

MPI TS2000-SE | 200 mm Automated Probe System

For accurate and reliable DC/CV, RF and mmW measurements

FEATURES / BENEFITS

Designed for Variety of On-Wafer Applications

- Device Modeling - DC-IV / DC-CV / Pulse-IV
- RF and mmW - RF Setup from 26 GHz to 110 GHz & beyond
- Failure Analysis - Probe card / Internode Probing
- Wafer Level Reliability - Hot / Cold / Long-term test

MPI ShieldEnvironment™ for Accurate Measurements

- Designed for Advanced EMI / RFI / Light-Tight Shielding
- fA low-leakage capabilities
- Ready for temperature range -60 °C to 300 °C

Ergonomic Design and Options

- Front and advanced automated single wafer side loading capability with easy pre-alignment for automated routines
- Vertical Control Environment (VCE™) with observation of the probing area from the side for safe operation
- Integrated active vibration isolation
- Completely integrated prober control for faster, safer and convenient system and test operation
- The Safety Test Management (STM™) option to load/un-load wafers at any chuck temperatures and auto dew point control



SPECIFICATIONS

Chuck XY Stage (Programmable)

Travel range	210 x 300 mm (8.27 x 11.81 in)
Resolution	0.5 µm
Accuracy	± 2.0 µm
Repeatability	± 2.0 µm
XY stage drive	High resolution stepper motor with linear encoder feedback system
Speed*	4-Speed XY chuck stage adjustable speed movement Slowest: 10 µm / sec Fastest: 50 mm / sec

Chuck Z Stage (Programmable)

Travel range	50 mm (2 in)
Resolution	0.2 µm
Accuracy	± 2.0 µm
Repeatability	± 1.0 µm
Z stage drive	High resolution stepper motor with integrated pin drive system for easy wafer loading
Speed*	3-Speed Z chuck stage adjustable speed movement Slowest: 10 µm / sec Fastest: 4 mm / sec

*The speed is instantaneous speed, not average speed. There is accelerate and decelerate time when moving.

SPECIFICATIONS

Chuck Theta Stage (Programmable)

Travel range	± 6.0°
Resolution	0.0004°
Accuracy	< 2.0 µm (measured at the edge of the 200 mm chuck)
Repeatability	< 1.0 µm
Theta stage drive	High resolution stepper motor with linear encoder feedback system

Video Camera (Vertical Control Environment™)

Sensor type	1/1.8" mono CCD
Sensor size	7.07 mm x 5.3 mm
Camera pixels	3 MP
Resolution	2048 x 1536 pixels

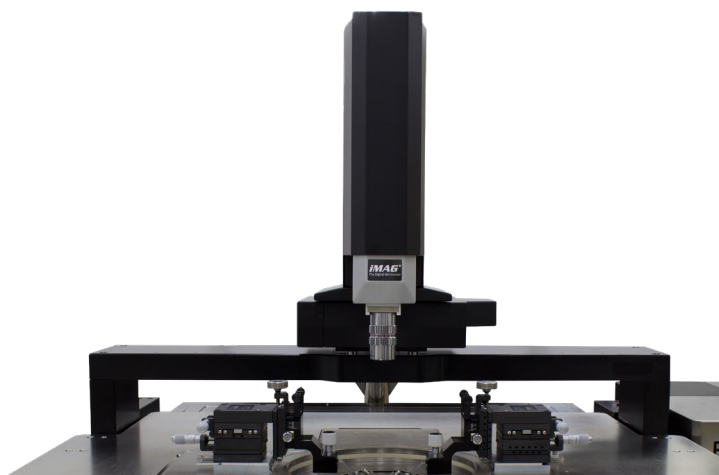
Wafer Alignment Camera

Sensor type	1/1.8" color CCD
Sensor size	7.07 mm x 5.3 mm
Camera pixels	3 MP
Resolution	2048 x 1536 pixels

MICROSCOPE MOVEMENT

	XYZ Programmable	XY manual, Z programmable	XYZ manual
Travel range*	50 x 50 mm	50 x 50 mm	50 x 50 mm / 80 x 80 mm
Resolution	1 µm (0.04 mils)	< 5 µm (0.2 mils)	< 5 µm (0.2 mils)
Repeatability	< 2 µm (0.08mils)	N/A	N/A
Accuracy	< 5 µm (0.2 mils)	N/A	N/A
Z Travel range	140 mm	140 mm	140 mm, pneumatic
Resolution	0.05 µm (0.002 mils)	0.05 µm (0.002 mils)	N/A
Repeatability	< 2 µm (0.08mils)	< 2 µm (0.08mils)	< 2 µm (0.08mils)
Accuracy	< 4 µm (0.016 mils)	< 4 µm (0.016 mils)	N/A

