Organisme belge d'Accréditation
Belgische Accreditatieinstelling
Belgische Akkreditierungsstelle
Belgian Accreditation Body

EA MLA Signatory

Certificat d'Accréditation n° 001-CAL

En application des dispositions de l'arrêté royal du 31 janvier 2006 créant BELAC, le Bureau d'Accréditation atteste avoir délivré une accréditation conformément aux exigences de la norme EN ISO/IEC 17025:2017 à:

TRESCAL nv

Nijverheidsstraat 70

2160 Wommelgem

Numéro d'entreprise: 0414.459.224

L'organisme a démontré posséder la compétence pour effectuer les activités réalisées dans les sites d'activités mentionnés dans la portée d'accréditation 001-CAL qui fait partie intégrante du présent certificat.

La version en vigueur de la portée d'accréditation est disponible via www.belac.be.

Ce certificat reste valable à condition que l'organisme continue de répondre aux conditions d'accréditation.

La Présidente du Bureau d'Accréditation BELAC,



Maureen LOGGHE

Version : **16**

Période de validité : **2026-09-24 - 2031-06-01**

La version originale de ce certificat est en néerlandais.

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BELAC 6-319 R2-2025

Organisme belge d'Accréditation
Belgische Accreditatieinstelling
Belgische Akkreditierungsstelle
Belgian Accreditation Body

EA MLA Signatory

Accreditatiecertificaat nr. 001-CAL

In uitvoering van de beschikkingen van het koninklijk besluit van 31 januari 2006 tot oprichting van BELAC, verklaart het Accreditatiebureau accreditatie conform de eisen van de norm EN ISO/IEC 17025:2017 te hebben verleend aan:

TRESCAL nv

Nijverheidsstraat 70

2160 Wommelgem

Ondernemingsnummer: 0414.459.224

De instelling heeft aangetoond bekwaamheid te bezitten voor de activiteiten uitgevoerd in de activiteitencentra zoals gespecificeerd in de accreditatiescope 001-CAL die integraal deel uitmaakt van dit certificaat.

De huidige versie van de accreditatiescope is beschikbaar op www.belac.be.

Dit certificaat blijft geldig onder voorwaarde dat de instelling blijft voldoen aan de accreditatievoorwaarden.

De Voorzitster van het Accreditatiebureau BELAC,

Maureen LOGGHE

Versie : **16**

Geldigheidsduur : **2026-09-24 - 2031-06-01**

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BELAC 6-319 R2-2025

Organisme belge d'Accréditation
Belgische Accreditatieinstelling
Belgische Akkreditierungsstelle
Belgian Accreditation Body

EA MLA Signatory

Accreditation Certificate No. 001-CAL

In compliance with the provisions of the Royal Decree of 31 January 2006 setting up BELAC, the Accreditation Board hereby declares to have granted accreditation conform the requirements of the standard EN ISO/IEC 17025:2017 to:

TRESCAL nv

Nijverheidsstraat 70

2160 Wommelgem

Enterprise number: 0414.459.224

The body demonstrated the competence to perform the activities in the activity sites, as described in the scope of accreditation 001-CAL which is an integral part of the present certificate.

The current version of the scope of accreditation is available at www.belac.be.

This certificate remains valid as long as the body continues to meet the accreditation conditions.

The Chair of the Accreditation Board BELAC,

Maureen LOGGHE

Version : **16**

Validity period : **2026-09-24 - 2031-06-01**

Original version of this certificate is in Dutch.

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BELAC 6-319 R2-2025

Organisme belge d'Accréditation
Belgische Accreditatieinstelling
Belgische Akkreditierungsstelle
Belgian Accreditation Body

EA MLA Signatory

Akkreditierungszertifikat Nr. 001-CAL

Aufgrund der Bestimmungen des königlichen Erlasses vom 31. Januar 2006 zur Gründung von BELAC, bestätigt das Akkreditierungsbüro, gemäß den Vorschriften der Norm EN ISO/IEC 17025:2017, die folgende Stelle akkreditiert zu haben:

TRESCAL nv

Nijverheidsstraat 70

2160 Wommelgem

Unternehmensnummer: 0414.459.224

Die Stelle hat ihre Kompetenz für die in den Aktivitätszentren durchgeführten Aktivitäten gemäß dem Geltungsbereich der Akkreditierung 001-CAL, der ein integraler Bestandteil des vorliegenden Zertifikats ist, nachgewiesen.

Die aktuelle Version des Geltungsbereichs der Akkreditierung ist unter www.belac.be verfügbar.

Dieses Zertifikat bleibt unter der Bedingung gültig, dass die Stelle die Akkreditierungsanforderungen weiterhin erfüllt.

Die Vorsitzende des Akkreditierungsbüros BELAC,

Maureen LOGGHE

Fassung : **16**

Gültigkeitsdauer : **2026-09-24 - 2031-06-01**

Die Originalfassung dieses Zertifikats ist in niederländischer Sprache.

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BELAC 6-319 R2-2025

Bijlage bij accreditatiecertificaat
Annexe au certificat d'accréditation
Annex to the accreditation certificate
Beilage zur Akkreditierungszertifikat

001-CAL

EN ISO/IEC 17025:2017

Versie / Version / Version / Fassung	27
Geldigheidsperiode / Validité / Validity / Gültigkeitsdauer	2026-09-24 - 2031-06-01



Maureen Logghe
Voorzitster van het Accreditatiebureau
La Présidente du Bureau d'Accréditation
Chair of the Accreditation Board
Vorsitzende des Akkreditierungsbüro

De accreditatie werd uitgereikt aan / L'accréditation est délivrée à / The accreditation is granted to / Die akkreditierung wurde erteilt für:

TRESCAL nv
Nijverheidsstraat 70
2160 Wommelgem

Ondernemingsnummer / Numéro d'entreprise / Enterprise number / Unternehmensnummer:
0414.459.224

Activiteitencentra / Sites d'activités / Sites of activities / Standorte mit aktivitäten:

Locatie - WOMMELGEM (Ant.)	Nijverheidsstraat 70 2160 Wommelgem
Locatie - LOUVAIN-LA-NEUVE (LLN)	Rue du Bosquet 7 1348 Ottignies-Louvain-la-Neuve
Locatie - ON SITE (OS)	op de locatie van de klant / het object

DCLF Electricity:

Calibration and Measurement Capabilities

Direct voltage
Measure

Measuring range or point	Frequency	expanded uncertainty (*)	Remark	Calib
± 100 mV	DC	$5{,}0 \times 10^{-6} \times U$	• Transfer standard in "30 day" loop • Fixed points • positive /negative • measuring	P1-02- P1-02- P1-02- P1-02- P1-02-
± 1 V	DC	$2{,}7 \times 10^{-6} \times U$		
± 10 V	DC	$2{,}1 \times 10^{-6} \times U$		
± 19 V	DC	$2{,}3 \times 10^{-6} \times U$		
± 100 V	DC	$3{,}0 \times 10^{-6} \times U$		
± 1000 V	DC	$3{,}0 \times 10^{-6} \times U$		

Measuring range or point	Frequency	expanded uncertainty (*)	Remark	Calib
0 mV to 200 mV	DC	$7{,}0 \times 10^{-6} \times U$ or 0,1 µV[1]	• measure • positive / negative	P1-02- P1-02- P1-02- P1-02- P1-02-
0,2 V to 2 V	DC	$5{,}0 \times 10^{-6} \times U$		
2 V to 20 V	DC	$4{,}5 \times 10^{-6} \times U$		
20 V to 200 V	DC	$5{,}5 \times 10^{-6} \times U$		
200 V to 1000 V	DC	$5{,}5 \times 10^{-6} \times U$		
1 kV to 75 kV	DC	$3{,}0 \times 10^{-4} \times U$	Measure	
0,2 V to 11 V	DC	$1{,}0 \times 10^{-4} \times U$	Loop calibration	P1-02- P1-02- P1-02- P1-02- P1-02-

[1] Whichever is greater

Direct voltage Generate				
Generating range or point	**Frequency**	**expanded uncertainty (*)**	**Remark**	**Calib**
100 mV	DC	$1{,}5 \times 10^{-6} \times U$	• generate / measure • Fixed points with Zener	
1 V, 10 V, 100 V	DC	$1 \times 10^{-6} \times U$		
1000 V	DC	$1{,}2 \times 10^{-6} \times U$		
Generating range or point	**Frequency**	**expanded uncertainty (*)**	**Remark**	**Calib**
0 mV to 200 mV	DC	$18 \times 10^{-6} \times U$ or 0,5 µV[1]	• generate • positive / negative	P1-02- P1-02- P1-02- P1-02- P1-02-
0,2 V to 2 V	DC	$8{,}0 \times 10^{-6} \times U$		
2 V to 20 V	DC	$4{,}5 \times 10^{-6} \times U$		
20 V to 200 V	DC	$7{,}0 \times 10^{-6} \times U$		
200 V to 1100 V	DC	$10 \times 10^{-6} \times U$		
1,1 kV to 40 kV	DC	$3{,}0 \times 10^{-4} \times U$	Generate	
0,2 V to 11 V	DC	$1{,}0 \times 10^{-4} \times U$	Loop calibration	P1-02- P1-02- P1-02- P1-02- P1-02-

[1] Whichever is greater

Direct current
Measure

Measuring range or point	**Frequency**	**expanded uncertainty (*)**	**Remark**	**Calib**
±100 µA	DC	$24 \times 10^{-6} \times I$	• Transfer standard in "30 day" loop • Fixed points • positive / negative • Measurement	P1-02- P1-02- P1-02- P1-02- P1-02-
±1 mA	DC	$16 \times 10^{-6} \times I$		
±10 mA	DC	$16 \times 10^{-6} \times I$		
±100 mA	DC	$19 \times 10^{-6} \times I$		
±1 A	DC	$31 \times 10^{-6} \times I$		
±10 A	DC	$60 \times 10^{-6} \times I$		

Measuring range or point	Frequency	expanded uncertainty (*)	Remark	Cali
1 pA to 10 pA	DC	$2 \times 10^{-3} \times I$	• measure / generate • positive / negative • with standard resistances	P1-02- P1-02- P1-02- P1-02- P1-02-
10 pA to 100 pA	DC	$1 \times 10^{-3} \times I$		
100 pA to 1 nA	DC	$3 \times 10^{-4} \times I$		
1 nA to 10 nA	DC	$1 \times 10^{-4} \times I$		
10 nA to 100 nA	DC	$6 \times 10^{-5} \times I$		
100 nA to 100 mA	DC	$5 \times 10^{-6} \times I$		
100 mA to 1 A	DC	$1 \times 10^{-5} \times I$		
1 A to 10 A	DC	$2 \times 10^{-5} \times I$		

Measuring range or point	Frequency	expanded uncertainty (*)	Remark	Cali
0 µA to 200 µA	DC	$12 \times 10^{-6} \times I$ or 0,5 nA[1]	• measure • in the lowest possible range • positive / negative	P1-02- P1-02- P1-02- P1-02- P1-02-
0,2 mA to 2 mA	DC	$11 \times 10^{-6} \times I$		
2 mA to 20 mA	DC	$9{,}0 \times 10^{-6} \times I$		
20 mA to 200 mA	DC	$16 \times 10^{-6} \times I$		
0,2 A to 2 A	DC	$90 \times 10^{-6} \times I$		
2 A to 20 A	DC	$90 \times 10^{-6} \times I$		
0,2 mA to 24 mA	DC	$1{,}0 \times 10^{-4} \times I$	Loop calibration	P1-02- P1-02- P1-02- P1-02- P1-02-

[1] Whichever is greater

Measuring range or point	Frequency	expanded uncertainty (*)	Remark	Cali
20 A to 3000 A	DC	$2{,}0 \times 10^{-4} \times I$	measure/generate	P1-02-

