SiPH Upgrade | 200 and 300 mm Automated Probe Systems

The Dedicated Solution for Silicon Photonics Device Characterisation

FEATURES / BENEFITS

Dedicated for silicon photonics on-wafer test

- Including various options of high-precision fiber alignment systems for ultra-fast scanning routines
- Multiple measurement capabilities for O-O, O-E, E-O and E-E device configuration
- Integrated Z-sensing for detecting the fiber to wafer contact point
- Crash protection when using two optical fiber arms
- Temperature capability from -50 °C to 200 °C
- Optional dark box for testing in light tight environment

System compatibility

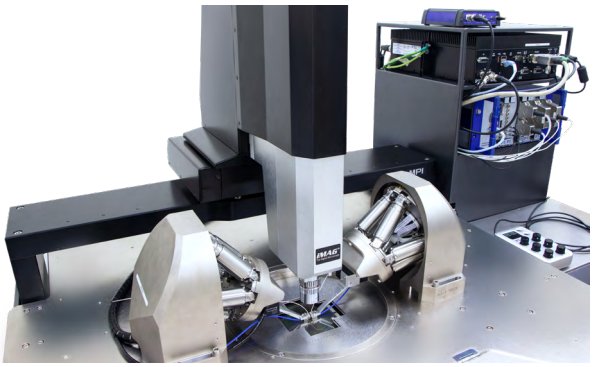
- Manual: TS150-AIT, TS200-THZ, TS200-IFE, TS300-THZ and TS300-IFE
- 200 mm: TS2000-IFE and TS2000-SE
- 300 mm: TS3000, TS3000-IFE, TS3000-SE, TS3500, TS3500-IFE and TS3500-SE

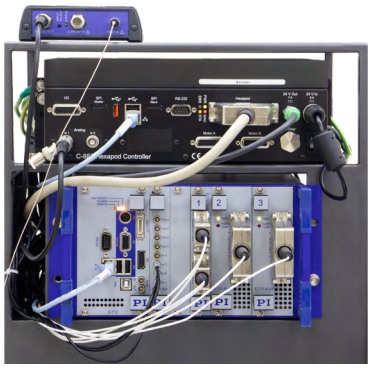
KEY FEATURES

Integrated Rack For Optical Alignment Electronics

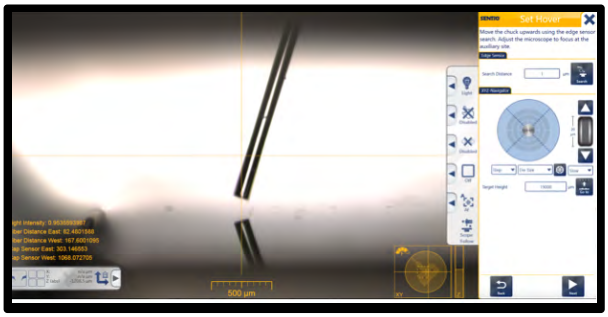
The SiPH optical alignment system requires appropriate electronic components. To avoid consuming additional floor space, an extra electronic rack has been integrated inside the probe systems foot print. It is located right above the optional chiller for the thermal chuck system and consists all the drivers for positioning, distance control and optical detection.

The photonics alignment system is designed for single fiber and and multichannel arrays. Its modular design allows the use of up to 6-axis fiber positioning stages.

