Elite300

300 mm Semi-automated Probe System

DATA SHEET

The Elite™ 300 is essential for characterizing devices at the 32 nm technology node and beyond. This probe systems uses PureLine™ technology to achieve one of the lowest noise levels available on the market. Patented AttoGuard® and MicroChamber® technologies significantly improve low-leakage and low-capacitance measurements. An advanced linear air stage provides unprecedented stepping accuracy and wafer planarity across a wide temperature range of -60°C to 300°C. Additionally, the Elite features a "hands-free," high-stability microscope bridge mount and delivers true optical magnification with the eVue™ digital imaging system.

The powerful Velox™ probe station control software features easy on-screen navigation, wafer mapping, seamless integration with analyzers and measurement software, and enables simple operation of motorized positioners and thermal systems.

For a wide range of applications, the Elite 300 probe station powered by Velox software achieves high accuracy and high test efficiency.

FEATURES / BENEFITS

Measurement accuracy	Best solution for low-noise and 1/f measurements with advanced PureLine, AttoGuard and MicroChamber technologies Minimize AC and spectral noise with effective shielding capability Optimal test instrument integration
Positioning accuracy	Precision linear-motor/ air-bearing stage for accurate positioning with temperature compensation Precision sub-micron stepping with auto XYZ and theta correction High-force Z stage
Productivity	Unattended testing over multiple temperatures with VueTrack™ technology and High-Temperature Stability (HTS) enhancement eVue digital imaging system with enhanced optical visualization, fast set-up, and in-die and wafer navigation Powerful automation tools, such as automatic die-size measurements and wafer alignment
Flexibility and application-tailored solutions	RF/microwave device characterization, 1/f, WLR, FA and design debug Seamless integration between Velox and analyzers/measurement software Full thermal range of -60°C to +300°C Complete solution for small- and large-area multi-site probe cards Large-area TopHat™, universal test accessories mounting system and rotatable universal platen ring Versatile microscope mount system for fine-structure and large-area probing, and for wafer-level reliability test
Ease of use	Comfortable and ergonomic operation "Hands-free" microscope remote control, arm rest, and quick-access control panel Low-profile design Quick and comfortable wafer access via locking roll-out stage Easy on-screen navigation, wafer mapping, and operation of motorized positioners and thermal systems with Velox

CascadeMicrotech®

Note: For physical dimensions and facility requirements, refer to the Elite300 Facility Planning Guide.

MECHANICAL PERFORMANCE

X-Y Stage

Travel	301 mm x 301 mm (11.9 in. x 11.9 in.)
Resolution	0.1 μm (0.004 mils)
Repeatability	≤ 1 μm (0.04 mils)
Accuracy	Precision mode: ≤ 0.3 μm (0.012 mils), Standard mode: ≤ 2 μm (0.08 mils)
Speed	100 mm/sec (4 in./sec)
Bearings	Air
Motor-drive system	Brushless linear servo motor
Feedback system	Ceramic ultra-low thermal expansion linear encoder

Z Stage

Travel	10.0 mm (.39 in.)
Resolution	0.1 μm (0.004 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)	≤ 0.001 μm/μm slope per 10 kg load (0.001 in./in. / 22 lb)

Theta Stage

Travel	± 7.5°
Resolution	0.65 μm (0.03 mils)*
Repeatability	≤ 1 μm (0.04 mils)*
Accuracy of standard moves	≤ 2 μm (0.08 mils)*
Accuracy of large moves	≤ 5 μm (0.20 mils)*

* Measured at edge of 300 mm chuck

MICROCHAMBER

Electrical	Elite300/AP	Elite300/M
EMI shielding	> 30 dB (typical) > 1 KHz	> 20 dB (typical) > 1 KHz
Light attenuation	≥ 120 dB	≥ 120 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) **

Air-Purge Management	
Purge	Dry air or nitrogen
Purge control	Manual or automatic (software controlled)
Purge flow rate – Standard	0 to 1.9 liters/sec (0 to 4 SCFM)
Purge flow rate – Quick purge	> 1.9 liters/sec (4 SCFM)

* 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).