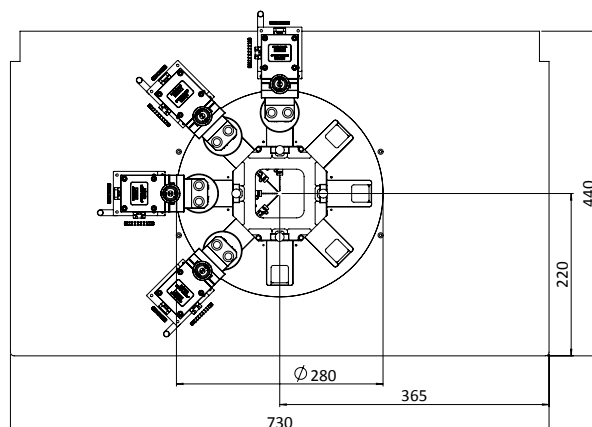
*In case of ShieldEnvironment™ X x Y: 25 mm x 25 mm



PROBE PLATEN

Specifications

Material	Nickel plated steel
Chuck to ShieldGuard height	min. 5 mm
Feature	Integrated Air-Cool platen control for thermal stability of MicroPositioners
Max. No of MicroPositioners	8x DC or 4x DC + 2x RF or 2x DC + 4x RF or 4x DC + 4x RF Setup



Optional MPI MP50 MicroPositioners are shown with the drawing

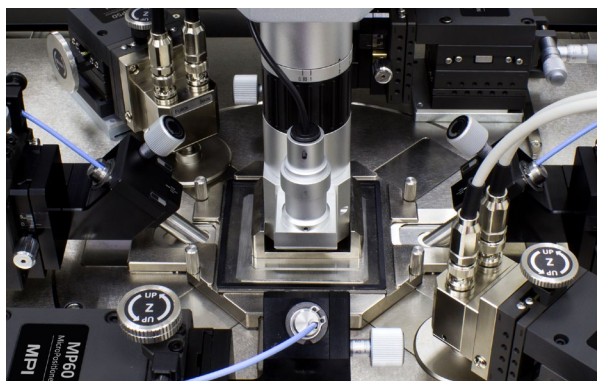
ShieldEnvironment™

MPI ShieldEnvironment™ is a high performance local environmental chamber providing excellent EMI- and light-tight shielded test environment for ultra-low noise, low capacitance measurements. MPI ShieldEnvironment™ allows up to 4-port RF or up to 8-ports DC/Kelvin or a combination of those configurations. MPI ShieldCap™ provides easy reconfiguration of measurement setup as well as EMI/noise shielding - which make great difference in simplifying day to day operations.

ShieldEnvironment™ Electrical Specifications*

EMI shielding	> 30 dB (typical) @ 1 kHz to 1 MHz
Light attenuation	≥ 130 dB
Spectral noise floor	≤ -180 dBVrms/rHz (≤ 1 MHz)
System AC noise	≤ 5 mVp-p (≤ 1 GHz)

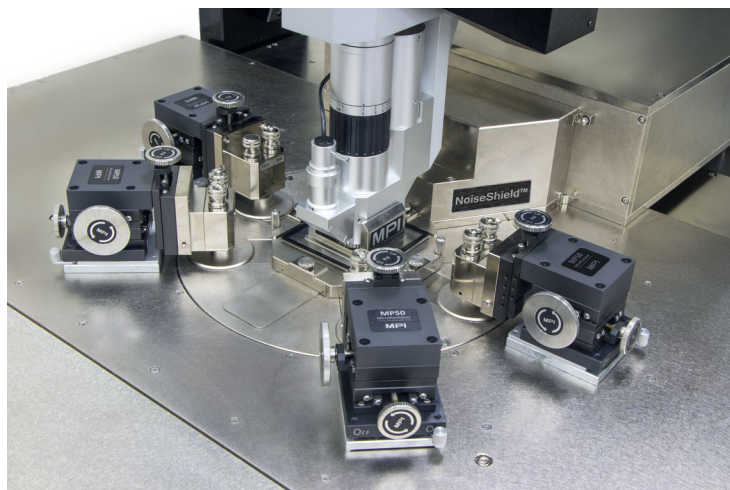
*Including 4 MicroPositioners.



MPI NoiseShield™ OPTION FOR 1/f (Flicker) & RTN MEASUREMENTS

MPI's exclusive NoiseShield™ offers in combination with MPI ShieldEnvironment™ for unsurpassed active EMI-Shielding of DUT and the measurement instrument (such as pre-amplifier unit). In addition, it provides all cables and connectors close to DUT.

