

Keysight Technologies

WaferPro Express Software

Automated On-Wafer Measurement Software

Efficient and powerful automated measurement
test platform for wafer-level characterization

Features At A Glance

- WaferPro Express is a key component of Keysight Technologies and Cascade Microtech Wafer-level Measurement Solutions (WMS). These system solutions are pre-validated to minimize the time to first measurement and provide accurate and repeatable device and component characterization. WMS delivers guaranteed system configuration, installation and support (Figure 1). For more information about WMS, please visit: <http://www.keysight.com/find/wms>
- The modern and simple to use interface reduces time to first measurement on newly assembled measurement systems and simplifies the everyday procedure of setting up automated measurements.
- Large library of tests and instrument configurations available for most common semiconductor devices. Standard S-parameters, DC-IV/CV, noise figure, 1/f noise, and gain compression measurements can be set up and executed very quickly.
- Highly optimized for Cascade Microtech wafer probers, especially when using the new Cascade Velox as prober control software. Other prober manufacturers are efficiently supported as well (see Table 2)
- The Python programming environment enables users to design and implement custom tests and data post-processing. Measured data can be conveniently saved to ASCII files or to SQL database format, which greatly improves security and allows users to quickly search data.
- The comprehensive support for a variety of instruments, probers, and switch matrices enables lab managers to optimize lab equipment. WaferPro Express provides a unified test measurement platform as WaferPro test projects are independent of instrument firmware.
- Fully integrated in the Keysight Technologies, Inc. device modeling flow.
- Data can easily be exported to modeling platforms such as Keysight ICCAP, Keysight MBP and Keysight MQA.
- Highly efficient turn-key drivers for the most common Keysight instruments, such as DC analyzers and the PNA Series of network analyzers, CV meters and power supplies.

