

Cascade

CM300xi-SiPh

300 mm Semi-/ Fully-automated Probe System
with Autonomous Silicon Photonics Measurement Assistant

Overview

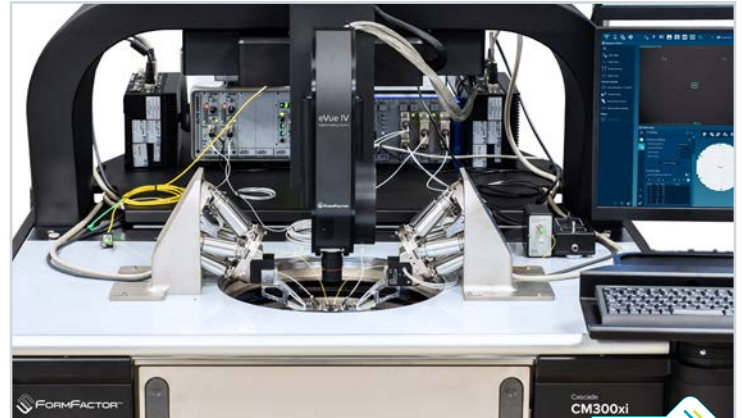
The CM300xi-SiPh probe station is the first verified, fully integrated silicon photonics (SiPh) measurement solution that delivers engineering- and production-proven optical performance immediately after installation – without additional development effort. With an installed base of far more than 100 systems worldwide, the CM300xi-SiPh is a solution trusted by leading silicon photonics users across research, development, and production environments.

Equipped with the unique **Autonomous SiPh Measurement Assistant**, it provides a groundbreaking set of functions that precisely calibrate the optical positioning hardware to the probe station and verify the performance of the fully integrated system.

The **OptoVue™ Calibration Kit** enables real-time, in-situ optical calibration directly at the device under test. It supports singulated die testing, true die-level edge coupling, in-situ optical power measurements, and a comprehensive set of advanced calibration technologies, ensuring traceable, repeatable, and highly accurate results across a wide range of SiPh test scenarios.

Quick changeover for a multitude of testing needs is supported, from single fibers to arrays and from vertical to edge coupling. In combination with the exclusive SiPh TopHat, the system supports stable optical measurements across a temperature range from -40°C to $+125^{\circ}\text{C}$.

Built on the CM300xi platform, the solution delivers outstanding measurement accuracy and long-term reliability in a fully modular architecture. It supports RF, DC, and optical measurements within a single semi-automated system, or as a fully-automated configuration capable of handling 200 mm and 300 mm wafers.



Industry-first Features / Benefits

OptoVue Pro	<ul style="list-style-type: none"> Real-time in-situ calibrations, singulated die testing, true die-level edge coupling, in-situ power measurements, advanced calibration technologies
Edge Coupling	<ul style="list-style-type: none"> Repeatable measurement results due to exclusive automated fiber-to-facet alignment technology Reduced risk of damaging fibers with collision avoidance technology Horizontal die-level edge coupling: lowest coupling loss and highest accuracy in test results Wafer-level edge coupling: innovative technology aligns fibers/arrays in a wafer-level trench
Vertical Coupling	<ul style="list-style-type: none"> Industry standard for vertical coupling to wafer-level grating couplers Pivot Point calibration determines the optimal point of minimal translation at the fiber/array tip Search First Light feature enables automated determination of initial position for optimization Incident Angle Cal, Optical Rotation Scan, Optical Scan Data Analysis, Optical Tracking, Align Optical Probes
Thermal Capability	<ul style="list-style-type: none"> Dark, shielded and frost-free, -40°C to +125°C Only solution available that enables minimized air flow impact at cold temperatures to the fibers/fiber arrays for stable and repeatable measurement results Enables hands-free autonomous calibration and re-calibration at multiple temperatures
Exclusive Automated Calibrations	<ul style="list-style-type: none"> Pioneering set of automated functions that perform critical calibrations of the optical positioning system to the probe station Faster time to measurement and reduced cost of test with real-time in-situ automated calibrations Further exclusive calibration functions: motor calibration, Z-displacement calibration, theta calibrations, PZT calibration, planarity calibrations, automatic pivot point calibration

Note: For physical dimensions and facility requirements, refer to the CM300xi Facility Planning Guide. If not otherwise mentioned, the specified values are given for a temperature range from +18°C to +24°C and relative humidity of 20% to 50%.

CM300xi Product Family

Models

CM300xi-F	CM300xi, fully-shielded	EMI-shielded system for low-current and low-noise measurements (full thermal range)
CM300xi-S	CM300xi, shielded	Shielded system for low-temperature and dark environment (full thermal range)
CM300xi-O	CM300, open	Open system for ambient or above ambient temperature usage

Programmable Chuck Stage

	X-Y Stage	Z Stage	Theta Stage
Travel	301 mm x 501 mm (11.9 in. x 19.7 in.)	10 mm (0.4 in.)	± 3.75°
Resolution	0.2 µm (0.008 mils)	0.2 µm (0.008 mils)	0.0001°
Repeatability	≤ 1 µm (0.04 mils)	≤ 1 µm (0.04 mils)	≤ 1 µm (0.04 mils)*
Accuracy	≤ 2 µm (0.08 mils)	≤ 2 µm (0.08 mils)	≤ 2 µm (0.08 mils) ≤ 5 µm (0.2 mils) (Movements >2°)
Speed	50 mm/s (2 in./s)	20 mm/s (2 in./s)	
Stepping Time	≤ 1.5 sec (200 µm Z down – 1000 µm X-Y – 200 µm Z up)		-
Lifting capacity (in excess of chuck)	-	20 kg (44 lbs.)	-
Probe-force deflection	-	≤ 0.0007 µm/µm slope per 10 kg load	-

*Measured at the edge of 300 mm chuck

Electrical	CM300xi-F	CM300xi-S
EMI shielding	> 30 dB (typical) @ 1 kHz to 1 MHz	> 20 dB (typical) @ 1 kHz to 1 MHz
Light attenuation	≥ 130 dB	≥ 130 dB
Spectral noise floor**	≤ -170 dBVrms/rtHz (≤ 1 MHz)	≤ -150 dBVrms/rtHz (≤ 1 MHz)
System AC noise***	≤ 5 mVp-p (≤ 1 GHz)	≤ 15 mVp-p (≤ 1 GHz)

* Available for CM300xi-F and CM300xi-S only.

** Typical results. Actual values depend on probe / test setup. Test setup uses triaxial thermal chuck, 50 Ω termination, high quality LNA, and DSA/DSO instrument.

*** Test setup: Station power ON, Thermal system ON (40°C), MicroChamber® closed. Instrument setup: Time domain digital scope (DC to 1 GHz), 50 Ω input impedance, cable to chuck BNC connector. Measurement: Peak-Peak Noise Voltage (acquire 1000 data points, and calculate mean of Vp-p data).

Air-Purge Management¹

Purge	Clean dry air (CDA)
Purge Control	Automated flow control using dew point sensor.
Purge Flow	By default, the microchamber purge flow rate is automatically regulated to the lowest possible value required to ensure a frost-free environment. Experienced customers may also choose to control the CDA flow manually or via scripting (not recommended).
Typical Purge Flow Rates	80 l/min (2.8 SCFM) at chuck operating temperatures of -40°C to +300°C and during standby 100 l/min (3.5 scfm) at chuck operating temperatures below -40°C 240 l/min ² (8.5 scfm) (max. purge flow), temporarily for cooling down to temperatures below -40°C or during wafer loading and unloading below ambient.

¹ See Facilities Planning Guide for detailed specification of facilities requirements.

² In case the max. purge flow is not made available, this might result in longer temperature transition times.

