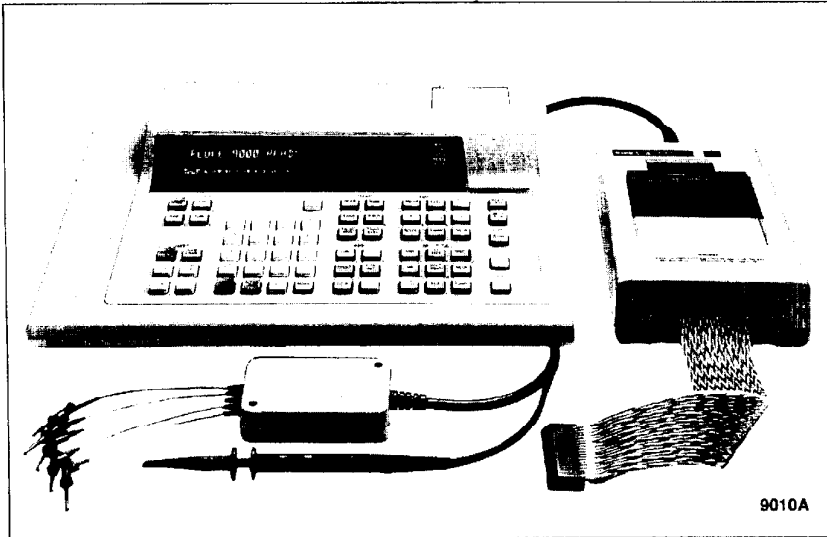


# Board Testers & Troubleshooters

9000 Series



RS-232



## Partial List of Processors Supported

Z80A	68010	8042	8344
Z80B	6802	8044	8741
Z8001	6802NS	8048	8741A
Z8002	6808	8049	8742
Z8003	6809	8050	8744
Z8004	6809E	8051	8748
1802	8031	8052	8749
1804	8032	8080	8751
1805	8035	8085A	9900
1806	8039	8085-2	80186
6502	8040	8086	80188
6800	8041	8088	80286
68000	8041A		

The 9000 Series Micro-System Troubleshooters – 9005A, 9010A, and 9020A – are among the most comprehensive troubleshooting instruments ever developed for locating faults on microprocessor-based systems. They include built-in preprogrammed test routines for checking the entire microprocessor kernel: bus, RAM, ROM, and I/O. Included is a troubleshooting probe that you can use either to monitor logic action on a node-by-node basis or to inject stimulus pulses.

The three troubleshooters differ primarily in their programming and system capabilities.

**The 9010A** is a self-contained, programmable model that lets you develop your own customized test programs. Using the 9010A, you can perform specialized guided fault-isolation routines on any portion of a board's digital circuitry.

**The nonprogrammable 9005A** includes the same built-in tests as the 9010A but cannot generate new test routines. It can, however, run test sequences developed on the 9010A and transferred from a mini-cassette tape. With the optional RS-232C interface, you can also download test sequences directly from the 9010A or a host computer. Typically, you would develop guided fault-isolation programs at a central location, using a 9010A, and then run the programs at remote sites on 9005As.

**The 9020A**, designed for systems use, runs test programs written and stored in a system controller or other computer. You can also combine the 9020A with other test instruments to troubleshoot complex microprocessor-based products with special measurement and control problems. The 9020A has no programming keys or cassette tape capability, so test sequences must be executed through the RS-232C or GPIB/IEEE-488 port.

## Read/Write Emulation

The 9000 Series Micro-System Troubleshooters eliminate tedious, manual probing techniques. Instead, they take control of the unit under test by plugging into its microprocessor socket. They then emulate the actions of the microprocessor, both reading data from and writing data to the unit's RAM, ROM, and I/O addresses.