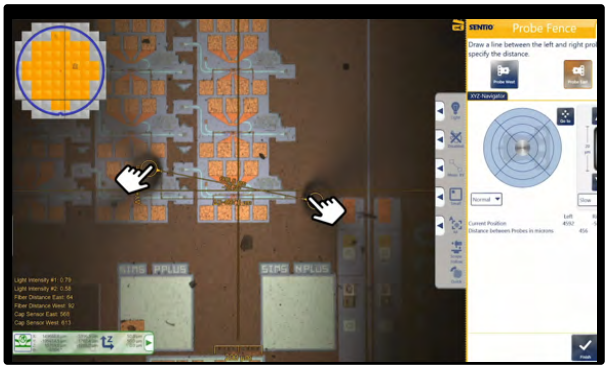




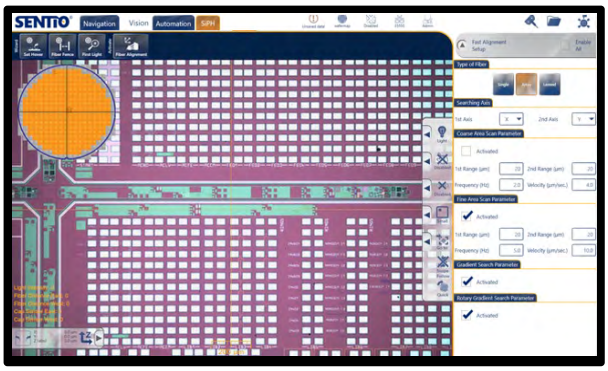
SiPH SENTIO® Integration
Necessary optical alignment stages, such as the hexapod, are fully integrated into the SENTIO® probe station control software. Those are operated just like any other automated positioner including its additional alignment features. And not only integrated in the multi touch software, even the hardware control panel supports the SiPH positioner type. This makes it easy to perform optical measurements.



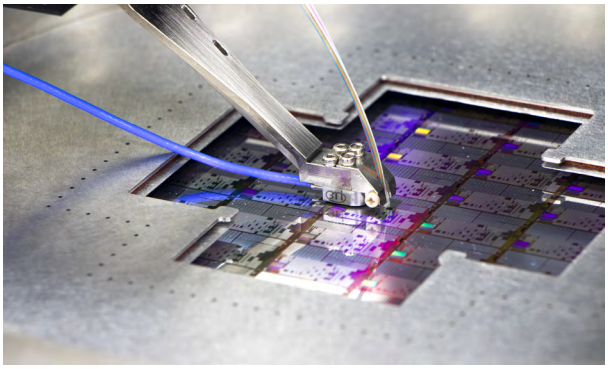
SENTIO® SmartFence™
SENTIO® offers further useful functions for measurements on silicon photonics devices. For example, the user is guided through the setup process with wizards. And the integrated SmartFence™ enables safe and convenient manual fiber navigation.



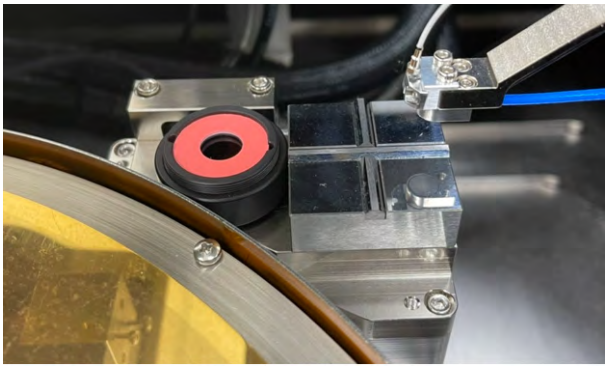
Fiber Type Handling
The different fiber types are managed via the graphical user interface. In this way, the variety of silicon photonics devices can be conveniently tested. For easy test executive integration of the SiPH functionality MPI is providing free sample scripts. Those are covering all necessary operation required for automated testing. Additionally, optical measurement equipment, can be embedded to trigger the actual measurement such as IL or PDL measurements.



Thermal
MPI IceFreeEnvironment™ provides unique capability to perform measurements with optical fibers at negative temperatures down to -60 °C. For higher temperatures, components were selected that can work for optical measurements up to 200 °C.



