

# Mag-NetX<sup>®</sup>

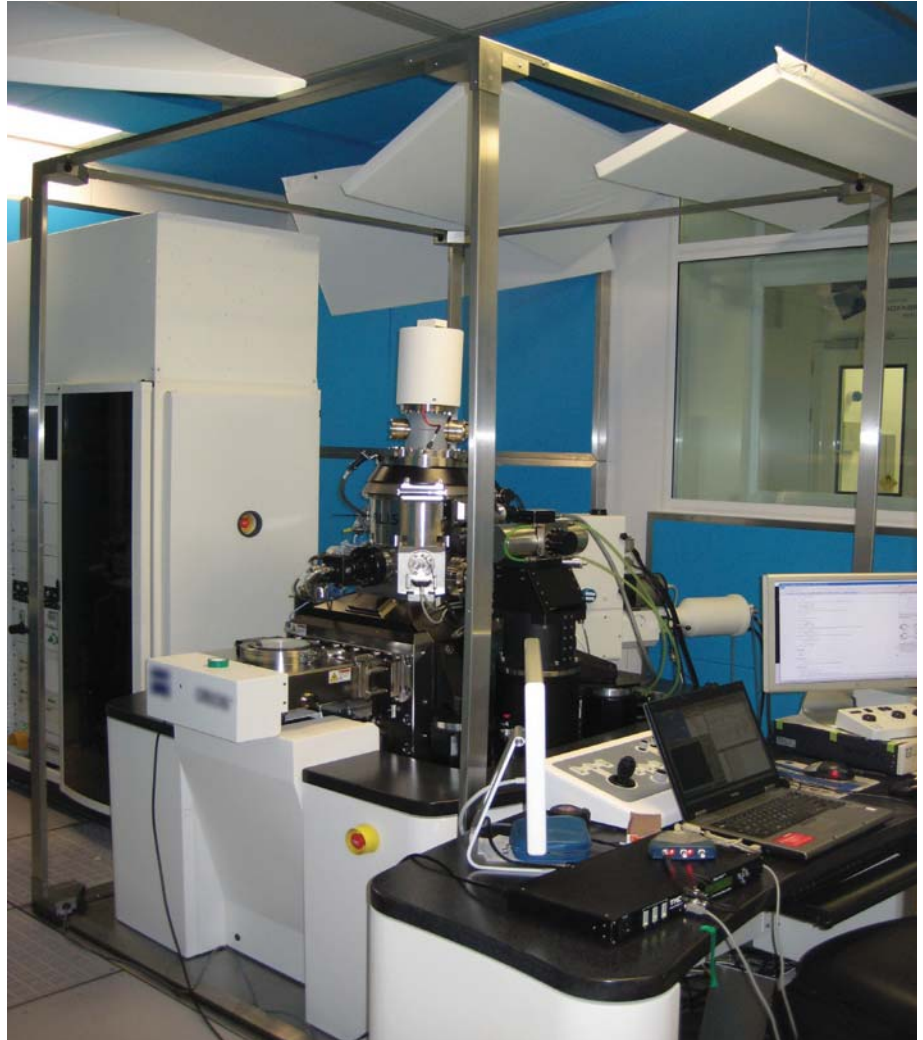
## Magnetic Field Cancellation

### The Mag-NetX<sup>®</sup> Advantage

**Analog Controller with Digital interface:** Analog control of Helmholtz-type coils results in more precise real-time cancellation. Digital panel provides simple LCD read-out or PC-based Graphical User Interface (GUI) to the user.

**Flexibility for On-site Tuning:** Auto-tuning at start up for typical environments and applications, or adjustable on-site tuning for more challenging environments.

**Real-time monitoring:** Continuous monitoring with measured fields displayed via the PC-based GUI allows for fine tuning even without relying on microscope image.