## 9000 Series Micro-System Troubleshooters

### Special Functions

- Preprogrammed functional tests offer structured testing and troubleshooting of the  $\mu$ P's BUS, RAM, ROM and I/O Registers.
- TROUBLESHOOTING functions: simple READ and WRITE commands allow you to stimulate and observe responses from peripheral interface adapters (PIAs, CTCs, and UARTs) and circuitry beyond the  $\mu$ P bus. Several special functions are available (RAMP, WALK) with preprogrammed stimulus sequences.
- Optional RS-232C: easy downloading of programs and test results to storage mediums, printers and other testers at remote locations. Optional GPIB/IEEE-488\* for computer controller operation (9020A).
- TAPE deck controls for storing and reading programs and UUT memory maps on the mini-cassette.

- LEARN function which is used on a "known good" system, finds and maps RAM, ROM and read/writable I/O addresses.
- Hexadecimal entry of address descriptors.
- MODE control of tests and programs.
- TEST SEQUENCING and ARITHMETIC keys for creating unique user-generated test routines. (9010A only.)
- PROBE controls used for synchronizing the troubleshooting probe to  $\mu$ P cycles and to drive nodes high and/or low.
- Pod design provides for safe easy use – extensive input protection prevents damage to the pod from common accidental abuses such as plugging the pod into the socket backwards. Plug is inserted into socket on pod for self-test. Pins can be protected there when not in use.

\*The terms GPIB and IEEE-488 may be used interchangeably throughout this catalog.

# Board Testers & Troubleshooters

## 9000 Series

### Built-in Tests

Fluke has taken the trouble out of verifying that the kernel – the heart of the microprocessor system – is operating properly, by including built-in kernel tests in all the 9000 Series Troubleshooters. These tests, initiated by a single keystroke, check the electrical integrity of the microprocessor bus, the read/write capability of the I/O registers, the data in ROM, and RAM operation. A fifth built-in test provides more extensive RAM tests when necessary, checking for pattern-sensitive failures.

The five tests, which cover more than 50% of the components on most boards, check for the problems that are often the most difficult to identify and isolate – including failures that lock up the microprocessor bus. Even if the troubleshooters had no other capabilities, the time saved by these built-in tests alone would more than justify their cost.

Of the five built-in tests, you should run the bus test first, since it verifies the integrity of the microprocessor's basic communication network. To test the remainder of the kernel, you need to enter the address range of RAM, ROM, and I/O for the unit under test, so the troubleshooter will know what addresses to read from and write to. You can enter this information manually through the front-panel keyboard or read it from a mini-cassette – or, if you have the RS-232C interface, you can download it from a host computer or system controller. If address information is not readily available from the unit's documentation, there is a LEARN algorithm to let you generate a memory map from a known-good board. Once entered, memory-map information can be stored on a mini-cassette for later use (9005A/9010A).

### Beyond the Bus

The 9000 Series Troubleshooters aren't limited to finding kernel-related problems: they can also isolate failures in synchronous circuitry outside the bus. The troubleshooting probe that comes with the 9000 Series will help you track such off-the-bus failures to their source. This probe is a powerful fault-finding tool, useful both for monitoring logic action and for injecting stimulus pulses.

In monitoring, or response mode, the troubleshooting probe takes signatures, counts events, and shows high/low logic states in each node probed. In stimulus mode, it can inject high or low pulses to stimulate readouts, print heads, interfaces, or other devices. Driven by a sync pulse from the interface pod, the probe can be synchronized to various microprocessor events, such as valid address or data periods on the microprocessor bus. You can also choose to use it in "free run" mode, injecting 1 kHz pulses at the contacted nodes.

To further extend the capabilities of the troubleshooting probe, add the asynchronous signature option. This option lets you test asynchronous circuits located outside the microprocessor bus structure (such as DMA controllers, video controllers, and video-generation circuits) without using a logic analyzer or oscilloscope. Tests performed include signature gathering, waveform capture, and event counting. For more information, see the description of the Asynchronous Signature Probe Option.