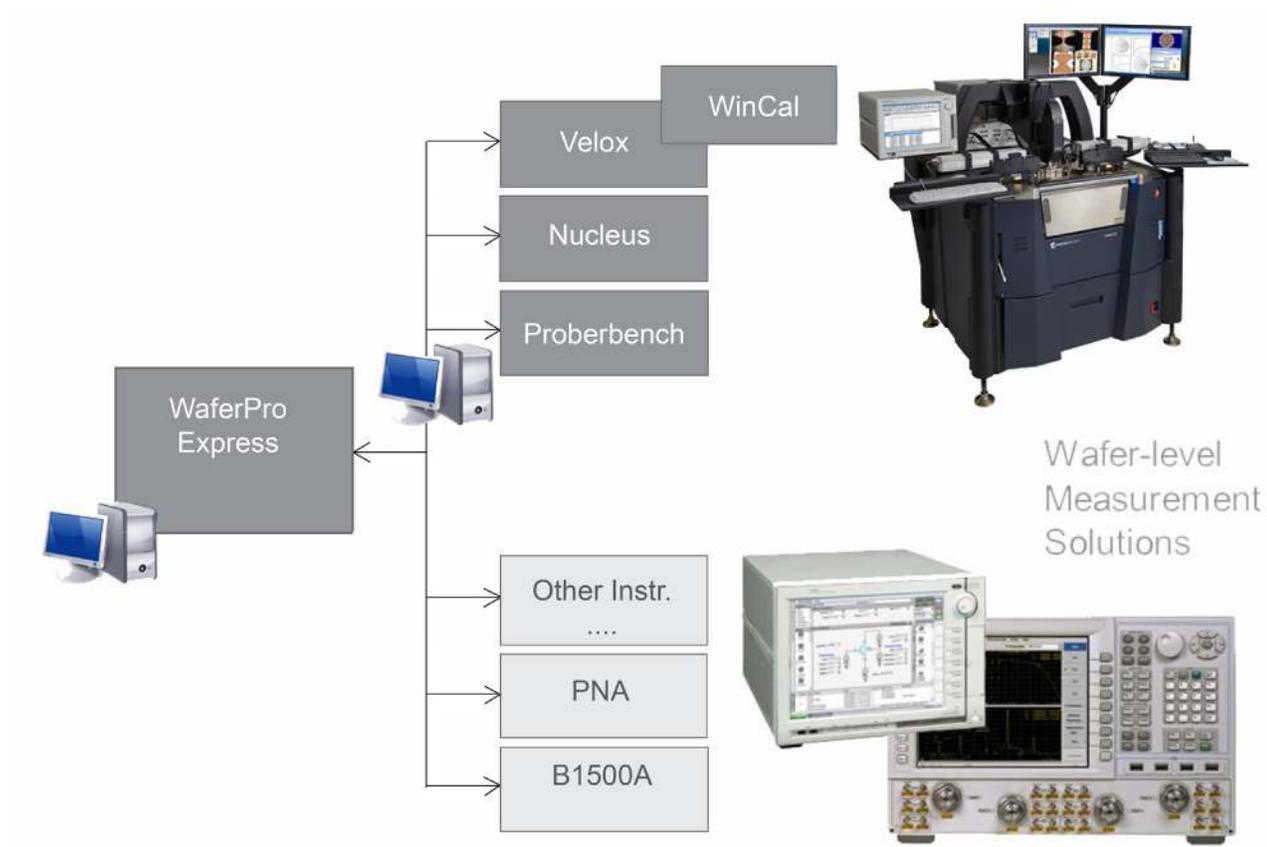


Figure 1. WaferPro Express with Wafer-level Measurement Solutions

About WaferPro Express

In a typical R&D device characterization lab, the integration of measurement equipment such as benchtop instruments, wafer probers and other components can be a very complex and daunting task. Often times, it takes months to integrate all the parts and accessories and get the system up and running to execute the very first measurements. Each one of the components generally comes with its own firmware or software control and the integration is left to the end user who often needs to rely either on solid programming skills or use of specialized test software that only works on one test cell but not others. With WaferPro Express, Keysight provides a unified measurement platform that takes the software integration complexity out of the end user's job. WaferPro Express (WaferPro-XP) software allows users to setup and execute automated wafer-level measurements of semiconductor devices such as transistors and circuit components. WaferPro-XP drives Keysight (and select non-Keysight) instruments as well as prober control software (including temperature control), and provides powerful data handling and display capabilities. WaferPro-XP's modern and intuitive user interface allows test engineers to reduce the necessary steps to setup the system for automated measurements.

