

Electricity and Magnetism, Serbia, DMDM (Directorate of Measures and Precious Metals)

Calibration or Measurement Services			Measurand Level or Range			Measurement Conditions/Independent variables		Expanded Uncertainty							
Quantity	Instrument or artifact	Instrument Type or Method	Minimum value	Maximum value	units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Uncertainty matrix	Comments	NMI Service Identifier
DC voltage sources: single values	Standard cell, solid state voltage standard	Difference measurement	1.018	1.018	V			450	nV	2	95%	No		Approved on 14 March 2006	1
DC voltage sources: single values	Solid state voltage standard	Difference measurement	1	10	V	Fixed voltage	1 V, 10 V	1	μV/V	2	95%	Yes		Approved on 14 March 2006	2
DC voltage sources: low values	DC voltage source, multifunction calibrators: voltage	Direct measurement	0.01	0.1	V			38 to 6	μV/V	2	95%	Yes		Approved on 14 March 2006	3
DC voltage sources: low values	DC voltage source, multifunction calibrators: voltage	Direct measurement	0.1	1	V			5 to 2	μV/V	2	95%	Yes		Approved on 14 March 2006	4
DC voltage sources: low values	DC voltage source, multifunction calibrators: voltage	Direct measurement	1	10	V			1.5 to 1.2	μV/V	2	95%	Yes		Approved on 14 March 2006	5
DC voltage sources: intermediate values	DC voltage source, multifunction calibrators: voltage	Direct measurement	10	100	V			6.4 to 3.4	μV/V	2	95%	Yes		Approved on 14 March 2006	6
DC voltage sources: intermediate values	DC voltage source, multifunction calibrators: voltage	Direct measurement	100	1000	V			4.2 to 3.2	μV/V	2	95%	Yes		Approved on 14 March 2006	7
DC voltage meters: intermediate values	DC voltmeter, multimeter, MTS	Direct measurement	0.01	0.1	V			38 to 6	μV/V	2	95%	Yes		Approved on 14 March 2006	8
DC voltage meters: intermediate values	DC voltmeter, multimeter, MTS	Direct measurement	0.1	1	V			5 to 2	μV/V	2	95%	Yes		Approved on 14 March 2006	9
DC voltage meters: intermediate values	DC voltmeter, multimeter, MTS	Direct measurement	1	10	V			1.5 to 1.2	μV/V	2	95%	Yes		Approved on 14 March 2006	10
DC voltage meters: intermediate values	DC voltmeter, multimeter, MTS	Direct measurement	10	100	V			6.4 to 3.4	μV/V	2	95%	Yes		Approved on 14 March 2006	11

Electricity and Magnetism, Serbia, DMDM (Directorate of Measures and Precious Metals)

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DC voltage meters: intermediate values	DC voltmeter, multimeter, MTS	Direct measurement	100	1000	V			4.2 to 3.2	$\mu\text{V/V}$	2	95%	Yes		Approved on 14 March 2006	12
DC current sources: low values	Current generator, multifunction calibrator	Voltage drop across standard resistor	0.1	0.1	mA	Power dissipation of standard resistor	0.1 mW	1.3	nA	2	95 %	No		Approved on 22 February 2008	78
DC current sources: intermediate values	Current generator, multifunction calibrator	Voltage drop across standard resistor	0.1	1	mA	Power dissipation of standard resistor	up to 10 mW	1.3 to 12	nA	2	95%	No		Approved on 22 February 2008	79
DC current sources: intermediate values	Current generator, multifunction calibrator	Voltage drop across standard resistor	1	3	mA	Power dissipation of standard resistor	up to 10 mW	12 to 35	nA	2	95%	No		Approved on 22 February 2008	80
DC current sources: intermediate values	Current generator, multifunction calibrator	Voltage drop across standard resistor	3	10	mA	Power dissipation of standard resistor	up to 10 mW	33 to 98	nA	2	95%	No		Approved on 22 February 2008	81
DC current sources: intermediate values	Current generator, multifunction calibrator	Voltage drop across standard resistor	10	30	mA	Power dissipation of standard resistor	up to 10 mW	0.14 to 0.33	μA	2	95%	No		Approved on 22 February 2008	82
DC current sources: intermediate values	Current generator, multifunction calibrator	Voltage drop across standard resistor	30	100	mA	Power dissipation of standard resistor	up to 10 mW	1.2 to 1.4	μA	2	95%	No		Approved on 22 February 2008	83
DC current sources: intermediate values	Current generator, multifunction calibrator	Voltage drop across standard resistor	0.1	1	A	Power dissipation of standard resistor	up to 100 mW	11 to 16	μA	2	95%	No		Approved on 22 February 2008	84
DC current sources: intermediate values	Current generator, multifunction calibrator	Voltage drop across standard resistor	1	3	A	Power dissipation of standard resistor	up to 100 mW	0.11 to 0.32	mA	2	95%	No		Approved on 22 February 2008	85
DC current sources: intermediate values	Current generator, multifunction calibrator	Voltage drop across standard resistor	3	10	A	Power dissipation of standard resistor	up to 100 mW	0.59 to 1.1	mA	2	95%	No		Approved on 22 February 2008	86
DC current sources: intermediate values	Current generator, multifunction calibrator	Voltage drop across standard resistor	10	20	A	Power dissipation of standard resistor	up to 100 mW	3.9 to 4.8	mA	2	95%	No		Approved on 22 February 2008	87
DC current sources: high values	Current generator, multifunction calibrator	Voltage drop across standard resistor	20	30	A	Power dissipation of standard resistor	up to 100 mW	4.8 to 6	mA	2	95%	No		Approved on 22 February 2008	88

