

Translation of the Annex to the accreditation certificate D-K-15055-01-01 according to DIN ISO/IEC 17025:2018

Accreditation for Electrical Measuring Quantities

German Accreditation Authority

Annex to the accreditation certificate D-K-15055-01-01
according to DIN ISO/IEC 17025:2018

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This document annex is part of the accreditation certificate D-K-15055-01-00.

Holder of the accreditation certificate:

europascal GmbH
An der Wiesenhecke 10, 63456 Hanau

With the location:

europascal GmbH
An der Wiesenhecke 10, 63456 Hanau

The calibration laboratory meets the requirements according to DIN EN ISO/IEC 17025:2018 to perform the conformity assessment activities listed in this annex.

The calibration laboratory conforms, where applicable, to additional legal and normative requirements, including those in relevant sectoral programs, provided that these are explicitly confirmed in the annexes to the partial accreditation certificates listed below.

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

This document attachment is only valid together with the written accreditation certificate and reflects the status at the time of issue. The current status of valid and monitored accreditation can be found in the database of accredited bodies of the German Accreditation Body (www.dakks.de)

Abbreviations used: see last page Page

Liability for translation or typographical errors is excluded.

Translation of the Annex to the accreditation certificate D-K-15055-01-01

Calibrations in the areas:

Electrical measurands

Direct current and low frequency measurands

- Direct voltage ^{a)}
- Direct current intensity ^{a)}
- Direct current resistance ^{a)}
- Capacitance ^{a)}
- Inductivity ^{a)}
- AC Voltage ^{a)}
- AC current ^{a)}
- Electrical power ^{a)}
- Power factor ^{a)}

Time and frequency

- Frequency and RPM ^{a)}

High frequency measurands

- Oscilloscope measurands ^{a)}
- Bandwidth ^{a)}

^{a)} Also on-site calibrations

For example, we can calibrate the following measuring devices:

- - Multimeter 1100 V
- - Current clamps up to 1000A
- - Resistance decades
- - LCR meter
- - Safety measuring devices
- - Laboratory power supplies
- - Oscilloscopes
- - Frequency counter
- - Power measuring devices up to 20KW
- - Special measuring devices on request

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Accreditation for Electrical Measuring Quantities

Permanent laboratory and on-site calibration

Calibration and measurement capabilities (CMC)

Measurement quantity / Calibration item	Measuring range / Measuring span	Measuring conditions / methods	Advanced measurement uncertainty ¹⁾	Remarks
DC voltage Measuring Devices	0 V		0,5 μ V	U = measurement
	> 0 V to 0,22 V		$9 \cdot 10^{-6} \cdot U + 0,5 \mu\text{V}$	
	> 0,22 V to 2,2 V		$7 \cdot 10^{-6} \cdot U + 0,7 \mu\text{V}$	
	> 2,2 V to 22 V		$6,0 \cdot 10^{-6} \cdot U$	
	> 22 V to 220 V		$9,0 \cdot 10^{-6} \cdot U$	
	> 220 V to 1100 V		$10 \cdot 10^{-6} \cdot U$	
DC Voltage Sources	0 V		0,2 μ V	U = measurement
	> 0 V to < 0,2 V		$5 \cdot 10^{-6} \cdot U + 0,2 \mu\text{V}$	
	0,2 V to < 2 V		$3,5 \cdot 10^{-6} \cdot U + 0,4 \mu\text{V}$	
	2 V to < 20 V		$3,5 \cdot 10^{-6} \cdot U + 4 \mu\text{V}$	
	20 V to < 200		$6 \cdot 10^{-6} \cdot U + 40 \mu\text{V}$	
	200 V to 1000 V		$6 \cdot 10^{-6} \cdot U + 0,4 \text{ mV}$	
High-voltage measurands	>1kV to 7 kV	45 Hz to 65 Hz	$2 \cdot 10^{-3} \cdot U + 2 \text{ V}$	
	>1kV to 7 kV		$4 \cdot 10^{-3} \cdot U + 2$	
DC Current Measuring Devices	0 A		8 nA	I = measurement
	1 μ A to 220 μ A		$45 \cdot 10^{-6} \cdot I + 8 \text{ nA}$	
	> 220 μ A to 2,2 mA		$45 \cdot 10^{-6} \cdot I + 10 \text{ nA}$	
	> 2,2 mA to 22 mA		$45 \cdot 10^{-6} \cdot I + 50 \text{ nA}$	
	> 22 mA to 220 mA		$60 \cdot 10^{-6} \cdot I + 1 \mu\text{A}$	
	>0,22 A to 2,2 A		$0,10 \cdot 10^{-3} \cdot I + 15 \mu\text{A}$	
	> 2,2 A to 3 A		$0,30 \cdot 10^{-3} \cdot I + 50 \mu\text{A}$	
	>3 A to 11 A		$0,45 \cdot 10^{-3} \cdot I + 0,5 \text{ mA}$	
	>11 A to 20,5 A		$0,80 \cdot 10^{-3} \cdot I + 1,5 \text{ mA}$	
DC Current Sources	1 μ A to < 200 μ A		$45 \cdot 10^{-6} \cdot I + 8 \text{ nA}$	I = measurement
	200 μ A to < 2 mA		$45 \cdot 10^{-6} \cdot I + 10 \text{ nA}$	
	2 mA to < 20 mA		$45 \cdot 10^{-6} \cdot I + 50 \text{ nA}$	
	20 mA to < 200 mA		$60 \cdot 10^{-6} \cdot I + 1 \mu\text{A}$	
	0,2 A to < 2 A		$0,20 \cdot 10^{-3} \cdot I + 30 \mu\text{A}$	
	2 A to < 20 A		$0,70 \cdot 10^{-3} \cdot I$	
	0 A to 100 A	Voltage drop at normal resistance	$15 \cdot 10^{-6} \cdot I + 0,3 \text{ nA}$	I = measurement
	>100 A to 2000 A		$50 \cdot 10^{-6} \cdot I$	
DC Current Current clamps	1 mA to 20 A		$1,0 \cdot 10^{-3} \cdot I + 0,2 \mu\text{A}$	I = measurement
	>20 A to 100 A		$1,2 \cdot 10^{-3} \cdot I$	
	>100 A to 1000 A		$2 \cdot 10^{-3} \cdot I$	