Platen System

Outer Platen

Dimensions	1058 mm (W) x 866 mm (D) x 25 mm (T)
Platen-to-chuck height	43.0 ± 0.5 mm (1.69 ± 0.02 in.)
Accessory mounting	Universal Rail System: 53 cm (21 in.) Left / Right Rail, 70 cm (28 in.) Rear Rail
Platen mount	Fixed height, High Thermal Stability kinematic mount
HTS Thermal Management	Integrated laminar-flow air-cooling for thermal expansion control

Inner Platen

Dimension	720 mm x 720 mm x 38 mm (incl. guard for fully-shielded version)
Weight	47 kg (104 lb.)
Material	Steel for magnetic positioners
Surface finish	Fine ground for vacuum positioner high stability

Platen Insert

Diameter	344 mm (13.5 in.)
Standard interfaces	TopHat™, probe card holders and IceShield™

Probe Card Holder*

Probe card shape	Rectangular
Probe card width	114.5 mm (4.5 in.)
Max. probe card length (standard)	284 mm (11.18 in) / 142 mm (5.59 in) from probe center to front/rear
Max. probe card length (HTS)	160 mm (6.30 in) / 80 mm (3.15 in) from probe center to front/rear
Tip drop**, (standard)	3.0 mm to 5.0 mm (0.12 in. to 0.20 in.)
Tip drop** (High Thermal Stability)	4.7 mm (0.185 in.)

* For more details, please see the Probe Station Accessory Catalog.

** Tip drop corresponds to the vertical distance between mounting level of probe card and needle tips. Field of view of ContactView (side view) camera within +/- 0.5 mm from nominal value (4.7 mm)

Active Vibration Isolation System

Attenuation*	0 dB @ 6Hz, 5 dB per octave @ 6Hz to 48Hz, 15 dB above 48Hz
Stage damping	15 dB in less than 1500 m sec

Sound level

Constant level	< 60 dB (A)
Peak level	< 72 dB (A)

* Please see facilities planning guide for minimum requirements concerning background vibrations.

Communication Ports

Type	Qty	Location	Notes
USB 3.0	2	IPC front	For access to USB devices
GPIB IEEE 488.2	1	Rear connection panel	For test instrument control
LAN	1	Rear connection panel	For integration into measurement environment and local network
USB 3.0	1	Front	For access to USB devices (IntelliControl option)
USB 2.0	3	Font and rear	For connecting customer equipment (IntelliControl option)
LAN	3	Rear connection panel	For connecting customer equipment and local network (IntelliControl option)

Contact Intelligence Technology

The CM300xi provides the lab automation capabilities needed to make critical precision electrical measurements. With Contact Intelligence technology, CM300xi adapts to temperature variance and provides automated drift correction for unattended testing on small pads over time and temperature. Contact Intelligence technology is enabled by the following features:

- VueTrack™ closed-loop positioning capability minimizes the need of manual re-adjustment when probing small pads across multiple temperatures.
- Velox probe station software provides a single command interface for automated temperature transitions continuously managing the separation between probes and pad during temperature ramp.
- Velox probe station software provides the ability to optimize the soak time after a temperature transition or when stepping across the wafer based on the temperature variance.
- ReAlign offers the capability to perform automated probe to pad alignment and unattended testing over temperature using probe cards that do not allow unlimited top microscope view of probes and pads.
- High Thermal Stability (HTS) microscope bridge enables automated over-temperature measurements.
- HTS platen provides stability over a wide thermal probing range.
- HTS probe card holder ensures EMI-shielded and light-tight environment, achieving accurate and reliable small-pad probing (option).
- As an additional option, motorized positioners allow automatic drift correction for each probe individually and facilitate unattended testing on small pads across multiple temperatures using Vuetrack Pro or Auto RF. Motorized positioners are part of the Autonomous DC and Autonomous RF Measurement Assistants.

➤ Microscope Bridges/Transports

Programmable High Temperature Stability (HTS) Microscope Bridge for eVue Microscope System

Travel	75 mm (X) x 75 mm (Y) x 150 mm (Z) (3.0 in. x 3.0 in. x 5.9 in.)
Travel in TopHat	26 mm x 26 mm (1 in. x 1 in.)
Z Lift	150 mm (5.9 in.)
Resolution, X-Y axis	1 μm (0.04 mils)
Resolution, Z axis	0.4 μm (0.016 mils)
Repeatability, X-Y axis	$\leq 2 \mu\text{m}$ (0.08mils)
Repeatability, Z axis	$\leq 1 \mu\text{m}$ (0.04mils)
Accuracy, X-Y axis	$\leq 5 \mu\text{m}$ (0.2 mils)
Accuracy, Z axis	$\leq 4 \mu\text{m}$ (0.016 mils)
Speed	5 mm/sec (0.2 in./sec)

Programmable Large Area Transport/Microscope Bridge

Travel	300 mm (X) x 300 mm (Y) x 150 mm (Z) (12 in. x 12 in. x 5.9 in.)
Travel in TopHat	26 mm x 26 mm (1 in. x 1 in.)
Z Lift	150 mm (5.9 in.)
Resolution, X-Y axis	1 μm (0.04 mils)
Resolution, Z axis	0.4 μm (0.016 mils)
Repeatability, X-Y axis	$\leq 5 \mu\text{m}$ (0.2 mils)
Repeatability, Z axis	$\leq 2 \mu\text{m}$ (0.08 mils)
Accuracy, X-Y axis	$\leq 10 \mu\text{m}$ (0.4 mils)
Speed	50 mm/sec (2 in./sec)
Planarity compensated	$\pm 5 \mu\text{m}$ (0.2 mils)

➤ Wafer Chuck

Diameter	305 mm (12 in.)
Material	Nickel- or gold-plated aluminum
DUT sizes supported	Shards (10 mm x 10 mm or SEMI-M1 compliant wafers up to 300 mm / 12 in.)
Vacuum rings	7 mm, 66 mm, 130 mm, 180 mm, 280 mm
Vacuum-ring actuation	Software controlled (Center, 200 mm, 300 mm)
Planarity incl. stage movement (with active z-profiling)	+/- 5 μm (0.2 mils)



➤ Aux Chuck

Left-side Aux Chuck	Ceramic vacuum chuck optimized for RF calibration Two 22 x 22 mm ² substrates Stop pins as alignment aid
Planarity	+/- 5 μm , adjustable
Thermal isolation	Air gap, > 10 mm
Positional repeatability	2 μm (0.08 mils) after rollout event
Vacuum actuation	Independent manual vacuum switches

> OptoVue / OptoVue Pro

OptoVue and OptoVue Pro are revolutionary technology advancements for wafer and die-level photonics probing. They include advanced calibration technologies with more viewing directions and significant additional features that enable faster time to more accurate measurement results.

- Features**
- Real-time in-situ calibrations
 - Singulated die testing
 - True die-level edge coupling
 - In-situ power measurements
 - Advanced calibration technologies
 - Enables autonomous measurements

CalVue
/ In-situ calibration for Z-Displacement and optical positioning

PowerVue
/ High sensitivity photodiode
/ Power Measurements up to 40 mW
/ Enables in-situ power measurements at the measurement plane of single fiber and fiber array
/ Measure and remove laser to fiber tip path loss

ProbeVue
/ Upward looking probe inspection function for single fibers, fiber arrays, DC and RF probes
/ Find initial array coupling offset position from corner

DieVue
/ Singulated die test
/ Up to 25 x 25 mm die
/ Vacuum secured
/ Customizable die holder
/ Vertical and edge coupling



Feature	OptoVue Pro	OptoVue
CalVue	✓	✓
PowerVue	✓	-
ProbeVue	✓	-
DieVue	✓	-

➤ CalVue - Exclusive Automated Calibrations

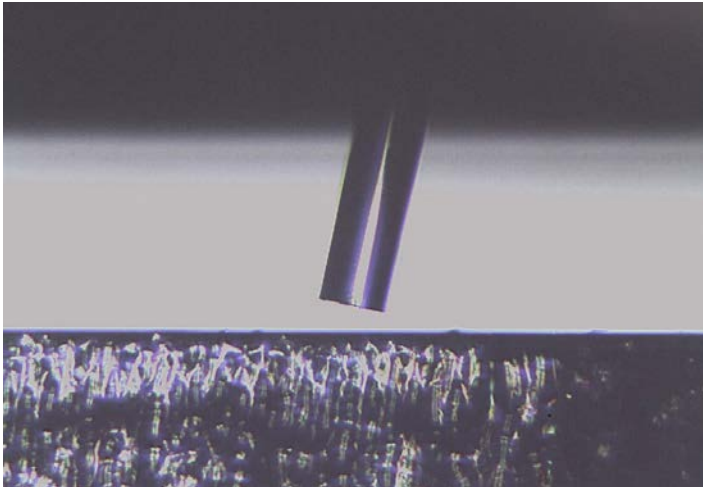
FormFactor has developed a pioneering set of automated functions that perform critical calibrations of the optical positioning system to the probe station and step-by-step wafer to probe height training - even for combined optical and electrical probing.