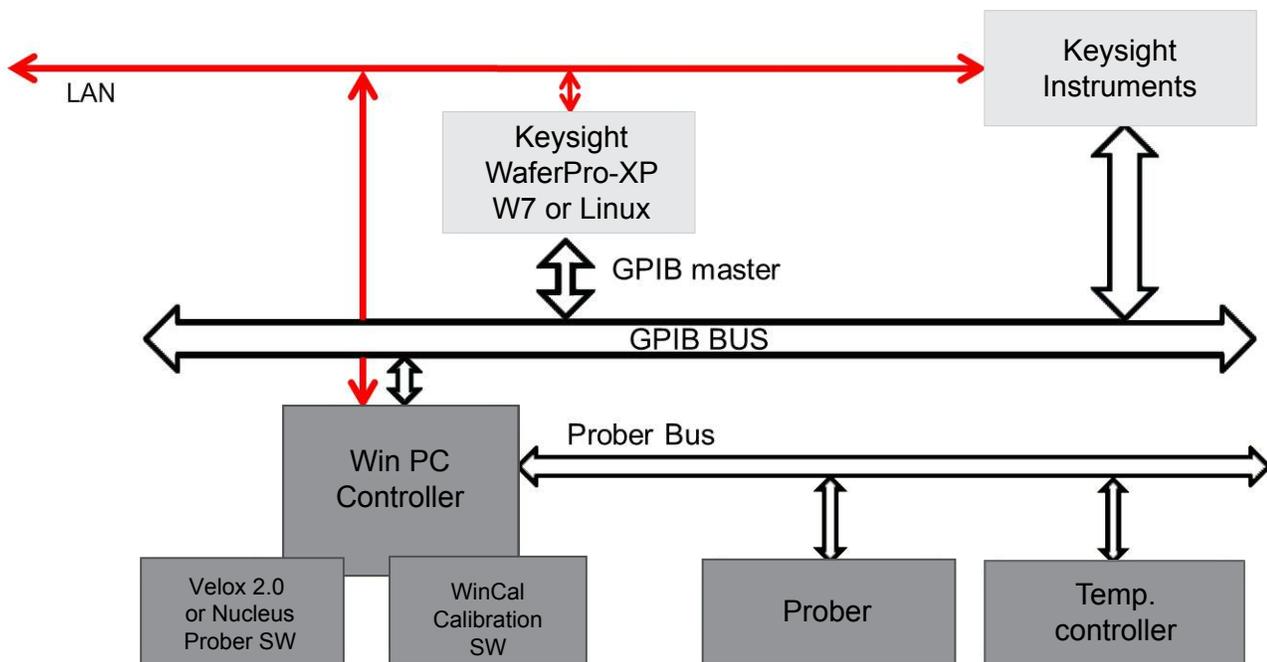


Figure 2. Typical system architecture when WaferPro Express works in conjunction with Cascade Microtech probing systems (e.g., Cascade Microtech Elite 300 or SUMMIT 12000 systems) WaferPro Express can also be installed on Cascade PC controller when running with Cascade probe control software Velox 2.0.

Product Overview

In order to efficiently setup and manage wafer-level automated measurements, WaferPro Express provides the following components in a convenient and easy to use user interface. Figure 1 shows the WaferPro Express main window.

- Interface to instruments and prober systems that are connected to the controlling PC via GPIB bus. WaferPro supports several types and brands of GPIB, LAN to GPIB, USB to GPIB interfaces on both Windows and LINUX systems. See Table 6 for list of supported interfaces.
- Turnkey built-in drivers for a variety of Keysight and non-Keysight instruments, including the Keysight B1500A, Keysight PNA and PNA-X Series, most Keysight C-V meters and impedance analyzers. Also, WaferPro Express supports an impressive list of Keysight, Agilent and Hewlett-Packard legacy instruments. Instruments and prober settings are all managed in a single convenient window. For details, please see Table 5.
- A complete wafer map environment that is completely independent from the prober control software. This dedicated wafer map environment allows WaferPro-XP projects to run on different test benches with little or no modifications. Figure 4 shows the wafer mapping definition in WaferPro-XP.
- The maximum efficiency is obtained in conjunction with Cascade Microtech Velox prober control software. A dedicated interface link allows WaferPro advanced control of Velox and enables key features such as full wafer map synchronization to seamlessly import and export wafer map and subdies table to and from Velox, temperature control as well as dynamic RF Calibration. The latter allows WaferPro Express to monitor the validity of the RF calibration during long measurements and is achieved by controlling Cascade WinCal XE calibration software.
- A test plan sequencer allows users to create a test plan to measure devices located in wafers and dies at different temperatures. Devices to be tested in each die are listed in convenient table format with each row showing the device name, polarity and pad connections, as well as the test routine to be applied. The sequencer controls temperature, wafer and chuck positioning every step of the way, making fully automated measurements possible.
- An extensive library of example DC, CV and RF routines tests for the most common device technologies, CMOS and BJT. New tests can be easily created directly from the user interface.
- A powerful programming environment that supports two languages, the Python language and the IC-CAP Programming Extraction Language (PEL), for users who want to deploy programs that were developed in the IC-CAP platform. WaferPro Express users can write programs that execute custom measurements, check results, flag measurement success/failure and post-process raw measured data before information is saved to file.
- Powerful data display capabilities. Sweep data can be displayed on a variety of plots, using various color and line formats. In addition, wafer map plots can show the distribution of spot data on the wafer. See Figure 5 for examples of graphics.

