DAkkS
Deutsche
Akkreditierungsstelle

Deutsche Akkreditierungsstelle GmbH

Beliehene gemäß § 8 Absatz 1 AkkStelleG i.V.m. § 1 Absatz 1 AkkStelleGBV
Unterzeichnerin der Multilateralen Abkommen
von EA, ILAC und IAF zur gegenseitigen Anerkennung

Akkreditierung

Die Deutsche Akkreditierungsstelle GmbH bestätigt hiermit, dass das Kalibrierlaboratorium

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

die Kompetenz nach DIN EN ISO/IEC 17025:2005 besitzt, Kalibrierungen in folgenden Bereichen durchzuführen:

Thermodynamische Messgrößen
Temperaturmessgrößen
- **Klimaschränke (Temperatur) #)**
- **Widerstandsthermometer**
- **Direktanzeigende Thermometer**
- **Temperatur-Transmitter, Datenlogger**
- **Temperaturanzeigegeräte und -simulatoren**

Chemische Analysen, Referenzmaterialien
- **Flüssigkeitsvolumen**

Elektrische Messgrößen
Gleichstrom und Niederfrequenz
- **Gleichstromwiderstand**
- **Gleichstromstärke**
- **Gleichspannung**
- **Wechselstrom**
- **Wechselspannung**

Zeit und Frequenz
- **Frequenz und Drehzahl**

#) auch Vor-Ort-Kalibrierungen

Die Akkreditierungsurkunde gilt nur in Verbindung mit dem Bescheid vom 09.11.2017 mit der Akkreditierungsnummer D-K-17616-01 und ist gültig bis 08.11.2022. Sie besteht aus diesem Deckblatt, der Rückseite des Deckblatts und der folgenden Anlage mit insgesamt 8 Seiten.

Registrierungsnummer der Urkunde: **D-K-17616-01-00**

Braunschweig, 09.11.2017

Im Auftrag
Dr. Michael Wolf
Abteilungsleiter

Siehe Hinweise auf der Rückseite

Deutsche Akkreditierungsstelle GmbH

Standort Berlin
Spittelmarkt 10
10117 Berlin

Standort Frankfurt am Main
Europa-Allee 52
60327 Frankfurt am Main

Standort Braunschweig
Bundesallee 100
38116 Braunschweig

Es darf nicht der Anschein erweckt werden, dass sich die Akkreditierung auch auf Bereiche erstreckt, die über den durch die DAkkS bestätigten Akkreditierungsbereich hinausgehen.

Die Akkreditierung erfolgte gemäß des Gesetzes über die Akkreditierungsstelle (AkkStelleG) vom 31. Juli 2009 (BGBl. I S. 2625) sowie der Verordnung (EG) Nr. 765/2008 des Europäischen Parlaments und des Rates vom 9. Juli 2008 über die Vorschriften für die Akkreditierung und Marktüberwachung im Zusammenhang mit der Vermarktung von Produkten (Abl. L 218 vom 9. Juli 2008, S. 30).
Die DAkkS ist Unterzeichnerin der Multilateralen Abkommen zur gegenseitigen Anerkennung der European co-operation for Accreditation (EA), des International Accreditation Forum (IAF) und der International Laboratory Accreditation Cooperation (ILAC). Die Unterzeichner dieser Abkommen erkennen ihre Akkreditierungen gegenseitig an.

Der aktuelle Stand der Mitgliedschaft kann folgenden Webseiten entnommen werden:
EA: www.european-accreditation.org
ILAC: www.ilac.org
IAF: www.iaf.nu

Deutsche Akkreditierungsstelle GmbH

Annex to the Accreditation Certificate D-K-17616-01-00 according to DIN EN ISO/IEC 17025:2005

Period of validity: 09.11.2017 to 08.11.2022 Date of issue: 04.12.2017

Holder of certificate:

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

Head: Harald Gutknecht
Deputy head: Matthias Goschier

Accredited as calibration laboratory since: 12.12.2003

Calibration in the fields:

Thermodynamic quantities
Temperature quantities
- **Climatic chambers (temperature) #)**
- **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**

#) 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.

