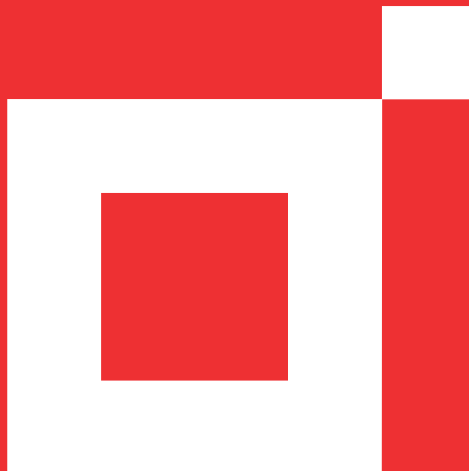




Potvrda o akreditaciji Accreditation Certificate

Ovime se utvrđuje da je
This is to recognize that

ZAVOD ZA ISPITIVANJE KVALITETE d.o.o.
Ljudevita Gaja 17/III, HR-10000 Zagreb
Laboratorij za umjeravanje
Križna cesta 18, HR-10000 Zagreb

osposobljen prema zahtjevima norme
is competent according to
HRN EN ISO/IEC 17025:2017
(ISO/IEC 17025:2017;
EN ISO/IEC 17025:2017)
za/to carry out

**Umjeravanje mjerila električnih veličina, frekvencije i vremena
te umjeravanje mjerila temperature i tlaka**

Calibration of instruments for measurement of electrical quantities,
frequency and time and calibration of temperature and pressure gauges

**u području opisanom u prilogu koji je sastavni dio ove potvrde o
akreditaciji.**

for the scope described in the annex which is the constituent part of
this accreditation certificate.

Br./No.: 2155
Klasa/Ref.No.: 383-02/23-80/004
Urbroj/Id.No.: 569-02/10-23-47
Zagreb, 2023-11-27

Akreditacija istječe-Accreditation expiry: 2028-11-26
Prva akreditacija-Initial accreditation: 2008-11-06

HAA je potpisnica multilateralnog sporazuma s Europskom organizacijom za akreditaciju (EA)
HAA is a signatory of the European co-operation for Accreditation (EA) Multilateral Agreement

Ravnateljica:
Director General:
mr. sc. Mirela Zečević



HAA

Hrvatska akreditacijska agencija
Croatian Accreditation Agency

PRILOG POTVRDI O AKREDITACIJI br.: 2155

Annex to the Accreditation Certificate No.:

Klasa/Ref. No.: 383-02/23-80/004

Urbroj/Id. No.: 569-02/10-25-26

Datum izdanja priloga /Annex issued on: 2025-09-11

Zamjenjuje prilog/Replaces annex:

Klasa/Ref. No.: 383-02/23-80/004

Urbroj/Id. No.: 569-02/10-23-46

Datum/Date: 2023-11-27

Norma: HRN EN ISO/IEC 17025:2017

Standard: (ISO/IEC 17025:2017; EN ISO/IEC 17025:2017)

Akreditacija istječe: 2028-11-26

Accreditation expiry:

Prva akreditacija: 2008-11-06

Initial accreditation:

Akreditirani laboratorij

Accredited laboratory

Zavod za ispitivanje kvalitete d.o.o.

Ljudevita Gaja 17/III, HR-10000 Zagreb

Laboratorij za umjeravanje

Križna cesta 18, HR-10000 Zagreb

Područje akreditacije:

Scope of Accreditation:

**Umjeravanje mjerila električnih veličina, frekvencije i vremena
te umjeravanje mjerila temperature i tlaka**

*Calibration of instruments for measurement of electrical quantities,
frequency and time and calibration of temperature and pressure gauges*

Važeće izdanje Priloga dostupno je na web adresi: www.akreditacija.hr /
Valid issue of the Annex is available at the web address: www.akreditacija.hr

Ravnateljica:

Director General

mr. sc. Mirela Zečević

PODRUČJE AKREDITACIJE / SCOPE OF ACCREDITATION

Mjerne sposobnosti umjeravanja (CMC)/ Calibration and Measurement Capabilities (CMC)

Umjeravanje u laboratoriju/ Calibration performed in a laboratory						
Br. No.	Mjerna veličina / Mjerilo Measurand / Calibration item	Mjerno područje Measurement range	Uvjeti mjerenja Measurement Conditions	Proširena mjerna nesigurnost Expanded Uncertainty	Metoda umjeravanja Calibration method	Napomene Remarks
1.	Istosmjerni napon DC voltage	0,1 V		$31 \cdot 10^{-6} \cdot U$	Vlastiti postupci In-house procedures O.ULB-RU-0012 ver1 O.ULB-RU-0013 ver1 O.ULB-RU-0014 ver1 EURAMET cg-15 ver. 3.0, 02/2015	mjerjenje + generiranje measurement + generating
		1 V		$3,3 \cdot 10^{-6} \cdot U$		
		1,018 V		$4,0 \cdot 10^{-6} \cdot U$		
		10 V		$1,3 \cdot 10^{-6} \cdot U$		
		100 V		$1,7 \cdot 10^{-6} \cdot U$		
		1000 V		$2,2 \cdot 10^{-6} \cdot U$		
		0 mV do/to 220 mV		$9 \cdot 10^{-6} \cdot U + 0,8 \mu V$	Vlastiti postupci In-house procedures O.ULB-RU-0011 ver1 O.ULB-RU-0012 ver1 EURAMET cg-15 ver. 3.0, 02/2015	generiranje generating
		220 mV do/to 2,2 V		$8 \cdot 10^{-6} \cdot U + 1,2 \mu V$		
		2,2 V do/to 11 V		$8 \cdot 10^{-6} \cdot U + 4 \mu V$		
		11 V do/to 22 V		$8 \cdot 10^{-6} \cdot U + 8 \mu V$		
		22 V do/to 220 V		$9 \cdot 10^{-6} \cdot U + 0,1 mV$		
		220 V do/to 1100 V		$11 \cdot 10^{-6} \cdot U + 0,6 mV$		

