

# DEFECTOMAT®

Non-destructive eddy current testing of long products like tubes, bars, wire and profiles



## The company

**FOERSTER is a global technology leader for non-destructive testing of metallic materials. One of the "Hidden Champion" companies, FOERSTER operates worldwide with an extensive network of ten subsidiaries plus qualified representatives in more than 60 countries and works closely with its customers.**

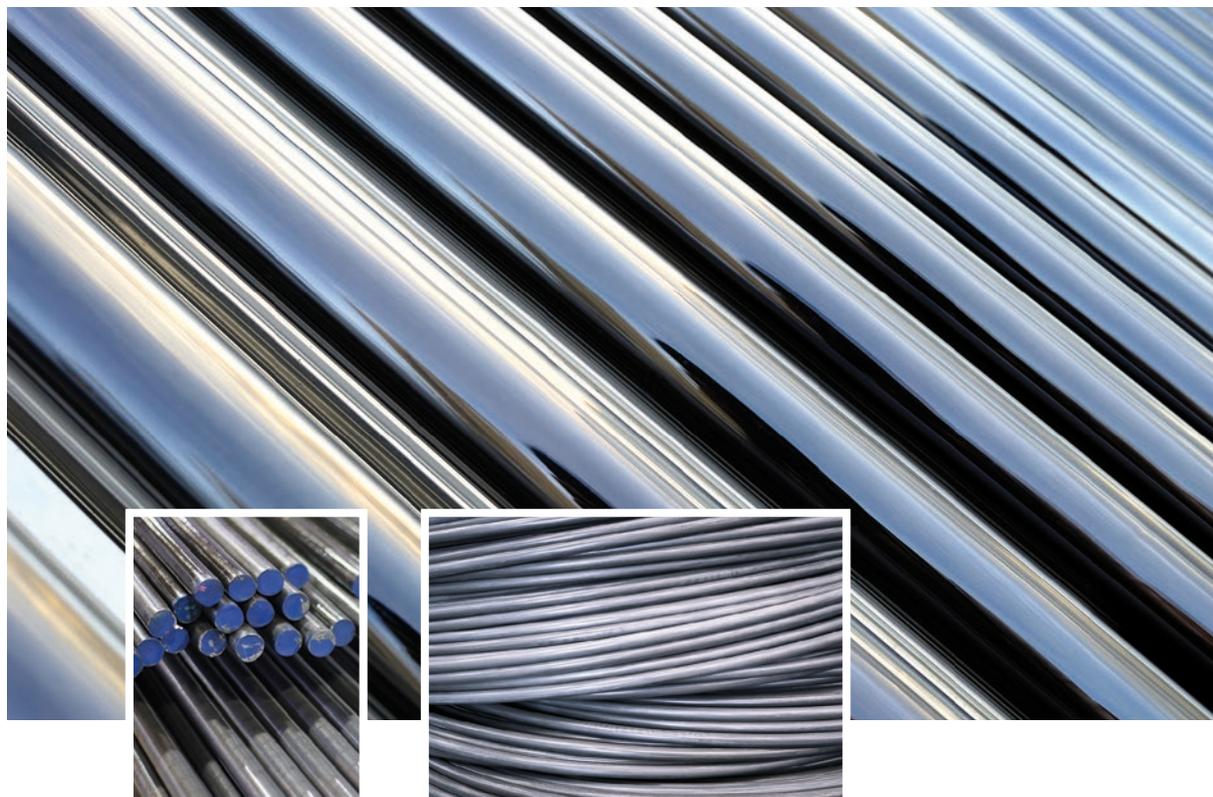
### **FOERSTER Division Testing Systems (TS)**

Division TS specializes in developing and manufacturing systems for the automated, non-destructive testing of metallic long products and heavy plates. Electromagnetic methods such as eddy current and flux leakage testing, ultrasound and inductive heat flow thermography are used to inspect these semi-finished products for flaws that are invisible to the naked eye.

These systems are made for the metal producing and metalworking industries, where tubes, wires, bars, billets, rails, profiles, metal sheets and similar items are produced on rolling mills, drawing lines, welding lines or processed in various finishing operations. FOERSTER products perform many critical test applications during these processes.



## Making quality visible with DEFECTOMAT®



### Quality control and process monitoring

Manufacturers of semi-finished metal products are under constant pressure to meet ever-higher quality demands and comply with international standards. So you can always keep an eye on the quality of your products, FOERSTER has developed the DEFECTOMAT series for process monitoring throughout the fabrication of your long products. Starting in the rolling mill and continuing through to your bright finishing, these systems allow you to examine the surfaces of semi-finished products such as tubes, bars and wire for a wide variety of defects – no matter whether the material under test is austenitic, non-ferromagnetic or ferromagnetic. Furthermore, you can utilize the resultant readings to optimize your processes and ensure that you meet your quality objectives.

