



# TESCAN VEGA

## Analytical SEM for routine materials characterization, research and quality control applications at the micron scale.

TESCAN VEGA's 4<sup>th</sup> generation Scanning Electron Microscope (SEM) with tungsten filament electron source combines SEM imaging and live elemental composition analysis in a single window of TESCANA's Essence™ software. This combination

significantly simplifies acquisition of both morphological and elemental data from the sample, making VEGA SEM an efficient analytical solution for routine materials inspection in quality control, failure analysis and research labs.

### Key benefits:

- ✓ Analytical platform featuring fully integrated TESCANA Essence™ EDS, which efficiently combines SEM imaging with elemental composition analysis in a single Essence™ software window.
- ✓ Optimum imaging and analytical conditions immediately available thanks to TESCANA's unique apertureless design powered by InFlight Beam Tracing™.
- ✓ Effortless and precise SEM navigation on the sample at magnification as low as 2× without the need for an additional optical navigation camera due to the unique Wide Field Optics™ design.
- ✓ Intuitive and modular Essence™ software designed for effortless operation regardless of a user's experience level.
- ✓ Ultimate safety of the chamber mounted detectors when the stage and sample are in motion is guaranteed with Essence™ 3D Collision model.
- ✓ SingleVac™ mode as a standard feature for observing charging and beam-sensitive samples.
- ✓ Optional vacuum buffer significantly reduces vacuum rotary pump run-time to deliver both ecological and economic benefits.
- ✓ Modular analytical platform which can be optionally equipped with widest selection of fully integrated detectors (e.g. CL, Water cooled BSE or RAMAN spectrometer).



Single Beam  
(SEM)



Tungsten  
Electron  
Source



Variable  
Pressure  
(MultiVac)



Integrated  
EDS analyzer



TESCAN VEGA features an innovative optics design which guarantees immediate and seamless selection of imaging or analytical conditions whenever required, without need for mechanical re-alignment of any in-column element. With the fully integrated Essence™ EDS, switching from imaging to analytical operation is fast and easy. A single mouse click changes all set-up parameters through the software.

Furthermore, precise navigation to the desired area of interest is guaranteed by Wide Field Optics™, which provides the operator with a live SEM overview of the sample. Wide Field Optics™ replaces the traditional CCD camera and provides unprecedented depth of focus along with a view of the sample's actual topography for a more intuitive navigation process. Begin observation in the live SEM window at 2× magnification for a detailed overview, then continuously magnify directly over areas of interest—without the need for an optical navigation camera. Live SEM overview also can be used with pre-tilted holders, such as those for EBSD, and supports scanning tilt correction for accurate navigation on tilted analytical samples.

TESCAN VEGA is operated from TESCAN Essence™ multiuser software, which features many tools to speed analytical work, like quick search function, undo commands and presets. TESCAN Essence™ is built to allow users to define specific workflows that match their level of experience and/or specific

application need. Additionally, Essence™ Collision model virtually replicates the chamber interior for a live visualization of hardware geometry, size and position of stage, samples and chamber mounted equipment. Essence™ Collision model predicts the intended movements and interactions for a particular imaging or analytical routine to make it nearly impossible for samples to collide with any chamber mounted detector or 3<sup>rd</sup> party devices, like tensile or heating stages.

TESCAN VEGA is delivered with SingleVac™ mode as standard. SingleVac™ uses a factory preset pressure value to make observation of charging samples possible, without a conductive surface coating. SingleVac™ can be accompanied by optional MultiVac mode to allow continual adjustments to chamber pressure, up to 500 Pa for SE and BSE imaging of extreme charging, outgassing and beam sensitive materials. Another option for the VEGA vacuum system is a vacuum buffer which significantly reduces the run time of the rotary pump for both ecological and economic returns.

These features make TESCAN VEGA an ideal analytical solution for a variety of materials characterization requirements in quality analysis labs of manufacturing industries, as well as R&D facilities.