With CalVue, part of OptoVue and OptoVue Pro, FormFactor moves these industry-exclusive automated calibration functions into the probe station. Utilizing uniquely designed retro-mirror technology, the objective lighting of eVue can be used to view all aspects of the fiber/array without external light.

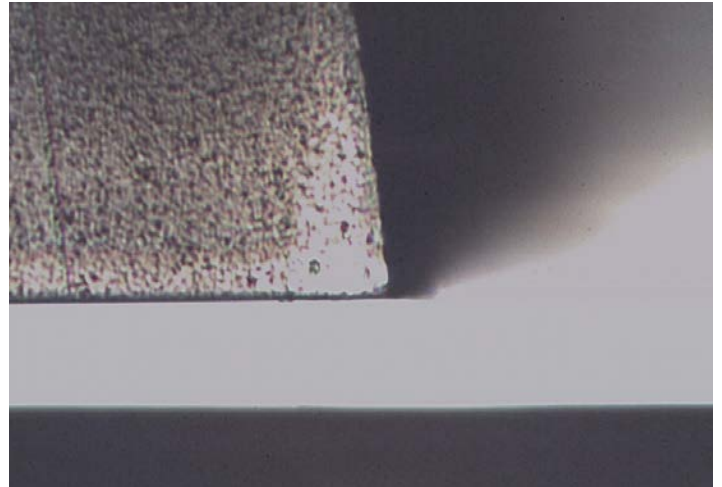
This eliminates the need for oblique lighting and enables real-time in-situ automated machine vision calibrations.

Calibration functions

- Motor calibration
 - Z-displacement calibration
 - Theta calibrations
 - PZT calibration
 - Planarity calibrations
 - Automatic pivot point calibration
-



Horizontal view of single fiber with CalVue



Horizontal view of fiber array with CalVue

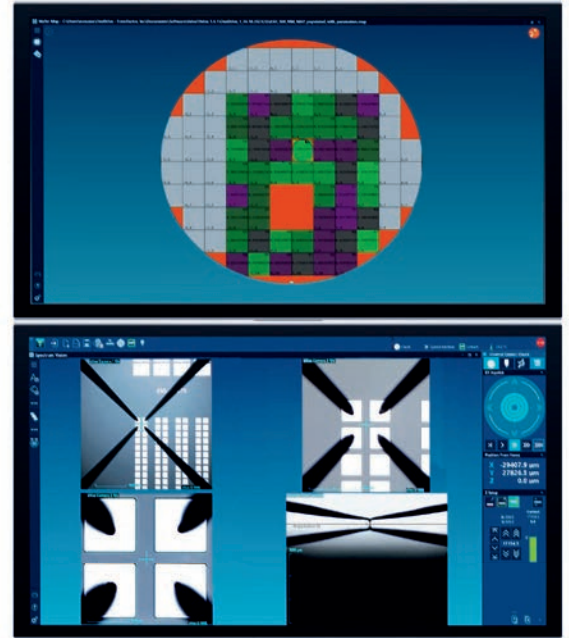
➤ Station Controller PC and Software

The CM300xi is equipped with a high-performance controller PC including Velox probe station control software.

Velox Probe Station Control Software

Velox software provides all features and benefits required for semi- and fully-automated operation of the probe system, such as:

- **User-centered design:**
Minimized training costs and enhanced efficiency.
- **Loader integration:**
No need for any additional software. Easy creation of workflows and receipts.
- **Smart automation features:**
Faster time to data due to reduced test cycle times.
- **Hundreds of tuneable options:** High flexibility for a large variety of applications.
- **Simplified operation for inexperienced users:** Reduced training costs with Workflow Guide and condensed graphical user interface.
- **Integrated Python Development Environment:** Including Syntax Highlighting, AutoComplete, Debugger, Integrated Documentation.
- **Velox Integration Tool Kit:** Enables integration of the prober into Customer Test Executives, supporting LabView, C++, C#, Visual Basic, MatLab.
- **Velox Interval Backup:** Automated Backup with easy-to-use recovery function. Data is stored on a separate HDD drive.



VeloxPro Package (Optional)

VeloxPro is a SEMI E95-compliant enhancement with test executive capabilities, featuring:

- **SEMI E95-compliant** probe station control software with condensed graphical user interface for simplified operation
- **Test executive software** enabling control of third-party measurement equipment via the probe station

Tester Interface

The CM300xi uses commands through GPIB as a permanent listener. The GPIB interface provides the ability to:

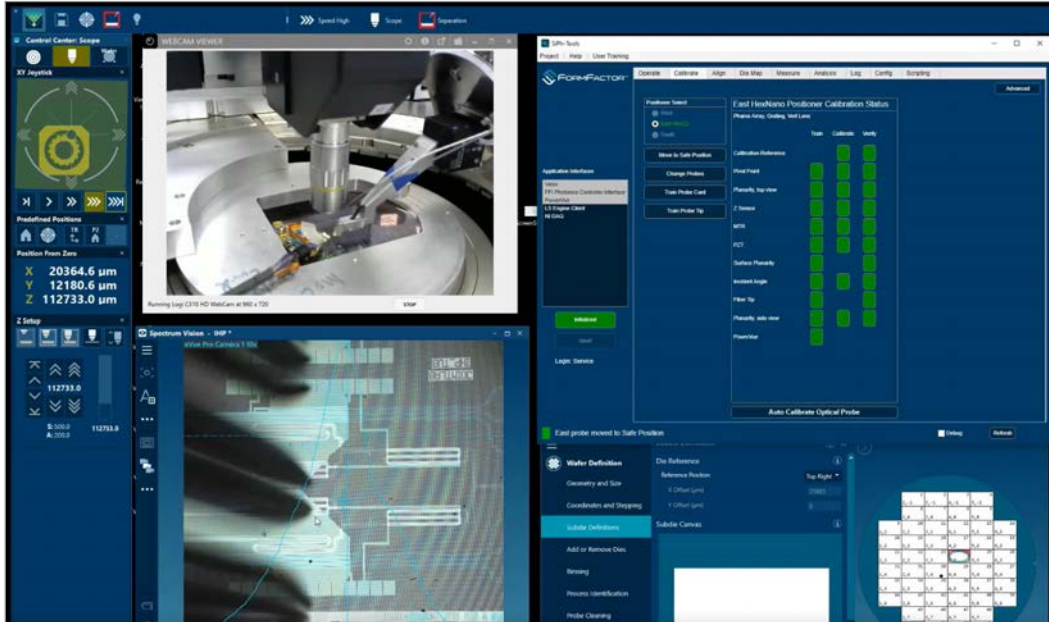
- Request an inventory of all wafers available in the cassettes
- Define a wafer map
- Define a job (out of wafers and recipe)
- Change chuck temperature and initiate re-alignment
- Receive notifications when the wafer is aligned and ready to test

➤ SiPh-Tools and Photonics Controller Interface

SiPh-Tools is a powerful software package from FormFactor that includes a vast tool set for enabling and facilitating optical probing.