Umjeravanje u laboratoriju/ Calibration performed in a laboratory

Br. No.	Mjerna veličina / Mjerilo Measurand / Calibration item	Mjerno područje Measurement range	Uvjeti mjerenja Measurement Conditions	Proširena mjerna nesigurnost Expanded Uncertainty	Metoda umjeravanja Calibration method	Napomene Remarks
1.↑	Istosmjerni napon DC voltage	0 mV do/to 100 mV		$10,4 \cdot 10^{-6} \cdot U + 0,4 \mu\text{V}$	Vlastiti postupci In-house procedures O.ULB-RU-0014 ver1	mjerenje measurement
		100 mV do/to 1 V		$9,3 \cdot 10^{-6} \cdot U + 0,4 \mu\text{V}$		
		1 V do/to 10 V		$9,3 \cdot 10^{-6} \cdot U + 0,6 \mu\text{V}$		
		10 V do/to 100 V		$12 \cdot 10^{-6} \cdot U + 35 \mu\text{V}$		
		100 V do/to 1000 V		$26 \cdot 10^{-6} \cdot U + 116 \mu\text{V}$		
		1 kV do/to 6 kV		$1,2 \cdot 10^{-2} \cdot U$		
		6 kV do/to 20 kV		$2,3 \cdot 10^{-2} \cdot U$		
2.	Izmjenični napon AC voltage	0,22 mV do/to 2,2 mV	10 Hz do/to 20 Hz	$6 \cdot 10^{-4} \cdot U + 5 \mu\text{V}$	Vlastiti postupci In-house procedures O.ULB-RU-0011 ver1 O.ULB-RU-0012 ver1 EURAMET cg-15 ver. 3.0, 02/2015	generiranje generating
			20 Hz do/to 40 Hz	$2,4 \cdot 10^{-4} \cdot U + 5 \mu\text{V}$		
			40 Hz do/to 20 kHz	$1,2 \cdot 10^{-4} \cdot U + 5 \mu\text{V}$		
			20 kHz do/to 50 kHz	$4,1 \cdot 10^{-4} \cdot U + 5 \mu\text{V}$		
			50 kHz do/to 100 kHz	$9,5 \cdot 10^{-4} \cdot U + 8 \mu\text{V}$		
			100 kHz do/to 300 kHz	$1,3 \cdot 10^{-3} \cdot U + 15 \mu\text{V}$		
			300 kHz do/to 500 kHz	$1,8 \cdot 10^{-3} \cdot U + 30 \mu\text{V}$		
			500 kHz do/to 1 MHz	$3,6 \cdot 10^{-3} \cdot U + 30 \mu\text{V}$		

Umjeravanje u laboratoriju/ Calibration performed in a laboratory						
Br. No.	Mjerna veličina / Mjerilo Measurand / Calibration item	Mjerno područje Measurement range	Uvjeti mjerenja Measurement Conditions	Proširena mjerna nesigurnost Expanded Uncertainty	Metoda umjeravanja Calibration method	Napomene Remarks
2.↑	Izmjenični napon AC voltage	2,2 mV do/to 22 mV	10 Hz do/to 20 Hz	$6 \cdot 10^{-4} \cdot U + 6 \mu\text{V}$	Vlastiti postupci In-house procedures O.ULB-RU-0011 ver1 O.ULB-RU-0012 ver1 EURAMET cg-15 ver. 3.0, 02/2015	generiranje generating
			20 Hz do/to 40 Hz	$2,4 \cdot 10^{-4} \cdot U + 6 \mu\text{V}$		
			40 Hz do/to 20 kHz	$1,2 \cdot 10^{-4} \cdot U + 6 \mu\text{V}$		
			20 kHz do/to 50 kHz	$4,1 \cdot 10^{-4} \cdot U + 6 \mu\text{V}$		
			50 kHz do/to 100 kHz	$9,5 \cdot 10^{-4} \cdot U + 8 \mu\text{V}$		
			100 kHz do/to 300 kHz	$1,3 \cdot 10^{-3} \cdot U + 15 \mu\text{V}$		
			300 kHz do/to 500 kHz	$1,8 \cdot 10^{-3} \cdot U + 30 \mu\text{V}$		
			500 kHz do/to 1 MHz	$3,6 \cdot 10^{-3} \cdot U + 30 \mu\text{V}$		
		22 mV do/to 220 mV	10 Hz do/to 20 Hz	$6 \cdot 10^{-4} \cdot U + 16 \mu\text{V}$		
			20 Hz do/to 40 Hz	$2,4 \cdot 10^{-4} \cdot U + 10 \mu\text{V}$		
			40 Hz do/to 20 kHz	$1,1 \cdot 10^{-4} \cdot U + 10 \mu\text{V}$		
			20 kHz do/to 50 kHz	$3,6 \cdot 10^{-4} \cdot U + 10 \mu\text{V}$		
			50 kHz do/to 100 kHz	$9 \cdot 10^{-4} \cdot U + 30 \mu\text{V}$		
			100 kHz do/to 300 kHz	$1,1 \cdot 10^{-3} \cdot U + 30 \mu\text{V}$		
			300 kHz do/to 500 kHz	$1,8 \cdot 10^{-3} \cdot U + 40 \mu\text{V}$		
			500 kHz do/to 1 MHz	$3,6 \cdot 10^{-3} \cdot U + 100 \mu\text{V}$		
		220 mV do/to 2,2 V	10 Hz do/to 20 Hz	$6 \cdot 10^{-4} \cdot U + 100 \mu\text{V}$		
			20 Hz do/to 40 Hz	$1,8 \cdot 10^{-4} \cdot U + 30 \mu\text{V}$		
			40 Hz do/to 20 kHz	$0,9 \cdot 10^{-4} \cdot U + 7 \mu\text{V}$		
			20 kHz do/to 50 kHz	$1,4 \cdot 10^{-4} \cdot U + 20 \mu\text{V}$		
			50 kHz do/to 100 kHz	$2,8 \cdot 10^{-4} \cdot U + 80 \mu\text{V}$		
			100 kHz do/to 300 kHz	$4,8 \cdot 10^{-4} \cdot U + 0,15 \text{ mV}$		
			300 kHz do/to 500 kHz	$1,2 \cdot 10^{-3} \cdot U + 0,4 \text{ mV}$		
			500 kHz do/to 1 MHz	$2,4 \cdot 10^{-3} \cdot U + 1 \text{ mV}$		

