Deutsche Akkreditierungsstelle GmbH

Annex to the Accreditation Certificate D-K-17616-01-00 according to DIN EN ISO/IEC 17025:2018

Valid from: **23.10.2020**

Date of issue 23.10.2020

Holder of certificate:

Thermo Electron LED GmbH
Robert-Bosch-Straße 1. 63505 Langenselbold

Calibration in the fields:

Thermodynamic quantities
Temperature quantities
- **Climatic chambers (temperature) [a)]**
- **Resistance thermometers**
- **Direct reading thermometers**
- **Temperature transmitters, data loggers**
- **Temperature indicators and simulators**

Chemical analysis, reference materials
- **Volume of liquids**

Electrical quantities
DC and low frequency quantities
- **DC resistance**
- **DC current**
- **DC voltage**
- **AC current**
- **AC voltage**

Time and frequency
- **Frequency**

[a)] also on-site calibration

Within the measurands/calibration items 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.

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
Temperature Heated, climatic and cooling chambers in empty or defined loaded useful volume [*)]	-90 °C to 0 °C	Measurement in air DKD-R 5-7:2018 Calibration methods A and B	0.8 K	Comparison with standard resistance thermometers If loaded, type and arrangement of the load are to be precisely stated in the calibration certificate.
	> 0 °C to 100 °C		0.5 K	
	> 100 °C to 200 °C		0.8 K	
	> 200 °C to 350 °C		1.2 K	
Measuring locations in heated, climatic and cooling chambers in empty or defined loaded useful volume [*)]	-90 °C to 0 °C	Measurement in air DKD-R 5-7:2018 Calibration method C	0.5 K	
	> 0 °C to 100 °C		0.3 K	
	> 100 °C to 200 °C		0.5 K	
	> 200 °C to 350 °C		0.8 K	
Resistance thermometers; Indicating thermometers [a)], temperature sensors with transmitter [b)] and combined temperature-humidity sensors [*)]	0 °C	Ice point of Water	5 mK	
	-196 °C	Comparative measurement in liquid nitrogen (LN_2)	0.06 K	With aluminum or brass compensation block
	-92 °C to -80 °C	DKD-R 5-1:2018 Comparative measurement in cryogenic chamber	0.15 K	
	> -80 °C to -50 °C		0.25 K	
	-90 °C to -62 °C	DKD-R 5-1:2018 Comparative measurement in dry block calibrator	0.15 K	
	> -62 °C to -2 °C		0.1 K	
	> -2 °C to 125 °C		0.05 K	
	> 125 °C to 200 °C		0.1 K	
	> 200 °C to 300 °C		0.15 K	
	> 300 °C to 400 °C		0.2 K	
	10 °C to 70 °C	DKD-R 5-1:2018 Comparative measurement in climatic chamber Measurement in air	0.08 K	
	-30 °C to 200 °C	DKD-R 5-1:2018 Comparative measurement in stirred liquid bath Measurement in glycol/water mix, water or oil	0.08 K	

[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.

