Model 9100

WAVETEK

Universal Calibration System

Model 9100 — the world's *best value* multi-product calibrator

- ***Calibrates Over 15 Different Categories of General-Purpose Test Equipment***
- ***Options for Power Meter, Insulation/Continuity Tester and Oscilloscope Calibration — Internally Installed and Retrofittable***
- ***Semi-Automated and Fully Automated Procedure Modes for Maximum Calibration Throughput***
- ***Fully Supported by Portocal-II/9010 Calibration Software and Procedure Libraries (updates via the World Wide Web from www.wavetek.com)***
- ***Rapid Return on Investment***
- ***Zero-Downtime Support Using Wavetek's Model 4950 MTS***
- ***Intuitive Front Panel Operation for Ease of Use***

Unmatched Workload Coverage

If you're constantly being asked to calibrate more and more with less and less, Wavetek's Model 9100 Calibration System is the answer you've been waiting for. Its exceptional performance in both the analog and digital domain allows it to calibrate an extremely wide range of test and measurement equipment – quickly, efficiently and to ISO9000 requirements.

For the Model 9100, calibrating everything from handheld digital multimeters to high performance digital-storage oscilloscopes is all part of a day's work.

Take advantage of the Model 9100's unique procedure mode, which guides operators step-by-step through the entire calibration process, and you'll not only calibrate more with less – you'll do it faster.

The Model 9100 is a multi-function calibrator with a breadth and depth of outputs never before available from a single calibration source. In addition to DC and AC Voltage to 1050V, variable Resistance to 400MΩ and DC and AC Current to 20A (1000A via the optional current coils), the Model 9100 delivers continuously variable Capacitance values to 40mF and Conductance values to 2.5 milliSiemens. It also generates digitally synthesized and phase-locked Sine, Square, Triangle, Impulse and Trapezoidal waveforms, variable amplitude Pulses to 10MHz, Pulse Widths to 2 seconds, and Duty Cycles between 0.05% and 99.95%.

Add one of the two oscilloscope calibration options and it generates all the waveforms required to calibrate oscilloscopes up to 250MHz or 600MHz.

Fit the insulation/continuity tester option and it synthesizes resistance values as high as 2GΩ at test voltages up to 1000V. Fit the power meter option and it simultaneously generates variable phase angle voltages and currents that allow you to calibrate power meters up to 1MW or 1MVAR.

No other multi-product calibrator gives you such wide workload coverage and versatility. Weighing in at only 41 lbs (18.5kg), it's also the ideal solution to on-site calibration.

Model 9100 – the low-cost solution to calibrating:-

- Handheld Multimeters
- Bench Multimeters (up to 6-1/2 digit scale length)
- Analog Meters
- Clamp Meters
- Panel Meters
- Power Meters
- Harmonic Analyzers
- Oscilloscopes
- Combination Scope/Multimeters
- Insulation/Continuity Testers
- Counters
- Electronic Thermometers
- Chart Recorders
- Oscillograph Recorders
- XY Recorders
- Data Loggers

