

# MPI TS2000-HP | 200 mm Automated Probe System

## For accurate and reliable High Power measurements

### FEATURES / BENEFITS

#### Dedicated designed for High Voltage and High Current application

- On wafer high power device measurement up to 10kV/600A
- Gold plated chuck surface for minimum contact resistance and vacuum holes optimized for thin wafer handling down to 50  $\mu\text{m}$
- Taiko wafer chuck option
- Dedicated high voltage and high current probes
- Anti-arcing solutions

#### 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 Safety

- Front and advanced automated single wafer side loading capability with easy pre-alignment for automated routines
- Regulatory approved safety interlocked light curtain to protect users
- 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/unload 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 $\mu\text{m}$
Accuracy	< 2.0 $\mu\text{m}$
Repeatability	< 2.0 $\mu\text{m}$
XY stage drive	High resolution stepper motor with linear encoder feedback system
Speed*	4-Speed XY chuck stage adjustable speed movement Slowest: 10 $\mu\text{m}$ / sec   Fastest: 50 mm / sec

#### Chuck Z Stage (Programmable)

Travel range	50 mm (2.0 in)
Resolution	0.2 $\mu\text{m}$
Accuracy	< 2.0 $\mu\text{m}$
Repeatability	< 1.0 $\mu\text{m}$
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 $\mu\text{m}$ / sec   Fastest: 20 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	$\pm 6.0^\circ$
Resolution	0.0004°
Accuracy	< 2.0 $\mu\text{m}$ (measured at the edge of the 200 mm chuck)
Repeatability	< 1.0 $\mu\text{m}$
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

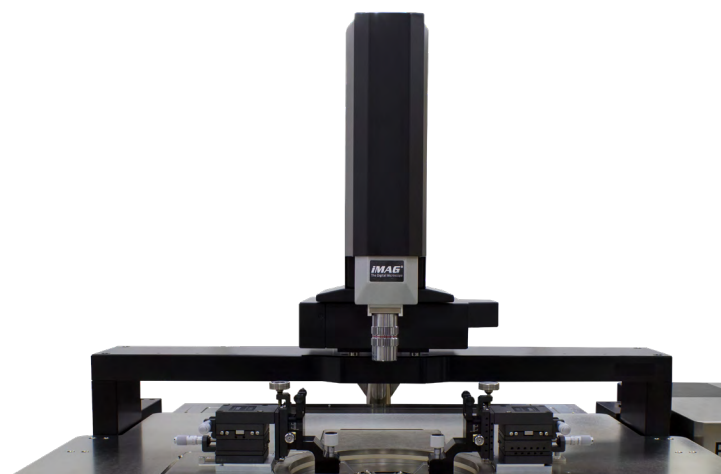
### Wafer Alignment Camera

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
XY - Travel range*	50 x 50 mm	50 x 50 mm	50 x 50 mm / 80 x 80 mm
Resolution	1 $\mu\text{m}$ (0.04 mils)	< 5 $\mu\text{m}$ (0.2 mils)	< 5 $\mu\text{m}$ (0.2 mils)
Repeatability	< 2 $\mu\text{m}$ (0.08 mils)	N/A	N/A
Accuracy	< 5 $\mu\text{m}$ (0.2 mils)	N/A	N/A
Z - Travel range	140 mm	140 mm	140 mm, pneumatic
Resolution	0.05 $\mu\text{m}$ (0.002 mils)	0.05 $\mu\text{m}$ (0.002 mils)	N/A
Repeatability	< 2 $\mu\text{m}$ (0.08 mils)	< 2 $\mu\text{m}$ (0.08 mils)	< 2 $\mu\text{m}$ (0.08 mils)
Accuracy	< 4 $\mu\text{m}$ (0.16 mils)	< 4 $\mu\text{m}$ (0.16 mils)	N/A

