Time Electronics
Calibration, Test and Measurement

Extended Specifications

7051Plus / 5051Plus Multifunction Calibrators

Version: 1.2

Revision: D

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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 23 °C ± 5 °C
4. For temperatures outside the above range apply 0.2 x specification per °C
5. Warm up time at least 30 minutes.
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 (Source)

DC VOLTAGE

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

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

AC VOLTAGE

Range	Frequency	Accuracy (%)	Output Resistance	Max Output Current	Resolution
20 mV	10 Hz to 45 Hz	0.05 + 250 µV	10 Ω		1 µV
	45 Hz to 1 kHz	0.05 + 100 µV	10 Ω		
	1 kHz to 10 kHz	0.05 + 150 µV	10 Ω		
	10 kHz to 20 kHz	0.05 + 250 µV	10 Ω		
	20 kHz to 100 kHz	0.05 + 0.1mV	50 Ω		
	100 kHz to 300 kHz	0.1 + 0.5mV	50 Ω		
200 mV	10 Hz to 45 Hz	0.05 + 250 µV	10 Ω		1 µV
	45 Hz to 1 kHz	0.04 + 100 µV	10 Ω		
	1 kHz to 10 kHz	0.04 + 150 µV	10 Ω		
	10 kHz to 20 kHz	0.05 + 250 µV	10 Ω		
	20 kHz to 100 kHz	0.1 + 0.5mV	50 Ω		
	100 kHz to 300 kHz	0.1 + 1mV	50 Ω		
2 V	10 Hz to 45 Hz	0.08 + 500 µV	< 0.1 Ω	20 mA	10 µV
	45 Hz to 1 kHz	0.03 + 170 µV	< 0.1 Ω		
	1 kHz to 10 kHz	0.03 + 250 µV	< 0.1 Ω		
	10kHz to 20 kHz	0.08 + 500 µV	< 0.1 Ω		
	20 kHz to 100 kHz	0.05 + 1 mV	< 0.5 Ω		
	100 kHz to 300 kHz	0.1 + 5 mV	< 0.5 Ω		
	300 kHz to 1 MHz	1 + 10 mV	< 0.5 Ω		
20 V	10 Hz to 45 Hz	0.08 + 4 mV	< 5 Ω	20 mA	100 µV
	45 Hz to 1 kHz	0.03 + 2 mV	< 5 Ω		
	1 kHz to 10 kHz	0.03 + 3 mV	< 5 Ω		
	10 kHz to 20 kHz	0.08 + 4 mV	< 5 Ω		
	20 kHz to 100 kHz	0.15 + 15 mV			
200 V	40 to 45 Hz	0.12 + 40 mV	< 5 Ω	20 mA	1 mV
	40 Hz to 1 kHz	0.06 + 20 mV			
1050 V	40 to 45 Hz	0.16 + 180 mV	< 10 Ω	10 mA	10 mV
	45 Hz to 1 kHz	0.08 + 90 mV			

The frequency accuracy for AC ranges is 0.01% and is crystal controlled. The setting resolution is 1 Hz.
The output resistance on the 20 mV and 20 0mV ranges is 10 Ω or 50 Ω. This must be taken into account when loads of 100 kΩ or less are being driven.
A 100 kΩ load will result in a 0.01% error. All AC outputs exclude the DC component.

DC CURRENT

Range	Accuracy (ppm)	Resolution	Compliance Voltage
200 µA	150 + 15 nA	1 nA	11 V
2 mA	100 + 40 nA	10 nA	11 V
20 mA	80 + 200 nA	10 nA	11 V
200 mA	80 + 3 µA	100 nA	11 V
2 A	250 + 40 µA	1 µA	5 V
22 A	600 + 2 mA	10 µA	4 V

For full accuracy the 2 A range load must be between 0.1 and 0.4 Ω and between 0.04 and 0.1 Ω for the 20 A range.

AC CURRENT (sine wave)

Range	Frequency	Accuracy (%)	Resolution	Compliance Voltage
200 µA	20 Hz to 1 kHz	0.07 + 300 nA	10 nA	8 V rms
2 mA	20 Hz to 1 kHz	0.05 + 300 nA	10 nA	
20 mA	20 Hz to 1 kHz	0.05 + 3 µA	100 nA	
200 mA	20 Hz to 1 kHz	0.05 + 30 µA	1 µA	
2 A	20 Hz to 500 Hz	0.1 + 0.5 mA	10 µA	3.5 V rms
22 A	20 Hz to 500 Hz	0.2 + 5 mA	100 µA	3 V rms

For full accuracy the 2 A range load must be between 0.1 and 0.4 Ω and between 0.04 and 0.1 Ω for the 20 A range.

