



5025 Multi Function Calibrator

Time Electronics

Calibration, Test & Measurement

- 0 - 1050 V AC/DC voltage
- 0 - 22 A AC/DC current
- 0 - 1GΩ resistance
- Thermocouple simulation
- Digital Frequency
- Oscilloscope Calibration
- PT100 simulation
- Capacitance & Inductance
- Power Calibration
- Clamp Meter Calibration
- GPIB, RS232 & USB Interface
- Calibrate up to 4.5 digit DMM's



EasyCal
Software Compatible

Multi Instrument Calibration

A calibrator with a wide range of capabilities to cover multiple functions is a modern day necessity. The 5025 is the ultimate multi-product calibrator, designed for both traditional and new measurement equipment.

The 5025 can calibrate, bench and handheld multi-meters, frequency meters, ohm meters, ac/dc millivoltmeters, thermocouple indicators, clamp meters, temperature indicators, timer counters, oscilloscopes and many other measurement devices.

Simple Operation

Functions and ranges are easily accessed from the front panel. Increase and decrease keys per digit, are used to quickly set the output value. Deviation control then enables the user to finely adjust the output value as a percentage (+/-9.999%). All this information is shown on a clear, easy to read LED display.

Flexible Options

The 5025 can be equipped to specific requirements. The standard unit is fitted with AC/DC voltage to 1050kV, AC/DC current to 22A, digital frequency to 10MHz, decade resistance to 1G ohms, conductance and thermocouple simulation.

Individual options include; capacitance and inductance, full range resistance (incorporating PT100 simulation), and oscilloscope calibration. These options can be specified at time of order or fitted at a later date by an authorised service agent.

In addition external adaptors are available for clamp meter calibration (up to 1000A), optical tachometer calibration and low noise attenuation.

Calibration Made Easy

Connect the 5025 to a PC/Laptop (via RS233, GPIB or USB) installed with Time Electronics EasyCal and automate the calibration process. Increase speed of calibration and consistency of results, produce calibration certificates and reports to ISO 9001 quality standards.

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5025 Technical Specifications

Voltage DC	Range: Best 1 Year Specification:	0 to \pm 1050V \pm 15ppm of setting
Current DC	Range: Best 1 Year Specification:	0 to \pm 22A. 1100A with Clamp Meter Adaptor \pm 80ppm of setting
Voltage AC	Range: Best 1 Year Specification:	1mV to 1050V (10Hz to 20kHz, Sine-wave) \pm 300ppm of setting
Current AC	Range: Best 1 Year Specification:	10uA to 22A (20Hz to 1kHz, Sine-wave) 100A AC with CT. 1100A with Clamp Meter Adaptor \pm 0.05% of setting
Resistance	Range: Best 1 Year Specification:	0 to 1G Ω (Fixed Values, decade steps) \pm 20ppm of setting
Conductance	Range: Best 1 Year Specification:	1 S to 1n S (Fixed Values, decade steps) \pm 20ppm of setting
Thermocouple Simulation	Range: Best 1 Year Specification:	-270 to 1800°C (Type J,K,R,T,S,B,E,N) \pm 0.3 °C
10MHz Digital Frequency/Period	Range: Best 1 Year Specification:	0.1Hz to 10MHz / 100nS to 10S \pm 20ppm of setting