Uniquely developed features

- Measurement position training
- Wafer training
- Automated alignment functions
- Calibration wafer verifications
- Optical alignment verifications
- Sub-die management



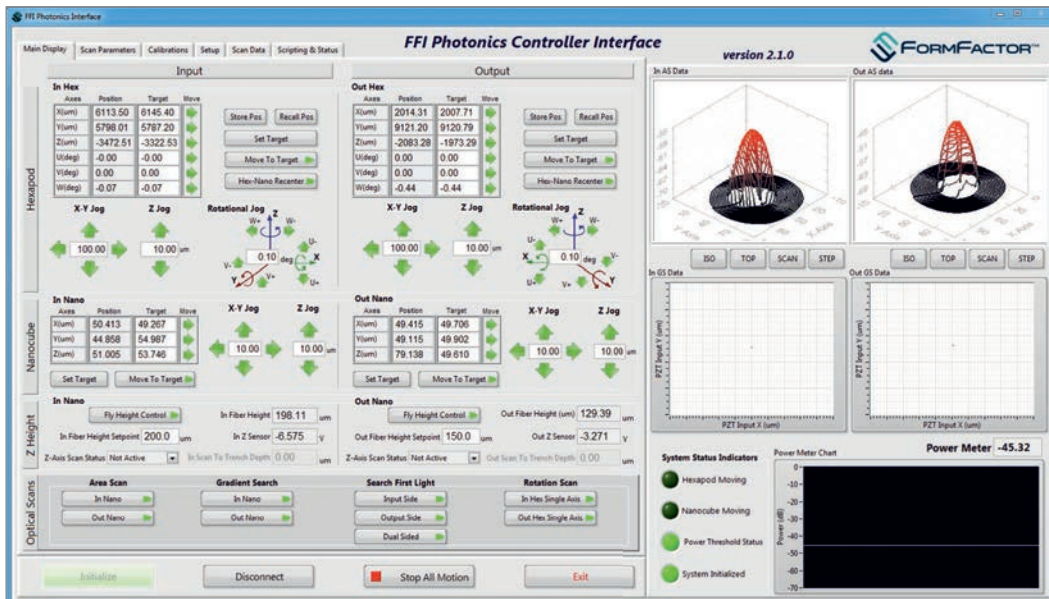
SubDie Mapping

Mapping of sub-die optical and electrical measurement locations for automated stepping to multiple sub-structures within a die can be complicated.

FormFactor has developed a function in SiPh-Tools that simplifies this task by enabling the user to map between wafer, positioner, and microscope coordinate systems so that sub-die probing locations can be specified in wafer (e.g., CAD) coordinates. Then the required positioner and scope positions to probe those location are mapped through a set of coordinate references.

Once references have been trained, all optical and electrical positioners in the system and the scope can be automatically moved to arbitrary probing locations that have been specified in wafer coordinates.

FormFactor's SiPh-Tools provides the communication link between multiple applications, including Velox and PCI.



FormFactor's Photonics Controller Interface - controls manual positioning, scan parameter configuration, and initial optical alignment functions.

> Proven Performance

FormFactor has developed an automated test methodology that demonstrates the full performance of the positioning solution calibrated to the probe station with one click of a button.

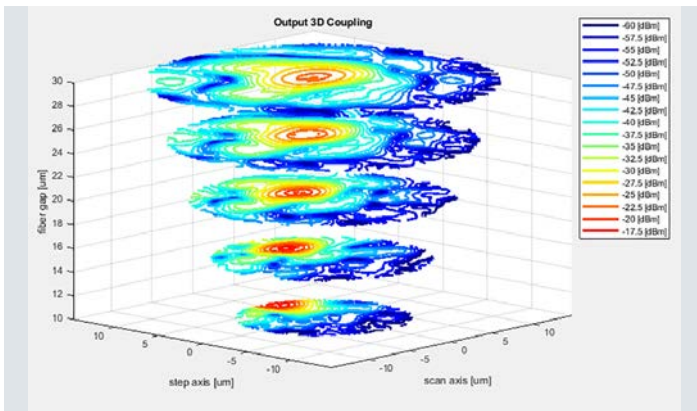
The performance verification script ensures that all 9 or 18 Axis' of the positioning solution are accurately calibrated to the 4 Axis' of the probe station by measuring the coupled power repeatability of the whole system. A total of 900 measurements are made at 9 different waveguides in 3 reticles of FormFactor's Silicon Photonics Test Coupon wafer.

In between each of the 100 measurements performed at each waveguide, all solution elements are moved including the wafer chuck, hexapod stages and piezo stages. After all these motions, we verify that the system measures the coupled power results at each waveguide to within less than 0.3 dB across these 100 measurements.

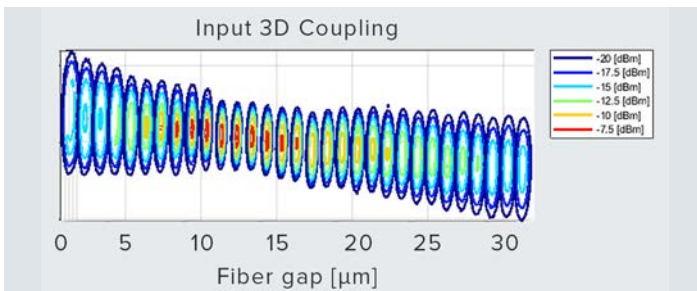
Verified parameters

- Coupled power repeatability
- PZT motion calibrations
- Hexapod motion calibrations
- Chuck calibration to optical positioning

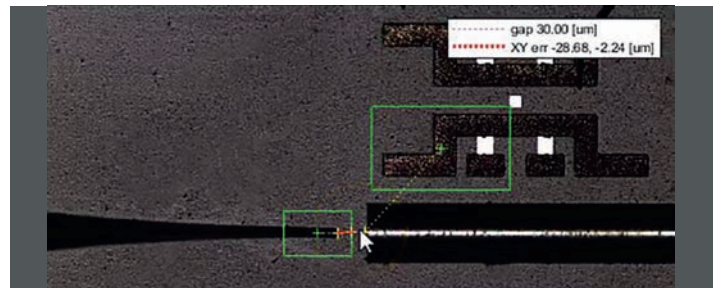
> Industry-Leading Edge Alignment Functions



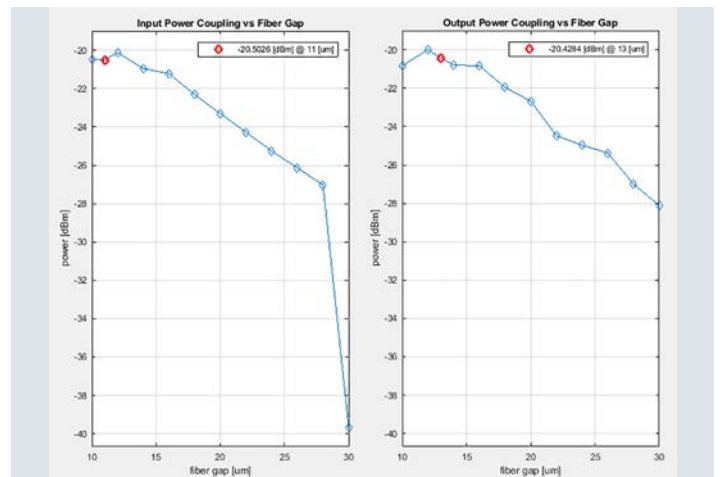
Measure3DCoupling performs successive area scans and stepping moves along the coupling axis, constructing a 3D image of power coupling. Useful for multiple purposes such as detecting fiber damage, detecting DUT contamination, measuring the focal length of lensed fiber, etc. Applicable to both edge and vertical coupling.



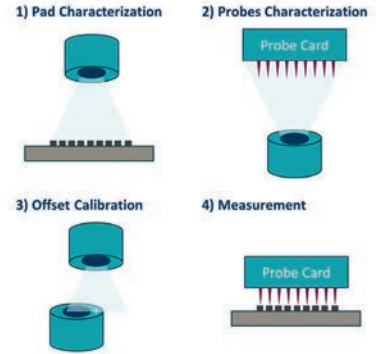
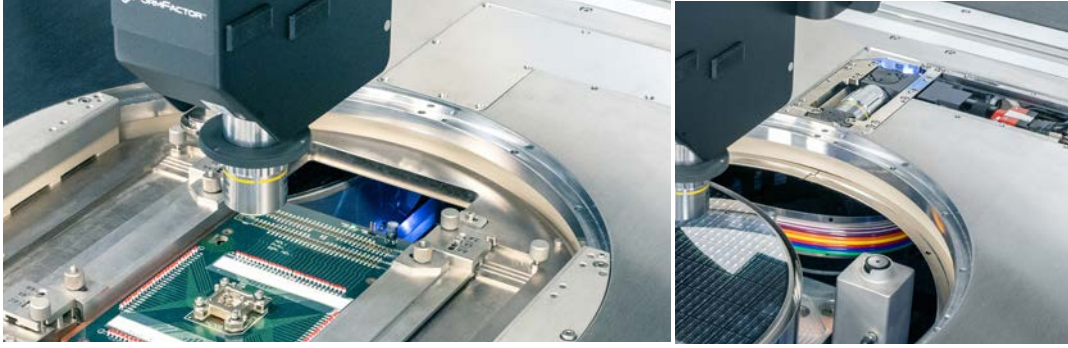
AlignOpticalProbes3D searches for the optimum gap for both input and output fibers that results in the maximum coupled power.



