



***Time Electronics***  
*Calibration, Test and Measurement*

# Extended Specifications

## 5077 Series 2 Multifunction Calibrator

Revision: 2206-1

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## 5077 Series 2 Specifications

1. Specifications are stated as  $\pm$  ppm or % of output + floor, unless otherwise indicated.
2. Specifications apply at 23 °C  $\pm$  5 °C.
3. For temperatures outside this range add 0.2 x specification per °C.
4. Specifications include stability, linearity, and traceability of external standards used for calibration.

### DC Voltage

Range	Uncertainty 1 Year	Resolution	Output Resistance	Max. Burden
0 to 20 mV	40 ppm + 4 $\mu$ V	0.1 $\mu$ V	10 $\Omega$	
20 to 200 mV	40 ppm + 4 $\mu$ V	1 $\mu$ V	10 $\Omega$	
0.2 to 2 V	40 ppm + 15 $\mu$ V	1 $\mu$ V	0.1 $\Omega$	20 mA
2 to 20 V	40 ppm + 75 $\mu$ V	10 $\mu$ V	0.1 $\Omega$	20 mA
20 to 200 V	50 ppm + 15 mV	1 mV	<5 $\Omega$	20 mA
200 to 1050 V	150 ppm + 30 mV	10 mV	<10 $\Omega$	10 mA

Maximum capacitance 1000 pF.  
1 % of full scale overrange, except for function limits.

### DC Current

Range	Uncertainty 1 Year	Resolution	Compliance Voltage	Max. Inductance
0 to 200 $\mu$ A	150 ppm + 25 nA	0.1 nA	10 V	50 $\mu$ H
0.2 to 2 mA	120 ppm + 55 nA	1 nA	10 V	50 $\mu$ H
2 to 20 mA	120 ppm + 200 nA	10 nA	10 V	50 $\mu$ H
20 to 200 mA	120 ppm + 2 $\mu$ A	100 nA	10 V	30 $\mu$ H
0.2 to 2 A	400 ppm + 100 $\mu$ A	1 $\mu$ A	4 V	5 $\mu$ H
2 to 22 A	600 ppm + 1 mA	10 $\mu$ A	4 V	2 $\mu$ H

For full accuracy the 2 A and 20 A ranges compliance is limited to 2.2 V. For settling and stabilisation, see notes.  
1 % of full scale overrange, except for function limits.

### DC Power

Voltage Range	Uncertainty 1 Year	Resolution	Output Resistance	Max. Burden
2 to 20 mV	100 ppm + 10 $\mu$ V	1 $\mu$ V	10 $\Omega$	
20 to 200 mV	100 ppm + 25 $\mu$ V	1 $\mu$ V	10 $\Omega$	
0.2 to 2 V	100 ppm + 50 $\mu$ V	10 $\mu$ V	0.1 $\Omega$	20 mA
2 to 20 V	100 ppm + 500 $\mu$ V	100 $\mu$ V	0.1 $\Omega$	20 mA
20 to 200 V	200 ppm + 10 mV	1 mV	<5 $\Omega$	20 mA
200 to 1050 V	500 ppm + 50 mV	10 mV	<10 $\Omega$	10 mA
Current Range	Uncertainty 1 Year	Resolution	Compliance Voltage	Max Inductance
2 to 20 mA	150 ppm + 10 $\mu$ A	1 $\mu$ A	10 V	50 $\mu$ H
20 to 200 mA	150 ppm + 100 $\mu$ A	10 $\mu$ A	10 V	30 $\mu$ H
0.2 to 2 A	500 ppm + 500 $\mu$ A	100 $\mu$ A	4 V	200 $\mu$ H
2 to 22 A	650 ppm + 5 mA	1 mA	4 V	150 $\mu$ H

Simultaneous output of voltage and current. Output displayed in Watts or VA. Specification applies with low terminals isolated.  
Additional current errors apply for use with common low terminals, see notes.

