



**m-axis**  
by matesy

## Investigation of permanent magnet properties

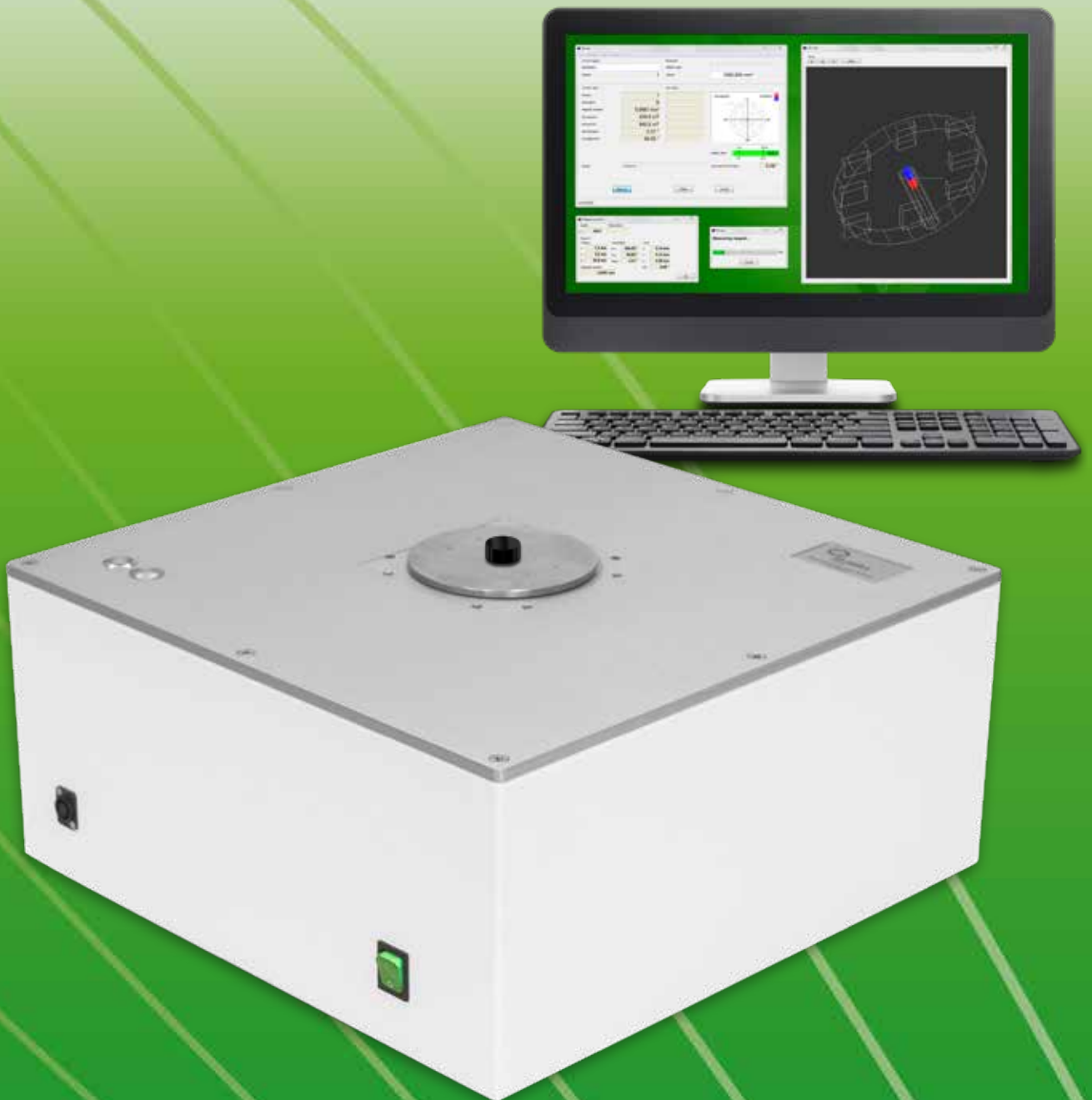




Figure: m-axis software



Figure: m-axis with rotation axis module



**m-axis** is a measurement system to investigate the magnetic specifications of permanent magnets (magnetization angle and magnetic moment). Due to the modular setup it is possible to customize the measurement range of the m-axis system in addition to the four standard ranges and for 100% quality control.

