9000 Series Micro-System Troubleshooters

IEEE-488

FLUKE®

Testers you can use the first day.

Solving the need for low-cost fault isolation in µP-based PCBs and systems.

9010A: The most comprehensive troubleshooting instrument ever developed, with built-in tests for Bus, RAM, ROM and I/O. For devices with special testing requirements such as those not tied directly on the bus, you can use the Test Sequencing capabilities for developing guided-fault-isolation routines.

9005A: A non-programmable version of the 9010A that has all of its functional testing capabilities. Designed to run test sequences developed on a 9010A and downloaded from a mini-cassette or from a 9010A, 9005A or host computer via the optional RS-232 interface.

9020A: For factory or depot-level repair and test groups who need a powerful, integrated ATE system. Full talk/listen IEEE-488 or RS-232 interface for programming via your instrument controller and operation with analog stimulus and measurement devices in a custom test system.

For most of us the microprocessor has been both a blessing and a curse: the same technology that has driven down the price of electronic equipment has also made repairing it more costly and complex.

The problems are familiar. Lengthy down times. Extensive inventories and board-float delays. Reliance on highly-skilled technicians. Test equipment that is expensive to acquire, difficult to use and may take months of programming before it's running right.

At Fluke we understand these critical problems of productivity, and the limitations of conventional troubleshooting techniques. Our 9000 Series Micro-System Troubleshooters were designed in direct response to the industry's need for fast, effective fault isolation in μP-based PCB's and systems.

This concept is helping technicians work smarter, not harder.

Working smart with automated testing.

There's no need to learn a processor's programming language to operate a Fluke Micro-System Troubleshooter. Four built-in, preprogrammed test routines are provided to automatically check the entire μP kernel—Bus, RAM, ROM and I/O. One keystroke initiates all four. Each is a comprehensive routine with descriptive diagnostics to help guide you to the fault. Since bus, memory and I/O failures are usually the most difficult to identify and isolate, the time saved by these tests alone more than justifies the Troubleshooter's price.

Troubleshooting power—to the node and beyond.

9000-Series Troubleshooters give you a head start at fast fault-isolation, on-or off-the-bus. But you don't have to learn complex testing procedures. The basic READ and WRITE functions can be used to program peripheral devices such as PIAs, CTCs, UARTs, PICs, etc.

These high-level functions overcome a major limitation of conventional test instruments: their inability to control logic in the unit under test (UUT). Most are single keystroke operations and can be repeated, looped, continued or stopped as needed.

Once you access and control the UUT logic, the 9000-Series "Smart" Troubleshooting Probe can be used to track the failure to the node level.

Outwitting the documentation dilemma.

It's easy to begin testing with a 9000-Series Micro-System Troubleshooter. Simply key in the address locations for RAM, ROM and read/writable I/O as well as the signatures for ROM and the read/writable bits for I/O. Or use our exclusive LEARN algorithm to generate a memory map from a known good board. That's all it takes to start testing with the basic functional routines. You are up and testing without writing a single word of program code.

No problems with fixtures, hookups or early obsolescence.

9000-Series Mainframes use the universal connection of the UUT's microprocessor socket as the point of interface. This way, the Interface Pod gains direct control over all components which communicate with the μP, and performs tests using the UUT clock for correct μP timing.

All 9000-Series Instruments are fully compatible with 8-bit, 16-bit and 32-bit processors and support more μP types than any other tester on the market.

With Fluke Micro-System Troubleshooters, you're not buying obsolescence. You're gaining long-term flexibility, with a family of testers that will meet your production test and service requirements today and tomorrow.

Partial list of processors supported

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

Two easy ways to develop 9010A test software.

Front panel programming allows a 9010A operator to develop short stimulus programs as needed to exercise a suspected faulty component. The new 9010A Language Compiler lets you write powerful test and troubleshooting software off-line with your personal computer.

A closer look at the Fluke 9010A.

Fast, automatic testing that goes far beyond signature analysis.

LEARN function which is used on a "known good" system, finds and maps RAM, ROM and read/writable I/O addresses.

TROUBLESHOOTING function control keys. Primarily used for programming and stimulating peripheral devices such as PIAs, CTCs, UARTs, etc.