Umjeravanje u laboratoriju/ Calibration performed in a laboratory						
Br. No.	Mjerna veličina / Mjerilo Measurand / Calibration item	Mjerno područje Measurement range	Uvjeti mjerenja Measurement Conditions	Proširena mjerna nesigurnost Expanded Uncertainty	Metoda umjeravanja Calibration method	Napomene Remarks
2.↑	Izmjenični napon AC voltage	2,2 V do/to 22 V	10 Hz do/to 20 Hz	$6 \cdot 10^{-4} \cdot U + 1 \text{ mV}$	Vlastiti postupci In-house procedures O.ULB-RU-0011 ver1 O.ULB-RU-0012 ver1	generiranje generating
			20 Hz do/to 40 Hz	$1,8 \cdot 10^{-4} \cdot U + 0,3 \text{ mV}$		
			40 Hz do/to 20 kHz	$0,9 \cdot 10^{-4} \cdot U + 0,07 \text{ mV}$		
			20 kHz do/to 50 kHz	$1,4 \cdot 10^{-4} \cdot U + 0,2 \text{ mV}$		
			50 kHz do/to 100 kHz	$2,8 \cdot 10^{-4} \cdot U + 0,4 \text{ mV}$		
			100 kHz do/to 300kHz	$6 \cdot 10^{-4} \cdot U + 1,7 \text{ mV}$		
			300 kHz do/to 500kHz	$1,4 \cdot 10^{-3} \cdot U + 5 \text{ mV}$		
			500 kHz do/to 1 MHz	$3 \cdot 10^{-3} \cdot U + 9 \text{ mV}$		
		22 V do/to 220 V	10 Hz do/to 20 Hz	$6 \cdot 10^{-4} \cdot U + 10 \text{ mV}$	EURAMET cg-15 ver. 3.0, 02/2015	
			20 Hz do/to 40 Hz	$1,8 \cdot 10^{-4} \cdot U + 3 \text{ mV}$		
			40 Hz do/to 20 kHz	$0,9 \cdot 10^{-4} \cdot U + 1 \text{ mV}$		
			20 kHz do/to 50 kHz	$2,5 \cdot 10^{-4} \cdot U + 4 \text{ mV}$		
			50 kHz do/to 100 kHz	$6 \cdot 10^{-4} \cdot U + 10 \text{ mV}$		
		220 V do/to 1100 V	50 Hz do/to 1 kHz	$0,9 \cdot 10^{-4} \cdot U + 4 \text{ mV}$		
			1 kHz do/to 20 kHz	$5 \cdot 10^{-4} \cdot U + 50 \text{ mV}$		
			20 kHz do/to 50 kHz	$9 \cdot 10^{-4} \cdot U + 80 \text{ mV}$		
			50 kHz do/to 100 kHz	$1,2 \cdot 10^{-3} \cdot U + 130 \text{ mV}$		
		1 mV do/to 10 mV	40 Hz do/to 1 kHz	$2,3 \cdot 10^{-4} \cdot U + 1,3 \text{ } \mu\text{V}$	Vlastiti postupci In-house procedures O.ULB-RU-0014 ver1	mjerenje measurement
			1 kHz do/to 20 kHz	$3,5 \cdot 10^{-4} \cdot U + 1,3 \text{ } \mu\text{V}$		
			20 kHz do/to 50 kHz	$1,2 \cdot 10^{-3} \cdot U + 1,3 \text{ } \mu\text{V}$		
			50 kHz do/to 100 kHz	$5,8 \cdot 10^{-3} \cdot U + 1,3 \text{ } \mu\text{V}$		
		10 mV do/to 100 mV	40 Hz do/to 1 kHz	$8,1 \cdot 10^{-5} \cdot U + 2,3 \text{ } \mu\text{V}$		
			1 kHz do/to 20 kHz	$1,6 \cdot 10^{-4} \cdot U + 2,3 \text{ } \mu\text{V}$		
			20 kHz do/to 50 kHz	$3,5 \cdot 10^{-4} \cdot U + 2,3 \text{ } \mu\text{V}$		
			50 kHz do/to 100 kHz	$9,2 \cdot 10^{-4} \cdot U + 2,3 \text{ } \mu\text{V}$		

