

# 5025E

## Extended Specifications

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# 5025E Specifications

1. Specifications are stated as  $\pm$  ppm or % of output + floor, unless otherwise indicated.
2. Specifications apply at  $23^{\circ}\text{C} \pm 5^{\circ}\text{C}$
3. For temperatures outside this range add  $0.2 \times$  specification per  $^{\circ}\text{C}$ .
4. Specifications include stability, linearity, and traceability of external standards used for calibration.
5. For operation outside specified range add  $0.25 \times$  specification.

## DC Voltage

Range	Resolution	Output Resistance	Max Burden	Specification 1 Year
0 to 200mV	1 $\mu$ V	10 $\Omega$		40ppm + 4 $\mu$ V
0.2 to 2.0V	1 $\mu$ V	0.1 $\Omega$	20mA	40ppm + 25 $\mu$ V
2 to 20V	10 $\mu$ V	0.1 $\Omega$	20mA	40ppm + 250 $\mu$ V
20 to 200V	1mV	<5 $\Omega$	20mA	40ppm + 3mV
200 to 1050V	10mV	<10 $\Omega$	10mA	60ppm + 30mV

Specifications are between 0.1Hz and 10Hz bandwidth. Maximum capacitance 1000pF.

The output resistance of the 200mV range is 10 $\Omega$ . This must be taken into account when loads of 100k $\Omega$  or less are being driven.

A 100k $\Omega$  load will result in a 0.01% error.

## DC Current

Range	Resolution	Compliance Voltage	Max Inductance	Specification 1 Year
0 to 200 $\mu$ A	1nA	10V	50 $\mu$ H	150ppm + 25nA
0.2 to 2mA	10nA	10V	50 $\mu$ H	120ppm + 55nA
2 to 20mA	10nA	10V	50 $\mu$ H	120ppm + 200nA
20 to 200mA	100nA	10V	30 $\mu$ H	120ppm + 8 $\mu$ A
0.2 to 2A	1 $\mu$ A	5V	5 $\mu$ H	400ppm + 80 $\mu$ A
2 to 22A	10 $\mu$ A	4V	2 $\mu$ H	600ppm + 2mA

## AC Voltage

Range	Frequency	Resolution	Output Resistance	Max Burden	Specification 1 Year
1 to 200mV	20 to 45Hz	1 $\mu$ V	10 $\Omega$		0.07% + 250 $\mu$ V
	45Hz to 1kHz		10 $\Omega$		0.05% + 100 $\mu$ V
0.2 to 2V	1 to 20kHz	10 $\mu$ V	10 $\Omega$	20mA	0.10% + 150 $\mu$ V
	20 to 45Hz		<0.1 $\Omega$		0.07% + 250 $\mu$ V
	45Hz to 1kHz		<0.1 $\Omega$		0.04% + 200 $\mu$ V
2 to 20V	1 to 20kHz	100 $\mu$ V	<0.1 $\Omega$	20mA	0.06% + 250 $\mu$ V
	20 to 45Hz		<5 $\Omega$		0.08% + 4mV
	45Hz to 1kHz		<5 $\Omega$		0.06% + 2mV
20 to 200V	1 to 20kHz	1mV	<5 $\Omega$	20mA	0.07% + 3mV
	40Hz to 1kHz		<5 $\Omega$		0.06% + 25mV
200 to 1050V	40Hz to 1kHz	10mV	<10 $\Omega$	10mA	0.09% + 100mV

Frequency accuracy 0.01%. Frequency resolution 1Hz.

The output resistance of the 200mV range is 10 $\Omega$ . This must be taken into account when loads of 100k $\Omega$  or less are being driven.

A 100k $\Omega$  load will result in a 0.01% error. All AC outputs exclude the DC component.

## AC Current

Range	Frequency	Resolution	Compliance Voltage	Specification 1 Year
20 to 200 $\mu$ A	20Hz to 1kHz	10nA	8V RMS	0.07% + 300nA
0.2 to 2mA	20Hz to 1kHz	10nA	8V	0.07% + 300nA
2 to 20mA	20Hz to 1kHz	100nA	8V	0.07% + 3 $\mu$ A
20 to 200mA	20Hz to 1kHz	1 $\mu$ A	8V	0.08% + 30 $\mu$ A
0.2 to 2A	20Hz to 500Hz	10 $\mu$ A	3.5V	0.10% + 0.5mA
2 to 22A	20Hz to 500Hz	100 $\mu$ A	3V	0.20% + 6mA

