

9100 Universal Calibration System

FLUKE®

DC/LF Calibration

Versatile entry-level performance



Tech Tip

The lead mat supplied with the 9100 will automatically optimize the signal paths to the UUT.

- Unique insulation and continuity meter calibration
- AC current to 30 KHz
- AC/DC current to 20 amps
- Extensive range of available calibration procedures

The affordable and versatile 9100 is designed to calibrate an impressive range of portable meter workload including: handheld multimeters, bench multimeters, analog meters, panel meters, clamp meters, power meters, harmonic analyzers, oscilloscopes, ScopeMeter® Test Tools, insulation/continuity meters, counters, electronic thermometers, chart recorders, oscillograph recorders, XY recorders, and data loggers. With its easy-to-use front panel featuring a clear and informative LCD display, and its unique procedure-driven calibration routines, the 9100 is not only a versatile calibrator but also one that will increase calibration throughput significantly.

For full and comprehensive specifications, refer to the extended specification data sheet at www.fluke.com.

DC Voltage Accuracy

Voltage Output Polarities	Accuracy ^[1] ± (% of Output + Floor) 1 Year - Tcal ± °C ^[2]	Absolute Resolution
000.000 mV to 320.000 mV	0.006 % + 4.16 µV	1 µV
0.32001 V to 3.2000 V	0.006 % + 41.6 µV	10 µV
03.2001 V to 32.0000 V	0.0065 % to 416 µV	100 µV
032.001 V to 320.000 V	0.0065 % to 4.48 mV	1 mV
0320.01 V to 1050.00 V	0.006 % to 19.95 mV	10 mV

^[1] = For loads < 1 MΩ: add load regulation error.

^[2] Tcal = temperature at calibration. Factory calibration temperature = 23 °C

AC Voltage Accuracy (Sinusoidal Waveshape)

Voltage Output	Frequency Band ^[2] (Hz)	Accuracy ^[1] ± (% Output + Floor) 1 Year - Tcal ^[3] ± 5 °C	Absolute Resolution
000.000 mV to 010.000 mV	10 to 3 k	0.04 + 384 µV	1 µV
	3k to 10 k	0.04 + 512 µV	1 µV
	10 k to 30 k	0.06 + 960 µV	1 µV
	30 k to 50 k	0.09 + 1.92 mV	1 µV
	50 k to 100 k	0.20 + 5.12 mV	1 µV
010.001 mV to 032.000 mV	10 to 3 k	0.4 + 96.0 µV	1 µV
	3 k to 10 k	0.4 + 128 µV	1 µV
	10 k to 30 k	0.06 + 240 µV	1 µV
	30 k to 50 k	0.09 + 430 µV	1 µV
	50 k to 100 k	0.20 + 1.28 mV	1 µV
032.001 mV to 320.000 mV	10 to 3 k	0.4 + 19.2 µV	1 µV
	3 k to 10 k	0.4 + 25.6 µV	1 µV
	10 k to 30 k	0.06 + 48.0 µV	1 µV
	30 k to 50 k	0.09 + 960 µV	1 µV
	50 k to 100 k	0.20 + 256 µV	1 µV
0.32001 V to 3.20000 V	10 to 3 k	0.04 + 192 µV	10 µV
	3 k to 10 k	0.04 + 256 µV	10 µV
	10 k to 30 k	0.06 + 480 µV	10 µV
	30 k to 50 k	0.09 + 960 µV	10 µV
	50 k to 100 k	0.20 + 2.56 mV	10 µV
03.2001 V to 32.0000 V	10 to 3 k	0.04 + 1.92 mV	100 µV
	3 k to 10 k	0.06 + 2.56 mV	100 µV
	10 k to 30 k	0.08 + 4.80 mV	100 µV
	30 k to 50 k	0.15 + 9.60 mV	100 µV
	50 k to 100 k	0.35 + 32.0 mV	100 µV
032.001 V to 105.000 V	10 to 3 k	0.04 + 6.30 mV	1 mV
	3 k to 10 k	0.06 + 8.40 mV	1 mV
	10 k to 30 k	0.08 + 15.8 mV	1 mV
	30 k to 50 k	0.15 + 31.5 mV	1 mV
	50 k to 100 k	0.35 + 105 mV	1 mV
105.001 V to 320.000 V	40 to 100	0.05 + 19.2 mV	1 mV
	100 to 1 k	0.05 + 19.2 mV	1 mV
	1 k to 3 k	0.08 + 19.2 mV	1 mV
	3 k to 10 k	0.08 + 32.0 mV	1 mV
	10 k to 20 k	0.12 + 48.0 mV	1 mV
	20 k to 30 k	0.15 + 64.0 mV	1 mV
0320.01 V to 0800.00 V	40 to 100	0.05 + 63.0 mV	10 mV
	100 to 1 k	0.05 + 63.0 mV	10 mV
	1 k to 3 k	0.08 + 63.0 mV	10 mV
	3 k to 10 k	0.08 + 105 mV	10 mV
	10 k to 20 k ^[4]	0.12 + 158 mV	10 mV
	20 k to 30 k ^[4]	0.15 + 210 mV	10 mV
0800.01 V to 1050.00 V	40 to 100	0.05 + 126 mV	10 mV
	100 to 1 k	0.05 + 126 mV	10 mV
	1 k to 3 k	0.08 + 126 mV	10 mV
	3 k to 10 k	0.08 + 210 mV	10 mV
	10 k to 20 k ^[4]	0.12 + 315 mV	10 mV