Umjeravanje u laboratoriju/ Calibration performed in a laboratory						
Br. No.	Mjerna veličina / Mjerilo Measurand / Calibration item	Mjerno područje Measurement range	Uvjeti mjerenja Measurement Conditions	Proširena mjerna nesigurnost Expanded Uncertainty	Metoda umjeravanja Calibration method	Napomene Remarks
2.↑	Izmjenični napon AC voltage	100 mV do/to 1 V	40 Hz do/to 1 kHz	$8,1 \cdot 10^{-5} \cdot U + 23,1 \mu\text{V}$	Vlastiti postupci In-house procedures O.ULB-RU-0014 ver1	mjerenje measurement
			1 kHz do/to 20 kHz	$1,6 \cdot 10^{-4} \cdot U + 23,1 \mu\text{V}$		
			20 kHz do/to 50 kHz	$3,5 \cdot 10^{-4} \cdot U + 23,1 \mu\text{V}$		
			50 kHz do/to 100 kHz	$9,2 \cdot 10^{-4} \cdot U + 23,1 \mu\text{V}$		
			100 kHz do/to 300 kHz	$3,5 \cdot 10^{-3} \cdot U + 116 \mu\text{V}$		
			300 kHz do/to 1 MHz	$1,2 \cdot 10^{-2} \cdot U + 116 \mu\text{V}$		
		1 V do/to 10 V	40 Hz do/to 1 kHz	$8,1 \cdot 10^{-5} \cdot U + 0,23 \text{ mV}$		
			1 kHz do/to 20 kHz	$1,6 \cdot 10^{-4} \cdot U + 0,23 \text{ mV}$		
			20 kHz do/to 50 kHz	$3,5 \cdot 10^{-4} \cdot U + 0,23 \text{ mV}$		
			50 kHz do/to 100 kHz	$9,2 \cdot 10^{-4} \cdot U + 0,23 \text{ mV}$		
			100 kHz do/to 300 kHz	$3,5 \cdot 10^{-3} \cdot U + 1,2 \text{ mV}$		
			300 kHz do/to 1 MHz	$1,2 \cdot 10^{-2} \cdot U + 1,2 \text{ mV}$		
		10 V do/to 100 V	40 Hz do/to 1 kHz	$2,3 \cdot 10^{-4} \cdot U + 2,3 \text{ mV}$		
			1 kHz do/to 20 kHz	$2,3 \cdot 10^{-4} \cdot U + 2,3 \text{ mV}$		
			20 kHz do/to 50 kHz	$4,0 \cdot 10^{-4} \cdot U + 2,3 \text{ mV}$		
			50 kHz do/to 100 kHz	$1,4 \cdot 10^{-3} \cdot U + 2,3 \text{ mV}$		
		100 V do/to 700 V	40 Hz do/to 1 kHz	$4,6 \cdot 10^{-4} \cdot U + 23,1 \text{ mV}$		
		700 V do/to 1000 V	50 Hz do/to 1 kHz	$5,8 \cdot 10^{-3} \cdot U + 2,3 \text{ V}$		
		1 kV do/to 6 kV	50 Hz do/to 500 Hz	$1,2 \cdot 10^{-2} \cdot U$		
			500 Hz do/to 1 kHz	$2,3 \cdot 10^{-2} \cdot U$		
		6 kV do/to 20 kV	50 Hz	$5,8 \cdot 10^{-2} \cdot U$		

Umjeravanje u laboratoriju/ Calibration performed in a laboratory						
Br. No.	Mjerna veličina / Mjerilo Measurand / Calibration item	Mjerno područje Measurement range	Uvjeti mjerenja Measurement Conditions	Proširena mjerna nesigurnost Expanded Uncertainty	Metoda umjeravanja Calibration method	Napomene Remarks
3.	Istosmjerna struja DC current	0 µA do/to 220 µA		$60 \cdot 10^{-6} \cdot I + 10 \text{ nA}$	Vlastiti postupci In-house procedures O.ULB-RU-0011 ver1 O.ULB-RU-0012 ver1 EURAMET cg-15 ver. 3.0, 02/2015	generiranje generating
		220 µA do/to 2,2 mA		$60 \cdot 10^{-6} \cdot I + 10 \text{ nA}$		
		2,2 mA do/to 22 mA		$60 \cdot 10^{-6} \cdot I + 100 \text{ nA}$		
		22 mA do/to 220 mA		$70 \cdot 10^{-6} \cdot I + 1 \text{ µA}$		
		220 mA do/to 2,2 A		$95 \cdot 10^{-6} \cdot I + 30 \text{ µA}$		
		2,2 A do/to 20 A		$0,3 \cdot 10^{-3} \cdot I + 1,2 \text{ mA}$		
		20 A do/to 32 A		$3 \cdot 10^{-3} \cdot I + 1,4 \text{ mA}$	Vlastiti postupci In-house procedures O.ULB-RU-0012 ver1 O.ULB-RU-0023 ver1 EURAMET cg-15 ver. 3.0, 02/2015	samo za strujna kliješta current clamps only
		32 A do/to 105 A		$3 \cdot 10^{-3} \cdot I + 11 \text{ mA}$		
		105 A do/to 200 A		$3 \cdot 10^{-3} \cdot I + 52 \text{ mA}$		
		200 A do/to 525 A		$3 \cdot 10^{-3} \cdot I + 54,3 \text{ mA}$		
		525 A do/to 1000 A		$3 \cdot 10^{-3} \cdot I + 260 \text{ mA}$		
		10 µA do/to 100 µA		$23,1 \cdot 10^{-6} \cdot I + 0,92 \text{ nA}$	Vlastiti postupci In-house procedures O.ULB-RU-0014 ver1	mjerenje measurement
		100 µA do/to 1 mA		$23,1 \cdot 10^{-6} \cdot I + 5,8 \text{ nA}$		
		1 mA do/to 10 mA		$23,1 \cdot 10^{-6} \cdot I + 58 \text{ nA}$		
		10 mA do/to 100 mA		$40,4 \cdot 10^{-6} \cdot I + 0,6 \text{ µA}$		
		100 mA do/to 1 A		$1,3 \cdot 10^{-4} \cdot I + 12 \text{ µA}$		
		1 A do/to 20 A		$6,6 \cdot 10^{-5} \cdot I$		
		20 A do/to 150 A		$1,6 \cdot 10^{-4} \cdot I$		