AlignOpticalProbesEdge executes a vision-based gap alignment on multiple selected probes and then performs YZ area scans while recentering as necessary.



AlignOpticalProbeGap executes a vision-based gap alignment on a single probe in XY, moves to probe height in Z and readies for an area scan.



The optional ReAlign™ feature offers the capability to perform “off-axis” probe to pad alignment (PTPA) independent from the main eVue microscope. In addition, it automatically manages chuck temperature transitions without the need for operator intervention.

ReAlign is specifically designed for probe cards that do not allow direct viewing of pads and probe tips from above. This is typically the case with vertical probe cards.

The ReAlign hardware includes two additional cameras: the downward looking “Platen Camera” is integrated into the platen of the CM300xi and is used for observation of the wafer and contacting pads; the upward looking “ChuckView Camera” is used for characterization of the probe tips of the probe card. Together, these cameras enable fully automated probe-to-pad alignment.

The ReAlign wizard allows easy and fast setup with predefined algorithms for a variety of vertical and cantilever probe cards.¹

Hardware	Downward Looking Platen Camera, integrated into the Platen of the CM300xi
	Upward looking "ChuckView" camera. Mounted on chuck stage (independent from roll-out).
	"ContactView" camera for observation of wafer and probes from the side
Software	ReAlign software algorithm including ReAlign wizard

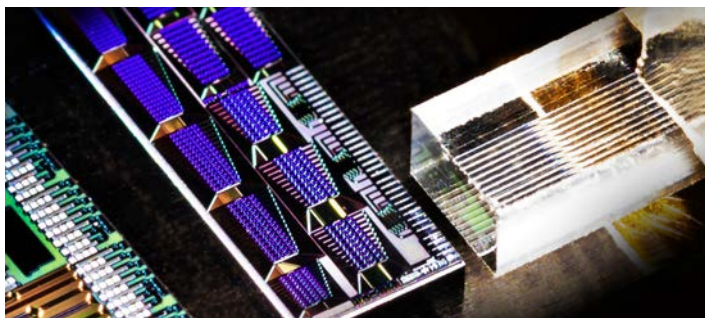
¹ Examples include T11, MF80R, MF110F, Pyramid, and most cantilever probe cards. Please contact your regional sales representative to confirm compatibility for your specific probe card.

> Edge Coupling

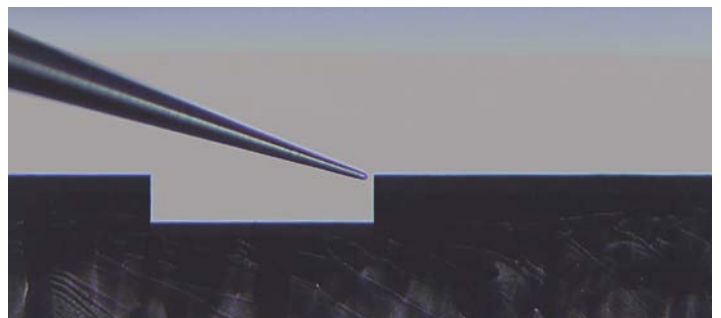
FormFactor provides the only solution on the market that enables advanced automated alignment for horizontal die-level edge coupling and wafer-level trench edge coupling.

Industry-first features

- Highest accuracy in test results with lowest coupling loss
- Automated fiber-to-facet alignment
- Fiber collision avoidance
- Optimization of gap between fiber tip and waveguide
- Ease of use for less experienced users



True horizontal die-level edge coupling enables close simulation of real-world conditions with device performance closest to the final application.



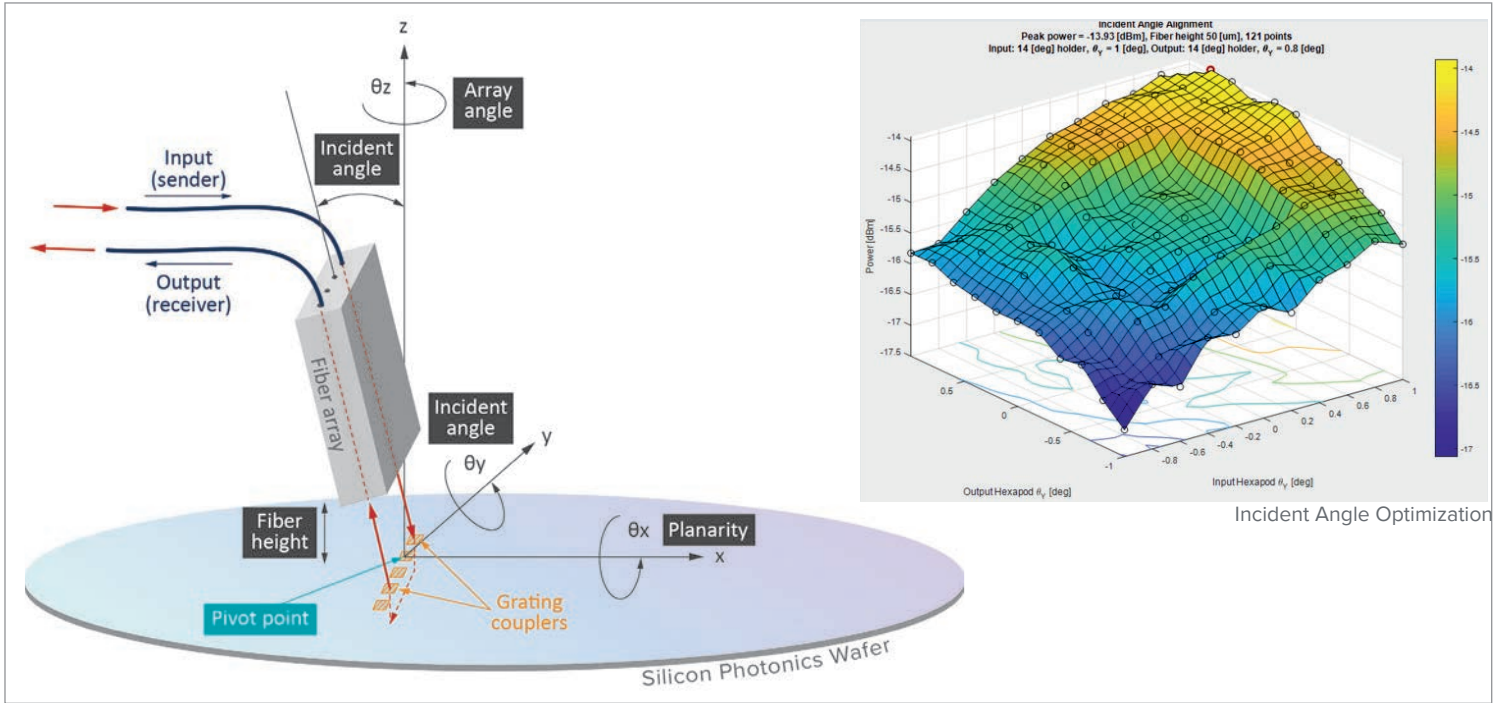
Wafer-level edge coupling: A suite of software alignment algorithms enable YZ optimization scans in a wafer trench while tapered lensed fiber holders provide a low approach angle relative to the wafer surface.

Vertical Coupling

FormFactor's technology has become the industry standard for vertical coupling to wafer-level grating couplers.

