

# Cascade

# EVOLVITY™ 300

## 300 mm semi-automated Probe System

### > Overview

The EVOLVITY™ 300 is FormFactor's latest semi-automated engineering wafer probe system, complementing our proven CM300 product line. EVOLVITY 300 focuses on simplifying on-wafer probing with a compact, easy-to-use 300 mm system. It is specifically designed to meet the needs of RF/DC modelling and device characterization tasks such as

- IV / CV testing
- S-Parameter characterization
- Load-pull testing
- DC parametric testing using probe cards
- DC needle tests using parametric instruments like the Keysight B1500, E8720, 4156, Keithley 4200

Building on the proven legacy of Cascade's S300 and Elite probers, the EVOLVITY 300 provides a flexible, space-efficient platform that easily integrates into existing laboratory floor plans.



FormFactor's new EVOLVITY 300 is the industry's only probe station that seamlessly pivots between RF and DC measurements in real-time without risk, limitations, or uncertainty.



### > Features / Benefits

<b>Low Volume Microchamber</b>	<ul style="list-style-type: none"><li>• EMI and light shielded, dry shielded, dry environment for measurements down to -60°C</li></ul>
<b>Exchangeable Platen Inserts</b>	<ul style="list-style-type: none"><li>• TopHat, probe card holder, IceShield can be easily swapped enabling multiple applications and wafer sizes on one single probe station</li></ul>
<b>Mechanical Platen Lift</b>	<ul style="list-style-type: none"><li>• Mechanical Platen Lift for 100% alignment safety during complex RF setups</li></ul>
<b>Roll-out Stage</b>	<ul style="list-style-type: none"><li>• For safe wafer loading from the front with full access to thermal chuck and auxiliary sites</li></ul>
<b>Automation Options</b>	<ul style="list-style-type: none"><li>• Fully compatible and upgradable with FormFactor's Autonomous Assistants AutoDC and AutoRF</li></ul>
<b>Ergonomics</b>	<ul style="list-style-type: none"><li>• Adjustable floor-to-platen height</li></ul>
<b>Spacious Platen Design</b>	<ul style="list-style-type: none"><li>• Flexibility for any RF or DC setup without space limits</li></ul>
<b>Compact Footprint</b>	<ul style="list-style-type: none"><li>• Allowing 1:1 replacement of legacy Cascade S300/Elite probers</li></ul>

## System Components

Instrument shelf for customer equipment (option)

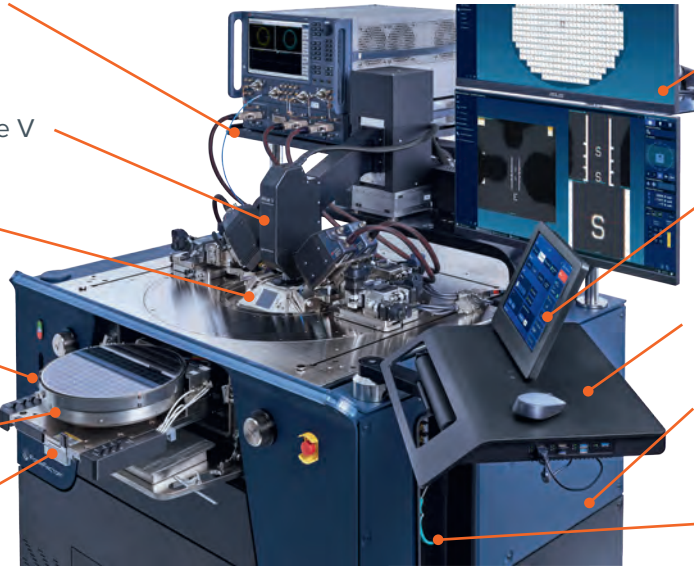
Microscope bridge with programmable stage and eVue V

Platen insert as interface to MicroChamber

Mechanical platen lift

FemtoGuard triaxial thermal chuck

Manual loading via roll-out stage



Controller PC with Velox Software, dual monitors

Velox Dash (optional)

