

# METRALINE | DMM16

## International TRMS Multimeter

3-349-721-03  
2/1.15

- Resolution: 100  $\mu$ V, 100 m $\Omega$ , 10  $\mu$ A, 10 pF, 0.1 Hz
- Precision temperature measurement (-50 ... +800 °C)
- Frequency and duty cycle measurement at 2 to 14 V signals up to 1 MHz
- Capacitance measurement
- RPM Measurement with Inductive Sensor (accessory)
- Automatic and manual measuring range selection
- Backlit digital display with additional analog scale
- Measured value memory, Hold, Max-Min value
- Overload and blown fuse indicators
- IP 40 protection
- 3 year guarantee
- Protective rubber holster (Option)
- DAkkS calibration certificate (Option)



## Features

### Automatic Blocking Sockets (ABS) \*

Automatic blocking sockets prevent incorrect connection of measurement cables and inadvertent selection of the wrong measured quantity. This significantly reduces danger to the user, the instrument and the system under test, and eliminates it entirely in many cases.

### Automatic / Manual Measuring Range Selection

Measured quantities are selected with the rotary switch. The measuring range is automatically matched to measured values. The measuring range can be selected manually as well with the help of the AUTO/MAN key.

### Display of Negative Values at the Analog Scale

Negative values are also displayed at the analog scale for zero-frequency quantities, allowing for observation of measured quantity fluctuation around the zero-point.

### Storage of Measured Values

By pressing the **HOLD/MIN/MAX** key, the currently displayed measurement value can be „frozen“ in the display. The minimum and maximum values which were present at the input of the measuring instrument after activation of the MIN/MAX mode can be selectively "retained" with the MIN/ MAX function. The most important application is the determination of the minimum or maximum value during long-term observation of measurement quantities. MIN/MAX has no effect on the analog display; it continues to display the current measurement value.

### Continuity Test

Allows for the detection of short-circuits and interrupted conductors. In addition to displaying test results, an acoustic signal can also be generated if desired.

### Power Saving Circuit

The device is switched off automatically if the measured value remains unchanged for a period of approximately 10 minutes, and if none of the controls are activated during this time. Automatic shutdown can be deactivated.

### Protective Cover for Harsh Conditions (Option)

The instrument 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.

### Duty Cycle Measurement – Measurement of 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 14 V and frequencies of 100 Hz to 10 kHz.

### Voluntary Manufacturer's Guarantee

36 months for material and workmanship  
1 ... 3 years for calibration (depending on application)

\* Patented (patent no. EP 1801 598, US 7,439,725)