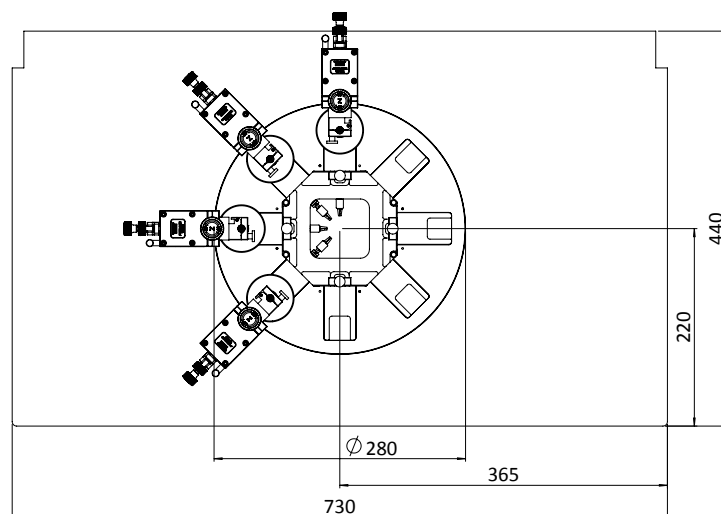
\*In case of ShieldEnvironment™ X x Y: 25 mm x 25 mm



## 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 Setup



Optional MPI MP40 MicroPositioners are shown with the drawing

## ShieldEnvironment™

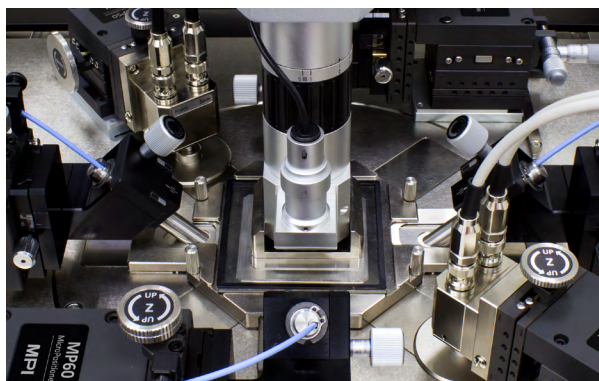
MPI ShieldEnvironment™ is a high performance local environmental chamber providing excellent EMI- and light-tight shielded test environment for ultra-low noise, low capacitance measurements.

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 20 GHz
Light attenuation	≥ 130 dB
Spectral noise floor	≤ -180 dBVrms/rHz (≤ 1 MHz)
System AC noise	≤ 5 mVp-p (≤ 1 GHz)

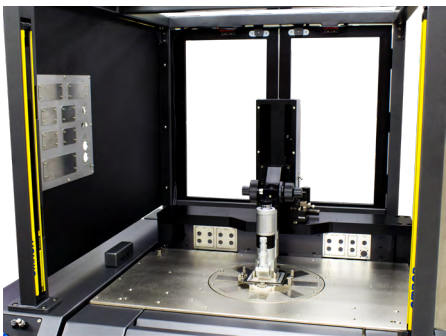
\*Including 4 MicroPositioners.



SAFETY MANAGEMENT

Light Curtain

Light Curtain Interlock protects user from accidental high voltage shock by shutting down the instrument through interlock system. The interlock system at rear doors provides safety, easy and convenient initial measurement set-up.



Optional Anti-Arcing Solution

Specially designed anti-arcing LiquidTray™ can be used for arcing suppressing by simply place on the high power chuck surface. Wafers can be safely placed inside the tray to submerge in the liquid for arcing free high voltage test.



HIGH POWER PROBES - SELECTION GUIDE

	High current probes			High voltage probes		
	3 fingers	5 fingers	7 fingers	PA-HVT	PA-HVC	PA-HVC-10KV
Max current	40 A	65 A	100 A	2 A	2 A	2 A
Max voltage	500 V	500 V	500 V	3,000 V	5,000 V	10,000 V
Residual resistance (Typical)	≤ 5 mΩ	≤ 3 mΩ	≤ 1 mΩ	--	--	--
Leakage @ max. V	--	--	--	≤ 1 pA	≤ 600 pA	> 35 TΩ
Connector options	Banana <sup>[3]</sup> plug or BNC <sup>[4]</sup>			HV triaxial <sup>[2]</sup>	SHV	10 KV UHV or banana <sup>[3]</sup> plug
Replaceable tip	Yes	Yes	Yes	Yes	Yes	Yes
Probe pitch <sup>[1]</sup>	350 μm (Std)	350 μm (Std)	350 μm (Std)	Single needle	Single needle	Single needle