Permanent Laboratory

Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement [1)]	Remarks
Indicating thermometers, measuring chains with thermocouple sensor*)	0 °C	Ice point of water	0.25 K	
	-196 °C	Comparative measurement in liquid nitrogen (LN_2)	0.3 K	With aluminum or brass compensation block
	-92 °C to -80 °C	DKD-R 5-3:2018 Comparative measurement in cryogenic chamber	0.35 K	
	> -80 °C to -50 °C		0.45 K	
	-90 °C to -62 °C	DKD-R 5-3:2018 Comparative measurement in block calibrator	0.35 K	
	> -62 °C to -2 °C		0.3 K	
	> -2 °C to 125 °C		0.25 K	
	> 125 °C to 200 °C		0.3 K	
	10 °C to 70 °C	DKD-R 5-3:2018 Comparative measurement in climatic chamber Measurement in air	0.3 K	
	-30 °C to 200 °C	DKD-R 5-3:2018 Comparative measurement in stirred liquid bath Measurement in glycol/water mix, water or oil	0.3 K	
Temperature indicators and simulators for resistance thermometers*)	-200 °C to 200 °C	DKD-R 5-5:2018	0.02 K	Characteristic curve according to DIN EN 60751:2009
	> 200 °C to 650 °C		0.03 K	
	> 650 °C to 850 °C		35 mK	
Temperature indicators and simulators for noble metal thermocouples*)	0 °C to 1760 °C	DKD-R 5-5:2018 without internal reference junction	0.2 K	Characteristic curve according to DIN EN 60584:2014 Type S
	0 °C to 1760 °C	DKD-R 5-5:2018 with internal reference junction	0.3 K	
Temperature indicators and simulators for base metal thermocouples*)	-200 °C to 1300 °C	DKD-R 5-5:2018 without internal reference junction	0.1 K	Characteristic curve according to DIN EN 60584:2014 Type K
	-200 °C to 1300 °C	DKD-R 5-5:2018 with internal reference junction	0.3 K	

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Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement [1)]	Remarks
Volume of liquids Piston-operated volumetric apparatus: piston pipettes [*)], dispensers[*)], positive displacement pipettes [*)]	0.1 µL to < 10 µL	Gravimetric method DKD-R 8-1:2011 together with DIN EN ISO 8655-6:2002	0.75 %	The best measurement capability refers to the nominal volume. To state these uncertainty values the reference temperature shall be set equal to the temperature of the test liquid
	10 µL to < 100 µL		0.30 %	
	100 µL to 10 mL		0.12 %	
Piston-operated volumetric apparatus (with variable volume): piston pipettes [*)], dispensers[*)], positive displacement pipettes [*)]	0.1 µL to < 10 µL	Gravimetric method DKD-R 8-1:2011 together with DIN EN ISO 8655-6:2002	0.80 %; 0.60 %; 0.40 %	First uncertainty: upper test volume. Second uncertainty: medium test volume. Third uncertainty: lower test volume. To state these uncertainty values the reference temperature shall be set equal to the temperature of the test liquid
	10 µL to < 100 µL		0.30 %; 0.23 %; 0.15 %	
	100 µL to 10 mL		0.15 %; 0.11 %; 0.075 %	
Multichannel piston pipettes [*)], Multichannel - dispensers [*)]	0.1 µL to < 10 µL	Gravimetric method DKD-R 8-1:2011 together with DIN EN ISO 8655-6:2002	0.80 %; 0.60 %; 0.40 %	First uncertainty: upper test volume. Second uncertainty: medium test volume. Third uncertainty: lower test volume. To state these uncertainty values the reference temperature shall be set equal to the temperature of the test liquid
	10 µL to < 100 µL		0.35 %; 0.27 %; 0.18 %	
	100 µL to 1.25 mL		0.18 %; 0.14 %; 0.09 %	