### Make testing both reliable and reproducible

Our DEFECTOMAT systems operate fully automatically, contact-free, and non-destructively using the eddy current method. Their primary purpose is to detect short flaws like holes, spots and transverse defects. Then, according to pre-defined parameters, the defective material is marked, classified and mechanically sorted out. With scanning speeds of up to 150 m/s,

100% inspection is possible even at high throughput rates. Our DEFECTOMAT systems are distinguished by their excellent test accuracy and reproducibility.

### We keep our eye on your bottom line

Low operating costs and low energy consumption make testing with our DEFECTOMAT systems an extremely economical solution. And calculated over their entire service life, the costs for maintenance, wear parts and media consumption are also very low.

### Customized system configuration

Our DEFECTOMAT systems are configured individually for your specific application. Because they're compact, the systems can be integrated into almost any process sequence. The modular design and the large selection of sensor systems allow you to reconfigure for each new inspection task as required.



## DEFECTOMAT® DA – Ready for the future



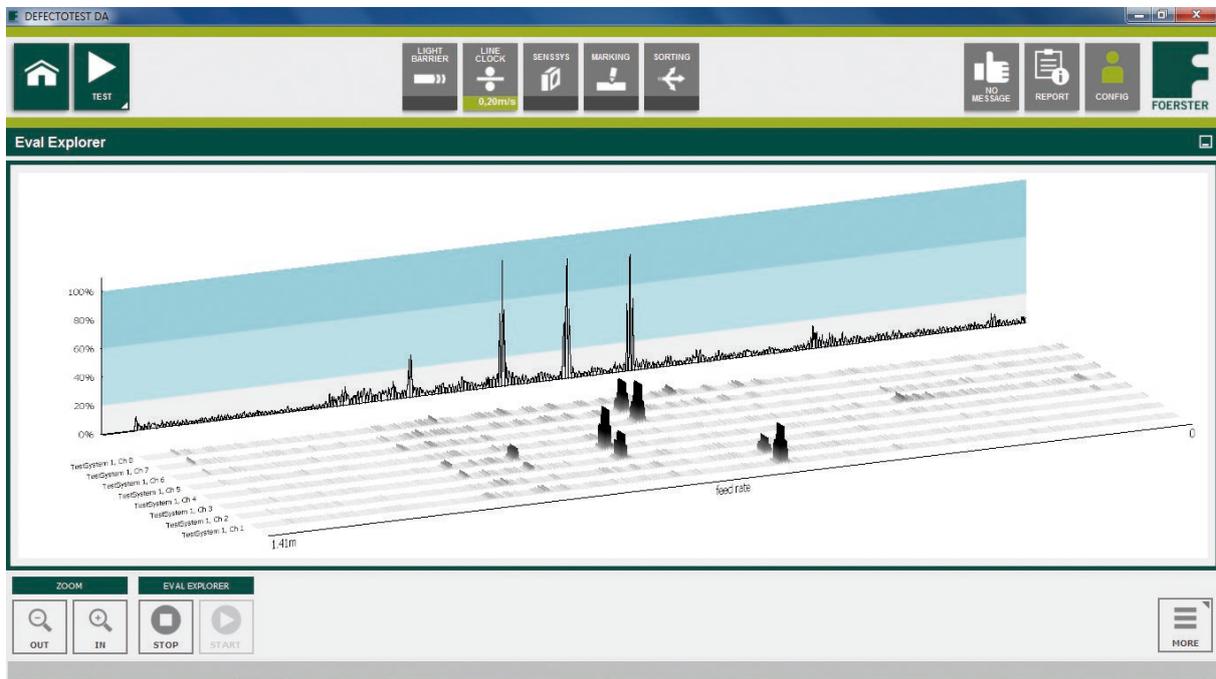
### Multi-channel – Digital – Flexible

With the DEFECTOMAT DA you're optimally prepared for all current and future testing needs. Thanks to its combination of state-of-the-art digital electronics and sophisticated system architecture, the DEFECTOMAT DA offers you maximum reproducibility even at very high testing speeds. Its modular system design and corresponding expansion options guarantee you the utmost in flexibility for varying test requirements.

