TRANSMILLE
SOLUTIONS IN CALIBRATION

TRANSMILLE 3010A PRECISION MULTIPRODUCT CALIBRATOR

EXTENDED SPECIFICATIONS

Warm Up Time	Double the time since last used up to 20 minutes maximum	
Standard Interfaces	USB	
Optional Interfaces	GPIB (IEEE-488) : RS232	
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	55 Watts (Standby)	400 Watts (Maximum)
Low Analogue Isolation	100V	
Connections	Voltage / 2 Wire Resistance Low Current (<=2A) High current (>2A) Earth Connection Oscilloscope Functions Adapter Interface USB 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 2x BNC terminal 1x Female 'D' type socket 1x Female 'B' type socket
Display Information	Type Viewing Area Resolution Backlight Type Brightness	Backlit blue on white STN Type 133mm * 39mm 240 x 64 dots LED 230 to 260 cd/m^2
Indicators	Voltage / Current / High Current Negative to ground Oscilloscope Adapter Interface	Red LED (between terminals) Green LED (left of Earth terminal) Green LED (right of BNC Connector) Green LED (right of 'D' type connector)
Keyboard	Rubber key	
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 USB 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 USB 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 ±5°C & Range Parameters

Range	Resolution	Max. Burden Current	Typical Output Resistance[1]	Overload Protection	1 Year Total ppm set	1 Year Total µV
0-202mV	0.01µV	1mA[2]	50 Ohms	20 V	15	+ 2
0.2-2.02V	0.1µV	50mA	0.2 Ohms	150V	9	+ 2.5
2-20.2V	1µV	50mA	0.2 Ohms	150V	8	+ 24
20-202V	10µV	20mA[3]	0.5 Ohms	1200V	12	+ 240
200-1025V	100µV	20mA[3]	0.7 Ohms	1200V	12	+ 2400

Stability (Accuracy relative to calibration Standards)

Range	24 Hour Stability ppm Set	24 Hour Stability µV	Noise[4] µV	90 day Rel ppm Set	90 day Rel µV	180 Day Rel ppm Set	180 Day Rel µV	1 year Rel ppm Set	1 year Rel µV	2 year Rel ppm Set	2 year Rel µV
0-202mV	2	+ 1	0.3	9.6	+ 2	10.8	+ 2	12	+ 2	16.8	+ 2.8
0.2-2.02V	2	+ 1.2	0.4	5.6	+ 2.5	6.3	+ 2.5	7	+ 2.5	9.8	+ 3.5
2-20.2V	2	+ 9	3	4.8	+ 24	5.4	+ 24	6	+ 24	8.4	+ 33.6
20-202V	3.5	+ 120	40	8	+ 240	9	+ 240	10	+ 240	14	+ 336
200-1020V	5	+ 1100	363	8	+ 2400	9	+ 2400	10	+ 2400	14	+ 3360

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 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, 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. This function can be disabled

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 ± 5°C

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

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

Range	Resolution	Max. Inductive Load	Compliance Voltage	Overload Protection	1 Year Total % set		µA
0-202µA	10pA	10mH	4.2 Volts	150V	0.01	+	0.01
0.2-2.02mA	100pA	10mH	4.2 Volts	150V	0.005	+	0.03
2-20.2mA	1nA	10mH	4.2 Volts	150V	0.005	+	0.2
20-202mA	10nA	10mH	4.2 Volts	150V	0.005	+	2
0.2-2.02A	100nA	10mH	4.2 Volts	150V	0.013	+	30
2-20.2A	1µA	10mH	3.9 Volts	150V	0.03	+	300
20.2-30A	1µA	10mH	3.9 Volts	150V	0.05	+	450

Stability (Accuracy relative to calibration Standards)

Range	Noise[1] 0.1-1Hz	90 Day Rel %Set		µA	180 Day Rel %Set		µA	1 Year Rel %Set		µA	2 Year Rel %Set		µA
0-202µA	180pA	0.006	+	0.01	0.007	+	0.01	0.008	+	0.01	0.011	+	0.014
0.2-2.02mA	500pA	0.0032	+	0.03	0.0036	+	0.03	0.004	+	0.03	0.006	+	0.042
2-20.2mA	4nA	0.0032	+	0.2	0.0036	+	0.2	0.004	+	0.2	0.006	+	0.28
20-202mA	40nA	0.0032	+	2	0.0036	+	2	0.004	+	2	0.006	+	2.8
0.2-2.02A	1µA	0.0056	+	30	0.006	+	30	0.007	+	30	0.01	+	42
2-20.2A[2]	20µA	0.016	+	300	0.018	+	300	0.02	+	300	0.028	+	420
20.2-30A[2]	20µA	0.024	+	450	0.027	+	450	0.03	+	450	0.042	+	630