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Permanent Laboratory

Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement [1)]	Remarks
DC voltage	0V		2µV	*U* = set value
	0.001 V to < 0.33 V		$27 \cdot 10^{-6} \cdot U + 2\ \mu V$	Fluke 5522A
	0.33 V to < 3.3 V		$15 \cdot 10^{-6} \cdot U + 3\ \mu V$	
	3.3 V to < 33 V		$17 \cdot 10^{-6} \cdot U + 25\ \mu V$	
	33V to < 330 V		$22 \cdot 10^{-6} \cdot U + 0.1\ mV$	
	330 V to < 1000 V		$22 \cdot 10^{-6} \cdot U + 1.7\ mV$	
	0 V		2 µV	*U* = measured value
	> 0 V to < 0.2 V		$5 \cdot 10^{-6} \cdot U + 2\ \mu V$	Fluke 8508A
	0.2 V to < 2 V		$5 \cdot 10^{-6} \cdot U + 1\ \mu V$	
	2 V To < 20 V		$5 \cdot 10^{-6} \cdot U + 5\ \mu V$	
	20 V to < 200 V		$7 \cdot 10^{-6} \cdot U + 50\ \mu V$	
	200 V to < 1000 V		$7 \cdot 10^{-6} \cdot U + 0.6\ mV$	
DC current	0 A		2 µA	*I* = set value
	100 µA to < 330 µA		$10 \cdot 10^{-6} \cdot I + 2\ \mu A$	Fluke 5522A
	330 µA to < 3.3 mA		$30 \cdot 10^{-6} \cdot I + 2\ \mu A$	
	3.3 mA to < 33 mA		$0.10 \cdot 10^{-3} \cdot I + 2\ \mu A$	
	33 mA to < 330 mA		$0.12 \cdot 10^{-3} \cdot I + 5\ \mu A$	
	330 mA to < 1.1 A		$0.25 \cdot 10^{-3} \cdot I + 50\ \mu A$	
	1.1 A To < 3 A		$0.45 \cdot 10^{-3} \cdot I + 50\ \mu A$	
	3 A to < 11 A		$0.6 \cdot 10^{-3} \cdot I + 0.6\ mA$	
	11 A to 20.5 A		$1.2 \cdot 10^{-3} \cdot I + 1.7\ mA$	
	0 A		2 µA	*I* = measured value
	0.1m A to < 2 mA		$1 \cdot 10^{-6} \cdot I + 2\ \mu A$	Fluke 8508A
	2 mA to < 20 mA		$4 \cdot 10^{-6} \cdot I + 2\ \mu A$	
	20 mA to < 200 mA		$45 \cdot 10^{-6} \cdot I + 2\ \mu A$	
	0.2A to < 2 A		$0.21 \cdot 10^{-3} \cdot I + 20\ \mu A$	
	2A to < 20 A		$0.47 \cdot 10^{-3} \cdot I + 0.47\ mA$	

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Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement [1]	Remarks
DC resistance	0 Ω		0.5 mΩ	R = set value Fluke 5522A
	0.01 Ω to < 11 Ω		$50 \cdot 10^{-6} \cdot R + 1.2$ mΩ	
	11 Ω to < 110 Ω		$35 \cdot 10^{-6} \cdot R + 1.7$ mΩ	
	110 Ω to < 1.1 kΩ		$35 \cdot 10^{-6} \cdot R + 2.5$ mΩ	
	1.1 kΩ to < 11 kΩ		$35 \cdot 10^{-6} \cdot R + 25$ mΩ	
	11 kΩ to < 110 kΩ		$35 \cdot 10^{-6} \cdot R + 0.25$ Ω	
	110 kΩ to < 1.1 MΩ		$40 \cdot 10^{-6} \cdot R + 2.5$ Ω	
	1.1 MΩ to < 3.3 MΩ		$70 \cdot 10^{-6} \cdot R + 35$ Ω	
	3.3 MΩ to < 11 MΩ		$0.16 \cdot 10^{-3} \cdot R + 60$ Ω	
	11 MΩ to < 33 MΩ		$0.3 \cdot 10^{-3} \cdot R + 3$ kΩ	
	33 MΩ to < 110 MΩ		$0.6 \cdot 10^{-3} \cdot R + 3.5$ kΩ	
	110 MΩ to < 330 MΩ		$3.5 \cdot 10^{-3} \cdot R + 0.15$ MΩ	
	330 MΩ to < 1.1 GΩ		$17 \cdot 10^{-3} \cdot R + 0.6$ MΩ	
DC resistance	0 Ω		0.5 mΩ	R = measured value Fluke 8508A
	0.1 mΩ to < 2 Ω		$20 \cdot 10^{-6} \cdot R + 0.015$ mΩ	
	2 Ω to < 20 Ω		$15 \cdot 10^{-6} \cdot R + 0.02$ mΩ	
	20 Ω to < 200 Ω		$10 \cdot 10^{-6} \cdot R + 0.06$ mΩ	
	200 Ω to < 2 kΩ		$10 \cdot 10^{-6} \cdot R + 0.6$ mΩ	
	2 kΩ to < 20 kΩ		$10 \cdot 10^{-6} \cdot R + 6$ mΩ	
	20 kΩ to < 200 kΩ		$10 \cdot 10^{-6} \cdot R + 60$ mΩ	
	200 kΩ to < 2 MΩ		$12 \cdot 10^{-6} \cdot R + 1.2$ Ω	
	2 MΩ to < 20 MΩ		$25 \cdot 10^{-6} \cdot R + 0.12$ kΩ	
	20 MΩ to < 200 MΩ		$0.15 \cdot 10^{-3} \cdot R + 12$ kΩ	
	200 MΩ to < 2 GΩ		$1.7 \cdot 10^{-3} \cdot R + 1.2$ MΩ	
	2 GΩ to < 20 GΩ		$1.7 \cdot 10^{-3} \cdot R + 12$ MΩ	

