Semiconductor Test Solutions
Today’s device technology is more complex and demanding. Can your probe system keep up?

SemiProbe designs and manufactures manual, semiautomatic and fully automatic probing solutions to help you solve your most difficult test challenges quickly, accurately and at lower cost.

Semiconductor test requirements are changing—quickly. Test groups are continually confronted with new device types, new materials and new geometries. Today’s tests run at higher voltage, power and frequency and lower noise. Optical devices require double sided probing, MEMs devices require test under vacuum and most devices require wider temperature ranges—all while development schedules demand faster time to data and lower cost of test.

Probe systems with fixed architectures, limited configurability, restricted wafer access space and limited instrumentation placement can’t keep up with today’s test environment. Probe systems that are difficult and expensive to upgrade and reconfigure cause higher cost of test and strand valuable capital expense funds.

We have a better solution—Adaptive Architecture Probe Systems.

SemiProbe’s Probe System for Life (PS4L) series of probe solutions are based on its patented Adaptive Architecture technology. Unlike traditional systems, Adaptive Architecture foundation modules are interchangeable, reconfigurable and field upgradable. The platen surface is large to accommodate multiple probe types, environmental chambers and instrumentation. SemiProbe systems are quick to set up, easy to operate and deliver test data faster and at lower cost. This unique modular platform enables you to acquire test capabilities that precisely match your requirements today. As the environment or test conditions inevitably change, SemiProbe systems can be transformed rapidly at your site to meet these new demands. With this design philosophy, SemiProbe users realize substantial test time and cost savings over traditional probe systems when wafer size, parameters, levels of automation, or test requirements change.

Our commitment to you is to empower you with the latest technology you need to help lower the cost of acquisition and test while speeding your time to market.

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PS4L Adaptive Architecture Probe Systems

Foundation modules and probes are configurable and interchangeable
• Rapidly configure the probe system to meet your specific application requirements
• Optimize all test elements for the highest performance
• Transform the system at your site when your requirements or environment changes
• Maintain the value of your system while lowering the cost of test

The PS4L family of wafer probing systems is based on SemiProbe’s patented Adaptive Architecture. Unlike traditional probe systems, all foundation modules – bases, stages, chucks, microscope mounts, microscope movements, optics, manipulators and more - are interchangeable and configurable. The PS4L Adaptive Architecture ensures an optimal test configuration for almost any test type. All test elements, including environment and instrumentation interfaces, can be individually configured to deliver the highest possible performance.

This innovative modular design enables users to implement test capabilities that precisely match their specific requirements – now and in the future. As the environment or test conditions change, the PS4L can be rapidly transformed to meet these new requirements. Changes in wafer size, levels of automation, or test requirements do not translate into new equipment requirements, substantially reducing acquisition and training costs and time. With SemiProbe’s Adaptive Architecture, PS4L users realize substantial time and cost savings over traditional probe systems.

All SemiProbe semiautomatic and fully automatic systems operate on the powerful PILOT control application suite, designed employing SemiProbe’s Adaptive Architecture. PILOT is modular, intuitive and easy to learn. PILOT’s powerful object-oriented software enables users to integrate the probe system quickly and easily with a broad array of test instrumentation. Drivers for most types of test instrumentation are readily available and new interfaces can be easily added.

A complete line of accessories is available for the PS4L family including thermal chucks, probe card holders, manipulators, probe arms and bases, probe tips, laser cutters, optics, CCTV systems, vibration isolation tables, dark boxes and much more.
HIGH FREQUENCY PROBING

SemiProbe high frequency probing solutions provide a broad array of capabilities for measurements ranging from DC to > 300 GHz. Testing the many different types of high frequency components requires a measurement system of specifically designed components that include the chuck – standard and thermal, manipulators, probe arms, probes, calibration substrates, calibration software, cables, tuner modules and test instrumentation. Manual, semiautomatic or fully automatic, the system can be enhanced with PILOT Control Software to simplify integration of test equipment and automate test suites.

- Multiple HF and DC bias manipulators
- Supports HF & DC probes, multi-contact wedges and probe cards
- Large, open platen surface accommodates a variety of manipulator configurations.
- This configuration supports both HF and DC Probes with a tuner manipulator
- SPCal provides a manual step-by-step setup procedure, reducing HF measurement time and eliminating errors.
- Integrated with PILOT, SPCal delivers highly repeatable calibration with contact placement within 1 μm.