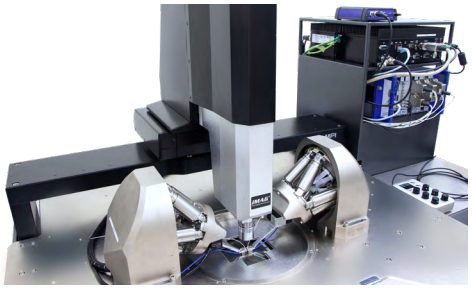
SiPH Calibration Area
All MPI SiPH systems include a calibration area for silicon photonics. In this area, the fiber height is calibrated to allow repeatable placement of the fiber as chip by chip is being measured. An optical power sensor enables the measurement of fiber output power to accurately determine the optical power delivered to the device under test.



ALIGNMENT OPTIONS: FAST MULTICHANNEL PHOTONIC ALIGNMENT SYSTEM[1]

System with 6 Degrees of Freedom for Ultra-Fast Scan Routines

- Integrated scan routines for fiber optic alignment
- Extensive software package
- Direct detection of the optical signal
- Position sensors for high accuracy and operational reliability
- Automatic alignment and coupling optimization
- Suitable for single fiber and fiber arrays
- Simplified setup with 3-axis stage for single fiber applications
- Optional optical power meter



Specifications

Six-axis coarse positioning	
Active axes	X, Y, Z, θX, θY, θZ
Travel range in X, Y, Z	±6.5, ±16, ±8.5 mm*
Travel range in θX, θY, θZ	±14.5, ±10, ±10°*
Minimum incremental motion	0.1 µm
Max. velocity	10 mm/s
Sensor type	Rotary encoder
Drive type	Brushless DC motor
Three-axis coarse positioning	
Alternatively to the six-axis coarse positioning the MPI positioner MP60, MP80, PMP60 and PMP80 can be used	
Manual three-axis rotation	
As an alternative to automated rotation in six-axis coarse positioning, manual rotation can also be used in conjunction with the MPI‘s MP80 or PMP80	
Fine positioning	
Active axes	X, Y, Z
Closed-loop travel in X, Y, Z	100 µm
Min. incremental motion, closed-loop	2.5 nm
Linearity error, for the entire travel range**	2 %
Repeatability (bidirectional) 10% travel range	2 nm
Sensor type	Incremental
Drive type	PICMA®

Features	PMP80*	Hexapod
Rotation for roll, yaw and pitch	Manual, at home die	Automated
XY In-die stepping	Automated	Automated
Alignment when stepping	++	++
Price	++	--

**Plus manual rotation and nano-positioner*

Alignment	
Alignment time area scan 100 µm x 100 µm***	<1 s
Alignment time gradient search, randomized with ±5 µm****	<0.3 s
Repeatability (fiber to fiber)	0.02 dB
Fiber output power measurement	
Wavelength range	700 to 1800 nm
Minimum input power	50 nW
Maximum input power	40 mW

Miscellaneous

Operating temperature range, mechanics	0 to 50 °C
Operating temperature range, controller	5 to 40 °C
Cable length	2 m

**The travel ranges of the individual coordinates (X, Y, Z, θX, θY, θZ) are interdependent. The data for each axis in this table shows its maximum travel range, where all other axes and the pivot point are at the reference position. See the dimensional drawings for the default coordinate system and pivot point coordinates of the hexapod. Changing the pivot point will reduce the travel range in θX, θY, θZ. Changing the orientation of the coordinate system (e.g., when the optical axis is to be the Z axis), will change the travel range in X, Y, and Z.*
***Without polynomial linearization*
****Typical time span for scanning the entire area and moving to the highest intensity*
*****Reaching the global maximum after first light has been found*

[1]All these texts, images and drawings are courtesy of Physik Instrumente (PI) GmbH & Co. KG., © 2017

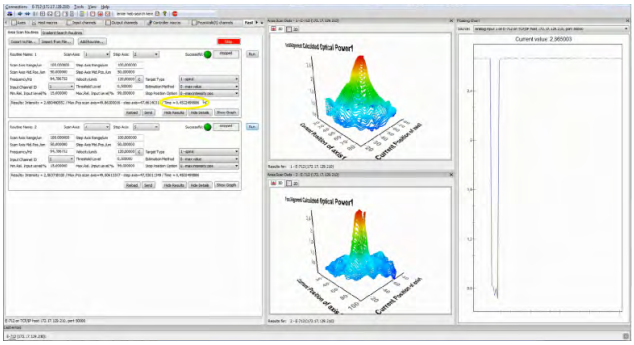
Comprehensive Software Package and Development Tool-Kits