Integrated alignment features

- Search first light
- Incident angle calibration
- Optical rotation scan
- Optical scan data analysis
- Optical tracking
- Align optical probes

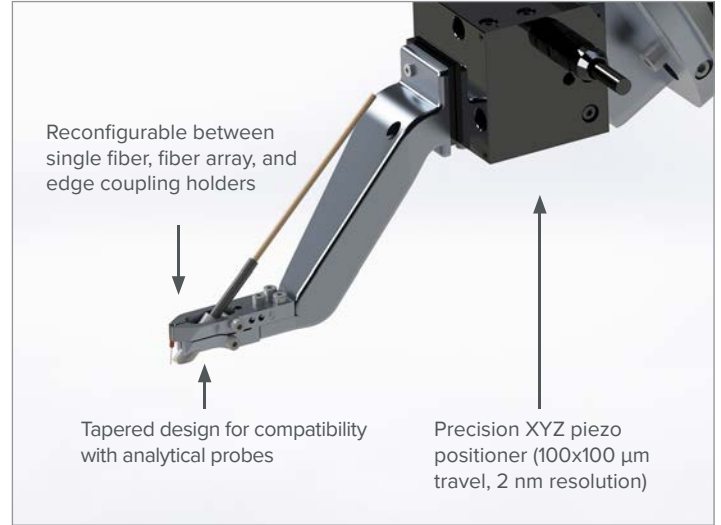
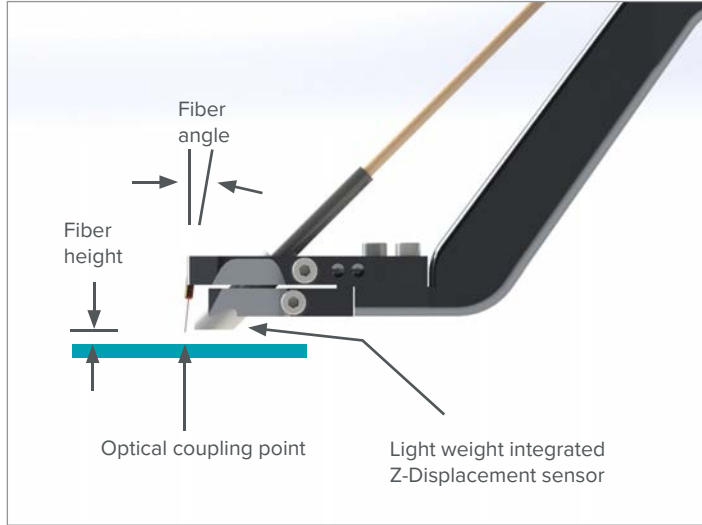


> Reconfigurable Fiber Arm

The specially developed reconfigurable fiber arm guarantees perfected alignment with Z-Displacement and Light Guide Technology.

Uniquely developed features

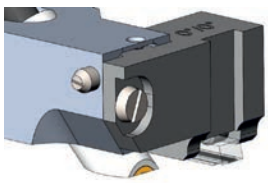
- Flexibility for engineering and volume environments
- Configurable between single fibers and fiber arrays
- Supports a wide range of incident angles
- Z-Displacement kit includes custom light weight close proximity integrated sensors



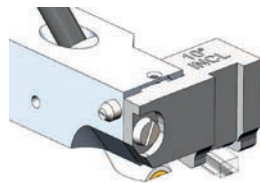
> Fiber/Array Holders

Uniquely developed features

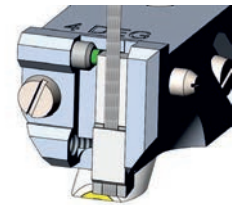
- Wafer-level edge coupling holders
- Horizontal edge coupling holders
- Vertical coupling holders
- Single fibers
- Fiber arrays
- Offset angles



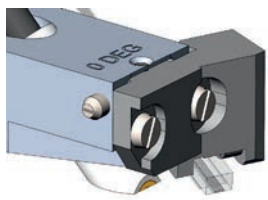
Edge coupling array holder, 90°



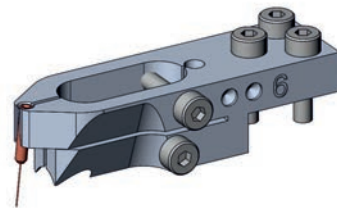
Edge coupling array holder, 70°



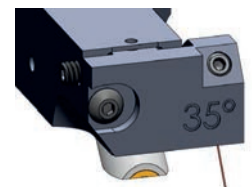
Vertical array holder, 4° to 20°



Offset angle fiber holder



Vertical single fiber holder, 6° to 20°



Custom vertical and edge coupling holders, e.g. 35°

➤ Non-Thermal Chucks

FemtoGuard® Chuck Performance*

Breakdown Voltage**	Force-to-Guard	≥ 500 V
	Guard-to-Shield	≥ 500 V
	Force-to-Shield	≥ 500 V
Resistance***	Force-to-Guard	≥ 5 x 10 ¹² Ω
	Guard-to-Shield	≥ 1 x 10 ¹² Ω
	Force-to-Shield	≥ 5 x 10 ¹² Ω
Capacitance****	Force-to-Guard	≤ 800 pF
	Guard-to-Shield	≤ 3000 pF

* Chuck performance measured inside test chamber at dew point < -70°C.

** Breakdown voltage tested at 500 V DC

*** The chuck resistance is measured in a dry environment. Moisture in the chuck may degrade performance. The chuck layer resistance is measured with a B1500 with HR SMU B1517, the FormFactor program "F-G_R_@10V@50Hz" at defined test conditions.

**** The chuck layer capacitance is measured with a B1500 with HR-SMU B1517, the FormFactor program "CAP_F-G-300pA" at defined test conditions.

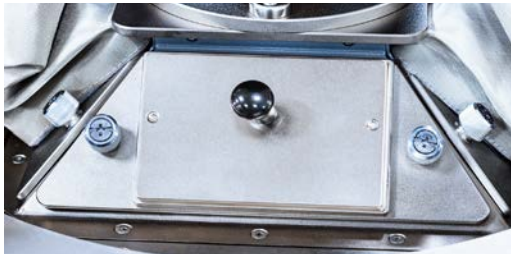
System Electrical Performance (with non-thermal chuck)	CM300xi-F FemtoGuard	CM300xi-S FemtoGuard	CM300xi-S Coax Chuck	CM300xi-0 Coax Chuck
Probe leakage*	≤ 1 fA	≤ 1 fA	≤ 1 fA	N/A
Chuck leakage*	≤ 3 fA	≤ 15 fA	≤ 600 fA	≤ 1 pA
Residual capacitance	≤ 2.5 pF	≤ 75 pF	N/A	N/A
Capacitance variation**	≤ 2 fF	≤ 75 fF	≤ 75 fF	N/A
Settling time***	≤ 50 fA @ 0.5 sec	≤ 100 fA @ 2 sec	N/A	N/A

➤ Thermal Capability

FormFactor's unique SiPh TopHat is the only solution that provides a completely sealed, dark, shielded and frost-free environment with full thermal capability from -40°C to +125°C. Only the SiPh TopHat enables minimized air flow impact at cold temperatures to the fibers/fiber arrays for stable and repeatable measurement results.

Features

- Dark, shielded and frost-free
- Exclusive ITO-coated TopHat window for easy setup
- -40°C to +125°C
- Minimized air flow impact to the fibers/arrays at cold temperatures
- Enables true hands-free autonomous calibration and re-calibration at multiple temperatures
- Reliable and accurate measurements



FemtoGuard® Chuck Performance*

		Thermal Chuck				
		@ -55°C	@ -40°C	@ 25°C	@ 200°C	@ 300°C
Breakdown Voltage**	Force -to-Guard	≥ 500 V	≥ 500 V	≥ 500 V	≥ 500 V	≥ 500 V
	Guard-to-Shield	≥ 500 V	≥ 500 V	≥ 500 V	≥ 500 V	≥ 500 V
	Force -to-Shield	≥ 500 V	≥ 500 V	≥ 500 V	≥ 500 V	≥ 500 V
Resistance***	Force -to-Guard	≥ 5 x 10 ¹² Ω	≥ 5 x 10 ¹² Ω	≥ 5 x 10 ¹² Ω	≥ 5 x 10 ¹¹ Ω	≥ 1 x 10 ¹¹ Ω
	Guard-to-Shield	≥ 5 x 10 ¹¹ Ω	≥ 5 x 10 ¹¹ Ω	≥ 5 x 10 ¹¹ Ω	≥ 5 x 10 ¹⁰ Ω	≥ 1 x 10 ¹⁰ Ω
	Force -to-Shield	≥ 5 x 10 ¹² Ω	≥ 5 x 10 ¹² Ω	≥ 5 x 10 ¹² Ω	≥ 5 x 10 ¹¹ Ω	≥ 1 x 10 ¹¹ Ω
Capacitance****	Force -to-Guard	≤ 1100 pF	≤ 1100 pF	≤ 1100 pF	≤ 1100 pF	≤ 1200 pF
	Guard-to-Shield	≤ 5000 pF	≤ 5000 pF	≤ 5000 pF	≤ 5000 pF	≤ 5000 pF

* Chuck performance measured inside test chamber at dew point < -70°C.

