3M COMBI521 Multifunction Tester Instructions

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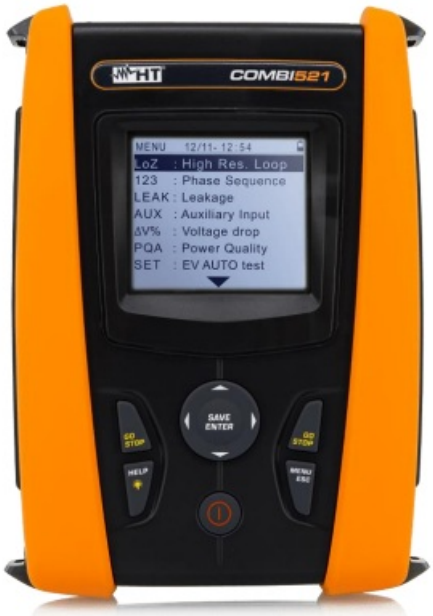
3M COMBI521 Multifunction Tester



Multifunction instrument for electrical installation safety testing, power quality analysis and EVSE safety

testing
COMBI521 carries out tests on electric systems in compliance with IEC/EN 61557-1 and therefore measurements of continuity of the protection cable, insulation resistance (with calculation of PI and DAR), overall earth resistance, RCDs type B, A and AC tripping time and current, line / fault impedance with calculation of prospective short circuit / fault current, phase sequence and conformity. COMBI521 also allows measuring and saving environmental parameters (illuminance, temperature), leakage current and electric quantities such as voltage, current, power factor, power and harmonics on single-phase systems. In combination with EV-TEST100, COMBI521 performs verification and control of electric car charging stations (EVSE) in accordance with IEC / EN 61851-1 and IEC / EN60364-7-722 standards. COMBI521 is provided with the innovative AUTO function: by selecting this function and only setting the value of RCD current, COMBI521 carries out tests of overall earth resistance, RCD tripping time and insulation resistance in a sequence. At the end of the test, the device shows all results with the indication of compliance or non-compliance with the standards with simple OK or NOT OK symbols.The internal memory allows saving the measures and subsequently transfer them onto the PC through the optical/USB connection. Thanks to the brand new HTAnalysis App, free to download for iOS and Android systems, COMBI521 is capable of transferring measured and recorded data

onto tablets and smartphones, thus giving the operator the possibility to customize and share through HtCloud the result of their tests.

Measurement function:

- All electrical safety measurements as required by the international safety standards
- AUTOMATIC test (no-trip ground resistance, RCD tripping time, insulation resistance) in a sequence
- Continuity of protective conductors with 200mA
- Insulation resistance up to 1000V, with dielectric absorption ratio D.A.R. and polarization index P.I.
- Polarity test
- Type A, AC, B General and Selective RCD tripping time and current
- Line/Fault impedance, Phase-Phase, Phase-Neutral, Phase-PE (also at high resolution with optional accessory IMP57)
- Coordination of MCBs and fuses
- Global earth resistance
- Phase sequence and conformity measurement
- Measurement of leakage current
- Measurement of electrical parameters in single-phase installations (V, A, W, VAR, VA, PF)
- Measurement of environmental parameters through external probes (HT52/05 and HT53/05)
- Internal memory and PC connection
- Wi-Fi connection to Android and iOS smartphones and tablets

TECHNICAL SPECIFICATION

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 >10V

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 (⩙),General (G), Selective (S) and B(⎓)
Voltage range P-PE, P-N: 100V ÷265V RCD type A, A and B (IΔN ≤100mA), 190V ÷265V RCD type B (IΔN = 300mA)
Voltage range N-PE: <10V
Rated tripping currents (IΔN): 6mA,10mA, 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
A, AC, B	6mA,10mA	(0.2 ÷ 1.1) $I_{\Delta N}$	0.1$I_{\Delta N}$	- 0%, +10%$I_{\Delta N}$
A, AC, B	30mA ≤IΔN ≤300mA			- 0%, +5%$I_{\Delta N}$
AC, A	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
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	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	G	S
6mA 10mA 30mA	AC	999	999	999	999	50	150	✓	✓	310		✓	
	A	999	999	999	999	50	150	✓	✓	310		✓	
	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	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 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)

Hamonics 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

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/EN61010-2-03 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

Documents / Resources

	3M COMBI521 Multifunction Tester [pdf] Instructions COMBI521 Multifunction Tester, COMBI521, Multifunction Tester