## Decade Resistance

Value	Max Rating	Specification 1 Year
10 $\Omega$	0.1W	500ppm
100 $\Omega$	0.1W	90ppm
1k $\Omega$	0.1W	60ppm
10k $\Omega$	0.1W	60ppm
100k $\Omega$	0.1W	60ppm
1M $\Omega$	200V	150ppm
10M $\Omega$	200V	0.1%
100M $\Omega$	200V	1%
1G $\Omega$	200V	10%

After subtraction of lead resistance. All resistance specifications are  $\pm 5\text{m}\Omega$

## Decade Conductance

Value	Max Rating	Specification 1 Year
100m S	0.1W	500ppm
10m S	0.1W	90ppm
1m S	0.1W	60ppm
100 $\mu$ S	0.1W	60ppm
10 $\mu$ S	0.1W	60ppm
1 $\mu$ S	200V	150ppm
100n S	200V	0.1%
10n S	200V	1%
1n S	200V	10%

## Capacitance

Value	Resolution	Frequency	Max Rating	Specification 1 Year
1nF	0.1pF	1kHz	25V	0.2%
10nF	1pF	1kHz	25V	0.2%
20nF	1pF	1kHz	25V	0.2%
50nF	1pF	1kHz	25V	0.2%
100nF	10pF	1kHz	25V	0.2%
200nF	10pF	1kHz	25V	0.2%
500nF	10pF	1kHz	25V	0.2%
1uF	100pF	1kHz	25V	0.2%

All values are  $\pm 10\text{pF}$ . Specifications apply to the displayed value, after subtraction of residual capacitance. Specification based on 4 wire sine-wave measurement technique.

## Thermocouples

Type	Range °C	Specification 1 Year	Type	Range °C	Specification 1 Year
J	-210 to -50 -50 to 1200	$\pm 0.15^\circ\text{C}$ $\pm 0.2^\circ\text{C}$	B	300 to 800 800 to 1820	$\pm 1.5^\circ\text{C}$ $\pm 0.8^\circ\text{C}$
K	-200 to -100 -100 to 1372	$\pm 0.25^\circ\text{C}$ $\pm 0.18^\circ\text{C}$	N	-200 to 0 0 to 600 600 to 1300	$\pm 0.4^\circ\text{C}$ $\pm 0.15^\circ\text{C}$ $\pm 0.2^\circ\text{C}$
T	-200 to 100 100 to 400	$\pm 0.2^\circ\text{C}$ $\pm 0.15^\circ\text{C}$	E	-200 to 0 0 to 1000	$\pm 0.20^\circ\text{C}$ $\pm 0.12^\circ\text{C}$
R	-50 to 50 50 to 250 250 to 1768	$\pm 1.0^\circ\text{C}$ $\pm 0.7^\circ\text{C}$ $\pm 0.6^\circ\text{C}$	S	-50 to 500 500 to 1768	$\pm 0.9^\circ\text{C}$ $\pm 0.6^\circ\text{C}$

Resolution  $0.1^\circ\text{C}$ . Switchable automatic internal cold junction reference, accuracy  $\pm 0.5^\circ\text{C}$  (applies to ambient changes of  $\pm 1^\circ\text{C}$ )  
°F and °K units also selectable. ITS-90.

## Simulated Resistance

Range	Resolution*	Specification 1 Year
40 $\Omega$ to 400 $\Omega$	0.01 $\Omega$	0.05% + 50m $\Omega$
400 $\Omega$ to 4000 $\Omega$	0.01 $\Omega$	0.02% + 1 $\Omega$
4k $\Omega$ to 40k $\Omega$	0.01 $\Omega$ / 1 $\Omega$	0.02% + 5 $\Omega$

Maximum input current allowed is 20mA. Maximum output voltage is 2V. Suitable for DC currents only.  
\*Simulated Resistance is selectable from 40.00 $\Omega$  to 9999.99 $\Omega$  or 0.040k $\Omega$  to 40.000k $\Omega$

## PT100

Range	Resolution	Specification 1 Year
-140 to 50°C	0.01°C	$\pm 0.25^\circ\text{C}$
50 to 850°C	0.01°C	0.08% + 0.25°C
Alpha = 0.00385, ITS-90		

## Digital Frequency

Range	Resolution	Specification 1 Year
0.1Hz to 1kHz	0.01Hz	20ppm
1kHz to 1MHz	1Hz	20ppm
1MHz to 10MHz	10Hz	20ppm

Square wave output. Amplitude ~2V peak to peak.