Electricity and Magnetism, Serbia, DMDM (Directorate of Measures and Precious Metals)

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Quantity	Instrument or artifact	Instrument Type or Method	Minimum value	Maximum value	units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Uncertainty matrix			
DC current meters: low values	Ammeter, multimeter	Voltage drop across standard resistor	0.1	0.1	mA	Power dissipation of standard resistor	0.1 mW	1.3	nA	2	95 %	No		Approved on 22 February 2008	89	
DC current meters: intermediate values	Ammeter, multimeter	Voltage drop across standard resistor	0.1	1	mA	Power dissipation of standard resistor	up to 10 mW	1.3 to 12	nA	2	95%	No		Approved on 22 February 2008	90	
DC current meters: intermediate values	Ammeter, multimeter	Voltage drop across standard resistor	1	3	mA	Power dissipation of standard resistor	up to 10 mW	12 to 35	nA	2	95%	No		Approved on 22 February 2008	91	
DC current meters: intermediate values	Ammeter, multimeter	Voltage drop across standard resistor	3	10	mA	Power dissipation of standard resistor	up to 10 mW	33 to 98	nA	2	95%	No		Approved on 22 February 2008	92	
DC current meters: intermediate values	Ammeter, multimeter	Voltage drop across standard resistor	10	30	mA	Power dissipation of standard resistor	up to 10 mW	0.14 to 0.33	μA	2	95%	No		Approved on 22 February 2008	93	
DC current meters: intermediate values	Ammeter, multimeter	Voltage drop across standard resistor	30	100	mA	Power dissipation of standard resistor	up to 10 mW	1.2 to 1.4	μA	2	95%	No		Approved on 22 February 2008	94	
DC current meters: intermediate values	Ammeter, multimeter	Voltage drop across standard resistor	0.1	1	A	Power dissipation of standard resistor	up to 100 mW	11 to 16	μA	2	95%	No		Approved on 22 February 2008	95	
DC current meters: intermediate values	Ammeter, multimeter	Voltage drop across standard resistor	1	3	A	Power dissipation of standard resistor	up to 100 mW	0.11 to 0.32	mA	2	95%	No		Approved on 22 February 2008	96	
DC current meters: intermediate values	Ammeter, multimeter	Voltage drop across standard resistor	3	10	A	Power dissipation of standard resistor	up to 100 mW	0.59 to 1.1	mA	2	95%	No		Approved on 22 February 2008	97	
DC current meters: intermediate values	Ammeter, multimeter	Voltage drop across standard resistor	10	20	A	Power dissipation of standard resistor	up to 100 mW	3.9 to 4.8	mA	2	95%	No		Approved on 22 February 2008	98	
DC current meters: high values	Ammeter, multimeter	Voltage drop across standard resistor	20	30	A	Power dissipation of standard resistor	up to 100 mW	4.8 to 6	mA	2	95%	No		Approved on 22 February 2008	99	
DC resistance standards and sources: low values	Fixed resistor, resistance box	Comparison by means of a direct current comparator bridge	100	100	μΩ	Power	100 mW	20	μΩ/Ω	2	95%	Yes		In air, temperature: (23 ± 1) °C. Approved on 14 March 2006	13	

Electricity and Magnetism, Serbia, DMDM (Directorate of Measures and Precious Metals)



