

# MÜLLER-BBM



High-precision system to reduce interfering magnetic fields

## MACOM II<sup>®</sup> Active Magnetic Field Compensation System

[www.MuellerBBM.com](http://www.MuellerBBM.com)

# MACOM II®

Magnetic fields reduced to a minimum – essential for the professional use of electron microscopes, electron-beam lithography systems and magnetic resonance imaging

Electron microscopy, electron-beam lithography and magnetic resonance tomography are highly sensitive techniques often used in research, development, quality control and in diagnostics. They require ideal environmental conditions to ensure the best possible results.

Apart from stable temperatures, minimum floor vibration and quiet acoustic conditions, a magnetically quiet environment is crucial for optimum performance.

Magnetic interference fields of just a few 10 nT already affect the resolution of sensitive systems, while typical sources of interference, such as trams and trains, power cables and electrical installations in buildings, often generate magnetic interference fields of several 100 nT. Passive screening of these fields is usually very complex and expensive.

Not so MACOM II®, the active magnetic field compensation system from Müller-BBM: with MACOM II®, comparatively low effort is needed to achieve optimum magnetic conditions for your systems.



### More than 15 years of experience

For more than 15 years, Müller-BBM has been developing, producing and selling magnetic field compensation systems for rooms with particularly high demands on the stability of the interfering magnetic field. These systems are continuously developed further and with their various filter settings they are designed not only for use in normal laboratories but also

### Maintenance-free operation

MACOM II® automatically compensates interfering magnetic fields. Once it has been set up correctly during commissioning, the system requires no further maintenance. For operating the system and monitoring its functions, MACOM II® has a display on which all parameters can be viewed and adjusted, if necessary. During operation the display shows either the



for installations in metal-shielded rooms or metal shielding chambers. MACOM II® is state-of-the-art technology, easy to operate and virtually maintenance-free.

### Patented technology

The patented sensor enables the systems to operate in an exceptionally large frequency range between 0 Hz and approx. 50 kHz. Thus, it is possible to most effectively reduce very slow field fluctuations – such as those due to trams or vehicles – or fields caused by energy plants with 50 Hz and the corresponding harmonic waves. But also very rapid field fluctuations – e. g. those produced by switching operations in electrical supply networks of buildings – can perfectly be minimized.

remaining magnetic field in all three coordinate directions or the coil current required to create the opposing field.