Faster Throughput Calibration

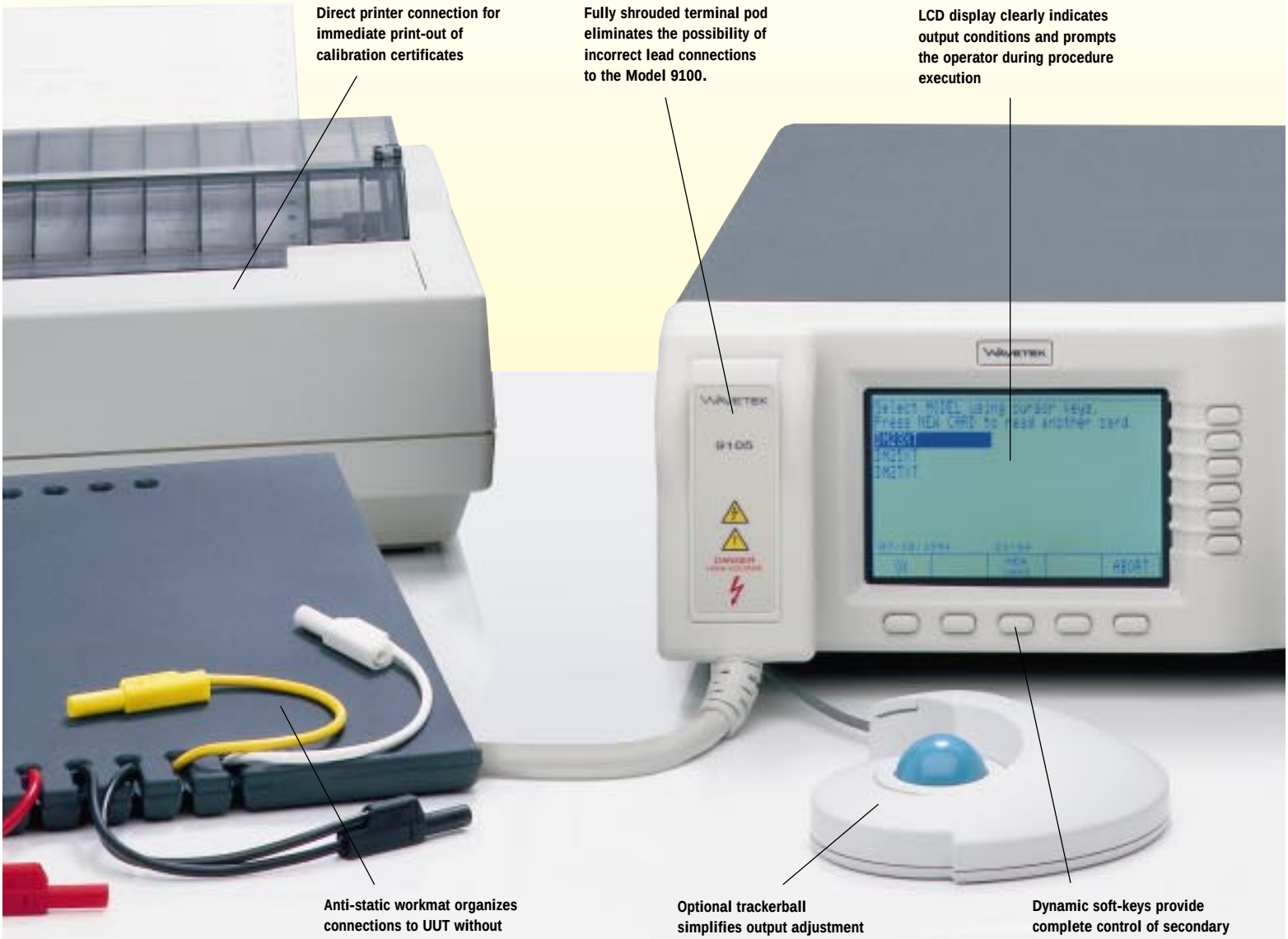
To cope with the varied and demanding workload of a modern calibration department, you not only need a calibrator that's versatile, you also need one that maximizes throughput.

That's why the Model 9100 incorporates a unique procedure mode that guides untrained operators through the entire calibration process, with direct printout of calibration results on a connected printer.

By utilizing PCMCIA cards to import procedures into the Model 9100, we've eliminated the added cost and complexity of a separate computer – so operators don't have to be conversant with Windows™ software to enjoy the benefits of semi-automated calibration.

For commonly used instruments, the chances are you'll find the calibration procedures you need in our comprehensive procedure library. Already containing over 800 fully tested procedures, this library is continually being added to as part of Wavetek's ongoing commitment to calibrate the widest range of equipment possible.

If you want to write your own procedures, or you want to fully automate the calibration of instruments that can be controlled and interrogated via the IEEE-488 bus, you can integrate the Model 9100 into a PC-based calibration workstation, by running Wavetek's Portocal-II or 9010 calibration software. In addition to directly



controlling a Model 9100 calibrator, both Portocal-II and the 9010 software let you transfer calibration procedures to PCMCIA cards so that you can run them on a stand-alone Model 9100.

To make the operator's task as simple as possible, the Model 9100 solves other aspects of the calibration process as well.

Before running a procedure, all the additional information required for ISO9000 compliance – such as the operator's name and the instrument-under-test serial number – can be entered using the Model 9100's alphanumeric keypad.