<sup>[1]</sup>Configurable

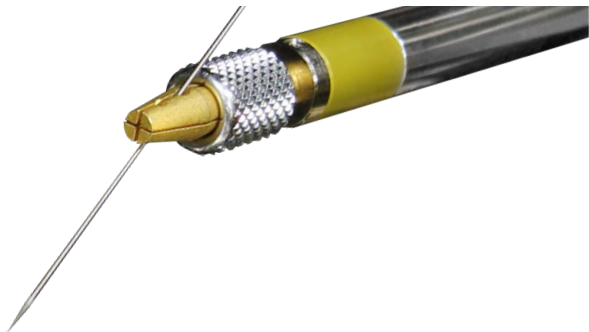
<sup>[2]</sup>Keysight or Keithley

<sup>[3]</sup>Banana: 100 A max, 1 ms max PW, 1% max PLC

<sup>[4]</sup>BNC: 40 A max, 1 ms max PW, 1% Max PLC

High Voltage Probes (HVP)

Low leakage probes specially designed to withstand high voltage up to 10 kV (coaxial) and 3 kV (triaxial). Choice of various connectors options such as Keysight Triax/UHV, Keithley Triax/UHV, SHV or Banana.



### High Current Probe (HCP)

High performance probes specially designed for on wafer measurement of high current up to 200 A (pulse). MPI multi-fingers high current probes are single piece construction to efficiently handle high current and provide low contact resistance.



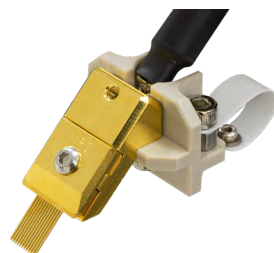
## ULTRA HIGH POWER PROBES - SELECTION GUIDE

	1 finger	4 fingers	6 fingers	8 fingers	12 fingers
Max current*	20 A	80 A	120 A	160 A	250 A
Max voltage	10 KV	10 KV	10 KV	10 KV	10 KV
Residual resistance (Typical)	≤ 5 mΩ	≤ 3 mΩ	≤ 1 mΩ	≤ 1 mΩ	≤ 1 mΩ
Connector options	Banana	Banana	Banana	Banana	Banana
Replaceable tip	Yes	Yes	Yes	Yes	Yes
Probe tip width	250 μm	250 μm	250 μm	250 μm	250 μm
Probe pitch	--	650 μm	650 μm	650 μm	650 μm

\*1 ms Max PW, 0.4% max PLC

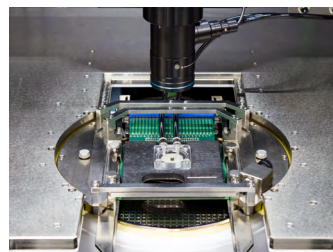
### Ultra High Power Probe (UHP)

Designed for Ultra high voltage and current on wafer measurement up to 10 kV/600 A (pulse). MPI replaceable multi-fingers probes tips and probe arms are design for low contact resistance for ultra-high current measurement and to support ultra-high voltage of up to 10 KV, without having to change probes for high voltage and current application.



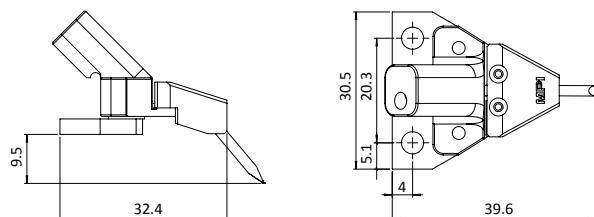
### Optional Anti-Arcing Probe Card

The anti-arcing probe card has a capability to apply high-pressure around the DUT and by using the Paschen law to prevent arcing between the pads.

