TESCAN TIMA

FOR EARTH SCIENCE AND MINERAL PROCESSING

TESCAN TIMA G4, our latest generation Automated Mineralogy analyzer, improves ease of use and delivers ultra-fast analysis—speeding your time to trustworthy data. TIMA is equipped with up to four EDS detectors which work simultaneously to increase sample processing throughput, as well as scan with the higher spatial resolution required to identify the composition of fine grains. TESCAN's unique, high sensitivity spectral summing algorithm assures accurate quantification for low abundance and light elements. TIMA Automated Mineralogy software features automation scripts to guide unattended operation, assuring reproducible petrographic data along with liberation degree, locking and mineral associations. TIMA data is easily correlated with other techniques for mineral characterization. And when TIMA isn't used for dedicated mineralogical and petrographic studies, it doubles as a high-performance FE-SEM for other imaging and microanalysis applications.

Key benefits:

- ✓ **Identify and quantify minerals automatically** – even without extensive experience – using algorithm-generated or user-defined rules and the built-in mineralogical database
- ✓ **Collect high speed, detailed measurements on more types of samples** with improved mineral–chemical resolution, increased sensitivity for low abundance elements and good sampling statistics, using the 4 EDS detectors and TIMA's unique spectral summing algorithm
- ✓ **Correlate high resolution BSE images, elemental maps and cathodoluminescence in a single run**
- ✓ **Pinpoint the locations of specific minerals using TIMA's automated search** for minerals of interest
- ✓ **Maintain continuous operation and rapid turnaround with a minimal number of laboratory operators** using the automation software to support unattended operation and remote, off-line analysis
- ✓ **Understand chemical variability within entire grain populations** as well as the bulk chemical sample composition using built-in EDS batch quantification
- ✓ **Free-up instrument time for interactive microanalysis** or automated measurement and by taking advantage of TIMA's offline data analysis and reporting capability

Single Beam (SEM)

Field Emission Electron Source

Variable Pressure (UniVac)

Integrated EDS detectors

Base unit configuration

- ✓ **Choice of 2 chamber / stage configurations: LMS and GMS**
- ✓ **Chamber vacuum modes: high vacuum, low vacuum (SingleVac™)**
- ✓ **Chamber-mounted SE and BSE detectors**
- ✓ **2 TIMA EDS detectors (30 mm²)**
- ✓ **SEM operation software (Essence™)**
- ✓ **TIMA Automated Mineralogy software**
- ✓ **Sample holder for multiple 30 mm epoxy blocks**

TESCAN TIMA Electron Optical Column:

- Schottky field electron emitter
- Electron beam landing energy range: 200 eV–30 keV (down to 50 eV with BDT option)
- Spot optimization by electromagnetic beam aperture control (Intermediate Lens™)
- Probe current: 2 pA–400 nA, continuously adjustable
- Maximum field of view: >12 mm at WD=15 mm, >50 mm at max. WD
- Magnification: 2× to 1,000,000×

Electron Beam Resolution:

High Vacuum Mode

- 1.2 nm @ 30 keV with SE detector
- 3.5 nm @ 1 keV with In-Beam SE detector*
- 1.8 nm @ 1 keV with BDT*

Low Vacuum Mode

- 2.0 nm @ 30 keV with BSE
- 1.5 nm @ 30 keV with LVSTD*

Vacuum Chamber

LM Chamber

- Internal diameter: 230 mm
- Ports: 12+
- Chamber view (IR) camera
- Manual or motorized retraction of chamber mounted detectors
- Pneumatic or optionally active vibration isolation system

LM Stage

- Motorized, 5-axis goniometer stage
- X & Y axis travel range: 80 (X) x 60 (Y) mm*[a]
- X & Y axis travel range with TIMA LM sample holders: 78 mm (−25 mm to +53 mm X) x 60 mm (−30 mm to +30 mm Y)
- Z axis travel range: 50 mm*[a]
- Z axis travel range with TIMA LM sample holders: 31 mm
- Tilt range: compucentric, -80° to +80°*[a]
- Rotation: compucentric, 360 degrees (continuous)
- Max. specimen height: 54 mm (81 mm without rotation platform)
- Maximum sample size: 145 (X) × 145 (Y) mm
- Maximum sample weight: 500 g (X, Y, Z, R, tilt)*[a]
- Without rotation platform: 1000 g (X, Y, Z)*[a]

Standard LM chamber TIMA sample holder

- Holder for 7 samples (30 mm round epoxy blocks)

GM Chamber

- Width: 340 mm
- Depth: 315 mm
- Ports: 20+
- Extension for parallel Raman microscope with spectrometer (RISE™)*
- Chamber view (IR) camera
- 2nd chamber view (IR) camera*
- Motorized retraction of chamber mounted detectors
- Pneumatic or optional active vibration isolation system