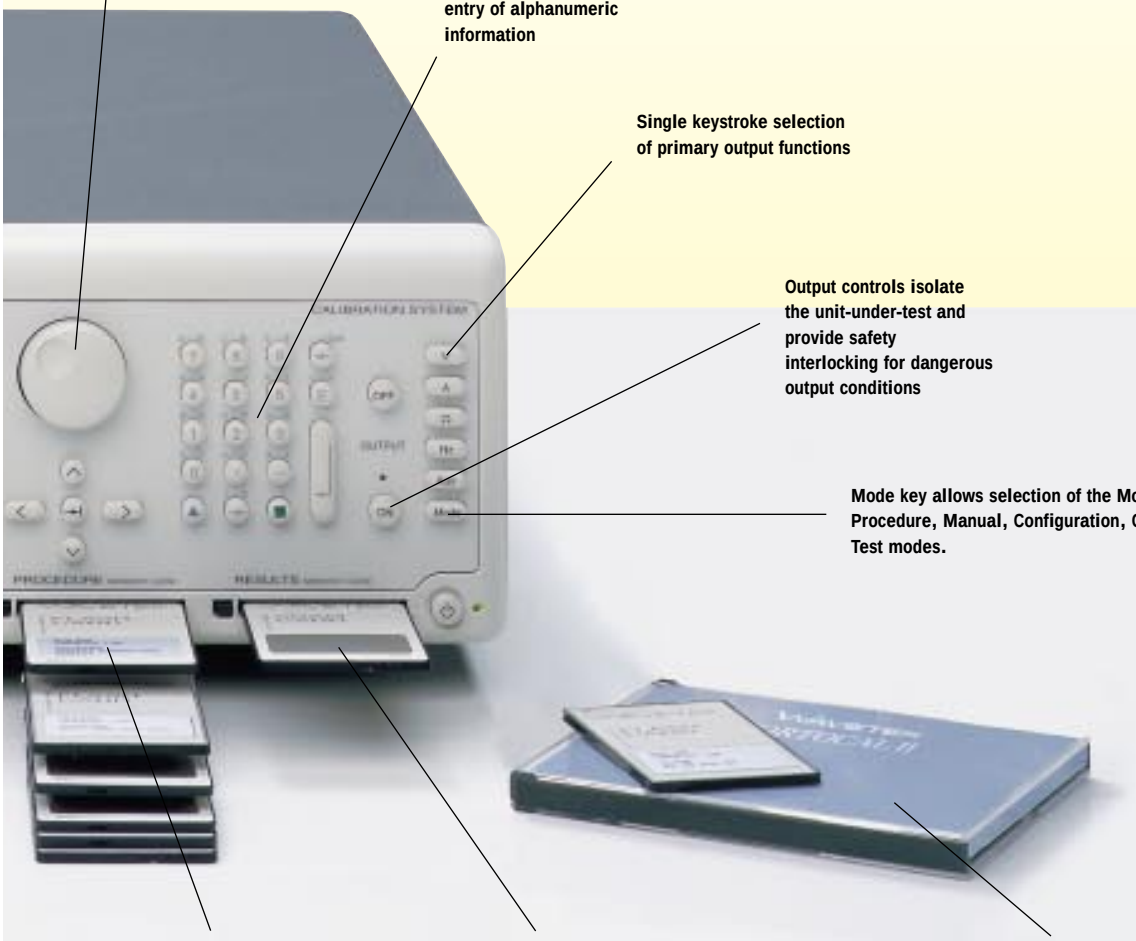
An optional trackerball provides finger-tip control of output values, go/no-go decision making and procedure stepping. And after the procedure has been completed, a single keystroke prints out a full certificate of calibration results on any Centronics compatible printer.

The whole process is as simple as A-B-C, taking less than five minutes for the average test instrument.

Even when you use the Model 9100 in manual mode, we've given it a simplicity of operation that minimizes human error and speeds the calibration process.

Frequently used functions such as Voltage, Current and Resistance have dedicated front-panel keys that allow you to activate them at the touch of a button. Less commonly used functions are selected using screen menus and soft-keys to avoid cluttering the front-panel with too many keys.

Three different methods of adjusting the output value – numeric entry, increment/decrement keys or spinwheel control – let you choose one that suits the calibration operation. Soft keys allow you to implement any of the commonly used range sequences, while Δ and Δ% modes give you an instantaneous display of output deviation.



