

MAGNETICS | ELECTRONICS | PROTOTYPING
MEASUREMENT | TESTING





Driving Innovations in all Fields of Intelligent Mechatronics

We are developing and optimising complex mechatronic drive systems for more than 25 years.

The unique measurement technology MagHyst® allows quality assessment and evaluation of electromagnetic actuators over their entire life cycle.

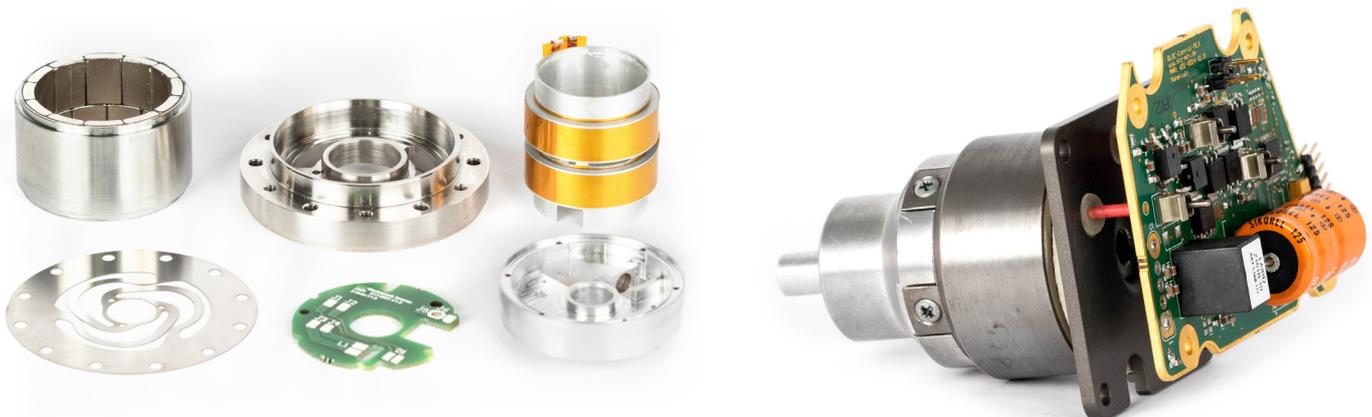


History

- 1992 Founding of the Steinbeis Transferzentrum Mechatronik (STZ) by Prof. Dr.-Ing. habil. Prof. h. c. Eberhard Kallenbach
- 2005 Relocation from the „Technologie- und Gründerzentrum Ilmenau“ to the new company building and present headquarter
- 2010 Continuation of the successful development of the STZ Mechatronik by the Steinbeis Mechatronik GmbH
- 2015 Acquisition by the Kendrion Group - change of the company name to Kendrion Mechatronics Center GmbH (KMC)
- 2018 Management buy-out of KMC by Ilmenauer Mechatronik GmbH with all employees, rights and patents
- 2019 Shareholder participation by Jenaer Antriebstechnik GmbH

Mechatronic Drive Systems

- Development and optimisation of mechatronic drive systems at the highest technical level from idea to product
 - Electromagnets (DC and polarized solenoids)
 - Rotary drives as BLDC and SR motors
 - Translational drives
- Implementation of projects in close cooperation with TU Ilmenau and a network of universities
- Development of servo drive systems in close cooperation with Jenaer Antriebstechnik GmbH
- Implementation of the mechatronic development methodology according to VDI 2206
- Participation in individual and joint founded research projects



Development and Optimisation of Mechatronic Drive Systems



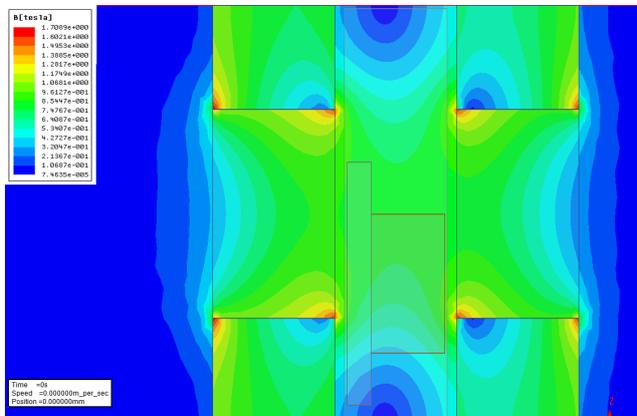
Magnetics

- Design, layout and simulation of application specific mechatronic drive systems
- Magnetic field calculations with MAXWELL 2D / 3D
- Analysis of the potential for optimisation of existing actuators
- Concept and feasibility studies
- Support and advice on the selection and use of optimal magnetic materials