DECADE RESISTANCE

Value	Accuracy	Rating
1 Ω	100 ppm + 5 mΩ	0.1 W
10 Ω	70 ppm + 5 mΩ	
100 Ω	30 ppm + 5 mΩ	
1 kΩ	20 ppm + 5 mΩ	
10 kΩ	30 ppm + 5 mΩ	

Value	Accuracy	Rating
100 kΩ	30 ppm	200 V
1 MΩ	150 ppm	
10 MΩ	0.1 %	
100 MΩ	1 %	
1 GΩ	10 %	

Specifications apply to models fitted with 4 wire decade resistance. Above 10 kΩ connections can be made as either 4 or 2 wire. Settling time < 10 seconds.
Models fitted with 2 wire only decade resistance an additional floor of ± 15 mΩ applies, after subtraction of external lead resistance.

DECADE CONDUCTANCE

Value	Accuracy 4 Wire	Accuracy 2 Wire	Rating
1 S	0.51 %	2 %	0.1 W
100 mS	570 ppm	0.2 %	
10 mS	80 ppm	300 ppm	
1 mS	35 ppm	225 ppm	
100 µS	31 ppm	200 ppm	

Value	Accuracy 4 Wire	Accuracy 2 Wire	Rating
10 µS	30 ppm	200 ppm	200 V
1 µS	150 ppm	300 ppm	
100 nS	0.1 %	0.11 %	
10 nS	1 %	1 %	
1 nS	10 %	10 %	

4 wire specifications apply to models fitted with 4 wire decade conductance. 2 wire conductance does not include external lead conductance.
Conductance is a mathematical calculation of the resistance functions and therefore does not require calibration.

THERMOCOUPLE SIMULATION

Thermocouple Type	Temperature Range (ºC)	Accuracy (ºC)
J	-210 to -200	±0.35
	-200 to -50	±0.15
	-50 to 1200	±0.18
K	-270 to -260	±3.75
	-260 to -250	±1.55
	-250 to -240	±1.05
	-240 to -200	±0.7
	-200 to 1372	±0.25
T	-270 to -260	±1.85
	-260 to -250	±1.05
	-250 to -240	±0.8
	-240 to -200	±0.6
	-200 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

Thermocouple Type	Temperature Range ºC	Accuracy (ºC)
S	-50 to 300	±0.9
	300 to 1768	±0.8
E	-270 to -260	±1.45
	-260 to -250	±0.85
	-250 to -240	±0.5
	-240 to -100	±0.3
	-100 to 0	±0.2
	0 to 1000	±0.15
N	-270 to -260	±5.4
	-260 to -250	±2.6
	-250 to -240	±1.95
	-240 to -200	±1
	-200 to -100	±0.8
	-100 to 1300	±0.3
B	300 to 800	±1.8
	800 to 1820	±1.0

Resolution 0.1 °C. Switchable automatic internal cold junction reference, accuracy ± 1.0 °C (applies to ambient changes of ± 1 ºC)
The xx51 uses precise digital interpretation of the standard thermocouple tables BS EN 60584-1.
Accredited measurements are not available for Type B thermocouple simulation.

FULL RANGE RESISTANCE

Range	Accuracy	Resolution	Max Rating
1 Ω to 20 Ω	100 ppm + 15 mΩ	1 Ω	0.1 W
20 Ω to 50.00 Ω	100 ppm + 15 mΩ	10 mΩ	0.1 W
50 Ω to 99.999 Ω	100 ppm + 15 mΩ	1 mΩ	0.1 W
100 Ω to 999.999 Ω	100 ppm + 15 mΩ	1 mΩ	0.1 W
1 kΩ to 9.999 kΩ	200 ppm + 25 mΩ	1 Ω	0.1 W
10 kΩ to 99.999 kΩ	100 ppm + 1 Ω	1 Ω	0.1 W
100 kΩ to 999.99 kΩ	100 ppm + 10 Ω	10 Ω	0.1 W
1 MΩ to 9.9999 MΩ	200 ppm + 100 Ω	100 Ω	0.1 W
10 MΩ to 120 MΩ	0.1 % + 1 kΩ	1 kΩ	0.1 W

2 wire. Accuracies apply after subtraction of external lead resistance.

