# Seica
Test Solutions

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PILOT 4D

Flying Probe test platform

Pilot⁴ᴰ is the most versatile and complete line of automatic flying probers, offering the widest range of solutions and performances on the market for a Flying Probe tester for electronic boards.

THE ADVANTAGES OF A FLYING PROBE TESTER

Compared to a traditional in-circuit tester, a flying probe test system offers three main advantages:

- **The test fixture is not required:** the board is locked in position via a universal clamping system, no need of mechanical adapters; eliminating the fixture setup times and production costs, the test program development is immediate, with an improved response time and flexibility towards the test requirements.
- **Improved NET accessibility:** it is not essential that the board has a test point for every net, since a flying probe ATE can easily contact also the pads of SMD components and vias. Moreover, some flying-probe solutions provide the dual-side probing capability.
- **All-in-one In-circuit, functional testing and programming:** a single test program enables different types of tests in a unique system, instead of multiple test stations, optimizing test times and decreasing UUT manipulations.
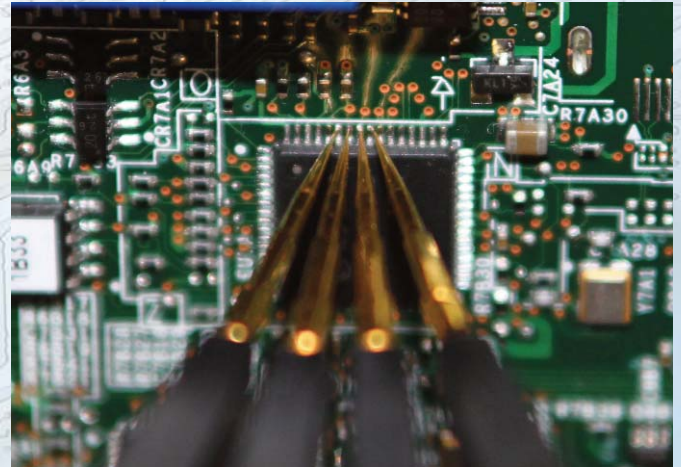

DIFFERENT ARCHITECTURES FOR DIFFERENT SOLUTIONS

The **Pilot⁴ᴰ** line offers several solutions, each with an architecture optimized for its specific purpose.
The horizontal architecture featuring the **Pilot⁴ᴰ L4** testers, is the **"pass-through"** in-line solution, enabling the complete automation of the test process, in accordance with the SMEMA protocol, and providing the opportunity of integrated customized "fixture" for an improved testing (for example including an on-board programming stage).
The vertical architecture proposed by **Pilot⁴ᴰ M4** and **Pilot⁴ᴰ V8** optimizes the simultaneous UUT **dual-side** probing, with 4 or 8 test probes respectively, featuring an increased test coverage when the test points are on one side only and the nets are accessible on the other side.
This solution, achieved along the years also in the PCB testing, is a relevant technological innovation, which redefines the applicability of flying probes in board testing, above all in the context of widely-populated boards with reduced accessibility.
When the board is positioned vertically, the effect of the force of gravity is null: on a vertical flying prober, vibration are considerably reduced and damped, with benefit to contact accuracy and stability.
Software algorithm guarantee a perfect contact management, capable of learning and recovering possible warpage or bending of the UUT, providing increased a soft-touch and accurate probing: essential performances when contacting pads of SMD components.
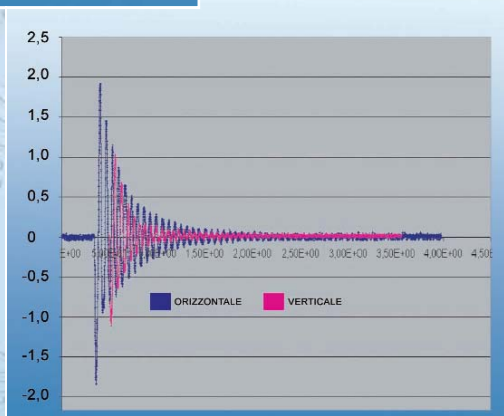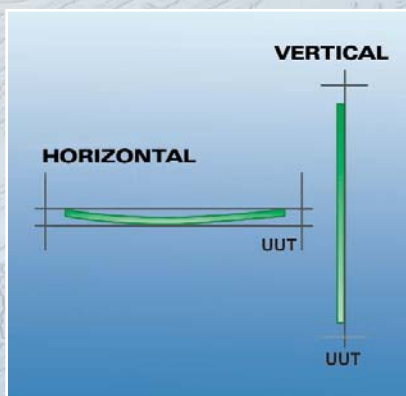
UUT vibrations on a flying probe tester