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Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement [1]	Remarks
AC voltage	0.001 V to < 0.033 V	10 Hz to 45 Hz	$0.95 \cdot 10^{-3} \cdot U + 8\ \mu V$	U = set value Fluke 5522A
		> 45 Hz to 10 kHz	$0.20 \cdot 10^{-3} \cdot U + 8\ \mu V$	
		> 10 kHz to 20 kHz	$0.25 \cdot 10^{-3} \cdot U + 8\ \mu V$	
		> 20 kHz to 50 kHz	$1.2 \cdot 10^{-3} \cdot U + 8\ \mu V$	
		> 50 kHz to 100 kHz	$4.2 \cdot 10^{-3} \cdot U + 15\ \mu V$	
		> 100 kHz to 500 kHz	$9.5 \cdot 10^{-3} \cdot U + 65\ \mu V$	
	0.033 V to < 0.33 V	10 Hz to 45 Hz	$0.40 \cdot 10^{-3} \cdot U + 10\ \mu V$	
		> 45 Hz to 10 kHz	$0.17 \cdot 10^{-3} \cdot U + 10\ \mu V$	
		> 10 kHz to 20 kHz	$0.20 \cdot 10^{-3} \cdot U + 10\ \mu V$	
		> 20 kHz to 50 kHz	$0.42 \cdot 10^{-3} \cdot U + 10\ \mu V$	
		> 50 kHz to 100 kHz	$0.95 \cdot 10^{-3} \cdot U + 40\ \mu V$	
		> 100 kHz to 500 kHz	$2.5 \cdot 10^{-3} \cdot U + 85\ \mu V$	
	0.33 V to < 3.3 V	10 Hz to 45 Hz	$0.37 \cdot 10^{-3} \cdot U + 60\ \mu V$	
		> 45 Hz to 10 kHz	$0.17 \cdot 10^{-3} \cdot U + 75\ \mu V$	
		> 10 kHz to 20 kHz	$0.22 \cdot 10^{-3} \cdot U + 75\ \mu V$	
		> 20 kHz to 50 kHz	$0.35 \cdot 10^{-3} \cdot U + 60\ \mu V$	
		> 50 kHz to 100 kHz	$0.85 \cdot 10^{-3} \cdot U + 0.15\ mV$	
		> 100 kHz to 500 kHz	$3.0 \cdot 10^{-3} \cdot U + 0.70\ mV$	
	3.3 V to < 33 V	10 Hz to 45 Hz	$0.37 \cdot 10^{-3} \cdot U + 0.73\ mV$	
		> 45 Hz to 10 kHz	$0.17 \cdot 10^{-3} \cdot U + 0.70\ mV$	
		> 10 kHz to 20 kHz	$0.28 \cdot 10^{-3} \cdot U + 0.70\ mV$	
		> 20 kHz to 50 kHz	$0.41 \cdot 10^{-3} \cdot U + 0.70\ mV$	
		> 50 kHz to 100 kHz	$1.1 \cdot 10^{-3} \cdot U + 1.8\ mV$	
	33 V to < 330 V	45 Hz to 1 kHz	$0.22 \cdot 10^{-3} \cdot U + 2.3\ mV$	
		> 1 kHz to 10 kHz	$0.25 \cdot 10^{-3} \cdot U + 7\ mV$	
		> 10 kHz to 20 kHz	$0.30 \cdot 10^{-3} \cdot U + 7\ mV$	
		> 20 kHz to 50 kHz	$0.37 \cdot 10^{-3} \cdot U + 7\ mV$	
		> 50 kHz to 100 kHz	$2.4 \cdot 10^{-3} \cdot U + 57\ mV$	
	330 V to < 1000 V	45 Hz to 1 kHz	$0.35 \cdot 10^{-3} \cdot U + 12\ mV$	
		> 1 kHz to 5 kHz	$0.30 \cdot 10^{-6} \cdot U + 12\ mV$	
		> 5 kHz to 10 kHz	$0.35 \cdot 10^{-3} \cdot U + 12\ mV$	

