

METRAHIT | 28C

Calibrator, Multimeter and Milliohmmeter

3-349-098-03
7/6.06

- **Universal calibrator, simulator and multimeter**
mA / mV ... V / °C (Pt100/1000, Ni100/1000, type J, L, T, U, K, E, S, R, B and N thermocouples) / 30 ... 2000 Ω
- Dual mode – simultaneous simulation and measurement (U/I)
- Simulation and sensing in absolute terms, and as percentages (scaled)
- Memory for calibration procedures and results
- Frequency and pulse generator
- Ramp and step functions
- Interface and METRAwin®90-2 calibration software
- Transmitter simulator (sink: 0 ... 24 mA)
- DKD calibration certificate included
- Rugged, EMC compliant design
- **Precision multimeter** (V, A, Ω , F, Hz, °C/°F)
300,000 digits and triple display
- TRMS AC-measurement up to 1 kHz
- **Milliohmmeter**
4-wire measurement with 0.01 m Ω resolution



DKD

Calibration Certificate included

QUALITY MANAGEMENT SYSTEM



DQS certified per
DIN EN ISO 9001 reg. no.1262



Applications

Process engineers can use the **METRAHIT | 28C** as a calibrator and a multimeter simultaneously, for example in order to simulate sensor conditions at the input of a transmitter while measuring and saving the output signal.

If the **METRAHIT**®BD232 plug-in infrared interface adapter (accessory) is attached to the instrument, measurement and calibration results can be uploaded to a PC, where they can be recorded and printed as a calibration report. The multimeter can also be used as a data logger. **METRAwin**®10/**METRAHIT**® PC software (accessory) allows for convenient evaluation and display of measurement data, and **METRAwin**®90-2 (accessory) can be used to create, upload and download calibration procedures, as well as for the generation of calibration certificates.

Calibrator with Loop Current Measuring Instrument

Universal Calibration Source

Integrated electronics generate mV, V and mA signals. Beyond this, the electronics are capable of simulating thermovoltages for various types of thermocouples for predefined temperatures (°C or °F), as well as for Pt and Ni temperature sensors.

Frequency and Pulse Generator

Continuous frequency signals can be generated by the **METRAHIT | 28C** for testing PLCs, energy metering devices, flow rates and more. Amplitude is adjustable for the generated square-wave pulses, which are used to simulate sensor pulses. Pre-defined pulse runs are also generated at a chosen frequency.

Calibration and Simulation

Measuring transducers with a wide variety of input signals (voltage, thermovoltage, RTD and 2-wire resistance sensors etc.) can be directly connected and calibrated. If a multimeter is used (e.g. **METRAHIT | 26S**), respective values can be measured at the measuring transducer's output, transmitted to a PC via an adapter if desired, displayed with the help of **METRAwin**®90-2 software and compared with the appropriate calibration specifications. Setpoint values and actual values are displayed, or printed as a certificate. When operated in the "mA sink" mode, the **METRAHIT | 28C** simulates a 2-wire transmitter and pulls the selected current value from the device under test.

Data Storage

Individual values which have been manually saved (10 values per measuring range or sensor type), as well as complete calibration procedures are transferred to the integrated memory and can be queried one by one by pressing a key (forward or back). The calibrator is connected to a PC with the attached **METRAHIT**®BD232 interface adapter (accessory). Individual values, intervals and ramps which have been created with the help of **METRAwin**®90-2 software can be saved as data files, uploaded to the calibrator and saved to non-volatile memory.

METRAHIT | 28C

Calibrator, Multimeter and Milliohmmeter

Read-Out Modes for Source and Sink Functions

Calibration signals can be read out either manually (numerically with key entries), or automatically by means of intervals with intermediate steps, or as a ramp signal.

The **METRAHIT | 28C** can thus be used as a precision pulse generator for dynamic testing.

Depending upon individual needs, desired dynamic response can be based upon full-scale value and the number of intermediate steps (intervals), or rise and dwell periods (ramp). This is especially helpful for long-term testing of laboratory and panel recorders, as well as measuring transducers, and for "one-man" control rooms.

Numeric Read-Out

Calibration values are set and read out manually with the help of the instrument's keypad immediately after the calibration function has been selected.

Interval

Continuous read-out of calibration values is triggered in steps between the minimum and maximum values selected at the device to be calibrated in this read-out mode. The following step can be triggered automatically (time per step: 1 s ... 60 minutes), or manually.

Ramp

Continuous read-out of calibration values is triggered in a stepless fashion between the minimum and maximum values selected at the device to be calibrated in this read-out mode. Ramp duration for rising and falling ramps can be set within a range of 1 second to 60 minutes.

Temperature Simulation

The ten most common sensor types are available for the simulation of thermovoltages. Thermovoltages can be generated with reference to an internal (0 °C), or an external reference junction. Temperature for the external reference junction can be set at the calibrator or with a PC. This eliminates the need to connect the device to be calibrated with the calibrator via the respectively required compensating lead. A copper conductor between the calibrator and the device to be calibrated is sufficient in this case.

