Cascade

CM300xi-SiPh

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

Overview

The CM300xi-SiPh 300 mm probe station is the first verified integrated measurement solution on the market that enables engineering and production-proven, optimized optical measurements right after installation – without further development. 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 integrated system.

With the revolutionary OptoVue Calibration Kit and the exclusive SiPh TopHat for dark, shielded and frost-free measurements, the system enables true hands-free autonomous calibration and re-calibration at multiple temperatures. Quick changeover for a multitude of testing needs is enabled from single fibers to arrays and from vertical coupling to edge coupling.

Contact Intelligence™

The CM300xi offers measurement accuracy and reliability in a solution that is completely modular – RF, DC and optical measurements in one semi-automated system, or a fully-automated dual-prober system that handles any combination of 200 mm and 300 mm wafers.

Industry-first Features / Benefits

OptoVue Pro	• Real-time in-situ calibrations, singulated die testing, true die-level edge coupling, in-situ power measurements, advanced calibration technologies
Edge Coupling	• 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	• 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	• 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	• 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%.

System components

Prober System

The CM300 probe system (base platform) is available in three different configurations:

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)
CM300-O	CM300*, open	Open system for ambient or above ambient temperature usage

* *The CM300 open system is not equipped with the Contact Intelligence technology.*

Mechanical Performance

X-Y Stage

Travel XY	301 mm x 501 mm (11.9 in. x 19.7 in.)
Resolution	0.2 µm (0.008 mils)
Repeatability	≤ 1 µm (0.04 mils)
Accuracy	Standard mode: ≤ 2 µm (0.08 mils), Precision mode: ≤ 0.3 µm (0.012 mils)
Speed	50 mm/sec (2 in./sec)
Bearings	Precision balls bearings
Motor-drive system	High-performance micro stepper motor
Feedback system	Ceramic ultra-low thermal expansion linear encoder

Z Stage

Travel	10.0 mm (.39 in.)
Resolution	0.2 µm (0.008 mils)
Repeatability	≤ 1 µm (0.04 mils)
Accuracy	≤ 2 µm (0.08 mils)
Speed	20 mm/sec (0.8 in./sec)
Lifting capacity	20 kg (44 lb.)
Probe-force deflection (measured at the chuck edge)	≤ 0.0007 µm/µm slope per 10 kg load (0.0007 in./ in./22 lb)

Theta Stage

Travel	± 3.75°
Resolution	0.2 µm (0.008 mils)*; 0.00008°
Repeatability	≤ 1 µm (0.04 mils)*; ≤ 0.0004°
Accuracy of fine correction	≤ 2 µm (0.08 mils)*; ≤ 0.0008°
Accuracy of large movement (>2°)	≤ 5 µm (0.20 mils)*; ≤ 0.0019°

* *Measured at edge of 300 mm chuck*

Microchamber*

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)****	≤ 20 mVp-p (≤ 1 GHz) ***

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

** *Test setup uses triaxial thermal chuck, 50 Ω termination, high-quality LNA, and DSA /DSO instrument.*

*** *Typical results. Actual values depend on probe/test setup.*

**** *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 Management	
Purge	Clean dry air (CDA)
Purge control	Manual or automatic (software controlled)
Nominal purge flow rate – Maintenance	80 liters/min (2.8 SCFM)
Nominal purge flow rate – Quick purge conditioning	240 liters/min (8.5 SCFM)

Platen System

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*

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

Platen Insert	
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 Cut-out	
Diameter	344 mm (13.5 in.)
Standard interface	Probe card holders, custom adapters and TopHat™

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.*

** *Measured vertical step from mounting level to needle tips. Side view camera tolerates ± 0.5 mm deviation from nominal value.*

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*	≤ 10 µm (0.4 mils) @ 25°C
	≤ 30 µm (1.2 mils) @ -55°C
	≤ 30 µm (1.2 mils) @ 200°C
	≤ 40 µm (1.6 mils) @ 300°C

* *With active z-profiling.*

Platform

General

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

* *Due to the sensitivity of measurements to vibrations, the CM300xi is equipped with a high-performance active vibration damping system. However, unacceptable equipment vibrations can occur when the floor vibrations are high. For this reason, the CM300xi must be used in an environment having background vibrations at or below the Operating Theatre level. This corresponds to a maximum level of 4000 micro-inches/sec (72 dB), measured using the 1/3-octave band velocity spectra method (expressed in RMS velocity as specified by The International Standards Organization [ISO]). For further information and technical solutions with environments using raised floors, please see the FormFactor Stations Facility guide. Damper natural frequency 2.5 Hz.*

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.

* *CM300 open systems are not equipped with Contact Intelligence technology*

Platform (continued)

Software

The CM300xi is equipped with Velox probe station control software. VeloxPro can be added optionally for SEMI E95 compliance and test executive capabilities. Operating system is Windows 10.

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.
- **Windows 10 compatible:** Highest performance and safe operation with state-of-the-art hardware.
- **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.

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

Communication Ports

Type	Qty	Location	Notes
USB 2.0	1	IPC front	For quick access to USB devices
USB 2.0	4	IntelliControl (option)	For security keys (1x) and USB instrument control (3x)
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

Sound level

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

Station Controller

High-performance system controller with Velox probe station control software and Windows 10 OS

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

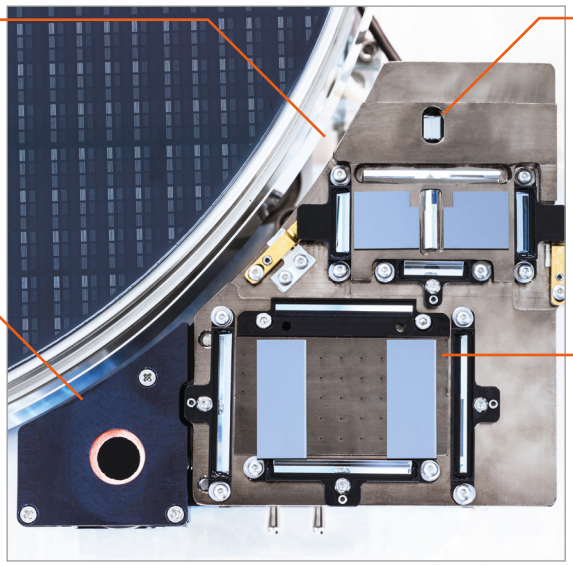
- Real-time in-situ calibrations
- Singulated die testing
- True die-level edge coupling
- In-situ power measurements
- Advanced calibration technologies
- Enables autonomous measurements

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

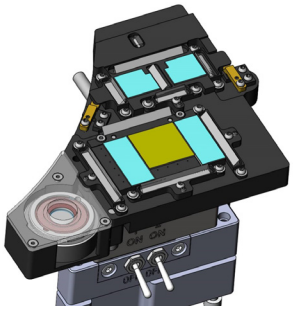


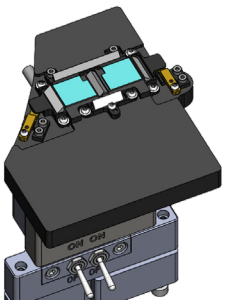
ProbeVue

- 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





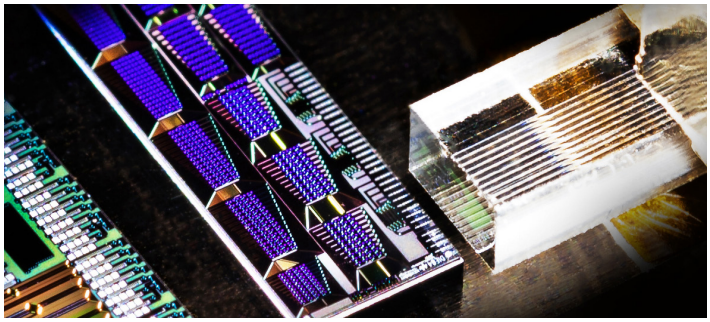
Feature	OptoVue Pro	OptoVue
CalVue	✓	✓
PowerVue	✓	-
ProbeVue	✓	-
DieVue	✓	-