GM Stage

- Motorized, 5-axis goniometer stage (rotation is available only with rotation assembly)
- 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: 106 mm (147 mm without rotation platform)
- Maximum sample size: 335 (X) × 310 (Y) mm
- Maximum sample weight: 1000 g (X, Y, Z, R, tilt)
- Without rotation platform: 8000 g (X, Y, Z)
- Cradle stage*
- Pneumatic or optional active vibration isolation system

Standard GM chamber TIMA sample holders

- Holder for 15 samples (30 mm round epoxy blocks)

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

** Optional equipment*
**[a] With rotation assembly mounted*

Vacuum

- High vacuum: 10^{-3} Pa
- SingleVac: 30 ±10 Pa*[b]
- Pump types: all oil-free

Detectors and Analyzers

- pA meter including touch alarm function
- Everhart-Thornley SE detector
- Retractable BSE, scintillator type CRY-18 (R-BSE)*[c]
- In-Beam SE detector*
- LE In-Beam BSE detector*
- Low vacuum SE detector*
- Aluminum-coated, scintillator type, retractable BSE for concurrent CL detection (Al-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*
- EDS* (3rd party)
- EBSD* (3rd party)
- WDS* (3rd party)
- Confocal RAMAN Spectrometer (RISE™)*

TESCAN TIMA EDS Detectors

- Base units include 2 EDS detectors (Peltier-cooled SDD). Option to add 2 additional EDS detectors for a total of 4.
- EDS detector chip/window size 30 mm^2
- EDS detector with Si_3N_4 window < 100 nm thick
- 129 eV best resolution on Mn Kα
- Detection range C to Am
- Maximum input count rate: up to 1 000 000 CPS / detector
- Maximum output count rate: up to 300 000 CPS / detector
- Operating conditions 5–50°C, 20–80% RH non-condensing
- Take-off angle 35°
- Analytical WD 15 mm

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
- Dynamic focus
- Drift-corrected frame accumulation (DCFA)

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
- Supported image formats include 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

- High performance PC: Intel Core i7-8700, RAM Hyper Fury 2x 8GB 2400MHz DDR4, 250 GB SSD M.2 and 2 TB SATA 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*
- 2x 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

Automated and Semi-Automated Routines

- SEM emission control
- Electron source alignment
- Contrast and brightness, autofocus
- In-Flight Beam Tracing™

** Optional equipment*

**[b] Vacuum pressure is factory preset at 30 Pa. Value can gradually change during actual use.*

**[c] Manually retractable BSE is a standard for LM whereas motorized version is standard for GM chamber*

Advanced Essence™ Modules

- Measurement, Tolerance Measurement
- Image Processing
- Presets
- Histogram and LUT
- SharkSEM™ Basic (Remote Control)
- 3D Collision Model*[d]
- Object Area
- Positioner
- Switch-off Timer
- CORAL™*
- Image Snapper*
- Sample Observer*
- SharkSEM™ Advanced (Python scripting)
- System Examiner*
- Synopsys Client*
- TESCAN Flow™ (offline processing)*

TESCAN TIMA Software

- **TIMA online** – SW installed on the PC delivered with the SEM. It is used to acquire the automated mineralogical data as well as process existing data. Analytical modules for **modal analysis, liberation analysis** and **bright phase search** are included (see below).

- **TIMA offline** – can be installed on any PC complying with specifications (available upon request). It is used only for offline data processing. Each TIMA system comes with two licenses of TIMA Offline software.

Modal Analysis module

- Mineral classification
- Mineral mass evaluation
- Elemental deportment evaluation
- Elemental distribution maps
- Point/region spectrum review and MSA export
- Microscope navigation for field review

Liberation Analysis module

- Automatic particle detection
- Automatic phase recognition and classification
- Mineral association evaluation
- Mineral liberation and locking classification
- Cumulative liberation yield evaluation
- Element distribution maps
- Particle and grain size distribution
- Mineral mass evaluation
- Elemental deportment evaluation
- Particle texture mapping
- Phase/grain spectrum review
- Microscope navigation for field review

Bright Phase Search module

- Automated bright phase detection
- Automatic phase recognition and classification
- Mineral association evaluation
- Mineral liberation and locking classification
- Cumulative liberation yield evaluation
- Particle and grain size distribution
- Particle texture mapping
- Phase/grain spectrum review
- Microscope navigation for field review

Base unit options

UniVac*

TESCAN TIMA system can be delivered with the optional UniVac vacuum system upgrade which allows work in the pressure range of 1-700 Pa apart from the standard high vacuum operation.

Additional TESCAN TIMA EDS detector*

Up to two additional TESCAN EDS detectors including pulse processors can be added to base unit configuration to speed the data acquisition and to minimize analytical shadowing effect. The total number of all EDS detectors (including 3rd party systems) mounted on TIMA chambers is limited to four.

** Optional equipment*
**[d] Integration of 3rd party equipment depends on the availability of a 3D CAD model.*

Essence™ EDS software module*

Optional software module that allows EDS analysis to be available in live SEM scanning window of Essence™when using fully integrated energy-dispersive X-ray spectroscopy (EDS) detectors of TESCAN TIMA.