Calibration of current clamps

Measuring range or point	Frequency	expanded uncertainty (*)	Remark	Cali
20 A to 1000 A	DC	$5{,}0 \times 10^{-3} \times I$	• with current coils	

Generate

Generating range or point	Frequency	expanded uncertainty (*)	Remark	Cali
0 µA to 20 µA	DC	1,5 nA	• generate • positive / negative	P1-02- P1-02- P1-02- P1-02- P1-02-
20 µA to 200 µA	DC	$1{,}7 \times 10^{-4} \times I$		
0,2 mA to 200 mA	DC	$0{,}70 \times 10^{-4} \times I$		
0,2 A to 2 A	DC	$1{,}9 \times 10^{-4} \times I$		
2 A to 11 A	DC	$2{,}7 \times 10^{-4} \times I$		
11 A to 20 A	DC	$6{,}0 \times 10^{-4} \times I$		
0,2 mA to 24 mA	DC	$1{,}0 \times 10^{-4} \times I$	Loop calibration	P1-02- P1-02- P1-02- P1-02- P1-02-

Alternating voltage

Measure

Measuring range or point	Frequency	expanded uncertainty (*)	Remark	Cali
1 mV	20 Hz to 20 kHz	$3{,}0 \times 10^{-4} \times U + 2$ µV	• Transfer standard in "30 day" loop • Fixed points • measuring	P1-02- P1-02- P1-02- P1-02- P1-02-
	30 kHz & 50 kHz	$4{,}0 \times 10^{-4} \times U + 2$ µV		
	100 kHz	$6{,}5 \times 10^{-4} \times U + 2$ µV		
10 mV	20 Hz to 20 kHz	$1{,}7 \times 10^{-4} \times U + 2$ µV		
	30 kHz & 50 kHz	$2{,}5 \times 10^{-4} \times U + 2$ µV		
	100 kHz	$4{,}5 \times 10^{-4} \times U + 2$ µV		
100 mV	20 Hz to 20 kHz	$1{,}2 \times 10^{-4} \times U + 2$ µV		
	30 kHz & 50 kHz	$2{,}0 \times 10^{-4} \times U + 2$ µV		
	100 kHz	$4{,}0 \times 10^{-4} \times U + 2$ µV		
1 V	10 Hz to 30 Hz	$4{,}0 \times 10^{-5} \times U$		
	40 Hz to 30 kHz	$3{,}0 \times 10^{-5} \times U$		
	50 kHz	$4{,}0 \times 10^{-5} \times U$		
	100 kHz	$5{,}0 \times 10^{-5} \times U$		
	300 kHz	$12 \times 10^{-5} \times U$		
	500 kHz	$25 \times 10^{-5} \times U$		
	1 MHz	$60 \times 10^{-5} \times U$		

10 V	10 Hz to 30 Hz	$4{,}0 \times 10^{-5} \times U$	• Transfer standard in "30 day" loop • Fixed points • measuring	P1-02- P1-02- P1-02- P1-02- P1-02-
	40 Hz to 30 kHz	$3{,}0 \times 10^{-5} \times U$		
	50 kHz	$3{,}5 \times 10^{-5} \times U$		
	100 kHz	$4{,}0 \times 10^{-5} \times U$		
	300 kHz	$11 \times 10^{-5} \times U$		
	500 kHz	$22 \times 10^{-5} \times U$		
	1 MHz	$60 \times 10^{-5} \times U$		
19 V	1 kHz	$4{,}0 \times 10^{-5} \times U$		
100 V	10 Hz to 30 Hz	$4{,}5 \times 10^{-5} \times U$		
	40 Hz & 55 Hz	$4{,}0 \times 10^{-5} \times U$		
	300 Hz to 20 kHz	$3{,}0 \times 10^{-5} \times U$		
	30 kHz	$3{,}5 \times 10^{-5} \times U$		
	50 kHz	$4{,}5 \times 10^{-5} \times U$		
	100 kHz	$7{,}4 \times 10^{-5} \times U$		
1000 V	40 Hz to 1 kHz	$4{,}0 \times 10^{-5} \times U$		
	10 kHz	$4{,}5 \times 10^{-5} \times U$		
	20 kHz	$5{,}0 \times 10^{-5} \times U$		
	30 kHz	$7{,}5 \times 10^{-5} \times U$		
700 V	50 kHz	$13 \times 10^{-5} \times U$		
	100 kHz	$35 \times 10^{-5} \times U$		

Measuring range or point	Frequency	expanded uncertainty (*)	Remark	Cali
0,7 mV to 2,2 mV	10 Hz to 20 Hz	$17 \times 10^{-4} \times U + 1{,}3\ \mu V$	• measure	P1-02- P1-02- P1-02- P1-02- P1-02-
	20 Hz to 40 Hz	$7{,}4 \times 10^{-4} \times U + 1{,}3\ \mu V$		
	40 Hz to 20 kHz	$4{,}2 \times 10^{-4} \times U + 1{,}3\ \mu V$		
	20 kHz to 50 kHz	$8{,}2 \times 10^{-4} \times U + 2{,}0\ \mu V$		
	50 kHz to 100 kHz	$12 \times 10^{-4} \times U + 2{,}5\ \mu V$		
	100 kHz to 300 kHz	$23 \times 10^{-4} \times U + 4{,}0\ \mu V$		
	300 kHz to 500 kHz	$26 \times 10^{-4} \times U + 8{,}0\ \mu V$		
	500 kHz to 1 MHz	$50 \times 10^{-4} \times U + 8{,}0\ \mu V$		

2 mV to 7 mV	10 Hz to 20 Hz	$8{,}5 \times 10^{-4} \times U + 1{,}3\ \mu V$	• measure	P1-02- P1-02- P1-02- P1-02- P1-02-
	20 Hz to 40 Hz	$3{,}7 \times 10^{-4} \times U + 1{,}3\ \mu V$		
	40 Hz to 20 kHz	$2{,}1 \times 10^{-4} \times U + 1{,}3\ \mu V$		
	20 kHz to 50 kHz	$4{,}1 \times 10^{-4} \times U + 2{,}0\ \mu V$		
	50 kHz to 100 kHz	$6{,}1 \times 10^{-4} \times U + 2{,}5\ \mu V$		
	100 kHz to 300 kHz	$12 \times 10^{-4} \times U + 4{,}0\ \mu V$		
	300 kHz to 500 kHz	$14 \times 10^{-4} \times U + 8{,}0\ \mu V$		
	500 kHz to 1 MHz	$36 \times 10^{-4} \times U + 8{,}0\ \mu V$		
7 mV to 22 mV	10 Hz to 20 Hz	$2{,}9 \times 10^{-4} \times U + 1{,}3\ \mu V$	• measure	P1-02- P1-02- P1-02- P1-02- P1-02-
	20 Hz to 40 Hz	$1{,}9 \times 10^{-4} \times U + 1{,}3\ \mu V$		
	40 Hz to 20 kHz	$1{,}1 \times 10^{-4} \times U + 1{,}3\ \mu V$		
	20 kHz to 50 kHz	$2{,}1 \times 10^{-4} \times U + 2{,}0\ \mu V$		
	50 kHz to 100 kHz	$3{,}1 \times 10^{-4} \times U + 2{,}5\ \mu V$		
	100 kHz to 300 kHz	$8{,}2 \times 10^{-4} \times U + 4{,}0\ \mu V$		
	300 kHz to 500 kHz	$10 \times 10^{-4} \times U + 8{,}0\ \mu V$		
	500 kHz to 1 MHz	$26 \times 10^{-4} \times U + 8{,}0\ \mu V$		
22 mV to 70 mV	10 Hz to 20 Hz	$2{,}4 \times 10^{-4} \times U + 1{,}5\ \mu V$	• measure	P1-02- P1-02- P1-02- P1-02- P1-02-
	20 Hz to 40 Hz	$1{,}3 \times 10^{-4} \times U + 1{,}5\ \mu V$		
	40 Hz to 20 kHz	$0{,}69 \times 10^{-4} \times U + 1{,}5\ \mu V$		
	20 kHz to 50 kHz	$1{,}3 \times 10^{-4} \times U + 2{,}0\ \mu V$		
	50 kHz to 100 kHz	$2{,}6 \times 10^{-4} \times U + 2{,}5\ \mu V$		
	100 kHz to 300 kHz	$5{,}3 \times 10^{-4} \times U + 4{,}0\ \mu V$		
	300 kHz to 500 kHz	$6{,}8 \times 10^{-4} \times U + 8{,}0\ \mu V$		
	500 kHz to 1 MHz	$13 \times 10^{-4} \times U + 8{,}0\ \mu V$		

70 mV to 220 mV	10 Hz to 20 Hz	$21 \times 10^{-5} \times U + 1{,}5\ \mu V$	• measure	P1-02- P1-02- P1-02- P1-02- P1-02-
	20 Hz to 40 Hz	$8{,}7 \times 10^{-5} \times U + 1{,}5\ \mu V$		
	40 Hz to 20 kHz	$4{,}3 \times 10^{-5} \times U + 1{,}5\ \mu V$		
	20 kHz to 50 kHz	$7{,}3 \times 10^{-5} \times U + 2{,}0\ \mu V$		
	50 kHz to 100 kHz	$16 \times 10^{-5} \times U + 2{,}5\ \mu V$		
	100 kHz to 300 kHz	$28 \times 10^{-5} \times U + 4{,}0\ \mu V$		
	300 kHz to 500 kHz	$40 \times 10^{-5} \times U + 8{,}0\ \mu V$		
	500 kHz to 1 MHz	$120 \times 10^{-5} \times U + 8{,}0\ \mu V$		
220 mV to 700 mV	10 Hz to 20 Hz	$21 \times 10^{-5} \times U + 1{,}5\ \mu V$	• measure	P1-02- P1-02- P1-02- P1-02- P1-02-
	20 Hz to 40 Hz	$8{,}7 \times 10^{-5} \times U + 1{,}5\ \mu V$		
	40 Hz to 20 kHz	$3{,}8 \times 10^{-5} \times U + 1{,}5\ \mu V$		
	20 kHz to 50 kHz	$5{,}6 \times 10^{-5} \times U + 2{,}0\ \mu V$		
	50 kHz to 100 kHz	$8{,}4 \times 10^{-5} \times U + 2{,}5\ \mu V$		
	100 kHz to 300 kHz	$21 \times 10^{-5} \times U + 4{,}0\ \mu V$		
	300 kHz to 500 kHz	$34 \times 10^{-5} \times U + 8{,}0\ \mu V$		
	500 kHz to 1 MHz	$120 \times 10^{-5} \times U + 8{,}0\ \mu V$		
0,7 V to 2,2 V	10 Hz to 20 Hz	$7 \times 10^{-5} \times U$	• measure	P1-02- P1-02- P1-02- P1-02- P1-02-
	20 Hz to 40 Hz	$6{,}9 \times 10^{-5} \times U$		
	40 Hz to 20 kHz	$2{,}9 \times 10^{-5} \times U$		
	20 kHz to 50 kHz	$5{,}2 \times 10^{-5} \times U$		
	50 kHz to 100 kHz	$7{,}6 \times 10^{-5} \times U$		
	100 kHz to 300 kHz	$20 \times 10^{-5} \times U$		
	300 kHz to 500 kHz	$31 \times 10^{-5} \times U$		
	500 kHz to 1 MHz	$120 \times 10^{-5} \times U$		