^[1] = For loads < |1MΩ|: add load regulation error.

^[2] Frequency Accuracy: 25 ppm of output frequency.

^[3] Tcal = temperature at calibration. Factory calibration temperature = 23 °C.

^[4] = Availability of voltage and frequency combinations is subject to the Volt-Hertz limit (see V-Hz profile).

DC Current Accuracy

Equivalent Current Output	Accuracy ± (% of Output + Floor) 1 Year - Tcal ± 5 °C [1]	Absolute Resolution
000.000 µA to 320.000 µA	0.014 + 11 nA	1 nA
0.32001 mA to 3.20000 mA	0.014 + 83 nA	10 nA
03.2001 mA to 32.0000 mA	0.014 + 900 nA	100 nA
032.001 mA to 320.000 mA	0.016 + 9.6 µA	1 µA
0.32001 A to 3.20000 A	0.060 + 118 µA	10 µA
03.2001 A to 10.5000 A	0.055 + 940 µA	100 µA
10.5001 A to 20.0000 A [2]	0.055 + 4.50 mA	100 µA

[1] Tcal = temperature at calibration. Factory calibration temperature = 23 °C.

[2] = With output 'ON', maximum duty cycle of (> 0.525FS : 0.525FS) is (1 : 4). Continuous output > 0.525FS will automatically reduce to < 0.525FS after 2 Minutes.

AC Current Accuracy (Sinusoidal Waveshape)

