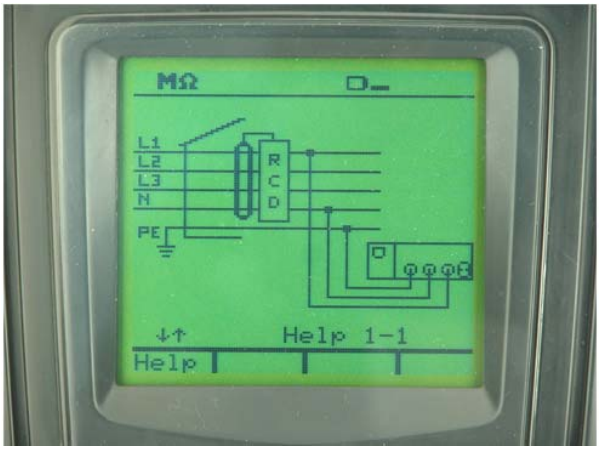
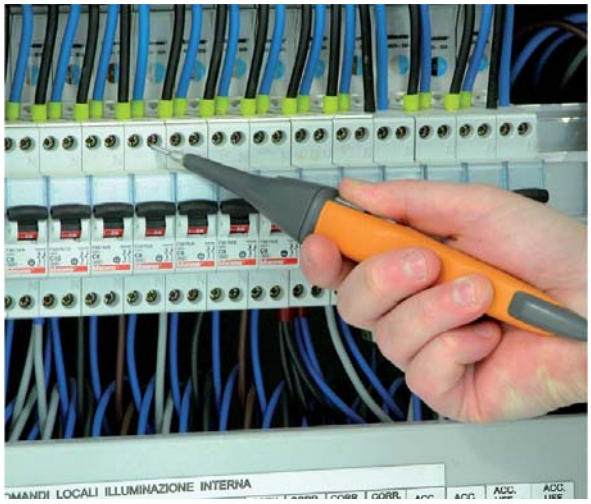
# 1. MAIN FEATURES OF FAMILY 400 METERS




Help on line (available on each function) to support the user while connecting the instrument to the installation under measurement




Each model permits the Start of measurements with remote probe (PR400 optional accessory)

General menu to quickly selection of available test performed by meter
(COMBI419 and COMBI420 models only)

# 1. MODELS AND FEATURES

| Measurements | ISO410 | SPEED418 | COMBI419 | COMBI420 |
|---|---|---|---|---|
| Continuity test on protective conductor with 200mA | ✓ | | ✓ | ✓ |
| Insulation resistance 50-100-250-500-1000VDC | ✓ | | ✓ | ✓ |
| RCDs tripping time and current (general and selective, AC and A types) 10-30-100-300-500-650mA | | ✓ | ✓ | ✓ |
| Contact voltage Ut | | ✓ | ✓ | ✓ |
| Loop impedance P-N, P-P, P-PE | | ✓ | ✓ | ✓ |
| Loop impedance P-N, P-P, P-PE with high resolution (0.1mΩ) with IMP57 optional accessory | | ✓ | ✓ | ✓ |
| Prospective short circuit current | | ✓ | ✓ | ✓ |
| Global earth resistance Ra without RCDs tripping | | ✓ | ✓ | ✓ |
| Phase sequence | | ✓ | ✓ | ✓ |
| Leakage current (with HT96U optional accessory) | | | ✓ | ✓ |
| AUTOMATIC test (Ra, RCD time, Insulation) directly on outlet | | | ✓ | ✓ |
| ACTRMS voltage and current in Single phase system | | | | ✓ |
| Active, reactive, apparent powers and power factor in Single phase system | | | | ✓ |
| Harmonic analysis U, I, up to 49$^{th}$ order and THD% | | | | ✓ |
| Environmental parameters (°C, %HR, Lux) | | | | ✓ |
| Using optional remote probe for activation of tests | ✓ | ✓ | ✓ | ✓ |
| Contextual help at display | ✓ | ✓ | ✓ | ✓ |
| Memory and PC interface | ✓ | ✓ | ✓ | ✓ |

# 2. ELECTRICAL SPECIFICATIONS

## Continuity test on protective conductors

| Range (Ω) | Resolution (Ω) | Uncertainty (*) | Category of measure |
|---|---|---|---|
| 0.00 ÷ 9.99 | 0.01 | ±(2.0%rdg + 2dgt) | CAT III 240V to Ground<br>CAT III 415V between inputs |
| 10.0 ÷ 99.9 | 0.1 | | |