### The benefits

- **Utmost flexibility to adapt to your needs:** The modular system structure allows you to expand and optimize the system at any time: compatible with all FOERSTER sensors.
- **Multi-channel system:** Use up to 256 test channels with test frequencies that are continuously adjustable from 1 kHz to 1 MHz.
- **Better test quality:** Digitization minimizes the influence of electromagnetic interference.
- **Patented digital tracking filters:** Dynamically adapt the filter position to the test speed – even up to 150 m/s.
- **Simple user interface:** The software is intuitive to operate, and context-sensitive online help is always available when questions arise. Multi-user capability allows simultaneous access by several operators at once.
- **Comprehensive documentation:** The software creates individual test reports in common formats and archives all the test results.
- **Quality control according to international standards:** ASTM, API, DIN, ISO, JSA-JIS, among others.

## Fully digital test system



### Digitalized for better inspection quality

The sensors of the DEFECTOMAT DA system are directly connected to the TEST SYSTEM DA, which immediately digitizes the analog signals and transmits them via Ethernet to the LINE SYSTEM DA. This makes all test results available to you in real time. The sensor's proximity to the TEST SYSTEM DA means that analog test cables can be kept very short, minimizing the influence of electromagnetic interference and significantly increasing test quality. But since the length of an Ethernet cable is nearly unlimited, the equipment cabinet can be located almost anywhere in the factory.

### Robust and well protected

The LINE SYSTEM DA and the operation PC are mounted inside a compact, 19" cabinet of protection class IP54 that also allows accommodation of a high-resolution, 15.6" touchscreen display plus other input devices like a keyboard or mouse.

### Ease of use with DEFECTOTEST® DA

The DEFECTOTEST DA software is clearly structured and intuitive to use. To facilitate the work, the user interface is split to show the operating elements and a centralized area that collects all the relevant information, which is displayed in freely configurable windows. The buttons have also been optimized for input via touchscreen. The different elements are uniformly color-coded to ensure quick orientation and prevent errors.

### Modularity for more flexibility

The modular design of the DEFECTOMAT DA and its compatibility with all FOERSTER sensors offer great flexibility. Existing FOERSTER test systems can be exchanged or modernized without difficulty. The individual components are quick to install, so you can resume production in short order. Existing DEFECTOMAT DA systems can be flexibly augmented and adapted to new inspection tasks.

## DEFECTOMAT® CI and DI

**Dual-channel eddy current testing**

Equipped with up to two fully operational test channels each (difference, absolute and/or Ferromat), the compact DEFECTOMAT CI and DEFECTOMAT DI are perfectly suited for eddy current testing of long products directly in the production line. The many technical functions allow for use in a wide range of applications. Your cost-effective introduction to fully automated quality assurance:

**Advantages of DEFECTOMAT® DI and CI**

- **Two-channel testing:** Optional 2-channel evaluation (Diff/Abs, Diff/Diff, Diff/Ferromat) with 12 test frequencies from the range of 1–1000 kHz.
- **Many technical functions:** Including automatic filter tracking, location-true marking, and sector signal evaluation with 2 trigger thresholds.

**The standard-model DEFECTOMAT® DI**

The DI series provides all the functions necessary for the most common applications. Operation and setting of the DEFECTOMAT DI, as well as the archiving of test results, can be undertaken comfortably at an external PC connected via Ethernet. Or, the DEFECTOMAT DI can be operated in standalone mode with no web connection at all.

**The benefits**

- **External operations computer for more flexibility:** Multiple DEFECTOMAT DI instruments can be controlled via the same PC, which can be provided by customer.
- **Cost-effective system:** The test instrument is designed for standard applications in eddy current testing. Expand the system as needed with optional functions.



### More convenience with DEFECTOMAT® CI

The DEFECTOMAT CI is controlled directly on the unit using built-in function keys and an intuitive turn-and-push button. This makes it fast and easy to set all relevant test parameters. You can also plug a keyboard, mouse and external monitor into the instrument. Connection to a higher-level process computer is possible via Ethernet.

### The benefits

- **Simple and intuitive operation:** Function keys and a turn-and-push button for maximum ease of use. Password-protected operating levels control access rights.
- **Visualization of the test sequence:** All relevant information is shown in the status bar. Important test parameters are always visible. The test signals can be displayed as |V|, Y or XY.
- **Storage of settings parameters:** Profit from an unlimited settings archive and storage of the list of sensors along with specific features.
- **Interfaces for full network integration:** To manage the test tasks and transfer readings, the instrument can be connected to higher-level computer systems for quality monitoring or production control (Level 2). Plus, the settings can be quickly adjusted via remote control.
- **Comprehensive quality documentation:** Results data are transferred directly; the standard-format XML document structure ensures easy viewing in Internet Explorer. You can design the test protocols to suit your own needs.