## Essential Specifications

### TESCAN VEGA™ column

- Electron source: Tungsten heated cathode
- Electron beam landing energy range: 200 eV–30 keV
- Setup of beam current by electromagnetic beam aperture control (Intermediate Lens™)
- Probe current: 1 pA–2 µA, continuously adjustable
- Maximum field of view: 7.7 mm @ WD=10 mm, >50 mm @ max. WD
- Magnification: 2× to 1,000,000×

### Electron Beam Resolution:

#### High Vacuum Mode

- 3 nm @ 30 keV with SE detector
- 8 nm @ 3 keV with SE detector

#### Low Vacuum Mode

- 3.5 nm @ 30 keV with BSE\*
- 3.4 nm @ 30 keV with GSD\*

### Vacuum Chamber

#### LM Chamber

- Internal diameter: 230 mm
- Ports: 12+
- Chamber view (IR) camera
- 2<sup>nd</sup> chamber view (IR) camera\*
- Manual or motorized retraction of chamber mounted detectors

#### LM Stage

- Motorized, 5-axis compucentric Stage
- X & Y axis travel range: 80 (X) x 60 (Y) mm
- Z axis travel range: 50 mm
- Tilt range: compucentric, -80° to +80°
- Rotation: compucentric, 360 degrees (continuous)
- Max. specimen height<sup>a)</sup>: 39 mm (65 mm without stage rotation)
- Max. specimen size: 100 mm diameter with full XY moves, rotation, no tilt (larger samples possible with limited stage travel and rotation)
- Max. specimen weight: 1000 g
  - With stage rotation: 500g
  - Without stage rotation: 1000 g

#### GM Chamber

- Width: 340 mm
- Depth: 315 mm
- Ports: 20+
- Extension for 6" and 8" wafers\*
- Extension for 6", 8" and 12" wafers (with cradle stage)\*
- Extension for parallel Raman microscope with Spectrometer (RISE™)\*
- Chamber view (IR) camera
- 2<sup>nd</sup> chamber view (IR) camera\*
- Motorized retraction of chamber mounted detectors

#### GM Stage

- Motorized, 5-Axis Compucentric Stage
- X & Y axis travel range: 130 mm
- Z axis travel range: 100 mm
- Tilt range: compucentric, -60° to +90°
- Rotation: compucentric, 360 degrees (continuous)
- Max. specimen height<sup>a)</sup>: 92 mm (133 mm without stage rotation)
- Max. specimen size: 180 mm diameter with full XY moves, rotation, no tilt (larger samples possible with limited stage travel and rotation)
- Max. specimen weight: 8000 g
  - With stage rotation: 1000g
  - Without stage rotation: 8000 g
- Cradle stage\*

*Note: The range of movements is dependent on the configuration and WD/Z*

### Vacuum System

- High vacuum: Operating pressure in order of 10<sup>-3</sup> Pa or below<sup>\*1</sup>
- SingleVac™: 30 ±10 Pa<sup>\*a</sup>
- MultiVac (N<sub>2</sub>, H<sub>2</sub>O)\*: 7-500 Pa
- Pump types: Oil rotary pump or Dry Scroll pump\*
- Vacuum buffer<sup>\*b</sup>
- Load lock (manual or motorized)\*
- Integrated plasma cleaner (Decontaminator)

<sup>\*a)</sup> Vacuum pressure is factory preset at 30 Pa. Value can gradually change during actual use. Exact value of pressure is not subjected to any kind of measurement during the acceptance protocol at customer's site. SingleVac™ pressure cannot be adjusted or measured by user or service engineer at customer's site.

<sup>\*b)</sup> Cannot be ordered if SEM is equipped with Load Lock and/or decontaminator.

*\*Optional equipment*

*<sup>\*a)</sup> Clearance to analytical WD*

*<sup>\*1</sup> <5x10<sup>-2</sup> Pa measured with standard gauge*

*<1x10<sup>-3</sup> Pa measured with optional wide range gauge*



## Detectors and Analyzers

- pA meter including touch alarm function
- Everhart-Thornley chamber detector (SE)
- Gaseous SE detector (GSD), standard with MultiVac\*
- Retractable BSE, scintillator type (R-BSE)\*
- Low energy, scintillator type, retractable BSE (LE-BSE)\*
- Low energy, solid state, retractable, 4 quadrant BSE (4Q LE-BSE)\*
- Water-cooled, scintillator type, retractable BSE, heat resistant <800°C\*
- Aluminum-coated, scintillator type, retractable BSE for concurrent CL detection (Al-coated BSE)\*
- Compact, retractable panchromatic CL detector, 350–650 nm\*
- Compact, retractable panchromatic CL detector, 185–850 nm\*
- Compact, retractable, color Rainbow CL detector\*
- CL retractable panchromatic detector, 350–650 nm\*
- CL retractable panchromatic detector, 185–850 nm\*
- CL retractable panchromatic rainbow detector\*
- Retractable STEM detector, BF, DF and HADF sectors, holders for up to 8 grids (HADF R-STEM)\*
- Optical Navigation and Correlation Camera (ONCam)\*<sup>2</sup>
- EDS (3<sup>rd</sup> party)\*
- EBSD (3<sup>rd</sup> party)\*
- WDS (3<sup>rd</sup> party)\*
- Confocal RAMAN Spectrometer (RISE™)\*

## Essence™ EDS\*

EDS analysis is available in live SEM scanning window of Essence™ software using fully integrated energy dispersive X-ray spectroscopy (EDS) detector.