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DC current power	100 μ W to 330 W	$33\text{mV} \leq U \leq 1000\text{V}$ $1\text{ mA} \leq I \leq 330\text{ mA}$	$0,35 \cdot 10^{-3} \cdot P + 1\text{ } \mu\text{W}$	P = set value
	33 mW to 3 kW	$33\text{mV} \leq U \leq 1000\text{V}$ $0,33\text{ mA} \leq I \leq 3\text{ A}$	$0,6 \cdot 10^{-3} \cdot P$	
	300 mW to 20 kW	$33\text{ mV} \leq U \leq 1000\text{ V}$ $3\text{ A} \leq I \leq 20\text{ A}$	$1,1 \cdot 10^{-3} \cdot P$	
DC Resistance Measuring Devices	0 Ω to < 11 Ω		$35 \cdot 10^{-6} \cdot R + 1,2\text{ m}\Omega$	R = measurement
	11 Ω to < 110 Ω		$28 \cdot 10^{-6} \cdot R + 1,7\text{ m}\Omega$	
	110 Ω to < 1,1 k Ω		$30 \cdot 10^{-6} \cdot R + 2,0\text{ m}\Omega$	
	1,1 k Ω to < 11 k Ω		$30 \cdot 10^{-6} \cdot R + 20\text{ m}\Omega$	
	11 k Ω to < 110 k Ω		$30 \cdot 10^{-6} \cdot R + 0,2\text{ }\Omega$	
	110 k Ω to < 1,1 M Ω		$33 \cdot 10^{-6} \cdot R + 2\text{ }\Omega$	
	1,1 M Ω to < 3,3 M Ω		$52 \cdot 10^{-6} \cdot R + 30\text{ }\Omega$	
	3,3 M Ω to < 11 M Ω		$0,11 \cdot 10^{-3} \cdot R + 50\text{ }\Omega$	
	11 M Ω to < 33 M Ω		$0,28 \cdot 10^{-3} \cdot R + 3\text{ k}\Omega$	
	33 M Ω to < 110 M Ω		$0,45 \cdot 10^{-3} \cdot R + 3\text{ k}\Omega$	
	110 M Ω to < 330 M Ω		$3,1 \cdot 10^{-3} \cdot R + 0,1\text{ M}\Omega$	
	330 M Ω to < 1,1 G Ω		$12 \cdot 10^{-3} \cdot R + 0,5\text{ M}\Omega$	
	0 Ω		0,1 $\mu\Omega$	R = measurement
	15 $\mu\Omega$		$0,1 \cdot 10^{-3} \cdot R$	
	40 $\mu\Omega$		$0,1 \cdot 10^{-3} \cdot R$	
	62,5 $\mu\Omega$		$0,1 \cdot 10^{-3} \cdot R$	
	100 $\mu\Omega$		$0,1 \cdot 10^{-3} \cdot R$	
	1 m Ω		$15 \cdot 10^{-6} \cdot R$	
	10 m Ω		$15 \cdot 10^{-6} \cdot R$	
	100 m Ω		$15 \cdot 10^{-6} \cdot R$	
	1 Ω		$12 \cdot 10^{-6} \cdot R$	
	1,9 Ω		$12 \cdot 10^{-6} \cdot R$	
	10 Ω		$10 \cdot 10^{-6} \cdot R$	
	19 Ω		$10 \cdot 10^{-6} \cdot R$	
	100 Ω		$5 \cdot 10^{-6} \cdot R$	
	190 Ω		$7 \cdot 10^{-6} \cdot R$	
	1 k Ω		$3 \cdot 10^{-6} \cdot R$	
	1,9 k Ω		$3 \cdot 10^{-6} \cdot R$	
	10 k Ω		$3 \cdot 10^{-6} \cdot R$	
	19 k Ω		$3 \cdot 10^{-6} \cdot R$	
	100 k Ω		$3 \cdot 10^{-6} \cdot R$	

