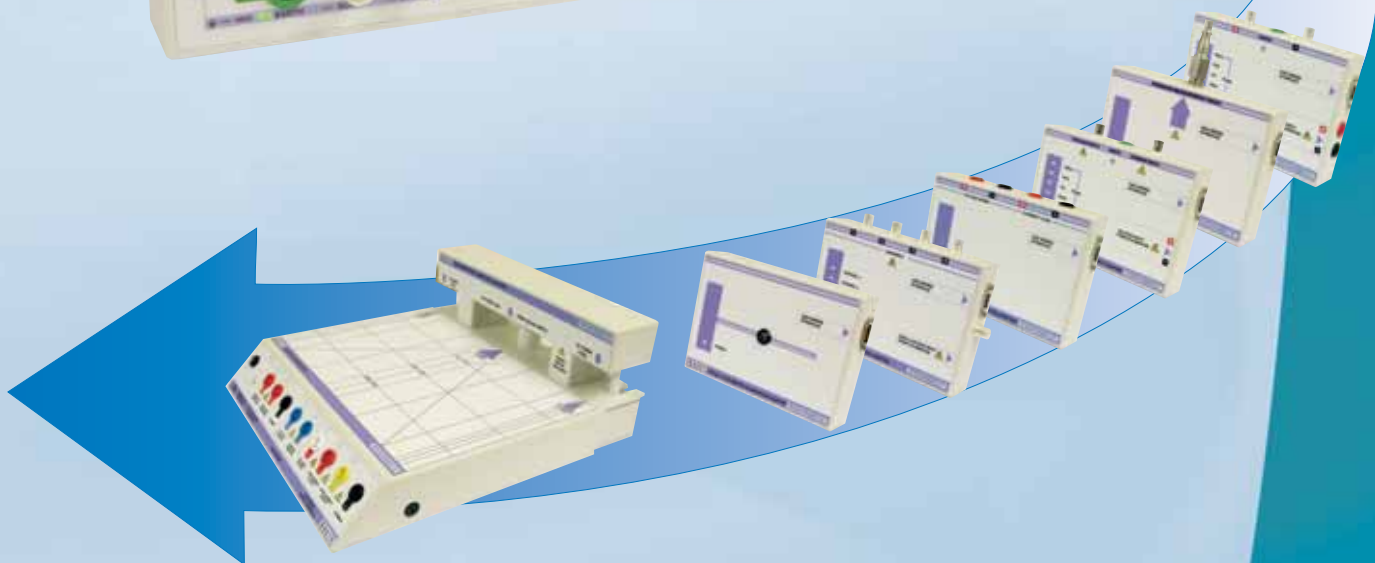


MODEL 3050

EXTENDED SPECIFICATIONS



50ppm MULTI PRODUCT CALIBRATOR

DECLARATION OF CONFORMITY

CE

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

Declares, that the product

Product Name: Multi-product Calibrator
Model Number: 3050 / 3041 / 3010
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

IEC616326-1:1997+A1:1998 / EN 61326-1:1997+A1:1998 EN55011:1991

Standard

***IEC 61000-4-2:1995+A1:1998 / EN 61000-4-2:1995
IEC 61000-4-3:1995 / EN 61000-4-3:1995
IEC 61000-4-4:1995 / EN 61000-4-4:1995
IEC 61000-4-5:1995 / EN 61000-4-5:1995
IEC 61000-4-6:1996 / EN 61000-4-6:1996
IEC 61000-4-11:1994 / EN 61000-4-11:1994***

Limit

***Group 1 Class A
4kV CD, 8kV AD
3 V/m, 80-1000 MHz
0.5kV signal lines, 1kV power lines
0.5kV line-line, 1kV line-ground
3V, 0.15-80 MHz 1 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

16/01/2006

Date Of Issue



Managing Director

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 Adapter Interface RS232 Interface	1x Black : 1x Red 4mm Safety sockets 1x Black : 1x Red 4mm Safety sockets 1x Blue : 1x Yellow 4mm Safety sockets 1x Green 4mm Safety Socket 2x 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	Ergonomic Rubber Keyboard	
Fuses	Mains Inlet	3.15A 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.	
Dimensions & Weights	Calibrator Only Calibrator in Shipping Box Calibrator in Soft Carry Case Calibrator in Hard Transit case	14cm x 43cm x 46cm : 12.5kgs 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 1x Adaptor Connection Lead (if at least one adaptor ordered)	1x Mains Lead
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	Cream (RAL 9002)	

1 Year Total Accuracy Specifications at TCal $\pm 5^{\circ}\text{C}$ & Range Parameters

Range	Resolution	Max. Burden Current	Typical Output Resistance ¹	Overload Protection	1 Year Total	
					ppm set	uV
0-202mV	0.1uV	1mA ²	50 Ohms	20 V	50	+ 4
0.2-2.02V	1uV	50mA	0.2 Ohms	150V	50	+ 35
2-20.2V	10uV	50mA	0.2 Ohms	150V	50	+ 300
20-202V	100uV	20mA ³	0.5 Ohms	1200V	50	+ 3000
200-1025V	1mV	20mA ³	0.7 Ohms	1200V	50	+ 20000

Stability (Accuracy relative to calibration Standards)

Range	24 Hour Stability		Noise ⁴ uV	90 day Rel		180 Day Rel		1 year Rel		2 year Rel	
	ppm Set	uV		ppm Set	uV	ppm Set	uV	ppm Set	uV	ppm Set	uV
0-202mV	11.5	+ 4	1.3	36.8	+ 4	41.4	+ 4	46	+ 4	64.4	+ 5.6
0.2-2.02V	11.5	+ 12	4	36.8	+ 35	41.4	+ 35	46	+ 35	64.4	+ 49
2-20.2V	11.5	+ 60	20	36.8	+ 300	41.4	+ 300	46	+ 300	64.4	+ 420
20-202V	11.5	+ 1200	396	36.8	+ 3000	41.4	+ 3000	46	+ 3000	64.4	+ 4200
200-1020V	11.5	+ 10000	3300	36.8	+ 20000	41.4	+ 20000	46	+ 20000	64.4	+ 28000

Notes

Note 1 : Allowance must be made for output resistance when driving into a load.