Electronics and Software

- Development of drive-specific measurement and control systems
- PCB layout and simulation with Altium Designer, Eagle and Pulsonix
- Circuit design, simulation, construction, commissioning and test
- Design of analogue and digital filters and controllers
- EMC and device safety tests
- Software development in C, C#, C++, Java, LabVIEW™





Unveiling the Secrets of Magnetic Systems

MagHyst® technology is an intelligent measurement and testing technology for the **sensorless** and **non-destructive** determination of the magnetic properties of complex electromagnetic systems.

With the innovative **MagHyst®** measurement and control technology, the excitation coil from any electromagnetic drive system can be operated simultaneously as a measuring coil to detect defects.

The so called single coil measurement enables high resolution **functional testing**, **error detection** and **quality control** of electromagnetic actuators, based on the

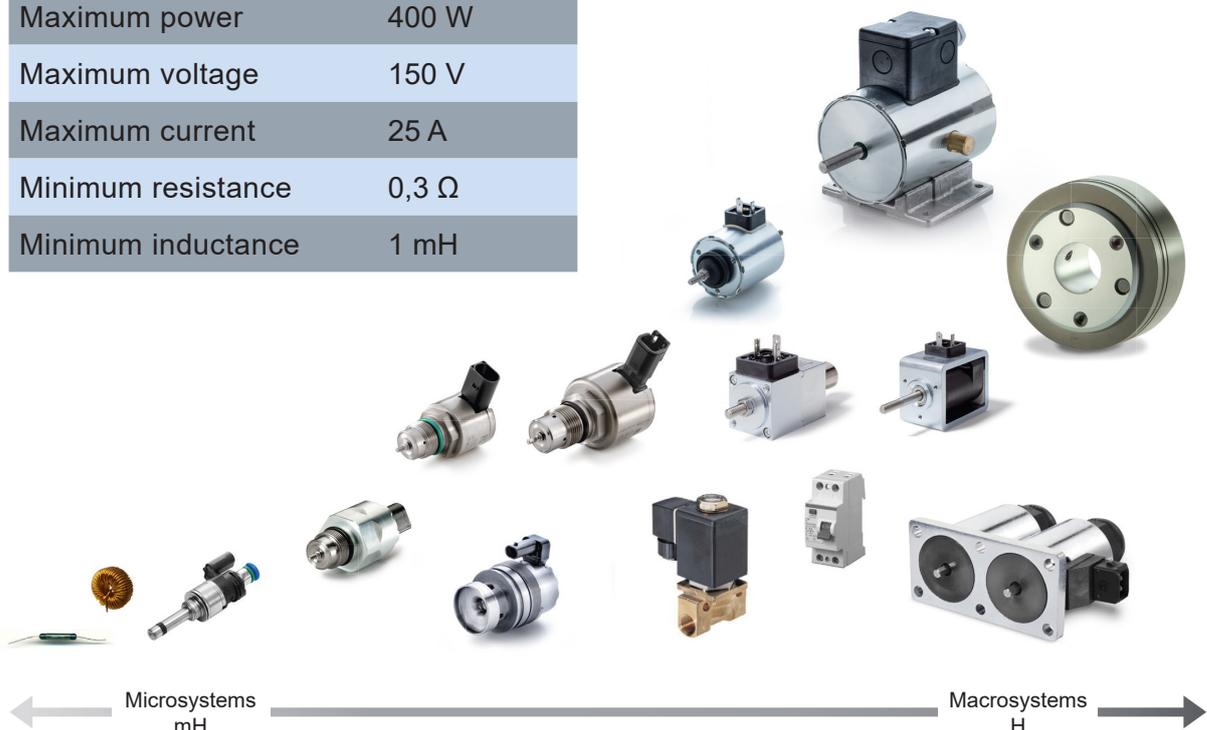
evaluation of a magnetization characteristic $\Psi(i)$. The used principle of measurement is applicable to all actuators based on reluctance force.