PLATEN SYSTEM

Platen	
Dimensions	101.6 cm (W) x 86.4 cm (D) x 25 mm (T) (40.0 in. x 34.0 in. x 1.0 in.)
Mounting system	Kinematic, high thermal stability enhanced
Platen-to-chuck height	40.0 ± 0.5 mm (1.575 ± 0.02 in.)
Lift range	3.0 mm (0.12 in.)
Lift repeatability	≤ 3 µm (0.12 mils)
Accessory mounting	Universal Rail System: 53 cm (21 in.) Left / Right Rail, 71 cm (28 in.) Top Rail

Platen Ring	
Diameter	717.6 mm (28.25 in.)
Weight	43 kg (95 lb.)
Material	Steel for magnetic positioners
Surface finish	Fine ground for vacuum positioner high stability
Usability features	Removable and clockable in 90°C

Platen Ring Insert	
Diameter	342.9 mm (13.5 in.)
Standard interface	Probe card holders and custom adapters

WAFER CHUCK

Diameter	305 mm (12 in.)
Material	Nickel- or gold-plated aluminum
DUT sizes supported	Shards or wafers 50 mm (2 in.) through 300 mm (12 in.)
Vacuum rings	50 mm, 130 mm, 180 mm, 280 mm (1.97 in., 5.12 in., 7.09 in., 11.02 in.)
Vacuum-ring actuation	Software controlled
Planarity	≤ 10 µm (1.0 mils) @ 25°C
	≤ 30 µm (1.2 mils) @ -60°C
	≤ 30 µm (1.2 mils) @ 200°C
	≤ 40 µm (1.6 mils) @ 300°C

PLATFORM

General

Attenuation of the vibration dampening system	≥ 0 dB @ 6 Hz, 5 dB per octave @ 6 Hz to 48 Hz, ≥ 15 dB above 48 Hz*
Stage move time	≤ 0.75 sec (200 µm Z down – 1000 µm X-Y – 200 µm Z up)
Stage dampening	≥ 15 dB in less than 1500 msec

Velox Probe Station Control Software

The semi-automated Elite 300 probe station is equipped with Velox probe station control software. The Velox software provides all features and benefits required for semi-automated operation of the probe system, such as:

- WaferMap with Z-profiling, sub-die stepping, binning and other useful features
- Integrated thermal controls
- CellView using stitched image of the full device to enable on-screen navigation within the die layout when using eVue
- Configurable user interface and programmable buttons

Communication Ports

Type	Qty	Locacation	Notes
USB 2.0	2	Side of station	For quick access to USB devices
USB 2.0	4	Rear connection panel	For security keys and USB instrument control
RS232	4	Rear connection panel	For instrument control (thermal, LASER, microscope, etc)
GPIB IEEE 488.2	1	Rear connection panel	For test instrument control

Accessory Interface Ports

EDGE	1	Rear connection panel	Probe card contact sense
VNA-CAL	1	Rear connection panel	Control for switched GPIB (remote/local software control)
INKER	1	Rear connection panel	Control for die inker
ULC	1	Rear connection panel	Control for upward looking camera

PLATFORM (CONTINUED)

Switched ACAC Power

IEC (f) Microscope	1	Rear connection panel	Software ON/OFF control for Microscope light
IEC (f) Aux	1	Rear connection panel	Software ON/OFF control for Auxiliary power

* Due to the sensitivity of measurements to vibrations, the Elite is equipped with a high-performance active vibration dampening system. However, unacceptable equipment vibrations can occur when the floor vibrations are high. For this reason the Elite 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 Cascade Microtech Stations Facilities guide.

NON-THERMAL CHUCKS

Note: Results measured with non-thermal chuck at standard probing height (10,000 µm) with chuck in a dry environment. Moisture in the chuck may degrade performance.

