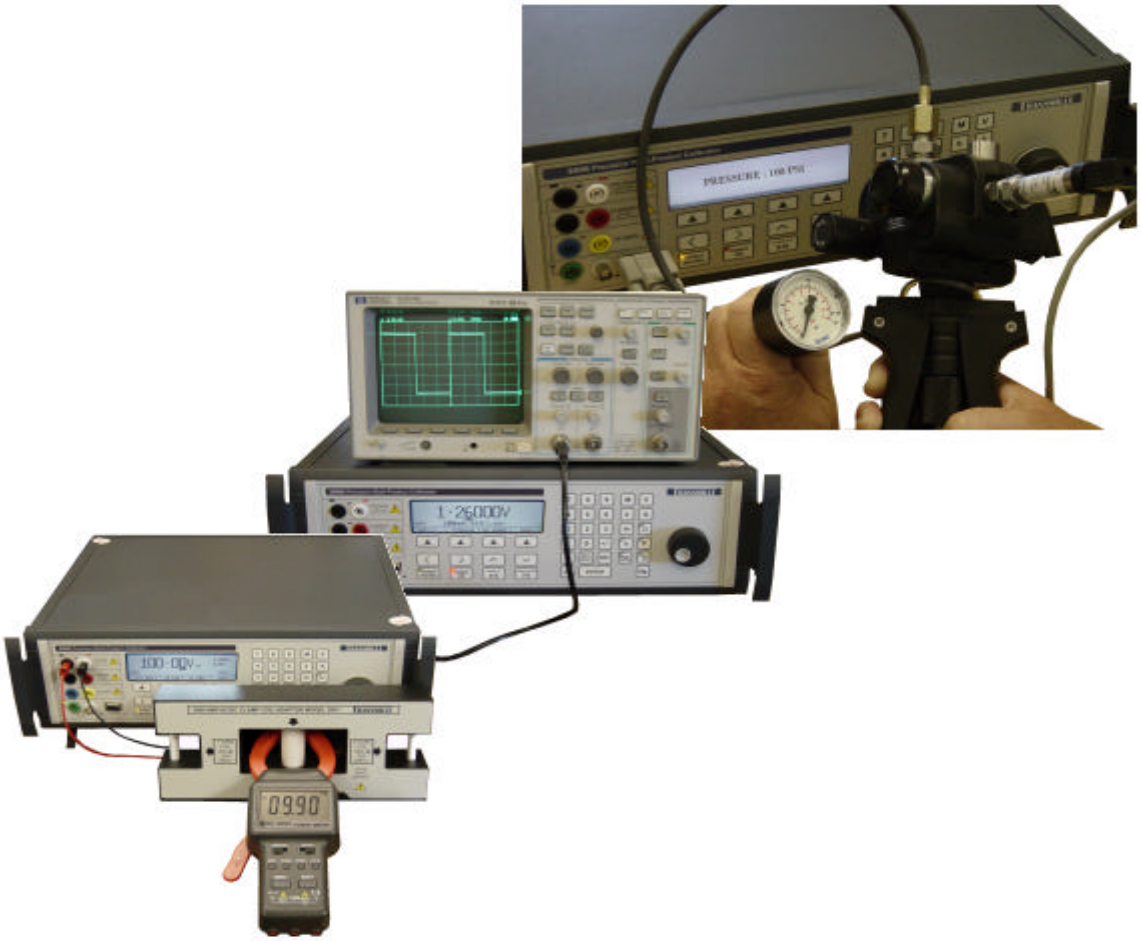
2006A MULTI-PRODUCT CALIBRATOR

5ppm LABORATORY STANDARD



EXTENDED SPECIFICATIONS

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www.transmille.com : sales@transmille.com : Tel : +44 (0) 1580 890700 : Fax : +44 (0) 1580 890711

DECLARATION OF CONFORMITY CE

Manufacturer's Name: **Transmille Ltd.**
Manufacturer's Address: **Unit 4, Select Business Centre**
Lodge Road
Staplehurst
TN12 0QW

Declares, that the product

Product Name: **Multi-product Calibrator**
Model Number: **2050 / 2041A / 2006A**
Product Options: **This declaration covers all options of the above product(s)**

Conforms with the following European Directives:

The product herewith complies with the requirements of the Low Voltage Directive 73/73EEC and the EMC Directive 89/336/EEC (including 93/68/EEC) and carries the CE Marking accordingly

Conforms with the following product standards:

EMC

Standard	**Limit**
IEC616326-1:1997+A1:1998 / EN 61326-1:1997+A1:1998 EN55011:1991	
IEC 61000-4-2:1995+A1:1998 / EN 61000-4-2:1995 Group 1Class A	
IEC 61000-4-3:1995 / EN 61000-4-3:1995	***4kV CD, 8kV AD***
IEC 61000-4-4:1995 / EN 61000-4-4:1995	***3 V/m, 80-1000 MHz***
IEC 61000-4-5:1995 / EN 61000-4-5:1995	***0.5kV signal lines, 1kV power lines***
IEC 61000-4-6:1996 / EN 61000-4-6:1996	***0.5kV line-line, 1kV line-ground***
IEC 61000-4-11:1994 / EN 61000-4-11:1994	***3V, 0.15-80 MHz I cycle, 100%***
	Dips: 30% 10ms; 60% 100ms
	Interrupt > 95%@5000ms

