



## 1. TECHNICAL SPECIFICATIONS

Accuracy is calculated as:  $\pm[\% \text{reading} + (\text{no. of digits}) * \text{resolution}]$  at 23°C, <80%RH

### AC TRMS VOLTAGE

Range (V)	Resolution (V)	Accuracy
15 ÷ 460	1	$\pm(3.0\% \text{ rdg} + 2\text{dgt})$

### FREQUENCY

Range (Hz)	Resolution (Hz)	Accuracy
47.50 ÷ 52.50 / 57.00 ÷ 63.00	1	$\pm(0.1\% \text{ rdg} + 1\text{dgt})$

### CONTINUITY OF PROTECTION CONDUCTORS WITH 200mA

Range ( $\Omega$ )	Resolution ( $\Omega$ )	Accuracy
0.00 ÷ 9.99	0.01	$\pm(5.0\% \text{ rdg} + 3\text{dgt})$
10.0 ÷ 99.9	0.1	
100 ÷ 1999	1	

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

### INSULATION RESISTANCE

DC test voltage (V)	Range (M $\Omega$ )	Resolution (M $\Omega$ )	Accuracy
50	0.01 ÷ 9.99	0.01	$\pm(2.0\% \text{ rdg} + 2\text{dgt})$
	10.0 ÷ 49.9	0.1	$\pm(5.0\% \text{ rdg} + 2\text{dgt})$
	50.0 ÷ 99.9		
100	0.01 ÷ 9.99	0.01	$\pm(2.0\% \text{ rdg} + 2\text{dgt})$
	10.0 ÷ 99.9	0.1	$\pm(5.0\% \text{ rdg} + 2\text{dgt})$
	100 ÷ 199	1	
250	0.01 ÷ 9.99	0.01	$\pm(2.0\% \text{ rdg} + 2\text{dgt})$
	10.0 ÷ 99.9	0.1	$\pm(5.0\% \text{ rdg} + 2\text{dgt})$
	100 ÷ 249		
500	250 ÷ 499	1	$\pm(5.0\% \text{ rdg} + 2\text{dgt})$
	0.01 ÷ 9.99	0.01	$\pm(2.0\% \text{ rdg} + 2\text{dgt})$
	10.0 ÷ 199.9	0.1	
1000	200 ÷ 499	1	$\pm(5.0\% \text{ rdg} + 2\text{dgt})$
	500 ÷ 999		
	0.01 ÷ 9.99	0.01	$\pm(2.0\% \text{ rdg} + 2\text{dgt})$
10.0 ÷ 199.9	0.1		
1000	200 ÷ 999	1	$\pm(5.0\% \text{ rdg} + 2\text{dgt})$
	1000 ÷ 1999		

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

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

Range ( $\Omega$ )	Resolution ( $\Omega$ ) (*)	Accuracy
0.01 ÷ 19.99	0.01	$\pm(5.0\% \text{ rdg} + 3\text{dgt})$
20.0 ÷ 199.9	0.1	

(\*) 0.1m $\Omega$  in range 0.1 ÷ 199.9 m $\Omega$  (by using the optional accessory IMP57)

Maximum test current: 3.31A (at 265V); 5.71A (at 457V)  
 P-N/P-P Test voltage: (100V  $\pm$  265V) / (100V  $\pm$  460V); 50/60Hz  $\pm$  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 (⌚), General (G), Selective (S) and B (⌚)
Voltage range P-PE, P-N:	100V ÷ 265V RCD type A, A and B ( $I_{\Delta N} \leq 100\text{mA}$ ), 190V ÷ 265V RCD type B ( $I_{\Delta N} = 300\text{mA}$ )
Voltage range N-PE:	<10V
Rated tripping currents ( $I_{\Delta N}$ ):	6mA, 10mA, 30mA, 100mA, 300mA, 500mA, 650mA, 1000mA
Frequency:	50/60Hz ± 5%

### RCD tripping current (for General RCDs only)

Type RCD	$I_{\Delta N}$	Range $I_{\Delta N}$ (mA)	Resolution (mA)	Accuracy
A, AC, B	6mA, 10mA	$(0.2 \div 1.1) I_{\Delta N}$	$0.1 I_{\Delta N}$	- 0%, +10% $I_{\Delta N}$
A, AC, B	$30\text{mA} \leq I_{\Delta N} \leq 300\text{mA}$			- 0%, +5% $I_{\Delta N}$
AC, A	$500\text{mA} \leq I_{\Delta N} \leq 650\text{mA}$			