FemtoGuard® Chuck Performance

Breakdown voltage	Force-to-guard	≥ 500 V
	Guard-to-shield	≥ 500 V
	Force-to-shield	≥ 500 V
Resistance	Force-to-guard	$\geq 5 \times 10^{12}\ \Omega$
	Guard-to-shield	$\geq 1 \times 10^{12}\ \Omega$
	Force-to-shield	$\geq 5 \times 10^{12}\ \Omega$
Capacitance	Force-to-guard	≤ 800 pF
	Guard-to-shield	≤ 4000 pF

Coaxial Chuck Performance

Breakdown voltage	≥ 500 V
Isolation	$\geq 5 \times 10^{12}\ \Omega$
Capacitance	800 pF

System Electrical Performance (with non-thermal chuck)	**Elite300/AP FemtoGuard Chuck**	**Elite300/M**	**Elite300/M Coax Chuck**
Probe leakage*	≤ 1 fA	≤ 1 fA	≤ 1 fA
Chuck leakage*	≤ 1 fA	≤ 15 fA	≤ 600 fA
Residual capacitance	≤ 0.4 pF	≤ 75 pF	N/A
Capacitance variation**	≤ 2 fF	≤ 75 fF	≤ 75 fF
Settling time***	≤ 25 fA @ 2 sec	≤ 100 fA @ 2 sec	N/A

* Overall leakage current is comprised of two distinctly separate components: 1) offset, and 2) noise. Offset is the DC value of current due to instrument voltage offset driving through isolation resistance. Noise is low frequency ripple superimposed on top of offset and is due to disturbances in the probe station environment.

Noise and leakage are measured with a 4156C NOISE.dat Cascade Microtech program or equivalent; 4 ms sample rate, auto scale, 1 nA compliance, 1 NPLC integration.

** This is chuck capacitance variation based upon chuck position anywhere in the 300 mm area, as measured by a stationary DC probe. Test conditions: Agilent 4284A LCR meter (Cp-d, 1 MHz, 4 Ave, 0 Power), DCP-150, 75 µm above chuck surface, 4-wire connection (HiZ/Hipot to chuck, Loz/Lopot to probe).

*** Settling time is measured with a 4156C SETLB.dat Cascade Microtech program or equivalent; 2 ms sampling rate, limited auto 1 nA, 1 µA compliance, 3 NPLC integration.

Note: Results measured with thermal chuck at standard probing height (10,000 µm) with chuck in a dry environment. Moisture in the chuck may degrade performance.

FemtoGuard Chuck Performance		**Thermal Chuck**			
		@ -60°C	**@ 25°C**	**@ 200°C**	**@ 300°C**
Breakdown Voltage	Force-to-guard	≥ 500 V	≥ 500 V	≥ 500 V	≥ 500 V
	Guard-to-shield	≥ 500 V	≥ 500 V	≥ 500 V	≥ 500 V
	Force-to-shield	≥ 500 V	≥ 500 V	≥ 500 V	≥ 500 V
Resistance	Force-to-guard	$\geq 5 \times 10^{12}\ \Omega$	$\geq 5 \times 10^{12}\ \Omega$	$\geq 5 \times 10^{11}\ \Omega$	$\geq 1 \times 10^{11}\ \Omega$
	Guard-to-shield	$\geq 5 \times 10^{11}\ \Omega$	$\geq 5 \times 10^{11}\ \Omega$	$\geq 1 \times 10^{10}\ \Omega$	$\geq 1 \times 10^{9}\ \Omega$
	Force-to-shield	$\geq 5 \times 10^{12}\ \Omega$	$\geq 5 \times 10^{12}\ \Omega$	$\geq 5 \times 10^{11}\ \Omega$	$\geq 1 \times 10^{11}\ \Omega$
Capacitance	Force-to-guard	≤ 1000 pF	≤ 1000 pF	≤ 1000 pF	≤ 1000 pF
	Guard-to-shield	≤ 5000 pF	≤ 5000 pF	≤ 5000 pF	≤ 5000 pF