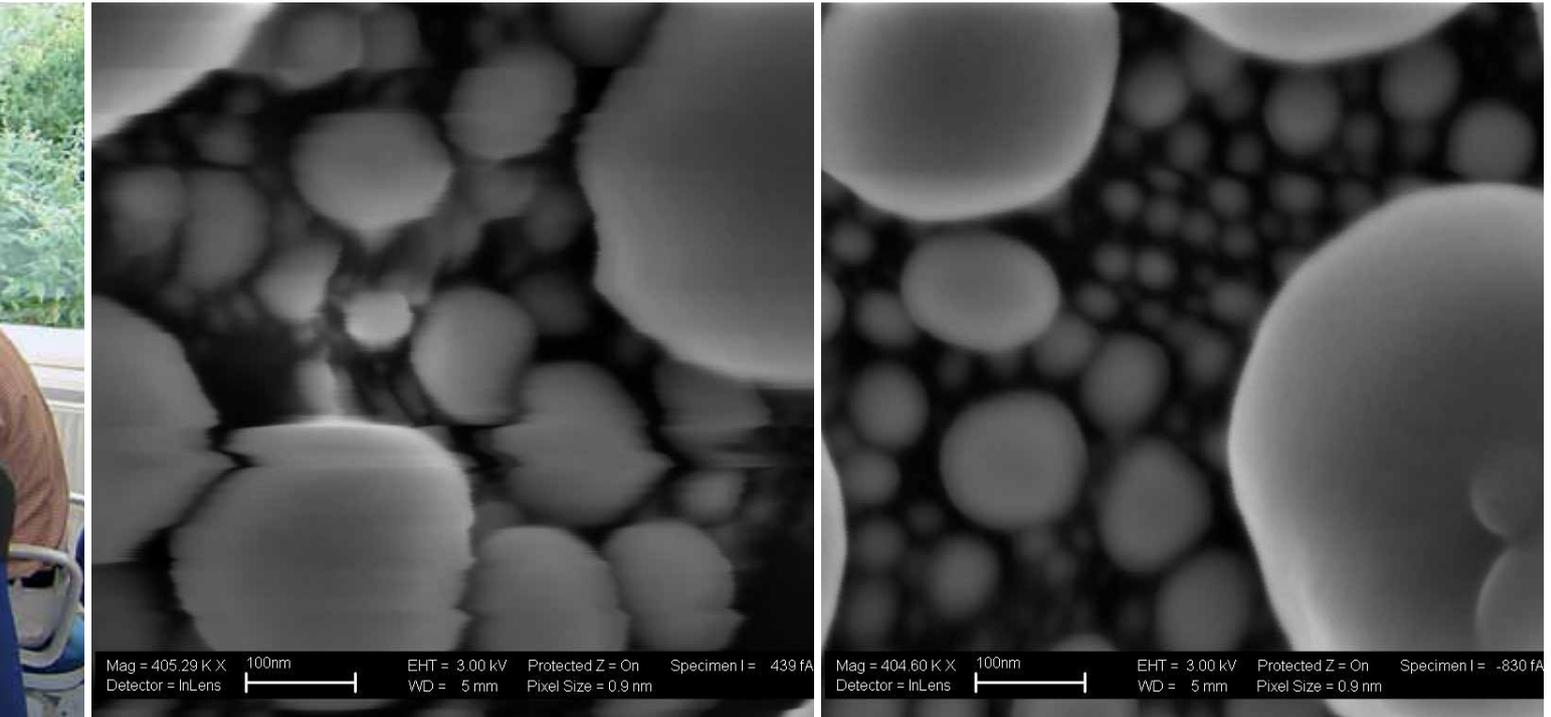
For optimum support, MACOM II® is equipped with one serial and one Ethernet port allowing it to be controlled from an external computer via intranet or internet. On request, global remote control and monitoring is available from Müller-BBM.

### Applications of MACOM II®:

- scanning electron microscopes and transmission electron microscopes
- electron-beam lithography systems
- magnetic field resonance tomography systems
- any installation requiring high magnetic field stability

# MACOM II<sup>®</sup> – the principle

Magnetic fields are vector fields. A field of equal magnitude, though in the opposite direction, may reduce and nearly cancel the vector field. To do so, the prevailing magnetic field is measured, then a matching opposing field is generated by an arrangement of current-conducting coils. Since magnetic fields change quickly or slowly depending on the particular source of the interference (e. g. DC electric trains, moving metallic objects such as lifts, steel doors or motor vehicles in the vicinity, switching operations), MACOM II<sup>®</sup> is operated in a wide frequency range.

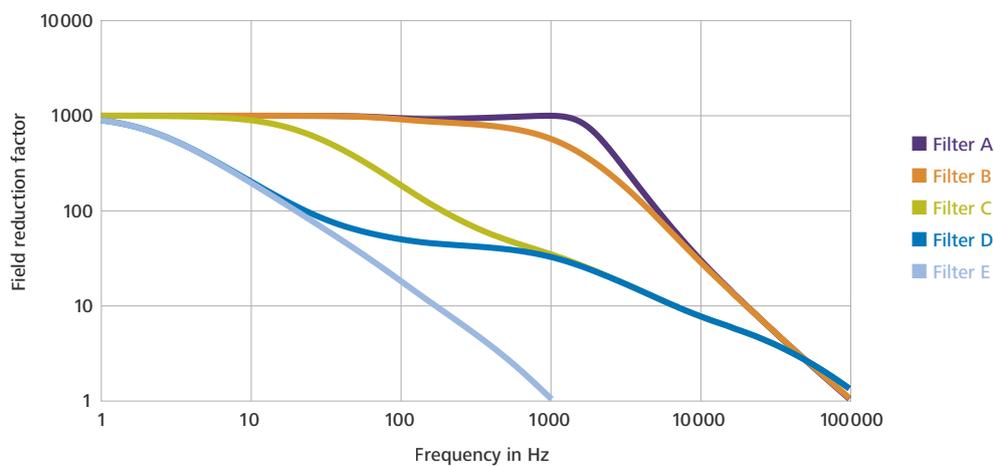


*Images taken by a scanning electron microscope before and after the installation of MACOM II<sup>®</sup>*

The heart of the system is the patented sensor which measures interference fields from 0 Hz (constant field) up to 100 kHz or even higher. The sensor signal is processed by an analogue automatic control unit, a broadband power amplifier supplies the current for the opposing field. The system works as a closed control loop with the opposing field instantaneously following the changes in the interference field.