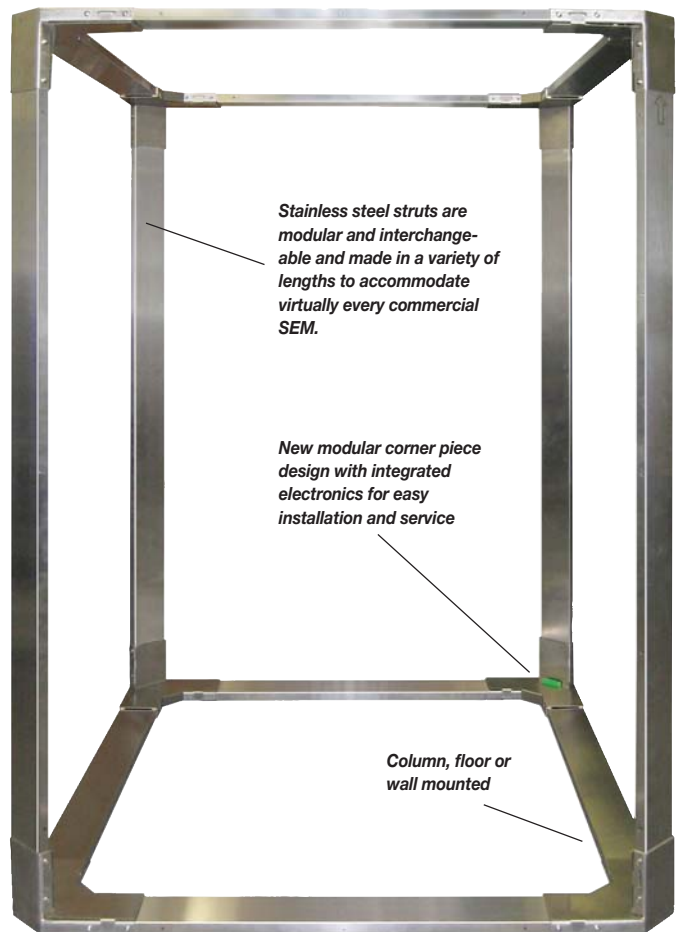
## Features

- Helmholtz coil pairs for maximum symmetry and uniformity
- Continuous field cancellation and monitoring
- Several AC and DC cancellation modes available
- 100x field improvement (typical)
- Dynamic, 100  $\mu$ s 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
- Cage systems available in any size
- Wall-mount and enclosure mounted configuration include plenum-rated cables

Designed for use with any charged-beam instrument, Mag-NetX is an innovative active control system for the compensation of magnetic field fluctuations. With a proprietary analog controller with digital interface to the user, Mag-NetX provides more real-time cancellation with continuous monitoring, while providing the user with a simple built-in LCD, or PC based Graphical user interface (GUI). Continuous monitoring with measured fields displayed via the GUI allows for fine tuning without relying on the microscope image. Alternatively, auto-tuning provides easy start up for typical SEM applications.

With Helmholtz-type configuration available in a free-standing cage, mounted in tracks on the walls of the room, or direct mounted inside of enclosures, Mag-NetX can be configured to your needs and application.

Challenge TMC with your most demanding requirements for both magnetic field compensation and vibration control for scanning and transmission microscopes, electron beam lithography and ion beam instruments.



## How to order:



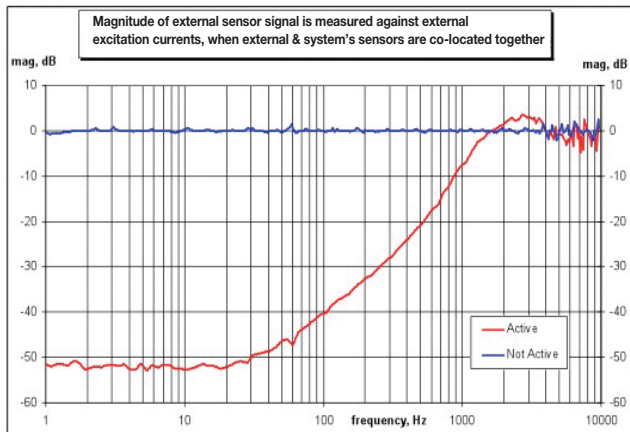
Distribution in the UK & Ireland



**Lambda Photometrics Limited**  
Lambda House Batford Mill  
Harpenden Herts AL5 5BZ  
United Kingdom

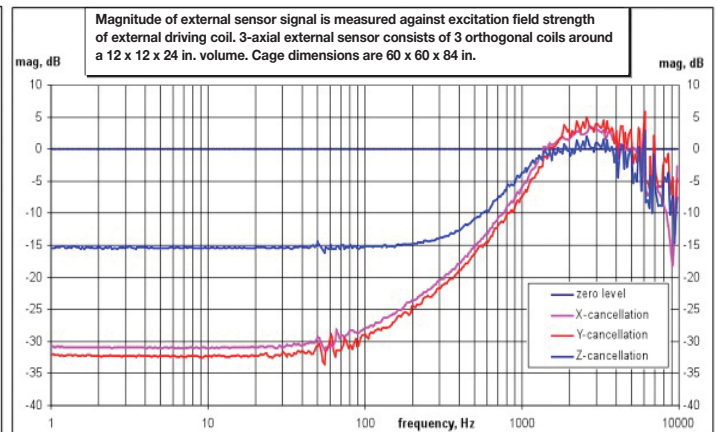
**Characterisation,  
Measurement &  
Analysis**

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**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).