DAkkS Deutsche Akkreditierungsstelle

Permanent Laboratory

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Best measurement capability [1)]	Remarks
Temperature Heated, climatic and cooling chambers in empty or defined loaded useful volume [*)]	-90 °C to 0 °C	Measurement in air DAkkS-DKD-R 5-7:2010 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 DAkkS-DKD-R 5-7:2010 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	DAkkS-DKD-R 5-1:2010 Comparative measurement in cryogenic chamber	0.15 K	
	> -80 °C to -50 °C		0.25 K	
	-90 °C to -62 °C	DAkkS-DKD-R 5-1:2010 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	DAkkS-DKD-R 5-1:2010 Comparative measurement in climatic chamber Measurement in air	0.08 K	
	-30 °C to 200 °C	DAkkS-DKD-R 5-1:2010 Comparative measurement in stirred liquid bath Measurement in glycol/water mix, water or oil	0.08 K	

[a)] semiconductor sensors as measurement chain or combined temperature-humidity sensors,

[b)] with direct indicator and/or signal transmitter as measuring chain (e.g. 4 mA to 20 mA)

[1)] The best measurement capabilities are stated according to EA-4/02. These are expanded uncertainties of measurement with a coverage probability of 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.

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Best measurement capability [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	DAkkS-DKD-R 5-3:2010 Comparative measurement in cryogenic chamber	0.35 K	
	> -80 °C to -50 °C		0.45 K	
	-90 °C to -62 °C	DAkkS-DKD-R 5-3:2010 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	DAkkS-DKD-R 5-3:2010 Comparative measurement in climatic chamber Measurement in air	0.3 K	
	-30 °C to 200 °C	DAkkS-DKD-R 5-3:2010) 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	DAkkS-DKD-R 5-5:2010	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	DAkkS-DKD-R 5-5:2010. without internal reference junction	0.2 K	Characteristic curve according to DIN EN 60584:2014 Type S
	0 °C to 1760 °C	DAkkS-DKD-R 5-5:2010 with internal reference junction	0.3 K	
Temperature indicators and simulators for base metal thermocouples*)	-200 °C to 1300 °C	DAkkS-DKD-R 5-5:2010. without internal reference junction	0.1 K	Characteristic curve according to DIN EN 60584:2014 Type K
	-200 °C to 1300 °C	DAkkS-DKD-R 5-5:2010 with internal reference junction	0.3 K	

[1)] The best measurement capabilities are stated according to EA-4/02. These are expanded uncertainties of measurement with a coverage probability of 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.

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Best measurement capability [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 %	

[1)] The best measurement capabilities are stated according to EA-4/02. These are expanded uncertainties of measurement with a coverage probability of 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.

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Best measurement capability [1)]	Remarks
DC voltage	0V		2µV	U = set value
	0.001 V to < 0.33 V		$27 \cdot 10^{-6} \cdot U + 2$ µV	Fluke 5522A
	0.33 V to < 3.3 V		$15 \cdot 10^{-6} \cdot U + 3$ µV	
	3.3 V to < 33 V		$17 \cdot 10^{-6} \cdot U + 25$ µV	
	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		$5 \cdot 10^{-6} \cdot U + 2$ µV	Fluke 8508A
	0.2 V to < 2 V		$5 \cdot 10^{-6} \cdot U + 1$ µV	
	2 V To < 20 V		$5 \cdot 10^{-6} \cdot U + 5$ µV	
	20 V to < 200 V		$7 \cdot 10^{-6} \cdot U + 50$ µV	
	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		$10 \cdot 10^{-6} \cdot I + 2$ µA	Fluke 5522A
	330 µA to < 3.3 mA		$30 \cdot 10^{-6} \cdot I + 2$ µA	
	3.3 mA to < 33 mA		$0.10 \cdot 10^{-3} \cdot I + 2$ µA	
	33 mA to < 330 mA		$0.12 \cdot 10^{-3} \cdot I + 5$ µA	
	330 mA to < 1.1 A		$0.25 \cdot 10^{-3} \cdot I + 50$ µA	
	1.1 A To < 3 A		$0.45 \cdot 10^{-3} \cdot I + 50$ µA	
	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		$1 \cdot 10^{-6} \cdot I + 2$ µA	Fluke 8508A
	2 mA to < 20 mA		$4 \cdot 10^{-6} \cdot I + 2$ µA	
	20 mA to < 200 mA		$45 \cdot 10^{-6} \cdot I + 2$ µA	
	0.2A to < 2 A		$0.21 \cdot 10^{-3} \cdot I + 20$ µA	
	2A to < 20 A		$0.47 \cdot 10^{-3} \cdot I + 0.47$ mA	
DC resistance	0 Ω		0.5 mΩ	R = set value
	0.01 Ω to < 11 Ω		$50 \cdot 10^{-6} \cdot R + 1.2$ mΩ	Fluke 5522A
	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	

[1)] The best measurement capabilities are stated according to EA-4/02. These are expanded uncertainties of measurement with a coverage probability of 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.

