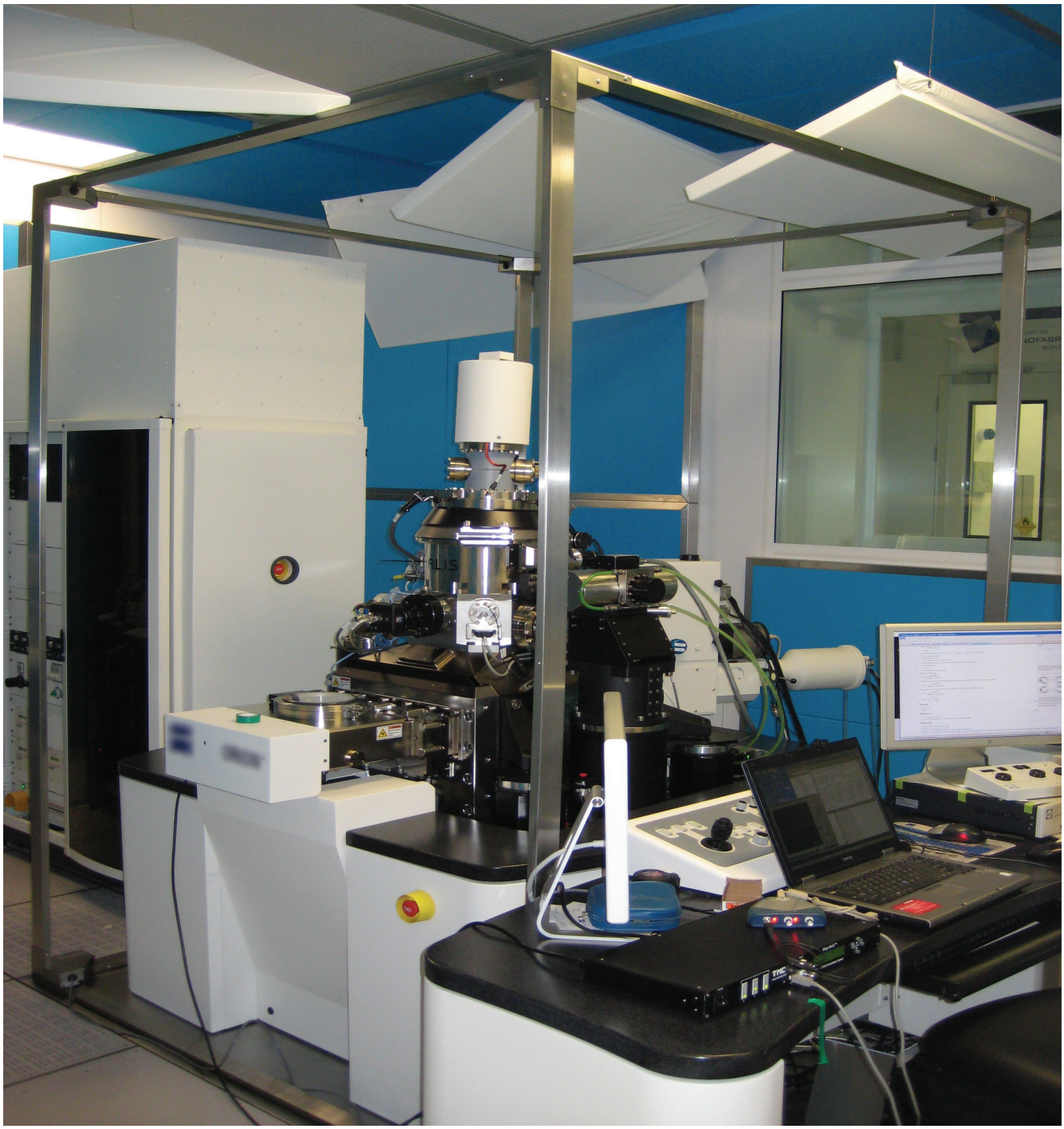
TMC™
VIBRATION CONTROL

GMP
GENERAL MICROTECHNOLOGY & PHOTONICS

Mag-NetX™

Magnetic Field Cancellation



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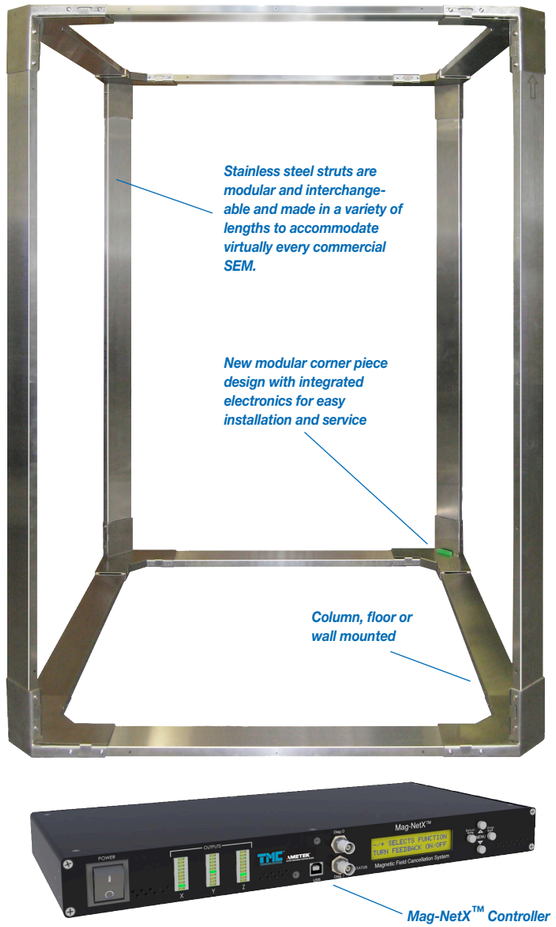


Building upon our advanced control systems engineering and technology to actively sense and cancel building floor vibrations, we now offer Mag-NetX™, an innovative system providing active compensation of magnetic field fluctuations.

Designed both for point-of-use and OEM applications, Mag-NetX is ideal for scanning and transmission electron microscopes, electron beam lithography systems, ion beam instruments, and any tools that incorporate a charged beam. Combining Mag-NetX with TMC's advanced vibration isolation systems, we can provide the ultimate control of vibration and magnetic fields.

