

Deutsche Akkreditierungsstelle GmbH

Annex to the Accreditation Certificate D-K-12029-01-00 according to DIN EN ISO/IEC 17025:2018

Valid from: 09.09.2020

Date of issue: 09.09.2020

Holder of certificate:

**Hottinger Brüel & Kjaer GmbH
Im Tiefen See 45, 64293 Darmstadt**

Calibration in the fields:

Mechanical quantities

- Torque ^{*)}
- Force ^{*)}
- Pressure ^{*)}

Thermodynamic quantities

- Temperature quantities**
- Temperature indicators
and simulators ^{a)*)}

Electrical quantities

- DC and low frequency quantities**
- Voltage ratio ^{a)}
 - DC voltage ^{a)}
 - DC current ^{a)}
 - DC resistance ^{a)}

Time and frequency

- Frequency ^{a)}

^{a)} also on-site calibration

Within the scope of accreditation marked with ^{*)} the calibration laboratory is permitted, without being required to inform and obtain prior approval from DAkks, to use calibration standards or equivalent calibration procedures listed here with different issue dates.

The calibration laboratory maintains a current list of all calibration standards / equivalent calibration procedures within the flexible scope of accreditation.

Abbreviations used: see last page

The management system requirements in DIN EN ISO/IEC 17025 are written in language relevant to operations of calibration laboratories and operate generally in accordance with the principles of DIN EN ISO 9001.

*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>*

Permanent Laboratory

Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement ¹⁾	Remarks
Torque^{*)} Torque transducer, Torque measuring chains	2 N·m to 200 N·m	DIN 51309:2005 DKD-R 10-5:2020 VDI/VDE 2646:2019	$4 \cdot 10^{-4}$	200-N-m Torque-RCM, correction 1.00025 counterclockwise and clockwise torque
	5 N·m to 1000 N·m		$1 \cdot 10^{-4}$	1-kN·m-Torque-RCM
	20 N·m to 1000 N·m		$2 \cdot 10^{-4}$	1-kN·m-Torque-RCM
	150 N·m to 10 kN·m		$2 \cdot 10^{-4}$	10-kN·m Torque-RCM
	50 N·m to 200 N·m		$4 \cdot 10^{-4}$	20-kN·m Torque-RCM
	250 N·m to 20 kN·m		$2 \cdot 10^{-4}$	
	100 N·m to 20 kN·m		$0.8 \cdot 10^{-4}$	25-kN·m Torque-RCM
	> 20 kN·m to 25 kN·m		$1 \cdot 10^{-4}$	
	3 kN·m to 400 kN·m	DIN 51309:2005 VDI/VDE 2646:2019	$1 \cdot 10^{-3}$	400-kN·m Torque-RCM
Force^{*)}	2.5 N to 200 N	DIN EN ISO 376:2011 DKD-R 3-3:2010	$5 \cdot 10^{-5}$	200-N-Force-RCM compression force
			$8 \cdot 10^{-5}$	200-N-Force-RCM tension force
	50 N to 2.5 kN		$5 \cdot 10^{-5}$	2.5-kN-Force-RCM compression force
			$8 \cdot 10^{-5}$	2.5-kN-Force-RCM tension force
	1 kN to 20 kN		$2 \cdot 10^{-4}$	20-kN-Force-RCM tension and compression force
	500 N to 25 kN		$5 \cdot 10^{-5}$	25-kN-Force-RCM compression force
			$8 \cdot 10^{-5}$	25-kN-Force-RCM tension force
	5 kN to 100 kN		$2 \cdot 10^{-4}$	100-kN-Force-RCM tension and compression force
	5 kN to 240 kN		$1 \cdot 10^{-4}$	240-kN-Force-RCM tension and compression force
	50 kN to 1 MN		$1 \cdot 10^{-4}$	1-MN-Force-RCM compression force
50 kN to 600 kN	$2 \cdot 10^{-4}$	1-MN-Force-RCM tension force		
100 kN to 5 MN	$2 \cdot 10^{-4}$	5-MN-Force-RCM tension and compression force		
Pressure^{*)} positive gauge pressure p_e	0 bar; 50 bar to 3600 bar	DKD-R 6-1:2014	$2 \cdot 10^{-4} p_e$; but not < 72 mbar	Pressure medium: Oil