Notes

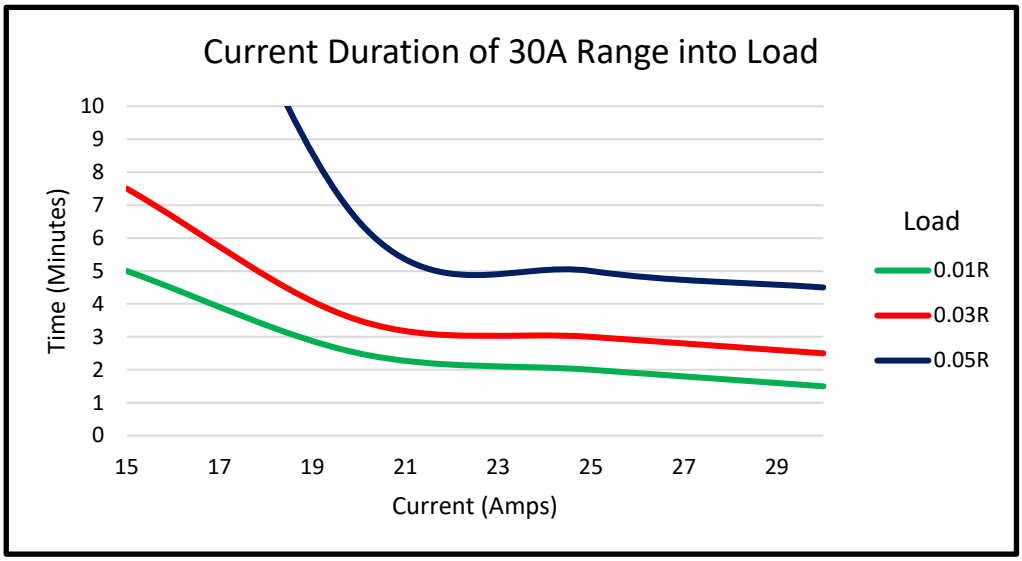
Note 1 : Typical RMS noise figures at 50% of full scale.

Note 2 : Power & temperature sensor on 30A range - microprocessor monitors & protects from overheating. Higher resistance loads allow a longer ON period. See graphs 1 and 2 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 ± 5°C
Outside this range an allowance of 0.18 x 1 Year Spec. per °C should be added.



Measurement Conditions : Ambient Temperature 20'C, Mains Voltage 230V, Mains Frequency 50Hz
Allow at least 7 minutes 'off' period between current output

Shorter periods will reduce the output time availiable.

A higher ohmic value load (for example, a 0.1R Shunt) allows greater output time as more heat is dissapated within the shunt / load. With lower loads more heat is dissapated within the instrument, reducing output time

Into a 0.1R Load outputs of up to 20A are available for periods of greater than 30 minutes continously, considerations of self heating of the external load/Uut should be considered due to the power being dissapate

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	100nV	1mA [1]	50 Ohms	20 V	0.0800	+	15
	45 to 999Hz	100nV	1mA [1]	50 Ohms	20 V	0.0160	+	15
	1 to 19.999kHz	100nV	1mA [1]	50 Ohms	20 V	0.0200	+	28
	20 to 99.999kHz	100nV	1mA [1]	50 Ohms	20 V	0.1000	+	40
	100 to 500kHz	100nV	1mA [1]	50 Ohms	20 V	0.4000	+	100
0.2 to 2.02V	10 to 44Hz	1µV	50mA	0.2 Ohms	1200V	0.0500	+	180
	45 to 999Hz	1µV	50mA	0.2 Ohms	1200V	0.0160	+	120
	1 to 19.999kHz	1µV	50mA	0.2 Ohms	1200V	0.0210	+	180
	20 to 99.999kHz	1µV	50mA	0.2 Ohms	1200V	0.0650	+	300
	100 to 500kHz	1µV	50mA	0.2 Ohms	1200V	0.3000	+	450
	500kHz to 1MHz	1µV	50mA	0.2 Ohms	1200V	0.5000	+	600
2-20.2V	10 to 44Hz	10µV	50mA	0.2 Ohms	1200V	0.0500	+	1600
	45 to 999Hz	10µV	50mA	0.2 Ohms	1200V	0.0160	+	1000
	1 to 19.999kHz	10µV	50mA	0.2 Ohms	1200V	0.0210	+	1600
	20 to 100kHz	10µV	50mA	0.2 Ohms	1200V	0.0600	+	3000
20-202V	30Hz to 44Hz	100µV	20mA [2]	0.5 Ohms	1200V	0.0500	+	20mV
	45Hz to 999Hz	100µV	15mA [2]	0.5 Ohms	1200V	0.0150	+	12mV
	1 to 9.999kHz	100µV	15mA [2]	0.5 Ohms	1200V	0.0200	+	16mV
	10 to 40KHz	100µV	2mA [2]	0.5 Ohms	1200V	0.0300	+	30mV
200-1020V [3]	30 to 44Hz	1mV	20mA [2]	0.7 Ohms	1200V	0.0550	+	200mV
	45 to 999Hz	1mV	15mA [2]	0.7 Ohms	1200V	0.0200	+	60mV
	1kHz to 10kHz	1mV	2mA [2]	0.7 Ohms	1200V	0.0250	+	120mV

Stability (Accuracy relative to calibration Standards)