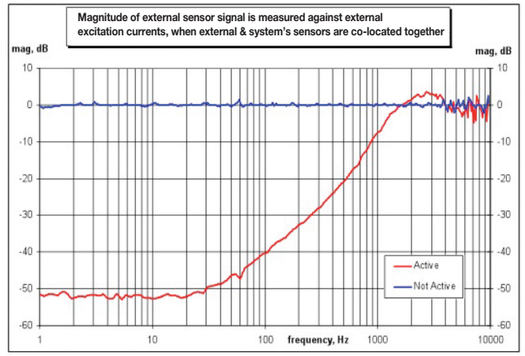
Features & Benefits

- Helmholtz coil pairs for maximum symmetry and uniformity
- Continuous field cancellation
- Continuous field monitoring
- Set and forget operation
- Several AC and DC cancellation modes available
- 100x field improvement (typical)
- Dynamic, 100 µs response
- Accurate field measurement
- Graphical User Interface with continuous system monitoring and analysis
- Optional feedforward compensation of line frequency and harmonics
- Optional feedforward capability for other inputs
- Optional custom field creation while suppressing disturbance
- Easy to assemble stainless steel cage, in-room wall-mount systems also available

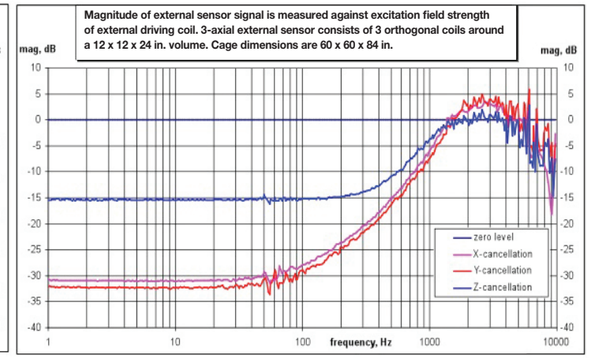
How to order:

▶ Contact TMC. An Applications Engineer will configure a system for your unique requirements and provide a quotation.