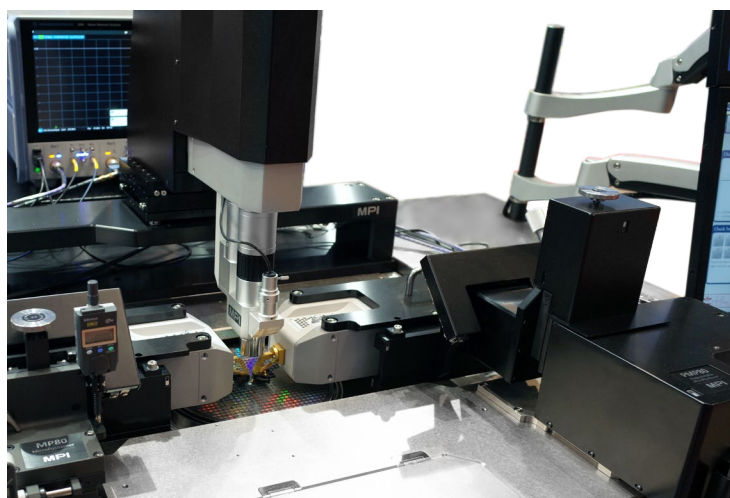
The **NoiseShield™** option provides shortest possible cable lengths to reduce parasitic capacitance and to maximize test system roll-off frequency. It reduces external magnetic field influences on the measurement results and makes the 1/f, RTN Setup more robust and test lab location less independent. Low impedance cables (for DC or RF pad design), excellent low-impedance system's grounding and ferrite cores on the unique MPI Kelvin probes are part of the delivery in order to make the probe station completely "invisible" and the measurement results to reach the limit of the instrumentation.



THZ-SELECTION

It converts TS2000-SE system into a dedicated, mmW and THz probe station, as the first one on the market:

- Automated testing of 200 mm wafers with unsurpassed measurement accuracy is possible now
- The MPI THZ-Selection incorporates MPI's innovative design of frequency extender's integration, developed for TS200-THZ, which hovers the extender over the entire 200 mm wafer
- This minimizes the distance to the DUT to a minimum in order to provide best possible measurement directivity and accuracy



KEY FEATURES

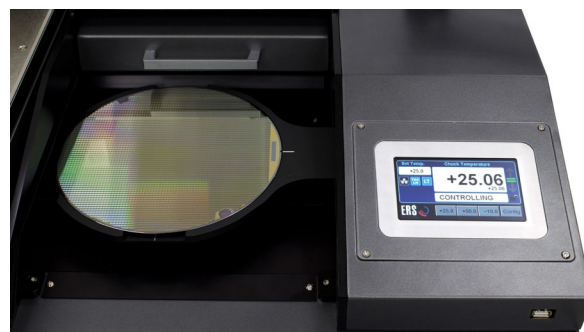
Automated Single Wafer Loader

Convenient wafer loading with easy pre-alignment for automated routines. Loading or unloading of 100, 150 or 200 mm wafer is straight forward and intuitive.



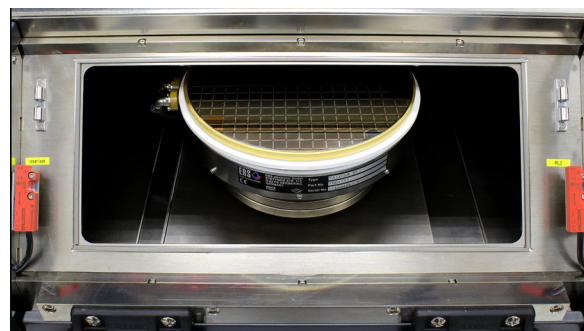
Wafer Hot Swap

The automated single wafer loader and the Safety Test Management (STM™) provide a unique capability to load/unload wafers at any chuck temperature. Cooling down or heating up to ambient is not required anymore for loading or unloading the wafer.



Safety Test Management STM™ Option

The STM™ system prevents opening of any doors during testing. Accidental opening of any system door during a negative chuck temperature is impossible on any event. Furthermore, an intelligent dew point control routine avoids moisture condensation during cold testing. The system automatically monitors the flow of CDA or Nitrogen. If the flow is interrupted or insufficient, the STM™ automatically turns the chuck into a safe mode by heating up the chuck as fast as possible to 60 °C.



Integrated Active Vibration Isolation

Highly effective vibration insulation with automatic level controlled air-spring damping system.

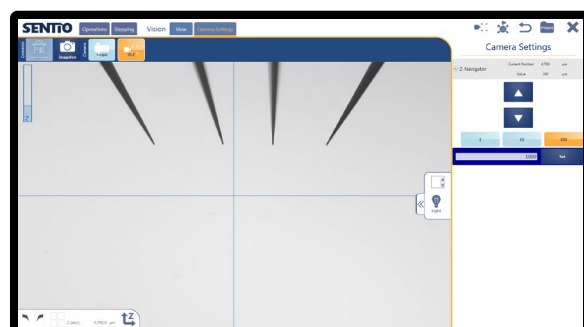
Internal frequency: 2.5 Hz

Automatic load leveling.