The coils for the opposing field are adapted to fit best for the respective room properties. Occasionally, it may be appropriate to arrange the coils in a cantilever aluminium construction. The sensor is mounted at the point where the maximum field reduction is to be attained. If this is not feasible, it can also be placed outside this area, so to some extent it is possible to utilize the symmetrical properties of the coil arrangement to freely select the point of maximum field reduction.

# MACOM II<sup>®</sup> and MACOM II<sup>®</sup> MR technical data



## Field reduction \*

0 Hz – 1 kHz: 60 dB

1 kHz – 5 kHz: 60 dB–40 dB

5 kHz – 100 kHz: 40 dB–0 dB

**Noise (0 Hz – 50 kHz) < 1 nT**

**Long-term stability < 1 nT**

**Maximum interference field \*\* ca. 10 μT**

**Output current 3 x 3 A**

**Display** flux density or output current,  
system parameters

**Interfaces** RS 232, Ethernet

**Power input** max. 600 W

**Model shape** 19"–4U insert or desktop housing

\*) The specifications are given relative to the location of the probe and filter settings A.

\*\*) The strength of the opposing field, and consequently of the maximum interference field, depends on the size of the room volume to be compensated. Values are given for a room volume of approximately 4 m x 4 m x 3 m.

## Buildings

Building acoustics  
Room acoustics  
Media and communications technology  
Thermal building physics  
Building climatology  
Sustainability  
Fire protection  
Structural dynamics  
Building pollutants

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Noise control  
Air pollution control  
Vibration control  
Light and electromagnetic fields  
Environmental compatibility  
Plant safety  
Legally compliant business organization  
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Chemical analysis

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Ship acoustics  
Rail acoustics  
Industrial acoustics  
Machine acoustics and machine dynamics  
Psychoacoustics  
Mobile communication

## Comprehensive solutions from a single source

### Consulting · Planning · Measuring Expert Opinion · Research

Müller-BBM GmbH is a subsidiary of Müller-BBM Holding AG, with headquarters in Planegg near Munich. Since 1962 Müller-BBM has been advising clients nationally and internationally and is now one of the world's leading engineering firms. More than 400 highly qualified employees form an interdisciplinary team of architects, scientists and engineers in the most diverse specialist fields. The company currently has twelve offices in Germany as well as a branch office in Austria.

#### Notifications

Müller-BBM is notified as an expert authority in accordance with § 29 b of the German Federal Pollution Control Act (BImSchG). The notification comprises

- determining emissions and immissions of air pollutants, noise and vibration
- verifying the correct installation and function in addition to the calibration of continuous emission measurement systems (CEMS)
- checking combustion conditions

As a test laboratory, Müller-BBM is authorized to render the services of an independent third-party provider for assessing and examining performance reliability in accordance with EU regulation no. 305/2011 (Construction Products Regulation).

#### Accreditations

Our testing and calibration laboratories are accredited according to ISO/IEC 17025:

- Test laboratory for sound and vibration, electromagnetic fields and light, air pollution control, measurement of hazardous substances
- Acoustic testing laboratory
- Calibration laboratory for acceleration and acoustical quantities

Müller-BBM has a significant number of employees with competency certificates that were awarded to them on an individual basis. They include publicly appointed and sworn experts, state-recognised experts and otherwise appointed and notified experts.

Detailed information on the scope of our accreditation, its international validity and the corresponding certificates can be found on <http://www.muellerbbm.com/quality/>.

## Headquarters

Müller-BBM GmbH  
Helmut-A.-Müller-Straße 1 – 5  
82152 Planegg/Munich  
Germany  
Phone +49 89 85602-0  
Fax +49 89 85602-111

[www.MuellerBBM.com](http://www.MuellerBBM.com)