

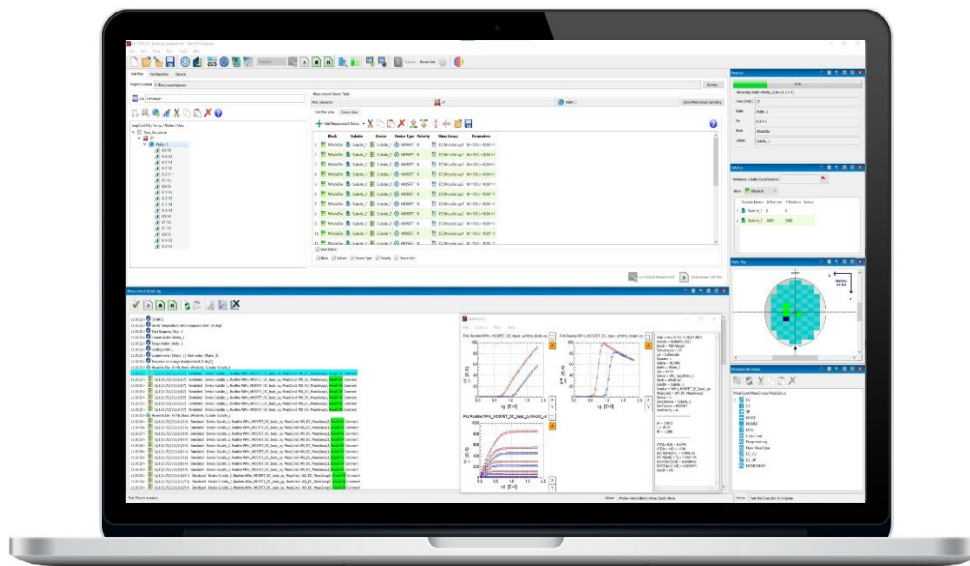
Device Modeling WaferPro Software

Automated On-Wafer Measurement Software

Simplify Your Test Software Integration

Many R&D device characterization labs develop custom software to drive and control instruments, switch matrices, and probe stations using various languages such as Perl, MATLAB, LabVIEW, C#, or Python. In-house software allows lab managers to control new features, custom drivers, data handling, and other key operational aspects. While this may seem like an attractive solution, seamless integration of probe stations, thermal chucks, and instruments is challenging, often resulting in high hidden costs. Developing a mature measurement software can take years, which could be better spent optimizing your devices, circuits, and systems. Today, an ideal solution contains built-in measurement routines and a flexible and powerful programming environment to enable more challenging and specialized measurements.

Keysight WaferPro offers that solution by enabling measurement automation, wafer prober control, and data ready for modeling. Furthermore, your test plans may be easily scaled across your lab. WaferPro provides a unified measurement platform that eliminates the complexity of software integration, allowing an engineer to set up and execute wafer-level measurements of semiconductor devices. The modern and intuitive user interface propels your lab into the next generation of innovations by streamlining set-up, thereby saving time and money.



Features at a Glance

- Easy setup and execution of automated measurements.
- Automatic control of wafer positioning and prober's chuck temperature.
- Extensive library of configurations for various semiconductor devices to quickly execute S-parameters, DC-IV, CV, noise figure, 1/f noise, gain compression, and more.
- Highly efficient turnkey drivers for most Keysight instruments.
- Design and implement custom drivers and tests with Python or PEL and save measured data to ASCII files or HDF5 database format.
- Highly optimized drivers for FormFactor, MPI, and other wafer probers manufacturers.
- Data visualization across the wafer using the data mapping viewer.
- Export data directly to modeling platforms such as Keysight's Device Modeling IC-CAP and MBP, or use HDF5 API to export data to a centralized HDF5 database file.
- Python 3 enables instrument links, customized measurement algorithms, and data processing.
- Support for PXIe SMU for A-LFNA and regular DC Measurements.
- Remote control to enable third-party applications to control A-LFNA and WaferPro.



Features Overview

WaferPro provides the ease of use of a test executive combined with power and flexibility to allow engineers to customize analyses and data views. Python 3 allows you to write custom measurement algorithms or data processing. Engineers can save time and money by leveraging built-in features and routines to develop new test sequences.