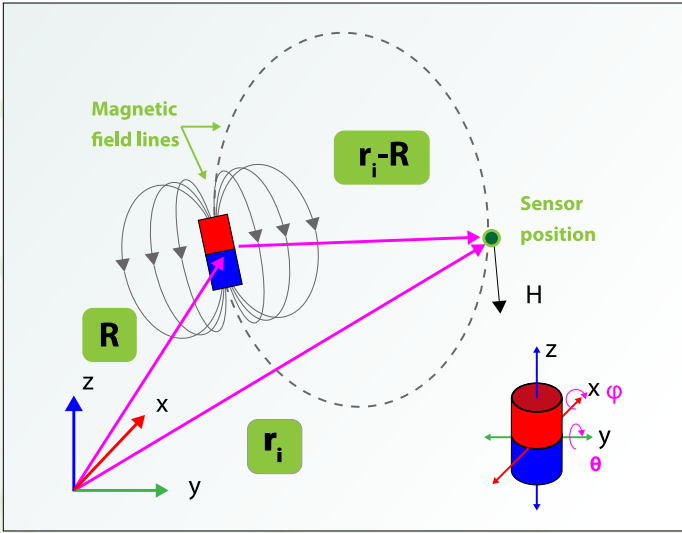


Figure: measurement principle

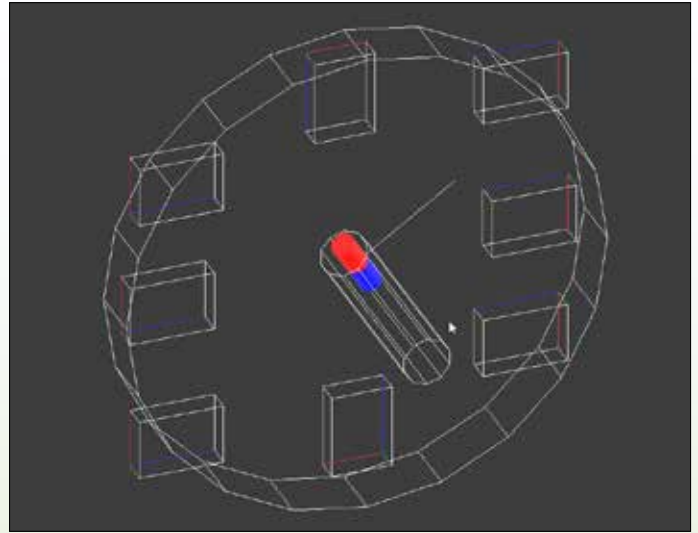


Figure: schematic 3D view of a dipole magnet and the circuit boards

### Measurement process :

The calculation routine of the **m-axis**-system is based on the determination of the dipole parameters of permanently magnetic materials using an integrated AMR sensor set-up. That way the three-dimensional position (x, y, z) of the magnet as well as its magnetic moment (m) and the angular direction ( $\varphi$ ,  $\theta$ ) of the magnetization are determined simultaneously.

Because of the universally applicable approach the evaluation of axially as well as diametrically magnetized dipole permanent magnets regarding their quality and strength. By implementation of various user defined magnet types and measurement processes in the comprehensive user software the system delivers a real time classification of numerous dipole possibilities. All relevant settings and measurement results can be saved to a single report file.

Parameter	Magnetic Moment [Am²]	Longitude	Axis Deviation	Quality
Max. all	0.983	137.22	1.100	146.8
Min. all	0.982	137.96	1.300	146.8
Mean. all	0.983	137.61	1.200	146.8
Deviation all	0.000	0.00	0.000	1.2
Max. all	0.000	0.00	0.000	0.0
Min. all	0.000	0.00	0.000	0.0
Mean. all	0.000	0.00	0.000	0.0
Deviation all	0.000	0.00	0.000	0.0