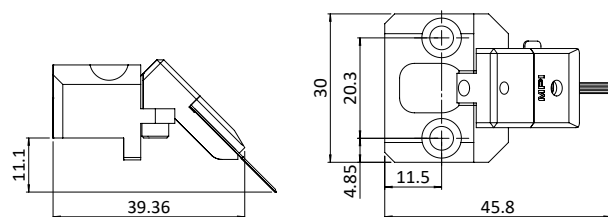


## DIMENSIONS

### High current probe



### Ultra High Power probe





## KEY FEATURES

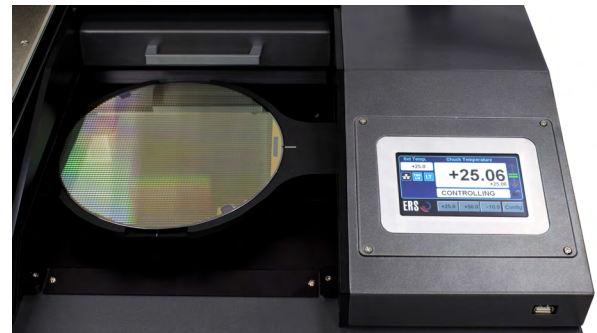
### Automated Single Wafer Loader

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.



### Integrated Active Vibration Isolation

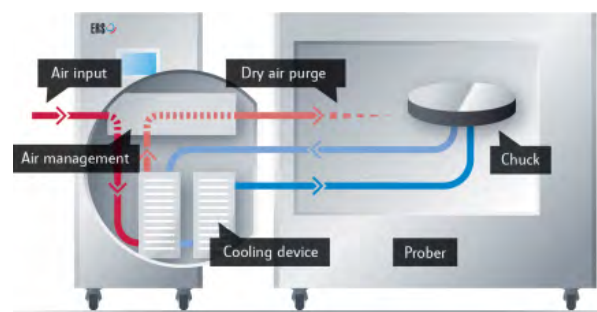
Highly effective vibration insulation with automatic level controlled air-spring damping system.

Internal frequency: 2.5 Hz  
Automatic load leveling.



### 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

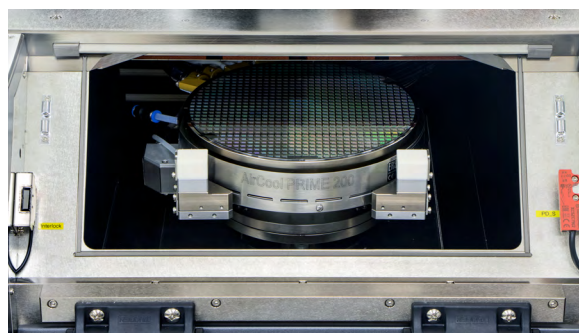
The hardware system controller is completely integrated into the probe system and designed to provide faster, safer and a more convenient probe system control and test operation. The keyboard and mouse are strategically located to control the software if necessary, as well as the Windows® based instrumentation.



### OPTIONAL FEATURES

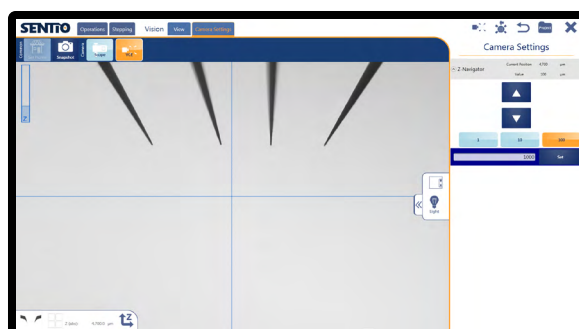
#### Safety Test Management STM™ Option

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.



#### Vertical Control Environment™ (VCE™)

The VCE™ allows the probing area to be observed from the side for safe operation. It automatically detects the height of the tips and defines the position of the chuck contact. The wizard-guided setup procedure takes into account working with probe cards and DC or RF probes. It saves time during initial contacting and prevents damage to probes or pads, especially in the covered MPI ShieldEnvironment™.