Note 2 : Limited by 50 Ohm output impedance.

Note 3 : Internally adjustable from 2mA to 30mA - Factory set to 20mA as standard.

For safety the trip is controlled by a fail-safe circuit independent 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, bandwidth 1Hz to 10Hz

High Voltage Safety

High voltage output is ramped to allow instrument 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.

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 at TCal $\pm 5^{\circ}\text{C}$

Outside this range an allowance of 0.18 x 1 Year Spec. per $^{\circ}\text{C}$ should be added.

1 Year Total Accuracy Specifications at TCal $\pm 5^{\circ}\text{C}$ & Range Parameters

Range	Resolution	Max. Inductive Load	Compliance Voltage	Overload Protection	1 Year Total % set	uA
0-202uA	100pA	10mH	4.2 Volts	150V	0.0120 +	0.02
0.2-2.02mA	1nA	10mH	4.2 Volts	150V	0.0100 +	0.08
2-20.2mA	10nA	10mH	4.2 Volts	150V	0.0100 +	0.8
20-202mA	100nA	10mH	4.2 Volts	150V	0.0120 +	8
0.2-2.02A	1uA	10mH	4.2 Volts	150V	0.0500 +	90
2-20.2A	10uA	10mH	3.9 Volts	150V	0.0500 +	900

Stability (Accuracy relative to calibration Standards)

Range	Noise ¹		90 day Rel		180 Day Rel		1 year Rel		2 year Rel	
	0.1-1Hz		%Set	uA	%Set	uA	%Set	uA	%Set	uA
0-202uA	180pA		0.0080 +	0.02	0.0090 +	0.02	0.0100 +	0.02	0.0140 +	0.028
0.2-2.02mA	500pA		0.0064 +	0.08	0.0072 +	0.08	0.0080 +	0.08	0.0112 +	0.112
2-20.2mA	4nA		0.0064 +	0.8	0.0072 +	0.8	0.0080 +	0.8	0.0112 +	1.12
20-202mA	40nA		0.0072 +	8	0.0081 +	8	0.0090 +	8	0.0126 +	11.2
0.2-2.02A	1uA		0.0336 +	90	0.0378 +	90	0.0420 +	90	0.0588 +	126
2-20.2A ²	20uA		0.0280 +	900	0.0315 +	900	0.0350 +	900	0.0490 +	1260

Notes

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

Note 2 : Power & temperature sensor on 20A range - microprocessor monitors & protects from overheating.

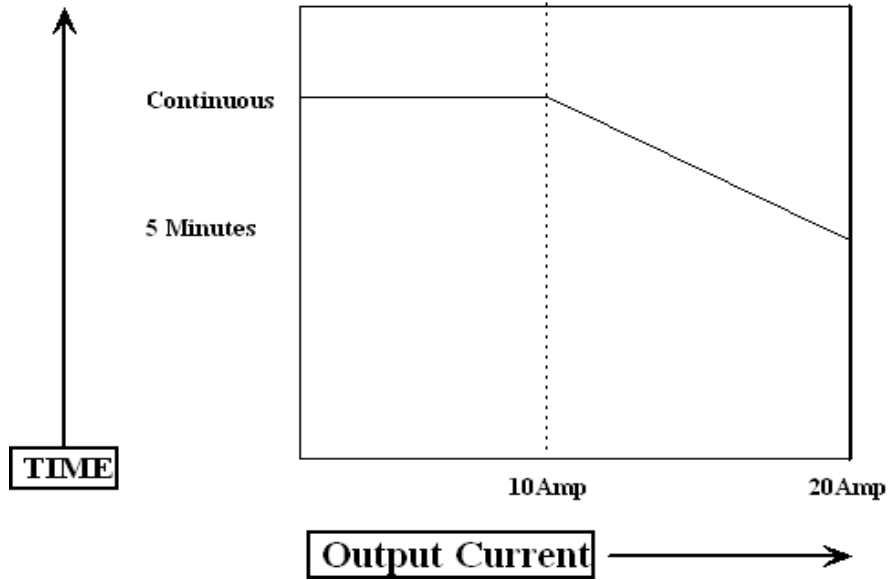
Higher resistance loads allow a longer ON period. See graph 1 for details.

Note 3 : Specifications apply to loads of less than 10% of the maximum burden voltage.

Note 4: Zero or floor allowance.

Specifications apply at TCal $\pm 5^{\circ}\text{C}$

Outside this range an allowance of 0.18 x 1 Year Spec. per $^{\circ}\text{C}$ should be added.



Graph 1* : Operating time on 20A range with current into a short circuit at 20°C
Continuous current available up to 10A output.

