In-Circuit Test Vendor Support

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In-circuit testers are widely used for manufacturing tests and for the measurement of printed circuit board (PCB) systems. In-circuit testers can also program and verify programmable logic devices (PLDs) that support in-system programmability (ISP). Using in-circuit testers to program ISP-capable devices allows device programming to fit into the standard manufacturing flow, reducing time-to-market.

The following in-circuit test vendors support Altera® ISP-capable devices.

- Hewlett Packard
- GenRad Inc.
- Teradyne
- ASSET InterTech
- Corelis
- JTAG Technologies

For additional information on in-circuit testers, including availability, pricing, and support, contact the vendor directly.

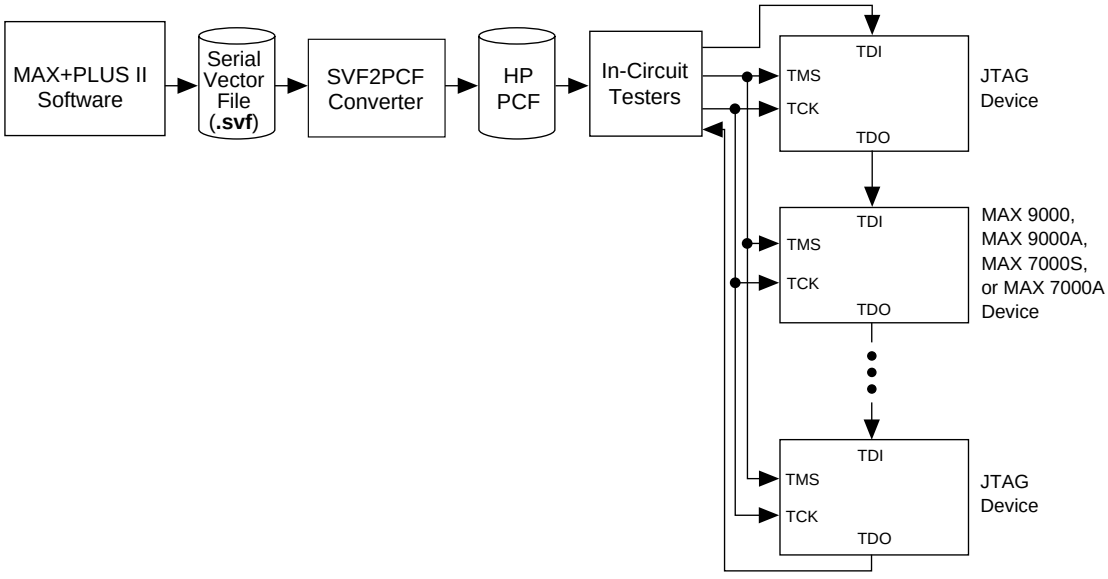
Hewlett-Packard

Hewlett-Packard, the world's leading supplier of testing and measurement products and services, offers the HP 3070 Series II family of board test systems for PCB testing. The HP 3070 Series II board test systems combine low prices with several innovations that reduce test costs and increase test effectiveness. Whether you need unpowered process test, traditional in-circuit test, or high-performance combinational test, the Series II family provides affordable entry points across a wide range of systems. Series II systems are designed to keep test costs low with high-quality, high-fault coverage tests, fast test throughput, reliable system hardware, and comprehensive programming. Hewlett-Packard offers the following products:

- HP 3072 Series II process test system with 5,184 nodes
- HP 3172 Series II process test system with 2,592 nodes
- HP 3272 Series II process test system with 1,296 nodes
- HP 3073 Series II low-cost combinatorial board test system with 5,184 nodes
- HP 3173 Series II low-cost combinatorial board test system with 2,592 nodes
- HP 3273 Series II low-cost combinatorial board test system with 1,296 nodes
- HP 3075 Series II high-performance combinatorial board test system with 5,184 nodes
- HP 3175 Series II high-performance combinatorial board test system with 2,592 nodes
- HP 3275 Series II high-performance combinatorial board test system with 1,296
- HP 3079CT Series II combinatorial communications board test system
- HP 3179CT Series II low-cost combinatorial communications board test system
- HP 3279CT Series II functional communications board test system

Altera has developed advanced software to support Hewlett-Packard in-circuit testers. This software, which is fully supported by Altera when used in conjunction with Altera's MAX+PLUS® II software, outputs a Hewlett-Packard Pattern Capture Format (**.pcf**) File that enables all Altera ISP-capable devices to be quickly programmed on all Hewlett-Packard in-circuit testers. Figure 1 shows the software flow between Altera and Hewlett-Packard tools.