Figure: measuring report

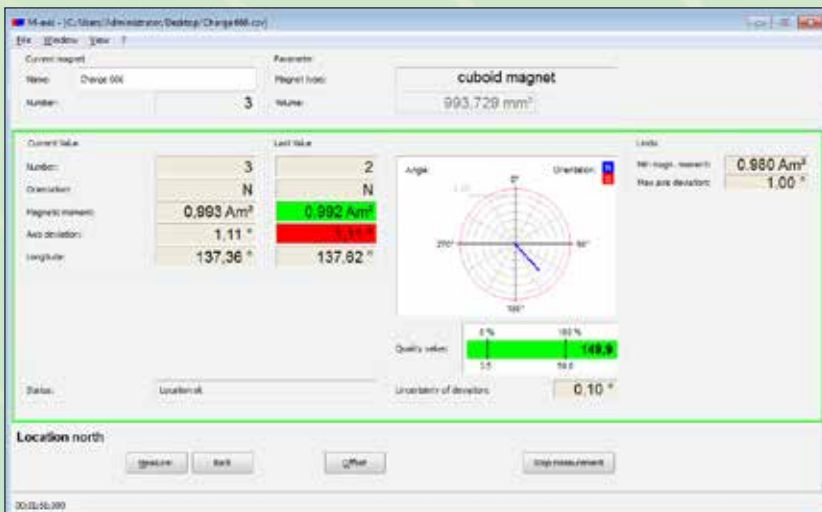
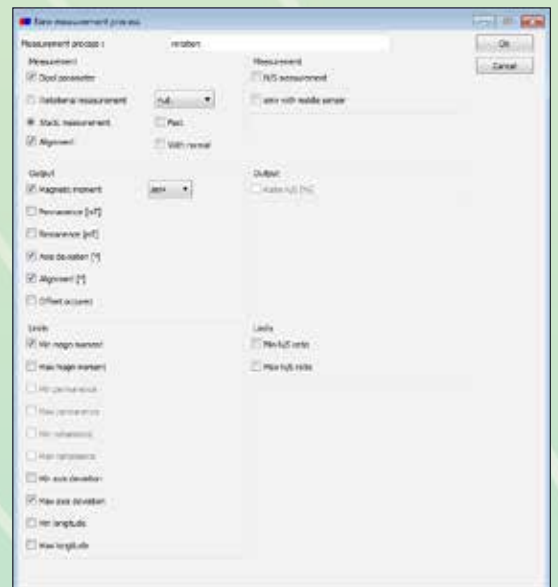


Figure : Software main window & settings menu for a measurement process



## Standard measurement systems:

The concept of the m-axis-system allows by the help of different set-ups four standard models available:

- **m-axis S** measurement range: 0.01 - 1.00 Am<sup>2</sup>
- **m-axis M** measurement range: 0.10 - 3.00 Am<sup>2</sup>
- **m-axis L** measurement range: 1.00 - 10.00 Am<sup>2</sup>
- **m-axis XL** measurement range: 4.00 - 50.00 Am<sup>2</sup>

Models with specifically customized measurement ranges can be offered as well.



## Items delivered:



PC (optional) & software



Test magnet for system check



Angled plate (optional)



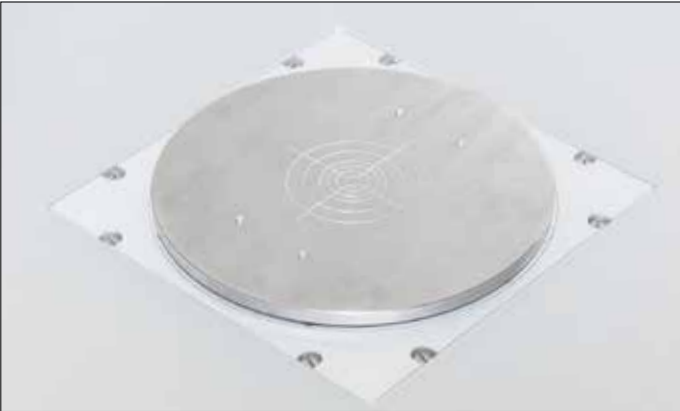
Foot switch

## Advantages of the m-axis measurement system:

- No temperature-related signal drift due to calibrated AMR sensors with temperature correction
- System-check by the user with the attached test magnet possible at any time
- Calibrated as a system
- Extensive user software for definition of various measurement processes and magnet types
- Automatically generated protocols with all relevant settings and measurement data
- Measurement independent of direction of magnetization (axially or diametrically)
- Display of measurement quality during the process
- User independent measurement of magnetic properties
- Option for integration in measurement environments
- Foot switch with USB interface
- Measurement processes are transferable to other m-axis systems
- Modulated set-up for application specific measurements
- SAP-interface



## m-axis modules:



### Rotation axis module:

Systems containing a rotatable axis provide the possibility for 360°-rotation during the measurement process.

Hereby more than 160 distinct measurements are done and ultimately averaged. The angular accuracy is therefore improved to  $\pm 0.1^\circ$ .