Edge Coupling

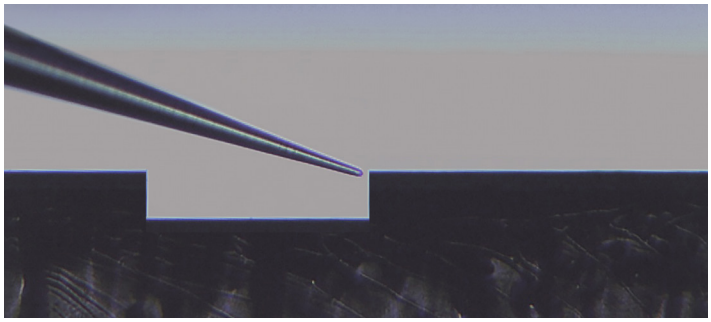
FormFactor provides the only solution on the market that enables advanced automated alignment for horizontal die-level edge coupling and wafer-level trench edge coupling.

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

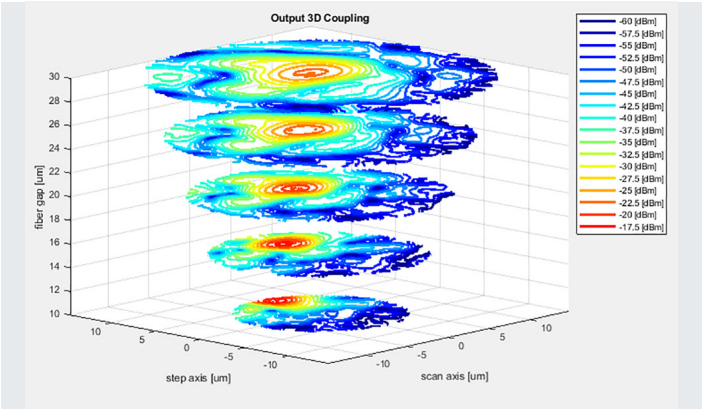


True horizontal die-level edge coupling enables close simulation of real-world conditions with device performance closest to the final application.

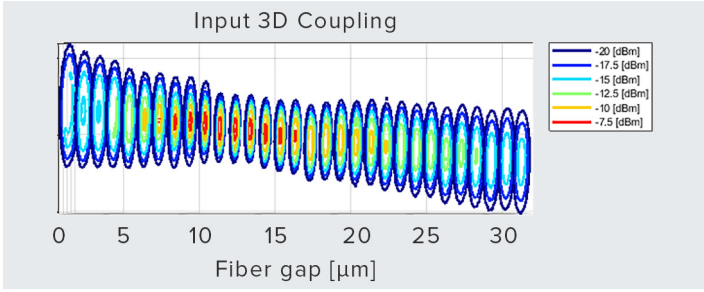


Wafer-level edge coupling: A suite of software alignment algorithms enable YZ optimization scans in a wafer trench while tapered lensed fiber holders provide a low approach angle relative to the wafer surface.

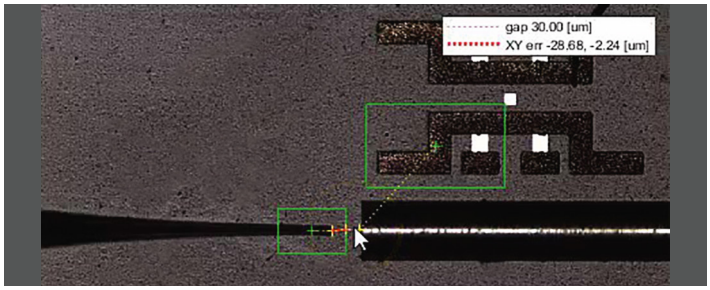
Industry-Leading Edge Alignment Functions



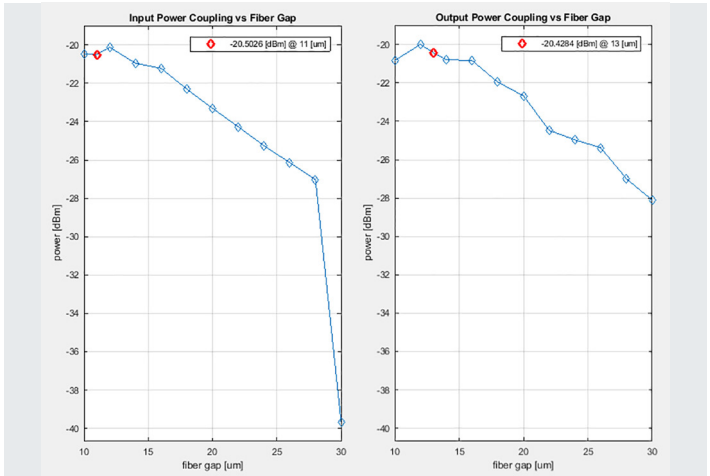
Measure3DCoupling performs successive area scans and stepping moves along the coupling axis, constructing a 3D image of power coupling. Useful for multiple purposes such as detecting fiber damage, detecting DUT contamination, measuring the focal length of lensed fiber, etc. Applicable to both edge and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



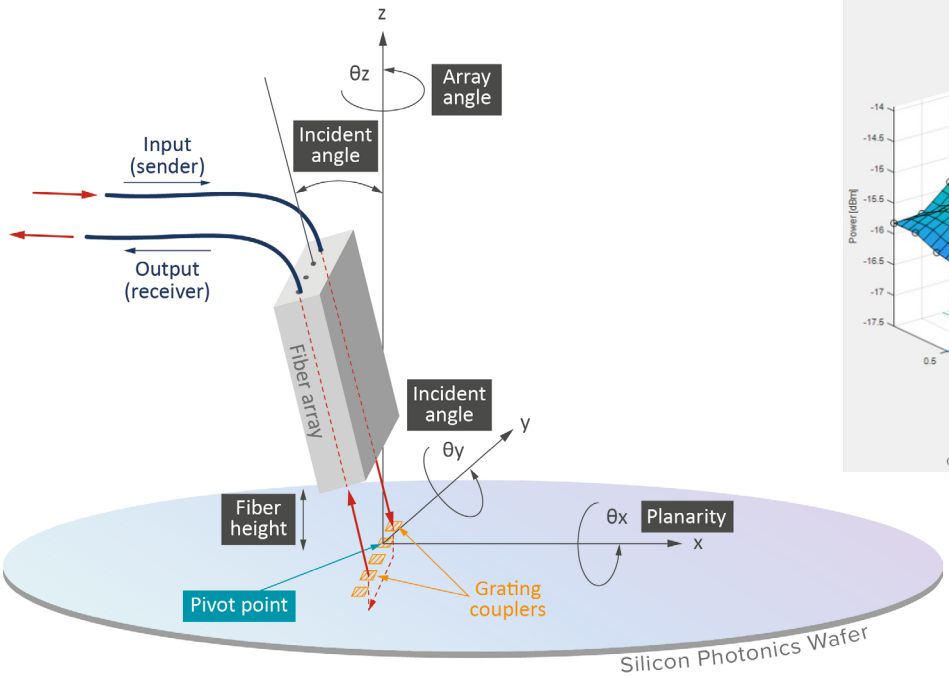
AlignOpticalProbeGap executes a vision-based gap alignment on a single probe in XY, moves to probe height in Z and readies for an area scan.

