# Safety of medical equipment
# MI 6601 MediTest

NEW

Medical tester



The MI 6601 MediTest is a new Metrel tester for testing the electrical safety of medical equipment in the accordance with the IEC/EN 60601 standard in any stage of medical equipment life cycle. It is accurate enough for development work, offers detailed measurements for type testing, it can be embedded into the production line and is portable enough for recurrent testing in accordance with IEC/EN 60601 or IEC/EN 62353. In addition it can help with diagnosing problems in service departments or can be used for troubleshooting in the field.

The MI 6601 MediTest can be used as stand-alone tester without a PC or laptop in the field. For office and laboratory use, the tester can work in combination with Metrel Medical Electrical Safety Manager (MMESM). It supports creation and execution of test sequences in accordance with IEC/EN 60601 and asset management. Reports are created with integrated online services Metrel Cloud Reports and Metrel Cloud Storage. Compliance with IEC/EN 60601 is a widely accepted benchmark and a requirement for commercialisation of electrical medical equipment around the world. In Metrel we believe that our new MI 6601 MediTest is the fastest and easiest-to-use electrical safety compliance tester on the market, which entirely covers prescribed standard test procedures, without any compromises or simplifications.

## MEASUREMENTS AND INSPECTIONS

- **PE resistance** with 200 mA$_{AC}$ and 25 A$_{AC}$;
- **Insulation resistance** with test voltage 250 V$_{DC}$ or 500 V$_{DC}$.
- All test configurations acc. to IEC/EN 62353 are supported;
- **Leakage current** measurements with 1 µA resolution;
- AC, DC and TRMS value of leakage currents;
- **All leakage current** measurements as defined in **IEC/EN 60601 standard** (patient, auxiliary, earth, touch);
- **All leakage current** measurements as defined in **IEC/EN 62353** (equipment and applied part; alternative, direct, differential method);
- Measurement according to **portable appliance standards EN 50678** and **EN 50699**;
- Point-to-point, touch and mains **voltage tests**;
- **Equipment power**;
- **IEC lead test**;
- Pre-set or configurable **visual and functional inspections**.

## KEY FEATURES

- The most complete IEC/EN 60601 tester on the market;
- 10 universal configurable connections. They can be configured as applied parts, non-earthed parts, earthed parts;
- Dedicated test ports for connection to functional earthing and signal I/O connections;
- All possible configurations acc. to the IEC/EN 60601 and IEC/EN 62353 standards;
- Tests can be run on the instrument directly or via a PC;
- Fully automatic test flow with Auto Sequences®;
- Tests and limits are automatically set acc. to the set configuration of medical equipment;
- Test sequences are optimized for fastest work flow;
- Supports measuring by standards IEC/EN 60601 (2nd and 3rd editions), IEC/EN 62353, ANS/NZS 3551, EN 50678 and EN 50669;
- Use of single tests to diagnose problems easily;
- High current for testing continuity of PE connections: up to 25 A;
- AC and DC values of patient leakage and patient auxiliary current;
- Communication over USB, RS232 and Ethernet;
- Input data in any desired way: touchscreen, barcode/QR code scanner, wireless keyboard, PC SW;
- Optional printers or NFC writers for creating labels and tags;
- New subscription-based software solution including MMESM, Metrel Cloud Reports and Metrel Cloud storage;
- IP 40 case open, IP 65 case closed;
- Carrying case and bag for accessories;
- Standard warranty 2 years.

## APPLICATIONS

- Safety of medical equipment during development, production, service, periodic verification.
- Troubleshooting of medical equipment.
- Safety of standard portable appliances.
- Troubleshooting portable devices.