## Period

Range	Resolution	Specification 1 Year
100ns to 10s	Fixed Values 1,2,5 Steps	20ppm

# Enhanced Performance Pack (Option 9702)

## Extended Capacitance

Value	Resolution	Frequency	Max Voltage	Specification
				1 Year
1nF	0.1pF	1kHz	25V	0.2%
10nF	1pF	1kHz	25V	0.2%
20nF	1pF	1kHz	25V	0.2%
50nF	1pF	1kHz	25V	0.2%
100nF	10pF	1kHz	25V	0.2%
200nF	10pF	1kHz	25V	0.2%
500nF	10pF	1kHz	25V	0.2%
1uF	100pF	1kHz	25V	0.2%
10uF	1nF	1kHz	25V	0.5%
20uF	1nF	1kHz	25V	0.5%
50uF	1nF	1kHz	25V	0.5%
100uF	10nF	100Hz	25V	0.5%

All values are  $\pm 10\text{pF}$ . Specifications apply to the displayed value, after subtraction of residual capacitance. Specification based on 4 wire sine wave measurement technique.

## Extended AC Voltage Frequency

Range	Frequency	Resolution	Output Resistance	Specification
				1 Year
1 to 200mV	20 to 100kHz	1uV	50 $\Omega$	0.05% + 1000 $\mu\text{V}$
0.2 to 2V	20 to 100kHz	10uV	<0.5 $\Omega$	0.09% + 900 $\mu\text{V}$
2 to 20V	20 to 100kHz	100uV	<0.5 $\Omega$	0.15% + 15mV

## Full Range Resistance

### Resistance

Range	Resolution	Max Rating	Specification
			1 Year
1 $\Omega$ – 20 $\Omega$	1 $\Omega$	0.1W	100ppm + 7m $\Omega$
20 $\Omega$ – 99.999 $\Omega$	1m $\Omega$ /5m $\Omega$ *	0.1W	100ppm + 7m $\Omega$
100 $\Omega$ – 999.999 $\Omega$	1m $\Omega$	0.1W	100ppm + 5m $\Omega$
1k $\Omega$ – 9.999k $\Omega$	1 $\Omega$	0.1W	200ppm + 20m $\Omega$
10k $\Omega$ – 99.999k $\Omega$	1 $\Omega$	0.1W	100ppm + 1 $\Omega$
100k $\Omega$ – 999.99k $\Omega$	10 $\Omega$	0.1W	100ppm + 10 $\Omega$
1M $\Omega$ – 9.9999M $\Omega$	100 $\Omega$	0.1W	200ppm + 100 $\Omega$
10M $\Omega$ – 120M $\Omega$	1k $\Omega$	0.1W	0.1% + 1k $\Omega$

### RTD

Range	Resolution	Specification
		1 Year
<b>Pt100</b>		
-180 to 200 $^{\circ}\text{C}$	0.01 $^{\circ}\text{C}$	$\pm 0.07^{\circ}\text{C}$
200 to 850 $^{\circ}\text{C}$	0.01 $^{\circ}\text{C}$	$\pm 0.15^{\circ}\text{C}$
<b>Pt200</b>		
-180 to 0 $^{\circ}\text{C}$	0.01 $^{\circ}\text{C}$	$\pm 0.03^{\circ}\text{C}$
0 to 850 $^{\circ}\text{C}$	0.01 $^{\circ}\text{C}$	0.02% + 0.03 $^{\circ}\text{C}$
<b>Pt500</b>		
-180 to 200 $^{\circ}\text{C}$	0.01 $^{\circ}\text{C}$	0.02% + 0.03 $^{\circ}\text{C}$
200 to 850 $^{\circ}\text{C}$	0.01 $^{\circ}\text{C}$	0.1% + 0.3 $^{\circ}\text{C}$
<b>Pt1000</b>		
-180 to 0 $^{\circ}\text{C}$	0.01 $^{\circ}\text{C}$	$\pm 0.03^{\circ}\text{C}$
0 to 850 $^{\circ}\text{C}$	0.01 $^{\circ}\text{C}$	0.1% + 0.3 $^{\circ}\text{C}$

After subtraction of lead resistance. Add  $\pm 2.5\text{m}\Omega$  for end resistance variation. \* Output resolution is 5m $\Omega$  below 50 $\Omega$ . The Full Range Resistance option uses real resistors. There is no limitation on excitation currents, and replaces the Simulated Resistance function. RTD Function: Alpha = 0.00385. (ITS-90). IEC 60751.