Options

Hi Frequency AC V	Range/Max Freq: Best 1 Year Specification:	20 to 200mV/300kHz. 0.2 to 2V/1MHz. 2 to 20V/100kHz 0.05% + 0.1mV
Capacitance	Values: Best 1 Year Specification:	1nF, 10nF, 100nF, 1uF, 10uF & 100uF (100V Max) \pm 0.25%
Inductance	Values: Best 1 Year Specification:	1, 1.9, 5, 10, 19, 50, 100, 190, 500mH - 1H & 10H \pm 0.1%
Full Range Resistance	Range: Best 1 Year Specification:	1 Ω to 120M Ω (Variable) \pm 0.01% of setting
PT100	Range: Best 1 Year Specification:	-200 to 850°C \pm 0.1°C
Power Calibration	Range: Best 1 Year Specification:	22A, 1050V. Phase \pm 90° 100A AC with CT. 1100A with Clamp Meter Adaptor ACV: 0.03%, DCV: 0.01%. ACI: 0.1%, ACV: 0.03% Phase: 0.3°
Oscilloscope Frequency/Period	Range: Best 1 Year Specification:	0.1Hz to 100MHz / 100ns to 10s \pm 0.1ppm of setting
Oscilloscope Duty Cycle	Values:	3 frequencies, 100Hz, 1kHz, 10kHz. Settable from 0 to 100%
Oscilloscope Amplitude	Range: Best 1 Year Specification:	0mV to 200V & 0mV to 2V 50 Ω (Square-wave) \pm 0.05%
Oscilloscope Fast-Rise	Values:	< 300ps. Bandwidth Checking up to 600 MHz
2.2 GHz Sweep	Range: Best 1 Year Specification:	100MHz - 2.2GHz levelled sine-wave (0.5, 1, 1.5V pk-pk). Amplitude \pm 1%, Frequency \pm 20ppm.

General Specification

Warm up	1 Hour to full accuracy
Settling Time	Less than 5 seconds
Standard Interfaces	GPIB (IEEE-488), RS-232, USB
Operation Environment	Temperature: Operating: 15 - 25°C, Full Spec: 22°C +/- 3°C, Storage: -10°C to 50°C Humidity: Operating < 80% non condensing. Altitude 0 - 3km. Non Operating 3Km - 12km
Line Power	100 - 230V AC 50/60 Hz. Power Consumption 200W max
Dimensions	W 430mm, D 480mm, H 155mm, (17x18x6") 16.5Kg (36.4lbs)

Ordering Information

Code	Description	Code	Description
9798	Capacitance and Inductance	9771	High Frequency AC Voltage
9774	Simulated Resistance (10 Ω - 40 M Ω)	9747	EasyCal Software
9787	Full Range Resistance (1 Ω - 120 M Ω)	9743	PCI GPIB Interface Card
9770	Oscilloscope Calibration	9794	USB to GPIB Interface
9761	2 GHz Sweep	9765	USB Interface
9790	100A AC Current Option	9597	GPIB Interface Cable
9780	Clamp Meter Adaptor 1 and 50 Turns	9728	19" Rack Mount Kit
9773	Optical Tachometer Calibration Adaptor	9796	Test Lead Set
9767	External Low Noise Attenuator 100:1	9159	Factory (NPL Traceable) Calibration Certificate
9766	External Low Noise Attenuator 1000:1	9103	UKAS Calibration Certificate (ISO 17025)
9797	Power Calibration (0-20KW AC and DC)	9113	Extended Certificate (UKAS - ISO 17025)
5065	6.5 Digit Bench Multimeter (external)	9085	Carry Case

Full specifications are available on request. Due to continuous development Time Electronics reserves the right to change specifications without prior notice.

SPECIFICATIONS DETAILS

1. Accuracies are shown as ppm or % of output + floor.
2. Specifications apply for settings between 10% and 100% of range.
3. Specifications apply at ambient temp of 22°C +/- 3°C
4. For temperatures outside the above range apply 0.2 x specification per °C
5. Calibrator warm up time at least 1 hour.
6. All values are relative to calibration standards.
7. Accuracies quoted are for 1 year.