AMETEK®
ULTRA PRECISION TECHNOLOGIES



Plot 1.
- *Magnitude of external sensor signal is measured against disturbance field strength of external excitation driving coil.*
- *Helmholtz Cage size 36 x 36 x 52 in. (91 x 91 x 132 cm)*
- *The best performance is at the system sensor location.*



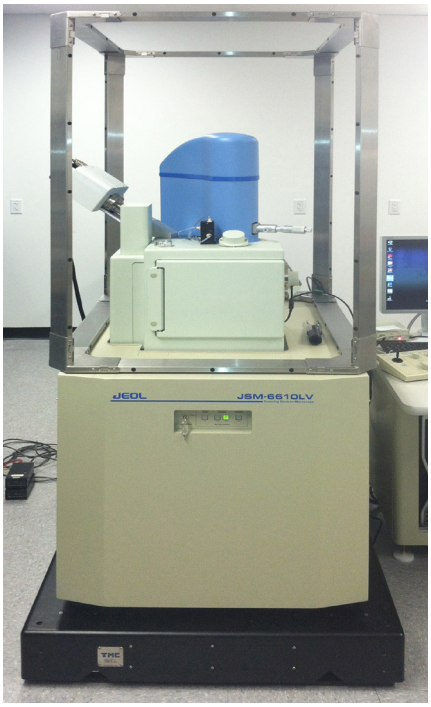
Plot 2.
- *Magnitude of external sensor signal is measured against disturbance field strength of external excitation driving coil.*
- *Helmholtz Cage size 60 x 60 x 84 in. (152 x 152 x 213 cm).*
- *3-axial external sensor consists of 3 orthogonal coils around a 12 x 12 x 24 in. volume.*
- *Excitation coil positioned outside Helmholtz cage, external sensor coils positioned around system sensors.*
- *Due to cage dimensions, Z suppression is lower because Z-compensation field has lower uniformity than X and Y, but longer protected dimension (24 in. vs. 12 in. for X and Y).*

GENERAL SPECIFICATIONS (may vary depending on configuration)

1. System Components:	Up to 3-axes orthogonal magnetic sensor, Mag-NetX controller, Up to 3 orthogonal pairs of coils
2. Performance:	
Active Magnetic Field Cancellation Axes	X, Y, Z
Sensor type, sensor noise	Fluxgate type, noise <10 pT/√Hz at 1 Hz
Max ambient DC field (sensor dependent)	Choice of 3 standard sensors: ∓ 70 µT, ∓ 100 µT, ∓ 250 µT
Bandwidth	DC - 1 KHz typical, up to 2 KHz (depends on cage and sensor)
Dynamic range – ability to cancel field (depends on cage and frequency)	∓ 10.0 µT typical, up to ∓ 100.0 µT 40 dB typ (55 dB max)
Controlling volume vs. magnetic field flux density	50 m^3 at 10 µT RMS (depending on cage parameters) 1 m^3 at 50 µT RMS (standard controller is able to cancel Earth magnetic field with special cage construction) 10 m^3 at 50 µT (with external amplifier and special cage)
Field reduction ratio at sensor location (using typical console-mounting cage of X*Y*Z = 36 x 36 x 52 in. [91 x 91 x 132 cm])	40-50 dB [100x - 300x] (typical) in DC – 100 Hz 26 dB [20x] (typical) in 100 – 500 Hz (See Plot 1)
Field reduction ratio in a typical volume of electron microscope column: X*Y*Z = 12 x 12 x 24 in. [30 x 30 x 60 cm], using typical floor-standing cage of 60 x 60 x 84 in. (152 x 152 x 213 cm)	X, Y: 30 dB [32 x] (typical) in DC – 100 Hz X, Y: 20 dB [10 x] (typical) in 100 – 500 Hz Z: 15 dB [5.2 x] (typical) in DC – 100 Hz Z: 10 dB [3 x] (typical) in 100 – 500 Hz 0 dB at 1000 Hz (See Plot 2)