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Quantity	Instrument or artifact	Instrument Type or Method	Minimum value	Maximum value	units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Uncertainty matrix	Comments	NMI Service Identifier
DC resistance standards and sources: low values	Fixed resistor, resistance box	Comparison by means of a direct current comparator bridge	1	1	mΩ	Power	100 mW	10	μΩ/Ω	2	95%	Yes		In air, temperature: (23 ± 1) °C. Approved on 14 March 2006	14
DC resistance standards and sources: low values	Fixed resistor, resistance box	Comparison by means of a direct current comparator bridge	10	10	mΩ	Power	100 mW	8.5	μΩ/Ω	2	95%	Yes		In air, temperature: (23 ± 1) °C. Approved on 14 March 2006	15
DC resistance standards and sources: low values	Fixed resistor, resistance box	Comparison by means of a direct current comparator bridge	100	100	mΩ	Power	100 mW	2	μΩ/Ω	2	95%	Yes		Fixed resistor in oil bath, temperature: 23 °C. Approved on 14 March 2006	16
DC resistance standards and sources: low values	Fixed resistor, resistance box	Comparison by means of a direct current comparator bridge	1	1	Ω	Power	10 mW	0.2	μΩ/Ω	2	95%	Yes		Fixed resistor in oil bath, temperature: 23 °C. Approved on 14 March 2006	17
DC resistance standards and sources: intermediate values	Fixed resistor, resistance box	Comparison by means of a direct current comparator bridge	10	10	Ω	Power	10 mW	1	μΩ/Ω	2	95%	Yes		Fixed resistor in oil bath, temperature: 23 °C. Approved on 14 March 2006	18
DC resistance standards and sources: intermediate values	Fixed resistor, resistance box	Comparison by means of a direct current comparator bridge	100	100	Ω	Power	10 mW	2	μΩ/Ω	2	95%	Yes		Fixed resistor in oil bath, temperature: 23 °C. Approved on 14 March 2006	19
DC resistance standards and sources: intermediate values	Fixed resistor, resistance box	Comparison by means of a direct current comparator bridge	1000	1000	Ω	Power	10 mW	7	μΩ/Ω	2	95%	Yes		Fixed resistor in oil bath, temperature: 23 °C. Approved on 14 March 2006	20
DC resistance standards and sources: intermediate values	Fixed resistor, resistance box	Comparison by means of a direct current comparator bridge	10000	10000	Ω	Power	10 mW	8	μΩ/Ω	2	95%	Yes		Fixed resistor in oil bath, temperature: 23 °C. Approved on 14 March 2006	21
DC resistance standards and sources: multiple ranges	Multifunction calibrator: R	Direct method of measurement	1	10	Ω			$(50 + 0.0015\%R)/\sqrt{3}$	μΩ	2	95%	No		Temperature: (23 ± 1) °C. Approved on 14 March 2006	22

Electricity and Magnetism, Serbia, DMDM (Directorate of Measures and Precious Metals)