Optional RS-232 interface for down-loading programs and test results to storage mediums, printers and other testers at remote locations.

TAPE deck controls for storing and reading programs and UUT memory maps with the mini-cassette.

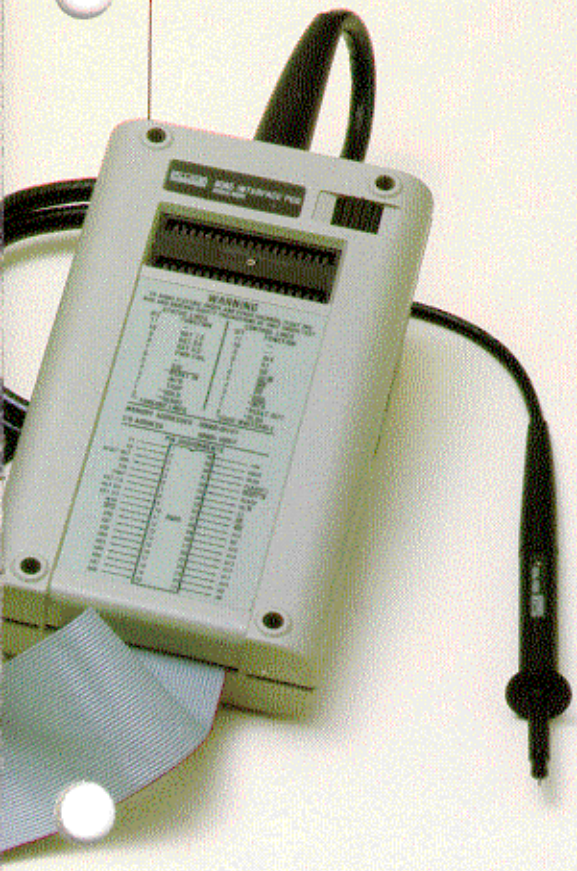
Automated, functional TEST controls for fast fault-isolation. These check the μP's buses, RAMs, ROMs, and I/O registers.

Hexadecimal keys for user entry of address descriptors.

MODE keys for controlling test programs in progress.

TEST SEQUENCING and ARITHMETIC keys for creating unique user-generated test routines.

PROBE c… used for synchron…ing the troubleshooting probe to μP cycles and to drive nodes high and/or low.



Pod design provides for easy servicing. 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.

There's no doubt that signature analysis and other digital troubleshooting techniques have been useful, providing one could justify the cost of preconditioning PCBs or purchasing specialized stimulus devices. But then, there were still the costs of engineering the stimulus program and the continuing costs of documentation, programming and training. Not to mention the hours these methods required as a technician isolated a fault with a troubleshooting tree or schematic.

To eliminate tedious, manual probing techniques, Fluke 9000-Series Troubleshooters put automatic testing power at your fingertips. Here's how easy it is to use the 9010A.

The Troubleshooter must know the location of the UUT's RAM, ROM and I/O before it can begin testing with its built-in troubleshooting routines. This "memory map" may be entered manually through the front panel keyboard, or loaded to memory from a mini-cassette or via the optional RS-232 interface. If the memory map of the UUT is not known, the LEARN algorithm may be used on a "known good" UUT to identify and store the RAM, ROM and I/O addresses.

