

# Deutsche Akkreditierungsstelle GmbH

## Annex to the Accreditation Certificate D-K-17589-01-00 according to DIN EN ISO/IEC 17025:2005

**Valid from: 2019-07-08**

Date of issue: 2019-07-08

Holder of certificate:

**TetraTec Instruments GmbH**  
**Gewerbestraße 8, 71144 Steinenbronn**

Head: Dr. rer. nat. Johannes Schubert  
Deputy head: Dipl.-Phys. Karl Ilg  
Dipl.-Ing. (FH) Peter Kienzle  
Dr. rer. nat. Marc Plüschau

Accredited as calibration laboratory since: 1999-03-31

Calibration in the fields:

**Fluid quantities**

- Gas flow rate <sup>a)</sup>
- Mass of flowing gases <sup>a)</sup>
- Volume of flowing gases <sup>a)</sup>

**Mechanical quantities**

- Pressure

**Electrical quantities**

**DC and low frequency quantities**

- DC voltage
- DC current
- DC resistance

**Thermodynamic quantities**

**Temperature quantities**

- Resistance thermometers
- Direct reading thermometers

**Humidity quantities**

- Relative humidity

<sup>a)</sup> also on site calibration

Abbreviations used: see last page

*The certificate together with its annex reflects the status at the time of the date of issue. The current status of the scope of accreditation can be found in the database of accredited bodies of Deutsche Akkreditierungsstelle GmbH.  
<https://www.dakks.de/en/content/accredited-bodies-dakks>*

**Annex to the accreditation certificate D-K-17589-01-00**

**Permanent Laboratory**

**Calibration and Measurement Capabilities (CMC)**

Measured quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement 1)	Remarks
<b>Fluid quantities</b> Volume flow rate or volume of flowing gases	0.01 m <sup>3</sup> /h to 6 m <sup>3</sup> /h	Drum-type gas meter	0.33 %	Calibration medium: - atmospheric air - decompressed air - synthetic air to max. 30 m <sup>3</sup> /h
	39 mL/h to 27 L/h	Sonic nozzle gallery	0.31 %	
	27 L/h to 60 m <sup>3</sup> /h		0.24 %	Calibration medium: - atmospheric air - decompressed air
	60 m <sup>3</sup> /h to 1920 m <sup>3</sup> /h		0.24 %	
	3 m <sup>3</sup> /h to 1000 m <sup>3</sup> /h	Low pulsation rotary piston gas meter	0.26 %	
	13 m <sup>3</sup> /h to 10000 m <sup>3</sup> /h	Turbine gas meter	0.26 %	
	10 L/h to 6000 L/h	Drum-type gas meter Calibration medium: - Nitrogen N <sub>2</sub> - Hydrogen H <sub>2</sub> - Helium He - Argon Ar under environmental conditions	0.46 %	
	10 L/h to 1500 L/h	Drum-type gas meter Calibration medium: - Carbon monoxide CO under environmental conditions	0.46 %	
0.5 L/h to 190 L/h	Laminar Flow Element: Calibration medium: - Propane C <sub>3</sub> H <sub>8</sub> under environmental conditions	0.40 %		
Mass flow rate or mass of flowing gases	12 g/h to 7.2 kg/h	Drum-type gas meter	0.32%	Calibration medium: - atmospheric air - decompressed air - synthetic air to max. 36 kg/h
	47 mg/h to 32 g/h	Sonic nozzle gallery	0.30 %	
	32 g/h to 72 kg/h		0.22 %	Calibration medium: - atmospheric air - decompressed air
	72 kg/h to 2300 kg/h		0.22 %	
	3.6 kg/h to 1200 kg/h	Low pulsation rotary piston gas meter	0.25 %	
	15 kg/h to 12000 kg/h	Turbine gas meter	0.25 %	

<sup>1)</sup> The expanded uncertainties according to EA-4/02 M:2013 are part of CMC and are the best measurement uncertainties within accreditation. They have a coverage probability of approximately 95 % and have a coverage factor of  $k = 2$  unless stated otherwise. Uncertainties without unit are relative uncertainties referring to the measurement value unless stated otherwise.

