DATA SHEET

Medalist i1000D In-Circuit Test System Family

U9401B/U9405A/U9403A

Keysight Medalist i1000D In-Circuit Tester (ICT) Family

U9401B – Medalist Standard i1000D
U9405A – Medalist SFP i1000D (In-Line/Off Line type)
U9403A – Medalist i1000D Mini-ICT

Introduction

Keysight Medalist i1000D redefines digital test to provide electronics manufacturers with user-friendly and affordable testing for digital devices.

The Medalist i1000D is now even better. Improving from its previous state of an analog-only ICT, the new digital release of the system now features per pin programmable digital cards with a whole new set of intuitive software graphical user interfaces (GUIs) that makes programming and development effortless.

With its new digital capabilities, the Medalist i1000D performs digital PCF/ VCL library-based testing, boundary scan, and I2C/ SPI serial programming at a low-cost by using a simple long-wired test fixture. This presents an excellent opportunity for better test coverage without any increase in cost.

KEYSIGHT TECHNOLOGIES

The digital subsystem of the i1000D harnesses the simplicity and power from the industry-leading Medalist i3070 ICT, to bring you the power to adjust test speeds, drive, and receive voltages with just a few clicks of the mouse.

Model number U9401B – Medalist Standard i1000D Tester.

Ease of Use

Retaining the simple and intuitive features of the previous U9401/2A model, the new Medalist i1000D software adds to its arsenal new features that make development and debugging of digital tests easy.

Following the development model of a typical manufacturing defects analyzer, you can now get a fixture and program up and running in just a few days. When the digital test is required, merely assign the test libraries and power supplies using the new developer GUI and let the i1000D software do the rest; Figure 1.

Simplified GUIs allow the user to quickly make changes to individual tests while debugging, with a comprehensive set of menus and buttons, complete with auto debug features. This allows inexperienced users to utilize the system quickly.

With the Medalist i1000D, unpowered passive analog components can debug with the click of a button, so even someone with limited ICT experience can perform a complete analog test debug in a matter of hours.

Auto debug fine tunes tests, so boards pass reliably in production. Statistical measures (CPK: Process Capability Index) are employed to determine the stability of the test. This automatic feature reduces the normal debug process to just a few hours.

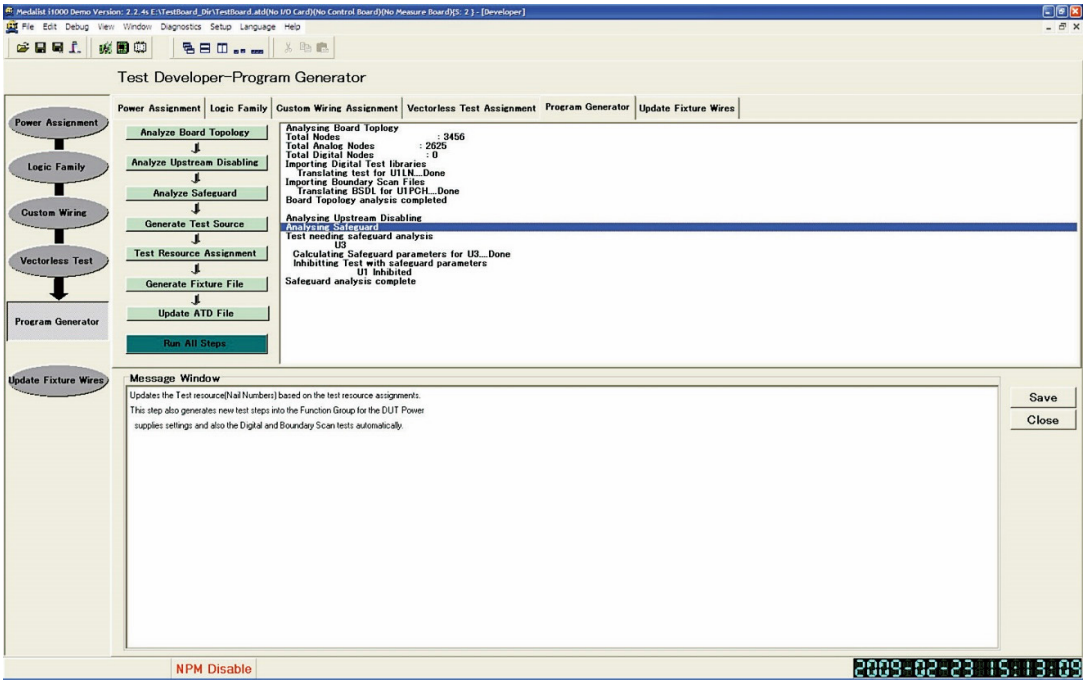


Figure 1: Easy-to-use test developer GUI enables new users to deploy a fixture and program in just a few hours.

System Highlights

Digital test is known as complex, and difficult to debug. With the i1000D, testing is straightforward. The digital debug GUI leverages the control and flexibility of the legendary i3070 PushButton debug GUI, to allow engineers and technicians to have full control of the digital test parameters and test source codes, yet making it easy to understand.

You can achieve this by transforming lines of the complicated digital test source codes into simple, easy to understand graphical waveforms. Engineers and technicians performing debug do not see the massive lines of codes; screen capture as in Figure 2.