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### Characteristic Values

Meas. Function	Measuring Range		Resolution	Input Impedance		Intrinsic Uncertainty at Max. Resolution under Reference Conditions		Overload Capacity		Meas. Function
						$\pm(\dots \% \text{ rdg.} + \dots \text{ d})$	$\pm(\dots \% \text{ rdg.} + \dots \text{ d})$	Value	Time	
<b>V</b>	600 mV		100 $\mu\text{V}$	10 M $\Omega$ // < 40 pF	8.1 M $\Omega$ // 50 pF	0.5 + 5	1 + 5	1000 V DC AC eff Sinus	Cont.	<b>V</b>
	6 V		1 mV	5.2 M $\Omega$ // < 40 pF	4.6 M $\Omega$ // 50 pF	0.5 + 5				
	60 V		10 mV	5 M $\Omega$ // < 40 pF	4.4 M $\Omega$ // 50 pF	0.5 + 5				
	600 V		100 mV	5 M $\Omega$ // < 40 pF	4.4 M $\Omega$ // 50 pF	0.5 + 5				
	1000 V		1 V	5 M $\Omega$ // < 40 pF	4.4 M $\Omega$ // 50 pF	0.5 + 5				
Voltage drop at approx. range limit										
<b>A</b>	60 mA		10 $\mu\text{A}$	100 mV	100 mV	1.0 + 5 (> 10 D)	1.5 + 5 (> 10 D)	1.0 A	Cont.	<b>A</b>
	600 mA		100 $\mu\text{A}$	700 mV	700 mV					
	6 A		1 mA	200 mV	200 mV					
	10 A		10 mA	300 mV	300 mV					
Open-circuit voltage				Meas. current at range limit		$\pm(\dots \% \text{ rdg.} + \dots \text{ d})$				
<b><math>\Omega</math></b>	600 $\Omega$		100 m $\Omega$	max. 1 V	max. 250 $\mu\text{A}$	1 + 5 <sup>2)</sup>	1000 V DC AC eff Sinus	max. 10 s		<b><math>\Omega</math></b>
	6 k $\Omega$		1 $\Omega$	max. 1 V	max. 100 $\mu\text{A}$	0.7 + 3				
	60 k $\Omega$		10 $\Omega$	max. 1 V	max. 12 $\mu\text{A}$	0.7 + 3				
	600 k $\Omega$		100 $\Omega$	max. 1 V	max. 1,2 $\mu\text{A}$	0.7 + 3				
	6 M $\Omega$		1 k $\Omega$	max. 1 V	max. 120 nA	0.7 + 3				
40 M $\Omega$		10 k $\Omega$	max. 1 V	max. 50 nA	2.0 + 3					
<b>→</b>	2 V		1 mV	max. 3 V		1.0 + 5				<b>→</b>
<b>(<math>\square</math>)</b>	600 $\Omega$		0.1 $\Omega$	max. 1 V	max. 250 $\mu\text{A}$	1.0 + 5				<b>(<math>\square</math>)</b>
						$\pm(\dots \% \text{ rdg.} + \dots \text{ K})$				
<b><math>^{\circ}\text{C}</math></b>	TYP K	-50,0 ... +400 $^{\circ}\text{C}$	0,1 $^{\circ}\text{C}$			1.0 + 5 K <sup>3)</sup>	1000 V DC/AC eff Sinus	max. 10 s		<b><math>^{\circ}\text{C}</math></b>
		+401 ... +800 $^{\circ}\text{C}$	0,1 $^{\circ}\text{C}$			5.0 + 7 K <sup>3)</sup>				
						$\pm(\dots \% \text{ v. MW} + \dots \text{ }^{\circ}\text{F})$				
<b><math>^{\circ}\text{F}</math></b>	TYP K	-58 ... +752 $^{\circ}\text{F}$	0,1 $^{\circ}\text{F}$			1.0 + 9 $^{\circ}\text{F}$ <sup>3)</sup>	1000 V DC/AC eff Sinus	max. 10 s		<b><math>^{\circ}\text{F}</math></b>
		+753 ... +1472 $^{\circ}\text{F}$	1 $^{\circ}\text{F}$			5.0 + 11 $^{\circ}\text{F}$ <sup>3)</sup>				
						$\pm(\dots \% \text{ rdg.} + \dots \text{ d})$				
<b>Hz (V ~)</b>	100 Hz		0,1 Hz			0.1 + 2	1000 V <sup>6)</sup>	max. 10 s		<b>Hz (V ~)</b>
	1000 Hz		1 Hz							
<b>Hz</b>	10 ... 100 Hz		0,1 Hz			0.1 + 2	1000 V <sup>6)</sup>	max. 10 s		<b>Hz</b>
	1000 Hz		1 Hz							
	1000 kHz		1 kHz							
Measuring Voltage										
<b>%</b>	30 Hz ... 1kHz: 2,0 ... 98,0			> 2 ... 14 V		0.2% v.MUL + 8 D	1000 V <sup>6)</sup>	max. 10 s		<b>%</b>
	1 kHz ... 4 kHz: 5,0 ... 95,0				0.2% v.MUL/kHz + 8 D					
	40 kHz ... 10 kHz: 10,0 ... 90,0				0.2% v.MUL + 8 D					
<b>Rpm</b>	0.060 k... 99.99 k		1 Rpm	Discharge Resistance		$\pm 2 \text{ Rpm}$	1000 V	max. 10 s		<b>Rpm</b>
						$\pm(\dots \% \text{ rdg.} + \dots \text{ MR})$				
<b>F</b>	40 nF		10 pF	10 M $\Omega$		2.0 + 10 with zero activ	1000 D DC AC	max. 10 s		<b>F</b>
	400 nF		100 pF	1 M $\Omega$		1.0 + 6				
	4 $\mu\text{F}$		1 nF	100 M $\Omega$		1.0 + 6				
	40 $\mu\text{F}$		10 nF	12 M $\Omega$		2.5 + 6				
	400 $\mu\text{F}$		100 nF	3 M $\Omega$		5.0 + 6				