To calculate the total power uncertainty, use the following formula:  $\sqrt{V_{spec}^2 + I_{spec}^2}$

## AC Voltage

Range	Frequency	Uncertainty 1 Year	Resolution	Output Resistance	Max. Burden
2 to 20 mV	20 Hz to 40 Hz	0.15 % + 40 $\mu$ V	1 $\mu$ V	10 $\Omega$	
	40 Hz to 2 kHz	0.10 % + 30 $\mu$ V			
	2 kHz to 20 kHz	0.15 % + 30 $\mu$ V			
20 to 200 mV	20 Hz to 40 Hz	0.10 % + 60 $\mu$ V	1 $\mu$ V	10 $\Omega$	
	40 Hz to 2 kHz	0.05 % + 50 $\mu$ V			
	2 kHz to 20 kHz	0.10 % + 75 $\mu$ V			
0.2 to 2 V	20 Hz to 40 Hz	0.10 % + 60 $\mu$ V	10 $\mu$ V	< 0.1 $\Omega$	20 mA
	40 Hz to 2 kHz	0.05 % + 50 $\mu$ V			
	2 kHz to 20 kHz	0.05 % + 75 $\mu$ V			
2 to 20 V	20 Hz to 40 Hz	0.10 % + 600 $\mu$ V	100 $\mu$ V	< 5 $\Omega$	20 mA
	40 Hz to 2 kHz	0.05 % + 500 $\mu$ V			
	2 kHz to 20 kHz	0.10 % + 750 $\mu$ V			
20 to 200 V	40 Hz to 1 kHz	0.05 % + 3 mV	1 mV	< 5 $\Omega$	20 mA
200 to 1050 V	40 Hz to 1 kHz	0.05 % + 20 mV	10 mV	< 10 $\Omega$	10 mA

Frequency accuracy 0.01 %. Frequency resolution 1 Hz. 1 % of full scale overrange, except for function limits.  
Additional noise floor uncertainties apply to settings below 5 mV, see notes.

## AC Current

Range	Frequency	Uncertainty 1 Year	Resolution	Compliance Voltage (RMS)	Max. Inductance
10 to 200 $\mu$ A	20 Hz to 40 Hz	0.10 % + 150 nA	10 nA	8 V	50 $\mu$ H
	40 Hz to 2 kHz	0.05 % + 150 nA			
	2 kHz to 5 kHz	0.10 % + 150 nA			
0.2 to 2 mA	20 Hz to 40 Hz	0.10 % + 150 nA	10 nA	8 V	50 $\mu$ H
	40 Hz to 2 kHz	0.05 % + 150 nA			
	2 kHz to 5 kHz	0.10 % + 200 nA			
2 to 20 mA	20 Hz to 40 Hz	0.10 % + 2 $\mu$ A	100 nA	8 V	50 $\mu$ H
	40 Hz to 2 kHz	0.05 % + 2 $\mu$ A			
	2 kHz to 5 kHz	0.10 % + 2.5 $\mu$ A			
20 to 200 mA	20 Hz to 40 Hz	0.10 % + 20 $\mu$ A	1 $\mu$ A	8 V	30 $\mu$ H
	40 Hz to 2 kHz	0.05 % + 20 $\mu$ A			
	2 kHz to 5 kHz	0.10 % + 25 $\mu$ A			
0.2 to 2 A	20 Hz to 40 Hz	0.15 % + 250 $\mu$ A	10 $\mu$ A	3 V	200 $\mu$ H
	40 Hz to 500 Hz	0.10 % + 250 $\mu$ A			
2 to 22 A	20 Hz to 40 Hz	0.15 % + 3 mA	100 $\mu$ A	3 V	150 $\mu$ H
	40 Hz to 500 Hz	0.10 % + 3 mA			

For full accuracy the 2 A and 20 A ranges compliance is limited to 2.2 V. 1 % of full scale overrange, except for function limits.