2,2 V to 7 V	10 Hz to 20 Hz	$7 \times 10^{-5} \times U$	• measure	P1-02- P1-02- P1-02- P1-02- P1-02-
	20 Hz to 40 Hz	$7{,}0 \times 10^{-5} \times U$		
	40 Hz to 20 kHz	$2{,}9 \times 10^{-5} \times U$		
	20 kHz to 50 kHz	$5{,}3 \times 10^{-5} \times U$		
	50 kHz to 100 kHz	$8{,}8 \times 10^{-5} \times U$		
	100 kHz to 300 kHz	$22 \times 10^{-5} \times U$		
	300 kHz to 500 kHz	$47 \times 10^{-5} \times U$		
	500 kHz to 1 MHz	$150 \times 10^{-5} \times U$		
7 V to 22 V	10 Hz to 20 Hz	$7 \times 10^{-5} \times U$	• measure	P1-02- P1-02- P1-02- P1-02- P1-02-
	20 Hz to 40 Hz	$7{,}0 \times 10^{-5} \times U$		
	40 Hz to 20 kHz	$3{,}1 \times 10^{-5} \times U$		
	20 kHz to 50 kHz	$5{,}3 \times 10^{-5} \times U$		
	50 kHz to 100 kHz	$8{,}5 \times 10^{-5} \times U$		
	100 kHz to 300 kHz	$22 \times 10^{-5} \times U$		
	300 kHz to 500 kHz	$47 \times 10^{-5} \times U$		
	500 kHz to 1 MHz	$150 \times 10^{-5} \times U$		
22 V to 70 V	10 Hz to 20 Hz	$7 \times 10^{-5} \times U$	• measure	P1-02- P1-02- P1-02- P1-02- P1-02-
	20 Hz to 40 Hz	$7{,}2 \times 10^{-5} \times U$		
	40 Hz to 20 kHz	$3{,}9 \times 10^{-5} \times U$		
	20 kHz to 50 kHz	$6{,}3 \times 10^{-5} \times U$		
	50 kHz to 100 kHz	$11 \times 10^{-5} \times U$		
	100 kHz to 300 kHz	$22 \times 10^{-5} \times U$		
	300 kHz to 500 kHz	$51 \times 10^{-5} \times U$		
	500 kHz to 1 MHz	$150 \times 10^{-5} \times U$		

70 V to 220 V	10 Hz to 20 Hz	$7 \times 10^{-5} \times U$	• measure	P1-02- P1-02- P1-02- P1-02- P1-02-
	20 Hz to 40 Hz	$7{,}2 \times 10^{-5} \times U$		
	40 Hz to 20 kHz	$3{,}8 \times 10^{-5} \times U$		
	20 kHz to 50 kHz	$7{,}7 \times 10^{-5} \times U$		
	50 kHz to 100 kHz	$11 \times 10^{-5} \times U$		
	100 kHz to 300 kHz	$26 \times 10^{-5} \times U$		
	300 kHz to 500 kHz	$70 \times 10^{-5} \times U$		
220 V to 700 V	10 Hz to 20 Hz	$7 \times 10^{-5} \times U$	• measure	P1-02- P1-02- P1-02- P1-02- P1-02-
	20 Hz to 40 Hz	$11 \times 10^{-5} \times U$		
	40 Hz to 20 kHz	$4{,}7 \times 10^{-5} \times U$		
	20 kHz to 50 kHz	$15 \times 10^{-5} \times U$		
	50 kHz to 100 kHz	$85 \times 10^{-5} \times U$		
700 V to 1000 V	10 Hz to 20 Hz	$7 \times 10^{-5} \times U$	• measure	P1-02- P1-02- P1-02- P1-02- P1-02-
	20 Hz to 40 Hz	$11 \times 10^{-5} \times U$		
	40 Hz to 20 kHz	$4{,}4 \times 10^{-5} \times U$		
	20 kHz to 50 kHz	$15 \times 10^{-5} \times U$		
	50 kHz to 100 kHz	$85 \times 10^{-5} \times U$		
1 kV to 53 kV	50 / 60 Hz	$3{,}0 \times 10^{-3} \times U$	• measure	

Generate

Generating range or point	Frequency	expanded uncertainty (*)	Remark	Cali
2 mV to 20 mV	1 kHz to10 kHz	$7{,}0 \times 10^{-4} \times U$	• generate	P1-02- P1-02- P1-02-
	10 kHz to100 kHz	$11 \times 10^{-4} \times U$		
20 mV to 200 mV	10 Hz to 300 Hz	$2{,}1 \times 10^{-4} \times U$	• generate	P1-02- P1-02- P1-02- P1-02- P1-02-
	300 Hz to 10 kHz	$1{,}8 \times 10^{-4} \times U$		
	10 kHz to 30 kHz	$2{,}8 \times 10^{-4} \times U$		
	30 kHz to 100 kHz	$6{,}1 \times 10^{-4} \times U$		
0,2 V to 2 V	10 Hz to 300 Hz	$1{,}6 \times 10^{-4} \times U$	• generate	P1-02- P1-02- P1-02- P1-02- P1-02-
	300 Hz to 1 kHz	$1{,}1 \times 10^{-4} \times U$		
	1 kHz to 30 kHz	$0{,}70 \times 10^{-4} \times U$		
	30 kHz to 100 kHz	$1{,}6 \times 10^{-4} \times U$		
	100 kHz to 300 kHz	$6{,}0 \times 10^{-4} \times U$		
	300 kHz to 1 MHz	$30 \times 10^{-4} \times U$		
2 V to 20 V	10 Hz to 300 Hz	$1{,}6 \times 10^{-4} \times U$	• generate	P1-02- P1-02- P1-02- P1-02- P1-02-
	300 Hz to 1 kHz	$1{,}0 \times 10^{-4} \times U$		
	1 kHz to 10 kHz	$0{,}80 \times 10^{-4} \times U$		
	10 kHz to 30 kHz	$0{,}70 \times 10^{-4} \times U$		
	30 kHz to 100 kHz	$1{,}7 \times 10^{-4} \times U$		
	100 kHz to 300 kHz	$6{,}0 \times 10^{-4} \times U$		
	300 kHz to 1 MHz	$30 \times 10^{-4} \times U$		
20 V to 200 V	10 Hz to 300 Hz	$1{,}6 \times 10^{-4} \times U$	• generate	P1-02- P1-02- P1-02- P1-02- P1-02-
	300 Hz to 1 kHz	$1{,}2 \times 10^{-4} \times U$		
	1 kHz to 10 kHz	$1{,}0 \times 10^{-4} \times U$		
	10 kHz to 30 kHz	$1{,}1 \times 10^{-4} \times U$		
	30 kHz to 100 kHz	$2{,}1 \times 10^{-4} \times U$		

200 V to 1000 V	40 Hz to 300 Hz	$2{,}3 \times 10^{-4} \times U$	• generate	P1-02- P1-02- P1-02- P1-02- P1-02-
	300 Hz to 1 kHz	$2{,}3 \times 10^{-4} \times U$		
	1 kHz to 10 kHz	$1{,}7 \times 10^{-4} \times U$		
	10 kHz to 30 kHz	$2{,}2 \times 10^{-4} \times U$		
200 V to 750 V	30 kHz to 100 kHz	$15 \times 10^{-4} \times U$	• generate	P1-02- P1-02- P1-02- P1-02- P1-02-
1 kV to 45 kV	50 / 60 Hz	$3{,}0 \times 10^{-3} \times U$	• generate	

Alternating current
Measure

Measuring range or point	Frequency	expanded uncertainty (*)	Remark	Calib
100 µA	10 Hz to 30 Hz	$1{,}4 \times 10^{-4} \times I$	• Transfer standard in "30 day" loop • Fixed points • Measurement	P1-02- P1-02- P1-02- P1-02- P1-02-
	40 Hz to 1 kHz	$1{,}1 \times 10^{-4} \times I$		
	5 kHz	$1{,}7 \times 10^{-4} \times I$		
1 mA	10 Hz to 30 Hz	$1{,}3 \times 10^{-4} \times I$		
	40 Hz to 1 kHz	$1{,}0 \times 10^{-4} \times I$		
	5 kHz	$1{,}5 \times 10^{-4} \times I$		
10 mA	10 Hz to 30 Hz	$1{,}3 \times 10^{-4} \times I$		
	40 Hz to 1 kHz	$1{,}0 \times 10^{-4} \times I$		
	5 kHz	$1{,}5 \times 10^{-4} \times I$		
100 mA	10 Hz to 30 Hz	$1{,}3 \times 10^{-4} \times I$		
	40 Hz to 1 kHz	$1{,}0 \times 10^{-4} \times I$		
	5 kHz	$1{,}5 \times 10^{-4} \times I$		
1 A	10 Hz to 30 Hz	$1{,}8 \times 10^{-4} \times I$		
	40 Hz to 1 kHz	$1{,}2 \times 10^{-4} \times I$		
	5 kHz	$2{,}3 \times 10^{-4} \times I$		
10 A	40 Hz	$3{,}0 \times 10^{-4} \times I$		
	50 Hz to 1 kHz	$2{,}9 \times 10^{-4} \times I$		
	5 kHz	$4{,}0 \times 10^{-4} \times I$		
	10 kHz	$7{,}0 \times 10^{-4} \times I$		

Measuring range or point	Frequency	expanded uncertainty (*)	Remark	Calib
10 mA	10 Hz to 300 Hz	$61 \times 10^{-6} \times I$	• measure / generate • AC/DC difference	P1-02- P1-02- P1-02- P1-02- P1-02-
	300 Hz to 5 kHz	$35 \times 10^{-6} \times I$		
	5 kHz to 10 kHz	$41 \times 10^{-6} \times I$		
	10 kHz to 30 kHz	$45 \times 10^{-6} \times I$		
100 mA	10 Hz to 300 Hz	$66 \times 10^{-6} \times I$		
	300 Hz to 5 kHz	$37 \times 10^{-6} \times I$		
	5 kHz to 10 kHz	$41 \times 10^{-6} \times I$		
	10 kHz to 30 kHz	$45 \times 10^{-6} \times I$		
1A	10 Hz to 300 Hz	$70 \times 10^{-6} \times I$		
	300 Hz to 5 kHz	$49 \times 10^{-6} \times I$		
	5 kHz to 10 kHz	$51 \times 10^{-6} \times I$		
	10 kHz to 30 kHz	$55 \times 10^{-6} \times I$		
10A	10 Hz to 300 Hz	$101 \times 10^{-6} \times I$		
	300 Hz to 5 kHz	$88 \times 10^{-6} \times I$		
	5 kHz to 10 kHz	$90 \times 10^{-6} \times I$		
	10 kHz to 30 kHz	$95 \times 10^{-6} \times I$		

Measuring range or point	Frequency	expanded uncertainty (*)	Remark	Cali
5 µA to 200 µA	10 Hz to 5 kHz	$1{,}6 \times 10^{-4} \times I$	• measure	P1-02-
	5 kHz to 10 kHz	$5{,}0 \times 10^{-4} \times I$		P1-02-
0,2 mA to 2 mA	10 Hz to 5 kHz	$0{,}60 \times 10^{-4} \times I$		P1-02-
	5 kHz to 10 kHz	$1{,}3 \times 10^{-4} \times I$		P1-02-
2 mA to 20 mA	10 Hz to 5 kHz	$1{,}0 \times 10^{-4} \times I$		P1-02-
	5 kHz to 10 kHz	$5{,}0 \times 10^{-4} \times I$		
20 mA to 200 mA	10 Hz to 1 kHz	$1{,}0 \times 10^{-4} \times I$		
	1 kHz to 10 kHz	$26 \times 10^{-4} \times I$		
0,2 A to 2 A	10 Hz to 1 kHz	$1{,}0 \times 10^{-4} \times I$		
	1 kHz to 10 kHz	$4{,}0 \times 10^{-4} \times I$		
2 A to 20 A	10 Hz to 1 kHz	$1{,}0 \times 10^{-4} \times I$		
	1 kHz to 5 kHz	$3{,}0 \times 10^{-4} \times I$		
	5 kHz to 10 kHz	$10 \times 10^{-4} \times I$		