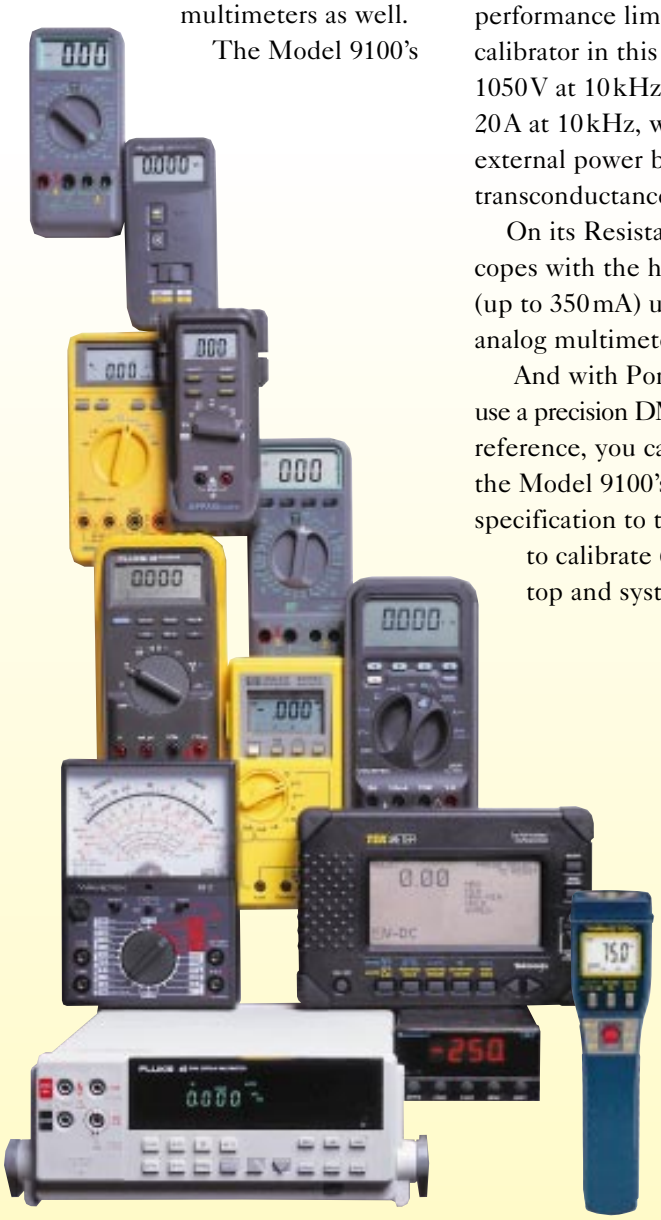
Multimeters and Panel Meters

Almost every year, DMM manufacturers introduce new models with more ranges and functions than ever before. To protect your investment in calibration equipment you need a calibrator that will cope with next-generation instruments, as well as those which make up today's calibration workload. To be really flexible, you also need one that will deal with analog multimeters as well.

The Model 9100's comprehensive range of outputs, which includes DC and AC Voltage, DC and AC Current, Resistance, Conductance, Capacitance, Frequency, Duty Cycle, Pulse Width, Logic Level and RTD/Thermocouple simulation, covers all the functions you're likely to find on modern DMMs. Every one of these functions has sufficient span to test virtually any multimeter to its performance limits. No other calibrator in this class can deliver 1050V at 10kHz, 350V at 30kHz or 20A at 10kHz, without the use of external power boosters or transconductance amplifiers.

On its Resistance function, it copes with the high sense currents (up to 350mA) used by older analog multimeters.

And with Portocal-II's ability to use a precision DMM as a system reference, you can even enhance the Model 9100's accuracy specification to the level required to calibrate 6-1/2 digit bench-top and systems DMMs.



Specifications

Uncertainties are for 1 year, Tcal ± 5°C.

FUNCTION	RANGE
DC Voltage	Zero to ±1050V
AC Voltage	Zero to 1050V 10Hz to 100kHz
DC Current	Zero to ±20A (Up to 1000A via current coil*)
AC Current	Zero to 20A (Up to 1000A via current coil*) 10Hz - 30kHz
DC Power	1mW to 20kW (Up to 1MW via current coil*)
AC Power	1mW/mVAR to 20kW/kVAR (Up to 1MW/MVAR via current coil*)
Resistance	Zero to 400MΩ
Conductance	2.5nS to 2.5mS
Capacitance	500pF to 40mF
Frequency	0.5Hz to 10MHz
Duty Cycle	0.05% to 99.95%
Pulse Width	0.30µs to 1999.99ms
Logic Level and Pulse	TTL, CMOS and ECL
Waveforms	Sine, square, triangle, trapezoid and impulse
Phase	±180°
Temperature (IPTS68 or ITS90)	
Thermocouples	
Type	B, C, E, J, K, L, N, R, S, T
Temperature	-250°C to +2320°C
RTD	
Type	Pt385, Pt392
0°C Resistance	10Ω to 2kΩ
Temperature	-200°C to +850°C

**The 50-turn coil has been designed for optimum accuracy and inductance. With some clamp meters and power meters, especially those using Hall effect sensors, the increase in inductance due to the design of*

Power Meters

Fitted with its Power Meter Calibration option (Option PWR), the Model 9100 simultaneously generates voltages and currents as high as 1000V and 1000A at any phase angle between ±180°, allowing you to calibrate power meters up to 1MW and 1MVAR.

Its ability to output squarewave, impulse, triangular and trapezoidal waveshapes as well as sinewaves allows you to evaluate power

RESOLUTION	BEST UNCERTAINTY
1µV	0.006%
1µV	0.04%
1nA	0.014%
1nA	0.07%
1mW	0.03%
1mW or 1mVAR	0.125%
100µΩ	0.015%
0.1pS	0.04%
0.1pF	0.3%
1mHz	25ppm (0.25ppm with Option 100)
0.01%	35ns
0.1µs	25ppm (0.25ppm with Option 100)
0.01°	0.07°
0.1°C	0.17°C
0.01°C	0.08°C

the current clamp may limit the Current/Hertz profile obtainable from the Model 9100. In some cases, 1000A may not be attainable at higher frequencies.

Clamp Meters

The Model 9100's unique Current Coil option (Option 200) overcomes all the magnetic circuit problems normally associated with clamp-on ammeter calibration.