SAFETY

IEC 61010-1:1990+A1:1992+A2:1995 / EN 61010-1:1993+A2:1995

12/12/2001

Revision No: 1.1
Date :12/12/2001

Managing Director

2006A General Specifications

TRANSMILLE
Solutions In Calibration

Warm Up Time	Double the time since last used up to 20 minutes maximum	
Standard Interfaces	RS232	
Optional Interfaces	GPIB (IEEE-488) : USB (Universal Serial Bus)	
Temperature Performance	Storage : -5°C to +60°C Operation : 0°C to +50°C	
Relative Humidity	Operation : <80% to 30°C, <70% to 40°C, <40% to 50°C Storage : <95%, non-condensing	
Altitude	Operation : 3000m (10,000ft) Maximum Transit : 12000m (40,000ft) Maximum	
EMC & Safety	The calibrator line input plug must be earthed See D.O.C for full details	
Line Power	Line Voltage Selectable : 110V / 230V Line Frequency : 50Hz to 60Hz Line Voltage Variation : -6% +10%	
Power Consumption	28 Watts (Standby)	200 Watts (Maximum)
Low Analogue Isolation	100V	
Connections	Voltage / 2 Wire Resistance Low Current (<=2A) High current (>2A) Earth Connection Oscilloscope Functions Feature (Ext. Pod) RS232 Interface	1x Black : 1x White 4mm Safety sockets 1x Black : 1x Red 4mm Safety sockets 1x Blue : 1x Yellow 4mm Safety sockets 1x Green 4mm Safety Socket 1x BNC terminal 1x Female 'D' type socket 1x Female 'D' type socket
RS232 Settings	Baud Rate Parity Data Bits Stop Bits	9600 None 8 1
Display Information	Type Viewing Area Resolution Backlight Type Brightness	Backlit Black on white film STN type 124.3mm * 34mm 256 * 94 dots Cold fluorescent lamp 70 to 90 cd/m^2
Indicators	Voltage / Current / High Current Negative to ground Oscilloscope Feature Connector (Ext. Pod)	Red LED (between terminals) Green LED (left of Earth terminal) Green LED (right of BNC Connector) Green LED (right of 'D' type connector)
Keyboard	Membrane type with tactile feedback	
Fuses	Mains Inlet	3A A/S (240 Volt) 5A A/S (110 Volt operation)
Isolation	Outputs are opto-isolated from mains earth and the RS-232 interface Maximum common mode voltage between earth and the low terminals 30 Volts ac/dc.	
	Calibrator in Shipping Box Calibrator in Soft Carry Case Calibrator in Hard Transit case	58cm x 56cm x 37cm : 15kgs 49cm x 50cm x 19cm : 13.5kgs 55cm x 56cm x 26cm : 22kgs
Warranty Period	3 Years (Parts & Labour)	
Recommended Service Interval	1 Year	
Supplied Connections	1x Serial Interface Connection	
Optional Lead Set Kit	1x Voltage connection leadset 1x Low Current connection leadset 1x High current connection leadset 1x AC connection leadset	
Mounting Kit (optional)	3U rack mount kit	
Case Colour	Matt Dark Grey (RAL7016)	

Due to continuous development specifications may be subject to change.

2006A DC Voltage Specifications

TRANSMILLE
Solutions In Calibration

General Specifications

Range	Resolution	Max. Burden Current[1]	Output Resistance	Overload Protection
0-202mV	10nV	1mA[2]	50 Ohms	20 V
0.2-2.02V	100nV	50mA	0.2 Ohms	150V
2-20.2V	1uV	50mA	0.2 Ohms	150V
20-202V	10uV	10mA[3]	0.5 Ohms	1200V
200-1020V	100uV	10mA[3]	0.7 Ohms	1200V

Accuracy Relative to Calibration Standards Specifications

Range	24 Hour Stability		Noise[4]	90 day Rel		180 Day Rel		1 year Rel		2 year Rel	
	ppm Set	Rng	1Hz to 10Hz	ppm Set	Rng	ppm Set	Rng	ppm Set	Rng	ppm Set	Rng
0-202mV	2	+ 1	60nV	6.4	+ 2	7.2	+ 2	8	+ 2	11.2	+ 2.8
0.2-2.02V	2	+ 1	280nV	5.6	+ 2	6.3	+ 2	7	+ 2	9.8	+ 2.8
2-20.2V	2	+ 1	2.5uV	4	+ 2	4.5	+ 2	5	+ 2	7	+ 2.8
20-202V	3.5	+ 1	50.7uV	4.8	+ 2	5.4	+ 2	6	+ 2	8.4	+ 2.8
200-1020V	5	+ 2	280uV	6.4	+ 4	7.2	+ 4	8	+ 4	11.2	+ 5.6

All specifications allow 2uV for lead and thermal emf effects

Notes

Note 1 : Current limited by self resetting thermal fuse. Shown as max. current for 10 seconds/continuous operating current

Note 2 : Limited by 50 Ohm output impedance

Note 3 : Internally adjustable from 2mA to 30mA - Factory set to 10mA as standard
For safety the trip is controlled by a fail-safe circuit independant of the processor which shuts the high voltage output off in the event of an overload.