The **MagHyst®** device family consists of individually adapted designs in the following variants

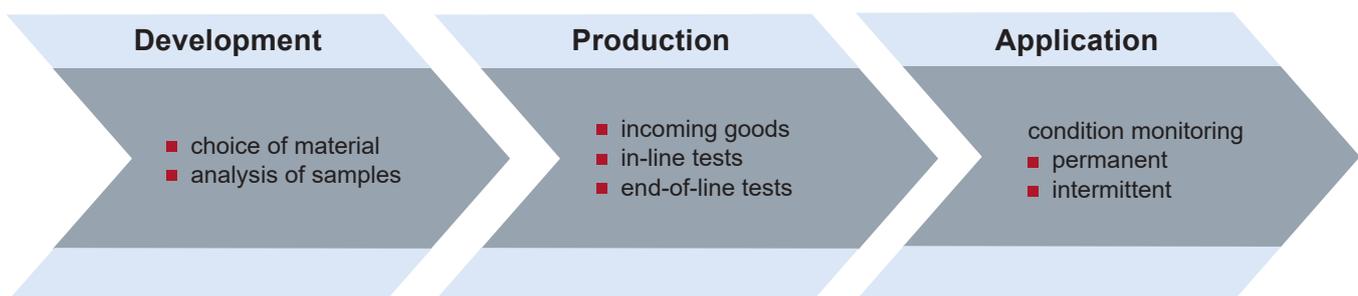
- MagHyst® modular
- MagHyst® automation
- MagHyst® mobile
- MagHyst® embedded

Technical data

| | |
|--------------------|--------------|
| Maximum power | 400 W |
| Maximum voltage | 150 V |
| Maximum current | 25 A |
| Minimum resistance | 0,3 Ω |
| Minimum inductance | 1 mH |



Life Cycle of Electromagnetic Actuators



With **MagHyst® technology** it is possible to analyse the complete life cycle of magnetic actuators regarding the following product specific characteristics:

- Determination of armature movement and position (stroke, residual air gap)
- Analysis of the armature movement during switching process (sticking, bouncing etc.)
- Determination of switching times and currents
- Evaluation of the forces in the electromagnet (friction, spring forces, fluidic forces, remanence etc.)
- Detection of friction and wear in the entire system
- Analysis of production defects of electromagnetic actuators and verification of the cause of fault

By controlling the development and manufacturing processes combined with the possibilities of function and condition monitoring, **MagHyst®** represents an important component for the digitalisation and implementation of your **Industry 4.0 Strategy**.



The expert for development

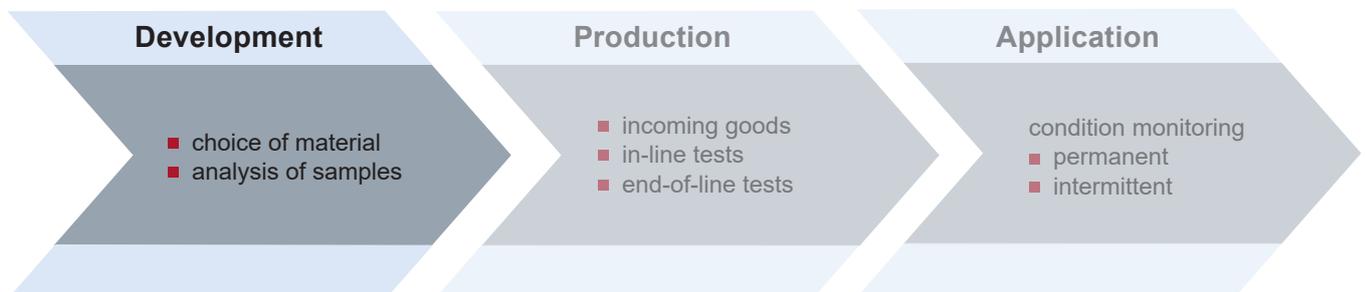
Measuring System for the Analysis of Soft Magnetic Materials and Electromagnetic Actuators

MagHyst® modular is a computer-controlled modular measuring system, adjustable to customer specific testing and evaluation tasks.

MagHyst® modular is especially well suited for research and development departments as well as in test laboratories and research facilities dealing with the development and manufacturing of electromagnetic systems.

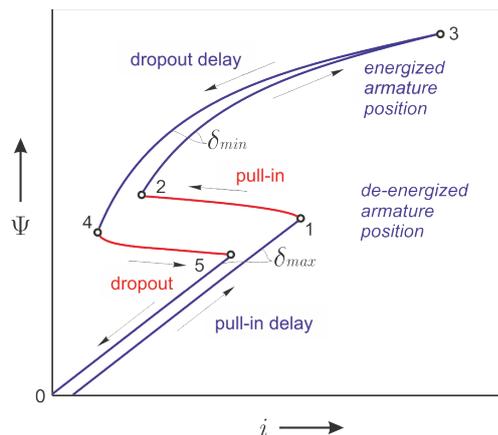
Due to the modular layout of this measuring device almost all measuring objects, both coils and actuators with different electrical parameters, can be measured with a single device.

