DATASHEET

Prisma E SEM

The most complete SEM for multi-use laboratories requiring all-round performance and ease-of-use

The Prisma E SEM offers all-round performance in imaging and analytics, a unique environmental mode (ESEM), and a full range of accessories that make it the most complete tungsten SEM available.

Academic and Industrial research laboratories expect a modern SEM to get the most data out of the widest variety of samples with excellent image quality. Since most laboratories are multi-user facilities, ease of use is of utmost importance for all data to be accessible for operators of all experience levels. The Thermo Scientific™ Prisma™ E SEM delivers excellent resolution, while three separate imaging modes (high vacuum, low vacuum and Thermo Scientific ESEM™) provide flexibility for accommodating the widest range of samples of any SEM available, including samples that are outgassing, uncoated or otherwise not vacuum compatible. The choice of detectors (directional backscatter detector, STEM, cathodoluminescence and more) provides all necessary sample information. Simultaneous acquisition and display of detector signals allows answers to be available in the shortest amount of time. Moreover, ESEM enables the *in situ* study of samples in real-world conditions, such as wet, hot, humid, or reactive environments. The Prisma E SEM also includes a range of software-integrated *in-situ* stages to perform and control dynamic experiments.

The increasing need for elemental (EDS, WDS) and crystallographic (EBSD) sample data is accommodated by the Prisma E SEM's analytical chamber, which supports multiple EDS detectors to increase throughput and remove shadowing effects. In addition, the analytical chamber supports coplanar EDS/EBSD and parallel beam WDS to ensure optimum positioning for all techniques. Thanks to the Prisma E SEM's *in situ* capabilities, reliable analytical results are obtained even on samples that are insulating or at high temperature.

As multi-user facilities require all this data to be acquired by a large group of users while minimizing the required training time, ease of use is paramount. The Prisma E SEM comes with the latest generation of the proven xT user interface on Windows 10 which includes User Guidance – a help function

Key benefits

***In-situ* study of materials in their natural state:** Prisma E offers a unique environmental mode (ESEM).

Minimize sample preparation time: low vacuum and ESEM capability enable charge-free imaging and analysis of non-conductive and/or hydrated specimens.

Observe all information from all samples with simultaneous SE and BSE imaging in every mode of operation

***In situ* analysis** at temperatures ranging from -165°C to 1400°C with specialized *in situ* stages.
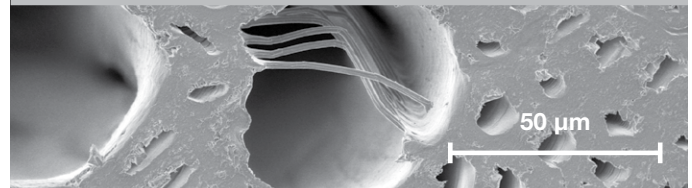
Excellent analytical capabilities with a chamber that allows 3 simultaneous EDS detectors, EDS ports that are 180° opposite, WDS, and coplanar EDS/EBSD.

Excellent analysis of non-conductive samples: high-quality EDS and EBSD are enabled in low vacuum with the Prisma E SEM's through-the-lens pumping.

Highly accurate eucentric sample stage tilt range of 105° for sample observation from all perspectives.

Easy to use, intuitive software with User Guidance and Undo functionality makes highly effective operation possible for novice users, while enabling experts to do their work faster and with fewer mouse clicks.

A wide range of options, including a retractable RGB CL detector, a 1100°C high vacuum heating stage, µHeater and Autoscript, a Python-based scripting tool (API).

50 µm

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that directly interacts with the microscope. It also includes a full 'Undo' functionality, encouraging novice users to experiment with peace of mind, while expert users easily shorten their time to results. The Prisma E SEM supports scanning presets, easy camera-based navigation and Thermo Scientific SmartSCAN™ to boost productivity, data quality and ease of use even further. For routine work, the Prisma E SEM can be automated with Autoscript, a powerful Python-based scripting tool.