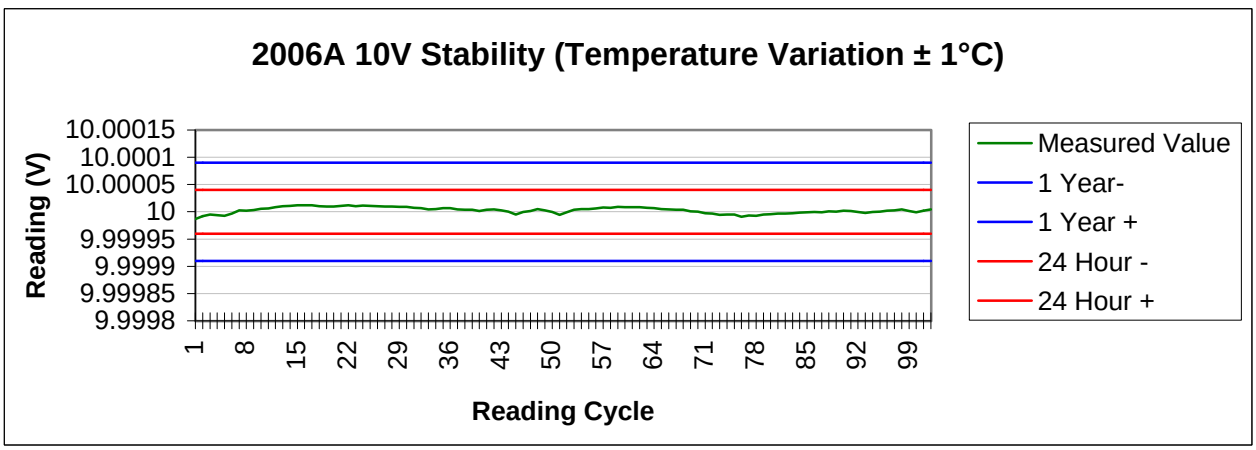
Note 4 : Typical RMS noise figures at 50% of full scale.

High Voltage Safety

High voltage output is ramped to allow instruments to auto range
Standby is automatically activated when setting voltages greater than 20V or 200V from a lower voltage
Standby is automatically selected for high voltage (>20V) after 5 minutes on the same setting
High voltage (> 20V) output is indicated to user through an audible warning beep
An external high voltage output/standby control switch is available as an option

2 Wire output / Remote sensing not available
Isolation : Floating or grounded selection available as standard
Maximum floating voltage : 100V

Specifications apply between 18°C and 25°C.
Outside this range an allowance of 0.18 x 1 Year Spec. per °C should be added.
Due to continuous development specifications may be subject to change.



2006A DC Current Specifications

General Specifications

Range	Resolution	Max. Inductive Load	Compliance Voltage	Overload Protection
0-202uA	10pA	10mH	4.2 Volts	150V
0.2-2.02mA	100pA	10mH	4.2 Volts	150V
2-20.2mA	1nA	10mH	4.2 Volts	150V
20-202mA	10nA	10mH	4.2 Volts	150V
0.2-2.02A	100nA	10mH	4.2 Volts	150V
2-20.2A	1uA	10mH	3.9 Volts	150V

Accuracy Relative to Calibration Standards Specifications

Range	Noise [1]	90 day Rel			180 Day Rel			1 year Rel			2 year Rel		
	0.1-1Hz	ppm set		Rng	ppm set		Rng	ppm set		Rng	ppm set		Rng
0-202uA	180pA	36	+	10	40.5	+	10	45	+	10	63	+	14
0.2-2.02mA	500pA	28	+	5	31.5	+	5	35	+	5	49	+	7
2-20.2mA	4nA	16	+	3	18	+	3	20	+	3	28	+	4.2
20-202mA	40nA	20	+	4	22.5	+	4	25	+	4	35	+	5.6
0.2-2.02A	1uA	68	+	12	76.5	+	12	85	+	12	119	+	16.8
2-20.2A	20uA	136	+	20	153	+	20	170	+	20	238	+	28

All specifications +/- 4nA.

Power & temperature sensor on 20A range - microprocessor monitors & protects from overheating
Duty Cycle into 0 Ohms = 90 seconds ON, 5 minutes OFF[2]

Notes

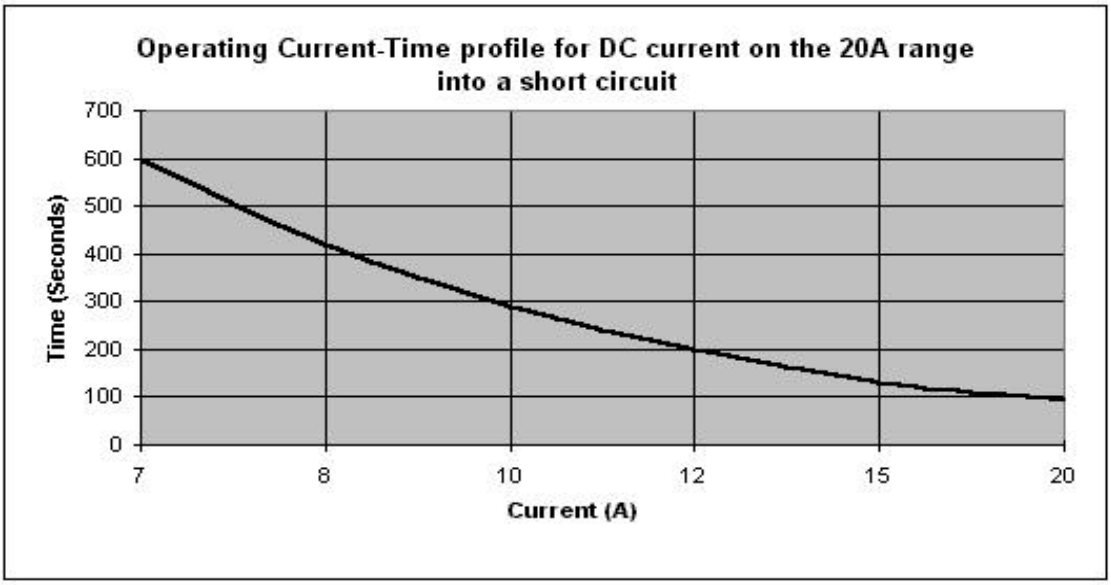
Note 1 : Typical RMS noise figures at 50% of full scale.