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

1 Year Total Accuracy Specifications at TCal ±5°C & Range Parameters

Range	Frequency	Resolution	Max. Burden Current	Typical Output Resistance	Overload Protection	1 Year Accuracy	
						% set	uV
0-202mV	10 to 44Hz	1uV	1mA ¹	50 Ohms	20 V	0.070 +	45
	45Hz to 1.999kHz	1uV	1mA ¹	50 Ohms	20 V	0.035 +	25
	2 to 20KHz	1uV	1mA ¹	50 Ohms	20 V	0.100 +	190
0.2-2.02V	10 to 44Hz	10uV	50mA	0.2 Ohms	1200V	0.060 +	280
	45Hz to 1.999kHz	10uV	50mA	0.2 Ohms	1200V	0.035 +	220
	2 to 19.999KHz	10uV	50mA	0.2 Ohms	1200V	0.060 +	390
	20 to 100kHz	10uV	50mA	0.2 Ohms	1200V	0.200 +	3000
2-20.2V	10 to 44Hz	100uV	50mA	0.2 Ohms	1200V	0.060 +	2.8mV
	45Hz to 1.999kHz	100uV	50mA	0.2 Ohms	1200V	0.035 +	2.2mV
	2 to 19.999KHz	100uV	50mA	0.2 Ohms	1200V	0.070 +	3.9mV
	20 to 100kHz	100uV	50mA	0.2 Ohms	1200V	0.300 +	30mV
20-202V	40Hz to 1.999kHz	1mV	20mA ⁴	0.5 Ohms	1200V	0.045 +	22mV
	2 to 20KHz	1mV	15mA ⁴	0.5 Ohms	1200V	0.090 +	39mV
200-1020V ⁵	40Hz to 1.999kHz	10mV	20mA ⁴	0.7 Ohms	1200V	0.045 +	120mV
	2 to 10KHz	10mV	15mA ⁴	0.7 Ohms	1200V	0.090 +	290mV

Stability (Accuracy relative to calibration Standards)

Range	Frequency	Frequency Resolution	90 day Rel		180 Day Rel		1 year Rel		2 year Rel	
			%Set	uV	%Set	uV	%Set	uV	%Set	uV
0-202mV	10 to 44Hz	1Hz	0.0400 +	45	0.0450 +	45	0.0500 +	45	0.0700 +	63
	45Hz to 1.999kHz	1Hz	0.0200 +	25	0.0225 +	25	0.0250 +	25	0.0350 +	35
	2 to 20kHz	1Hz	0.0640 +	190	0.0720 +	190	0.0800 +	190	0.1120 +	266
0.2-2.02V	10 to 44Hz	1Hz	0.0400 +	280	0.0450 +	280	0.0500 +	280	0.0700 +	392
	45Hz to 1.999kHz	1Hz	0.0200 +	220	0.0225 +	220	0.0250 +	220	0.0350 +	308
	2 to 19.999kHz	1Hz	0.0360 +	390	0.0405 +	390	0.0450 +	390	0.0630 +	546
	20 to 100kHz	1Hz	0.1360 +	3000	0.1530 +	3000	0.1700 +	3000	0.2380 +	4200
2-20.2V	10 to 44Hz	1Hz	0.0400 +	2.8mV	0.0450 +	2.8mV	0.0500 +	2.8mV	0.0700 +	4mV
	45Hz to 1.999kHz	1Hz	0.0200 +	2.2mV	0.0225 +	2.2mV	0.0250 +	2.2mV	0.0350 +	3mV
	2 to 19.999kHz	1Hz	0.0440 +	3.9mV	0.0495 +	3.9mV	0.0550 +	3.9mV	0.0770 +	5mV
	20 to 100kHz	1Hz	0.2080 +	30mV	0.2340 +	30mV	0.2600 +	30mV	0.3640 +	42mV
20-202V	40Hz to 1.999kHz	1Hz	0.0264 +	22mV	0.0297 +	22mV	0.0330 +	22mV	0.0462 +	30mV
	2 to 20kHz	1Hz	0.0560 +	39mV	0.0630 +	39mV	0.0700 +	39mV	0.0980 +	50mV
200-1020V ⁵	40Hz to 1.999kHz	1Hz	0.0240 +	120mV	0.0270 +	120mV	0.0300 +	120mV	0.0420 +	180mV
	2 to 10kHz	1Hz	0.0560 +	290mV	0.0630 +	290mV	0.0700 +	290mV	0.0980 +	455mV

All specifications apply from 10% of full scale. ⁵

Notes
Note 1: Current limited by 50 ohms output resistance.
Note 2 : Internally adjustable from 2mA to 30mA - Factory set to 20mA 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 3 : Frequency and voltage combinations are limited. See Volt-Hertz profile in Graph 3
Note 4 : Allowance must be made for output resistance when driving into a load.
Note 5 : Zero or floor allowance.