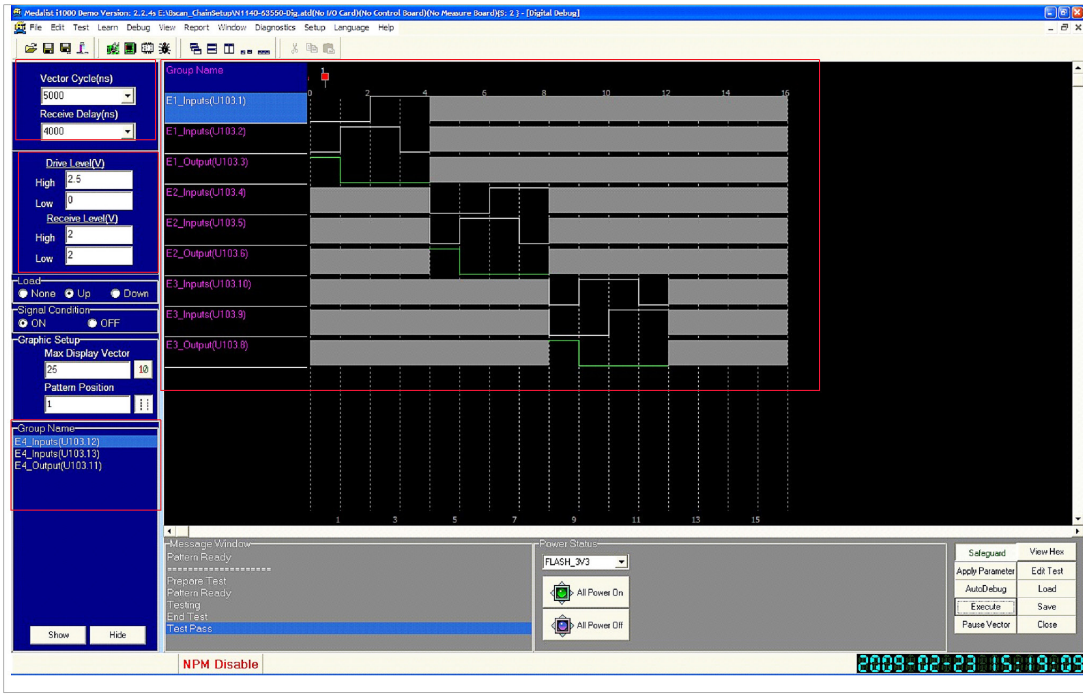


Figure 2: Digital debugging is made simple with the Medalist i1000D graphical interface.

Fixturing

Long-wired MDA Press Down fixtures are not suitable for digital tests. Is this true or false?

While it is commonly perceived to be true, the Medalist i1000D proves otherwise.

The Medalist i1000D runs digital tests using a traditional MDA-style long-wired press down fixture. Boundary scan tests, serial programming, library-based tests all run without a glitch. You now have a test solution that is simple and effective, and at the same time maintains reduced operational costs with the MDA-styluses. Reference Figure 3 and Figure 4.

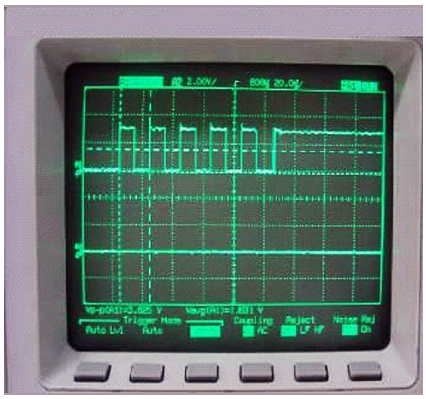


Figure 3: No cross talk on adjacent channels.

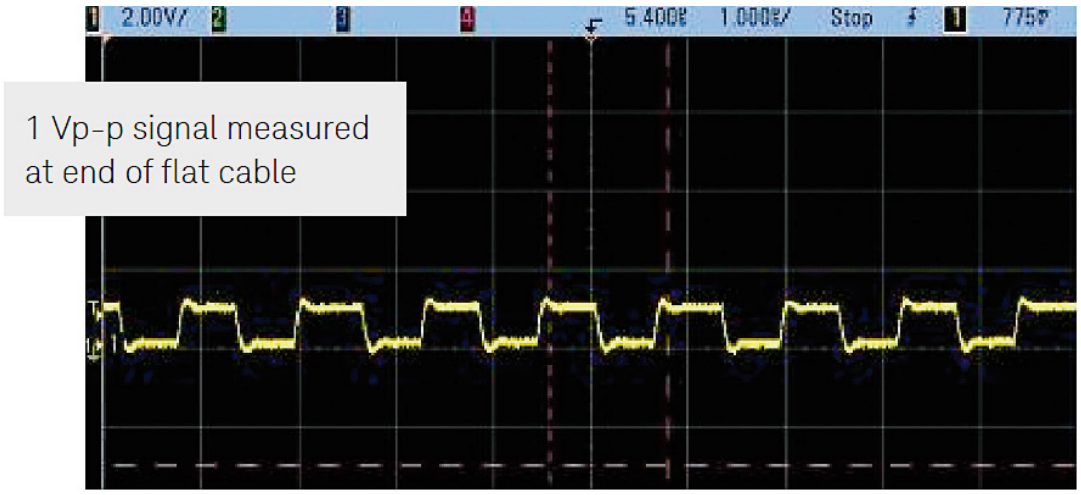


Figure 4: Low signal loss.