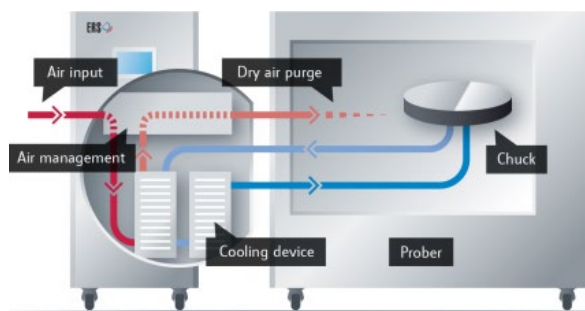
Vertical Control Environment™ (VCE)

Observation of the probing area from the side for safe operation.



Minimized CDA Consumption

With the ERS patented technology, using the chiller for purging the ShieldEnvironment™, the CDA consumption is reduced by as much as 50%. Nitrogen purging is still possible by using separate valve.



* Picture is courteously provided by ERS.

Thermal Chuck Operation

The thermal chuck can be operated by using the fully integrated touchscreen display, which is placed at a convenient location in front of the operator for fast operation and immediate feedback.



Integrated Prober Control

The hardware system controller is completely integrated into the probe system and designed to provide faster, safer and a more convenient probe system control and test operation. The keyboard and mouse are strategically located to control the software if necessary, as well as the Windows® based instrumentation.

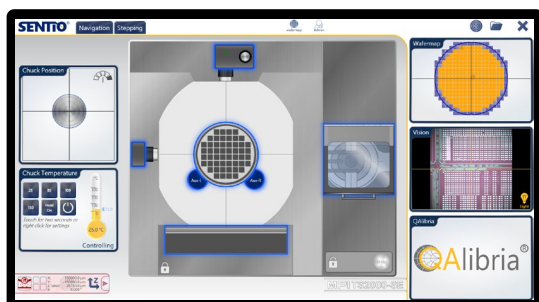


SOFTWARE SOLUTION

MPI's automated engineering probe systems are controlled by the unique and revolutionary, multi-touch operation SENTIO® Software Suite: simple and intuitive operation saves significant training time. The scroll, zoom, and move commands mimic modern smart mobile devices and allows everyone to become an expert in just minutes. Switching between the active application and the other APPs is just a matter of a simple finger sweep.

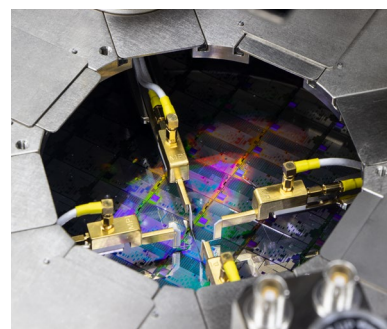
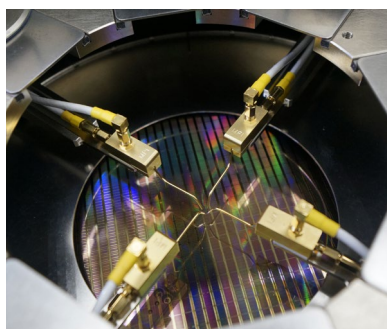
By implementing intuitive multi-touch operation, QAlibria® provides crisp and clear guidance to the RF calibration process, minimizes configuration mistakes and helps to reach accurate calibration results the fastest. QAlibria® offers industry standard and advanced calibration methods.

QAlibria® includes TOSM (SOLT), TMR, TMRR methods, and 4-port calibration capability additionally to the integration of NIST StatistiCal calibration packages providing easy access to the NIST multiline TRL metrology-level calibration and uncertain analysis.



TYPICAL CONFIGURATION WITH MPI KELVIN AND MPI KELVIN-HIGH TEMPERATURE PROBES INSIDE SHIELD ENVIRONMENT™

	Coax Probe	Triax Probe	Kelvin Probe	Kelvin HT Probe
Max voltage	500 V	500 V	500 V	500 V
Temperature range	-60 °C to 300 °C	-60 °C to 300 °C	-60 °C to 200 °C	-60 °C to 200 / 300 °C
Leakage current	< 0.8 pA	< ± 20fA	< ± 10fA	< ± 10fA / < ± 20fA
Connectivity	SMB / BNC	Standard Triax	Kelvin Triax	Kelvin Triax
Connectivity type	Single, Coaxial	Single, low noise Triaxial	Force / Sense, low noise Triaxial	
Characteristics impedance	50 Ohms	50 Ohms	50 Ohms	50 Ohms
Residual capacitance	< 95 fF	< 95 fF	< 95 fF	< 95 fF
Probe holder material	Au-plated Brass		Au-plated Brass (Guarded)	
Probe tip type	Variety of metal tips		Coaxial / Guarded	Guarded ceramic blades
Probe tips material	W, BeCu, Au-plated		W	WRe
Probe tips radius	0.5 μm – 25 μm	0.5 μm – 25 μm	0.5 μm – 5 μm	2 μm – 5 μm
Minimum pad size	25 μm x 25 μm	25 μm x 25 μm	30 μm x 30 μm	25 μm x 25 μm