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 Degrees of protection provided by enclosures (IP code)
DIN EN 61326 VDE 0843 Part 20	Electrical equipment for measurement, control and laboratory use – EMC requirements

Warranty

3 years for material and workmanship
1 year for calibration

Characteristic Values

Calibrator

Calibration Function	Simulation Range	Resolution 30,000 Digits (4¾ places)	with a Load of	Intrinsic Error	Overload
Direct Voltage Simulator				±(% s. + mV)	I _{max}
V	0...±300 mV	0.01 mV	700 Ω	0.05 + 0.02	18 mA
	0 ... 3 V	0.1 mV	1000 Ω	0.05 + 0.2	
	0 ... 10 V	1 mV	1000 Ω	0.05 + 2	
	0 ... 15 V	1 mV	1000 Ω	0.05 + 2	
Pulse / Frequency Generator Keying Ratio: 50% Amplitude: 10 mV ...15 V				±(% s. + Hz)	I _{max}
Hz	1 Hz ... 1 kHz	0.1 ... 8 Hz ¹⁾	1000 Ω	0.05 + 0.2	18 mA
Current Source			max. load	±(% s. + μA)	
mA	4 ... 20 mA	1 μA	20 V	0.05 + 2	
	0 ... 20 mA				
	0 ... 24 mA				
Current Sink				±(% s. + μA)	U _{max}
mA	4 ... 20 mA	1 μA	V _{in} = 4 ... 27 V	0.05 + 2	27 V
	0 ... 20 mA				
	0 ... 24 mA				
V _{in} : 4 ... 27 V, I _{in} : 0 ... 24 mA, P _{in} = V _{in} x I _{in} < 0.6 W					
Resistance-type Sensors Ω ₂ and Ω ₄			Sensor Current [mA]	±(% s. + Ω)	I _{max}
Ω	5...2000 Ω ₂	0.1 Ω	0.05...0.1...4...5	0.05 + 0.2	5 mA
	0...2000 Ω ₄				

¹⁾ Frequencies from 29 Hz onwards can only be set within a limited grid.

Simulator for Temperature Sensors (Resolution: 0.1 °K)

	Sensor Type	Simulation Range in °C	Simulation Range in °F	Intrinsic Error	Overload
°C / °F	Resistance Thermometer per IEC 751			±(% of s.+K)	I _{max}
	Pt100	-200 ... +850	-328 ... +1562	0.1 + 0.5	5 mA
	Pt1000	-200 ... +300	-328 ... +572	0.1 + 0.2	
	Resistance Thermometer per DIN 43760			±(%v.E.+K)	I _{max}
	Ni100	-60 ... +180	-76 ... +356	0.1 + 0.5	5 mA
	Ni1000	-60 ... +180	-76 ... +356	0.1 + 0.2	
	RTD-Fühlerstrom 0.05 ... 0.1 ... 4 ... 5 mA			*	
	Thermocouples per DIN and/or IEC 584-1			±(% of s.+K) **	I _{max}
	K (NiCr/Ni)	-250 ... +1372	-418 ... +2501	0.1 + 1	18 mA
	J (Fe/CuNi)	-210 ... +1200	-346 ... +2192		
	T (Cu/CuNi)	-270 ... +400	-454 ... + 752		
	B (Pt30Rh/Pt6Rh)	+500 ... +1820	+932 ... +3308		
	E (NiCr/CuNi)	-270 ... +1000	-454 ... +1832		
	R (Pt13Rh/Pt)	-50 ... +1768	-58 ... +3214		
	N (Cu/Cu10)	-270 ... +1300	-454 ... +2372		
	S (Pt10Rh/Pt)	-50 ... +1768	-58 ... +3214		
	L (Fe/CuNi)	-200 ... +900	-328 ... +1652		
	U (Cu/CuNi)	-200 ... +600	-328 ... +1112		

* Without internal reference junction

** Relative to fixed reference temperature °C and thermovoltage of the thermocouple
Reference junction, internal: 2 °K intrinsic error
Reference junction, external: entry of -30 ... 40 °C