Current Output	Frequency Band [2] (Hz)	Accuracy [1] ± (% Output + Floor) 1 Year - Tcal [3] ± 5 °C	Absolute Resolution
000.000 µA to 032.000 µA	10 to 3 k	0.07 + 900 nA	1 nA
	3 k to 10 k	0.10 + 1.8 µA	1 nA
	10 k to 20 k	0.20 + 6.0 µA	1 nA
	20 k to 30 k	0.25 + 9.0 µA	1 nA
032.001 µA to 320.000 µA	10 to 3 k	0.07 + 300 nA	1 nA
	3 k to 10 k	0.10 + 600 nA	1 nA
	10 k to 20 k	0.20 + 2.0 µA	1 nA
	20 k to 30 k	0.25 + 3 µA	1 nA
0.32001 mA to 3.20000 mA	10 to 3 k	0.07 + 300 nA	10 nA
	3 k to 10 k	0.10 + 600 nA	10 nA
	10 k to 20 k	0.20 + 2.0 µA	10 nA
	20 k to 30 k	0.25 + 3.0 µA	10 nA
03.2001 mA to 32.0000 mA	10 to 3 k	0.07 + 3.2 µA	100 nA
	3 k to 10 k	0.10 + 6.4 µA	100 nA
	10 k to 20 k	0.20 + 12.8 µA	100 nA
	20 k to 30 k	0.25 + 22.4 µA	100 nA
032.001 mA to 320.000 mA	10 to 3 k	0.08 + 32.0 µA	1 µA
	3 k to 10 k	0.10 + 48.0 µA	1 µA
	10 k to 20 k	0.20 + 64.0 µA	1 µA
	20 k to 30 k	0.25 + 96.0 µA	1 µA
0.32001 A to 3.20000 A	10 to 3 k	0.10 + 480 µA	10 µA
	3 k to 10 k	0.25 + 2.56 mA	10 µA
03.2001 A to 10.5000 A	10 to 3 k	0.20 + 3.0 mA	100 µA
	3 k to 10 k	0.50 + 10.0 mA	100 µA
10.5001 A to 20.0000 A [4]	10 to 3 k	0.20 + 6.9 mA	100 µA
	3 k to 10 k	0.50 + 23.0 mA	100 µA
03.2001 A to 32.0000 A [5]	10 to 100	0.20 + 5.5 mA	100 µA
	100 to 440	0.78 + 27 mA	100 µA
032.001 A to 200.000 A [4][5]	10 to 100	0.21 + 90 mA	1 mA
	100 to 440	0.67 + 0.25 A	1 mA
016.001 A to 160.000 A [6]	10 to 100	0.20 + 28 mA	1 mA
0160.01 A to 1000.00 A [4][6]	10 to 100 [8]	0.21 + 0.45 A	10 mA

[1] = Total uncertainty includes compliance errors for voltage 0.5 Vrms. Above 0.5 V, add appropriate compliance error, except for outputs marked [4] and [6].

[2] Frequency Accuracy: 25 ppm of output frequency.

[3] Tcal = temperature at calibration. Factory calibration temperature = 23 °C.

[4] = With output 'ON', maximum duty cycle of (> 0.525FS : 0.525FS) is (1 : 4). Continuous output > 0.525FS will automatically reduce to < 0.525FS after 2 minutes.

[5] = Accuracy at 9100 output terminals, option 200 10 turn coil connected. For the output from the coil, add ± 0.2 % of output from coil for uncertainty of coil.

[6] = Accuracy at 9100 output terminals, option 200 50 turn coil connected. For the output from the coil, add ± 0.2 % of output from coil for uncertainty of coil.

[7] = For frequencies < 40 Hz, compliance voltage is reduced by 0.5 Vrms.

[8] = These coils have been designed for optimum accuracy and inductance for use with the Model 9100. With some clamp meters, especially those using Hall effect, the increase in inductance due to the current clamp design will limit the obtainable 9100 Current/Hertz profile. In some cases, 1000 A cannot be reached at higher frequency.

Resistance Accuracy

Resistance Output	Accuracy (Source UUTi Low) ± (% of Output + Floor) 1 Year - Tcal ± 5°C ^[1]	Absolute Resolution
00.0000 Ω to 40.0000 Ω	0.025 + 10.0 mΩ	0.1 mΩ
040.001 Ω to 400.000 Ω	0.020 + 20.0 mΩ ^[2]	1 mΩ
0.40001 kΩ to 4.00000 kΩ	0.015 + 80.0 mΩ	10 mΩ
04.0001 kΩ to 40.0000 kΩ	0.020 + 800 mΩ	100 mΩ
040.001 kΩ to 400.000 kΩ	0.020 + 8.0 Ω	1 Ω
0.40001 MΩ to 4.00000 MΩ	0.050 + 100 Ω	10 Ω
04.0001 MΩ to 40.0000 MΩ	0.150 + 2.0 kΩ	100 Ω
040.001 MΩ to 400.000 MΩ	0.260 + 40.0 kΩ	1 kΩ

^[1] Tcal = temperature at calibration. Factory calibration temperature = 23 °C.