Figure 1. Programming Flow between Altera & Hewlett-Packard



GenRad

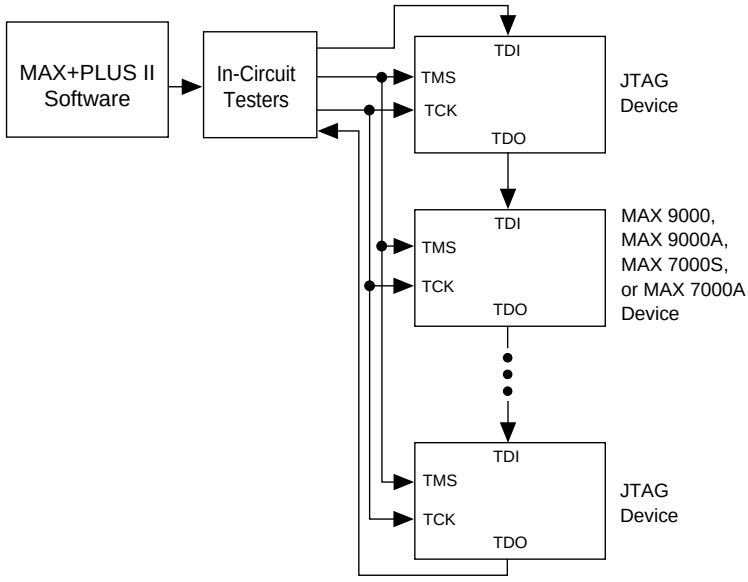
GenRad, Inc. is a leading world-wide supplier of integrated test, measurement, and diagnostic solutions for the manufacture and maintenance of electronic products. GenRad offers products and services for electronic manufacturing test systems. GenRad's in-circuit board test uses computerized systems to ensure that every device on a PCB is connected and working properly. Table 1 describes the in-circuit testers offered by GenRad.

Table 1. GenRad Production Test Systems

Product	Description
GR2280*i*/GR2281*i*	High-performance, low-cost tester for small, complex PCBs. Common to automative, telecommunications, data communications, and medical products.
GR2283*i*/GR2284*i*	Tester for manufacturers challenged to meet time-to-market demands, capitalize on new technologies, and reduce costs.
GR2286*i*/GR2287*i*	Tester for contract manufacturers and manufacturers of large, complex PCBs. Common to computer and communications applications.
GR2287L	Allows the testing of large, complex, and heavily integrated PCBs. Common to computer, medical, and telecommunications industries.

GenRad's in-circuit testers are capable of quickly programming Altera ISP-capable devices via a Serial Vector File (**.svf**) utility. Questions regarding this software support should be directed to the Altera technical support hotline at 1 (800) 800-EPLD. Figure 2 shows the programming flow between Altera and GenRad.

Figure 2. Programming Flow between Altera & GenRad



Teradyne

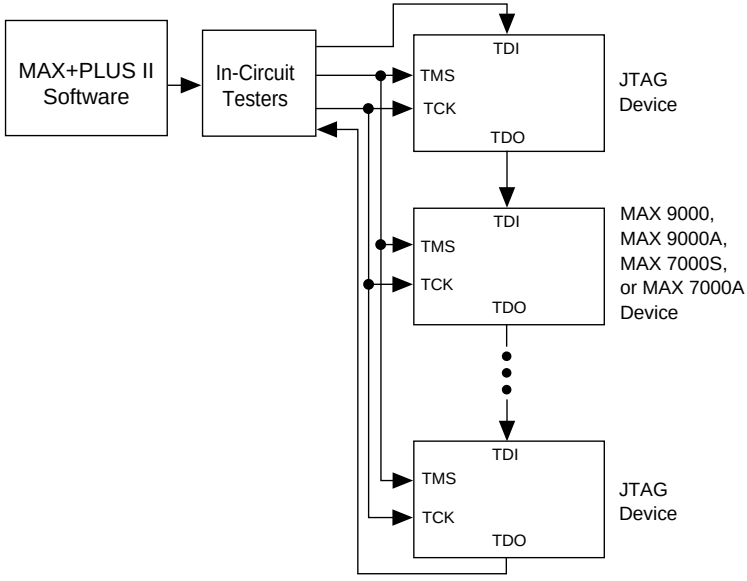
Teradyne is the world's largest supplier of in-circuit testers for the electronics and telecommunications industries. Teradyne's products are used to test semiconductors, circuit assemblies, telephone lines, networks, computerized telephone systems, and software. The company also manufactures backplane assemblies and high-density connectors that are used in high-performance electronic systems. Table 2 describes the in-circuit testers offered by Teradyne.