The coil module incorporates x10 and x50 coils, both of which feature internal magnetic shielding to eliminate interference from stray flux. Even the x50 coil accepts the full 20A output of the Model 9100 with sufficient voltage compliance to calibrate most popular clamp meters at currents up to 1000Arms. Yet the whole module is small enough and light enough to sit comfortably on the bench.

Because the coils can be driven with AC or DC currents, they are just as suitable for calibrating meters based on Hall-Effect* sensors as they are for calibrating meters that use a current transformer.

Once you've selected the x10 or x50 coil from the Model 9100's on-screen menu, all outputs are automatically scaled to the correct values, as are the calibration results that are printed out or transferred onto PCMCIA cards.

meter performance with simulated 'real-world' currents and voltages — such as those drawn by switchmode power supplies and lighting ballasts.

To calibrate harmonic analyzer functions, the Model 9100 generates harmonics up to 3kHz at amplitudes as high as 3.2Vrms.

Power meter calibration has never been as easy or as thorough.

Insulation/Continuity Testers

The high stimulus voltages delivered by insulation testers make particular demands on a calibration system. Demands that previously required the use of complicated switched resistor networks and high-impedance DMMs.

The Insulation/Continuity Tester option for the Model 9100 (Option 135) changes all that by employing a unique High-Voltage Active Resistance Technology that simulates variable resistances as high as 2GΩ at voltages up to 1350V. It also provides you with a simultaneous read-out of the test voltage and current. These features are unmatched by any other multi-product calibrator.

In addition to calibrating insulation resistance, Option 135 also calibrates the continuity test functions that are often provided on insulation testers. Four-Wire Active Resistance outputs from zero to 4kΩ allow you to precisely determine continuity thresholds. Direct read-out of current allows you to calibrate unit-under-test current sources.

Fitted internally, Option 135 is fully compatible with other Model 9100 options such as the Power Meter and Scope Calibration options.

Specifications

Uncertainties are for 1 year, Tcal ± 5°C.

FUNCTION	RANGE	BEST UNCERTAINTY
Insulation Resistance		
Resistance	100kΩ to 2GΩ	0.1%
Voltage (measured)	Zero to 1350V	0.6%
Current (derived)	1µA to 2.3mA	1.5%
Continuity		
Resistance	Zero to 4kΩ	0.035%
Voltage	Zero to 10V	
Current (derived)	100µA to 350mA	1.0%

Oscilloscopes

Adding one of the Model 9100's two Oscilloscope Calibration options (Option 250 or Option 600) allows you to comprehensively calibrate oscilloscopes up to 250MHz or 600MHz.

All the outputs required to calibrate the gain, linearity and bandwidth of vertical and horizontal deflection circuits, and the accuracy and linearity of timebase circuits, are delivered through a single pair of BNC cables (one for the calibration waveforms and one for the trigger signal), making complex lead changes a thing of the past. Full accuracy is maintained right up to the scope's BNC inputs.

These scope calibration options provide precision DC levels and 1kHz squarewaves up to 120V for vertical and XY deflection calibration, plus continuously variable leveled sine-waves from 10Hz to 250MHz (Option 250) or 10Hz to 600MHz (Option 600) for bandwidth and AC flatness checks.

They both generate ultra-fast low-level edges at repetition rates high enough to allow even the shortest persistence traces to be examined for overshoot, undershoot and ringing. And they generate fast high-level edges so that you can check the AC performance of input attenuators.

Clearly visible timing markers at intervals as short as 2ns or as far apart as 5 seconds calibrate timebase accuracy, while an optional high-stability crystal reference (Option 100) improves basic timing accuracy from 25ppm to 0.25ppm in order to calibrate high-performance DSOs.

And if you ever need to calibrate oscilloscopes with bandwidths higher than 600MHz, or require full multi-channel automation, remember that Wavetek also produces a range of dedicated scope calibration workstations – the Model 9500 Series.

Specifications

FUNCTION	RANGE
Voltage Amplitude*	
Into 1MΩ	5mV to 120V pk-pk dc and 1kHz
Into 50Ω	5mV to 3V pk-pk at 1kHz Up to ± 2.5V dc
Range Sequence	1-2-5
Adjustment	±10%
Low Edge*	
Amplitude into 50Ω	100mV to 1.1V pk-pk
Rise/Fall Time	<1ns
Period	100ns to 10ms
High Edge*	
Amplitude into 1MΩ	1V to 50V pk-pk
Rise Time	<100ns
Period	10µs to 10ms
Leveled Sinewave*	
Frequency	
Option 250	10Hz to 250MHz
Option 600	10Hz to 600MHz
Amplitude into 50Ω	4.5mV up to 5.5V pk-pk
Amplitude Adjustment	±10%
Markers*	
Period	
Option 250	4ns to 5s
Option 600	2ns to 5s
Range Sequence	1-2-5
Amplitude	Up to 1V into 50Ω
Timing Accuracy	
Normal	25ppm
With Option 100	0.25ppm

**External trigger output provided*

Electronic Thermometers

Capable of simulating ten different thermocouple types, plus RTDs with nominal resistance values anywhere between 10Ω and 2kΩ, the Model 9100 covers the calibration requirements of all popular electronic thermometers.

