Hitachi Tabletop Microscope

TM3030 specification

Specifications

<table>
<thead>
<tr>
<th>Items</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magnification</td>
<td>15 to 30,000x (digital zoom: 2x, 4x)</td>
</tr>
<tr>
<td>Observation condition</td>
<td>MK/1000 LED</td>
</tr>
</tbody>
</table>
| Observation mode | Standard mode/
| | Charge-coupled device |
| Image mode | CMOS-DD | Shadow 2/70FO |
| Sample stage features | X:17.6mm, Y:7.7mm |
| Maximum sample size | 78mm in diameter |
| Maximum sample height | 12mm |
| Electron gun | Pre-coated, multiple elements |
| Signal detection system | High-density semiconductor |
| | 4-segment BSE detector |
| Auto Image adjustment function | Auto start, Auto focus, Auto brightness, contrast |
| Frame memory | 640 x 480 pixels, 1,280 x 768 pixels |
| Image data memory | HD-HDD & other removable media |
| Image format | BMP, TIF, JPEG |
| Data display | Monitor: color, 64x64 pixels, Image number and comments, image mode, Observation condition (D, Distance, Observation mode) |
| | Evacuation system/ | Turbomolecular pump: 10liter/s x 1 unit, |
| | | Diaphragm pump: 10liter/s x 1 unit |
| Operation high functions | Remote mirror, Magnification preset (50 steps), Image shift (-50μm x 50μm) |
| Safety device | Overcurrent protection function, built-in ELOD |

Required PC specifications

<table>
<thead>
<tr>
<th>Items</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>OS</td>
<td>Windows 7 Professional (32/64bit version)</td>
</tr>
<tr>
<td>CPU</td>
<td>Intel “Core” TM i5-2520M (Equivalent or higher)</td>
</tr>
<tr>
<td>Memory</td>
<td>2GB minimum</td>
</tr>
<tr>
<td>Display resolution</td>
<td>1,280 x 800 pixels or 1,366 x 768 pixels</td>
</tr>
<tr>
<td>Display size</td>
<td>15.6 Type display</td>
</tr>
<tr>
<td>Interface connector</td>
<td>Installing USB2.0 and PC-card slot (IEEE1394 (For Oxford EDX is indispensable))</td>
</tr>
<tr>
<td>Memory device</td>
<td>With HDD/DVD-ROM Drive</td>
</tr>
<tr>
<td>Other</td>
<td>More than 100GB of free space in HDD is required</td>
</tr>
<tr>
<td></td>
<td>45%-70%RH</td>
</tr>
</tbody>
</table>

Dimensions and weight

<table>
<thead>
<tr>
<th>Items</th>
<th>Description (Width x Depth x Height / Weight)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main unit</td>
<td>330 x 650 x 545mm, 62kg (marking stage)</td>
</tr>
<tr>
<td></td>
<td>330 x 650 x 545mm, 66kg (motor drive stage)</td>
</tr>
<tr>
<td>Diaphragm pump</td>
<td>150 x 350 x 270mm, 25kg</td>
</tr>
</tbody>
</table>

Optional Accessories

<table>
<thead>
<tr>
<th>Items</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDX</td>
<td>Energy Dispersive X-ray spectrometer (EDX)</td>
</tr>
<tr>
<td></td>
<td>3-dimensional image display/measurement function 3D-VIEW</td>
</tr>
<tr>
<td></td>
<td>Cool stage</td>
</tr>
<tr>
<td></td>
<td>Tilt &amp; Rotate stage</td>
</tr>
</tbody>
</table>

Installation condition

<table>
<thead>
<tr>
<th>Items</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Room temperature</td>
<td>15 to 30°C (23±2°C, 50±10%RH)</td>
</tr>
<tr>
<td>Humidity</td>
<td>40% ± 20%</td>
</tr>
<tr>
<td>Power source (TM3030)</td>
<td>Single-phase AC100 to 240V (Minimum: 85V, Maximum: 265V)</td>
</tr>
<tr>
<td></td>
<td>Grounding</td>
</tr>
<tr>
<td></td>
<td>More than 100V at line</td>
</tr>
</tbody>
</table>

Installation layout

[Diagram of installation layout]

Notice: For correct operation, follow the instruction manual when using the instrument.
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HTD-E209 2013.5
Tabletop Microscope is further improved and explores the world.