Product Overview (continued)

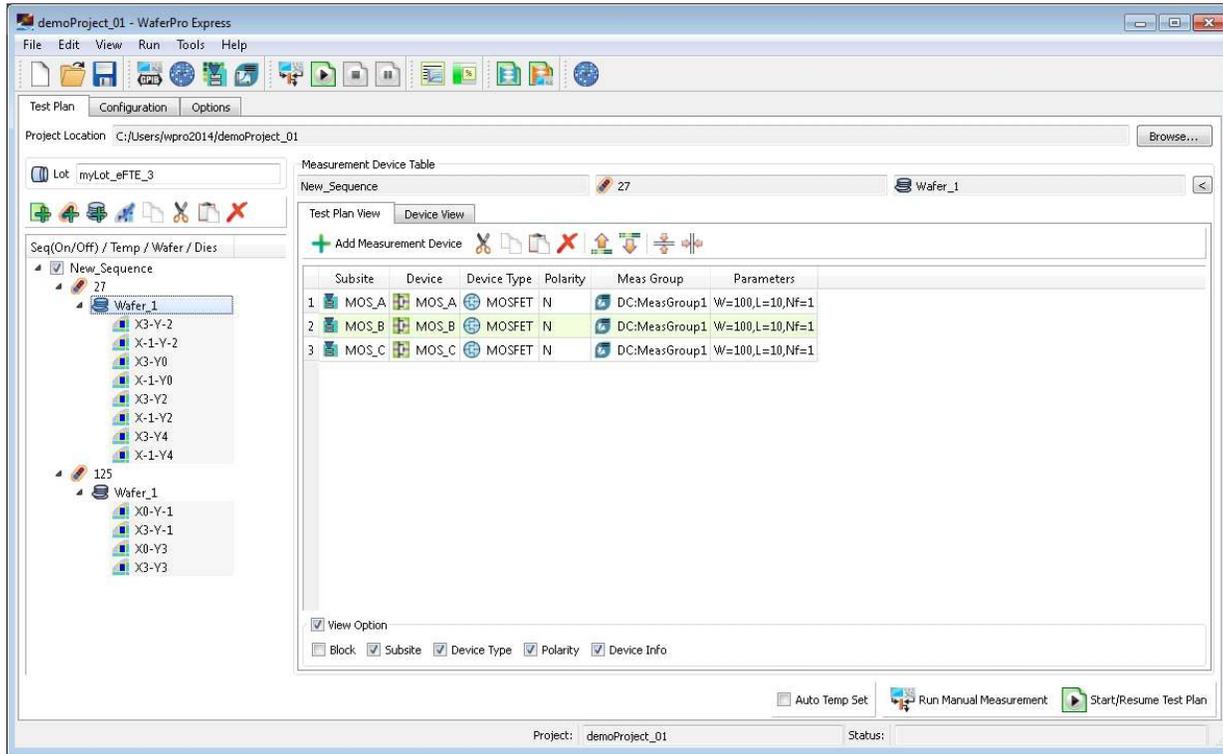


Figure 3. WaferPro Express Main Window