An exceptionally wide temperature range is offered from -250°C to +2320°C with temperature entry in either degrees Centigrade, degrees Fahrenheit or Kelvin.

And the Model 9100's conversion algorithms can be switched to follow either the IPTS68 or ITS90 temperature scales, producing precision

Counters

By adding the High Stability Crystal Reference option (Option 100) you can increase the Model 9100's frequency and timing accuracy to 0.25 ppm, making it suitable for counter/timer calibration.

voltage or resistance outputs that accurately simulate temperature to a resolution of 0.1°C for thermocouples or 0.01°C for RTDs.

The use of a specially designed thermocouple connector, which features integral cold junction sensing, allows thermometers to be calibrated on the workmat or connected directly into the Model 9100's front-panel terminals via a longer length of thermocouple cable – making it as easy to calibrate panel mounted temperature meters as it is to calibrate handhelds. For RTD meter calibration, the Model 9100 can be used with either 2-wire or 4-wire lead connections.

Specifications

Uncertainties are for 1 year, Tcal ± 5°C, and include cold junction compensation errors. Stated in °C. Selectable IPTS68 or ITS90 temperature scales.

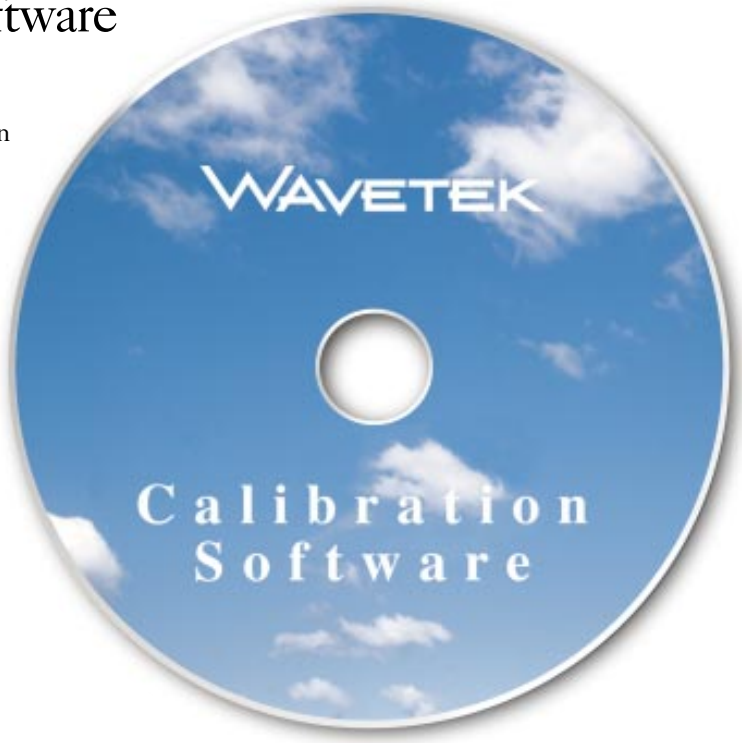
FUNCTION	RANGE	RESOLUTION	BEST UNCERTAINTY
Thermocouple			
Type			
B	+500°C to +1820°C	0.1°C	0.34°C
C	0°C to +2320°C	0.1°C	0.27°C
E	-250°C to +1000°C	0.1°C	0.17°C
J	-210°C to +1200°C	0.1°C	0.19°C
K	-250°C to +1372°C	0.1°C	0.19°C
L	-200°C to +900°C	0.1°C	0.18°C
N	-200°C to +1300°C	0.1°C	0.22°C
R	0°C to +1767°C	0.1°C	0.28°C
S	0°C to +1767°C	0.1°C	0.35°C
T	-250°C to +400°C	0.1°C	0.17°C
RTD			
Pt 385 10Ω to 2kΩ	-200°C to +850°C	0.01°C	0.08°C
Pt 392 10Ω to 2kΩ	-200°C to +630°C	0.01°C	0.08°C

Recorders

Because modern data recorders can be configured to accept a wide range of signal inputs – including thermocouples, 20mA current loops, unipolar/bipolar voltages, and digital bit streams – you need a versatile calibrator to calibrate them.