### Custom Test Programming on the Fluke 9010A

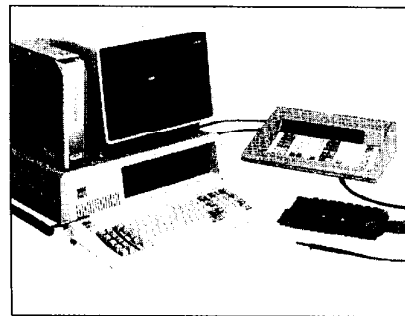
The 9010A lets you write your own comprehensive test routines tailored to the unique characteristics of the equipment you service. These programs can include prompting messages to help guide your technicians through the test procedures. Once written, your test programs can be stored on mini-cassettes for later use – or for downloading to a 9005A.

You can generate your own test software in two ways. First, you can develop short programs right on the 9010A's keyboard, in much the same way as with a scientific calculator. Second, for more extensive test routines, you can use the 9010A's Language Compiler, developing programs off-line on a personal computer and then downloading them to either a 9010A or 9005A. The compiler runs on a number of popular personal computers, including the IBM® PC and Kay Pro II® as well as on the Fluke 1720A and 1722A Instrument Controllers. For more information, see the description of the Language Compiler on the next page.

### A Powerful Test System Using the Fluke 9020A

The combination of a Fluke 9020A Micro-System Troubleshooter with an IBM or IBM compatible personal computer and Fluke's TestWriter™ software gives you a powerful system for performing large-scale guided fault-isolation. In this system, the 9020A is used to stimulate and gather response information from the unit under test; the personal computer acts as both the system controller and the storage medium; and the TestWriter software minimizes programmer time through simplified data-entry procedures.

This test configuration makes developing test programs so easy that it opens the door to new types of tests – tests that previously would have required too much programming time to be cost-effective. And it makes performing the tests so simple that virtually any technician can immediately begin troubleshooting, without going through the extensive training required to use more traditional test techniques.



### Options and Accessories

#### Utility Tape (9000A-910)

The 9000A-910 Utility Tape contains many programs designed to enhance the operation of the 9010A. These include:

- Merge Tape – Lets you read specific programs from a mini-cassette tape, renumbering them as desired and merging them with programs already in the 9010A. With this utility, you can combine programs from two or more tapes onto a single tape.
- Frequency Counter – Lets you use the troubleshooting probe to measure frequencies of up to 6 MHz.
- Setup – Lets the 9010A operator make changes in the setup menu while the system is under program control.
- Probe Pulser – Lets the 9010A operator change pulser status while the system is under program control.
- Register Addition and Subtraction – Allows for the addition or subtraction of the contents of two registers while the system is under program control.

The Utility Tape comes with a manual and one mini-cassette that describes how to use each of these programs.



### Language Compiler (9010A)

If your test routines are short, you can develop them right at the keyboard of the 9010A. For more extensive test routines, you'll find it easier to work off-line on a personal computer, using the 9010A Language Compiler and downloading the results to the 9010A.

The language compiler lets you write extensive test and troubleshooting routines more quickly and conveniently. The compiler is available in several versions, offering compatibility with the following computer systems:

- IBM® Personal Computer (9010A-923)
- Kay Pro® II (9010A-922)
- Fluke 1720A and 1722A Instrument Controllers (9010A-920)

Sophisticated development tools come with the Compiler to speed the program-development process. Using these features, you can:

- Share common test routines among multiple programs through a File Inclusion feature, linking them together automatically at compile time.
- Save time when entering code by using keyword abbreviations, optional command keywords, and shorthand notations.
- Assign symbolic names to your programs, labels, and registers, making it easier to understand and remember the purpose of the different program sections.
- Document programs with comments imbedded within the program listing, making them easier to follow should you later wish to revise them.