^[2] = Valid for UUTi ≥ 200 μA. Below 200 μA: new floor = (200 μA ÷ Actual UUTi) x 20 mΩ.

Conductance Accuracy

Conductance Output	Accuracy ±(% Output) 1 Year - Tcal ± 5 °C ^[1] UUTi Low & High UUTi Super
2.5 nS to 25.0 nS	0.40
25.0 nS to 250.0 nS	0.20
250.0 nS to 2.5 μS	0.12
2.5 μS to 25.0 μS	0.05
25.0 μS to 250.0 μS	0.05
250.0 μS to 2.5 mS	0.04

^[1] Tcal = temperature at calibration. Factory calibration temperature = 23 °C.

Frequency Function Accuracy

Frequency Output	Accuracy ± (ppm of Output Frequency) 1 Year - Tcal ± 5 °C ^[1] Standard	Accuracy ± (ppm of Output Frequency) 5 Year - Tcal ± 5 °C ^[1] Option 100	Mark/Period Ratio (%)
0.5 Hz to 10.0 MHz	25.0	0.25	50

^[1] Tcal = temperature at calibration. Factory calibration temperature = 23 °C.

Capacitance Accuracy

Capacitance Output	Accuracy ^[1] Source UUTi Low ± (% of Output + Floor) 1 Year - Tcal ± 5 °C ^[2]		Absolute Resolution
	Stim Repetition Rate ≤ 350 Hz	Stim Repetition Rate 350 Hz to 1.5 kHz	
0.5000 nF to 4.0000 nF	0.3 + 15 pF	0.6 + 30.0 pF	0.1 pF
4.0001 nF to 40.000 nF	0.3 + 30 pF	0.6 + 60.0 pF	1 pF
40.001 nF to 400.00 nF	0.3 + 160 pF	0.6 + 320 pF	10 pF
400.01 nF to 4.0000 μF	0.4 + 1.6 nF	0.8 + 3.2 nF	100 pF
4.0001 μF to 40.000 μF	0.5 + 16.0 nF	1.0 + 32.0 nF	1 nF
40.001 μF to 400.00 μF	0.5 + 160 nF	1.0 + 320 nF	10 nF
400.01 μF to 4.0000 mF	0.5 + 1.6 μF	1.0 + 3.2 μF	100 nF
4.0001 mF to 40.000 mF	1.0 + 60 μF	2.0 + 120 μF	1 μF

^[1] = Accuracy specifications apply both at the 9100 output terminals, and at the output leads of the Model 9105 lead set.

^[2] Tcal = temperature at calibration. Factory calibration temperature = 23 °C.