Umjeravanje u laboratoriju/ Calibration performed in a laboratory

Br. No.	Mjerna veličina / Mjerilo <i>Measurand / Calibration item</i>	Mjerno područje <i>Measurement range</i>	Uvjeti mjerenja <i>Measurement Conditions</i>	Proširena mjerna nesigurnost <i>Expanded Uncertainty</i>	Metoda umjeravanja <i>Calibration method</i>	Napomene <i>Remarks</i>								
4.	Izmjenična struja <i>AC current</i>	10 µA do/to 220 µA	40 Hz do/to 1 kHz	$1,6 \cdot 10^{-4} \cdot I + 20 \text{ nA}$	Vlastiti postupci <i>In-house procedures</i> O.ULB-RU-0011 ver1 O.ULB-RU-0012 ver1	generiranje <i>generating</i>								
			1 kHz do/to 5 kHz	$7 \cdot 10^{-4} \cdot I + 50 \text{ nA}$										
		220 µA do/to 2,2 mA	40 Hz do/to 1 kHz	$1,6 \cdot 10^{-4} \cdot I + 40 \text{ nA}$			EURAMET cg-15 ver. 3.0, 02/2015							
			1 kHz do/to 5 kHz	$7 \cdot 10^{-4} \cdot I + 0,5 \text{ µA}$										
		2,2 mA do/to 22 mA	40 Hz do/to 1 kHz	$1,6 \cdot 10^{-4} \cdot I + 0,4 \text{ µA}$										
			1 kHz do/to 5 kHz	$7 \cdot 10^{-4} \cdot I + 5 \text{ µA}$										
		22 mA do/to 220 mA	40 Hz do/to 1 kHz	$1,8 \cdot 10^{-4} \cdot I + 4 \text{ µA}$										
			1 kHz do/to 5 kHz	$7 \cdot 10^{-4} \cdot I + 50 \text{ µA}$										
		220 mA do/to 2,2 A	40 Hz do/to 1 kHz	$7,5 \cdot 10^{-4} \cdot I + 40 \text{ µA}$										
			1 kHz do/to 5 kHz	$8,5 \cdot 10^{-4} \cdot I + 100 \text{ µA}$										
		2,2 A do/to 20 A	50 Hz do/to 1 kHz	$8,1 \cdot 10^{-4} \cdot I + 1,2 \text{ mA}$										
			1 kHz do/to 2 kHz	$1,7 \cdot 10^{-3} \cdot I + 2,3 \text{ mA}$										
			2 kHz do/to 3 kHz	$2,5 \cdot 10^{-3} \cdot I + 3,5 \text{ mA}$										
			3 kHz do/to 4 kHz	$3,3 \cdot 10^{-3} \cdot I + 4,6 \text{ mA}$										
			4 kHz do/to 5 kHz	$4,1 \cdot 10^{-3} \cdot I + 5,8 \text{ mA}$										
		20 A do/to 32 A	10 Hz do/to 100 Hz	$4,6 \cdot 10^{-3} \cdot I + 6,4 \text{ mA}$			Vlastiti postupci <i>In-house procedures</i> O.ULB-RU-0012 ver1 O.ULB-RU-0023 ver1	samo za strujna kliješta <i>Current clamps only</i>						
			100 Hz do/to 440 Hz	$11,3 \cdot 10^{-3} \cdot I + 31,2 \text{ mA}$										
32 A do/to 200 A	10 Hz do/to 100 Hz	$4,8 \cdot 10^{-3} \cdot I + 0,1 \text{ A}$	EURAMET cg-15 ver. 3.0, 02/2015											
	100 Hz do/to 440 Hz	$10,1 \cdot 10^{-3} \cdot I + 0,3 \text{ A}$												
200 A do/to 1000 A	10 Hz do/to 100 Hz	$4,8 \cdot 10^{-3} \cdot I + 0,52 \text{ A}$												