Medalist Standard i1000D ICT (U9401B) Specifications

Standard Software and Firmware Features	
Open/short testing	Shorts pin groups learning
Analog testing	Yes
Vectorless testing	VTEP v2.0
I2C programming capability	Yes
SPI programming capability	Yes
Boundary scan capability	Yes
Frequency measurement	Yes
AC/DC voltage testing	Yes
Number of analog guarding points	10
First pass yield report	Yes
Quality tTest CPK rReport	Yes
Component-level coverage report	Yes
Yield enhancement test	Yes
Limited access tools	Keysight Medalist Bead Probe Technology
Keysight Cover-eExtend	
Panel test	Yes
Relay-level diagnostics tool	Built- in
SPC quality tool	Yes

Software Product	
VTEP v2.0 test suite	Test development software for vectorless test extended performance
Cover-eExtend tTechnology	Extending test coverage to devices without test access using VTEP

Modules and Pin Cards	
Pin cards	Un-multiplexed analog 128- channels Un-mulitplexedmultiplexed hybrid 64- channels
Analog stimulus card	Measurement board
Control card	System control board
Number of modules	Single module design which supports up to a total of 28 pin cards. SThis supports up to a total of 3456 node count.

Hybrid Pin Card 64-Channels	
Resource per card	Unmuxed 64- channels per card
Programmable receiver	0 to 4.85 V
Programmable driver	0 to 5 V
Maximum sink current	Peak 500 mA
Maximum source current	Peak 500 mA
Pattern rate	Max 2 MPS
Programmable vector cycle	Programmable
Programmable vector cycle resolution	50 ns
Programmable receive delay	Programmable
Programmable receive delay resolution	10 ns

Fixuring

Power Supplies		
DUT power supplies	0 V to +20 V 0 V to –14 V	
High voltage DUT power supplies	10 V to +100 V 0 V to –14 V	
Number of the supply channel	Normal	High voltage
Programmable 0 to 5 V @ 20 A	Two	One
Programmable 0 to 14 V @ 10 A	None	One
Programmable 0 to 20 V @ 4 A	One	None
Programmable 0 to –14 V @ 5 A	One	One
Programmable 10 to 100 V @ 10 mA	None	One
N6700 DUT power supply unit	4 x programmable channels 0 to 50 V @ 5 A per channel	
Over-voltage protection	Yes	
Over-current protection	Yes	
System power supplies	AC 200 V – 240 V 10 A	
Software Specifications		
Operating system	Windows 107 6432-bit	
Support languages	English Simplified Chinese Traditional Chinese (Supports localization)	
Vectorless test technology	VTEP v2.0 Test Suite (Includes VTEP, iVTEP and NPM) Cover-eExtend Extest Toggle	
Board/fFixture graphics display	Nails location graphic Pins location graphic Device location graphic	
Probe pin locator	Pin locator with guided probed	
Runtime yield display	Real- time First Pass Yield (FPY) (First Pass Yield) display at runtime	
Yield enhancement tool	Auto retest Auto test cycle repeat	
Debug interface	Spreadsheet layout for easy test options selections	
AutoDebug	AutoDebug on the analog unpowered test and VTEP v2.0	
Scalability	Single module design of up to 28 slots	
Failure message printer	Uses serial port interface (Printer not included)	

Shipping and installation assistance	Included (Keysight authorized representative)
Capacitor discharge protection	Yes
Fixture types supported	Long-wire press-down type
Maximum PCB size	650 mm x 400 mm
Hardware Specifications	
Maximum nodes	3456
Pin card	Un-multiplexed analog 128-channels Un-multiplexed hybrid 64-channels
Printer	Dot mt-Matrix TM-U220 Series

Overview – SFP In-line/Off-Line System (U9405A)

The Medalist i1000D in-circuit test (ICT) system is a revolutionary platform with best-in-class price and performance offerings. It comes with award-winning state-of-the-art features to answer most test challenges faced by today's manufacturers. Advanced limited access test features, coupled with a simplified, automated software model, reduces the learning the curve of new users.

Field evaluations have demonstrated the i1000D delivers the fastest ramp-up of test coverage among all similar category testers.

As the pressure to lower labor costs continues, improving quality and increasing throughput, as well as automation in the surface mount technology (SMT) production lines, are hot topics.

The i1000D is now deployed with an offline and inline configuration to provide electronics manufacturers with even greater ease of use and flexibility in their automated in-circuit test strategy. Coupled with low-cost fixturing requirements and superior signal quality, these result in significant improvements in throughput, coverage, and cost savings for electronics manufacturers.

Model number U9405A – Medalist Small Foot Print In-Line/Off-Line Tester.

Unified Offline and Inline Platform

Keysight has unified both the i1000D small footprint offline system and inline system into the same platform. Customers can purchase an offline system with the possibility to move it to inline usage when automation is needed. All previous investments, including test system, fixturing and programming are protected in this platform.