Range	Frequency	Frequency Resolution	90 day Rel %Set		µV	180 Day Rel %Set		µV	1 year Rel %Set		µV	2 year Rel %Set		µV
0-202mV	10 to 44Hz	1Hz	0.0480	+	12	0.0540	+	13.5	0.0600	+	15	0.0840	+	21
	45 to 999Hz	1Hz	0.0080	+	12	0.0090	+	15	0.0100	+	15	0.0140	+	21
	1 to 19.999kHz	1Hz	0.0096	+	22.4	0.0108	+	28	0.0120	+	28	0.0168	+	39
	20 to 99.999kHz	1Hz	0.0720	+	32	0.0810	+	40	0.0900	+	40	0.1260	+	56
	100 to 500kHz	1Hz	0.2400	+	80	0.2700	+	100	0.3000	+	100	0.4200	+	140
0.2-2.02V [6]	10 to 44Hz	1Hz	0.0360	+	144	0.0405	+	180	0.0450	+	180	0.0630	+	252
	45 to 999Hz	1Hz	0.0112	+	96	0.0126	+	120	0.0140	+	120	0.0196	+	168
	1 to 19.999kHz	1Hz	0.0128	+	144	0.0144	+	180	0.0160	+	180	0.0224	+	252
	20 to 99.999kHz	1Hz	0.0464	+	240	0.0522	+	300	0.0580	+	300	0.0812	+	420
	100 to 500kHz	1Hz	0.2000	+	360	0.2250	+	450	0.2500	+	450	0.3500	+	630
	500kHz to 1MHz	1Hz	0.3600	+	480	0.4050	+	600	0.4500	+	600	0.6300	+	840
2-20.2V	10 to 44Hz	1Hz	0.0344	+	1280	0.0387	+	1600	0.0430	+	1600	0.0602	+	2240
	45 to 999Hz	1Hz	0.0104	+	800	0.0117	+	1000	0.0130	+	1000	0.0182	+	1400
	1 to 19.999kHz	1Hz	0.0128	+	1280	0.0144	+	1600	0.0160	+	1600	0.0224	+	2240
	20 to 100kHz	1Hz	0.0416	+	2400	0.0468	+	3000	0.0520	+	3000	0.0728	+	4200
20-202V	30Hz to 44Hz	1Hz	0.0344	+	20mV	0.0387	+	20mV	0.0430	+	20mV	0.0602	+	28mV
	45Hz to 999Hz	1Hz	0.0104	+	12mV	0.0117	+	12mV	0.0130	+	12mV	0.0182	+	16mV
	1 to 9.999kHz	1Hz	0.0128	+	16mV	0.0144	+	16mV	0.0160	+	16mV	0.0224	+	22mV
	10 to 40Khz	1Hz	0.0192	+	30mV	0.0216	+	30mV	0.0240	+	30mV	0.0336	+	56mV
200-1020V [3]	30 to 44Hz	1Hz	0.0400	+	200mV	0.0450	+	200mV	0.0500	+	200mV	0.0700	+	280mV
	45 to 999Hz	1Hz	0.0120	+	60mV	0.0135	+	60mV	0.0150	+	60mV	0.0210	+	105mV
	1kHz to 10kHz	1Hz	0.0160	+	120mV	0.0180	+	120mV	0.0200	+	120mV	0.0280	+	180mV

All specifications apply from 10% of full scale. [5]

AC Frequency Accuracy : 30ppm

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.
Note 4 :	Specifications apply up to 10% of maximum load current. Above this level, allowance must be made for output resistance.
Note 5 :	Zero or floor allowance.
Note 7 :	THD less than 0.39% of output - 10Hz to 1MHz bandwidth at frequencies up to 50kHz

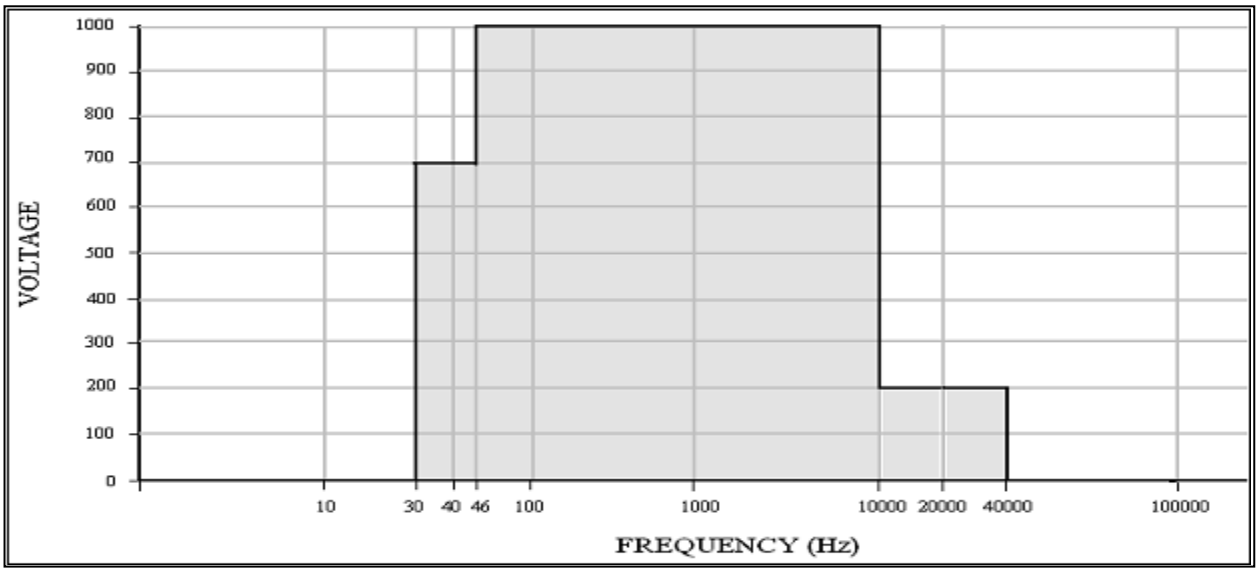
Due to continuous development specifications may be subject to change.