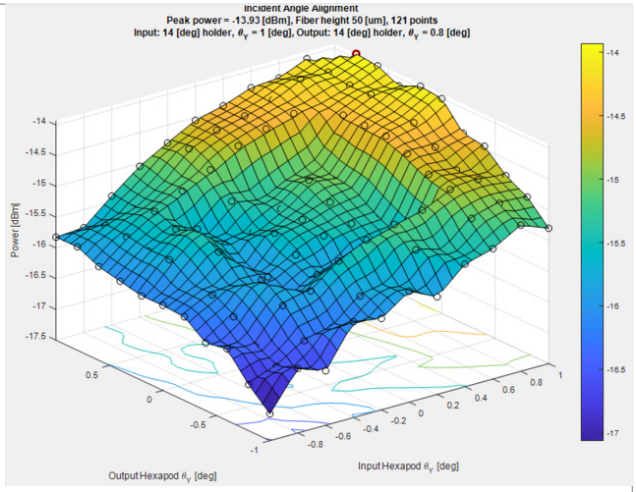
Vertical Coupling

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





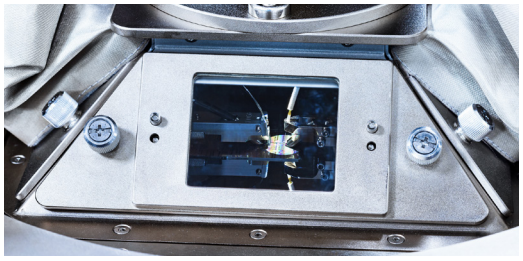
Incident Angle Optimization

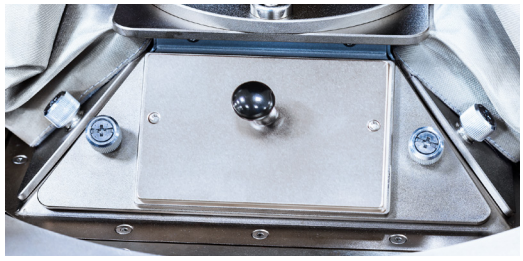
Thermal Capability

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





CalVue - Exclusive Automated Calibrations

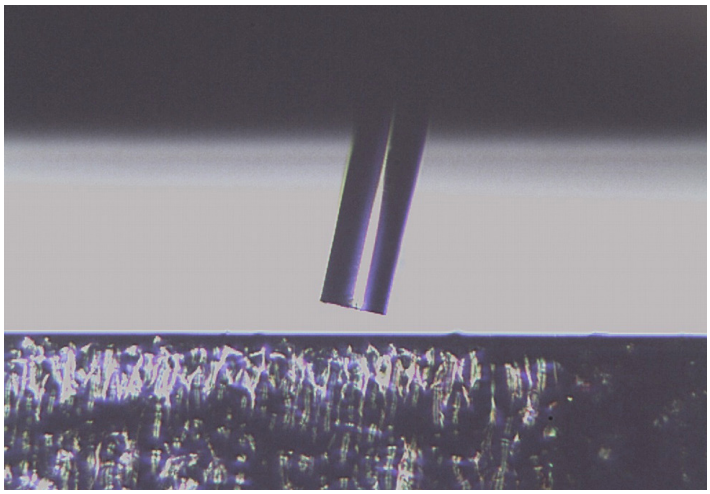
FormFactor has developed a pioneering set of automated functions that perform critical calibrations of the optical positioning system to the probe station and step-by-step wafer to probe height training - even for combined optical and electrical probing.

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.

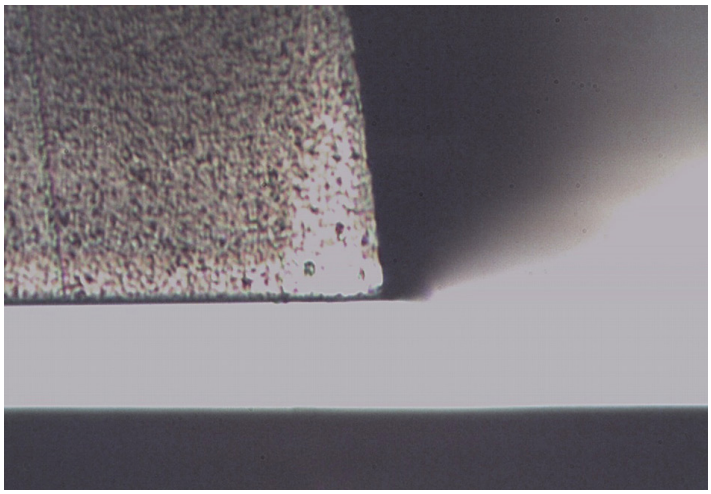
This eliminates the need for oblique lighting and enables real-time in-situ automated machine vision calibrations.

Calibration functions*	• Motor calibration • Z-displacement calibration • Theta calibrations • PZT calibration • Planarity calibrations • Automatic pivot point calibration

* *FormFactor's Autonomous SiPh Measurement Assistant is the only solution on the market that provides these features.*



Horizontal view of single fiber with CalVue



Horizontal view of fiber array with CalVue

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.

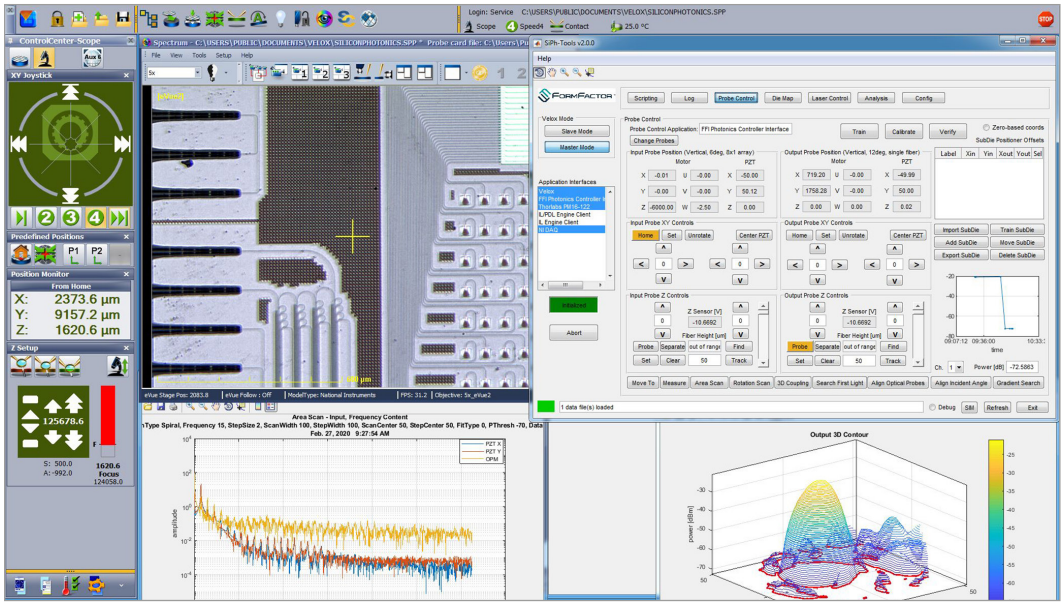
Verified parameters	• Coupled power repeatability • PZT motion calibrations • Hexapod motion calibrations • Chuck calibration to optical positioning