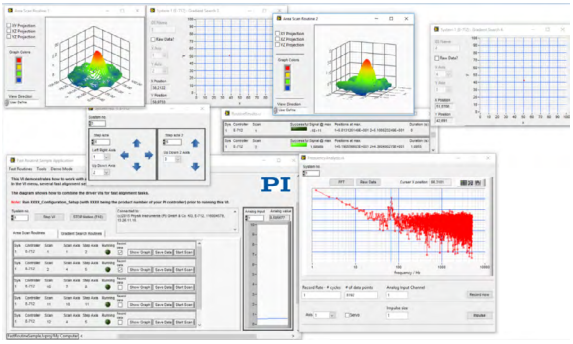
Software emulation allows application programs to be developed and pretested without having all components on site. Simulation tools also avoid collisions e.g., to prevent the moving platform from approaching positions where the platform or the mounted load would collide with the surroundings. The free choice of the pivot point and coordinate systems for definition of work- and tool-space can be done by a simple software command to enable scanning in inclined planes. Mobile apps allow wireless monitoring and control.

User-friendly application development libraries and sample applications for easy, fast, and flexible implementation

- Libraries for C++, C#, VB.net, etc.
- Python
- LabVIEW
- MatLab

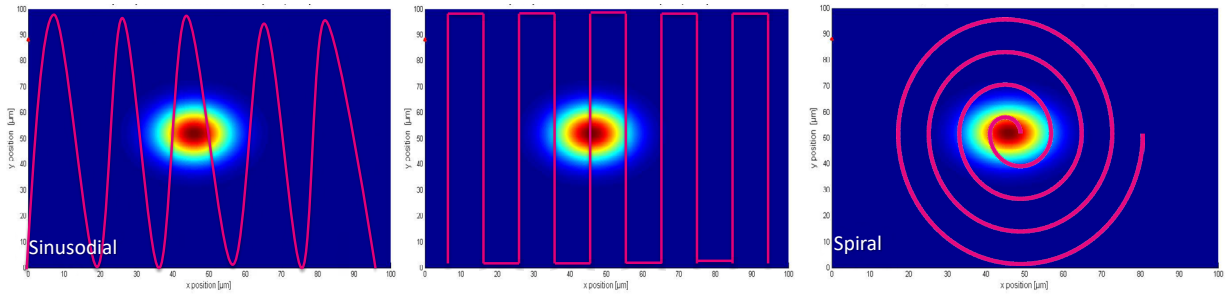
Available for Windows, Linux and OS X deployment. Universal Command Set (GCS) simplifies commissioning and programming. Supports PI controllers' built-in, ultrafast, and vibration-free scan/align algorithms. PIMikroMove® GUI for Windows provides quick access to motion and scanning across all PI products regardless of drive technology, controller type, number of axes etc. Includes softwarebased scan and align routines which work with all PI motion controllers.





Alignment Routines

- Gradient Search, define with FDG and start with one command FRS #
- Gradient of signal steers movement
- New approach with fastest results
- Run simultanously on any channels, in- and output as well
- Tracking functionality



Digital Motion Controller

Modular control system for up to 6 axis for highest precision:

- Real-time operating system for excellent trajectory control
- Highly stable 20-bit D/A converter
- 20 kHz servo update rate
- Flexible interfaces: Ethernet TCP/IP, RS-232, USB
- Supports capacitance sensors or lensed fibers for automatic Z sensing