Note 2 : Higher resistance loads allow a longer ON period

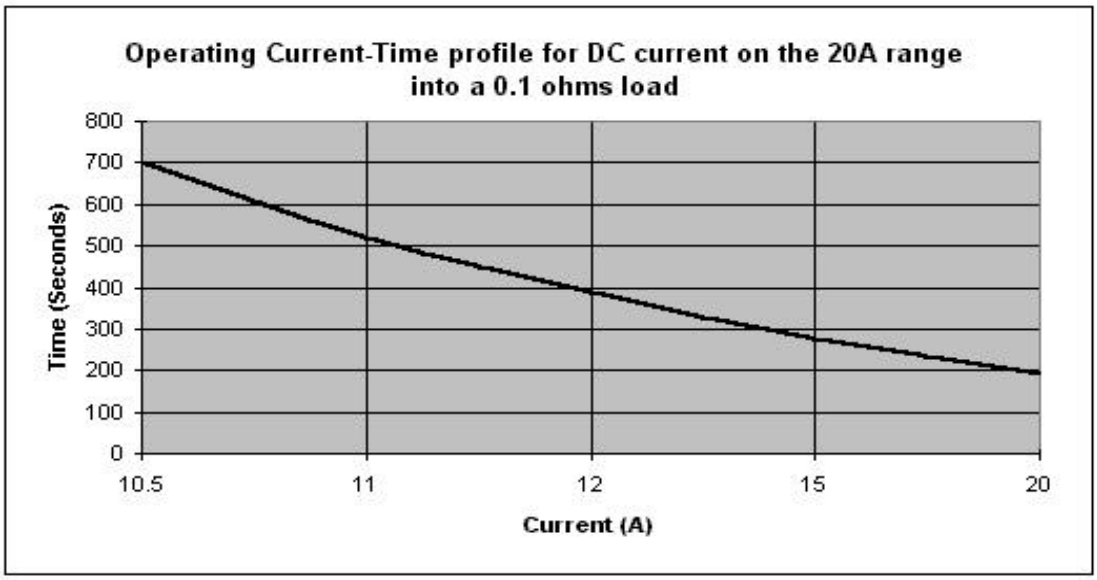
Specifications apply between 18°C and 25°C.

Outside this range an allowance of 0.18 x 1 Year Spec. per °C should be added.

Due to continuous development specifications may be subject to change.



Graph 1* : Operating time on 20A range with current into a short circuit at 20 deg C.
Continuous current in availiable below 7A output.



Graph 2* : Operating time on 20A range with current into a 0.1ohm load at 20 deg C.
Continuous current in availiable below 10.5A output.

* Note Timing is started after a minimum period of 7 minutes at zero output.
Shorter periods will reduce the output time availiable.

2006A AC Voltage Specifications

TRANSMILLE
Solutions In Calibration

General Specifications

Range	Frequency	Resolution	Max. Burden Current[1]	Output Resistance	Overload Protection
0-202mV	10Hz to 30Hz	100nV	1mA[2]	50 Ohms	20 V
	30Hz to 1kHz	100nV	1mA[2]	50 Ohms	20 V
	1kHz to 10kHz	100nV	1mA[2]	50 Ohms	20 V
	10kHz to 60kHz	100nV	1mA[2]	50 Ohms	20 V
0.2-2.02V	10Hz to 30Hz	1uV	50mA	0.2Ohms	1200V
	30Hz to 1kHz	1uV	50mA	0.2 Ohms	1200V
	1kHz to 20kHz	1uV	50mA	0.2 Ohms	1200V
	20kHz to 100kHz	1uV	50mA	0.2 Ohms	1200V
2-20.2V	10Hz to 30Hz	10uV	50mA	0.2 Ohms	1200V
	30Hz to 1kHz	10uV	50mA	0.2 Ohms	1200V
	1kHz to 20kHz	10uV	50mA	0.2 Ohms	1200V
	20kHz to 100kHz	10uV	50mA	0.2 Ohms	1200V
20-202V	30Hz to 1kHz	100uV	10mA[3]	0.5 Ohms	1200V
	1kHz to 10kHz	100uV	5mA[3]	0.5 Ohms	1200V
	10kHz to 40kHz	100uV	2mA[3]	0.5 Ohms	1200V
200-1020V	30Hz to 1kHz	1mV	10mA[3]	0.7 Ohms	1200V
	1kHz to 10kHz	1mV	2mA[3]	0.7 Ohms	1200V
	10kHz to 40kHz	1mV	2mA[3]	0.7 Ohms	1200V