In the offline configuration, the i1000D small footprint ICT is an actual digital ICT with advanced digital features for production runs. Users can also develop test programs and fixtures which are usable should they decide to deploy the system inline. It offers you maximum flexibility in both production test and test development as shown in Figure 5.

Figure 5: Inline and offline Medalist i1000D.

SMEMA Support

When upgraded to inline, the same system plugs into the SMT lines, and all existing fixtures/ programs are ready to run. Most of the existing hardware parts are shareable for an efficient service and maintenance environment.

The system handler hardware and its control signals are fully controllable from the i1000D software graphical user interface. The hardware is SMEMA compatible with additional pass/fail signals, communicable to downstream conveyors to separate “passed” and “failed” boards for follow-up actions; refer to Figure 6.

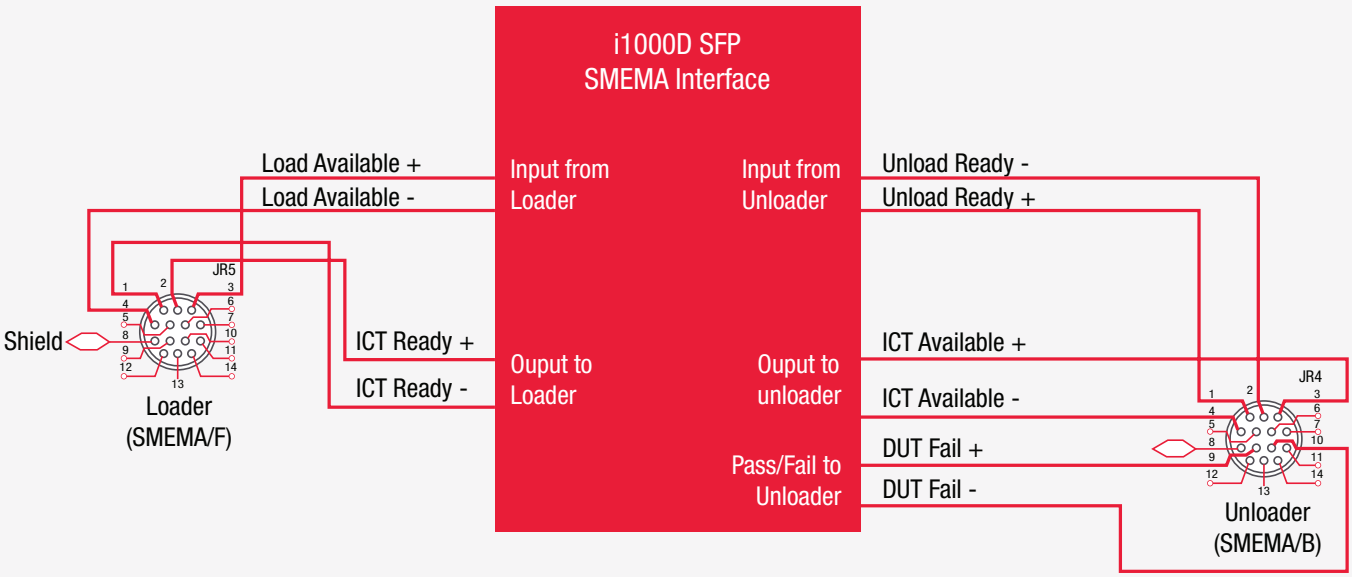


Figure 6: Medalist i1000D SFP inline SMEMA interface.

Ensuring Board Safety

A specially designed control path for board alignment verification, together with a protective mechanism, prevents the press-down fixture from engaging when the board is inaccurately positioned on the fixture. High-clearance space on both the upper and lower sides provide greater flexibility by allowing boards with very long connector pins, such as fuse contact pins found in automotive applications, to flow through without obstruction along the SMT conveyor. Deploying the i1000D with a board handler is easy, with its simple and robust design enabling excellent reliability, ease of maintenance, and of course, automation. See Figure 7 example.