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## TECHNICAL SPECIFICATION

| FUNCTION | | MEASURING RANGE | RESOLUTION | ACCURACY |
|---|---|---|---|---|
| **Continuity / Protective earth resistance** | | | | |
| [1]Continuity | R | 0.00 Ω ... 19.99 Ω | 0.01 Ω | ±(2 % of reading + 2 D) |
| | | 20.0 Ω ... 99.9 Ω | 0.1 Ω | ±3 % of reading |
| | | 100.0 Ω ... 199.9 Ω | 0.1 Ω | ±5 % of reading |
| | | 200 Ω ... 999 Ω | 1 Ω | Indicative |
| **Insulation Resistance (Riso, Riso-S)** | | | | |
| [2]Insulation resistance, Insulation resistance –S (250 V, 500 V) | Riso | 0.00 MΩ ... 19.99 MΩ | 0.01 Ω | ±(3 % of reading + 2 D) |
| | Riso-S | 20.0 MΩ ... 99.9 MΩ | 0.1 Ω | ±5 % of reading |
| | | 100.0 MΩ ... 199.9 MΩ | 0.1 Ω | ±10 % of reading |
| [2]Output voltage | Um | 0 V ... 600 V | 1 V | ±(3 % of reading + 2 D) |
| **Sub-Leakage Current, Substitute Leakage Current - S** | | | | |
| [3]Substitute leakage current, Substitute leakage current - S | Isub | 0.00 mA ... 1.99 mA | 0.01 mA | ±(3 % of reading + 3 D) |
| | Isub-S | 2.00 mA ... 19.99 mA | 0.01 mA | ±5 % of reading |
| **Differential Leakage current** | | | | |
| [4]Differential leakage current | Idiff | 0.000 mA ... 1.999 mA | 1 µA | ±(3 % of reading + 3 D) |
| | | 2.00 mA ... 19.99 mA | 0.01 mA | ±5 % of reading |
| [4]Power (active) | P | 0 W ... 999 W | 1 W | ±(5 % of reading + 5 D) |
| | | 1.00 kW ... 3.70 kW | 10 W | ±5 % of reading |
| **PE leakage current** | | | | |
| [5]PE leakage current | Ipe | 0.000 mA ... 1.999 mA | 1 µA | ±(3 % of reading + 3 D) |
| | | 2.00 mA ... 19.99 mA | 0.01 mA | ±5 % of reading |
| [5]Power (active) | P | 0 W ... 999 W | 1 W | ±(5 % of reading + 5 D) |
| | | 1.00 kW ... 3.70 kW | 10 W | ±5 % of reading |
| **Touch leakage current** | | | | |
| [6]Touch leakage current | Ipe | 0.000 mA ... 1.999 mA | 1 µA | ±(3 % of reading + 3 D) |
| | | 2.00 mA ... 19.99 mA | 0.01 mA | ±5 % of reading |
| [6]Power (active) | P | 0 W ... 999 W | 1 W | ±(5 % of reading + 5 D) |
| | | 1.00 kW ... 3.70 kW | 10 W | ±5 % of reading |
| **Power** | | | | |
| Power (active) | P | 0 W ... 999 W | 1 W | ±(5 % of reading + 5 D) |
| | | 1.00 kW ... 3.70 kW | 10 W | ±5 % of reading |
| Power (apparent) | S | 0 VA ... 999 VA | 1 VA | ±(5 % of reading + 5 D) |
| | | 1.00 kVA ... 3.70 kVA | 10 VA | ± 5 % of reading |
| Power (reactive) | Q | ±(0 VAr ... 999) VAr | 1 VAr | ±(5 % of reading + 5 D) |
| | | ±(1.00 kVAr ... 3.70) kVAr | 10 VAr | ±5 % of reading |
| Power factor | PF | 0.00i ... 1.00i | 0.01 | ±(5 % of reading + 5 D) |
| | | 0.00c ... 1.00c | | |
| Total Harmonic Distortion (voltage) | THDU | 0.0 % ... 99.9 % | 0.1 % | ±(5 % of reading + 5 D) |
| Total Harmonic Distortion (current) | THDI | 0.00 A ... 16.00 A | 0.01 A | ±(3 % of reading + 5 D) |
| Cosinus fi | Cos fi | 0.00i ... 1.00i | | |
| | | 0.00c ... 1.00c | 0.01 | ±(5 % of reading + 5 D) |
| Current | I | 0.00 A ... 16.00 A | 0.01 A | ±(3 % of reading + 5 D) |
| Voltage | U | 0.0 V ... 199.9 V | 0.1 V | ±(3 % of reading + 10 D) |
| | | 200 V ... 264 V | 1 V | ±3 % of reading |
| **Leak's & Power** | | | | |
| [7]Power (active) | P | 0 W ... 999 W | 1 W | ±(5 % of reading + 5 D) |
| | | 1.00 kW ... 3.70 kW | 10 W | ±5 % of reading |
| [7]Touch leakage current | Itou | 0.000 mA ... 1.999 mA | 1 µA | ±(3 % of reading + 3 D) |
| | | 2.00 mA ... 19.99 mA | 0.01 mA | ±5 % of reading |
| Differential leakage current | Idiff | 0.000 mA ... 1.999 mA | 1 µA | ±(3 % of reading + 3 D) |
| | | 2.00 mA ... 19.99 mA | 0.01 mA | ±5 % of reading |
| Power (apparent) | S | 0 VA ... 999 VA | 1 VA | ±(5 % of reading + 5 D) |
| | | 1.00 kVA ... 3.70 kVA | 10 VA | ± 5 % of reading |
| Power (reactive) | Q | ~(0 VAr ... 999) VAr | 1 VAr | ±(5 % of reading + 5 D) |
| | | ~(1.00 kVAr ... 3.70) kVAr | 10 VAr | ±5 % of reading |
| Power factor | PF | 0.00i ... 1.00i | 0.01 | ±(5 % of reading + 5 D) |
| | | 0.00c ... 1.00c | | |
| Total Harmonic Distortion (voltage) | THDU | 0.0 % ... 99.9 % | 0.1 % | ±(5 % of reading + 5 D) |
| Total Harmonic Distortion (current) | THDI | 0.00 A ... 16.00 A | 0.01 A | ±(3 % of reading + 5 D) |
| Cosinus fi | Cos fi | 0.00i ... 1.00i | 0.01 | ±(5 % of reading + 5 D) |
| | | 0.00c ... 1.00c | 0.01 A | |
| Current | I | 0.00 A ... 16.00 A | 0.1 V | ±(3 % of reading + 5 D) |
| Voltage | U | 0.0 V ... 199.9 V | 1 V | ±(3 % of reading + 10 D) |
| | | 200 V ... 264 V | | ±3 % of reading |
| **Clamp current** | | | | |
| [8]Clamp current | Idiff | 0.10 mA ... 9.99 mA | 0.01 mA | ±(5 % of reading + 10 D) |
| | Ip | 10.0 mA ... 99.9 mA | 0.1 mA | ±(5 % of reading + 5 D) |
| | | 100 mA ... 999 mA | 1 mA | ±(5 % of reading + 5 D) |
| | | 1.00 A ... 9.99 A | 0.01 A | ±(5 % of reading + 5 D) |
| | | 10.0 A ... 24.9 A | 0.1 A | ±(5 % of reading + 5 D) |
| **Insulation Resistance** Riso LN-PE, LN-NEP, LN-AP, AP-PE, AP-NEP | | | | |
| Riso | Riso | 0.00 MΩ ... 19.99 MΩ | 0.01 MΩ | ±(3 % of reading + 2 D) |
| | | 20.0 MΩ ... 199.9 MΩ | 0.1 MΩ | ±5 % of reading |
| [9]Output voltage | Um | 0 V ... 600 V | 1 V | ±(3 % of reading + 2 D) |
| **Equipment leakage (alternative, direct, differential)** | | | | |
| [10]Equipment leakage current (direct, differential, alternative) | Ieq | 0.000 mA ... 1.999 mA | 1 µA | ±(3 % of reading + 3 D) |
| [10]Ulpe (direct, differential, alternative) | Ulpe | 2.00 mA ... 19.99 mA | 0.01 mA | ±5 % of reading |
| [10]Power (direct, differential) | P | 0 V ... 299 V | 1 V | ±(2 % of reading + 2 D) |
| | | 0 W ... 999 W | 1 W | ±(5 % of reading + 5 D) |
| | | 1.00 kW ... 3.70 kW | 10 W | ±5 % of reading |
| **Applied Part leakage (alternative, direct)** | | | | |
| [11]Applied Part leakage current (direct, alternative) | Iap | 0.000 mA ... 1.999 mA | 1 µA | ±(3 % of reading + 3 D) |
| | | 2.00 mA ... 19.99 mA | 0.01 mA | ±5 % of reading |
| [11]Uap (direct, alternative) | Uap | 0 V ... 299 V | 1 V | ±(2 % of reading + 2 D) |
| [11]Power (direct) | P | 0 W ... 999 W | 1 W | ±(5 % of reading + 5 D) |
| | | 1.00 kW ... 3.70 kW | 10 W | ±5 % of reading |