¹⁾ 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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Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement ¹⁾	Remarks		
Frequency measuring instruments	2 kHz		$12 \cdot 10^{-6} \cdot f$	f: measured value		
	20 kHz					
	100 kHz					
	200 kHz					
	500 kHz					
	1 000 kHz					
	2 000 kHz					
Temperature*) indicators for resistance thermometers PT 100	-100 °C to 200 °C	DKD-R 5-5:2018 electrical simulation	0.02 K	electrical simulation of the sensor signal; temperature equivalent in Ω according to DIN EN 60751:2009		
	> 200 °C to 500 °C		0.03 K			
	> 500 °C to 800 °C		0.04 K			
	indicators for resistance thermometers PT 1000		-100 °C to 200 °C		0.02 K	
			> 200 °C to 500 °C		0.09 K	
			> 500 °C to 800 °C		0.12 K	
	indicators for thermocouples Type K		-100 °C to 800 °C		0.12 K	electrical simulation of the sensor signal; temperature equivalent in V
			> 800 °C to 1 300 °C		0.3 K	
	indicators for thermocouples Type T		-200 °C to 400 °C			0.12 K
DC voltage measuring instruments	0 V		1 μ V	U: measured value		
	0.001 V to 0.22 V		$7 \cdot 10^{-6} \cdot U + 2 \mu\text{V}$			
	> 0.22 V to 2.2 V		$8 \cdot 10^{-6} \cdot U + 2 \mu\text{V}$			
	> 2.2 V to 11 V		$8 \cdot 10^{-6} \cdot U + 4 \mu\text{V}$			
	> 11 V to 22 V		$9 \cdot 10^{-6} \cdot U + 10 \mu\text{V}$			
	> 22 V to 220 V		$30 \cdot 10^{-6} \cdot U + 40 \mu\text{V}$			
sources	0.0 V to 0.1 V		$6 \cdot 10^{-6} \cdot U + 0.4 \mu\text{V}$	U: measured value		
	> 0.1 V to 1 V		$5 \cdot 10^{-6} \cdot U + 0.4 \mu\text{V}$			
	> 1 V to 10 V		$5 \cdot 10^{-6} \cdot U + 0.4 \mu\text{V}$			
	> 10 V to 100 V		$50 \cdot 10^{-6} \cdot U + 1\,000 \mu\text{V}$			
DC current measuring instruments	0.001 A to 0.022 A		$50 \cdot 10^{-6} \cdot I + 0.3 \mu\text{A}$	I: measured value		
	> 0.022 A to 0.22 A		$60 \cdot 10^{-6} \cdot I + 2 \mu\text{A}$			

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Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement ¹⁾	Remarks
DC resistance measuring instruments	16 Ω to 400 Ω		$25 \cdot 10^{-6} \cdot R + 1.8 \text{ m}\Omega$	R: measured value
	> 400 Ω to 2 000 Ω		$40 \cdot 10^{-6} \cdot R + 0.1 \text{ m}\Omega$	
	> 2 000 Ω to 10 000 Ω		$95 \cdot 10^{-6} \cdot R + 0.45 \text{ m}\Omega$	
Voltage ratio bridge standards	0 mV/V	DC voltage bridge voltage: 1.0 V	0.2 μV/V	
	± 2 mV/V		0.25 μV/V	
	± 5 mV/V		0.3 μV/V	
	± 10 mV/V		0.3 μV/V	
	± 20 mV/V		0.4 μV/V	
	± 100 mV/V		1 μV/V	
	± 1 000 mV/V		10 μV/V	
	0 mV/V	DC voltage bridge voltage: > 1 V to 2.5 V	0.1 μV/V	
	± 2 mV/V		0.1 μV/V	
	± 5 mV/V		0.2 μV/V	
	± 10 mV/V		0.2 μV/V	
	± 20 mV/V		0.2 μV/V	
	± 100 mV/V		1 μV/V	
	± 1 000 mV/V		10 μV/V	
	0 mV/V	DC voltage bridge voltage: > 2.5 V to 7.5 V	0.1 μV/V	
	± 2 mV/V		0.1 μV/V	
	± 5 mV/V		0.1 μV/V	
	± 10 mV/V		0.1 μV/V	
	± 20 mV/V		0.2 μV/V	
	± 100 mV/V		1 μV/V	
	± 1 000 mV/V		10 μV/V	
Voltage ratio bridge standards	0 mV/V	DC voltage bridge voltage: > 7.5 V to 10 V	0.1 μV/V	
	± 2 mV/V		0.1 μV/V	
	± 5 mV/V		0.1 μV/V	
	± 10 mV/V		0.1 μV/V	
	± 20 mV/V		0.2 μV/V	
	± 100 mV/V		1 μV/V	
	± 200 mV/V		2 μV/V	
Voltage ratio bridge standards and measuring instruments	2.5 mV/V	frequency: 225 Hz bridge voltage: 2.5 V	0.03 μV/V	calibration of 350 Ω - bridge standards and associated indicators with inductive reference bridge standard