### Asynchronous Signature Probe Option (9000A-006)

The 9000A-006 Asynchronous Signature Probe Option gives you high-powered fault isolation capabilities for asynchronous circuits located outside the microprocessor bus structure. With this option, you no longer need to augment your 9000 Series Troubleshooter with a logic analyzer.

By adding the asynchronous signature probe to the 9000 Series, you gain the ability to perform real-time measurement of such asynchronous circuits as:

- DMA controllers
- Video controllers
- Video-generation circuits
- Communication circuits
- Peripheral controllers

The asynchronous signature probe provides three distinct troubleshooting measurements:



- Signature gathering, using the cyclic redundancy check technique.
- Waveform capture, in which the probe-tip data stream is sampled every 20 nanoseconds for a total of up to 32 data samples. The results of this sampling are both displayed and stored.
- Event counting, a powerful tool for node characterization. Using this feature, you can count events from the probe tip, either continuously or through a measurement window. A 24-bit register allows you to record over 16 million events.

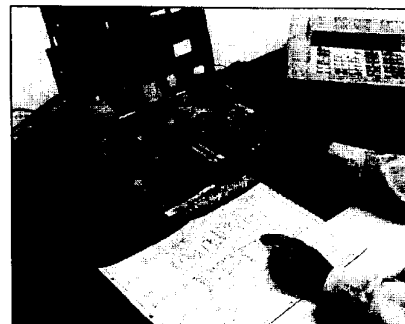
The asynchronous signature probe consists of a circuit board, installed in the 9000 Series mainframe; a clock module, which picks up timing and control signals from the unit under test; and a special set of operating programs contained on a mini-cassette tape.

### FREE Training Certificate Program

When you purchase any of the 9000 Series models, you will receive, upon request, a special certificate entitling you to the 9010 Board Tester Troubleshooting course. You will enhance your troubleshooting proficiency and become productive even faster with this program.

### Upward Migration from the 9010A to 9100A

For 9010A users who require upward compatibility of their existing programs to the 9100A, there is an automated program available for this purpose. The 9010A to TL/1 Translator (9100A-030) converts 9010A programs into the 9100A TL/1 language.



### TestWriter™ (9020A-925)

Fluke's TestWriter software, combined with the 9020A Micro-System Troubleshooter, an interface pod, and an IBM (or IBM-compatible) personal computer, makes it easy to develop Guided Fault-Isolation (GFI) or automated diagnostic programs for digital circuit testing. In this configuration, the personal computer, communicating with the 9020A-001 through its RS-232C interface, acts as both a system controller and a storage medium.

TestWriter offers the best of both worlds in regards to program generation and execution. Programmers will welcome TestWriter's time-saving and simplified data entry procedures. Operators will appreciate the use of menus in directing the testing process, as well as the easy-to-read graphic feedback of the testing process.

TestWriter's ability to automatically generate a fault tree eliminates the tedious time-consuming process of entering individual decision statements when structuring a program. The programmer simply enters UUT descriptive information: the component types and their interconnectivity. This time-saving feature, together with the increased memory capacity in the PC is what makes TestWriter extremely effective when generating large GFI programs.

The test engineer proceeds by developing a set of stimulus routines; one and, sometimes, several for each node on the UUT.

The last step in completing the GFI program is to gather responses on each node of a "known good" UUT while stimulated by the corresponding stimulus routine(s). These responses are stored in a separate file which will be used for comparison with responses from a defective board during the fault isolation process.

TestWriter also simplifies the process of troubleshooting defective units. The operator makes selections from menus, aided by prompts and graphic displays. The personal computer automatically sends the appropriate commands to the 9020A and records the responses. It also provides a graphic display of the node that the operator is probing, along with the other points that drive that node.