The entire spectrum of all standard solenoids is covered by different modules each of which is optimised to suit defined measuring and performance ranges.



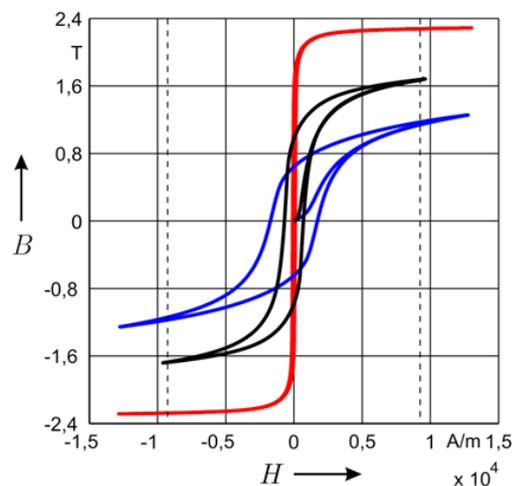
Solenoid Actuators

- Analysis of the complete development process
- Optimisation of functional samples and prototypes
- Inspection of samples under real application conditions
- Evaluation of parameters influencing different manufacturing and machining processes



Soft Magnetic Materials

- Determination of B(H) characteristics using ring core samples or measuring adapters
- Usage of measuring data for FEM calculations
- Build-up of a database for materials used in the company
- Comparative measurements for qualitative evaluation of raw materials and semi-finished products



Measuring Adapters

(MagHyst® modular and MagHyst® automation)

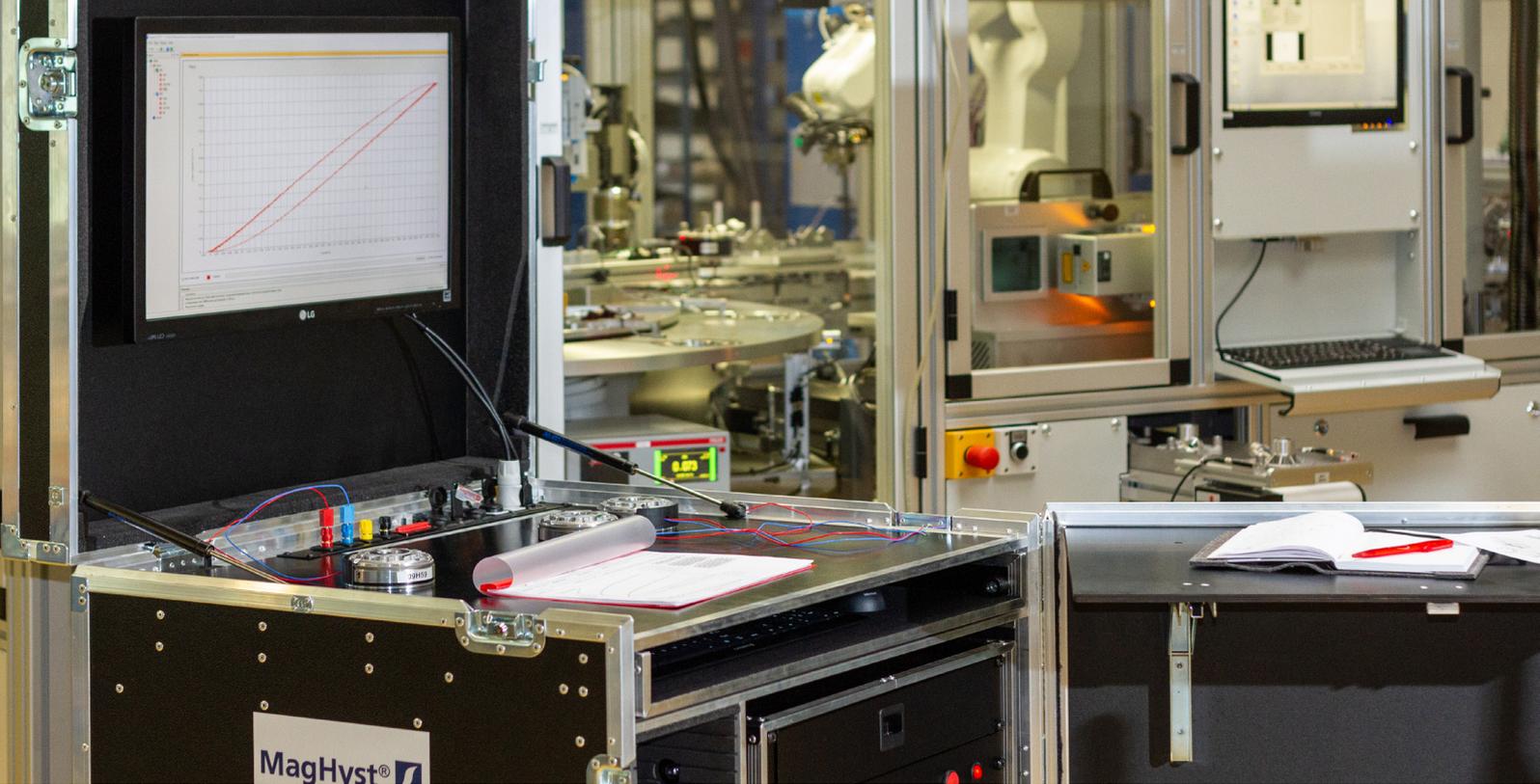
for soft magnetic materials:

- Rod adapter
- Sheet adapter

and components with complex geometries e.g.

- Magnetic housing
- Pole tube
- Armature





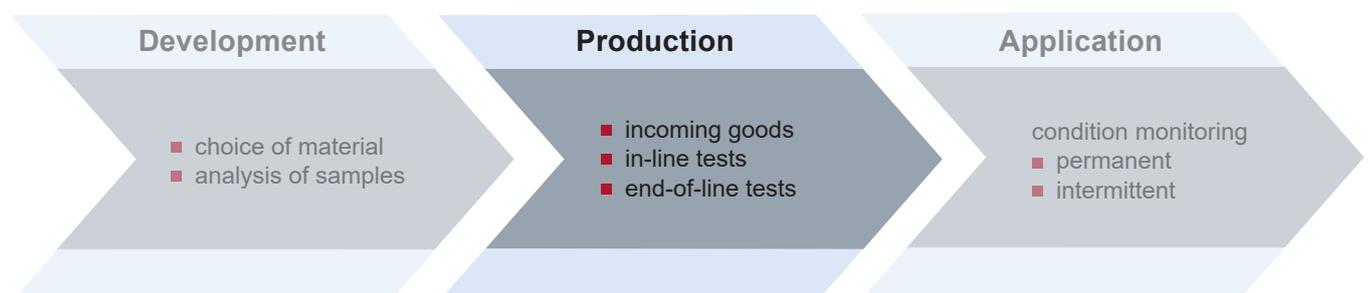
*The quality guarantor
for production*

Testing System for Fault Detection and Quality Control

MagHyst® automation is a testing system adapted to defined customer specific test tasks for the 100% quality control of all ferromagnetic components along the entire value chain.

Features and Advantages of the Testing System

- Monitoring of the complete production process of the solenoid with the precision of electrical measurement and short cycle times
- Communication with the PLC via fieldbus
- Automatic acquisition and evaluation of measurement data
- Detection of production defects and their causes (materials, mechanical machining, assembly, adjustment etc.)
- Endurance tests and wear analysis
- Function check of the entire system, even under load

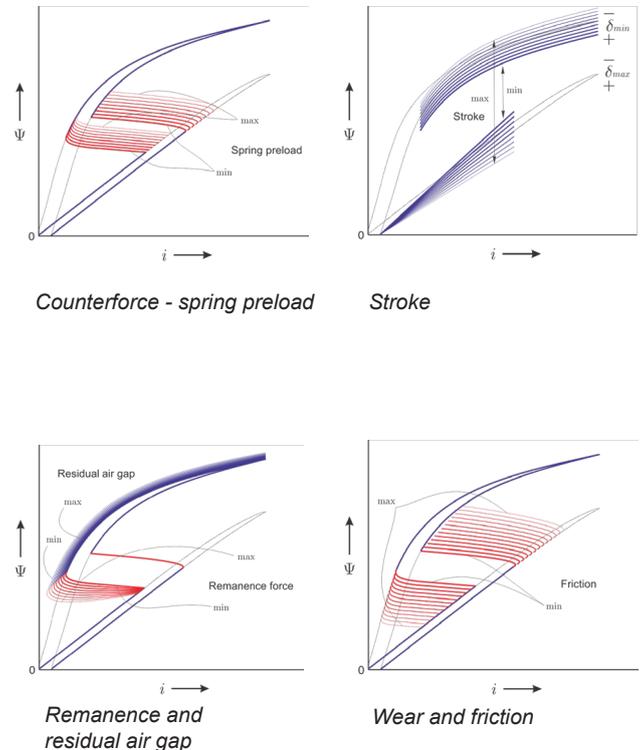


MagHyst® automation is a unique test technology that facilitates your **zero-defect strategy** in nearly all production steps, right from the development stage and during the production of electromagnetic systems.