** Breakdown voltage tested at 500 V DC

*** The chuck resistance is measured in a dry environment. Moisture in the chuck may degrade performance. The chuck layer resistance is measured with a B1500 with HR SMU B1517, the FormFactor program “F-G_R_@10V@50Hz” at defined test conditions.

**** The chuck layer capacitance is measured with a B1500 with HR-SMU B1517, the FormFactor program “CAP_F-G-300pA” at defined test conditions.

Coaxial Chuck Performance*

		Thermal Chuck				
		@ -55°C	@ -40°C	@ 25°C	@ 200°C	@ 300°C
Breakdown Voltage**		≥ 500 V	≥ 500 V	≥ 500 V	≥ 500 V	≥ 500 V
Resistance		≥ 5 x 10 ¹² Ω	≥ 5 x 10 ¹² Ω	≥ 5 x 10 ¹² Ω	≥ 5 x 10 ¹¹ Ω	≥ 5 x 10 ¹⁰ Ω
Capacitance		≤ 800 pF	≤ 800 pF	≤ 800 pF	≤ 800 pF	≤ 800 pF

* Chuck performance measured inside test chamber at dew point < -70°C.

** Breakdown voltage tested at 500 V DC

System Electrical Performance (With Thermal Chuck)

		CM300xi-F FemtoGuard	CM300xi-S FemtoGuard	CM300xi-S Coax	CM300xi-O Coax
Probe leakage*	Thermal Controller OFF	≤ 1 fA	≤ 1 fA	≤ 1 fA	N/A
	Thermal Controller ON	≤ 5 fA	≤ 10 fA	≤ 10 fA	N/A
Chuck leakage* (ATT)	Thermal Controller OFF	≤ 3 fA	≤ 15 fA	≤ 25 pA	≤ 100 pA
	-55°C	≤ 6 fA	≤ 20 fA	≤ 25 pA	N/A****
	-40°C	≤ 6 fA	≤ 20 fA	≤ 25 pA	N/A****
	25°C	≤ 3 fA	≤ 20 fA	≤ 25 pA	≤ 100 pA
	200°C	≤ 3 fA	≤ 20 fA	≤ 25 pA	≤ 100 pA
	300°C	≤ 6 fA	≤ 25 fA	≤ 220 pA	≤ 1 nA
Residual capacitance**		≤ 2.5 pF	≤ 75 pF	N/A	N/A
Capacitance variation**		≤ 2 fF	≤ 75 fF	≤ 75 fF	N/A
Settling time***		All temperatures @ 10 V	≤ 50 fA @ 0.5 sec	≤ 100 fA @ 2 sec	N/A

* Overall leakage current is comprised of two distinctly separate components: 1) offset, and 2) noise. Offset is the DC value of current due to instrument voltage offset driving through isolation resistance. Noise is low-frequency ripple superimposed on top of offset and is due to disturbances in the probe station environment. Noise and leakage are measured with a B1500 with HR-SMU B1517 and the FormFactor program “DCN@10V” at defined test conditions.

** The residual (triaxial) chuck capacitance is measured with a B1500 with HR-SMU B1517 with the FormFactor program “Cap-Trx-3pA” at defined test conditions. This is chuck capacitance variation based upon chuck position anywhere in the 300 mm area, as measured by a stationary DC probe.

*** Settling time is measured with a B1500 with HR-SMU B1517 and the FormFactor program “ST_10V” at defined test conditions.

**** For CM300xi-O: Thermal chucks can be used for above ambient temperatures only.

➤ Thermal System Performance

ATT Thermal System

Model	TS-426-14E/R TS-416-14E/R	TS-426-08P/R	TS-416-02T	TS-416-05T
Components	Controller, Chiller	Controller, Chiller	Controller	Controller, Booster
Type	Air-cooled	Air-cooled	Air-cooled	Air-cooled
Temperature range	-60°C to 300°C	-40°C to 300°C	+30°C to 300°C	+20°C to 300°C
Temperature control	Pt100 (in Chuck)	Pt100 (in Chuck)	Pt100 (in Chuck)	Pt100 (in Chuck)
Resolution	0.1°C	0.1°C	0.1°C	0.1°C
Wafer temperature accuracy ^{1,2}	+/- 2.5°C	+/- 2.5°C	+/- 2.5°C	+/- 2.5°C
Thermal uniformity ³	1.0°C (0.3°C ⁶) @25°C 2.0°C (1.2°C ⁶) @-60°C 2.0°C (1.0°C ⁶) @200°C 3.0°C (2.0°C ⁶) @300°C	1.0°C @25°C 2.0°C @-40°C 2.0°C @200°C 3.0°C @300°C	1.0°C @30°C 2.0°C @200°C 3.0°C @300°C	1.0°C @25°C 2.0°C @200°C 3.0°C @300°C

ATT Thermal Transition Times⁴

Cooling				
25°C to -40°C	17 min 34 min (Eco ⁵)	59 min	-	-
25°C to -60°C	53 min	-	-	-
200°C to 25°C	18 min 27 min (Eco ⁵)	28 min	60 min (200°C to 30°C)	80 min
300°C to 25°C	33 min 44 min (Eco ⁵)	35 min	70 min (300°C to 30°C)	90 min
Heating				
-60°C to 25°C	7 min	-	-	-
-40°C to 25°C	5 min	5 min	-	-
25°C to 200°C	19 min	19 min	17 min (30°C to 200°C)	23 min
25°C to 300°C	35 min	35 min	33 min (30°C to 300°C)	39 min

¹ As measured with type-K thermocouple surface probe. Conditions: 12 mm diameter probe head, closed chamber with minimum recommended purge air, probe centered in probing area, on standard silicon wafer, and chuck at standard probe height. Typical type K thermocouple probe tolerances are $\pm 2.2^\circ\text{C}$ or $\pm 0.75\%$ of the measured temperature in $^\circ\text{C}$ (whichever is greater).

² The test setup can change the wafer temperature accuracy from the calibration by $\pm 5^\circ\text{C}$ (typical). Test setup attributes include open or closed chamber, probe or probe card construction and number of contacts, purge air flow rate, and lab environmental conditions.

³ Peak-to-peak temperature measurement variation across probing sites.

⁴ Typical times using CM300xi with FemtoGuard Chuck with facilities that meet the requirements as set out in Facilities Planning Guide.