A New Dimension in Image Quality.

**NEW**
5kV mode
Surface detailed image resolution enhanced. TM3030

**NEW**
Enhanced sharpness & contrast capability
Image quality being sharpened and enhanced. TM3030

**Easy of Use**
Simple operation with extensive auto functions ▶P3

**NEW**
Unparalleled Image Quality
Optimized electron optics, enhanced observation capability ▶P9

**No Sample Preparation**
No need for specimen coating with TM3030’s charge-up reduction ▶P5

**Multi-purpose observation**
Directional imaging using the 4-segment detector ▶P11

**Multi-observation modes switchable with just one-click**
No adjustment is required when switching between modes ▶P7

**Variety of optional accessories**
EDX, 3D-VIEW, & Cool Stage, etc. ▶P17

Refer to page 9.10

Screen shows simulated image
Compact and portable, with incredibly simple operation.

Tabletop Microscope TM3030

Ease of Use

Compact and portable, with incredibly simple operation.

With a width of just 330mm, laptop-PC based operation and no special installation requirements the TM3030 can be installed almost anywhere. Comprehensive auto-functions ensure it can also be used by anyone.

Tabletop installation

The compact and lightweight design of TM3030 means it can be conveniently installed on a table*. No cooling water is needed, so installation is quick and easy and requires only a standard 100-240V AC power supply.

* requires a table capable of supporting 100kg.

Topographic imaging with a large depth of focus

Complex specimen structures are easily observed with a resolution and depth of focus far beyond what is achievable by optical microscopy.

Imaging with the TM3030 couldn’t be simpler. Pressing the “Start” button automatically turns on the beam, adjusts focus, brightness and contrast, as well as displays the image at an easy-to-view starting magnification of x100.

Fast specimen exchange

The high-performance vacuum system provides fast pumpdown and chamber venting. It takes 1 minute to vent the TM3030 specimen chamber, twice as fast as the TM-1000.

Comparison of chamber venting time

<table>
<thead>
<tr>
<th></th>
<th>TM-1000</th>
<th>TM3030</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time shortened</td>
<td>About 1 min</td>
<td>About 2 min</td>
</tr>
</tbody>
</table>

Environmentally-friendly pumping system

The TM3030 features a dry (oil-free) vacuum system, consisting of a diaphragm pump for rough evacuation and a high performance turbo-molecular pump for main pumping.

Comprehensive auto-functions, with one-click “Start”.

Imaging with the TM3030 couldn’t be simpler. Pressing the “Start” button automatically turns on the beam, adjusts focus, brightness and contrast, as well as displays the image at an easy-to-view starting magnification of x100.

Smooth magnification adjustment

Since magnification is increased simply by narrowing the scanned area, continuous magnification adjustment from x15 to x30,000 is achieved by clicking and dragging the mouse. This makes it quick and easy to find the area of interest.

Tools for measurement and annotation

- Distance measurement
  Distance can be quickly and easily measured by dragging the mouse between two points of interest.
- Graphics/comment input
  Simple graphics and comments can be added to the image.

Large specimen handling

The large specimen stage allows mounting of a specimen up to 70mm diameter and 50mm thick. X/Y specimen motion: ±17.5mm

Recommended to put gloves to avoid contamination.

Tabletop Microscope TM3030
Versatility is assured - with a wide magnification range and multiple operating conditions.

Not only can surface details be observed without any specimen preparation (such as metal coating), there is also a quick turnaround time for beam and vacuum sensitive materials. The TM3030 has the ability to utilize a low vacuum environment which allows for non-conductive, water and oil-based samples to be observed in their natural state.

Image non-conducting specimens with ease.

