GOSSEN METRAWATT

METRAHit®27M and I
Milliohm Resistance Meter and Digital Multimeter, Insulation Tester and Data Logger

3-349-206-03
1/12.02

- The **METRAHit®27M**
  is a compact milliohm resistance meter plus multimeter and thermometer for the measurement of low-value contact resistance on aircraft outer skins (lightning protection, wick test), and for general low-resistance measurements.
- The **METRA*Hit*®27I**
  is used additionally for service and repair work performed on airplane and helicopter electrical systems (voltage, insulation, milliohm and temperature measurement).
  In addition to its own multimeter functions for electrical quantities, the instrument also includes a mega-ohm measuring function with insulation test voltages of 50, 100, 250 and 500 V, as well as temperature measurement with Pt100 and Pt1000 sensors.

Quality Management System
DQS Certified per
DIN EN ISO 9001 reg. no. 1262

Deutscher Kalibrierdienst
DKD - K - 19701
DKD Calibration Certificate
DIN EN ISO/IEC 17025

METRAHit®27M Features

- **All-in-one: milliohm resistance meter, multimeter, insulation tester * and data logger**
  Compact and rugged for service under harsh conditions and laboratory use, a single device for many applications
- **Kelvin connection (4-wire measurement)**
  Suppresses influence from conductor and contact resistances on measuring results
- **Measuring current can be selected according to the measuring task:**
  Adaptation to various resistance measuring requirements and optimized battery service life
- **DATA Hold**
  For quick, reliable measurement and storage of individual measured values, e.g. voltages at discrete cells in batteries and emergency power supplies
- **Overload protection**
  Protects the instrument in the event of inadvertent connection to mains power
- **DKD calibration certificate as standard feature**
  Reduced operating costs for use within ISO 9000 quality systems, documented traceability
- Battery operation
- The instrument can be operated with optional rechargeable NiMH batteries and charger.

METRA*Hit*®27I Features

Includes all METRAHit®27M functions plus:

- **Insulation resistance tester ***
  Testing with 50 to 500 V for components, cables and conductors, for example in aircraft and in on-board electrical systems
- **LCD panel with background illumination ***
  High contrast, even under adverse ambient light conditions
- **Compact and multifunctional**
  Can be used advantageously in aircraft cockpits as well as in other constricted spaces, which would otherwise require the use of several individual instruments.
- **Mains power or battery operation ***
  Furnished with 3 rechargeable NiMH batteries and a charger as standard equipment for optimized instrument availability and low operating costs
- **DKD calibration certificate as standard feature**
  Reduced operating costs for use within ISO 9000 quality systems, documented traceability

* With METRA*Hit*®27I only

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Milliohm Resistance Meter and Digital Multimeter, Insulation Tester and Data Logger

Applications

The METRA*Hit*®27 is a compact, rugged and reliable instrument, which is equally suitable for precision measuring and recording tasks in the factory, for on-site service and in the laboratory:

- Adjustment of shunts in instrumentation
- Testing of electrical connections at conductor bars for open-pit mining, in potential bonding systems, and for industrial and household applications
- Testing of cable resistance, wiring, shunt resistors in PCBs and thick-film circuits
- Measurement of contact resistance in relays, contactors and power interrupters
- Testing of resistance in fuses, as well as conductor resistance in heavy current circuits
- Testing of winding resistance in transformers, coils, small motors etc.
- Testing of discharge resistance on aircraft, and at aircraft outer skin components
- Contact resistance testing in uninterruptible power supplies
- Measurement of cell voltages, for example in on-board batteries and emergency power supplies
- Contact resistance testing at welding seams