(*) after cable calibration which eliminates the cable resistance
Test current: >200mA DC per R≤5Ω (calibration included) ; Current measurement resolution: 1mA
Open leads voltage: $4 < V_0 < 24V$

## RCDs tripping time

| Range (ms) | | Resolution (ms) | Uncertainty | Category of measure |
|---|---|---|---|---|
| ½ $I_{\Delta N}$, $I_{\Delta N}$ | 1 ÷ 999 | 1 | ±(2.0%rdg + 2 dgt) | CAT III 240V to Ground<br>CAT III 415V between inputs |
| 2 $I_{\Delta N}$ | 1÷200 general | | | |
| | 1÷250 selective | | | |
| 5 $I_{\Delta N}$ RCD | 1÷ 50 general | | | |
| | 1÷160 selective | | | |

Nominal tripping current: 10mA, 30mA, 100mA, 300mA, 500mA, 650mA
RCD type: AC, A, general and selective
Phase-ground voltage: (110V ÷ 240V) ±10%
Frequency: 50Hz ± 0.5Hz, 60Hz ± 0.5Hz
Voltage contact limits: 25V or 50V

## RCDs tripping current (general, AC and A types)

| RCD's type | IΔN | Range IΔN (mA) | Resolution (mA) | Uncertainty | Category of measure |
|---|---|---|---|---|---|
| AC | IΔN ≤ 10mA | (0.5 ÷ 1.4) $I_{\Delta N}$ | 0.1 $I_{\Delta N}$ | 0%,+10%rdg | CAT III 240V to Ground<br>CAT III 415V between inputs |
| A | | (0.5 ÷ 2) $I_{\Delta N}$ | | | |
| AC | IΔN > 10mA | (0.5 ÷ 1.4) $I_{\Delta N}$ | | | |
| A | | (0.5 ÷ 2) $I_{\Delta N}$ | | | |

## Insulation resistance

| Test voltage (V) | Range (MΩ) | Resolution (MΩ) | Uncertainty | Category of measure |
|---|---|---|---|---|
| 50 | 0.01 ÷ 9.99 | 0.01 | ±(2.0%rdg + 2dgt) | CAT III 240V to Ground<br>CAT III 415V between inputs |
| | 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 ÷ 99.9 | 0.1 | | |
| | 100 ÷ 499 | 1 | | |
| | 500 ÷ 999 | | ±(5.0%rdg + 2dgt) | |
| 1000 | 0.01 ÷ 9.99 | 0.01 | ±(2.0%rdg + 2dgt) | |
| | 10.0 ÷ 99.9 | 0.1 | | |
| | 100 ÷ 999 | 1 | | |
| | 1000 ÷ 1999 | | ±(5.0%rdg + 2dgt) | |

Open leads voltage: 1.25 x nominal test voltage ; Voltage measurement resolution: 1V
Short circuit current: <15mA (peak) for each test voltage
Nominal current: >2.2mA with 230kΩ @, 500V; 1mA with 1MΩ @ other test voltage

## Contact voltage Ut

| Range (V) | Resolution (V) | Uncertainty | Category of measure |
|---|---|---|---|
| 0 ÷ 2Utlim | 0.1 | -0%, +(2.0%rdg + 2dgt) | CAT III 240V to Ground<br>CAT III 415V between inputs |

Utlim (Ul): 25V , 50V

## Loop impedance P-P, P-N, P-PE TT/TN systems

| Range (Ω) | Resolution (Ω) (*) | Uncertainty | Category of measure |
|---|---|---|---|
| 0.01 ÷ 9.99 | 0.01 | ±(5.0%rdg + 3dgt) | CAT III 240V to Ground<br>CAT III 415V between inputs |
| 10.0 ÷ 199.9 | 0.1 | | |
| 200 ÷ 1999 (only P-PE) | 1 | | |

*(*) 0.1mΩ in 0.0 ÷ 199.9 mΩ range (with option accessory IMP57)*
Maximum peak current: 3A @ 127V, 6A @ 230V, 10A @ 400V
Test voltage: (110÷240V) ±10% (P-N, P-PE) ; 50Hz ± 0.5Hz, 60Hz ± 0.5Hz
(110÷415V) ±10% (P-P); 50Hz ± 0.5Hz, 60Hz ± 0.5Hz