During the production of electromagnetic drive systems, **material, manufacturing or assembly defects** may occur. Such defects influence the magnetisation characteristics $\Psi(i)$ of the electromagnet. These deviations can be determined by **MagHyst® automation** within **milliseconds** during the entire production process without additional **sensors** and **non-destructive**.

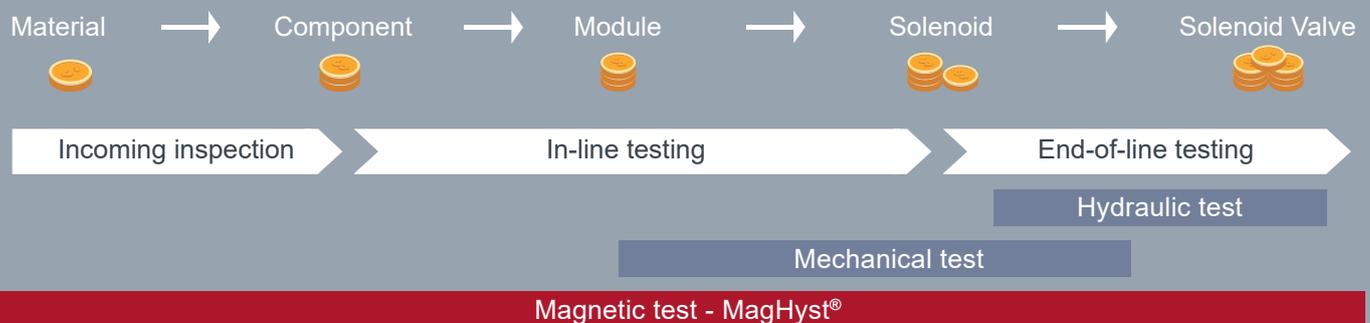
The measured data and evaluation results are transferred to a database and analysed regarding **quality and function** of the electromagnet.

By the early detection of faulty components time and material are already saved during production, leading to **reduced costs**.



Testing during production with MagHyst® automation on the example of a solenoid valve

Ferromagnetic components



- Incoming goods inspection of purchased soft magnetic materials and components
- Immediate detection of electrical, magnetic and mechanical manufacturing defects in the production of electromagnetic modules due to in-line testing
- Precise analysis of the solenoid valve as an extended end-of-line testing



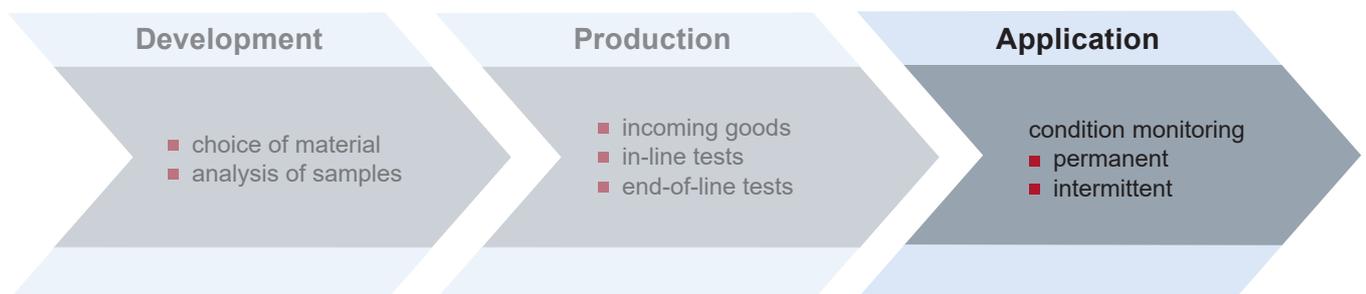
*The specialist for
on-site diagnostics*

Mobile Testing System for Condition Monitoring

MagHyst® mobile is the compact on-site testing system for the monitoring of function and condition of solenoid actuators as part of a regular maintenance.