Typical MPI configuration with Kelvin Probes

■ NON-THERMAL CHUCKS

Standard Wafer Chuck

Connectivity	Coax BNC (f)
Diameter	210 mm
Material	Stainless steel
Chuck surface	Planar with centric engraved vacuum grooves
Vacuum grooves sections (diameter)	3, 27, 45, 69, 93, 117, 141, 164, 194 mm
Vacuum actuation	Multizone control - All connected in meander shape, center hole in 3 mm diameter
Supported DUT sizes	Single DUTs down to 4 x 4 mm size or wafers 50 mm (2 in) thru 200 mm (8 in)*
Surface planarity	$\leq \pm 5 \mu\text{m}^{**}$
Rigidity	$< 15 \mu\text{m} / 10 \text{ N @edge}$

*Single DUT testing requires higher vacuum conditions dependent upon testing application.

**By using SENTIO® topography

RF Wafer Chuck

Connectivity	Kelvin Triax (f)
Diameter	210 mm with 2 integrated AUX areas
Material	Nickel plated aluminum (flat with 0.5 mm holes)
Chuck surface	Planar with 0.5 mm diameter holes in centric sections
Vacuum holes sections (diameter)	3, 27, 45, 69, 93, 117, 141, 164, 194 mm
Vacuum actuation	Manual switch between Center (4 holes), 100, 150, 200 mm (4, 6, 8 in)
Supported DUT sizes	Single DUTs down to 4 x 4 mm size or wafers 100 mm (4 in) thru 200 mm (8 in)*
Surface planarity	$\leq \pm 5 \mu\text{m}^{**}$
Rigidity	$< 15 \mu\text{m} / 10 \text{ N @edge}$

*Single DUT testing requires higher vacuum conditions dependent upon testing application.

**By using SENTIO® topography

Auxiliary Chuck

Quantity	2 AUX chucks
Position	Integrated to front side of main chuck
Substrate size (W x L)	Max. 25 x 25 mm (1 x 1 in)
Material	Ceramic, RF absorbing material for accurate calibration
Surface planarity	$\leq \pm 5 \mu\text{m}$
Vacuum control	Controlled independently, separate from chucks

Electrical Specification (Coax)

Operation voltage	In accordance with EC 61010, certificates for higher voltages available upon request
Maximum voltage between chuck top and GND	500 V DC
Isolation	$> 2 \text{ G}\Omega$

Electrical Specification (Triax)

Chuck isolation	Standard Chuck (10 V)
Force to guard	$\geq 1 \text{ T}\Omega$
Guard to shield	$\geq 1 \text{ T}\Omega$
Force to shield	$\geq 5 \text{ T}\Omega$

THERMAL CHUCKS

Specifications of MPI ERS Integrated Technology

Temperature Range	20 °C to 200 °C	20 °C to 200 °C	20 °C to 300 °C
Connectivity	Kelvin Triax (f)	Kelvin Triax (f)	Kelvin Triax (f)
Temperature control method	Cooling air / Resistance heater	Cooling air / Resistance heater	Cooling air / Resistance heater
Coolant	Air (user supplied)	Air (user supplied)	Air (user supplied)
Smallest temperature selection step	0.1 °C	0.1 °C	0.1 °C
Chuck temperature display resolution	0.01 °C	0.01 °C	0.01 °C
External touchscreen display operation	Yes	Yes	Yes
Temperature stability	±0.08 °C	±0.08 °C	±0.08 °C
Temperature accuracy	±0.1 °C	±0.1 °C	±0.1 °C
Control method	Low noise DC/PID	Low noise DC/PID	Low noise DC/PID
Interfaces	RS232C	RS232C	RS232C
Chuck surface plating	Nickel plated with pinhole surface	Nickel plated with pinhole surface	Nickel plated with pinhole surface
Temperature sensor	Pt100 1/3DIN, 4-line wired	Pt100 1/3DIN, 4-line wired	Pt100 1/3DIN, 4-line wired
Temperature uniformity	< ±0.5 °C	< ±0.5 °C	< ±0.5 °C at ≤ 200 °C < ±1.0 °C at > 200 °C
Surface flatness and base parallelism	< ±10 μm	< ±10 μm	< ±10 μm at ≤ 200 °C < ±15 μm at > 200 °C
Heating rates	20 to 200 °C < 15mm	20 to 200 °C < 20 min	20 to 300 °C < 30 min
Cooling rates*	200 to 20 °C < 20 min	200 to 20 °C < 25 min	300 to 20 °C < 30 min
Electrical isolation	> 10 T Ω at 25 °C > 300 G Ω at 200 °C	N/A	N/A
Leakage @ 10 V	N/A	< 15 fA at 25 °C < 30 fA at 200 °C	< 15 fA at 25 °C < 50 fA at 300 °C
Capacitance	< 900 pF	N/A	N/A
Maximum voltage between chuck top and GND	500 V DC	500 V DC	500 V DC

*All data are relevant for chucks in ECO mode.

