

# MACS™ Magnetic Active Compensation System for Electron Microscopy

## Features:

- Uniform protection from environmental AC/DC magnetic interference (1mHz to 1kHz)
- Patented wideband negative-feedback design provides electronic magnetic compensation without the need for continuous recalibration
- Offers protection against fluctuations in magnetic fields caused by:
  - Subways
  - Electrical Distribution Equipment
  - Elevators
  - Moving Vehicles
- Can be applied to existing or new installation



The ETS-Lindgren™ Magnetic Active Compensation System (MACS™) provides cost-effective, maintenance-free environmental magnetic field shielding solutions for high resolution EM (Electron Microscope) instrumentation. They are the highest-performance commercial active magnetic field compensation equipment available for protecting sensitive EM instruments from AC/DC environmental magnetic field fluctuation. These reliable systems provide real time compensation of environmental magnetic field fluctuations caused by moving vehicles, trains, elevators, electrical distribution equipment, and other sources.

ETS-Lindgren's MACS systems provide a uniform solution, at DC and through low frequency, using a highly sophisticated electronic magnetic compensation technology. Utilizing a patented wideband negative-feedback electronic design, the equipment deeply attenuates interfering magnetic fields at a fraction of the cost of

alternative methods, such as passive shielding or equipment relocation. Field attenuation at the protected EM exceeds a factor of 30. This permits the successful operation of Ems - especially units with highly susceptible FEG emitters - at virtually any site.

## Applications

MAC systems broaden siting possibilities by allowing EMs to be placed in locations where varying high magnetic field are present. As a result, they can be installed at sites that have been previously rejected due to magnetic field interference. In addition, if post installation site conditions change, the MACS can provide continuous protection.

## Performance

ETS-Lindgren's unique MACS-series active-feedback magnetic shielding technology\* provides instantaneous, high-level protection at any frequent-cy or combination of frequencies within a wide passband. No other commercially available compensation system

attains this high level of magnetic field cancellation at all frequencies that can interfere with EM operation. Extended-range MACS-QDC systems engage calibrated fluxgate probe to suppress lower-frequency magnetic field fluctuations caused by trucks, subway trains, and elevators or nearby analytical equipment such as mass spectrometers or MRI scanners. High level signals from the magnetic field sensor preamplifiers are conditioned and amplified by a phase-correcting signal processor and power driver in the controller chassis. Signal levels throughout the processing chain are supervised by an internal controller with front-panel programmable set-points for axial tripoff. The controller also implements a setup algorithm for easy initial adjustment and provides continuous fail-safe fault monitoring for the internal power supplies and power amplifiers. Typically, the distortion known as astigmatism can be corrected by using variable electro-magnetic compensation coils. To reduce interfering

magnetic fields throughout the room, compensation flux is generated by driven coils that are mounted along or near the room vertices. Coil sets for each axis are placed on opposing walls and consist of single 0.5" (1.3cm) o.d. cables installed in the plastic raceway.

### Maintenance-Free Operation

MAC systems are designed to require no maintenance or adjustments following initial installation under normal operating conditions. Additionally, the system is de-signed for 24-hour operation and protection from environmental interference.

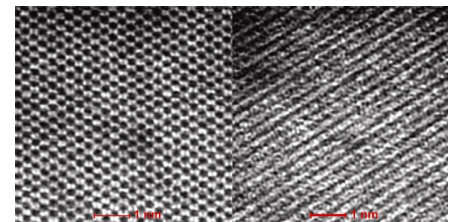
### Specifications

#### Model EMFC MK IV

- 3 axis
- 5m<sup>3</sup> minimum protected volume
- 30 dB (factor of 32) attenuation of magnetic field variation
- 3µTavg (30mGavg) max. compensation
- 0,001 Hz – 1 kHz bandwidth
- 1nTavg (10µGavg) noise floor

### System Installation

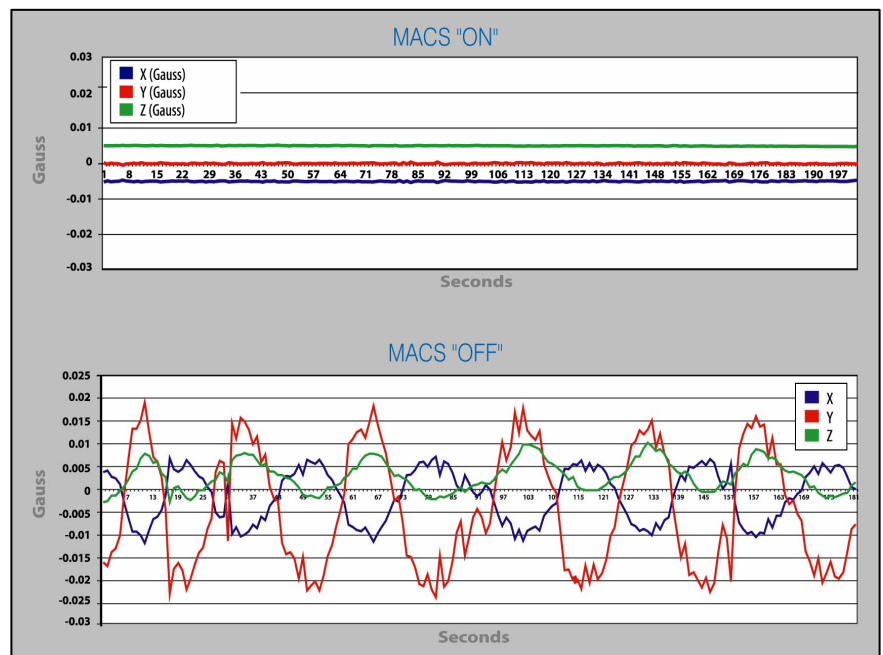
MAC systems may be installed and calibrated in as little as three days with the support of the EM vendor. The system can be installed on new EM sites as an insurance against EM interference, or on existing sites that are experiencing unanticipated low frequency magnetic field interference. Coils are installed in a neat and inconspicuous manner, ensuring that room aesthetics are not compromised.



MACS ON    MACS OFF

Above: The image at left shows the silicon (110) lattice with resolution near the 1.4 Å requirement for observing "dumbbells" while the image at right shows distortion "banding" resulting from stray AC fields. Data courtesy of International SEMATECH

\*U.S. Patent 5,465,012



Above: Magnetic fields in X,Y,Z-axis:

- Upper diagram shows MACS™ ON
- Lower diagram shows MACS™ OFF

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