Key

rdg. = reading (measured value)
s. = setting
d = digit

METRAHIT | 28C

Calibrator, Multimeter and Milliohmmeter

Multimeter

Meas. Function	Measuring Range	Resolution at Upper Range Limit		Input Impedance		Intrinsic Error for Max. Resolution under Reference Conditions		Overload Capacity ³⁾	
		300 000 ¹⁾	30 000 ¹⁾ 3 000 ¹⁾	DC	AC ⁶⁾	$\pm(\dots\% \text{ rdg.} + \dots \text{ d})$	$\pm(\dots\% \text{ rdg.} . + \dots \text{ d})$	Value	Duration
						DC	AC ⁶⁾		
V	300 V	1 μV	10 μV	> 20 M Ω	11 M Ω // < 50 pF	0.05 + 15	0.5 + 30 (>500d)	250 V DC AC eff sine	continuous
	3 mV	10 μV	100 μV	11 M Ω	11 M Ω // < 50 pF	0.05 + 15	0.2 + 30 (>100d)		
	30 V	100 μV	1 mV	10 M Ω	10 M Ω // < 50 pF	0.05 + 15	0.2 + 30 (>100d)		
	300 V	1 mV	10 mV	10 M Ω	10 M Ω // < 50 pF	0.05 + 15	0.2 + 30 (>100d)	600 V CAT I	
	600 V	10 mV	100 mV	10 M Ω	10 M Ω // < 50 pF	0.05 + 15	0.2 + 30 (>100d)		
				Voltage drop at approx. range limit					
				DC	AC ⁶⁾	DC	AC ⁶⁾		
mA	3 mA	10 nA	100 nA	160 mV	160 mV	0.05 + 15	0.5 + 30 (>100d)	0.36 A	continuous
	30 mA	100 nA	1 μA	200 mV	200 mV	0.05 + 15	0.5 + 30 (>100d)		
	300 mA	1 μA	10 μA	500 mV	500 mV	0.05 + 15	0.5 + 30 (>100d)		
				Open-circuit voltage	Meas. current at upper range limit	$\pm(\dots\% \text{ rdg.} + \dots \text{ d})$			
Ω_4	30 m Ω		0.01 m Ω	0.6 V	100 mA	0.5 + 5		$\pm 0.6 \text{ V}$	continuous
	300 m Ω		0.1 m Ω	0.6 V	100 mA	0.5 + 5			
	3 Ω		1 m Ω	0.6 V	10 mA	0.5 + 5			
	30 Ω		1 m Ω	0.6 V	10 mA	0.5 + 5			
Ω_2	300 Ω	1 m Ω		0.6 V	250 μA	0.07 + 20 ⁴⁾		250 V DC AC eff sine	5 min.
	3 k Ω	10 m Ω		0.6 V	45 μA	0.07 + 15 ⁴⁾			
	30 k Ω	100 m Ω		0.6 V	4.5 μA	0.07 + 15			
	300 k Ω	1 Ω		0.6 V	1.5 μA	0.07 + 15			
	3 M Ω	10 Ω		0.6 V	150 nA	0.07 + 15			
	30 M Ω	100 Ω		0.6 V	15 nA	1.5 + 15			
Ω_{eff}	300 Ω		0.1 Ω	3 V	1 mA	0.5 + 5			
$\rightarrow$	3 V		0.1 mV	6 V	1 mA	0.5 + 5		22 V	continuous
Zener $\rightarrow$	15 V		1 mV	22 V	1 mA	1 + 5 (> 10 d)			
				Discharge resistance	$U_0 \text{ max}$	$\pm(\dots\% \text{ rdg.} + \dots \text{ d})$			
F	3 nF		1 pF	10 M Ω	3 V	1 + 5 ⁴⁾		250 V DC AC eff sine	5 min.
	30 nF		10 pF	10 M Ω	3 V	1 + 5 ⁴⁾			
	300 nF		100 pF	1 M Ω	3 V	1 + 5			
	3 μF		1 nF	100 k Ω	3 V	1 + 5			
	30 μF		10 nF	11 k Ω	3 V	1 + 5			
				f_{min} ²⁾		$\pm(\dots\% \text{ rdg.} + \dots \text{ d})$			
Hz	300 Hz		0.01 Hz	1 Hz		0.05 + 5 ⁵⁾		250 V	continuous
	3 kHz		0.1 Hz					250 V	
	100 kHz < 30 kHz > 30 kHz		10 Hz					100 V 30 V	

Meas. Function	Temperature Sensor	Measuring Range	Resolution	Intrinsic Error for Max. Resolution under Reference Conditions $\pm(\dots\% \text{ rdg.} + \dots \text{ d})$ ⁷⁾	Overload Capacity ³⁾	Value	Time
$^{\circ}\text{C}/^{\circ}\text{F}$	Pt 100	-200.0 ... -100.0 $^{\circ}\text{C}$	0.1 K	1 K	250 V DC eff sine		5 min
		-100.0 ... +100.0 $^{\circ}\text{C}$		0.8 K			
		+100.0 ... +850.0 $^{\circ}\text{C}$		0.5 + 3			
	Pt 1000	-200.0 ... +100.0 $^{\circ}\text{C}$		0.8 K			
		+100.0 ... +850.0 $^{\circ}\text{C}$		0.5 + 3			
	Ni 100	-60.0 ... +180.0 $^{\circ}\text{C}$		0.5 + 3			
	Ni 1000	-60.0 ... +180.0 $^{\circ}\text{C}$		0.5 + 3			
	K (NiCr-Ni)	-250.0 ... +1372.0 $^{\circ}\text{C}$		0.7 + 3 ⁸⁾			
	J (Fe-CuNi)	-210.0 ... +1200.0 $^{\circ}\text{C}$		0.8 + 3 ⁸⁾			
	T (Cu-CuNi)	-270.0 ... +400.0 $^{\circ}\text{C}$		0.5 + 3 ⁸⁾			
	B (Pt30Rh/Pt6Rh)	+100.0 ... +1820.0 $^{\circ}\text{C}$		5 + 5 ⁸⁾			
	E (NiCr/CuNi)	-270.0 ... +1000.0 $^{\circ}\text{C}$		0.5 + 3 ⁸⁾			
	R (Pt13Rh/Pt)	-50.0 ... +1768.0 $^{\circ}\text{C}$		1 + 5 ⁸⁾			
	N (Cu/Cu10)	-270.0 ... +1300.0 $^{\circ}\text{C}$		0.5 + 3 ⁸⁾			
	S (Pt10Rh/Pt)	-50.0 ... +1768.0 $^{\circ}\text{C}$		1 + 5 ⁸⁾			
	L (Fe/CuNi)	-200.0 ... +900.0 $^{\circ}\text{C}$		1 + 5 ⁸⁾			
	U (Cu/CuNi)	-200.0 ... +600.0 $^{\circ}\text{C}$		1 + 5 ⁸⁾			