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Measured quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement 1)	Remarks
<b>Fluid quantities</b> Mass flow rate or mass of flowing gases	12 g/h N <sub>2</sub> to 7 kg/h N <sub>2</sub> 0.9 g/h H <sub>2</sub> to 0.5 kg/h H <sub>2</sub> 1.7g/h He to 1 kg/h He 17 g/h Ar to 10 kg/h Ar 12 g/h CO to 1.7 kg/h CO	Drum-type gas meter Calibration medium - Nitrogen N <sub>2</sub> - Hydrogen H <sub>2</sub> - Helium He - Argon Ar - Carbon monoxide CO under environmental conditions	0.46 %	
	1 g/h to 350 g/h	Laminar Flow Elemente Calibration medium - Propane C <sub>3</sub> H <sub>8</sub> under environmental conditions	0.40 %	
<b>Pressure</b> Negative and positive gauge pressure $p_e$	-1000 mbar to -14 mbar	DKD-R 6-1: 2014 EURAMET Calibration Guide No. 17, Version 3.0	$5 \cdot 10^{-3} \cdot \text{mbar} + 4.9 \cdot 10^{-5} \cdot  p_e $	Pressure medium: dried compressed air or nitrogen
	-10 mbar to 14 mbar		$4 \cdot 10^{-4} \cdot  p_e $ . jedoch nicht kleiner als 0.003 mbar	
	> 14 mbar to 1700 mbar		$3.4 \cdot 10^{-3} \cdot \text{mbar} + 2.9 \cdot 10^{-5} \cdot p_e$	
	> 1.7 bar to 7 bar		$14 \cdot 10^{-3} \cdot \text{mbar} + 3.2 \cdot 10^{-5} \cdot p_e$	
	> 7 bar to 70 bar		$0.14 \cdot \text{mbar} + 3.3 \cdot 10^{-5} \cdot p_e$	
Absolut pressure $p_{abs}$	14 mbar to 1700 mbar	DKD-R 6-1: 2014 EURAMET Calibration Guide No. 17, Version 3.0	$3.4 \cdot 10^{-3} \cdot \text{mbar} + 3.1 \cdot 10^{-5} \cdot p_{abs}$	Pressure medium: dried compressed air or nitrogen
	> 1.7 bar to 7 bar		$14 \cdot 10^{-3} \cdot \text{mbar} + 3.4 \cdot 10^{-5} \cdot p_{abs}$	The uncertainty of the measured residual gas pressure $U_{rest}$ has to be taken into account.
	> 7 bar to 70 bar		$0.14 \cdot \text{mbar} + 3.5 \cdot 10^{-5} \cdot p_{abs}$	
<b>Temperature quantities</b> Resistance thermometers, direct reading thermometers and measuring transducers with resistance sensors	0 °C to 90 °C	DKD-R 5-1: 2018 Comparison measurement	17 mK	Comparison with standard resistance thermometers in thermostatic stirred liquid baths
	21 °C to 25 °C	DKD-R 5-1: 2018 Comparison measurement	0.15 K	Comparison with standard resistance thermometers in air channel
	0.01 °C	Triple point of water	5 mK	Calibration at fixed points temperatures
Simulators for resistance thermometers	0 °C to 90 °C	DKD-R 5-5: 2018	5 mK	Comparison with standard DC resistances

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**Calibration and Measurement Capabilities (CMC)**