Specifications

Function	Modular digital controller for multi-axis piezo nanopositioning systems
Axes	6
Processor	PC-based, real-time operating system
Sampling rate, servo control	20 kHz
Sensor	
Servo characteristics	P-I, two notch filters
Sensor type	Capacitive
Sensor channels	6
Sensor resolution	18 bits
External synchronization	Yes
Amplifier	
Amplifier channels	8
Output voltage	–30 to 135 V
Peak output power per channel	25 W
Average output power per channel	8 W
Current limitation	Short-circuit-proof
Resolution DAC	20-bit
Overheat protection	Output voltage switch-off at 75 °C
Interfaces and operation	
Interface / communication	Ethernet, USB, RS-232, SPI
Piezo / sensor connection	Sub-D Mix 25W3
Analog inputs	LEMO: 4 × ±10 V differential; bandwidth: max. 25 kHz; resolution: 18 bit; max. impedance: 250 Ohm
Analog outputs	LEMO: 4 × ±10 V differential; bandwidth: max. 25 kHz; resolution: 16 bit
Digital input/output	MDR20: 8 × TTL
Command set	PI General Command Set (GCS)
User software	PIMikroMove
Application programming interfaces	API for C / C++ / C# / VB.NET / MATLAB / Python, drivers for NI LabVIEW
Supported functions	Wave generator, trigger I/O, macros
Indicators	LEDs for OnTarget, Error, Power, Over Temp
Linearization	4th order polynomials, DDL option (Dynamic Digital Linearization)
Miscellaneous	
Operating temperature range	5 to 40 °C
Mass	5.96 kg
Dimensions	9.5” chassis, 236 mm × 132 mm × 296 mm + handles (47 mm length)
Max. power consumption	225 W
Operating voltage	100 to 240 VAC, 50 to 60 Hz

OPTIONAL FEATURES

Z-Distance Sensing

For precise fiber positioning a distance sensor is integrated into the probe arm. The sensor supports an easy and safe setup when fiber and DUT are brought into close proximity.

Specifications	
Sensor Type	Capacitive
Measurement range	1000 µm
Resolution	40 nm
Interface	Ethernet for easy access via browser
Analog output	0 to 10 Volt for direct connection to alignment system and probe system hardware
Quantity	1 or 2, depending on configuration for single or dual setup