When a non-conductive sample is observed with a high-vacuum SEM, electrons accumulate on the specimen surface causing a charge-up phenomenon. Charging prevents imaging. In order to resolve this charge, the sample is usually coated with a thin layer of metal prior to observation. This process is not only time consuming, but also interferes with optical imaging of surface details as well as EDX analysis. The TM3030 overcomes this problem with "charge-up reduction mode." This mode uses low-vacuum functionality to dissipate the charge.

Low-vacuum microscopy

By utilizing a low vacuum level inside the specimen chamber, more gas molecules are present. These gas molecules can collide with the electron beam to generate positive ions and electrons. Each positive ion can be neutralized by one of the excess electrons on the specimen surface. In this way the excess electrons on the surface of the sample are removed and the charge-up effect is eliminated or reduced.

Charge-up reduction mode

The TM3030 can operate either in "standard mode" or "charge-up reduction mode" depending on the extent of the specimen charging.

Compositional imaging

In addition to traditional topographic imaging, the TM3030 can produce compositional images, where the different brightness levels represent different composition in the sample. In this mode, higher brightness corresponds to higher atomic number.
Three independent observation condition modes.

The TM3030 features three beam conditions to choose from depending on the information required in the image. The '5kV', '15kV' and 'EDX' modes greatly simplify operating condition setup, and no adjustment is required when switching between modes.

Accelerating voltages

By providing different accelerating voltages in '5kV' and '15kV' modes, and using the high sensitivity backscattered electron detector, different types of imaging are possible with the TM3030. An accelerating voltage of 15kV is used for most imaging applications and offers the best resolution. At 5kV, the electron beam does not penetrate so far into the sample, so the images show more surface detail.

<table>
<thead>
<tr>
<th>Accelerating voltage</th>
<th>5kV</th>
<th>15kV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resolution</td>
<td>Lower</td>
<td>Best</td>
</tr>
<tr>
<td>Image information</td>
<td>Surface</td>
<td>Subsurface</td>
</tr>
<tr>
<td>Beam damage</td>
<td>Low</td>
<td>High</td>
</tr>
</tbody>
</table>

- **5kV**: Accelerating voltage 5kV emphasizes surface detail.
- **15kV**: Accelerating voltage 15kV can be used throughout the magnification range and gives the best resolution.
- **EDX**: 15kV Accelerating voltage with large current mode used for elemental analysis or low contrast specimens.

**Specimen:**
- Powdered medicine
- Pistil of dandelion
- Eye shadow
- Tooth paste
- Field of dandelion
- Powdered medicine

**Difference in image appearance using different observation condition modes**
**NEW Unparalleled Image Quality**

**Surface detailed image resolution enhanced.**

Thanks to optimized electron-optics, 5kV observation is further enhanced throughout high magnifications.

### 5kV mode

The 5kV accelerating voltage allows for observation of surface details, not only offering traditional topographic imaging but also compositional imaging information. The 5kV observation condition is further enhanced throughout high magnifications by improving the electron optics.

<table>
<thead>
<tr>
<th>Application Gallery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grain contrast is observed by reducing accelerating voltage.</td>
</tr>
<tr>
<td>Organic materials covered over surface which are normally not available at higher accelerating voltage, can be observed.</td>
</tr>
</tbody>
</table>

### Image quality being sharpened and enhanced.

Image further enhanced and optimized by various automatic functions and software algorithm.

#### Enhanced sharpness & contrast capability

These functions will be utilized to enhance image quality at any observation condition modes and will be very effective for higher magnification specimens.

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Tabletop Microscope

**TM3030**
Directional imaging using the 4-segment detector.

The TM3030 features a backscattered electron detector with 4 independent segments. By adding or subtracting the signals from the segments in different combinations it is possible to emphasize compositional or topographic detail in the image, as well as produce 'shadowed' images which highlight the sample from a particular direction.
Application Gallery

Processed materials

Electronic and metallic materials

Tabletop Microscope TM3030
Application Gallery

**Textiles**

- **Specimen:** Nylon stocking  
  - 5x, charge-up reduction mode  
  - Magnification: x3,000

- **Specimen:** Photocatalyst fiber  
  - 5x, charge-up reduction mode  
  - Magnification: x2,000