Solutions range from 4 to 8 test probes, to access simultaneously one or both sides of the board, which can be positioned either horizontally or vertically into the test system.

PILOT4D: 4 DIMENSIONS OF TESTING

The Pilot4D testers are obviously used in the production testing of electronic boards of any kind.

Prototyping (NPI): when the board prototype is not yet completed and an assessment of prototype operation is required, the Flying Prober is fast and flexible, no fixtures or dedicated testbenches.

Production: the evolution of algorithms and test strategies featuring the new VIVA 3.0 software release, make the Seica flying prober increasingly faster and usable in the production phase. Several test solutions are integrated, like the on board programming (OBP), optical inspection, thermal scan and possibility to add functional tests on the powered board, allow to combine and optimize the different manufacturing phases.

Repair: when the standard ICT tests are reduced or abandoned due to lack of accessibility and production relies on a final functional test, the Flying Probe can be a valuable repair tool, capable of providing a focused and efficient diagnostics. Against multiple faults detected on the board, evolved algorithms guide the technician to the most likely cause, managing and rationalizing what was once the repairer experience.

Reverse Engineering: The repair of boards coming from the field may be difficult, especially when the deisgn documentation is no longer available; the reverse engineering operation facilitate the rebuilding of board layout and schematics.

In this case, the Pilot M4 and Pilot V8 testers are the most suitable, providing the double-side probing capability. For reverse engineering, it is essential to access both sides of the UUT, in order to detect the connections between the different layers. Multiple software options are available on the Seica VIP platform, ranging from the netlist learning techniques, to the net-oriented test methods, and the software utilities helping the operator in the accurate identification of the faulty components. These options differentiate the Seica Flying Probe systems from the production standard MDA testers, making the Pilot4D line extremely powerful, flexible and efficient for every purpose.
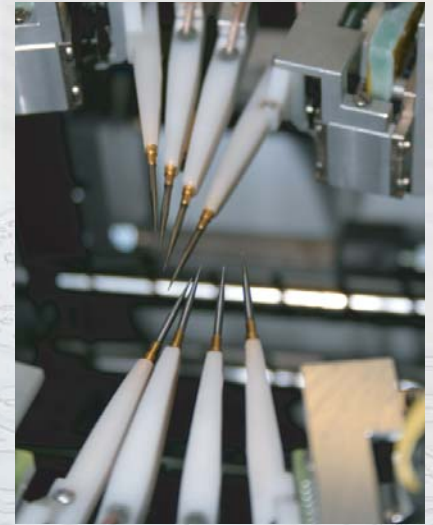
COMMON VIP PLATFORM

All the Pilot4D line test systems are based on the Seica VIP platform (Viva Integrated Platform), a mix of state-of-the-art technology and powerful software, easy to use and also intended for non-specialist users.

This is made possible, first of all, from an hardware point of view, thanks to the sophisticated and **integrated measurement system (ACL module)**, based on **DSP technology**, enabling fully-automated measurements as well as drive and sense operations; secondly, the VIVA management software, equipped with powerful **autodebug routines** of test programs, eliminating the need for long manual debug operations.

The absence of measurement interference is guaranteed via **optical fiber wiring** connection between the measurement module and the central management unit (PC): this effectively eliminates from the measurements any electrical "noise" inevitably generated by other parts of the system, ensuring extremely high measurement accuracy in any condition.