## Loop impedance P-P, P-N, P-PE IT systems

| Range (mA) | Resolution (mA) | Uncertainty | Category of measure |
|---|---|---|---|
| 5 ÷ 999 | 1 | ±(5.0%rdg + 3dgt) | CAT III 240V to Ground<br>CAT III 415V between inputs |

Utlim (Ul): 25V , 50V

## Global Earth Resistance $R_A$ without tripping the RCD

| Range (Ω) | Resolution (Ω) | Uncertainty | Category of measure |
|---|---|---|---|
| 0.01 ÷ 9.99 | 0.01 | ±(5.0%rdg+ 1.0Ω) | CAT III 240V to Ground<br>CAT III 415V between inputs |
| 10.0 ÷ 199.9 | 0.1 | | |
| 200 ÷ 1999 (solo F-PE) | 1 | | |

Test current @ 265V: <15 mA
Test voltage: (110÷240V) ±10% (phase-neutral/PE); 50Hz ± 0.5Hz, 60Hz ± 0.5Hz
Utlim (Ul): 25V , 50V

## Phase sequence with 1 or 2 wires

| Range (V) | Results displayed | Category of measure |
|---|---|---|
| (100 ÷ 240) ±10% | "123" → correct phase sequence<br>"132" → wrong phase sequence<br>"11-" → phase coincidence | CAT III 240V to Ground<br>CAT III 415V between inputs |

The instrument detects the phase sequence by touching the hot wire. The detection is not performed on insulated cables.
Frequency: 50Hz ± 0.5Hz, 60Hz ± 0.5Hz

## AC TRMS Voltage

| Range (V) | Frequency (Hz) | Resolution (V) | Uncertainty | Category of measure |
|---|---|---|---|---|
| 5.0 ÷ 265.0 | 47 ÷ 63 | 0.1 | ±(0.5%rdg + 2dgt) | CAT III 240V to Ground<br>CAT III 415V between inputs |

Max crest factor: <1.5
Voltage indicated it's the Max TRMS value considered between any couple of inputs

## Frequency

| Range (Hz) | Resolution (Hz) | Uncertainty | Category of measure |
|---|---|---|---|
| 47.0 ÷ 63.0 | 0.1 | ± (2%rdg + 2dgt) | CAT III 240V to Ground<br>CAT III 415V between inputs |

Voltage range: 15V ÷ 460Vrms

## Voltage harmonics

| Range | Resolution (V) | Uncertainty | Category of measure |
|---|---|---|---|
| 2a ÷ 15a | 0.1 | ± (2% rdg + 5dgt) | CAT III 240V to Ground<br>CAT III 415V between inputs |
| 16a ÷ 49a | | ± (5%rdg + 10dgt) | |

Voltage range: 0.0V ÷ 265Vrms
Fundamental frequency range : 47 ÷ 63Hz

## AC TRMS Current (In1 input)

| Range (A) | Resolution (A) | Uncertainty | Category of measure |
|---|---|---|---|
| 0.005 ÷ 1.2 x FS | See table | ±(1.0%rdg + 2dgt) | CAT I 30V to Ground and between inputs |

Frequency range : 47Hz ÷ 63Hz

## Current harmonics (In1 input)

| Range | Resolution (A) | Uncertainty | Category of measure |
|---|---|---|---|
| 2a ÷ 15a | See table | ± (2% rdg + 5dgt) | CAT I 30V to Ground and between inputs |
| 16a ÷ 49a | | ± (5%rdg + 10dgt) | |

Frequency range: 47Hz ÷ 63Hz ; Current range: ≥ 0.020 x FS

| Full scale FS [A] | Resolution [A] | Full scale FS [A] | Resolution [A] |
|---|---|---|---|
| 1 | 0.001 | 300 | 0.1 |
| 10 | 0.01 | 400 | 0.1 |
| 30 | 0.01 | 1000 | 1 |
| 100 | 0.1 | 2000 | 1 |
| 200 | 0.1 | 3000 | 1 |

