A AC
40A/400mV AC/DC	0.01A ÷ 39.99A AC/DC	0.01A AC/DC
100A/1V AC/DC	0.01A ÷ 99.99A AC/DC	0.01A AC/DC
200A/1V AC	0.01A ÷ 199.99A AC	0.01A AC
300A/3V AC	0.01A ÷ 299.99A AC	0.01A AC
400A/400mV AC/DC	0.1A ÷ 399.9A AC/DC	0.1A AC/DC
1000A/1V AC/DC	0.1A ÷ 999.9A AC/DC	0.1A AC/DC
2000A/1V AC	0.1A ÷ 1999.9A AC	0.1A AC
3000A/3V AC	0.1A ÷ 2999.9A AC	0.1A AC

MEASUREMENT OF NETWORK PARAMETERS AND HARMONICS (PQA)

DC Voltage

Range [V]	Resolution [V]	Accuracy
15.0 ÷ 265.0	0.1V	±(1.0%rdg + 1dgt)

Values lower 15V are zeroed

AC TRMS Voltage

Range [V]	Resolution [V]	Accuracy
15.0 ÷ 459.9	0.1V	±(1.0%rdg + 1dgt)

Values lower 15V are zeroed; Max crest factor: 1.5

Frequency

Range [Hz]	Resolution [Hz]	Accuracy
47.5 ÷ 63.0	0.01	±(2.0%rdg + 2dgt)

Allowed voltage range: 5.0 ÷ 459.9V ; Allowed current range: ≥5mVAC

DC Current with transducer clamp (in1 input – std clamp)

Range [mV]	Resolution [mV]	Accuracy
-1999.9 ÷ -1.0	0.1	±(5.0%rdg + 2 dgt)
1.0 ÷ 1999.9		

Values lower to ±1mVDC are zeroed

AC TRMS Current with transducer clamp (in1 input – std clamp)

Range [mV]	Frequency [Hz]	Resolution [mV]	Accuracy
1.0 ÷ 2999.9	50/60Hz ±5%	0.1	±(5.0%rdg + 2dgt)

Values lower to 1mVAC are zeroed ; Max crest factor: 3

DC/AC TRMS current with transducer clamp (In1 input – STD clamp)

FS clamp / Output ratio	Measurement range	Resolution
1A/1V AC	0.1mA ÷ 999.9mA AC	0.1mA AC
5A/1V AC	0.001A ÷ 4.999A AC	0.001A AC
10A/1V AC/DC	0.001A ÷ 9.999A AC/DC	0.001A AC/DC
30A/3V AC	0.01A ÷ 29.99A AC	0.01A AC
40A/400mV AC/DC	0.01A ÷ 39.99A AC/DC	0.01A AC/DC
100A/1V AC/DC	0.01A ÷ 99.99A AC/DC	0.01A AC/DC
200A/1V AC	0.01A ÷ 199.99A AC	0.01A AC
300A/3V AC	0.01A ÷ 299.99A AC	0.01A AC
400A/400mV AC/DC	0.1A ÷ 399.9A AC/DC	0.1A AC/DC
1000A/1V AC/DC	0.1A ÷ 999.9A AC/DC	0.1A AC/DC
2000A/1V AC	0.1A ÷ 1999.9A AC	0.1A AC
3000A/3V AC	0.1A ÷ 2999.9A AC	0.1A AC

DC Power

FS clamp	Range [kW]	Resolution [kW]	Accuracy
≤ 10A	0.015 ÷ 2.650k	0.001	±(2.0%rdg + 5 dgt)
10A ≤ FS ≤ 40	0.15 ÷ 10.60k	0.01	
40A ≤ FS ≤ 100	0.15 ÷ 26.50k	0.1	
100A ≤ FS ≤ 1000	1.5 ÷ 265.0k	1	

Active Power (@ 230V 1Ph systems, cosφ=1, f=50/60Hz)

FS clamp	Range [kW]	Resolution [kW]	Accuracy
≤ 10A	0.000 ÷ 9.999	0.001	±(2.0%rdg + 5 dgt)
10A ≤ FS ≤ 200	0.00 ÷ 999.99	0.01	
200A ≤ FS ≤ 1000	0.0 ÷ 999.9	0.1	
1000A ≤ FS ≤ 3000	0 ÷ 9999	1	

Reactive Power (@ 230V 1Ph systems, cosφ=0, f=50/60Hz)

FS clamp	Range [kVAr]	Resolution [kVAr]	Accuracy
≤ 10A	0.000 ÷ 9.999	0.001	±(2.0%rdg + 5 dgt)
10A ≤ FS ≤ 200	0.00 ÷ 999.99	0.01	
200A ≤ FS ≤ 1000	0.0 ÷ 999.9	0.1	
1000A ≤ FS ≤ 3000	0 ÷ 9999	1	