### 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	
6mA	AC	999	999	999	999	50	150	✓	✓	310		✓
	A	999	999	999	999	50	150	✓	✓	310		✓
	B	999	999	999	999					310		
10mA	AC	999	999	999	999	50	150	✓	✓	310		✓
	A	999	999	999	999	50	150	✓	✓	310		✓
	B	999	999	999	999					310		
30mA	AC	999	999	999	999	50	150	✓	✓	310		✓
	A	999	999	999	999	50	150	✓	✓	310		✓
	B	999	999	999	999					310		
100mA	AC	999	999	999	999	50	150	✓	✓	310		
	A	999	999	999	999	50	150	✓	✓	310		
	B	999	999	999	999					310		
300mA	AC	999	999	999	999	50	150	✓	✓	310		
	A	999	999	999	999	50	150	✓	✓	310		
	B	999	999	999	999					310		
500mA 650mA	AC	999	999	999	999	50	150	✓	✓	310		
	A	999	999	999	999					310		
	B											
1000mA	AC	999	999	999								
	A	999	999									
	B											

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	
6mA	AC	999	999	999	999	50	150	✓	✓	310		✓
10mA	A	999	999	999	999	50	150	✓	✓	310		✓
30mA	B	999	999	999	999					310		
100mA 300mA	AC	999	999	999	999	50	150	✓	✓	310		
	A	999	999	999	999	50	150	✓	✓	310		
	B	999	999	999	999					310		
500mA 650mA	AC	999	999	999	999	50	150	✓		310		
	A	999	999	999	999			✓		310		
	B											
1000mA	AC	999	999	999	999							
	A	999	999									
	B											

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



## 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 without 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 without 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	



# COMBI521

Ver. 1.00 of 27/07/21

Multifunctional instrument for safety measurements

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## Active Power (@ 230V 1Ph systems, $\cos\phi=1$ , $f=50/60\text{Hz}$ )

FS clamp	Range [kW]	Resolution [kW]	Accuracy
$\leq 10\text{A}$	0.000 ÷ 9.999	0.001	$\pm(2.0\%\text{rdg} + 5 \text{ dgt})$
$10\text{A} \leq \text{FS} \leq 200$	0.00 ÷ 999.99	0.01	
$200\text{A} \leq \text{FS} \leq 1000$	0.0 ÷ 999.9	0.1	
$1000\text{A} \leq \text{FS} \leq 3000$	0 ÷ 9999	1	

## Reactive Power (@ 230V 1Ph systems, $\cos\phi=0$ , $f=50/60\text{Hz}$ )

FS clamp	Range [kVAr]	Resolution [kVAr]	Accuracy
$\leq 10\text{A}$	0.000 ÷ 9.999	0.001	$\pm(2.0\%\text{rdg} + 5 \text{ dgt})$
$10\text{A} \leq \text{FS} \leq 200$	0.00 ÷ 999.99	0.01	
$200\text{A} \leq \text{FS} \leq 1000$	0.0 ÷ 999.9	0.1	
$1000\text{A} \leq \text{FS} \leq 3000$	0 ÷ 9999	1	

## Apparent Power (@ 230V 1Ph systems, $\cos\phi=0$ , $f=50/60\text{Hz}$ )

FS clamp	Range [kVA]	Resolution [kVA]	Accuracy
$\leq 10\text{A}$	0.000 ÷ 9.999	0.001	$\pm(2.0\%\text{rdg} + 5 \text{ dgt})$
$10\text{A} \leq \text{FS} \leq 200$	0.00 ÷ 999.99	0.01	
$200\text{A} \leq \text{FS} \leq 1000$	0.0 ÷ 999.9	0.1	
$1000\text{A} \leq \text{FS} \leq 3000$	0 ÷ 9999	1	

## Power factor (@ 230V 1Ph systems, $f=50.0\text{Hz}$ , current $\geq \text{FS}$ )

Range	Resolution	Accuracy
0.70c ÷ 1.00 ÷ 0.70i	0.01	$\pm(2.0\%\text{rdg} + 3\text{dgt})$

## $\cos\phi$ (@ 230V 1Ph systems, $f=50.0\text{Hz}$ , current $\geq \text{FS}$ )

Range	Resolution	Accuracy
0.70c ÷ 1.00 ÷ 0.70i	0.01	$\pm(2.0\%\text{rdg} + 3\text{dgt})$

## Voltage harmonics (@ 230V 1Ph systems, $f=50.0\text{Hz}$ )

Range [%]	Resolution [%]	Order	Accuracy
0.1 ÷ 100.0	0.1	00, 02 ÷ 25	$\pm(5.0\%\text{rdg} + 5\text{dgt})$

Fundamental frequency: 50/60Hz  $\pm 5\%$ 

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 ( $f=50/60\text{Hz}$ )

Range [%]	Resolution [%]	Order	Accuracy
0.1 ÷ 100.0	0.1	00, 02 ÷ 25	$\pm(5.0\%\text{rdg} + 5\text{dgt})$

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
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### 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)
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 2014/35/EU**

**This instrument satisfies the requirements of European Directive 2011/65/EU (RoHS) and 2012/19/EU (WEEE)**