User interface keyboard, mouse

Compact MicroChamber for EMI shielded, dark and dry conditions

Air gun integrated

## System Configuration Options

<b>Default Configuration</b> <b>(always included)</b>	<ul style="list-style-type: none"> <li>• Controller Software Velox 3.x with Windows 10/11, Dual Monitor (27")</li> <li>• Control console with keyboard, mouse, USB Access to PC at front</li> <li>• Mechanical platen lift, XY knobs</li> <li>• AttoGuard Microchamber, suitable for establishing a dark, dry, and EMI shielded measurement environment</li> <li>• FemtoGuard triaxial thermal chuck</li> <li>• Auxiliary chuck with 3 sites for cleaning, calibration, and planarization</li> <li>• Programmable XYZTheta chuck stage</li> <li>• Programmable XYZ microscope stage</li> <li>• Manual wafer loading via roll-out stage at front</li> <li>• Air gun integrated</li> <li>• Vibration isolation table</li> </ul>
<b>Exchangeable Platen Inserts Options</b>	<ul style="list-style-type: none"> <li>• 8-sided TopHat enabling dark, dry and EMI shielded MicroChamber environment.</li> <li>• 4-sided RF TopHat.</li> <li>• Probe card holder.</li> <li>• IceShield.</li> </ul>
<b>Thermal System Options</b>	<ul style="list-style-type: none"> <li>• -40°C to +300°C (chiller and controller)</li> <li>• -60°C to +300°C (chiller and controller)</li> <li>• Controlled ambient: +20°C to +300°C (controller and booster)</li> </ul>
<b>eVue Microscope Options</b>	<ul style="list-style-type: none"> <li>• eVue V 10x</li> <li>• eVue V 10x Pro, eVue V 40x Pro</li> </ul>
<b>User Interface Options</b>	<ul style="list-style-type: none"> <li>• Keyboard, mouse, Velox Dash (option)</li> </ul>
<b>Autonomous Assistants</b>	<ul style="list-style-type: none"> <li>• Auto Align, Auto XY, Auto Z, Auto <math>\theta</math>, VueTrack, Autonomous RF (option), Autonomous DC (option)</li> </ul>
<b>Shelf Options</b>	<ul style="list-style-type: none"> <li>• VNA shelf, side shelf, corner shelf</li> </ul>

> Programmable Chuck Stage

	X-Y Stage	Z Stage	Theta Stage
Travel	301 mm x 301 mm (11.9 in. x 11.9 in.)	10 mm (0.4 in.)	± 3.75°
Repeatability	≤ 1 µm (0.04 mils)	≤ 1 µm (0.04 mils)	≤ 1 µm (0.04 mils)*, ≤0.0004°
Accuracy	≤ 2 µm (0.08 mils)	≤ 5 µm (0.08 mils) (small movements)	≤ 2 µm (0.08 mils) (small movements) ≤ 5 µm (0.2 mils) (large movements)
Speed	50 mm/s (2 in./s)	9 mm/s (0.8 in./s)	

*\*Measured at the edge of the chuck*

> MicroChamber

Interfaces

Platen Insert Options	TopHat, probe card holder, IceShield
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MicroChamber Purge

Purge	Clean Dry Air (CDA)
Purge control	Manual
Purge flow rate	Maintenance: 80 liters/min (adjustable), maximum: 170 liters/min

Electrical

EMI shielding	> 30 dB (typical) @ 1 kHz to 1 MHz (with TopHat or probe card holder)
Spectral noise floor*	≤ -170 dBVrms/rtHz (≤ 1 MHz) (with TopHat or probe card holder with cover)
System AC noise**	≤ 5 mVp-p (≤ 1 GHz)
Light attenuation	≥ 130 dB (with TopHat or probe card holder)

\* Typical results. Test setup: Triaxial thermal chuck, 50 Ω termination, high quality LNA, and DSA/DSO instrument.