MECHANICAL RELIABILITY GUARANTEED

The mechanical architecture of the Pilot4D line, employs a technology consolidated over time: the combination of sophisticated brushless motors and robust ball-bearing screws, makes a low inertia an lean solution, enabling high acceleration, fast and accurate motion, with reduced power; streamlining the shielding of any source of electric disturbance. Instead, the linear motor technology is employed to move the flying probes along the Z axis, where the small physical loads involved allow to make full use of this technology.

The motor control of any Pilot4D tester, either brushless or linear, is guaranteed by the **Seica VIP motion drives; their optical fiber connection**, combined with a motion **closed loop feedback** do not merely manage the motion of all the system axes, but also the axis and motor integrated encoders.

The Seica VIP controls and drives guarantee highest accuracy, positioning repeatability and safety for the system and the operator.

THE PILOT LINE⁴ᴰ:

PILOT⁴ᴰ M4

Pilot ⁴ᴰ M4 is the solution for those who seek the highest flexibility from a flying probe tester, from production test to repair, all the way to reverse engineering
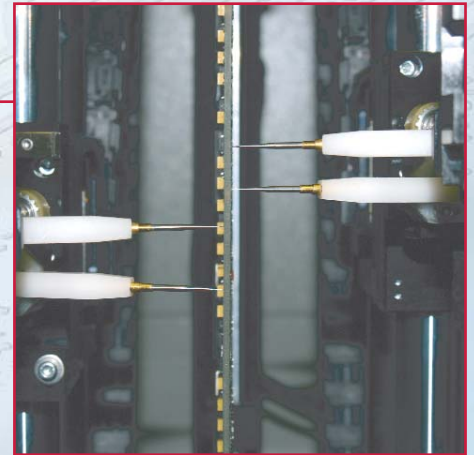

The Pilot⁴ᴰ M4 has a vertical architecture and two flying probes on each side, two additional Openfix probes and two cameras (one on each side respectively). This configuration allows the Pilot⁴ᴰ M4 to perform true in-circuit tests, giving full access even to boards that do not have all the test points on one side only, and the capability to place guarding points as well as the use of all the vectorless test techniques for ICs, with or without powering up the UUT. With probes and cameras on both sides of the UUT, the Pilot⁴ᴰ M4 is ideal for rebuilding the board netlist: the system can acquire images of components, pads and test point coordinates, to enable the complete reverse engineering and hence rebuilding the electric schemes or even the CAD data of a product which has no design documentation. The possibility to equip the Pilot⁴ᴰ M4 with two thermal probes (one for each side of the UUT) also enables the fully automated check of the component temperature, through the Thermal Scan function, and the complete thermal scan of the UUT, guaranteeing an unmatched tool to detect faults on boards coming from repair lots.

PILOT⁴ᴰ L4/H4

The Pilot⁴ᴰ L4 represents the best solution for those wishing to fully automate the flying probe test process, eliminating the need for continuous operator presence in order to manage the test system. Thanks to its integrated SMEMA conveyor, the Pilot⁴ᴰ L4 can be combined can be combined with automatic load/unload magazines or lines, executing in-circuit/functional/visual tests of electronic boards in a completely automated mode, integrating all its measurement capabilities and techniques in a single test program.
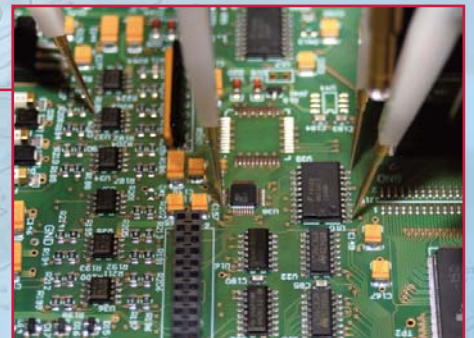
Pilot⁴ᴰ L4 is the ideal solution to achieve a complete flying prober, suitable to test boards accessible on one side only, designed in accordance with the common design for testability standards.
The horizontal architecture of the Pilot⁴ᴰ L4, essential to convey and house the boards into the test system, also enables the use of frames/carriers and/or support fixtures which facilitate the use of fixed channels, Openfix sensors and power connections on the side opposite to the probes, to maximize test program fault coverage. These fixed resources are positioned on the elevator platform under the UUT, which enables them to be applied in the automatic mode with no need for further operator intervention. Its 610 x 540mm test area allows Pilot⁴ᴰ L4 to handle even big boards or board panels, and the high expandability of the ATE rack can hold up to 1032 analog channels, connectable to a possible external bed of nails fixture coupled to the system. The unique VIP platform and the VIVA management software, allow the user to run the same test program on Pilot⁴ᴰ L4 using the flying probes or a bed of nails fixture, depending on his production requirements. Those not requiring automation, is offered Pilot H4 solution, with manual loading downloading.