System	
System components	3-axes orthogonal magnetic sensor, Mag-NetX controller, Helmholtz type coil pairs in cage, enclosure-mounted or wall-mounted configuration
Active magnetic field cancellation axes	X, Y, Z
Sensor type	Fluxgate type, noise <10 pT/√Hz @ 1 Hz
Max. ambient DC field (sensor dependent)	±70 μT standard up to ±250 μT available
Bandwidth (cage and sensor dependent)	DC to 1 kHz typical, up to 2 kHz
Dynamic range (cage and frequency dependent)	±10 μT typ., up to ±100 μT 40 dB typ., 55 dB max.
Controlling volume vs. magnetic field flux density	50 m <sup>3</sup> @ 10 μT RMS (depending on cage parameters) 1 m <sup>3</sup> @ 50 μT RMS (standard controller is able to cancel Earth magnetic field with special cage construction) 10 m <sup>3</sup> @ 50 μT RMS (for canceling Earth's field in larger volume with special cage and external amplifier)
Field reduction ratio at sensor location using typical cage of 36 x 36 x 52 in. / 91 x 91 x 132 cm (L x W x H)	40 - 50 dB (100x - 300x) typ. in DC 100 Hz 26 dB (20x) typ. in 100-500 Hz See Plot 1
Field reduction ratio in a typical electron microscope column volume of 12 x 12 x 24 in. / 30 x 30 x 60 cm using cage of 60 x 60 x 84 in. / 1152 x 152 x 213 cm (L x W x H)	X, Y: 30 dB (32x) typ. in DC 100 Hz X, Y: 20 dB (10x) typ. in 100-500 Hz Z: 15 dB (5.2x) typ. in DC 100 Hz Z: 10 dB (3x) typ in 100-500 Hz 0 dB @ 1000 Hz See Plot 2

Controller	
Dimensions	17 x 9 x 1.75 in. / 43 x 23 x 4.5 cm
Operational modes	After power-on: <ul style="list-style-type: none"> <li>• Automatic self test/calibration and switch to controlled mode in 1 min. No user involvement required.</li> <li>• Manual test/debug mode</li> <li>• True DC mode (compensating Earth magnetic field)</li> <li>• Offset-DC mode (ignoring Earth magnetic field)</li> <li>• Track DC-shift due to microscope moving parts</li> <li>• Quasi-DC mode (ignoring &gt;100 sec. fluctuations)</li> <li>• Cancel-and-create (simultaneously cancelling disturbance and creating custom field)</li> </ul>
Types of control tools	<ul style="list-style-type: none"> <li>• Analog feedback with digitally controlled gain, DC - 2 kHz</li> <li>• Digital feedback</li> <li>• Digital feedforward (cancels AC-line power frequency and harmonics without gain-stability limits of feedback)</li> </ul>
OK LED indicator	green=ok; yellow=warning/error
LCD 2x20 symbol display	Show menu and status
Bar-LED indicators	Show XYZ real time strength of compensation field
4 directional buttons	for LCD menu navigation
2 BNC sockets	for calibration testing/debugging
USB socket (appears as COM port on PC)	Graphical user interface for advanced tuning/testing, accepts ASCII commands and shows menu
Aux. analog inputs (rear DB-37)	Can be used as feedforward or to create custom field
GO - NO GO signal relay	Binary, for use as input for protected system
Power requirements	90-240 VAC, 50/60 Hz, 500 VA max.

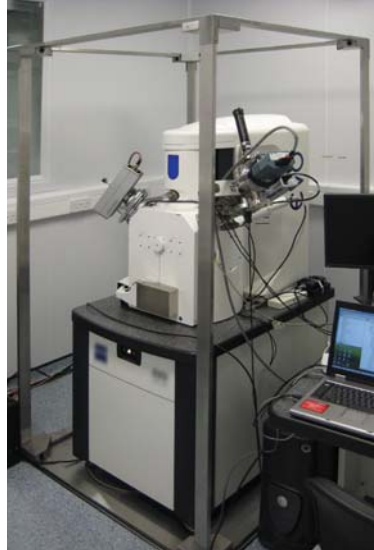
\*may vary depending on configuration

## Column-Mounted Helmholtz Coils



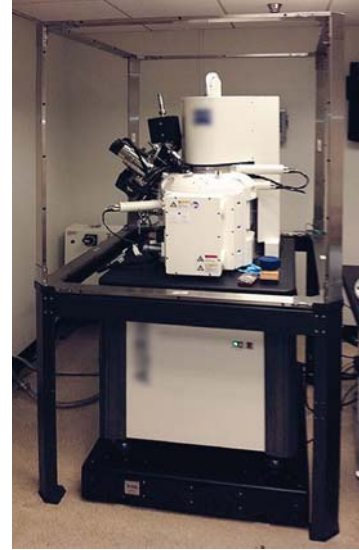
Column-mounted Helmholtz Coils are readily adapted to SEM columns but impractical for TEMs.

## 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

Special design available for mounting inside passively shielded rooms

Low-noise DC-5 kHz fluxgate sensor with independent X-Y-Z leads is standard; several options for sensors and sensor configurations available

Two-piece tamper resistant PVC power rated channel houses Helmholtz-type cables, mounted directly to walls

Plenum rated cables for all wall-mounted room systems

Aluminum covers for door thresholds, cut and trimmed to size on-location

PVC or aluminum floor thresholds for partitioning off large rooms when required

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