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Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement ¹⁾	Remarks
Voltage ratio measuring instruments	± 2 mV/V	DC voltage bridge voltage: 1.0 V	0.5 µV/V	
	± 5 mV/V		0.5 µV/V	
	± 10 mV/V		1.0 µV/V	
	± 20 mV/V		1.5 µV/V	
	± 100 mV/V		15 µV/V	
	± 1 000 mV/V		150 µV/V	
	± 2 mV/V	DC voltage bridge voltage: > 1 V to 10 V	0.3 µV/V	
	± 5 mV/V		0.6 µV/V	
	± 10 mV/V		1.2 µV/V	
	± 20 mV/V		2.4 µV/V	
	± 100 mV/V		12 µV/V	
	± 1 000 mV/V		120 µV/V	
	± 5 mV/V	frequency: 600 Hz to 1 250 Hz square wave bridge voltage: 1 V	0.5 µV/V	
	± 10 mV/V		1 µV/V	
	± 20 mV/V		1.5 µV/V	
	± 100 mV/V		15 µV/V	
	± 2 mV/V	frequency: 600 Hz to 1 250 Hz square wave bridge voltage: > 1 V to 5 V	0.3 µV/V	
	± 5 mV/V		0.6 µV/V	
	± 10 mV/V		1.2 µV/V	
	± 20 mV/V		2.4 µV/V	
Voltage ratio quarter- and half-bridge measuring instruments	± 10 mV/V	DC voltage bridge voltage: 1.0 V	5 µV/V	
	± 20 mV/V		5 µV/V	
	± 100 mV/V		20 µV/V	
	± 2 mV/V	DC voltage bridge voltage: > 1 V to 2.5 V	2 µV/V	
	± 5 mV/V		2 µV/V	
	± 10 mV/V		2 µV/V	
	± 20 mV/V		5 µV/V	
	± 100 mV/V	20 µV/V		
	± 2 mV/V	DC voltage bridge voltage: > 2.5 V to 5.0 V	2 µV/V	
	± 5 mV/V		3 µV/V	
	± 10 mV/V		5 µV/V	

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Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement ¹⁾	Remarks
Voltage ratio	± 0.5 mV/V ± 1 mV/V ± 2 mV/V ± 5 mV/V ± 10 mV/V	DC voltage bridge voltage: 5 V or 10 V	1 · 10 ⁻⁴ from measured value; but not < 0.2 µV/V	calibration of 350 Ω - bridge standards and associated indicators
	± 2 mV/V	frequency: 600 Hz bridge voltage: 1 V bridge voltage: 2.5 V bridge voltage: 5 V	0.2 µV/V 0.15 µV/V 0.1 µV/V	calibration of 350 Ω - bridge standards and associated indicators with reference bridge standard HBM-K3608
	± 2 mV/V	frequency: 4,8 kHz bridge voltage: 1 V bridge voltage: 2.5 V bridge voltage: 5 V	0.4 µV/V 0.3 µV/V 0.25 µV/V	
	± 2.5 mV/V	frequency: 600 Hz bridge voltage: 2.5 V bridge voltage: 5 V	0.06 µV/V 0.03 µV/V	calibration of 350 Ω - bridge standards and associated indicators with inductive reference bridge standard
	± 5 mV/V	frequency: 600 Hz bridge voltage: 2.5 V bridge voltage: 5 V	0.08 µV/V 0.06 µV/V	
	± 5 mV/V	frequency: 225 Hz bridge voltage: 2.5 V bridge voltage: 5 V	0.04 µV/V 0.03 µV/V	
	± 10 mV/V	frequency: 600 Hz bridge voltage: 1 V; 2.5 V or 5 V	0.5 µV/V	calibration of 350 Ω - bridge standards and associated indicators with reference bridge standard HBM-K3608
	± 10 mV/V	frequency: 4.8 kHz bridge voltage: 1 V; 2.5 V or 5 V	1.5 µV/V	
	± 100 mV/V	frequency: 4.8 kHz bridge voltage: 1 V; 2.5 V or 5 V	10 µV/V	
	± 1 000 mV/V	frequency: 4.8 kHz bridge voltage: 1 V or 2.5 V	50 µV/V	
	± 2.5 mV/V	frequency: 225 Hz bridge voltage: 5 V or 10 V	0.02 µV/V	calibration of 350 Ω - bridge standards and associated indicators with an inductive reference bridge standard