2 Wire output. Remote sensing not available. Maximum floating voltage : 100V.

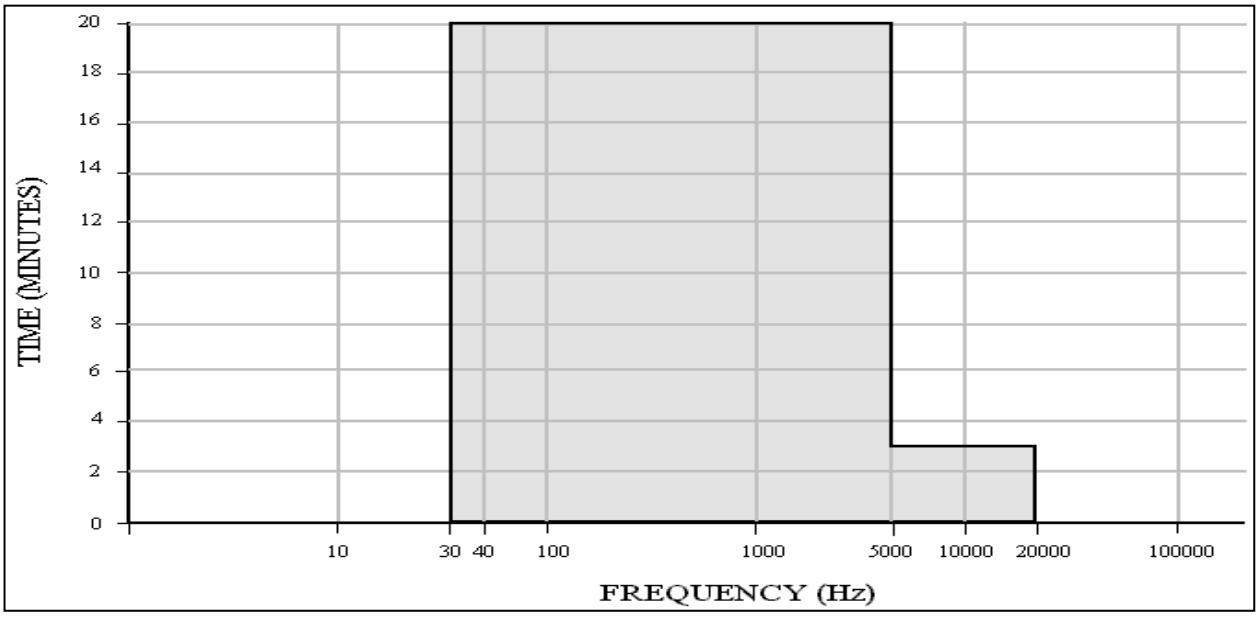
Isolation : Floating or grounded selection available as standard.

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. This function can be disabled
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 ±5°C & Range Parameters

Range	Frequency	Resolution	Max. Burden Voltage (peak)	Overload Protection	1 year Accuracy %Set	1 year Accuracy µA
20-202µA	10Hz to 44Hz	0.1nA	3 Volts	150V	0.20	+ 0.25
	45Hz to 999Hz				0.07	+ 0.15
	1kHz to 10kHz				0.80	+ 0.25
0.2-2.02mA	10Hz to 44Hz	1nA	3 Volts	150V	0.20	+ 0.25
	45Hz to 999Hz				0.06	+ 0.2
	1kHz to 10kHz				0.50	+ 0.3
2-20.2mA	10Hz to 44Hz	10nA	3 Volts	150V	0.20	+ 3
	45Hz to 999Hz				0.04	+ 2
	1kHz to 10kHz				0.25	+ 3
20-202mA	10Hz to 44Hz	100nA	3 Volts	150V	0.20	+ 30
	45Hz to 999Hz				0.04	+ 20
	1kHz to 10kHz				0.50	+ 40
0.2-2.02A	10Hz to 44Hz	1µA	3 Volts	150V	0.20	+ 300
	45Hz to 999Hz				0.06	+ 200
	1kHz to 5kHz				0.50	+ 400
2-30.0A	30Hz to 44Hz	10µA	2.8 Volts	150V	0.20	+ 3000
	45Hz to 99Hz				0.08	+ 2000
	100Hz to 1kHz				0.30	+ 4000

