GOSSEN METRAWATT

METRAHIT | ENERGY
TRMS SYSTEM Multimeter

3-349-574-03
1/4.10

- Digital hand-held multimeter with **TRMS measurement** including: V AC TRMS, V AC+DC TRMS with a bandwidth of 100 kHz, V DC, dB, Hz (V), Hz (A), Ω, µF, V→⊢, °C/°F (TC/RTD)
- **Power measurement** (W, VAr, VA, PF): active, reactive and apparent power with extreme values, power factor
- **Energy measurement** (Wh, VArh, VAh)
  active, reactive and apparent energy, mean power value with adjustable observation period and maximum value
- **Mains quality analysis:** recording of over and undervoltage, dips, swells, voltage peaks and transients in 0, 50 and 60 Hz systems
- **Harmonic analysis:** RMS values and distortion components up to the 15th harmonic at 16.7, 50, 60 and 400 Hz
- **Special measuring functions**: crest factor CF, conductivity nS, low resistance R_{SL}, duty cycle %, cable length km
- Resolution of 60,000 digits, **triple display**, display illumination can be activated under difficult lighting conditions
- 1 kHz / –3 dB low-pass filter can be activated
- Direct current measurement from 10 nA to 10 A, 16 A intermittently, current measurement with current transformer clamp and sensors, transformation ratio is taken into account at the display
- Large data memory for up to 300,000 measured values
- Instrument is **completely remote controllable** without activating the rotary switch or changing current sockets

CAT IV

Deutscher Kalibrierdienst DKD-K-19701
DKD
DKD calibration certificate as standard feature

Quality Management System
DQS Certified per DINENISO9001:2000 reg. no.1262

Applications

The power multimeter is extremely rugged and reliable with a housing made of impact resistant ABS. With a resolution of 60,000 digits and more than 35 different measuring functions, it's been developed for professional use.

Features

Power and Energy Measurement

The **METRAHIT ENERGY** is a compact power meter for direct and alternating current in single-phase systems. The electrical circuit can be connected either directly, or via a current transformer. If a current transformer is connected to the multimeter (mA/A input), all current and power displays are represented with the correct value based upon the selected transformation ratio.
Universal power measurement includes the following measuring functions: active, reactive and apparent power, power factor and energy.
Beyond this, the mean power value can be generated over a specified time period (e.g. 15 min.), and the corresponding maximum value can be recorded along with time of occurrence. Suitable AC current transformers with current output are listed on page 10.

Systematic Voltage Quality Analysis

The **METRAHIT ENERGY** is equipped with a function for acquiring and recording power disturbances which is unique amongst the handheld multimeters. It allows for simultaneous, continuous recording of voltage characteristics and event-triggered recording of the following disturbances:

- Under and overvoltage with start time, duration and extreme value
- Under and overvoltage of the half-period RMS value (dips and swells) with start time, as well as min. and max. values
- Momentarily exceeded values with a duration of greater than 1 ms (peak) with time of occurrence and maximum value
- Steep transients with a rise time of 0.5 to 5 ms within a range of 200 to 1000 V including time of occurrence, relative voltage value and the previous 1 ms instantaneous value

Harmonic Analysis

In the ⫴ and current measurement (A) switch positions, harmonic analysis is performed approximately once per second using 32 sampling values per mains period (adjustable to 16.7, 50, 60 or 400 Hz).
FFT (fast Fourier transformation) makes oscillations up to the 15th harmonic available to this end. These are used to calculate the RMS values of the fundamental harmonic (HD 1) and the individual higher harmonics (HD 2 ... 15), as well as total harmonic distortion (THD). RMS values and harmonic components are displayed in each case (RMS values relative to the RMS value of the fundamental harmonic). Harmonic analysis is also available for current clamp measurement.

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Convenient Triple Display

The momentary measured value and up to two additional values are displayed simultaneously, for example:

- Extreme value with date and time
- Frequency and RMS value of AC measuring voltage

Or in the case of power measurement:

- Momentary measured values of active power, voltage and current
- Maximum value for periodic power with date and time

User Safety and Overload Protection

Dangerous alternating contact voltages of greater then 30 V and direct voltages of greater than 35 V are indicated visually.

Overload protection safeguards the instrument in all measuring functions for up to 600 V. Voltages of greater than 600 V and currents of greater than 10 or 16 A are indicated acoustically. Dangerous contact voltages are indicated when the 1 kHz low-pass filter has been activated.
FUSE appears at the display if the fuse for the current measuring input blows.

Switching between high and low impedance measuring functions is disabled in the vent of dangerous contact voltage.

Three Connector Jacks with Automatic Blocking Sockets (ABS) *

All current ranges are implemented via a single connector jack which prevents any possibility of operator error. Auto-ranging is available in all current measuring ranges. Beyond this, the automatic blocking sockets prevent incorrect connection of the measurement cables, as well as selection of the wrong measured quantity. Danger to the user, the instrument and the device under test resulting from operator error is thus ruled out.
Exceptions include switch positions W, Wh and A.

* Patented (patent no. DE 10 2005 062 624, US 7,439,725)

RMS Value with Distorted Waveshape

The utilized measuring method allows for waveshape independent RMS measurement (TRMS AC and AC+DC) for voltage up to 100 kHz and current (up to 10 kHz and up to CF = 10).

Activatable Filter for V AC Measurement

A 1 kHz low-pass filter can be activated if required, for example when measuring motor voltage at electronic frequency converters. The input signal is checked by a voltage comparator for dangerous voltages as long as the low-pass filter is activated. A high-voltage symbol appears at the display if dangerous voltage is present.

Measuring of 5 V Square-Wave Signals

This function makes it possible to test circuits and transmission cables by measuring the frequency and the duty cycle of pulses with amplitudes of 2 to 5 V and frequencies of 1 Hz to 1 MHz.

