

Annex to the accreditation certificate BELAC No. 368-CAL


TRESCAL SA

Version No. 2

Issue date : 2010-08-12

Validity date : 2012-06-22

In the name of the Accreditation Board,
The Chair,

A handwritten signature in black ink, appearing to read 'Nicole Meurée-Vanlaethem'.

Nicole Meurée-Vanlaethem

BELAC

Secretariat :

FEDERAL PUBLIC SERVICE ECONOMY, SME's, SELF-EMPLOYED AND ENERGY
General Direction Quality and Safety
Accreditation

Bd du Roi Albert II, 16 – 5th floor – BE-1000 Brussels - Belgium

Tel: +32 2 277 54 34 Fax: +32 2 277 54 41

Web site : <http://Belac.fgov.be> - E-Mail: Belac@economie.fgov.be

TABLE 1 – Volt DC

Measurement Range	Frequency	Best measurement capability expressed as an expanded uncertainty (k=2)	Remarks
Specific Value 0 V	DC	0,5 μ V	Generation only
Others values			
0 mV to 200 mV	DC	$8 \cdot 10^{-6} \cdot U + 2 \mu$ V	Generation only
> 200 mV to 2 V	DC	$8 \cdot 10^{-6} \cdot U + 2 \mu$ V	Positive or negative measurand
> 2 V to 20 V	DC	$8 \cdot 10^{-6} \cdot U + 7 \mu$ V	
> 20 V to 200 V	DC	$10 \cdot 10^{-6} \cdot U + 80 \mu$ V	
> 200 V to 1000 V	DC	$11 \cdot 10^{-6} \cdot U + 500 \mu$ V	
0 mV to < 200 mV	DC	$8 \cdot 10^{-6} \cdot U + 2 \mu$ V	Measurement only
200 mV to < 2 V	DC	$8 \cdot 10^{-6} \cdot U + 2 \mu$ V	Positive or negative measurand
2 V to < 20 V	DC	$8 \cdot 10^{-6} \cdot U + 7 \mu$ V	
20 V to < 200 V	DC	$13 \cdot 10^{-6} \cdot U + 80 \mu$ V	
200 V to 1000 V	DC	$13 \cdot 10^{-6} \cdot U + 500 \mu$ V	

TABLE 2 – DC Current

Measurement range	Frequency	Best measurement capability expressed as an expanded uncertainty (k=2)	Remarks
Specific value 0 A	DC	10 pA	Generation only
Others value			
10 μ A to 100 μ A	DC	$6 \cdot 10^{-5} \cdot I + 10$ nA	Generation only
100 μ A to 2 mA	DC	$6 \cdot 10^{-5} \cdot I + 10$ nA	Positive or negative value
> 2 mA to 20 mA	DC	$6 \cdot 10^{-5} \cdot I + 80$ nA	
> 20 mA to 200 mA	DC	$8 \cdot 10^{-5} \cdot I + 1 \mu$ A	
> 200 mA to 2 A	DC	$1,3 \cdot 10^{-4} \cdot I + 25 \mu$ A	
> 2 A to 10 A	DC	$4 \cdot 10^{-4} \cdot I + 500 \mu$ A	
10 μ A to 100 μ A	DC	$1,2 \cdot 10^{-4} \cdot I + 1$ nA	Measurement only
100 μ A to 199 μ A	DC	$1,2 \cdot 10^{-4} \cdot I + 1$ nA	Positive or negative value
> 199 μ A to 1,99 mA	DC	$1,2 \cdot 10^{-4} \cdot I + 5$ nA	
> 1,99 mA to 19,9 mA	DC	$1,2 \cdot 10^{-4} \cdot I + 50$ nA	
> 19,9 mA to 199 mA	DC	$1,3 \cdot 10^{-4} \cdot I + 1 \mu$ A	
> 199 mA to 1,99 A	DC	$2,5 \cdot 10^{-4} \cdot I + 20 \mu$ A	
> 1,99 A to 10 A	DC	$1,0 \cdot 10^{-4} \cdot I + 200 \mu$ A	
> 10 A to 100 A	DC	$1,5 \cdot 10^{-4} \cdot I + 2$ mA	