1 PLATFORM, 3 SYSTEMS... MANY SOLUTIONS

PILOT⁴ᴰ V8

The **Pilot⁴ᴰ** V8 represents the latest frontier in flying probe test technology, and is the complete solution for those seeking to combine the maximum performance, both in terms of speed and coverage in any context: prototypes, manufacturing lots, or repairing any type of boards.
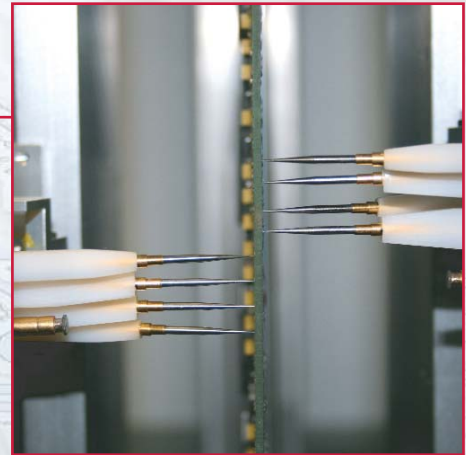
Pilot⁴ᴰ V8 provides up to a 16 mobile resource to test the UUT: 8 electrical flying probes (4 on each side), 2 Openfix mobile probes (1 per side), 2 mobile power probes (1 per side), 2 CCD cameras (1 on each side) and 2 thermal probes (1 on each side), combined in a very compact and robust vertical architecture, making the **Pilot⁴ᴰ** V8 really unique in its genre. The multiple mobile probes also facilitate the execution of parallel tests on two UUTs at the same time, halving the test times with respect to a standard 4-probe tester.
Moreover, the power probes, are used to power up the UUT without requiring any additional wiring, so very useful when implementing functional tests on panels of multiplied boards.
As the most complete solution, **Pilot⁴ᴰ** V8 can easily "receive" and use any existing test program, even developed on other Seica flying probers, its supply of mobile probes enable its operation in any possible mode (2 or 4 probes, single-side or double side).


Pilot⁴ᴰ V8 with automated loader

Parallel test on Pilot⁴ᴰ V8

The new automated version of **Pilot⁴ᴰ** V8 tester is equipped with an opening on the right side to enable the board loading/downloading in accordance with SMEMA protocol. If necessary, the **Pilot⁴ᴰ** V8 may be equippled with a loading/downloading module where the boards are housed into standard racks, for operator-free system operation.
The loading/downloading module is available in the single rack, or in the "multi-rack" versions, with a number of racks ranging between 3 and 12; providing a considerably increased autonomy of operation. Also, each rack may house different types of boards, then, using a barcode on the rack, the **Pilot⁴ᴰ** V8 will be able to load appropriate test program.

FNODE-PWMON "NET-ORIENTED" TECHNIQUES
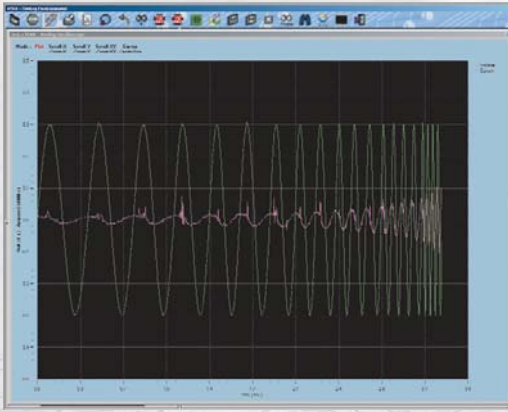
Net analog signature (FNODE)