Table 2. Teradyne Manufacturing Test Systems & Software

Product	Description
Spectrum 8800-Series VXI Manufacturing Test Platform	Open systems for manufacturing test based on VXI, Windows NT, and Lab Windows/CVI.
Z1803 Power-Off In-Circuit Tester	The low-cost gateway to full manufacturing process test.
Z1880 Manufacturing Process Tester	The low-cost, full-function, in-circuit test system.
Z1884 High-Channel Count Test System	Cost-effective process test for SMT boards with high node counts.
Z1890 Single Stage Tester	Practical single-stage test to reduce your product functional test costs.
MultiScan Vectorless Test Toolset	Fast programming and high-fault coverage on modern SMT boards.
Momentum Programming Environment for Z1800-Series	Comprehensive software for integrated test-program generation and fixture design.

Altera MAX® 9000 (including MAX 9000A), MAX 7000S, and MAX 7000A devices can be programmed quickly in-system with Teradyne in-circuit testers using a Jam™ File (**.jam**), which can be automatically generated by Altera's MAX+PLUS II software. The Jam File is an emerging industry-standard file that allows designers to program and test devices through the JTAG interface. Jam Files simplify in-system programming. Figure 3 shows the programming flow between Altera and Teradyne.

Figure 3. Programming Flow between Altera & Teradyne



ASSET InterTech

ASSET InterTech develops, markets, sells, and supports testability software products world-wide. The ASSET product family allows designers to quickly and easily test semiconductors, PCBs, or entire systems during product design, manufacturing, and in-field maintenance. Table 3 describes the manufacturing test systems offered by ASSET InterTech.

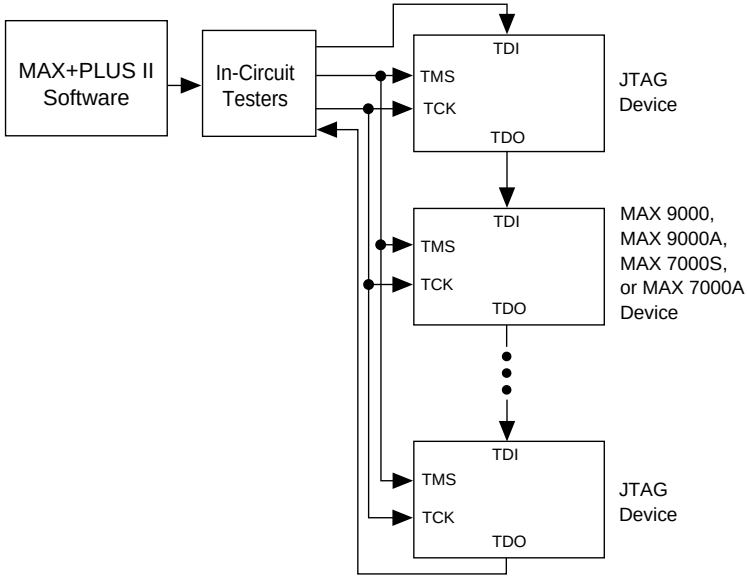
Table 3. ASSET InterTech Product Support

Product	Description
ScanDeveloper	Test development platform for creating test vectors through automatic pattern generation or macro language. The ScanDeveloper also provides the ability to test vectors in batch mode.
ScanConnect	Automatic interconnect pattern generation system for verifying boundary-scan interconnects. It also provides fault diagnosis to the net level.
ScanProgrammer	Programmer supports the Jam programming and test language, Serial Vector Format (**.svf**) File, and other methods of ISP. It allows programming of multiple devices and verifying of scan path integrity before programming.
SystemMerge	System automates the building of system-level netlists for test pattern generation.
ScanObjects	Tool for creating custom test applications for advanced diagnostics or in the manufacturing environment. These test applications can be used as stand alone to integrated with other third-party tools.
STEM	Benchtop tester for extending boundary-scan tests to include non-scannable signals. It provides up to 960 individually controllable boundary-scan test channels.
ScanDriver	Test application system for applying boundary-scan tests in a manufacturing environment. Test programs can be integrated with third-party test executables or custom user interfaces.
ScanDetect	Advanced fault isolation to the pin level of interconnect patterns for design debugging during development, prototype testing, post production, or field service repair.