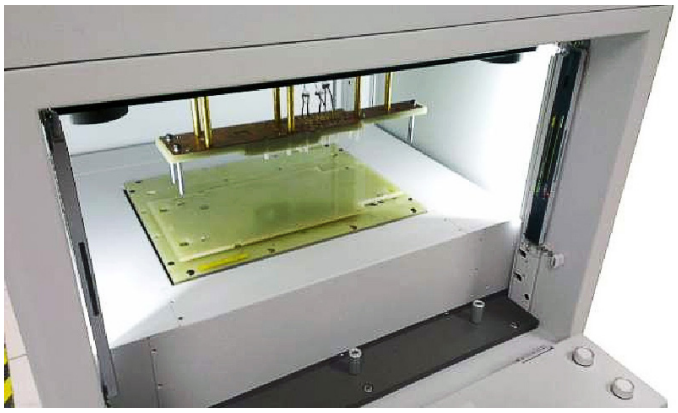
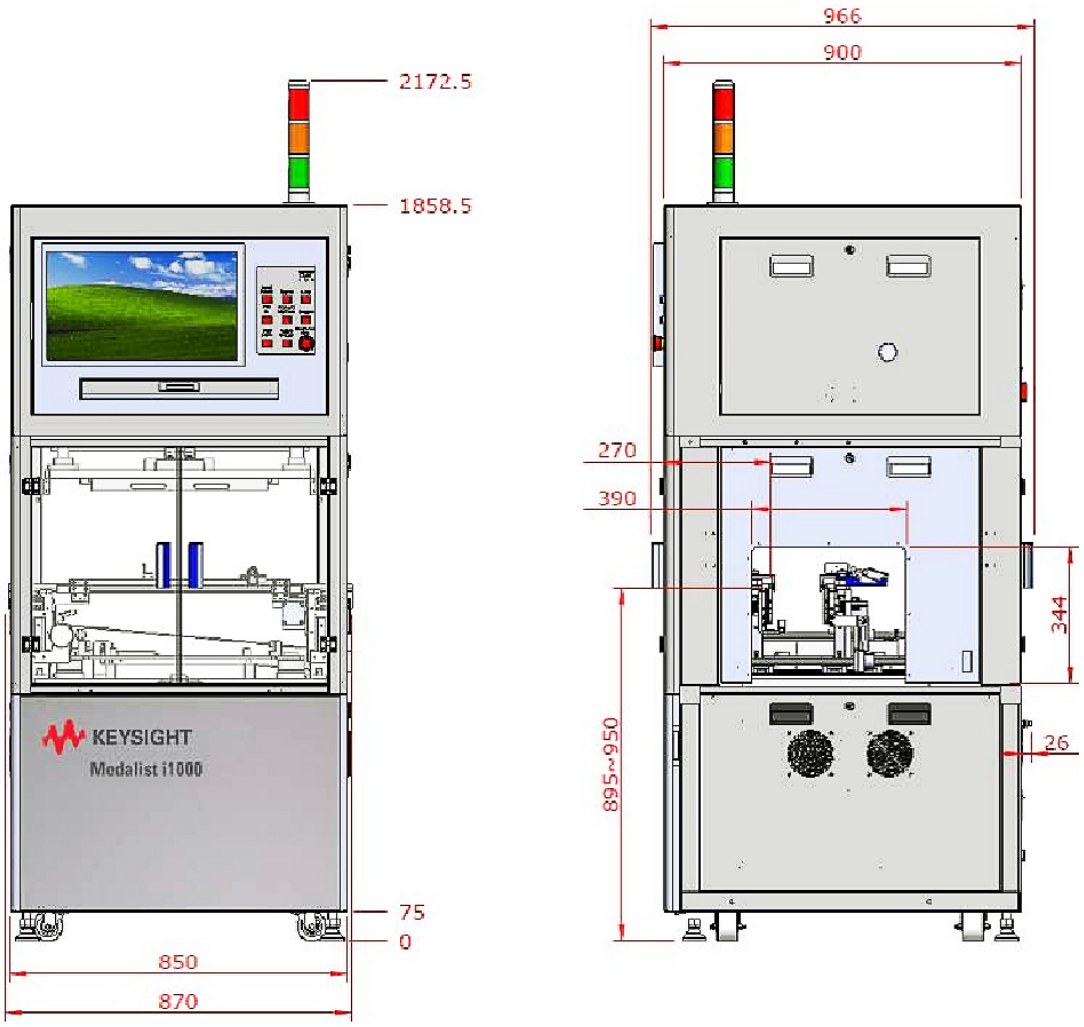


Figure 7: Internal board placement area of the i1000D SFP offline system.

Keysight Medalist i1000D Small Foot Print inline ICT Specification

The Device Under Test Specifications	
Maximum PCB size	430 mm x 300 mm
Minimum PCB size	50 mm x 50 mm
PCB guide hole diameter	2-4 mm
PCB guide hole location	Minimum 10 mm from center
Bottom side clearance height	40 mm
Topside clearance height	100 mm
PCB thickness	0.5 - 4.0 mm
PCB shape	Square
Deviation	1 mm (maximum)
PCB weight	3 kg (maximum)
PCB margin for conveyor	3 mm
PCB alignment	Fixed by 2-4 guide pins
Maximum test points	1,664
Mechanical Specifications	
Dimension	850 mm (W) x 900 mm (D) x 1,883 (H)
Conveying direction	Left to right/Right to left
Conveyor belt width	3.0 mm
Height of conveyer	895 mm ~ 1,000 mm
Power	200 V - 240 V AC
Power frequency	50 Hz/60 Hz
Air pressure	6~8 kg/cm^2
Working temperature	5 to 45 °C
Working humidity	20 to 80%
PCB Exchange time	5 seconds
Board markers	Up to 7
Fixture lock mechanism	Automatic engagement

Dimensions



Overview – Mini In-Circuit Tester (U9403A)

Keysight Mini In-Circuit Tester (ICT) is the first modular in-circuit tester with a standard communication protocol for instruments (SCPI) command support. It is integrated into different applications to provide in-circuit test coverage with the device or pin-level defect information. In this data sheet, we are going to discuss the SCPI commands and the potential use models.

Ordinarily, multiple test strategies used in a manufacturing line are automatic optical inspection (AOI), in-circuit test (ICT), and functional test. Different test strategies offer different defect information. For example, AOI systems frequently provide device-level defect information in graphical view, ICT reports device-level defects with failed information about the functionality of the device while functional test provides functional failures, such as “display failure.”