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



Platen System

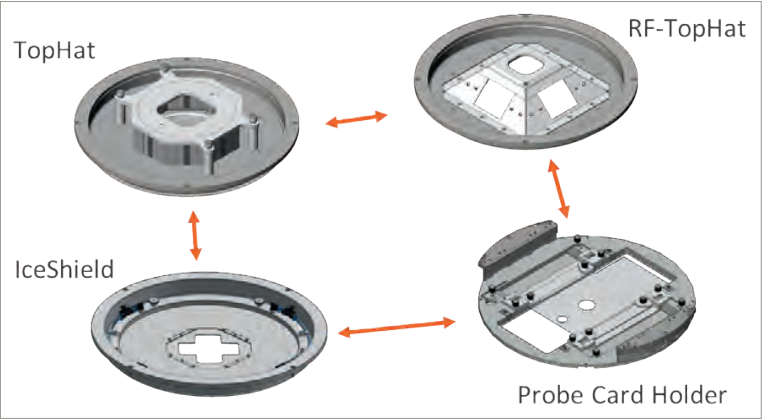
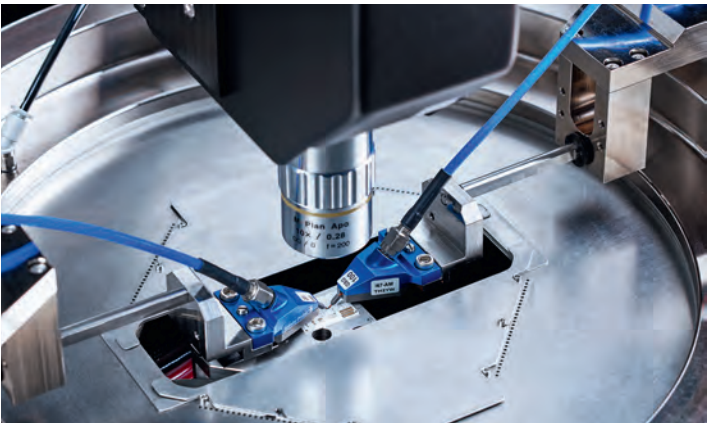
<b>Platen</b>	
Dimensions (width x depth)	968 mm x 831 mm (38.1 in. x 32.7 in.)
Platen-to-chuck height	40.0 ± 0.5 mm (1.575 in. ± 0.02 in.)
Platen lift range	3.0 mm (0.12 in.)
Mounting system	Kinematic, high thermal stability enhanced
Thermal management	Integrated laminar-flow air-cooling for thermal expansion control (switchable)
Accessory mounting	Rail System: 53 cm (21 in.) Left / Right, 70 cm (28 in.) Rear Rail

<b>Platen Ring</b>	
Diameter	717.6 mm (28.25 in.)
Compatibility	Magnetic positioners, bolt down positioners, and vacuum positioners

<b>Platen Insert</b>	
Diameter	342.9 mm (13.5 in.)
Compatibility	TopHat, IceShield, probe card holder (also from SUMMIT200 <sup>1</sup> , ELITE <sup>1</sup> )

<sup>1</sup> Only standard parts. Chuck-top to platen-top distance 40 mm

IceShield (option)



IceShield™ is an optional platen insert that can be used as an open alternative to the TopHat. It enables frost-free operation down to -60°C<sup>1</sup> in an open environment. It is ideal for applications that require short cable lengths, such as S-parameter and load-pull measurements, and do not require EMI shielding or a dark measurement environment.

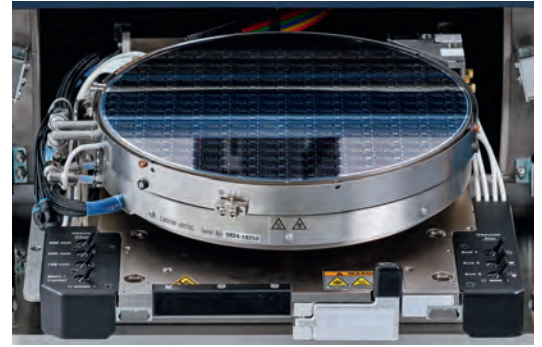
Design	IceShield Platen Insert including 4 different aperture shapes. Modular design, easy to swap IceShield with TopHat, or Probe Card Holder.
Features	Frost-free operation down to -60°C <sup>1</sup> Open interface, no EMI-shielding, no dark measurement environment

<sup>1</sup> -40°C requiring ambient conditions of 50% relative humidity at 23°C. -60°C requiring 25% rel. humidity at 23°C

## ➤ Wafer Chuck and Auxiliary Chuck

### Wafer Chuck

Diameter	305 mm (12 in.)
Type	FemtoGuard Triaxial Thermal Chuck
DUT sizes supported	Shards (10 mm x 10 mm), wafers up to 300 mm (12 in.)
Vacuum rings	7 mm, 66 mm, 130 mm, 180 mm, 280 mm
Vacuum-ring actuation	Center, 66 mm & 130 mm, 180 mm, 280 mm
Planarity incl. stage movement (with active z-profiling)	+/-5 $\mu$ m (0.2 mils)



### Auxiliary Chuck

Type	One planarizable Auxiliary Chuck including 3 sites for calibration, cleaning, and planarization. Including fiducials and stop pins as alignment aid.
Material options	Eccosorb, ceramic, steel
Vacuum actuation	Manual toggle switches, at front of rollout
Planarity	Planarity +/- 5 $\mu$ m, adjustable

