TRANSMILLE
SOLUTIONS IN CALIBRATION

8100 SERIES

ADVANCED 7.5 DIGIT MULTIMETER

8109 EXTENDED SPECIFCATIONS



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Interpreting Specifications

Transmille have taken great care over presenting the extended specificaiton in a manner that is easy to read while including a high level of detail

Transmille specify specification as both Absolute and Relative specification, with varying calibration intervals from 90 Days to 2 Years

By 'Absolute Uncertainties' this means that all internal components of the multimeter have been compensated for. This includes staiblity, line voltage variation, temperature and humidity as well as the uncertainty of calibration as performed by Transmille Ltd. Two specifications are provided, the first for use at temperatures 1°C from calibration temperature, the second for use at temperatures 3°C from calibration temperature. The term 'Tcal' has been used to indicate the Temperautre of calibration

This does NOT include external sources of uncertainty such as the leads that are used to connect the multimeter to sources, nor does it include zero offsets that may have been stored.

Relative Accuracy refers to the stability of the instrument itself, without any external factors with the exception of temperature variation. This means that no allowance is made for the uncertainty of calibration.

During re-calibration, the 'Absolute Uncertainties' should be used for verification of the instrument. If the calibration laboratory performing the calibration offers better uncertainties than those of Transmille the published absolute uncertianties may be used, or new absolute uncertainties can be calculated by combining the relative specification and uncertainty of calibration.

If the calibration laboratory has LARGER uncertainties than that of Transmille, new absolute uncertainties must be calculated for the instrument as the absolute specification in this datasheet will no longer be valid.

All of Transmille's Absolute Uncertainty specifications are presented at a confidence interval of 95%, $k=2$

This is for ease of use in an accredited laboratory where other uncertainty contributions are likely to be calculated or $k=2$, minimising the requirement for allowing for differences in confidence intervals

DC Voltage

Range Specifications

Range	Full Scale	Resolution	Input Impedance
100 mV	120,000,00	10nV	> 10 GOhms
1 V	1.200,000,0	100nV	> 10 GOhms
10 V	12.000,000	1uV	> 10 GOhms
100 V	120.000,00	10µV	10 MOhms, 1%
1000 V	1.050,000,0	100µV	10 MOhms, 1%

Accuracy Relative To Calibration Standards

Range	90 Day	180 Day	1 Year	2 Year
	± (ppm Reading + ppm Range)			
100 mV	9.6 + 4	10.8 + 4	12 + 4	17 + 4
1 V	7.2 + 1	8.1 + 1	9 + 1.4	13 + 1.4
10 V	7.2 + 1	8.1 + 1	9 + 1.4	13 + 1.4
100 V	11.2 + 2	12.6 + 2	14 + 2.8	20 + 1.8
1000 V	11.2 + 3	12.6 + 3	14 + 2.8	20 + 2.8

Absolute Uncertainty (95% Confidence)

Range	1 Year					
	Tcal ± 1°C			Tcal ± 3°C		
	± (ppm Reading + ppm Range)					
100 mV	14.7	+	4	19.3	+	4
1 V	10.6	+	1.4	14.1	+	1.4
10 V	10.8	+	1.4	14.3	+	1.4
100 V	16.5	+	1.8	22.0	+	1.8
1000 V	16.5	+	2.8	22.0	+	2.8

Notes :
1) Specifications valid only when Null verified/performed. Errors caused by thermals on external leads can be greater than 5uV which equates to 5ppm at the 1V level
2) Specifications apply for default filter settings.
3) Input protection of 1,100V RMS is provided on all ranges

DC Current

Range Specifications

Range	Full Scale	Resolution	Input Impedance
100 µA	120,000,0	100 pA	10 kOhms
1 mA	1.200,000	1 nA	1 kOhms
10 mA	12.000,00	10 nA	100 Ohms
100 mA	120,000,0	100 nA	10 Ohms
1 A	1.200,000	1 µA	0.5 Ohms
10 A	12.000,00	10 µA	10 mOhms
30 A	30.500,0	100µA	10 mOhms

Accuracy Relative To Calibration Standards

Range	90 Day			180 Day			1 Year			2 Year		
	± (ppm Reading + ppm Range)											
100 µA	20	+	14	23	+	14	25	+	14	35	+	14
1 mA	20	+	14	23	+	14	25	+	14	35	+	14
10 mA	28	+	14	32	+	14	35	+	14	49	+	14
100 mA	88	+	22	99	+	22	110	+	22	154	+	22
1 A	440	+	45	495	+	45	550	+	45	770	+	45
10 A	1200	+	120	1350	+	120	1500	+	120	2100	+	120
30 A	1600	+	500	1800	+	500	2000	+	500	2800	+	500

Total Accuracy (95% Confidence)