| | | | | |
|---|---|---|---|---|
| **Touch current, Touch current NEP -NEP** | | | | |
| Touch current | Itou | 0.000 mA ... 1.999 mA | 1 µA | ±(3 % of reading + 3 D) |
| | | 2.00 mA ... 19.99 mA | 0.01 mA | ±5 % of reading |
| **Patient leakage** | | | | |
| Patient leakage (Vext on SIO), Total patient leakage (Vext on SIO) | Itou | 0.000 mA ... 1.999 mA | 1 µA | ±(3 % of reading + 3 D) |
| | | 2.00 mA ... 19.99 mA | 0.01 mA | ±5 % of reading |
| Patient leakage (Vext on NEP), Total patient leakage (Vext on NEP) | Itou | 0.000 mA ... 1.999 mA | 1 µA | ±(3 % of reading + 3 D) |
| | | 2.00 mA ... 19.99 mA | 0.01 mA | ±5 % of reading |
| Patient leakage (Vext on AP), Total patient leakage (Vext on AP) | Itou | 0.000 mA ... 1.999 mA | 1 µA | ±(3 % of reading + 3 D) |
| | | 2.00 mA ... 19.99 mA | 0.01 mA | ±5 % of reading |
| Patient leakage, Total patient leakage | Itou | 0.000 mA ... 1.999 mA | 1 µA | ±(3 % of reading + 3 D) |
| | | 2.00 mA ... 19.99 mA | 0.01 mA | ±5 % of reading |
| Patient auxiliary leakage | Itou | 0.000 mA ... 1.999 mA | 1 µA | ±(3 % of reading + 3 D) |
| | | 2.00 mA ... 19.99 mA | 0.01 mA | ±5 % of reading |