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



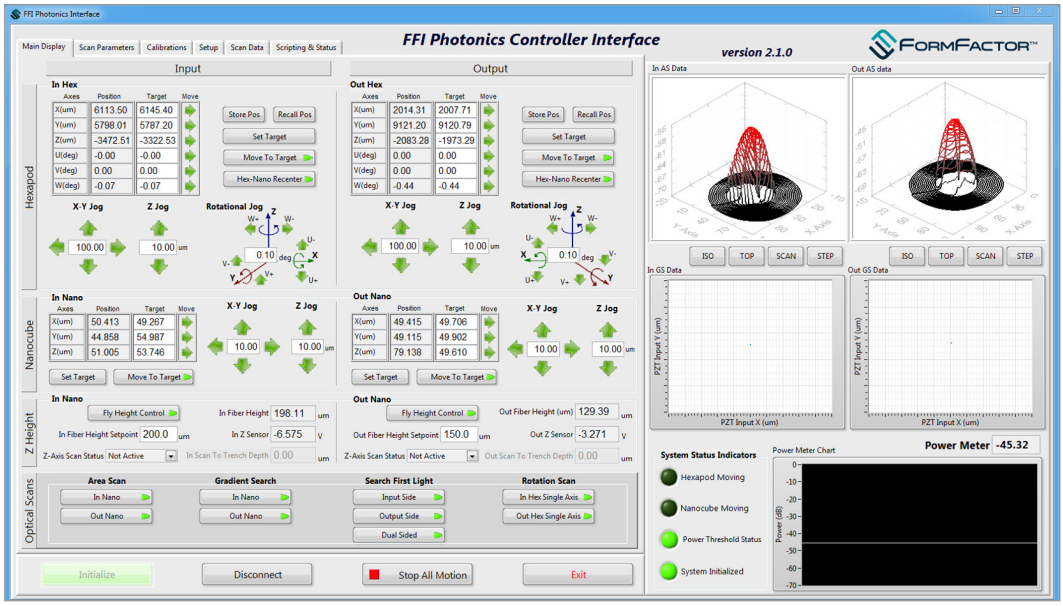
FormFactor's SiPh-Tools provides the communication link between multiple applications, including Velox and PCI.

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.



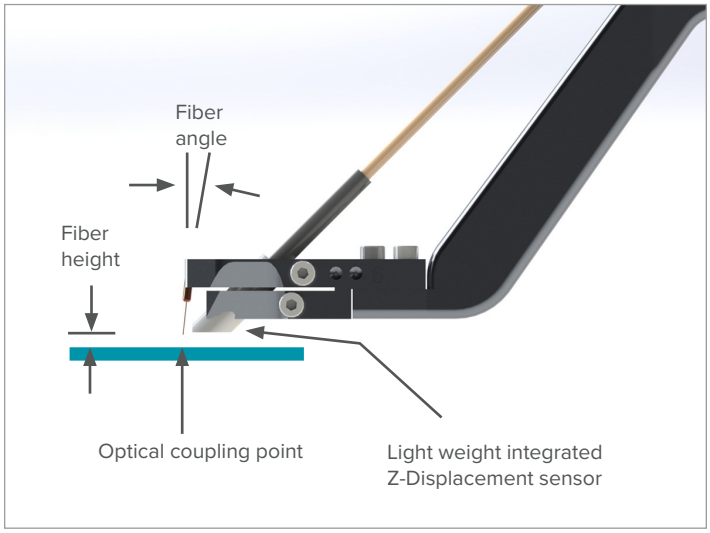
FormFactor's Photonics Controller Interface - controls manual positioning, scan parameter configuration, and initial optical alignment functions.

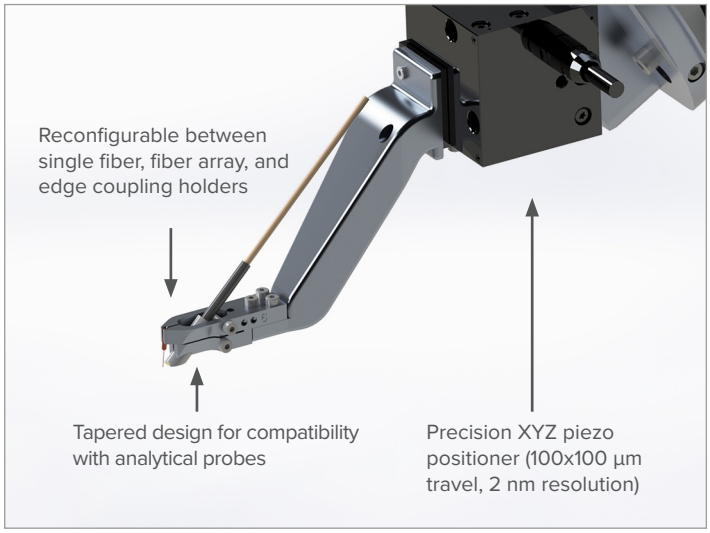
Reconfigurable Fiber Arm

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

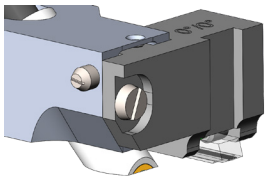




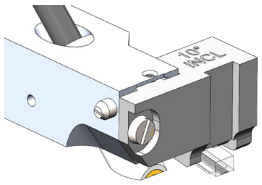
Fiber/Array Holders

Uniquely developed features

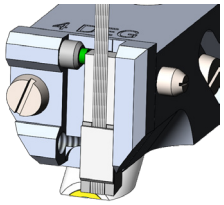
- Wafer-level edge coupling holders
- Horizontal edge coupling holders
- Vertical coupling holders
- Single fibers
- Fiber arrays
- Offset angles



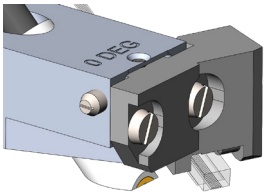
Edge coupling array holder, 90°



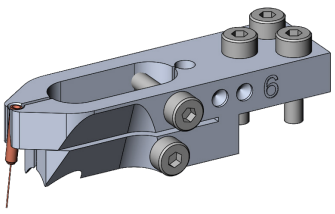
Edge coupling array holder, 70°



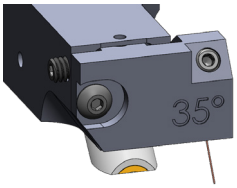
Vertical array holder, 4° to 20°



Offset angle fiber holder



Vertical single fiber holder, 6° to 20°



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

Partner-provided Data Sheets for Components Used in Our Solution

PI F-712.HA2 High-Precision Double-Sided Fiber Alignment System

Motion and positioning	F-712.HA2	Unit
Number of active axes	18	
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	
Guide	–	
Drive type	Brushless DC motor	
Fine positioning		
Active axes	X, Y, Z	
Travel range in X, Y, Z, closed loop	100	µm
Min. incremental motion, open-loop	0.3	nm
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®	
Alignment		
Scanning time of spiraled area scan 500 µm Ø**	<5	s
Scanning time of spiraled area scan 100 µm Ø**	<1	s
Scanning time of spiraled area scan 10 µm Ø**	<0.5	s
Scanning time, gradient scan, randomized with ±5 µm (repeatability < 0.01 dB)***	<0.3	s

Miscellaneous	F-712.HA2	Unit
Operating temperature range, mechanics	0 to 50	°C
Operating temperature range, controller	5 to 40	°C
Cable length	2	m

	Requirements for the optical power meter	Unit
Output signal	Analog output, ideally converted from linear to logarithmic	
Output voltage range, max.	-5 to 5	V
Bandwidth, min.	1	kHz
Noise level, max.	-60	dBm

Technical data specified at 20±3 °C.