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DC Resistance Measuring Devices	190 kΩ		$7 \cdot 10^{-6} \cdot R$	R=measurement
	1 MΩ		$10 \cdot 10^{-6} \cdot R$	
	1,9 MΩ		$18 \cdot 10^{-6} \cdot R$	
	10 MΩ		$10 \cdot 10^{-6} \cdot R$	
	19 MΩ		$20 \cdot 10^{-6} \cdot R$	
	100 MΩ		$36 \cdot 10^{-6} \cdot R$	
	1 GΩ		$0,2 \cdot 10^{-3} \cdot R$	
	10 GΩ		$0,5 \cdot 10^{-3} \cdot R$	
	100 GΩ		$2 \cdot 10^{-3} \cdot R$	
	1 TΩ		$8 \cdot 10^{-3} \cdot R$	
DC Resistance Resistances	10 μΩ to < 1 mΩ		$0,3 \cdot 10^{-3} \cdot R + 0,05 \mu\Omega$	R=resistance
	1 mΩ to < 0,2 Ω		$0,15 \cdot 10^{-3} \cdot R$	
	0,2 Ω to < 2 Ω		$20 \cdot 10^{-6} \cdot R + 6 \mu\Omega$	
	2 Ω to < 20 Ω		$12 \cdot 10^{-6} \cdot R + 15 \mu\Omega$	
	20 Ω to < 200 Ω		$12 \cdot 10^{-6} \cdot R + 50 \mu\Omega$	
	200 Ω to < 2 kΩ		$12 \cdot 10^{-6} \cdot R + 0,5 \text{ m}\Omega$	
	2 kΩ to < 20 kΩ		$12 \cdot 10^{-6} \cdot R + 5 \text{ m}\Omega$	
	20 kΩ to < 200 kΩ		$12 \cdot 10^{-6} \cdot R + 50 \text{ m}\Omega$	
	200 kΩ to < 2 MΩ		$12 \cdot 10^{-6} \cdot R + 1 \Omega$	
	2 MΩ to < 20 MΩ		$18 \cdot 10^{-6} \cdot R + 0,12 \text{ k}\Omega$	
	20 MΩ to < 200 MΩ		$95 \cdot 10^{-6} \cdot R + 12 \text{ k}\Omega$	
	200 MΩ to < 2 GΩ		$1,2 \cdot 10^{-3} \cdot R + 1,2 \text{ M}\Omega$	
	2 GΩ to < 20 GΩ		$1,2 \cdot 10^{-3} \cdot R + 12 \text{ M}\Omega$	

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Calibration and measurement capabilities (CMC)