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Quantity	Instrument or artifact	Instrument Type or Method	Minimum value	Maximum value	units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Uncertainty matrix	Comments	NMI Service Identifier
DC resistance standards and sources: multiple ranges	Multifunction calibrator: <i>R</i>	Direct method of measurement	10	100	Ω			$(0.5 + 0.0012\%R)^{\wedge}3$	m Ω	2	95%	No		Temperature: (23 \pm 1) °C. Approved on 14 March 2006	23
DC resistance standards and sources: multiple ranges	Multifunction calibrator: <i>R</i>	Direct method of measurement	100	1000	Ω			$(0.5 + 0.001\%R)^{\wedge}3$	m Ω	2	95%	No		Temperature: (23 \pm 1) °C. Approved on 14 March 2006	24
DC resistance standards and sources: multiple ranges	Multifunction calibrator: <i>R</i>	Direct method of measurement	1	10	k Ω			$(5 + 0.001\%R)^{\wedge}3$	m Ω	2	95%	No		Temperature: (23 \pm 1) °C. Approved on 14 March 2006	25
DC resistance standards and sources: multiple ranges	Multifunction calibrator: <i>R</i>	Direct method of measurement	10	100	k Ω			$(50 + 0.001\%R)^{\wedge}3$	m Ω	2	95%	No		Temperature: (23 \pm 1) °C. Approved on 14 March 2006	26
DC resistance standards and sources: multiple ranges	Multifunction calibrator: <i>R</i>	Direct method of measurement	0.1	1	M Ω			$(2 + 0.0015\%R)^{\wedge}3$	Ω	2	95%	No		Temperature: (23 \pm 1) °C. Approved on 14 March 2006	27
DC resistance standards and sources: multiple ranges	Multifunction calibrator: <i>R</i>	Direct method of measurement	1	10	M Ω			$(100 + 0.005\%R)^{\wedge}3$	Ω	2	95%	No		Temperature: (23 \pm 1) °C. Approved on 14 March 2006	28
DC resistance standards and sources: multiple ranges	Multifunction calibrator: <i>R</i>	Direct method of measurement	10	100	M Ω			$(1 + 0.05\%R)^{\wedge}3$	k Ω	2	95%	No		Temperature: (23 \pm 1) °C. Approved on 14 March 2006	29
DC resistance standards and sources: multiple ranges	Multifunction calibrator: <i>R</i>	Direct method of measurement	0.1	1	G Ω			$(10 + 0.5\%R)^{\wedge}3$	k Ω	2	95%	No		Temperature: (23 \pm 1) °C. Approved on 14 March 2006	30
DC resistance meters: low values	Multimeter, resistance bridge	Direct method of measurement	100	100	$\mu\Omega$			20	$\mu\Omega/\Omega$	2	95%	Yes		Temperature: (23 \pm 1) °C. Approved on 14 March 2006	31
DC resistance meters: low values	Multimeter, resistance bridge	Direct method of measurement	1	1	m Ω			10	$\mu\Omega/\Omega$	2	95%	Yes		Temperature: (23 \pm 1) °C. Approved on 14 March 2006	32
DC resistance meters: low values	Multimeter, resistance bridge	Direct method of measurement	10	10	m Ω			8.5	$\mu\Omega/\Omega$	2	95%	Yes		Temperature: (23 \pm 1) °C. Approved on 14 March 2006	33
DC resistance meters: low values	Multimeter, resistance bridge	Direct method of measurement	100	100	m Ω			2	$\mu\Omega/\Omega$	2	95%	Yes		Temperature: (23 \pm 1) °C. Approved on 14 March 2006	34

Electricity and Magnetism, Serbia, DMDM (Directorate of Measures and Precious Metals)



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DC resistance meters: low values	Multimeter, resistance bridge	Direct method of measurement	1	1	Ω			0.5	$\mu\Omega/\Omega$	2	95%	Yes		Temperature: (23 \pm 1) °C. Approved on 14 March 2006	35
DC resistance meters: intermediate values	Ohmmeter, multimeter, resistance bridge	Direct method of measurement	10	10	Ω			1	$\mu\Omega/\Omega$	2	95%	Yes		Temperature: (23 \pm 1) °C. Approved on 14 March 2006	36
DC resistance meters: intermediate values	Ohmmeter, multimeter, resistance bridge	Direct method of measurement	100	100	Ω			2	$\mu\Omega/\Omega$	2	95%	Yes		Temperature: (23 \pm 1) °C. Approved on 14 March 2006	37
DC resistance meters: intermediate values	Ohmmeter, multimeter, resistance bridge	Direct method of measurement	1	1	$k\Omega$			7	$\mu\Omega/\Omega$	2	95%	Yes		Temperature: (23 \pm 1) °C. Approved on 14 March 2006	38
DC resistance meters: intermediate values	Ohmmeter, multimeter, resistance bridge	Direct method of measurement	10	10	$k\Omega$			0.2	$\mu\Omega/\Omega$	2	95%	Yes		Temperature: (23 \pm 1) °C. Approved on 14 March 2006	39
DC resistance meters: intermediate values	Ohmmeter, multimeter, resistance bridge	Direct method of measurement	100	100	$k\Omega$			16	$\mu\Omega/\Omega$	2	95%	Yes		Temperature: (23 \pm 1) °C. Approved on 14 March 2006	40
DC resistance meters: intermediate values	Ohmmeter, multimeter, resistance bridge	Direct method of measurement	1	1	$M\Omega$			20	$\mu\Omega/\Omega$	2	95%	Yes		Temperature: (23 \pm 1) °C. Approved on 14 March 2006	41
DC resistance meters: intermediate values	Ohmmeter, multimeter, resistance bridge	Direct method of measurement	10	10	$M\Omega$			60	$\mu\Omega/\Omega$	2	95%	Yes		Temperature: (23 \pm 1) °C. Approved on 14 March 2006	42
DC resistance meters: intermediate values	Ohmmeter, multimeter	Comparison by means of reference DMM	100	100	$M\Omega$			500	$\mu\Omega/\Omega$	2	95%	Yes		Temperature: (23 \pm 1) °C. Approved on 14 March 2006	43
DC resistance meters: intermediate values	Ohmmeter, multimeter	Comparison by means of reference DMM	1	1	$G\Omega$			5000	$\mu\Omega/\Omega$	2	95%	Yes		Temperature: (23 \pm 1) °C. Approved on 14 March 2006	44
Capacitance: dielectric capacitors	Fixed capacitor, mica, polystyrene, four terminal-pair	LCR meter	0.01	10000	nF	Frequency	20 Hz to 2 MHz	0.59 to 8.07	mF/F	2	95%	Yes	Cap_1	Approved on 17 August 2011	109
Capacitance: meters	Capacitance bridge, LCR meter	Direct measurement	1	1000	pF	Frequency	100 Hz to 1 MHz	0.005 to 0.26	mF/F	2	95%	Yes	Cap_2	Approved on 17 August 2011	110