- 1) Display: 5 1/2 places for DC and 4 3/4 places for AC, a different resolution and sampling rate can 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 $^{\circ}$... + 40 $^{\circ}\text{C}$
- 4) ZERO is displayed for "zero adjustment" function.
- 5) Range 300 mV~: $U_E = 100 \text{ mV}_{\text{eff/rms}} \dots 300 \text{ mV}_{\text{eff/rms}}$
3 V~: $U_E = 0.3 \text{ V}_{\text{eff/rms}} \dots 3 \text{ V}_{\text{eff/rms}}$
30 V~: $U_E = 3 \text{ V}_{\text{eff/rms}} \dots 30 \text{ V}_{\text{eff/rms}}$
300 V~: $U_E = 30 \text{ V}_{\text{eff/rms}} \dots 300 \text{ V}_{\text{eff/rms}}$
600 V~: $U_E = 300 \text{ V}_{\text{eff/rms}} \dots 600 \text{ V}_{\text{eff/rms}}$
for voltages > 100 V: power limiting of $3 \cdot 10^6 \text{ V} \cdot \text{Hz}$
- 6) 20 ... 45 ... 65 Hz ... 1 kHz sine, for alternating voltage TRMS_{AC}, influences see page 4
- 7) plus sensor deviation
- 8) without integrated reference junction;
additional error with internal reference temperature: $\pm 2 \text{ K}$

Key

rdg. = reading (measured value)
d = digit

METRAHIT | 28C

Calibrator, Multimeter and Milliohmmeter

Influence Quantities and Influence Errors

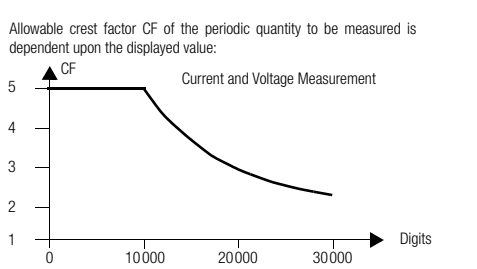
Influencing Quantity	Sphere of Influence	Measured Quantity / Measuring Range ¹⁾	Influence Error $\pm (... \% \text{ rdg.} + d)/10 \text{ K}$
Temperature	0 ... +21 °C and +25 ... +40 °C	V DC, °C (TC)	0.1 + 10
		V AC	0.5 + 10
		3/30 mA DC	0.1 + 10
		3/30 mA AC	0.5 + 10
		300 mA DC, AC	0.5 + 10
		300 Ω /3/30/300 k Ω 2L	0.2 + 10
		3 M Ω 2L	0.5 + 10
		30 M Ω 2L	1 + 10
		Ω 4L	1 + 10
		3/30/300 nF/3/30 μ F	0.5 + 10
		Hz	0.1 + 10
		°C (RTD)	0.2 + 10
		Source quantity ¹⁾	
		mV/V, °C (TC)	0.1 + 10
		Ω , °C (RTD)	0.2 + 10
		mA source	0.1 + 10
		mA sink	0.1 + 10

Influencing Quantity	Frequency	Meas. Qty. / Meas. Range	Influence Error ²⁾ $\pm (... \% \text{ rdg.} + d)$
Frequency V_{AC}	> 20Hz ... 45Hz	300.00 mV	2 + 30
	> 65Hz ... 1kHz	... 250.0 V	

Influencing Quantity	Frequency	Meas. Qty. / Meas. Range	Influence Error ²⁾ $\pm (... \% \text{ rdg.} + ... d)$
Frequency I_{AC}	> 20Hz ... 45Hz	3 mA	1 + 30
	> 65Hz ... 1kHz	30 mA	
		300 mA	

¹⁾ With zero adjustment

²⁾ 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 ²⁾
Measured Quantity Waveshape	Crest Factor CF	1 ... 2	$\pm 1 \% \text{ rdg.}$
		2 ... 4	$\pm 5 \% \text{ rdg.}$
		4 ... 5	$\pm 7 \% \text{ rdg.}$
	Allowable crest factor CF of the periodic quantity to be measured is dependent upon the displayed value: 		

Influencing Quantity	Sphere of Influence	Measured Quantity / Measuring Range ¹⁾	Influence Error
Relative Humidity	75%	V, A, Ω F, Hz °C	1 x intrinsic error
	3 days		
	instrument off		