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

DC VOLTAGE				
Range	Accuracy ppm	Output Resistance	Max Output Current	Resolution
20mV ¹	100 + 4uV	10 Ω ³	-	100nV
200mV ¹	30 + 6uV	10 Ω ³	-	1uV
2V ¹	15 + 20uV	< 0.1 Ω	20mA	1uV
20V ¹	15 + 150uV	< 0.1 Ω	20mA	10uV
200V ¹	30 + 6mV	< 5 Ω	20mA	1mV
1050V	50 + 30mV	< 10 Ω	10mA	1mV

AC VOLTAGE (sine-wave). (* 9771 AC Hi Frequency Option Required)					
Range RMS	Frequency ²	Accuracy %	Output Resistance	Max Output Current	Resolution
20mV ¹	10Hz-45Hz	0.05 + 250uV	10 Ω ³		1uV
	45Hz-1kHz	0.05 + 100uV	10 Ω ³		
	1kHz-10kHz	0.05 + 150uV	10 Ω ³		
	10kHz-20kHz	0.05 + 250uV	10 Ω ³		
	* 20kHz-100kHz	0.05% + 0.1mV	50 Ω		
* 100kHz-300kHz	0.1% + 0.5mV	50 Ω			
200mV ¹	10Hz-45Hz	0.05 + 250uV	10 Ω ³		1uV
	45Hz-1kHz	0.04 + 100uV	10 Ω ³		
	1kHz-10kHz	0.04 + 150uV	10 Ω ³		
	10kHz-20kHz	0.05 + 250uV	10 Ω ³		
	* 20kHz-100kHz	0.1% + 0.5mV	50 Ω		
* 100kHz-300kHz	0.1% + 1mV	50 Ω			
2V ¹	10Hz-45Hz	0.08 + 500uV	< 0.1 Ω	20mA	10uV
	45Hz-1kHz	0.03 + 170uV	< 0.1 Ω		
	1kHz-10kHz	0.03 + 250uV	< 0.1 Ω		
	10kHz-20kHz	0.08 + 500uV	< 0.1 Ω		
	* 20kHz-100kHz	0.05% + 1mV	< 0.5 Ω		
* 100kHz-300kHz	0.1% + 5mV	< 0.5 Ω			
* 300kHz-1MHz	1% + 10mV	< 0.5 Ω			
20V ¹	10Hz-45Hz	0.08 + 4mV	< 5 Ω	20mA	100uV
	45Hz-1kHz	0.03 + 2mV	< 5 Ω		
	1kHz-10kHz	0.03 + 3mV	< 5 Ω		
	10kHz-20kHz	0.08 + 4mV	< 5 Ω		
	* 20kHz-100kHz	0.15% + 15mV			
200V ¹	40Hz-1kHz	0.06 + 20mV	< 5Ω	20mA	1mV
1050V	40Hz-1kHz	0.08 + 90mV	< 10 Ω	10mA	10mV

1. Over-Range 10%

2. The frequency accuracy for standard AC ranges is 0.01% and is crystal controlled. The setting resolution is 1Hz.

3. The output resistance on the 20mV and 200mV ranges is 10 ohms. This must be taken into account when loads of 100K ohms or less are being driven. A 100K load will result in a 0.01% error.

All AC outputs exclude the DC component.

It is recommended that for very high accuracy low level AC calibration a precision attenuator with known characteristics is used. This can be driven from the 5025's 2V or 20V ranges and with proper screening of the attenuator the signal to noise ratio of the resulting output can be improved significantly. A 1000:1 screened precision attenuator is available from Time Electronics.

DC CURRENT			
Range	Accuracy ppm	Compliance Voltage	Resolution
200uA ¹	150 + 15nA	11V	1 nA
2mA ¹	100 + 40nA	11V	10 nA
20mA ¹	80 + 200nA	11V	10 nA
200mA ¹	80 + 3uA	11V	100 nA
2A ¹	250 + 40uA	5V	1 uA
20A ¹	600 + 2mA	4V	10 uA

1. Over-Range 10%.

AC CURRENT (sine-wave)				
Range	Frequency	Accuracy %	Compliance Voltage rms	Resolution
200uA ¹	20Hz – 1kHz	0.07 + 300nA	8V	10nA
2mA ¹	20Hz – 1kHz	0.05 + 300nA	8V	10nA
20mA ¹	20Hz – 1kHz	0.05 + 3uA	8V	100nA
200mA ¹	20Hz – 1kHz	0.05 + 30uA	8V	1uA
2A ¹	20Hz – 500Hz	0.1 + 0.5mA	3.5V	10uA
20A ¹	20Hz – 500Hz	0.2 + 5mA	3V	100uA