** 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.*

Partner-provided Data Sheets for Components Used in Our Solution (Continued)

PI C-887 Digital controller for 6-axis parallel kinematics

High-performance digital controller for hexapods (6-axis parallel-kinematics) with DC motors. Additional control for two further single axes with integrated ActiveDrive.

Function	6-axis controller for hexapods, incl. control of two additional single axes
Drive type	Servo motors (hexapod and single axes)

Motion and control	**C-887.521**
Controller type	32-bit PID controller
Trajectory profiles	Jerk-controlled generation of dynamics profile with linear interpolation
Processor	Intel Atom dual core (1.8 GHz)
Servo cycle time	100 µs
Encoder input	AB (quadrature) differential TTL signal, 50 MHz BiSS
Stall detection	Servo off, triggered by position error
Reference point switch	TTL

Electrical properties	**C-887.521**
Hexapod control	12-bit PWM signal, TTL, 24 kHz
Hexapod power supply	24 V
Maximum output current	7 A

Interfaces and operation	**C-887.521**
Communication interfaces	TCP/IP, RS-232 USB (HID, manual control unit)
Hexapod connection	HD Sub-D 78 (f) for data transmission M12 4 (f) for power supply
Connectors for single axes	Sub-D 15 (f)
I/O lines	HD Sub-D 26 (f): 4 × utility analog input (-10 to 10 V, via 12-bit A/D converter) 4 × digital input (TTL) 4 × digital output (TTL)
Analog inputs	C-887.521 alignment interfaces: 2 × BNC, -5 V to 5 V, via 16-bit A/D converter, 5 kHz bandwidth
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
Manual control	Optional: C-887.MC manual control unit for hexapods

Miscellaneous	**C-887.521**
Operating voltage	24 V (external power adapter for 100 to 240 V AC, 50 / 60 Hz in the scope of delivery)
Maximum current consumption	8 A
Operating temperature range	5 to 40 °C
Mass	2.8 kg
Dimensions	280 (320) mm × 150 mm × 103 mm Power adapter: 170 mm × 85 mm × 42.5 mm

Partner-provided Data Sheets for Components Used in Our Solution (Continued)

PI H-811 High accuracy miniature hexapod

Active axes: X, Y, Z, θX, θY, θZ

Motion and positioning	H-811K044	Unit	Tolerance
Travel range* X, Y, Z	±17, ±16, ±6.5	mm	
Travel range* θX, θY, θZ	±10, ±10, ±21	°	
Single-actuator design resolution	10	nm	
Min. incremental motion X / Y	0.1	µm	typ.
Min. incremental motion Z	0.05	µm	typ.
Min. incremental motion θX, θY, θZ	**1**	µrad	typ.
Backlash X / Y	0.2	µm	typ.
Backlash Z	0.06	µm	typ.
Backlash θX, θY	**4**	µrad	typ.
Backlash θZ	**4**	µrad	typ.
Repeatability X / Y	±0.15	µm	typ.
Repeatability Z	±0.06	µm	typ.
Repeatability θX, θY	±2	µrad	typ.
Repeatability θZ	±3	µrad	typ.
Max. velocity X / Y / Z	10	mm/s	
Max. velocity θX, θY, θZ	250	mrad/s	
Typ. velocity X / Y / Z	5	mm/s	
Typ. velocity θX, θY, θZ	120	mrad/s	

Mechanical properties			
Stiffness X / Y	0.7	N/µm	
Stiffness Z	8	N/µm	
Load (base plate horizontal / any orientation)	5 / 2.5	kg	max.
Holding force, de-energized*	15 / 2.5	N	max.
Motor type	Brushless DC motor		
Miscellaneous			
Operating temperature range	0 to 50	°C	
Material	Stainless steel, aluminum		
Mass	2.2	kg	±5%
Cable length	2	m	±10 mm

Partner-provided Data Sheets for Components Used in Our Solution (Continued)

PI E-712 Modular digital multi-channel piezo controller system

Function	Modular digital controller for multi-axis piezo nanopositioning systems with capacitive sensors
Axes	Depends on prober configuration, 3 to 12
Processor	PC-based, 600 MHz, real-time operating system
Sampling rate, servo control	Depends on prober configuration, 10-20kHz
Sampling rate, sensor	Depends on prober configuration, 10-20kHz

Sensor	
Controller type	P-I, two notch filters
Sensor type	Incremental
Sensor channels	Alignment/data recording/cap probes: 4
Sensor bandwidth (-3 dB)	10 kHz
Sensor resolution	18 (interpolated: 20) bits
External synchronization	Yes

Amplifier	
Output voltage	-30 to 135 V
Amplifier channels	Depends on prober configuration, 4-8 typ
Peak output power / channel*	25 W
Average output power / channel	8 W
Current limitation	Short-circuit proof
Resolution DAC	20-bit
Temperature sensor	Yes
Communication interfaces	TCP/IP, USB, RS-232
Piezo / sensor connector	Sub-D Mix 25W3
Analog inputs	4 (or more, optional)
Analog outputs	4 (or more, optional)
4 × ±10 V differential	
Bandwidth	Max. 25 kHz
Resolution	18 bit
Max. impedance	250 Ohm
Digital inputs/outputs	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, LEDs for OnTarget, Err, Power, Over Temp
Linearization	4th-order polynomials, DDL option (Dynamic Digital Linearization)

PI E-712 Modular digital multi-channel piezo controller system (continued)

Miscellaneous	
Operating temperature range	5 to 40 °C
Overheat protection	Max. 75 °C, deactivation of the voltage output
Max. power consumption	225 W
Operating voltage	100 to 240 VAC, 50 to 60 Hz

Housing types	2*6DOF Probers	2*3DOF Probers
Function	Chassis with power adapter	Chassis with power adapter
Piezo voltage range	-30 to 135 V	-250 to 250 V
Dimensions	E-712.R1: 9.5" (236 mm × 132 mm × 296 mm + handles (47 mm length)) E-712.R3: 19" (450 mm × 132 mm × 296 mm + handles (47 mm length))	E-712.R2: 19" (450 mm × 132 mm × 296 mm + handles (47 mm length)) E-712.R4: 9.5" (236 mm × 132 mm × 296 mm + handles (47 mm length))
Mass	.R1: 4.16 kg / .R3: 6.7 kg	.R2: 6.7 kg / .R4: 4.16 kg
Operating voltage	100 to 240 VAC, 50-60 Hz	100 to 240 VAC, 50-60 Hz
Line power fuses	2 × T1.6AH, 250 V**	2 × T1.6AH, 250 V**
Current consumption, max.	225 VA	225 VA
Max. output power	100 W	100 W

Master modules	E-712.M1
Function	Digital processor and interface module
Supported drive type	Piezo nanopositioning systems (except PiezoWalk® systems)
Axes	up to 16
Sampling rate, servo control	max. 50 kHz
Sampling rate, sensor	max. 50 kHz
Communication interfaces	TCP/IP, USB, RS-232, SPI

Partner-provided Data Sheets for Components Used in Our Solution (Continued)

