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 60601 or IEC 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 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 60601-1 standard** (patient, auxiliary, earth, touch);
- **All leakage current** measurements as defined in **IEC 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 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 60601 and IEC 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.

METREL®

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 60601 and IEC 61557-16 requirements
Measurement type	AC, DC or True RMS, as per IEC 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

Photo	Part No.	Description
	A 1579	Leakage current clamp
	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

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
- Subscription to Metrel Medical Software solution:
  - Metrel Medical ES Manager
  - Metrel Cloud Reports
  - Metrel Cloud Storage

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