#### mDrive™

In addition to the standard joystick control, mDrive™ provides a truly intuitive, manual, one or two hands operation of all existing programmable stages, such as chuck, scope or MicroPositioners. X- and Y-axis fine control is available for the selected stage, where Z safety function requires additional enabling.



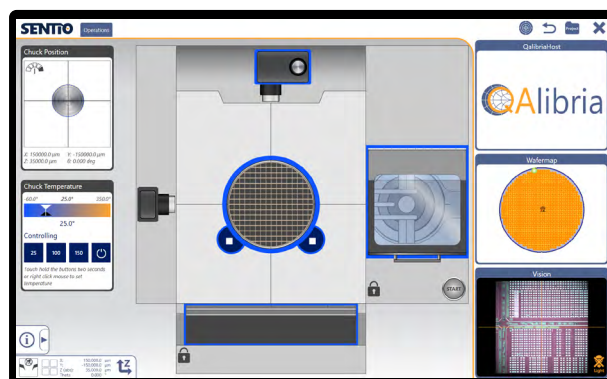
#### Probe Hover Control PHC™

MPI Probe Hover Control PHC™ Allows easy manual control of probe contact and separation to wafer. Separation distance can accurately control with micrometer feedback for probe to wafer/pad positioning. Ease of use guarantees the safest operation by minimizing error during critical set-up and probe change operations.



## 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.



## NON-THERMAL HIGH POWER CHUCKS

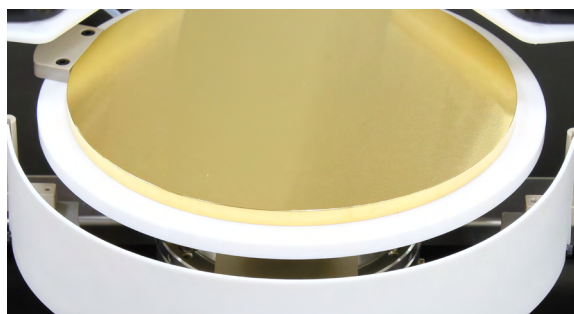
### High Power Wafer Chucks

Connectivity 1	10 kV Coaxial (Banana or SHV)
Connectivity 2	Kelvin Triax (f), 3 kV or 10 kV Coaxial
Diameter	210 mm with 2 integrated AUX areas
Material	Gold plated aluminum (flat with 100 $\mu$ m 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
SmartVacuum™ distribution	In center for 5x5 mm (4 holes), 100, 150, 200 mm (4, 6, 8 in)
Supported DUT sizes	Single DUTs down to 5 x 5 mm size or wafers 100 mm (4 in) thru 200 mm (8 in)*
Surface planarity	$\leq \pm 5 \mu$ m
Rigidity	< 15 $\mu$ m / 10 N @edge

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

### Electrical Specification (Triax)

Chuck isolation	> 30 T $\Omega$
Force to guard	> 30 T $\Omega$
Guard to shield	> 500 G $\Omega$
Force to shield	> 100 G $\Omega$



MPI Non-thermal Triaxial High Power Chuck with gold plated surface for low contact resistance