| | |
|---|---|
| [1]**Operating range (acc. to EN 61557-4)** | 0.08 Ω ... 199.9 Ω |
| Test currents | 0.2 A, 25 A |
| Current source (at nominal mains voltage, use of standard accessories) | > 0.2 A at R < 2 Ω / |
| | > 25 A into short circuit at 230 V |
| Open circuit voltage | < 9 VAC |
| [2]**Operating range (acc. to EN 61557-2)** | 0.08 MW ... 199.9 (999) MW |
| Nominal voltages Un | 250 V, 500 V (-0 %, +10 %) |
| Short circuit current | max. 2.0 mA |
| [3]**Operating range (acc. to EN 61557-16)** | 0.02 mA ... 19.99 mA |
| Open circuit voltage | 230 VAC, 110 VAC |
| Current calculated to mains supply voltage (110 V or 230 V) is displayed. | |
| [4]**Operating range (acc. to EN 61557-16)** | 0.010 mA ... 19.99 mA |
| Influence of load current | < 0.02 mA/A |
| [5]**Operating range (acc. to EN 61557-16)** | 0.010 mA ... 19.99 mA |
| [6]**Operating range (acc. to EN 61557-16)** | 0.010 mA ... 19.99 mA |
| [7]**Operating range (acc. to EN 61557-16)** | 0.010 mA ... 19.99 mA |
| [8]**True RMS current using 1000:1 current clamp. Accuracy of current transformer is not considered. Frequency range of current clamp is not considered.** | |
| [9]**Operating range (acc. to EN 61557-2)** | 0.08 MW ... 199.9 (999) MW |
| Nominal voltages Un | 500 V (-0 %, +10 %) |
| Short circuit current | max. 2.0 mA |
| [10]**Operating range direct and differential method (acc. to EN 61557-16)** | 0.010 mA ... 19.99 mA |
| Operating range alternative method (acc. to EN 61557-16) | 0.020 mA ... 19.99 mA |
| Influence of load current (differential method) | < 0.02 mA/A |
| [11]**Operating range direct method (acc. to EN 61557-16)** | 0.010 mA ... 19.99 mA |