Functional test results provide a go/no-go for the product, but repairing boards based on functional test results is difficult due to lack of details of the reported failures. A combination of functional test and ICT provides a viable way to improve the level of details which functional test alone fails to provide. The Keysight Mini ICT design provides detailed failure information when needed.

Model number U9403A – Medalist Mini-ICT Tester.

Mini ICT Use Model

Standalone model

The Mini ICT as a standalone tester is a miniaturized ICT system for a low node count environment, enabling flexible PCB testing or boards with low node count. As a repair station, it complements existing analog-only ICT testers, sometimes called MDA (Manufacturing Defect Analyzer).” The Mini ICT provides additional test coverage where test access is available.

In this model, users benefit from powered test features, such as Vectorless Test Extended Performance (VTEP) or voltage/frequency measurements, boundary scan, and programming.

Integrated model

Combined with a functional test, the Mini ICT is considered an integrated model. For example, products are verified by Mini ICT for any opens/shorts defects, followed by powered-up and voltage measurements. The board under test can then be handed over to other test instruments, such as a counter, to make accurate frequency measurements, and the results are then sent back to the Mini ICT for data calibration programming for software clock compensation.

Integrated model usage requires an external test sequencer, such as Keysight TestExec SL, or NI TestStand typically, to run tests through SCPI and pass parameters between instruments as shown in Figure 8.

Figure 8: Mini ICT in an Integrated model with instruments.

Parallel/integrated parallel model

Parallel and integrated parallel models are powerful when panelized boards are in production on the manufacturing line. Boards are tested all together in the same fixture with the single test sequencer from the centralized controller. Optimized test time is according to the manufacturing beat rate.

Sometimes boards are built in sets. For example, a logic board, I/O board, and connection boards are required to complete a product. Building all these boards in one panel makes inventory management simpler and cheaper. Using the Mini ICT, you can test all the boards simultaneously with the benefits of product throughput, best line balance, and process flow.

Keysight Mini ICT Test Generation

No matter which model is selected, the first step to using the Mini ICT is generating the test program. The test program describes the in-circuit tests required in the overall tests. There are two approaches to get test programs done on the Mini ICT:

Simple test generation

When the test access is low, or only specific tests necessary for the product, you can type the device name and test value with test thresholds in the graphical interface in the Mini ICT.

Automated test generation

When there are hundreds of tests to perform on the Mini ICT, it is not realistic to generate the tests one-by-one manually. The Test Program Generator (TPG) tool helps with automated test generation.

TPG requires CAD data converted into component information (pins) and probe information (nails). With a bill of materials (BOM), TPG can mass convert the components on the board into tests. It also applies to part libraries, for example, diode packages or digital tests, when those parts are known, as shown in Figure 9.

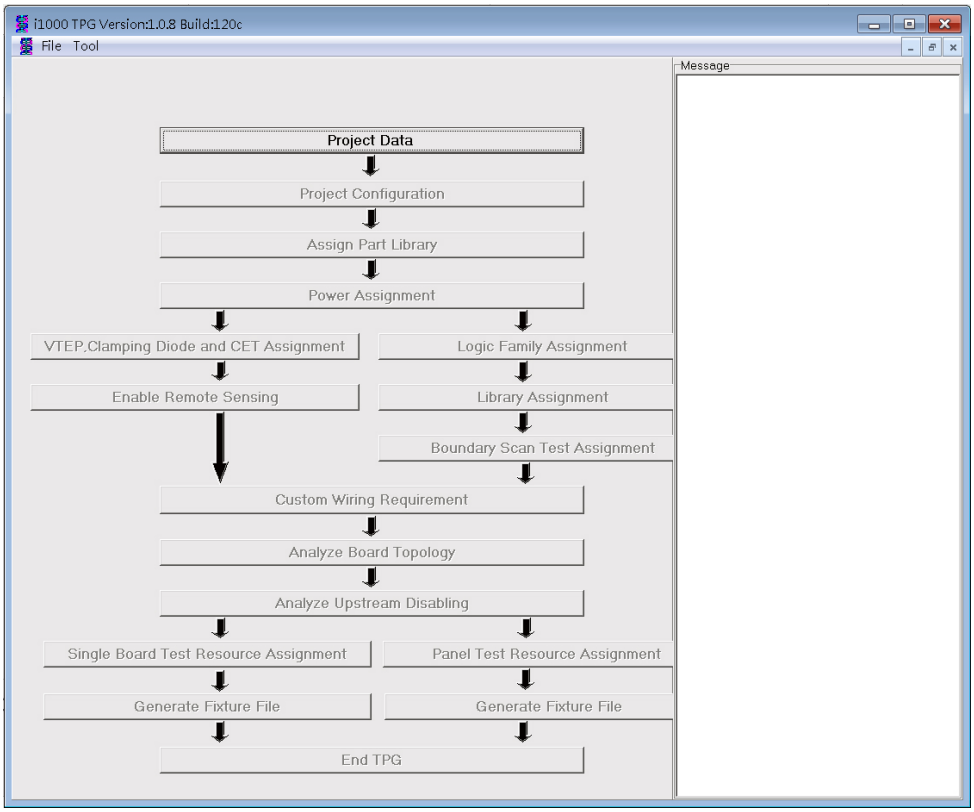


Figure 9: Automated program generation with TPG.