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Best measurement capability [1]	Remarks
DC resistance	0 Ω		0.5 mΩ	R = measured value
	0.1 mΩ to < 2 Ω		$20 \cdot 10^{-6} \cdot R + 0.015$ mΩ	Fluke 8508A
	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	
AC voltage	0.001 V to < 0.033 V	10 Hz to 45 Hz	$0.95 \cdot 10^{-3} \cdot U + 8$ µV	U = set value
		> 45 Hz to 10 kHz	$0.20 \cdot 10^{-3} \cdot U + 8$ µV	Fluke 5522A
		> 10 kHz to 20 kHz	$0.25 \cdot 10^{-3} \cdot U + 8$ µV	
		> 20 kHz to 50 kHz	$1.2 \cdot 10^{-3} \cdot U + 8$ µV	
		> 50 kHz to 100 kHz	$4.2 \cdot 10^{-3} \cdot U + 15$ µV	
		> 100 kHz to 500 kHz	$9.5 \cdot 10^{-3} \cdot U + 65$ µV	
	0.033 V to < 0.33 V	10 Hz to 45 Hz	$0.40 \cdot 10^{-3} \cdot U + 10$ µV	
		> 45 Hz to 10 kHz	$0.17 \cdot 10^{-3} \cdot U + 10$ µV	
		> 10 kHz to 20 kHz	$0.20 \cdot 10^{-3} \cdot U + 10$ µV	
		> 20 kHz to 50 kHz	$0.42 \cdot 10^{-3} \cdot U + 10$ µV	
		> 50 kHz to 100 kHz	$0.95 \cdot 10^{-3} \cdot U + 40$ µV	
		> 100 kHz to 500 kHz	$2.5 \cdot 10^{-3} \cdot U + 85$ µV	
	0.33 V to < 3.3 V	10 Hz to 45 Hz	$0.37 \cdot 10^{-3} \cdot U + 60$ µV	
		> 45 Hz to 10 kHz	$0.17 \cdot 10^{-3} \cdot U + 75$ µV	
		> 10 kHz to 20 kHz	$0.22 \cdot 10^{-3} \cdot U + 75$ µV	
		> 20 kHz to 50 kHz	$0.35 \cdot 10^{-3} \cdot U + 60$ µV	
		> 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	

[1] The best measurement capabilities are stated according to EA-4/02. These are expanded uncertainties of measurement with a coverage probability of 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.

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Best measurement capability [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	$0.25 \cdot 10^{-3} \cdot U + 50\ mV$	
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	$2.4 \cdot 10^{-3} \cdot I + 0.12\ mA$	

[1)] The best measurement capabilities are stated according to EA-4/02. These are expanded uncertainties of measurement with a coverage probability of 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.

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Best measurement capability [1]	Remarks
AC current	0.33 A to < 1.1 A	10 Hz to 45 Hz	$2.1 \cdot 10^{-3} \cdot I + 0.12$ mA	I = measured value Fluke 5522A
		> 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	$55 \cdot 10^{-6} \cdot I + 1.5$ µA	I = measured value Fluke 8508A
	0.2 mA to < 2 mA	10 Hz to 10 kHz	$0.2 \cdot 10^{-3} \cdot I + 1.5$ µA	
	2 mA to < 20 mA	10 Hz to 10 kHz	$0.4 \cdot 10^{-3} \cdot I + 2.5$ µA	
	20 mA to < 200 mA	10 Hz to 10 kHz	$0.4 \cdot 10^{-3} \cdot I + 25$ µA	
	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		$4 \cdot 10^{-6} \cdot f + 10$ µHz + U_{tf}	f = measured value U_{tf} = trigger-uncertainty Fluke 5522A

On-site calibration

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Best measurement capability [1]	Remarks
Temperature Heated, climatic and cooling chambers in empty or defined loaded useful volume [*]	-90 °C to 0 °C	Measurement in air DAkkS-DKD-R 5-7:2010 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 DAkkS-DKD-R 5-7:2010 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:

DAkkS-DKD-R Calibration Guideline of Deutsche Akkreditierungsstelle GmbH
DKD-R Calibration Guideline of Deutscher Kalibrierdienst

[1] The best measurement capabilities are stated according to EA-4/02. These are expanded uncertainties of measurement with a coverage probability of 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.