Fast Acoustic Continuity Test

Testing for short circuiting and interruption is possible with the selector switch in the position. The threshold value for acoustic signaling can be set to 1, 10, 20 ... 500 Ω in 10 ohm steps.

Automatic / Manual Measuring Range Selection

Measured quantities are selected by means of a rotary switch and a function key. The measuring range is automatically matched to the measured values. The measuring range can also be selected and locked manually with a key.

Peak Value Monitoring for Automatic and Manual Measuring Range Selection

The peak value is measured in addition to RMS measurement in the V / A DC, AC and AC+D functions, as well as for power measurement. If the peak value exceeds the valid range of the corresponding measuring path, the instrument is switched up one range, even if the displayed RMS measured value has not yet reached the threshold value. If the momentary measuring range is manually locked, (–)OL appears to indicate the peak value.

This assures that measurement only takes place in the permissible range for these functions (e.g. during measurement of a signal with a high crest factor or measurement of the DC component of high AC+DC voltages).

Measurement with Current Transformer Clamps and Sensors

Current transformer clamps and sensors are used for current measurements without interrupting the circuit under test, and for high amperages (> 16 A). All E series multimeters offer convenient measurement with current clamps. The measured current value is automatically calculated for the user with the help of the adjustable clamp factor.

Automatic Storage of Measured Values *

The DATA function automatically saves the digitally displayed measured value after settling in. Acoustic signaling is also used to indicate whether the new measured value deviates from the initial reference value less or more than 0.1% of the measuring range.

* Patented

Storage of Min-Max Values

Comparable to the slave-pointer function of an analog instrument, the device saves the highest and lowest measured values after the Min-Max function has been activated or reset. These extreme values and their time stamps can be queried at the display.

Memory Mode Operation

The **METRAHIT ENERGY** is equipped with a quartz-movement synchronized measurement data memory (2048 kB), which has enough capacity for up to 300,000 measured values depending upon configuration. This allows for use of the instrument as an autonomous real-time data logger.

Measurement data recording is executed either:

- In a time controlled fashion with an adjustable sampling interval within a range of 0.5 ms (for V/A DC only) to 9 hours
- Dependent upon measured value in the event of exceeded limit/delta value
- Automatically after stabilization of the measuring value
- As an individual measured value by pressing a key

Memory content can be read out from a PC with the help of the USB X-TRA adapter, as well as analyzed and documented with **METRAwin 10** evaluation software.

Battery Charging Status – Power Saving Circuit

The battery charging status is indicated by means of four symbols.

The device is switched off automatically if the measured value remains unchanged for a period of between 10 and 59 minutes (adjustable), and if none of the controls are activated during this time (automatic shutdown is deactivated for power and energy measurement as well as for power quality analysis).
Automatic shutdown can be disabled by switching the instrument to continuous operation.

The standby mode for the infrared interface can be deactivated.

Protective Cover for Harsh Conditions

The instrument is protected against damage in the event of impacts or dropping by means of a soft rubber cover with tilt stand and test probe holder. The rubber material also assures that the instrument does not wander if it is set up on a vibrating surface.

Infrared Data Interface

The device can be remote configured, and momentary and saved measurement data can be read out via the bidirectional infrared interface. The USB X-TRA interface adapter and **METRAwin 10** software are required to this end (see accessories). An interface protocol and device drivers for LabVIEW® (National Instruments™) are available upon request.

DKD Calibration Certificate

Each multimeter is individually adjusted, subjected to final inspection and calibrated. Adherence to the specification is confirmed by means of the included DKD calibration certificate, which is valid worldwide (recognized by EA and ILAC). After the specified calibration interval has elapsed (recommended interval: 1 to 3 years), the multimeters can be recalibrated at any time in our own DKD calibration laboratory.

Applicable Regulations and Standards

IEC/EN 61010, part 1:2001/VDE 0411-1:2002	Safety requirements for electrical equipment for measurement, control and laboratory use
DIN EN 61326-1 VDE 0843-20-1	Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 1: General requirements
DIN EN 60529 DIN VDE 0470, part 1	Test instruments and test procedures – Degrees of protection provided by enclosures (IP code)

Scope of Delivery

1 multimeter
1 KS29 (3 safety measurement cables with 4 mm test probes, 1000 V CAT III, 600 V CAT IV)
2 batteries, 1.5 V, type AA
1 condensed operating instructions, English/German
1 CD ROM with operating instructions in English and German
1 DKD calibration certificate
1 rubber holster

Extended, Voluntary Manufacturer's Guarantee

36 months for materials and workmanship
1 to 3 years for calibration (depending upon application)

Functions Overview

Function	
Power measurement	W (Var, VA, PF)
Energy measurement	Wh (varh, VAh)
Energy recording	DC / AC events
Power disturbance recording	PQ
Harmonic Analysis	V, A
Voltage (Ri ≥ 17 MΩ)	V_{DC}
Voltage (Ri ≥ 9 MΩ)	V_{AC} TRMS
Voltage (Ri ≥ 9 ... 17 MΩ)	V_{AC+DC} TRMS
Crest factor (1 ≤ CF ≤ 11)	✓
Frequency in Hz with V_{AC}	... 300 kHz
Low-pass filter	1 kHz with V_{AC}
Bandwidth for V_{AC+DC} or V_{AC}	100 kHz
Pulse frequency in MHz at 5V TTL	1 Hz...1 MHz
Duty cycle as %	2.0% ... 98%
Voltage level measurement in dB	✓
Resistance	Ω
Conductivity	nS
Low resistance measurement with I_{CONST} = 3 mA	R_{SL}
Continuity test with I_{CONST} = 1 mA	✓
Diode test with I_{CONST} = 1 mA	✓
Temperature measurement °C/°F with T_C	Type K
Temp. measurement °C/°F R_{TD}	Pt100/Pt1000
Capacitance measurement in F	✓
Cable length in m	✓
Current	A_{DC}
	A_{AC} TRMS
	A_{AC+DC} TRMS
Bandwidth for A_{AC+DC} or A_{AC}	10 kHz
Frequency in Hz for A_{AC}	... 60 kHz
Current clamp measurement with adjustable transformation ratio	mV / A mA / A
Relative value measurement (reference value measurement) ΔREL	✓
Zero point	✓
Data logger function [1] (memory)	16 MBit
Min / Max / data hold	✓
IR interface (38.4 kBd)	✓
Power pack socket	✓
Rubber holster	✓
Fuse	10 A / 1000 V
Protection [3]	IP 52
Measuring category	600 V CAT III 300 V CAT IV
Calibration	DKD