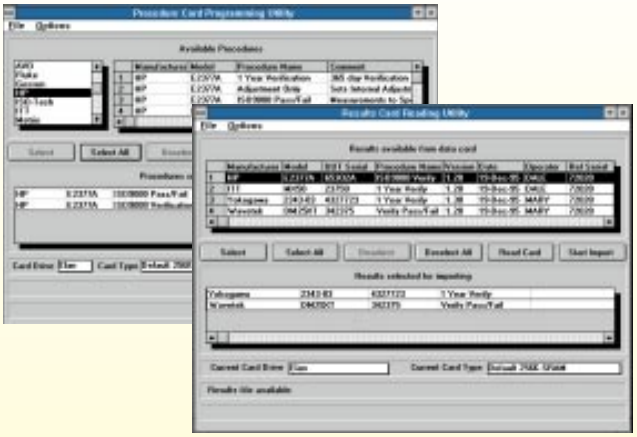
The Model 9100's comprehensive coverage of functions, ranges and waveforms, in both the analog and digital domains, makes it an ideal unit for calibrating these instruments.

9010 Calibrator Support Software



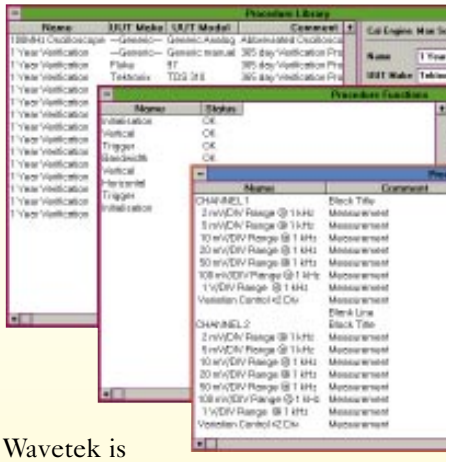
Running under Windows™, the 9010 Support Software allows you to automate the calibration process, either by using the Model 9100's PCMCIA-based procedure mode or by integrating the calibrator into a PC-based IEEE-488 bus system. It also gives you the ability to generate custom calibration procedures, analyze and archive calibration results and print custom reports and certificates, while its powerful inventory management capabilities maintain calibration records and help you schedule instruments through your calibration laboratory. To ensure you get the productivity benefits from the moment you install the software, it comes complete with a library of over 800 calibration procedures for popular test and measurement equipment.

Easy Procedure Execution



If you run the Model 9100 in an IEEE-488 bus system, you execute calibration procedures directly from the PC. If you use procedure mode, you transfer procedures and results to and from the Model 9100 on PCMCIA cards. The 9010's Procedure Card Programming and Results Card Reading utilities support a wide range of PCMCIA card types, reducing procedure/results selection to simple point-and-click operations. You can even control the language in which annotation on the Model 9100's LCD is displayed. A suitable PCMCIA card drive can be supplied with the 9010 software.

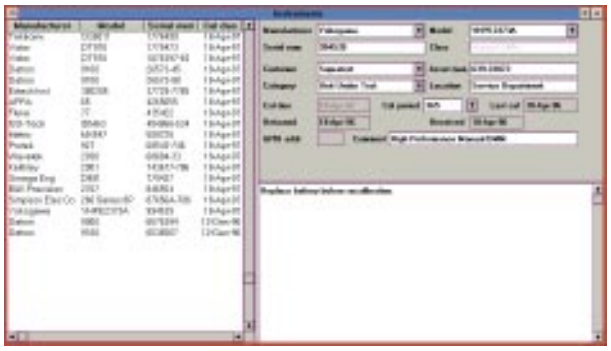
New Procedure Generation



Wavetek is continuously generating new procedures for the Model 9100, making them available for instant download from its World Wide Web site (www.wavetek.com) as part of the Portocal-II/9010 Option 10 support program.

However, if you do need to write your own procedures, the 9010

Sophisticated Data Management

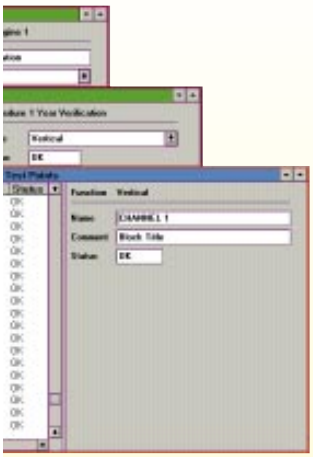


In addition to supporting the Model 9100 Calibrator, the 9010 Software is a complete inventory management package in its own right. It can store complete information, including extended repair histories or special notes, on any instrument – not only those calibrated by a Model 9100.

Calibration results are uniquely attached to the instrument's inventory record, together with all the information required by stringent quality standards such as ISO9000 to ensure both forward and backward traceability.

Full network access to the entire instrument inventory database means you can integrate the 9010 Software into sophisticated information management systems.

We've also recognised the need for users to add corporate identity to their documentation. That's why the 9010 Software has a built-in report generator that allows you to design your own certificates and reports, complete with company logos, custom headers and footers etc.



Software contains a powerful yet easy to use procedure generator. Powerful because it enables you to write procedures entirely logically using a hierarchical approach. Easy to use because the complete process is menu driven so that you won't have to remember a single programming language instruction.

