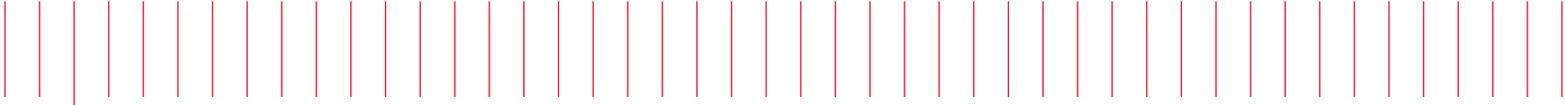


Keysight Technologies Mini In-Circuit Tester

Application Note





Abstract

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

Overview

Normally multiple test strategies are used in a manufacturing line, such as automatic optical inspection (AOI), in-circuit test (ICT), and functional test. Different test strategies offer different defect information. For example, AOI systems normally 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 will provide a viable way to improve the level of details which functional test alone fails to provide. The Keysight Mini ICT is designed for providing detailed failure information when needed.

Common Use Model of Keysight Mini ICT

We can categorize the use model of the Keysight Mini ICT into three major groups:

1. Standalone model

When the Mini ICT is used as a standalone tester, it is a miniaturized ICT system for a low node-count environment, enabling flexible PCB testing or boards with low node count. It can also be used as a repair station, or complement existing analog-only ICT testers, sometimes called “MDAs.” Keysight 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.

2. Integrated model

When the Mini ICT is combined with functional test, it is considered as an Integrated Model. For example, products can be 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 normally requires an external test sequencer, such as Keysight TestExec SL, or NI TestStand, to run tests through SCPI and pass parameters between instruments.



Figure 1. Mini ICT in Integrated model with instruments

3. Parallel/integrated parallel model

Parallel and integrated parallel models are powerful when panelized boards are being produced in the manufacturing line. Boards can be tested all together in the same fixture with the single test sequencer from the centralized controller. Test time will be optimized 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 will be able to 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 getting the test program generated. The test program describes the in-circuit tests needed in the overall tests. There are two approaches to get test programs done on the Mini ICT:

1. Simple test generation

When the test access is low or only certain tests are required for the product, users can just type the device name and test value with test thresholds in the graphical interface in the Mini ICT.

2. Automated test generation

When there are hundreds of tests to be performed 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 to be converted into component information (pins) and probe information (nails). With bill of materials (BOM), TPG will be able to mass-convert the components on the board into tests. It will also apply part libraries, for example, diode packages or digital tests, when those parts are identified.

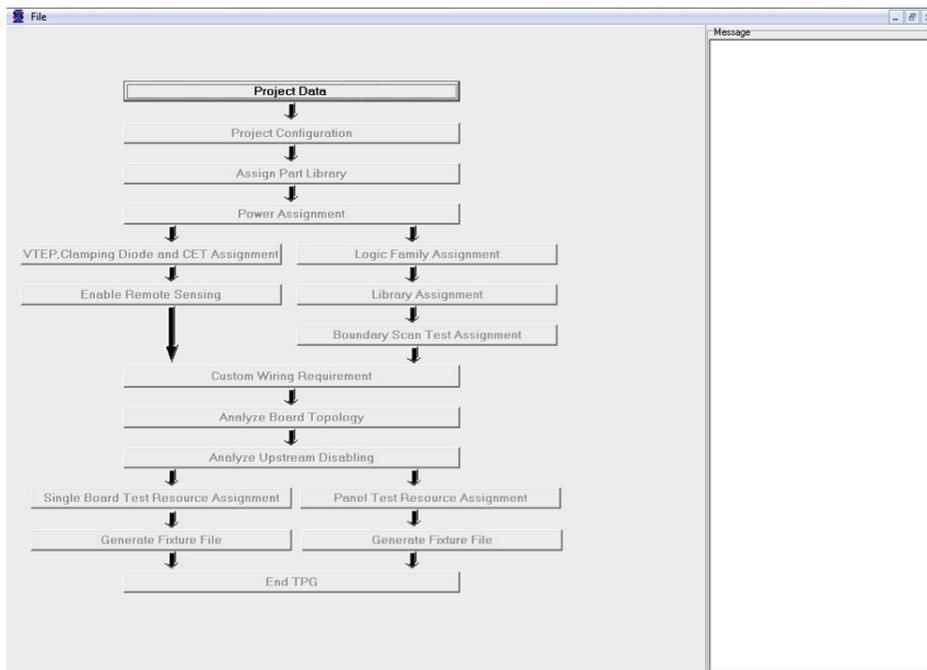


Figure 2. Automated program generation with Test Program Generator

Control Using SCPI

With test programs completed, now the Mini ICT is ready for test. While it is able to run with its own software, as in 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 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 will be able to respond to *IDN? by VISA (virtual instrument software architecture) tools such as Keysight I/O library or NI Measurement and Automation Explorer.