Influencing Quantity	Sphere of Influence	Measuring Range	Damping $\pm \text{dB}$
Common Mode Interference Voltage	Interference quantity max. 250 V $\sim$ 50 Hz, 60 Hz sine	V $\equiv$	> 90 dB
		300 mV ... 30 V $\sim$	> 80 dB
		300 V $\sim$	> 70 dB
		1000 V $\sim$	> 60 dB
Series Mode Interference Voltage	Interference quantity: V $\sim$, respective nominal value of the measuring range, max. 250 V $\sim$, 50 Hz, 60 Hz sine	V $\equiv$	> 60 dB
		V $\sim$	> 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 Waveshape sine, deviation between RMS and rectified value < 0.1 %
Battery Voltage 4.5 V ± 0.1 V

Response Time (Multimeter Functions)

Response Time (after manual range selection)

Measured Quantity / Measuring Range	Response Time for Digital Display	Measured Quantity Step Function
V DC, V AC A DC, A AC	1.5 s	from 0 to 80% of upper range limit value
300 Ω ... 3 M Ω	2 s	from ∞ to 50% of upper range limit value
30 M Ω	5 s	
Continuity	< 50 ms	
 1.5 s	1.5 s	
°C Pt100	max. 3 s	from 0 to 50% of upper range limit value
3 nF ... 30 μ F	max. 2 s	
>10 Hz	max. 1.5 s	

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 display: 7 mm

Resolution 5 $\frac{1}{4}$ digit $\triangleq$ 309,999 counts

Overflow Display "OL" appears

Polarity Display "—" sign is displayed if positive pole is connected to "⊥"

LCD Test All display segments available during operation of the 28C are activated after the instrument is switched on.

METRAHIT | 28C

Calibrator, Multimeter and Milliohmmeter

Power Supply

Battery 3 ea. 1.5 V AA-Size
alkaline-manganese batteries per IEC LR6,
or equivalent rechargeable battery

Service Life With alkaline-manganese batteries
(2200 mAh)

Measuring Function	Current	Service Life
V, Hz, mA, Ω , F, °C	25 mA	70 h
Standby (MEM + clock)	350 μ A	approx. 1 year
Calibration Function		Service Life
mV, thermocouple	48 mA	40 h
15 V	85 mA	20 h
Ω , RTD	95 mA	18 h
Sink, 20 mA	175 mA	10 h
Source, 20 mA	140 mA	12 h

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. 3.5 V.

Mains Power with NA5/600 power line adapter

Power Saving Circuit

The device is switched off automatically if none of the controls are activated for a period of approximately 10 minutes. The simulator is switched off after a period of only 5 minutes (sockets are current and voltage-free). Automatic shutdown can be deactivated.

Fuses

Fuse links **DMM** (mA measuring ranges):
F500mA/250V, 5 mm x 20 mm
switching capacity 1.5 kA at 250 V AC
and ohmic load

Calibrator:
M125mA/250V, 5 mm x 20 mm
switching capacity 1.5 kA at 250 V AC
and ohmic load

Multimeter Electrical Safety

Safety Class II per EN 61010-1:2001/VDE 0411-1:2002

Measuring Category II

Operating Voltage 250 V

Contamination Degree 2 2

Test Voltage 2.2 kV~ per EN 61010-1:2001/
VDE 0411-1:2002

Electromagnetic Compatibility (EMC)

Interference Emission EN 61326:2002 class B

Interference Immunity EN 61326:2002
IEC 61000-4-2: 1995/A1: 1998
8 kV atmosph. discharge
4 kV contact discharge
IEC 61000-4-3: 1995/A1: 1998
3 V/m

Ambient Conditions

Accuracy Range 0 °C ... +40 °C

Operating Temperature -10 °C ... +50 °C

Storage Temperature -25 °C ... +70 °C (without batteries)

Relative Humidity 45 % ... 75%, no condensation allowed

Elevation to 2,000 m

Mechanical Design

Protection Instrument: IP 50,
Connector sockets: IP 20

Extract from table on the meaning of IP codes

IP XY (1 st digit X)	Protection against foreign object entry	IP XY (2 nd digit Y)	Protection against the penetration of water
0	not protected	0	not protected
1	≥ 50.0 mm dia.	1	vertically falling drops
2	≥ 12.5 mm dia.	2	vertically falling drops with enclosure tilted 15°
3	≥ 2.5 mm dia.	3	spraying water
4	≥ 1.0 mm dia.	4	splashing water
5	dust protected	5	water jets

Dimensions 84 mm x 195 mm x 35 mm

Weight approx. 420 gr. with batteries

Data Interface

Data Transmission optical via infrared light through the
housing

with interface adapter as accessory

Type RS 232C, serial, per DIN 19241

Bidirectional baud rate (read and write)

(DMM ↔ PC) METRAHIT® BD232: 9600 baud

Standard Equipment

- 1 METRAHIT | 28C calibrator with 3 batteries per IEC LR6 (AA size)
- 1 KS17 cable set (yellow) including two measurement cables
(1 black, 1 yellow) with angle plugs and test probes
- 1 KS17 cable set (red and black)
- 1 operating instructions
- 1 GH18 protective rubber holster
- 1 DKD calibration certificate

METRAHIT | 28C

Calibrator, Multimeter and Milliohmmeter

Accessories

METRAHIT[®] BD232 Interface Adapter

The **METRAHIT | 28C** calibrator can be set up, its parameters can be configured and measurement data can be uploaded to a PC with the help of the **METRAHIT[®] BD232** bidirectional adapter. The adapter has no memory of its own. It can be used to read out data from the memory integrated into the **METRAHIT | 28C**. It supports all measuring functions and data formats included in the **METRAHIT | 20** series, and is included in the user-friendly BD-Pack 1.