General

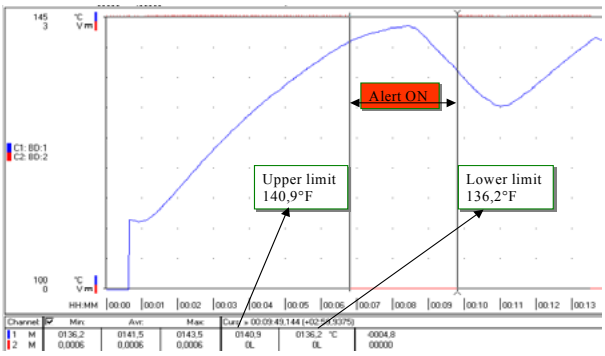
The METRA*Hit*®27 milliohm resistance meter is the modern alternative for the well known TH2 (Thomson) and Wh2 (Wheatstone) measuring bridges. It provides an expanded measuring range, greater accuracy and easier reading. As a universal measuring and test instrument, it acquires and records values to an integrated memory module including resistance in the milliohm and micro-ohm ranges, as well as “normal multimeter resistance values” in the ohm to mega-ohm ranges by feeding a measuring current to the resistor, conductor or contact under test. The respective measuring current is determined by the rotary selector switch setting and lies within a range of 1 to 0.02 A in the milliohm ranges. The instrument also measures and records insulation resistance (METRA*Hit*®27I only) with test voltage selectable in steps, for example in order to test resistance in on-board electrical systems for aircraft, ocean going vessels etc., and for testing overvoltage arresters and much more.

Easy Operation

Operation is very easy. Simply connect the low-resistance device under test to the instrument with the included measurement cables, Kelvin clips or 4-pole probes (KC27), and select the ideal measuring range.

Integrated Measured Value Memory and Interface

Each METRA*Hit*®27 is equipped with a measured value memory module and can thus be utilized as a data logger or a recording instrument for all measuring functions. Measurement results can be transmitted to a PC either off-line via the optical interface which is furnished as standard equipment, or online with an optional bidirectional adapter. In this way, for example, characteristic voltage and temperature curves (see figure below) can be displayed and analyzed in line recorder format relative to real-time, or individual measured values, e.g. voltages for each of the cells in a rechargeable battery, can be saved with the DATA Hold function and analyzed at a PC in tabular form.



METRAwin®10/METRA*Hit*® (software option):
Recorded characteristic temperature curve and triggering characteristics (2-channel recording with 2 METRA*Hit*® instruments) plus evaluation at a PC

METRAwin®10/METRA*Hit*® Software Option

Measurement data recorded to the measured value memory module can be evaluated at a PC if required with the help of the IR interface supplied as standard equipment and a bidirectional IR adapter (BD adapter) with conversion to the RS 232 protocol. METRAwin®10/METRA*Hit*® software (see above figure) is recommended to this end, and is suitable for display, analysis and documentation of measurement results using Windows® 98, NT, 2000 or XP. The software is available as an accessory. User-friendly complete packages (e.g. the BD Pack or the complete METRAHit®27AS case) are easy to connect and install and include everything required for high performance measurement data processing.

Offset Balancing

Automatic offset balancing is provided for the lower measuring ranges. Manual offset balancing, as required with the METRA*Hit*®17 predecessor model, is thus no longer necessary.

Protection Against Operator Error

The METRA*Hit*®27 is safeguarded against erroneous short-term connection to devices under test with fault voltages of up to 600 V by means of protective devices.

Test Functions and Automatic Functions

All METRA*Hit*®27 instruments are equipped with diode and continuity test functions, as well as automatic and manual measuring range selection and battery shutdown.

Protective Cover for Harsh Conditions

The device features a very compact, rugged design. Beyond this, it is protected against damage in the event of impacts or dropping by means of a soft rubber cover with tilt stand. The rubber material also assures that the instrument does not wander if it is set up on a vibrating surface.

Applicable Regulations and Standards

IEC 61010-1/EN 61010-1/ VDE 0411-1	Safety requirements for electrical equipment for measurement, control and laboratory use
EN 60529 VDE 0470, Part 1	Test instruments and test procedures Protection provided by enclosures (IP code)
IEC 61326/EN 61326	Electromagnetic compatibility (EMC)

