Deutsche Akkreditierungsstelle GmbH

Annex to the Accreditation Certificate D-K-17602-01-00 according to DIN EN ISO/IEC 17025:2018

Valid from: **04.06.2021**

Date of issue 04.06.2021

Holder of certificate:

Tektronix GmbH
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Calibration in the fields:

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

Time and frequency quantities
- **Frequency** *)

High frequency quantities
- **Oscilloscope quantities** *)
- **Risetime** *)
- **Bandwidth** *)

*) **also on site calibrations**

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

The certificate together with the annex reflects the status as indicated by the date of issue.
The current status of any given scope of accreditation may be found respectively in the database of accredited bodies of Deutsche Akkreditierungsstelle GmbH https://www.dakks.de/en/content/accredited-bodies-dakks.

Abbreviations used: see last page

Permanent Laboratory

Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement [1]	Remarks
DC voltage measurement instruments	10 mV to 220 mV > 220 mV to 2.2 V > 2.2 V to 22 V > 22 V to 220 V > 220 V to 1100 V		$4 \cdot 10^{-6} \cdot U + 2\ \mu V$ $5 \cdot 10^{-6} \cdot U + 3\ \mu V$ $5 \cdot 10^{-6} \cdot U + 10\ \mu V$ $5 \cdot 10^{-6} \cdot U + 0.15\ mV$ $6 \cdot 10^{-6} \cdot U + 1\ mV$	U = measured value
sources	10 mV to 100 mV > 0.1 V to 1 V > 1 V to 10 V > 10 V to 100 V > 100 V to 1100 V		$5 \cdot 10^{-6} \cdot U + 3\ \mu V$ $4 \cdot 10^{-6} \cdot U + 9\ \mu V$ $5 \cdot 10^{-6} \cdot U + 15\ \mu V$ $5 \cdot 10^{-6} \cdot U + 0{,}15\ mV$ $7 \cdot 10^{-6} \cdot U + 1{,}5\ mV$	
DC current measurement instruments	1 µA to 220 µA > 0.22 mA to 2.2 mA > 2.2 mA to 22 mA > 22 mA to 220 mA > 0.22 A to 2.2 A > 2.2 A to 10 A		$45 \cdot 10^{-6} \cdot I + 7\ nA$ $43 \cdot 10^{-6} \cdot I + 70\ nA$ $50 \cdot 10^{-6} \cdot I + 0.40\ \mu A$ $65 \cdot 10^{-6} \cdot I + 0.50\ \mu A$ $0.2 \cdot 10^{-3} \cdot I + 4\ \mu A$ $0.21 \cdot 10^{-3} \cdot I + 0.14\ mA$	I = measured value
current probes	5 mA to 30 A > 50 mA to 50 A > 50 mA to 250 A > 5 A to 500 A		$0.22 \cdot 10^{-3} \cdot I + 0.35\ \mu A$ $0.5 \cdot 10^{-3} \cdot I + 4\ \mu A$ $0.22 \cdot 10^{-3} \cdot I + 0.35\ \mu A$ $13 \cdot 10^{-3} \cdot I + 0.1\ mA$	coil with 5 turns coil with 10 turns coil with 50 turns coil with 250 turns
sources	1 µA to 100 µA > 0.1 mA to 1 mA > 1 mA to 10 mA > 10 mA to 100 mA > 0.1 A to 1 A > 1 A to 10 A		$50 \cdot 10^{-6} \cdot I + 9\ nA$ $50 \cdot 10^{-6} \cdot I + 80\ nA$ $60 \cdot 10^{-6} \cdot I + 0.5\ \mu A$ $70 \cdot 10^{-6} \cdot I + 2\ \mu A$ $0.24 \cdot 10^{-3} \cdot I + 10\ \mu A$ $0.25 \cdot 10^{-3} \cdot I + 0.30\ mA$	I = measured value
DC resistance measurement instruments	1 Ω 1.9 Ω 10 Ω 19 Ω 100 Ω 190 Ω 1 kΩ 1.9 kΩ 10 kΩ 19 kΩ 100 kΩ 190 kΩ 1 MΩ 1.9 MΩ 10 MΩ 19 MΩ 100 MΩ		$90 \cdot 10^{-6} \cdot R$ $90 \cdot 10^{-6} \cdot R$ $60 \cdot 10^{-6} \cdot R$ $75 \cdot 10^{-6} \cdot R$ $75 \cdot 10^{-6} \cdot R$ $75 \cdot 10^{-6} \cdot R$ $75 \cdot 10^{-6} \cdot R$ $75 \cdot 10^{-6} \cdot R$ $75 \cdot 10^{-6} \cdot R$ $75 \cdot 10^{-6} \cdot R$ $75 \cdot 10^{-6} \cdot R$ $75 \cdot 10^{-6} \cdot R$ $75 \cdot 10^{-6} \cdot R$ $0.1 \cdot 10^{-3} \cdot R$ $0.1 \cdot 10^{-3} \cdot R$ $20 \cdot 10^{-6} \cdot R$ $15 \cdot 10^{-6} \cdot R$ $75 \cdot 10^{-6} \cdot R$	R = measured value
DC resistance resistors	1 Ω to 10 Ω > 10 Ω to 100 Ω > 100 Ω to 1 MΩ > 1 MΩ to 10 MΩ > 10 MΩ to 100 MΩ		$20 \cdot 10^{-6} \cdot R$ $15 \cdot 10^{-6} \cdot R$ $25 \cdot 10^{-6} \cdot R$ $40 \cdot 10^{-6} \cdot R$ $0.1 \cdot 10^{-3} \cdot R$	R = measured value