Range	1 Year					
	Tcal ± 1°C			Tcal ± 3°C		
	± (ppm Reading + ppm Range)					
100µA	30	+	14	40	+	14
1mA	30	+	14	40	+	14
10mA	41	+	14	55	+	14
100mA	127	+	22	171	+	22
1A	636	+	45	856	+	45
10A	1735	+	120	2333	+	120
30A	2313	+	500	3111	+	500

Notes :
1) Specifications valid only when Null verified/performed
2) Specifications apply for default filter settings.
3) 1A Fuse provided on rear panel for protection of 1A range and below

AC Voltage

Range Specifications

Range	Full Scale	Resolution	Input Impedence
100mV	105,000	1µV	>1 GOhm / 90pF
1V	1.050,00	10µV	>1 GOhm / 90pF
10V	10.500,0	100µV	>1 GOhm / 90pF
100V	105.000	1mV	1 MOhm / 130pF
1000V	1050.00	10mV	1 MOhm / 130pF

Accuracy Relative To Calibration Standards

Range	Frequency	90 Day			180 Day			1 Year			2 Year		
		± (% Reading + % Range)											
100mV	10Hz to 40Hz	0.06	+	0.08	0.12	+	0.08	0.2	+	0.08	0.28	+	0.08
	40Hz to 200Hz	0.02	+	0.05	0.05	+	0.05	0.08	+	0.05	0.11	+	0.05
	200Hz to 1KHz	0.02	+	0.04	0.04	+	0.04	0.07	+	0.04	0.10	+	0.04
	1kHz to 2kHz	0.02	+	0.04	0.04	+	0.04	0.07	+	0.04	0.10	+	0.04
	2kHz to 20kHz	0.03	+	0.05	0.06	+	0.05	0.1	+	0.05	0.14	+	0.05
	20kHz to 100kHz	0.09	+	0.2	0.18	+	0.2	0.3	+	0.2	0.42	+	0.2
1V, 10V	10Hz to 40Hz	0.05	+	0.015	0.11	+	0.08	0.18	+	0.08	0.25	+	0.08
	40Hz to 200Hz	0.02	+	0.006	0.04	+	0.05	0.07	+	0.05	0.10	+	0.05
	200Hz to 1KHz	0.02	+	0.006	0.03	+	0.03	0.05	+	0.03	0.07	+	0.03
	1KHz to 2KHz	0.02	+	0.006	0.03	+	0.03	0.05	+	0.03	0.07	+	0.03
	2kHz to 20kHz	0.03	+	0.01	0.06	+	0.05	0.1	+	0.05	0.14	+	0.05
	20kHz to 100kHz	0.09	+	0.05	0.18	+	0.2	0.3	+	0.2	0.42	+	0.2
100V, 1000V [5]	10Hz to 40Hz	0.05	+	0.09	0.11	+	0.09	0.18	+	0.09	0.25	+	0.09
	40Hz to 200Hz	0.02	+	0.06	0.05	+	0.06	0.08	+	0.06	0.11	+	0.06
	200Hz to 1kHz	0.02	+	0.03	0.04	+	0.03	0.06	+	0.03	0.08	+	0.03
	1kHz to 2kHz	0.02	+	0.03	0.04	+	0.03	0.06	+	0.03	0.08	+	0.03
	2kHz to 20kHz	0.03	+	0.05	0.05	+	0.05	0.1	+	0.05	0.14	+	0.05

Notes :
1) Specifications valid from 10% + 3mV of range
2) High input impedance on 100mV, 1V and 10V range enable direct connection for AC current shunts for measurement of current
3) Settling time : 100mV, 1V, 10V Ranges : < 20 s, 100V, 1000V Ranges : < 5s
4) Input protection of 1,100V RMS provided
5) 100V Range to 20kHz, 1000V Range to 10kHz

Absolute Uncertainty (95% Confidence)

Range	Frequency	1 Year					
		Tcal ± 1°C			Tcal ± 3°C		
		± (% Reading + % Range)					
100mV	10Hz to 40Hz	0.1	+	0.08	0.12	+	0.08
	40Hz to 200Hz	0.09	+	0.05	0.11	+	0.05
	200Hz to 1kHz	0.09	+	0.04	0.11	+	0.04
	1kHz to 2kHz	0.09	+	0.04	0.11	+	0.04
	2kHz to 20kHz	0.12	+	0.05	0.16	+	0.05
	20kHz to 100kHz	0.35	+	0.20	0.47	+	0.20
1V 10V	10Hz to 40Hz	0.21	+	0.08	0.28	+	0.08
	40Hz to 200Hz	0.08	+	0.05	0.11	+	0.05
	200Hz to 1kHz	0.06	+	0.03	0.08	+	0.03
	1kHz to 2kHz	0.06	+	0.03	0.08	+	0.03
	2kHz to 20kHz	0.12	+	0.05	0.16	+	0.05
	20kHz to 100kHz	0.35	+	0.20	0.47	+	0.20
100V 1000V [5]	10Hz to 40Hz	0.21	+	0.09	0.28	+	0.09
	40Hz to 200Hz	0.09	+	0.06	0.12	+	0.06
	200Hz to 1kHz	0.07	+	0.03	0.09	+	0.03
	1kHz to 2kHz	0.08	+	0.03	0.09	+	0.03
	2kHz to 20kHz	0.12	+	0.05	0.16	+	0.05