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On-site Calibration

Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement ¹⁾	Remarks	
Frequency measuring instruments	2 kHz		$12 \cdot 10^{-6} \cdot f$	<i>f</i> : measured value	
	20 kHz				
	100 kHz				
	200 kHz				
	500 kHz				
	1 000 kHz				
	2 000 kHz				
Temperature^{*)} indicators for resistance thermometers PT 100	-100 °C to 200 °C	DKD-R 5-5:2018 electrical simulation	0.02 K	electrical simulation of the sensor signal; temperature equivalent in Ω according to DIN EN 60751:2009	
	> 200 °C to 500 °C		0.03 K		
	> 500 °C to 800 °C		0.04 K		
	indicators for resistance thermometers PT 1000		-100 °C to 200 °C		0.02 K
			> 200 °C to 500 °C		0.09 K
			> 500 °C to 800 °C		0.12 K
indicators for thermocouples Type K	-100 °C to 800 °C	DKD-R 5-5:2018 electrical simulation	0.12 K	electrical simulation of the sensor signal; temperature equivalent in V (with regard to reference function temperature 0 °C) according to DIN EN 60584:2014	
	> 800 °C to 1 300 °C		0.3 K		
indicators for thermocouples Type T	-200 °C to 400 °C		0.12 K		
DC voltage measuring instruments	0 V to 0.045 V		$30 \cdot 10^{-6} \cdot U + 4 \mu\text{V}$	<i>U</i> : measured value	
	> 0.045 V to 0.3 V		$35 \cdot 10^{-6} \cdot U + 13 \mu\text{V}$		
	> 0.3 V to 0.45 V		$35 \cdot 10^{-6} \cdot U + 22 \mu\text{V}$		
	> 0.45 V to 3 V		$35 \cdot 10^{-6} \cdot U + 125 \mu\text{V}$		
	> 3 V to 4.5 V		$35 \cdot 10^{-6} \cdot U + 215 \mu\text{V}$		
	> 4.5 V to 30 V		$35 \cdot 10^{-6} \cdot U + 1\,300 \mu\text{V}$		
	> 30 V to 60 V		$35 \cdot 10^{-6} \cdot U + 2\,500 \mu\text{V}$		
sources	0.001 V to 0.1 V		$35 \cdot 10^{-6} \cdot U + 8 \mu\text{V}$	<i>U</i> : measured value	
	> 0.1 V to 1 V		$35 \cdot 10^{-6} \cdot U + 11 \mu\text{V}$		
	> 1 V to 10 V		$35 \cdot 10^{-6} \cdot U + 60 \mu\text{V}$		
	> 10 V to 100 V		$50 \cdot 10^{-6} \cdot U + 1\,000 \mu\text{V}$		