TABLE 3 – Volt AC

Measurement Range	Frequency	Best measurement capability expressed as an expanded uncertainty (k=2)	Remarks
22 mV to < 220 mV	20 Hz to < 40 Hz	$3 \cdot 10^{-4} \cdot U + 10 \mu\text{V}$	Generation only
	40 Hz to 20 kHz	$1,5 \cdot 10^{-4} \cdot U + 10 \mu\text{V}$	
	> 20 kHz to 50 kHz	$3,5 \cdot 10^{-4} \cdot U + 10 \mu\text{V}$	
	> 50 kHz to 100 kHz	$1 \cdot 10^{-3} \cdot U + 25 \mu\text{V}$	
0,22 V to < 2,2 V	20 Hz to < 40 Hz	$2 \cdot 10^{-4} \cdot U + 25 \mu\text{V}$	
	40 Hz to 20 kHz	$1 \cdot 10^{-4} \cdot U + 10 \mu\text{V}$	
	> 20 kHz to 50 kHz	$1,5 \cdot 10^{-4} \cdot U + 20 \mu\text{V}$	
	> 50 kHz to 100 kHz	$3 \cdot 10^{-4} \cdot U + 70 \mu\text{V}$	
2,2 V to < 22 V	20 Hz to < 40 Hz	$2 \cdot 10^{-4} \cdot U + 250 \mu\text{V}$	
	40 Hz to 20 kHz	$1 \cdot 10^{-4} \cdot U + 60 \mu\text{V}$	
	> 20 kHz to 50 kHz	$1,5 \cdot 10^{-4} \cdot U + 160 \mu\text{V}$	
	> 50 kHz to 100 kHz	$3 \cdot 10^{-4} \cdot U + 350 \mu\text{V}$	
22 V to < 220 V	20 Hz to < 40 Hz	$2 \cdot 10^{-4} \cdot U + 2,5 \text{ mV}$	Measurement only
	40 Hz to 20 kHz	$1 \cdot 10^{-4} \cdot U + 0,8 \text{ mV}$	
	> 20 kHz to 50 kHz	$2,5 \cdot 10^{-4} \cdot U + 3,5 \text{ mV}$	
	> 50 kHz to 100 kHz	$6 \cdot 10^{-4} \cdot U + 8 \text{ mV}$	
220 V to 1000 V	40 Hz to 1 kHz	$1,5 \cdot 10^{-4} \cdot U + 4 \text{ mV}$	
	> 1 kHz to 20 kHz	$2 \cdot 10^{-4} \cdot U + 6 \text{ mV}$	
22 mV to 199 mV	20 Hz to < 40 Hz	$3 \cdot 10^{-4} \cdot U + 5 \mu\text{V}$	
	40 Hz to 10 kHz	$3 \cdot 10^{-4} \cdot U + 5 \mu\text{V}$	
	> 10 kHz to 30 kHz	$6 \cdot 10^{-4} \cdot U + 10 \mu\text{V}$	
	> 30 kHz to 100 kHz	$1 \cdot 10^{-3} \cdot U + 25 \mu\text{V}$	
> 199 mV to 1,99 V	20 Hz to < 40 Hz	$2,5 \cdot 10^{-4} \cdot U + 25 \mu\text{V}$	
	40 Hz to 10 kHz	$2 \cdot 10^{-4} \cdot U + 25 \mu\text{V}$	
	> 10 kHz to 30 kHz	$3 \cdot 10^{-4} \cdot U + 50 \mu\text{V}$	
	> 30 kHz to 100 kHz	$6 \cdot 10^{-4} \cdot U + 250 \mu\text{V}$	
> 1,99 V to 19,9 V	20 Hz to < 40 Hz	$2,5 \cdot 10^{-4} \cdot U + 250 \mu\text{V}$	
	40 Hz to 10 kHz	$2 \cdot 10^{-4} \cdot U + 250 \mu\text{V}$	
	> 10 kHz to 30 kHz	$3 \cdot 10^{-4} \cdot U + 500 \mu\text{V}$	
	> 30 kHz to 100 kHz	$6 \cdot 10^{-4} \cdot U + 2,5 \text{ mV}$	
> 19,9 V to 199 V	20 Hz to < 40 Hz	$2,5 \cdot 10^{-4} \cdot U + 2,5 \text{ mV}$	
	40 Hz to 10 kHz	$2 \cdot 10^{-4} \cdot U + 2,5 \text{ mV}$	
	> 10 kHz to 30 kHz	$3 \cdot 10^{-4} \cdot U + 5 \text{ mV}$	
	> 30 kHz to 100 kHz	$7 \cdot 10^{-4} \cdot U + 25 \text{ mV}$	
> 199 V to 1000 V	40 Hz to 10 kHz	$2,5 \cdot 10^{-4} \cdot U + 50 \text{ mV}$	
	> 10 kHz to 20 kHz	$4 \cdot 10^{-4} \cdot U + 100 \text{ mV}$	