## DEFECTOMAT® ECM



### Modular entry-level instrument for cost-effective quality assurance

The DEFECTOMAT ECM module is small in size and offers many possibilities for integration into common production lines. The basic module is equipped with a test channel that displays transverse and short longitudinal defects in high resolution. The instrument lets you sort your material into good/bad. Typical applications are surface inspections in tube welding lines and of fine wire. Moreover, the DEFECTOMAT ECM is frequently used for detecting cross-welding seams between braces and for tube end detection.

### The benefits

- **Add functionalities as you need them:** An absolute channel can be included for detection of open seams. Various fixed frequency modules are available, as well as an optional multi-frequency module.
- **Simple operating elements:** A one-dimensional signal is displayed via the LED bar graph. The module enables simple good/bad sorting.
- **Compact dimensions:** Easily incorporated into control cabinets.
- **Connection to external process control (PLC):** For example, control of the test sequence, output of threshold value overruns and sorting signals.
- **Documentation of the test results:** You can log, evaluate and archive the inspection results via a connected host computer.

## Overview DEFECTOMAT® systems

### DEFECTOMAT®

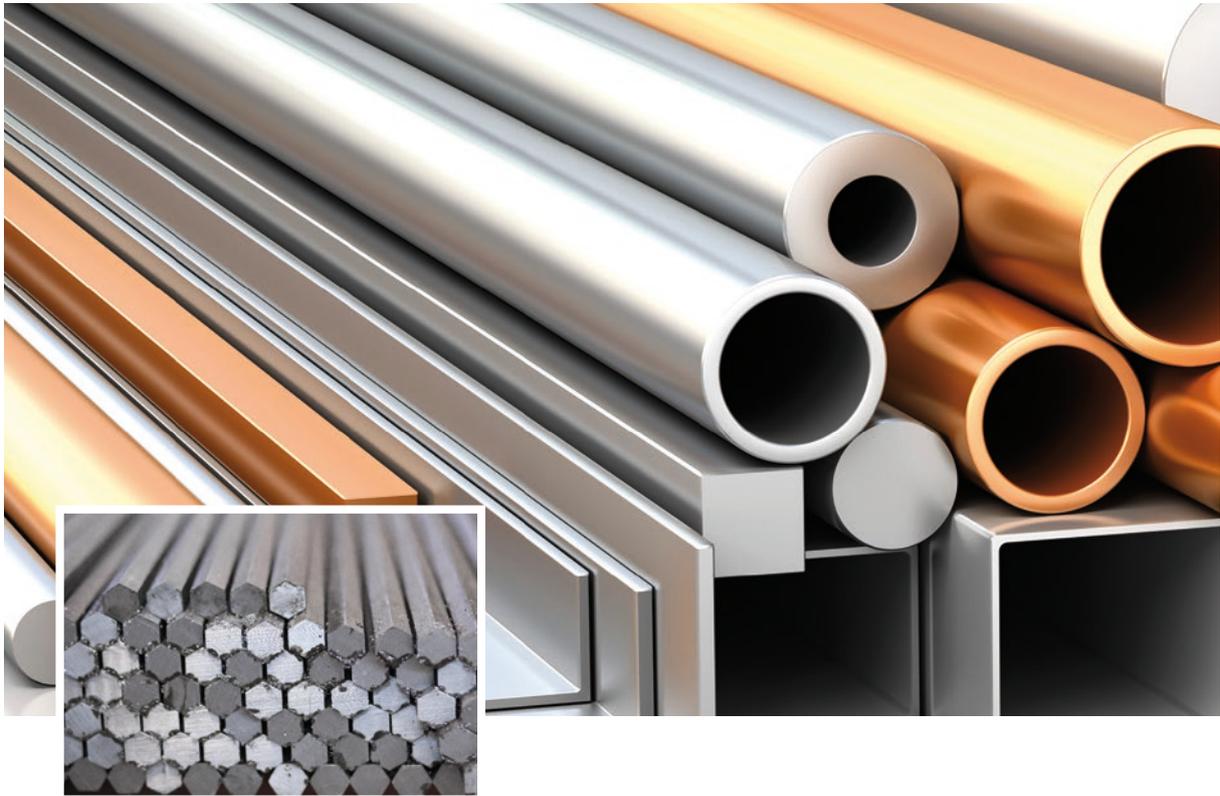
Diverse applications and production specifications require test electronics that are precisely tuned to the conditions at hand. To fulfill your individual requirements, we provide the following DEFECTOMAT systems:

DEFECTOMAT	ECM	DI	CI	DA
Sensors (max.)	1	2	2	32
Channels (max.)	1	2	2	256
Graphical interface	-	-	✓	✓
Database	-	-	-	✓
Line function	-	✓	✓	✓
Reports	-	Optional	✓	✓

