

**7051**

# **Extended Specification**

**V1.6**

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## 7051 SPECIFICATIONS

1. Total 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.

### CALIBRATOR SECTION

<b>DC VOLTAGE</b>				
Range	Accuracy ppm	Output Resistance	Max Output Current	Resolution
20mV <sup>1</sup>	100 + 4uV	10 Ω	-	100nV
200mV <sup>1</sup>	30 + 6uV	10 Ω	-	1uV
2V <sup>1</sup>	15 + 20uV	< 0.1 Ω	20mA	1uV
20V <sup>1</sup>	15 + 150uV	< 0.1 Ω	20mA	10uV
<b><i>With 9782 High Voltage/Current option fitted</i></b>				
200V <sup>1</sup>	30 + 6mV	< 5 Ω	20mA	100uV
1050V	50 + 30mV	< 10 Ω	10mA	1mV

1. Over-Range 10%.

<b>AC VOLTAGE 10Hz - 20kHz (sine-wave)</b>					
Range RMS	Frequency <sup>2</sup>	Accuracy %	Output Resistance	Max Output Current	Resolution
20mV <sup>1</sup>	10Hz-45Hz	0.05 + 250uV	10 Ω <sup>3</sup>	-	1uV
	45Hz-1kHz	0.05 + 100uV	10 Ω <sup>3</sup>		1uV
	1kHz-10kHz	0.05 + 150uV	10 Ω <sup>3</sup>		1uV
	10kHz-20kHz	0.05 + 250uV	10 Ω <sup>3</sup>		1uV
200mV <sup>1</sup>	10Hz-45Hz	0.05 + 250uV	10 Ω	-	1uV
	45Hz-1kHz	0.04 + 100uV	10 Ω		1uV
	1kHz-10kHz	0.04 + 150uV	10 Ω		1uV
	10kHz-20kHz	0.05 + 250uV	10 Ω		1uV
2V <sup>1</sup>	10Hz-45Hz	0.08 + 500uV	< 0.1 Ω	20mA	10uV
	45Hz-1kHz	0.03 + 170uV	< 0.1 Ω		10uV
	1kHz-10kHz	0.03 + 250uV	< 0.1 Ω		10uV
	10kHz-20kHz	0.08 + 500uV	< 0.1 Ω		10uV
20V <sup>1</sup>	10Hz-45Hz	0.08 + 4mV	< 5 Ω	20mA	100uV
	45Hz-1kHz	0.03 + 2mV	< 5 Ω		100uV
	1kHz-10kHz	0.03 + 3mV	< 5 Ω		100uV
	10kHz-20kHz	0.08 + 4mV	< 5 Ω		100uV
<b><i>With 9782 High Voltage/Current option fitted</i></b>					
200V <sup>1</sup>	40Hz-1kHz	0.06 + 20mV	< 5Ω	20mA	1mV
1050V	40Hz-1kHz	0.08 + 90mV	< 10Ω	10mA	10mV

1. Over-Range 10%

2. The frequency accuracy for 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 7051'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.

<b>DC CURRENT</b>			
<b>Range</b>	<b>Accuracy ppm</b>	<b>Compliance Voltage</b>	<b>Resolution</b>
200uA <sup>1</sup>	150 + 15nA	11V	1 nA
2mA <sup>1</sup>	100 + 40nA	11V	10 nA
20mA <sup>1</sup>	80 + 200nA	11V	10 nA
200mA <sup>1</sup>	80 + 3uA	11V	100 nA
<b>With 9782 High Voltage/Current option fitted</b>			
2A <sup>1</sup>	250 + 40uA	5V	1 uA
20A <sup>1</sup>	600 + 2mA	4V	10 uA