PI P616 NanoCube® for Closed-Loop Travel Ranges of 100 µm x 100 µm x 100 µm

	P-616.3C	Unit	Tolerance
Active axes	X, Y, Z		
Travel range at -20 to 120 V, open loop	110 / axis	µm	+20 % / -0 %
Travel range, closed loop	100 / axis	µm	+20 % / -0 %
Resolution, 1 σ, open loop	0.3	nm	typ.
Resolution, 1 σ, closed loop	0.4	nm	typ.
Linearity error	0.03	%	typ.
Bidirectional repeatability, 1 σ, 10 % travel range	<10	nm	typ.
Bidirectional repeatability, 1 σ, 100 % travel range	<15	nm	typ.
Motion and positioning sensor			
Sensor type	Capacitive sensors		
Stiffness	0.5	N/µm	±10 %
Resonant frequency X / Y / Z, no load	700	Hz	±10 %
Resonant frequency with 38 g load X / Y / Z	380	Hz	±20 %
Resonant frequency with 100 g load X / Y / Z	250	Hz	±20 %
Push/pull force capacity	15	N	max.
Maximum permissible torque	0.4	Nm	max.
Recommended maximum load	300	g	max.
Mechanical properties			
Ceramic type	PICMA® P-885.50		
Electrical capacitance	1.5 / axis	µF	±20 %
Drive properties miscellaneous			
Operating temperature range	-20 to 80	°C	
Material	Aluminum, steel		
Dimensions	40 × 40 × 40	mm	
Moved mass without load	0.021	kg	
Mass without cable	0.125	kg	

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	CM300-0 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

* *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 progam "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.*

Note: Results measured with thermal chuck at standard probing height (20,500 µm) with chuck in a dry environment. Moisture in the chuck may degrade performance.

Thermal Chucks

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 progam "F-G_R_@10V@50Hz" at defined test conditions.*

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

Thermal Chucks (continued)

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	CM300-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	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 progam "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 CM300-O: Thermal chucks can be used for above ambient temperatures only.*

Thermal System Performance

Thermal System Overview[1]		
Temperature ranges	-60°C to 300°C, ATT, air cool (200/230 VAC 50/60 Hz)	(TS-426/416-14E/R)
	-40°C to 300°C, ATT, air cool (200/230 VAC 50/60 Hz)	(TS-426-08P/R)
	+20°C to 300°C, ATT, air cool (100/230 VAC 50/60 Hz)	(TS-416-05T)
	+30°C to 300°C, ATT, air cool (100/230 VAC 50/60 Hz)	(TS-416-02T)
Wafer temperature accuracy[2,3]	± 2.5°C at 100°C	

1. *CM300-O can be used for above ambient temperatures only.*
2. *As measured with an Anritsu WE-11K-TSI-ANP or WE-12K-GW1-ANP type K thermocouple surface temperature measurement probe with offset calibration procedure. Conditions: closed chamber with minimum recommended purge air, probe centered on a blank silicon wafer, chuck at center of travel and standard probe height. Typical type K thermocouple probe tolerances are ±2.2°C or ±0.75% of the measured temperature in °C (whichever is greater).*
3. *The test setup can change the wafer temperature accuracy from the calibration by ±5°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.*

Thermal System Performance (continued)

ATT Thermal System Specifications (-60°C to 300°C) – TS-426-14E/R	
Temperature range	-60°C to 300°C
Resolution	0.1°C
Thermal uniformity[1, 2]	1.0°C @ 25°C, 2.0°C @ -60°C, 3.0°C @ 300°C

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 ±2.2°C or ±0.75% of the measured temperature in °C (whichever is greater).*
2. *Peak-to-peak temperature measurement variation across probing sites.*

ATT Transition Time (Typical)*		Standard Mode	ECO Mode
Cooling	25°C to -40°C	17 min	34 min
	25°C to -60°C	53 min	N/A
	200°C to 25°C	18 min	27 min
	300°C to 25°C	33 min	44 min
Heating	-60°C to 25°C	7 min	N/A
	-40°C to 25°C	5 min	5 min
	25°C to 200°C	19 min	19 min
	25°C to 300°C	35 min	35 min

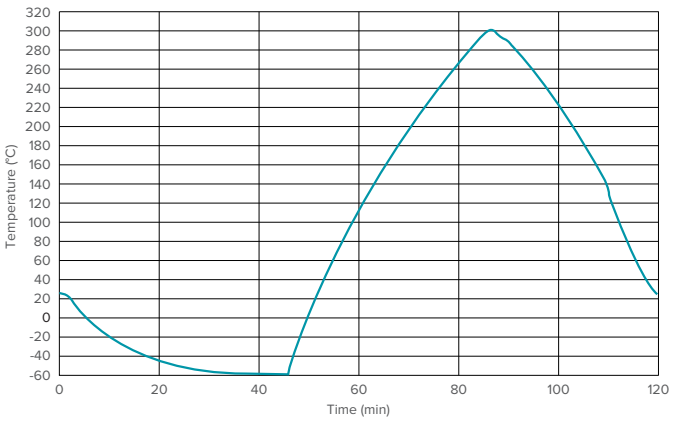
* *Performance valid within fulfilled facility media requirements as stated in the Facility Planning Guide.*

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

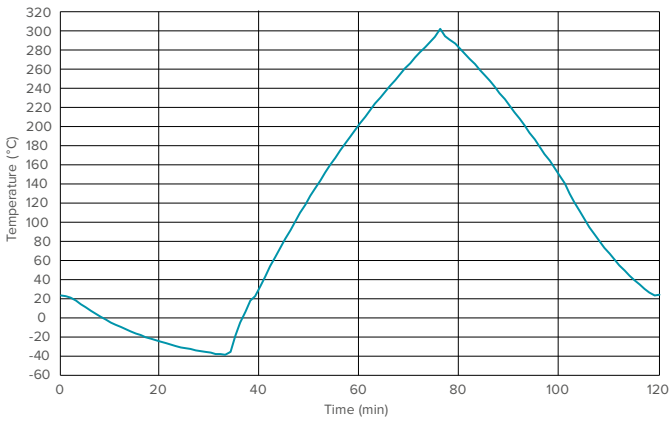
ATT Thermal Transition Time (-60°C to 300°C)

Typical times using CM300xi with FemtoGuard Chuck

Standard Mode



ECO Mode



Thermal System Performance (continued)

ATT Thermal System Specifications (-40°C to 300°C) – TS-426-08P/R	
Temperature range	-40°C to 300°C
Resolution	0.1°C
Thermal uniformity1, 2	1.0°C @ 25°C, 2.0°C @ -40°C, 3.0°C @ 300°C

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 ±2.2°C or ±0.75% of the measured temperature in °C (whichever is greater).*
2. *Peak-to-peak temperature measurement variation across probing sites.*

ATT Transition Time (Typical)*		Standard Mode**	Power Mode***
Cooling	25°C to -40°C	59 min	49 min
	200°C to 25°C	28 min	24 min
	300°C to 25°C	35 min	31 min
Heating	-40°C to 25°C	5 min	5 min
	25°C to 200°C	19 min	19 min
	25°C to 300°C	35 min	35 min

* *Performance valid within fulfilled facility media requirements as stated in the Facility Planning Guide.*

