FORTE a.s.

CAB number 2302, Metrological Laboratory Mostkovice 529, 798 02 Mostkovice

CMC for the field of measured quantity: Electrical quantities

Calibrated quantity /		No	minal r	ange		Parameter(s) of the			Calibration principle	Calibration	Location
Subject of calibration	min	unit		max	unit	measurand	uncertainty ²			identification ³	Location
DC electrical voltage									Voltage generation using a	KP 02/2019	
	0			20	* 7			10 14	calibrator		
voltmeters	-						0.045.0/	10 μ ν			
	600	тv	to	1100	v		0.0040 %		x7 1		
voltmeters	10	mV	to	60	mV	32 Hz to 300 Hz		0.15 mV	calibrator	KP 14/2019	
						0.3 kHz to 30 kHz		0.15 mV			
						30 kHz to 100 kHz					
	60	mV	to	200	mV	32 Hz to 300 Hz	0.20 %				
						0.3 kHz to 30 kHz					
						30 kHz to 100 kHz					
	200	mV	to	20	V	32 Hz to 300 Hz					
						0.3 kHz to 30 kHz					
						30 kHz to 100 kHz					
	20	V	to	200	V	32 Hz to 300 Hz					
					·	0.3 kHz to 30 kHz					
	200	V	to	1000	V						
	200	•	10	1000	·						
	Subject of calibration DC electrical voltage / multimeters, voltmeters AC electrical voltage / multimeters,	Subject of calibrationminDC electrical voltage / multimeters, voltmeters02040100600AC electrical voltage / multimeters, voltmeters10AC electrical voltage / multimeters, voltmeters60202020204010020020200200	Subject of calibrationminunitDC electrical voltage / multimeters, voltmeters0mV20mV40mV400mV100mV600mV600mVAC electrical voltage / multimeters, voltmeters10mV600mV600mV	Subject of calibrationminunitDC electrical voltage / multimeters, voltmeters0mVto20mVto20mVto40mVto100mVto600mVto600mVtoAC electrical voltage / multimeters, voltmeters10mVto600mVto60mVto200mVto200mVto200Vto200to100	Subject of calibrationminunitmaxDC electrical voltage / multimeters, voltmeters0mVto2020mVto4040mVto10040mVto100100mVto600600mVto1100AC electrical voltage / multimeters, voltmeters10mVto60mVto6060mVto200200mVto200	Subject of calibrationminunitmaxunitDC electrical voltage / multimeters, voltmeters0mVto20mV0mVto20mVto40mV20mVto40mV100mV40mVto100mV100mV100mVto600mVto1100VAC electrical voltage / multimeters, voltmeters10mVto60mV60mVto60mVfo200mV200mVto200mVfo200mV200mVto200Vfo200V	Subject of calibrationminunitmaxunitmeasurandDC electrical voltage / multimeters, voltmeters0mVto20mV20mVto40mV40mVto100mV100mVto600mV600mVto1100VAC electrical voltage / multimeters, voltmeters10mVto600mVto600mV600mVto1000WAC electrical voltage / multimeters, voltmeters10mVto600mVto200mV7mWto200mV7mWto200mV7mWto200mV7multimeters, woltmeters10mV7mWto200mV7mWto200mV7mWto200mV7mWto200mV7mWto200V7mWto200V7mWto200V7mWto200V7mWto200V7mWto200V7mWto200V7mWto200V7mWto200V7mWto	Subject of calibration min unit max unit measurand measura	$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	Calibration min unit max unit measurand measurand measurement uncertainty ² Calibration principle DC electrical voltage /multimeters, voltmeters 0 mV to 20 mV 100 μV 0.045 % 0.0045 % 0.020 % 0.020 % 0.020 % 0.020 % 0.020 % 0.020 % 0.0040 % 0.020 % 0.0041 % 0.015 mV 0.016m V	$ \begin{array}{ c c c c } \hline \begin{tabulary}{ c c } \hline \begin{tabular}{ c c } \hline \hline \begin{tabular}{ c c } \hline $

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Mostkovice 529, 798 02 Mostkovice