FULL RANGE TRIAXIAL THERMAL CHUCKS

Specifications of MPI ERS Integrated Technology

Temperature Range	-10 °C to 200 °C/300 °C	-40 °C to 200 °C/300 °C	-60 °C to 200 °C/300 °C
Connectivity	Kelvin Triax	Kelvin Triax	Kelvin Triax
Temperature control method	Cooling air / Resistance heater	Cooling air / Resistance heater	Cooling air / Resistance heater
Coolant	Air (user supplied)	Air (user supplied)	Air (user supplied)
Smallest temperature selection step	0.1 °C	0.1 °C	0.1 °C
Chuck temperature display resolution	0.01 °C	0.01 °C	0.01 °C
External touchscreen display operation	Yes	Yes	Yes
Temperature stability	±0.08 °C	±0.08 °C	±0.08 °C
Temperature accuracy	0.1 °C	0.1 °C	0.1 °C
Control method	Low noise DC/PID	Low noise DC/PID	Low noise DC/PID
Interfaces	RS232C	RS232C	RS232C
Chuck surface plating	Nickel plated with pinhole surface	Nickel plated with pinhole surface	Nickel plated with pinhole surface
Temperature sensor	Pt100 1/3DIN, 4-line wired	Pt100 1/3DIN, 4-line wired	Pt100 1/3DIN, 4-line wired
Temperature uniformity	< ±0.5 °C at ≤ 200 °C < ±1.0 °C at > 200 °C	< ±0.5 °C at ≤ 200 °C < ±1.0 °C at > 200 °C	< ±0.5 °C at ≤ 200 °C < ±1.0 °C at > 200 °C
Surface flatness and base parallelism	< ±10 μm at ≤ 200 °C < ±15 μm at > 200 °C	< ±10 μm at ≤ 200 °C < ±15 μm at > 200 °C	< ±10 μm at ≤ 200 °C < ±15 μm at > 200 °C
Heating rates			
200°C	-10 to 25°C < 7 min	-40 to 25°C < 10 min	-60 to 25°C < 15 min
		25 to 200 °C < 20 min	
300°C	-10 to 25°C < 7 min	-40 to 25°C < 10 min	-60 to 25°C < 15 min
		25 to 300 °C < 30 min	
Cooling rates*			
200°C		200 to 25°C < 15 min	
	25 to -10°C < 15 min	25 to -40°C < 20 min	25 to -60°C < 30 min
300°C		300 to 25°C < 25 min	
	25 to -10°C < 15 min	25 to -40°C < 20 min	25 to -60°C < 30 min
Leakage @ 10 V Kelvin Triax (f)			
-60°C	--	--	< 30 fA
-40°C	--	< 30 fA	< 30 fA
-10°C	< 30 fA	< 30 fA	< 30 fA
25°C	< 15 fA	< 15 fA	< 15 fA
200°C	< 30 fA	< 30 fA	< 30 fA
300°C	< 50 fA	< 50 fA	< 50 fA
Capacitance	N/A	N/A	N/A
Maximum voltage between chuck top and GND	500 V DC	500 V DC	500 V DC

*All data are relevant for chucks in ECO mode.

STANDARD ERS THERMAL CHUCKS

Specifications of ERS AC3 Technology

Temperature Range	-10 °C to 200 °C	-40 °C to 200 °C	-60 °C to 200 °C
Connectivity	Kelvin Triax (f)	Kelvin Triax (f)	Kelvin Triax (f)
Temperature control method	Cooling air / Resistance heater	Cooling air / Resistance heater	Cooling air / Resistance heater
Coolant	Air (user supplied)	Air (user supplied)	Air (user supplied)
Smallest temperature selection step	0.1 °C	0.1 °C	0.1 °C
Chuck temperature display resolution	0.01 °C	0.01 °C	0.01 °C
External touchscreen display operation	Yes	Yes	Yes
Temperature stability	±0.08 °C	±0.08 °C	±0.08 °C
Temperature accuracy	±0.1 °C	±0.1 °C	±0.1 °C
Control method	Low noise DC/PID	Low noise DC/PID	Low noise DC/PID
Interfaces	RS232C	RS232C	RS232C
Chuck surface plating	Nickel plated with pinhole surface	Nickel plated with pinhole surface	Nickel plated with pinhole surface
Temperature sensor	Pt100 1/3DIN, 4-line wired	Pt100 1/3DIN, 4-line wired	Pt100 1/3DIN, 4-line wired
Temperature uniformity	< ±0.5 °C at -10 to 200 °C	< ±0.5 °C at -40 to 200 °C	< ±0.5 °C at -60 to 200 °C
Surface flatness and base parallelism	< ±10 μm	< ±10 μm	< ±10 μm
Heating rates			
25 °C	-10 to 25°C < 5 min	-40 to 25°C < 8 min	-60 to 25°C < 10 min
200 °C	25 to 200 °C < 15 min		
Cooling rates*			
200 °C	200 to 25°C < 12 min		
25 °C	25 to -10°C < 12 min	25 to -40°C < 18 min	25 to -60°C < 25 min
Isolation	> 10 TΩ at 25 °C > 2.5 TΩ at 200 °C > 2.5 TΩ at -10 °C	> 10 TΩ at 25 °C > 2.5 TΩ at 200 °C > 2.5 TΩ at -40 °C	> 10 TΩ at 25 °C > 2.5 TΩ at 200 °C > 2.5 TΩ at -60 °C
Capacitance	N/A	N/A	N/A
Maximum voltage between chuck top and GND	500 V DC	500 V DC	500 V DC