As each nodal measurement is taken, the display will show whether the response was

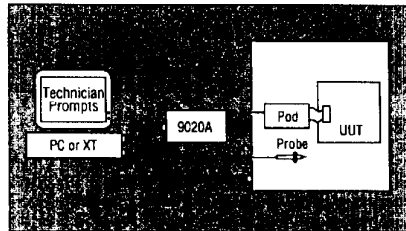
# Board Testers & Troubleshooters

## 9000 Series

GOOD or BAD. The software will continue to ask for probe points until it can make a decision on the cause of the problem. Once made, this decision is displayed on the CRT.

For cases where the operator is experienced in troubleshooting a particular board, TestWriter also allows unguided fault isolation, in which the operator decides the order in which nodes are to be tested.

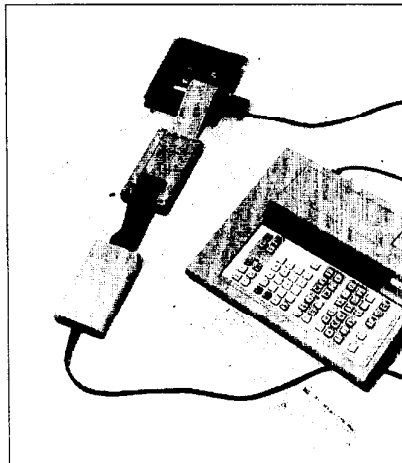
### Test Station Configuration



### Upgrade Kit (9010A/GF)

This kit, in conjunction with the 9010A-001 (RS-232C interface port), transforms a 9010A into a dual purpose unit: it will continue to function as a standard 9010A and, in addition, can function as a 9020A-001. As a 9020A, this unit can operate with the above described TestWriter software, which executes on an MS-DOS compatible personal computer.

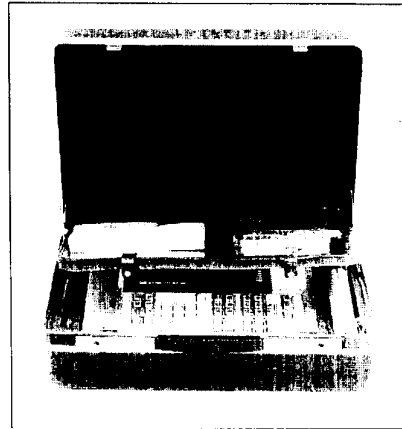
This upgrade kit allows you to execute all existing test procedures on the 9010A and expands its utility by offering you the ability to interface it with a PC and utilizing the power of the TestWriter software system.



The upgrade may be ordered as a kit for Fluke field service center installation in your unit or can be ordered factory installed for new units. The installation adds an internal module and a switch labeled GFI (Guided Fault Isolation) on the rear panel. In the GFI-ON mode the 9010A with 9010A/GF option behaves as a 9020A.

### Transit Case (9000A-900)

Lockable hard case holds 9000 Series pod, probe, accessories, four mini-cassette tapes, and user's manual. Foam-lined, sturdy construction.



## Specifications

### Technical Specifications

**Display:** Vacuum fluorescent; displays up to thirty-two 14-segment alphanumeric characters at once

**Self-Test:** All 9000 Series units perform self-tests at each power-up, verifying proper operation of internal RAM, ROM, clock, power supply, display, and communications with interface pod. The pod has its own self-test socket to verify proper operation at microprocessor plug.

**Test Speed:** Tests run at full system speed, based on clock in unit under test

**Keyboard Data Entry:** Hexadecimal 0 through 9 and A through F

**Mag Tape:** (9005A and 9010A only). Mini-cassette tapes store all "learned" data plus test programs generated on-line for off-the-bus testing. One tape holds up to 12K bytes - the same as internal memory on the 9005A and 9010A. Both units come with a built-in tape drive.

**Interface Pod:** Plugs into 9000 Series mainframe; must match type of microprocessor used in circuits being tested. Pods available for 8-bit and 16-bit microprocessors. Special circuitry protects pods from damage even if plugged in backwards.