Electricity and Magnetism, Serbia, DMDM (Directorate of Measures and Precious Metals)

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Inductance: meters	Inductance bridge, LCR meter	Direct measurement	0.1	10000	mH	Frequency	100 Hz, 1 kHz	0.2 to 0.5	mH/H	2	95%	Yes	Induct_1	Approved on 17 August 2011	111	
AC voltage: AC-DC transfer difference at low voltages	AC-DC transfer standard, thermal converters	Comparison	10	500	mV	Frequency	10 Hz to 1 MHz	17 to 240	µV/V	2	95%	Yes	matrix AC-DC transfer standard	Approved on 17 August 2011	45	
AC voltage: AC-DC transfer difference at medium voltages	AC-DC transfer standard, thermal converters	Comparison	0.5	5	V	Frequency	10 Hz to 1 MHz	10 to 56	µV/V	2	95%	Yes	matrix AC-DC transfer standard	Approved on 17 August 2011	46	
AC voltage: AC-DC transfer difference at higher voltages	AC-DC transfer standard, thermal converters	Comparison	5	1000	V	Frequency	10 Hz to 1 MHz	13 to 73	µV/V	2	95%	Yes	matrix AC-DC transfer standard	Approved on 17 August 2011	47	
AC voltage up to 1000 V: sources	Multifunction calibrator	Comparison	0.5	5	V	Frequency	500 Hz to 50 kHz	0.2 to 0.3	mV/V	2	95%	Yes	Multifunction calibrator	Approved on 14 March 2006	52	
AC voltage up to 1000 V: sources	Multifunction calibrator	Comparison	0.5	5	V	Frequency	50 kHz to 1 MHz	0.2 to 1.5	mV/V	2	95%	Yes	Multifunction calibrator	Approved on 14 March 2006	53	
AC voltage up to 1000 V: sources	Multifunction calibrator	Comparison	5	10	V	Frequency	500 Hz to 50 kHz	0.2	mV/V	2	95%	Yes	Multifunction calibrator	Approved on 14 March 2006	54	
AC voltage up to 1000 V: sources	Multifunction calibrator	Comparison	5	10	V	Frequency	50 kHz to 1 MHz	0.2 to 1.7	mV/V	2	95%	Yes	Multifunction calibrator	Approved on 14 March 2006	55	
AC voltage up to 1000 V: sources	Multifunction calibrator	Comparison	100	100	V	Frequency	500 Hz to 100 kHz	0.7 to 0.8	mV/V	2	95%	Yes	Multifunction calibrator	Approved on 14 March 2006	56	
AC voltage up to 1000 V: meters	AC voltmeter, multimeter	Comparison	10	100	mV	Frequency	20 Hz to 100 kHz	0.18 to 6	mV/V	2	95%	Yes	AC voltage	Approved on 22 February 2008	57	
AC voltage up to 1000 V: meters	AC voltmeter, multimeter	Comparison	1	10	V	Frequency	20 Hz to 1 MHz	0.12 to 11.8	mV/V	2	95%	Yes	AC voltage	Approved on 22 February 2008	58	
AC voltage up to 1000 V: meters	AC voltmeter, multimeter	Comparison	10	100	V	Frequency	20 Hz to 1 MHz	0.12 to 11.8	mV/V	2	95%	Yes	AC voltage	Approved on 22 February 2008	60	
AC voltage up to 1000 V: meters	AC voltmeter, multimeter	Comparison	100	1000	V	Frequency	20 Hz to 100 kHz	0.26 to 1.4	mV/V	2	95%	Yes	AC voltage	Approved on 22 February 2008	62	
AC current up to 100 A: sources	Multifunction calibrator, transconductance amplifier	Direct measurement	0.1	1000	mA	Frequency	10 Hz to 10 kHz	0.68 to 7.9	mA/A	2	95%	Yes	AC current 1	Approved on 22 February 2008	100	
AC current up to 100 A: meters	AC ammeter, multimeter, current transducers	Direct comparison	0.1	1000	mA	Frequency	45 Hz to 5 kHz	0.21 to 0.58	mA/A	2	95%	Yes	AC current 2	Approved on 22 February 2008	101	
AC current up to 100 A: meters	AC ammeter, multimeter, current transducers	Direct comparison	0.05	100	A	Frequency	50 Hz to 60 Hz	0.08 to 0.11	mA/A	2	95%	Yes		Approved on 22 February 2008	102	