2 Wire output / Remote sensing not available.

THD less than .6%

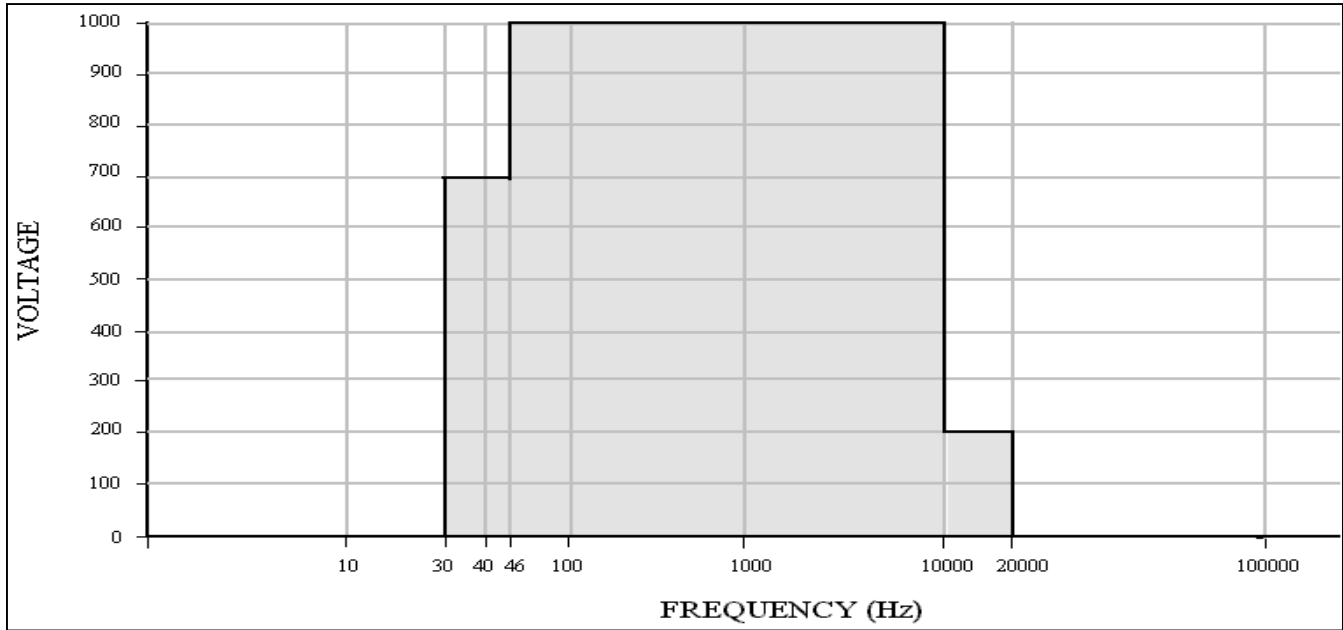
Isolation : Floating or grounded selection available as standard.

Specifications apply at TCal ± 5°C. Outside this range an allowance of 0.18 x 1 Year Spec. per °C should be added.

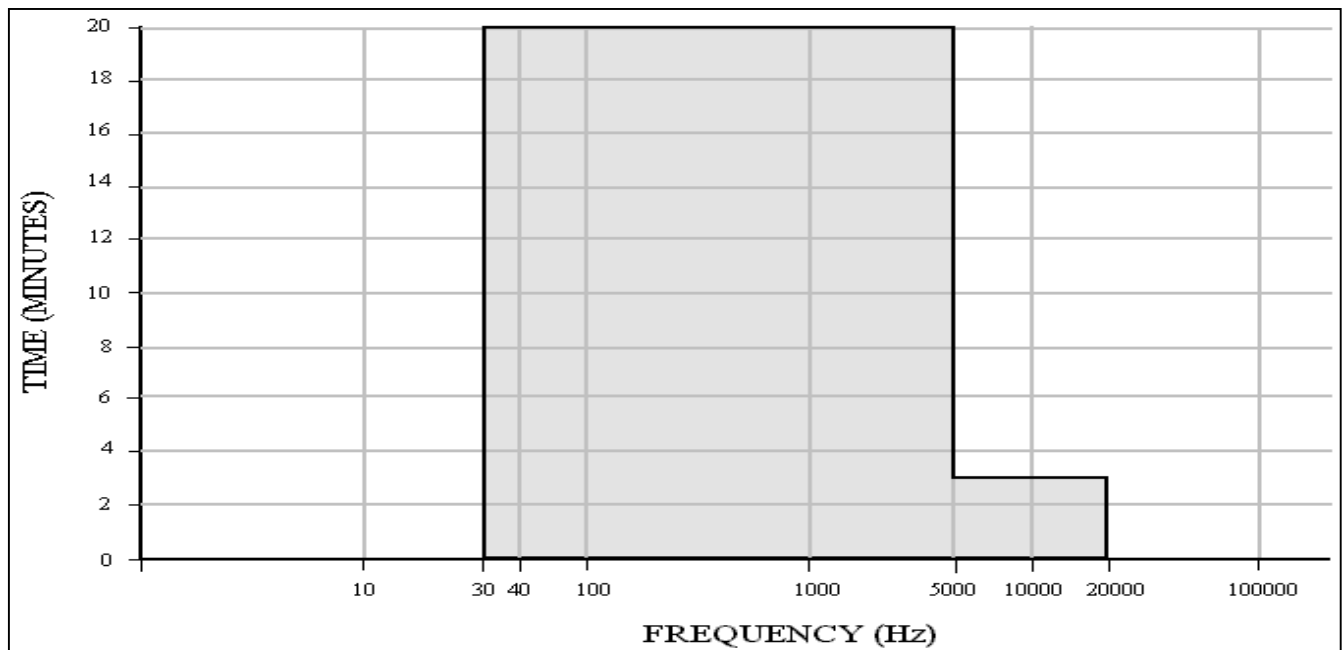
High Voltage Safety
High voltage output is ramped to allow instruments under test to auto-range.
Standby is automatically activated when setting voltages greater than 20V or 200V from a lower voltage
Standby is automatically selected for high voltage (>20V) after 20 minutes on the same setting for frequencies: up to 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

2 Wire output / Remote sensing not available.
 Isolation : Floating or grounded selection available as standard.
 Specifications apply at TCal ± 5°C.