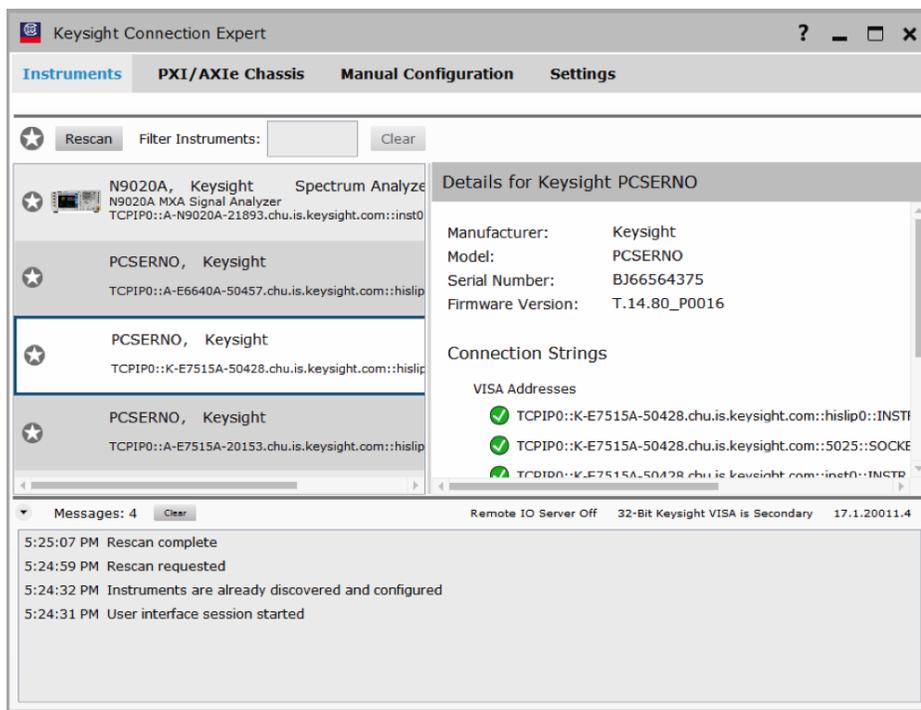


Figure 3. Keysight I/O library and connection expert.

Once the communication link is established, users will be able to send commands such as “i1000:Testall” to control the tests through the external test sequencer.

Keysight Mini ICT enables a different approach for ICT. It not only provides high quality test coverage at a lower cost, but 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 yet full functional ICT system. When it runs with the SCPI and Test sequencing software, it can be operated in an integrated mode with other instruments, or even run as several Mini ICT systems in parallel.

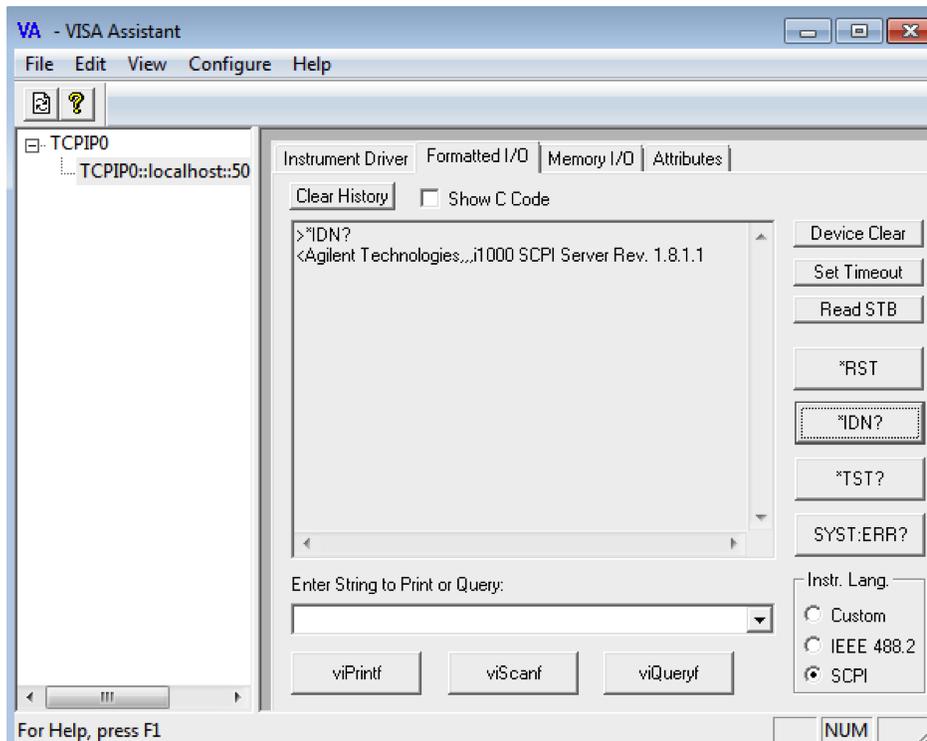


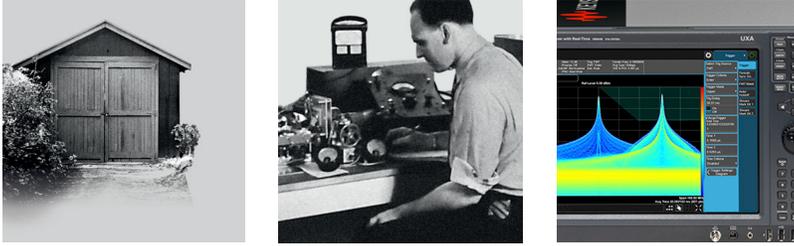
Figure 4. Running SCPI commands from VISA Assistant

Conclusion

Keysight Mini ICT enables a different approach for ICT. It not only provides high quality test coverage at a lower cost, but 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 yet full functional ICT system. When it runs with the SCPI and Test sequencing software, it can be operated in an integrated mode with other instruments, or even run as several Mini ICT systems in parallel.

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