1. Over-Range 10%.

THERMOCOUPLE SIMULATION		
Thermocouple Type	Temperature Range °C	Accuracy °C
J	-210 to -50	0.3
	-50 to 1200	0.18
K	-200 to -150	0.3
	-150 to 1250	0.2
T	-200 to -150	0.4
	-150 to 0	0.3
	0 to 400	0.2
R	-50 to 50	1.5
	50 to 250	0.8
	250 to 1750	0.6
S	-50 to 300	1.5
	300 to 1750	0.8
B	100 to 800	1.8
	800 to 1800	0.8
N	-200 to -100	0.8
	-100 to 500	0.3
	500 to 1300	0.2
E	-200 to -100	0.5
	-100 to 0	0.2
	0 to 1000	0.15

Cold Junction Compensation +/- 0.5°C (applies to ambient changes of +/- 1°C)

The accuracy of the thermocouple simulation is determined by the accuracy of the 5025's DC Voltage function and the accuracy of the standard thermocouple tables (BS EN 60584-1) published by the British Standards Institute.

The 5025 uses precise digital interpretation of the tables to output voltage levels that are within the accuracies specified in the table above.

DECADE RESISTANCE ¹		
Value	Accuracy	Max Rating
1 Ω	800 ppm	0.1W
10 Ω	70 ppm	0.1W
100 Ω	30 ppm	0.1W
1K Ω	20 ppm	0.1W
10K Ω	20 ppm	0.1W
100k Ω	30 ppm	0.1W
1M Ω	150 ppm	200V
10M Ω	0.1%	200V
100M Ω	1%	200V
1G Ω	10%	200V

1. Resistance specifications are +/- 5m Ω .

CONDUCTANCE		
Value	Accuracy	Max Rating
1 S	800 ppm	0.1W
100m S	70 ppm	0.1W
10m S	30 ppm	0.1W
1m S	20 ppm	0.1W
100u S	20 ppm	0.1W
10u S	30 ppm	0.1W
1u S	150 ppm	200V
100n S	0.1%	200V
10n S	1%	200V
1n S	10%	200V

1. Conductance specifications are +/- 5m Ω

10MHz DIGITAL FREQUENCY
Variable Values 0.1Hz to 10MHz, ~2V pk-pk square wave. Accuracy 20ppm

PERIOD
Fixed Values (1, 2, 5 steps) 100nS to 10S, ~2V pk-pk square wave. Accuracy 20ppm

OPTIONS

CAPACITANCE ¹			
Value	Frequency	Accuracy %	Max volts
1 nF	1kHz	0.5 +/-10pf	100V
10 nF	1kHz	0.5 +/-10pf	
100 nF	1kHz	0.5	
1 uF	1kHz	0.25	
10 uF	1kHz	0.5	
100 uF	100Hz	0.5	

1. After Subtraction of residual capacitance.

INDUCTANCE ^{1 2}			
Value	Frequency	Accuracy	Max current
1 mH	1kHz	1% of nominal	10mA
1.9 mH	1kHz		
5 mH	1kHz		
10 mH	1kHz	OR	
19 mH	1kHz		
50 mH	1kHz	0.1% of previous calibration value	
100 mH	1kHz		
190 mH	1kHz		
500 mH	1kHz		
1H	1kHz		
10H	100Hz		