[1] 16 Mbit = 2048 kByte = up to 300,000 measured values, sampling rate adjustable from 0.5 second to 9 hours

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Characteristic Values

Meas. Function	Measuring Range		Resolution at Upper Range Limit 60,000	Resolution at Upper Range Limit 6,000	Input impedance ⎓	Input impedance ~ / ≂	Intrinsic Uncertainty at Ref. Cond. for High Resolution (59,999 digits) ±(... % rdg. + ... d) ⎓	±(... % rdg. + ... d) ~ [1]	±(... % rdg. + ... d) ≂ [1]	Overload Capacity [2] Value	Overload Capacity [2] Time
V	60	mV	1	µV			0.02 + 15 with ZERO	—	—	600 V DC AC TRMS sine	Max. 10 s
	600	mV	10	µV	≥ 17	MΩ	≥9 MΩ // < 50 pF	0.02 + 15 with ZERO	0.2 + 30	1 + 30	Cont.
	6	V	100	µV	≥ 17	MΩ	≥9 MΩ // < 50 pF	0.02 + 15	0.2 + 30	1 + 30	
	60	V	1	mV	≥ 17	MΩ	≥9 MΩ // < 50 pF	0.02 + 15	0.2 + 30	1 + 30	
	600	V	10	mV	≥ 17	MΩ	≥9 MΩ // < 50 pF	0.02 + 15	0.2 + 30	1 + 30	
					Display range where reference voltage U_{REF} = 0.775 V			**Intrinsic uncertainty**			
dB	0.6 ... 600	V~		0.01	dB	−48 dB ... +58 dB		0.1 dB (U > 10% MR)		600 V DC AC TRMS sine	Cont.
					Voltage drop at approx. range limit		⎓	~ [1]	≂ [1]		
A	600	µA	10	nA	160	mV	160 mV	0.1 + 20	0.5 + 25	1.0 + 30	0.7 A Cont.
	6	mA	100	nA	160	mV	160 mV	0.05 + 20	0.5 + 25	1.0 + 30	
	60	mA	1	µA	180	mV	180 mV	0.05 + 20	0.5 + 25	1.0 + 30	
	600	mA	10	µA	250	mV	250 mV	0.1 + 20	0.5 + 25	1.0 + 30	
	6	A	100	µA	360	mV	360 mV	0.2 + 30	0.5 + 25	1.0 + 30	10 A: ≤ 5 min [10]
	10	A	1	mA	600	mV	600 mV	0.2 + 30	0.5 + 25	1.0 + 30	16 A: ≤ 30 s [10]
	Factor: 1:1/10/100/1000		**Input**		**Input impedance**						
A⏦C	0.06, 0.6, 6, 60	A	60	mA	Current meas. input (⏦ mA/A jack)		See A~ current measuring range for specification			Measurement input	
	0.6, 6, 60, 600	A	600	mA						0.7 A continuous	
	6, 60. 600, 6000	A	6	A			Plus current transformer clamp error			10 A: 5 min	
A⏦C	0.6, 6, 60, 600	A	600	mV	Voltage measurement input (V jack) Ri = 9 MΩ		See voltage measuring range V~ [1] for specification			Measurement input	
	6, 60, 600, 6000	A	6	V						600 V RMS	
	60, 600, 6000, 60,000	A	60	V			Plus Current clamp sensor error			max. 10 s	
					Open-circuit voltage	Meas. current at range limit	±(... % rdg. + ... d)				
Ω	600	Ω	10	mΩ	< 1.4 V	Approx. 250 µA	0.1 + 5 with ZERO function active			600 V DC AC TRMS sine	Max. 10 s
	6	kΩ	100	mΩ	< 1.4 V	Approx. 60 µA	0.1 + 5				
	60	kΩ	1	Ω	< 1.4 V	Approx. 7 µA	0.1 + 5				
	600	kΩ	10	Ω	< 1.4 V	Approx. 0.8 µA	0.2 + 5				
	6	MΩ	100	Ω	< 1.4 V	Approx. 180 nA	0.5 + 5				
	60	MΩ	1	kΩ	< 1.4 V	Approx. 15 nA	2.0 + 10 (battery operation)				
nS	600	nS	0.1	nS	< 1.4 V	0.45 µA	2 + 10 (as of 3% MR)				
RSL	60	Ω	001	Ω	9 V	Approx. 3 mA	1 + 5 with ZERO function active				
🔊	600	Ω	—	0.1 Ω	Approx. 3.2 V	Approx. 1 mA const.	1 + 5 with ZERO function active				
⏩	6,0	V [3]	—	1	mV	Approx. 9 V	Approx. 1 mA const.	0.5 + 3			
					Discharge resist.	$U_{0\ max}$	±(... % rdg. + ... d)				
F	60	nF	—	10	pF	1 MΩ	0.7 V	1 + 10 [4] with ZERO function active		600 V DC AC TRMS sine	Max. 10 s
	600	nF	—	100	pF	100 kΩ	0.7 V	1 + 6 [4]			
	6	µF	—	1	nF	12 kΩ	0.7 V	1 + 6 [4]			
	60	µF	—	10	nF	12 kΩ	0.7 V	1 + 6 [4]			
	600	µF	—	100	nF	3 kΩ	0.7 V	5 + 6 [4]			
							f_{min} [5]	±(... % rdg. + ... d)			
Hz (V)	600.00	Hz	0.01	Hz	Input impedance, V jack: Ri = 9 MΩ		1 Hz	0.05 + 5 [8]	As of 15% MR for U ≥ 0.18 V	Hz (V) [6]: 600 V Hz (A): [7]	Max. 10 s
Hz (A)	6.0000	kHz	0.1	Hz							
Hz (A⏦C)	60.000	kHz	1	Hz						Hz (A⏦C) [6]: 600 V	
Hz (V)	300.00	kHz	10	Hz			10 Hz				
MHz	600 Hz ... 1 MHz		0.01 ... 100 Hz				1 ... 100 Hz	0.05 + 5	> 2 V ... 5 V	600 V	Max. 10 s
%	2.0 ... 98 %		—	0.01%	15 Hz ... 1 kHz		1 Hz	0.1 MR + 10 d	> 2 V ... 5 V		
	5.0 ... 95%		—	0.01%	1 ... 10 kHz		1 Hz	0.1 MR per kHz + 10 d	> 2 V ... 5 V		
	10... 90%		—	0.01%	10 ... 50 kHz		1 Hz	0.1 MR per kHz + 10 d	> 2 V ... 5 V		
								±(... % rdg. + ... d)			
°C/°F	Pt100	– 200.0 ... +850.0 °C	0.1 °C					0.3 + 10 [9]		600 V DC/AC RMS sine	Max. 10 s
	Pt1000	– 150.0 ... +850.0 °C						0.3 + 10 [9]			
	K (NiCr-Ni)	– 250.0 ... – 150 °C						1.0% + 2.0 K [9]			
		– 150 °C ... +1372.0 °C						1.0% + 0.5 K [9]			