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Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement [1]	Remarks
AC voltage	0.001 V to < 0.2 V	10 Hz to 40 Hz	$0.18 \cdot 10^{-3} \cdot U + 5\ \mu V$	U = measured value Fluke 8508A
		> 40 Hz to 100 Hz	$0.13 \cdot 10^{-3} \cdot U + 5\ \mu V$	
		> 100 Hz to 2 kHz	$0.13 \cdot 10^{-3} \cdot U + 5\ \mu V$	
		> 2 kHz to 10 kHz	$0.15 \cdot 10^{-3} \cdot U + 5\ \mu V$	
		> 10 kHz to 30 kHz	$0.37 \cdot 10^{-3} \cdot U + 10\ \mu V$	
		> 30 kHz to 100 kHz	$0.85 \cdot 10^{-3} \cdot U + 25\ \mu V$	
	0.2 V to < 2 V	10 Hz to 40 Hz	$0.14 \cdot 10^{-3} \cdot U + 25\ \mu V$	
		> 40 Hz to 100 Hz	$0.11 \cdot 10^{-3} \cdot U + 25\ \mu V$	
		> 100 Hz to 2 kHz	$90 \cdot 10^{-6} \cdot U + 25\ \mu V$	
		> 2 kHz to 10 kHz	$0.13 \cdot 10^{-3} \cdot U + 25\ \mu V$	
		> 10 kHz to 30 kHz	$0.26 \cdot 10^{-3} \cdot U + 50\ \mu V$	
		> 30 kHz to 100 kHz	$0.66 \cdot 10^{-3} \cdot U + 0.25\ mV$	
		> 100 kHz to 300 kHz	$3.5 \cdot 10^{-3} \cdot U + 2.5\ mV$	
		> 300 kHz to 1 MHz	$12 \cdot 10^{-3} \cdot U + 24\ mV$	
	2 V to < 20 V	10 Hz to 40 Hz	$0.14 \cdot 10^{-3} \cdot U + 0.25\ mV$	
		> 40 Hz to 100 Hz	$0.11 \cdot 10^{-3} \cdot U + 0.25\ mV$	
		> 100 Hz to 2 kHz	$90 \cdot 10^{-6} \cdot U + 0.25\ mV$	
		> 2 kHz to 10 kHz	$0.13 \cdot 10^{-3} \cdot U + 0.25\ mV$	
		> 10 kHz to 30 kHz	$0.26 \cdot 10^{-3} \cdot U + 0.50\ mV$	
		> 30 kHz to 100 kHz	$0.66 \cdot 10^{-3} \cdot U + 2.5\ mV$	
		> 100 kHz to 300 kHz	$3.5 \cdot 10^{-3} \cdot U + 25\ mV$	
		> 300 kHz to 1 MHz	$12 \cdot 10^{-3} \cdot U + 0.25\ V$	
	20 V to < 200 V	10 Hz to 40 Hz	$0.14 \cdot 10^{-3} \cdot U + 2.3\ mV$	
		> 40 Hz to 100 Hz	$0.11 \cdot 10^{-3} \cdot U + 2.3\ mV$	
		> 100 Hz to 2 kHz	$95 \cdot 10^{-6} \cdot U + 2.3\ mV$	
		> 2 kHz to 10 kHz	$0.13 \cdot 10^{-3} \cdot U + 2.3\ mV$	
		> 10 kHz to 30 kHz	$0.26 \cdot 10^{-3} \cdot U + 5.0\ mV$	
		> 30 kHz to 100 kHz	$0.67 \cdot 10^{-3} \cdot U + 25\ mV$	
	200 V to < 1000 V	> 40 Hz to 10 kHz	$0.15 \cdot 10^{-3} \cdot U + 25\ mV$	
		> 10 kHz to 30 kHz	$0.25 \cdot 10^{-3} \cdot U + 50\ mV$	