1. After Subtraction of residual inductance.

2. Specification based on 4 wire sinewave measurement technique.

OSCILLOSCOPE 100MHz	
FREQUENCY 0.1Hz to 10MHz accuracy 0.1ppm* 20, 50, 100MHz accuracy 20ppm	PERIOD 100nS to 10S accuracy 0.1ppm* 50, 20, & 10nS accuracy 20ppm
* Fitted with Oven-Controlled Frequency Reference. Otherwise - 20ppm. 1.5V pk-pk - 0.1Hz to 100kHz. 1V pk-pk - 100kHz to 100MHz (sine-wave at 100MHz) Fixed outputs in 1, 2, 5 steps. Deviation function is not available.	
DUTY CYCLE 3 frequencies, 100Hz, 1kHz, 10kHz. Duty cycle settable from 0 to 100% Setting resolution 0.01% at 100Hz, 0.1% at 1 kHz, 1% at 10 kHz Deviation function is not available.	
OSCILLOSCOPE AMPLITUDE 1kHz square-wave	
Range	Accuracy
200mV	0.2%
200mV 50Ω	0.25%
2V 50Ω	0.25%
20V	0.05%
200V	0.05%
OSCILLOSCOPE FAST RISE	< 300ps. Bandwidth Checking up to 600 MHz

2.2GHz-LEVELLED SWEEP ¹ 0.5V, 1V, 1.5V pk-pk Sine-Wave, 50Ω Output.	
Range	Amplitude Accuracy
100 MHz to 200 MHz	1%
200 MHz to 500 MHz	4%
500 MHz to 1 GHz	10%
2.2 GHz to 2.2 GHz	20%

1. Max frequency at 1.5V is 2GHz

OPTIONS (continued)

FULL RANGE RESISTANCE			
Range	Accuracy ¹	Resolution	Max Rating
1Ω – 20Ω	0.01% +/- 7mΩ	1Ω	0.1W
20Ω – 99.999Ω	0.01% +/- 7mΩ	1mΩ /5mΩ*	0.1W
100Ω – 999.999Ω	0.01% +/- 5mΩ	1mΩ	0.1W
1kΩ – 9.999kΩ	0.02% +/- 20mΩ	1Ω	0.1W
10kΩ – 99.999kΩ	0.01% +/- 1Ω	1Ω	0.1W
100kΩ – 999.99kΩ	0.01% +/- 10Ω	10Ω	0.1W
1MΩ – 9.9999MΩ	0.02% +/- 100Ω	100Ω	0.1W
10MΩ – 120MΩ	0.1% +/- 1kΩ	1kΩ	0.1W

1. After subtraction of lead resistance. End resistance variation +/- 2.5mΩ

* Output resolution is 5mΩ below 50Ω

PRT SIMULATION (Uses Full Range Resistance option)			
Pt100 DIN	Alpha Coeff 0.003850	Range -180 to 850°C	Accuracy 0.1°C

It should be noted that the accuracy of the PRT simulation is determined by the accuracy of the PRT tables (BS EN 60751) published by the British Standards Institute. The 5025 uses precise digital interpretation of the tables to output resistance values that are within the accuracies specified in the table above.

SIMULATED RESISTANCE	
RANGE	ACCURACY
2 Wire¹	
40 ohms (min 10 ohms)	0.15% of setting +/- 20 milliohms
400 ohms	0.05% of setting +/- 0.05% of range
4K ohms	0.02% of setting +/- 0.05% of range
40K ohms	0.02% of setting +/- 0.05% of range
400K ohms	0.02% of setting +/- 0.05% of range
4M ohms	0.05% of setting +/- 0.05% of range
40M ohms	0.2% of setting +/- 0.05% of range

1. After subtraction of lead resistance.

Maximum measure current allowed in simulated resistance mode is 20mA. Simulated resistance mode is suitable for DC only, i.e. only DC current may be passed through the active resistance.

Simulated resistance limitations

It should be noted that the 5025's simulated resistance circuitry has a 2V voltage compliance. This means that the simulation is only valid if the measure current multiplied by required resistance is less than 2V. For example, if the measure current is 1mA, the maximum simulated resistance will be 2K ohms. The user should be aware of the measure currents being used by the instrument being calibrated in order to prevent incorrect simulated resistance being output by the 5025.