[1] Specified accuracy valid as of 1% of measuring range for AC, and 3% for AC+DC. See frequency influence on page 6.
[2] At 0 ° ... + 40 °C
[3] Display of up to max. 6.0 V, "OL" in excess of 5.1 V.
[4] Applies to measurements at film capacitors during battery operation
[5] Lowest measurable frequency for sinusoidal measuring signals symmetrical to the zero point
[6] Overload capacity of the voltage measurement input: power limiting: frequency x max. voltage 6 x 10^6 V x Hz for U > 100 V
[7] Overload capacity of the current measurement input: see current measuring ranges for max. current values
[8] Input sensitivity, sinusoidal signal, 10% to 100% MR (mV range: as of 30%)
[9] Plus sensor deviation for measurement with external reference temperature, plus ±2 K for internal reference temperature
[10] Off-time > 30 min. and T_A ≤ 40 °C

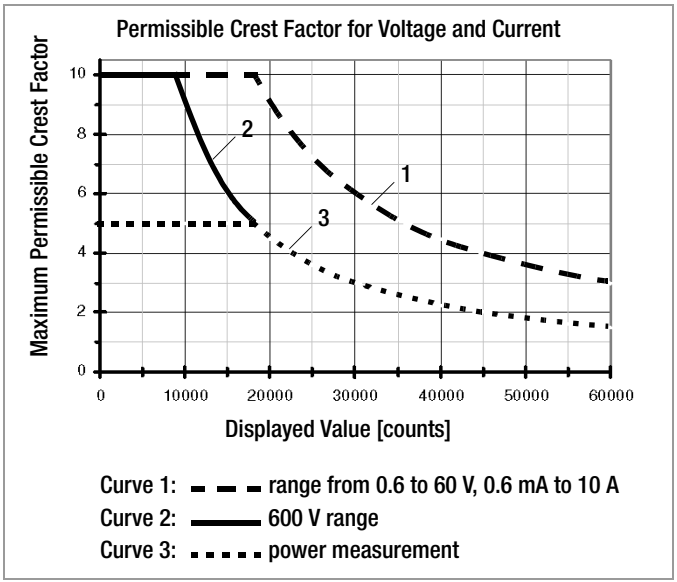
Key: d = digit(s), MR = measuring range, rdg. = reading (measured value)

Crest Factor CF

Measuring range: 1.0 ≤ CF ≤ 11.0; resolution: 0.1

Typical (not specified) maximum deviation:

Frequency	CF ≤ 3.0	3.0 < CF ≤ 5.0	5.0 < CF ≤ 10.0
10 to 70 Hz	±0.2	±0.2	±0.5
70 to 440 Hz	±0.2	±0.5	Not valid
440 Hz to 1 kHz	±0.5	Not valid	Not valid
> 1 kHz	Not valid	Not valid	Not valid



Above figure: Influence of Crest Factor on Display Range

Additional error caused by the signal's crest factor:

≥ 1.5 < CF ≤ 3 1% rdg.
≥ 3 < CF ≤ 5 3% rdg.

Power Measurement (measuring ranges for a current clamp factor of 1) – Single-Phase Measurement for Direct and Alternating Current

Measuring Function	Measuring Range	Resolution at Upper Range Limit	Overload capacity at 0 ... + 40 °C	
		36,000 Counts	Value	Time
W, VAr, VA	360 µW	10 nW	V: 600 V A: 10 A DC AC TRMS sine	V continuous 10 A: 5 min. 2) 16 A: 30 s 2)
	3. mW	100 nW		
	36 mW	1 µW		
	360 mW	10 µW		
	3. W	100 µW		
	36 W	1 mW		
	360 W	10 mW		
	600 W	100 mW		
	3.6 kW	100 mW		
	6 kW	1 W		
	36 kW 1)	1 W		
	360 kW 1)	10 W		
	3600 kW 1)	100 W		