MEMS MOTION ANALYSIS

Static and dynamic analysis and visualization are a critical part of the test and development process for MEMS microstructures in order to characterize surface metrology and to measure in-plane and out-of-plane motions. SemiProbe’s modular architecture enables seamless integration of advanced capabilities to deliver precise, accurate, repeatable measurements for complex MEMS components.

- Customized stage provides up to +/-5° roll, both side-to-side and back to front, for out-of-plane vibrometry and motion detection
- Integrated Platen Lift provides precise user-defined movement up to 40 mm
- PS4L Manual 8” (200 mm) probe system with a Polytec® MSA-500 Micro System Analyzer
DOUBLE SIDED PROBERS

Double sided testing with the PS4L can be performed on a single die to a full wafer employing a manual or semiautomatic test configuration. The PS4L can probe in a variety of combinations including top side only, bottom side only, or both sides simultaneously and supports both manual or programmable manipulators and probe cards in combination. Manipulators and probe cards can be positioned separately or together on either side of the device under test (DUT). Custom wafer carriers are available for single die, partial wafers, or wafers with hold-down clamps to insure ease of use and stability. Stimulus and output measurements can be applied to the top and/or bottom sides. With its integrating sphere option, the flexibility of the double sided prober makes it ideal for an array of optoelectronic applications including horizontal edge emitting laser diodes (EELD) and vertical cavity surface emitting laser diodes (VCSEL) testing.

Discrete, Power, Optoelectronic devices including Through Silicon Vias (TSV), have active regions on both sides of the wafers, which require simultaneous double sided probing for testing.

Double sided probing requires specialized chucks and carriers with retaining clamps in order to insure stability and accuracy in testing. SemiProbe wafer carriers are interchangeable, easy to slide in and out and lock into place. Probes contact the front side of the wafer. A camera or detector is mounted on the underside looking up at the back side or bottom of the wafer to collect the output.

MAGNETIC STIMULATION

SemiProbe’s Magnetic Stimulation configuration provides testing solutions for memory devices – Fram, FeRam, MRAM and Spintronics. This configuration is designed to use standard DC or HF probes on individual manipulators and probe cards. All components and fasteners used are non-ferric.

In order to obtain minimum distance to the magnetic source, an ultra-thin glass chuck is used with non-ferric clamps. The chuck system is open for the magnetic source and positioning system. The magnetic source holder is a rigid mount that maintains multiple degrees of freedom for positioning in relationship to the device under test (DUT).

The PS4L Magnetic Stimulation configuration will support individual die, fragments, or wafers up to 300 mm in either manual or semiautomatic modes.
VACUUM PROBERS

Sized for the user’s wafer/substrate, SemiProbe vacuum probers are used extensively in MEMS development and production. From sensors to gyros, any product that will be vacuum packaged in either a conventional or via 3D package can be characterized earlier in the process. SemiProbe vacuum systems will test wafers or substrates up to 300 mm. Individual die and partial wafers can also be tested. Thermal chuck options are available for temperature ranges from -65°C to 300°C.

Different size viewing ports, windows and flanges are available in a variety of materials, as well as several different types of pumps and controls to meet a broad range of vacuum levels. The PS4L interchangeable modules make it easy to convert to provide testing solutions for a number of applications including DC, HF, OPTO, MEMS and more.

HIGH POWER DEVICE CHARACTERIZATION

SemiProbe’s Volterus™ family of probe systems addresses the unique challenges of testing high power devices at wafer level prior to packaging. Available in manual, semi and fully automatic configurations, Volterus can test and characterize power devices up to 10 kV or 100 A (pulsed). Based on the PS4L Adaptive Architecture, Volterus can test individual die or wafers from 100 mm to 300 mm using manipulators or probe cards and at temperatures from -65°C to 300°C in a fully guarded and shielded environment.
CONTROLLED TEMPERATURE PROBING

SemiProbe offers a broad selection of temperature probing solutions ranging from \(-190^\circ\text{C}\) to \(1,000^\circ\text{C}\). The majority of wafer probing applications are between \(-65^\circ\text{C}\) to \(300^\circ\text{C}\). Depending on application and test requirements, the thermal chucks are placed in either a localized environmental chamber or a vacuum chamber to provide a controlled environment.