The functionality of the systems can be further expanded as needed in order to fulfill additional or changing specifications:

DEFECTOMAT	ECM	DI	CI	DA
Analog signal output	✓	Optional	✓	Optional
Phase-selective evaluation	Optional	Optional	✓	✓
Speed shift filter	-	Optional	✓	✓
Cutting with FIFO sorting	-	Optional	✓	✓
Small defect evaluation	-	Optional	✓	✓
Automatic adjustment	-	Optional	✓	✓
Test reports	-	Optional	✓	✓
Result investigation	-	Optional	Optional	Optional
Software interface	-	Optional	Optional	Optional
Result export	-	Optional	Optional	Optional
FOERSTERnet	-	-	-	Optional

## Sensors for the most demanding test requirements



### High-quality sensors – Made in Germany

Each customer's inspection tasks are vastly different – that's why, at FOERSTER, we're constantly developing new sensor technologies to ensure that you always get the best possible results. We offer a wide range of sensors with different profiles and dimensions. They're the fundamental tool for exact detection of defects on semi-finished products like wire, bars, profiles or tubing. Tried and true, for decades FOERSTER sensors have delivered reproducible test results for dependable quality and process control. Our sensor expertise encompasses encircling coils, segment coils, demagnetization units and probes, among others. It allows us to assemble end-to-end systems that achieve your objectives and integrate perfectly into your production lines.

### Encircling coils

With encircling coils, you can check your semi-finished products for surface cracks and hole-like defects. We offer a broad range of coil shapes suited to various test-piece cross-sections. For round material, fine gradations are available for diameters from 1 – 240 mm. On request, we can also develop customer-specific coils for special geometries; this ensures the highest possible defect resolution. The coils are used with sensor system H, P or M, depending on the test material.



## DEFECTOARRAY® and sensor systems



### DEFECTOARRAY® sensor – Innovative and patented

Due to its special design, the DEFECTOARRAY sensor enables precise defect detection. It comprises eight circumferential segments with one clearance winding each for dynamic clearance compensation. This significantly increases the reproducibility of test results, reduces false positives and minimizes rejection rates. The clearance compensation eliminates the influences of dimension variations and eccentricity, as well as entry and vibration effects. Both the longitudinal and the circumferential coordinates of the defect's position are recorded.

DEFECTOARRAY sensors are available in diameters between 18 and 180 mm. To accommodate new test material diameters, coils and nozzles need only be changed in 3 mm steps. These sensors are otherwise identical to the encircling coils; depending on the test material, they can be used with sensor systems H, P or M.

### Sensor systems for eddy current testing

We offer various sensor systems for encircling coils and DEFECTOARRAY sensors. Working closely with you, together we select the right sensor system to suit the test material. To ensure optimal results, coils and protective nozzles are available in many different sizes.

#### Sensor system H

Sensor system H is used for testing non-ferromagnetic material ranging from 1 - 170 mm in diameter.