Characteristic Values

Measuring Function	Measuring Range	Resolution at Upper Range Limit	Input Impedance		Intrinsic Error at Max. Resolution under Reference Conditions ±(... % rdg. + ... d)		Overload Capacity [3]	
		4¾ 30000 / 3¾ 3000 [1]	DC	AC [6]	DC	AC [6]	Value	Time
V	3 V	100 µV	2.1 MΩ	2.1 MΩ // < 50 pF	0.1 + 10 [4]	0.2 + 10 (>500 d)	600 V DC AC eff sine	Cont.
	30 V	1 mV	2.1 MΩ	2.1 MΩ // < 50 pF	0.1 + 5	0.2 + 10 (>500 d)		
	300 V	10 mV	2.1 MΩ	2.1 MΩ // < 50 pF	0.1 + 5	0.2 + 10 (>500 d)		
	600 V	100 mV	2.1 MΩ	2.1 MΩ // < 50 pF	0.1 + 5	0.2 + 10 (>500 d)		
			Open-Circuit Voltage	Measuring Current, Approx.	±(... % rdg. + ... d)			
mΩ @1A (4 L)	3 mΩ	0.001 mΩ	3.5 … 4 V	1 A [7]	1 + 10		±0.6 V	Cont.
	30 mΩ	0.001 mΩ	3.5 … 4 V	1 A [7]	0.5 + 10			
	300 mΩ	0.01 mΩ	3.5 … 4 V	1 A [7]	0.5 + 10			
mΩ (4 L)	30 mΩ	0.01 mΩ	3.5 … 4 V	200 mA	0.25 + 10		±0.6 V	Cont.
	300 mΩ	0.01 mΩ	3.5 … 4 V	200 mA				
	3 Ω	0.1 mΩ	3.5 … 4 V	20 mA				
	30 Ω	1 mΩ	3.5 … 4 V	20 mA				
Ω (2 L)	300 Ω	10 mΩ	3.5 … 4 V	1 mA	0.1 + 10 [4]		600 V DC AC eff sine	max. 10 s
	3 kΩ	100 mΩ	3.5 … 4 V	100 µA	0.1 + 5 [4]			
	30 kΩ	1 Ω	3.5 … 4 V	20 µA	0.1 + 5			
	300 kΩ	10 Ω	3.5 … 4 V	20 µA	0.1 + 5			
	3 MΩ	100 Ω	3.5 … 4 V	10 µA	0.1 + 5			
	30 MΩ	1 kΩ	3.5 … 4 V	10 µA	1.5 + 10			
🔊	300 Ω	0.1 Ω	3 V	1 mA	1 + 5			
⊣▶⊢	3 V	0.1 mV	3 V	1 mA	1 + 5			
			Test Voltage	Measuring Current				
MΩ @ ... V	30 MΩ	0.01 MΩ	50/100/250/500 V	< 1.5 mA	2 + 10		600 V DC/AC	max. 10 s
	300 MΩ	0.1 MΩ	50/100/250/500 V		2 + 10			
	3000MΩ [10]	1 MΩ	50/100/250/500 V		3 + 10			
			f_{min} [2]		±(... % rdg. + ... d)			
Hz	300 Hz	0.01 Hz	1 Hz		0.05 + 5 [5]		600 V AC	Cont.
	3 kHz	0.1 Hz						

	Temperature Sensor	Measuring Range	Resolution	Intrinsic Error at Max. Resolution under Reference Conditions ±(...% rdg. + ... d) [8]		
°C / °F	Pt 100 [9]	−200.0 … +100.0 °C	0.1 °K	1 K + 5	600 V DC AC eff sine	max. 10 s
		+100.0 … +600.0 °C		0.5 + 5		
	Pt 1000	−200.0 … +100.0 °C		1 K + 5		
		+100.0 … +600.0 °C		0.5 + 5		
	Ni 100	−60.0 … +180.0 °C		0.5 + 5		
	Ni 1000	−60.0 … +180.0 °C		0.5 + 5		

[1] Display: 3¾ places in following ranges: 3 mΩ @ 1A, 30 mΩ, 🔊, MΩ@...V, a different sampling rate can also be selected in the rAtE menu for saving and transmitting measured values.

[2] Lowest measurable frequency for sinusoidal measuring signals symmetrical to the zero point

[3] At 0° to + 40° C

[4] ZERO is displayed for “zero balancing” function.

[5] Range 3 V~: U_E = 0.15 $V_{eff/rms}$ . . . 3 $V_{eff/rms}$
30 V~: U_E = 1.5 $V_{eff/rms}$ . . . 30 $V_{eff/rms}$
300 V~: U_E = 15 $V_{eff/rms}$ . . . 300 $V_{eff/rms}$
600 V~: U_E = 300 $V_{eff/rms}$ . . . 600 $V_{eff/rms}$
For voltages > 100 V: power limiting of $1.8 \cdot 10^6$ V · Hz

[6] 20 … 45 … 65 Hz … 1 kHz sine, see influences on page 4.

[7] Pulsating measuring current with interval of T = 1 s

[8] Plus sensor deviation

[9] Temperature value is based upon the characteristic curve per EN 60751.