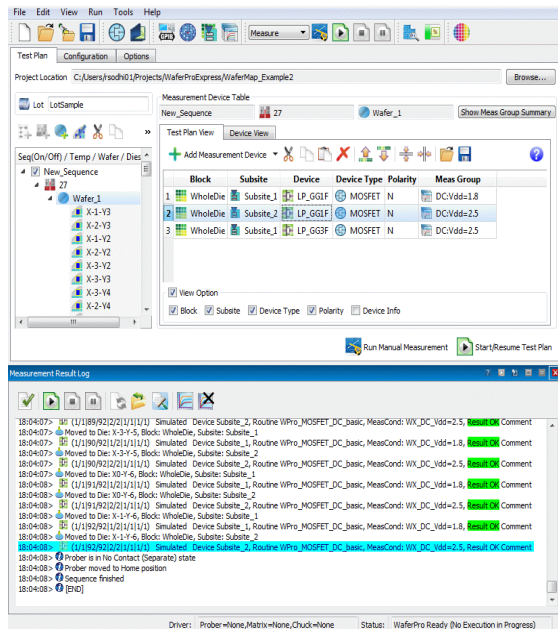


Figure 1. A test plan describes the measured devices, measurement routines, and wafer/device locations in the sequence.

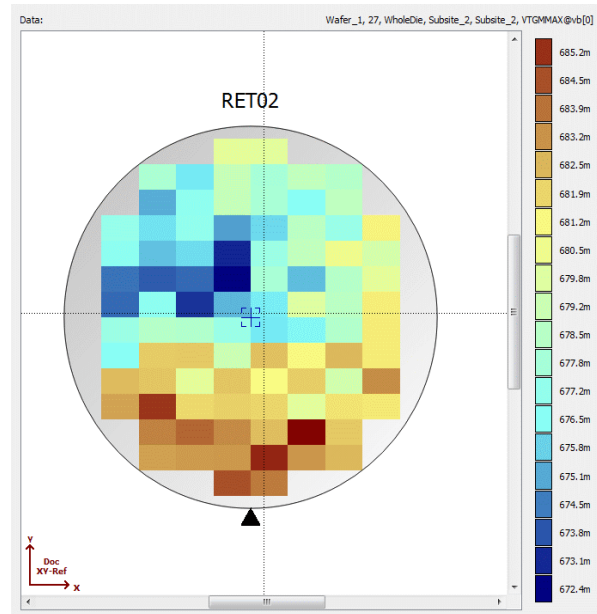


Figure 2. Scalar (or "spot") data across the wafer is presented as a heat map.

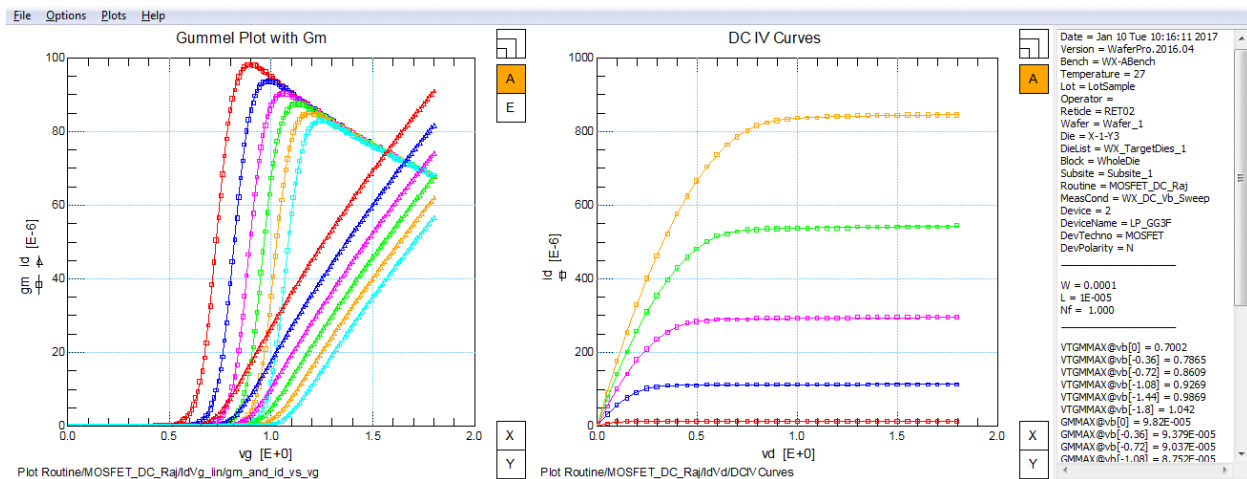


Figure 3. Multi-plot data viewer of DC data, where the plots have been configured in the underlying measurement routine.