In addition to the usual in-circuit and functional tests the **Pilot⁴ᴰ** systems can also implement "net-oriented" measurement techniques, based on measurements executed on the board nets, with no particular reference to its single components. These new test methods significantly **cut the time required for in-circuit test** by considerably lowering the number of measurements required, maintaining the same level of fault coverage. The use of net-oriented test techniques is also strategic and practically essential in those situations when it is necessary to set up a test for a board for which the information (such as CAD data and electrical schematics) is either incomplete or lacking entirely.

In these cases, the possibility to compare the analog behavior of a net on a sample reference board and a faulty board, provides several useful indications for locating the defects (**FNODE** technique).

In the same way, the **PWMON** technique, allows the behavioral analysis of the nets **with power on the board**, to intercept all those faults on digital components that normally do not come out in a "cold" test.

All of the "net-oriented" techniques require no debug by the user at the test program level, but are based on the autolearn of the values on one or more "good" sample boards.

PROBES

The wide probe range featuring the **Pilot⁴ᴰ** line tester, covers any contact requirements: ranging from reduced weight to a minimized contact pressure, up to the type of probe capable of punching most of the coatings on the boards returning from field; and probes for vias and high accuracy and fine-pitch needed for state-of-the-art board testing.


AUTIC-OPENFIX TECHNIQUE "VECTORLESS"

The **Pilot⁴ᴰ** line test systems are also equipped with "vectorless" measurement techniques, not based on pattern libraries or vectors specific for each type of component, able to perform the tests for process faults on ICs (typically shorts and unsoldered pins) by executing clamp diode and parasitic transistors type measurements (**AUTIC** technique) or using dedicated capacitive sensors (**OPENFIX** technique) The tests are generated automatically, requiring only one (or more)

Openfix mobile probe

sample boards from which the measurement values are auto-learned, without any manual intervention by the user. These two techniques may also be combined to optimize test times and fault coverage.
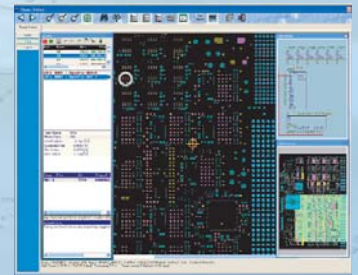
TEST STATISTICS COLLECTION
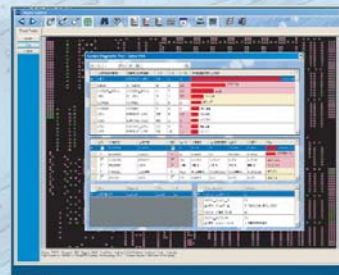
Diagnostic expert system   *Repair station software*

Among the multiple capabilities offered, the Pilot testers may be provided with a comprehensive graphic software environment for fault location and repair which can graphically display the test results (**RPS** module), store the history of all the tests executed (**QSTAT** module) and supply useful tips and information for the operator, based on past experience and on the body of tests executed on a specific kind of board (**DES** module).

The different software modules dedicated to repair and fault statistics may reside both on the test system or on separate, dedicated stations (PC) networked to the test system, operating with autonomous barcode reader for the local identification of the parts to be repaired.

CAMERAS AND OPTICAL INSPECTION

The different solutions in the **Pilot⁴ᴰ** range are always equipped with one or **two color cameras** which, in addition to the UUT automated optical centering, provide **a series of optical inspection capabilities**, complementary to the electrical test, in case of constraints arising from design or circuitry features of the board under test.

A visual test can check the presence/absence and polarity of a component, regardless of its electrical characteristics and of the type of test (visual or electrical), the images of faulty components may be referred in the test report for an easier understanding of the fault.

Moreover, the system cameras are used **for serial barcode reading**, on panels and/or single boards, meeting flexibly the process and fault traceability requirements.