[10] In the case of high resistance values of greater than 300 MΩ, the capacitive influence of the person performing the measurement or the measurement cable may distort the measured value. Use short or shielded measurement cables for this reason.

Key

rdg. = reading (measured value), R = measuring range, D = digit(s),
2/4 L = 2/4-wire measurement

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Influencing Quantities and Influence Error

Influencing Quantity	Sphere of Influence	Measured Quantity / Measuring Range [1]	Influence Error ± (... % rdg. + d) / 10 K
Temperature	0 … +21 °C and +25… +40 °C	V DC	0.1 + 5
		V AC	0.5 + 5
		mΩ @ 1 A 4L	1 + 5
		mΩ @ 200 mA 4L	1 + 5
		300 Ω … 300 kΩ 2L	0.2 + 5
		3 MΩ 2L	0.5 + 5
		30 MΩ 2L	1 + 5
		Insulation, 30 MΩ … 3 GΩ	2 + 5
		Hz	0.1 + 5
		°C (RTD)	0.5 + 10

) With zero balancing

Influencing Quantity	Frequency	Measured Quantity / Measuring Range	Influence Error [1] ± (... % rdg. + d)
Frequency V_{AC}	> 20 Hz ... 45 Hz	3 V to 600.0 V	2 + 10
	> 65 Hz ... 1 kHz		

[1] Specified error valid as of display values of 10% of the measuring range

Influencing Quantity	Sphere of Influence	Measured Quantity / Measuring Range [1]	Influence Error
Relative Humidity	75% 3 days instrument off	all measured quantities	1 x intrinsic error

[1] With zero balancing

Influencing Quantity	Sphere of Influence	Measuring Range	Damping ±dB
Common Mode Interference Voltage	Interference quantity max. 600 V ~	V DC	> 90 dB
	Interference quantity max. 600 V ~ 50 Hz, 60 Hz sine	30 V ~	> 80 dB
		300 V ~	> 70 dB
		600 V ~	> 60 dB
Series Mode Interference Voltage	Interference quantity: V~, respective nominal value of the measuring range, max. 600 V ~, 50 Hz, 60 Hz sine	V =	> 60 dB
	Interference quantity: max. 600 V DC	V ~	> 60 dB

Real-Time Clock

Accuracy ±1 minute per month

Temperature Influence 50 ppm/K

Reference Conditions

Ambient temperature +23 °C±2 K

Relative humidity, 40 ... 60%

Measured quantity frequency 45 ... 65 Hz

Measured quantity wave shape Sinusoidal, deviation between RMS and rectified value < 0.1%

Battery voltage 3.6 V ± 0.2 V

Response Time (after manual range selection)

Measured Quantity / Measuring Range	Response Time for Digital Display	Measured Quantity Step Function
V DC, V AC	1.5 s	from 0 to 80% of upper range limit value
mΩ @ 1 A 4L	2 s	from ∞ to 50% of upper range limit value
mΩ	1.5 s	
300 Ω ... 3 MΩ	2 s	
3 GΩ *	5 s	
Continuity	< 50 ms	
⇻	1.5 s	
°C Pt100	max. 3 s	
>10 Hz	1.5 s	from 0 to 50% of upper range limit value

* Without parallel connected capacitance

Display

LCD panel (65 mm x 30 mm) with display of up to 3 measured values, unit of measure, type of current and various special functions.

Display / char. height 7-segment characters
Main display: 12 mm
Auxiliary displays: 7 mm

Number of places 4¾ places, ≙ 30999 steps

Overflow display "OL" appears

Polarity display "–" sign is displayed if plus pole is connected to ⊥

LCD Test All display segments available during operation of the METRA*Hit*®27 are activated after the instrument is switched on.

Background illumination METRA*Hit*®27I only

Power Supply

Rechargeable batteries METRA*Hit*®27I (standard):
3 ea. 1.2 V/1600 mAh NiMH (AA)

Batteries METRAHit,27M:
3 ea. 1.5 V mignon, IEC LR6 (AA)

Service life with 1600 mAh NiMH battery set

Measuring Function	Current [mA] / 3.6 V	Operating Hours [h]
V, Hz, Ω, ⇻, °C	70	20
mΩ @ 1A	700	2
mΩ @ 200mA	260	5.4
mΩ @ 20mA	85	16.5
MΩ @ ... V / 1 MΩ	100	15
Standby (MEM + clock)	0.15	6 months

Additional consumption for:

Interface operation: 0.5 mA

LCD illumination: 25 mA at 3.6 V. If voltage drops below 2.7 V, the instrument is switched off automatically.