Measuring range or point	Frequency	expanded uncertainty (*)	Remark	Calib
20 A to 6000 A	50 / 60 Hz	$5{,}0 \times 10^{-4} \times I$	measure	P1-02-
20 A to 4000 A	50 / 60 Hz	$5{,}0 \times 10^{-4} \times I$	generate	P1-02-

Calibration of current clamps

Measuring range or point	Frequency	expanded uncertainty (*)	Remark	Calib
20 A to 1000 A	45 Hz to 440 Hz	$5{,}0 \times 10^{-3} \times I$	• with current coils	

Generate

Generating range or point	Frequency	expanded uncertainty (*)	Remark	Calib
20 µA to 200 µA	10 Hz to 1 kHz	$4{,}0 \times 10^{-4} \times I$	• generate • in the lowest range possible	P1-02- P1-02- P1-02- P1-02- P1-02-
	1 kHz to 5 kHz	$6{,}0 \times 10^{-4} \times I$		
0,2 mA to 2 mA	10 Hz to 1 kHz	$3{,}2 \times 10^{-4} \times I$		
	1 kHz to 5 kHz	$4{,}0 \times 10^{-4} \times I$		
2 mA to 20 mA	10 Hz to 1 kHz	$3{,}1 \times 10^{-4} \times I$		
	1 kHz to 5 kHz	$4{,}1 \times 10^{-4} \times I$		
20 mA to 200 mA	10 Hz to 1 kHz	$3{,}1 \times 10^{-4} \times I$		
	1 kHz to 5 kHz	$4{,}0 \times 10^{-4} \times I$		
0,2 A to 2 A	10 Hz to 1 kHz	$6{,}0 \times 10^{-4} \times I$		
	1 kHz to 5 kHz	$7{,}1 \times 10^{-4} \times I$		
2 A to 10 A	10 Hz to 1 kHz	$6{,}1 \times 10^{-4} \times I$		
	1 kHz to 5 kHz	$12 \times 10^{-4} \times I$		
	5 kHz to 10 kHz	$34 \times 10^{-4} \times I$		
10 A to 20 A	45 Hz to 100 Hz	$17 \times 10^{-4} \times I$		
	100 Hz to 1 kHz	$20 \times 10^{-4} \times I$		

Power and Energy

Measuring range or point	Frequency	expanded uncertainty (*)	Remark	Calil
Mono phase , direct without measuring clamps				
33 mV to 1000 V / 0,33 mA to 330 mA	DC	$3{,}0 \times 10^{-4} \times P$	11 µW to 330 W generate	
33 mV to 1000 V / 0,33 A to 3,3 A	DC	$5{,}0 \times 10^{-4} \times P$	3,3 kW generate	
33 mV to 1000 V / 3,3 A to 10,5 A	DC	$6{,}0 \times 10^{-4} \times P$	10,5 kW generate	
33 mV to 1000 V / 10,5 A to 20,5 A	DC	$11 \times 10^{-4} \times P$	20,5 kW generate	
33 mV to 1000 V / 0,1 mA to 20,5A	45 Hz to 1 kHz	$15 \times 10^{-4} \times P$	3,3 µW to 20,5 kW / kVA(r) generate cosphi/sinphi > 0,5	
33 mV to 1000 V / 0,1 mA to 20,5A	45 Hz to 1 kHz	$40 \times 10^{-4} \times P$	3,3 µW to 20,5 kW / kVA(r) generate cosphi/sinphi > 0,25	
Mono phase , direct with measuring clamps				
33 mV to 1000 V / 20 A to 500 A	DC	$10 \times 10^{-3} \times P$	0,66 W to 500 kW / kVA(r) generate	
33 mV to 1000 V / 20 A to 500 A	45 Hz to 100 Hz	$11 \times 10^{-3} \times P$	0,66 W to 500 kW / kVA(r) generate cosphi/sinphi > 0,25	
33 mV to 1000 V / 20 A to 500 A	100 Hz to 440 Hz	$16 \times 10^{-3} \times P$	0,66 W to 500 kW / kVA(r) generate cosphi/sinphi > 0,25	
3-phase, direct without measuring clamps				
1 V to 300 V / 0,3 A to 100 A	50 Hz & 60 Hz	$2{,}0 \times 10^{-3} \times P$	0,3 W to 30 kW / kVA(r) generate cosphi/sinphi > 0,5	
1 V to 300 V / 0,3 A to 100 A	50 Hz & 60 Hz	$4{,}0 \times 10^{-3} \times P$	0,3 W to 30 kW / kVA(r) generate cosphi/sinphi > 0,25	
1 V to 1000 V / 0,3 A to 100 A	10 Hz to 1 kHz	$2{,}0 \times 10^{-3} \times P$	0,3 W to 100 kW / kVA(r) measure cosphi/sinphi > 0,5	
1 V to 1000 V / 0,3 A to 100 A	10 Hz to 1 kHz	$4{,}0 \times 10^{-3} \times P$	0,3 W to 100 kW / kVA(r) measure cosphi/sinphi > 0,25	

3-phase, direct with measuring clamps				
1 V to 300 V / 20 A to 500 A	50 Hz & 60 Hz	$11 \times 10^{-3} \times P$	20 W to 150 kW / kVA(r) generate cosphi/sinphi > 0,25	
1 V to 1000 V / 20 A to 100 A	15 Hz to 440 Hz	$16 \times 10^{-3} \times P$	20 W to 100 kW / kVA(r) measure cosphi/sinphi > 0,25	
Phase / phase angle				
Cosphi/sinphi -1 to 1	10 Hz to 1 kHz	0,000 40	measure / generate	
Phase angle -180 to 180 °	10 Hz to 1 kHz	0,02°	measure / generate	
Active energy				
kWh (cos phi >0,5)	DC, 50 Hz & 60 Hz	$2{,}0 \times 10^{-3} \times E$	measure / generate	

P indicates active,reactive as well as apparent power.
E indicates Energy

RF Power

Range amplitude	Frequency	expanded uncertainty (*)	Remark	Cali
-67 dBm to -19 dBm	20 kHz to 100 MHz	0,056 dB	• measure	P1-02
	100 MHz to 4 GHz	0,047 dB		
-19 dBm to 1 dBm	20 kHz to 100 MHz	0,066 dB	• measure	P1-02
	100 MHz to 4 GHz	0,058 dB		
1 dBm to 23 dBm	20 kHz to 100 MHz	0,083 dB	• measure	P1-02
	100 MHz to 4 GHz	0,072 dB		
24 dBm to 20 dBm	10 Hz to 20 kHz	0,050 dB	• generate	P1-02
	20 kHz to 100 kHz	0,050 dB		
	100 kHz to 10 MHz	0,050 dB		
	10 MHz to 125 MHz	0,050 dB		

20 dBm to 14 dBm	10 Hz to 20 kHz	0,050 dB	• generate	P1-02
	20 kHz to 100 kHz	0,050 dB		
	100 kHz to 10 MHz	0,050 dB		
	10 MHz to 125 MHz	0,050 dB		
	125 MHz to 300 MHz	0,10 dB		
	300 MHz to 1,4 GHz	0,25 dB		
14 dBm to -17 dBm	10 Hz to 20 kHz	0,050 dB	• generate	P1-02
	20 kHz to 100 kHz	0,050 dB		
	100 kHz to 10 MHz	0,050 dB		
	10 MHz to 125 MHz	0,050 dB		
	125 MHz to 300 MHz	0,10 dB		
	300 MHz to 1,4 GHz	0,25 dB		
	1,4 GHz to 3 GHz	0,30 dB		
	3 GHz to 4 GHz	0,50 dB		
-17 dBm to -48 dBm	10 Hz to 20 kHz	0,050 dB	• generate	P1-02
	20 kHz to 100 kHz	0,050 dB		
	100 kHz to 10 MHz	0,050 dB		
	10 MHz to 125 MHz	0,050 dB		
	125 MHz to 300 MHz	0,10 dB		
	300 MHz to 1,4 GHz	0,50 dB		
	1,4 GHz to 3 GHz	0,50 dB		
	3 GHz to 4 GHz	0,50 dB		

-48 dBm to -74 dBm	100 kHz to 10 MHz	0,20 dB	• generate	P1-02
	10 MHz to 125 MHz	0,20 dB		
	125 MHz to 300 MHz	0,20 dB		
	300 MHz to 1,4 GHz	0,50 dB		
	1,4 GHz to 3 GHz	0,50 dB		
	3 GHz to 4 GHz	0,50 dB		
-74 dBm to -84 dBm	100 kHz to 10 MHz	0,50 dB	• generate	P1-02
	10 MHz to 125 MHz	0,50 dB		
	125 MHz to 300 MHz	0,50 dB		
	300 MHz to 1,4 GHz	1,0 dB		
	1,4 GHz to 3 GHz	1,0 dB		
	3 GHz to 4 GHz	1,0 dB		
-84 dBm to -94 dBm	100 kHz to 10 MHz	0,50 dB	• generate	P1-02
	10 MHz to 125 MHz	0,50 dB		
	125 MHz to 300 MHz	0,50 dB		
	300 MHz to 1,4 GHz	1,0 dB		
	1,4 GHz to 3 GHz	1,0 dB		
-94 dBm to -124 dBm	100 kHz to 10 MHz	1,5 dB	• generate	P1-02
	10 MHz to 125 MHz	1,5 dB		
	125 MHz to 300 MHz	1,5 dB		
	300 MHz to 1,4 GHz	1,5 dB		
	1,4 GHz to 3 GHz	1,5 dB		

Impedance (DC/LF)
Measure

Measuring range or point	Frequency	expanded uncertainty (*)	Remark	Cali
1 Ω	DC	$11 \times 10^{-6} \times R$	• Transfer standard in "30 day" loop • Fixed points • Measuring • 4-wire resistance measurement • Negligible dissipated power	P1-02- P1-02- P1-02- P1-02- P1-02-
10 Ω	DC	$9,5 \times 10^{-6} \times R$		
100 Ω	DC	$6,5 \times 10^{-6} \times R$		
1 kΩ	DC	$4,5 \times 10^{-6} \times R$		
10 kΩ	DC	$4,5 \times 10^{-6} \times R$		
100 kΩ	DC	$7,5 \times 10^{-6} \times R$		
1 MΩ	DC	$1,4 \times 10^{-5} \times R$		
10 MΩ	DC	$2,5 \times 10^{-5} \times R$		
100 MΩ	DC	$2,0 \times 10^{-4} \times R$		
Measuring range or point	**Frequency**	**expanded uncertainty (*)**	**Remark**	**Cali**
0 Ω to 2 Ω	DC	$18 \times 10^{-6} \times R$ or 20 μΩ[1]	• measure • 4-wire resistance measurement • negligible dissipated power	P1-02- P1-02- P1-02- P1-02- P1-02-
2 Ω to 20 Ω	DC	$3,1 \times 10^{-6} \times R$		
20 Ω to 200 Ω	DC	$5,5 \times 10^{-6} \times R$		
0,2 kΩ to 2 kΩ	DC	$5,0 \times 10^{-6} \times R$		
2 kΩ to 20 kΩ	DC	$5,0 \times 10^{-6} \times R$		
20 kΩ to 200 kΩ	DC	$6,3 \times 10^{-6} \times R$		
0,2 MΩ to 2 MΩ	DC	$6,0 \times 10^{-6} \times R$		
2 MΩ to 20 MΩ	DC	$11 \times 10^{-6} \times R$		
20 MΩ to 200 MΩ	DC	$60 \times 10^{-6} \times R$		
0,2 GΩ to 2 GΩ	DC	$1,2 \times 10^{-3} \times R$		

[1] Whichever is greater

Generate

Generating range or point	Frequency	expanded uncertainty (*)	Remark	Calib
0 Ω	DC	100 μΩ		
1 mΩ	DC	$12 \times 10^{-6} \times R$	• generate • standard resistors • also combinations of these resistors1 • 4-wire resistance • maximum dissipated power 10 mW[1,2]	P1-02- P1-02- P1-02- P1-02- P1-02-
10 mΩ	DC	$12 \times 10^{-7} \times R$		
100 mΩ	DC	$3 \times 10^{-6} \times R$		
1 Ω	DC	$12 \times 10^{-7} \times R$		
10 Ω, 25 Ω, 50 Ω, 75 Ω, 100 Ω, 378 Ω, 1 kΩ, 10 kΩ, 100 kΩ	DC	$5 \times 10^{-7} \times R$		
1 MΩ	DC	$15 \times 10^{-7} \times R$		
10 MΩ	DC	$8 \times 10^{-6} \times R$		
100 MΩ	DC	$2 \times 10^{-5} \times R$		
1 GΩ	DC	$7 \times 10^{-5} \times R$		
10 GΩ	DC	$3 \times 10^{-4} \times R$		
100 GΩ	DC	$1 \times 10^{-3} \times R$		
1 TΩ	DC	$2 \times 10^{-3} \times R$		
10 TΩ	DC	$6 \times 10^{-3} \times R$		
100 TΩ	DC	$2 \times 10^{-2} \times R$		

[1] The uncertainty varies as the combinations and the dissipated power are different.