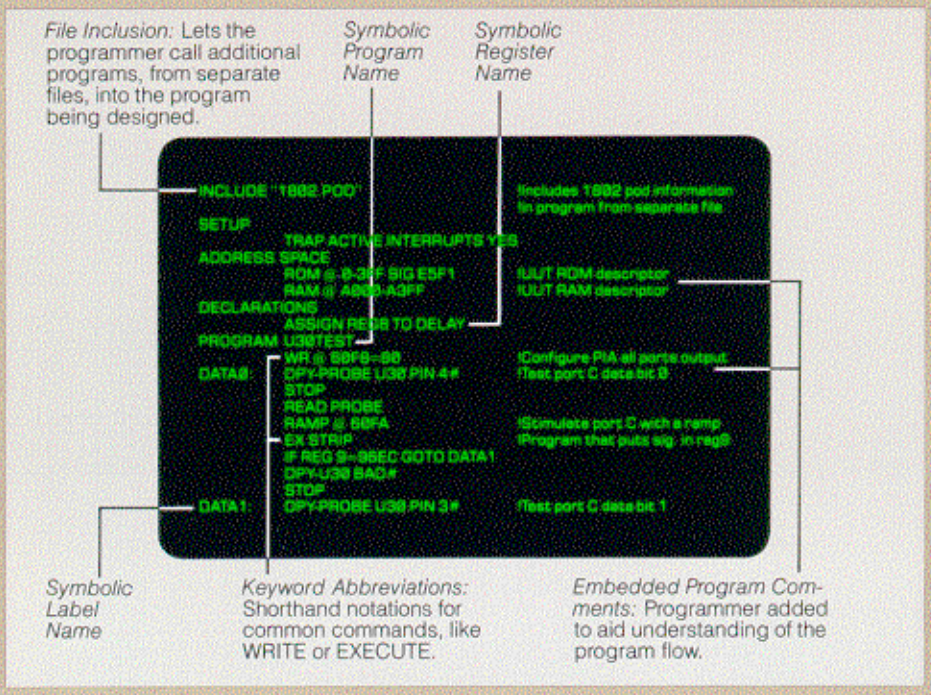
Using these basic descriptors, the four built-in functional tests let the operator automatically check the electrical integrity of the μP bus, the read/write capability of I/O registers, the data in ROM and the operation of RAM. There's even a fifth test, a more extensive RAM check, to locate pattern-sensitive failures. These tests alone often cover more than 50% of the components on most boards, so fault isolation has never been easier. Your operators can start testing the day you receive your 9010A.

If the problem lies outside the kernel, use the "Troubleshooting" functions to isolate the failure. These range from simple read/write data operations to automatically generated patterns such as walking ones/zeros and digitally incrementing ramps. They can be repeated, looped, continued or stopped under your control. Once off-the-bus logic has been stimulated, the 9000-Series Troubleshooting Probe can be synchronized to track the failure to its source.

Ours is a "smart" probe, and a powerful fault-finding tool. You select the stimulus or measurement most appropriate for the logic you are testing. Driven by a sync pulse from the interface pod, the probe can be synchronized to various μP events such as address or data periods. In the stimulus mode, the probe can inject high and/or low pulses synchronized to μP activity or operate in a "free run" mode; in the response mode it takes signatures, counts events and shows high/low logic states.

Designed to run with popular personal computers.

Extensive programming made easy with our new 9010A Language Compiler.



The powerful programming features of the 9010A Language Compiler enable faster development of sophisticated test or fault-isolation programs on your personal computer.

Fluke's 9010A was designed to let you automatically troubleshoot much of your micro-system without writing a single word of program code. To take full advantage of the 9010A's capabilities, however, you can augment the built-in test routines by programming additional sequences for a particular unit-under-test. While our pre-programmed tests automatically troubleshoot the standard architecture of the PCB, your customized tests allow equally fast diagnosis for the specialized aspects of a UUT. Your programs may even include prompting messages to help guide operators through test procedures.

Fluke makes it practical to generate your own software by offering two ways to program a 9010A. With just a few keystrokes, you can write short programs right on the 9010A's keyboard. For more extensive software requirements, Fluke has designed the 9010A Language Compiler. This powerful new programming tool lets you write comprehensive test routines quickly and more conveniently than ever before.

With the 9010A Language Compiler you develop troubleshooting programs off-line, using your own personal computer, leaving the 9010A Troubleshooter free for testing. And the Compiler gives you access to a host of sophisticated programming tools which speed program development considerably.

Software shortcuts.

The Compiler offers a number of features to make programming more efficient. For example, a File Inclusion feature allows common test programs to be shared. When you compile the program, it links the appropriate sections from different source files. By drawing upon existing programs to develop new test procedures, you will significantly reduce total programming time.