MPI 10 kV Triaxial Connector used for Kelvin chuck connection



## HIGH POWER THERMAL CHUCKS

### Specifications of MPI ERS Integrated Technology

Temperature Range	20 to 200 °C	20 to 300 °C
Connectivity	Kelvin Triax (f), 3 kV or 10 kV Coaxial	Kelvin Triax (f), 3 kV or 10 kV Coaxial
Temperature control method	Cooling air / Resistance heater	Cooling air / Resistance heater
Coolant	Air (user supplied)	Air (user supplied)
Smallest temperature selection step	0.1 °C	0.1 °C
Chuck temperature display resolution	0.01 °C	0.01 °C
External touchscreen display operation	Yes	Yes
Temperature stability	±0.08 °C	±0.08 °C
Temperature accuracy	0.1 °C	0.1 °C
Control method	Low noise DC/PID	Low noise DC/PID
Interfaces	RS232C	RS232C
Chuck surface plating	Gold plated with pinhole surface	Gold plated with pinhole surface
SmartVacuum™ distribution	In center for 5x5 mm (4 holes), 100, 150, 200 mm (4, 6, 8 in)	
Temperature sensor	Pt100 1/3DIN, 4-line wired	Pt100 1/3DIN, 4-line wired
Temperature uniformity	< ± 0.5 °C	< ±0.5 °C at ≤ 200 °C < ±1.0 °C at > 200 °C
Surface flatness and base parallelism	< ±10 μm	< ±10 μm at ≤ 200 °C < ±15 μm at > 200 °C
Heating rates	20 to 200 °C < 31 min	20 to 300 °C < 39 min
Cooling rates*	200 to 20 °C < 57 min	300 to 20 °C < 55 min
Maximum voltage between chuck top and GND	10 kV DC	10 kV DC
Leakage @ 10 V Kelvin Triax (f)		
-60 °C, -40 °C and -10 °C	--	--
25 °C	< 15 fA	< 15 fA
200 °C	< 30 fA	< 30 fA
300 °C	--	< 50 fA
Leakage @ 3000 V Kelvin Triax (f)		
-60 °C, -40 °C and -10 °C	--	--
25 °C	< 5 pA	< 5 pA
200 °C	< 10 pA	< 10 pA
300 °C	--	< 15 pA
Leakage @ 10 kV Coax UHV/SHV (f)		
-60 °C, -40 °C and -10 °C	--	--
25 °C	< 6 nA	< 6 nA
200 °C	< 6 nA	< 6 nA
300 °C	--	< 6 nA

\* All data are relevant for chucks in ECO mode.

**Specifications of MPI ERS Integrated Technology**

Temperature Range	-10 to 200 °C/300 °C	-40 to 200 °C/300 °C	-60 to 200 °C/300 °C
Connectivity	Kelvin Triax (f), 3 kV or 10 kV Coaxial		
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	0.1 °C	0.1 °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	Gold plated with pinhole surface		
SmartVacuum™ distribution	In center for 5x5 mm (4 holes), 100, 150, 200 mm (4, 6, 8 in)		
Temperature sensor	Pt100 1/3DIN, 4-line wired		
Temperature uniformity	< ±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
Maximum voltage between chuck top and GND	10 kV DC	10 kV DC	10 kV DC
Heating rates			
200 °C	-10 to 25 °C < 3 min	-40 to 25 °C < 7 min	-60 to 25 °C < 8 min
		25 to 200 °C < 20 min	
300 °C	-10 to 25 °C < 3 min	-40 to 25 °C < 7 min	-60 to 25 °C < 8 min
		25 to 300 °C < 36 min	
Cooling rates*			
AC3 Mode	300 °C	300 to 25 °C < 17 min	300 to 25 °C < 17 min
	200 °C	200 to 25 °C < 14 min	200 to 25 °C < 15 min
	25 °C	25 to -10 °C < 12 min	25 to -40 °C < 13 min 25 to -60 °C < 25 min
TURBO Mode	300 °C	300 to 25 °C < 17 min	300 to 25 °C < 16 min
	200 °C	200 to 25 °C < 14 min	200 to 25 °C < 13 min
	25 °C	25 to -10 °C < 12 min	25 to -40 °C < 13 min 25 to -60 °C < 25 min
Leakage @ 10 V Kelvin Triax (f)			
-60 °C, -40 °C and -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
Leakage @ 3000 V Kelvin Triax (f)			
-60 °C, -40 °C and -10 °C	< 10 pA	< 10 pA	< 10 pA
25 °C	< 5 pA	< 5 pA	< 5 pA
200 °C	< 10 pA	< 10 pA	< 10 pA
300 °C	< 15 pA	< 15 pA	< 15 pA

## Leakage @ 10 kV Coax UHV/SHV (f)

-60 °C, -40 °C and -10 °C	--	--	--
25 °C	< 6 nA	< 6 nA	< 6 nA
200 °C	< 6 nA	< 6 nA	< 6 nA
300 °C	< 6 nA	< 6 nA	< 6 nA

\*Typical data for all chucks based on FPS requirements.