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 to 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.



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



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

1 Year Total Accuracy Specifications at TCal $\pm 5^{\circ}\text{C}$ & Range Parameters

Range	Frequency	Resolution	Maximum Burden Voltage (Peak)	Overload Protection	1 year Accuracy		
					%Set		μA
20-202 μA	10 to 44Hz	1nA	3 Volts	150V	0.090	+	0.4
	45Hz to 1.999kHz				0.070	+	0.3
	2kHz to 10kHz				0.100	+	0.5
0.2-2.02mA	10 to 44Hz	10nA	3 Volts	150V	0.090	+	0.6
	45Hz to 1.999kHz				0.070	+	0.4
	2kHz to 10kHz				0.100	+	0.7
2-20.2mA	10 to 44Hz	100nA	3 Volts	150V	0.090	+	4
	45Hz to 1.999kHz				0.070	+	3
	2kHz to 10kHz				0.100	+	6
20-202mA	10 to 44Hz	1 μA	3 Volts	150V	0.090	+	40
	45Hz to 1.999kHz				0.070	+	30
	2kHz to 10kHz				0.100	+	60
0.2-2.02A	10 to 44Hz	10 μA	3 Volts	150V	0.100	+	450
	45Hz to 2kHz				0.090	+	400
2-20.2A	10 to 44Hz	100 μA	2.8 Volts	150V	0.200	+	9000
	45Hz to 200Hz				0.150	+	6000
	200Hz to 2kHz				0.200	+	8000

All specifications apply from 10% of full scale.

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

Inductive Loads: Up to 1H may be connected without additional protection providing the frequency / inductance combination does not exceed the maximum burden voltage.

Stability (Accuracy relative to calibration Standards)

Range	Frequency	Frequency Resolution	90 day Rel		180 Day Rel		1 year Rel		2 year Rel	
			%Set	μA	%Set	μA	%Set	μA	%Set	μA
20-202 μA	10 to 44Hz	1Hz	0.0560	+ 0.4	0.0630	+ 0.4	0.0700	+ 0.4	0.0980	+ 0.56
	45Hz to 1.999kHz	1Hz	0.0360	+ 0.3	0.0405	+ 0.3	0.0450	+ 0.3	0.0630	+ 0.42
	2kHz to 10kHz	1Hz	0.0640	+ 0.5	0.0720	+ 0.5	0.0800	+ 0.5	0.1120	+ 0.7
0.2-2.02mA	10 to 44Hz	1Hz	0.0560	+ 0.6	0.0630	+ 0.6	0.0700	+ 0.6	0.0980	+ 0.84
	45Hz to 1.999kHz	1Hz	0.0360	+ 0.4	0.0405	+ 0.4	0.0450	+ 0.4	0.0630	+ 0.56
	2kHz to 10kHz	1Hz	0.0640	+ 0.7	0.0720	+ 0.7	0.0800	+ 0.7	0.1120	+ 0.98
2mA-20.2mA	10 to 44Hz	1Hz	0.0560	+ 4	0.0630	+ 4	0.0700	+ 4	0.0980	+ 5.6
	45Hz to 1.999kHz	1Hz	0.0360	+ 3	0.0405	+ 3	0.0450	+ 3	0.0630	+ 4.2
	2kHz to 10kHz	1Hz	0.0640	+ 6	0.0720	+ 6	0.0800	+ 6	0.1120	+ 8.4
20-202mA	10 to 44Hz	1Hz	0.0560	+ 40	0.0630	+ 40	0.0700	+ 40	0.0980	+ 56
	45Hz to 1.999kHz	1Hz	0.0400	+ 30	0.0450	+ 30	0.0500	+ 30	0.0700	+ 42
	2kHz to 10kHz	1Hz	0.0640	+ 60	0.0720	+ 60	0.0800	+ 60	0.1120	+ 84
200-2.02A	10 to 44Hz	1Hz	0.0640	+ 450	0.0720	+ 450	0.0800	+ 450	0.1120	+ 630
	45Hz to 2kHz	1Hz	0.0480	+ 400	0.0540	+ 400	0.0600	+ 400	0.0840	+ 560
2-30.0A ¹	10 to 44Hz	1Hz	0.1360	+ 9000	0.1530	+ 9000	0.1700	+ 9000	0.2380	+ 12600
	45Hz to 200Hz	1Hz	0.0960	+ 6000	0.1080	+ 6000	0.1200	+ 6000	0.1680	+ 8400
	200Hz to 2kHz	1Hz	0.1360	+ 8000	0.1530	+ 8000	0.1700	+ 8000	0.2380	+ 11200

Notes

Note 1 : Temperature sensor on 20A range - microprocessor monitors & protects from overheating.

Higher resistance loads allow a longer ON period. See graphs 5 and 6 for details.

Note 2 : Specifications apply to loads of less than 10% of the maximum burden voltage.

Specifications apply at TCal $\pm 5^{\circ}\text{C}$. Outside this range an allowance of 0.18 x 1 Year Spec. per $^{\circ}\text{C}$ should be added.

Notes

Note 1 : Temperature sensor on 20A range - microprocessor monitors & protects from overheating.

Higher resistance loads allow a longer ON period. See graph 5 for details.

Note 2 : Specifications apply to loads of less than 10% of the maximum burden voltage.