- **Specimen:** Alabesos  
  - 5x, standard mode  
  - Magnification: x3,000

**Biological specimen**

- **Specimen:** Butterfly wing  
  - 25x, standard mode  
  - Magnification: x2,000

- **Specimen:** Cross section of abalone shell  
  - 5x, charge-up reduction mode  
  - Magnification: x20,000

- **Specimen:** Shark skin  
  - 25x, charge-up reduction mode  
  - Magnification: x20,000

- **Specimen:** Photocatalyst fiber  
  - 5x, charge-up reduction mode  
  - Magnification: x30,000

- **Specimen:** Asbestos  
  - 5x, charge-up reduction mode  
  - Magnification: x3,000

- **Specimen:** Shark skin  
  - 25x, standard mode  
  - Magnification: x2,000

**Observation of biological specimen by TI blue staining**

- **Specimen:** Specimen treated by Hitachi Ion Milling System  
  - Flat/cross-section milling

**Specimen treated by Hitachi Ion Milling System**

- **Specimen:** Specimen treated by Hitachi Ion Milling System  
  - TM3030 can be used to check the surface of specimen after milling. It is possible to transfer the specimen stub of IM4000 directly to the TM3030.
**Motorized Stage Version**

With the optional* motorized specimen stage, all functions of the TM3030 can be operated using the mouse alone.

* Please specify manual or motor-drive stage when ordering the TM3030

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**Tilt Rotate Stage**

Tilt Rotate Stage enable observation at -15° to 60° degree angles. It is allowable to monitor the positioning in the sample chamber through a chamber scope.

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**Cooling System**

The cooling stage for the TM3030 is manufactured by Deben UK, Ltd. The stage is coolable -25°C. This stage allows for observation and analysis of samples containing water for up to a couple of hours without deformation of samples from the vacuum pressure.

At an ambient temperature
Sample shrinkage is seen after 5 minutes.

At -20°C (A cooling stage was used)
Sample shrinkage is not seen after 5 minutes.

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**Tabletop Microscope TM3030**

- **Specimen:** Chocolate mousse
- **Specimen:** Marshmallow
- **Electronic component:** Rose petal
- **Variable pressure range of the low-vacuum SEM**
  - Temperature: 0°C to -20°C
  - Pressure (Pa): 10⁻³ to 10⁻⁷
- **Motorized Stage Version**
  - Tilt Rotate Stage enable observation at -15° to 60° degree angles.
  - It is allowable to monitor the positioning in the sample chamber through a chamber scope.
- **Evaporation**
- **Freezing**

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**Variety of special stage.**
Elemental Analysis made easy.

EDX* for the TM3030 is available using 2 different systems. Each system is equipped with the latest SDD (silicon drift detector). The detectors are compact and designed to be housed within the main TM3030 unit. Liquid nitrogen is not required, as with all modern EDX systems.

* EDX: Energy Dispersive X-ray Spectrometer

SwiftED3000

- Detectable elements: Bi to Uz
- Swift multi-point analysis by POINT&ID

Example of configuration with TM3030 Detector built-in type

Quantax70

- Detectable elements: Bi to Am
- Capable of full EDX analysis via spectrum map even after measurement

Tabletop Microscope TM3030

Continuing the “Simple Operation” design concept of the TM3030, all users can take full advantage of the powerful analytical capability including point analysis, area analysis and element mapping.

SwiftED3000 operation window

- Element mapping
- Point & ID
- Line scan

Example measurement with SwiftED3000 Analysis of ground thin-section rock specimen (non-coated)

Quantax70 operation window

- Element mapping
- Point/Area analysis
- Line scan

Example measurement with Quantax70 Analysis of electronic component sample embedded in resin (non-coated)
3-dimensional image display / measurement function.

A 3-dimensional model can be generated without sample tilting and alignment, using 4 directional surface profiles from the signals acquired with each segment of the 4-segment backscattered electron detector.

Surface roughness can be measured easily based on the height measurement between 2 points, the surface area and cross-sectional profile.