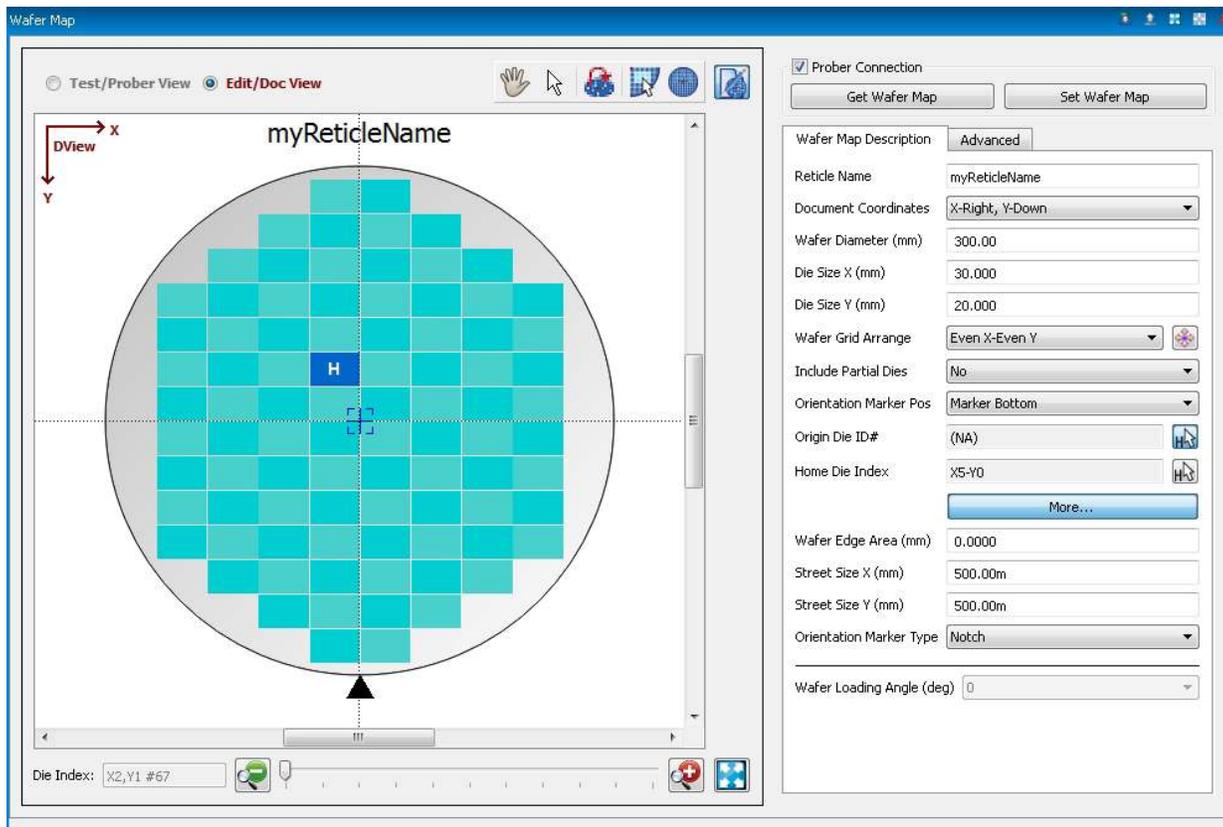


Figure 4. WaferPro Express Wafer Map

Product Overview (continued)