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Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement ¹⁾	Remarks
DC current measuring instruments	0.002 A to 0.0075 A		$90 \cdot 10^{-6} \cdot I + 0.9 \mu\text{A}$	I: measured value
	> 0.0075 A to 0.052 A		$90 \cdot 10^{-6} \cdot I + 4 \mu\text{A}$	
DC resistance measuring instruments	16 Ω to 400 Ω		$25 \cdot 10^{-6} \cdot R + 1.8 \text{ m}\Omega$	R: measured value
	> 400 Ω to 2 000 Ω		$40 \cdot 10^{-6} \cdot R + 0.1 \text{ m}\Omega$	
	> 2 000 Ω to 10 000 Ω		$95 \cdot 10^{-6} \cdot R + 0.45 \text{ m}\Omega$	
Voltage ratio measuring instruments	$\pm 2 \text{ mV/V}$		DC voltage bridge voltage: 1.0 V	0.5 $\mu\text{V/V}$
	$\pm 5 \text{ mV/V}$	0.5 $\mu\text{V/V}$		
	$\pm 10 \text{ mV/V}$	1.0 $\mu\text{V/V}$		
	$\pm 20 \text{ mV/V}$	1.5 $\mu\text{V/V}$		
	$\pm 100 \text{ mV/V}$	15 $\mu\text{V/V}$		
	$\pm 1 000 \text{ mV/V}$	150 $\mu\text{V/V}$		
	$\pm 2 \text{ mV/V}$	DC voltage bridge voltage: > 1 V to 10 V	0.3 $\mu\text{V/V}$	
	$\pm 5 \text{ mV/V}$		0.6 $\mu\text{V/V}$	
	$\pm 10 \text{ mV/V}$		1.2 $\mu\text{V/V}$	
	$\pm 20 \text{ mV/V}$		2.4 $\mu\text{V/V}$	
	$\pm 100 \text{ mV/V}$		12 $\mu\text{V/V}$	
	$\pm 1 000 \text{ mV/V}$		120 $\mu\text{V/V}$	
	$\pm 5 \text{ mV/V}$	frequency: 600 Hz to 1 250 Hz square wave bridge voltage: 1 V	0.5 $\mu\text{V/V}$	
	$\pm 10 \text{ mV/V}$		1 $\mu\text{V/V}$	
	$\pm 20 \text{ mV/V}$		1.5 $\mu\text{V/V}$	
	$\pm 100 \text{ mV/V}$		15 $\mu\text{V/V}$	
	$\pm 2 \text{ mV/V}$	frequency: 600 Hz to 1 250 Hz square wave bridge voltage: > 1 V to 5 V	0.3 $\mu\text{V/V}$	
	$\pm 5 \text{ mV/V}$		0.6 $\mu\text{V/V}$	
	$\pm 10 \text{ mV/V}$		1.2 $\mu\text{V/V}$	
	$\pm 20 \text{ mV/V}$		2.4 $\mu\text{V/V}$	
	$\pm 2 \text{ mV/V}$	frequency: 4.8 kHz bridge voltage: 1 V	0.5 $\mu\text{V/V}$	
	$\pm 10 \text{ mV/V}$		2 $\mu\text{V/V}$	
	$\pm 100 \text{ mV/V}$		15 $\mu\text{V/V}$	
	$\pm 1 000 \text{ mV/V}$		120 $\mu\text{V/V}$	
$\pm 2 \text{ mV/V}$	frequency: 4.8 kHz bridge voltage: 2.5 V	0.4 $\mu\text{V/V}$		
$\pm 5 \text{ mV/V}$		2 $\mu\text{V/V}$		
$\pm 10 \text{ mV/V}$		2 $\mu\text{V/V}$		
$\pm 100 \text{ mV/V}$		15 $\mu\text{V/V}$		
$\pm 2 \text{ mV/V}$	frequency: 4.8 kHz bridge voltage: 5 V	0.4 $\mu\text{V/V}$		

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Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement ¹⁾	Remarks
Voltage ratio measuring instruments	± 2 mV/V	frequency: 600 Hz bridge voltage: 2.5 V	0.1 µV/V	calibration of indicators with inductive reference bridge standard
	± 5 mV/V		0.2 µV/V	
	± 10 mV/V		1 µV/V	
	± 2 mV/V	frequency: 600 Hz bridge voltage: 5 V	0.1 µV/V	
	± 5 mV/V		0.2 µV/V	
	± 2.5 mV/V	frequency: 225 Hz bridge voltage: 2.5 V	0.06 µV/V	
	± 5 mV/V		0.08 µV/V	
	± 10 mV/V		0.2 µV/V	
	± 2.5 mV/V	frequency: 225 Hz bridge voltage: 5 V	0.04 µV/V	
	± 5 mV/V		0.06 µV/V	
Voltage ratio quarter- and half-bridge measuring instruments	± 10 mV/V	DC voltage bridge voltage: 1.0 V	5 µV/V	
	± 20 mV/V		5 µV/V	
	± 100 mV/V		20 µV/V	
	± 2 mV/V	DC voltage bridge voltage: > 1 V to 2.5 V	2 µV/V	
	± 5 mV/V		2 µV/V	
	± 10 mV/V		2 µV/V	
	± 20 mV/V		5 µV/V	
	± 100 mV/V		10 µV/V	
	± 2 mV/V	DC voltage bridge voltage: > 2.5 V to 5.0 V	2 µV/V	
	± 5 mV/V		3 µV/V	
	± 10 mV/V		5 µV/V	

Abbreviations used:

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

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