## ➤ Platform

### General

Wafer Loading	Manual wafer loading via roll-out chuck on front of the prober, enabling full access to wafer chuck and aux chucks
User Interfaces	Dual 27" monitor, keyboard tray with keyboard and mouse, or Velox Dash (option)
Vibration Dampening System	Built-in vibration isolation
Vibration Attenuation	0 dB @ 6Hz, 5 dB per octave @ 6Hz to 48Hz, 15 dB above 48 Hz
Chuck stepping time	$\leq 0.75$ sec (200 $\mu$ m Z down – 800 $\mu$ m X-Y – 200 $\mu$ m Z up)

### User Ports

At Front	USB 3.2 Type A ports integrated into keyboard tray
At Back	4x USB 3.2 Type A
	4x LAN for customer use
	6x IEC power outlets for customer equipment. Current limited by 6.3 A fuse for 6-port outlet strip.
	Edge Sense (DSUB DE9), probe card contact sense, normally closed (NC)
	General Purpose output (DSUB DE9), for custom defined applications, e.g. Inker
	Interlock Outlet
	1x GPIB via USB (option)

### Sound level

Constant Level	$\leq 60$ dB (A)
Peak Level	$\leq 74$ dB (A)

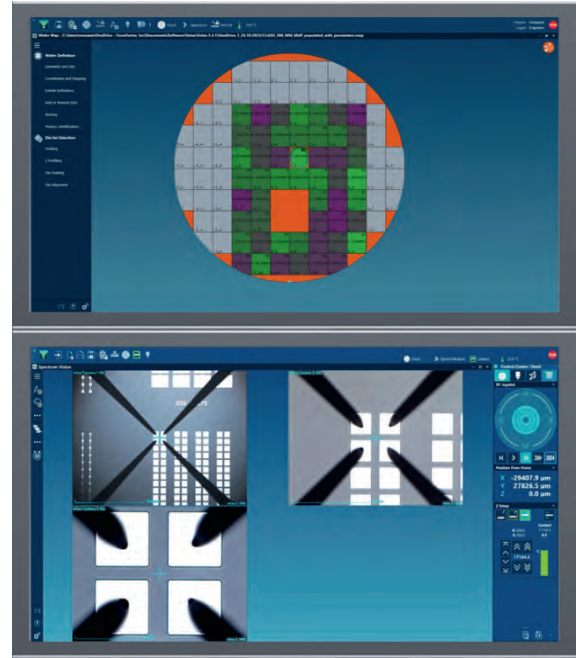


## ➤ Station Controller PC and Software

The EVOLVITY 300 is equipped with a high-performance controller PC including Velox probe station control software and Windows 10 operating system.

### Velox Probe Station Control Software

- **User-centered design**  
Minimized training costs and enhanced efficiency.
- **Smart automation features**  
Faster time to data due to reduced test cycle times.
- **Hundreds of tuneable options**  
High flexibility for a large variety of applications.
- **Simplified operation for inexperienced users**  
Reduced training costs with Workflow Guide and condensed graphical user interface.
- **Integrated Python Development Environment**  
Including Syntax Highlighting, AutoComplete, Debugger, Integrated Documentation.
- **Velox Integration Tool Kit**  
Enables integration of the prober into Customer Test Executives, supporting LabView, C++, C#, Visual Basic, MatLab.
- **Velox Interval Backup**  
Automated Backup with easy-to-use recovery function.



## ➤ Thermal Chuck Performance

### FemtoGuard® Thermal Chuck Performance

		@ -55°C	@ -40°C	@ 25°C	@ 200°C
Resistance <sup>1</sup>	Force-to-Guard	$\geq 5 \times 10^{12} \Omega$	$\geq 5 \times 10^{12} \Omega$	$\geq 5 \times 10^{12} \Omega$	$\geq 5 \times 10^{11} \Omega$
	Guard-to-Shield	$\geq 5 \times 10^{11} \Omega$	$\geq 5 \times 10^{11} \Omega$	$\geq 5 \times 10^{11} \Omega$	$\geq 5 \times 10^{10} \Omega$
	Force-to-Shield	$\geq 5 \times 10^{12} \Omega$	$\geq 5 \times 10^{12} \Omega$	$\geq 5 \times 10^{12} \Omega$	$\geq 5 \times 10^{11} \Omega$
Capacitance <sup>2</sup>	Force-to-Guard	$\leq 1100 \text{ pF}$	$\leq 1100 \text{ pF}$	$\leq 1100 \text{ pF}$	$\leq 1100 \text{ pF}$
	Guard-to-Shield	$\leq 5000 \text{ pF}$	$\leq 5000 \text{ pF}$	$\leq 5000 \text{ pF}$	$\leq 5000 \text{ pF}$