Features and Advantages of the Testing System

- Active or passive on-site measurement of electromagnetic actuators under operating conditions
- Wi-Fi communication, activation and evaluation by tablet or smartphone
- Automatic evaluation and display of measurement results
- Detection of causes of defects (wear, friction, short circuit between windings)
- Storage of measuring and testing data for all devices in a common database
- Improvement of safety with maximum protection of life, environment and technology
- Boosting of system efficiency through condition-oriented maintenance





*The solution for the
Smart Actuator*

Smart Actuator with Permanent Function Monitoring

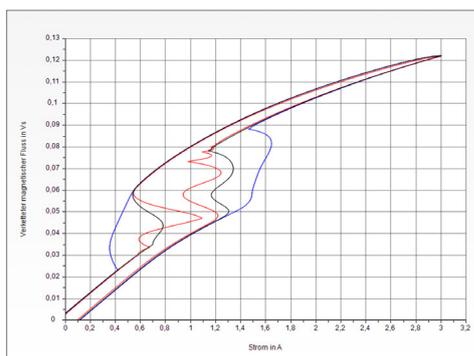
MagHyst® embedded offers the possibility of permanent sensorless monitoring of function and condition of electromagnetic drive systems by using an existing or extended electronic control circuit.

Applications of MagHyst® mobile and MagHyst® embedded

- Maintenance of industrial plants and power station systems
- Automotive, commercial vehicles, construction machinery
- Mechanical engineering and tool making
- Automation and robotics
- Elevator and conveyor technology
- Safety technology

Features and Advantages of the Integrated Solution:

- Sensorless determination of
 - Switching times and switching currents
 - Armature position, stroke as well as start and end position
 - Friction and wear
 - Pollution in the whole system
 - Counteracting forces
- Substitution of additional sensors like limit switches, travel, force or Hall sensors



MagHyst[®] solenoid evaluator



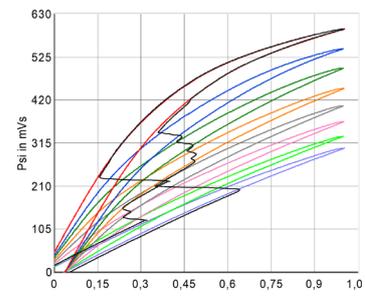
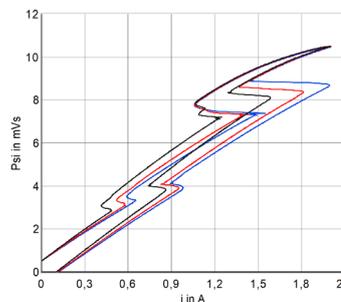
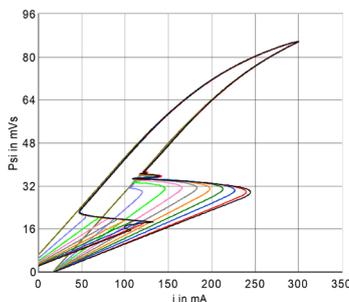
The expert for data analysis

Software for Evaluation of Measuring and Testing Data

MagHyst[®] solenoid evaluator is a LabVIEW™ based software for analysis and interpretation of test and measuring data recorded with the **MagHyst[®]** device family.

Features and Advantages of MagHyst[®] solenoid evaluator

- Interactive visualisation, evaluation, analysis and logging of single and multiple characteristics
- Spreadsheet-based filtering and evaluation of measuring and testing data
- Accurate detection of functionally relevant test points to determine tolerance limits
- Individually configurable evaluation algorithms for automated analysis of magnetic, mechanical and hydraulic characteristics curves
- Magnetic force calculation based on $\Psi(i)$ characteristics
- Endurance and wear analysis
- Observation of energy conversion in the electromagnet
- Evaluation of armature movement and determination of armature position
- Automatic switch time determination e.g. switch-on delay, pull-in time, switch-off time, moving time, drop-out time
- Loading of large amounts of measuring and testing data
- Statistical evaluations



Examples of evaluation with MagHyst[®] solenoid evaluator

Contact us – we will find the best solution for you!