- Closed environment chamber with locking knobs
- Localized environment Air or Nitrogen flow control
- Removable Top Hat for easy positioning access or reconfiguration
- Multiple HF and DC bias manipulators with the Top Hat
- Supports DC, HF, Kelvin, wedges and probe cards.
- Gold plated thermal chuck
- Independent calibration substrate chuck
- Removable front platen wedge for easy access

Designed for research on small samples, the Research Assistant enables users to transform a single platform into a multi-use platform for vacuum and ultra-high temperature (1,000^\circ\text{C}). It is ideal for small materials research, MEMS and more.

SemiProbe vacuum systems will test wafers or substrates up to 300 mm. Individual die and partial wafers can also be tested. Thermal chuck options are available to provide temperature ranges from \(-65^\circ\text{C}\) to \(300^\circ\text{C}\).
FULLY AUTOMATIC PROBERS

Many manufacturers prefer fully automated probe systems in order to minimize wafer handling, damage and the associated cost – particularly when producing wafers 200 mm and larger. Other manufacturers experience rapid growth and success, necessitating replacing manual and/or semiautomatic test platforms in order to achieve the higher test throughput and precision that only fully automated systems can deliver.

At the center of the fully automated configuration is the Material Handling Unit (MHU). The PS4L Material Handling Unit consists of a large travel, multi-axis robot with a pre-aligner, single or dual end effector, scanner and two cassettes. The robot has the ability to use end effectors for wafer handling or edge grippers for frames and trays of die. With a minimum amount of time, the user can swap between end effector and gripper applications. Additional MHU options include end effectors, EZTeach robot teaching pendant, bar code scanner and software.

The MHU is in a safety enclosure – either Plexiglas or light curtain - and integrated on a vibration isolation table with casters and leveling feet. Minimum planning and downtime is needed to integrate, level and teach the system.

SemiProbe’s unique, modular adaptive architecture also enables timely, cost effective conversion of existing PS4L semiautomatic configurations to fully automatic operation:
- At your facility
- While maintaining your investment in existing equipment and test suites
- For a fraction of the cost and time associated with traditional wholesale upgrades to your existing facilities

Once pre-aligned in the MHU, transfer to the probe system consists of a programmable four pin Z stage movement. Side mount camera works in conjunction with PILOT pattern recognition software to insure precise, consistent wafer placement and removal.
PILOT CONTROL SOFTWARE SUITE

The SemiProbe PILOT Control software Suite for PS4L semiautomatic and fully automatic probe systems also employs the SemiProbe patented Adaptive Architecture. Software modules can be added to the base system as needed. PILOT Control Software consists of a Microsoft Windows-based user interface built on the SemiServer application for communicating to and from the probe system. Individual customer applications can be integrated with PILOT Control Software for a more customized system to meet individual needs.

PILOT Control Software comes with standard modules including Navigator and Position Matrix with more sophisticated options like the Wafer Map and Vision module available. Modules interfacing to the SemiServer have a set of remote commands that can be accessed by any other module, providing the capability to perform its own specific function, yet access all other features of the suite seamlessly. Full driver libraries are available for LabView, C++, and Visual Basic with specific instrument drivers to support the most advanced instrumentation available. Communications may be made using RS-232, GPIB or TCP/IP, enabling the system to be either a controller or a slave in an integrated solution.

The Wafer Map automatically generates a wafer based on the wafer’s size and die size. The user can bin based on pass/fail criterion and save the wafer map. The Wafer Map has the unique ability to rotate the wafer, enabling back-side and front-side probing. Wafer Map files can be exported for viewing and reporting.

The Vision Module performs the “Align Wafer”, “Find Home” and “Find Feature” commands on the probe system automatically. The Vision module can create templates or set the home location displayed when the wafer is aligned. Images of the die can be also recorded and saved for later use.

The Navigator is the control hub for the probe system. The Navigator module can:
- Align a wafer
- Set index and Z heights
- Control the theta direction
- Bring the chuck to contact or separation
- Turn the chuck vacuum on or off
- Enable the joystick
- Place a wafer in the load position
The chuck can also be controlled with a directional-arrow keypad to simulate the joystick and mark sections of the wafer that require further test.