PT100 SIMULATION

Range	Accuracy	Resolution
-180 to 50 ºC	± 0.07 ºC	0.01 ºC
50 to 200 ºC	100 ppm + 0.07 ºC	
200 to 850 ºC	100 ppm + 0.10 ºC	

Alpha = 0.00385 ITS90. Based on tables published in IEC 60751.

CAPACITANCE AND INDUCTANCE

Value	Frequency	Accuracy	Max Volts
1 nF	1 kHz	0.25 % + 10 pF	25 V
10 nF		0.25 % + 10 pF	
100 nF		0.25 %	
1 µF		0.25 %	
10 µF		0.5 %	
100 µF		0.5 %	
Value	**Frequency**	**Accuracy**	**Test Voltage**
1 mH, 1.9 mH	1 kHz	0.1 % + 1 µH	0.05, 0.1 V rms
5 mH,10 mH	1 kHz	0.1 % + 1 µH	0.2, 0.3 V rms
19 mH, 50 mH	1 kHz	1 %	0.4, 0.6 V rms
100 mH, 190 mH	1 kHz	1 %	0.6, 0.7 V rms
500 mH, 1 H	1 kHz	1 %	0.7, 0.7 V rms
10 H	100 Hz	1 %	0.7 V rms

Specifications apply to the displayed value, after subtraction of residual capacitance / inductance.
Specification based on 4 wire sine-wave series mode measurement technique.
For full accuracy the warmup period is extended to 12 hours at Tcal ± 3 °C.

OSCILLOSCOPE / FREQUENCY CALIBRATION

FREQUENCY Fixed Values 1, 2, 5 steps 0.1 Hz to 10 MHz accuracy 20ppm or 0.1ppm* 20, 50, 100 MHz accuracy 20ppm	**PERIOD** Fixed Values 1, 2, 5 steps 100 ns to 10 s accuracy 20ppm or 0.1ppm* 50, 20, & 10 ns accuracy 20ppm

* Fitted with Oven-Controlled Frequency Reference (Option 9783)
1.5 V pk-pk - 0.1 Hz to 100 kHz. 1 V pk-pk – 100 kHz to 100 MHz (sine-wave at 100MHz)
Period is a mathematical calculation of the Frequency function and therefore does not require calibration.

DUTY CYCLE

3 frequencies, 100 Hz, 1 kHz, 10 kHz. Duty cycle settable from 0 to 100%
Setting resolution 0.01% at 100 Hz, 0.1% at 1 kHz, 1% at 10 kHz
Deviation function is not available. Accredited measurements are not available for Duty Cycle & Fast Rise

AMPLITUDE

Output per div	12 mV to 50 V in 1, 2, 5 sequence. 1 kHz square wave or DC.
Graticule X	1, 2, 4, 6, 8. Max output 200 V

Range	Accuracy
6 mV to 200 mV (1 MΩ)	0.2 % +/- 4 µV
200 mV to 200 V (1 MΩ)	0.05 %
6 mV to 20 mV (50 Ω)	0.5 % +/- 10 µV
20 mV to 2V (50 Ω)	0.25 %
FAST RISE	400 ps ±150 ps (Into 50 Ω Load)

At 1 mV / div 1, 2, & 4x graticules not available. The square wave signal is a chopped DC voltage, and the accuracy applies to the top line measurement relative to ground. Calibration is performed using the DC signal.

DMM (Measure)

DC VOLTAGE

Range	**Accuracy** (ppm of reading + range)	Input Impedance	Resolution
100 mV	50 + 40	10 MΩ	0.1 µV
1 V	40 + 8	10 MΩ	1 µV
10 V	35 + 6	10 MΩ	10 µV
100 V	45 + 7	10 MΩ	100 µV
1 kV	45 + 10	10 MΩ	1 mV

AC VOLTAGE

Range RMS	Frequency	**Accuracy** (% of reading + range)	Resolution
100 mV	5 Hz to 10 Hz	0.4 + 0.04	0.1 µV
	10 Hz to 20 kHz	0.06 + 0.04	
	20 kHz to 50 kHz	0.12 + 0.05	
	50 kHz to 100 kHz	0.6 + 0.1	
	100 kHz to 300 kHz	5.0 + 0.5	
1 V to 750 V	5 Hz to 10 Hz	0.4 + 0.03	1 µV to 1 mV
	10 Hz to 20 kHz	0.15 + 0.05	
	20 kHz to 50 kHz	0.6 + 0.1	
	50 kHz to 100 kHz	5.0 + 0.5	