### System Electrical Performance

	Thermal Controller Off	@ -55°C	@ -40°C	@ 25°C	@ 200°C
Probe leakage <sup>3</sup>	$\leq 1 \text{ fA}$	$\leq 5 \text{ fA}$	$\leq 5 \text{ fA}$	$\leq 5 \text{ fA}$	$\leq 5 \text{ fA}$
Chuck leakage <sup>3</sup>	$\leq 3 \text{ fA}$	$\leq 6 \text{ fA}$	$\leq 6 \text{ fA}$	$\leq 3 \text{ fA}$	$\leq 3 \text{ fA}$

### System Capacitance

Residual capacitance <sup>4</sup>	$\leq 2.5 \text{ pF}$
Capacitance variation <sup>4</sup>	$\leq 2 \text{ fF}$

Breakdown Voltage <sup>5</sup>	$> 500 \text{ V}$
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<sup>1</sup> 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.

<sup>2</sup> The chuck layer capacitance is measured with a B1500 with HR-SMU B1517, the FormFactor program "CAP\_F-G-300pA" at defined test conditions.

<sup>3</sup> 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.

<sup>4</sup> The residual (triaxial) chuck capacitance is measured with a B1500 with HR-SMU B1517 with the FormFactor program "Cap-Trx-3pA" at defined test conditions on prober with standard TopHat installed. This corresponds to the chuck capacitance variation over the chuck area (300 mm), as measured by a stationary DC probe.

<sup>5</sup> Tested between Force and Guard, and Guard and Shield.

## ➤ Thermal System Performance

### ATT Thermal System

Model	<b>TS-428-14E/R</b> <b>TS-418-14E/R</b>	<b>TS-428-08P/R</b>	<b>TS-418-02T</b>	<b>TS-418-05T</b>
Components	Controller, Chiller	Controller, Chiller	Controller	Controller, Booster
Type	Air-cooled	Air-cooled	Air-cooled	Air-cooled
Temperature range	-60°C to +300°C	-40°C to +300°C	+30°C to 300°C	+20°C to 300°C
Resolution	0.1°C	0.1°C	0.1°C	0.1°C
Chuck temperature accuracy <sup>1,2</sup>	+/- 2.5°C	+/- 2.5°C	+/- 2.5°C	+/- 2.5°C
Thermal uniformity <sup>3</sup>	1.0°C @25°C 2.0°C @-60°C 2.0°C @200°C	1.0°C @25°C 2.0°C @-40°C 2.0°C @200°C	1.0°C @30°C 2.0°C @200°C	1.0°C @25°C 2.0°C @200°C

### ATT Thermal Transition Times<sup>4</sup>

Cooling				
25°C to -40°C	20 min	60 min	-	-
25°C to -60°C	45 min	-	-	-
200°C to 25°C	20 min	35 min	60 min (200°C to 30°C)	80 min (200°C to 25°C)
Heating				
-55°C to 25°C	7 min	-	-	-
-40°C to 25°C	5 min	5 min	-	-
25°C to 200°C	20 min	20 min	20 min (30°C to 200°C)	23 min

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

<sup>2</sup> The test setup can change the wafer temperature accuracy from the calibration by  $\pm 5^\circ\text{C}$  (typical). Test setup attributes include with or without TopHat, probe card holder, or IceShield, probe or probe card construction and number of contacts, purge air flow rate, and lab environmental conditions.

<sup>3</sup> Peak-to-peak temperature measurement variation across probing sites.

<sup>4</sup> Typical values, facilities media according to requirements as defined in the Facility Planning Guide.