**Troubleshooting Probe:** Plugs into 9000 Series mainframe. In response mode, takes signatures, counts events, shows logic states; in stimulus mode, injects either clock-synchronized or 1 kHz pulses. Measurement thresholds are 0.8V (low), 2.4V (high). Stimulus pulses are <0.2V at 100 mA (low), >4V at 100 mA (high). Probe is protected to  $\pm 30V$ .

### Automatic Functions Summary

**Learn Mode:** (9010A and 9020A only). Uses a known-good system of same type as unit under test to locate and determine size of RAM, ROM, and read/writeable I/O registers, and to compute signatures. Stores results in memory for immediate comparison to circuits being tested; data can also be saved on mini-cassette or (with RS-232C option) downloaded to another system or device.

**Built-In Kernel Tests:** Using data entered either automatically through Learn mode or manually through the keyboard, the 9000 Series Troubleshooters can perform the following tests of kernel circuitry (each initiated by a single keystroke):

- **BUS** - Checks electrical integrity of address, data, and control lines; isolates stuck nodes and adjacent-trace shorts.
- **RAM SHORT** - Checks each RAM location for ability to read and write; verifies address decoding; detects data-line shorts beyond bus buffers.
- **ROM** - Computes ROM signatures and compares them with those in the known-good unit.
- **I/O** - Checks each I/O register identified in the known-good system to make sure it is read/writeable.
- **AUTO** - Runs all the above tests; initiated by a single keystroke. (Typically requires several minutes, depending on size of memory being checked.)
- **RAM LONG** - A more complex RAM test, used to isolate "soft" or pattern-sensitive RAM faults.

In addition, 9000 Series Troubleshooters continually monitor the power supply of the unit under test for out-of-tolerance conditions as well as the UUT clock signal. An error message is displayed if they detect a defect.

# Board Testers & Troubleshooters

9000 Series

## Troubleshooting Functions Summary

The following function keys are available on the 9000 Series Micro-System Troubleshooters:

- **READ** – Displays data contents of specified address.
- **WHITE** – Writes specified data to any address location.
- **WALK** – Writes automatic walking pattern to specified address.
- **RAMP** – Writes automatic binary incrementing ramp to specified location.
- **TOGGL DATA** – Pulses specified data bit between high and low state.
- **TOGGL ADDR** – Pulses specified address bit between high and low state.
- **TOGGL DATA, then STS/CTL** – Pulses specified control bit between high and low state.
- **READ PROBE** – Displays probe measurements, including signatures, logic states and event counts.
- **SYN** – Allows probe measurements or stimulus to be either asynchronous or synced to valid address or data periods on the microprocessor bus.
- **HIGH (Pulse)** – Activates high-going pulses. The frequency and width of the pulses depend on the sync mode selected.
- **LOW (Pulse)** – Activates low-going pulses. The frequency and width of the pulses depend on the sync mode selected.
- **HIGH and LOW toggle** – Pulses alternate between high-going and low-going.

Also, a scope trigger-signal of about 100 mV amplitude can be synchronized with address or data sync pulses from the mainframe.

## Test-programming Functions Summary (9010A)

(Not applicable to 9020A; available in execute-only mode on 9005A.) Users wishing to troubleshoot beyond the system kernel into peripheral devices can write and edit test programs tailored to the unique architecture of the systems they work with. The following keys are available for on-line programming:

- **PROGM** – Opens and closes test programs (both for development and for editing).
- **EXEC** – Runs selected test program.
- **DISPL** – Allows programs to include operator prompts (e.g., PROBE U6 PIN 7).
- **Sequencing keys (IF, > =, GOTO, LABEL)** available for comparison, branching, looping, and labeling steps in the test program.

- **Arithmetic keys** – Eight logical operations available for arithmetic control of mainframe registers that store user-specified address and data information during program writing.
- **Editing keys** – Allow the operator to scroll backwards or forwards through the programming steps.