The **Pilot⁴ᴰ** system cameras are essential in the reverse engineering operations, allowing to learn the board images and, as a consequence, of the usable testpoints.
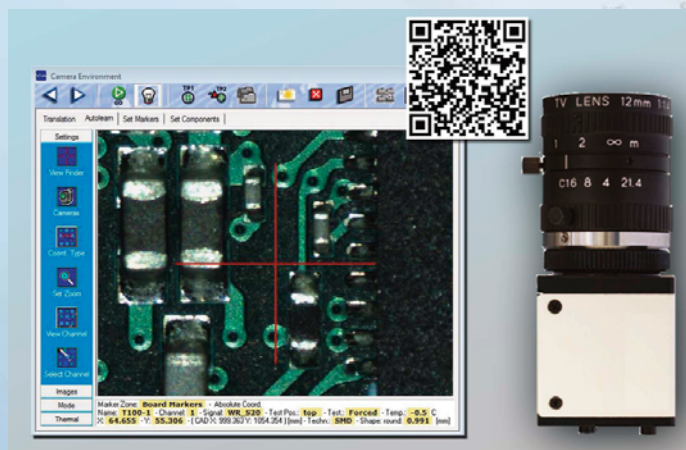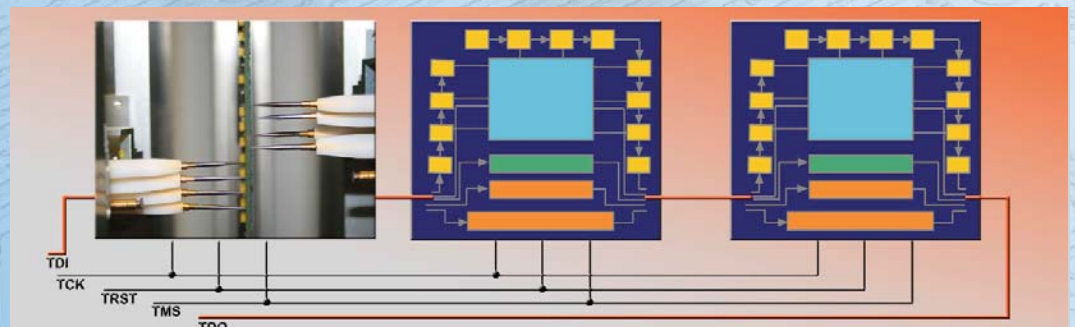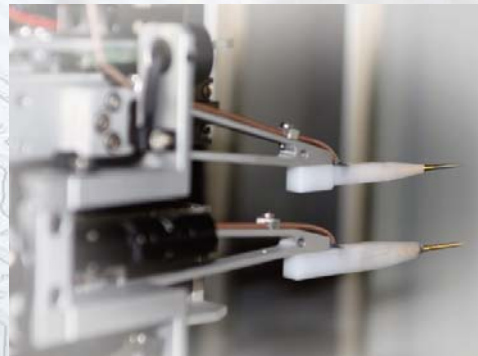

Optical inspection test

FLYSCAN

The opened architecture of the VIVA software , enables the execution of **Boundary Scan** tests, thanks to the innovative **FlyScan** module which, including the system into the Jtag chains of the UUT, allows an extended test also of the not Jtag-type components and the implementation of an extremely accurate extended diagnostic.

The use of the boundary scan test technique through FlyScan allows a higher electrical accessibility also for components (e.g. BGA) not physically accessible through flying probes and, above all, improves the test fault coverage combined to a considerable decrease of the test time.

FUNCTIONAL AND OBP TEST

Electrical probe and power probe

Taking advantage of the same VIP common platform, which is the core of functional testers by Seica, the **Pilot⁴ᴰ** test systems may easily **power the UUT either with fixed or mobile probes** (only Pilot V8) and perform analog, digital or mixed functional tests, even combined with fixed measuring channels (either analog or hybrid). For Pilot V8, when it is equipped with the **Power Probes** module, the UUT power up is guaranteed by two additional mobile probes (one on each side) that may be connected to any of the user power supplies available on the system, eliminating the need of a fixed dedicated cable to be connected to the board under test. Thanks to the hardware/software module designated as OBP (**On Board Programming**), the Pilot test systems are also capable of carrying out the in-circuit programming of digital devices, like microcontrollers and flash memories, before, during, or after the standard test, but always within a unique test program.