Measured quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement 1)	Remarks				
Indicators for resistance thermometers	0 °C to 90 °C	DKD-R 5-5: 2018	5 mK	Comparison with reference resistances (fixed resistances of 100 Ω, 110 Ω, 120 Ω, 130 Ω and 140 Ω )				
<b>Relative humidity</b> Hygrometers, hygrometric sensors and measuring transducers	10 % to 95 %	Calibration with humidity generator Temperatur range 15 °C to 30 °C Measuring medium: air	$0.1 \% + 7.5 \cdot 10^{-3} \cdot rF$	Comparison with dew point mirror Uncertainty as absolute value of relative humidity $rF$ = measured value				
<b>Electrical quantities</b> DC voltage Measuring devices and sources	0 mV to 120 mV > 120 mV to 1.2 V > 1.2 V to 12 V > 12 V to 60 V	with system multimeters	$50 \cdot 10^{-6} \cdot U + 3.5 \mu V$ $40 \cdot 10^{-6} \cdot U + 7 \mu V$ $45 \cdot 10^{-6} \cdot U + 50 \mu V$ $45 \cdot 10^{-6} \cdot U + 0.6 mV$	$U$ = measured value				
DC current Measuring devices and sources	0 mA to 12 mA > 12 mA to 20 mA > 20 mA to 120 mA > 120 mA to 1 A > 1 A to 3 A		with system multimeter		$50 \cdot 10^{-6} \cdot I + 1 \mu A$ $30 \cdot 10^{-6} \cdot I + 1.4 \mu A$ $0.5 \cdot 10^{-3} \cdot I + 5.0 \mu A$ $1 \cdot 10^{-3} \cdot I + 0.1 mA$ $1.2 \cdot 10^{-3} \cdot I + 0.6 mA$	$I$ = measured value		
DC resistance Resistances	0 Ω to 120 Ω > 120 Ω to 150 Ω > 150 Ω to 1.2 kΩ > 1.2 kΩ to 12 kΩ > 12 kΩ to 120 kΩ > 120 kΩ to 1.2 MΩ > 1.2 MΩ to 12 MΩ				with system multimeter or resistance meter		$2 \cdot 10^{-6} \cdot R + 0.75 m\Omega$ $5 \cdot 10^{-6} \cdot R + 0.75 m\Omega$ $0.1 \cdot 10^{-3} \cdot R + 100 m\Omega$ $0.1 \cdot 10^{-3} \cdot R + 100 m\Omega$ $0.1 \cdot 10^{-3} \cdot R + 1 \Omega$ $0.1 \cdot 10^{-3} \cdot R + 10 \Omega$ $0.4 \cdot 10^{-3} \cdot R + 100 \Omega$	$R$ = measured value
DC resistance Measuring devices	50 Ω 100 Ω; 110 Ω; 120 Ω; 130 Ω; 140 Ω						with fixed resistances	

<sup>1)</sup> The expanded uncertainties according to EA-4/02 M:2013 are part of CMC and are the best measurement uncertainties within accreditation. They have a coverage probability of approximately 95 % and have a coverage factor of  $k = 2$  unless stated otherwise. Uncertainties without unit are relative uncertainties referring to the measurement value unless stated otherwise.

**On-site Calibration**
**Calibration and Measurement Capabilities (CMC)**

Measured quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement 1)	Remarks
<b>Fluid quantities</b> Volume flow rate or volume of flowing gases	160 m <sup>3</sup> /h to 1600 m <sup>3</sup> /h	Turbine gas meter	0.34 %	Calibration medium: - atmospheric air - decompressed air  medium supply must be provided by customers
	1,6 m <sup>3</sup> /h to 250m <sup>3</sup> /h	Rotary piston gas meter	0.34 %	
	> 530 m <sup>3</sup> /h to 4700 m <sup>3</sup> /h	Laminar flow elements	0.39 %	
	10 L/h to 530 m <sup>3</sup> /h		0.38 %	
	60 mL/h to < 10 L/h		0.43 %	
Mass flow rate or mass of flowing gases	192 kg/h to 1920 kg/h	Turbine gas meter	0.33 %	
	1,9 kg/h to 300 kg/h	Rotary piston gas meter	0.33 %	
	> 635 kg/h to 5640 kg/h	Laminar flow elements	0.39 %	
	12 g/h to 635 kg/h		0.37 %	
	72 mg/h to < 12 g/h		0.42 %	

**Abbreviations used:**

- DKD-R Calibration Guideline of Deutscher Kalibrierdienst (DKD), published by Physikalisch-Technische Bundesanstalt
- EURAMET European Association of National Metrology Institutes

<sup>1)</sup> The expanded uncertainties according to EA-4/02 M:2013 are part of CMC and are the best measurement uncertainties within accreditation. They have a coverage probability of approximately 95 % and have a coverage factor of  $k = 2$  unless stated otherwise. Uncertainties without unit are relative uncertainties referring to the measurement value unless stated otherwise.