Measurement quantity / Calibration item	Measuring range / Measuring span	Measuring conditions / method	Advanced measurement uncertainty ¹⁾	Remarks
AC Voltage Measuring Devices	1 mV to 2,2 mV	10 Hz to 40 Hz	$0,14 \cdot 10^{-3} \cdot U + 8 \mu V$	U=measurement
		> 40 Hz to 20 kHz	$50 \cdot 10^{-6} \cdot U + 8 \mu V$	
		>20 kHz to 50 kHz	$0,12 \cdot 10^{-3} \cdot U + 8 \mu V$	
		>50 kHz to 100 kHz	$0,31 \cdot 10^{-3} \cdot U + 8 \mu V$	
		>100 kHz to 300 kHz	$0,75 \cdot 10^{-3} \cdot U + 15 \mu V$	
		>300 kHz to 500 kHz	$1,1 \cdot 10^{-3} \cdot U + 25 \mu V$	
		>500 kHz to 1 MHz	$2,1 \cdot 10^{-3} \cdot U + 25 \mu V$	
	> 2,2 mV to 22 mV	10 Hz to 40 Hz	$0,16 \cdot 10^{-3} \cdot U + 8 \mu V$	
		> 40 Hz to 20 kHz	$50 \cdot 10^{-6} \cdot U + 8 \mu V$	
		>20 kHz to 50 kHz	$0,13 \cdot 10^{-3} \cdot U + 8 \mu V$	
		>50 kHz to 100 kHz	$0,35 \cdot 10^{-3} \cdot U + 8 \mu V$	
		>100 kHz to 300 kHz	$0,83 \cdot 10^{-3} \cdot U + 15 \mu V$	
		>300 kHz to 500 kHz	$1,1 \cdot 10^{-3} \cdot U + 25 \mu V$	
		>500 kHz to 1 MHz	$2,2 \cdot 10^{-3} \cdot U + 25 \mu V$	
AC Current Measuring Devices	>22 mV to 220 mV	10 Hz to 40 Hz	$0,20 \cdot 10^{-3} \cdot U + 15 \mu V$	U=measurement
		> 40 Hz to 20 kHz	$65 \cdot 10^{-6} \cdot U + 10 \mu V$	
		>20 kHz to 50 kHz	$0,16 \cdot 10^{-3} \cdot U + 10 \mu V$	
		>50 kHz to 100 kHz	$0,38 \cdot 10^{-3} \cdot U + 20 \mu V$	
		>100 kHz to 300 kHz	$0,73 \cdot 10^{-3} \cdot U + 25 \mu V$	
		>300 kHz to 500 kHz	$1,1 \cdot 10^{-3} \cdot U + 30 \mu V$	
		>500 kHz to 1 MHz	$2,2 \cdot 10^{-3} \cdot U + 50 \mu V$	
	>0,22 V to 2,2 V	10 Hz to 40 Hz	$0,20 \cdot 10^{-3} \cdot U + 45 \mu V$	
		> 40 Hz to 20 kHz	$40 \cdot 10^{-6} \cdot U + 10 \mu V$	
		>20 kHz to 50 kHz	$70 \cdot 10^{-6} \cdot U + 10 \mu V$	
		>50 kHz to 100 kHz	$0,10 \cdot 10^{-3} \cdot U + 35 \mu V$	
		>100 kHz to 300 kHz	$0,35 \cdot 10^{-3} \cdot U + 0,10 mV$	
		>300 kHz to 500 kHz	$0,80 \cdot 10^{-3} \cdot U + 0,25 mV$	
		>500 kHz to 1 MHz	$1,4 \cdot 10^{-3} \cdot U + 0,35 mV$	
	>2,2 V to 22 V	10 Hz to 40 Hz	$0,20 \cdot 10^{-3} \cdot U + 0,5 mV$	
		> 40 Hz to 20 kHz	$45 \cdot 10^{-6} \cdot U + 50 \mu V$	
		>20 kHz to 50 kHz	$70 \cdot 10^{-6} \cdot U + 0,10 mV$	
		>50 kHz to 100 kHz	$90 \cdot 10^{-6} \cdot U + 0,25 mV$	
		>100 kHz to 300 kHz	$0,24 \cdot 10^{-3} \cdot U + 0,70 mV$	
		>300 kHz to 500 kHz	$0,83 \cdot 10^{-3} \cdot U + 2,3 mV$	
		>500 kHz to 1 MHz	$1,3 \cdot 10^{-3} \cdot U + 3,6 mV$	

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Calibration and measurement capabilities (CMC)