Analysis Software METRA | View (accessory)

The **METRA | View** PC software is a multilingual measurement data logging program for time-related recording, visualizing, evaluating and documenting measured values from the multimeters of the **METRAHIT | X-TRA** and 27M/I series and from the multimeter component (measuring element) of the **METRAHIT | 28C** calibrator. Communications between the PC and the measuring instrument(s) is established via the bidirectional interface adapter **METRAHIT[®] BD232**.

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

A demo software with restricted functions can be downloaded from the internet.

Configuration of the Measuring Instrument (METRAHIT | 28C restricted)

Remote configuration and querying of device-specific functions and parameters such as measuring function, measuring range and memory parameters:

- start/stop recording,
 - delete memory,
 - display of memory occupancy
 - setting of recording speed in 3 groups
 - 0,1 ... 50 seconds
 - 1 ... 50 minutes
 - 1 ... 9 hours
- as a function of time per measured value.

Online Recording of Measurement Data

Read-in, display and recording of momentarily measured data from the interconnected device.

- Number of measuring channels
 - maximum of 4
 - (further channels in preparation)
 - Start of recording
 - manual or triggered by meas. value
 - 0.1 s/measurement ... 5 min/meas.
 - max. 2,000 measurements/channel
- Recording:** consecutive no., measuring duration, measured value and measurement quantity, recording either in text file or Excel format.

Reading Out Stored Data (not for METRAHIT | 28C)

Read-out and display of the measurement data recorded to the device's memory and filing as a text file.

Display of Measured Values

- Display of measured value, measuring quantity and range in numeric decimal values
(simulation of a device display, see figure 1, left-hand side)
- scalable representation in the form of 1, 2 or 4 measuring mechanisms (see picture 1, bottom right).
Each measuring mechanism can also be shown as a full-frame display
Print-out of measuring mechanism diagram
- Display of measured values in digital figures.
- Parallel display and recording of 4 measuring channels as storable data table, see picture 1, top right)
(date, time of measurement, measured value, measuring quantity, measuring range)

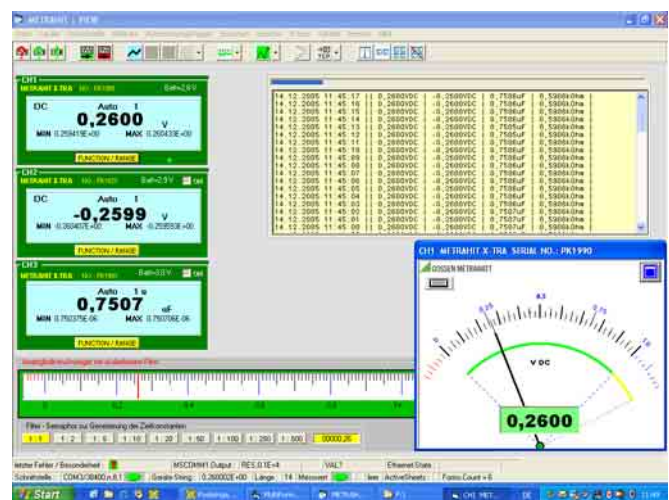


Figure 1: 3-channel display with table and view of measuring mechanism

Graphic Display

Upon keystroke, a stored data table can easily be converted into a chart with the following features:

- scalable scope representation of a maximum of 4 channels
- selectable sampling rate and scalings
- Choice of background and chart colour
„Line thickness“ can be switched between normal/bold.

The chart can subsequently be stored as a bmp file or printed out.

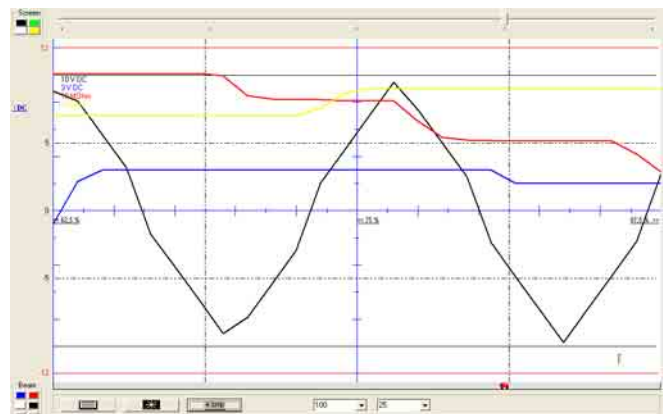


Figure 2: 4-channel graphic display

METRAHIT | 28C

Calibrator, Multimeter and Milliohmmeter

METRAWin® 90-2 Calibration Software (accessory)

This software allows for paperless documentation and management of calibration results, the creation of calibration procedures and remote control of the calibrator.