Thermocouple Temperature Accuracy

Thermocouple Type	Temperature Output (Screen Resolution Shown)	Accuracy ^{[1][2][3]} (\pm °C) 1 Year - Tcal \pm 5 °C ^[4]
B	0500.0 °C to 0800.0 °C	0.55
	0800.0 °C to 1000.0 °C	0.41
	1000.0 °C to 1400.0 °C	0.34
	1400.0 °C to 1820.0 °C	0.37
C	0000.0 °C to 0600.0 °C	0.29
	0600.0 °C to 1000.0 °C	0.27
	1000.0 °C to 1800.0 °C	0.40
	1800.0 °C to 2320.0 °C	0.41
E	-0250.0 °C to -0200.0 °C	0.45
	-0200.0 °C to -0100.0 °C	0.22
	-0100.0 °C to 0100.0 °C	0.17
	0100.0 °C to 1000.0 °C	0.21
J	-0210.0 °C to -0100.0 °C	0.25
	-0100.0 °C to 0800.0 °C	0.19
	0800.0 °C to 1000.0 °C	0.21
	1000.0 °C to 1200.0 °C	0.23
K	-0250.0 °C to -0200.0 °C	0.57
	-0200.0 °C to -0100.0 °C	0.27
	-0100.0 °C to 0100.0 °C	0.19
	0100.0 °C to 0600.0 °C	0.23
	0600.0 °C to 1372.0 °C	0.27
L	-0200.0 °C to -0050.0 °C	0.26
	-0050.0 °C to 0200.0 °C	0.18
	0200.0 °C to 0700.0 °C	0.20
	0700.0 °C to 0900.0 °C	0.23
N	-0200.0 °C to -0100.0 °C	0.33
	-0100.0 °C to 0900.0 °C	0.23
	0900.0 °C to 1100.0 °C	0.22
	1100.0 °C to 1300.0 °C	0.24
R	0000.0 °C to 0100.0 °C	0.52
	0100.0 °C to 0200.0 °C	0.40
	0200.0 °C to 1600.0 °C	0.35
	1600.0 °C to 1767 °C	0.28
S	0000.0 °C to 0200.0 °C	0.49
	0200.0 °C to 1000.0 °C	0.37
	1000.0 °C to 1400.0 °C	0.35
	1400.0 °C to 1767.0 °C	0.36
T	-0250.0 °C to -0200.0 °C	0.59
	-0200.0 °C to -0100.0 °C	0.27
	-0100.0 °C to 0000.0 °C	0.22
	0000.0 °C to 0400.0 °C	0.17

^[1] = Accuracy figures include CJC error.

^[2] = Compensated output determined from pre-defined tables based on:
 IPTS-68 Reference Table NIST Monograph 125 for Types: B, E, J, K, R, S and T.
 ITS-90 Reference Table NIST Monograph 175 for Types: B, E, J, K, N, R, S and T.
 IPTS-68 Reference Table DIN 43710 for Type L.
 ITS-90 Reference Table DIN 43710 for Type L.

^[3] = For loads < 1 M Ω add load regulation error.

^[4] Tcal = temperature at calibration. Factory calibration temperature = 23 °C.

^[5] = Types R & S adjusted above 1700 °C for IPTS-68 as per NIST monograph 175.

Other Thermocouple Output Specifications

Settling time to within 10 % of accuracy	0.08 s
Load regulation	(200/R _{LOAD}) % of output
Maximum capacitance	1000 pF

RTD Temperature Accuracy

Temperature Output	Accuracy ^[1] : ± (% of Output + Floor) 1 Year – Tcal ± 5 °C ^[2]		
	Resistance at 0 °C = 10 Ω to 60 Ω	Resistance at 0 °C = 60 Ω to 1 kΩ	Resistance at 0 °C = 1 kΩ to 2 kΩ
–200 °C to –100 °C	0.00 + 0.225 °C	0.00 + 0.15 °C	0.00 + 0.12 °C
–100 °C to 100 °C	0.00 + 0.15 °C	0.00 + 0.10 °C	0.00 + 0.08 °C
100 °C to 630 °C	0.00 + 0.30 °C	0.00 + 0.20 °C	0.00 + 0.16 °C
630 °C to 850 °C	0.00 + 0.45 °C	0.00 + 0.30 °C	0.00 + 0.24 °C

^[1] = Accuracy figures apply to Output Temperature vs Resistance curves PT385 or PT392 and to Temperature Scales IPTS-68 or ITS-90 as selected by the user:

PT385, IPTS-68 as per IEC751.

PT392, IPTS-68 as per SAMA.

PT385, ITS-90 as per IEC751 amendment 2.

PT392, ITS-90 as per NIST monograph 175 corrections (90-68).

^[2] Tcal = temperature at calibration. Factory calibration temperature = 23 °C.