All specifications apply from 10% of full scale.
AC Frequency Accuracy : 30ppm

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 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 %Set	90 Day Rel µA	180 Day Rel %Set	180 Day Rel µA	1 Year Rel %Set	1 Year Rel µA	2 Year Rel %Set	2 Year Rel µA
20-202µA	10Hz to 44Hz	1Hz	0.128	+ 0.25	0.144	+ 0.25	0.160	+ 0.25	0.224	+ 0.35
	45Hz to 999Hz	1Hz	0.040	+ 0.15	0.045	+ 0.15	0.050	+ 0.15	0.070	+ 0.21
	1kHz to 10kHz	1Hz	0.640	+ 0.2	0.720	+ 0.2	0.800	+ 0.2	1.120	+ 0.28
0.2-2.02mA	10Hz to 44Hz	1Hz	0.120	+ 0.25	0.135	+ 0.25	0.150	+ 0.25	0.210	+ 0.35
	45Hz to 999Hz	1Hz	0.032	+ 0.2	0.036	+ 0.2	0.040	+ 0.2	0.056	+ 0.28
	1kHz to 10kHz	1Hz	0.320	+ 0.3	0.360	+ 0.3	0.400	+ 0.3	0.560	+ 0.42
2mA-20.2mA	10Hz to 44Hz	1Hz	0.120	+ 3	0.135	+ 3	0.150	+ 3	0.210	+ 4.2
	45Hz to 999Hz	1Hz	0.028	+ 2	0.032	+ 2	0.035	+ 2	0.049	+ 2.8
	1kHz to 10kHz	1Hz	0.160	+ 3	0.180	+ 3	0.200	+ 3	0.280	+ 4.2
20-202mA	10Hz to 44Hz	1Hz	0.120	+ 30	0.135	+ 30	0.150	+ 30	0.210	+ 42
	45Hz to 999Hz	1Hz	0.028	+ 20	0.032	+ 20	0.035	+ 20	0.049	+ 28
	1kHz to 10kHz	1Hz	0.320	+ 40	0.360	+ 40	0.400	+ 40	0.560	+ 56
200-2.02A	10Hz to 44Hz	1Hz	0.120	+ 300	0.135	+ 300	0.150	+ 300	0.210	+ 420
	45Hz to 999Hz	1Hz	0.032	+ 200	0.036	+ 200	0.040	+ 200	0.056	+ 280
	1kHz to 5kHz	1Hz	0.320	+ 400	0.360	+ 400	0.400	+ 400	0.560	+ 560
2-30.0A[1]	30Hz to 44Hz	1Hz	0.120	+ 3000	0.135	+ 3000	0.150	+ 3000	0.210	+ 4200
	45Hz to 99Hz	1Hz	0.032	+ 2000	0.036	+ 2000	0.040	+ 2000	0.056	+ 2800
	100Hz to 1kHz	1Hz	0.320	+ 4000	0.360	+ 4000	0.400	+ 4000	0.560	+ 5600

Notes

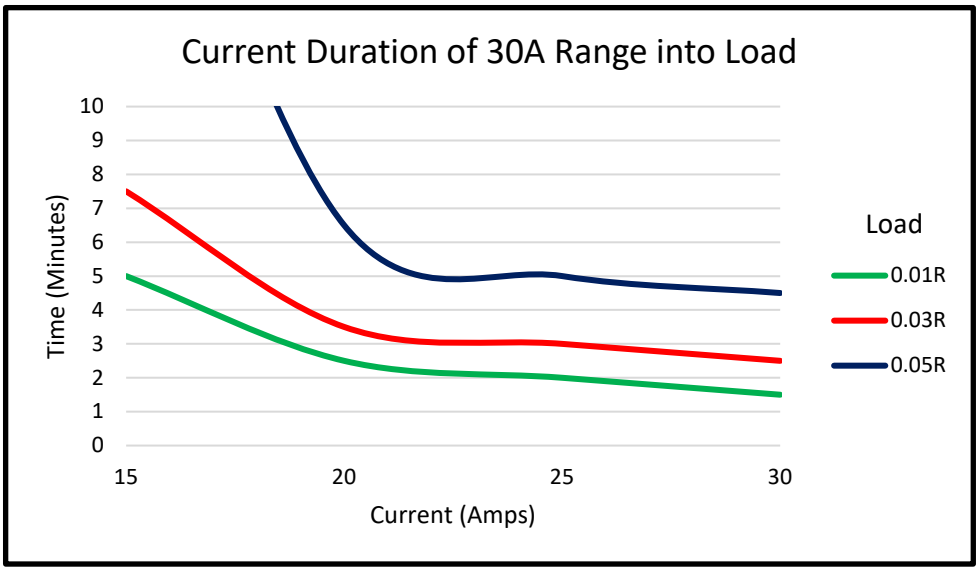
Note 1 : Temperature sensor on 30A range - microprocessor monitors & protects from overheating.
Higher resistance loads allow a longer ON period. See graph for details.
Note 2 : Specifications apply to loads of less than 10% of the maximum burden voltage.

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 30Amps/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.



Measurement Conditions : Ambient Temperature 20'C, Mains Voltage 230V, Mains Frequency 50Hz
Allow at least 7 minutes 'off' period between current output

Shorter periods will reduce the output time availiable.