### Temperature module:

The magnetic moment is corrected to the reference value at 20°C by simultaneously measuring the room temperature and entering the temperature coefficient for the evaluated magnets. Additionally studies of the magnetic moment at varying temperatures may be performed. The accuracy of the temperature correction is  $\pm 0.1^\circ$  for every 10°C temperature difference.



### North/South module:

The North/South module measures the surface magnetic field of axially magnetized permanent magnets using hall-sensors. Through a 180°-flip of the magnet and a second measurement the ratio regarding north pole and south pole can be determined and issued in %. This measurement can be done both in addition to the dipole property determination and as a stand-alone test.



### Table module:

To reduce the noise originating from laboratory tables the system electronics can be integrated within a non-magnetic table.

## Automatic measurement:

For 100% automated measurement and classification an I/O-module for connection with a PLC as well as an embedded version are available.

## I/O modul:

The I/O module possesses 16 predefined PINs for inclusion of the m-axis into a measurement environment:

- Input: 110-230V/AC, 50-60Hz
- Output: 24V/DC
- Data-Interface: USB
- adjusted m-axis-software for inclusion of the I/O module
- # of I/O PINs: 16



INPUT	
PIN NO 1	Measurement Manual(Auto)
PIN NO 2	Measurement Start
PIN NO 3	Offset Start
PIN NO 4	Measurement Reference
PIN NO 5	
PIN NO 6	
PIN NO 7	Measurementprocess
PIN NO 8	
PIN NO 9	
PIN NO 10	Mold cavity number
PIN NO 11	
OUTPUT	
PIN NO 15	Measurement Manual(Auto)
PIN NO 7	Measurement ready
PIN NO 5	Measurement active
PIN NO 4	Measurement result
PIN NO 16	Reference magnet
PIN NO 8	
PIN NO 3	
PIN NO 14	Measurement process
PIN NO 17	
PIN NO 9	
PIN NO 2	Mold cavity number
PIN NO 13	
	System active

Figure: I/O PIN Settings



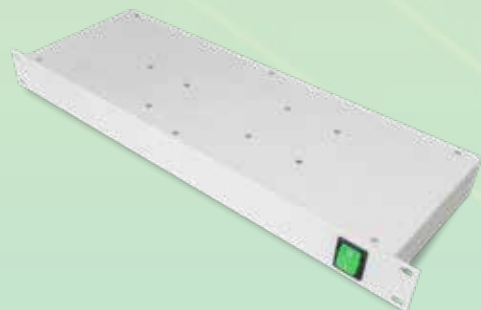
Figure: SUB-D male socket



Figure: SUB-D female connector

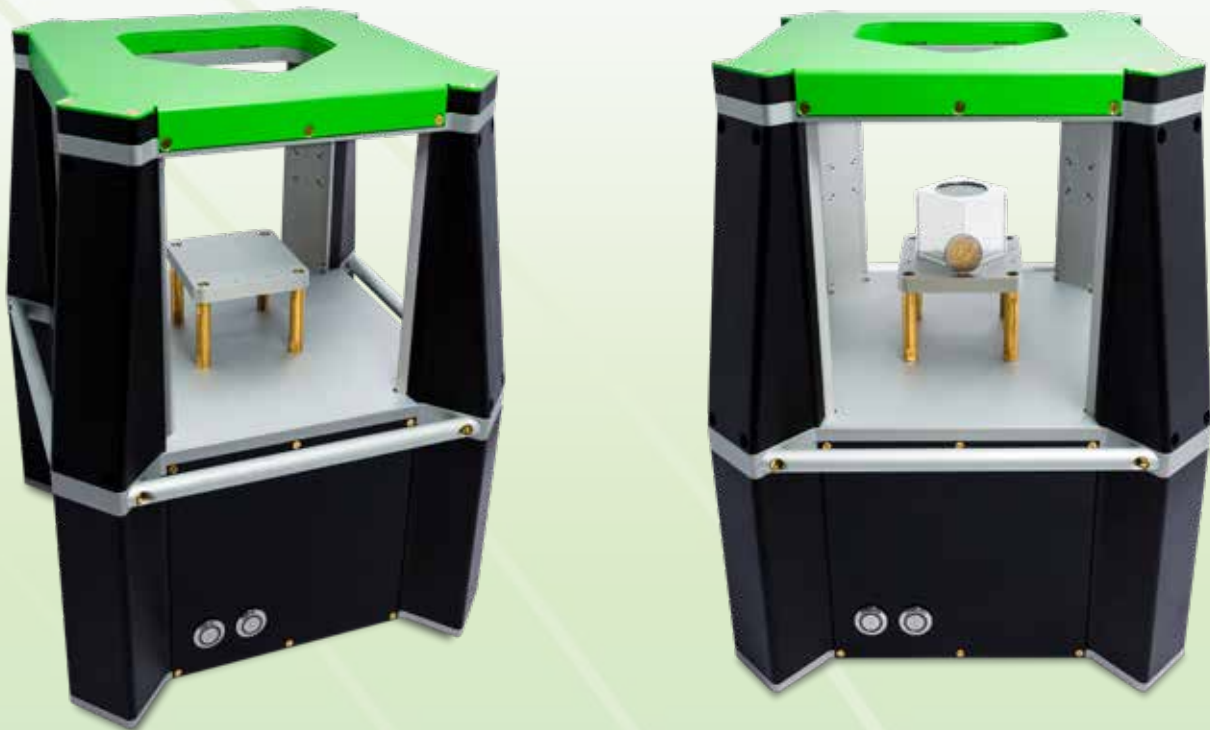
## Embedded version:

With the integration of an embedded PC into the **m-axis** power supply unit the measurement system can be accessed externally using USB, serial BUS or via an Ethernet interface. Additionally a screen and a keyboard may be connected to the power supply unit.



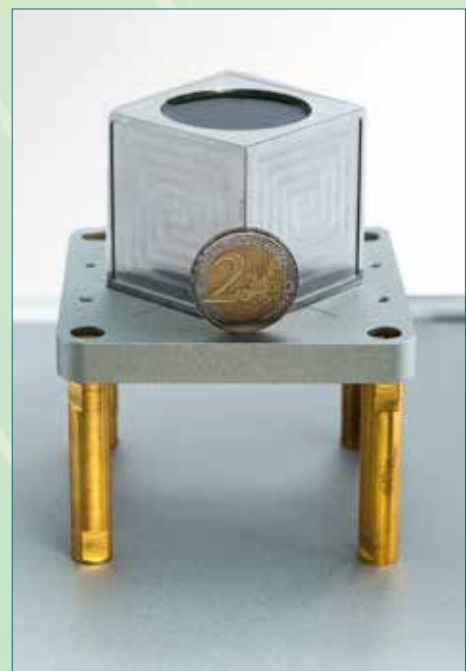
## For large magnets: m-axis XL

The m-axis XL is the latest development in the m-axis family and was specially designed for large magnets. It is now possible to determine the magnetic properties in a measuring range from 4 to 50 Am<sup>2</sup>.



### Technical features:

<b>Measuring range:</b>	4.0 - 50.00 Am <sup>2</sup>
<b>Accuracy:</b>	± 0.5° (magnetization angle) ± 1% (magnetic moment)
<b>Measurement speed:</b>	< 1s
<b>Max. sample size in mm:</b>	90 x 90 x 90 (H x W x D)
<b>Sample geometry:</b>	various shapes possible
<b>Dimension in mm:</b>	380 x 310 x 310 (H x W x D)
<b>Weight in Kg:</b>	9.25
<b>Options:</b>	<ul style="list-style-type: none"> <li>Automation possible</li> </ul>



## Technical features:

<b>Measurement range m-axis (m-axis S - m-axis XL)</b>	0.01 - 50.00 Am <sup>2</sup>
<b>Sensors:</b>	Calibrated AMR sensors with temperature correction
<b>Determination of the magnetic moment:</b>	± 1% (within calibration range)
<b>Repeatability of the magnetic moment (determined through MSA):</b>	± 0.1%
<b>Accuracy of magnetization angle:</b>	
• Static measurement:	± 0.3°
• Rotation axis module measurement:	± 0.1°
<b>Measurement time:</b>	
• Static measurement:	1s
• Rotation axis module measurement:	appr. 12s
<b>Interface:</b>	USB
<b>User software:</b>	Software adjustable for data acquisition and storage (Q-DAS interface)
<b>Dimensions:</b>	450 x 450 x 60 - 230 mm <sup>3</sup> (depending on module choice)
<b>Power supply:</b>	100 - 230V/AC, 50 - 60Hz
<b>System check:</b>	Testing with adapted fixtures possible through 4 included holes
<b>Items delivered:</b>	<b>m-axis</b> measurement system, software, test magnet, foot switch
<b>Options:</b>	PC, rotation axis module, temperature module, table module, North/South module, angled plate, USB-cable

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