STAMPER

Seica offers, as an option on the whole **Pilot⁴ᴰ** line, the opportunity to install an automated marking equipment, for an easier identification of the board which has passed the electrical test. This solution is particularly suitable for a fully automated flying prober configuration.

Different types of printable symbols are available, as well as the option for test PASS or test FAIL marking

Flyscan inserts the Flying Probe tester into the JTAG chain

THERMAL SCAN

The Thermal Scan module allows the user of the Pilot test system the **monitoring**, in a fully automated way, **of the temperature of each electronic component** mounted on the UUT, hence to detect faults by comparing the temperatures of a working sample and the lot of boards to be tested. During the Thermal Scan phase, the UUT is powered by the Pilot test system, and a pyrometer mounted on one of the flying probes (one on each side for double side systems) detects the different temperatures.

As for any other test technique, available on Seica test systems, also the Thermal Scan can be integrated in a comprehensive test program for a specific board.
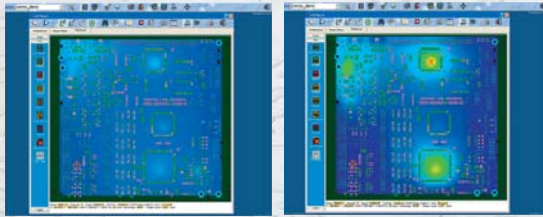
UUT thermal scan

QUICK TEST

The innovative graphic software **Quick Test** is available for all the Pilot users **to write and execute functional tests in short times** and to program correctly all the system resources without knowledge of the internal architecture or a specific programming language.

To use Quick Test and possibly enrich the classic ICT test program with one or more functional tests, only the functional specifications of the UUT to be tested is required, and its description in a very simple and user-friendly graphic environment integrated in the VIVA environment.

Quick Test is suitable also **to use the ATE as a lab instrument** and hence set up functional measurements even in lack of a complete test program, being very useful for the expert users dedicated to board repair and require a quick interaction with the test system.
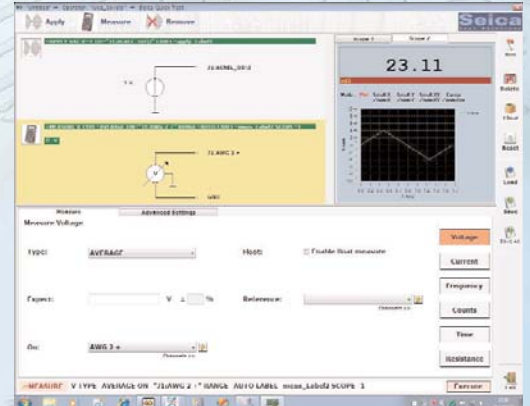
Graphical GUI of Quick Test software

SYSTEM COMPARISON TABLE

SYSTEMS	PILOT⁴ᴰ M4	PILOT⁴ᴰ L4/H4	PILOT⁴ᴰ V8
ARCHITECTURE	Vertical	Horizontal	Vertical
NUMBER OF FLYING PROBES	2+2	4	4+4
IN-LINE	N/A	Pass Through/Manual	Option Automatic
FNODE	✓	✓	✓
AUTIC	✓	✓	✓
PWMON	✓	✓	✓
OPENFIX	✓	✓	✓
TEST IN-CIRCUIT	✓	✓	✓
QUICK TEST	✓	✓	✓
POWER PROBES	N/A	N/A	✓
FLYSCAN	✓	✓	✓
OBP	✓	✓	✓
OPTICAL INSPECTION	✓	✓	✓
THERMAL SCAN	✓	✓	✓
REVERSE ENGINEERING	✓	✓	✓
BARE BOARD TEST	✓	✓	✓
PARALLEL TEST	N/A	N/A	✓
BEST FOR	Production, Repair Reverse Engineering	Production	Throughput, Repair Reverse Engineering

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