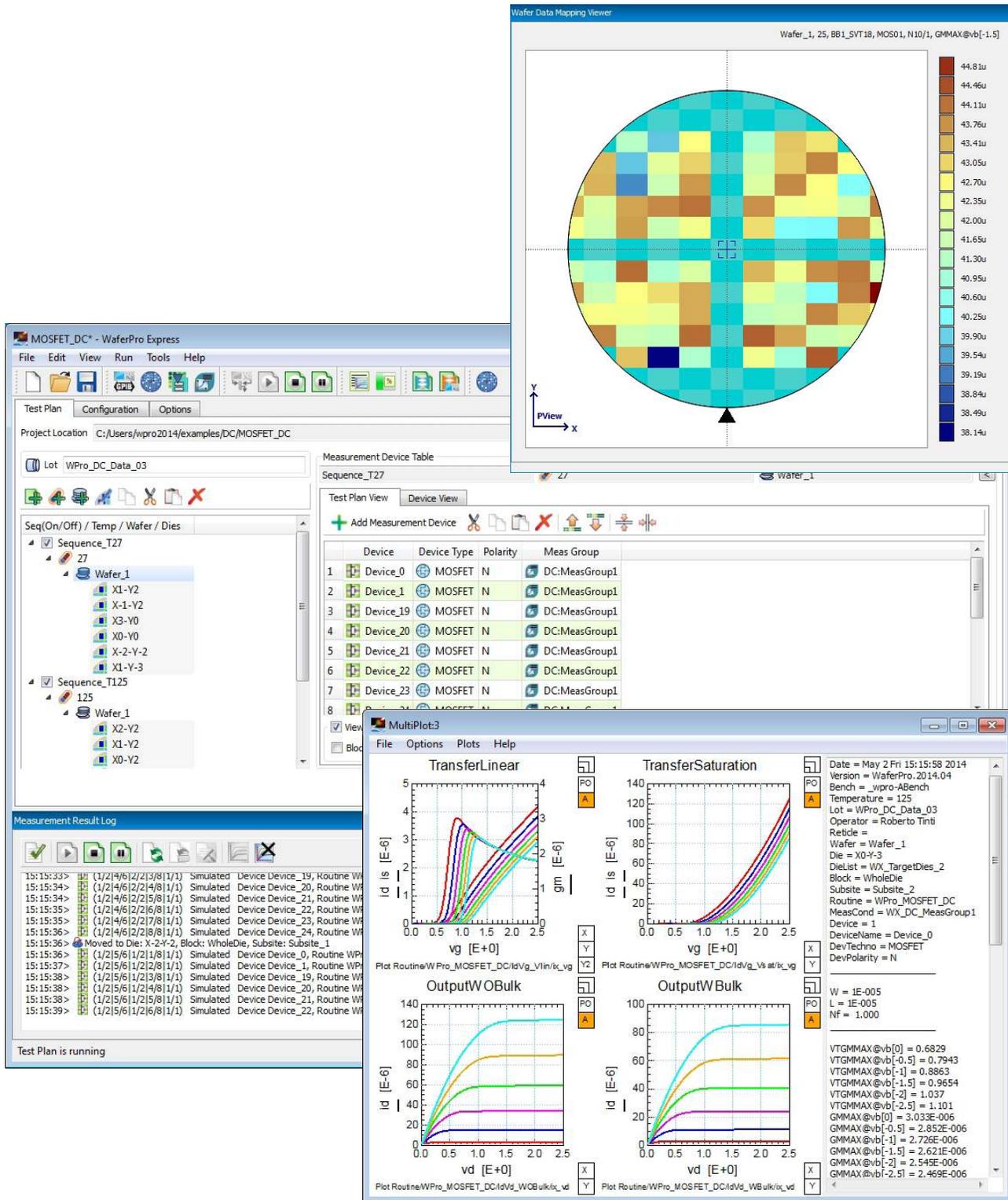


Figure 5. WaferPro-XP execution and output graphics

Product Configuration

Keysight offers two WaferPro Express configurations (also called bundles). The W8580BP WaferPro Express Core bundle includes the user interface, which allows users to define and manage test plan execution. It also includes all the instrument drivers and drivers for Cascade Microtech probers. The W8581BP WaferPro Express Core and Programming bundle adds the ability to further customize tests by using the Python and PEL programming environment. It also adds the ability to run the test in virtual or simulation mode when a model card or a Spice3 subcircuit of the device under test is provided. Support for non-Cascade Microtech probers can be enabled by purchasing the W8585EP add-on product.

The W8580BP core bundle allows the execution of routines and test plans created with the most advanced W8581BP bundle, i.e. using the Python or PEL programming environment, however, program routines cannot be edited in the base bundle.

	W8580BP WaferPro Express Core bundle	W8581BP WaferPro Express Core and Programming bundle
DC/CV/RF/TD turnkey measurements and test plan execution	Yes	Yes
Turnkey GBIB instrument connectivity and drivers (see Table 5 for supported instruments)	Yes	Yes
Data display including wafer map distribution	Yes	Yes
Test configuration and setup via UI	Yes	Yes
Cascade Microtech support (Table 1)	Yes	Yes
SQL Database support	Yes	Yes
Python and PEL programming environment	Execution only	Yes
Virtual Test Plan Simulation (Spice3 only)	No	Yes
W8585EP Expanded probers support (see Table 2)	Yes, add-on product	Yes, add-on product

Supported Cascade Microtech Probers and Software

Table 1. Supported Cascade Microtech prober software included with W8580BP and W8581BP

Nucleus software	ProberBench software	Velox 2.0 software
Summit	PA200	Summit 12000
S300	PA300	Elite300
Elite 300		CM300 (semi-automated only)
		PA200
		PA300
		BlueRay

Expanded Prober Support

Table 2. Expanded prober support included with W8585EP

Micromanipulators P300A
Accretech UF-3000
TEL P8-P12

In addition to the support for the above probers, the W8585EP allows the user to add custom prober drivers, the W8585EP allows the user to add custom prober drivers.

Supported Switching Matrices

Table 3. Supported switching matrices

Keysight B2200A/B2201A
Keysight E5250
Keithley 707/708

Support for these switching matrices includes support for Kelvin and coupled modes.

