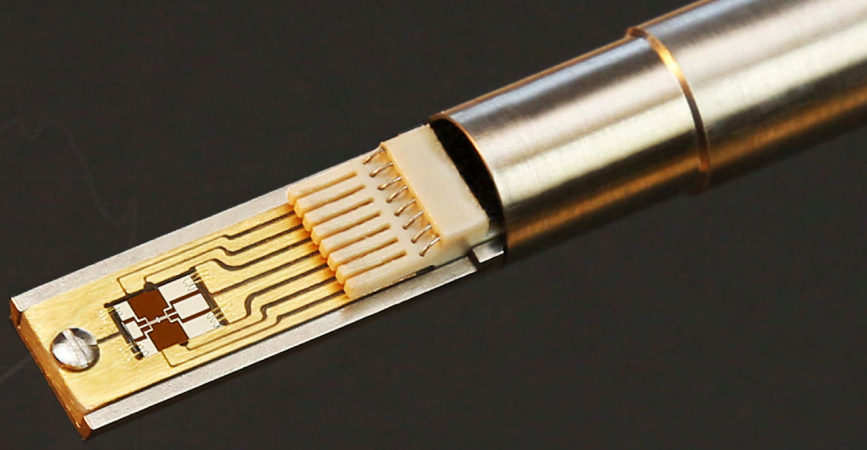
HUMMINGBIRD SCIENTIFIC

current



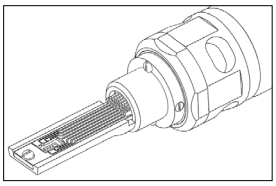
Electrical Biasing

voltage

Technical Specs

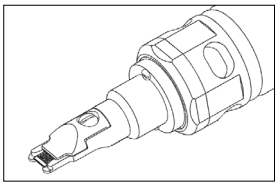
	1600 Series
Tilt Range	±45° depending on microscope and pole piece
Number of Electrical Contacts	6, 8, or 9 *
Contact Type	Flexible wirebond contacts or fixed spring contact
Chip Carrier	Mobile Chip Carrier
Carrier Compatibility	Standard TEM Sample Supports
Carrier Size	Fits up to 3 x 6mm samples
Wiring	Standard or low-noise shielded
TEM Compatibility	FEI, JEOL, Hitachi, Zeiss

Sample Contact Options



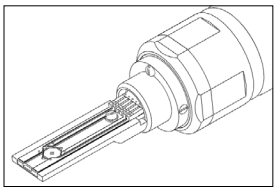
Board Contact (Type I)

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 at 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.



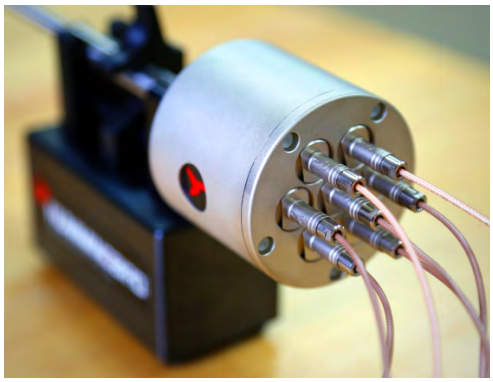
Spring Contact (Type III)

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.

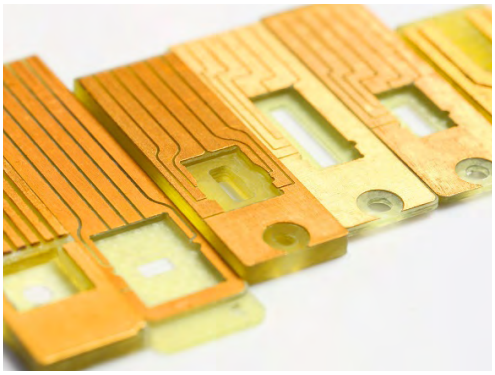
Options

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



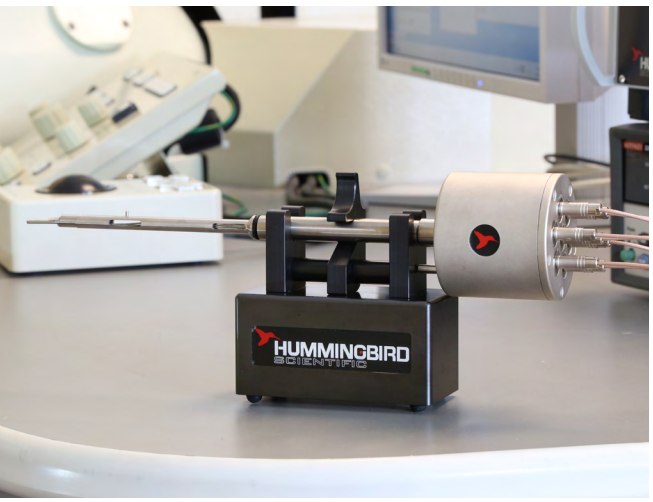
Accessories available for your electrical biasing holder:

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

Available For

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

Application Example

Void Formation Induced Electrical Switching in Phase-Change Nanowires

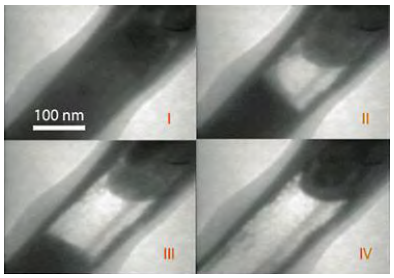
Voltage-current curve and accompanying in-situ TEM micrographs of void formation in GeTe single-nanowire devices as part of an induced phase change.

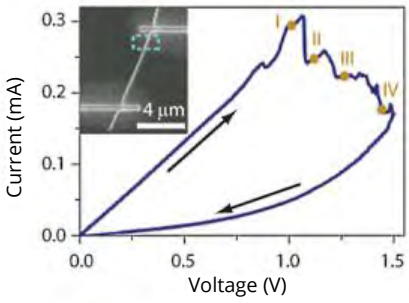
Left: TEM images taken in-situ during the voltage scan at times I, II, III, and IV.

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.

Reference: S. Meister, D.T. Schoen, M.A. Topinka, A.M. Minor, and Y. Cui. "Void Formation Induced Electrical Switching in Phase-Change Nanowires," Nano Letters 8 (2008) pp. 4562. Abstract

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





Selected Publications

M. Puster, J.A. Rodríguez-Manzo, A. Balan, M. Drndić. **"Toward Sensitive Graphene Nanoribbon-Nanopore Devices by Preventing Electron Beam-Induced Damage,"** ACS Nano 7:12 (2013) pp. 11283–11289

C.R. Winkler, M.L. Jablonski, A.R. Damodaran, K. Jambunathan, L.W. Martin, M.L. Taheri. **"Accessing Intermediate Ferroelectric Switching Regimes With Time-Resolved Transmission Electron Microscopy,"** J. Applied Physics 112:5 (2012)

C.R. Winkler, A.R. Damodaran, J. Karthik, L.W. Martin, M.L. Taheri. **"Direct Observation of Ferroelectric Domain Switching in Varying Electric Field Regimes Using In-Situ TEM"**, Micron 43:11 (2012) pp. 1121–1126

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