## Mode Control Summary

Mode control keys give operator control over all functions: automatic tests, programmed tests, and troubleshooting operations. The following mode control keys are available:

- **STOP** – Halts current test or operation.
- **REPEAT** – Causes test or operation to repeat once.
- **CONT** – Advances to next test step or continues last operation.
- **LOOP** – Continuously repeats a functional test, programmed test step, or troubleshooting command or loops on any fault.
- **RUN UUT** – Allows full exercise of both the self-diagnostics and normal run operation of the unit under test, with the pod microprocessor acting as the processor of the unit being tested.

## General Specifications

**Temperature:** 0°C to +50°C operating temperature (+10°C to +40°C for mini-cassette); -40°C to +70°C non-operating temperature (+4°C to +50°C for mini-cassette)

**Power:** 100, 120, 220, 240V ac ±10%; 50 Hz, 60 Hz ±5%; 40W maximum

**Size:** 11.5 cm H x 35.5 cm W x 30.5 cm D (4.5 in H x 14 in W x 12 in D)

**Weight:** 6 kg (13 lb) mainframe; 0.7 kg (1.5 lb) per interface pod

**Included with Instrument:** Probe, probe accessories, two mini-cassettes (none with 9020A), manuals, power cord

## Ordering Information

Models	January 1990 prices
<b>9005A</b> Micro-System Troubleshooter ....	\$3190
<b>9010A</b> Micro-System Troubleshooter	
w/Program Functions .....	5290
<b>9020A-001*</b> Micro-System Troubleshooter	
w/RS-232C Interface .....	5590
<b>9020A-002*</b> Micro-System Troubleshooter	
w/IEEE-488 Interface .....	5590

\*A 9020A without interface is not available.

## Options\* (For 9010A & 9005A)

<b>-001</b> RS-232-C Interface .....	\$ 450
<b>-910</b> Utility Program Tape .....	95
<b>-920</b> Language Compiler, 1722A	
Instrument Controller .....	495
<b>-922</b> Language Compiler for Kay Pro® II	495
<b>-923</b> Language Compiler for IBM	
Personal Computer .....	495
<b>9010A/GF</b> Kit (field-installed) .....	495
<b>9010A/GF</b> Kit (factory-ordered) .....	495
<b>9100A-030</b> A program that converts	
9010A programs to TL/1, which can	
be executed on a 9100A or 9105A .....	495

\*See option compatibility chart on last page of this section.

## Options (For 9010A, 9005A & 9020A)

<b>-006*</b> Asynchronous Signature Probe ....	\$ 995
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\*Service Center installable only.

## Options (For 9020A and 9010A/GF)

<b>-925</b> TestWriter Software .....	\$1500
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## Accessories

<b>9000A-200</b> Pod Adapter Packaging Kit .	\$ 195
<b>9000A-900</b> Transit Case .....	295
<b>Y8007</b> Ten-Pack of Mini-cassettes .....	150

## Customer Support Services

### Warranty

One-year product warranty. See Section 16 for further information on warranty terms and conditions.

### Extended Warranty

A 10% discount is available when you order the following at the time of the instrument purchase or when ordered within the factory warranty period.

<b>SC1-9005A</b> Repair .....	\$ 152
<b>SC3-9005A</b> Full Service .....	216
<b>SC4-9005A</b> Performance Verification+ .	81
<b>SC1-9010A</b> Repair .....	\$ 195
<b>SC3-9010A</b> Full Service .....	255
<b>SC4-9010A</b> Performance Verification+ .	81
<b>SC1-9020A-001</b> Repair .....	\$ 201
<b>SC3-9020A-001</b> Full Service .....	260
<b>SC4-9020A-001</b> Performance Verification+ .	81
<b>SC1-9020A-001</b> Repair .....	\$ 201
<b>SC3-9020A-001</b> Full Service .....	260
<b>SC4-9020A-001</b> Performance Verification+ .	81

Note: Incoming and/or outgoing calibration readings are available as an option.