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Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement [1]	Remarks
AC current	0.029 mA to < 0.33 mA	10 Hz to 20 Hz	$1 \cdot 10^{-3} \cdot I + 1.5\ \mu A$	I = measured value Fluke 5522A
		> 20 Hz to 45 Hz	$0.6 \cdot 10^{-3} \cdot I + 1.5\ \mu A$	
		> 45 Hz to 1 kHz	$0.45 \cdot 10^{-3} \cdot I + 1.5\ \mu A$	
		> 1 kHz to 5 kHz	$1.9 \cdot 10^{-3} \cdot I + 1.5\ \mu A$	
		> 5 kHz to 10 kHz	$7.5 \cdot 10^{-3} \cdot I + 1.5\ \mu A$	
	0.33 mA to < 3.3 mA	10 Hz to 20 Hz	$2.2 \cdot 10^{-3} \cdot I + 1\ \mu A$	
		> 20 Hz to 45 Hz	$1.3 \cdot 10^{-3} \cdot I + 1\ \mu A$	
		> 45 Hz to 1 kHz	$1 \cdot 10^{-3} \cdot I + 1\ \mu A$	
		> 1 kHz to 5 kHz	$2.2 \cdot 10^{-3} \cdot I + 1\ \mu A$	
		> 5 kHz to 10 kHz	$6 \cdot 10^{-3} \cdot I + 1\ \mu A$	
	3.3 mA to < 33 mA	10 Hz to 20 Hz	$2.1 \cdot 10^{-3} \cdot I + 2.5\ \mu A$	
		> 20 Hz to 45 Hz	$1.1 \cdot 10^{-3} \cdot I + 2.5\ \mu A$	
		> 45 Hz to 1 kHz	$0.5 \cdot 10^{-3} \cdot I + 2.5\ \mu A$	
		> 1 kHz to 5 kHz	$1.0 \cdot 10^{-3} \cdot I + 2.4\ \mu A$	
		> 5 kHz to 10 kHz	$2.5 \cdot 10^{-3} \cdot I + 3.5\ \mu A$	
	33 mA to < 330 mA	10 Hz to 20 Hz	$2.1 \cdot 10^{-3} \cdot I + 25\ \mu A$	
		> 20 Hz to 45 Hz	$1.1 \cdot 10^{-3} \cdot I + 25\ \mu A$	
		> 45 Hz to 1 kHz	$0.5 \cdot 10^{-3} \cdot I + 25\ \mu A$	
		> 1 kHz to 5 kHz	$1.2 \cdot 10^{-3} \cdot I + 60\ \mu A$	
		> 5 kHz to 10 kHz	$2.4 \cdot 10^{-3} \cdot I + 0.12\ mA$	
	0.33 A to < 1.1 A	10 Hz to 45 Hz	$2.1 \cdot 10^{-3} \cdot I + 0.12\ mA$	
		> 45 Hz to 1 kHz	$0.6 \cdot 10^{-3} \cdot I + 0.12\ mA$	
		> 1 kHz to 5 kHz	$7 \cdot 10^{-3} \cdot I + 1.2\ mA$	
		> 5 kHz to 10 kHz	$30 \cdot 10^{-3} \cdot I + 6\ mA$	
	1.1 A to < 3 A	10 Hz to 45 Hz	$2.1 \cdot 10^{-3} \cdot I + 0.12\ mA$	
		> 45 Hz to 1 kHz	$0.7 \cdot 10^{-3} \cdot I + 0.13\ mA$	
		> 1 kHz to 5 kHz	$7 \cdot 10^{-3} \cdot I + 1.2\ mA$	
		> 5 kHz to 10 kHz	$29 \cdot 10^{-3} \cdot I + 5.9\ mA$	
	3 A to < 11 A	45 Hz to 100 Hz	$0.72 \cdot 10^{-3} \cdot I + 2.5\ mA$	