Control Using SCPI

With test programs complete, now the Mini ICT is ready for test. While it can run with its software as a standalone model, the SCPI interface is critical when working with other instruments.

The supported SCPI commands on the Mini ICT are:

- Load test program, select boards in the panel
- Test all, query results, and retrieve failure information
- Component-type-test, query results and retrieve failure information
- Single test-step-test, query results and retrieve failure information
- Turn on SCPI features in software

Once the feature is turned on, Mini ICT can respond to *IDN? by virtual instrument software architecture (VISA) tools such as Keysight I/O library or NI Measurement and Automation Explorer. Refer to Figure 10.

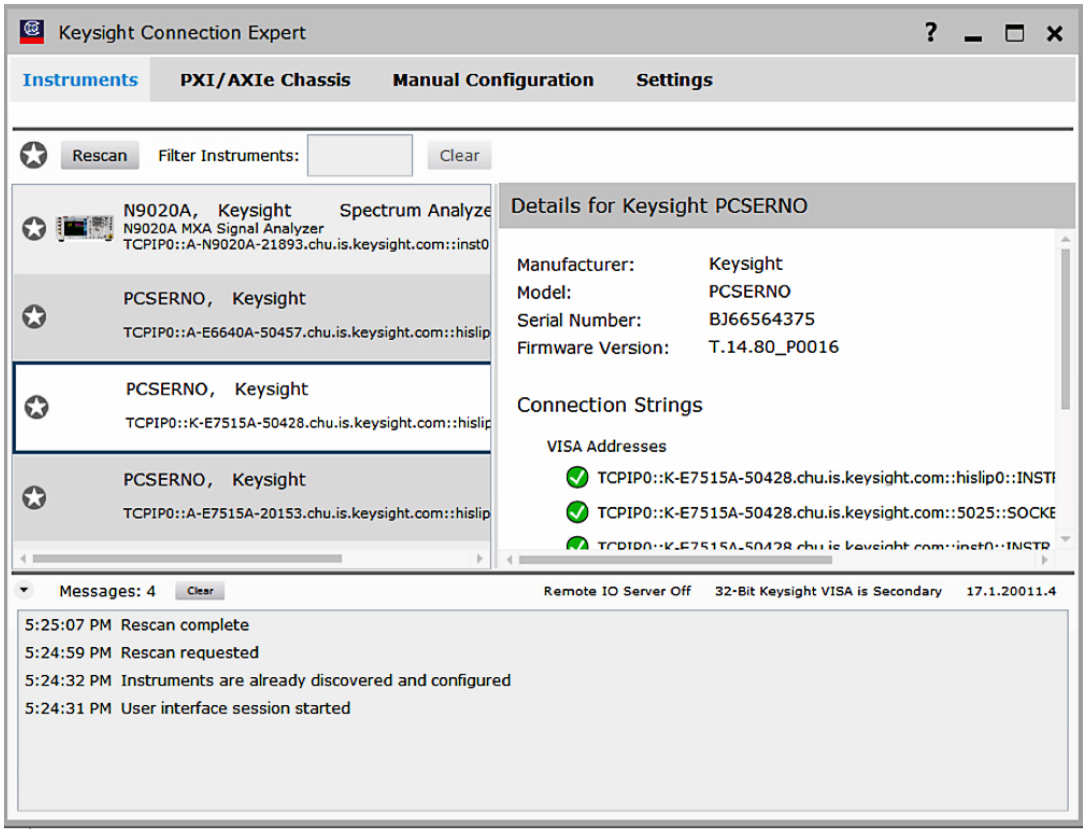


Figure 10: Keysight I/O library and connection expert.

Once the communication link establishes, users can send commands such as “i1000:Testall” to control the tests through the external test sequencer; see Figure 11.