A higher ohmic value load (for example, a 0.1R Shunt) allows greater output time as more heat is dissapated within the shunt / load. With lower loads more heat is dissapated within the instrument, reducing output time

Into a 0.1R Load outputs of up to 20A are available for periods of greater than 30 minutes continously, considerations of self heating of the external load/Uut should be considered due to the power being dissapated

Total Accuracy - Standard Accuracy

Range	Resolution	90 day ppm	180 Day ppm	1 year ppm	2 year ppm
1Hz - 1MHz	1Hz	16	18	20	28
1MHz - 5MHz*	1Hz	16	18	20	28
10MHz	1Hz	16	18	20	28

Total Accuracy - High Accuracy (Option)

Range	Resolution	90 day ppm	180 Day ppm	1 year ppm	2 year ppm
1Hz - 1MHz	1Hz	0.8	0.9	1	1.4
1MHz - 5MHz*	1Hz	0.8	0.9	1	1.4
10MHz	1Hz	0.8	0.9	1	1.4

* Frequency band available from Firmware Version 12.3.16 / 13.0.06

Specifications apply at TCal ± 5°C

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

PWM (%) - Frequency Range 5Hz to 10kHz	
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 ±5°C & Range Parameters

Range	Maximum Current	Maximum Voltage	Display Resolution	1 Year Total Accuracy % set		Ohms
0Ω	0.5A	-	1μΩ			0.005
0.1Ω	0.5A	-	1μΩ	0.0025	+	0.005
1Ω	0.4A	-	1μΩ	0.0025	+	0.005
10Ω	0.3A	-	1μΩ	0.0025	+	0.005
100Ω	0.1A	-	10μΩ	0.0018	+	0.005
1kΩ	-	10V	100μΩ	0.0018	+	0.005
10kΩ	-	50V	1mΩ	0.0008	+	0.05
100kΩ	-	100V	10mΩ	0.0018	+	0.5
1MΩ*	-	100V	100mΩ	0.0025	+	5
10MΩ*	-	100V	1Ω	0.009	+	100
100MΩ*	-	100V	1kΩ	0.18	+	2000
1000MΩ*		100V	10kΩ	1	+	30000

*** 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
0Ω	-		0.005	-		0.005	-		0.005	-		0.005
0.1Ω	0	+	0.005	0	+	0.005	0	+	0.005	0	+	0.005
1Ω	0	+	0.005	0	+	0.005	0	+	0.005	0	+	0.005
10Ω	0	+	0.005	0	+	0.005	0	+	0.005	0	+	0.005
100Ω	0.0012	+	0.005	0.00135	+	0.005	0.0015	+	0.005	0.0021	+	0.005
1kΩ	0.00128	+	0.005	0.00144	+	0.005	0.0016	+	0.005	0.0022	+	0.005
10kΩ	0.00048	+	0.05	0.00054	+	0.05	0.0006	+	0.05	0.0008	+	0.05
100kΩ	0.00096	+	0.5	0.00108	+	0.5	0.0012	+	0.5	0.0017	+	0.5
1MΩ	0.00144	+	5	0.00162	+	5	0.0018	+	5	0.0025	+	5
10MΩ	0.0064	+	100	0.0072	+	100	0.008	+	100	0.0112	+	100
100MΩ	0.136	+	2000	0.153	+	2000	0.17	+	2000	0.238	+	2000
1000MΩ	0.72	+	30000	0.81	+	30000	0.9	+	30000	1.26	+	30000

For 2-Wire connection allow 35mW 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 ± 5°C.

Outside this range an allowance of 0.18 x 1 Year Spec. per °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
1nF	50V	0.1pF	0.006	N/A
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
1µF	30V	100pF	0.002	N/A
10µF	20V	1nF	0.014	0.2Ω

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

Total Accuracy

Range	90 day %	180 Day %	1 year %	2 year %
1nF	0.2	0.225	0.25	0.35
10nF	0.2	0.225	0.25	0.35
20nF	0.2	0.225	0.25	0.35
50nF	0.2	0.225	0.25	0.35
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

Measurement methods
C_p up to 1µF C_s above 1µF

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

Range	Maximum Voltage	Display Resolution
100uF	8V	10nF
1mF	8V	100nF
10mF	8V	1µF

Total Accuracy

Range	90 day %	180 Day %	1 year %	2 year %
100µF	0.48	0.54	0.6	0.84
1mF	0.8	0.9	1	1.4
10mF	0.8	0.9	1	1.4

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.

Minimum terminal voltage = 80mV
Maximum terminal voltage = 8V
Maximum current input = 20mA
Performance/compatibility may be affected using other measurement methods/techniques for the simulated capacitance function in which case passive capacitance functionality may be employed.

Total Accuracy

Range	Display Resolution	Measurement Current (Max.)	1 year % (Rng)	1 year Zero
0R to 100R	10mΩ	20mA	0.01	50mΩ
101R to 1kR	100mΩ	2mA	0.01	50mΩ
1.01kR to 10kR	1Ω	300µA	0.01	50mΩ
10.1kR to 100kR	10Ω	40µA	0.01	50mΩ
101kR to 1MR	100Ω	4µA	0.01	50mΩ
1.01MR to 10MR	1kΩ	0.4µA	0.01	50mΩ

Minimum terminal voltage = 80mV
Maximum current input = 20mA
Input measurement current must be a constant DC current isolated from earth
Performance/compatibility may be affected using other measurement methods/techniques for the simulated resistance function eg. AC or pulsed, in which case passive resistance functionality may be employed.
Current must be stable for a period of 1s - it is therefore recommended the UUT range is selected manually

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

Range	Maximum Current	DC Resistance	Q	Display Resolution
1mH	30mA	7.8Ω	1	100nH
10mH	25mA	24Ω	2.8	1µH
19mH	20mA	33Ω	3.8	1µH
29mH	20mA	41Ω	4.7	1µH
50mH	20mA	54Ω	6.1	1µH
100mH	20mA	78Ω	8.6	10µH
1H	10mA	260Ω	29	100µH
10H	1mA	950Ω	110	1mH

All Inductance specifications ± 50uH.