Driving Coils and Inductive Loads

When driving any load exceeding the maximum compliance voltage will cause the calibrator to trip into standby

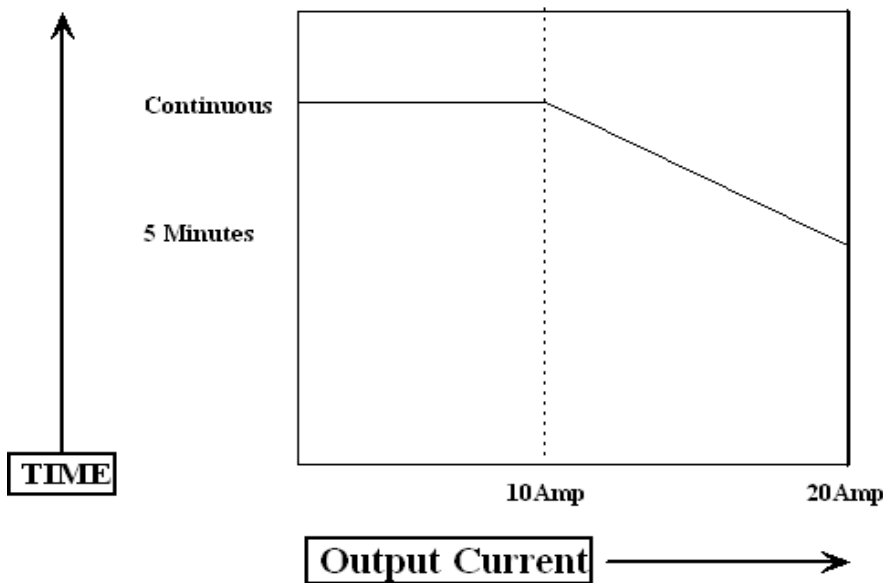
The maximum compliance voltage on the 10Amp range is specified at a max 2.8V RMS, 7.8V Peak to Peak at 220V supply

Slightly higher compliances are available when powered from a 240V supply.

When using EA002 with leads supplied it is possible to drive 20Amps/50Hz from a 230V supply, falling to 10Amps at 400Hz

Specifications apply at TCal ± 5°C.

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



Graph 5* : Operating time on 20A range with current into a short circuit at 20°C
 Continuous current available up to 10A output.

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

Total Accuracy - Standard Accuracy

Range	90 day ppm	180 Day ppm	1 year ppm	2 year ppm
1Hz	16	18	20	28
10Hz	16	18	20	28
100Hz	16	18	20	28
1kHz	16	18	20	28
10kHz	16	18	20	28
100kHz	16	18	20	28
1MHz	16	18	20	28
10MHz	16	18	20	28

Total Accuracy - High Accuracy (Option)

Range	90 day ppm	180 Day ppm	1 year ppm	2 year ppm
1Hz	0.8	0.9	1	1.4
10Hz	0.8	0.9	1	1.4
100Hz	0.8	0.9	1	1.4
1kHz	0.8	0.9	1	1.4
10kHz	0.8	0.9	1	1.4
100kHz	0.8	0.9	1	1.4
1MHz	0.8	0.9	1	1.4
10MHz	0.8	0.9	1	1.4

Specifications apply at TCal \pm 5°C.

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

FREQUENCY - TTL	Standard Spec.	Optional Spec.
10Hz to 10MHz	12ppm	1ppm

PWM (%)	
5% to 95%	Better than 0.001%

For the highest possible accuracy and dependability of the measured value, regardless of the measurement technique used, the 3000 Series calibrators use passive standard resistors, the calibrated value of which is displayed when selected.

1 Year Total Accuracy Specifications at TCal $\pm 5^{\circ}\text{C}$ & Range Parameters

Range	Maximum Current	Maximum Voltage	Display Resolution	1 Year Total Accuracy	
				% set	Ohms
10 Ω	0.3A	-	10 $\mu\Omega$	0.060 +	0.02
100 Ω	0.1A	-	100 $\mu\Omega$	0.009 +	0.02
1k Ω	-	10V	1m Ω	0.006 +	0.02
10k Ω	-	50V	10m Ω	0.006 +	0.02
100k Ω	-	100V	100m Ω	0.006	-
1M Ω^*	-	100V	1 Ω	0.011	-
10M Ω^*	-	100V	10 Ω	0.060	-
100M Ω^*	-	100V	1k Ω	0.110	-

* 2-Wire only

Stability (Accuracy relative to calibration Standards)

Range	90 day Rel		180 Day Rel		1 year Rel		2 year Rel	
	%	Ohms	%	Ohms	%	Ohms	%	Ohms
10 Ω	0.0400	+ 0.005	0.0450	+ 0.005	0.0500	+ 0.02	0.0700	+ 0.005
100 Ω	0.0064	+ 0.005	0.0072	+ 0.005	0.0080	+ 0.02	0.0112	+ 0.005
1k Ω	0.0040	+ 0.04	0.0045	+ 0.04	0.0050	+ 0.02	0.0070	+ 0.04
10k Ω	0.0040	+ 0.4	0.0045	+ 0.4	0.0050	+ 0.02	0.0070	+ 0.4
100k Ω	0.0040	+ 4	0.0045	+ 4	0.0050	-	0.0070	+ 4
1M Ω	0.0080	+ 40	0.0090	+ 40	0.0100	-	0.0140	+ 40
10M Ω	0.0400	+ 400	0.0450	+ 400	0.0500	-	0.0700	+ 400
100M Ω	0.0800	+ 4000	0.0900	+ 4000	0.1000	-	0.1400	+ 4000

For 2-Wire connection allow 35m Ω on all resistance specifications.