The 3-dimensional model under observation can be manipulated (rotated and zoomed), while rotational manipulation of the model can be recorded in a dynamic image file (AVI format).

**Variety of optional accessories**

**3D-VIEW**

**3D-Image viewer function**

- **Import function**
  - Automatic select and read function of four elements data (displayed with automatic SEM condition acquisition function)

- **Measurement performance**
  - Depth accuracy ±2% (Reference: Measurement performance in different depending on calibration accuracy, the condition of the kind of specimen, the observation mode, and the observation condition, Difference between 3D and 4D, Resolution (Z) and X, Y, length and angle measurement between two points specified on the image/Surface area measurement/Depth of X, Y, Z, length and angle measurement between two points specified on section profile/Surface roughness measurement on section profile/Depth direction information in function of section profile display/3D line function correction function (parallel line and curved line)/3D wire view display/Color contour line display

- **3D-Image capture function**
  - Automatic image acquisition by four elements of quad BSE detector

**4-sector backscattered electron detector**

- **Detector**
  - Silicon drift detector (SDD)

- **Energy resolution**
  - 167 eV (Ge(111) as standard is 1272 eV with Mn(Ka))

- **Area window**
  - Si(Li) ( owes to the atmospheric EELS window)

- **Thermal control**
  - 100°C to 400°C

- **Cooling method**
  - 2-stage (Peltier cooling/He cool) Liquid nitrogen cooling

- **Cooling temperature**
  - Cooling is not necessary when not in use. No detector damage occurred during cooling or sample changing.

**Software**

- **Spectrum display**
  - Standardized display, can be shown in vertical/horizontal, KLM marker display

- **Qualitative analysis**
  - Auto ID and manual peak ID

- **Quantitative analysis**
  - Standard grabs, quantitative analysis, normalized to 100%

- **Image capture**
  - 1,024 x 768, 512 x 384, 256 x 192 pixel

- **Point & ID**
  - 320 points, adjacent points (128 points)

- **Element mapping**
  - Resolution: 128 x 128, 512 x 512 pixel

- **Line scan**
  - Spectrum comparison: two specific lines

- **Data management**
  - Managed by project

- **Spectrum exporting**
  - BMP, TIF, JPEG, EMMA, Text

- **Data reporting**
  - 3D images, reports, templates, 3D-Image Viewer

**Dimensions and weight**

- **Specimen: Solar cell**
  - 165 x 165 x 200mm, 2.7kg

- **Specimen: Food packaging material (Pt-coated)**
  - 299 x 285 x 332mm, 9.2kg

**Installation condition**

- **Power (SwiftED3000)**
  - Single-phase AC100-240V (±10%) 50/60Hz 100VA, 3.9A cable

- **Power (Quantax70)**
  - Single-phase AC100-240V (±10%) 50/60Hz 100VA, 3.9A cable

**External scan box**

- **Interface**
  - USB 2.0 or Ethernet

**Software**

- **Spectrum display**
  - Scale expansion in vertical/horizontal direction, Automatic scaling, KLM marker display

- **Qualitative analysis**
  - Auto ID and manual peak ID

- **Quantitative analysis**
  - Standard grabs, quantitative analysis, normalized to 100%

- **Image capture**
  - 1,024 x 768, 512 x 384, 256 x 192 pixel

- **Element mapping**
  - 1,024 x 768, 512 x 256, 256 x 192 pixel

- **Line scan**
  - Flexible line pointing in all directions

**Software**

- **Spectrum analysis**
  - Spot can be predetermined anywhere on the image

- **Dimensions and weight**
  - Detectors (base area) 115 x 120 x 180mm, 1.8kg

- **SwitfeED5000**
  - 228 x 115 x 180mm, 1.2kg

- **External scan box (SwiftED5000)**
  - 228 x 115 x 180mm, 1.2kg

**Installation conditions**

- **Power (Quantax70)**
  - Single-phase AC100-240V (±10%) 50/60Hz 100VA, 3.9A cable

- **External scan box (Quantax70)**
  - Single-phase AC100-240V (±10%) 50/60Hz 100VA, 3.9A cable