Coaxial Chuck Performance	**Thermal Chuck**			
	@ -60°C	**@ 25°C**	**@ 200°C**	**@ 300°C**
Breakdown voltage	≥ 500 V	≥ 500 V	≥ 500 V	≥ 500 V
Resistance	$\geq 5 \times 10^{11}\ \Omega$	$\geq 5 \times 10^{11}\ \Omega$	$\geq 1 \times 10^{10}\ \Omega$	$\geq 1 \times 10^{9}\ \Omega$
Capacitance	≤ 5000 pF	≤ 5000 pF	≤ 5000 pF	≤ 5000 pF

System Electrical Performance (with thermal chuck)

		Elite300/AP FemtoGuard	Elite300/M FemtoGuard	Elite300/M Coaxial
Probe leakage*	Thermal Controller OFF	≤ 1 fA	≤ 1 fA	≤ 1 fA
	Thermal Controller ON	≤ 5 fA	≤ 10 fA	≤ 10 fA
Chuck leakage* (ATT)	Thermal Controller OFF	≤ 3 fA	≤ 15 fA	25 pA
	-60°C	≤ 6 fA	≤ 20 fA	25 pA
	25°C	≤ 3 fA	≤ 20 fA	25 pA
	200°C	≤ 3 fA	≤ 20 fA	25 pA
	300°C	≤ 6 fA	≤ 25 fA	220 pA
Residual capacitance		≤ 2.5 pF	≤ 75 pF	N/A
Capacitance variation**		≤ 2 fF	≤ 75 fF	≤ 75 fF
Settling time***	All temperatures @ 10 V	≤ 50 fA @ 0.5 sec	≤ 100 fA @ 2 sec	N/A

* Overall leakage current is comprised of two 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 4156C NOISE.dat Cascade Microtech program or equivalent; 4 ms sample rate, auto scale, 1 nA compliance, 1 NPLC integration

** This is chuck capacitance variation based upon chuck position anywhere in the 300 mm area, as measured by a stationary DC probe. Test conditions: Agilent 4284A LCR meter (Cp-d, 1 MHz, 4 Ave, 0 Power), DCP-150, 75 µm above chuck surface, 4-wire connection (HiZ/Hipot to chuck, Loz/Lopot to Probe), 25°C.

*** Settling time is measured with a 4156C SETLB.dat Cascade Microtech program or equivalent; 2 ms sampling rate, limited auto 1 nA, 1 µA compliance, 3 NPLC integration.

Note: For details on facility requirements, refer to the Facility Planning Guide for your thermal system.

THERMAL SYSTEM PERFORMANCE

Thermal System Overview

Temperature ranges	-60°C to 300°C, ATT, air cool (200/230 VAC 50/60 Hz)
	+20°C to 300°C, ATT, air cool (100-230 VAC 50/60 Hz)
	+30°C to 300°C, ATT, air cool (100-230 VAC 50/60 Hz)
Wafer temperature accuracy[1, 2]	± 2.5°C at 100°C