[2] these resistors can be used to generate/measure currents from 10pA up to 10A with decreased uncertainties.

Calibration of resistor / insulation meters

Measuring range or point	@Voltage range	expanded uncertainty (*)	Remark	Calib
10 kΩ to 40 MΩ	50 V to 250 V	$1{,}0 \times 10^{-4} \times R$		
40 MΩ to 200 MΩ		$5{,}0 \times 10^{-4} \times R$		
100 kΩ to 200 MΩ	250 V to 1000 V	$1{,}0 \times 10^{-4} \times R$		
200 MΩ to 1000 MΩ		$3{,}0 \times 10^{-4} \times R$		
1 MΩ to 10 GΩ	1 kV to 10 kV	$60 \times 10^{-4} \times R$		

Capacity

Measuring range or point	Frequency	expanded uncertainty (*)	Remark	Cali
10 pF to 100 pF	1 kHz	$15 \times 10^{-4} \times C$	Measure / generate	
100 pF to 1000 nF	1 kHz	$10 \times 10^{-4} \times C$	Measure / generate	
1000 nF to 10 µF	100 Hz & 1 kHz	$6 \times 10^{-4} \times C$	Measure / generate	
10 µF tot 100 µF	100 Hz & 1 kHz	$7 \times 10^{-4} \times C$	Measure / generate	
10 pF, 100 pF, 1 nF, 10 nF	1 kHz	$1{,}0 \times 10^{-4} \times C$	Generate	
100 nF, 1 µF	1 kHz	$1{,}5 \times 10^{-4} \times C$		
10 µF	1 kHz	$3{,}0 \times 10^{-4} \times C$		
100 µF	1 kHz	$5{,}0 \times 10^{-4} \times C$		
1 µF	100 Hz	$2{,}0 \times 10^{-4} \times C$		
10 µF	100 Hz	$3{,}0 \times 10^{-4} \times C$		
100 µF	100 Hz	$5{,}0 \times 10^{-4} \times C$		

Inductance

Measuring range or point	Frequency	expanded uncertainty (*)	Remark	calib
100 µH to 1 H	1 kHz	$10 \times 10^{-4} \times L$	Measure / generate	
1 H to 10 H	1 kHz	$20 \times 10^{-4} \times L$	Measure / generate	
100 µH, 1 mH, 10 mH, 100 mH, 1H	1 kHz	$5{,}0 \times 10^{-4} \times L$	Generate	
10 H	100 Hz, 1 kHz	$7{,}0 \times 10^{-4} \times L$		

Oscilloscopes (on screen) – input impedance 50 Ω and 1 MΩ

Measuring range or point	Frequency	expanded uncertainty (*)	Remark	Calib
± 1 mV to 200 V	DC	$2{,}5 \times 10^{-4} \times U + 25\ \mu V$	50 Ω to 5,56 V	
1 mVpp to 21 mVpp	10 Hz to 10 kHz	$25 \times 10^{-4} \times U + 10\ \mu V$	Square wave	
21 mVpp to 556 mVpp	10 Hz to 10 kHz	$10 \times 10^{-4} \times U + 10\ \mu V$	Square wave	
556 mVpp to 210 Vpp	10 Hz to 10 kHz	$5{,}0 \times 10^{-4} \times U + 10\ \mu V$	Square wave 50 Ω to 5,56 V	
4,44 mVpp to 5,56 Vpp	100 mHz to 100 MHz	$1{,}5 \times 10^{-2} \times U$	Sine wave	
4,44 mVpp to 5,56 Vpp	100 MHz to 550 MHz	$3{,}0 \times 10^{-2} \times U$	Sine wave	
4,44 mVpp to 3,35 Vpp	550 MHz to 1 GHz	$4{,}0 \times 10^{-2} \times U$	Sine wave	
4,44 mVpp to 3,54 Vpp	1 GHz to 4 GHz	$6{,}0 \times 10^{-2} \times U$	Sine wave	
500 ps	-	40 ps	Rise/ falltime (max. 3 V)	P1-02
250 ps to 10 ks	-	$5{,}0 \times 10^{-9} \times t$	Time base	
40 Ω to 90 Ω	1 kHz	$1{,}0 \times 10^{-3} \times Z$	Input impedance	
0,8 MΩ to 1,2 MΩ				
10 Ω to 150 Ω	1 kHz	$5{,}0 \times 10^{-3} \times Z$	Input impedance	
50 kΩ to 12 MΩ				
	0,1 Hz to 100 MHz	0,15 dB	Attenuation at bandwidth	
	100 MHz to 550 MHz	0,30 dB	Attenuation at bandwidth	
	550 MHz to 1 GHz	0,40 dB	Attenuation at bandwidth	
	1 GHz to 4 GHz	0,50 dB	Attenuation at bandwidth	P1-02

Bridge calibration

Measuring range or point	Frequency	expanded uncertainty (*)	Remark	Calib
-2,5 mV / V to 2,5 mV / V	225 Hz	50×10^{-6} mV / V	5 V supply / 350 Ω bridges	

(*) the smallest uncertainty of measurement the laboratory can provide to its customers, expressed as the expanded uncertainty approximately 95%.

Relative time

Measured quantity, instrument or gauge	Range	expanded uncertainty (*)	Remarks	
Tachometers, stroboscopes (optical)	1,2 rpm to 100 000 rpm	$3{,}0 \times 10^{-7} \times n$		
Mechanical tachometers	10 rpm to 17 000 rpm	$0{,}050 \text{ rpm} + 10 \times 10^{-5} \times n$		

n: number of rotations in rpm

Measured quantity, instrument or gauge	Range	expanded uncertainty (*)	Remarks	
Frequencymeters, frequencygenerators, counters	1 Hz	$5{,}0 \times 10^{-11} \times f$	• generate • fixed points	P1 P1 P1 P1 P1
	1 MHz	$5{,}0 \times 10^{-11} \times f$		
	5 MHz	$5{,}0 \times 10^{-11} \times f$		
	10 MHz	$5{,}0 \times 10^{-11} \times f$		
	0,002 Hz to 3 GHz	$6{,}0 \times 10^{-11} \times f$	• meassure Tavg >600s	P1 P1 P1 P1 P1
Frequencymeters, frequencygenerators, counters	0,002 Hz to 4 GHz	$5{,}0 \times 10^{-9} \times f$	• generate	P1 P1 P1 P1 P1

Measured quantity, instrument or gauge	Range	expanded uncertainty (*)	Remarks	
Electronic chronometers	n.a.	0,10 s / 24 h	direct measurement	P1
Mechanic chronometers	n.a.	5,0 s / 24 h	direct measurement	
Electronic & mechanic chronometers	Standard 0 h to 72 h	0,50 s / 24 h with a minimum of 0,30 s	By comparison with a standard chronometer via a digital-optical recorder	P1
Signal-triggered chronometers	Standard 0 h to 72 h	0,15 s / 24 h with a minimum of 0,060 s	By comparison with a standard chronometer via a digital-optical recorder	

(*) the smallest uncertainty of measurement the laboratory can provide to its customers, expressed as the expanded uncertainty l
95%.

Dimensional Quantities

Calibration and Measurement Capabilities

Length gauges

Measured quantity, instrument or gauge	**Range**	**expanded uncertainty (*)**	**Rema**
Central length steel	0,5 mm to 100 mm 0,02 inch to 4 inch	0,060 µm + 0,90 × 10^{-6} × *l*	
Central length tungsten carbide		0,060 µm + 0,70 × 10^{-6} × *l*	fixed s
Central length ceramic		0,060 µm + 0,80 × 10^{-6} × *l*	
		0,060 µm + 1,2 × 10^{-6} × *l*	reference
Central length steel, tungsten carbide, ceramic	0,05 mm to 500 mm 0,005 inch to 20 inch	0,10 µm + 2,0 × 10^{-6} × *l*	all siz
Lengthvariation steel, tungsten carbide, ceramic	0,5 mm to 100 mm 0,02 inch to 4 inch	0,050 µm	
Step gauge	to 1200 mm	0,80 µm + 3,0 × 10^{-6} × *l*	

Angle gauges

Measured quantity, instrument or gauge	**Range**	**expanded uncertainty (*)**	**Rema**
Conicity on conical plug and ring gauges	to 1:1	0,00001 + 0,0020 mm / *l*	*l* in m

Clinometers
See Angle (measuring instruments)

Line scales, distances

Measured quantity, instrument or gauge	Range	expanded uncertainty (*)	Rema
Ruler (all models)	to 200 mm	$1{,}5\ \mu m + 3{,}0 \times 10^{-6} \times l$	e.g. sprin
	to 400 mm	$2{,}0\ \mu m + 3{,}0 \times 10^{-6} \times l$	
	to 3000 mm	$12\ \mu m + 3{,}0 \times 10^{-6} \times l$	
	to 100 m	$6{,}0\ \mu m + 5{,}0 \times 10^{-6} \times l$	
Feeler gauges	to 5 mm	$0{,}50\ \mu m + 2{,}0 \times 10^{-6} \times l$	
Setting standard for external micrometers	to 300 mm	$0{,}50\ \mu m + 2{,}0 \times 10^{-6} \times l$	
	to 500 mm	$0{,}90\ \mu m + 0{,}60 \times 10^{-6} \times l$	
	to 3000 mm	$3{,}0\ \mu m + 3{,}0 \times 10^{-6} \times l$	
Other distance of 2 parallel planes	to 300 mm	$0{,}50\ \mu m + 2{,}0 \times 10^{-6} \times l$	
	to 500 mm	$0{,}90\ \mu m + 0{,}60 \times 10^{-6} \times l$	
	to 3000 mm	$3{,}0\ \mu m + 3{,}0 \times 10^{-6} \times l$	