## TECHNICAL SPECIFICATION

| | |
|---|---|
| **Mains supply** | |
| Supply voltage, frequency | 110 V / 230 V AC, 50 Hz / 60 Hz |
| Supply voltage tolerance | ±10 % |
| Max. power consumption | 300 VA (without load on test socket) |
| Max. load | 10 A continuous, 16 A short duration, 1.5 kW motor |
| Mains supply overvoltage category | CAT II / 300V |
| Altitude | ≤ 2000 m |
| **Measuring categories** | |
| Instrument | CAT II / 300 V |
| Test socket | CAT II / 300 V |
| Plug test cable | CAT II / 300 V |
| Altitude | ≤ 2000 m |
| **Leakage current measurements** | |
| Measuring device (MD) | Comply to IEC/EN 60601 and IEC 61557-16 requirements |
| Measurement type | AC, DC or True RMS, as per IEC/EN 60601, IEC 61557-16 requirements |
| **Protection classifications** | |
| Power supply | Class I |
| Pollution degree | 2 |
| Degree of protection | IP 40 |
| | IP 20 (mains test socket) |
| Case | Shock proof plastic/portable/IP 65 |
| **Display** | |
| Display | Colour TFT display, 4.3 inch, 480 x 272 pixels |
| Touch screen | Capacitive |
| **Communication** | |
| Memory | Depends on microSD card size |
| RS-232 interfaces | 3 |
| USB 2.0 | Standard USB Type B |
| Bluetooth | Class 2 |
| Ethernet | Dynamic IP (DHCP) |
| **Reference conditions** | |
| Reference temperature range | 15 °C ... 35 °C |
| Reference humidity range | 35 % ... 65 % RH |
| **Operation conditions** | |
| Working temperature range | 0 °C ... +40 °C |
| Maximum relative humidity | 85 % RH (0 °C ... 40 °C), non-condensing |
| **Storage conditions** | -10 °C ... +60 °C |
| Temperature range | 90 % RH (-10 °C ... +40 °C) |
| Maximum relative humidity | 80 % RH (40 °C ... 60 °C) |
| **Fuses** | |
| F1, F2 | T 16 A / 250 V / 32 mm x 6.3 mm / 1500 A |
| **General** | |
| Dimensions (w×d×h) | 42 cm x 33 cm x 18 cm |
| Weight | 8.1 kg |

[1]Accuracies apply for 1 year in reference conditions. Temperature coefficient outside these limits is 0.2 % of measured value per °C plus 1 digit, otherwise noted.

## OPTIONAL ACCESSORIES

| Photo | Part No. | Description |
|---|---|---|
|  | A 1758 | Test lead, black, 1 m |
|  | A 1759 | Test lead, brown, 1 m |
|  | A 1760 | Test lead, green, 1 m |
|  | A 1761 | Test lead, yellow, 1 m |
|  | A 1762 | Test lead, violet, 1 m |
|  | A 1014 | Test probe, black |
|  | A 1298 | Test probe, brown |
|  | A 1062 | Test probe, green |
|  | A 1013 | Crocodile clip, black |
|  | A 1297 | Crocodile clip, brown |
|  | A 1309 | Crocodile clip, green |
|  | A 1546 | Crocodile clip, yellow |
|  | A 1579 | Leakage current clamp |

| Photo | Part No. | Description |
|---|---|---|
|  | A 1488 | BT Able printer, (battery or mains operated) |
|  | A 1489 | Label printer Able, with power and data cables, (battery or mains operated) |
|  | S 2062 | BT label printer set, (mains operated) |
|  | A 1628 | Spare label roll for S 2062 |
|  | A 1450 | Spare label roll for S 2062 |
|  | A 1520 | Labels for ABLE printer, (250 labels per roll) |
|  | A 1105 | Barcode scanner |
|  | A 1105 2D | Barcode scanner 2D RS232 connection |
|  | A 1571 | NFC reader / writer |
|  | A 1572 | NFC tags, fi 34mm self-stick 50 pcs |
|  | A 1573 | NFC labels, fi 29 mm self-stick 50 pcs |
|  | P 1403 | 3-year Metrel Smart Cloud PRO subcription<br>• Metrel Cloud Reports<br>• Metrel Cloud Storage (24 GB) |

## ORDERING INFORMATION



**Standard set MI 6601**

- Instrument MI 6601 MediTest
- A 1080 Mains cable
- A 1758 Test lead, black, 1 m
- A 1759 Test lead, brown, 1 m
- A 1760 Test lead, green, 1 m
- A 1761 Test lead, yellow, 1 m
- A 1762 Test lead, violet, 1 m
- A 1014 Test probe, black
- A 1298 Test probe, brown
- A 1062 Test probe, green
- A 1013 Crocodile clip, black, 2pcs
- A 1297 Crocodile clip, brown
- A 1309 Crocodile clip, green
- A 1546 Crocodile clip, yellow
- A 1727 USB cable
- A 1017 Communication cable RS232
- A 1500 Bag for accessories

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Note! Photographs in this catalogue may slightly differ from the instruments at the time of delivery.
Subject to technical change without notice.

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