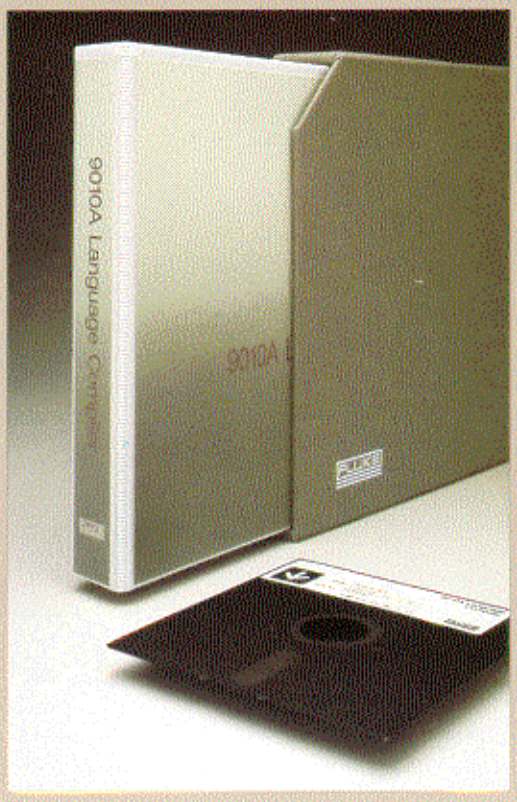
Keyword abbreviations, optional command keywords and shorthand notations minimize the time and effort required to enter program lines. You can also assign symbolic names to the programs, labels or registers. These names within a program listing make the purpose of various sections of the program easy to understand and remember.

The Compiler makes software more manageable during its creation and also during later revision. To provide comprehensive program documentation, the Compiler allows you to embed comments within the program listing. The programs you write today can be easily understood weeks or months later, should you choose to revise a test procedure.

Written for popular computers.

The 9010A Language Compiler runs on a number of popular personal computers such as the IBM® Personal Computer* and the Kaypro II®*. Of course, you can develop programs on both the Fluke 1720A and 1722A Instrument Controllers. All programs written with the Compiler can be downloaded to either the 9010A or the 9005A.

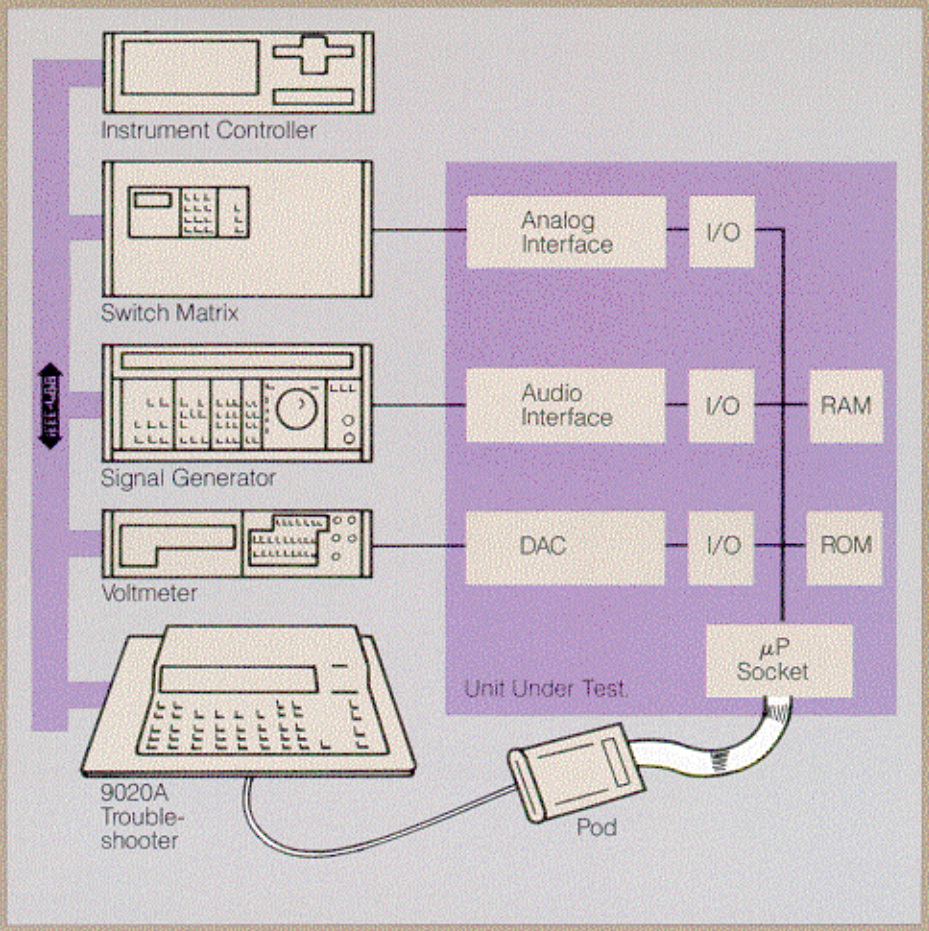
Whether you want to generate new, customized programs or enhance existing 9000-Series software, you'll find the 9010A Language Compiler a sophisticated and convenient programming tool.