*All data are relevant for chucks in ECO mode.

System Controller / Chiller Dimensions and Power / Air Consumption

System type	W x D x H (mm)	Weight (kg)	Power cons. (VA)	max. Air flow*(l/min)
20 to 200 °C / 300 °C	300 x 360 x 140	12	1000	200
-10 to 200 °C / 300 °C	420 x 355 x 450	50	1650	250
-40 to 200 °C / 300 °C	420 x 500 x 1020	140	2400	400
-60 to 200 °C / 300 °C	420 x 500 x 1020	140	2400	400

*All data are relevant for chucks in ECO mode.

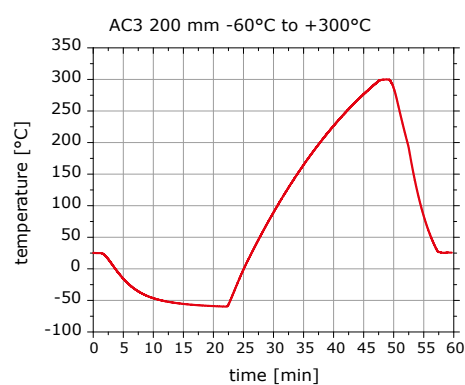
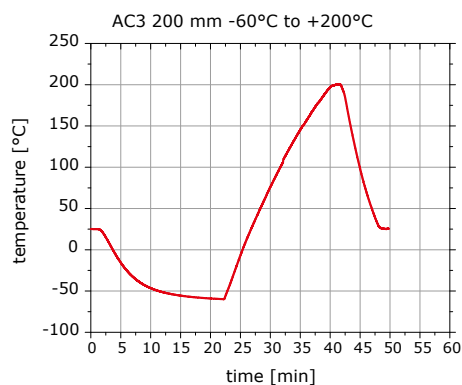
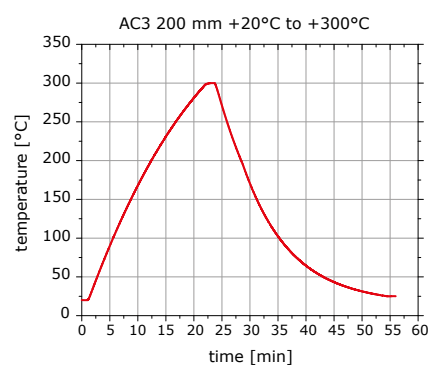
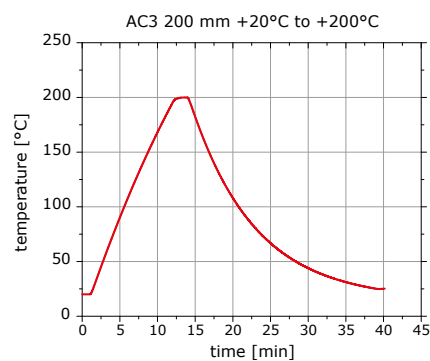


ERS AirCool® (patented) Controller Integrated
Chiller -40°C / -60°C



ERS AirCool® (patented) Controller Integrated
Chiller -10°C

TYPICAL TRANSITION TIME



SYSTEM CONTROLLER SPECIFICATIONS

CPU	Intel® Core™ i7-7700, 3.6 GHz, 8M Cache, 14nm, 65W TDP, LGA1151(4C/8T)
RAM	DDR4 2400 MHz 16 GB x 1
64 bit operating system	Windows 10 Professional (English)
Power	460 W
Storage	SSD 500 GB
LAN	One internal and one external TCP/IP ports
USB Ports	Internal (on PC) x3, external x1
GPIO interface	Optional

SUPPORTED SOFTWARE PLATFORMS

Drivers	WaferPro / IC-CAP & EasyEXPERT from Keysight, BSIMPro & NoisePro from ProPlus, ACS from Keithley
Emulation mode	Available for various prober control software*

* Please contact your local support for more details.