Electricity and Magnetism, Serbia, DMDM (Directorate of Measures and Precious Metals)



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AC power and energy: single phase ($f \leq 400$ Hz), active power	Power meter, power convertor, wattmeter	Direct comparison	0	1200	W	Voltage	12 V to 240 V	66 to 80	μ W/VA	2	95 %	Yes		The expanded uncertainties are referred to the apparent power of the range of the watt-convertor. Uncertainties are minimum and maximum values. Approved on 22 February 2008	75
						Current	0.05 A to 5 A								
						Power factor	1 to 0, inductive or capacitive								
						Frequency	45 Hz to 65 Hz								
AC power and energy: single phase ($f \leq 400$ Hz), active power	Power meter, power convertor, wattmeter	Direct comparison	0	48000	W	Voltage	30 V to 480 V	116 to 129	μ W/VA	2	95 %	Yes		Uncertainties are minimum and maximum values. Approved on 22 February 2008	103
						Current	0.05 A to 100 A								
						Power factor	1 to 0, inductive or capacitive								
						Frequency	50 Hz to 60 Hz								
AC power and energy: single phase ($f \leq 400$ Hz), reactive power	Power meter, power convertor	Direct comparison	0	48000	var	Voltage	30 V to 480 V	116 to 129	μ var/VA	2	95 %	Yes		Uncertainties are minimum and maximum values. Approved on 22 February 2008	76
						Current	0.05 A to 100 A								
						Power factor	1 to 0, inductive or capacitive								
						Frequency	50 Hz to 60 Hz								

Electricity and Magnetism, Serbia, DMDM (Directorate of Measures and Precious Metals)



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AC power and energy: single phase ($f \leq 400$ Hz), apparent power	Power meter, power convertor, wattmeter	Sampling method	6	1200	VA	Voltage	12 V to 240 V	43 to 62	$\mu\text{VA}/\text{VA}$	2	95 %	Yes		The expanded uncertainties are referred to the apparent power measured. Uncertainties are minimum and maximum values. Approved on 22 February 2008	77
						Current	0.05 A to 5 A								
						Power factor	1 to 0, inductive or capacitive								
						Frequency	45 Hz to 65 Hz								
AC power and energy: single phase ($f \leq 400$ Hz), active energy	Energy meter	Direct comparison	0.4	4800000	Ws	Voltage	30 V to 480 V	116 to 129	$\mu\text{Wh}/\text{VAh}$	2	95%	Yes		Uncertainties are minimum and maximum values. Approved on 22 February 2008	104
						Current	0.05 A to 100 A								
						Power factor	1 to 0.25, inductive or capacitive								
						Frequency	50 Hz to 60 Hz								
AC power and energy: single phase ($f \leq 400$ Hz), reactive energy	Energy meter	Direct comparison	0.4	4800000	vars	Voltage	30 V to 480 V	116 to 129	$\mu\text{varh}/\text{VAh}$	2	95%	Yes		Uncertainties are minimum and maximum values. Approved on 22 February 2008	105
						Current	0.05 A to 100 A								
						Reactive power factor	1 to 0.25, inductive or capacitive								
						Frequency	50 Hz to 60 Hz								
						Measurement time	1 s to 100 s								

Electricity and Magnetism, Serbia, DMDM (Directorate of Measures and Precious Metals)