Notes :
1) Specifications valid from 10% + 3mV of range
2) High input impedance on 100mV, 1V and 10V range enable direct connection for AC current shunts for measurement of current
3) Settling time : 100mV, 1V, 10V Ranges : < 20 s, 100V, 1000V Ranges : < 5s
4) Input protection of 1,100V RMS provided
5) 100V Range to 20kHz, 1000V Range to 10kHz

AC Current

Range Specifications

Range	Full Scale	Resolution	Input Impedance
100µA	100.500	1nA	1 kOhm
1mA	1.050,00	10nA	1 kOhm
10mA	10.500,0	100nA	100 Ohms
100mA	105.000	1µA	10 Ohms
1A	1.050,00	10µA	0.5 Ohms
10A	10.500,0	100µA	10 mOhms
30A	30.500	1mA	10 mOhms

Accuracy Relative To Calibration Standards

Range	Frequency	90 Day			180 Day			1 Year			2 Year		
		± (% Reading + % Range)											
100µA , 1mA 10mA, 100mA	10Hz to 40Hz	0.040	+	0.04	0.08	+	0.04	0.13	+	0.04	0.18	+	0.04
	40Hz to 1kHz	0.024	+	0.03	0.05	+	0.03	0.08	+	0.03	0.08	+	0.03
	1KHz to 10kHz	0.090	+	0.09	0.18	+	0.09	0.3	+	0.09	0.30	+	0.09
1 A	10Hz to 40Hz	0.06	+	0.06	0.12	+	0.06	0.20	+	0.06	0.20	+	0.06
	40Hz to 1kHz	0.03	+	0.05	0.06	+	0.05	0.10	+	0.05	0.10	+	0.05
	1KHz to 10kHz	0.09	+	0.15	0.18	+	0.15	0.30	+	0.15	0.30	+	0.15
10 A 30 A	10Hz to 40Hz	0.09	+	0.10	0.18	+	0.10	0.30	+	0.10	0.30	+	0.10
	40Hz to 1kHz	0.12	+	0.10	0.25	+	0.10	0.40	+	0.10	0.40	+	0.10

Absolute Uncertainty (95% Confidence)

Range	Frequency	1 Year					
		Tcal ± 1°C			Tcal ± 3°C		
		± (% Reading + % Range)					
100µA, 1mA 10mA, 100mA	10Hz to 40Hz	0.16	+	0.04	0.20	+	0.04
	40Hz to 1kHz	0.09	+	0.03	0.12	+	0.03
	1kHz to 10kHz	0.35	+	0.09	0.47	+	0.09
1A	10Hz to 40Hz	0.24	+	0.06	0.31	+	0.06
	40Hz to 1kHz	0.12	+	0.05	0.16	+	0.05
	1kHz to 10kHz	0.35	+	0.15	0.47	+	0.15
10A 30A	10Hz to 40Hz	0.36	+	0.10	0.47	+	0.10
	40Hz to 1kHz	0.47	+	0.10	0.62	+	0.10

Notes :
1) Specifications valid from 10% of range
2) 1A Fuse provided on rear panel for protection of 1A range and below

Resistance

Range Specifications

Range	Full Scale	Resolution	Measurment Current
10 Ohm	12.000,000	1 µOhm	10mA
100 Ohm	120.000,00	10 µOhm	10mA
100 Ohm Low Current	120.000,00	10 µOhm	1mA
1 kOhm	1.200,000,0	100 µOhms	10mA
1 kOhm Low Current	1.200,000,0	100 µOhms	1mA
10 kOhm	12.000,000	1 mOhms	1mA
10 kOhm Low Current	12.000,000	1 mOhms	100µA
100 kOhm	120.000,00	10 mOhms	100µA
1 MOhm [1]	1.200,000,0	100 mOhms	10µA
10 MOhm [1]	12.000,000	1 Ohm	1µA
100 MOhm [12]	120.000,00	10 Ohm	1uA / 10 Mohm
1 GOhm [12]	1.100,000,0	100 Ohms	1uA / 10 Mohm