The 2 and 4 Wire value for each resistor is calibrated. The 2-Wire value is measured at the terminals
The 4-Wire values are taken using the zero position to NULL the measuring system.

Specifications apply at TCal $\pm 5^{\circ}\text{C}$.

Outside this range an allowance of 0.18 x 1 Year Spec. per $^{\circ}\text{C}$ should be added.

For the highest possible accuracy and dependability of the measured value, regardless of the measurement technique used, the 3000 Series calibrators use passive standard capacitors, the calibrated value of which is displayed when selected.

General Specifications

Range	Maximum Voltage	Display Resolution	D	R _s
10nF	50V	0.1pF	0.006	N/A
20nF	50V	0.1pF	0.006	N/A
50nF	50V	1pF	0.006	N/A
100nF	50V	10pF	0.006	N/A
1uF	30V	100pF	0.002	N/A

**Specifications apply at 1kHz. Allow 20pF for lead effects.
No appreciable variation is noticeable at frequencies below 1kHz.**

Total Accuracy

Range	90 day %	180 Day %	1 year %	2 year %
10nF	0.32	0.36	0.4	0.56
20nF	0.32	0.36	0.4	0.56
50nF	0.32	0.36	0.4	0.56
100nF	0.32	0.36	0.4	0.56
1uF	0.48	0.54	0.6	0.84

Measurement methods

C_p up to 1uF
C_s above 1uF

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

Specifications apply at TCal ± 5°C.

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

General Specifications	
Voltage Range	1V to 1000V DC
Current Range	0.3A to 20A DC
Output Terminals	Voltage output from top (Black & White) terminals 300mA to 2A current output from middle 2A (Black & Red) terminals 2.01A to 20A current output from bottom 20A (Blue & Yellow) terminals Note : Indicator LEDs for both sets of terminals will illuminate to indicate DC Power mode

1 Year Accuracy Relative to Calibration standards

Current Range	Resolution	Setting	Zero
0.3A to 2A	200uA	0.08%	600uA
2.01A to 20A	2mA	0.08%	6mA

1 Year Accuracy Relative to Calibration standards

Voltage Range	Resolution	Setting	Zero
20V	1uV	0.008%	500uV
200V	10uV	0.008%	5mV
1000V	100uV	0.008%	30mV

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 20 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

20A available as standard - external amplifier **not** required
 Specifications apply at TCal ± 5°C.
 Outside this range an allowance of 0.18 x 1 Year Spec. per °C should be added.

General Specifications	
Voltage Range	1V to 1000V AC
Current Range	0.3A to 20A AC
Frequency Range	40 to 400Hz
Output Terminals	Voltage output from top (Black & White) terminals 300mA to 2A current output from middle 2A (Black & Red) terminals 2.01A to 20A current output from bottom 20A (Blue & Yellow) terminals Note : Indicator LEDs for both sets of terminals will illuminate to indicate AC Power mode

1 Year Accuracy Relative to Calibration standards

Current Range	Resolution	Setting	Zero
0.2A to 2A	200uA	0.15%	800uA
2.01A to 20A	2mA	0.25%	8mA

1 Year Accuracy Relative to Calibration standards

Voltage Range	Resolution	Setting	Zero
20V	1uV	0.05%	4.4mV
200V	10uV	0.06%	35mV
1000V	100uV	0.06%	150mV

Frequency range 45Hz to 400Hz

Power Factor = 1

Phase Specifications

Phase Angle	Resolution	Accuracy
0° to 359.9°	0.1°	0.1° + 6us*

*6us represents 0.109° at 50Hz or 0.87° at 400Hz

Note : Phase accuracy specification applies for levels above 10V/5A

3050 calibrators **automatically correct for any errors in the phase** caused by inductive loading, for example when using the clamp coil adaptor.

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 20 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

20A available as standard - external amplifier **not** required

Specifications apply at TCal ± 5°C.

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

Amplitude								
Ranges	2mV/Div : 5mV/Div : 10mV/Div : 20mV/Div : 50mV/Div : 100mV/Div 200mV/Div : 500mV/Div : 1V/Div : 2V/Div : 5V/Div : 10V/Div : 20V/Div : 50V/Div							
Sequence	1, 2, 5							
Waveshapes	Square Wave (positive going from ground) : DC							
Frequency	1kHz							
Frequency Accuracy	30ppm							
Graticule Height	6 Graticules							
Rise Time	2us							
Fall Time	2us							
Output Terminal	Front BNC (Green LED indicates terminal active)							
Range @ 1M Ω load	90 Day Rel.		180 Day Rel.		1 Year Rel.		2 Year Rel.	
	%	μ V	%	μ V	%	μ V	%	μ V
2mV to 50V/Div	0.009	\pm 20	0.01	\pm 20	0.01	\pm 5	0.014	\pm 20

High Voltage Safety
 High voltage output is ramped to allow instruments to auto range
 Auto standby is activated when passing through 20V or 200V output values
 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

Amplitude Deviation								
Deviation Range	\pm 10%							
Deviation Resolution	3050 : Better than 10ppm							
Range	90 Day Rel.		180 Day Rel.		1 Year Rel.		2 Year Rel.	
	%	μ V	%	μ V	%	μ V	%	μ V
-10% to +10%	0.008	\pm 20	0.01	\pm 20	0.01	\pm 20	0.014	\pm 20