		> 100 Hz to 1 kHz	$1.2 \cdot 10^{-3} \cdot I + 2.5\ mA$	
		> 1 kHz to 5 kHz	$35 \cdot 10^{-3} \cdot I + 2.5\ mA$	
	11 A to < 20.5 A	45 Hz to 100 Hz	$1.5 \cdot 10^{-3} \cdot I + 6\ mA$	
		> 100 Hz to 1 kHz	$1.8 \cdot 10^{-3} \cdot I + 6\ mA$	
		> 1 kHz to 5 kHz	$35 \cdot 10^{-3} \cdot I + 6\ mA$	
AC current	0.1 mA to < 0.2 mA	10 Hz to 10 kHz	$55 \cdot 10^{-6} \cdot I + 1.5\ \mu A$	I = measured value Fluke 8508A
	0.2 mA to < 2 mA	10 Hz to 10 kHz	$0.2 \cdot 10^{-3} \cdot I + 1.5\ \mu A$	
	2 mA to < 20 mA	10 Hz to 10 kHz	$0.4 \cdot 10^{-3} \cdot I + 2.5\ \mu A$	
	20 mA to < 200 mA	10 Hz to 10 kHz	$0.4 \cdot 10^{-3} \cdot I + 25\ \mu A$	
	200 mA to < 2 A	10 Hz to 10 kHz	$0.9 \cdot 10^{-3} \cdot I + 0.25\ mA$	
	2 A to < 20 A	10 Hz to 2 kHz	$3 \cdot 10^{-3} \cdot I + 2.5\ mA$	
Frequency	1 Hz to 2 MHz		$4 \cdot 10^{-6} \cdot f + 10\ \mu Hz + U_{tf}$	f = measured value U_{tf} = trigger-uncertainty Fluke 5522A

[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.

On-site Calibration

Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement [1)]	Remarks
Temperature Heated, climatic and cooling chambers in empty or defined loaded useful volume *)	-90 °C to 0 °C	Measurement in air DKD-R 5-7:2018 Calibration methods A and B	0.8 K	Comparison with standard resistance thermometers If loaded, type and arrangement of the load are to be precisely stated in the calibration certificate.
	> 0 °C to 100 °C		0.5 K	
	> 100 °C to 200 °C		0.8 K	
	> 200 °C to 350 °C		1.2 K	
Measuring locations in heated, climatic and cooling chambers in empty or defined loaded useful volume *)	-90 °C to 0 °C	Measurement in air DKD-R 5-7:2018 Calibration method C	0.5 K	
	> 0 °C to 100 °C		0.3 K	
	> 100 °C to 200 °C		0.5 K	
	> 200 °C to 350 °C		0.8 K	

Abbreviations used:

DIN	Deutsches Institut für Normung e.V.
DKD-R	Guideline of Deutscher Kalibrierdienst (DKD), published by Physikalisch-Technische Bundesanstalt (PTB)

[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.