## Technical Specs

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tilt Range</td>
<td>±45° depending on microscope and pole piece</td>
</tr>
<tr>
<td>Number of Electrical Contacts</td>
<td>6, 8, or 9 *</td>
</tr>
<tr>
<td>Contact Type</td>
<td>Flexible wirebond contacts or fixed spring contact</td>
</tr>
<tr>
<td>Chip Carrier</td>
<td>Mobile Chip Carrier</td>
</tr>
<tr>
<td>Carrier Compatibility</td>
<td>Standard TEM Sample Supports</td>
</tr>
<tr>
<td>Carrier Size</td>
<td>Fits up to 3 x 6mm samples</td>
</tr>
<tr>
<td>Wiring</td>
<td>Standard or low-noise shielded</td>
</tr>
<tr>
<td>TEM Compatibility</td>
<td>FEI, JEOL, Hitachi, Zeiss</td>
</tr>
</tbody>
</table>

## Sample Contact Options

### Board Contact (Type I)
This contact configuration features a reusable removable sample board carrier. As a result, researchers can prepare the sample directly on the board, which is then placed into the holder tip for a quick connection to an electrical connector with up to 8 contacts. Samples up to 3 x 6mm in size can be mounted on the standard board carrier. Electrical connections between the chip and the carrier are made using ultra-sonic wire bonding, allowing for a flexible connection between the contacts and the chip.

### Direct Chip Contact (Type II)
This contact configuration features a single chip that is directly inserted into the holder via a proprietary connector with up to 9 electrical contacts. The sample is prepared directly on the standard sample substrate chip. Pre-patterned metal leads lead up to the electron transparent membrane onto which the sample is built.

### Spring Contact (Type III)
The spring contact configuration is a variation of the Type I connector, but instead of flexible wire-bonded contacts between the sample carrier and chip, it has fixed-location spring contacts. The configuration still allows researchers to prepare the sample directly on the chip courtesy of a detachable carrier.
Options

The 1600-series holder features a range of special options:

- Custom-designed sample carriers to fit any TEM sample geometry
- Bundled shielded wiring (standard)
- Low-noise, individually-shielded cabling option for pA-range current measurements.
- Keithley 2400 SMU

Accessories

Accessories available for your electrical biasing holder:

- Specialized Sample Substrate Chips
- Vacuum Tip Cover
- Custom Chip Carriers
- Keithley 2400 SMU

Available For

- TECNAI/TITAN/CMX00 SUPER TWIN, X-TWIN, ULTRA-TWIN
- 2010/2100/ARM, HR/ARP POLE, URP/URP POLE, GRAND ARM
- FEI
- HITACHI
- JEOL
- ZEISS

Product Summary

Hummingbird Scientific’s in-situ electrical biasing holder allows researchers to investigate the electrical response of materials inside the transmission electron microscope. The standard biasing holder has a removable chip carrier that accommodates a wide range of sample geometries. This allows for convenient sample preparation outside the holder and is compatible with all of Hummingbird Scientific’s membrane substrates. Low-noise wiring ensures accurate measurements.

Sample Applications:

- Correlating the electrical properties and microstructure of nanoscale materials
- Studying the relationships between material defect populations and electrical response
- Electromigration studies
- Operating microelectomechanical systems (MEMS) base mechanical testing devices
- In-situ testing of solid-state energy devices
Void Formation Induced Electrical Switching in Phase-Change Nanowires

Voltage-current curve and accompanying in-situ TEM micrographs of void formation in GeTe single-nanowire devices as part of an induced phase change.

Left: TEM images taken in-situ during the voltage scan at times I, II, III, and IV.

Right: In-situ TEM voltage scan of a single nanowires device. Note the correlation of resistance with void size in the nanowire on the left.


Image courtesy of Yi Cui (Stanford University) and Andrew Minor (UC Berkeley).

Copyright © 2008, American Chemical Society

Selected Publications


For the most up-to-date Selected Publications please visit http://hummingbirdscientific.com/electrical-biasing-selected-publications/