Timebase								
Ranges	2ns/Div : 5ns/Div : 10ns/Div : 20ns/Div : 50ns/Div : 100ns/Div : 200ns/Div 500ns/Div : 1ms/Div : 2ms/Div : 5ms/Div : 10ms/Div : 20ms/Div : 50ms/Div 100ms/Div : 200ms/Div : 500ms/Div : 1s/Div : 2s/Div : 5s/Div							
Sequence	1, 2, 5							
Waveshape	Comb below 100ns Sine Wave above 100ns							
Oscillator	Internal Crystal TCXO							
Output Terminal	Front BNC (Green LED indicates terminal active)							
Range	90 Day Rel.		180 Day Rel.		1 Year Rel.		2 Year Rel.	
	ppm		ppm		ppm		ppm	
2ns/Div to 5s/Div	4.5		4.75		5		6	

Timebase Deviation								
Deviation Range	\pm 10% in 0.05% Steps							
Deviation Resolution	Better than 0.05%							
Range	90 Day Rel.		180 Day Rel.		1 Year Rel.		2 Year Rel.	
	%		%		%		%	
-9.5% to +9.5%	0.01		0.01		0.01		0.01	

Levelled Sweep				
Sweep Range	5MHz to 250MHz			
Waveform	Sine Wave			
Levelled Sweep	600mV pk-pk into 50 Ohms			
Reference Level	50kHz			
Output Terminal	Front BNC (Green LED indicates terminal active)			
Range	90 Day Rel. db	180 Day Rel. db	1 Year Rel. db	2 Year Rel. db
5MHz to 250MHz	0.8	0.90	1	1.4

Levelled Sweep	
Frequency Accuracy	See Time markers

50kHz Reference				
Accuracy	90 Day Rel.	180 Day Rel.	1 Year Rel.	2 Year Rel.
Frequency Accuracy	27 ppm	29 ppm	30 ppm	36 ppm
Level Accuracy	0.4 %	0.45 %	0.5 %	0.7 %

Fast Rise Output	
Rise/Fall Time	Typically 1ns

Specifications apply at TCal \pm 5°C.

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

Amplitude				
Ranges	2mV/Div : 5mV/Div : 10mV/Div : 20mV/Div : 50mV/Div : 100mV/Div 200mV/Div : 500mV/Div : 1V/Div : 2V/Div : 5V/Div : 10V/Div : 20V/Div : 50V/Div			
Sequence	1, 2, 5			
Waveshapes	Square Wave (positive going from ground) : DC			
Frequency	1kHz			
Frequency Accuracy	30ppm			
Graticule Height	6 Graticules			
Rise Time	2us			
Fall Time	2us			
Output Terminal	Front BNC (Green LED indicates terminal active)			
Range @ 1MOhm load	90 Day Rel. % uV	180 Day Rel. % uV	1 Year Rel. % uV	2 Year Rel. % uV
2mV to 50V/Div	0.009 ± 20	0.01 ± 20	0.01 ± 5	0.014 ± 20

High Voltage Safety	
High voltage output is ramped to allow instruments to auto range	
Auto standby is activated when passing through 20V or 200V output values	
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	

Amplitude Deviation				
Deviation Range	±10%			
Deviation Resolution	3050 : Better than 10ppm			
Range	90 Day Rel. % uV	180 Day Rel. % uV	1 Year Rel. % uV	2 Year Rel. % uV
-10% to +10%	0.008 ± 20	0.01 ± 20	0.01 ± 20	0.014 ± 20

Timebase				
Ranges	2ns/Div : 5ns/Div : 10ns/Div : 20ns/Div : 50ns/Div : 100ns/Div : 200ns/Div 500ns/Div : 1ms/Div : 2ms/Div : 5ms/Div : 10ms/Div : 20ms/Div : 50ms/Div 100ms/Div : 200ms/Div : 500ms/Div : 1s/Div : 2s/Div : 5s/Div			
Sequence	1, 2, 5			
Waveshape	Comb below 100ns Sine Wave above 100ns			
Oscillator	Internal Crystal TCXO			
Output Terminal	Front BNC (Green LED indicates terminal active)			
Range	90 Day Rel. ppm	180 Day Rel. ppm	1 Year Rel. ppm	2 Year Rel. ppm
2ns/Div to 5s/Div	4.5	4.75	5	6

Timebase Deviation				
Deviation Range	±10% in 0.05% Steps			
Deviation Resolution	Better than 0.05%			
Range	90 Day Rel. %	180 Day Rel. %	1 Year Rel. %	2 Year Rel. %
-9.5% to +9.5%	0.01	0.01	0.01	0.01

Levelled Sweep				
Sweep Range	5MHz to 400MHz			
Waveform	Sine Wave			
Levelled Sweep	600mV pk-pk into 50 Ohms			
Reference Level	50kHz			
Output Terminal	Front BNC (Green LED indicates terminal active)			
Range	90 Day Rel. db	180 Day Rel. db	1 Year Rel. db	2 Year Rel. db
5MHz to 250MHz	0.8	0.90	1	1.4

Levelled Sweep	
Frequency Accuracy	See Time markers

50kHz Reference				
Accuracy	90 Day Rel.	180 Day Rel.	1 Year Rel.	2 Year Rel.
Frequency Accuracy	27 ppm	29 ppm	30 ppm	36 ppm
Level Accuracy	0.4 %	0.45 %	0.5 %	0.7 %

Fast Rise Output	
Rise/Fall Time	Typically 1ns

Specifications apply at TCal $\pm 5^{\circ}\text{C}$.

Outside this range an allowance of 0.18 x 1 Year Spec. per $^{\circ}\text{C}$ should be added.