Umjeravanje u laboratoriju/ Calibration performed in a laboratory

Br. No.	Mjerna veličina / Mjerilo Measurand / Calibration item	Mjerno područje Measurement range	Uvjeti mjerenja Measurement Conditions	Proširena mjerna nesigurnost Expanded Uncertainty	Metoda umjeravanja Calibration method	Napomene Remarks
4.↑	Izmjenična struja AC current	10 µA do/to 100 µA	45 Hz do/to 100 Hz	$7 \cdot 10^{-4} \cdot I + 35 \text{ nA}$	Vlastiti postupci In-house procedures O.ULB-RU-0014 ver1	mjerenje measurement
			100 Hz do/to 1 kHz	$7 \cdot 10^{-4} \cdot I + 35 \text{ nA}$		
		100 µA do/to 1 mA	45 Hz do/to 100 Hz	$7 \cdot 10^{-4} \cdot I + 0,23 \text{ µA}$		
			100 Hz do/to 5 kHz	$3,5 \cdot 10^{-4} \cdot I + 0,23 \text{ µA}$		
			5 kHz do/to 20 kHz	$7 \cdot 10^{-4} \cdot I + 0,23 \text{ µA}$		
		1 mA do/to 10 mA	45 Hz do/to 100 Hz	$7 \cdot 10^{-4} \cdot I + 2,3 \text{ µA}$		
			100 Hz do/to 5 kHz	$3,5 \cdot 10^{-4} \cdot I + 2,3 \text{ µA}$		
			5 kHz do/to 20 kHz	$7 \cdot 10^{-4} \cdot I + 2,3 \text{ µA}$		
		10 mA do/to 100 mA	45 Hz do/to 100 Hz	$7 \cdot 10^{-4} \cdot I + 23,1 \text{ µA}$		
			100 Hz do/to 5 kHz	$3,5 \cdot 10^{-4} \cdot I + 23,1 \text{ µA}$		
			5 kHz do/to 20 kHz	$7 \cdot 10^{-4} \cdot I + 23,1 \text{ µA}$		
		100 mA do/to 1 A	45 Hz do/to 100 Hz	$9,2 \cdot 10^{-4} \cdot I + 0,23 \text{ mA}$		
			100 Hz do/to 5 kHz	$1,2 \cdot 10^{-3} \cdot I + 0,23 \text{ mA}$		
			5 kHz do/to 20 kHz	$3,5 \cdot 10^{-3} \cdot I + 0,23 \text{ mA}$		
		1 A do/to 20 A	50 Hz	$4,1 \cdot 10^{-4} \cdot I$		
			1 kHz	$4,8 \cdot 10^{-4} \cdot I$		
			2 kHz	$5,8 \cdot 10^{-4} \cdot I$		
			3 kHz	$6,9 \cdot 10^{-4} \cdot I$		
			4 kHz	$8,1 \cdot 10^{-4} \cdot I$		
			5 kHz	$9,4 \cdot 10^{-4} \cdot I$		
		20 A do/to 150 A	50 Hz	$4,2 \cdot 10^{-4} \cdot I$		

Umjeravanje u laboratoriju/ Calibration performed in a laboratory

Br. No.	Mjerna veličina / Mjerilo Measurand / Calibration item	Mjerno područje Measurement range	Uvjeti mjerenja Measurement Conditions	Proširena mjerna nesigurnost Expanded Uncertainty	Metoda umjeravanja Calibration method	Napomene Remarks
5.	Otpor Resistance	80 $\mu\Omega$		$1,2 \cdot 10^{-3} \cdot R$	Vlastiti postupak In-house procedure O.ULB-RU-0011 ver1 O.ULB-RU-0012 ver1 O.ULB-RU-0016 ver1 EURAMET cg-15 ver. 3.0, 02/2015	generiranje generating
		0,4 m Ω		$5,8 \cdot 10^{-4} \cdot R$		
		1 m Ω		$2,3 \cdot 10^{-3} \cdot R$		
		10 m Ω		$1,2 \cdot 10^{-4} \cdot R$		
		0,1 Ω ; 0,19 Ω		$28 \cdot 10^{-6} \cdot R$		
		0 Ω		50 $\mu\Omega$		
		1 Ω		$8,6 \cdot 10^{-6} \cdot R$		
		1,9 Ω		$110 \cdot 10^{-6} \cdot R$		
		10 Ω		$33 \cdot 10^{-6} \cdot R$		
		19 Ω		$31 \cdot 10^{-6} \cdot R$		
		100 Ω ; 190 Ω		$20 \cdot 10^{-6} \cdot R$		
		1 k Ω ; 1,9 k Ω		$15 \cdot 10^{-6} \cdot R$		
		10 k Ω		$4,4 \cdot 10^{-6} \cdot R$		
		19 k Ω		$14 \cdot 10^{-6} \cdot R$		
		100 k Ω ; 190 k Ω		$16 \cdot 10^{-6} \cdot R$		
		1 M Ω		$23 \cdot 10^{-6} \cdot R$		
		1,9 M Ω		$24 \cdot 10^{-6} \cdot R$		
		10 M Ω		$46 \cdot 10^{-6} \cdot R$		
		19 M Ω		$55 \cdot 10^{-6} \cdot R$		
		100 M Ω		$1,3 \cdot 10^{-4} \cdot R$		
		1 G Ω		$1,2 \cdot 10^{-2} \cdot R$		
		10 G Ω		$1,2 \cdot 10^{-2} \cdot R$		
		0 Ω do/to 10 Ω		$17,4 \cdot 10^{-6} \cdot R + 58 \mu\Omega$	Vlastiti postupak In-house procedure O.ULB-RU-0014 ver1 O.ULB-RU-0016 ver1	mjerenje measurement
		10 Ω do/to 100 Ω		$14 \cdot 10^{-6} \cdot R + 0,6 \text{ m}\Omega$		
		100 Ω do/to 1 k Ω		$12 \cdot 10^{-6} \cdot R + 0,6 \text{ m}\Omega$		
		1 k Ω do/to 10 k Ω		$12 \cdot 10^{-6} \cdot R + 6 \text{ m}\Omega$		
		10 k Ω do/to 100 k Ω		$12 \cdot 10^{-6} \cdot R + 58 \text{ m}\Omega$		
		100 k Ω do/to 1 M Ω		$17,3 \cdot 10^{-6} \cdot R + 2,3 \Omega$		
		1 M Ω do/to 10 M Ω		$58 \cdot 10^{-6} \cdot R + 116 \Omega$		
		10 M Ω do/to 100 M Ω		$6 \cdot 10^{-4} \cdot R + 1,2 \text{ k}\Omega$		
		100 M Ω do/to 1 G Ω		$6 \cdot 10^{-3} \cdot R + 12 \text{ k}\Omega$		