Accuracy Relative to Calibration Standards Specifications

Range	Frequency	Frequency Resolution	90 day Rel		180 Day Rel		1 year Rel		2 year Rel	
			ppm set	Rng	ppm set	Rng	ppm set	Rng	ppm set	Rng
0-202mV	10Hz to 30Hz	1Hz	640 +	100	720 +	100	800 +	100	1120 +	140
	30Hz to 1kHz	1Hz	96 +	80	108 +	80	120 +	80	168 +	112
	1kHz to 10kHz	1Hz	160 +	80	180 +	80	200 +	80	280 +	112
	10kHz to 60kHz	1Hz	280 +	100	315 +	100	350 +	100	490 +	140
0.2-2.02V	10Hz to 30Hz	1Hz	520 +	80	585 +	80	650 +	80	910 +	112
	30Hz to 1kHz	1Hz	80 +	50	90 +	50	100 +	50	140 +	70
	1kHz to 20kHz	1Hz	168 +	80	189 +	80	210 +	80	294 +	112
	20kHz to 100kHz	1Hz	480 +	190	540 +	190	600 +	190	840 +	266
2-20.2V	10Hz to 30Hz	1Hz	400 +	80	450 +	80	500 +	80	700 +	112
	30Hz to 1kHz	1Hz	80 +	50	90 +	50	100 +	50	140 +	70
	1kHz to 20kHz	1Hz	168 +	80	189 +	80	210 +	80	294 +	112
	20kHz to 100kHz	1Hz	480 +	190	540 +	190	600 +	190	840 +	266
20-202V	30Hz to 1kHz	1Hz	80 +	60	90 +	60	100 +	60	140 +	84
	1kHz to 10kHz	1Hz	160 +	80	180 +	80	200 +	80	280 +	112
	10kHz to 40kHz	1Hz	240 +	150	270 +	150	300 +	150	420 +	210
200-1020V	30Hz to 1kHz	1Hz	80 +	100	90 +	100	100 +	100	140 +	140
	1kHz to 10kHz	1Hz	160 +	120	180 +	120	200 +	120	280 +	168
	10kHz to 40kHz	1Hz	280 +	250	315 +	250	350 +	250	490 +	350

All specifications +/- 20uV. All specifications apply from 10% of full scale.

Notes

Note 1 : Current limited by self resetting thermal fuse. Shown as max. current for 10 seconds/continuous operating current

Note 2 : Limited by 50 Ohm output impedance

Note 3 : Internally adjustable from 2mA to 30mA - Factory set to 10mA as standard
For safety the trip is controlled by a fail-safe circuit independant of the processor which shuts the high voltage output off in the event of an overload.

2 Wire output / Remote sensing not available Maximum floating voltage : 100V Isolation : Floating or grounded selection available as standard

Specifications apply between 18°C and 25°C. Outside this range an allowance of 0.18 x 1 Year Spec. per °C should be added.

Due to continuous development specifications may be subject to change.

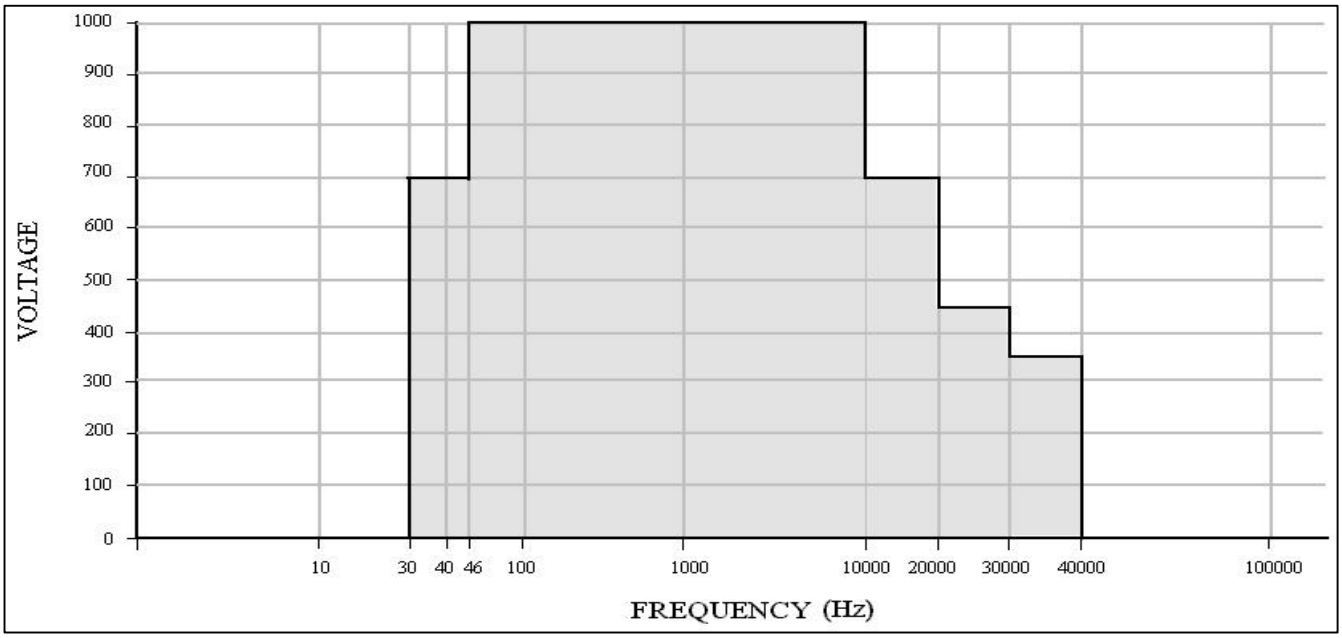
2006A AC Voltage Specifications

High Voltage Safety
High voltage output is ramped to allow instruments under test to auto-range.
Standby is automatically activated when setting voltages greater than 20V or 200V from a lower voltage.
Standby is automatically selected for high voltage (>20V) after 20 minutes on the same setting for frequencies up 5kHz or 3 mins for frequencies above 5kHz. See graph 4.
High voltage (> 20V) output is indicated to user through an audible warning beep.
An external high voltage output/standby control switch is available as an option.