Accuracy Relative to Calibration Standards Specifications

Range	90 day Rel %	180 Day Rel %	1 year Rel %	2 year Rel %
1mH	0.4	0.45	0.5	0.7
10mH	0.4	0.45	0.5	0.7
19mH	0.4	0.45	0.5	0.7
29mH	0.4	0.45	0.5	0.7
50mH	0.4	0.45	0.5	0.7
100mH	0.4	0.45	0.5	0.7
1H	0.4	0.45	0.5	0.7
10H	0.4	0.45	0.5	0.7

Measurement methods
L_s up to 1H
L_p from 1H to 10H

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	0.5mA to 30A DC
Output Terminals	Voltage output from top (Black & White) terminals 0.5mA to 2A current output from middle 2A (Black & Red) terminals 2.01A to 30A current output from bottom 30A (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
0.5mA to 300mA	10µA	0.100%	40µA
0.3A to 2A	0.1mA	0.015%	400µA
2.01A to 30A	1mA	0.04%	4mA

1 Year Accuracy Relative to Calibration standards

Voltage Range	Resolution	Setting	Zero
20V	1µV	0.0025%	40µV
200V	10µV	0.0030%	400µV
1000V	100µV	0.0030%	4000µV

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.This function can be disabled

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

30A 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	0.5mA to 30A AC
Frequency Range	10Hz to 400Hz
Output Terminals	Voltage output from top (Black & White) terminals 200mA to 2A current output from middle 2A (Black & Red) terminals 2.01A to 30A current output from bottom 30A (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
0.5mA to 0.2A	10uA	0.2%	40µA
0.2A to 2A	0.1mA	0.1%	400µA
2.01A to 30A	1mA	0.05%	4mA

1 Year Accuracy Relative to Calibration standards

Voltage Range	Resolution	Setting	Zero
20V	1µV	0.035%	900µV
200V	10µV	0.04%	7.5mV
1000V	100µV	0.04%	75mV

Frequency Specifications

Frequency	
Range	40 to 400Hz (1V to 699V) : 46 to 400Hz (700V to 1000V)

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 into loads of 100mOhms and greater

3010 calibrators **automatically correct for any errors in the phase** caused by inductive loading, for example when using the clamp coil adaptor.

Note that when in Power output mode the Voltage and Current negative terminals are internally tied together, and as default negative to ground is selected. Phase speciications apply only when the UUT current and voltage measurement channels are isolated from eachother. Ground loops caused by externally earthing or tieing low's together will cause phase errors

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. This function can be disabled

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

30A 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.

DDS Harmonic Specifications (in addition to AC Power Specifications) (apply only if Power DDS Option fitted)

DDS Harmonic Power Simulation - General Specifications	
Harmonics in a User Defined Waveform ProWave PC software required to upload waveform data - supplied when PWRDDS option fitted	**48** from 2nd to 49th Harmonic
Fundamental Frequency	**40Hz to 400Hz**
Harmonic Frequency Range	**Up to 20kHz**
Harmonic Frequency Accuracy	**0.1% + (N x 0.08%)** Where N is the Harmonic number
Harmonic Amplitude Resolution	**0.10%** of Fundamental
Harmonic Phase Range (relative to fundamental)	**0 to 360°**
Harmonic Phase Resolution	**0.1°** Relative to Fundamental
Composite Voltage Waveform Range	**2V to 1000V**
Composite Current Waveform Range	**300mA to 30A**

DDS Harmonic Power Simulation - Pre Loaded Waveforms
3rd 5%
3rd 10%
5th 10%
12th 10%
21st 10%
USER+SINE
USER

Amplitude

Range	Resolution
2mV/Div to 10mV/Div	10nV
20mV/Div to 100mV/Div	100nV
200mV/Div to 2V/Div	1µV
5V/Div to 20V/Div	10µV
50V/Div	100µV

Sequence	1, 2, 5
Waveshapes	Square Wave (positive going from ground), DC
Square Wave Frequency	1kHz
Frequency Accuracy	30ppm
Graticule Height	6 Graticules
Rise Time	2us
Fall Time	2us
Output Terminal	Front BNC (Green LED indicates terminal active)

DC Level

Range @ 1MOhm load	90 Day Rel. %		µV	180 Day Rel. %		µV	1 Year Rel. %		µV	2 Year Rel. %		µV
2mV to 50V/Div	0.009	±	20	0.01	±	20	0.01	±	20	0.014	±	20

AC Square Wave

Range @ 1MOhm load	90 Day Rel. %		µV	180 Day Rel. %		µV	1 Year Rel. %		µV	2 Year Rel. %		µV
2mV to 50V/Div	0.09	±	40	0.08	±	40	0.1	±	40	0.14	±	40

