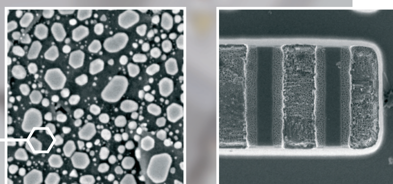
PRODUCT DATA

FEI COMPANY™
TOOLS FOR NANOTECH



Discover a world never seen before

Magellan™ XHR SEM

Discover the world of Extreme High Resolution scanning electron microscopy

The new Magellan™ 400 SEM is the first SEM to offer subnanometer resolution over the full 1 kV to 30 kV electron energy range, effectively establishing a new performance category known as XHR SEM. Its extraordinary low voltage performance provides extreme high resolution, surface specific information that is simply unavailable from other techniques.

In the semiconductor and data storage markets, the Magellan 400'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 subnanometer resolution and full analytical capability on large or multiple samples, including cross sections. The Magellan 400 provides industry leading performance without compromising the high throughput, sample flexibility and ease of use of a traditional SEMs.

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 imaging technique.

The Magellan 400's top-of-the-line performance is enabled by a unique electron column design integrating FEI's novel and patented UC technology, together with a high stability platform design and advanced 5 axis 100 mm piezoceramic stage. An integrated plasma cleaner and liquid nitrogen cold trap ensure the cleanliness of the sample. The Magellan 400 complements its unique low energy performance with high resolution STEM imaging at higher energies, and full analytical capability including EDS and EBSD analysis.

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

Key benefits

- *Subnanometer resolution from 1 kV to 30 kV with uncompromised stability and beam currents to up to 20 nA*
- *Innovative electron optics, including FEI's patented UniColore (UC) technology that enables an energy spread of less than 0.2 eV*
- *High throughput and fast 'time to answer' by performing material and defect analysis on a single tool*
- *Landing energies down to 50 V for surface sensitive high resolution imaging*
- *High precision, high stability stage, offering XHR imaging on the complete surface of a 100 x 100 mm sample, in a large analytical chamber*
- *No compromises in sample size, shape, composition, preparation*
- *Application versatility that includes analysis and prototyping*
- *Simple and easy to use, as any SEM should be*

Essential specifications

Electron optics
- UHR immersion lens FE-SEM column with:
  - Elstar electron gun, Schottky thermal field emitter, hot swap capability, and UC technology
  - 60 degree dual objective lens with pole piece protection
  - Heated objective apertures
  - Electrostatic scanning
  - ConstantPower™ lens
  - Beam deceleration

Source lifetime
- Electron source lifetime: 12 months

Electron beam resolution
(site survey required to determine attainable resolution)
- Resolution @ optimum WD
  - 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 beam coincident point (WD 4 mm)

Landing energy range
- 50 V – 30 kV

Probe current
- E-beam: 1 pA to 22 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
- NG in-lens detector (TLD) for secondary and back-scattered electrons
- Everhardt Thornley SED for secondary electrons
- IR camera for viewing sample/column
- Retractable low kV, high contrast solid state detector (vCD), NSR

Chamber
- E-beam and EDX coincidence point at 4 mm WD

5 axes UHR motorized stage
- Mechanically tilt eucentric stage with < 5 µm image motion when tilting 0 ° to 52 °
- X, Y = 100 mm
- Z ≥ 20 mm
- T = - 10 ° to + 60 °
- R = 720 ° stroke
- X, Y repeatability 0.5 µm
- X, Y accuracy < 1.5 µm 85 % tolerance interval

Sample sizes
- Maximum size: 100 mm diameter with full rotation
- Maximum thickness (via loadlock, standard shuttle, including stub or any kind of holder): 8.7 mm
- Maximum thickness (via chamber door): 20 mm
- Weight: 200 g (including holder)

Sample holders
- Multi-stub holder (std for 400 L)
- Cross-sectional holder (std for 400 L)
- 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 µs/pixel
- Up to 4096 x 3536 pixels
- File type: TIFF (8, 16, 24 bit), BMP or JPEG
- Single frame or 4 quadrant image display
- Variable average or integration up to 256 frames

System control
- 32 bit GUI with *Windows® XP* SP 2, keyboard, optical mouse
- Two 19 inch LCD displays, SVGA 1280 x 1024
- Software controlled switchbox
- Joystick
- Multifunctional control panel

Supporting software
- 'Beam per quad' graphical user interface concept

Common accessories
- EDX integration kit (EDAX/Oxford Instruments)
- EDX options

Consumables (partial list)
- Replacement electron source module
- Aperture strips for electron