ASSET InterTech also offers ISPAccess for any base system. With this product, designers can program devices in-system as part of the boundary-scan test (BST) process. ISPAccess supports the Jam language and other ISP methods, allows ISP integration and boundary-scan based test processes, and can quickly turnaround new designs during boundary-scan design debugging.

Altera MAX 9000, MAX 7000S, and MAX 7000A devices can be quickly programmed in-system with ASSET InterTech in-circuit testers using a Jam File, which can be automatically generated by Altera's MAX+PLUS II software. Figure 4 shows the programming flow between Altera and ASSET InterTech.

Figure 4. Programming Flow between Altera & ASSET InterTech



Corelis

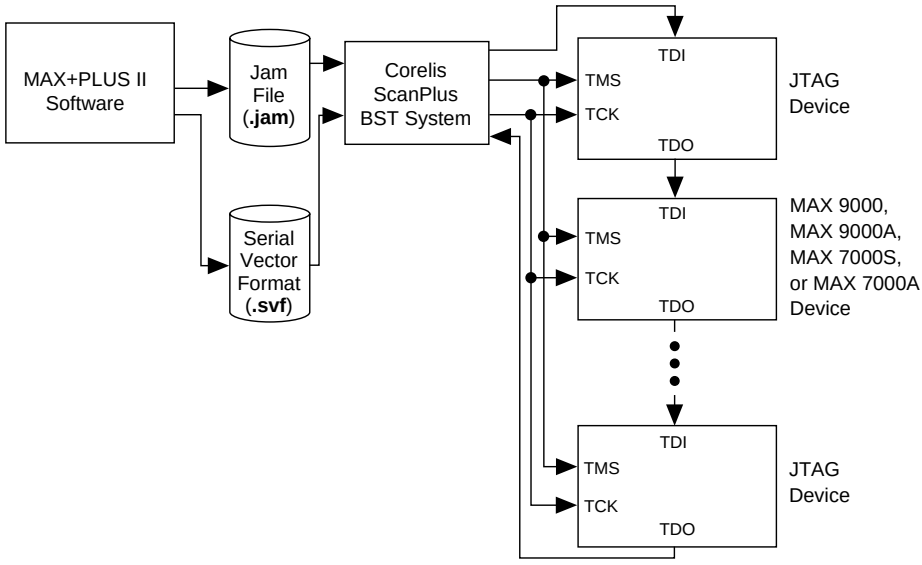
Corelis is a leading supplier of PC-based IEEE Std. 1149.1 BST systems. Corelis offers complete solutions for testing individual boards and complete systems using boundary-scan techniques. Systems are available for design and debugging, manufacturing test, and field service and support. A variety of system options are available, including desktop solutions and portable solutions for use in the field with laptops. Corelis also offers complete boundary-scan ISP tools for CPLDs and FLASH memories. Table 4 describes the products offered by Corelis.

Table 4. Corelis Product Support

Product	Description
ScanPlus Runner	BST execution software including a test sequencer, Truth Table Display (TTR) diagnostics, and ISP support of CPLDs and FLASH memories. It provides comprehensive testing of boundary-scan chain infrastructure, interconnects, buswires, clusters, memories, and FIFO buffers. Includes drivers for LabWindows CVI and LabView and command line interface for integration with third-party test executives.
ScanPlus TPG	Boundary-scan automatic test pattern generator. Automatically generates test patterns that enable testing of boundary-scan chain integrity, PCB interconnects, buswires, and clusters.
ScanPlus ADO	ScanPlus Advanced Diagnostics option to the ScanPlus Runner that isolates interconnect faults to the net and pin level, including bridging faults.
ScanPlus Controllers	Boundary-scan hardware controllers, including support for PCI, ISA, PCMCIA, ethernet/LAN, VXI, and other platforms.
ScanPlus ScanIO	Boundary-scan controlled individually programmable I/O modules.

Altera MAX 9000 (including MAX 9000A) and MAX 7000 (including MAX 7000A) devices can be programmed in-system quickly and easily with Corelis ScanPlus Boundary-Scan Test System using a Jam file or SVF file, which are generated automatically by Altera's MAX+PLUS II software. Figure 5 shows the programming flow between Altera and Corelis.