⁵ Eco mode limits the CDA consumption of the chuck to max. 315 l/min

⁶ With (optional) high uniformity mode

Standard and Optional Features

		CM300xi-F	CM300xi-S	CM300xi-O
Base	Fully-shielded probe station platform, with MicroChamber, AttoGuard and PureLine technologies	●	-	-
	Shielded - Probe station platform with MicroChamber	-	●	-
	Open probe station without MicroChamber	-	-	●
	Programmable XYZ Theta Chuck stage	●	●	●
	Velox Controller PC with dual TFT monitor 27" on ergo arm	●	●	●
	ContactView™ (side view camera) in East-West direction	◐	◐	◐
	IntelliControl, including Airgun and Vacuum connection at front, additional LAN and USB ports at rear side	●	○	○
	Active Vibration Dampening System	●	●	●
	AirGun and Vacuum connection at front	-	○	○
	GPIB interface	●	●	●
Microscope	Programmable HTS Microscope Bridge 75 mm x 75 mm	◐	◐	◐
	Large area microscope bridge/transport – programmable 300 mm x 300 mm	○	○	○
Platen Inserts	SiPh TopHat (4 sides) for dark, dry and shielded measurement conditions	○	○	-
	TopHat (8 sides), EMI- and light-tight shielding with AttoGuard technology for accurate, frost-free IV/CV measurements	●	-	-
	TopHat (8 sides), dry and light-tight shielding	-	◐	-
	Probe card holder	○	○	○
User Interface Options	Velox Dash, tablet with Velox companion app, keyboard, mouse	◐	◐	◐
	Classic user interface with joystick, keyboard and mouse	○	○	○
	3D Manual Controls, including XY Knobs and Virtual Platen Lift for intuitive, rapid and precise manual control of the stage in X, Y and Z direction	○	○	○
Automation Options	Semi-automated configuration	◐	◐	◐
	Fully-automation configuration for operation with MHU301 or MHU300	○	○	○
	VueTrack on-axis probe-to-pad alignment solution	◐	◐	◐
	ReAlign off-axis probe-to-pad alignment solution for opaque/vertical probe cards	○	○	○
Chucks Options¹	Roll-out stage chuck mounting for convenient and safe manual loading of wafers from the front	●	●	●
	OptoVue / OptoVue Pro for photonics calibration and advanced photonics measurement automation	○	○	○
	Auxiliary Chuck (left side) in addition to OptoVue/OptoVue Pro or Auxiliary Chuck Kit	●	○	○
Non-Thermal Chucks¹ (300 mm)	FemtoGuard triaxial chuck, non-thermal	○	○	-
	Coaxial chuck, non-thermal	-	○	○
	FemtoGuard triaxial chuck, non-thermal, with lift pins for fully-automated operation with MHU301 or MHU300	○	○	-
	Coaxial chuck, non-thermal, with lift pins for fully-automated operation with MHU301 or MHU300	-	○	○
Thermal Chucks¹ (300 mm)	FemtoGuard triaxial chuck, thermal, -60°C to 300°C (ATT)	◐	○	-
	Coaxial chuck, thermal, -60°C to +300°C (ATT)	-	◐	◐
	FemtoGuard triaxial chuck, thermal, -60°C to 300°C (ATT), with lift pins for fully-automated operation with MHU301 or MHU300	○	○	-
	Coaxial chuck, thermal, -60°C to +300°C (ATT), with lift pins for fully-automated operation with MHU301 or MHU300	-	○	○
Custom Adaptions	Customer specific adaptations are available upon request	○	○	○

¹ All chucks are available with either nickel or gold plating. Thermal Chucks require a thermal system for operation at a controlled temperature.

● Always included ◐ Default configuration ○ Option

Thermal Systems

Part Number	General Description	Compatibility		
		CM300xi-F	CM300xi-S	CM300xi-O
TS-426-14E	Thermal System, -60°C to 300°C, ATT (220-240 VAC 50 Hz), CDA-saving, requires CDA dew point <-80°C	○	○	-
TS-426-14R	Thermal System, -60°C to 300°C, ATT (200-220 VAC 60 Hz, 200 VAC 50 Hz), CDA-saving, requires CDA dew point <-80°C	○	○	-
TS-416-14E	Thermal System, -60°C to 300°C, ATT (220-240 VAC 50 Hz), with air dryer	○	○	-
TS-416-14R	Thermal System, -60°C to 300°C, ATT (200-220 VAC 60 Hz, 200 VAC 50 Hz), with air dryer	○	○	-
TS-426-08P	Thermal System, -40°C to 300°C, ATT (200-230 VAC 50/60 Hz), CDA-saving, requires CDA dew point <-70°C	○	○	-
TS-426-08R	Thermal System, -40°C to 300°C, ATT (200-220 VAC 60 Hz), CDA-saving, requires CDA dew point <-70°C, UL-certified	○	○	-
TS-416-05T	Thermal System, +20 to 300°C, ATT (100-230 VAC 50/60Hz)	○	○	○
TS-416-02T	Thermal System, +30 to 300°C, ATT (100-230 VAC 50/60Hz)	○	○	○

Note: Thermal systems must match the thermal chuck selected, i.e. TS-416-xxx and TS-426-xxx thermal systems are compatible with TC-426-xxx chucks. The upper temperature limit is defined by the chuck.



CM300xi fully-automated system with material handling unit MHU301.



CM300xi fully-automated system with material handling unit MHU300, showing dual load port configuration.

➤ Wafer Loaders MHU300 and MHU301

Material handling unit	The footprint-optimized MHU301 or the powerful MHU300 can be configured to provide fully automated testing. Both offer automated loading of the probe system with 200 mm and 300 mm SEMI spec wafers from FOUP/FOSB cassettes. The MHU301 comes with one SEMI standard load port, whereas the MHU300 can be configured with up to two load ports. Manual loading of wafer fragments (> 10 mm x 10 mm), as well as full wafers, are supported through manual loading of the prober, which bypasses the MHU.
Dual-prober ready	For the MHU300 up to two probe systems can be docked and operated simultaneously to a single central loader.
Wafer Cassettes	SEMI-compliant FOUP/FOSB cassettes (SEMI E47.1 , SEMI M31) ¹
Wafers	SEMI M1 compliant
Wafer ID Reading	The probe system has the optional ability to automatically identify wafers. Wafers are identified by a barcode [BC 412 (SEMI T1-95 Standard)] and IBM 412, OCR text [SEMI M12, M13 and M1.15 Standard], IBM, Triple and OCR-A fonts or 2D code [Data Matrix (T7 and M1.15 Standard)] at the top or bottom side of the wafer.

Fully-automated system²

FOUP Cassette loading	≤ 30 sec (incl. wafer scan)
Wafer handling cycle @ ambient	≤ 1.3 min (Cassette → PreAligner → Prober → Cassette)
	≤ 1.6 min (Cassette → PreAligner → IDReader ³ → PreAligner → Prober → Cassette)
	< 1 min (Wafer 1: Prober → Cassette; Wafer 2: Quick Access Port ³ → Prober)

¹ Tested on Entegris F300 Autopod (300 mm) and Entegris 198/192 (200 mm)

² Tested on Entegris F300 Autopod

³ Optional

Standard and Optional Features	MHU301	MHU300
Prober Orientation - single configuration with one CM300xi either on left or right side of the MHU	●	◐
Dual Configuration for 2 CM300xi in combination with one MHU	–	○
SEMI-compliant Load Port for 300 mm FOUP/FOSB cassettes	●	●
Additional Load Port for MHU300	–	○
Prealigner	●	●
Horseshoe End Effector for 200 mm and 300 mm wafers	●	●
RFID Reader for RFID tags on 300 mm wafer cassettes	○	○
Adapter for use of open 200 mm Wafer Cassettes	○	○
Adapter for use of open 200 mm Wafer Cassettes, including RFID reader for 200 mm cassettes	○	○
Optical Wafer ID Reader for reading optical codes ¹ on top and back side of wafer	○	○
Optical Wafer ID Reader for reading optical codes ¹ on top side of wafer	○	–
Optical Wafer ID Reader for reading optical codes ¹ on back side of wafer	○	–
Fan Filter Unit for reducing dust pollution level inside MHU	○	○
Quick Access Port: Additional temporary storage slot inside MHU for 2 wafers	○	–
Seismic restraint kit	○	○

¹ OCR: Semi-Font (SEMI M12, M13 or SEMI M1.15), Triple, OCR-A, IBM, Chartered fonts; 2D: T7 Data Matrix (SEMI M1.15), Data Matrix, QR Code; Barcodes: BC 412 (SEMI T1-95), IBM 412

● Always included ◐ Default configuration ○ Option

➤ Regulatory Compliance

Certification	CE declared, 3rd party tested for CB against IEC 61010 including National Standard CSA C22.2 No. 61010-1-12 / UL 61010-1:2012, certified for US and Canada (cNRTLus), SEMI S2 and S8. Copies of certificates are available on request.
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➤ Warranty

Warranty*	Fifteen months from date of delivery or twelve months from date of installation
Service contracts	Single- and multi-year programs available to suit your needs

* See FormFactor's Terms and Conditions of Sale for more details.

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