Accuracy Relative To Calibration Standards

Range	90 Day			180 Day			1 Year			2 Year		
	± (ppm Reading + ppm Range)											
10 Ohm	24	+	8	27	+	8	30	+	8	42	+	8
100 Ohm	20	+	3	23	+	3	25	+	3	35	+	3
100 Ohm Low Current	22	+	10	25	+	10	27	+	10	37.8	+	10
1 kOhm	16	+	2	18	+	2	20	+	2	28	+	2
1 kOhm Low Current	18	+	6	20	+	6	22	+	6	30.8	+	6
10 kOhm	20	+	2	23	+	2	25	+	2	35	+	2
10 kOhm Low Current	22	+	10	25	+	10	27	+	10	37.8	+	10
100 kOhm	24	+	2	27	+	2	30	+	2	42	+	2
1 MOhm [1]	28	+	5	32	+	5	35	+	5	49	+	5
10 MOhm [1]	38	+	20	43	+	20	48	+	20	67.2	+	20
100 MOhm [12]	400	+	20	450	+	20	500	+	20	700	+	20
1 GOhm [12]	0.4%	+	20	0.45%	+	20	0.5%	+	20	0.7%	+	20

Notes :
1) Available as 2 Wire Measurement Only
2) Measurement performed in Parallel with 10 MOhm
3) Specifications valid only after Null performed with measurement leads or in Ohms Compensation
4) Ohms Compensation function available - automatically compensates for thermals in measurement leads

Absolute Uncertainty (95% Confidence)

Range	1 Year					
	Tcal ± 1°C			Tcal ± 3°C		
	± (ppm Reading + ppm Range)					
10 Ohm	34.8	+	8	46.7	+	8
100 Ohm	29.0	+	3	38.9	+	3
100 Ohm Low Current	31.3	+	10	42.0	+	10
1 kOhm	23.2	+	2	31.1	+	2
1 kOhm Low Current	25.5	+	6	34.3	+	6
10 kOhm	28.9	+	2	38.9	+	2
10 kOhm Low Current	31.3	+	10	42.0	+	10
100 kOhm	34.8	+	2	46.7	+	2
1 MOhm [1]	40.9	+	5	54.8	+	5
10 MOhm [1]	55.7	+	20	74.8	+	20
100 MOhm [12]	597	+	20	792	+	20
1 Gohm [12]	0.57%	+	20	0.77%	+	20

Notes :
1) Available as 2 Wire Measurement Only
2) Measurement performed in Parallel with 10 MOhm
3) Specifications valid only after Null performed with measurement leads or in Ohms Compensation
4) Ohms Compensation function available - automatically compensates for thermals in measurement leads

Frequency

Signal Amplitude Range	5% of range to full scale	
Resolution (FAST Gate)	0.1Hz (after 5 samples)	
Resolution (SLOW Gate)	1Hz - 99.999Hz	10uHz
	100Hz to 999.99Hz	100uHz
	1kHz to 9.9999kHz	1mHz
	10kHz to 1MHz	1Hz
Frequency Range	10Hz to 1MHz	
Accuracy (1 Year)*	2ppm ± 2 Digits	
Sample Interval	FAST : 1s, SLOW 5s	

Operational Specifications

Resolution	Filter Speeds
4.5 Digits	**125 ms**, 250 ms, 500 ms, 1s, 2s, 4s, 8s, 16s, 32s
5.5 Digits	125 ms, **250 ms**, 500 ms, 1s, 2s, 4s, 8s, 16s, 32s
6.5 Digits	125 ms, 250 ms, **500 ms,** 1s, 2s, 4s, 8s, 16s, 32s
7.5 Digits	**1s**, 2s, 4s, 8s, 16s, 32s

ABOUT US

We truly believe in offering Solutions in Calibration, offering bespoke solutions for calibration laboratories and manufacturers across the globe. Our mission statement is not just a phrase, it is our design and support philosophy, offering support and advice that cannot be found elsewhere with a friendly atmosphere.

Transmille was founded in 1997 as a commercial calibration service, and soon after began to develop and manufacture a range of electrical calibration products and software to answer a growing requirement for solutions to common problems. Following this small beginning, Transmille has worked year on year to provide unique equipment and software to benefit calibration laboratories and manufacturers across the globe.

Ever since releasing the very first products Transmille have continued to innovate and develop new products for the metrology community, from world first products such as the 2100 Electrical Test Equipment calibrator, through to the worlds lowest cost multi product calibrator the 1000 series.

Transmille now produce over 600+ calibration instruments per year, shipping instruments to customers ranging from National Standards Laboratories and manufacturers through to small calibration test houses around the world.

An unrivalled commitment to quality and innovation drives Transmille forwards, with a dedicated design and support team in house with a combined experience of over 60 years in manufacture and design of electrical calibration products and software.

With 3 offices (UK, USA and India) and local representatives around the globe we can offer exceptional support to users big and small.

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