Product Configuration

Keysight offers three WaferPro configurations, also called bundles. The W7501B WaferPro Measurement and Programming bundle executes automated wafer-level measurement with turnkey measurement drivers and measurement routines and uses Python/PEL programming to create custom measurement algorithms. The W7801B WaferPro WGFMU Measurement bundle executes automated wafer-level low-frequency noise measurement with turnkey measurement drivers and measurement routines for WGFMU. The W7802B WaferPro A-LFNA Measurement and Programming software bundle performs automated low-frequency noise measurements with turnkey measurement drivers and measurement routines for A-LFNA and WGFMU.

W7501B WaferPro Measurement and Programming

- Over 50 turnkey measurement drivers fully optimized for speed.
 - Support for most industry-standard probe stations from FormFactor, MPI, Accretech, TEL, and others
 - Integrated Wafer map support
 - Extensive library of example measurement drivers and algorithms
 - Python/PEL programming environment
 - Remote Control Python & C++ API's
-

W7801B WaferPro WGFMU Measurement

- Automated measurement without programming
 - Auto prober control
 - Wafer mapping
 - Single data display for multiple decades in the frequency domain
 - Upgradeable from your existing B1500A
 - Random Telegraph Noise (RTN) data analysis capabilities like Ton/Toff
-

W7802B WaferPro A-LFNA Measurement and Programming

- Seamless integration with the WaferPro measurement platform
 - Advanced data display and analysis, enabling noise data comparisons and modeling with respect to bias current
 - Automated control of all major wafer probing systems
 - A-LFNA module features DC measurement, 1/f noise, RTN, and data analysis
 - Flexible hardware averaging for throughput-accuracy tradeoffs
 - Multiple built-in biasing schemes for flicker noise characterization
 - Measured data compatible with Keysight device modeling software
 - Guided system calibration procedure
 - PEL and Python measurement routine language support
 - RTN data analysis capabilities like Ton/Toff
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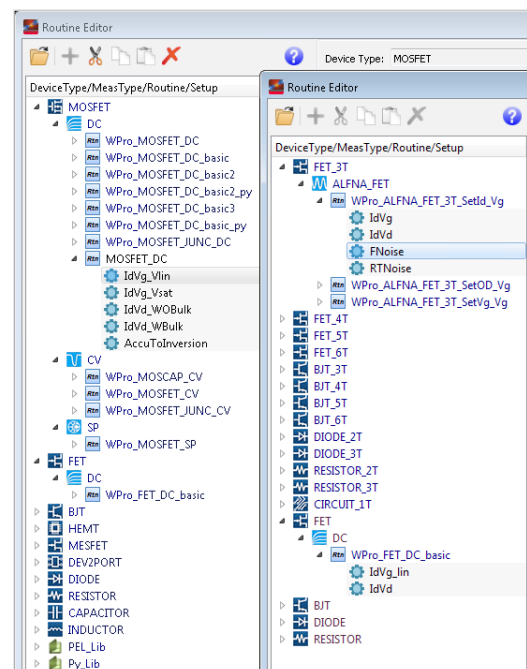
Advanced Low-Frequency Noise Analyzer (A-LFNA)



The E4727B Advanced Low-Frequency Noise Analyzer (A-LFNA) enables fast, accurate, and repeatable low-frequency noise measurements on numerous device types. Thanks to its tight integration with WaferPro, device modeling, and characterization engineers can now add noise measurements to a more extensive suite that includes high-speed DC, capacitance, and RF S-parameter measurements while automating wafer probe control. Designed for both on-wafer and discrete device/ circuit measurements, it is the premier tool for low-frequency and random telegraph noise measurements.

Users may launch WaferPro natively as a regular Test Executive Application or in “A-LFNA mode.” Factory-defined routines in each mode have been tailored to different device types.

- In normal WaferPro, device types are MOSFET, FET, BJT, HEMT, etc.
- In A-LFNA mode, device types reflect the number of terminals, like FET_3T, FET_4T, etc.