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Quantity	Instrument or artifact	Instrument Type or Method	Minimum value	Maximum value	units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Uncertainty matrix	Comments	NMI Service Identifier
AC power and energy: three phase, active energy	Energy meter	Direct comparison	0.4	4800000	Ws	Voltage	30 V to 480 V	116 to 129	μWh/VAh	2	95%	Yes		Range values per phase. Uncertainties are minimum and maximum values. Approved on 22 February 2008	106
						Current	0.05 A to 100 A								
						Power factor	1 to 0.25, inductive or capacitive								
						Frequency	50 Hz to 60 Hz								
AC power and energy: three phase, reactive energy	Energy meter	Direct comparison	0.4	4800000	vars	Voltage	30 V to 480 V	116 to 129	μvarh/VAh	2	95%	Yes		Range values per phase. Uncertainties are minimum and maximum values. Approved on 22 February 2008	107
						Current	0.05 A to 100 A								
						Reactive power factor	1 to 0.25, inductive or capacitive								
						Frequency	50 Hz to 60 Hz								
Phase angle: sources	Phase source	Direct measurement	0	360	°	Frequency	50 Hz to 100 kHz	0.04 to 1.68	°	2	95 %	No	Phase angle	Approved on 22 February 2008	108
						Voltage	10 mV to 350 V								
Current and voltage waveform: main frequency current harmonics	Main frequency harmonics analyser, flicker meter	Comparison	0.016	10	A	Harmonic number	1 to 50	0.4 to 2.9 (of fundamental)	mA/A	2	95%	Yes	matrix I harmonics	For IEC 61000-3-2, IEC 61000-3-3, current in A dependent on wave shape Approved on 17 August 2011	112
Current and voltage waveform: flicker severity (Pst), square or sine wave modulation	Flicker meter	Comparison	0.5	10		Voltage	120 V, 230 V	0.05		2	95%	No		For IEC 61000-3-2, IEC 61000-3-3 Approved on 17 August 2011	113

Electricity and Magnetism, Serbia, DMDM (Directorate of Measures and Precious Metals)

Uncertainties table: AC voltage

AC voltage up to 1000 V: meters, DMDM Internal Identifiers: 57, 58, 60, 62

	20 Hz to 50 Hz	51 Hz to 1 kHz	1.1 kHz to 20 kHz	21 kHz to 50 kHz	51 kHz to 100 kHz	101 kHz to 200 kHz	201 kHz to 500 kHz	501 kHz to 1 MHz
10 mV	0.61	0.61	0.69	-	6	-	-	-
100 mV	0.18	0.18	0.24	-	1.2	-	-	-
1 V	0.12 to 0.20	0.12	0.19	0.38	0.96	3.6	11.7	11.8
10 V	0.12 to 0.20	0.12 to 0.32	0.19	0.38	0.95	3.6	11.7	11.8
100 V	0.26	0.26	0.26	-	1.4	-	-	-
1000 V	0.5	0.5	-	-	-	-	-	-

The expanded uncertainties given in this table are expressed in mV/V

Electricity and Magnetism, Serbia, DMDM (Directorate of Measures and Precious Metals)

Uncertainties table: AC current 1

AC current up to 100 A: sources, DMDM Internal Identifier: 100

	10 Hz, 20 Hz	21 Hz to 50 Hz	51 Hz to 1 kHz	1.1 kHz to 5 kHz	5.1 kHz to 10 kHz
0.1 mA	-	1.1	1.1	-	-
1 mA	-	1.0	0.7	2.1	2.2
10 mA	-	0.99	0.68	1.6	1.8
30 mA	-	-	1.2	-	-
50 mA	-	-	0.88	-	-
100 mA	4.9	0.99	0.68	0.7	1.4
1 A	-	1.3	1.5	7.1	7.9

The expanded uncertainties given in this table are expressed in mA/A

Electricity and Magnetism, Serbia, DMDM (Directorate of Measures and Precious Metals)

Uncertainties table: AC current 2

AC current up to 100 A: meters, DMDM Internal Identifier: 101

	45 Hz to 1 kHz	1.1 kHz to 5 kHz
0.1 mA	0.25	0.43
1 mA	0.22	0.35
10 mA	0.22	0.30
100 mA	0.21	0.28
1000 mA	0.36	0.58

The expanded uncertainties given in this table are expressed in mA/A

Electricity and Magnetism, Serbia, DMDM (Directorate of Measures and Precious Metals)

Uncertainties table: Phase angle

Phase angle: sources, DMDM Internal Identifier: 108

	$U_1 = U_2$	$U_2 / U_1 \leq 1000$
50 Hz to 100 Hz	0.04	0.06 to 0.21
100 Hz to 1 kHz	0.08	0.18 to 0.48
1 kHz to 10 kHz	0.08 to 0.14	0.18 to 0.78
10 kHz to 100 kHz	0.14 to 0.83	0.29 to 1.68

U_1 and U_2 are signals whose phase difference is measured

The expanded uncertainties given in this table are expressed in °.