Battery test ⊣ is displayed automatically if battery voltage drops to below approx. 3.3 V.

Battery charging With NA4/500 power pack (1600 mAh rechargeable battery set: 14 h charging time)

Fuses

Fuse links for all mΩ measuring ranges	FF (UR) 1.6 A/1000 V AC/DC, 6.3 mm x 32 mm, 10 kA switching capacity at 1000 V AC /DC and ohmic load
Acoustic Signal	For display > 610 V in 600 V range (intermittent tone, 250 ms on/off)

Electrical Safety

Safety class	II per IEC 61010-1/EN 61010-1 /VDE 0411-1
Overvoltage category	II
Operating voltage	600 V
Fouling factor	2
Test voltage	3.5 kV~ per IEC 61010-1/EN 61010-1/ VDE 0411-1

Electromagnetic Compatibility (EMC)

Interference emission	EN 61326: 2002 class B
Interference immunity	EN 61326: 2002 IEC 61000-4-2: 1995/A1: 1998 Feature A: 8 kV atmospheric discharge 4 kV contact discharge IEC 61000-4-3: 1995/A1: 1998 Feature B: 3 V/m

Data Interface

With BD232 interface adapter as accessory:

Data transmission	Optical via infrared light through the housing
Type	RS 232 C, serial, per DIN 19241
Bidirectional baud rate (read and write)	SI232-II: all baud rates BD232: 9600 baud

Ambient Conditions

Accuracy range	0 °C ... +40 °C
Operating temp.	–10 °C ... +50 °C
Storage temperature	–25 °C ... +70 °C (without batteries)
Relative humidity	40% ... 60%, no condensation allowed
Elevation	to 2000 m
Deployment	Indoors only, except within specified ambient conditions

Mechanical Design

Protection	Housing: IP 54, Connector jacks: IP 20
Dimensions	84 mm x 195 mm x 35 mm
Weight	Approx. 420 gr. with batteries (without GH18 protective rubber cover)

Standard Equipment

METRAHit®27M including

3 size AA alkaline manganese batteries
1 KS17S measurement cable set
1 operating instructions
1 abbreviated operating instructions
1 GH18 protective rubber cover with carrying strap
1 DKD calibration certificate

METRA*Hit*®27I including

3 size AA rechargeable NiMH batteries
1 NA4/500 mains adapter
1 KS17S measurement cable set
1 KC4 Kelvin clip set
1 operating instructions
1 abbreviated operating instructions
1 GH18 protective rubber cover with carrying strap
1 DKD calibration certificate

METRAHit®27AS (avionics set) including

1 METRA*Hit*®27I
3 size AA rechargeable NiMH batteries
1 NA4/500 mains adapter
1 HC30 hard case
1 KS17S measurement cable set
1 KC27 Kelvin probe
1 operating instructions
1 abbreviated operating instructions
1 BD pack including adapter, cable and METRAwin10 software
1 GH18 protective rubber cover with carrying strap
1 DKD calibration certificate

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Milliohm Resistance Meter and Digital Multimeter, Insulation Tester and Data Logger

Accessories

(See also table "Order Information" below.)

The following accessories, some of which are included as standard equipment, are recommended for use with the METRA*Hit*®27:

Milliohm Measurement with Type KC4 Kelvin Clips

Kelvin clips are suitable for establishing contact between the METRA*Hit*®27 and low-resistance devices under test. They compensate for influence resulting from cable and contact resistance. The KC4 set includes two clips with insulated, twist-resistant jaws and good clamping action. They can be used for establishing contact with very fine wires, up to rails and rods with a maximum diameter of 15 mm. 4-pole connection is highly advisable for the measurement of values of less than 30 Ω.

Milliohm Measurement with Type KC27 Kelvin Probe

Same usage as KC4, but with two 2 spring loaded steel tips for piercing insulation coatings (e.g. on the outer skin of aircraft) and oxide layers (e.g. at oxidized battery contacts), in order to assure good contact for milliohm measurements, as well as for current and voltage measurements.

Power Supply with NA4/500

The NA4/500 mains adapter is used during stationary operation in order to recharge the NiMH batteries, or for battery operation.