- Manual retraction\*
- Acquisition modes: Spectrum from region, point & ID, line scan and elemental mapping are included
- EDS detector chip/window size 30 mm<sup>2</sup>
- EDS detector with Si<sub>3</sub>N<sub>4</sub> window
- 129 eV resolution @ Mn Kα
- Number of pulse processing settings: 3
- Maximum input count rate: up to 1,000,000 CPS
- Maximum output count rate: up to 300,000 CPS
- Quantification: standardless, ZAF corrected
- Reporting: Yes

## Accessories

- Electron Beam Lithography\*
  - Electrostatic beam blanker for SEM column\*
  - TESCAN Essence™ EBL Kit\*
  - TESCAN Flow™ EBL Offline\*

## SEM Scanning Systems

- Dwell time: 20 ns–10 ms, in steps or continuously adjustable
- Full frame, selected area, line or point
- Image shift, scan rotation, tilt correction
- Line and frame accumulation
- Drift-corrected frame accumulation (DCFA)
- Dynamic focus

## Image Acquisition

- Max. frame size: 16k x 16k
- Aspect ratio: 1:1, 4:3 and 2:1
- Image stitching\* (requires Essence™ Image Snapper)
- Up to 8 channels can be acquired simultaneously
- Color mapping and multi-channel signal mixing
- Multitude of image formats including TIFF, PNG, BMP, JPEG and GIF
- Dynamic range: 8 or 16 bits

## User Interface

- Keyboard and Mouse
- Trackball
- Control panel\*
- TESCAN Essence™ graphical user interface

## Microscope Control PC

- Standard PC: Intel® Core i3-9100F, Quad Core 3.60 GHz, RAM Hyper Fury 2x 4GB 2400MHz DDR4, 500 GB SSD M.2, nVIDIA GT1030 2GB GDDR5 PCI-E x16, Windows 10 Pro 64-bit
- High performance PC: Intel Core i7-8700, RAM Hyper Fury 2x 8GB 2400MHz DDR4, 250 GB SSD M.2 and 2 TB S-ATA 7200 RPM, Nvidia GTX 1060 3GB GDDR5 PCI-E x16, Windows 10 Pro 64-bit (details available upon request)\*
- CCC PC: PC which has China Compulsory Certification (CCC) - Intel® Core i7-6700 Quad Core 3.40 GHz, RAM 16 GB, HDD 2TB, AMD FirePro W5100 4GB, Windows 10 Pro 64-bit\*
- 32" QHD monitor
- 2<sup>nd</sup> 32" QHD monitor\*
- UPS\*

## TESCAN Essence™ Software

- Customizable GUI layout
- Multi-user account management
- Quick search bar
- Undo/Redo commands
- Single, dual, quad or hexa live image(s) display
- Multi-channel colored live image

\*Optional equipment

<sup>2</sup>Navigation image can be acquired for samples with maximum height 40 mm.



### Automated and Semi-Automated Routines

- SEM emission control
- Electron source heating
- Electron source centering
- Column centering
- Vacuum control
- Auto diagnostic
- Electron source alignment
- Contrast and brightness, autofocus
- In-Flight Beam Tracing™
- Switch-off Timer
- CORAL™\*
- Image Snapper\*
- Sample Observer\*
- SharkSEM™ Advanced (Python scripting)\*
- System Examiner\*
- Synopsys Client\*
- TESCAN Flow™ (offline processing)\*

*\*c) Integration of 3<sup>rd</sup> party equipment depends on the availability of a 3D CAD model.*

### Advanced Essence™ Modules

- Measurement, Tolerance Measurement
- Image Processing
- Presets
- Histogram and LUT
- SharkSEM™ Basic (Remote Control)
- 3D Collision Model<sup>\*c</sup>
- Object Area
- Positioner