Supported Thermal Controller

Table 4. Supported thermal controllers. Additional controllers can be implemented programmatically

Cascade Microtech Summit
Cascade Microtech PS21
Temptronics TP032A

Supported Measurement Drivers

Table 5. Supported measurement drivers

	Instrument supported
LCRZ measurement drivers	Keysight E4991A impedance analyzer
	Keysight E4980A precision LCR meter
	Keysight 4194 impedance analyzer ¹
	Keysight 4271 1 MHz dig. capacitance meter ¹
	Keysight 4275 multi-frequency LCR meter ¹
	Keysight 4280 2 MHz capacitance meter ¹
	Keysight 4284 precision LCR meter
	Keysight 4285 precision LCR meter
	Keysight 4294A precision LCR meter
	DC measurement drivers
Keysight B1505A power device analyzer/curve tracer	
Keysight E5270 Series parameter analyzer: E5270B, E5272A, and E5273A	
Keysight B2900 Series precision source/measure unit	
Keysight N6705 DC power analyzer	
Keysight 4156x semiconductor parameter analyzer	
Keysight 4140 pA meter/DC voltage source ¹	
Keysight 4141 DC source/monitor ¹	
Keysight 4142x modular DC source/monitor	
Keysight 4145x semiconductor parameter analyzer ¹	
Keysight 4155x semiconductor parameter analyzer	
Keithley 2410 source meter	
Keithley 26nn class source meter	
Keithley 4200 semiconductor characterization system	
AC measurement drivers	Keysight PNA Series
	Keysight PNA-X Series (S-parameters, gain compression and intermodulation, Noise Figure) ¹
	Keysight ENA Series
	Keysight E8356A 10 MHz to 3 GHz ¹
	Keysight E8357A 10 MHz to 6 GHz ¹
	Keysight E8358A 10 MHz to 9 GHz ¹
	Keysight N5250A millimeter-wave PNA, 10 MHz to 110 GHz
	Keysight 3577 network analyzer ¹
	Keysight 8510 network analyzer
	Keysight 8702 network analyzer ¹
	Keysight 8719 network analyzer
	Keysight 8720 network analyzer
	Keysight 8722 network analyzer
	Keysight 8753 network analyzer
	Anritsu VectorStar network analyzer (Windows only)
	Anritsu 37000 network analyzer (Windows only)
	Wiltron 360 network analyzer
Time- domain measurement drivers	Keysight 54121T-54124T digitizing oscilloscopes ¹
	Keysight 54510 digitizing oscilloscopes ¹
	Keysight 54750 TDR oscilloscope ¹
Noise measurement drivers	Keysight 35670A dynamic signal analyzer

1. Discontinued product.

Supported GPIB Interfaces

Table 6. Supported GPIB Interfaces

On LINUX:

Description	Part number
Supported GPIB Interfaces on Linux OS Workstations	
TAMS L488 GPIB/LAN Interface	L488 L488-POE1 TAMS IO Library
Keysight LAN/GPIB Gateway Interface TAMS IO Library	E5810A ¹ 82091
TAMS High Speed PCI GPIB and TAMS IO Library TAMS IO Library Only	81488 82091
TAMS PCI and TAMS IO Library TAMS IO Library	80488 82091
TAMS USB GPIB and TAMS IO Library TAMS IO Library Only	83488 82091
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. Discontinued product.

On Windows:

Description	Part number
TAMS L488 GPIB/LAN Interface and Keysight IO Libraries version 14.2	L488 L488-POE1
Keysight GPIB PCI card and Keysight IO Libraries	82350A ¹ /B
Keysight LAN/GPIB Gateway Interface and Keysight IO Libraries	E5810A ²
Keysight USB/GPIB converter and Keysight IO Libraries	82357A ¹ /B
National Instruments PCMCIA-GPIB card and NI-488.2M drivers	778034
National Instruments PCI-GPIB card and NI-488.2 drivers	778032

1. Discontinued product.

2. LAN Interface is typically slower than GPIB card.

Licensed Software

Each WaferPro Express 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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