

Taking EDS capability on FEG-SEM to extreme levels

Ultim Extreme is a breakthrough solution for ultra high resolution FEG-SEM. For the first time, this unique detector enables EDS data collection at very low kV (e.g. 1-3 kV) and very short working distance to provide elemental analysis under the conditions customers are using to analyse nano-materials and surfaces at the highest SEM resolution.

Ultim Extreme delivers solutions beyond conventional micro and nano-analysis:

- Ultimate spatial resolution for SEM-EDS
- Surface science sensitivity
- Materials discrimination down to 1kV
- Fastest and most accurate nano-characterisation
- Extreme light element sensitivity including detection of Lithium

	Specification
Sensor	<p>Single sensor with 100 mm² active area with a unique design that achieves >5x the solid angle of conventional large area sensors of equivalent size.</p> <p>Solid angles of up to 0.35sr are possible using Ultim Extreme.</p> <p>Solid angles vary depending on the particular microscope, for the solid angle for your configuration, please consult Oxford Instruments.</p>
Unique detector geometry	Optimised tube, sensor, electron trap and collimator design to minimise analytical working distance for unparalleled spatial resolution and extended operating range down to <1 kV.
Low energy performance	Windowless operation for maximum sensitivity at low energy (see table)
Detection range	<p>Detection from Lithium (Li) to Bismuth (Bi)</p> <p>Electron trap for operation up to 7 kV.</p> <p>Extended operation up to 15 kV for element identification*</p>
Resolution guarantees	<p>Standard</p> <ul style="list-style-type: none"> ● Mn Kα resolution guaranteed to be less than 127 eV at 130,000cps ● F Kα resolution guaranteed to be less than 64 eV at 130,000cps ● C Kα resolution guaranteed to be less than 56 eV at 130,000cps <p>Detector resolution specifications are in compliance with ISO15632:2012</p>
Cooling	<p>LN₂-free, vibration free, Peltier Cooling</p> <ul style="list-style-type: none"> ● Requires only an electrical supply ● No external compressors, chillers, or gas lines required – no vibration
Multiple detector option	<ul style="list-style-type: none"> ● Optional additional Ultim Max detector to fulfill requirements for conventional microanalysis at lower vacuum or high accelerating voltage conditions

* Range of extended operation is microscope dependant with greater than 15kV possible in some immersion lens fields.

Light element collection efficiency compared to detector with ultra thin window

The difference the windowless operation makes to the effective solid angle (collection efficiency) for lighter elements on the **Ultim Extreme** is shown below.

	Si L ℓ	Be K α	N K α	O K α	Si K α
Improvement	x8	x3.3	x2.8	x2.1	x1.5

Special requirements for detector operation

Ultim Extreme is a unique detector that requires special precautions during operation:

- Windowless operation means the detector can only be cooled when a high vacuum is attained in the SEM chamber
- The detector must be placed in standby mode before sample exchange or chamber venting
 - Standby mode will warm up the sensor and retract the detector behind the integrated flap
 - The detector is safe for chamber venting 10 minutes after the detector is placed in standby mode
 - A sample exchange airlock is recommended
 - If no sample exchange airlock is available, the chamber must be vented to dry nitrogen
 - The integrated pressure sensor will protect the detector from accidental loss of chamber pressure
- Windowless operation means the detector must be placed in standby mode and retracted behind the integrated flap during operation of an in chamber plasma cleaner, focused ion beam, gas injection system, or any other source of non-electron based ions or gases
- Windowless operation means the detector must be placed in standby mode and retracted behind the integrated flap before the warm up of liquid nitrogen or other cryo-cooled anti-contaminators
- The Geometry of this detector places the detector extremely close to the sample. Special care must be taken to ensure there is no collision between sample and detector
 - The use of an IR camera positioned so the detector and sample are clearly visible is required when using this detector
- The electron trap is designed to stop up to 7kV backscatter electrons
 - When operating above 7kV some backscatter electrons will impact with the sensor
 - When used with some immersion lens effective trapping of electrons may be possible at higher accelerating voltages
 - These electrons will not affect the performance or life of the detector, but will impact the quality of results
 - Where electrons are impacting the detector sensor, it should not be used for quantitative EDS analysis
- When the detector is not in use we strongly recommend it is placed in standby mode, retracted behind the integrated flap

Failure to follow these operating instructions could damage your detector and will invalidate the detector warranty.

As Standard:

- Motorised slide
- **Extreme** electronics, ensuring accurate results at all count rates. Includes pulsed restore for performance at high throughput and a stable response with changing count rate
- Customised detector interface for your microscope with 'O' ring vacuum seals to the chamber and vacuum bellows seal to the detector probe
- Manufactured under ISO9001 standard

X4 pulse processor and imaging electronics

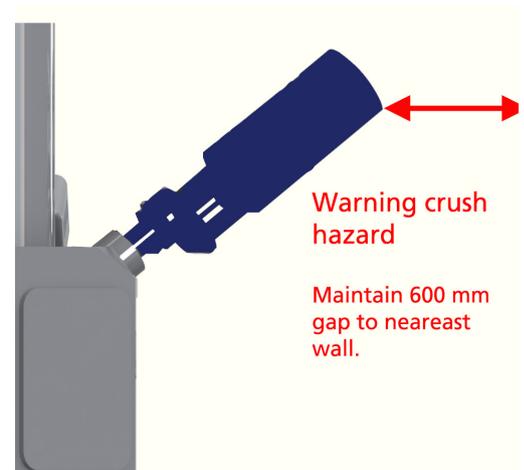
X4 is the latest generation pulse processor with fully integrated microscope digital control and image capture. **X4** uses fully digital pulse processing for accurate handling of very high count rates. Ethernet high speed communications connect with the analyser PC.

- Digital pulse processing and control for up to 4 EDS detectors
- Effective pile-up discrimination when working at very high count rates
- Six process times to provide full control of count rate and resolution
- 4 imaging inputs
- Microscope X,Y beam control
- External synchronisation of beam position for EBSD, WDS and other techniques

Ultim Extreme environmental specification

These requirements are necessary for the installation and operation of the system and are the responsibility of the purchaser.

- Operating temperature: 10°C to 30°C
- Operating humidity: <80% relative humidity, non-condensing
- Warning crush hazard: detector may retract without warning. Maintain 600 mm distance from wall.

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