Figure 5. Programming Flow between Altera & Corelis



JTAG Technologies

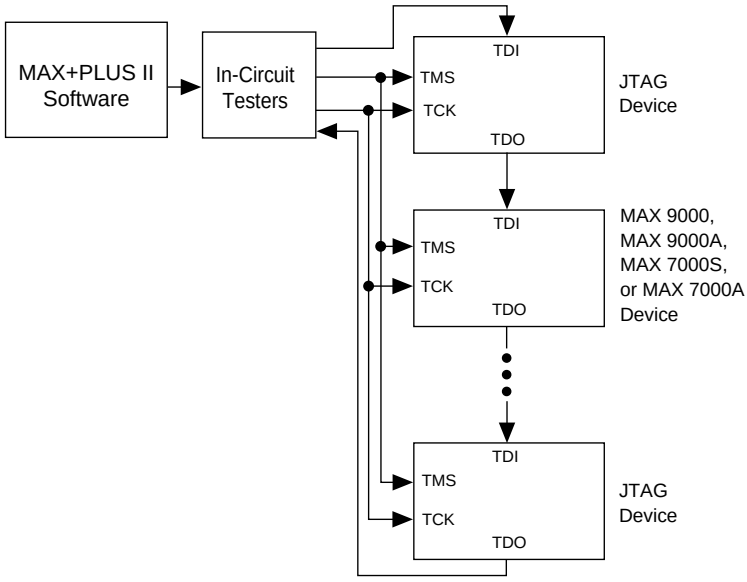
JTAG Technologies IEEE 1149.1 boundary-scan product offers complete solutions for testing PCBs and systems that support JTAG BST. JTAG Technologies also offers products for programming devices in-system via boundary-scan. Products are available for design, manufacturing, and field service. Thus, JTAG Technologies provides complete product life-cycle support. JTAG Technologies provides a range of proven solutions to match a designer's needs. The designer simply starts with a basic boundary-scan controller module, such as the PC-parallel port driven PM 3705 Explorer, a PC-ISA, or PCMCIA interface card. If the application demands, the designer can choose the high-speed GPIB-based PM 3720 VectorBlaster, which is suitable for high-speed and high-volume testing and programming applications. Table 5 describes the in-circuit testers offered by JTAG Technologies.

Table 5. JTAG Technologies Product Support

Product	Description
JTAGTEST	Automatic test pattern generation tools, test execution, diagnostic tools, and system test support.
JTAGTAPS	Hardware controllers, auxiliary hardware products for testing and programming.
JTAGPROG	In-system programming tools and system-level programming support.
JTAGLINK	Seamless interface between EDA schematic systems and JTAG Technologies automatic test program generation tools.

Altera MAX 9000, MAX 7000S, and MAX 7000A devices can be quickly programmed in-system with JTAG Technologies in-circuit testers using a Jam File, which can be automatically generated by Altera's MAX+PLUS II software. Figure 6 shows the programming flow between Altera and JTAG Technologies.

Figure 6. Programming Flow between Altera & JTAG Technologies



Altera ISP Devices

Altera's MAX 9000, MAX 7000S, and MAX 7000A devices offer a broad selection of devices with ISP capability that range in density from 32 to 1,024 macrocells. All Altera ISP-capable devices support programming and testing on in-circuit testers via a Jam File. These devices allow designers to use the same programming file throughout the lifetime of a PLD design. Unless the actual design changes, the original PLD programming file will never need to be updated. Table 6 lists the Altera devices that support ISP.

Table 6. Altera Devices with ISP

Family	Device	Macrocells
MAX 9000	EPM9560, EPM9560A	560
	EPM9480, EPM9480A	480
	EPM9400	400
	EPM9320, EPM9320A	320
MAX 7000S	EPM7256S	256
	EPM7192S	192
	EPM7160S	160
	EPM7128S	128
	EPM7064S	64
	EPM7032S	32
MAX 7000A	EPM7512AE	512
	EPM7384AE	384
	EPM7256AE	256
	EPM7128AE	128
	EPM7064AE	64
	EPM7032AE	32
MAX 7000B	EPM7512B	512
	EPM7256B	256
	EPM7128B	128
	EPM7064B	64
	EPM7032B	32

Programming a device in-system increases manufacturing efficiency by eliminating the need to handle surface-mount packages, such as quad-flat pack (QFP) packages. Reduced handling helps prevent bent leads and reduce the possibility of electrostatic discharge (ESD)-related problems. Altera devices that support ISP capability fit into the standard manufacturing flow and enable the integration of programming and testing for improved manufacturing efficiency.

Revision History

The information contained in *In-Circuit Test Vendor Support* version 2.01 supersedes information published in previous versions. Version 2.01 contains the following changes:

- Added information on Corelis, a new in-circuit test vendor that supports Altera ISP-capable devices.
- Updated Table 6.

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