Umjeravanje u laboratoriju/ <i>Calibration performed in a laboratory</i>						
Br. No.	Mjerna veličina / Mjerilo <i>Measurand / Calibration item</i>	Mjerno područje <i>Measurement range</i>	Uvjeti mjerenja <i>Measurement Conditions</i>	Proširena mjerna nesigurnost <i>Expanded Uncertainty</i>	Metoda umjeravanja <i>Calibration method</i>	Napomene <i>Remarks</i>
6.	Kapacitet <i>Capacitance</i>	50 pF do/to 1,1 µF	1 kHz	$5,8 \cdot 10^{-3} \cdot C + 5,8 \text{ pF}$	Vlastiti postupci <i>In-house procedures</i> O.ULB-RU-0011 ver1 O.ULB-RU-0012 ver1 EURAMET cg-15 ver. 3.0, 02/2015	generiranje <i>generating</i>
7.	Frekvencija <i>Frequency</i>	0,1 Hz do/to 50 MHz		$1,2 \cdot 10^{-6} \cdot f$	Vlastiti postupak <i>In-house procedure</i> O.ULB-RU-0012 ver1 O.ULB-RU-0015 ver2	generiranje <i>generating</i>
		50 MHz do/to 1,05 GHz		$1,2 \cdot 10^{-7} \cdot f$	EURAMET cg-15 ver. 3.0, 02/2015	
		1 Hz do/to 225 MHz		$5,8 \cdot 10^{-7} \cdot f$	Vlastiti postupak <i>In-house procedure</i> O.ULB-RU-0014 ver1 O.ULB-RU-0015 ver2	mjerenje <i>measurement</i>
		225 MHz do/to 1 GHz		$0,6 \text{ Hz} + 2,3 \cdot 10^{-8} \cdot f$		
8.	Vremenski interval <i>Time interval</i>	18,3 ms do/to 1711 ms		$5,8 \cdot 10^{-3} \cdot t + 1,2 \text{ ms}$	Vlastiti postupak <i>In-house procedure</i> O.ULB-RU-0015 ver2	generiranje <i>generating</i> * samo za RCD * <i>only for RCD</i>
		10 µs do/to 10 ⁵ s		$10 \text{ ns} + 5,8 \cdot 10^{-7} \cdot t$	Vlastiti postupak <i>In-house procedure</i> O.ULB-RU-0015 ver2	mjerenje <i>measurement</i>

Umjeravanje u laboratoriju/ Calibration performed in a laboratory

Br. No.	Mjerna veličina / Mjerilo <i>Measurand / Calibration item</i>	Mjerno područje <i>Measurement range</i>	Uvjeti mjerenja <i>Measurement Conditions</i>	Proširena mjerna nesigurnost <i>Expanded Uncertainty</i>	Metoda umjeravanja <i>Calibration method</i>	Napomene <i>Remarks</i>
9.	Temperatura / Indikatori za otpornička mjerila <i>temperature / Indicators for resistance thermometers</i>	Pt385 100 Ω	(-200 do/to -100) °C	0,17 °C	Vlastiti postupak <i>In-house procedure</i> O.ULB-RU-0024 ver2 EURAMET cg-11 ver. 2.0, 03/2011	generiranje <i>generating</i>
			(-100 do/to 100) °C	0,12 °C		
			(100 do/to 630) °C	0,23 °C		
			(630 do/to 850) °C	0,35 °C		
	Temperatura / Simulatori za otpornička mjerila <i>temperature / Simulators for resistance thermometers</i>	Pt385 100 Ω	(-200 do/to 0) °C	0,005 °C	Vlastiti postupak <i>In-house procedure</i> O.ULB-RU-0024 ver2 EURAMET cg-11 ver. 2.0, 03/2011	mjerenje <i>measurement</i>
			(0 do/to 400) °C	0,010 °C		
			(400 do/to 600) °C	0,013 °C		
			(600 do/to 850) °C	0,017 °C		
10.	Temperatura / Indikatori i simulatori za termoelemente <i>Temperature / Indicators and simulators for thermocouples</i>	Tip Type K	(-200 do/to -100) °C	0,31 °C	Vlastiti postupak <i>In-house procedure</i> O.ULB-RU-0024 ver2 EURAMET cg-11 ver. 2.0, 03/2011	Bez automatske kompenzacije referentne temperature <i>Without automatic compensation of reference temperature</i>
			(-100 do/to 100) °C	0,22 °C		
			(100 do/to 600) °C	0,27 °C		
			(600 do/to 1372) °C	0,31 °C		
		Tip Type J	(-210 do/to -100) °C	0,29 °C		
			(-100 do/to 800) °C	0,22 °C		
			(800 do/to 1000) °C	0,24 °C		
			(1000 do/to 1200) °C	0,27 °C		