1) Ranges achieved with current clamp only
2) Off-time > 30 min. and T_A ≤ 40 °C

Intrinsic Uncertainty and Frequency Influence for Power and Energy Measurement

Measured Quantity	Measuring Range	Intrinsic Uncertainty (... % rdg + ... d)		
		DC	10 Hz to 65 Hz	65 Hz ... 1 kHz
Voltage, auxiliary display	U ≥ 0.1 x Umax and U ≥ 0.15 V	0.5 + 10	0.3 + 10	0.4 + 10 [1]
Current, auxiliary display	I ≥ 0.01 x Imax	0.2 + 5	0.1 + 5	0.9 + 10
Power factor		1 d	1 d	1 d [1]
Apparent power		1.0 + 20	0.4 + 20	1.3 + 20 [1]
Active power	|PF| ≥ 0.4	1.0 + 20	0.4 + 20	1.5 + 20 [1]
	|PF| < 0.4	—	1.0 + 20	3.0 + 20 [1]
Reactive power	|PF| ≤ 0.8	—	1.0 + 20	3.0 + 20 [1]

[1] Not valid for mV range.

Display range
- Voltage and current: 6000 digits
- Apparent, reactive and active power: 36,000 digits
- Power factor: 100 digits

Intrinsic error: stable sinusoidal voltage, stable sinusoidal current, mean voltage value: max. 10% of amplitude. U > 10% of the upper range limit is usually the case during normal operation due to auto-ranging, except in the smallest range.
Bandwidth up to 1 kHz; signal components of higher frequency are clipped by input filters.

Note: Power is measured with a separate measurement circuit: As a result, specified accuracies for voltage and current measurement do not correspond with the specified values for the respective measuring functions. Principally, DC voltage linearity is only assured with voltages of ≥ 0.15 V or ≥ 10% of the upper range limit.

Additional deviation for U, I during power measurement with higher crest factor, f = 0 … 65 Hz:
CF ≤ 2: -0.3% rdg., CF = 3: -0.9% rdg.,
CF = 4: -1.5% rdg., CF = 5: -2.5% rdg.

Square-wave signal, 10 to 65 Hz to U or I:
Additional intrinsic uncertainty of +0% / –0.7% rdg.

Mains Monitoring / Mains Disturbance Recording

Type of Disturbance	Measuring Range	Resolution (display)	Intrinsic Uncertainty under Reference Conditions with Fixed Frequency of 50/60 Hz	Pulse Time
Over/ undervoltage	6 ... 600 V	60,000 digits		
Dip/swell	6 ... 600 V	6000 digits	1% rdg. + 1% MR	≥ 1 half-period
Peak	6 ... 600 V	6000 digits	1% rdg. + 2% MR	≥ 1 ms
Transient	200 ... 1000 V*	10 V	± 50 V	0.5 ... 5 µs

* Absolute value of the transients is limited to approximately 1000 V by input protection.

Internal Clock

Time format	DD.MM.YYYY hh:mm:ss
Resolution	0.1 s
Accuracy	±1 minute per month
Temperature influence	50 ppm per K

Reference Conditions

Ambient temperature	+23 °C ±2 K
Relative humidity	40 ... 75% (no condensation allowed)
Meas. quantity frequency	45 ... 65 Hz
Meas. quantity waveform	Sine
Battery voltage	1.8 V ... 3.2 V

Influencing Quantities and Influence Error

Influencing Quantity	Sphere of Influence	Measured Quantity / Measuring Range	Influence Error per 10 K ±(...% rdg. + ... d)
Temperature	0 °C ... +21 °C and +25 °C ... +40 °C	60 mV ⎓ [1]	0.2 + 5
		600 mV ... 600 V ⎓	0.1 + 5
		600 mV ≂	0.3 + 20
		V ∼, 6 ... 600 V ≂	0.2 + 10
		600 Ω ... 60 MΩ, nS	0.2 + 5
		A ⎓, ∼, ≂	0.2 + 10
		60 nF ... 6 µF, km	1 + 5
		60, 600 µF	3 + 5
		Hz, dB	0.2 +10
		Diode measurement	0.3 + 5
		RSL measurement	1 + 10
		Pt100 / Pt1000	0.5 + 10
		Type K thermocouple [1]	0.2 + 10
		Power measurement: V	0.3 + 10
		Power measurement: A	0.2 + 5
		W, VA, Wh, VAh	0.5 + 10

[1] The 60 mV DC range and thermocouple measurement are sensitive to temperature fluctuation: For this reason, specified values are not valid 30 until minutes after ambient temperature has stabilized.

Influencing Qty.	Meas. Quantity / Measuring Range		Sphere of Influence	Intrinsic Uncertainty [3] ±(... % rdg. + ... d)
Frequency	V_{AC}	600.00 mV	> 15 Hz ... 45 Hz	3 + 30
			> 65 Hz ... 1 kHz	2 + 30
			> 1 kHz ... 20 kHz	3 + 30
			> 20 kHz ... 100 kHz [4]	3.5 + 30 [4]
		6.0000 V ... 60.00 V	> 15 Hz ... 45 Hz	2 + 30
			> 65 Hz ... 1 kHz	1 + 30
			> 1 kHz ... 20 kHz	3 + 30
			> 20 kHz ... 100 kHz [4]	3.5 + 30 [4]
		600.00 V [2]	> 15 Hz ... 45 Hz	2 + 30
			> 65 Hz ... 1 kHz	1 + 30
			> 1 kHz ... 20 kHz	3 + 30
	A_{AC}	600.00 µA ... 10.0000 A	> 15 Hz ... 45 Hz	3 + 25
			> 65 Hz ... 10 kHz	

[2] Power limiting: frequency x voltage max. 6×10^6 V x Hz for U > 100 V
[3] The accuracy specification for frequency response is valid as of a display value of 10% of the measuring range for both measuring modes with the TRMS converter in the A AC and A (AC+DC) ranges.
[4] Frequency response up to 100 kHz, > 60 kHz plus 5%