Ord.	Calibrated quantity /		No	minal r	ange		Parameter(s) of the		ted expanded urement	Calibration principle	Calibration procedure	Location
number ¹	Subject of calibration	min	unit		max	unit	measurand		rtainty ²		identification ³	Location
3	DC current /									Current generation using a	KP 02/2019	
	multimeters,	10								calibrator		
	ammeters	10	mA	to		mA			1.0 µA			
		2	mA	to	2	А		0.05 %				
		2	А	to	20	А		0.026 %	+ 1.1 mA			
4	AC current /									Current generation using a	KP 02/2019	
	multimeters,						0.04.133			calibrator		
	ammeters	1	mA	to	2	mA	0.01 kHz to 1 kHz		3 μΑ			
		2	mA	to	200	mA	0.01 kHz to 1 kHz	0.1 %				
		200	mA	to	2	А	0.01 kHz to 1 kHz	0.15 %				
		2	А	to	20	А	0.01 kHz to 1 kHz	0.095 %	+ 1.14 mA			
5	Electrical resistance /									Direct resistance	KP 01/2019	
	resistance boxes,									measurement using a		
	multimeters, ohmmeters	0	Ω	to	0.5	0			1.0 mΩ	multimeter		
	ommitteers							0.05.04	1.0 11122			
		0.5	Ω	to	1	Ω		0.25 %				
		1	Ω	to	4	Ω		0.07 %				
		4	Ω	to	1	MΩ		0.035 %				
		1	MΩ	to	3	MΩ		0.06 %				
		3	MΩ	to	10	MΩ		0.035 %				
		10	MΩ	to	40	MΩ		0.30 %				
			MΩ									
		40	11177	to	100	MΩ		0.15 %		Resistance generation	KP 02/2019	
					10	Ω		0.010 %		using a calibrator	KF 02/2019	
					100	Ω		0.0050 %				
					100							
1					1	kΩ		0.0050 %		1	l	

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Ord. number ¹	Calibrated quantity / Subject of calibration		N	ominal	range		Parameter(s) of the	Lowest stated expanded measurement	Calibration principle	Calibration procedure	Location
		min	unit		max	unit	measurand	uncertainty ²	Canoration principle	identification ³	
					10	kΩ		0.0050 %			
					100	kΩ		0.0050 %			
					1	MΩ		0.010 %			
					10	MΩ		0.030 %			
					100	MΩ		0.050 %			
6	Electric capacity / capacity meters,								Generation using capacity standards	KP 04/2019	
	RLC bridges	1	r	to	3	pF	1 kHz	1.0 %			
		4	pF	to	7	pF	1 kHz	0.30 %			
		8	pF	to	20	pF	1 kHz	0.20 %			
		20	pF	to	1	μF	1 kHz	0.080 %			
7	Electrical inductance / inductance meters,								Generation using inductance standards	KP 07/2019	
	RLC bridges				10	μΗ	1 kHz	0.70 %			
					100	μΗ	1 kHz	0.070 %			
					1	mH	1 kHz	0.070 %			
					10	mH	1 kHz	0.070 %			
					100	mH	1 kHz	0.070 %			
					1	Н	1 kHz	0.070 %			
8	High-frequency power / Hf generators, signal generators, conjulators, frequency								Measurement using a thermoelectric sensor	KP 03/2019	
	oscillators, frequency converters	1	μW	to	2	μW	0.01 GHz to 2 GHz	8.1 %			
							2 GHz to 12.4 GHz 11_01-P508b K-20221122	9.2 %		Page 3 c) of 7

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Ord.	Calibrated quantity /		No	minal r	ange		Parameter(s) of the	Lowest stated expande measurement	d Calibration principle	Calibration procedure	Location
number ¹	Subject of calibration	min	unit		max	unit	measurand	uncertainty ²	Canor ation principle	identification ³	Locution
							12.4 GHz to 18 GHz	9.9 %			
		2	μW	to	4	μW	0.01 GHz to 2 GHz	5.0 %			
							2 GHz to 12.4 GHz 12.4 GHz to 18	6.5 %			
		2	μW	to	5	μW	GHz	7.5 %			
		4	μW	to	8	μW	0.01 GHz to 2 GHz	3.4 %			
		4	μW	to	7	μW	2 GHz to 12.4 GHz 12.4 GHz to 18	5.5 %			
		5	μW	to	20	μW	GHz	6.5 %			
		8	μW	to	30	μW	0.01 GHz to 2 GHz	3.0 %			
		7	μW	to	20	μW	2 GHz to 12.4 GHz 12.4 GHz to 18	5.2 %			
		20	μW	to	100	mW	GHz	6.4 %			
		30	μW	to	100	mW	0.01 GHz to 2 GHz	2.8 %			
		20	μW	to	100	mW	2 GHz to 12.4 GHz	5.1 %			
9	Inspection equipment / modulus meters, loop impedance								Loop impedance generation using a calibrator of inspection	KP 18/2019	
	I I I I I I I I I I I I I I I I I I I	0.5	Ω	to	1.5	Ω	50 Hz	0.073 Ω	instruments		
		1.5	Ω	to	10	Ω	50 Hz	0.26 Ω			
		10	Ω	to	100	Ω	50 Hz	2.6 %			
		100	Ω	to	1800	Ω	50 Hz	2.2 %			
	meters of circuit breaker tripping current								Tripping current generation using a calibrator of inspection		
		3	mA	to	10	mA	50 Hz	0.15 mA	instruments		