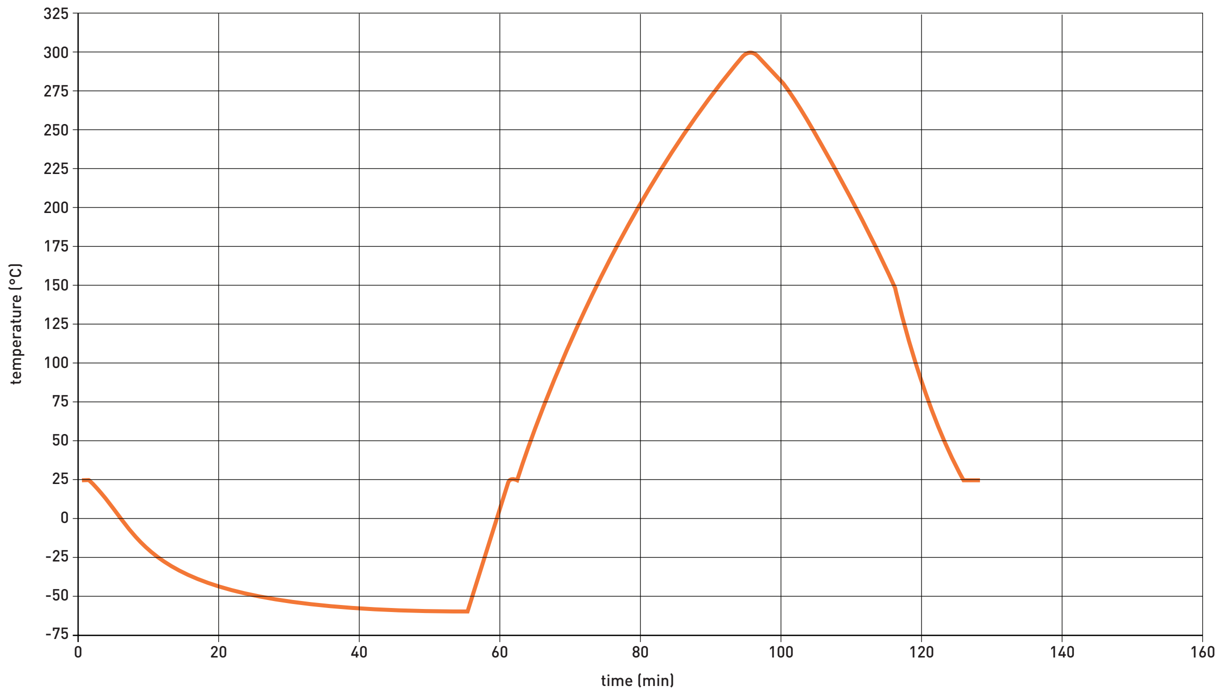
1. As measured with an Anritsu WE-11K-TSI-ANP or WE-12K-GW1-ANP type K thermocouple surface temperature measurement probe with offset calibration procedure. Conditions: closed chamber with minimum recommended purge air, probe centered on a blank silicon wafer, chuck at center of travel and standard probe height. Typical type K thermocouple probe tolerances are ±2.2°C or ±0.75% of the measured temperature in °C (whichever is greater).
2. 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.

ATT Thermal System Specifications (-60 °C to 300 °C)

Temperature range	-60°C to 300°C
Resolution	0.1°C
Transition time – Heating	-60°C to 25°C = 6 min, 25°C to 300°C = 33 min (typical)
Transition time – Cooling	300°C to 25°C = 31 min, 25°C to -60°C = 54 min (typical)

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

Typical times using Elite300/AP with FemtoGuard Chuck.