The Position Matrix creates a table used to save specific locations and set a home location on the wafer or device under test. These locations can be used to revisit the same locations on the wafer. The Position Matrix is an effective alternative when the points of interest are not equidistant on a wafer.

SPCal HIGH FREQUENCY CALIBRATION SOFTWARE

Calibrating Vector Network Analyzer (VNA) sensitivity, cabling configuration, and probe response are critical for accurate and repeatable results in high frequency measurements. SPCal is a SemiProbe wizard-driven application, providing step-by-step procedures to simplify and automate calibration setup and measurement, reducing measurement time and eliminating errors.

When used with SemiProbe’s PILOT control software, SPCal can download preconfigured measurement files for automated calibration setup. SPCal delivers highly repeatable calibration with contact placement within 1 µm, maintaining a stable resistance between the substrate and the probe tip. Rapid calibrations can be integrated directly into the wafer measurement procedure with PILOT, utilizing on-wafer calibration features or external calibration substrates.

SPCal supports most popular VNAs and can interface additional VNAs by using the SPCal ADD VNA feature. SPCal also performs S-Parameter measurements and can plot up to 4 different plots using PILOT’s Plotter application, or can be customized by the user for a wide range of measurements.

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LAB ASSISTANT

Small footprint manual systems with probing capabilities ranging from individual die to 200 mm wafers or substrates

The SemiProbe Lab Assistant family of probe systems is specifically designed to address the requirements of Universities and research personnel - simplicity and ease of operation, portability, affordability and modularity. The Lab Assistant provides features and options for both DC and HF/Microwave testing that are typically only available in much more expensive systems – multiple stages, chucks including thermal chucks, optics and manipulators. Numerous accessories are available to enhance the system functionality.

The Lab Assistant is packaged as a complete system that can be unpacked and ready to use in as little as an hour. System choices include 50 mm, 100 mm, 150 mm or 200 mm for either DC or HF/Microwave applications.

The Lab Assistant configuration includes:
- Rigid aluminum base with rubber vibration isolation feet
- Rapid magnetic coarse stage adjustment with coaxial and linear fine adjustment
- Aluminum with stainless steel plated platen with removable front wedge
- Precision micrometer platen planarity adjustment
- 7x to 90x trinocular stereo zoom microscope
  - wide field adjustable 10x eyepieces
  - 100 mm (4") working distance
- Chuck with isolation adapter and vacuum control system
- Chuck Z lift adjustment with contact/separate lever
- 360 degree theta
- Microscope post with coaxial and linear microscope movement
- Two HF or DC manipulators with magnetic base and probe arms
- CCTV system ready

The Lab Assistant can accommodate a wide variety of optics found on much larger probe systems. This configuration includes a programmable zoom tube with optional CCTV camera.

The front wedge of the Lab Assistant is removable for trouble free access, shown here with the integrated probe card holder.

A complete line of accessories can be added to address specific test requirements. This Lab Assistant is shown with its optional Dark Box.
ACCESSORIES

We offer a comprehensive line of accessories to complement your investment including:

- Manipulators
- Probe Arms, Cables & Connectors
- Dark Boxes & Environmental Chambers
- Packaged Part & Probe Card Holders
- Thermal Chucks -80°C to 500°C
- Optics, Cameras & Monitors
- HF Probe Arms & Probes
- Probe Tips (Tungsten, BeCu, Gold-plated, Kelvin)

SUMMARY

With over 75 years of experience, we deliver application specific probing solutions to help you solve your most difficult test challenges quickly and cost effectively. We would like the opportunity to work with you and become your probe system vendor. Of course, if you have a particular need or challenge now or in the future, we’d love to hear from you. Here is what some of our current customers have said:

“For our application we were interested in a flexible and upgradeable system. SemiProbe’s Probe System for Life met those needs perfectly, employing interchangeable standard products alongside custom SemiProbe components.”

- Semiconductor Company

“We are very impressed by what this station can do in terms of flexibility”

- University Research Facility

“Brilliant Design. Finally a probing company that provides an affordable multipurpose system with a myriad of upgrade options.”

- University Research Facility

“It’s refreshing to hear a probing system vendor say yes to providing customized solutions for newly developed products”

- Semiconductor Company