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Ord.	Calibrated quantity / Subject of calibration		No	minal 1	ange		Parameter(s) of the	Lowest stated expanded measurement	Calibration principle	Calibration procedure identification ³	Location
number ¹		min	unit		max	unit	measurand	uncertainty ²			
		10	mA	to	3000	mA	50 Hz	2.0 %			
	meters of tripping contact voltage								Contact voltage generation using a calibrator of		
	contact voltage	1	V	to	10	V	50 Hz	4.9 V	inspection instruments		
		10	V	to	100	V	50 Hz	11 V			
	meters of transition resistance								Resistance generation using a calibrator of		
		0.1	Ω	to	1	Ω		0.019 Ω	inspection instruments		
		1	Ω	to	10	Ω		0.042 Ω			
		10	Ω	to	10000	Ω		0.42 %			
	meters of insulation resistance								Resistance generation using a calibrator of		
		0.01	MΩ	to	1	MΩ		0.28 %	inspection instruments		
		1	MΩ	to	10	MΩ		0.44 %			
		10	MΩ	to	1000	MΩ		0.72 %			
		1000	MΩ	to	10000	MΩ		1.4 %			
	meters of leakage current								Leakage current generation using a calibrator of		
		0.1	mA	to	1	mA	50 Hz	8.6 µA	inspection instruments		
		1	mA	to	10	mA	50 Hz	0.86 %			
		10	mA	to	28	mA	50 Hz	0.62 %			

Asterisk at the ordinal number identifies the calibrations, which the Laboratory is qualified to carry out outside the permanent laboratory premises.

2 The expanded measurement uncertainty is in accordance with ILAC-P14 and EA-4/02 M a part of CMC and it is the lowest value of the respective uncertainty. If not stated otherwise, its coverage probability is approx. 95 %. If not stated otherwise, the uncertainty values stated without a unit are relative to the measured value. The uncertainty value stated herein is based on the best conditions achievable by the laboratory; the uncertainty value of a specific calibration may be higher depending on the conditions of such a calibration. For identical extreme values of adjacent ranges, the lower uncertainty value always applies.

3 If the document identifying the calibration procedure is dated only these specific procedures are used. If the document identifying the calibration procedure is not dated, the latest edition of the specified procedure is used (including any changes).

FORTE a.s.

CAB number 2302, Metrological Laboratory Mostkovice 529, 798 02 Mostkovice

CMC for the field of measured quantity: Time and frequency quantities

Ord.	Calibrated quantity /		Noi	ninal ra	ange		Paramete	r(s) of the	Lowest stated expanded		Calibration	
number ¹	Subject of calibration	min	unit		max	unit	measu		measurement uncertainty ²	Calibration principle	procedure identification ³	Location
1	Relative frequency deviation from f ₀ (1; 5; 10) MHz / generators, reference oscillators frequency converters	0		to	1.10-7				2.5.10 ⁻¹⁰	Measurement of frequency deviation by a frequency comparator	KP 05/2019	
		1.10-7		to	1.10-6				1.2.10-9			
2	Frequency f/lf generators, hf generators, calibrators,									Frequency measurement using a counter	KP 09/2019	
	reference oscillators	0.1	Hz	to	100	Hz			3.10 ⁻⁴ /f			
		100	Hz	to	1	kHz			6.10 ⁻⁴ /f			
		1	kHz	to	1.5	GHz			6.10-7			
		1.5	GHz	to	12	GHz			2.10-6	Frequency measurement using a counter	KP 15/2019	
	Oscilloscopes	0.1	Hz	to	100	Hz			3.10 ⁻⁴ /f	Comparison with a counter	KP 14/2019	
		100	Hz	to	1	kHz			6.10 ⁻⁴ /f			
		1	kHz	to	1.5	GHz			6.10-7			
	Frequency meters	1.5	GHz	to	12	GHz			2.10-6	Frequency generation by a reference generator	KP 16/2019	
3	Pulse rise time / oscilloscopes			\geq	3.5	ns			0.80 ns	Rise time generation by a pulse generator	KP 14/2019	
4	Inspection equipment, meters of circuit breaker	10		4.5	100				0.00	Tripping time generation by a calibrator	KP 18 /2019	
	tripping times	10 100	ms ms	to to	100 1000	ms ms			0.69 ms 0.85 ms			
<u> </u>		100	1115	10	1000		DEOSH K 201		0.03 1118		Pogo 6 /	

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¹ Asterisk at the ordinal number identifies the calibrations, which the Laboratory is qualified to carry out outside the permanent laboratory premises.

² The expanded measurement uncertainty is in accordance with ILAC-P14 and EA-4/02 M a part of CMC and it is the lowest value of the respective uncertainty. If not stated otherwise, its coverage probability is approx. 95 %. If not stated otherwise, the uncertainty values stated without a unit are relative to the measured value. The uncertainty value stated herein is based on the best conditions achievable by the laboratory; the uncertainty value of a specific calibration may be higher depending on the conditions of such a calibration. For identical extreme values of adjacent ranges, the lower uncertainty value always applies.

³ If the document identifying the calibration procedure is dated only these specific procedures are used. If the document identifying the calibration procedure is not dated, the latest edition of the specified procedure is used (including any changes).

"This document is an appendix to the certificate of accreditation. In case of any discrepancies between the English and Czech versions, the Czech version shall prevail, both for the certificate appendix and the certificate itself."