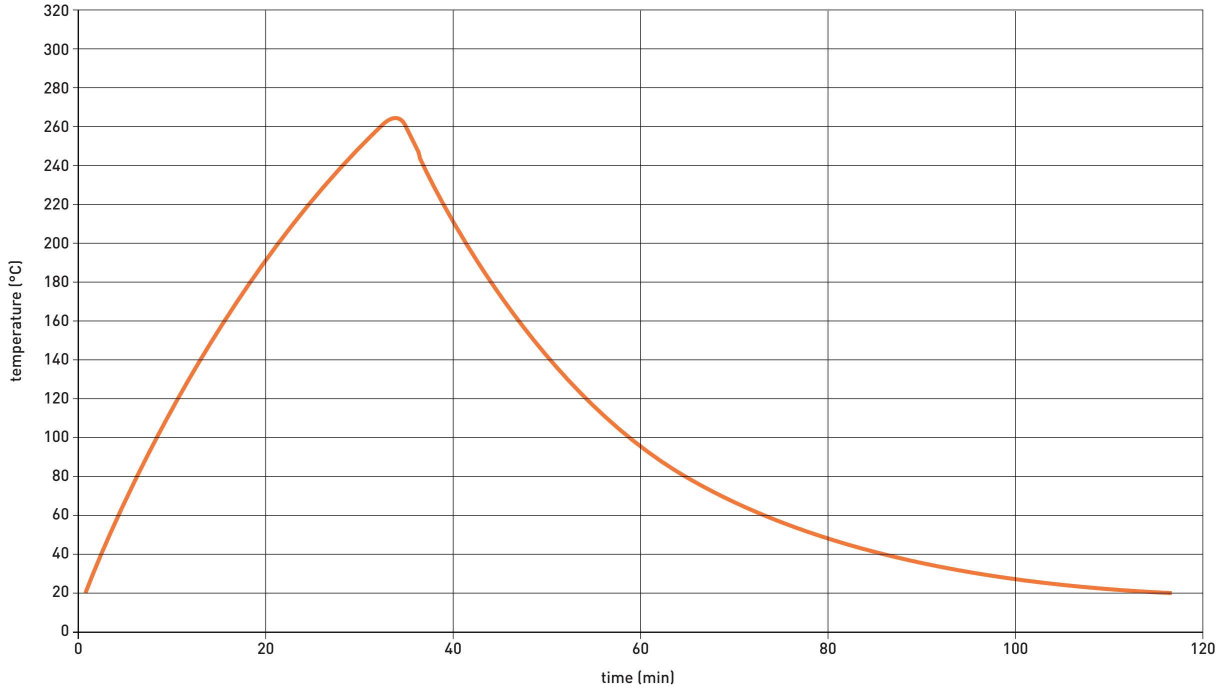


ATT Thermal System Specifications (+20°C to 300°C)

Temperature range	+20°C to 300°C
Resolution	0.1°C
Transition time – Heating	20°C to 300°C = 33 min (typical)
Transition time – Cooling	300°C to 20°C = 78 min (typical)

ATT Thermal Transition Time (+20°C to 300°C)

Typical times using Elite300/M with FemtoGuard Chuck.