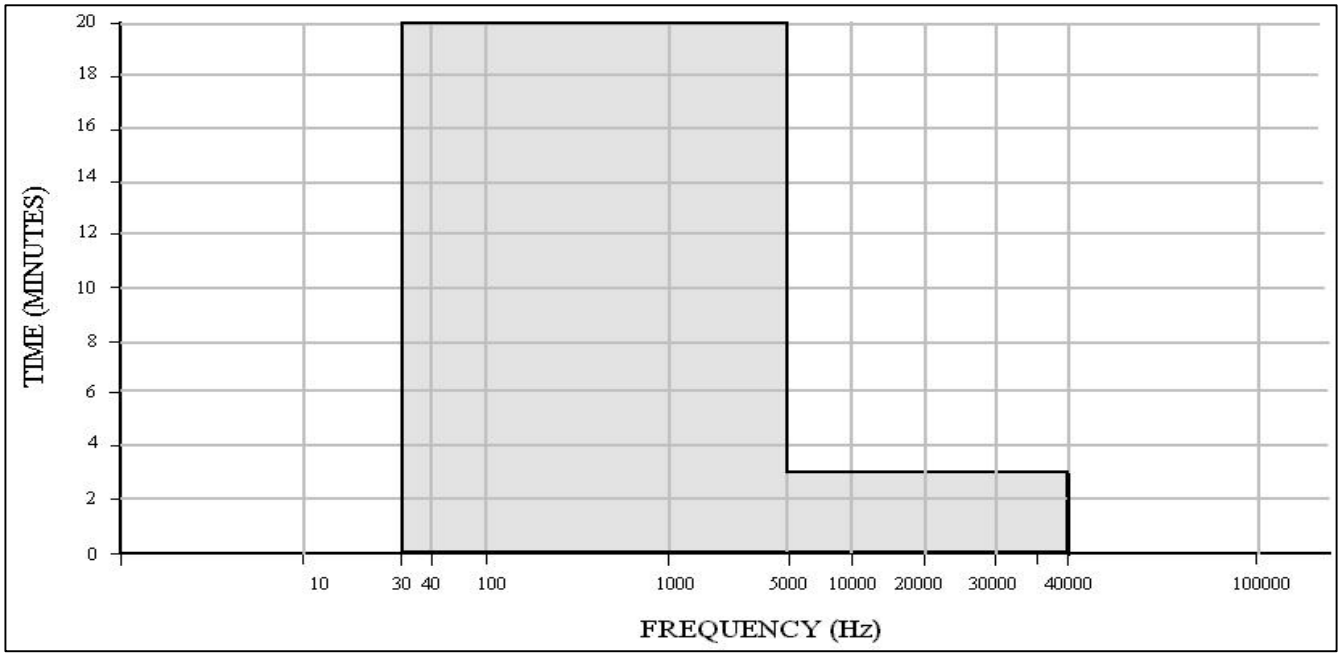
Worked Accuracy Calibration of 1V output at 5kHz on the 2V range at 20°C using 180 day spec.

189ppm Set (Output setting on calibrator = 1V)	189ppm of 1V =	189uV
80ppm Rng (Full scale of range selected = 2V)	80ppm of 2V =	160uV
Zero or floor allowance		20uV
Total accuracy of calibrator only =		± 369uV

Absolute accuracy must also include the accuracy (uncertainty) of the original calibration of the 2041A and the accuracy of the instrument used to verify its performance.



Graph 3 : Volt-Hertz profile for 1000V AC range



Graph 4 : Time-Hertz profile for voltages above 20V

2006A AC Current Specifications

General Specifications

Range	Frequency	Resolution	Maximum Burden Voltage	Overload Protection	Inductive Load
20-202uA	10Hz to 10kHz	1nA	3 Volts	150V	5mH
0.2-2.02mA	10Hz to 10kHz	10nA	3 Volts	150V	5mH
2-20.2mA	10Hz to 10kHz	100nA	3 Volts	150V	5mH
20-202mA	10Hz to 5kHz	1uA	3 Volts	150V	5mH
0.2-2.02A	10Hz to 2kHz	10uA	3 Volts	150V	5mH
2-20.2A	30Hz to 1kHz	100uA	2.8 Volts	150V	0.8mH

All specifications +/- 650nA. All specifications apply from 10% of full scale.

Settling Time: For 50% change in output: Less than 3 second from standby to within spec

Inductive Loads: Up to 1H may be connected without additional protection.

High current output is limited to a maximum of 2 Mins.