*Registered trademarks of IBM, Non-Linear Systems Inc.

Low-cost ATE

Build a custom test system with a 9020A and precision instrumentation.



The 9020A gives a test system full control of the microprocessor bus, allowing complete "closed-loop" testing of each functional circuit in the product.

Testing complex microprocessor-based products often creates special measurement and control problems. In these types of products, the microprocessor may control the coordination of stimulus and measurement operations. Building your own test system using a 9020A, and other IEEE-488-compatible test instruments, gives you the flexibility to control most operations and solve these unique testing requirements.

Increasingly, your test system must contend with products combining both digital and analog circuitry. Often these products are designed with a microprocessor as the center of a board or circuit, with few connections to board-edge contacts or the outside world. To make matters worse, the microprocessor has its own clock cycle with which the test system must synchronize to provide a thorough test.

On the analog side, products used to be much simpler, with analog inputs, analog processing circuitry, and analog outputs. A test system simply provided analog stimulus to the inputs and then measured analog signals at the outputs to accomplish "closed-loop" testing.

Today, analog inputs are controlled and monitored by digital signals. These digital signals are then processed by on-board microprocessor software, and used to control analog outputs.

The 9020A interfaces your test system to the heart of your product.

Like the 9010A, the 9020A plugs into the microprocessor socket of the unit-under-test to give the test system control of the UUT's internal buses. Through those buses the test system controls both digital and analog circuitry for stimulus and measurements during testing.

Microprocessor testing of the RAM, ROM, data buses, and interface logic can be integrated with closed-loop testing of each analog sub-unit, to give your test a very high confidence level. The 9020A stimulates the UUT functionally, the way the microprocessor would, allowing more thorough automatic testing of your product.

The 9020A in a typical system.

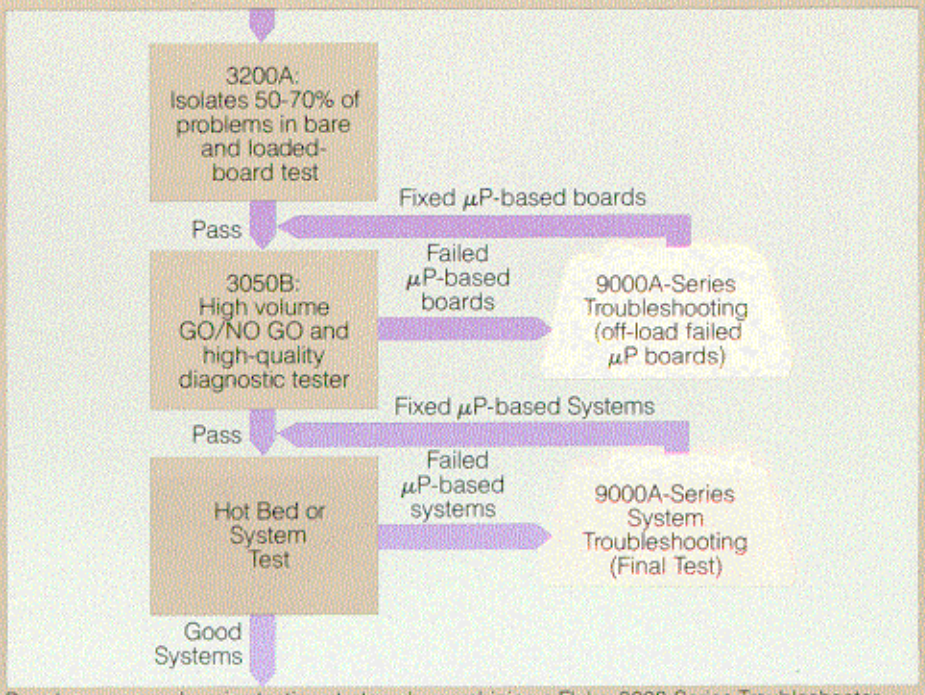
To understand how a 9020A could be applied in a testing situation, consider a typical system as illustrated above. It might include the 9020A, analog stimulus and measurement instruments, and the Fluke 1722A Instrument Controller, all linked via the IEEE-488 bus. The 9020A would be connected to the UUT's microprocessor socket, allowing you to control the circuitry and to run completely closed-loop tests, automatically.