DC CURRENT

Range	**Accuracy** (ppm of reading + range)	Burden Voltage	Resolution
10 mA	500 + 200	< 0.1 V	10 nA
100 mA	500 + 50	< 0.7 V	100 nA
1 A	1000 + 100	< 1 V	1 µA
3 A	1200 + 200	< 2 V	10 µA

AC CURRENT

Range	Frequency	**Accuracy** (% of reading + range)	Resolution
1 A	10 Hz to 5 kHz	0.15 + 0.05	1 µA
3 A	10 Hz to 5 kHz	0.25 + 0.1	10 µA

RESISTANCE

Range	Test Current	**Accuracy** (ppm of reading + range)	Resolution
100 Ω	1 mA	100 + 40	0.1 mΩ
1 kΩ	1 mA	100 + 10	1 mΩ
10 kΩ	100 µA	100 + 10	10 mΩ
100 kΩ	10 µA	100 + 10	100 mΩ
1 MΩ	5 µA	100 + 10	1 Ω
10 MΩ	0.5 µA	450 + 20	10 Ω
100 MΩ	0.1 µA	1 % + 0.02 %	100 Ω

Specification applies to 4 wire mode. 2 wire specifications are x2 the stated accuracy with null / zero applied.

FREQUENCY/PERIOD (100 mV to 750 V)

Range	Accuracy
3 Hz to 10 Hz	0.1 % of reading
10 Hz to 40 Hz	0.03 % of reading
40 Hz to 300 kHz	0.01 % of reading

THERMOCOUPLES

Thermocouple Type	Temperature Range °C	Accuracy °C
J	-210 to -200	0.35
	-200 to 1200	0.18
K	-270 to -260	3.75
	-260 to -250	1.55
	-250 to -240	1.05
	-240 to -200	0.7
	-200 to 1300	0.4
S	-50 to 1749	1.2

Thermocouple Type	Temperature Range °C	Accuracy °C
T	-200 to 380	0.4
R	-50 to 1749	1.0
N	-270 to -260	5.4
	-260 to -250	2.6
	-250 to -240	1.95
	-240 to -200	1
	-200 to 1280	0.4
E	-50 to 980	0.3

Resolution 0.001 °C. Switchable automatic internal cold junction compensation, accuracy ±0.5 °C (applies to ambient changes of ±1 °C)
The xx51 uses precise digital interpretation of the standard thermocouple tables BS EN 60584-1. Additional errors apply for temperatures below -200 °C.

RTD

	Range ºC	Accuracy ºC	Resolution
Pt100 (Alpha = 0.00385 ITS-90 IEC 60751)	-180 to -100	0.5	0.01
	-100 to 550	0.1	
	550 to 850	0.15	

Calibrator Options

2.2 GHz LEVELLED SWEEP (9769)

Range	Amplitude Accuracy
100 MHz to 200 MHz	1 % + 5 mV pk-pk
200 MHz to 500 MHz	2 % + 5 mV pk-pk
500 MHz to 1 GHz	4 %
1 GHz to 2.2 GHz	6 %

Sine-Wave, 50 Ω Output. Accredited measurements are not available for levelled sinewave amplitude.

General Specifications

PC / CONTROL CENTRE

Processor	64 bit, quad core (or equivalent)
RAM	4 GB (or higher)
Hard Drive	120 GB Solid State (or higher)
Ports	4 x USB, 1 x Fast Ethernet.
5051 Display	10.4”. Capacitive Touch Screen.
CC12 Display	12.1” Wide. Capacitive Touch Screen
Operating System / Software	Windows 10, EasyCal Calibration Software.

POWER SUPPLY (5051 only)

Mains Voltage	100 to 260 V AC 50/60 Hz.
Fuse Ratings	3.15 A anti-surge
Power Consumption	125 W typical, 220 W Max.

MAXIMUM ALLOWABLE VOLTAGE BETWEEN TERMINALS

Source Terminals	
Between V- and Earth	< 75 V Peak
Between Main, Aux and Earth	< 75 V Peak
Measure Terminals	
Between V+ and V- terminals	<1000 V Peak
Between V- and Earth < 75V Peak	<75 V Peak

ENVIRONMENTAL

Operating Temperature	5 to 45 °C
Storage Temperature	-10 °C to 50 °C
Humidity	Operating < 80 %
Altitude	0 to 3 km. Non-operating 3 to 12 km
Warm Up Time	30 Minutes

MECHANICAL (5051 only)

Dimensions	Width 430 mm, Height 202 mm, Depth 538 mm
Weight	23 kg