It should also be noted that some DMMs use measuring currents which are outside the 5025 simulated resistance limits. If in doubt over the validity of the 5025's output it is recommended that the voltage across the output terminals is checked – it should be less than 2V for correct operation.

PRT SIMULATION (Uses Simulated Resistance option)			
Pt100 DIN	Alpha Coeff 0.003850	Range -180 to 850°C	Accuracy 0.1°C

It should be noted that the accuracy of the PRT simulation is determined by the accuracy of the 5025's simulated (active) resistance function and the accuracy of the PRT tables (BS EN 60751) published by the British Standards Institute. The 5025 uses precise digital interpretation of the tables to output resistance values that are within the accuracies specified in the table above.

POWER CALIBRATION							
DC Current	Accuracy	Compliance	Resolution	AC Current 45-400Hz	Accuracy	Compliance	Resolution
0.2 – 2.2A	0.03 + 500uA	5V	100uA	0.2 – 2.2A	0.1% + 2mA	3.5V	100uA
2.2 - 22A	0.05 + 6mA	4V	1mA	2.2 - 22A	0.1% + 20mA	3V	1mA
DC Voltage	Accuracy	Output Current	Resolution	AC Voltage 45-400Hz	Accuracy	Output Current	Resolution
1- 22V	0.01 + 500uV	20mA	100uV	1 - 22V	0.03% + 2mV	20mA	100uV
22 – 220V	0.02 + 30mV	20mA	1mV	22 – 220V	0.06% + 30mV	20mA	1mV
220 – 1050V	0.05 + 50mV	10mA	10mV	220 – 1050V	0.08% + 90mV	10mA	10mV
Phase	Accuracy	Range	Resolution	Power Factor		Range	Resolution
45 to 99Hz	0.3 deg	+/-90deg	0.1 deg	45 to 99Hz		0.00 – 1.00	0.001
100Hz to 400Hz	1.0 deg	+/-90deg	0.1 deg	100Hz to 400Hz		0.00 – 1.00	0.001

The accuracy of the power is complex and is determined by using a formula, which combines the errors due to Voltage, Current, and Phase.

Power Acc (%) = $\text{SqrRt}(\text{Vacc}^2 + \text{Iacc}^2 + \text{Phase Correction}^2)$

Where Phase Correction (%) = $100 \times (1 - \text{Cos}(\text{Phase} + \text{PhaseAcc}) / \text{Cos Phase})$.

The current and voltage terminals must be isolated. A current transformer or clamp meter adaptor must be used if instrument under test has a common negative.

OPTIONS (continued)

High Accuracy DC Hi Voltage (DCHV+)				
Range	Accuracy 1 year	Output Resistance	Max Output Current	Resolution
220V*	15ppm + 1mV	<0.25Ω	10mA	100uV
1kV*	25ppm + 3mV	<1Ω	1mA	1mV

*Minimum Load 20kΩ

GENERAL

POWER SUPPLY	
Mains Voltage	100 - 230V AC 50/60 Hz.
Fuse Ratings	3.15A anti-surge
Connector	IEC Plug
Power Consumption	120W typical, 200W Max.
MAXIMUM ALLOWABLE VOLTAGE BETWEEN TERMINALS	
Between V+ and V- terminals	< 1500V Peak
Between V- and Earth	< 75V Peak
Between Main, Aux and Earth	< 75V
ENVIRONMENTAL	
Operating Temperature	15 - 35 °C, Full Spec: 22 °C +/- 3°C.
Storage Temperature	-10 °C to 50 °C
Humidity	Operating < 80%
Altitude	0 - 3km. Non Operating 3Km - 12km
Warm Up Time	1 hour to full accuracy
MECHANICAL	
Dimensions	Width 447mm, Height 152, Depth 470mm
Weight	16.5kg 19" Rack Mounting Kit Available
REMOTE OPERATION	
Interfaces	GPIB, RS232 and optional USB
Command Set	Standard SCPI