## Active, Reactive, Apparent power @ Vmis>60V, cosφ=1, f=50.0Hz

| Range (W, VAR, VA) | Resolution (W,VAR, VA) | FS Clamp (A) | Uncertainty |
|---|---|---|---|
| 0.0 ÷ 999.9 | 0.1 | FS ≤ 1 | ± (1.0%rdg + 6dgt) |
| 1.000 ÷ 9.999 k | 0.001 k | | |
| 0.000 ÷ 9.999 k | 0.001 k | 1 < FS ≤ 10 | |
| 10.00 ÷ 99.99 k | 0.01 k | | |
| 0.00 ÷ 99.99 k | 0.01 k | 10 < FS ≤ 100 | |
| 100.0 ÷ 999.9 k | 0.1 k | | |
| 0.0 ÷ 999.9 k | 0.1 k | 100 < FS ≤ 3000 | |
| 1000 ÷ 9999 k | 1 k | | |

## Power factor (cosφ) @ Vmis>60V, f=50.0Hz

| Current range (A) | Range | Resolution | Uncertainty |
|---|---|---|---|
| 0.005 ÷ 0.1 x FS | 0.80c ÷ 1.00 ÷ 0.80i | 0.01 | ± 2° |
| 0.1 ÷ 1.2 x FS | | | ± 1° |

## Leakage current AC TRMS (In1 input)

| Range (mV) | Resolution (mV) | Uncertainty | Category of measure |
|---|---|---|---|
| 1 ÷ 1200 | 0.1 | ±(1.0%rdg + 2dgt) | CAT I 30V to Ground and between inputs |

Frequency range: 50Hz ÷ 60Hz

## Environmental parameters

| Feature | Range | Resolution | Transduced signal | Uncertainty |
|---|---|---|---|---|
| Temperature | -20.0 ÷ 80.0°C | 0.1°C | -20 ÷ +80mV | ±(2.0%rdg + 2dgt) |
| | -4.0 ÷ 176.0°F | 0.1°F | -4 ÷ +176mV | |
| Humidity | 0.0 ÷ 100.0% RH | 0.1% RH | 0 ÷ +100mV | |
| DC Voltage | ±(0.0 ÷ 999.9mV) | 0.1mV | ±(0.2 ÷ 999.9mV) | |
| Illuminance | 0.001 ÷ 20.00Lux | 0.001 ÷ 0.02Lux | 0 ÷ +100mV | |
| | 0.1 ÷ 2000Lux | 0.1 ÷ 2Lux | | |
| | 1 ÷ 20000Lux | 0.1 ÷ 2Lux | | |

# 3. GENERAL SPECIFICATIONS

| | |
|---|---|
| **MECHANICAL FEATURES** | |
| Dimensions: | 235 (L)x165(La)x75(H)mm |
| Weight (batteries included): | about 1.2kg |
| Protection degree: | IP50 |
| **MEMORY AND SERIAL INTERFACE** | |
| Each measurement can be stored | |
| Memory: | >600 locations |
| PC communication port: | optical / USB |
| **DISPLAY:** | |
| Features: | graphic LCD with backlight |
| **POWER SUPPLY:** | |
| Batteries: | 6x 1.5V type LR6, AA, AM3, MN 1500 |
| Battery life: | > 600 measurements (without using the timer) |
| **ENVIRONMENTAL CONDITIONS:** | |
| Reference temperature of calibration: | 23°C ± 5°C |
| Working temperature: | 0° ÷ 40°C |
| Working humidity: | < 80%HR |
| Storage temperature (batteries not included): | -10 ÷ 60°C |
| Storage humidity: | < 80%HR |
| **GENERAL REFERENCE STANDARDS:** | |
| Safety: | IEC/EN61010-1, IEC/EN61557-1, -2, -3, -4, -6, -7 |
| Technical literature: | IEC/EN61187 |
| Safety of accessories: | IEC/EN61010-031, IEC/EN61010-2-032 |
| LOWΩ (200mA): | IEC/EN61557-4 |
| MΩ: | IEC/EN61557-2 |
| RCD: | IEC/EN61557-6 |
| LOOP P-P, P-N, P-PE: | IEC/EN61557-3 |
| Ra $15_{mA}$ | IEC/EN61557-3 |
| 123: | IEC/EN61557-7 |
| Insulation: | double insulation |
| Pollution degree: | 2 |
| Max altitude: | 2000m |
| Overvoltage category: | CAT III 240V to ground, max 415V among inputs |

**This instrument complies with the requirements of the European Low Voltage Directives 2006/95/EEC (LVD) and EMC 2004/108/EEC**