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

Standby is automatically selected for high voltage (>20V) after 20 minutes on the same setting. This function can be disabled

An external high voltage output/standby control switch is available as an option

Amplitude Deviation

Deviation Range	±10%
Deviation Resolution	3010 : Better than 10ppm

Range	90 Day Rel. %		µV	180 Day Rel. %		µV	1 Year Rel. %		µV	2 Year Rel. %		µV
-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 0.001% Steps			
Deviation Resolution	0.001%			
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 350MHz or 5MHz to 600MHz (dependant on option fitted)			
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 350MHz	0.8	0.90	1	1.4
5MHz to 600MHz	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, Maximum 1.5ns*

*Note : Rise time can be affected by leads and impedance mismatch. 1.5ns should be used for certification

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

Range	Actual Value (Ohms)	Max. Power Rating (Watts)	Maximum Voltage (V)	Maximum Current (mA)	Display Resolution
-100°C	60.25	0.2	3.47	57.62	1m°C
0°C	100.00	0.2	4.47	44.72	1m°C
+30°C	111.67	0.2	4.73	42.32	1m°C
+60°C	123.24	0.2	4.96	40.28	1m°C
+100°C	138.50	0.2	5.26	38.00	1m°C
+200°C	175.84	0.2	5.93	33.73	10m°C
+400°C	247.04	0.2	7.03	28.45	10m°C
+800°C	375.51	0.2	8.67	23.08	10m°C

4-Wire connection. Allow 1mW on all resistance specifications.

Accuracy Relative to Calibration Standards Specifications

Range	Actual Value (Ohms)	90 day Rel %	180 Day Rel %	1 year Rel %	2 year Rel %
-100°C	60.25	0.008	0.009	0.01	0.014
0°C	100.00	0.008	0.009	0.01	0.014
+30°C	111.67	0.008	0.009	0.01	0.014
+60°C	123.24	0.008	0.009	0.01	0.014
+100°C	138.50	0.008	0.009	0.01	0.014
+200°C	175.84	0.008	0.009	0.01	0.014
+400°C	247.04	0.008	0.009	0.01	0.014
+800°C	375.51	0.008	0.009	0.01	0.014

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

PRT Type	Range °C	1 Year * ± °C
PT25	-200 to 0	0.50
	0 to 800	0.60
PT100	-200 to 0	0.13
	0 to 800	0.55
PT250	-200 to 0	0.25
	0 to 800	0.30
PT500	-200 to 260	0.10
	260 to 500	0.90
PT1000	-200 to 0	0.08
	0 to 800	0.45

2-Wire connection only

Display resolution : 10m°C

Minimum terminal voltage = 80mV

Maximum current input = 20mA

Input measurement current must be a constant DC current isolated from earth

Performance/compatibility may be affected using other measurement methods/techniques for the variable PRT function eg. AC or pulsed, in which case passive resistance functionality may be employed.

Current must be stable for a period of 1s - it is therefore recommended the UUT range is selected manually

* Specifications apply at TCal ± 5°C.

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

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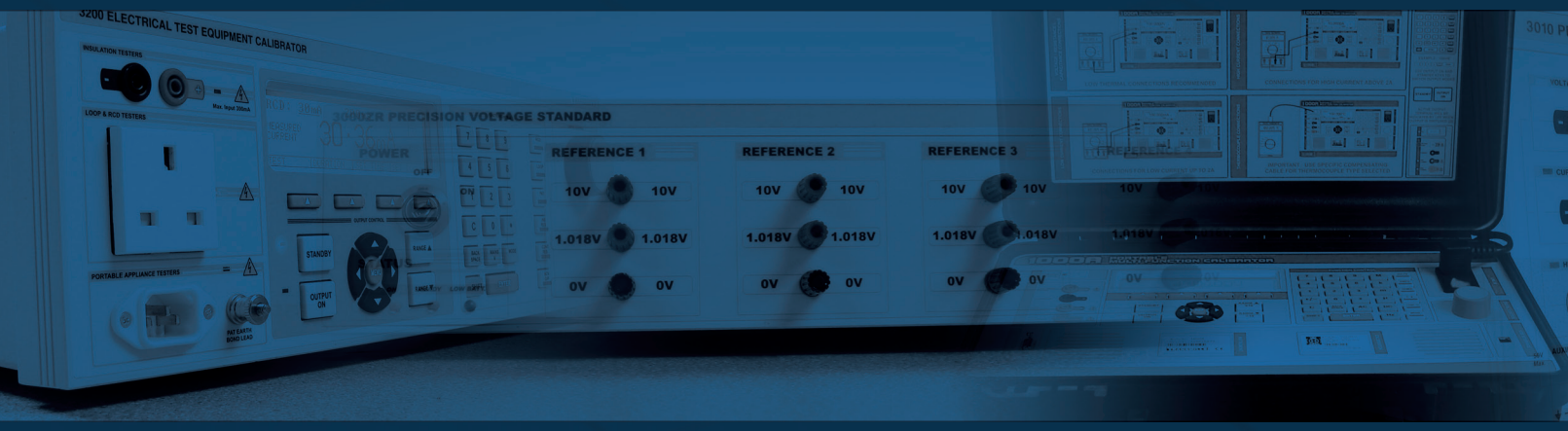

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