TABLE 4 – AC Current

Measurement Range	Frequency	Best measurement capability expressed as an expanded uncertainty (k=2)	Remarks
100 μA to 200 μA	40 Hz to 1 kHz	$3 \cdot 10^{-4} \cdot I + 25 \text{ nA}$	Generation only
> 200 μA to 2 mA	> 1 kHz to 5 kHz	$6 \cdot 10^{-4} \cdot I + 50 \text{ nA}$	
> 2 mA to 20 mA	40 Hz to 1 kHz	$3 \cdot 10^{-4} \cdot I + 50 \text{ nA}$	
> 20 mA to 200 mA	> 1 kHz to 5 kHz	$6 \cdot 10^{-4} \cdot I + 500 \text{ nA}$	
> 200 mA to 2 A	40 Hz to 1 kHz	$3 \cdot 10^{-4} \cdot I + 500 \text{ nA}$	
> 2 A to 10 A	> 1 kHz to 5 kHz	$6 \cdot 10^{-4} \cdot I + 5 \text{ μA}$	
	40 Hz to 1 kHz	$3 \cdot 10^{-4} \cdot I + 5 \text{ μA}$	
	> 1 kHz to 5 kHz	$6 \cdot 10^{-4} \cdot I + 50 \text{ μA}$	
	40 Hz to 1 kHz	$8 \cdot 10^{-4} \cdot I + 50 \text{ μA}$	
	> 1 kHz to 5 kHz	$8 \cdot 10^{-4} \cdot I + 100 \text{ μA}$	
	40 Hz to 1 kHz	$6 \cdot 10^{-4} \cdot I + 200 \text{ μA}$	Measurement only
	> 1 kHz to 5 kHz	$1,1 \cdot 10^{-3} \cdot I + 400 \text{ μA}$	
100 μA to 199 μA	40 Hz to 1 kHz	$4 \cdot 10^{-4} \cdot I + 25 \text{ nA}$	
> 199 μA to 1,99 mA	> 1 kHz to 5 kHz	$8 \cdot 10^{-4} \cdot I + 25 \text{ nA}$	
> 1,99 mA to 19,9 mA	40 Hz to 1 kHz	$4 \cdot 10^{-4} \cdot I + 250 \text{ nA}$	
> 19,9 mA to 199 mA	> 1 kHz to 5 kHz	$8 \cdot 10^{-4} \cdot I + 250 \text{ nA}$	
> 199 mA to 2 A	40 Hz to 1 kHz	$4 \cdot 10^{-4} \cdot I + 2,5 \text{ μA}$	
	> 1 kHz to 5 kHz	$8 \cdot 10^{-4} \cdot I + 2,5 \text{ μA}$	
	40 Hz to 1 kHz	$4 \cdot 10^{-4} \cdot I + 25 \text{ μA}$	
	> 1 kHz to 5 kHz	$8 \cdot 10^{-4} \cdot I + 25 \text{ μA}$	
	40 Hz to 1 kHz	$8 \cdot 10^{-4} \cdot I + 500 \text{ μA}$	
	> 1 kHz to 5 kHz	$2,5 \cdot 10^{-3} \cdot I + 1 \text{ mA}$	