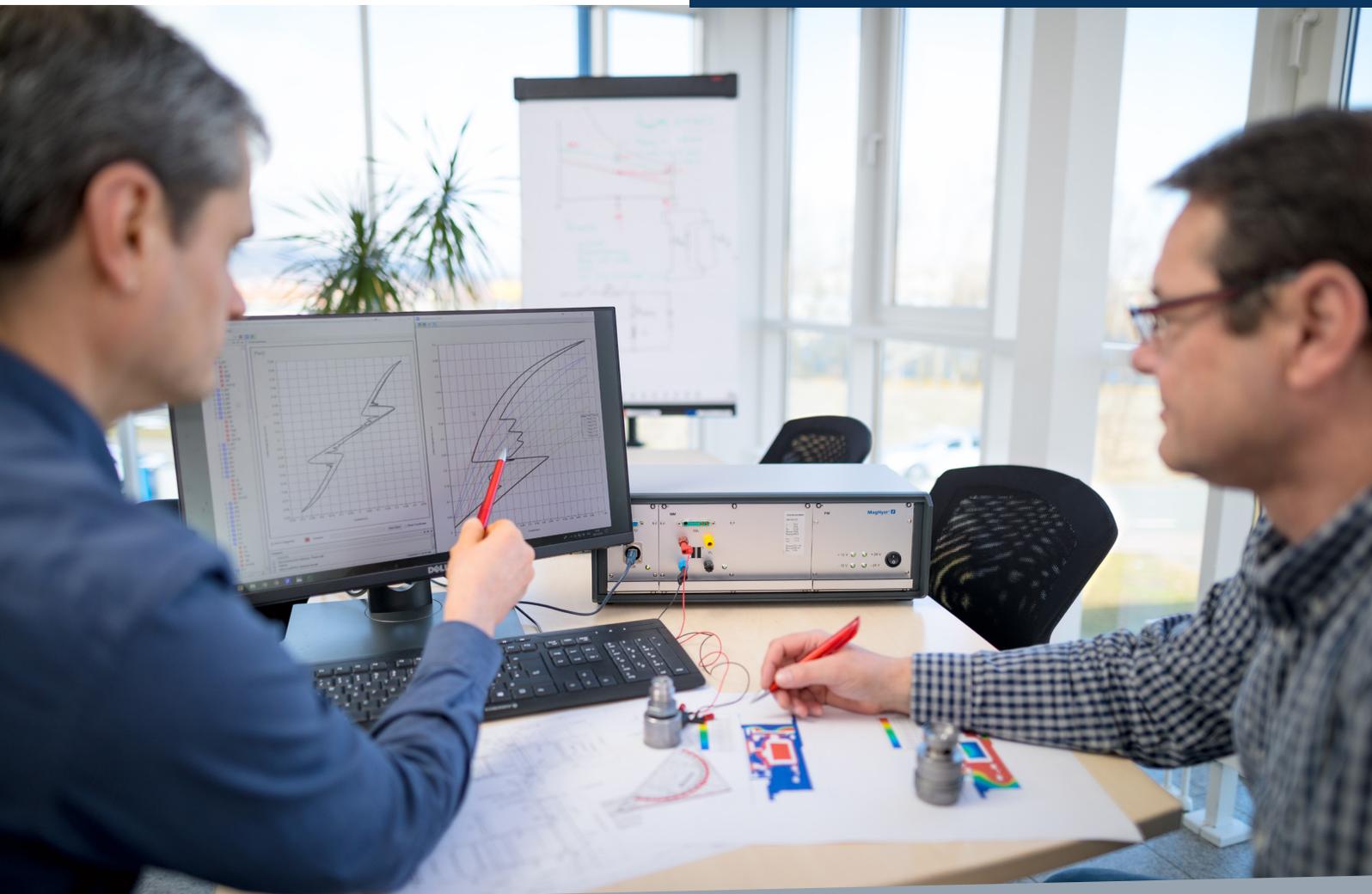
Today's challenges require increasingly complex, more efficient and resource-conserving drive systems. Due to many years of collaboration with global innovation leaders in automotive and industrial sectors, we support the development and optimisation of your future products.

Our goal is to create outstanding added value for you with every drive solution.

The integration of **MagHyst® technology** in development, production and application of electromagnetic systems is a key element for the successful implementation of your **Industry 4.0 Strategy**.

Your Benefits at a Glance

- More than 25 years of know-how in the development and optimisation of mechatronic drive systems
- Implementation of development projects based on the latest scientific findings through close cooperation with universities
- Sensorless and non-destructive analysis of complex electromagnetic drive systems with **MagHyst® technology**
- Function and condition monitoring of magnetic actuators over the entire product life cycle from development over production to application





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