This unique combination of accessible all-round performance with a complete set of accessories makes the Prisma E SEM the go-to SEM for research and failure analysis in any industry or field. Typical applications include:

Nanocharacterization
- Metals & alloys, fractures, welds, polished sections, magnetic and superconducting materials
- Ceramics, composites, plastics
- Films/coatings
- Geological sections, minerals

- Soft materials: polymers, pharmaceuticals, filters, gels, tissues, plant material
- Particles, porous materials, fibers

In-situ characterization
- Crystallization / phase transformation
- Oxidation, reduction, catalysis
- Material growth
- Hydration/dehydration/wetting/contact angle analysis
- Tensile (with heat or cooling)

Electron optics
- High performance thermal emission SEM column with dual-anode source emission geometry
- Fixed objective aperture for ease of operation
- 45° objective lens geometry
- Through-the-lens differential pumping reduces beam skirting for the most accurate analysis and highest resolution

Electron beam resolution
- High-vacuum imaging
  - 3.0 nm @ 30 kV (SE)
  - 4.0 nm @ 30 kV (BSE)*
  - 8.0 nm @ 3 kV (SE)
- High-vacuum imaging with beam deceleration
  - 7.0 nm @ 3 kV (BD mode* + DBS*)
- Low-vacuum imaging
  - 3.0 nm @ 30 kV (SE)
  - 4.0 nm @ 30 kV (BSE)
  - 10 nm @ 3 kV (SE)
- ESEM
  - 3.0 nm @ 30 kV (SE)

Electron beam parameter space
- Beam current range: up to 2 µA, continuously adjustable
- Accelerating voltage range: 200 V – 30 kV
- Magnification: 6 to 1000000×

Chamber
- Inside width: 340 mm
- Analytical working distance: 10 mm
- Ports: 12
- EDS take-off angle: 35°

Optimized detection for every vacuum mode			
Vacuum range	SE	BSE	Other
High vacuum: < 6·10⁻⁴ Pa	ETD, ICD*	DBS*, GAD*	
Low vacuum: up to 200 Pa	LVD	GAD*, DBS*	IR camera, Nav-Cam, STEM3+, CL, Current measurement, External
ESEM: up to 4000 Pa	GSED, ESEM-GAD*	ESEM-GAD*, GAD*	

- Three simultaneous EDS detectors possible, two at 180°

- Coplanar EDS/EBSD orthogonal to the tilt axis of the stage

- General purpose 9-pin electrical feedthrough

Detectors

Prisma E detects up to four signals simultaneously from any combination of the available detectors or detector segments:

- ETD – Everhart-Thornley SE detector

- Low-vacuum SE detector (LVD)

- Gaseous SED (GSED) (used in ESEM mode)

- IR camera for viewing sample in chamber

- Nav-Cam™: color optical camera for sample navigation*

- DBS – Directional Backscatter Detector; retractable or lens-mounted segmented under-the-lens BSED*

- DBS-GAD – Lens-mounted gaseous analytical BSED*

- ESEM-GAD for simultaneous SE and BSE detection in ESEM at high chamber pressure*

- STEM 3+ – Retractable segmented detector (BF, DF, HADF, HAADF)*

- WetSTEM™ – Cooling stage integrated STEM for observation of thin wet samples*

- RGB-CLD – real color CL detector*

- Electron beam current measurement*Vacuum system

- 1 × 250 liter/s TMP, 1 × PVP

- Patented through-the-lens differential pumping

- Beam gas path length: 10 mm or 2 mm

- Evacuation time: ≤ 3.5 minute to high vacuum and ≤ 4.5 minute to ESEM

- Optional CryoCleaner cold trap

- Optional upgrade to oil free scroll/dry PVPs

Sample holders

- Standard multi-sample SEM holder, uniquely mounts directly onto the stage, hosts up to 18 standard stubs (ø 12 mm), does not require tools to mount a sample

- Multi-purpose holder for 18 stubs, three pre-tilted stubs, cross-section samples and STEM samples as an option