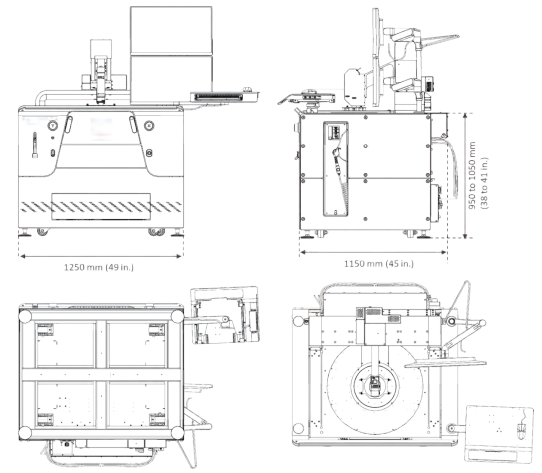
## ➤ Microscope Bridges/Transports

### Programmable Microscope Bridge/Transport for eVue V Microscope System

Bridge material	Mineral casting	
Transport type	Stepper motor with encoder	
Planarity	10 $\mu\text{m}$ (0.4 mils) over full travel	
	<b>XY-axis</b>	<b>Z-axis</b>
Travel	50 mm x 50 mm (2 in. x 2 in.)	125 mm (4 in.)
Travel inside 8-sided TopHat and shielded probe card holders	26 mm x 26 mm (1 in. x 1 in.)	125 mm (4 in.)
Travel inside 4-sided RF TopHat	5 mm x 5 mm (0.2 in. x 0.2 in.)	125 mm (4 in.)
Resolution	1 $\mu\text{m}$	0.4 $\mu\text{m}$
Repeatability	$\leq 2 \mu\text{m}$ (0.08 mils)	$\leq 2 \mu\text{m}$ (0.08 mils)
Accuracy	$\leq 5 \mu\text{m}$ (0.2 mils)	-
Speed	5 mm/sec (0.2 in./sec)	5 mm/sec (0.2 in./sec)

## ➤ Dimensions and Footprint

Footprint (width x depth)	1250 mm x 1150 mm (49 in. x 45 in.)
Clearances	<p>Left/right: 200 mm (8 in.)</p> <p>Right: &gt; 800 mm (32 in.) recommended during installation or service</p> <p>Front: 800 mm (32 in.)</p> <p>Back: 1000 mm (40 in.) recommended during installation or service</p>
Platen-to-floor distance	950 to 1050 mm (38 to 41 in.) (adjustable)



## ➤ Power Requirements<sup>1</sup>

Probe station incl. monitors, eVue microscope, and 6 power outlets (IEC C13) for customer use	<p>Single phase: 100-127 VAC or 208-240 VAC 50/60 Hz (Maximum 1500 VA)</p> <p>Required receptables: NEMA 5-15 (North America), CEEVII (EU)<sup>2</sup></p>
Thermal Controller	<p>Single phase: 100-127 VAC, 50/60 Hz, (Maximum 1600 VA) or 208-240 VAC at 60 Hz (200 VAC at 50 Hz) (Maximum 2200 VA)</p> <p>Required receptables: NEMA L5-20 or NEMA L6-15 (North America), CEEVII (EU)<sup>2</sup>.</p>
Thermal Chiller (-40°C version)	<p>Dedicated versions “P” and “R”:</p> <ul style="list-style-type: none"> <li>• “P”: Single phase: 208-230 VAC at 50Hz and 220-230 VAC at 60Hz; (Maximum 1500 VA)</li> <li>• “R”: Single phase: 208-230 VAC at 60Hz (Maximum 1700 VA)</li> </ul> <p>Required receptables: NEMA L6-20 (North America), CEEVII (EU)<sup>2</sup>.</p>
Thermal Chiller (-60°C version)	<p>Dedicated versions “E” and “R”:</p> <ul style="list-style-type: none"> <li>• “E”: Single phase: 220-240 VAC at 50Hz (Maximum 2350 VA)</li> <li>• “R”: Single phase: 200-220 VAC at 60Hz (200 VAC 50 Hz) (Maximum 2350 VA)</li> </ul> <p>Required receptables: NEMA L6-20 (North America), CEEVII (EU)<sup>2</sup>.</p>

<sup>1</sup> Note: For details, please refer to the respective facilities planning guide.

<sup>2</sup> Full receptable list for all regions available upon request.

## ➤ Regulatory Compliance

Certification	CE and UKCA declared, 3rd party tested for CB against IEC 61010-1 including National Standard USA UL 61010-1:2012 and Canada CAN/CSA-C22.2. No.1010-1-12, 3rd party certified for USA and Canada (cNRTLus), FCC 47 CFR 15 Subpart B, ICES-003 Issue 7, SEMI S2 and S8.
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## ➤ Warranty

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

\* All performance metrics identified in this document are valid only when the system is installed and operated within the terms specified in the Facility Planning Guide.