Apparent Power (@ 230V 1Ph systems, cosφ=0, f=50/60Hz)

FS clamp	Range [kVA]	Resolution [kVA]	Accuracy
≤ 10A	0.000 ÷ 9.999	0.001	±(2.0%rdg + 5 dgt)
10A ≤ FS ≤ 200	0.00 ÷ 999.99	0.01	
200A ≤ FS ≤ 1000	0.0 ÷ 999.9	0.1	
1000A ≤ FS ≤ 3000	0 ÷ 9999	1	

Power factor (@ 230V 1Ph systems, f=50.0Hz, current ≥FS)

Range	Resolution	Accuracy
0.70c ÷ 1.00 ÷ 0.70i	0.01	±(2.0%rdg + 3dgt)

cosφ (@ 230V 1Ph systems, f=50.0Hz, current ≥FS)

Range	Resolution	Accuracy
0.70c ÷ 1.00 ÷ 0.70i	0.01	±(2.0%rdg + 3dgt)

Voltage harmonics (@ 230V 1Ph systems, f=50.0Hz)

Range [%]	Resolution [%]	Order	Accuracy
0.1 ÷ 100.0	0.1	00, 02 ÷ 25	±(5.0%rdg + 5dgt)

Fundamental frequency: 50/60Hz ±5%
Harmonics are zeroed in the followed conditions:

- DC : if the DC value <0.5% fundamental value or if the DC value < 1.0V
- 1° harmonic: if the value of 1°harmonic < 15V (not displayed)
- 2nd ÷ 25th harmonics: if harmonic value <0.5% fundamental value or if the value < 1.0V

Current harmonics (f=50/60Hz)

Range [%]	Resolution [%]	Order	Accuracy
0.1 ÷ 100.0	0.1	00, 02 ÷ 25	±(5.0%rdg + 5dgt)

Harmonics are zeroed in the followed conditions:

- DC : if the DC value <0.5% fundamental value or if the DC value < 5mV
- 1° harmonic: if the value of 1°harmonic <5mV (not displayed)
- 2nd ÷ 25th harmonics: if harmonic value <0.5% fundamental value or if the value <5mV

2. GENERAL SPECIFICATIONS

MECHANICAL CHARACTERISTICS	
Dimensions (L x W x H):	225 x 165 x 75mm (9 x 6 x 3in)
Weight (batteries included):	1.2kg (42 ounces)
Mechanical protection:	IP40
MEMORY AND PC CONNECTIONS	
Memory:	999 locations, 3 mark levels
PC connection:	optical/USB port
DISPLAY	
Characteristics:	COG Black/white graphic LCD, 320x240pxl
POWER SUPPLY	
Battery type:	6x1.5V alkaline batteries type AA IEC LR06 or 6 x1.2V rechargeable NiMH type AA
Battery life:	> 500 tests for each function
Auto Power OFF:	after 5 minutes' idling (if activated)
ENVIRONMENTAL CONDITIONS FOR USE	
Reference temperature:	23°C ± 5°C (73°F ± 41°F)
Operating temperature:	0°C ÷ 40°C (32°F ÷ 104°F)
Allowable relative humidity:	<80%RH
Storage temperature:	-10°C ÷ 60°C (14°F ÷ 140°F)
Storage humidity:	<80%RH
Max. operating altitude:	2000m (6562ft
REFERENCE GUIDELINES	
Safety:	IEC/EN61010-1,IEC/EN61010-2-030,IEC/EN61010-2-033 IEC/EN61010-2-034, IEC/EN61557-1
EMC :	IEC/EN61326-1
Technical documentation:	IEC/EN61187
Safety of accessories:	IEC/EN61010-031
Insulation:	double insulation
Pollution level:	2
Measurement category:	CAT IV 300V to earth, maximum 415V between inputs
RPE:	IEC/EN61557-4, BS7671 17th ed., AS/NZS3000/3017
MΩ:	IEC/EN61557-2, BS7671 17th ed., AS/NZS3000/3017
RCD:	IEC/EN61557-6 (only on Phase-Neutral-Earth systems)
RCD-DD:	IEC62955
RCD CCID:	UL2231-2
LOOP P-P, P-N, P-PE:	IEC/EN61557-3, BS7671 17th ed., AS/NZS3000/3017
Multifunction:	IEC/EN61557-10, BS7671 17th ed., AS/NZS3000/3017
Short-circuit current:	EN60909-0

This instrument satisfies the requirements of Low Voltage Directive 2014/35/EU (LVD) and of EMC Directive 2014/30/EU
This instrument satisfies the requirements of European Directive 2011/65/EU (RoHS) and 2012/19/EU (WEEE)