- Acquisition modes: Spectrum from region, point & ID, line scan and elemental mapping are included
- Multi point analysis
- Number of pulse processing settings: 3
- Quantification: standardless, ZAF corrected
- Reporting: Yes

EDAX Element EDS with APEX software suite*

TESCAN TIMA chamber can accommodate other third-party EDS systems. EDAX APEX Element detector offers a higher level of compatibility if combined with the hardware solution TIMA DPP LINK (see below). EDAX Element EDS is delivered with its own DPP and PC running the Apex SW suite.

TIMA DPP LINK*

Additional TESCAN DPP to link optional EDAX Element EDS detector to both TESCAN TIMA and EDAX DPP system. Linked EDAX Element EDS can be used for automated TIMA data acquisition in addition to its standard use with EDAX DPP and APEX SW suite.

Holders*

LM chamber

- Adaptor rings to analyze 25 mm round blocks in holder for 30 mm samples
- Holder for 2 thin sections (27 x 47 mm thin sections)
- Holder for 20 common stubs

GM chamber

- Holder for 22 samples (25 mm round epoxy blocks)
- Adaptor rings to analyze 25 mm round blocks in holder for 30 mm samples
- Holder for 9 thin sections (27 x 47 mm thin sections)

TIMA offline software*

TIMA offline – option to order any number of TIMA offline SW licenses can be ordered in addition to the two included standard licenses

Installation and environmental requirements

Installation Requirements*[e]:

- Power supply: 230 V ± 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 1.0 m

Training:

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

Environmental Requirements*[f]:

- 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: <5 µm/s below 30 Hz, <10 µm/s above 30 Hz
- Acoustic noise: Less than 60 dBC
- Altitude: max. 3000 m above sea level

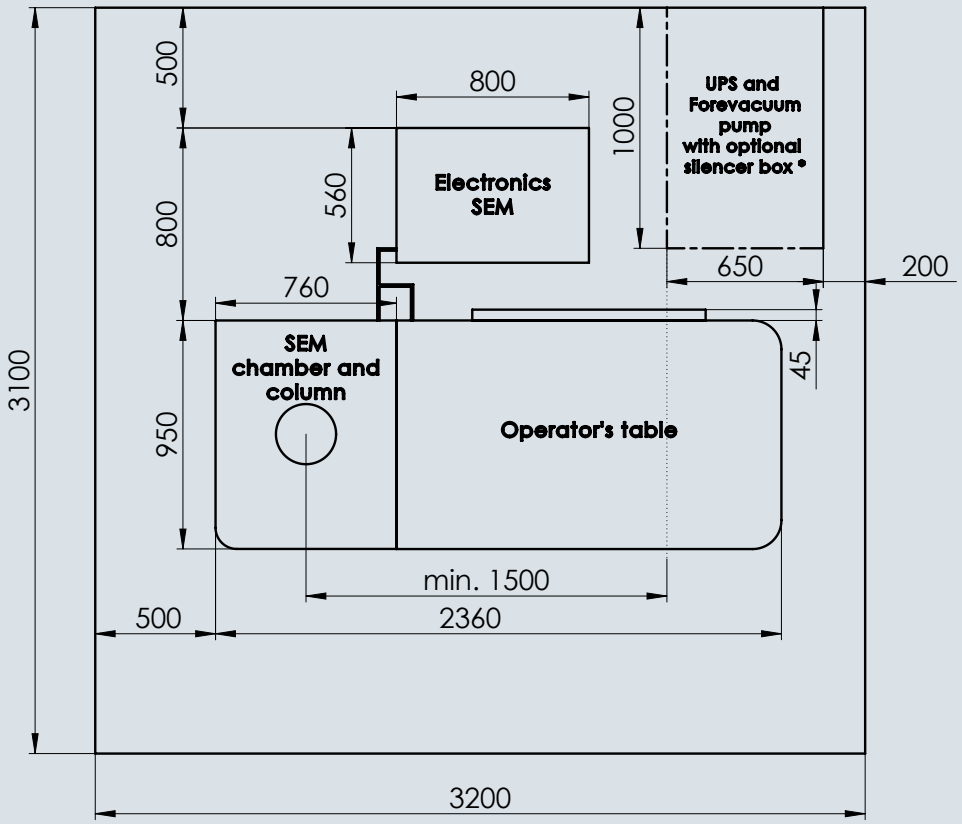
** Optional equipment*

**[e] Request site-survey by TESCAN authorized technician*

**[f] Specification of background magnetic field is subject to actual acceleration voltage. Specified values are for 20 kV acceleration voltage.*

Footprint of the microscope (all dimensions in mm):

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



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TESCAN GROUP, a.s.
Libušina tř. 21, 623 00 Brno - Kohoutovice / Czech Republic
(phone) +420 530 353 411 / (email) sales@tescan.com / marketing@tescan.com