Influencing Quantity	Sphere of Influence	Measured Quantity	Influence Error
Relative humidity	75% 3 days instrument off	V, A, Ω, F, Hz, dB, °C	1 x intrinsic uncertainty
Battery voltage	1.8 ... 3.2 V	V, A, Ω, F, Hz, dB, °C	Included in intrinsic uncertainty

Influencing Quantity	Sphere of Influence	Measured Quantity / Measuring Range	Damping
Common mode interference voltage	Interference quantity max. 600 V ∼	V ⎓	> 120 dB
	Interference quantity max. 600 V ∼ 50 Hz ... 60 Hz, sine	6 V ∼, 60 V ∼	> 80 dB
		600 V ∼	> 70 dB
Series-mode interference voltage	Interference quantity V ∼, respective nominal value of the measuring range, max. 600 V ∼, 50 Hz ... 60 Hz, sine	V ⎓	> 50 dB
	Interference quantity max. 600 V ⎓	V ∼	> 100 dB

Response Time (after manual range selection)

Measured Quantity/ Measuring Range	Digital Display Response Time	Measured Quantity Jump Function
V ⎓, V ∼, dB AV ⎓, A ∼	1.5 s	From 0 to 80% of upper range limit value
600 Ω ... 6 MΩ	3 s	From ∞ to 50% of upper range limit value
nS, R_{SL}	3 s	
60 MΩ	8 s	
Continuity (acoustic signal)	< 50 ms	
°C (Pt100)	Max. 3 s	
⇻	1.5 s	
60 nF ... 600 µF	Max. 2 s	From 0 to 50% of upper range limit value
>10 Hz	1.5 s	

Data Interface

Type	Optical via infrared light through the housing
Data transmission	Serial, bidirectional (not IrDa compatible)
Protocol	Device specific
Baud rate	38,400 baud
Functions	– Select/query measuring functions and parameters – Query momentary measurement data – Read out stored measurement data

The USB X-TRA plug-in interface adapter (see accessories) is used for adaptation to the PC's USB port.

Internal Measured Value Storage

Memory capacity	16 MBit for approx. 300,000 measured values with indication of date and time

Power Supply

Battery	2 each 1.5 V AA batteries, alkaline manganese per IEC LR6 (2 each 1.2 V NiMH rechargeable batteries also possible)
Service life	With alkaline manganese: approx. 120 hrs.
Battery indicator	Battery capacity display with battery symbol in 4 segments: ▮▮▮▮. Querying of momentary battery voltage via menu function.
Power OFF function	The multimeter is switched off automatically: – When battery voltage drops below approx. 1.8 V – If none of the keys or the rotary switch are activated for an adjustable duration of 10 to 59 min. and the multimeter is not in the continuous operation mode (assuming the instrument is not set to power measurement or mains analysis)
Power pack socket	If the NA X-TRA power pack has been plugged into the instrument, the batteries are disconnected automatically. Rechargeable batteries can only be recharged externally. Power pack voltage: 5.1 V ±0.2 V

Display

Transreflective LCD panel (65 x 36 mm) with display of up to 3 measured values, unit of measure, type of current and various special functions.

Background Illumination

LED fiber-optic background illumination is switched off approx. 1 minute after it has been activated. If necessary, automatic deactivation of background illumination can be disabled with the appropriate parameter setting or via the interface.

Digital

Display / char. height	7-segment characters Main display: 13 mm Auxiliary displays: 7.5 mm
Number of places	60,000 counts/steps
Overflow display	"OL" is displayed as of 61,000 + 1 digits
Polarity display	"–" sign is displayed if plus pole is connected to "⊥"
Sampling rate	10 or 40 measurements per second with the Min-Max function except for the capacitance, frequency, duty cycle and power measuring functions, 2000 measurements per second for fast DC measurement
Refresh rate	
V (DC, AC+DC), A, Ω, →|←, EVENTS AC/DC, count	2 per second
Hz, °C (Pt100, Pt1000)	1 to 2 per second
°C (J, K)	0.5 per second

Acoustic Signals

For voltage	Intermittent signal at above 600 V
For current	Intermittent signal at above 10 A Continuous signal at above 16 A

Fuse

Fuse link	FF (UR) 10 A/1000 V AC/DC, 10 mm x 38 mm, breaking capacity of at least 30 kA at 1000 V AC/DC, protects the current measurement input in the 600 µA to 10 A ranges

Electrical Safety

Per IEC 61010-1:2001/VDE 0411-1:2002

Protection class	II	
Measuring category	CAT III	CAT IV
Operating voltage	600 V	300 V
Pollution degree	2	
Test voltage	5.2 kV~	

Electromagnetic Compatibility (EMC)

Interference emission	EN 61326-1: 2006, class B
Interference immunity	EN 61326-1: 2006 EN 61326-2-1: 2006

Ambient Conditions

Accuracy Range	0 °C to +40 °C
Op. temp. range T_A	–10 °C to +50 °C*
Storage temp. range	–25 °C to +70 °C (without batteries)
Relative humidity	40 to 75%, no condensation allowed
Elevation	To 2000 m
Deployment	Indoors, except within specified ambient conditions

* Exception: measurement of current > 10 to 16 A, operation at up to 40 °C

Mechanical Design

Housing	Impact resistant plastic (ABS)
Dimensions	200 x 87 x 45 mm (without rubber holster)
Weight	Approx. 0.4 kg with batteries
Protection	Housing: IP 52

Table Excerpt Regarding Significance of IP Codes

IP XY (1st digit X)	Protection Against Foreign Object Entry	IP XY (2nd digit Y)	Protection Against Penetration by Water
5	Dust protected	2	Dripping (at angle of 15°)

METRAHIT | ENERGY
TRMS SYSTEM Multimeter

Accessories

NA X-TRA Power Pack (90 ... 250 V AC / 5 V DC)

Power pack for battery-saving mains operation, for continuous measurement using multimeters with internal memory

- Broad range input, 50/60 Hz
- Measuring category: CAT IV at 600 V

PMA16 Power Measuring Adapter

The adapter is used for safe, trouble-free measurement of current consumption (up to 16 A) at earthing contact plugs, as well as for connecting the voltage path to the **METRAHIT ENERGY** for power measurement.

