

PTM 600: High Performance, Affordable CD SEM

Gauge-capable, automated, full-image SEM metrology for today's advanced technology nodes—and tomorrow's challenges

Precision, Throughput and Value

Discover the most cost-effective, fully automated, SEM metrology available for small parts and wafers in data storage, semiconductor and micro-electro-mechanical systems (MEMS) industries.

Value Drivers:

- *Dynamic Precision: <math><0.75\text{ nm }1\sigma</math>*
- *Throughput: <math><20\text{ second per site}</math>*
- *Robustness: >98%*
- *Uptime: >95%*

Benefits:

High Precision

- *<math><1.5\text{ nm }3\sigma</math> precision for gauge-capable pole measurement*
- *Confident data for correlating wafer and rowbar processing*

High throughput

- *<math><20\text{ seconds per site (MAM)}</math>*
- *Cost-effective rowbar metrology*

Production-friendly

- *Fully automated*
- *Designed for ease of operation*

Superior Value

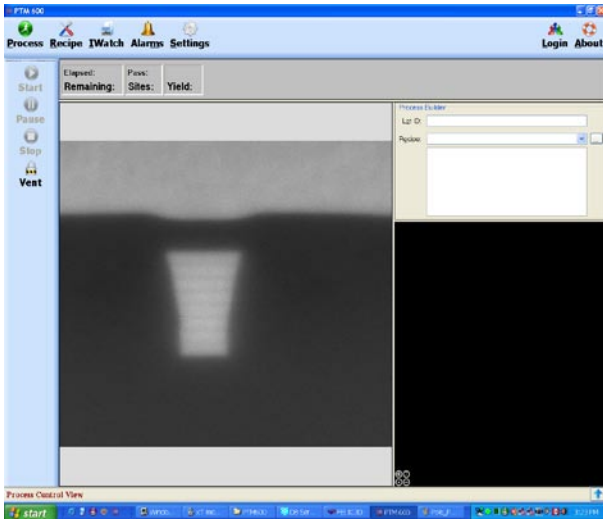
- *List price of \$1.1M (US), compared to ~\$2M (US) for a typical CD SEM with this level of precision and customization*

The ultimate solution for high-throughput device modification and analysis

The PTM 600™ CD SEM delivers world-class sub-nanometer precision at a fraction of the cost of traditional large-wafer CD SEM products. Ample quantitative data for new development, faster ramps, rapid excursion correction and overall process control are now at your fingertips. The PTM 600 is an affordable solution tailored for the needs of process owners managing small wafers and piece parts.

High-resolution milling and imaging

The PTM 600 enables manufacturers of write heads for hard disk drives to completely control their slider fab processes by providing extensive geometric and dimensional data. Correlation of write pole trimming between the wafer and rowbar level ensures the best possible yield for the wafer process. Physical measurement and characterization of lapping guides give you a tight handle on the physical and magnetic properties of the write pole at the final air bearing surface (ABS).



The operator-friendly user interface means quick production integration.

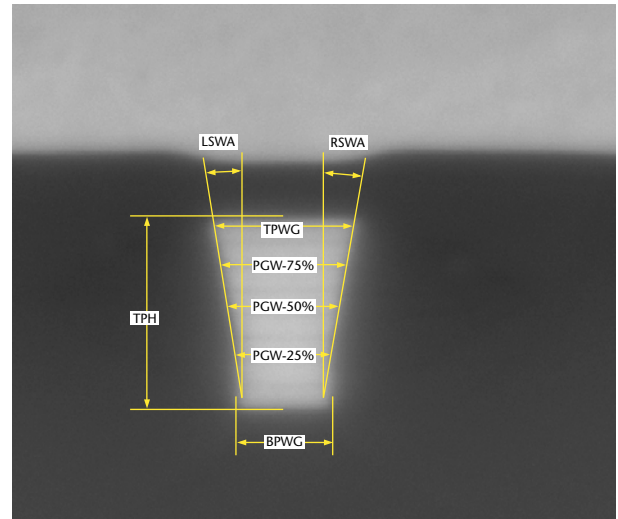
Value and precision in one fully automated system

Through hybridization of advanced technology components and a value-priced SEM platform, the PTM 600 delivers operator-friendly, high-end automated SEM metrology at nearly half the traditional cost.

With its piezoelectric sample stage, state-of-the-art backscatter detection and automated machine vision, the PTM 600 offers precise high-resolution imaging for data you can rely on. A proven field emission SEM column with a non-immersion lens delivers nm-resolution imaging, even on challenging magnetic materials. Customizable sample handling options provide reliable positioning of piece parts and wafers up to 150 mm in size.

FEI provides software automation tools that increase the speed and volume of data collection from the PTM 600 during manufacturing for analysis and storage. Running on Windows XP, the IC3D™ metrology software dynamically creates and manages large volumes of image data within its embedded Microsoft SQL database. The optional IWatch™ software simplifies the navigation of this large database.

You can use the optional Data Transfer Service™ (DTS) to migrate both recent and historical operation data from one or more PTM 600 systems to a centralized server. DTS simplifies the archive and analysis of all your imaging data by storing it in one place, providing greater insight about the efficiency, effectiveness and quality of your manufacturing process.



The PTM 600 integrates automated IC3D™ machine vision to measure critical dimensions and angles with sub-nm precision.