1. Over-Range 10%.

<b>AC CURRENT (sine-wave)</b>				
<b>Range</b>	<b>Frequency</b>	<b>Accuracy %</b>	<b>Compliance Voltage rms</b>	<b>Resolution</b>
200uA <sup>1</sup>	20Hz – 1kHz	0.07 + 300nA	8V	10nA
2mA <sup>1</sup>	20Hz – 1kHz	0.05 + 300nA	8V	10nA
20mA <sup>1</sup>	20Hz – 1kHz	0.05 + 3uA	8V	100nA
200mA <sup>1</sup>	20Hz – 1kHz	0.05 + 30uA	8V	1uA
<b>With 9782 High Voltage/Current option fitted</b>				
2A <sup>1</sup>	20Hz – 500Hz	0.1 + 0.5mA	3.5V	10uA
20A <sup>1</sup>	20Hz – 500Hz	0.2 + 5mA	3V	100uA

1. Over-Range 10%.

<b>THERMOCOUPLE SIMULATION</b>		
<b>Thermocouple Type</b>	<b>Temperature Range °C</b>	<b>Accuracy °C</b>
J	-210 to -50	0.15
	-50 to 1200	0.18
K	-270 to 1372	0.25
T	-270 to -150	0.25
	-150 to 0	0.2
	0 to 400	0.15
R	-50 to 50	1.0
	50 to 250	0.8
	250 to 1768	0.6
S	-50 to 300	0.9
	300 to 1768	0.8
B	0 to 800	1.8
	800 to 1820	1.0
N	-270 to -100	0.8
	260-100 to 1300	0.3
E	-270 to -100	0.3
	-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 7051's DC Voltage function and the accuracy of the standard thermocouple tables (BS EN 60584-1) published by the British Standards Institute. The 7051 uses precise digital interpretation of the tables to output voltage levels that are within the accuracies specified in the table above.

DECADE RESISTANCE <sup>1</sup>		
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 +/- 5mΩ.

SIMULATED RESISTANCE	
RANGE	ACCURACY
<b>2 Wire<sup>1</sup></b>	
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 7051'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 7051.

It should also be noted that some DMMs use measuring currents which are outside the 7051 simulated resistance limits. If in doubt over the validity of the 7051'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

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 +/- 5mΩ

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

PERIOD
Variable Values 100nS to 10S, ~2V pk-pk square wave. Accuracy 20ppm

# DMM SECTION

DC VOLTAGE			
Range	Accuracy PPM (Reading + Range)	Input Impedance	Resolution
100 mV	50 + 40	10M $\Omega$	1uV
1 V	40 + 8	10M $\Omega$	1uV
10 V	35 + 6	10M $\Omega$	10uV
100 V	45 + 7	10M $\Omega$	100uV
1 kV	45 + 10	10M $\Omega$	1mV

AC VOLTAGE			
Range RMS	Frequency	Accuracy % (Reading + Range)	Resolution
100 mV	5 Hz – 10 Hz	0.4 + 0.04	10uV
	10 Hz – 20 kHz	0.06 + 0.04	10uV
	20 Hz – 50 kHz	0.12 + 0.05	10uV
	50 kHz – 100 kHz	0.6 + 0.1	10uV
	100 kHz – 300 kHz	5.0 + 0.5	100uV
1V – 750V	5 Hz – 10 Hz	0.4 + 0.03	0.01% of f.s.
	10 Hz – 20 kHz	0.15 + 0.05	0.01% of f.s.
	20 kHz – 50 kHz	0.6 + 0.1	0.01% of f.s.
	50 kHz – 100 kHz	5.0 + 0.5	0.01% of f.s.

DC CURRENT			
Range	Accuracy PPM (Reading + Range)	Burden Voltage	Resolution
10 mA	500 + 200	<0.1V	100nA
100 mA	500 + 50	<0.7V	1uA
1 A	1000 + 100	<1V	10uA
3 A	1200 + 200	<2V	100uA

AC CURRENT			
Range RMS	Frequency	Accuracy % (Reading + Range)	Resolution
1 A	10Hz – 5kHz	0.15 + 0.05	100uA
3 A	10Hz – 5kHz	0.25 + 0.1	100uA

RESISTANCE		
Range	Test Current	Accuracy (Reading + Range)
100 $\Omega$	1mA	100ppm + 40ppm
1k $\Omega$	1mA	100ppm + 10ppm
10k $\Omega$	100uA	100ppm + 10ppm
100k $\Omega$	10uA	100ppm + 10ppm
1 M $\Omega$	5uA	100ppm + 10ppm
10 M $\Omega$	0.5uA	400ppm + 10ppm
100 M $\Omega$	0.1uA	1% + 10ppm