- Each optional row-bar accommodates 6 S/TEM grids

- Wafer and custom holders*

Stage and sample

Type	Eucentric goniometer stage, 5-axes motorized
XY	110 × 110 mm
Repeatability	< 3.0 µm (@ 0° tilt)
Motorized Z	65 mm
Rotation	n × 360°
Tilt	-15° / +90°
Max. sample height	Clearance 85 mm to eucentric point (10 mm)
Max. sample weight	500 g in any stage position (up to 2 kg at 0° tilt)

Stage and sample

Max. sample size	122 mm diameter with full X,Y, rotation (larger samples possible with limited stage travel or rotation)

System Control

- 64-bit GUI with Windows 10, keyboard, optical mouse

- 24-inch LCD display, WUXGA 1920 × 1200 (second monitor optional)

- Customizable graphical user interface, with up to 4 simultaneously active views

- Image registration

- Navigation montage

- Image analysis software

- Undo / Redo functionality

- User Guidance for basic operations / applications

- Optional joystick

- Optional manual user interface (knob board)

Image processor

- Dwell time range from 25 ns – 25 ms/pixel

- Up to 6144 × 4096 pixels

- File type: TIFF (8, 16, 24 bit), JPEG or BMP

- Single-frame or 4-view image display

- SmartSCAN (256-frame average or integration, line integration and averaging, interlaced scanning)

- DCFI (Drift Compensated Frame Integration)

In-situ accessories (optional)

- Software controlled -20°C to +60°C Peltier cold stage

- Software controlled 1000°C ESEM heating stage

- Software controlled 1100°C High Vacuum Heating Stage

- Software controlled 1200°C µHeater

- Software controlled 1400°C ESEM heating stage

- Manipulators

- Cryo-stage

- Electrical probing / multi-probing stations

System options

- Beam deceleration with stage bias from -4000 V to +50 V

- Fast beam blanker

- Sample / chamber cleaning: CryoCleaner, Integrated Plasma Cleaner

- QuickLoader™: load lock for fast sample transfer

- Support PC

- Manual user interface

- Joystick

- Analysis: EDS, EBSD, parallel beam WDS, CL, Raman

- Integrated 16-bit patterning engine, electron beam lithography modules

- Specimen current meter

- Specimen holder kit

- Acoustic enclosure for vacuum pump
- 7 or 52 pin electrical feedthrough
- Oil free pre-vacuum option (dual scroll pumps)
- SEM start-up kit

Software options
- Maps™ for automatic large area acquisition using tiling and stitching; correlative work
- Autoscript 4; a Python-based application programming interface
- TopoMaps for image colorization, image analysis and 3D surface reconstruction
- Web-enabled data archive software
- Advanced image analysis software
- Remote control software

Documentation
- Online User Guidance
- Operating instructions handbook
- Online help
- Prepared for RAPID™ (remote diagnostic support)

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

Installation requirements
(Refer to preinstall guide for detailed data)

- Power:
    - Voltage 100 – 240 V AC (-6%, +10%)
    - Frequency 50 or 60 Hz (±1%)
    - Consumption: < 3.0 kVA for basic microscope
- Earth resistance < 0.1 Ω
- Environment:
    - Temperature (20 ± 5)°
    - Relative humidity below 80%
    - Stray AC magnetic fields < 100 nT asynchronous, < 300 nT synchronous for line times, 20 ms (50 Hz mains) or 17 ms (60 Hz mains)
- Minimum door size: 0.9 m wide × 1.9 m high
- Weight: column console 550 kg
- Dry nitrogen recommended for venting
- Compressed air 4-6 bar – clean, dry and oil-free
- Acoustics: < 68 dBC (site survey required as acoustics spectrum relevant)
- Floor vibrations: site survey required, as floor spectrum relevant
- Optional active vibration isolation table

Consumables (partial list)
- Tungsten filaments

* Optional

Find out more at **thermofisher.com/EM-Sales**

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