Accessories for Operation at a PC

Interface Adapter for USB Connection

The following functions can be executed with the USB X-TRA bidirectional interface adapter:

- Configure the **METRAHIT** multimeter from a PC.
- Transmit live measurement data to the PC.
- Read data out of memory from the **METRAHIT ENERGY**.

The adapter does not require a separate power supply.
Its baud rate is 38,400 baud.
A CD ROM is included which contains current drivers for Windows operating systems.

METRAwin®10/METRA*Hit*® Software

METRAwin®10/METRA*Hit*®PC software is a multilingual, measurement data logging program for recording, visualizing, evaluating and documenting measured values with reference to time from **METRAHIT** E series multimeters.

Communication between the PC and the measuring instrument(s) is established via available interface adapters.

Depending upon device type, one or several of the following operating modes are possible:

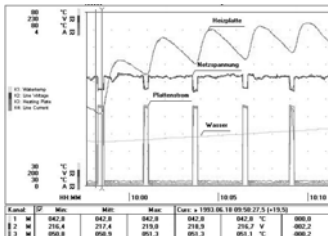
- **Device Parameters Configuration**
  Remote configuration and querying of device-specific functions and parameters, for example measuring function, measuring range and memory parameters. Frequently used device settings can be saved to configuration files for easy recall.
- **Online Recording of Measurement Data**
  Read-in, display and recording of momentarily measured data from the interconnected device.
  – Measuring channels Up to 10
  – Start recording Manual, triggered by measured value, time triggered
  – Recording mode > Time controlled with a sample interval of 0.05 s* ... 1 s ... 60 min.
  > Manually controlled
  > Measured value controlled in event of exceeded limit/delta value
  – Recording duration: max. 10 million intervals

* Depending upon device type, measuring function, number of measuring channels and communication mode (e.g. via modem), sample intervals of less than 1 second cannot be used.

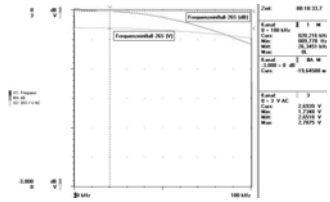
- **Reading Out and Visualizing Stored Data**
  If supported by the device: read-in and display of offline data recorded to device memory

For purposes of analysis, data recorded online or read in from the device's memory can be displayed in various formats:

Y(t) Recorder Display for Up to 6 Channels

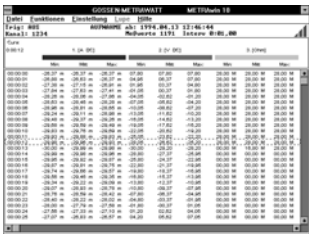


XY Recorder Display for Up to 4 Channels



Multimeter Display for Up to 4 Channels

Tabular Display for Up to 10 Channels



System Requirements

METRAwin 10 (version 5.3.x) can be run on IBM compatible PCs with Microsoft Windows® 98, ME, NT 4.0, 2000, XP, Vista (32/64 bit) or 7 (32/64 bit).

Order Information

Designation	Type	Article Number
Professional, digital TRMS multimeter with power measurement. Triple digital display with a resolution of 60,000 digits. Multimeter functions: voltage and current (DC and TRMS AC and AC+DC), frequency, resistance, diode, temperature, power, energy and power quality, data logger and IR interface. Scope of delivery includes DKD calibration certificate, set of measurement cables and rubber holster	**METRAHIT ENERGY**	M249A
Accessories for operation at a PC		
IR-USB bidirectional interface adapter	USB X-TRA	Z216C
METRAwin 10 software	**METRAwin 10**	GTZ3240000R0001
Accessories for temperature measurement with resistance thermometer		
Pt100 temperature sensor for surface and immersion measurements, −40 ... +600 °C	Z3409	GTZ3409000R0001
Pt1000 temperature sensor for measurement in gases and liquids, −50 ... +220 °C	TF220	Z102A
Pt100 oven sensor, −50 ... +550 °C	TF550	GTZ3408000R0001
Ten adhesive Pt100 temperature sensors, −50 ... +550 °C	TS Chipset	GTZ3406000R0001
Replacement fuse		
Fuses (pack of 10)	FF (UR) 10 A / 1000 V AC/DC	Z109L
Power measuring adapter	PMA16	Z228A
Power pack	NA X-TRA	Z218G
Rubber holster and carrying strap	GH X-TRA	Z104C

Transport Accessories

HitBag Cordura Belt Pouch for **METRA HIT** multimeters (with/without rubber holster) and METRAport

HC30 Hard Case
for two multimeters (with/without rubber holster) and accessories

F836 Ever-Ready Case
for multimeter (without rubber holster) and accessories

F829 Ever-Ready Case
for multimeter (with/without rubber holster) and accessories

Designation	Type	Article Number
Imitation leather carrying pouch for **METRA HIT** and METRAmax	F829	GTZ3301000R0003
Cordura belt pouch for **METRA HIT** series multimeters and METRAport	HitBag	Z115A
Imitation leather ever-ready case with cable compartment	F836	GTZ3302000R0001
Ever-ready case for 2 **METRA HIT**s, 2 adapters and accessories	F840	GTZ3302001R0001
Hard case for one **METRA HIT** and accessories	HC20	Z113A
Hard case for two **METRA HIT**s and accessories	HC30	Z113A

For additional information regarding accessories please refer to:

- Measuring Instruments and Testers catalog
- www.gossenmetrawatt.com

METRAHIT | ENERGY
TRMS SYSTEM Multimeter

Accessories for Current and Power Measurement All current sensors and transformers are equipped with a terminal with 4 mm safety banana plugs.									Suitable for measuring:	
Type	**Designation**	**Measuring Range**	**Meas. Category**	**Max. Cable Diameter**	**Transformation Ratio**	**Frequency Range**	**Intrinsic Uncertainty ±(% rdg. + ...)**	**Article Number**	**Power**	**Current**
DC/AC Current Sensors with Voltage Output										
Z201A	DC-AC current sensor clamp with battery operation (30 h)	0.01 ... 20 A~/30 A–	300 V CAT III	19 mm	100 mV/A	DC ... 400 Hz ... 20 kHz	1% + 0.002 A	Z201A		●
Z202A	DC-AC current sensor clamp with 2 measuring ranges, battery operation (50 h)	0.1 ... 20 A~/30 A–; 1 ... 200 A~/300 A–	300 V CAT III	19 mm	10 mV/A; 1 mV/A	DC ... 2 kHz ... 10 kHz	1% + 0.03 A; 1% + 0.3 A	Z202A		●
Z203A	DC-AC current sensor clamp with 2 measuring ranges, battery operation (50 h)	1 ... 200 A~/300 A–; 1 ... 1000 A~/A–	300 V CAT III	31 mm	1 mV/A	DC ...10 kHz	1% + 0.5 A	Z203A		●
Z13B	DC-AC current sensor clamp with 2 measuring ranges, battery operation (50 h)	0.2 ... 40 A~/60 A–; 0.5 ... 400 A~/600 A–	300 V CAT IV	50 mm	10 mV/A; 1 mV/A	DC ... 65 Hz ... 10 kHz	1.5% + 0.5 A 2.5%	Z13B		●
AC Current Sensors with Voltage Output										
WZ12B	AC current sensor clamp	10 mA~ ... 100 A~	300 V CAT III	15 mm	100 mV/A	45 ... 65 ... 500 Hz	1.5 % + 0.1 mA	Z219B		●
WZ12C	AC current sensor clamp with 2 measuring ranges	1 mA~ ... 15 A~, 1 ... 150 A~	300 V CAT III	15 mm	1 mV/mA; 1 mV/A	45 ... 65 ... 400 Hz	3% + 0.15 mA; 2% + 0.1 A	Z219C		●
WZ11B	AC current sensor clamp with 2 measuring ranges	0.5 ... 20 A~;, 5 ... 200 A~	600 V CAT III	20 mm	100 mV/A; 10 mV/A	30...48... 65 ... 500 Hz	1 ... 3%	Z208B		●
Z3512A	AC current sensor clamp with 4 measuring ranges	1 mA ... 1/10/100/ 1000 A~	600 V CAT III	52 mm	1 V/A;100 mV/A; 10 mV/A; 1 mV/A	10...48... 65 ... 3 kHz	0.5 ... 3%; 0.2 ... 1%	Z225A		●
METRAFLEX 3000	Flexible AC current sensor with 3 measuring ranges, batteries (2000 h)	0.5 ... 30 A, 0.5 ... 300 A, 0.5 ... 3000 A	1000 V CAT III 600 V CAT IV	Length: 610 mm	100 mV/A, 10 mV/A, 1 mV/A	10 ... 20 kHz	1%	Z207E		●
AF033A	Amp*FLEX* flexible AC current sensor with 2 measuring ranges, battery (150 h)	5 ... 30 A~, 5 ... 300 A~	1000 V CAT III	Length: 600 mm	100 mV/A; 10 mV/A	10 ...100 Hz ... 20 kHz	1% + 0.5 A; 1% + 0.5 A	Z207A		●
AF33A	Amp*FLEX* flexible AC current sensor with 2 measuring ranges, battery (150 h)	5 ... 300 A~, 5 ... 3000 A~	1000 V CAT III	Length: 900 mm	10 mV/A; 1 mV/A	10 ...100 Hz ... 20 kHz	1% + 0.5 A; 1 % + 2 A	Z207B		●
AF101A	Amp*FLEX* flexible AC current sensor with 2 measuring ranges, battery (150 h)	5 A~... 1 k A~, 50 A~... 10 k A~	1000 V CAT III	Length: 1200 mm	1 mV/A; 0.1 mV/A	10 ...100 Hz ... 20 kHz	1% + 2 A; 1 % + 10 A	Z207C		●
AC Current Transformer with Current Output										
WZ12A	AC current transformer clamp	15 ... 180 A~	300 V CAT III	15 mm	1 mA/A	45 ... 65 ... 400 Hz	3%	Z219A	●	●
WZ12D	AC current transformer clamp	30 mA ... 150 A~	300 V CAT III	15 mm	1 mA/A	45 ... 65 ... 500 Hz	2.5 % + 0.1 mA	Z219D	●	●
WZ11A	AC current transformer clamp	1 ... 200 A~	600 V CAT III	20 mm	1 mA/A	48 ... 65 ... 400 Hz	1 ... 3%	Z208A	●	●
Z3511	AC current transformer clamp	4 ... 500 A~	600 V CAT III	30 x 63 mm	1 mA/A	48 ... 65 ... 1 kHz	3 % + 0.4 A	GTZ3511000R0001	●	●
Z3512	AC current transformer clamp	0.5 ... 1000 A~	600 V CAT III	52 mm	1 mA/A	30...48... 65 ... 5 kHz	0.5% ... 0.7%	GTZ3512000R0001	●	●
Z3514	AC current transformer clamp	1 ... 2000 A~	600 V CAT III	64 x 150 mm	1 mA/A	30...48... 65 ... 5 kHz	0.5% + 0.1 A	GTZ3514000R0001	●	●

● With adjustable transformation ratio of 1 to 1, 10, 100 or 1000

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