Electricity and Magnetism, Serbia, DMDM (Directorate of Measures and Precious Metals)**Uncertainties table: AC-DC transfer standard**

AC voltage, DMDM Internal Identifiers: 45, 46, 47

	10 Hz	20 Hz	40 Hz	500 Hz	1 kHz	10 kHz	20 kHz	50 kHz	100 kHz	200 kHz	500 kHz	700 kHz	1 MHz
10 mV	230	220	210	220	210	220	220	220	230	220	230	230	240
20 mV	110	94	96	95	91	91	91	96	100	100	110	120	150
30 mV	81	64	64	60	60	60	59	64	68	73	81	100	110
60 mV	55	47	47	47	47	47	47	47	47	55	64	81	90
100 mV	37	37	37	37	37	37	37	33	37	33	37	46	60
200 mV	37	37	37	37	37	37	37	37	33	37	46	60	60
400 mV	24	24	24	17	17	17	18	18	20	28	37	47	52
600 mV	17	17	17	17	17	17	17	17	20	28	37	47	52
1 V	14	14	13	13	13	13	13	13	14	17	24	35	44
2 V	11	11	11	10	10	10	10	11	11	14	23	33	43
3 V	12	11	11	10	10	10	10	11	11	14	23	33	43
6 V	18	16	15	13	13	13	13	13	16	21	28	42	56
10 V	23	18	18	14	14	14	14	14	18	25	32	47	64
20 V	27	21	21	16	16	16	16	16	22	27	37	53	73
30 V	30	25	24	17	17	18	18	18	25	25	-	-	-
60 V	39	30	29	22	22	22	22	22	30	40	-	-	-
100 V	40	30	30	22	22	22	22	22	30	-	-	-	-
200 V	43	33	33	24	24	24	24	24	33	-	-	-	-
300 V	48	36	37	27	27	27	27	27	36	-	-	-	-
600 V	53	40	40	27	27	27	27	27	40	-	-	-	-
800 V	58	43	40	27	27	27	27	28	42	-	-	-	-
1000 V	57	43	40	27	27	27	27	28	42	-	-	-	-

The expanded uncertainties given in this table are expressed in mV/V

Electricity and Magnetism, Serbia, DMDM (Directorate of Measures and Precious Metals)

Uncertainties table: Multifunction calibrator

AC voltage up to 1000 V, DMDM Internal Identifiers: 52, 53, 54, 55, 56

	500 Hz	50 kHz	100 kHz	1 MHz
0.5 V	0.2	0.3	-	1.4
1 V	0.2	0.2	-	1.4
2 V	0.2	0.2	-	1.4
5 V	0.2	0.2	-	1.5
10 V	0.2	0.2	-	1.7
100 V	0.7	-	0.8	-

The expanded uncertainties given in this table are expressed in mV/V

Electricity and Magnetism, Serbia, DMDM (Directorate of Measures and Precious Metals)

Uncertainties table: Cap_1

Capacitance: dielectric capacitors, DMDM Internal Identifiers: 109

	20 Hz	120 Hz	1 kHz	10 kHz	100 kHz	1 MHz	2 MHz
0.01 nF	-	-	-	-	0.81	0.72 to 0.81	0.84
0.1 nF	-	-	-	-	0.62	0.61 to 0.63	0.71
1 nF	-	-	0.71 to 1.31	-	-	0.59 to 0.69	0.60 to 0.78
100 nF	-	0.6	-	-	0.69	-	-
10000 nF	3.06	3.06	3.1	3.56	8.07	-	-

The expanded uncertainties given in this table are expressed in mF/F.

Electricity and Magnetism, Serbia, DMDM (Directorate of Measures and Precious Metals)

Uncertainties table: Cap_2

Capacitance: meters, DMDM Internal Identifiers: 110

	1 kHz	100 Hz to 1 MHz
1 pF	0.01	0.03 to 0.26
10 pF	0.007	0.012 to 0.13
100 pF	0.007	0.012 to 0.09
1000 pF	0.005	0.01 to 0.014

The expanded uncertainties given in this table are expressed in mF/F.

Electricity and Magnetism, Serbia, DMDM (Directorate of Measures and Precious Metals)

Uncertainties table: Induct_1

Inductance: meters, DMDM Internal Identifiers: 111

	100 Hz	1 kHz
0.1 mH to 1000 mH	-	0.2
1 H to 10 H	0.5	0.2

The expanded uncertainties given in this table are expressed in mH/H.

Electricity and Magnetism, Serbia, DMDM (Directorate of Measures and Precious Metals)

Uncertainties table: matrix I harmonics

Current and voltage waveform, DMDM Internal Identifiers: 112

	1	2 to 9	10 to 17	18 to 50
0.016 A to 10 A	0.4	-	-	-
(0.016 A to 10 A)/n	-	1.4	1.7	2.9

n, number of harmonics

The expanded uncertainties given in this table are expressed in mA/A.