Portocal-II

The Portocal-II Software does everything the 9010 Support Software can do, plus it allows you to integrate the Model 9100 alongside other calibrators in a fully automated PC-based calibration system. Portocal-II supports all 9000-Series, 4800-Series and 4000-Series calibrators from Wavetek, plus a range of calibrators from other manufacturers. It also supports the use of measuring instruments as system references, making it possible to enhance the Model 9100's accuracy specification.

By monitoring the output of the Model 9100 with a precision DMM, such as a Wavetek Model 1281, the higher accuracy of this DMM can be transferred to the Model 9100's outputs. Portocal-II calibration procedures that use this technique to allow a Model 9100 to calibrate 6-1/2 digit DMMs (for example, the Hewlett Packard HP34401A) are already in the procedure library.

Reliability and Support

The Model 9100's built-in reliability not only ensures that the unit gives you years of trouble-free service, it also ensures maximum operator safety.

Comprehensive power-on self-test routines check all the major internal circuits for correct operation, while internal watchdogs continuously monitor the status of the calibrator for fault conditions. Automatic shut-down of the output under fault conditions protects the operator and prevents equipment damage.

Zero Downtime Recalibration

In common with all other calibrators from Wavetek's Test & Measurement Division, the Model 9100 can be calibrated using our Model 4950 Multifunction Transfer Standard System.

And because we offer a unique on-site calibration service based around the Model 4950, your Model 9100 won't even have to leave the bench to be calibrated – so you won't incur expensive downtime and shipment costs. For more information on our Model 4950 On-site Calibration Service, contact your local Wavetek Service Center.

Global Customer Care

In addition to providing innovative, customer-focused solutions for calibration and test, our mission is to provide the highest quality of customer service and care worldwide.

Wavetek has Master Service Centers and Calibration facilities in the United States, United Kingdom, France, Germany, China and Singapore, that work closely with a network of service partners throughout the world.

This global network provides a range of preventative maintenance, repair, calibration and other value-added services – proof of our commitment to deliver services that meet the highest standard of customer satisfaction.

General Specification

Environment

Temperature:

Operating:	5°C to 40°C
Storage:	0°C to 50°C

Humidity (non-condensing):

Operating:	<90% over 5°C to 30°C; <75% over 30°C to 40°C.
Storage:	<95% over 0°C to 50°C.
Warm-up Period:	20 minutes

Power

Voltage:	100V/120V/220V/240V ±10%
Frequency:	48Hz to 63Hz
Consumption:	450VA maximum

Dimensions

H x W x D:	133 x 427 x 460 mm (5.24 x 16.8 x 18.1 inches)
Weight:	18.5kg (41lbs)

Safety

Designed to UL3111 and EN61010-1-1:1993/A2:1995
CE Marked

EMC

Emissions:	EN55011:1991
Generic Immunity:	EN50082-1:1992

FCC Rules part 15 sub-part J class B

Detailed Specification

For detailed performance specifications see separate booklet '9100 Specifications'

Ordering Information

Model 9100	Universal Calibration System including Lead Kit, Workmat and Calibration Certificate
Option 10	Blank 256-Kbyte FLASH card
Option 30	Blank 256-Kbyte battery-backed SRAM card
Option 50	Tracker ball
Option 60	Carry case
Option 65	Ruggedized Transit Case
Option 70	NAMAS Calibration Certificate
Option 90	Rack Mounting Kit
Option 100	High Stability Crystal Reference
Option 135	Insulation/Continuity Tester Calibration Module (fitted internally)
Option 200	x10/x50 Current Coils
Option 250*	250MHz Oscilloscope Calibration Module (fitted internally)
Option 600*	600MHz Oscilloscope Calibration Module (fitted internally)
Option PWR	Power Meter Calibration Module (fitted internally)

** Option 250 and Option 600 cannot be fitted together*

Software

9010	Windows™ Automated Calibration Software for Wavetek 9000-Series Calibrators
Portocal-II	Windows™ Automated Calibration Software for Wavetek Calibrators and Calibrators from Other Manufacturers (See separate Portocal-II brochure)

Procedure Library

Access ***www.wavetek.com*** to view the latest list of procedures

Other Calibration Instruments from Wavetek

4800-Series DMM Calibrators

DC & AC Voltage, DC & AC Current and Ohms. Calibration of DMMs to 8-½ digits. Two levels of precision.

Model 9500 Oscilloscope Calibration Workstations

High accuracy calibration of analog and digital-storage oscilloscopes up to 3.2 GHz.

Model 4950 Multi-Function Transfer Standard

Ultra-stable transfer measurements for on-site calibrator support.

Model 4920 Alternating Voltage Measurement Standard

The world's most advanced AC Voltage measuring instrument.

Model 1281 Precision Digital Multimeter

Ultra-low noise, 8-½ digit precision, multi-function measurements.

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