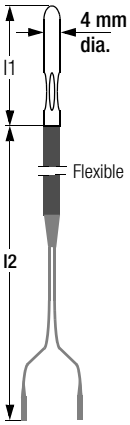
The mains adapter may only be used together with the above specified, rechargeable NiMH batteries.

Recording System with BD Pack

This option includes all additionally required hardware and software components for creating a PC supported measuring and recording system together with the METRA*Hit*®27. A full version of METRAwin®10/METRA*Hit*® is included with this package, which can be run with Windows 95, 98, 2000, NT or XP (see figure on page 2). Additional information is available from the Internet at: http://www.gmc-instruments.com/deutsch/produkte/metrawin10metrahit.htm

Temperature Measurement with TF220 / Current Measurement with Z13B

The TF220 is just one of many temperature sensors which can be selected from a wide ranging product spectrum. For further information regarding temperature and current sensors, as well as other accessories, please refer to our "*Measuring Instruments and Testers*" catalog or visit www.gmc-instruments.com



TF220


Z13B

Ever-Ready Cases and Hard Cases

The following hard-shell cases are available:

HC20 with space for one METRA*Hit*® and accessories.

HC30 with space for 2 METRA*Hit*® instruments, one 2-channel PC recording system with software, adapter, cable and accessories.

F836 imitation leather carrying pouch for one METRA*Hit*® and accessories (dimensions: 175 x 210 x 75 mm)

F840 imitation leather carrying pouch for two METRA*Hit*® instruments, 2 adapters and accessories (dimensions: 305 x 285 x 70 mm)

HC20

HC30


F836


F840 (with sample contents)

Order Information

Description	Type	Article Number
Milliohm resistance meter and multimeter with memory	METRAHit®27M	M227A
Insulation tester, milliohm resistance meter and multimeter with memory	METRA*Hit*®27I	M227B
Avionics set: insulation tester, milliohm resistance meter and multimeter with memory, adapter, software and extensive accessories	METRAHit®27AS	M227C
Hardware Accessories		
Power pack, 230 V~/4.5 V, 600 mA	NA4/500	Z218A
Fuses for all mΩ measuring ranges	FF (UR) 1.6 A/ 1000 V AC/DC	Z109C
Kelvin clips (1 set) for 4-pole connection of low-resistance DUTs, cable length: 120 cm	KC4	Z227A
Kelvin probes (1 set) with double steel tips for 4-pole connection of low-resistance DUTs	KC27	Z227B
Cable set with 2 mm diameter steel tips and 120 cm cable, 1000 V / CAT III	KS17S	Z110H
Extension cable 1.5 square mm, max. 5 A / 33 V, 15 m long, on reel, may not be used with mains voltage	VL15	Z110I
Pt1000 temperature sensor, −20 ... +220 °C for measurement in household appliances, as well as in gases and liquids, 3.2 mm diameter stainless steel immersion tube	TF220	Z102A
Clip-on current sensor	Z13B	Z213B
Carrying pouch	F829	GTZ 3301 000 R0003
Imitation leather carrying pouch for one METRA*Hit*® and accessories	F836	GTZ 3302 000 R0001
Imitation leather carrying pouch for 2 METRA*Hit*® instruments, adapter and accessories	F840	GTZ 3302 001 R0001
Hard case for one METRA*Hit*® and accessories	HC20	Z113A
Hard case for 2 METRA*Hit*® instruments, adapter and accessories	HC30	Z113A
Optional PC Analysis Software		
Single-channel pack consisting of METRA*Hit*®BD232 bidirectional interface adapter, cable, METRAwin®10/METRA*Hit*® software and installation instructions	BD-Pack 1	Z215A
Bidirectional interface adapter	BD232	GTZ 3242 100 R0001
Single-channel pack including cable, METRAwin®10/METRA*Hit*® software and installation instructions	Z3231	GTZ 3231 000 R0001
RS 232 interface cable, 2 m long (included with Z3231)	Z3241	GTZ 3241 000 R0001
METRAwin®10/METRA*Hit*® software update and installation instructions	Z3240	GTZ 3240 000 R0001

Please refer to our Measuring Instruments and Testers catalog for additional information concerning accessories.

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GOSSEN METRAWATT GMBH
Thomas-Mann-Str. 16-20
90471 Nürnberg, Germany
Member of GMC Instruments Group

Phone: +49-(0)-911-8602-0
Fax: +49-(0)-911-8602-669
e-mail: info@gmc-instruments.com
www.gmc-instruments.com

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