Length measuring instruments

Measured quantity, instrument or gauge	Range	expanded uncertainty (*)	Rema
Hand held tools for external measurements	0 mm to 200 mm	$0{,}45\ \mu m + 0{,}50 \times R + 25 \times 10^{-6} \times l$	e.g. vernier, mi
	200 mm to 3000 mm	$4{,}0\ \mu m + 0{,}50 \times R + 5{,}0 \times 10^{-6} \times l$	
Hand held tools for internal measurements			
2-point	0 mm to 200 mm	$0{,}70\ \mu m + 0{,}50 \times R + 25 \times 10^{-6} \times l$	e.g. internal m
	200 mm to 400 mm	$5{,}0\ \mu m + 0{,}50 \times R + 4{,}0 \times 10^{-6} \times l$	
2- and 3-point	0 mm to 250 mm	$1{,}5\ \mu m + 0{,}50 \times R + 25 \times 10^{-6} \times l$	
Hand held tools for height and depth measurements	0 mm to 500 mm	$0{,}70\ \mu m + 0{,}50 \times R + 25 \times 10^{-6} \times l$	
Linear displacement sensor	to 200 mm	$0{,}050\ \mu m + 2{,}5 \times 10^{-6} \times l + 0{,}80 \times R$	
Height gauge	to 1500 mm	$0{,}80\ \mu m + 0{,}70 \times R + 2{,}5 \times 10^{-6} \times l$	
Film thickness gauge	to 2 mm	$1{,}0\ \mu m + 2{,}0 \times 10^{-3} \times l$	
Laser distance meter	to 25 m	$0{,}50\ mm + 40 \times 10^{-6} \times l + 0{,}60 \times R$	

Diameter

Measured quantity, instrument or gauge	Range	expanded uncertainty (*)	Rema
Setting rings and ring gauges	Ø 1 mm to Ø 250 mm	0,50 µm + 2,0 × 10^{-6} × *l*	
Cylindrical setting pins	to 200 mm	0,50 µm + 1,5 × 10^{-6} × *l*	
Plain plug gauges	to 200 mm	0,50 µm + 1,5 × 10^{-6} × *l*	
Thread wires	to 20 mm	0,50 µm + 1,5 × 10^{-6} × *l*	
Radius gauge	to Ø 200 mm	3,0 µm + 5,0 × 10^{-6} × *l*	
Other internal diameters	Ø 1 mm to Ø 250 mm	0,50 µm + 2,0 × 10^{-6} × *l*	
Other external diameters	Ø 0,05 mm to Ø 300 mm	0,50 µm + 1,5 × 10^{-6} × *l*	
	Ø 300 mm to Ø 500 mm	0,90 µm + 0,60 × 10^{-6} × *l*	
Conical plug gauge	Ø 0,5 mm to Ø 300 mm	1,2 µm + 2,5 × 10^{-6} × *d*	
Conical ring gauge	Ø 1,0 mm to Ø 300 mm	1,2 µm + 2,5 × 10^{-6} × *d*	

Form error

Measured quantity, instrument or gauge	Range	expanded uncertainty (*)	Rema
Knife edge straight edge	to 300 mm	0,30 µm	
Straight edge	to 6000 mm	0,50 µm + 0,50 × 10^{-6} × *l*	
Surface plate	to 6 000 mm x 10 000 mm	0,30 µm + 1,6 × 10^{-6} × *l*	*l* = longest side plat
Roundness tester	to 300 µm	0,050 µm + 0,50 × R	
Roundness standard	to Ø 300 mm	0,050 µm + 0,020 × A	A = measured
Flick standard (roundness standard)	to 1 mm	0,25 µm	

Roughness

Measured quantity, instrument or gauge	Range	expanded uncertainty (*)	Rema
Surface texture measuring instruments	Ra: 0,05 µm to 5 µm	0,040 × A + 0,50 × R (minimum 0,030 µm)	A = Ra-value o
	Rz: 0,1 µm to 10 µm	0,060 × *A* + 0,50 × R (minimum 0,050 µm)	A = Rz-value o
	Rt (Rmax): 0,1 µm to 10 µm	0,060 × *A* + 0,50 × R (minimum 0,050 µm)	A = Rt(Rmax)-valu
Roughness standards	Ra: to 10 µm	0,025 µm + 0,060 × A	A = measured
	Rz: to 15 µm	0,030 µm + 0,090 × A	A = measured
	Rt(Rmax): to 15 µm	0,030 µm + 0,090 × A	A = measured Rt

Thread quantities

Thread external			
Measured quantity, instrument or gauge	**Range**	**expanded uncertainty (*)**	**Rema**
Pitch	to 10 mm	2 µm	
Profile angle	to 180°	(0,50 + 12/*l*) bgmin	*l* = leg lengt
Simple pitch diameter	Ø 1 mm to Ø 300 mm	α = 30°: (6,0 µm to 9,7 µm)	Acc. to Euramet/C 1a or
		α = 60°: (3,2 µm to 5,9 µm)	
		α = 90°: (2,6 µm to 5,5 µm)	
Pitch diameter	Ø 3 mm to Ø 90 mm	2,5 µm + 5 × 10^{-6} × *l*	Acc. to Euramet/C 2b, α ≥
		4,5 µm + 10 × 10^{-6} × *l*	Acc. to Euramet/C 2b, α <
Outside, core diameter	Ø 3 mm to Ø 90 mm	1,5 µm + 10 × 10^{-6} × *l*	Acc. to Euramet/C 2b

Thread internal			
Measured quantity, instrument or gauge	**Range**	**expanded uncertainty (*)**	**Rema**
Pitch	to 10 mm	2 µm	
Profile angle	to 180°	(0,50 + 12/*l*) bgmin	*l* = leg lengt
Simple pitch diameter	Ø 4 mm to Ø 300 mm	α = 30°: (9,0 µm to 14 µm)	Acc. to Euramet/C 1a or
		α = 60°: (3,6 µm to 7,0 µm)	
		α = 90°: (3,1 µm to 6,2 µm)	
Pitch diameter	Ø 3 mm to Ø 90 mm	$2{,}5\ \mu m + 10 \times 10^{-6} \times l$	Acc. to Euramet/C 2b, α ≥
		$4{,}5\ \mu m + 10 \times 10^{-6} \times l$	Acc. to Euramet/C 2b, α <
Outside, core diameter	Ø 3 mm to Ø 90 mm	$1{,}5\ \mu m + 10 \times 10^{-6} \times l$	Acc. to Euramet/C 2b

Coordinate measuring machines

Measured quantity, instrument or gauge	**Range**	**expanded uncertainty (*)**	**Rema**
Deviation of nominal displacement	to 20 m		e.g. 1D/2D/3D machine
		$0{,}15\ \mu m + 0{,}70 \times R + 1{,}0 \times 10^{-6} \times l$	Zerodur
		$0{,}15\ \mu m + 0{,}70 \times R + 1{,}3 \times 10^{-6} \times l$	Glass sc
		$0{,}15\ \mu m + 0{,}70 \times R + 1{,}6 \times 10^{-6} \times l$	Steel sc
	to 400 mm	$0{,}30\ \mu m + 2{,}3 \times 10^{-6} \times l$	using reference
Deviations transverse to the translation directions	to 0,5 mm	$0{,}30\ \mu m + 3{,}0 \times 10^{-6} \times l + 5{,}0 \times 10^{-3} \times A$	A = measured Measuring length
Rotational deviations around the translation direction	to 400 as	$0{,}50\ as + 3{,}5 \times 10^{-3} \times A$	A = measured ang translatio
Other rotational deviations	to 7200 as	$0{,}50\ as + 1{,}6 \times 10^{-3} \times A$	A = measure measured length

as = arcsecond

Angle gauges

Measured quantity, instrument or gauge	Range		Rema
Angle gauge block	to 180°	0,000 28° + 10 × 10^{-6} × A	A = measur
		1,0” + 10 × 10^{-6} × A	
Cylindrical square	to Ø 300 mm to height 300 mm	0,30 µm + 2,0 × 10^{-6} × *l*	Squarer
Square	to 300 mm leg length	0,30 µm + 2,0 × 10^{-6} × *l*	Squarer
Angle plate	90°	0,50 as	
Polygon	to 360 °	0,50 as	
Pentagonprism	90 °	0,50 as	

as = arcsecond

Angle (measuring instruments)

Measured quantity, instrument or gauge	Range	expanded uncertainty (*)	Rema
Spirit level	to 12,5 mm/m	0,50 µm/m + 1,0 × 10^{-3} × A + 0,7 × R	A = set a
	to 2600 as	0,10 as + 1,0 × 10^{-3} × A + 0,70 × R	
Autocollimator	to 12,5 mm/m	0,50 µm/m + 1,0 × 10^{-3} × A + 0,70 × R	A = set a
	to 2600 as	0,10 as + 1,0 × 10^{-3} × A + 0,70 × R	
Angle meters	0° - 360°	0,50 amin	e.g. protr
Angle sensor	0° - 360°	2,0 as	e.g. protr
Clinometers	0° - 360°	2,0 as	
Theodolites	180°	3,0 as	Rotation around
	180°	1,5 as	Defining horiz
	180°	1,8 as	Deviation of cr rotatio

as = arcsecond
amin = arcminute

Product measurement

Measured quantity, instrument or gauge	Range	expanded uncertainty (*)	Rema
Form			
Surface profile	to 10 mm × 100 mm	1,0 µm + 0,010 × A	A = measured p
Roughness value	Ra: to 10 µm	0,025 µm + 0,060 × A	A = measured
	Rz: to 15 µm	0,030 µm + 0,090 × A	A = measured
	Rt(Rmax): to 15 µm	0,030 µm + 0,090 × A	A = measured Rt
Straightness	to 10 mm × 100 mm	1,0 µm + 0,010 × A	A = measured p
	to 300 mm	0,30 µm	
	to 6000 mm	0,50 µm + 0,50 × 10^{-6} × L	
Roundness			
Roundness external	to Ø 300 mm	0,050 µm + 0,020 × A	A = measured
Roundness internal	Ø 0,7 mm to Ø 300 mm	0,050 µm + 0,020 × A	A = measured
Cilindricity			
Cilindricity external	to Ø 300 mm to height 300 mm	0,40 µm + 0,040 × A	A = measured
Cilindricity internal	Ø 0,7 mm to Ø 300 mm to height 300 mm	0,40 µm + 0,040 × A	A = measured
Coaxiality and concentricity	Ø 0,7 mm to Ø300 mm to height 300 mm	0,10 µm + 0,040 × A	A = measured concent

Planes or sides			
Flatness	to Ø 55 mm	0,050 µm	
	to Ø 150 mm	0,060 µm	
	to Ø 290 mm	0,15 µm	
	to 6 000 mm × 10 000 mm	0,50 µm + 1,5 × 10^{-6} × *l*	*l* = longest side o
Angle between sides or planes	to 180°	(0,50 + 12/*l*) amin	*l* = leg length in m 200 m
		3,0 as	optical su
Squareness	to 1200 x 550 mm	2,1 µm + 4,0 × 10^{-6} × *l*	*l* = leg le ratio leg length : re = 1 :
Parallelism	to 1200 mm	1,0 µm + 2,0 × 10^{-6} × *l*	*l* = leg le
Diameter			
External	Ø 0,05 mm to Ø 300 mm	0,50 µm + 1,5 × 10^{-6} × *l*	
	Ø 300 mm to Ø 500 mm	0,90 µm + 0,60 × 10^{-6} × *l*	
	Ø 500 mm to Ø 3000 mm	0,40 µm + 2,0 × 10^{-6} × *l*	
Internal	Ø 1 mm to Ø 250 mm	0,50 µm + 2,0 × 10^{-6} × *l*	
Distance of 2 parallel surfaces			
External	to 200 mm	0,50 µm + 2,0 × 10^{-6} × *l*	
	to 3000 mm	0,40 µm + 4,0 × 10^{-6} × *l*	
Internal	to 1200 mm	1,2 µm + 4,0 × 10^{-6} × *l*	