The PTM 600 includes these key features:

- *Metrology of any exposed patterns (not limited to pole itself)*
 - *Pole tip metrology*
 - *Lapping feedback*
 - *Lapping guide metrology*
- *Fully automated pole tip metrology on rowbars*
- *Automated processing with integrated IC3D machine vision*
- *Digitally controlled FEG SEM (1–30 kV)*
- *Passive vibration isolation system*
- *High-precision 150 mm piezoelectric stage*
- *Advanced backscatter electron detection*
- *High-duty-cycle digitally controlled vacuum system*
- *Intuitive, flow-diagram-driven recipe creation and editing*

PTM 600 CD SEM essential specifications

SEM OPTICS

Design:

- Unique Schottky Field-Emitter
- Emitter constant condition for stable operation
- Pre-field corrected lens
- Magnetic dipole saddle coil
- Double deflection
- Double quadrupole stigmator

Performance:

- Software controlled HV supply range 200V to 30 kV
- Voltage drift after 30 minute warm up < 0.25 V/10min
- Lifetime: > 1 year
- Beam current stability after 30 min. stabilization within 0.1 % / 10 minutes
- Focus range: 2.5 mm - 99 mm working distance
- Maximal field of view: 5.0 mm at WD 10 mm
- Resolution (Gold Particle Separation on a Carbon Substrate): <2 nm @ 30kV

SYSTEM CONTROLS

SEM:

- Automatic control; user command reduced to a simple beam on/off
- Degauss functionality in the software user interface
- Automatic compensation and adjustment for beam energy and magnification
- Computer-guided column alignments
- Automatic focus, stigmation, contrast and brightness

SCAN/VIDEO

Detectors:

- Everhart-Thornley scintillator secondary electron detector
- vCD Backscatter Detector

Scan Characteristics:

- Dwell time (time per pixel): 50 ns to 1 ms adjustable with 100 ns step
- Pixel resolutions
 - 512 x 442
 - 1024 x 884
 - 2048 x 1768
 - 4096 x 3536
- Image averaging and integration
- Magnification:
 - Minimum 10x @ WD = 40 mm in quad mode
 - Maximum 2.5Mx @ WD = 5 mm in full screen mode
 - Accuracy better than 0.5% (at the calibrated beam energy and FOV)
- Scan rotation 360° continuous

Saved Image Formats:

- Automated Process (BMP)
- Manual UI (TIFF, BMP, JPG)

Digital Video:

- 512 x 512 - 10 frames per sec
- 1k x 1k - 5 frames per sec
- File format compressed AVI (*.avi)

STAGE

150 mm Piezoelectric Stage:

- Max Speed: > 10 mm/s
- Accuracy incl. mapping (85% tolerance interval): 2.5 μ m over 150 mm
- Repeatability: 1.5 μ m (85% tolerance interval)
- Dimensions and weight of specimen:
 - Max. dimensions: 150 mm diameter wafer
 - Max. weight: 500 g (inc. holder)

VACUUM SYSTEM

- Edwards XDS 10 Dry Scroll Roughing Pump
- Edwards 250 l/s Turbo Molecular Pump
- Automated chamber pressure control using dedicated microprocessor
- Vacuum systems are safeguarded against:
 - Power failure
 - User failure
 - Gauge disconnection or defect
- Final pressure: specimen chamber <6E-4 Pa (dry nitrogen used as the venting gas)

COMPUTER SYSTEM

Microscope Control Computer:

- Intel Core 2 Duo E8300 processor
- Processor speed 2.8 GHz or more
- 2 GB RAM or more
- Two 500 GB or larger hard disk drives
- DVD+/-RW
- At least 3 USB ports
- At least 1 IEEE1394 port
- Network Interface: Broadcom 5755 Netxtreme Gigabit Ethernet
- Display Monitor: 19" color LCD monitor with 1280 x 1024 pixel resolution
- Mouse and keyboard

Standard Software:

- FEI Software: xT 3.7, PTM 1.0, IC3D 8
- Windows XP Professional, SP2
- Visio 2003
- Microsoft Excel 2003
- Microsoft Word Viewer 2003
- Cognex VisionPro 3.0.1
- Microsoft .NET 1.1, 2.0, 3.0
- Microsoft SQL Server 2005 (basic version)
- Backup Exec 8
- Diskeeper 2008
- Roxio (DVD/CD burning sw)
- Drivers for microscope hardware (NYCe3000, Logitech Camera)
- Internet Explorer 6 (IE 6)

Optional Software:

- FEI RAPID (FEI FSE/TSG Remote Diagnostics)
- IWatch 8.0 (Human Friendly Database Interface)
- Anti-virus software (suggested that customers purchase this on their own)

SAFETY COMPLIANCE

The PTM 600 has been S2 Certified.

- This system is designed to meet the following CE standards:
 - EN55011 Group 1 Class A for EMC emission, industrial, scientific and medical equipment (March 1991)
 - EN50082-1 for EMC immunity, residential, commercial and light industry (January 1992)
 - EN61010-1 (1993) for safety requirements for electrical equipment for measurement, control and laboratory use
 - Safety class 1, installation class / over voltage category 2, pollution class 2 (see IEC61010-1)
- FEI certifies that X-ray emission is < 1 µSv/h (10 cm from any surface)

SITE AND MECHANICAL SPECIFICATIONS

See the PTM 600 Pre-installation Manual for detailed information

SYSTEM DIMENSIONS AND WEIGHT

- 2.5m x 2.5m
- 660 kg

FACILITIES REQUIREMENTS

- 230 V 50\60 Hz, single phase, 30 Amp Twist Lock Receptacle
- Clean Dry Air (Compressed)
- Dry Nitrogen
- Dry Vacuum Pump Exhaust

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