[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
Frequency sources and measurement instruments	1 MHz to 10 MHz 0.1 Hz to 20 GHz		$1 \cdot 10^{-11} \cdot f$ $1 \cdot 10^{-8} \cdot f + U_{Tf}$	1 MHz step width u_{Tf} = trigger uncertainty
Rise time sources	14 ps to 25 ns	50 mV to 50 V	$3 \cdot 10^{-2} \cdot t_R + 4$ ps	Periodic signals and impulse amplitudes
measurement instruments	18 ps to 1 ns 500 ps to 3 ns 1.5 ns to 25 ns	10 mV to 250 mV 0.25 V to 3 V 25 V and 50 V	$3 \cdot 10^{-2} \cdot t_R + 8$ ps $2 \cdot 10^{-2} \cdot t_R + 65$ ps $2 \cdot 10^{-2} \cdot t_R + 120$ ps	t_R = rise time
current probes	1.5 ns to 20 ns 100 ns to 300 ns	0.5 A and1A 5A	$3 \cdot 10^{-2} \cdot t_R + 200$ ps $3 \cdot 10^{-2} \cdot t_R$	
Oscilloscopes with oscilloscope calibrator DC voltage	0.0 V > 0.0 V to 0.1 V > 0.1 V to 1 V > 1 V to 5.6 V	1 MΩ or 50 Ω Input impedance	15 µV $0.50 \cdot 10^{-3} \cdot U + 26$ µV $0.22 \cdot 10^{-3} \cdot U + 65$ µV $0.26 \cdot 10^{-3} \cdot U + 50$ µV	with Fluke 9500 U = measured value
	> 5.6 V to 222.4 V	1 MΩ Input impedance	$0.30 \cdot 10^{-3} \cdot U$	U = measured value
Flatness	4.4 mV to 5.6 V 4.4 mV to 5.6 V 4.4 mV to 3.4 V 4.4 mV to 3.4 V 4.4 mV to 2.2 V	10 MHz to 100 MHz > 100 MHz to 550 MHz > 550 MHz to 1.1 GHz > 1.1 GHz to 2.5 GHz > 2.5 GHz to 3.2 GHz	0.22 dB 0.29 dB 0.37 dB 0.48 dB 0.48 dB	Measurement quantity: ratio of rms-value at frequency of interest- and reference frequency f_{ref}: 50 kHz to 10 MHz Measurement range: peak-to-peak value of incident wave $\lvert\Gamma_{\mathrm{DUT}}\rvert \leq 0.23\,(50\ \Omega)$
DC resistance	50 Ω 75 Ω 1 MΩ		$0.11 \cdot 10^{-2} \cdot R$ $0.13 \cdot 10^{-2} \cdot R$ $0.12 \cdot 10^{-2} \cdot R$	R = measured value
DC voltage scources	0 V to 5 V		$0.14 \cdot 10^{-3} \cdot U + 90$ µV	U = measured value
Frequency scources	12 kHz to 3.2 GHz		$0.27 \cdot 10^{-6}$	

[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
Rise time sources	40 ps to 25 ns	50 mV to 50 V	$4 \cdot 10^{-2} \cdot t_R + 4$ ps	Periodic signals Impulse amplitudes
measurement instruments	40 ps to 1 ns 500 ps to 3 ns 1.5 ns to 25 ns	10 mV to 250 mV 0.25 V to 3 V 25 V and 50 V	$4 \cdot 10^{-2} \cdot t_R + 8$ ps $2 \cdot 10^{-2} \cdot t_R + 65$ ps $2 \cdot 10^{-2} \cdot t_R + 120$ ps	t_R = rise time
current probes	1.5 ns to 20 ns 100 ns to 300 ns	0.5 A and 1A 5A	$3 \cdot 10^{-2} \cdot t_R + 200$ ps $3 \cdot 10^{-2} \cdot t_R$	
Oscilloscopes with oscilloscope calibrator DC voltage	0.0 V > 0.0 V to 0.1 V > 0.1 V to 1 V > 1 V to 5.6 V	1 MΩ or 50 Ω Input impedance	15 µV $0.50 \cdot 10^{-3} \cdot U + 26$ µV $0.22 \cdot 10^{-3} \cdot U + 65$ µV $0.26 \cdot 10^{-3} \cdot U + 50$ µV	U= measured value
	> 5.6 V to 222.4 V	1 MΩ Input impedance	$0.30 \cdot 10^{-3} \cdot U$	
scources	0 V to 5 V		$0{,}14 \cdot 10^{-3} \cdot U + 90$ µV	
DC resistance	50 Ω 75 Ω 1 MΩ		$0.11 \cdot 10^{-2} \cdot R$ $0.13 \cdot 10^{-2} \cdot R$ $0.12 \cdot 10^{-2} \cdot R$	R = measured value
Flatness	4.4 mV 4 to 5.6 V 4.4 mV to 5.6 V 4.4 mV to 3.4 V 4.4 mV to 3.4 V 4.4 mV to 2.2 V	10 MHz to 100 MHz > 100 MHz to 550 MHz > 550 MHz to 1.1 GHz > 1.1 GHz to 2.5 GHz > 2.5 GHz to 3.2 GHz	0.22 dB 0.29 dB 0.37 dB 0.48 dB 0.48 dB	Measurement quantity: ratio of rms-value at frequency of interest- and reference frequency f_{ref}: 50 kHz to 10 MHz Measurement range: peak-to-peak value of incident wave $\lvert\Gamma_{\mathrm{DUT}}\rvert \leq 0.23$ (50 Ω)
Frequency scources	12 kHz to 3.2 GHz		$0.27 \cdot 10^{-6}$	

Abbreviations used:

CMC	Calibration and measurement capabilities
EA-4/02 M: 2013	Evaluation of the Uncertainty of Measurement in Calibration, European co-operation for Accreditation

[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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