Measurement quantity / Calibration item	Measuring range / Measuring span	Measuring conditions / method	Smallest specifiable measurement uncertainty ¹⁾	Remarks
AC Voltage Measuring Devices	>22 V to 220 V	10 Hz to 40 Hz	$0,20 \cdot 10^{-3} \cdot U + 4,5 \text{ mV}$	U=measurement
		> 40 Hz to 20 kHz	$55 \cdot 10^{-6} \cdot U + 0,60 \text{ mV}$	
		>20 kHz to 50 kHz	$75 \cdot 10^{-6} \cdot U + 1,1 \text{ mV}$	
		>50 kHz to 100 kHz	$0,13 \cdot 10^{-3} \cdot U + 2,8 \text{ mV}$	
	>220 V to 1100V	50 Hz to 1 kHz	$70 \cdot 10^{-6} \cdot U + 3,5 \text{ mV}$	
AC Voltage Sources	0,001 V to <0,01 V	10 Hz to 20 Hz	10µV	U=measurement
		> 20 Hz to 50 kHz	15 µV	
		>50 kHz to <100 kHz	$3 \cdot 10^{-3} \cdot U + 15 \text{ µV}$	
		>100 kHz to 300 kHz	$30 \cdot 10^{-3} \cdot U + 15 \text{ µV}$	
	>0,01 V to <0,1 V	10 Hz to 40 Hz	$45 \cdot 10^{-6} \cdot U + 8 \text{ µV}$	
		> 40 Hz to 1 kHz	$45 \cdot 10^{-6} \cdot U + 6 \text{ µV}$	
		>1 kHz to 20 kHz	$90 \cdot 10^{-6} \cdot U + 6 \text{ µV}$	
		>20 kHz to 50 kHz	$0,21 \cdot 10^{-3} \cdot U + 6 \text{ µV}$	
		>50 kHz to 100 kHz	$0,6 \cdot 10^{-3} \cdot U + 6 \text{ µV}$	
		>100 kHz to 300 kHz	$2,5 \cdot 10^{-3} \cdot U + 10 \text{ µV}$	
		>300 kHz to 1 MHz	$8 \cdot 10^{-3} \cdot U + 10 \text{ µV}$	
	>0,1 V to 1 V	10 Hz to 40 Hz	$65 \cdot 10^{-6} \cdot U + 45 \text{ µV}$	
		> 40 Hz to 1 kHz	$65 \cdot 10^{-6} \cdot U + 25 \text{ µV}$	
		>1 kHz to 20 kHz	$0,12 \cdot 10^{-3} \cdot U + 25 \text{ µV}$	
		>20 kHz to 50 kHz	$0,24 \cdot 10^{-3} \cdot U + 25 \text{ µV}$	
		>50 kHz to 100 kHz	$0,65 \cdot 10^{-3} \cdot U + 25 \text{ µV}$	
		>100 kHz to 300 kHz	$2,5 \cdot 10^{-3} \cdot U + 0,1 \text{ mV}$	
		>300 kHz to 1 MHz	$8 \cdot 10^{-3} \cdot U + 0,1 \text{ mV}$	
	>1 V to 10 V	10 Hz to 40 Hz	$65 \cdot 10^{-6} \cdot U + 0,45 \text{ mV}$	
		> 40 Hz to 1 kHz	$65 \cdot 10^{-6} \cdot U + 0,25 \text{ mV}$	
		>1 kHz to 20 kHz	$0,11 \cdot 10^{-3} \cdot U + 0,25 \text{ mV}$	
		>20 kHz to 50 kHz	$0,24 \cdot 10^{-3} \cdot U + 0,25 \text{ mV}$	
		>50 kHz to 100 kHz	$0,65 \cdot 10^{-3} \cdot U + 0,25 \text{ mV}$	
		>100 kHz to 300 kHz	$2,5 \cdot 10^{-3} \cdot U + 1 \text{ mV}$	
	>10 V to 100 V	>300 kHz to 1 MHz	$8 \cdot 10^{-3} \cdot U + 1 \text{ mV}$	
		10 Hz to 40 Hz	$0,16 \cdot 10^{-3} \cdot U + 4,5 \text{ mV}$	
		> 40 Hz to 20 kHz	$0,16 \cdot 10^{-3} \cdot U + 2,5 \text{ mV}$	
		>20 kHz to 50 kHz	$0,28 \cdot 10^{-3} \cdot U + 2,5 \text{ mV}$	
		>50 kHz to 100 kHz	$0,95 \cdot 10^{-3} \cdot U + 2,5 \text{ mV}$	