## Microscope Installation

### Installation Requirements<sup>\*1</sup>:

- Power supply: 230 V  $\pm$ 10% / 50 Hz (or 120 V / 60 Hz-optional), power 1300 VA
- Compressed air: 6–7 bar (87–102 psi), clean, dry, oil free
- Compressed nitrogen for venting: 1–7 bar (15–102 psi), 99.99% purity (4.0 purity level)
- Room for installation: min. 3 × 3 m; minimum door width 0.9 m (1.0 m if equipped with R-STEM and/or Motorized Load-lock)

*\*1 Request site-survey by TESCAN authorized technician*

### Environmental Requirements<sup>\*2</sup>

- Temperature of environment: 17–24°C with stability better than 2°C with a rate of change 1°C/hour
- Relative humidity: <65 %
- Background magnetic field: synchronous <300 nT, asynchronous <100 nT
- Vibrations: <4  $\mu$ m/s below 30 Hz, <8  $\mu$ m/s above 30 Hz
- Altitude: max. 3000 m above sea level

*\*2Specification of background magnetic field is subject to actual acceleration voltage. Specified values are for 20 kV acceleration voltage.*

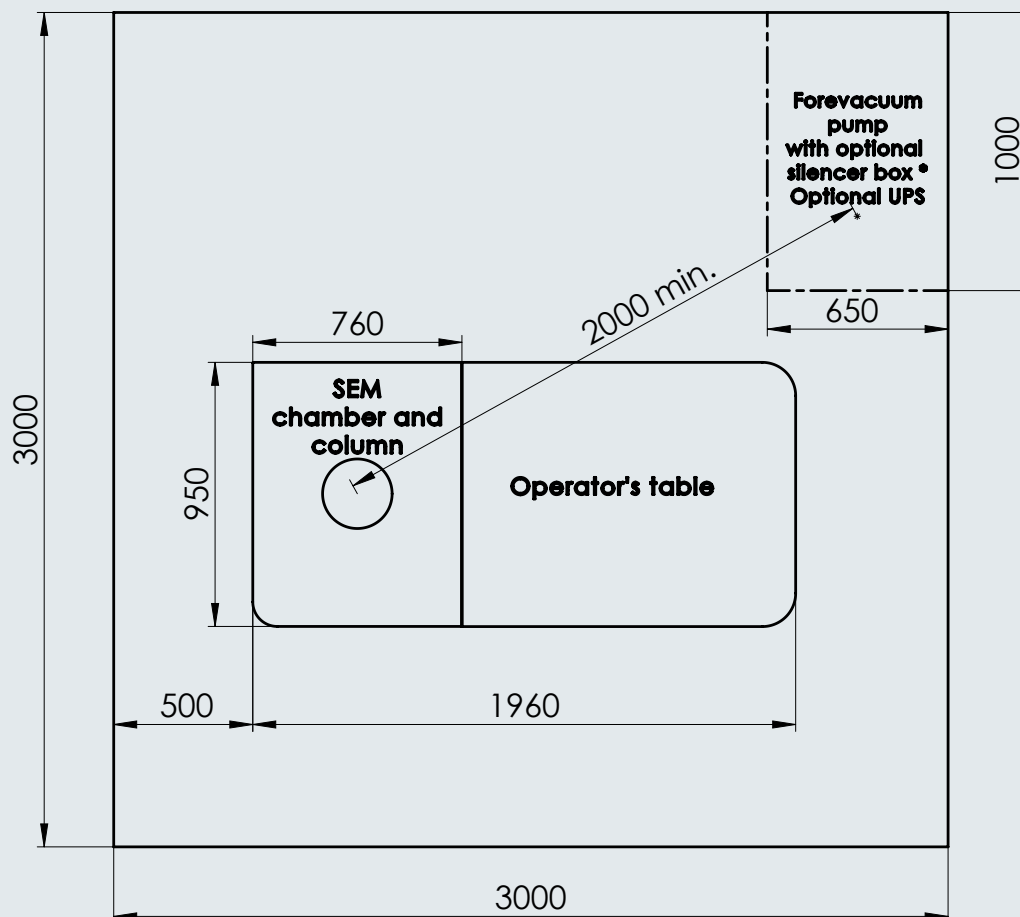
### Training

- **Introductory:** by TESCAN engineer after installation
- **Advanced (option):** at TESCAN facilities or on-site

### Footprint of the microscope (all dimensions in mm):

If a fore-vacuum pump is to be placed in the same room as the TESCAN VEGA microscope, then it is highly recommended to purchase the TESCAN silencer box together with the microscope (to be ordered separately).

*\*Optional equipment*



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TESCAN VEGA is based on the TESCANA S5000 platform

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