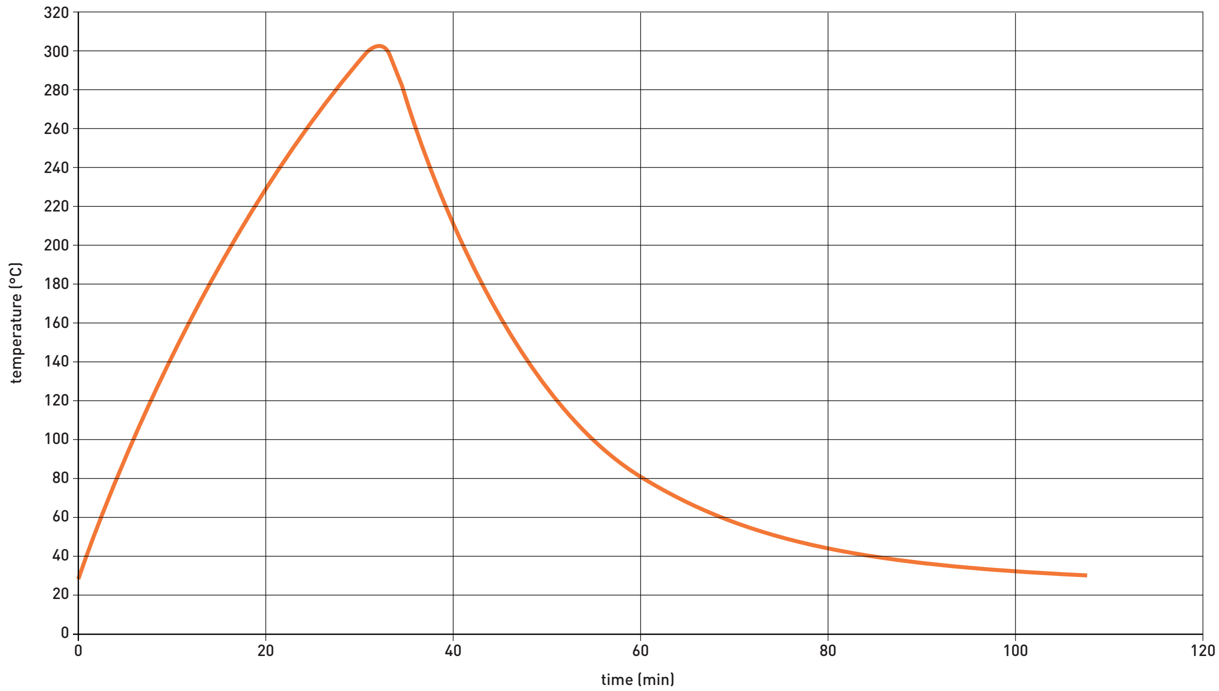


ATT Thermal System Specifications (+30°C to 300°C)

Temperature range	+30°C to 300°C
Resolution	0.1°C
Transition time – Heating	30°C to 300°C = 32 min (typical)
Transition time – Cooling	300°C to 30°C = 73 min (typical)

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

Typical times using Elite300/M with FemtoGuard Chuck.



MICROSCOPE BRIDGE MOUNT/TRANSPORTS

Programmable Bridge/Transport Specifications

Travel	75 mm (X) x 75 mm (Y) x 150 mm (Z) (3.0 in. x 3.0 in. x 6.0 in.)
Travel in TopHat	13 mm x 13 mm (0.5 in. x 0.5 in.)
Z Lift	150 mm (6.0 in.)
Resolution, X-Y axis	0.4 µm (.02 mils)
Resolution, Z axis	0.08 µm (0.003 mils)
Repeatability, X-Y axis	≤ 2 µm (0.08 mils)
Repeatability, Z axis	≤ 1 µm
Accuracy, X-Y axis	≤ 5 µm (0.20 mils)
Accuracy, Z axis	≤ 4 µm
Speed	5 mm/sec (0.2 in./sec)

Motorized Bridge/Transport Specifications

Travel	75 mm (X) x 75 mm (Y) x 150 mm (Z) (3.0 in. x 3.0 in. x 6.0 in.)
Travel in TopHat	13 mm x 13 mm (0.5 in. x 0.5 in.)
Z lift	150 mm (6.0 in.)
Resolution, X-Y axis	0.4 µm (0.02 mils)
Resolution, Z axis	0.08 µm (0.003 mils)
Repeatability, Z axis	≤ 1 µm
Speed	5 mm/sec (0.2 in./sec)

Manual Bridge/Transport Specifications

Travel	50 mm (X) x 50 mm (Y) x 50 mm (Z) (2.0 in. x 2.0 in. x 2.0 in.)
Travel in TopHat	13 mm x 13 mm (0.5 in. x 0.5 in.)
Z lift	150 mm (6.0 in.)

AUX CHUCK

Quantity	Two positions, mounted independent of the thermal chuck
Max substrate size	15.2 mm x 22.1 mm (0.6 in. x 0.87 in.) ISS substrate 19 mm x 19 mm (0.75 in. x 0.75 in.) Square substrate
Material	Magnetically loaded, RF absorbing Eccosorb
Thermal isolation	Air gap, > 10 mm
Flatness	≤ 10 µm (0.39 mils)
Positional repeatability	≤ 2 µm (0.08 mils) after rollout event
Vacuum actuation	Independent software control

STATION CONTROLLER

E3-CTL3	Standard system controller with Velox probe station control software and Windows 7
E3-CTL1	Optional system controller with Nucleus probe station control software and Windows XP

AVAILABLE MODELS

Elite 300/AP – Probe station platform, semi-automatic with MicroChamber, AttoGuard, AttoGuard and PureLine technologies