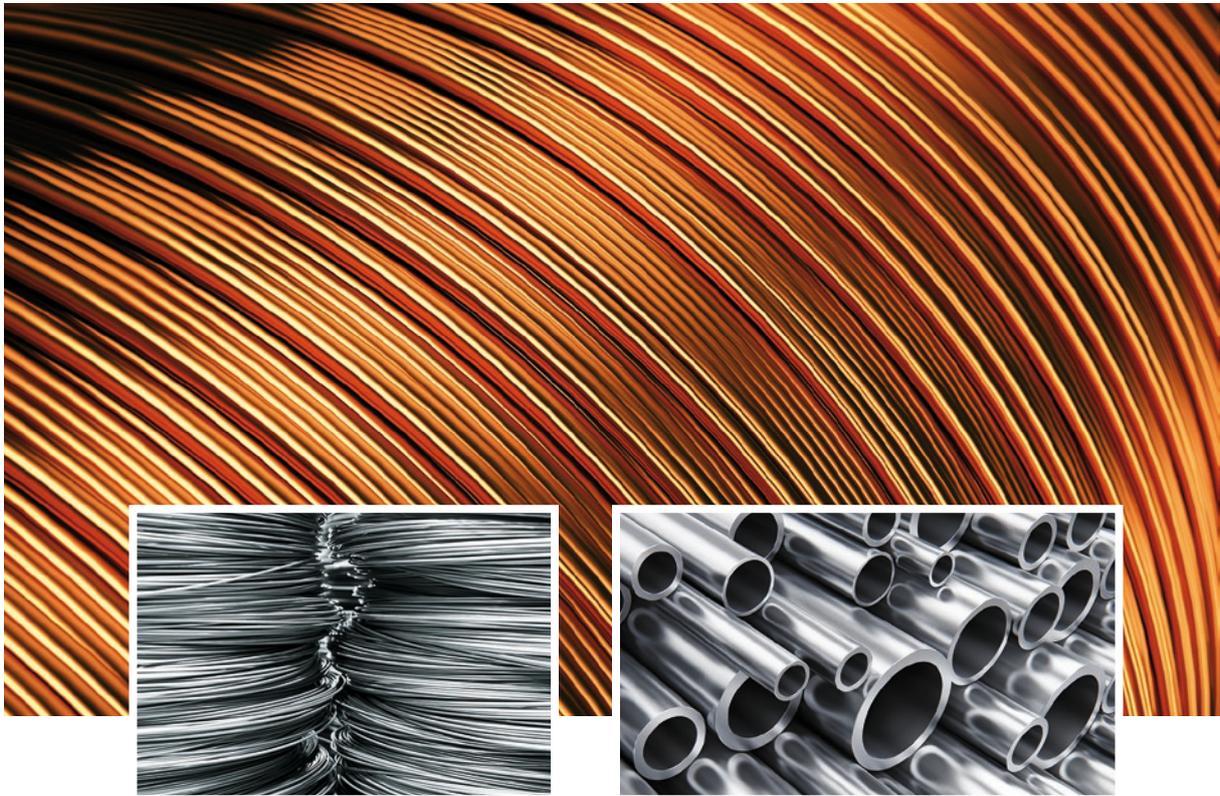
#### Sensor system P

Sensor system P is equipped with permanent magnets to inspect material that requires low magnetization power. This includes thin wires, thin-walled tubes or austenitic material.

#### Sensor system M

Sensor system M is for testing ferromagnetic material. The test material is brought to magnetic saturation by DC field magnetization. This eliminates any permeability fluctuations that could disturb the reading. The required magnetization power can be set individually.

## Application-specific sensors and sensor systems



### **Extensive product portfolio**

Special inspection tasks require optimized sensor systems to achieve the best possible inspection results. That's why FOERSTER has developed special encircling coils, sensors and probes for particular applications. We also offer suitable sensor systems and holders to integrate the coils and sensors into the respective test line. Other special sensors are also available on a standard basis.

### **Customized solutions**

Our goal is always to provide you with a perfectly adapted testing system. For this reason, at FOERSTER we also develop application-specific solutions for custom purposes.

The exact requirements are determined through close cooperation between our customers, our development department and our application specialists. The result of this technological expertise are individualized solutions – no matter how tough the challenge.

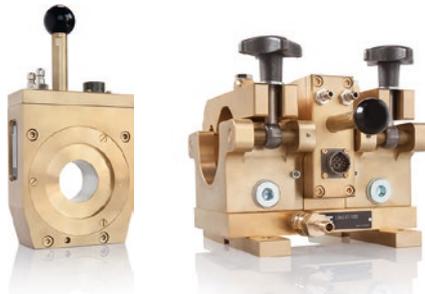


### Coils and sensor systems for small diameters

For the most accurate eddy current testing of fine wire made of e.g. tungsten or molybdenum, coils are available in fine gradations for material diameters of 0.1 to 2 mm. Due to the instrument's compact dimensions, it can be installed in a rewinding line or directly in the drawing line.

### DEFECTOMINI® sensor and sensor system

When you want to test wires and tubes with material diameters between 0.3 and 4 mm, the DEFECTOMINI sensor is ideal. Its permanent magnets allow you to inspect all kinds of metals, including ferritic materials. The sensor system can be installed directly in wire drawing machines. The test coil adjusts automatically to the wire under test and can thus compensate for position changes.



### DEFECTOTHERM® sensor and sensor system

Testing at temperatures up to 1200 °C in the rolling line is quite a challenge, but our DEFECTOTHERM sensor system is up to the task! It allows steel and copper wires, as well as tubes and bars, to be tested directly in the rolling line. For this purpose, water-cooled therm-coils are available in fine gradations for material diameters of 5 to 180 mm.