FREQUENCY/PERIOD (100mV – 750V)	
Range	Accuracy (Reading)
3Hz to 10Hz	0.1%
10Hz to 40Hz	0.03%
40Hz to 300kHz	0.01%

# Calibrator Options

(Option code shown in brackets)

CAPACITANCE AND INDUCTANCE (9798)			
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	
Value	Frequency	Accuracy	Max current
1 mH	1kHz	1% of nominal /	10mA
1.9 mH	1kHz	0.1% of displayed	
5 mH	1kHz	value	
10 mH	1kHz		
19 mH	1kHz	2% of nominal /	
50 mH	1kHz	0.1% of displayed	
100 mH	1kHz	value	
190 mH	1kHz		
500 mH	1kHz		
1H	1kHz		
10H	100Hz		

Specifications are shown after subtraction of residual capacitance / inductance.

1mH to 10mH 1% of nominal value. 19mH to 10H 2% of nominal value

Specification based on 4 wire sine-wave measurement technique.

OSCILLOSCOPE (9770)	
<b>FREQUENCY</b> Fixed Values 1, 2, 5 steps 0.1Hz to 10MHz accuracy 0.1ppm* 20, 50, 100MHz accuracy 20ppm	<b>PERIOD</b> Fixed Values 1, 2, 5 steps 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)	
<b>DUTY CYCLE</b> 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.	
AMPLITUDE	
<b>Output per div</b>	1mV to 50V in 1, 2, 5 sequence. 1kHz square wave or DC.
<b>Graticule X</b>	1, 2, 4, 6, 8. Max output 200V pk-pk <sup>1</sup>
Range	Accuracy
1mV to 200mV	0.2% +/- 4uV
200mV to 200V	0.05%
1mV to 20mV 50Ω	0.5% +/- 10uV
20mV to 2V 50Ω	0.25%
<b>FAST RISE</b>	< 850ps. Bandwidth Checking up to 400 MHz

1. At 1mV/div 1,2,4X not available

2.2GHz-LEVELLED SWEEP (9769) 1Vpk-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%
1 GHz to 2.2 GHz	20%

## Calibrator Options (continued)

FULL RANGE RESISTANCE (9787)			
Range	Accuracy <sup>1</sup>	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

<sup>1</sup> After subtraction of lead resistance. Add 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 7051's simulated (active) resistance function and the accuracy of the PRT tables (BS EN 60751) published by the British Standards Institute. The 7051 uses precise digital interpretation of the tables to output resistance values that are within the accuracies specified in the table above.

AC VOLTAGE HI FREQUENCY (9771)			
Range	20 kHz – 100 kHz	100 kHz to 300 kHz	300kHz to 1MHz
20mV	0.05% + 0.1mV	0.1% + 0.5mV	-
200mV	0.05% + 0.1mV	0.1% + 0.5mV	-
2V	0.05% + 1mV	0.1% + 5mV	1% + 10mV
20V	0.1% + 10mV	-	-

Frequency Accuracy 0.01%

## PC SPECIFICATION

Processor	2 GHz
RAM	512MB
Hard Drive	40 GB
Ports	4 x USB, 1 x Fast Ethernet.
Display	10.5in LCD, (Touch Screen)
Operating System	Windows XP Embedded

## GENERAL

<b>POWER SUPPLY</b>	
Mains Voltage	100 - 230V AC 50/60 Hz.
Fuse Ratings	3.15A anti-surge
Connector	IEC Plug
Power Consumption	125W typical, 220W Max.
<b>MAXIMUM ALLOWABLE VOLTAGE BETWEEN TERMINALS</b>	
Source	
Between V+ and V- terminals	< 1500V Peak
Between V- and Earth	< 75V Peak
Between Main, Aux and Earth	< 75V Peak
Measure	
Between V+ and V- terminals	<1000V Peak
Between V- and Earth	<75V Peak
<b>ENVIRONMENTAL</b>	
Operating Temperature	15 - 25 °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

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