Umjeravanje u laboratoriju/ Calibration performed in a laboratory

Br. No.	Mjerna veličina / Mjerilo Measurand / Calibration item	Mjerno područje Measurement range	Uvjeti mjerenja Measurement Conditions	Proširena mjerna nesigurnost Expanded Uncertainty	Metoda umjeravanja Calibration method	Napomene Remarks
11.	Temperatura / Mjerila temperature s izravnim pokazivanjem Temperature / Direct reading thermometers	(-25 do/to 150) °C		0,12 °C	Vlastiti postupak In-house procedure O.ULB-RU-0025 ver2 DKD-R 5-1:11/2023	Usporedba s etalonskim otporničkim mjerilom temperature u suhom kalibratoru (dubina 150 mm) Comparison with standard resistance thermometer in dry block calibrator (depth 150 mm)
		(151 do/to 250) °C		1,0 °C		Umjeravanje u suhom blok-kalibratoru (dubina 100 mm) Calibration in dry block calibrator (depth 100 mm)
		(251 do/to 300) °C		1,2 °C		
		(301 do/to 400) °C		4,0 °C		
12.	Temperatura / Temperaturne komore Temperature / Temperature chambers	(0 do/to 50) °C		2,7 °C	Vlastiti postupak In-house procedure O.ULB-RU-0017 ver2 DKD-R 5-7:01/2025 EURAMET cg-20 ver. 5.0, 09/2017	Usporedba s višekanalnim mjerilom temperature (osjetila termoparovi tipa K) DAkKS podmetoda A i B za komore $V < 2000$ L, podmetoda C za za sve obujme Comparison with data logger thermometer (thermocouple type K) DAkKS methods A and B for chambers with $V < 2000$ L, metod C for all volumes

Umjeravanje u laboratoriju/ Calibration performed in a laboratory

Br. No.	Mjerna veličina / Mjerilo <i>Measurand / Calibration item</i>	Mjerno područje <i>Measurement range</i>	Uvjeti mjerenja <i>Measurement Conditions</i>	Proširena mjerna nesigurnost <i>Expanded Uncertainty</i>	Metoda umjeravanja <i>Calibration method</i>	Napomene <i>Remarks</i>
13.	Tlak / Mjerila pretlaka s izravnim pokazivanjem <i>Pressure / Vacuum gauges with direct reading</i>	(-1 do/to 0) bar		1 mbar	Vlastiti postupak <i>In-house procedure</i> O.SVM-RU-0002 ver1 EURAMET cg-17 ver. 4.1, 09/2022 DKD R-6-1:2014	Tlačni medij: <i>Pressure medium:</i> plin (zrak, dušik) <i>gas (air, nitrogen)</i>
		(0 do/to 2,5) bar		2 mbar		
		(2,5 do/to 10) bar		3,5 mbar		
		(10 do/to 60) bar		20 mbar		
		(0 do/to 600) bar		180 mbar		tekućina (ulje, alkohol, voda) <i>fluid (oil, alcohol, water)</i>
		(600 do/to 1000) bar		300 mbar		

Umjeravanje na terenu/ <i>On-site calibration</i>					
Br. <i>No.</i>	Mjerna veličina / Mjerilo <i>Measurand / Calibration item</i>	Mjerno područje <i>Measurement range</i>	Proširena mjerna nesigurnost <i>Expanded Uncertainty</i>	Metode umjeravanja <i>Calibration methods</i>	Napomene <i>Remarks</i>
T1.	Temperatura / Mjerila temperature s izravnim pokazivanjem <i>Temperature / Direct reading thermometers</i>	(-25 do/to 150) °C	0,12 °C	Vlastiti postupak <i>In-house procedure</i> O.ULB-RU-0025 ver2	Usporedba s etalonskim otporničkim mjerilom temperature u suhom kalibratoru (dubina 150 mm) <i>Comparison with standard resistance thermometer in dry block calibrator (depth 150 mm)</i>
		(151 do/to 250) °C	1,0 °C	DKD-R 5-1:11/2023	Umjeravanje u suhom blok-kalibratoru (dubina 100 mm) <i>Calibration in dry block calibrator (depth 100 mm)</i>
		(251 do/to 300) °C	1,2 °C		
		(301 do/to 400) °C	4,0 °C		
T2.	Temperatura / Temperaturne komore <i>Temperature / Temperature chambers</i>	(0 do/to 50) °C	2,7 °C	Vlastiti postupak <i>In-house procedure</i> O.ULB-RU-0017 ver2 DKD-R 5-7:01/2025 EURAMET cg-20 ver. 5.0, 09/2017	Usporedba s višekanalnim mjerilom temperature (osjetila termoparovi tipa K) DAkkS podmetoda A i B za komore $V < 2000$ L, podmetoda C za za sve obujme <i>Comparison with data logger thermometer (thermocouple type K)</i> <i>DAkkS methods A and B for chambers with $V < 2000$ L, metod C for all volumes</i>
T3.	Tlak / Mjerila pretlaka s izravnim pokazivanjem <i>Pressure / Vacuum gauges with direct reading)</i>	(-1 do/to 0) bar	1 mbar	Vlastiti postupak <i>In-house procedure</i> O.SVM-RU-0002 ver1	Tlačni medij: - plin (zrak, dušik) <i>Pressure medium:</i> - gas (air, nitrogen)
		(0 do/to 2,5) bar	2 mbar		
		(2,5 do/to 10) bar	3,5 mbar	EURAMET cg-17 ver. 4.1, 09/2022	
		(10 do/to 60) bar	20 mbar	DKD R-6-1:2014	

Proširena mjerna nesigurnost je izračunata u skladu s postupkom opisanom u EA 4/02 M, s razinom povjerenja 95 %, što uobičajeno i ako nije drugačije navedeno, znači množenje standardne nesigurnosti faktorom pokrivanja $k=2$. Laboratorij ne smije u potvrdama o umjeravanju koje izdaje u statusu akreditiranog laboratorija izražavati manju mjernu nesigurnost od objavljene CMC.

Expanded measurement uncertainty has been calculated according to the procedures given in EA 4/02 M, at a coverage probability of 95 %, which usually and if not stated otherwise, means by multiplying standard uncertainty by a coverage factor of $k = 2$. An accredited laboratory is not permitted to quote an uncertainty that is smaller than the published CMC in certificates issued under its accreditation.