



Key benefits

- Best-in-class Elstar™ Schottky Monochromated (UC) FESEM technology and performance, with sub-nanometer resolution from 1 to 30 kV
- Innovative electron optics, including FEI's patented UC gun (monochromator), constant power lenses and electrostatic deflection for accurate and stable imaging
- Easy access to beam landing energies as low as 20 eV with very high resolution, for true surface characterization
- Advanced suite of high sensitivity in-lens & below-the-lens detectors and signal filtering for low dose operation and optimal contrast selection
- Unique imaging technologies and solutions, including the second generation of Magellan advanced detectors, process monitoring, FEI SmartSCAN™ and DCFI to help imaging charging samples
- Very high precision & stability, piezo-driven 100x100 mm stage in a large analytical chamber
- Full analytical and prototyping capabilities

MagellanTM XHR SEM Discover the world of Extreme High Resolution scanning electron microscopy

The Magellan[™] is the first Scanning Electron Microscope to offer sub-nanometer resolution over the full 1 keV to 30 keV energy range, effectively establishing a new performance category known as XHR (eXtreme Hign Resolution) SEM. Its extraordinary low voltage performance provides extremely precise, surface specific information that is simply unavailable from other techniques.

In the Semiconductor and Data Storage markets, the Magellan's unprecedented performance significantly extends SEM capability to future technology nodes, offering a complete solution for basic research, process and material development, process control, and failure analysis. It delivers fast, high contrast imaging with sub-nanometer resolution and full analytical capability on large or multiple samples, including cross sections. The Magellan provides industry leading performance without compromising the high throughput, sample flexibility and ease of use of a traditional SEM.

In Scientific and Industrial Research and Development, the Magellan's unique ability to clearly image nanoscale surface details, particles and material interfaces with high resolution opens whole new investigative frontiers that are rich with opportunities for the next breakthrough discovery. It allows researchers to see essential attributes – of catalyst particles, nanotubes, biological objects, and other nanoscale structures – that they have never seen before and could not have seen with any other microscope or technique.

The outstanding imaging capabilities of the Magellan begin with the Elstar[™] FESEM column. On top of its integrated monochromator (UC) and beam deceleration, that enable Magellan's unique low kV performance, the Elstar features other unique technologies such as constant power lenses for higher thermal stability and electrostatic scanning for higher deflection linearity and speed. Its through-the-lens detector, set for highest collection efficiency of SE (secondary electrons) and on-axis BSE (backscattered electrons), is complemented by FEI's latest advanced detection suite including two novel, multi-segment solid state detectors for stunning low kV SE/BSE and S/TEM (scanning transmission electron mode) performance.

Empowered by its evolutionary xT software platform, the Magellan addresses both the occasional user with its easy-to-use yet robust and comprehensive interface, and the SEM expert who can rely on the instrument's flexibility and extended controls for XHR work.

See what no one has ever seen before with the Magellan. What will you discover?

Essential specifications

Electron optics

Elstar XHR immersion lens FESEM column

- Elstar electron gun with:
 - Schottky thermal field emitter
 - Hot-swap capability
 - UC technology (monochromator)
- 60 degree dual objective lens with pole piece protection
- Heated objective apertures
- Electrostatic scanning
- ConstantPower[™] lens technology
- Beam deceleration with stage bias from -50 V to -4 kV
- Integrated Fast Beam Blanker *

Source lifetime

• Electron source lifetime: 12 months

Electron beam resolution

(site survey required to determine attainable resolution)

- Resolution @ optimum WD
 - 0.8 nm at 30 kV (STEM)
 - 0.8 nm at 15 kV
 - 0.8 nm at 2 kV
 - 0.9 nm at 1 kV
 - 1.5 nm at 200 V
- Resolution @ coincident point
 - 0.8 nm at 15 kV
 - 0.9 nm at 5 kV
 - 1.2 nm at 1 kV

Maximum horizontal field width

• E-beam: 1.5 mm at WD 4 mm

Landing energy range

• 20 eV - 30 keV

Probe current

• E-beam: 0.8 pA up to 26 nA

Vacuum system

- 1 x 210 l/s TMP
- 1 x PVP (dry pump)
- 2 x IGP
- Chamber vacuum: < 2.6 * 10⁻⁶ mbar (after 24 h pumping)