## Thermal Controller Dimensions / Power and 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 135	12	700	200

## ERS AC3 Chiller Dimension / Power and Air Consumption

System type	W x D x H (mm)	Weight (kg)	Power cons. (VA)	max. Air flow* (l/min)
-10 °C to 200 °C / 300 °C	420 x 355 x 450	50	1650	250
-40 °C to 200 °C / 300 °C	422 x 1020 x 500	140	2400	400
-60 °C to 200 °C / 300 °C	422 x 1020 x 500	140	2400	400

\* All data are relevant for chucks in ECO mode.



ERS High Power Thermal Chuck



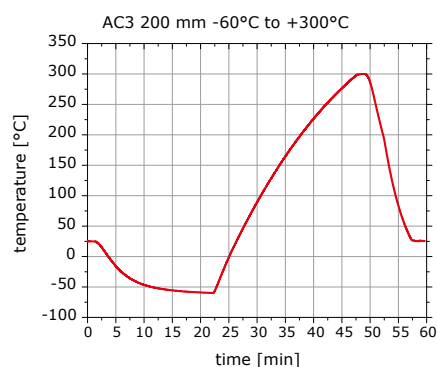
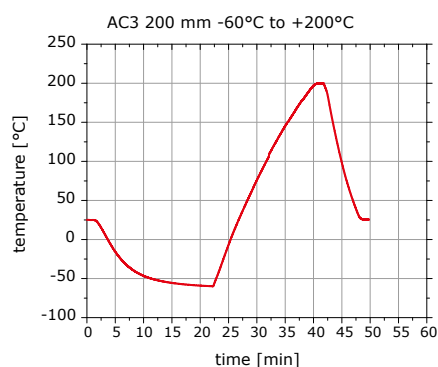
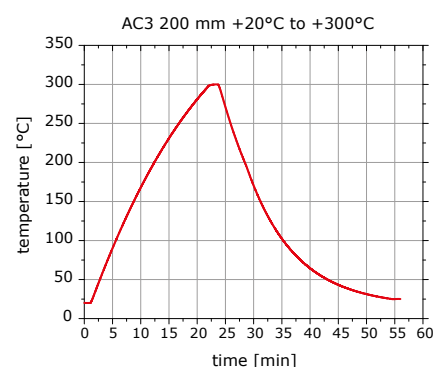
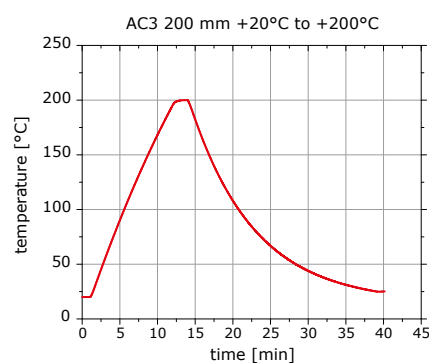
ERS AirCool® Fusion\*, Controller Integrated Chiller -40 °C / -60 °C

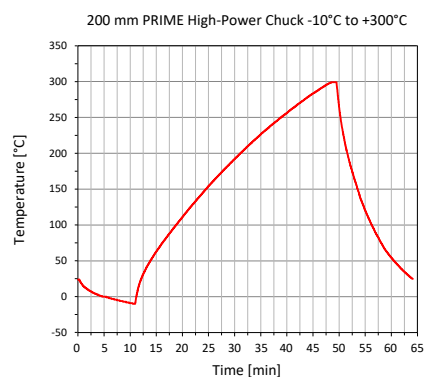


ERS AirCool® Fusion\*, Controller Integrated Chiller -10 °C

\*ERS electronic GmbH patented solution

## TYPICAL TRANSITION TIME





## SYSTEM CONTROLLER SPECIFICATIONS

CPU	Intel Core i7
RAM	16 GB
64 bit operating system	Windows 10 Professional (English) 64 bit
Storage	500 GB SSD
LAN	1 x internal, 1 x external TCP/IP port
USB Ports	3 x internal, 1 x external
GPIB 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

### Thermal Chuck Electrical Supply

Electrical primary connection	100 to 240 VAC auto switch
Electrical frequency	50 Hz / 60 Hz
Operating pressure	6.0 bar (0.6 MPa, 87 psi) at specified flow rate
CDA dew point	≤ 0 °C for hot chuck system (ambient to 300 °C) ≤ -45 °C for hot and cold chuck system (-60 °C to 300 °C)

\* Please contact your local support for more details.