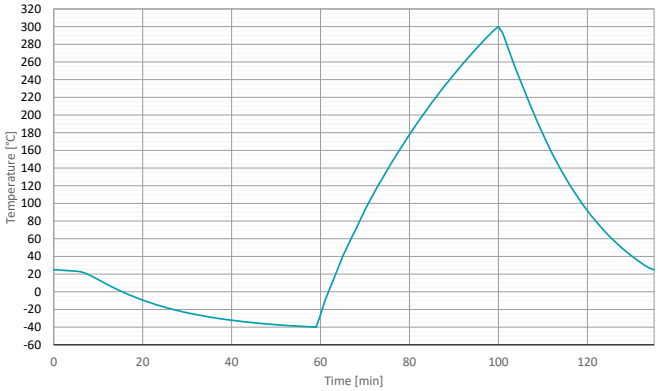
** *Standard Mode limits CDA consumption to max. 300 l/min.*

*** *Power Mode limits CDA consumption to max. 400 l/min.*

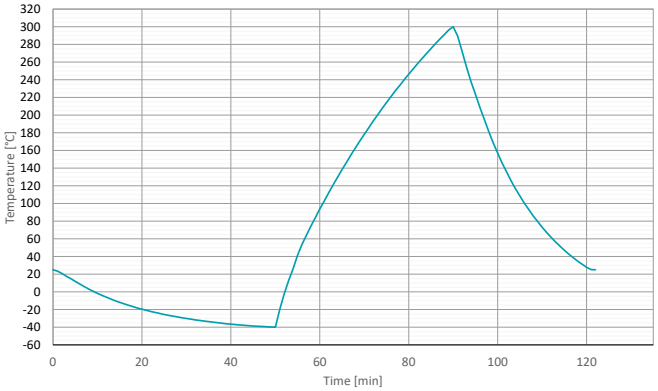
ATT Thermal Transition Time (-40°C to 300°C)

Typical times using CM300xi with FemtoGuard Chuck

Standard Mode



Power Mode



Thermal System Performance (continued)

ATT Thermal System Specifications (30°C to 300°C) – TS-416-02T

Temperature range	30°C to 300°C
Resolution	0.1°C
Thermal uniformity[1, 2]	1.0°C @ 25°C, 3.0°C @ 300°C

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 ±2.2°C or ±0.75% of the measured temperature in °C (whichever is greater).*
2. *Peak-to-peak temperature measurement variation across probing sites.*

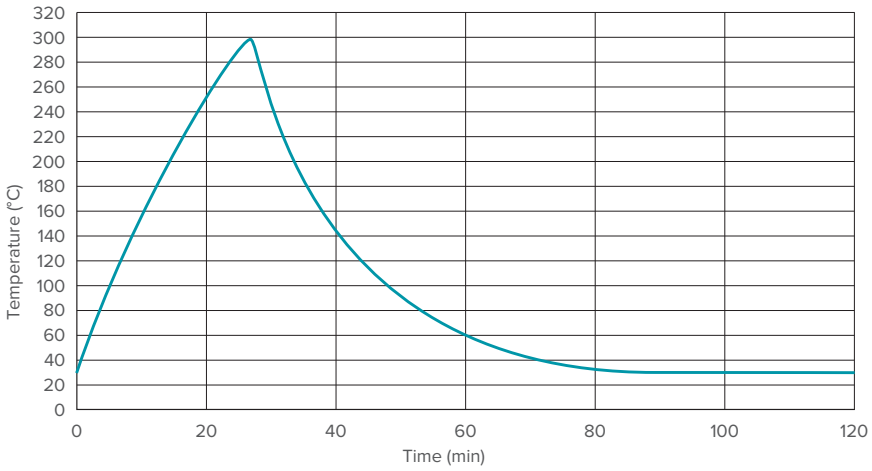
ATT Transition Time (Typical)*

Cooling	200°C to 30°C	60 min
	300°C to 30°C	70 min
Heating	30°C to 200°C	19 min
	30°C to 300°C	35 min

* *Performance valid within fulfilled facility media requirements as stated in the Facility Planning Guide.*

ATT Thermal Transition Time (30°C to 300°C)

Typical times using CM300xi with FemtoGuard Chuck



Mount/Transports

Programmable Bridge/Transport Specifications, High-Temperature Stability*	
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	≤ 2 µm (0.08mils)
Repeatability, Z axis	≤ 1 µm (0.04mils)
Accuracy, X-Y axis	≤ 5 µm (0.2 mils)
Accuracy, Z axis	≤ 4 µm (0.016 mils)
Speed	5 mm/sec (0.2 in./sec)

Large Area Programmable Bridge/Transport Specifications*	
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	≤ 5 µm (0.2 mils)
Repeatability, Z axis	≤ 2 µm (0.08 mils)
Accuracy, X-Y axis	≤ 10 µm (0.4 mils)
Speed	50 mm/sec (2 in./sec)
Planarity compensated	± 5 µm (0.2 mils)

Manual Bridge/Transport Specifications (for CM300-O)**	
Travel	50 mm (X) x 50 mm (Y) x 125 mm (Z) (2.0 in. x 2.0 in. x 4.9 in.)
Z Lift	125 mm (4.9 in.)
Feature resolution, X-Y axis	5 µm (0.2 mils)

* *Applicable with eVue only*

** *Only for use with microscope with focus drive.*

Aux Chuck

Quantity	Two separated chucks for RF calibration (CAL, two sites) and cleaning (CLEAN, three sites), mounted independent of the thermal chuck
Max substrate size CAL	22.15 mm x 22.15 mm ISS substrate
	16 mm x 14.5 mm Square substrate
Max substrate size CLEAN	38.1 mm x 38.1 mm gel pad
	Two 16 mm x 14.5 mm contact pads, solid clean pad, brush
Material	CAL: ceramic, CLEAN: steel
Flatness	≤ ± 10 µm (0.39 mils)
Thermal isolation	Air gap, > 10 mm
Positional repeatability	2 µm (0.08 mils) after rollout event
Vacuum actuation	Independent manual control

Models

CM300xi Fully-shielded - Probe station platform, semi-automated with MicroChamber, AttoGuard and PureLine technologies

Configuration includes:

Microscope Bridge/Transport – programmable 75 mm x 75 mm, High Thermal Stability

EMI- and light-tight shielding with TopHat, AttoGuard technology for accurate IV/CV measurements

ContactView™ East-West with ProbeHorizon for fast and safe wafer loading

AUX chuck kit for RF calibration and cleaning

Velox Controller with dual TFT monitor 24” on ergo arm

AirGun with front access, IntelliControl

CM300xi Shielded - Probe station platform, semi-automated with MicroChamber

Configuration includes:

Microscope Bridge / Transport – programmable 75 mm x 75 mm, High Thermal Stability

EMI- and light-tight shielding with TopHat

ContactView East-West with ProbeHorizon for fast and safe wafer loading

Velox Controller with single TFT monitor 24” on ergo arm

CM300 Open System - Probe station platform, semi-automated

Configuration includes:

Microscope Bridge / Transport – manual 50 mm x 50 mm

ContactView East-West with ProbeHorizon for fast and safe wafer loading

Velox Controller with single TFT monitor 24” on ergo arm

Options

Note: To complete the CM300xi probe system configuration

1. Select a modular chuck from the list on the next page (X=1 f or Nickel-plated chuck and 2 for Gold-plated)

2. Select additions/options from the following list (see compatibility chart on following page)

Part Number	General Description	CM300xi-F	CM300xi-S	CM300-O
171-294	CM300xi, microscope bridge/transport HTS – programmable 75 mm x 75 mm	Std	Std	●
168-930	CM300xi/CM300-O, large area microscope bridge/transport – programmable 300 mm x 300 mm	●	●	●
169-120	CM300-O, microscope bridge/transport – manual 50 mm x 50 mm			Std
161-677	CM300xi/CM300-O, AUX chuck kit	Std	●	●
167-640	CM300xi/CM300-O, AirGun with front access, IntelliControl	Std	●	●
167-500	CM300xi/CM300-O, AirGun with front access		●	●
163-262	CM300xi/CM300-O, 2nd ContactView North-South	●	●	●
169-121	CM300xi/CM300-O, Option PTPA for CM300	●	●	●
161-676	CM300xi/CM300-O, 2nd TFT monitor 24” with ergo arm	Std	●	●
186-000	3D Manual Controls, including XY Knobs and Platen Lift - provides extremely intuitive, rapid and precise manual control of the stage in X, Y and Z direction	●	●	
OPT-CM300-TOPCHMBR	CM300xi, TopChambers for simultaneous use with probe card and positioners (EMI-shielded)	●	●	
VeloxPro	Software option, VeloxPro Test Automation Software for 300 mm systems (included if system ordered with MHU)	●	●	●

Models (Continued)

Non-Thermal Chucks

Part Number	General Description	Chuck Compatibility CM300xi-F	CM300xi-S	CM300-O
TC-006-30x	FemtoGuard triaxial chuck, non-thermal, 300 mm (12”)	●	●	
TC-006-10x	Coaxial chuck, non-thermal, 300 mm (12”)		●	●

Thermal Chucks**

Part Number	General Description	Chuck Compatibility CM300xi-F	CM300xi-S	CM300-O*
TC-426-30x	FemtoGuard triaxial chuck, thermal, -60°C to 300°C (ATT), 300 mm (12”)	●	●	
TC-426-10x	Coaxial chuck, thermal, -60°C to +300°C (ATT) , 300 mm (12”)		●	●

Note: X = 1 (Nickel), X = 2 (Gold)

* *For CM300-O: Thermal chucks can be used for above ambient temperatures only.*

** *Thermal chucks requires thermal systems to control chuck temperature.*

Thermal Systems

Part Number	General Description	Compatibility CM300xi-F	CM300xi-S	CM300-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.

System Features

General Probe System Specifications

Usability feature:

- ContactView (East-West orientation)

Automation features:

- Option off-axis PTPA
- Automated Thermal Management (ATM)

Top shielding:

- TopHat (for shielded configurations only)
- TopChambers (optional, for shielded configurations only)
- Probe card holder for use with 4.5” probe cards (with cover for shielded configurations)

Note: All performance metrics identified in this document are valid only when the system is installed and operated within the terms specified in the Facilities Preparation Guide.

CM300xi fully-automated system with material handling unit MHU301.

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

MHU Features

Material handling unit	The footprint-optimized MHU301 or the powerfull 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 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.

Note: 200 mm wafers require a dedicated open cassette adapter to fit to the 300 mm load port.

Configuration Options

Semi-Automated

Stand-alone CM300xi probe system with no integrated wafer loader

Fully-Automated

Wafer loader MHU301 interfaced to one CM300xi probe system (at left or right side)

Dual-Prober

Wafer loader MHU300 interfaced to two independent CM300xi probe systems

Notes: For detailed facility requirements, refer to the CM300xi Facility Planning Guide.
The MHU300 is also available for only one CM300. It can be later upgraded for two probe systems.

System Upgrade Options

MHU-ready option:

OPT-CM300-MHU-L/R	Upgrade capability for conversion of a CM300xi to fully-automated probe system, requires definition of prober location against MHU; feature is required to prepare a CM300xi for later upgrade in the field.

Non-Thermal Chucks

		Chuck Compatibility		
Part Number	**General Description**	**CM300xi-F**	**CM300xi-S**	**CM300-O**
TC-006-32x	FemtoGuard triaxial chuck, non-thermal, 300 mm (12”), with lift pins	●	●	
TC-006-12x	Coaxial chuck, non-thermal, 300 mm (12”), with lift pins		●	●

Thermal Chucks*

		Chuck Compatibility		
Part Number	**General Description**	**CM300xi-F**	**CM300xi-S**	**CM300-O****
TC-426-33x	FemtoGuard triaxial chuck, thermal, -60°C to +300°C (ATT), 300 mm (12”), with HT lift pins	●	●	
TC-426-32x	FemtoGuard triaxial chuck, thermal, -60°C to +200°C (ATT), 300 mm (12”), with lift pins	●	●	
TC-426-13x	Coaxial chuck, thermal, -60°C to +300°C (ATT), 300 mm (12”), with HT lift pins		●	●
TC-426-12x	Coaxial chuck, thermal, -60°C to +200°C (ATT), 300 mm (12”), with lift pins		●	●

Note: X = 1 (Nickel), X = 2 (Gold)

* *Thermal chucks require thermal systems to control chuck temperature. The chucks and thermal systems mutually determine the temperature range.*

Thermal Systems

		Compatibility		
Part Number	**General Description**	**CM300xi-F**	**CM300xi-S**	**CM300-O****
TS-426-14E-I	Thermal system, -60°C to 300°C, ATT (220-240 VAC 50 Hz)* to be used with MHU300, requires CDA dew point <-80°C	●	●	
TS-426-14R-I	Thermal system, -60°C to 300°C, ATT (200-220 VAC 60 Hz, 200 VAC 50 Hz)* to be used with MHU300, requires CDA dew point <-80°C	●	●	
TS-416-14E-I	Thermal system, -60°C to 300°C, ATT (220-240 VAC 50 Hz)* to be used with MHU300, with air dryer	●	●	
TS-416-14R-I	Thermal system, -60°C to 300°C, ATT (200-220 VAC 60 Hz, 200 VAC 50 Hz)* to be used with MHU300, with air dryer	●	●	

* *The upper temperature limit is defined by the chuck.*

** *For CM300-O: Thermal Chucks can only be used for temperatures above ambient temperature.*

Available options

Automation with MHU301

MHU301-L/R	Material handling unit with one load port for 300 mm FOUP/FOSB cassettes, for CM300xi at left (-L) or right (-R) side
180-402	Open Cassette Adapter for 200mm Wafer Cassettes
182-825	ID reading for MHU301 for front side of the wafer
183-038	ID reading for MHU301 for back side of the wafer
182-826	ID reading for MHU301 Top and Bottom
183-820	Fan Filter unit for MHU301 reducing dust pollution level inside MHU
183-027	Quick Access Port: Additional storage for 2 wafers for faster testing

CM300xi fully-automated system with material handling unit MHU301.

Automation with MHU300

MHU300-L/R	Material handling unit with one loadport for 300 mm FOUP/FOSB cassettes, for CM300xi at left (-L) or right (-R) side
MHU300-2	Material handling unit with one loadport for 300 mm FOUP/FOSB cassettes for two CM300xi probe systems (dual-prober configuration)
180-410	Second load port for MHU300
180-402	Adapter for use of open 200 mm cassettes
159-660	ID reader station for codes on the surface and back side of wafers
164-678	Fan filter unit for MHU300 reducing dust pollution level in MHU

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

System Throughput

Semi-automated system	
Chuck stepping time	≤ 0.75 sec (200 µm Z down – 1000 µm X-Y – 200 µm Z up)

Fully-automated system	
FOUP cassette load	≤ 30 sec (incl. wafer scan)
Wafer handling cycle @ ambient	≤ 1.3 min (Cassette ➔ PreAligner ➔ Prober ➔ Cassette) ≤ 1.6 min (Cassette ➔ PreAligner ➔ IDReader ➔ PreAligner ➔ Prober ➔ Cassette)

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.

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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CM300xi-SiPh-DS-1220