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Measurement quantity / Calibration item	Measuring range / Measuring span	Measuring conditions / method	Smallest specifiable measurement uncertainty ¹⁾	Remarks
AC Voltage Sources	>100 V to 700 V	10 Hz to 40 Hz	$0,34 \cdot 10^{-3} \cdot U + 30 \text{ mV}$	U=measurement
		> 40 Hz to < 1 kHz	$0,33 \cdot 10^{-3} \cdot U + 20 \text{ mV}$	
		>1 kHz to 20 kHz	$0,46 \cdot 10^{-3} \cdot U + 20 \text{ mV}$	
		>20 kHz to 50 kHz	$0,95 \cdot 10^{-3} \cdot U + 20 \text{ mV}$	
		>50 kHz to 100 kHz	$2,5 \cdot 10^{-3} \cdot U + 20 \text{ mV}$	
	>700 V to 1000 V	10 Hz to 10 kHz	$0,11 \cdot 10^{-3} \cdot U + 25 \text{ mV}$	
		>10 kHz to 30 kHz	$0,21 \cdot 10^{-3} \cdot U + 45 \text{ mV}$	
AC Voltage Measuring Devices	0,1 mA to 0,22 mA	10 Hz to 40 Hz	$0,30 \cdot 10^{-3} \cdot I + 20 \text{ nA}$	I=measurement
		> 40 Hz to < 1 kHz	$0,15 \cdot 10^{-3} \cdot I + 20 \text{ nA}$	
		1 kHz to < 5 kHz	$0,33 \cdot 10^{-3} \cdot I + 20 \text{ nA}$	
		5 kHz to 10 kHz	$1,2 \cdot 10^{-3} \cdot I + 80 \text{ nA}$	
	>0,22 mA to 2,2 mA	10 Hz to 40 Hz	$0,21 \cdot 10^{-3} \cdot I + 50 \text{ nA}$	
		> 40 Hz to < 1 kHz	$0,11 \cdot 10^{-3} \cdot I + 50 \text{ nA}$	
		1 kHz to < 5 kHz	$0,17 \cdot 10^{-3} \cdot I + 0,2 \text{ }\mu\text{A}$	
		5 kHz to 10 kHz	$0,91 \cdot 10^{-3} \cdot I + 0,8 \text{ }\mu\text{A}$	
	>2,2 mA to < 22 mA	10 Hz to 40 Hz	$0,21 \cdot 10^{-3} \cdot I + 0,5 \text{ }\mu\text{A}$	
		> 40 Hz to < 1 kHz	$0,11 \cdot 10^{-3} \cdot I + 0,5 \text{ }\mu\text{A}$	
		1 kHz to < 5 kHz	$0,17 \cdot 10^{-3} \cdot I + 0,6 \text{ }\mu\text{A}$	
		5 kHz to 10 kHz	$0,91 \cdot 10^{-3} \cdot I + 6 \text{ }\mu\text{A}$	
	22 mA to < 220 mA	10 Hz to 40 Hz	$0,21 \cdot 10^{-3} \cdot I + 5 \text{ }\mu\text{A}$	
		> 40 Hz to < 1 kHz	$0,10 \cdot 10^{-3} \cdot I + 5 \text{ }\mu\text{A}$	
		1 kHz to < 5 kHz	$0,17 \cdot 10^{-3} \cdot I + 5 \text{ }\mu\text{A}$	
		5 kHz to 10 kHz	$0,91 \cdot 10^{-3} \cdot I + 10 \text{ }\mu\text{A}$	
	220 mA to 2,2 A	20 Hz to < 1 kHz	$0,21 \cdot 10^{-3} \cdot I + 40 \text{ }\mu\text{A}$	
		1 kHz to < 5 kHz	$0,35 \cdot 10^{-3} \cdot I + 0,1 \text{ mA}$	
		5 kHz to 10 kHz	$6 \cdot 10^{-3} \cdot I + 0,2 \text{ mA}$	
	> 2,2 A to 3 A	10 Hz to 1 kHz	$1,6 \cdot 10^{-3} \cdot I + 0,1 \text{ mA}$	I=measurement
		>1 kHz to 5 kHz	$5 \cdot 10^{-3} \cdot I + 1 \text{ mA}$	
		>5 kHz to 10 kHz	$20 \cdot 10^{-3} \cdot I + 5 \text{ mA}$	
	>3 A to 11 A	45 Hz to 100 Hz	$0,6 \cdot 10^{-3} \cdot I + 2 \text{ mA}$	
		>100 Hz to 1 kHz	$1 \cdot 10^{-3} \cdot I + 2 \text{ mA}$	
		>1 kHz to 5 kHz	$25 \cdot 10^{-3} \cdot I + 2 \text{ mA}$	
	>11 A to 20,5 A	45 Hz to 100 Hz	$1,1 \cdot 10^{-3} \cdot I + 5 \text{ mA}$	
		>100 Hz to 1 kHz	$1,3 \cdot 10^{-3} \cdot I + 5 \text{ mA}$	
		>1 kHz to 5 kHz	$25 \cdot 10^{-3} \cdot I + 5 \text{ mA}$	
AC Voltage Sources	20 μA to <0,2 mA	10 Hz to 10 kHz	$0,25 \cdot 10^{-3} \cdot I + 0,03 \text{ }\mu\text{A}$	I = adjusted value
	0,2 mA to < 2 mA	10 Hz to 10 kHz	$0,25 \cdot 10^{-3} \cdot I + 0,30 \text{ }\mu\text{A}$	