Software options
- Web enabled data archive software
- Image analysis software

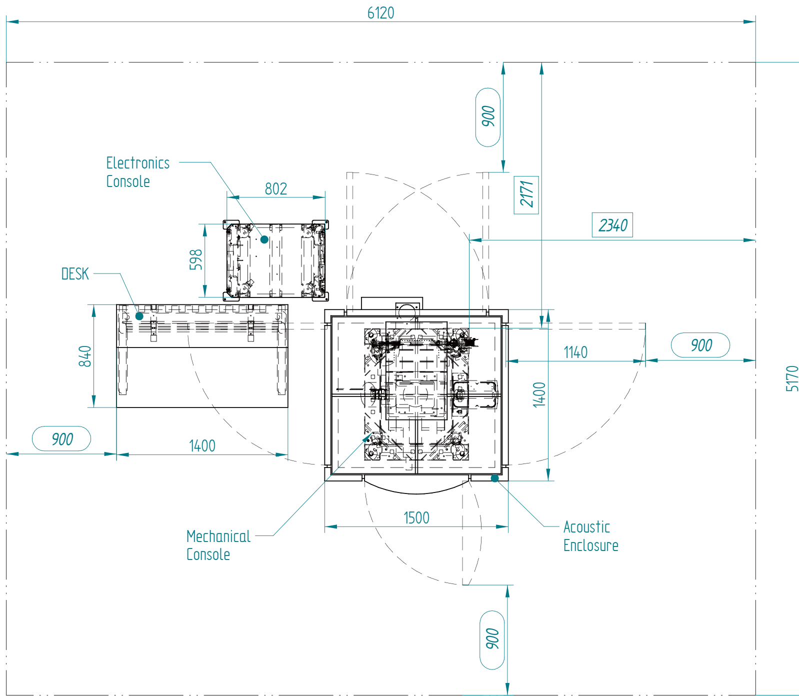
Warranty and training
- 1 year warranty
- Applications training class at NanoPort
- Application training onsite
- Choice of service maintenance contracts
- Choice of operation / application training contracts

Documentation
- Safety manual
- Operation manual (electronic)

Installation requirements

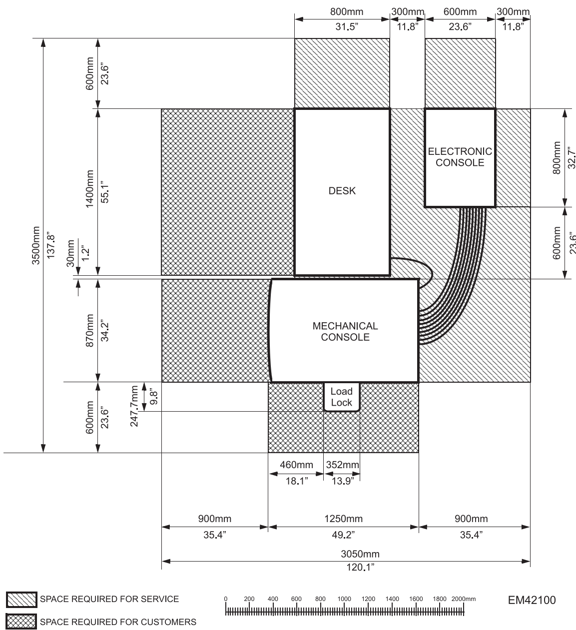
(refer to pre-install guide for additional data)
- Power: voltage 230 V (+/- 6 %), frequency 50 or 60 Hz (+/- 1 %)
- Power consumption: < 3.0 kVA for basic microscope
- Earth resistance: < 0.1 Ω
- Environment: temperation 20 °C +/- 3 °C, relative humidity below 80 % RH, stray AV magnetic fields
  < 100 nT asynchronous
  < 300 nT synchronous for line times > 20 ms (50 Hz mains) or > 17 ms (60 Hz mains)
- Preferred door width: 120 cm (90 cm is possible when removing load lock and the manifold)
- Weight: column console 850 kg
- Dry nitrogen: system (0.7 to 0.8 bar, max 10 l/min during vent); dry pump (1.0 bar, 2 l/min)
- Compressed air: 4 to 6 bar - clean, dry and oil free
- System chiller
- Acoustics guidelines:
  < 55 dBC (no acoustic enclosure)
  < 70 dBC (with acoustic enclosure present)
  (site survey required as acoustic spectrum relevant)
- Floor vibrations
  (site survey required as floor spectrum relevant)
- Vibration isolation table available as NSR

Floor plan with enclosure



Floor plan without enclosure

If you position the electronic console behind the desk, you can place the system in a room of 3500 x 3050 mm (137.8 x 120.1 inch).



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TÜV Certification for design, manufacture, installation and support of focused ion- and electron-beam microscopes for the NanoElectronics, NanoBiology, NanoResearch and Industry markets.

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