### Segment coils and sensor systems

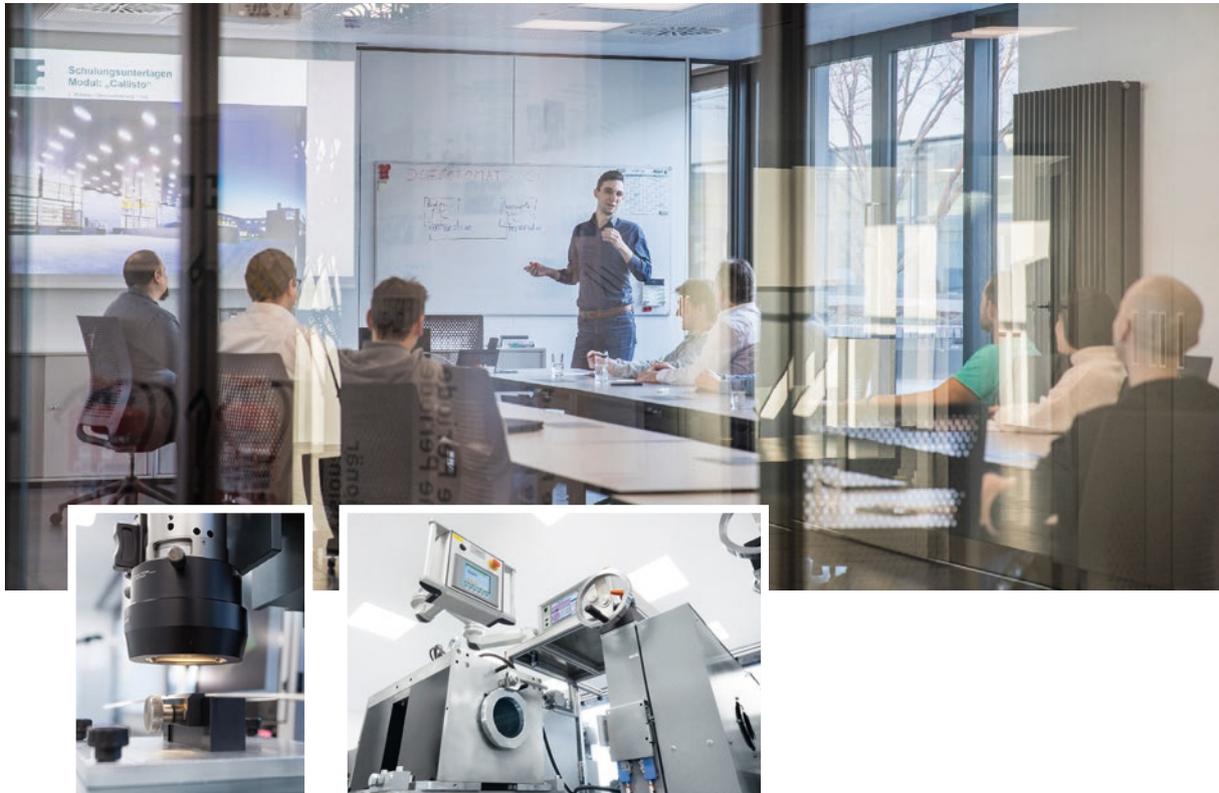
For testing weld seams, we offer shape-fitted segment coils ranging from 10 to 180 mm tube diameter. For larger dimensions, flat segment coils are also available for up to 500 mm tube diameter. For ferromagnetic tubes, the LSM segment coil yoke is ideal: Its magnetization power is individually adjustable. But if low magnetizing powers will suffice, you can use the LSP segment coil yoke.



### Weld seam probe and holder

You can easily test longitudinally welded tubes – regardless of size – using a weld seam probe and the corresponding holder. The holders are adjustable horizontally up to 200 mm and vertically up to 270 mm; furthermore, they can be pivoted up and locked in place. Their small size allows them to be integrated into any welding line, especially since no magnetization is needed.