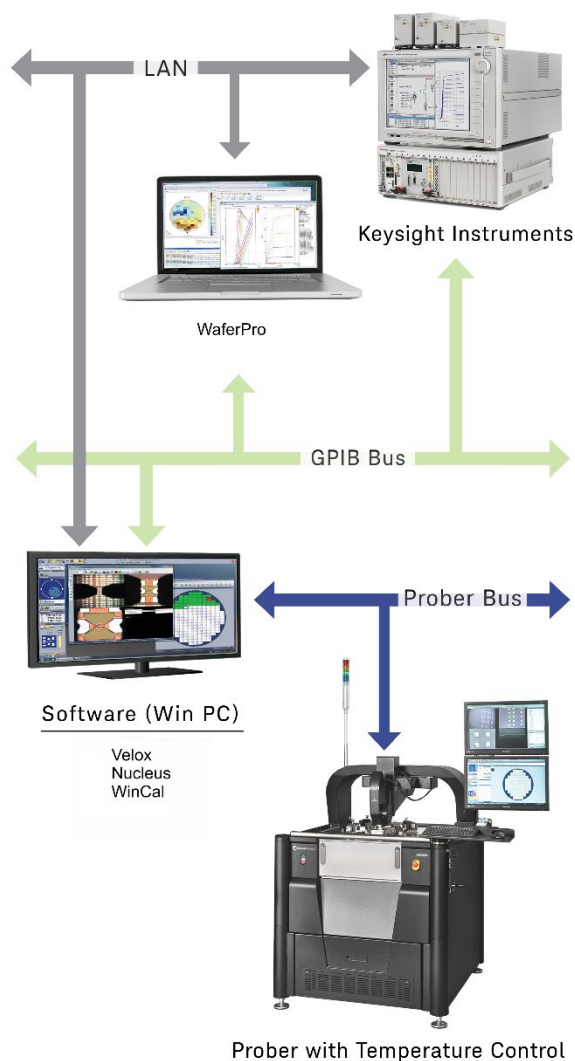
FormFactor Probers and Software

Integrating diverse measurement equipment with a probe station is complex, often leading to issues with compatibility and interference that can compromise results.

To address these challenges, we provide comprehensive solutions with pre-validated configurations, ensuring all necessary components are included. When sourcing instruments from different suppliers, integration problems can arise, which may delay your time to first data and time to market.

FormFactor and Keysight collaborate to pre-configure systems before delivery, with experts optimizing the setup. Their applications engineers will install and verify the probe station and instrumentation, ensuring seamless operation and reduced time to first measurement. Additionally, we offer training to help you maximize system performance.

When measuring 1/f noise with the A-LFNA, it is essential to minimize the prober's noise contributions. Some probers are noisier than others; choosing a prober is a crucial decision. Thanks to a close collaboration between Keysight and FormFactor, the lowest-noise ULN option is available with FormFactor CM 300-ULN probe stations.



Supported FormFactor Probers & Software

Velox	Nucleus (legacy)	ProberBench (legacy)
Summit 12000, 200	Summit 12000	PA 200
Elite 300	S300	PA 300
BlueRay	Elite 300	
CM300, CM300xi, CM300-ULN		
PA 200/300		
TS2500-SE		
TESLA300		