## AC Power

Voltage Ranges	Frequency	Uncertainty 1 Year	Resolution	Max. Burden
2 to 20 mV	40 to 500 Hz	0.10 % + 150 $\mu$ V	10 $\mu$ V	10 $\Omega$
20 to 200 mV		0.05 % + 150 $\mu$ V	10 $\mu$ V	
0.2 to 2 V		0.05 % + 100 $\mu$ V	100 $\mu$ V	20 mA
2 to 20 V		0.05 % + 500 $\mu$ V	1 mV	20 mA
20 to 200 V		0.10 % + 3 mV	10 mV	20 mA
200 to 1050 V		0.10 % + 20 mV	1 mV	10 mA
Current Ranges	Frequency	Uncertainty 1 Year	Resolution	Compliance Voltage (RMS)
2 to 20 mA	40 to 500 Hz	0.1 % + 20 $\mu$ A	100 nA	8 V
20 to 200 mA		0.1 % + 200 $\mu$ A	1 $\mu$ A	
0.2 to 2 A		0.1 % + 1.5 mA	10 $\mu$ A	3 V
2 to 22 A		0.1 % + 15 mA	100 $\mu$ A	

Frequency accuracy 0.02 %. Maximum Inductance: 2 A range 200  $\mu$ H, 20 A range 150  $\mu$ H  
 Specification applies with low terminals isolated. High terminals must not be connected. Additional current errors apply for use with common low terminals, see notes.  
 Additional noise floor uncertainties apply to settings below 5 mV, see notes.

Phase Angle	Frequency	Uncertainty 1 Year	Resolution
$\pm 90^\circ$	40 to 100 Hz	0.25 $^\circ$	0.1 $^\circ$
	100 to 500 Hz	1.0 $^\circ$	0.1 $^\circ$

Power Factor	Frequency	Resolution
0.00 to 1.00	40 to 500 Hz	0.01

Accredited measurements are not available for phase angle or power factor.

To calculate the total power uncertainty, use the following formulas:

$$\text{Power Specification (\%)} = \sqrt{V_{\text{spec}}^2 + I_{\text{spec}}^2 + PC^2}$$

Where  $V_{\text{spec}}$  and  $I_{\text{spec}}$  is the voltage and current accuracy expressed in %. PC is a Phase Correction derived from a formula given as:

$$\text{Phase Correction (\%)} = 100 \left( 1 - \frac{\cos(\text{Phase} + P_{\text{spec}})}{\cos \text{Phase}} \right)$$

Phase Correction Table

Phase Watts	Power Factor	Uncertainty 1 Year	
		40 to 100 Hz	100 to 500 Hz
0 $^\circ$	1.00	0.00 %	0.02 %
10 $^\circ$	0.99	0.08 %	0.32 %
20 $^\circ$	0.94	0.16 %	0.65 %
30 $^\circ$	0.87	0.25 %	1.02 %
40 $^\circ$	0.77	0.37 %	1.48 %
50 $^\circ$	0.64	0.52 %	2.10 %
60 $^\circ$	0.50	0.76 %	3.04 %
70 $^\circ$	0.34	1.20 %	4.81 %
80 $^\circ$	0.17	2.48 %	9.91 %