## Extended Thermocouples

Type	Range $^{\circ}\text{C}$	Specification
		1 Year
U	-200 to -100	$\pm 0.15^{\circ}\text{C}$
	380 to 600	$\pm 0.1^{\circ}\text{C}$
L	-200 to 900	$\pm 0.1^{\circ}\text{C}$

Type	Range $^{\circ}\text{C}$	Specification
		1 Year
C	0 to 1100	$\pm 0.2^{\circ}\text{C}$
	1100 to 1900	$\pm 0.35^{\circ}\text{C}$
	1900 to 2315	$\pm 0.5^{\circ}\text{C}$

Resolution 0.1 $^{\circ}\text{C}$ . Switchable automatic internal cold junction reference. Accuracy  $\pm 0.5^{\circ}\text{C}$  (applies to ambient changes of  $\pm 1^{\circ}\text{C}$ ).  $^{\circ}\text{F}$  and  $^{\circ}\text{K}$  units also selectable. Type U & L based on tables published in DIN 43710 (ITPS68). Type C based on tables published in ASTM E230/E230M – 12 (ITS-90)

# Oscilloscope Calibration (Option 9770)

## Amplitude

Range	Resolution	Specification
		1 Year
2 to 200mV	10µV	0.20% + 10µV
0.2 to 20V	1mV	0.05% + 25µV
1 to 200V	10mV	0.05% + 100µV
1mV to 200mV (50Ω)	100µV	0.25% + 20µV
0.2 to 2V (50Ω)	1mV	0.25% + 20µV

1kHz Square wave

## Frequency

Range	Resolution	Specification
		1 Year
0.1Hz to 10MHz	Fixed values	0.1ppm*
20, 50, 100MHz	1,2,5 sequence	20ppm

Deviation function is not available.

\* Fitted with Oven-Controlled Frequency Reference (option 9783). Otherwise - 20ppm.

1.5V pk-pk - 0.1Hz to 100kHz. 1V pk-pk - 100kHz to 100MHz (sine wave at 100MHz)

## Period

Range	Resolution	Specification
		1 Year
100ns to 10s	Fixed values	0.1ppm*
50, 20, 10ns	1,2,5 sequence	20ppm

## 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.

## Fast Rise

Into 50Ω Load	Specification 1 Year
400ps	±150ps

# Oscilloscope 2.2 GHz Levelled Sine (Option 9769)

Range	Resolution	Amplitude	Specification
			1 Year
50 MHz to 200 MHz	0.1MHz	0.5V, 1V, 1.5V	1%
200 MHz to 500 MHz	0.1MHz		2%
500 MHz to 1 GHz	0.1MHz		4%
1 GHz to 2.2 GHz	0.1MHz		6%

Sine-Wave, 50 Ω Output. From 50 to 499.9 MHz an additional error of 0.5% of range applies. Frequency Accuracy 50ppm. Specifications are relative to calibration standards.

# Power (Option 9797)

DC Current	Specification 1 Year	Compliance	Resolution	AC Current (45 to 400Hz)	Specification 1 Year	Compliance	Resolution
0.02 to 2A	0.03% + 500µA	5V	100µA	0.1 to 2A	0.1% + 2mA	3.5V	100µA
2 to 22A	0.05% + 6mA	4V	1mA	2 to 22A	0.1% + 20mA	3V	1mA
DC Voltage	Specification 1 Year	Output Current	Resolution	AC Voltage (45 to 400Hz)	Specification 1 Year	Output Current	Resolution
0.1 to 20V	0.01% + 500µV	20mA	100µV	0.1 to 20V	0.03% + 2mV	20mA	100µV
20 to 200V	0.02% + 30mV	20mA	1mV	20 to 200V	0.06% + 30mV	20mA	1mV
200 to 1050V	0.05% + 50mV	10mA	10mV	200 to 1050V	0.08% + 90mV	10mA	10mV
Phase	Specification 1 Year	Range	Resolution	Power Factor	Range	Resolution	
45 to 99Hz	0.3 °	±90 °	0.1 °	45 to 99Hz	0.00 to 1.00	0.001	
100Hz to 400Hz	1.0 °	±90 °	0.1 °	100Hz to 400Hz	0.00 to 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 Specification (%) =  $\sqrt{(V_{spec}^2 + I_{spec}^2 + \text{Phase Correction}^2)}$ . Where Phase Correction (%) =  $100 \times (1 - \text{Cos}(\text{Phase} + \text{Phase}_{spec}) / \text{Cos}(\text{Phase}))$ .

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.

Settling time < 15 seconds.

# General Specifications

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

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