TABLE 5 – DC Resistance

Measurement Range	Frequency	Best measurement capability expressed as an expanded uncertainty (k=2)	Remarks
Specific Values			Generation only
0 Ω	DC	1 mΩ	2 - wire
1 Ω	DC	$1 \cdot 10^{-4} \cdot R + 8 \text{ m}\Omega$	2 - wire
1,9 Ω	DC	$1 \cdot 10^{-4} \cdot R + 8 \text{ m}\Omega$	2 - wire
10 Ω	DC	$3 \cdot 10^{-5} \cdot R + 8 \text{ m}\Omega$	2 - wire
19 Ω	DC	$3 \cdot 10^{-5} \cdot R + 8 \text{ m}\Omega$	2 - wire
100 Ω	DC	$2 \cdot 10^{-5} \cdot R + 8 \text{ m}\Omega$	2 - wire
190 Ω	DC	$2 \cdot 10^{-5} \cdot R + 8 \text{ m}\Omega$	2 - wire
1 kΩ	DC	$1,5 \cdot 10^{-5} \cdot R + 20 \text{ m}\Omega$	2 - wire
1,9 kΩ	DC	$1,5 \cdot 10^{-5} \cdot R + 20 \text{ m}\Omega$	2 - wire
10 kΩ	DC	$1,5 \cdot 10^{-5} \cdot R + 100 \text{ m}\Omega$	2 - wire
19 kΩ	DC	$1,5 \cdot 10^{-5} \cdot R + 100 \text{ m}\Omega$	2 - wire
100 kΩ	DC	$2 \cdot 10^{-5} \cdot R + 100 \text{ m}\Omega$	2 - wire
190 kΩ	DC	$2 \cdot 10^{-5} \cdot R + 100 \text{ m}\Omega$	2 - wire
1 MΩ	DC	$2,5 \cdot 10^{-5} \cdot R$	2 - wire
1,9 MΩ	DC	$3 \cdot 10^{-5} \cdot R$	2 - wire
10 MΩ	DC	$5 \cdot 10^{-5} \cdot R$	2 - wire
19 MΩ	DC	$6 \cdot 10^{-5} \cdot R$	2 - wire
100 MΩ	DC	$1,4 \cdot 10^{-4} \cdot R$	2 - wire
Specific Values			Generation only
0 Ω	DC	100 μΩ	4 - wire
1 Ω	DC	$1 \cdot 10^{-4} \cdot R$	4 - wire
1,9 Ω	DC	$1 \cdot 10^{-4} \cdot R$	4 - wire
10 Ω	DC	$3 \cdot 10^{-5} \cdot R$	4 - wire
19 Ω	DC	$3 \cdot 10^{-5} \cdot R$	4 - wire
100 Ω	DC	$2 \cdot 10^{-5} \cdot R$	4 - wire
190 Ω	DC	$2 \cdot 10^{-5} \cdot R$	4 - wire
1 kΩ	DC	$1,5 \cdot 10^{-5} \cdot R$	4 - wire
1,9 kΩ	DC	$1,5 \cdot 10^{-5} \cdot R$	4 - wire
10 kΩ	DC	$1,5 \cdot 10^{-5} \cdot R$	4 - wire
19 kΩ	DC	$1,5 \cdot 10^{-5} \cdot R$	4 - wire
100 kΩ	DC	$2 \cdot 10^{-5} \cdot R$	4 - wire
190 kΩ	DC	$2 \cdot 10^{-5} \cdot R$	4 - wire
1 MΩ	DC	$2,5 \cdot 10^{-5} \cdot R$	4 - wire
1,9 MΩ	DC	$3 \cdot 10^{-5} \cdot R$	4 - wire
10 MΩ	DC	$5 \cdot 10^{-5} \cdot R$	4 - wire
19 MΩ	DC	$6 \cdot 10^{-5} \cdot R$	4 - wire
0 Ω to 19,9 Ω	DC	$2,5 \cdot 10^{-5} \cdot R + 50 \text{ }\mu\Omega$	4 - wire
> 19,9 Ω to 199 Ω	DC	$2 \cdot 10^{-5} \cdot R + 50 \text{ }\mu\Omega$	4 - wire
> 199 Ω to 1,99 kΩ	DC	$1,5 \cdot 10^{-5} \cdot R + 500 \text{ }\mu\Omega$	4 - wire
> 1,99 kΩ to 19,9 kΩ	DC	$1,5 \cdot 10^{-5} \cdot R + 5 \text{ m}\Omega$	4 - wire
> 19,9 kΩ to 199 kΩ	DC	$1,5 \cdot 10^{-5} \cdot R + 50 \text{ m}\Omega$	4 - wire
> 199 kΩ to 1,99 MΩ	DC	$2,5 \cdot 10^{-5} \cdot R + 3 \text{ }\Omega$	4 - wire
> 1,99 MΩ to 19,9 MΩ	DC	$4,5 \cdot 10^{-5} \cdot R + 100 \text{ }\Omega$	4 - wire
> 19,9 MΩ to 200 MΩ	DC	$4 \cdot 10^{-4} \cdot R + 10 \text{ k}\Omega$	4 - wire

TABLE 6 – Frequency

Measurement Range	Best measurement capability expressed as an expanded uncertainty (k=2)	Remarks
10 MHz	$4 \cdot 10^{-10} \cdot f$	Value generated by a Rb Quartz (Reference Frequency)
1 MHz to 10 MHz	$5 \cdot 10^{-10} \cdot f$	Measurements by means of an Electronic counter synchronized to the reference frequency
10 Hz to 1000 MHz	$5 \cdot 10^{-10} \cdot f + 0,5 \text{ mHz}$	Idem
1 GHz to 45 GHz	$5 \cdot 10^{-10} \cdot f + 1,5 \text{ Hz}$	Idem