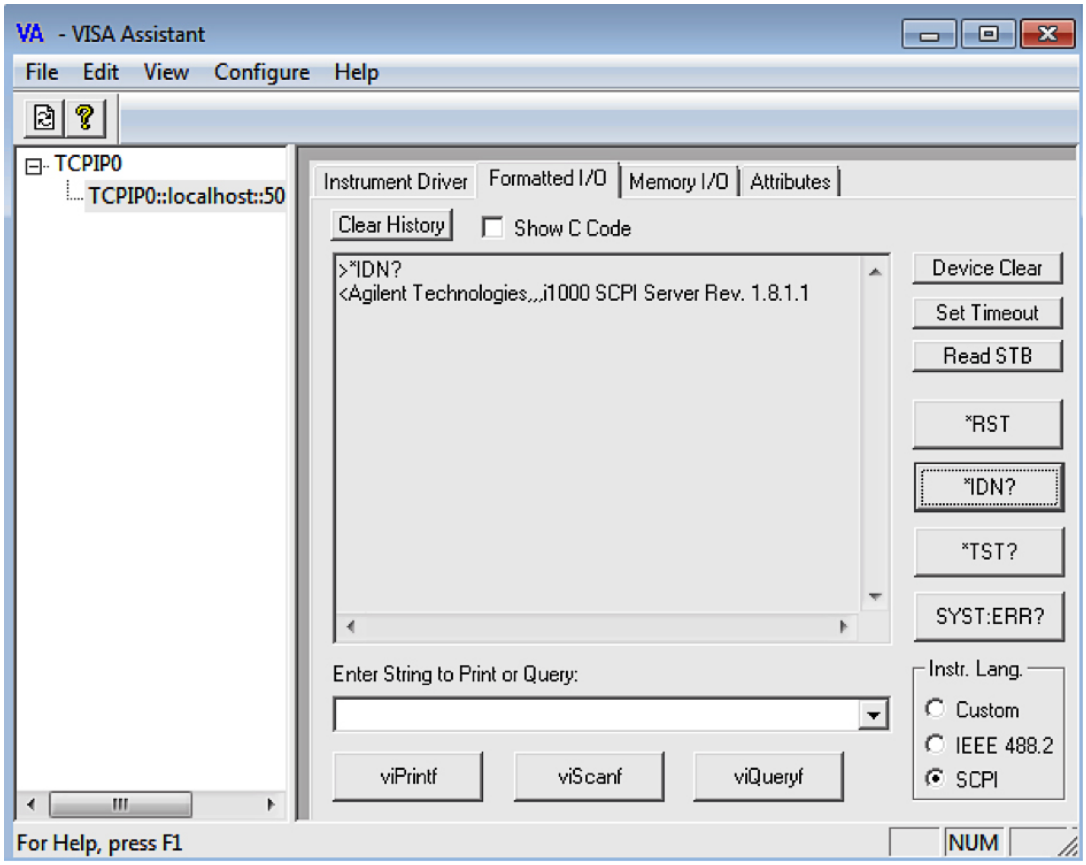


Figure 11: Running SCPI commands from VISA Assistant.

Keysight Medalist Mini ICT Specification

The Device Under Test Specifications	
Maximum node count	512
Minimum digital driver/receiver channels	256
SCPI command support	Yes
External power supply support	Yes
Keysight VTEP 2.0 support	Yes
Onboard programming	Yes
Boundary scan	Yes
Digital test library support	Keysight PCF/VCL
Analog component test	Resistors, capacitors, inductors, jumpers, diodes, and transistors
Voltage measurement	Max 100 v
Frequency test	200 Mhz, 12 sets with Frequency Mux card

Digital Test Capability	
Digital multiplexing	1:1; unmuxed
Per-pin programmable receiver	0 to 4.85 v
Per-pin programmable driver	0 to 5 v
Max sink current	Peak 500 mA
Max source current	Peak 500 mA
Pattern rate	Maximum 2 MPS
Programmable vector cycle resolution	50 ns
Programmable receive delay	Programmable
Programmable receive delay resolution	10 ns
Dimensions	630 mm (L) x 482.6 mm (W) x 222.5 mm (H)

Conclusion

Keysight Mini ICT enables a different approach for ICT. It provides high-quality test coverage at a lower cost, and the modular design complements existing tests to provide a complete board test strategy. With its built-in software, the Mini ICT runs as a modular, compact, and fully functional ICT system. When it runs with the SCPI and test sequencing software, it can operate in an integrated mode with other instruments, or even run as several Mini ICT systems in parallel.

Resources

Leading Innovation in Vectorless Test Solution – Nano VTEP
To learn more, visit:

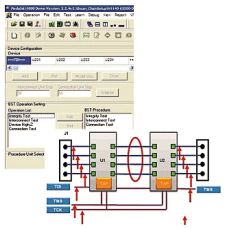
https://www.keysight.com/main/editorial.jspx?action=download&cc=US&lc=eng&ckey=923191&id=923191&cmpid=zzfindnanovt

Keysight Pathwave Analytics for Industry 4.0
To learn more, visit:
https://www.keysight.com/en/pc-2886070/data-analytics?nid=-31992.0&cc=US&lc=eng

Keysight Awards

Cover-extend Technology

The Medalist i1000D is cover-extend ready. With cover-extend, VTEP test is performed on devices without needing physical test access, thus lowering fixture costs and reducing the number of required test points on the printed circuit board assembly.

Network Parameter Measurement	
	Awarded to Network Parameter Measurement, an industry first, Network Parameter Measurement technology detects defects on power and ground pins while iVTEP focuses on ultra-low value measurement of signal pins (< 5fF) on Integrated Circuits (ICs). Furthermore, having the original Medalist VTEP as its core means enabling measurements which are 4X more sensitive and 5X better in standard deviation. As technology advances with shrinking packages and faster signaling speeds, VTEP v2.0 is a necessity to meet the challenges of today and beyond.
Automatic Guard	An automatic guard feature is a tool for the production test engineer as well as test programmer. It automatically selects different guard points based on board topology for the user during the debug process. This feature eliminates the need for the user to check the schematics for each guard point manually; significantly reducing the overall debug time.
Complete Boundary Scan Test Capabilities	
	Putting even more ICT power in the hands of its users, Keysight has equipped the i1000D with full boundary scan capabilities, from standard boundary scan and connect test to interconnect test. These capabilities help satisfy manufacturers' test needs for boundary scan enabled devices, and will ensure manufacturers are geared for the future where there will be increased needs to test Intel-based peripheral control hubs and processors.

Learn more at: www.keysight.com

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