The 9020A sends digital signals instructing a digital-to-analog converter to output an analog voltage which the system voltmeter then measures. Or, by providing an analog signal from the test system, the 9020A can test by checking the digital data from the microprocessor socket. It's the easiest way you'll find to verify the performance of your products' microprocessor *and* analog circuitry.

Our example demonstrates only a few of the innovative testing techniques possible with a 9020A in a custom ATE system. And whether your application is production test or depot repair, the 9020A helps you build a low-cost system that keeps automatic testing within your budget.

Off-load µP board failures to Trouble-shooters.

Improve large-scale ATE productivity by adding a Fluke Troubleshooter.



Develop a comprehensive testing strategy by combining a Fluke 9000-Series Troubleshooter with large-scale ATE.

From initial bare-board testing to final system test, choosing the right combination of Automatic Test Equipment is a challenge. To keep throughput high and costs low, you must not only consider test volume and the mixture of microprocessor and non-microprocessor based boards, but also the complexity of these boards. Often, the most practical solution requires several types of equipment, each matched to its most efficient testing task.

Keeping ATE productive with Troubleshooters

Process-related faults, which account for the majority of all board failures, can be quickly detected by a "bed-of-nails" tester. Faults caused by bad components, on the other hand, are more efficiently detected by functional testers. Fluke's family of Troubleshooters help complete the testing mix with capabilities that complement large-scale ATE systems.

The 9000-Series Troubleshooters were specifically designed to locate those elusive faults that commonly slow down ATE testing of microprocessor-based systems. At a fraction of the cost, they provide an efficient method of diagnosing faults detected on the larger ATE, while permitting that equipment to do what it does best: high volume production testing. Offloading bad boards to a 9000-Series Troubleshooter can improve your entire test throughput, making the 9000-Series a valuable addition to your total testing plan.

High-volume ATE from Fluke.

When you need to evaluate high-throughput ATE, look closely at Fluke's range of solutions. For example, you might pre-screen boards with Fluke's 3200A Circuit Board Analyzer to identify common, process-related failures. The 3200A quickly finds shorts, opens, missing components or wrong components in boards. The 3050B Digital/Analog Functional Test System, on the other hand, is well-suited for high-volume, high confidence level testing to the card edge.

We can help you develop your testing strategy.

One instrument or test system can never solve your entire range of manufacturing testing needs. Fluke can help you develop a comprehensive testing strategy that efficiently positions each testing alternative. Contact your Fluke Sales Engineer, System Specialist or Representative. Whether it's your first tester, custom ATE, a high-throughput system, or a total ATE solution, Fluke can help.