MPI Probe Systems

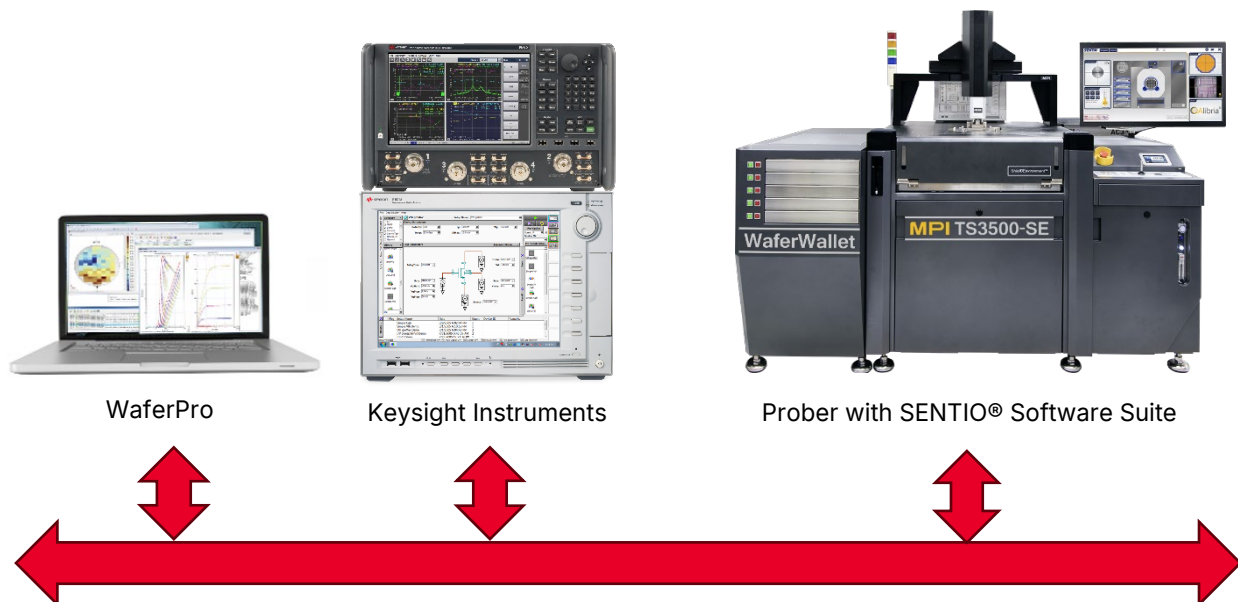
WaferPro supports direct integration with MPI's automated and fully automated probe systems via the SENTIO® Software Suite. This integration establishes a communication link between the probe station and measurement instrumentation, enabling coordinated control of wafer positioning, test execution, and environmental parameters such as chuck temperature.

SENTIO® provides a multi-touch interface for prober control, designed for efficient operation in advanced semiconductor test environments. Its intuitive layout reduces the learning curve for new users and supports consistent system behavior across different probe station configurations.

Through the integration, WaferPro can fully automate test sequences — from wafer loading and stepping to temperature variation — allowing users to execute complete test plans with minimal manual intervention. MPI probe systems are configurable with thermal and non-thermal chucks ranging from ambient to -60 °C and up to +300 °C, supporting a broad range of device testing conditions.

This combined solution is suited for semiconductor R&D applications, including device modeling, process development, failure analysis, and wafer-level reliability. It also addresses specialized testing needs, including those for PICs, MEMS, RF, and high-power devices.

By automating the interface between the probe system and measurement setup, this integration improves test throughput, ensures repeatability, and shortens the time required to collect measurement data.



Supported MPI AST Probe Systems with SENTIO® Software Suite

TS2000
TS2000-IFE (optionally with WWMax)
TS2000-SE
TS2500-RF
TS2500-SE

TS3000
TS3000-IFE
TS3000-SE
TS3500-SE (optionally with WW or WWMax)

Switch Matrices

For many modeling and characterization groups, a critical spec in their test plan is the number of touchdowns a prober must make to the wafer. What if we could measure four devices with a single touchdown? Using a switch matrix with a Source Measurement Unit (SMU) and probe card, one may run the same sequence of measurements on multiple devices with a single touchdown to a wafer. In another lab station, reliability engineers may put eight copies of a device in a single package. A list of supported switch matrices is provided as follows.

- Keysight B2200A fA Leakage Switch Mainframe
- Keysight B2201A 14ch Low Leakage Switch Mainframe
- Keysight E5250A Low-leakage Switch Mainframe
- Keithley 700 Series Semiconductor Switching Systems

* Note that both regular connections to the device and Kelvin connections are possible.



Additional Prober Support

WaferPro supports a growing list of prober manufacturers, such as the Accrettech UF-3000 and the Tokyo Electron P8 fully automated probers. WaferPro also enables users to add a new prober driver to support a GPIB-controllable prober that is currently not supported. Using the programming environment, a user can implement a set of basic driver functions, such as "contact probes to the wafer," "separate probes from the wafer," "go to the home position," "move to selected die," etc., enabling a new prober to be controlled by WaferPro. The current list of supported probers is provided below.