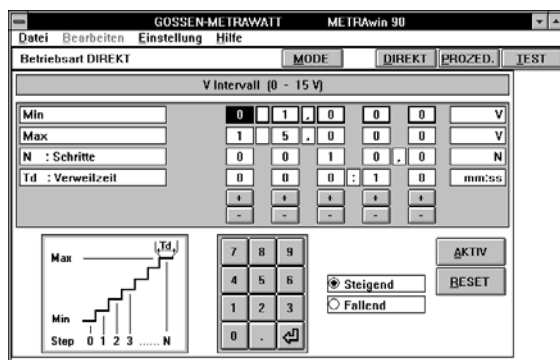
METRAHIT | 28C sequence controls can be implemented online, or off-line after downloading complete calibration procedures.

Direct Entry at the Calibrator

The calibrator is controlled by the PC, and preset values are uploaded from the PC directly to the calibrator.

The following operating modes are provided with the indicated calibration ranges:

- **DIRECT** A freely selectable, fixed numeric calibration value can be entered.
- **INTERVAL** Continuous read-out of calibration values from a calibration interval which can be subdivided into intermediate steps as desired.
- **RAMP** Continuous, stepless read-out of calibration values from a calibration ramp with definable rise and dwell periods. The ramp function may also be operated continuously.



Direct Entry of Calibration Values

Calibrator Program (sequence operation)

A calibrator test program is created at the PC (e.g. with several test steps for a complex instrument or a group of systems components), stored to a data file and uploaded to memory at the **METRAHIT | 28C**. Each calibration step can then be queried via the keypad at the **METRAHIT | 28C**.

GOSSEN-METRAWATT METRAWin 90						
Betriebsart PROZEDUR						
Programm 1.						
Schritt	Ausgabe	Funktion	Par. 1	Par. 2	Par. 3	Par. 4
1.	V	Manuell	1,2345 V			
2.	V	Intervall	01,000 V	14,500 V	0025,0 N	001:50 mm
3.	V	Rampe	01,000 V	10,000 V	000:50 mm:ss	000:10 mm
4.	mA Quelle	Manuell	20,000 mA			
5.	mA Senke	Intervall	00,100 mA	20,000 mA	0005,0 N	000:50 mm
6.	Ohm	Manuell	0100,0 Ohm			
7.	Ohm	Manuell	2000,0 Ohm			
8.	Ohm	Manuell	0150,0 Ohm			

Creation of a Test Program

Calibration "Test" Program in Accordance with ISO9001, 4.11

A calibration sequence can be pre-programmed in the TEST mode which can be run in selectable, individual steps, or fully automatically.

The calibration values and a freely definable comment are read out after each calibration step. After the output parameters of the device to be calibrated (e.g. a transducer) have been logged and evaluated with the multimeter, the measurement results are displayed in tabular form. Test sequence results can be saved to a data file or printed out as a calibration certificate. All requirements in accordance with ISO9001 section 11.4 are fulfilled.

GOSSEN-METRAWATT METRAWin 90						
Betriebsart TEST						
PASS-Prozentanteil 50%						
Programm 1.						
Schritt	Ausgabe	Funktion	Par. 1	Par. 2	Par. 3	Par. 4
1.	V	Manuell	1,5000 V			
Status:	Text		Warten 0:05	Sollwert 1,5000 V	Min 1,400 V	Max 1,55 V
2.	V	Manuell	00,250 V			
Status:	Text		Warten 0:15	Sollwert 8,2500 V	Min 8,200 V	Max 8,350 V
3.	V	Manuell	0,1500 V			
Status:	Text		Warten 0:05	Sollwert 0,150 V	Min 0,140 V	Max 0,155 V
4.	V	Manuell	12,500 V			
Status:	Text		Warten 0:10	Sollwert 12,500 V	Min 12,4 V	Max 12,65 V
5.	V	Manuell	1,5000 V			

Calibration Sequence for Measuring Transducer ("TEST" function)

Ausfertigendes Labor:	MUSTER KG	Zertifikat Nr.:	
Kalibriert von:	MUSTERMANN	Kalibriergarantie:	
Kalibrierdatum:		METRAHit 28C S-Nr.:	XXXX-YYYYY-ZZZZ
Prüfungsfabrikat:	MUSTER	Kalibriermittel:	
Typ:	MULTIMETER	METRAHit 28C S-Nr.:	WWW-ZZ-YYYY
Nummer:	328-45-3534	Kalibriermittel:	
Umgebung:		Hersteller:	GOSSEN-METRAWATT
Temperatur:	23 °C	Art der Messung:	Multimetertest
Luftfeuchtigkeit:	65 %	Unterschrift:	

Angelegter Wert	Sollwert	Grenzwert Unten	Grenzwert Oben	Prüfung Istwert	Prüfung Abweichung	% Fehler der Spezifikation	PASS/Grenze/FAIL
1,5000 V	1,5000 V	1,400 V	1,55 V	1,481 V	-0,0190 V	19%	PASSED
00,250 V	8,2500 V	8,200 V	8,350 V	8,28 V	0,0800 V	30%	PASSED
0,1500 V	0,150 V	0,140 V	0,155 V	0,148 V	-0,0020 V	20%	PASSED
12,500 V	12,500 V	12,4 V	12,65 V	12,39 V	-0,0900 V	60%	KRENNZWEIT
1,5000 V	1,500 V	1,45 V	1,55 V	1,482 V	-0,0180 V	36%	PASSED
1,4444 V	1,4444 V	1,400 V	1,4788 V	1,426 V	-0,0184 V	41%	PASSED
1,2000 V	1,25 V	1,2 V	1,3 V	1,283 V	-0,0170 V	34%	PASSED