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AC Voltage Sources	2 mA to <20 mA	10 Hz to 10 kHz	$0,25 \cdot 10^{-3} \cdot I + 3 \mu\text{A}$	
	20 mA to <200 mA	10 Hz to 10 kHz	$0,25 \cdot 10^{-3} \cdot I + 23 \mu\text{A}$	
	200 mA to <2 A	10 Hz to 2 kHz	$0,55 \cdot 10^{-3} \cdot I + 0,23 \text{ mA}$	
		>2 kHz to 10 kHz	$0,65 \cdot 10^{-3} \cdot I + 0,23 \text{ mA}$	
	2 A to 20 A	10 Hz to 2 kHz	$0,7 \cdot 10^{-3} \cdot I + 2,3 \text{ mA}$	
		>2 kHz to 10 kHz	$2 \cdot 10^{-3} \cdot I + 2,3 \text{ mA}$	
	50 μA to 20 A	10 Hz to 1 kHz	$75 \cdot 10^{-3} \cdot I$	
		>1 kHz to 20 kHz	$0,13 \cdot 10^{-3} \cdot I$	
		>20 kHz to 50 kHz	$0,25 \cdot 10^{-3} \cdot I$	
		>50 kHz to 100 kHz	$0,70 \cdot 10^{-3} \cdot I$	
AC Voltage Current clamps	1 mA to 20 A	45 Hz to 1 kHz	$2,0 \cdot 10^{-3} \cdot I + 15 \mu\text{A}$	I = measurement
	>20 A to 100 A		$2,5 \cdot 10^{-3} \cdot I$	
	>100 A to 1000 A		$3,0 \cdot 10^{-3} \cdot I$	
Capacity Measuring Devices	220 pF to < 400 pF	10 Hz to 10 kHz	20 pF	I = adjusted value
	0,4 nF to < 1,1 nF	10 Hz to 10 kHz	30 pF	
	1,1 nF to < 3,3 nF	10 Hz to 3 kHz	40 pF	
	3,3 nF to < 11 nF	10 Hz to 1 kHz	50 pF	
	11 nF to < 33 nF	10 Hz to 1 kHz	0,25 nF	
	33 nF to < 110 nF	10 Hz to 1 kHz	0,5 nF	
	110 nF to < 330 nF	10 Hz to 1 kHz	$9 \cdot 10^{-3} \cdot C$	
	330 nF to < 1,1 μF	10 Hz to 600 Hz	$9 \cdot 10^{-3} \cdot C$	
	1,1 μF to < 3,3 μF	10 Hz to 300 Hz	$9 \cdot 10^{-3} \cdot C$	
	3,3 μF to < 11 μF	10 Hz to 150 Hz	$9 \cdot 10^{-3} \cdot C$	
	11 μF to < 33 μF	10 Hz to 120 Hz	$9 \cdot 10^{-3} \cdot C$	
	33 μF to < 110 μF	10 Hz to 80 Hz	$13 \cdot 10^{-3} \cdot C$	
	110 μF to < 330 μF	0 Hz to 50 Hz	$9,5 \cdot 10^{-3} \cdot C$	
	0,33 mF to < 1,1 mF	0 Hz to 20 Hz	$9,5 \cdot 10^{-3} \cdot C$	
	1,1 mF to < 3,3 mF	0 Hz to 6 Hz	$9,5 \cdot 10^{-3} \cdot C$	
	3,3 mF to < 11 mF	0 Hz to 2 Hz	$9,5 \cdot 10^{-3} \cdot C$	
	11 mF to < 33 mF	0 Hz to 0,6 Hz	$12,5 \cdot 10^{-3} \cdot C$	
	33 mF to < 110 mF	0 Hz to 0,2 Hz	$18 \cdot 10^{-3} \cdot C$	

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Translation of the Annex to the accreditation certificate D-K-15055-01-01