9010A SPECIFICATIONS

General

Design: Compact mainframe with keyboard, display, and minicassette; detachable interface pod for each μP type; pod plugs into UUT μP socket; detachable probe for guided troubleshooting.
Mainframe Capability: 8-bit thru 32-bit μP's for present and future designs.
Interface Pods: Z80, 1802, 6502, 6800, 6802, 6809, 8048, 8080, 8085, 8086, 8088, 9900, 68000 (Contact factory about special μP requirements or soldered-in μP's.)
Probe: Single point stimulus-pulse high (>4V @100 mA), low (<0.2V @100 mA), hi/lo, Single point measurement-logic state, signature, event counts (thresholds: 0.8 and 2.4V). May be asynchronous or synchronized to μP address or data.
Protection: Pod can be plugged-in backwards with no damage. Probe protected to ±30 volts.
Test Speed: Tests run at full system speed from UUT clock.
Mag Tape: Minicassette stores all microsystem kernel tests "learned" in fully automatic mode, plus operator-prompted steps for testing outside the kernel via an on-line generated test program.
Display: 32-character, 14-segment alphanumeric, vacuum-fluorescent.
Data Entry: Hexidecimal keyboard 0 thru 9, A thru F and dedicated keys.
Self-Test: Mainframe self-tests at each power-up—verifies operation of RAM, ROM, clock, power supply, display. Pod has self-test socket to verify operation at μP plug; self-test also verifies communication with mainframe.
Communication Interface (Option 9010A-001): Full duplex RS-232 for transmitting or receiving test programs via modems or local connection. 110 to 9600 baud, 7-8 data bits, 1-2 stop bits, odd/even/no parity.
Power: 100, 120, 220, 240 Vac ±10%; 50, 60 Hz ±5%, 40W max.
Storage Temp: −40°C to +70°C (+4°C to +50°C for minicassette).
Operating Temp: 0 to +50°C (+10°C to +40°C for minicassette).
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 (11 lbs.) for mainframe; 0.7-1.4 kg (1.5-3.1 lb.) per pod.
Limited warranty: 1 year.

Automatic functions

Learn: Using known good UUT, locates and dimensions RAM, ROM, I/O read-write registers. Reads ROM's and computes signatures. Learn results are stored in memory for immediate testing of UUT's. At any time, learned data may be saved on cassette (or via RS-232) for permanent storage.
View (RAM, ROM, I/O): Displays LEARN results, including descriptions for all addresses and data locations, for comparison with known architecture. Allows manual entry of RAM, ROM , I/O information.
Functional Tests: Using stored results checks UUT as follows:
- *BUS—Checks electrical integrity of address, data, control lines, isolates nodes stuck at "1"/"0", adjacent trace shorts.*
- *ROM—Computes UUT ROM signatures, compares to stored reference signatures for verification.*
- *RAM Short—Checks read-writeability of each RAM location. Verifies address decoding. Detects data line opens and shorts beyond bus buffers.*
- *I/O—Checks read-writeability of all I/O registers.*
- *AUTO—Automatically runs all tests above.*
- *AUTO Test Time—Typical system requires several minutes for complete auto test.*
- *RAM Long—Complex RAM test for isolating "soft" RAM or pattern-sensitive failures.*

Power Supply Test: UUT μP power supply continuously monitored for out-of-tolerance condition.
Clock Test: UUT clock runs pod μP. Bad clock automatically gives pod error signal.

Troubleshooting functions

Read: Displays data contents of a user-specified address.
Write: Writes data to specified address.
Walk: Writes automatic walking pattern to specified address.
Ramp: Writes automatic binary incrementing ramp to specified address.
Data Toggle: Pulses user-specified data bit between high and low state.
Address Toggle: Pulses user-specified address bit between high and low state.
Probe Controls:
- *Read Probe—Displays probe measurements including signatures, logic states, event counts.*
- *Sync—Allows probe measurements or stimulus to be asynchronous or synced to address, data, or other μP activity (depends on Pod connected).*
- *High—Initiates high-going (tristate to logic "1") pulses, 1 ms period, 2 μsec long (Free-run, Sync).*
- *Low—Initiates low-going (tristate to logic "0") pulses (1 ms period, 2 μsec long Free-run, Sync).*
- *High/Low—Both depressed, pulses alternate low and high.*

Scope Trigger: Nominal 100 mV pulse, automatically synced same as probe.
Mode Controls: Allow immediate user-specified control over automatic tests, programmed tests, and all troubleshooting operations.
- *Stop—Halts current test or operation.*
- *Repeat—One-time repeat of test or operation.*
- *Continue—Advances next test step/continues last operation.*
- *Loop—Continuously repeats a functional test, e.g., ROM, RAM etc., continuously repeats a programmed test step, continuously repeats any troubleshooting command or loops on any fault.*
- *Run UUT—Normally used at end of testing, allows full exercise of UUT with pod μP emulating UUT μP.*