## Application lab and trainings



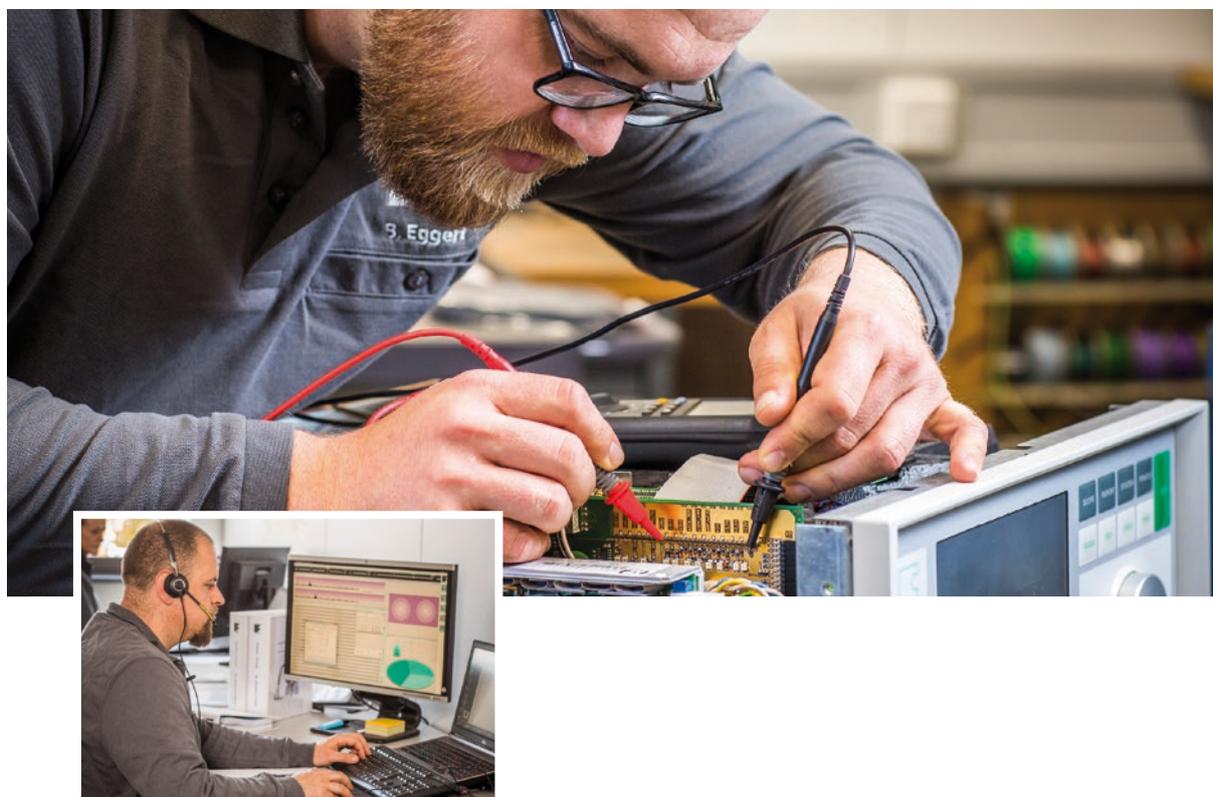
### Application laboratory

Our application specialists are always at the ready to provide customers with comprehensive technical advice. Equipped with the latest test equipment, the application laboratory is perfectly suited for the individualized testing of your application scenarios. Various tests are carried out on customer-provided samples. Depending on those results, we source the best-possible equipment and the correct parameters for your system. Due to their broad technical knowledge, our application specialists can support you from start to finish in developing an individualized solution – even on-site.

### Training

Our courses concentrate on the practical handling of FOERSTER test electronics and sensor systems, but the ideal configuration of key parameters for your test instrument is just as important for optimal alignment to the respective test line and task. Plus, we offer in-depth training courses for service and maintenance. The training content can be tailored to your individual needs and delivered on-site, directly at your test line.

## Global service



### **The highest quality service**

When it comes to FOERSTER test systems, we don't compromise on quality. In order to meet our own high standards, a team of experienced service engineers stands at the ready. They quickly and effectively carry out repair and maintenance tasks whenever necessary.

### **Available worldwide**

To foster proximity to our customers, FOERSTER has long pursued the goal of internationalization. Today, in addition to the headquarters in Reutlingen, the FOERSTER Group boasts ten subsidiaries with 15 branch offices across the globe. We've also grown a competent network of qualified representatives on every continent, which lets us act fast – worldwide.

So that we can impart the FOERSTER technological expertise and guarantee the same high service quality wherever it's needed, the service engineers of our subsidiaries and representatives are all trained at the Reutlingen location.

### **Available round-the-clock**

Should problems occur outside normal working hours, FOERSTER has a 24-hour emergency hotline that can be reached 365 days a year. FOERSTER service specialists can even initiate systematic error analysis over the telephone. When software installation or configuration questions arise, remote access can help clear up problems on the spot, so your instrument is quickly ready for use again.

[foerstergroup.com](http://foerstergroup.com)



## Worldwide sales and support offices



### Headquarters

- Institut Dr. Foerster GmbH & Co. KG, Germany

### Subsidiaries

- Magnetische Pruefanlagen GmbH, Germany
- FOERSTER Tecom, s.r.o., Czech Republic
- FOERSTER France SAS, France
- FOERSTER Italia S.r.l., Italy
- FOERSTER Russland AO, Russia
- FOERSTER U.K. Limited, United Kingdom
- FOERSTER (Shanghai) NDT Instruments Co., Ltd., China
- FOERSTER Japan Limited, Japan
- NDT Instruments Pte Ltd, Singapore
- FOERSTER Instruments Inc., USA

The FOERSTER Group is being represented by subsidiaries and representatives in over 60 countries – worldwide.

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