## INSTRUMENT CONNECTION PACKAGE

TS2000-HP can be configured with instrument connection package. The packages consists of necessary high voltage/high current probes and cabling accessories for optimal connection to the test instruments.

### Keysight B1505A

Seven MP40 MicroPositioners

Two RF probe arms for MP40

Five universal DC adapters

Two High-current probes

Three High-voltage (Coax) probe arms

Two High-voltage probe arms with Keysight HV Triax connector

Box of High-current multi-finger probe tips (5 tips)

Box of probe tips needle (25 tips)

High Power connection panel for Dark Box

Three High power chuck connection cables (Keysight Triax, SHV and BNC)

High Power chuck shorting and floating plugs

### Keithley 2600-PCT-XB

Five MP40 MicroPositioners

Two RF probe arms for MP40

Three universal DC adapters

Two High-current probes

Three High-voltage probe arms with Keithley HV Triax connector

Box of High-current multi-finger probe tips (5 tips)

Box of probe tips needle (25 tips)

High Power connection panel for Dark Box

Three High power chuck connection cables (Keithley Triax, SHV and BNC)

High Power chuck shorting and floating plugs

## 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

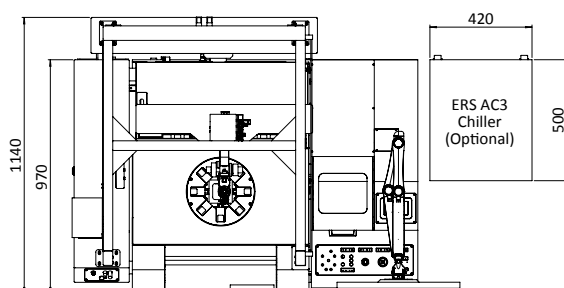
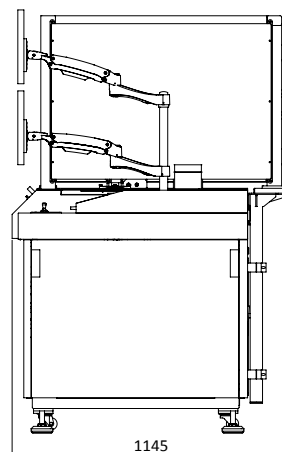
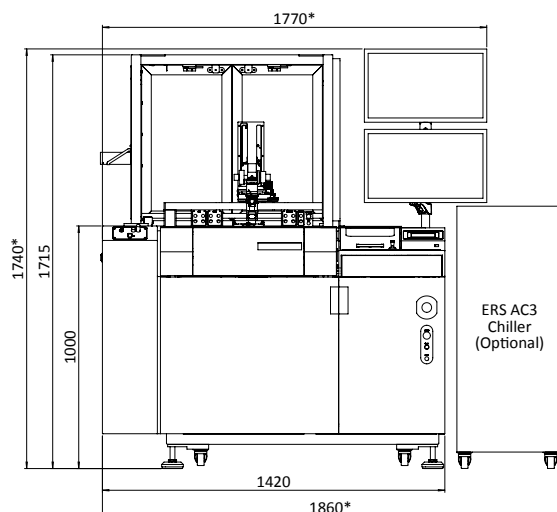
\*See MPI Corporation's Terms and Conditions of Sale for more details.

## PHYSICAL DIMENSIONS

### Specifications

System Dimensions (W x D x H)	1420 x 1140 x 1740 mm (55.9 x 44.9 x 68.5 in)
Weight	700 kg (includes anti-vibration table and system accessories)

\*Can vary depends on monitor/chiller position.



### MPI Global Presence

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

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