- 1) At 0 to + 40  $^{\circ}\text{C}$
- 2) With zero balancing, or + 35 digits without zero balancing
- 3) Without sensor
- 4) 12 A for 5 min, 16 A for 30 s
- 5) 1 ... 35 d from the zero point due to TRMS converter when probe tips are short-circuited
- 6) Power limit: frequency x voltage max.  $3 \cdot 10^6 \text{ V} \cdot \text{Hz}$  @  $U > 100 \text{ V}$

#### Key

rdg. = reading (measured value)  
d = digit  
MUL = upper range limit  
MR = measuring range

#### Reference Conditions

Ambient temperature + 23  $^{\circ}\text{C} \pm 2 \text{ K}$   
Relative humidity 40 ... 60%  
Measured quantity frequency 45 ... 65 Hz  
Measured quantity waveshape Sinusoidal  
Battery voltage 3 V  $\pm 0.1 \text{ V}$

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### Influencing Quantities and Influence Error

Influencing Quantity	Sphere of Influence	Measured Quantity / Measuring Range	Influence Error <sup>1)</sup> ±(... % rdg. + ... digits)
Temperature	0 °C ... +21 °C and +25 °C ... +40 °C	600 mV $\equiv$	1.0 + 3
		6 ... 600 V $\equiv$	0.15 + 1
		1000 V $\equiv$	0.2 + 1
		V $\sim$	0.4 + 2
		0 $\Omega$ <sup>2)</sup>	0.15 + 2
		600 $\Omega$ <sup>2)</sup>	0.25 + 2
		6 k $\Omega$ ... 6 M $\Omega$	0.15 + 1
		40 M $\Omega$	1.0 + 1
		mADC, ADC	0.5 + 1
		mAAC, AAC	0.75 + 1
		-50 ... +200 °C	0.5 K + 2
+200 ... +400 °C	0.5 + 2		
Measured Quantity Frequency	> 30 Hz ... 45 Hz	A $\sim$	2.0 + 10
	> 65 Hz ... 1 kHz	60 / 600 mA / 6 A	1.5 + 10
		10 A	2 + 10
	> 30 Hz ... 45 Hz	600 mV	3 + 10
		6 / 60 / 600 V	2.5 + 10
		1000 V	3.5 + 20
		600 mV	35 + 20
	> 65 Hz ... 500 Hz	6 / 60 V	2.5 + 10
		600 V	3 + 20
	> 65 Hz ... 800 Hz	600 V	3 + 20
1000 V		3.5 + 20	

Influencing Quantity	Sphere of Influence	Measured Quantity / Measuring Range	Influence Error
Battery Voltage	$\rightarrow$ <sup>3)</sup> ... < 2.9 V > 3.1 V ... 3.6 V	V $\equiv$	± 2 Digits
		V $\sim$	± 4 Digits
		A $\equiv$	± 4 Digits
		A $\sim$	± 6 Digits
		60 $\Omega$ / 600 $\Omega$ / °C	± 4 Digits
		6 k $\Omega$ ... 40 M $\Omega$	± 3 Digits
Relative Humidity	75% 3 days Instrument off	V $\approx$ A $\approx$ $\Omega$ °C	1 x intrinsic uncertainty
HOLD	—	—	± 1 Digits
MIN / MAX	—	V $\approx$ , A $\approx$	± 2 Digits

<sup>1)</sup> For temperature: specified error valid starting with temperature changes as of 10 K.  
For frequency: specified error valid starting with display values as of 300 digits.