FACILITY REQUIREMENTS

General Probe System

Power	100-240 V AC nominal ; 50/60 Hz
Vacuum	-0.9 bar
Compressed air	6.0 bar

REGULATORY COMPLIANCE

3rd party, TÜV tested according to

- IEC 61010-1: 2010 + Am1:2016; EN 61010-1: 2010; IEC/EN 61010-2-010: 2014; IEC/EN 61010-2-081: 2015; EN ISO 12100: 2010; UL 61010-1: 2012/R: 2016-04; UL 61010-2-010: 2015; CAN/CSA-C22.2 No. 61010-1: 2012/U2: 2016-04; CAN/CSA-C22.2 No. 61010-2-010:2015

and certified for CE and US/Canada (NRTL), SEMI S2 and S8.

Copies of certificates are available on request

WARRANTY

- Warranty*: 12 months
- Extended service contract: contact MPI Corporation for more information

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

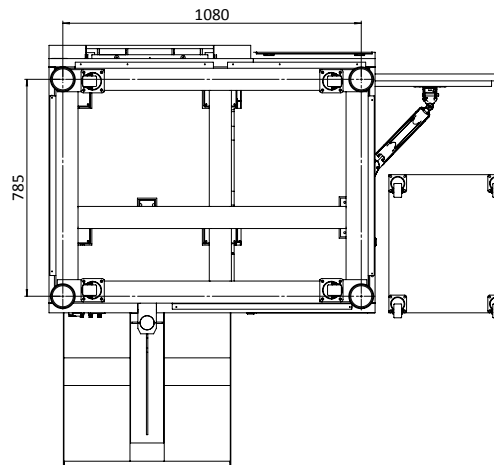
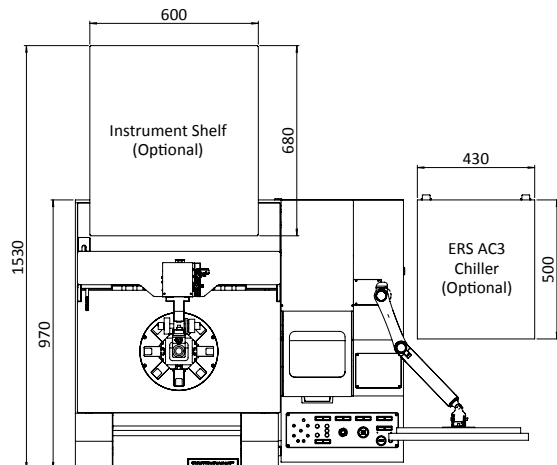
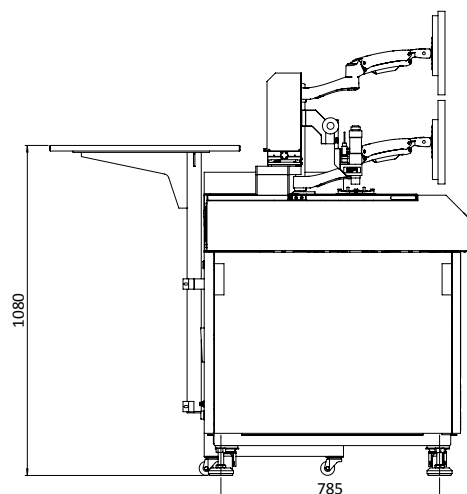
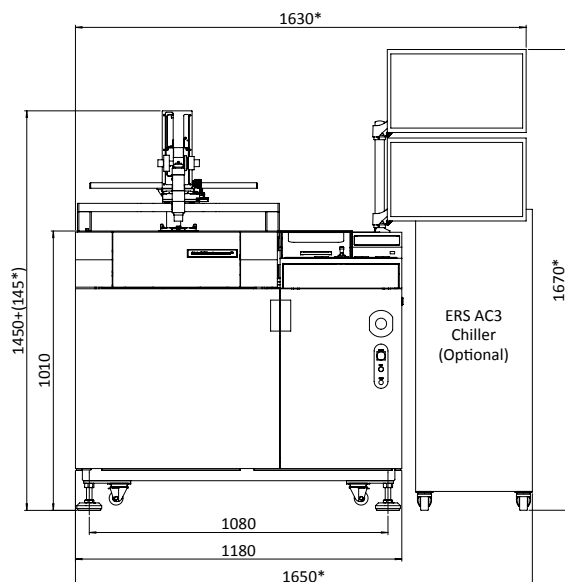
PHYSICAL DIMENSIONS

Specifications

System Dimensions (W x D x H) 1180 x 970 x 1450 mm (46.5 x 38.2 x 57.1 in)

Weight 650 kg (includes anti-vibration table and system accessories)

*Can vary depends on monitor/chiller position.



MPI Global Presence



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