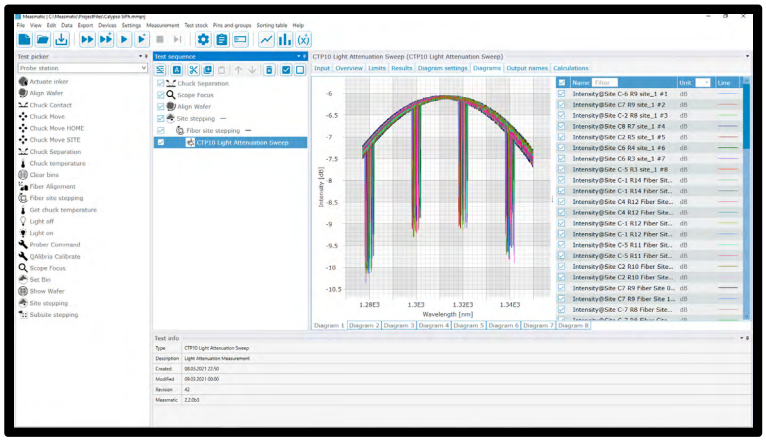
Optical Power Meter

Specifications	
Optical input	
Wavelength range	400 to 1550 nm
Connectors	FC/PC, FC/APC
Polarization dependence	None
Minimum input power at 1550 nm	85 nW
Maximum input power at 1550 nm	85 mW
Average noise at 1550 nm	<10 nW
Current input	
Connectors	BNC
Minimum input current	0
Maximum input current	1 mA
Average noise	<120 pA
Output	
Connectors	BNC
Output signal	Analog, logarithmic
Voltage range	-5 to 5 V
Bandwidth (3dB)	20 kHz
Logarithmic increase	1 V/10 dB
Output voltage at 85 mW, 1550 nm	≈ +5 V
Output voltage at 85 nW, 1550 nm	≈ -1.2 V
Output voltage at 1 mA input current	+5 V
Miscellaneous	
Operating voltage	12 to 24 V
Power consumption	2.4 W
Overall mass	0.6 kg
Relative humidity	20 to 70 %
Operating temperature range	5 to 40 °C
Storage temperature range	-10 to 50 °C
Requirements for customer supplied optical power meter	
Output signal	Analog, ideally logarithmic
Voltage range	Maximum -5 to 5 V
Bandwidth	Minimum 1 kHz
Noise level	Minimum -60 dBm

Measmatic - The Universal Test Sequencer
The Measmatic software provides a unique environment for automating silicon photonics measurements. With built-in SENTIO connectivity, all automated MPI probe stations including the SiPH alignment positioner are natively supported. A variety of device drivers are integrated for optical and electrical device measurements. The flexible architecture of the software allows the use of instruments from different manufacturers. Any instrument with a GPIB, Ethernet or RS232 interface can be supported. The graphical user interface and functionality are customizable with built-in Python and Lua scripting functions.

The test library contains predefined sequences for the characterization of silicon photonic devices. User-specific test routines including conditions and loop steps can be defined.

A variety of mathematical functions are used to extract parameters and visualize the acquired data. Data export is in a table format or can be customized in Python scripts.



Supported instruments

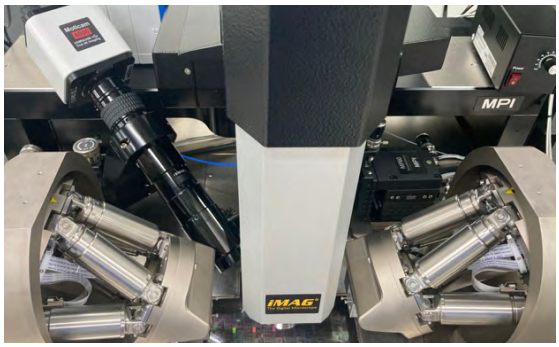
Photonics test
EXFO CTP10 including tunable lasers
EXFO MXS-9100 optical switch matrix
Keysight N7744C optical power meter
Keysight N7778C tunable laser
Keysight Photonic Application Suite

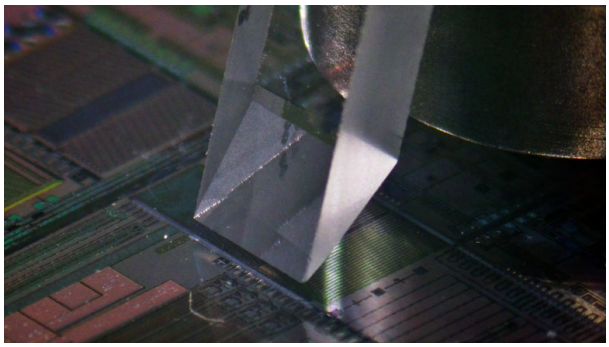
Electrical DC test
Keithley 707 and 708 switch matrix
Keithley 2400 and 2600 SMU
Keithley 3706 digital multimeter
Keithley 4200 parameter analyzer
Keithley 6500 digital multimeter
Keithley 7002 switch mainframe
Agilent E5250 switch mainframe
Agilent 33220A Arbitrary Waveform Generator
Agilent 81110 Pulse Generator

Electrical RF test
Anritsu VectorStar MS4640B
Keysight PNA
Rhode & Schwarz ZVA

Angled Microscope

The angled microscope offers an additional view alongside the standard alignment microscope. Especially when setting up optical fibers, this additional view helps to do this in a convenient way. The view is fully integrated into the SENTIO® microscope viewing environment, making it easy to switch between different requirements during setup.





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MPI global presence: for your local support, please find the right contact here:
www.mpi-corporation.com/ast/support/local-support-worldwide

MPI Global Presence