Detectors

- Elstar in-lens SE detector (TLD-SE)
- Elstar in-lens BSE detector (TLD-BSE)
- Everhart-Thornley SE detector (ETD)
- IR camera for viewing sample/column
- Chamber mounted Nav-Cam+[™]*
- Retractable low voltage, high contrast solid-state backscatter electron detector (DBS) **
- Retractable STEM detector with BF/DF/ HAADF segments *
- Integrated beam current measurement

Chamber

- E-beam and EDX coincidence point at 4 mm WD
- 21 ports

Ultra high precision 5-axes piezo-motorized stage

- X, Y = 100 mm
- Z≥20 mm
- T = 10 $^{\circ}$ to + 60 $^{\circ}$
- R = 720 $^{\circ}$ stroke
- X, Y repeatability 0.5 µm
- X, Y accuracy < 1.5 µm 85 % tolerance interval
- Mechanically tilt eucentric stage with < 5 μm image motion when tilting 0 $^\circ$ to 52 $^\circ$
- Compucentric rotation and tilt

Sample sizes

- Maximum size: 100 mm diameter with full rotation
- Maximum thickness (via chamber door): 20 mm
- Weight: 200 g (including holder)

Sample holders

- Multi-stub holder **
- Cross-sectional holder **
- Single stub mount, mounts directly onto stage
- Various wafer and custom holder(s) available by request

Image processor

- Dwell time range from 0.025 to 25000 μ s/pixel
- Up to 6144 x 4096 pixels
- File type: TIFF (8, 16, 24-bit), BMP or JPEG
- Single frame or 4 quadrant image display
- SmartSCAN™ (256 frame average or integration, line integration and averaging, interlaced scanning) and DCFI (Drift Compensated Frame Integration)

System control

- 32-bit GUI with Windows [®] XP, keyboard, optical mouse
- Two 24 inch widescreen LCD displays, WUXGA 1920x1200 pixels
- Microscope controlling and support computers seamlessly sharing one keyboard and mouse
- Joystick **
- Multifunctional control panel **
- Remote control *

Supporting software

 'Beam per quad' graphical user interface concept, with up to 4 simultaneously active quads

Common accessories

- Analysis: EDS *
- Loadlock **
- Integrated Plasma Cleaner **
- FEI CryoCleaner **
- Electron Beam Lithography: kits from Raith, Nabity or other vendors *
- FEI acoustic enclosure*
- Exclusive cryo solution for XHR-SEM *
 - FEI Arctic for universal cryo preparation and cryo stage
 - FEI CryoMAT for material science cryo applications
- Gas Injection System (GIS) *

Consumables (partial list)

- · Replacement Schottky electron source module
- Aperture strips for electron

Software options

- Web enabled data archive software *
- Image analysis software *
- iFast for advanced automation *
- MAPS[™] for automatic acquisition of large images and correlative work *

Warranty and training

- 1 year warranty
- Choice of service maintenance contracts
- Choice of operation / application training contracts

Documentation

- On-line help
- Prepared for RAPID[™] (remote diagnostic support)
- Free access to FEI for owners on-line resources

Installation requirements

(refer to pre-install guide for additional data)

- Power: voltage 100 240 V AC, frequency 50 or 60 Hz ± 1 %)
- Power consumption: < 3.0 kVA for basic microscope
- Earth resistance: < 0.1 Ω
- Environment:
 - temperation 20 °C ± 3 °C,
 - relative humidity below 80 % RH, 20 °C,
 - stray AC magnetic fields: < 200 nT a-synchronous, < 600 nT synchronous for line times > 20 ms (50 Hz mains) or > 17 ms (60 Hz mains)
- Door width x height: preferred 1.2 m x 2.0 m (minimum 0.9 m x 2.0 m)
- Weight: column console 850 kg
- Dry nitrogen
- Compressed air: 4 to 6 bar clean, dry and oil free
- System chiller
- Acoustics guidelines: Site survey required as floor spectrum relevant
- Floor vibrations: Site survey required as floor spectrum relevant
- Vibration isolation table *

Floor plan with enclosure



Floor plan without enclosure



Learn more at FEI.com

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