Zusammenfassung: Messungen = 7
 PASS (0...50%) = 6 Grenzfällt (50...100%) = 1 FAIL (>100%) = 0

Print-out of a calibration certificate in accordance with ISO9001 including traceability (4.11b), calibration process (4.11c), measurement deviation (4.11d), pass/fail results (4.11g) and ambient conditions (4.11h)

METRAHIT | 28C

Calibrator, Multimeter and Milliohmmeter

Milliohm measurement with Type KC4 Kelvin Clips

Kelvin clips provide for an easy way of contact between the **METRAHIT | 28C** and low-resistance DUTs. They compensate for the disturbing influences of line and contact resistances. The KC4 set consists of two clamping clips with insulated, torsion-free jaws providing for a good clamping effect. They are capable of contacting very fine wires as well as rails and/or rods with a maximum diameter of 15 mm.

For measurements below 30 Ω , a 4-pole connection is strongly recommended.



Order Information

Description	Type	Article Number
Calibrator, see standard equipment for METRAHIT 28C	METRAHIT 28C	M231A
Hardware Accessories		
Charger 230 V~/5 V, 600 mA	NA5/600	Z218F
Probe for voltage measurement in power installations to 1000 V	KS30	GTZ 3204 000 R0001
Pt100 temperature sensor for surface and immersion measurements, -40 ... +600 °C	Z3409	GTZ 3409 000 R0001
Pt1000 temperature sensor for measurement in gases and liquids, -50 ... +220 °C	TF220	Z102A
Pt100 oven sensor, -50 ... +550 °C	TF550	GTZ 3408 000 R0001
Ten adhesive Pt100 temperature sensors, -50 ... +550 °C	TS Chipset	GTZ 3406 000 R0001
Imitation leather carrying pouch for METRAHIT 	F829	GTZ 3301 000 R0003
Cordura belt pouch for METRAHIT multimeters	HitBag	Z115A
Imitation leather ever-ready case with cable compartment	F836	GTZ 3302 000 R0001
Ever-ready case for 2 METRAHIT , 2 adapters and accessories	F840	GTZ 3302 001 R0001
Hard case for one METRAHIT and accessories	HC20	Z113A
Hard case for two METRAHIT and accessories	HC30	Z113B
Fuse link for mA measuring ranges	F500mA/250V	Z109F
Fuse link for calibrator	M125mA/250V	Z109G

Description	Type	Article Number
Kelvin clips (1 set = 2 units) for 4-pole connection of low-resistance DUTs, cable length 120 cm	KC4	Z227A
Kelvin probes (1 set = 2 units) with double steel tips for 4-pole connection of low-resistance DUTs	KC27	Z227B
Software Accessory		
1-channel pack consisting of: METRAHIT BD232, bidirectional interface adapter, RS 232 interface cable, METRAwin ®10/ METRAHIT analysis software and installation instructions	BD-Pack 1	Z215A
Calibrator pack consisting of: METRAHIT BD232, bidirectional interface adapter, RS 232 interface cable, METRAwin ®90-2 calibration software and installation instructions	CP1	GTZ 3231 100 R0001
Calibrator pack consisting of METRAHIT 28C , METRAwin ®10/ METRAHIT , METRAwin ®90-2, RS 232 interface cable, BD232, KC2, HC30 and 1ASi battery set	CP28	M231B
Bidirectional interface adapter	METRAHIT BD232	GTZ 3242 100 R0001
RS 232 interface cable, 2 m	Z3241	GTZ 3241 000 R0001
METRAwin ®10/ METRAHIT software update and installation instructions	Z3240	GTZ 3240 000 R0001
Analysis software METRA VIEW	METRA VIEW	Z211G
Calibration software for controlling the METRAHIT 28C and for analysis of calibration results	METRAwin ®90-2	Z211A
Accessory Clip-On Current Transformers and Current Sensors *		
Clip-on current transformer 1 ... 200 A~, 1000:1, 48...65...400 Hz	WZ11A ^{D)}	Z208A
WZ12A ... Clip-On Current Transformers / Sensors D ^{D)} frequency range: 45...65...500 Hz, clip opening: $\varnothing$ 15 mm max. cable dia.		
Clip-on current transformer 15 A ... 180 A, 1000:1	WZ12A	Z219A
Clip-on current sensor 10 mA ... 100 A; 100 mV/A	WZ12B	Z219B
Clip-on current sensor selectable, 1 mA ... 15 A; 1 mV/mA und 1 A ... 150 A; 1 mV/A	WZ12C	Z219C
Clip-on current transformer 30 mA ... 150 A, 1000:1	WZ12D	Z219D

^{D)} Data sheet available

* Please refer to the Test and Measurement Catalog for further information on clip-on current transformers and current sensors

For additional information regarding accessories please refer to

- our *Measuring Instruments and Testers catalogue*
- our website www.gossenmetrawatt.com

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