- Micromanipulator P200A (tested) and P300A (not tested)
- Accrettech UF-3000
- Tokyo Electron Limited (TEL) P8-P12
- Electroglass Inc. EG6000

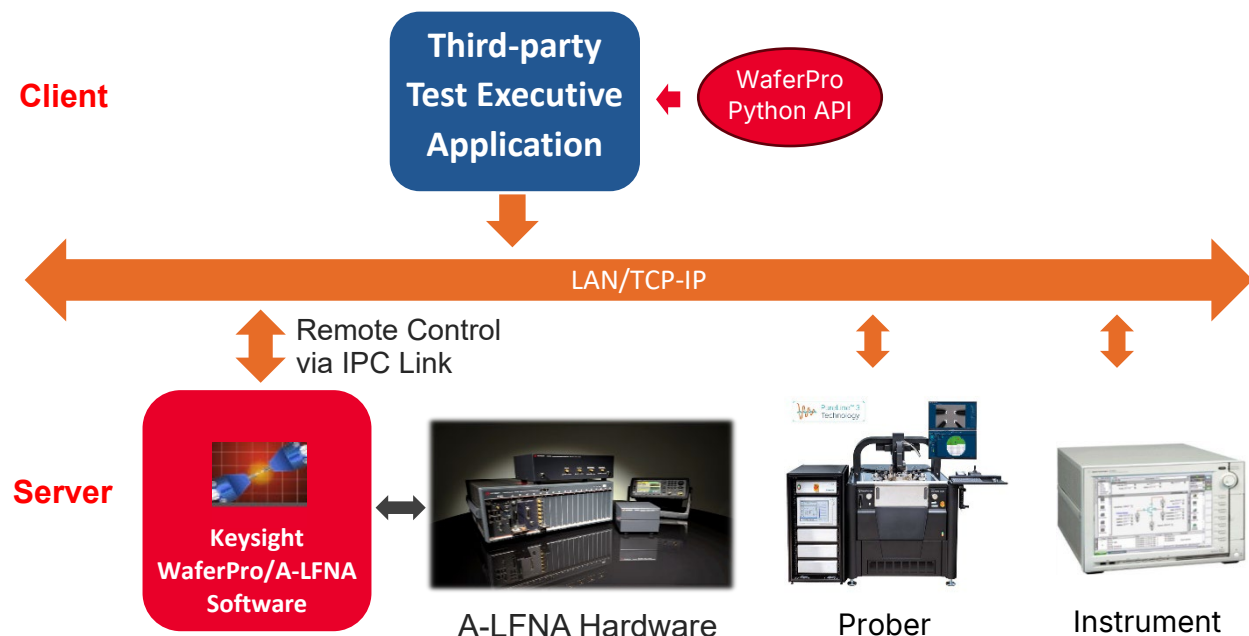
Thermal Controllers

In addition to the bulleted list below, additional thermal controller drivers may be implemented programmatically.

- FormFactor Velox®
- MPI SENTIO®
- FormFactor Summit
- FormFactor PS21
- Temptronic TP032A
- Accrettech
- Tokyo Electron (TEL)
- ATT

WaferPro/A-LFNA Remote Control API

In some measurement labs, test engineers already deploy in-house test-executive software that drives automated test plans using an extensive and often proprietary library of tests, drivers, and database solutions. In this situation, new Python & C++ APIs enable third-party applications to control WaferPro and A-LFNA to execute single-device measurements, leaving prober, thermal chuck, and switch matrix control to the test executive. If the test executive supports Python, a Python pip package allows you to develop and embed scripts to control WaferPro/A-LFNA measurements. The API uses a special Inter-Process Communication (IPC) link to control WaferPro/A-LFNA from any Python application running on a separate computer. A C++ API is also provided if Python support is not enabled.