Test programming

Program Preparation. For troubleshooting beyond the system kernel, through peripheral devices (PIAs, UARTs, etc.) and into the unique digital architecture that makes up the UUT personality, the following simple keystrokes by a technician with knowledge of the microsystem enable on-line writing/editing of a test program:
- *Program Key—Opens, closes test programs for development/editing.*
- *Execute Key—Runs operator selected test program.*
- *Sequencing Keys—IF, >, =, GOTO, LABEL for comparison, branching, looping, and labeling program steps.*
- *Display Key—Enables generation of operator prompts, e.g., "PROBE U6 PIN 7".*
- *Arithmetic Keys—Eight logical operations for arithmetic control of mainframe registers that store user-specified address and data information during program writing.*
- *Editing Keys—"Prior" to scroll display to prior program step; "More" to advance display to next program step.*

Programs: Operator-selected, 0 thru 99. Can also be called as subroutines.
Program Memory Space: 10K bytes (approximately 1000 program steps)
Mainframe registers: Sixteen 32-bit registers for storing and manipulating user-specified address and data information. Used to pass arguments to subroutines.
Write Tape: Transfers entire test program to minicassette, up to 12K bytes (same capacity as mainframe memory) per side.

9005A SPECIFICATIONS

Same as 9010A except:
Executes programs created on 9010A
No Test programming
No LEARN mode

9020A SPECIFICATIONS

Same as 9010A except:
Full remote control operation for system use. Specify either, RS-232 remote control or IEEE-488 remote control.
Test programs written/executed via system controller (no programming keys)
Test programs stored in system controller (no minicassette or program storage)

ORDERING INFORMATION

Model

9005A Micro-System Troubleshooter	*$2,995*
9010A Micro-System Troubleshooter	*3,995*
9020A-001 Micro-System Troubleshooter w/RS-232-C Interface	*4,595*
9020A-002 Micro-System Troubleshooter w/IEEE-488 Interface	*4,595*

Option

9010A-001 RS-232 Interface (For 9010A or 9005A)	*$ 395*

Accessories

9000A-200 Pod Adapter Packaging Kit	*$ 195*
9000A-900 Transit Case	*295*
9000A-9711 8520A Troubleshooting Tape	*195*
9010A-910 Utility Tape for 9010A	*95*
Y1705 0.25m RS-232-C Null Cable (required for 1720A/1722A connection to 9020A-001)	*75*
Y1707 2m RS-232-C Interface Cable (extension for Y1705)	*1*
Y1708 10m RS-232-C Interface Cable (extension for Y1705)	*1*
Y8001 1m IEEE-488 Interface Cable	*8*
Y8002 2m IEEE-488 Interface Cable	*95*
Y8003 4m IEEE-488 Interface Cable	*105*
Y8007 10-pack of mini-cassettes	*150*

Interface Pods

9000A-Z80 Interface Pod	*$ 995*	*9000A-8051*	*$1,995*
9000A-Z80AA Interface Pod	*1,295*	*9000A-8080 Interface Pod*	*995*
9000A-Z8000 Interface Pod	*1,995*	*9000A-8085 Interface Pod*	*995*
9000A-1802 Interface Pod	*1,595*	*9000A-8086 Interface Pod*	*2,495*
9000A-6502 Interface Pod	*995*	*9000A-8088 Interface Pod*	*1,995*
9000A-6800 Interface Pod	*995*	*9000A-9900 Interface Pod*	*1,995*
9000A-6802 Interface Pod	*995*	*9000A-68000 Interface Pod*	*1,995*
9000A-6809 Interface Pod	*1,295*	*9000A-80186 Interface Pod*	*2,695*
9000A-8048 Interface Pod	*$1,995*	*9000A-80188 Interface Pod*	*2,695*

9010A Language Compiler

9010A-920 Compatible with Fluke 1720A and 1722A Instrument Controllers	*$ 495*
9010A-922 Compatible with KayPro II	*495*
9010A-923 Compatible with IBM Personal Computer	*495*

FLUKE®

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PRINTED IN U.S.A. G0094C-01P8506/SE EN