Accuracy Relative to Calibration Standards Specifications

Range	Frequency	Frequency Resolution	90 day Rel		180 Day Rel		1 year Rel		2 year Rel	
			%Set	%Rng	%Set	%Rng	%Set	%Rng	%Set	%Rng
20-202uA	10Hz to 30Hz	1Hz	0.14	+ 0.08	0.16	+ 0.08	0.18	+ 0.08	0.25	+ 0.11
	30Hz to 1kHz	1Hz	0.06	+ 0.05	0.06	+ 0.05	0.07	+ 0.05	0.10	+ 0.07
	1kHz to 10kHz	1Hz	0.56	+ 0.08	0.63	+ 0.08	0.70	+ 0.08	0.98	+ 0.11
0.2-2.02mA	10Hz to 30Hz	1Hz	0.14	+ 0.08	0.16	+ 0.08	0.18	+ 0.08	0.25	+ 0.11
	30Hz to 1kHz	1Hz	0.06	+ 0.02	0.06	+ 0.02	0.07	+ 0.02	0.10	+ 0.03
	1kHz to 10kHz	1Hz	0.40	+ 0.05	0.45	+ 0.05	0.50	+ 0.05	0.70	+ 0.07
2mA-20.2mA	10Hz to 30Hz	1Hz	0.14	+ 0.08	0.16	+ 0.08	0.18	+ 0.08	0.25	+ 0.11
	30Hz to 1kHz	1Hz	0.02	+ 0.01	0.03	+ 0.01	0.03	+ 0.01	0.04	+ 0.01
	1kHz to 10kHz	1Hz	0.24	+ 0.05	0.27	+ 0.05	0.30	+ 0.05	0.42	+ 0.07
20-202mA	10Hz to 30Hz	1Hz	0.14	+ 0.08	0.16	+ 0.08	0.18	+ 0.08	0.25	+ 0.11
	30Hz to 1kHz	1Hz	0.02	+ 0.01	0.03	+ 0.01	0.03	+ 0.01	0.04	+ 0.01
	1kHz to 5kHz	1Hz	0.24	+ 0.05	0.27	+ 0.05	0.30	+ 0.05	0.42	+ 0.07
200-2.02A	10Hz to 30Hz	1Hz	0.14	+ 0.08	0.16	0.08	0.18	+ 0.08	0.25	+ 0.11
	30Hz to 1kHz	1Hz	0.02	+ 0.01	0.03	0.01	0.03	+ 0.01	0.04	+ 0.01
	1kHz to 2kHz	1Hz	0.40	+ 0.1	0.45	0.1	0.50	+ 0.1	0.70	+ 0.14
2-20.2A	30Hz to 500Hz	1Hz	0.06	+ 0.01	0.07	+ 0.01	0.08	+ 0.01	0.11	+ 0.01
	500Hz to 1kHz	1Hz	0.16	+ 0.05	0.18	+ 0.05	0.20	+ 0.05	0.28	+ 0.07

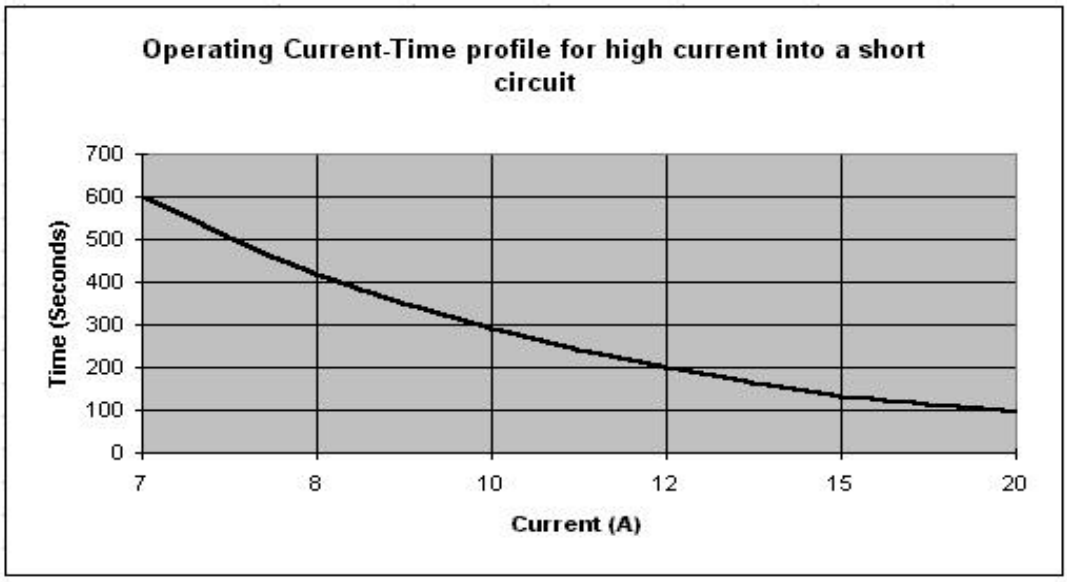
Power & temperature sensor on 20A range - microprocessor monitors & protects from overheating
Duty Cycle into 0 Ohms = 90 seconds ON, 5 minutes OFF[1]