## Turn Coil Ranges

Range	Frequency	Uncertainty 1 Year	Resolution	Compliance Voltage	Max. Inductance
2 A x1	DC	0.05 % + 500 $\mu$ A	100 $\mu$ A	4 V	200 $\mu$ H
	20 Hz to 40 Hz	0.10 % + 100 $\mu$ A	10 $\mu$ A	3 V RMS	
	40 Hz to 100 Hz	0.05 % + 100 $\mu$ A			
2 A x5 (10 A)	DC	0.05 % + 500 $\mu$ A	1 mA	4 V	
	20 Hz to 40 Hz	0.10 % + 100 $\mu$ A	100 $\mu$ A	3 V RMS	
	40 Hz to 100 Hz	0.05 % + 100 $\mu$ A			
2 A x50 (100 A)	DC	0.05 % + 500 $\mu$ A	10 mA	4 V	
	20 Hz to 40 Hz	0.10 % + 100 mA	1 mA	3 V RMS	
	40 Hz to 100 Hz	0.05 % + 100 mA			
20 A x1	DC	0.065 % + 5 mA	1 mA	4 V	150 $\mu$ H
	20 Hz to 40 Hz	0.15 % + 3 mA	100 $\mu$ A	3 V RMS	
	40 Hz to 100 Hz	0.10 % + 3 mA			
20 A x5 (100 A)	DC	0.065 % + 5 mA	10 mA	4 V	
	20 Hz to 40 Hz	0.15 % + 3 mA	1 mA	3 V RMS	
	40 Hz to 100 Hz	0.10 % + 3 mA			
20 A x50 (1100 A)	DC	0.065 % + 5 mA	100 mA	4 V	
	20 Hz to 40 Hz	0.15 % + 3 mA	10 mA	3 V RMS	
	40 Hz to 100 Hz	0.10 % + 3 mA			

The turn coil ranges are a mathematical calculation of the DCI Power and ACI current functions and therefore do not require calibration.  
 1 % of full scale overrange, except for function limits. The uncertainty refers to the output terminals and does not include clamp coil accuracy .

# General Specifications

<b>Mains Voltage</b>	100 to 260 V AC 50/60 Hz.
<b>Fuse Ratings</b>	3.15 A anti-surge.
<b>Power Consumption</b>	120 W typical, 200 W Max.
<b>Operating Temperature</b>	10 to 40 °C.
<b>Storage Temperature</b>	-10 to 50 °C.
<b>Operating Humidity</b>	< 80 %.
<b>Altitude</b>	0 to 3 km. Non-operating 3 to 12 km.
<b>Warm Up Time</b>	30 minutes to full accuracy.
<b>Dimensions</b>	Width 447 mm, Height 152 mm, Depth 470 mm.
<b>Weight</b>	16.5 kg.
<b>Interfaces</b>	RS-232, GPIB & USB (via RS232 adaptor).
<b>Command Set</b>	Standard SCPI.

## Notes

### Absolute Uncertainties

Specified at a 95 % confidence level, coverage factor k=2.

### Overrange and Function Limits

These are the minimum and maximum values for the function. Where stated, over or under these values cannot be set.

### Mathematical Functions

These functions are mathematical calculations performed by the instrument's internal processors and have been designed and validated by Time Electronics. Calibration of these functions can be performed upon request.

### Accredited Measurements

Certain functions or ranges are indicated as 'accredited measurements not available'. On an accredited calibration certificate, these measurements will be marked as 'not accredited' or will not be included. Traceable measurements can be provided upon request. For further information please contact Time Electronics.

### Power Function Information and Additional Uncertainties

Additional AC and DC current errors for use with common low terminals: 2 A Ranges: 500 ppm + 800  $\mu$ A. 22 A Range: 0.25 % + 50 mA  
Calibration is performed as separate voltage and current measurements.

### Output Resistance and Loading

The output resistance of the 20 and 200 mV ranges is 10  $\Omega$ . This must be considered when loads of 100 k $\Omega$  or less are being driven. A 100 k $\Omega$  load will result in a 0.01% error.

### Noise Information and Additional Uncertainties

Additional ACV noise floor uncertainties apply between 1 and 5 mV: 20 Hz to 20 kHz, add 20  $\mu$ V. 20 kHz to 300 kHz, add 50  $\mu$ V.  
DC specifications apply between 0.1 and 1 Hz bandwidth.

### Settling and Stabilisation

DC Current 2 A Range: Full accuracy applies after the momentary setting of full scale allowing for thermal stabilisation throughout the range. Settling time 30 seconds.

2 Wire Resistance: Specifications apply after 15 seconds of settling time. Above 1 M $\Omega$  the settling time increases to 30 seconds.

For further information about settling and stabilisation please contact Time Electronics.

Due to continuous development Time Electronics reserves the right to change specifications without prior notice.