Thread external			
Pitch	to 10 mm	2,0 µm	
Profile angle	to 180°	(0,50 + 12 / *l*) bgmin	*l* = leg lengt
Simple pitch diameter	Ø 1 mm to Ø 300 mm	α = 30°: (6,0 µm to 9,7 µm)	Acc. to Euramet/C 1a or
		α = 60°: (3,2 µm to 5,9 µm)	
		α = 90°: (2,6 µm to 5,5 µm)	
Pitch diameter	Ø 3 mm to Ø 90 mm	$2{,}5\ \mu m + 5 \times 10^{-6} \times l$	Acc. to Euramet/C 2b, α ≥
		$4{,}5\ \mu m + 10 \times 10^{-6} \times l$	Acc. to Euramet/C 2b, α <
Outside, core diameter	Ø 3 mm to Ø 90 mm	$1{,}5\ \mu m + 10 \times 10^{-6} \times l$	Acc. to Euramet/C 2b
Thread internal			
Pitch	to 10 mm	2,0 µm	
Profile angle	to 180°	(0,50 + 12 / *l*) bgmin	*l* = leg lengt
Simple pitch diameter	Ø 4 mm to Ø 300 mm	α = 30°: (9,0 µm to 14 µm)	Acc. to Euramet/C 1a or
		α = 60°: (3,6 µm to 7,0 µm)	
		α = 90°: (3,1 µm to 6,2 µm)	
Pitch diameter	Ø 3 mm to Ø 90 mm	$2{,}5\ \mu m + 10 \times 10^{-6} \times l$	Acc. to Euramet/C 2b, α ≥
		$4{,}5\ \mu m + 10 \times 10^{-6} \times l$	Acc. to Euramet/C 2b, α <
Outside, core diameter	Ø 3 mm to Ø 90 mm	$1{,}5\ \mu m + 10 \times 10^{-6} \times l$	Acc. to Euramet/C 2b

R: resolution of the instrument ; *l* : measured length

(*) the smallest uncertainty of measurement the laboratory can provide to its customers, expressed as the expanded uncertainty havi

Force and Torque

Calibration and Measurement Capabilities

Force

Measured quantity, instrument or gauge	Range	expanded uncertainty (*)	Remarks
Push pull force measuring devices in tension and compression	0,20 N to 5 000 N	$1{,}0 \times 10^{-4} \times F$	dead weights, according to ISO376
			dead weights, in-house method (performed ac to ISO7500-1)
	2 kN to 200 kN	$8{,}0 \times 10^{-4} \times F$	Generation and measurement by comparison standard load cells, according to ISO37
			Generation and measurement by comparison standard load cells, in-house method (perfo according to ISO7500-1)
	to 500 kN	$10 \times 10^{-4} \times F$	Generation and measurement by comparison standard load cells, according to ISO37
			Generation and measurement by comparison standard load cells, in-house method (perfo according to ISO7500-1)
	to 1,0 MN	$10 \times 10^{-4} \times F$	Measurement only by comparison with standa cells, according to ISO376
			Measurement only by comparison with standa cells, in-house method (performed accordi ISO7500-1)
Gram force gauges	0,050 N to 500 N	$0{,}030 \times F$	

Torque

Measured quantity, instrument or gauge	Range	Expanded uncertainty (*)	Remarks
Torque tools	0,1 Nm to 2700 Nm	$8{,}0 \times 10^{-3} \times M$	Accuracy acc. to ISO 6789
Torque measuring devices	0,1 to 1 Nm	$1{,}0 \times 10^{-3} \times M$	With torque arms and weights
	to 50 Nm	$5{,}0 \times 10^{-4} \times M$	
	to 1500 Nm	$1{,}1 \times 10^{-4} \times M$	
	to 4000 Nm	$1{,}5 \times 10^{-4} \times M$	

(*) the smallest uncertainty of measurement the laboratory can provide to its customers, expressed as the expanded uncertain
probability of approximately 95%.

Mass

Calibration and Measurement Capabilities

Mass standards

Measured quantity, instrument or gauge	Range	expanded uncertainty (*)	Remarks
Weights and masses	1 mg	0,001 0 mg	For example mass pieces up to grade E1 according to OIML R111-1
	2 mg	0,001 0 mg	
	5 mg	0,001 0 mg	
	10 mg	0,001 0 mg	
	20 mg	0,001 0 mg	
	50 mg	0,001 2 mg	
	100 mg	0,001 6 mg	
	200 mg	0,002 0 mg	
	500 mg	0,002 5 mg	
	1 g	0,003 0 mg	
	2 g	0,004 0 mg	
	5 g	0,005 0 mg	
	10 g	0,007 0 mg	
	20 g	0,008 0 mg	
	50 g	0,010 mg	
	100 g	0,017 mg	
	200 g	0,033 mg	
	500 g	0,080 mg	
	1 kg	0,16 mg	
	2 kg	0,33 mg	
	5 kg	0,80 mg	
	10 kg	1,7 mg	
	20 kg	10 mg	For example mass pieces up to grade E2 according to OIML R111-1
	50 kg	600 mg	For example mass pieces up to grade M1 according to OIML R111-1
	100 kg	1 000 mg	
	150 kg	1 600 mg	

Weighing instruments

Measured quantity, instrument or gauge	Range	expanded uncertainty (*)	Remarks
Non automatic weighing machines			Available weights: grade E1: 1 mg to 1 kg grade E2: 1 mg to 10 kg grade F1: 1 g to 20 kg grade M1: 1 g to 500 kg
	1 mg to 1 kg	$5{,}0 \times 10^{-6} \times m$ minimal 0,002 mg	
	> 1 kg to 10 kg	$2{,}0 \times 10^{-6} \times m$	
	> 10 kg to 240 kg	$3{,}0 \times 10^{-6} \times m$	
	> 240 kg to 10 000 kg	$1{,}1 \times 10^{-4} \times m$	

(*) the smallest uncertainty of measurement the laboratory can provide to its customers, expressed as the expanded uncertainty having a co
approximately 95%.

Calibration and Measurement Capabilities

Gas pressure

Measured quantity, instrument or gauge	Range	expanded uncertainty (*)	Remarks
Gauges, digital indicators, plotters, calibrators, liquid column, transmitters, transducers and pressure balances for relative and absolute[1] pressures	0 Pa to 4800 Pa	$1 \times 10^{-4} \times p$ minimum 0,03 Pa	By comparison wit pressure stand
	-100 kPa to -5 kPa	$25 \times 10^{-6} \times p$	By comparison wit pressure balan
	-5 kPa to -1,5 kPa	$80 \times 10^{-6} \times p$	
	1,5 kPa to 5,0 kPa	$80 \times 10^{-6} \times p$	
	5,0 kPa to 350 kPa	$20 \times 10^{-6} \times p$	
	5,0 kPa to 1,9 MPa	$26 \times 10^{-6} \times p$	
	1,9 MPa to 7,6 MPa	$30 \times 10^{-6} \times p$	
	7,6 MPa to 12 MPa	$70 \times 10^{-6} \times p$	
Barometers	5,0 kPa to 350 kPa abs	$20 \times 10^{-6} \times p$	By comparison wit pressure balan
Piston/cilinder combination (effective area)[2]	5,0 kPa to 350 kPa	$20 \times 10^{-6} \times p$	By comparison wit pressure balan
	350 kPa to 1,9 MPa	$25 \times 10^{-6} \times p$	
	1,9 MPa to 7,6 MPa	$30 \times 10^{-6} \times p$	
	7,6 MPa to 12 MPa	$70 \times 10^{-6} \times p$	

1 For absolute pressures the uncertainty of the atmospheric pressure is added to the uncertainty (except when working with

2 The masses can be calibrated in our mass laboratory

Liquid pressure

Measured quantity, instrument or gauge	Range	expanded uncertainty (*)	Remarks
Gauges, digital indicators, plotters, calibrators, liquid column, transmitters, transducers and pressure balances for relative and absolute[1] pressures	0,5 MPa to 100 MPa	$3{,}0 \times 10^{-5} \times p$	By comparison w liquid pressure ba
	100 MPa to 120 MPa	$7{,}0 \times 10^{-5} \times p$	
	120 MPa to 400 MPa	$2{,}5 \times 10^{-4} \times p$	
Piston/cilinder combination (effective area)[2]	0,5 MPa to 100 MPa	$3{,}0 \times 10^{-5} \times p$	By comparison w liquid pressure ba
	100 MPa to 120 MPa	$7{,}0 \times 10^{-5} \times p$	
	120 MPa to 400 MPa	$2{,}5 \times 10^{-4} \times p$	

1 For absolute pressures the uncertainty of the atmospheric pressure is added to the uncertainty (except when working with

2 The masses can be calibrated in our mass laboratory

Vacuum quantities

Measured quantity, instrument or gauge	Range	expanded uncertainty (*)	Remarks
Absolute pressure	1 Pa to 30 Pa	$2 \times 10^{-2} \times p$	By comparison v capacitive press indicators
	30 Pa to 5 kPa	$5{,}0 \times 10^{-3} \times p$	
	1 mPa to 1 Pa	$2{,}5 \times 10^{-2} \times p$ + 5 mPa	

Onsite

Measured quantity, instrument or gauge	Range	expanded uncertainty (*)	Remarks
Relative pressures	20 kPa to 60 MPa	$1 \times 10^{-3} \times p$	By comparison with pressure indicat
Absolute pressures	20 kPa to 60 MPa abs.	$1 \times 10^{-3} \times p$	

(*) the smallest uncertainty of measurement the laboratory can provide to its customers, expressed as the expanded uncertai approximately 95%.

Flow of Gas

Calibration and Measurement Capabilities

Velocity of gases

Measured quantity, instrument or gauge	Range	expanded uncertainty (*)	Remarks
Windspeed	0,1 m/s to 35 m/s	0,60 % + 0,020 m/s	By comparison with an LDV in a windtunnel

Mass Flow

Measured quantity, instrument or gauge	Range	expanded uncertainty (*)	Remarks
Balometers, accubalances, air flow meter	(28 to 195) kg/h	(3,5 to 5,7) kg/h	Supply & Return Mode - By comparison in an air performance test bench
	(196 to 975) kg/h	(6,5 to 20) kg/h	
	(976 to 5165) kg/h	(14 to 84) kg/h	

Volume Flow

Measured quantity, instrument or gauge	Range	expanded uncertainty (*)	Remarks
Balometers, accubalances, air flow meter	(25 to 170) m^3/h	(3,5 to 5,7) m^3/h	Supply & Return Mode By comparison in an air performance test bench
	(171 to 850) m^3/h	(7,8 to 21) m^3/h	
	(851 to 4500) m^3/h	(21 to 53) m^3/h	

(*) the smallest uncertainty of measurement the laboratory can provide to its customers, expressed as the expanded uncer
approximately 95%.