Insulation Specifications (Option 135)

Uncertainties are for 1 year, Tcal ± °C		
Function	Range	Best Uncertainty
Insulation Resistance		
Resistance	100 kΩ to 2 GΩ	0.1 %
Voltage (measured)	0 to 1350 V	0.6 %
Current (derived)	1 μA to 2.3 mA	1.5 %
Continuity		
Resistance	0 to 4 kΩ	0.035 %
Voltage	0 to 10 V	
Current (derived)	100 μA to 350 mA	1.0 %

Power Option Specifications (Option PWR)

Voltage Output	Frequency Band (Hz)	Output Phase Uncertainty
0.30000 V to 105.000 V	10 to 65	0.07 °
	65 to 1 k	0.07 + 0.001 x (f - 65) °
105.001 V to 750.000 V	45 to 65	0.16 °
	65 to 1 k	0.16 + 0.0037 x (f - 65) °
Current Output		
0.00000 A to 20.0000 A	10 to 65	0.08 °
	65 to 1 k	0.08 + 0.0008 x (f - 65) °
	> 1 k	0.08 + 0.0012 x (f - 65) °
03.2000 A to 1000.00 A	10 to 65	0.23 °
	65 to 440	0.23 + 0.003 x (f - 65) °
Auxiliary Channel Voltage Output		
0.32 mV to 7.500 A	10 to 65	0.007 °
	65 to 1 k	0.07 + 0.001 x (f - 65) °
	< 1 k	0.07 + 0.0015 x (f - 65) °

Oscilloscope calibration

For specifications for the oscilloscope calibration options, please refer to the oscilloscope calibration section of this catalog.

Calibration

A certificate traceable to NPL-UK, including measurement data, is supplied. For additional certificate types, contact your local representation.

General Specifications

Line power supply

Voltage (single I): 100 V/200 V/
220 V/240 V selectable from rear
panel
Variation: < +10 % nominal voltage
Line Frequency: 48 Hz to 63 Hz
Consumption: 450 VA max 500 VA
max with Option 250
Power Fuses: 220/240 V: T3, 15 A
HBC, 250 V, IEC127
100/120 V: T5, 0 A HBC, 250 V,
IEC 127

Dimensions

Height: 3 U
Width: 427 mm (16.8 in)
Depth: 460 mm (18.1 in)
Weight: 18.5 kg (41 lbs)
19 kg (42 lbs) with Option 250

Safety: Designed to UL1244,
IEC1010-1: Pollution degree 2;
installation category II; Protection
class I

Environmental conditions

Temperature

Operating: 5 °C to 40 °C
Transit: -20 °C to 60 °C < 100 hrs
Storage: 0 °C to 50 °C
Warm-up Time: 20 minutes

Max. relative humidity (non-condensing)

Operating: + 5 °C to + 30 °C:
< 90 %; + 30 °C to + 40 °C: <75 %
Storage: 0 °C to + 50 °C: < 95 %

Altitude

Operating: 0 to 2000 m (6.562 ft);
Non-operating: 0 to 12,00 m
(40,000 ft)
Shock: MIL-T-28800, type III, class
5, style E
Vibration: MIL-T-28800, type III,
class 5, style E
Enclosure: MIL-T-2880, type III,
class 5, style E
EMC: Designed to: Generic Emis-
sions: EN50081; Generic Immunity:
EN50082; FCC Rules part 15 sub-
part J class B

Ordering Information

Models

9100 Multifunction Calibration
Workstation

Options and Accessories

9100-600 600 MHz Oscilloscope
Calibration Module

9100-250 250 MHz Oscilloscope
Calibration Module

9100-200 10/50 Turn Coil

9100-PWR Power Calibration

9100-135 Insulation/Continuity
Test

9100-100 High Stability Crystal
Ref.

9100-90 Rack Mount Kit

9500-65 Hard Transit Case
(requires option 60)

9100-60 Soft Carry Case

Software

MET/CAL® Plus Automated
Calibration Management
Software