Accreditation for Electrical Measuring Quantities

Permanent laboratory and on-site calibration

Calibration and measurement capabilities (CMC)

Measurement quantity / Calibration item	Measuring range / Measuring span	Measuring conditions / methods	Advanced measurement uncertainty ¹⁾	Remarks
Capacity Sources	0,1 pF to 1 nF	10 Hz to 1 kHz	$1 \cdot 10^{-3} \cdot C + 0,05 \text{ pF}$	U = measurement (with LCR-6100)
		>1 kHz to 10 kHz	$2,4 \cdot 10^{-3} \cdot C + 0,05 \text{ pF}$	
		>10 kHz to 100 kHz	$16 \cdot 10^{-3} \cdot C + 0,05 \text{ pF}$	
	>1 nF to 10 μ	10 Hz to 1 kHz	$1 \cdot 10^{-3} \cdot C$	
		>1 kHz to 10 kHz	$2,4 \cdot 10^{-3} \cdot C$	
	>10 μ F to 1 mF	10 Hz to 1 kHz	$1 \cdot 10^{-3} \cdot C$	
	1 μ F to 70 μ F	DC-Method	$3 \cdot 10^{-3} \cdot C$	DC-Method
	> 70 μ F to 110 mF		$0,6 \cdot 10^{-3} \cdot C$	
Inductance Sources	0,1 μ H to 100 mH	10 Hz to 1 kHz	$1 \cdot 10^{-3} \cdot L + 0,03 \text{ } \mu\text{H}$	L = measurement (with LCR-6100)
		>1 kHz to 10 kHz	$2,4 \cdot 10^{-3} \cdot L + 0,03 \text{ } \mu\text{H}$	
	>100 mH to 100 H	10 Hz to 1 kHz	$1 \cdot 10^{-3} \cdot L$	
AC Voltage	1 mW to 20 kW	33 mV $\leq U \leq$ 1000 V 10 mA $\leq I \leq$ 20 A PF = 1,0 45 Hz to 65 Hz	$1,7 \cdot 10^{-3} \cdot P + 10 \text{ } \mu\text{W}$	P = set value with Fluke 5522A PF = Power Factor = $\cos \varphi$ φ = included angle I = measurement value U = measurement value
Power Factor	0 to 1	33 mV $\leq U \leq$ 1000 V 10 mA $\leq I \leq$ 20 A 45 Hz to 65 Hz	$2,0 \cdot 10^{-3} \cdot PF$	P = set value with Fluke 5522A PF = Power Factor = $\cos \varphi$ φ = included angle
Frequency Measuring Devies	10 mHz to 3 GHz		$90 \cdot 10^{-9} \cdot f + U$	f = measurement value U_f = Trigger uncertainty, with 33521A, DSG800
Transducer	10 mHz to 6 GHz		$90 \cdot 10^{-9} \cdot f + U$	f = measurement value U_f = Trigger uncertainty, with 33521A
Speed Optical tachometer	60 min ⁻¹ to 3 $\cdot 10^5$ min ⁻¹		$8 \cdot 10^{-6} \cdot U + 0,005 \text{ min}^{-1}$	U_f = measurement value with 33521A

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Calibration and measurement capabilities (CMC)

Measurement quantity / Calibration item	Measuring range / Measuring span	Measuring conditions / method	Advanced measurement uncertainty ¹⁾	Remarks
Oscilloscope measured variables vertical deflection	1 mV to 5 V 1 mV to 200 V	10 Hz to 10 kHz $R_1 = 50 \Omega$, $R_1 = 1 \text{ m}\Omega$	$2,5 \cdot 10^{-3} \cdot U + 15 \mu\text{V}$	U = measurement value R = resistance value
Oscilloscope measured variables horizontal deflection	1 ns to 40 ns	Time marker amplitude; sinus	$0,6 \cdot 10^{-3} \cdot t + 10 \text{ ps}$	t : <i>measured value</i>
bandwidth	100 kHz to 1,1 GHz	0,1 V to 2 V $R_1 = 50 \Omega$	$50 \cdot 10^{-3} \cdot f$	f : frequency (-3 dB)
frequency response signal generators	100 kHz to 3 GHz	0,1 V to 2 V $R_1 = 50 \Omega$	0,1 dB	Keysight U8481A

Abbreviations used:

CMC – Calibration and measurement capabilities

DIN – German institute for standardization e.v.

EN – European standard

IEC – International Electrotechnical Commission

ISO – International Organization for Standardization

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