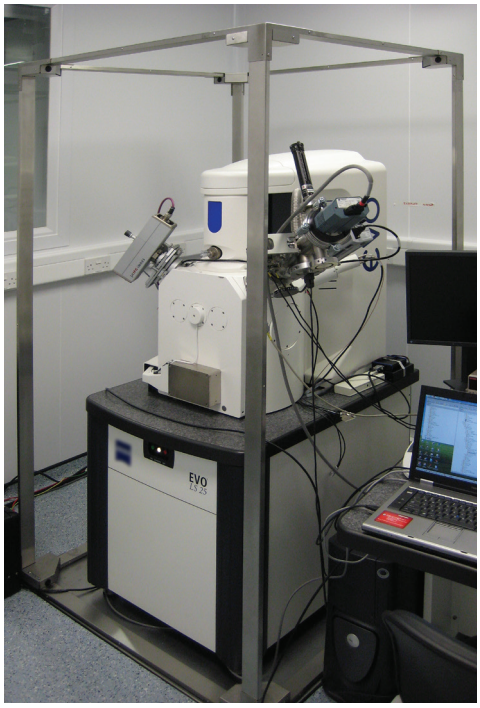
3. Mag-NetX Controller:	3 channels for X, Y, Z cancellation, 1U standard case
Dimensions of controller:	17 x 9 x 1.75 in. (43 x 23 x 4.5 cm)
Operational modes:	After power-on: Automatic self test/calibration and switch to controlled mode in 1 minute, no user involvement required. Manual test / debug mode. True DC mode (compensating Earth magnetic field) Offset-DC mode (Earth magnetic field ignored) Track DC-shift due to microscope moving parts Quasi-DC mode (ignoring slow, >100 sec, fluctuations) Cancel-and-Create (simultaneously cancelling disturbance and creating custom field)
Types of control loops:	Analog feedback with digitally controlled gain, DC - 2 KHz Digital feedback Digital feedforward (cancels AC-line power frequency and harmonics without gain-stability limits of feedback)
Front panel controls:	
"OK" LED indicator	Green – OK, Yellow – Warning/Error
LCD 2 x 20 symbols indicator	Show menu and status
Bar-LED indicators	Show X, Y, Z real time strength of compensation field
4 push buttons	For LCD menu access
2 BNC sockets	For calibration testing/debugging
Interfaces:	
USB socket (appears as COM port on PC)	Graphical user interface for advanced tuning/testing, accepts ASCII commands and shows menu
Auxiliary analog Inputs (rear DB-37)	Can be used as feedforward or to create custom field
GO - NO GO signal (relay)	Binary, for usage as input for protected system
Supply voltage, power consumption	90 - 240 VAC 50/60 Hz, 500 VA max

Column-Mounted Helmholtz Coils



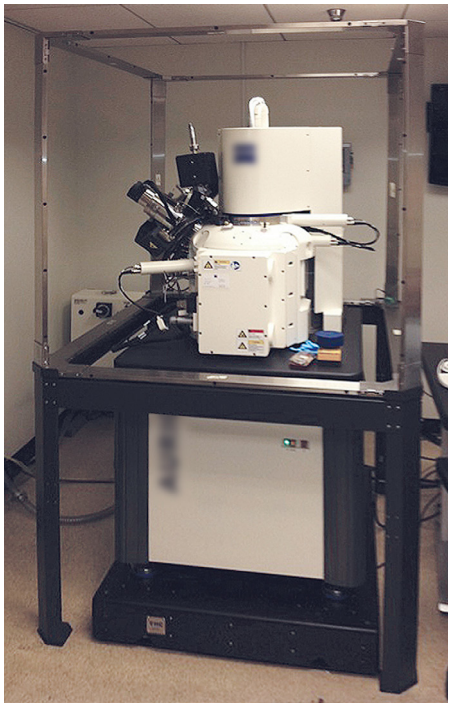
Column-mounted Helmholtz Coils are readily adapted to SEM columns but impractical for TEMs.

Floor-Mounted Helmholtz Coils



Floor-mounted Helmholtz Coils may be used for both SEMs and TEMs.

Helmholtz Coils on Leg Frame



Helmholtz Coils may be mounted on a TMC leg frame.

Wall-Mounted Helmholtz Coils

Wall-mounted coils are a practical alternative to column and floor-mounted coils for TEMs and SEMs installed near the center of a room.

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GMP SA Main office: Avenue des Baumettes 17 CH-1020 Renens Tél. 021 633 21 21 Fax. 021 633 21 29 info@gmp.ch
GMP SA Büro Zürich: Dübendorfstrasse 11a CH-8117 Fällanden Tel. 044 825 34 00 Fax. 044 825 34 01 info@gmp.ch