Notes

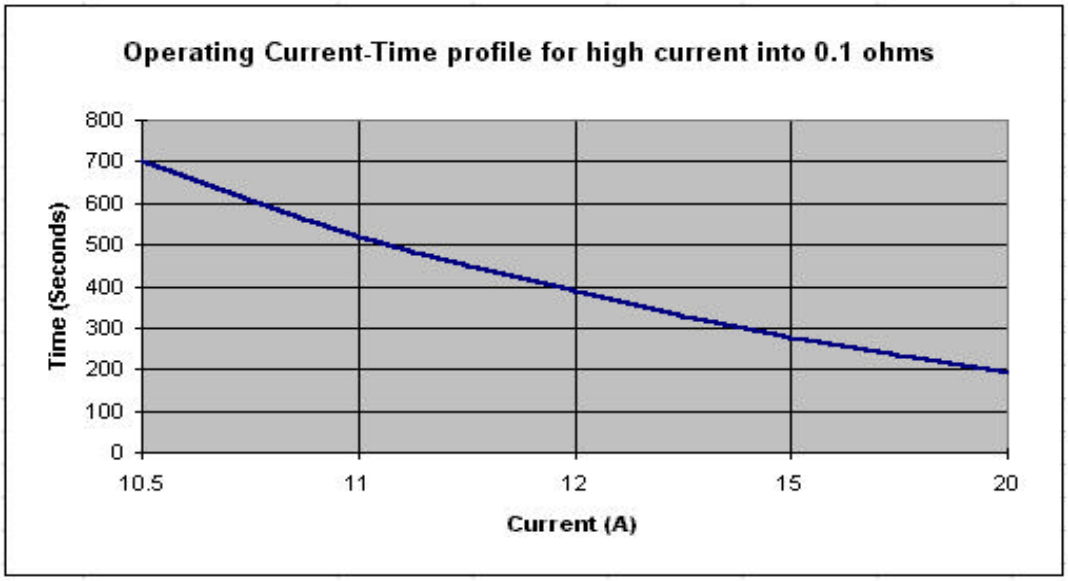
Note 1 : Higher resistance loads allow a longer ON period

Outside this range an allowance of 0.18 x 1 Year Spec. per °C should be added.

Due to continuous development specifications may be subject to change.



Graph 5* : Operating time on 20A range with current into a short circuit at 20 deg C.
Continuous current in availiable below 7A output.



Graph 6* : Operating time on 20A range with current into a 0.1ohm load at 20 deg C.
Continuous current in availiable below 10.5A output.

* Note Timing is started after a minimum period of 7 minutes at zero output.
Shorter periods will reduce the output time availiable.

2006A DC Resistance Specifications

For the highest possible accuracy and dependability of the measured value, regardless of the measurement technique used, the 2000 Series calibrators use passive standard resistors, the calibrated value of which is displayed when selected.

General Specifications

Range	Maximum Current	Maximum Voltage
0Ω	0.5A	-
0.1Ω	0.5A	0.05 Volts
1Ω	0.3A	0.3 Volts
10Ω	200mA	2 Volts
100Ω	50mA	5 Volts
1kΩ	10mA	10 Volts
10kΩ	3mA	30 Volts
100kΩ	1mA	100 Volts
1MΩ*	0.1mA	100 Volts
10MΩ*	10uA	100 Volts
100MΩ*	1uA	100 Volts
1GΩ*	100nA	100 Volts

*** 2-Wire only**

Accuracy Relative to Calibration Standards Specifications

Range	90 day Rel ppm	180 Day Rel ppm	1 year Rel ppm	2 year Rel ppm
0Ω	-	-	-	-
0.1Ω	36	41	45	63
1Ω	28	32	35	49
10Ω	20	23	25	35
100Ω	12	14	15	21
1κΩ	6	7	8	11
10κΩ	6	7	8	11
100κΩ	8	9	10	14
1MΩ	20	23	25	35
10MΩ	76	86	95	133
100MΩ	312	351	390	546
1000MΩ	7600	8550	9500	13300

For 4-Wire connection allow 1mW on all resistance specifications.

For 2-Wire connection allow 40mW on all resistance specifications.

The 2 and 4 Wire value for each resistor is calibrated. The 2-Wire value is measured at the terminals

Specifications apply between 18°C and 25°C.

Outside this range an allowance of 0.18 x 1 Year Spec. per °C should be added.

Due to continuous development specifications may be subject to change.

2006A Capacitance Specifications

For the highest possible accuracy and dependability of the measured value, regardless of the measurement technique used, the 2000 Series calibrators use passive standard capacitors, the calibrated value of which is displayed when selected.

General Specifications

Range	Maximum Voltage	D	R_s
1nF	50V	0.006	N/A
10nF	50V	0.006	N/A
20nF	50V	0.006	N/A
50nF	50V	0.006	N/A
100nF	50V	0.006	N/A
1uF	30V	0.002	N/A
10uF	20V	0.014	0.2Ω
100uF	10V	0.1	0.15Ω

Specifications apply at 1kHz. Allow 20pF for lead effects.
No appreciable variation is noticable in value above 1kHz.

Accuracy Relative to Calibration Standards Specifications

Range	90 day Rel %	180 Day Rel %	1 year Rel %	2 year Rel %
1nF	0.16	0.18	0.2	0.28
10nF	0.16	0.18	0.2	0.28
20nF	0.16	0.18	0.2	0.28
50nF	0.16	0.18	0.2	0.28
100nF	0.2	0.225	0.25	0.35
1uF	0.32	0.36	0.4	0.56
10uF	0.48	0.54	0.6	0.84
100uF	0.64	0.72	0.8	1.12

Measurement methods
C_p up to 1uF
C_s from 1uF to 10uF

Capacitance is calibrated as value at the terminals
ie. displayed value incorporates capacitance of circuit up to and including the terminals

Specifications apply between 18°C and 25°C.

Outside this range an allowance of 0.18 x 1 Year Spec. per °C should be added.

Due to continuous development specifications may be subject to change.