Instrument Drivers

Measurement Type	Supported Instruments
DC measurement drivers	Keysight B1500A Semiconductor Device Analyzer Keysight B1505A Power Device Analyzer/Curve Tracer Keysight E5270 Series parameter analyzer: E5270B, E5272A, and E5273A Keysight E5260 Modular Source/Measure Units Keysight B2900 Series Precision Source/Measure Unit Keysight M9601A PXIe Precision Source/Measure Unit Keysight PZ2100A High-Density Precision SMU Mainframe Keysight N6705 DC Power Analyzer Keysight 4156x Semiconductor Parameter Analyzer¹ Keysight 4140 pA Meter/DC voltage source¹ Keysight 4141 DC source/monitor¹ Keysight 4142x Modular DC source/monitor¹ Keysight 4145x Semiconductor Parameter Analyzer¹ Keysight 4155x Semiconductor Parameter Analyzer¹ Keithley instrument drivers for the 2410, 26xx Class Source meters, and 4200-SCS are provided as open-source and are not covered by standard maintenance. ¹ Discontinued or obsolete product - Keysight provides limited or no maintenance effort.
AC measurement drivers	Keysight PNA-X Series (S-parameters, multi-port, gain compression, and intermodulation) Keysight PNA Series (S-parameters, multi-port) Keysight ENA, E5080B, E5081A ENA-X, Streamline Series (S-parameters, multi-port) Keysight 3577 Network Analyzer¹ Keysight 8510 A/B/C/XF Network Analyzer¹ Keysight 8702 Network Analyzer¹ Keysight 87xx Network Analyzer¹ Keysight 89410 Vector Signal Analyzer Anritsu 37000 Network Analyzer¹ Anritsu VectorStar Network Analyzer² Rohde & Schwarz ZNA Series Vector Network Analyzers³ Please see the product documentation for an updated list of supported and discontinued Keysight PNA-X, PNA, and ENA network analyzers. ¹ Discontinued or obsolete product - Keysight provides limited or no maintenance effort. ² Provided by Anritsu. Contact Anritsu for questions/support about this driver. ³ Provided by Rohde & Schwarz. Contact Rohde & Schwarz for questions/support about this driver.
LCRZ measurement drivers	Keysight E4991A1, E4991B RF Impedance/Material Analyzer Keysight E4990A Impedance Analyzer Keysight E4980A Precision LCR meter Keysight 4194 Impedance Analyzer¹ Keysight 4271 1 MHz digital capacitance meter¹ Keysight 4275 Multi-frequency LCR Meter¹ Keysight 4280 2 MHz Capacitance Meter¹ Keysight 4284 Precision LCR Meter¹ Keysight 4285 Precision LCR Meter¹ Keysight 4294A Precision Impedance Analyzer¹ ¹Discontinued or obsolete product - Keysight provides limited or no maintenance effort.
Time-domain measurement drivers	Keysight 54120T-54124T Digitizing Oscilloscopes¹ Keysight 54510 Digitizing Oscilloscopes¹Keysight 54750 TDR Oscilloscope¹ Keysight 8130 Pulse Generator¹ Keysight 8131 Pulse Generator¹ Keysight 54720 Module Real-Time Oscilloscope¹ Keysight Infinium Oscilloscope 54800 Series¹ Keysight 85124 Pulse System¹ ¹Discontinued or obsolete product - Keysight provides limited or no maintenance effort.
Noise measurement drivers	Keysight 35670A Dynamic Signal Analyzer¹ Keysight E4727A Advanced Low-Frequency Noise Analyzer (A-LFNA) ¹Discontinued or obsolete product - Keysight provides limited or no maintenance effort.

I/O Libraries and Hardware

Supported SW Libraries and Interfaces

On LINUX

Description	Part Number
Keysight IO Libraries Suite 2025 Update 1.0	
NI VISA	
Keysight LAN/GPIB Gateway Interface TAMS IO Library	E5810B, E5810A ¹ 82091 TAMS L488 ¹ , L488-POE ¹
National Instruments USB-GPIB-HS card with NI 488.2 Software	779705-01
National Instruments PCI-GPIB card with NI 488.2 Software	778686-01
National Instruments PCIe-GPIB card with NI 488.2 Software	779779-01

1. TAMS L488, High-Speed PCI GPIB, and USB GPIB are discontinued

On Windows

Description	Part Number
Keysight IO Libraries Suite 2025 Update 1.0	
NI-VISA	
Keysight GPIB PCI card and Keysight IO Libraries	82350A ¹ /B ¹ /C
Keysight LAN/GPIB Gateway Interface and Keysight IO Libraries	E5810B, E5810A ¹
Keysight USB/GPIB converter and Keysight IO Libraries	82357A ² /B
National Instruments PCMCIA-GPIB card and NI-488.2M drivers	778034
National Instruments PCI-GPIB card and NI-488.2M drivers ³	778032

1. Discontinued product.

2. Typically, a LAN interface impacts speed; therefore, it could be slower than a card.

3. Keysight IO Libraries can substitute for the NI-488.2M drivers.

Licensed Software

Each WaferPro module is available in two license versions.

A node-locked version that allows the software to execute only on a single workstation or PC. A network-licensed version for execution on multiple workstations or PCs on a network, allowing various workgroups to share the software.

Both licenses use the FLEXlm license management system. These two license options can be mixed freely. For example, a node-locked license of an instrument driver package can reside on a workstation or PC in the lab, while a network license for the analysis module can be shared among a group of engineers for data analysis.

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