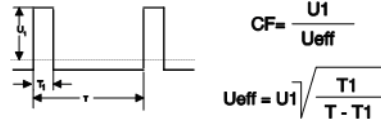
<sup>2)</sup> With zero balancing

<sup>3)</sup> After the  $\rightarrow$  symbol appears at the display

Influencing Quantity	Sphere of Influence	Measuring Ranges	Damping
Common Mode Interference Voltage	Interference quantity max. 600 V $\sim$	V $\equiv$	> 120 dB
		3 V $\sim$ , 30 V $\sim$	> 80 dB
	Interference quantity max. 600 V $\sim$ 50 Hz, 60 Hz sine	300 V $\sim$	> 70 dB
		600 V $\sim$	> 60 dB
Series Mode Interference Voltage	Interference quantity: V $\sim$ , respective nominal value of the measuring range, max. 600 V $\sim$ , 50 Hz, 60 Hz sine	V $\equiv$	> 50 dB
		Interference quantity max. 600 V $\equiv$	V $\sim$

### Crestfaktor CF

Test signal: Rectangle 55 Hz, no DC component



Influencing Quantity	Sphere of Influence	Measured Quantity / Measuring Range	Influence Error
Crest factor CF	1.5 < CF ≤ 2	6 V, 60 V, 600 V, 1000 V $\sim$	± 1 % rdg.
	2 < CF ≤ 4	—	± 5 % rdg.

The admissible crest factor CF of the alternating quantity to be measured depends on the display value.

Crest factor 4 at the end of range, it is increased accordingly when the range is reduced. However, due to input protection, voltage is limited to 1000 V, therefore the admissible crest factor in the 600 V ranges is half as high.

Power limiting: voltage x frequency max.  $3 \times 10^6$  V x Hz.

### Response Time (after manual range selection)

Measured Quantity / Measuring Range	Response Time		Measured Quantity Step Function
	Analog Display	Digital Display	
V $\equiv$ , V $\sim$ , A $\equiv$ , A $\sim$	0.7 s	1.5 s	from 0 to 80% of the upper range limit
600 $\Omega$ ... 6 M $\Omega$	1.5 s	2 s	from $\infty$ to 50% of the upper range limit
40 M $\Omega$	4 s	5 s	
$\rightarrow$ )	—	1.5 s	
$\square$ )	—	< 50 ms	
°C	—	max. 3 s	from 0 to 50% of the upper range limit
F	—	max. 5	

### Display

LCD panel (65 mm x 30 mm) with analog and digital display including unit of measure, type of current and various special functions

#### Analog:

Display LCD scale with pointer  
Scale length 55 mm in all ranges  
Scaling 0 ... ± 60 with 61 scale divisions in all ranges

Polarity display With automatic switching  
Overflow display Triangle  
Measuring rate 30 measurements per second

#### Digital:

Display / char. height 7-segment characters / 15 mm  
Number of places  $3^6/7$ -place  $\approx$ , 6000 steps  
Overflow display „D.L.“ appears  
Polarity display “-” sign is displayed if plus pole is connected to  $\perp$

Measuring rate 3 measurements per second

### Electromagnetic Compatibility (EMC)

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

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### Power Supply

Battery	2 x 1.5 V AA size batteries, alkaline manganese per IEC LR6 or equivalent rechargeable NiCd battery
Service life	With alkaline manganese: approx. 750 hours for V $\overline{\text{---}}$ , A $\overline{\text{---}}$ approx. 200 hours for V $\sim$ , A $\sim$
Battery test	$\text{+}$ is displayed automatically if battery voltage drops to below approximately 2.1 V.