Configuration includes:

- Elite 300 mm wafer probe system, microscope bridge/transport – programmable 75 mm (3"x3") (E3-ST75P)
- Elite 300 mm wafer probe system, Premium Control Kit (LCD, Manual XY Controls) (E3-PCK)
- Elite 300 mm wafer probe system, AUX chuck kit (E3-AUX)
- Elite 300 mm wafer probe system, computer accessory mount kit, 20" LCD monitor and ergo arm
- Elite 300 mm wafer probe system, Velox / Windows 7 controller (E3-CTL3)
- Elite 300 mm wafer probe system, height kit – Standard (E3-SHK)

Elite 300/M – Probe station platform, semi-automatic with MicroChamber

Configuration includes:

- Elite 300 mm wafer probe system, microscope bridge/transport – motorized 75 mm (3"x3") (E3-ST75)
- Elite 300 mm wafer probe system, computer accessory mount kit, 20" LCD monitor and ergo arm
- Elite 300 mm wafer probe system, Velox / Windows 7 controller (E3-CTL3)
- Elite 300 mm wafer probe system, height kit – Standard (E3-SHK)

Note: To complete the Elite probe system configuration:
1. Select a modular chuck from the following list (X=1 for Nickel-plated chuck and 2 for Gold-plated)
2. Select additional options from the following list (see compatibility chart below)

Options		Option Compatibility	
Part Number	**General Description**	**AP**	**M**
E3-ST75P	Elite 300 mm wafer probe system, microscope bridge/transport – programmable 75 mm (3"x3")	Std	●
E3-ST75	Elite 300 mm wafer probe system, microscope bridge/transport – motorized 75 mm (3"x3")		Std
E3-AUX	Elite 300 mm wafer probe system, AUX chuck kit	Std	●
E3-PCK	Elite 300 mm wafer probe system, Premium Control Kit (LCD, Manual X-Y Controls)	Std	●
E3-CTL3	Elite 300 mm wafer probe system, system controller, Velox / Windows 7	Std	Std
E3-CTL1	Elite 300 mm wafer probe system, system controller, Nucleus / Windows XP	●	●
E3-SHK	Elite 300 mm wafer probe system, height kit (Standard)	Std	Std
E3-LHK	Elite 300 mm wafer probe system, height kit (Low profile)	●	●

Non-Thermal Chucks		Chuck Compatibility	
Part Number	**General Description**	**AP**	**M**
TC-001-30x	FemtoGuard triaxial chuck, non-thermal, 300 mm (12")	●	
TC-001-10x	Coaxial chuck, non-thermal, 300 mm (12")		●

Thermal Chucks		Chuck Compatibility	
Part Number	**General Description**	**AP**	**M**
TC-411-30x	FemtoGuard triaxial chuck, thermal, -60°C to 300°C (ATT), 300 mm (12")	●	●
TC-411-10x	Coaxial chuck, thermal, -60°C to 300°C (ATT), 300 mm (12")		●

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

Thermal Systems		Thermal Compatibility	
Part Number	**General Description**	**AP**	**M**
TS-411-14P	Thermal system for Elite300 AP/M, -60°C to 300°C, ATT, air cool (200/230 VAC 50/60 Hz)	●	●
TS-411-02T	Thermal system for Elite300 AP/M, +30°C to 300°C, ATT, air cool (100/230 VAC 50/60 Hz)	●	●
TS-411-05T	Thermal system for Elite300 AP/M, +20°C to 300°C, ATT, air cool (100/230 VAC 50/60 Hz)	●	●

Note: Thermal systems must match the thermal chuck selected, i.e. TS-231-xxx thermal systems are compatible with TC-231-xxx chucks.

REGULATORY COMPLIANCE

Certification	TÜV compliance tested for CE, certified for US and Canada, SEMI S2 and S8

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 Cascade Microtech's Terms and Conditions of Sale for more details.

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