Temperature

Calibration and Measurement Capabilities

Resistance thermometers

Measured quantity, instrument or gauge	Range	expanded uncertainty (*)	Remarks
Resistance thermometers			Fixed points
	-38,8344 °C	0,003 °C	triple point of mercury
	0,01 °C	0,002 °C	triple point of water
	29,7646 °C	0,002 °C	melting point of gallium
	156,5985 °C	0,002 °C	freeze point of indium
	231,928 °C	0,003 °C	freeze point of tin
	419,527 °C	0,004 °C	freeze point of zinc
	660,323 °C	0,015 °C	freeze point of aluminum
	-196 °C	0,025 °C	By comparison with reference star liquid nitrogen at atmospheric pr
	-100 °C to -70 °C	0,05 °C	By comparison with reference sta
	-70 °C to 0 °C	0,015 °C	
	0 °C to 150 °C	0,011 °C	
	150 °C to 275 °C	0,012 °C	
	275 °C to 660 °C	0,04 °C	

Measured quantity, instrument or gauge	Range	Expanded uncertainty (*)	Remarks
Platinum resistance thermometers which meet the specifications of the ITS-90 or close to these specifications	-196 °C	0,01 °C	By comparison with reference star liquid nitrogen at atmospheric pr
			Fixed points
	-38,834 °C	0,004 °C	Triple point of mercury
	0,010 °C	0,001 °C	Triple point of water
	29,765 °C	0,004 °C	Melting point of gallium
	156,594 °C	0,004 °C	Triple point of indium
	231,928 °C	0,004 °C	Melting point of tin
	419,527 °C	0,006 °C	Freeze point of zinc

Standard Pt resistance thermometers

Measured quantity, instrument or gauge	Range	expanded uncertainty (*)	Remarks
Platinum resistance thermometers which meet the specifications of the ITS-90 or close to these specifications			Fixed points
	-38,8344 °C	0,003 °C	triple point of mercury
	0,01 °C	0,002 °C	triple point of water
	29,7646 °C	0,002 °C	melting point of gallium
	156,5985 °C	0,002 °C	freeze point of indium
	231,928 °C	0,003 °C	freeze point of tin
	419,527 °C	0,004 °C	freeze point of zinc
	660,323 °C	0,015 °C	freeze point of aluminum
Temperature probes with or without indicators (eg: resistance probes and thermocouples)	-196 °C	0,01 °C	By comparison with reference stan liquid nitrogen at atmospheric pr
	-100 °C to <-80 °C	0,022 °C	By comparison with reference stan thermal baths or ovens
	-80 °C to <-20 °C	0,010 °C	
	-20 °C to <300 °C	0,008 °C	
	300 °C to <450 °C	0,010 °C	
	450 °C to <660 °C	0,012 °C	
	660 °C to <1064 °C	0,80 °C	
	1064 °C to 1550 °C	1,60 °C	
	-40 °C to <80 °C	0,11 °C	By comparison with reference stan climatic chamber
	80 °C to <120 °C	0,15 °C	
	120 °C to 180 °C	0,18 °C	
	-40 °C to 0 °C	0,058 °C	Datalogger immerged in a bag comparison with reference stand thermal bath
	0 °C to 70 °C	0,083 °C	

Thermocouples

Measured quantity, instrument or gauge	Range	expanded uncertainty (*)	Remarks
Thermocouples B, R & S	0 °C to 280 °C	0,40 °C	By comparison with reference sta
	280 °C to 660 °C	0,70 °C	
	660 °C to 1100 °C	1,7 °C	
	1100 °C to 1300 °C	2,3 °C	
Thermocouples	-196 °C	0,20 °C	By comparison with reference star liquid nitrogen at atmospheric pr
	-100 °C to 280 °C	0,20 °C	By comparison with reference sta
	280 °C to 660 °C	0,50 °C	
	660 °C to 1100 °C	1,7 °C	
	1100 °C to 1300 °C	2,3 °C	

Self indicating thermometers

Measured quantity, instrument or gauge	Range	expanded uncertainty (*)	Remarks
Temperature indicators with resistance probe			Fixed points
	-38,8344 °C	0,003 °C	triple point of mercury
	0,01 °C	0,002 °C	triple point of water
	29,7646 °C	0,002 °C	melting point of gallium
	156,5985 °C	0,002 °C	freeze point of indium
	231,928 °C	0,003 °C	freeze point of tin
	419,527 °C	0,004 °C	freeze point of zinc
	660,323 °C	0,015 °C	freeze point of aluminum
	-196 °C	0,025 °C	By comparison with reference star liquid nitrogen at atmospheric pr
	-100 °C to -70 °C	0,05 °C	By comparison with reference sta
	-70 °C to 0 °C	0,015 °C	
	0 °C to 150 °C	0,011 °C	
	150 °C to 275 °C	0,012 °C	
	275 °C to 660 °C	0,04 °C	

Temperature indicators with thermocouple probes B, R & S	0 °C to 280 °C	0,40 °C	By comparison with reference sta
	280 °C to 660 °C	0,70 °C	
	660 °C to 1100 °C	1,7 °C	
	1100 °C to 1300 °C	2,3 °C	
Temperature indicators with thermocouple probes	-196 °C	0,20 °C	By comparison with reference star liquid nitrogen at atmospheric pr
	-100 °C to 280 °C	0,20 °C	By comparison with reference sta
	280 °C to 660 °C	0,50 °C	
	660 °C to 1100 °C	1,7 °C	
	1100 °C to 1300 °C	2,3 °C	
Analogue thermometers	-100 °C to 0 °C	0,60 °C	By comparison with reference sta
	0 °C to 280 °C	0,20 °C	
Liquid in glass thermometers	-100 °C to 0 °C	0,06 °C	By comparison with reference sta (totally or partially submerge Partially submerged thermometer bigger CMC than mentione The final uncertainty will depend thermometer's devision.
	0 °C to 275 °C	0,025 °C	
	-80 °C to < -58 °C	0,11 °C	
	-58 °C to < 160 °C	0,01 °C	
	160 °C to < 300 °C	0,03 °C	
	300 °C to 350 °C	0,10 °C	
Surface temperature probes	ambient to 300 °C	0,50 % × t + 0,50 °C	By comparison with reference sta

Radiation thermometry

Measured quantity, instrument or gauge	Range	expanded uncertainty (*)	Remarks
Infrared thermometry	-17 °C to 100 °C	0,50 °C	By comparison with reference sta
	100 °C to 200 °C	0,60 °C	
	200 °C to 400 °C	1,7 °C	
	400 °C to 600 °C	0,60%	
	600 °C to 800 °C	0,70%	

Temperature controlled chambers

Measured quantity, instrument or gauge	Range	expanded uncertainty (*)	Remarks
Charcterisation of ovens and climatic chambers	-100 °C to -38,5 °C	1,3 °C	By comparison with appropriate re standards (depending on the ty chamber or oven)
	-38,5 °C to 230 °C	0,070 °C	
	230 °C to 600 °C	0,50 °C	
	600 °C to 1000 °C	0,50 °C	
	1000 °C to 1550 °C	2,3 °C	

Other temperature enclosures

Measured quantity, instrument or gauge	Range	expanded uncertainty (*)	Remarks
Block calibrators	-100 °C to 650 °C	0,040 °C + 0,000 05 × $\|t\|$	Full evaluation following DOC EM "Guidelines on the Calibratio Temperature Block Calibrato Or calibration with known evalu information

Cold junction compensation

Measured quantity, instrument or gauge	Range	expanded uncertainty (*)	Remarks
Cold junction compensation B, R & S	0 °C	0,25 °C	
Cold junction compensation	0 °C	0,060 °C	

Onsite calibration

Measured quantity, instrument or gauge	Range	expanded uncertainty (*)	Remarks
Temperature probe with or without readout (pyrometers excepted)	-196 °C to <232 °C	0,05 °C	By comparison with reference sta thermal baths or ovens
	232 °C to <420 °C	0,06 °C	
	420 °C to <660 °C	0,08 °C	
	660 °C to <1064 °C	1,00 °C	
	1064 °C to 1550 °C	1,90 °C	
Temperature probe with or without readout	-100 °C to -20 °C	0,11 °C	By comparison in Block calibrato external reference standard
	-20 °C to 50 °C	0,09 °C	
	50 °C to 250 °C	0,16 °C	
	250 °C to 650 °C	0,22 °C	

(*) the smallest uncertainty of measurement the laboratory can provide to its customers, expressed as the expanded uncertain approximately 95%.

Humidity

Calibration and Measurement Capabilities

Hygrometers

Measured quantity, instrument or gauge	Range	Expanded uncertainty (*)	Remarks
Dew point meters, impedance hygrometers and psychrometers	-60 °Cfp to -30 °Cfp	0,10 °Cdp	Temperature frost- or dew
	-30 °Cfp to 60 °Cdp	0,08 °Cdp	
	60 °Cdp to 80 °Cdp	0,10 °Cdp	
	Relative humidity from 5% rh up to 95% rh	From 0,30% rh up to 1,3% rh	Temperature from -20 °C up to comparison with reference sta humidity generator

Measured quantity, instrument or gauge	Range	Expanded uncertainty (*)	Remarks
Dew point meters, impedance hygrometers and psychrometers	-20 °Cfp to +60 °Cdp	0,21 °Cdp	Temperature frost- or dew
	Relative humidity from 5 % rh up to 95 % rh	From 0,30 % rh up to 2,1 % rh	Temperature from -20 °C up to comparison with reference sta humidity generator

Measured quantity, instrument or gauge	Range	Expanded uncertainty (*)	Remarks
RH meters with sensor type: resistive, capacitive, electrolytic, impedance, …	5% rh to 95 % rh @ -10 °C to 70 °C	0,26 % rh to 0,73 % rh	By comparison with two press temperatures) humidity ge

Ambient thermometer / humidity meters with sensor type: resistive, capacitive, electrolytic, impedance, …	30 % rh to 85 % rh -20 °C to 140 °C	4,0 % rh 0,10 °C	By comparison with standard s climatic chamber

Other instruments for humidity

Measured quantity, instrument or gauge	Range	Expanded uncertainty (*)	Remarks
Dew point meters	-70 °C to 0 °C	0,10 °C	Temperature frost- or dew
	0 °C to 10 °C	0,12 °C	

Generators for Humidity

Measured quantity, instrument or gauge	Range	Expanded uncertainty (*)	Remarks
Humidity generator	5 % rh to 90 % rh	0,10 % rh to 0,90 % rh	By comparison with dewpoi

Humidity of temperature controlled chambers

Measured quantity, instrument or gauge	Range	Expanded uncertainty (*)	Remarks
Characterisation of climatic chambers	5 % rh to 95 % rh	from 0,30 % rh to 2,1 % rh	Temperature from -20 °C up to 80 °C With a dew point meter or hyg

(*) The smallest uncertainty of measurement the laboratory can provide to its customers, expressed as the expanded uncertaint
approximately 95%.

Chemical Analysis

Calibration and Measurement Capabilities

Inhouse calibrations			
Measured quantity, instrument or gauge	**Range**	**Expanded uncertainty (*)**	**Remarks**
Gas analyzers	0 % (mol/mol) CO2 up to 10 % (mol/mol) CO2	0,06 % (mol/mol) CO_2	By comparison with ISO/IEC 1 accredited gas cylinders
	10 % (mol/mol) CO2 up to 20 % (mol/mol) CO2	0,11 % (mol/mol) CO_2	
Onsite calibrations			
Measured quantity, instrument or gauge	**Range**	**Expanded uncertainty (*)**	**Remarks**
Gas analyzers, CO_2 incubators	from 0 % (mol/mol) CO2 up to 20 % (mol/mol) CO2	0,24 % (mol/mol) CO_2	By comparison with referen standards in the chamber of customer

(*) The smallest uncertainty of measurement the laboratory can provide to its customers, expressed as the expanded uncert approximately 95%.

Reference materials

Calibration and Measurement Capabilities

Hardness

Measured quantity, instrument or gauge	Range	expanded uncertainty (*)	Remarks
Hardness tester	0 Shore A to 100 Shore A	0,50 Shore A	
	0 Shore D to 100 Shore D	0,50 Shore D	
Reference for hardness tester	Shore A	2,0 mN	
	Shore D	6,0 mN	

(*) the smallest uncertainty of measurement the laboratory can provide to its customers, expressed as the expanded unc
of approximately 95%.

Volume

Calibration and Measurement Capabilities

Volume

Measure quantity, instrument or gauge	Range	expanded uncertainty (*)	Remarks	C
Volume measuring devices, pipettes	5 µl to 50 ml	0,05 + (0,002 x V) in µl	Gravimetric method	
Volume measuring devices, glass cups, recipients, …	50 ml to 100 ml	1,0 ml	Gravimetric method	
	100 ml to 200 ml	1,5 ml		
	200 ml to 300 ml	2,0 ml		
	300 ml to 500 ml	2,5 ml		
	500 ml to 1000 ml	3,0 ml		
	1 l to 5 l	3,5 ml		

(*) the smallest uncertainty of measurement the laboratory can provide to its customers, expressed as the expanded unce
approximately 95%.