### Electrical Safety

Safety class	II per IEC 61010-1:2010/EN 61010-1:2010/VDE 0411-1:2011
Measuring category	1000 V CAT III, 600 V CAT IV
Nominal voltage	1000 IV
Pollution degree	2
Test voltage	6.7 kV $\sim$ per IEC 61010-1/EN 61010-1

### Fuses

Fuse links for all ranges up to 600 mA	FF 1.6 A/1000 V, 6.3 mm x 32 mm, switching capacity: 10 kA at 1000 V $\sim$ with ohmic load, protects all current measuring ranges up to 600 mA in combination with power diodes
Fuse links for all ranges up to 10 A	FF 10 A/1000 V, 10 mm x 38 mm, switching capacity: 30 kA at 1000 V with ohmic load, protects 6A and 10 A ranges to 1000 V

### Data Interface

Type	Optical via infrared light through the housing
Data transmission	Serial, bidirectional (not IrDa compatible)
Protocol	Device specific
Baud rate	9600 baud

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

### Ambient Conditions

Accuracy range	0 °C ... + 40 °C
Operating temp.	-10 °C ... + 50 °C
Storage temperature	-25 °C ... + 70 °C without batteries
Relative humidity	45 ... 75%, no condensation allowed
Elevation	to 2000 m

### Mechanical Design

Protection	IP 40, IP 20 at the connector jacks per DIN VDE 0470, part 1 / EN 60529
Dimensions	84 mm x 195 mm x 35 mm
Weight	Approx. 350 gr. with battery

### 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)
DIN EN 61326-2-1 VDE 0843-02-2-1	Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 2-1: Particular requirements for sensitive test and measurement equipment
DIN EN 60529 DIN VDE 0470 Part 1	Test Instruments and test procedures – Degree of protection provided by enclosures (IP code)

### Standard Equipment

- 1 TRMS-digital multimeter
- 2 2 x 1.5 V AA size batteries
- 1 set of measurement cables KS17-2
- 1 short-form operating instructions

Detailed operating instructions are available on our website [www.gossenmetrawatt.com](http://www.gossenmetrawatt.com).

### Order Information

Description	Type	Article Number
Analog-digital multimeter with IR interface, standard equipment see above	METRALINE DMM16	M196A
<b>Accessories</b>		
protective rubber holster with carrying strap	GH18	GTZ3212000R0001
DAkKS calibration certificate for METRALINE DMM16	DAkKS	Z196A
Fast reacting surface temperature sensor, type K (NiCr-Ni) -50 ... +400 °C	TF400SURFACE	Z102E
Clip-on current transformer, 30 mA ... 150 A $\sim$ , 1000:1, $\pm$ 2.5 %, 1 mA/A	WZ12D	Z219D
Clip-on current sensor 60 / 600 A $\overline{\text{---}}$ , 40 / 400 A $\sim$ , 10 mV / A or 1 mV / A $\overline{\text{---}}$	Z13B	Z213B
Carrying pouch	F829	GTZ3301000R0003
Imitation leather carrying pouch for one METRAHit <sup>®</sup> and accessories	F836	GTZ3302000R0001
Imitation leather carrying pouch for two METRAHit <sup>®</sup> , adapter and accessories	F840	GTZ3302001R0001
Hard case for 1 METRAHit <sup>®</sup> and accessories	HC20	Z113A
Hard case for two METRAHit <sup>®</sup> , adapter and accessories	HC30	Z113B
Fuses (pack of 10)	FF 1.6 A / 1000 V	Z109C
Fuses (pack of 10)	FF 10 A / 1000 V	Z109L

For additional information on accessories, please refer to

- our „Measuring Instruments and Testers“ catalogue
- our website [www.gossenmetrawatt.com](http://www.gossenmetrawatt.com)