

CIRCOGRAPH®

Non-destructive eddy current testing of wires,
tubes and rods



proof.

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.

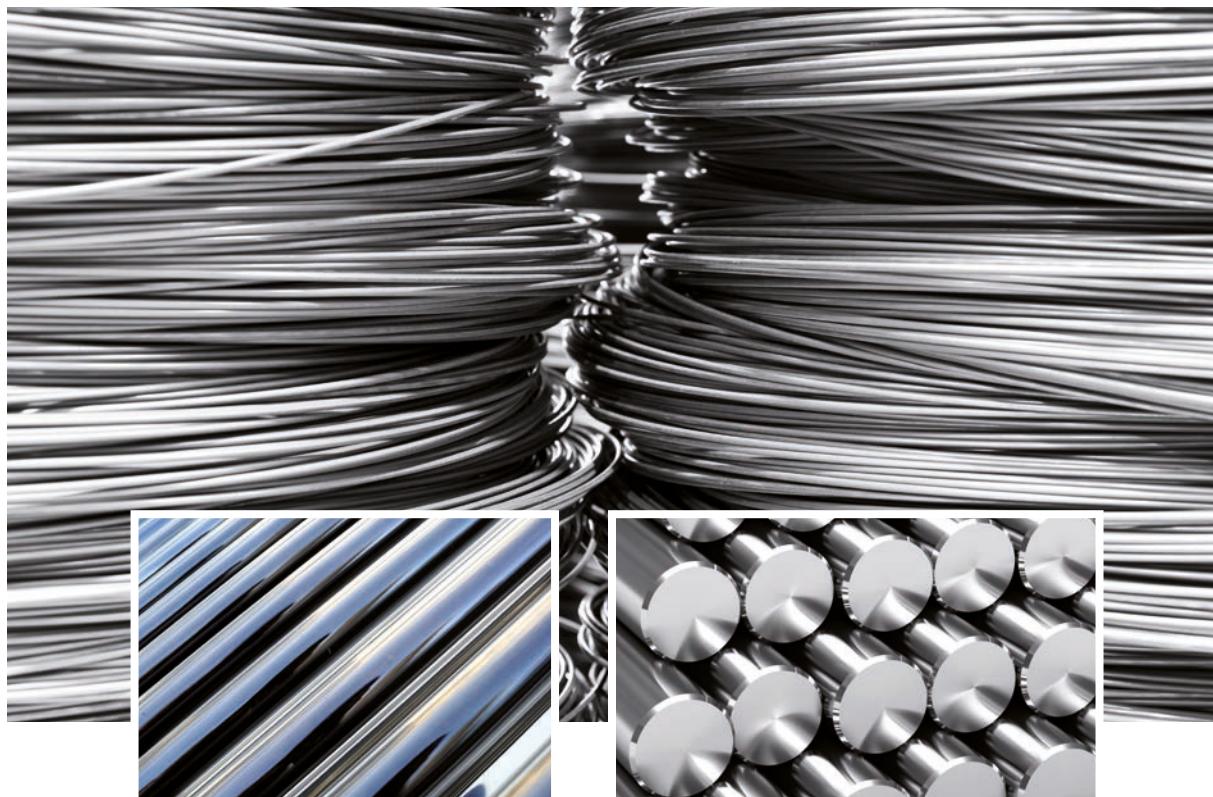
FOERSTER Division Test Systems (TS)

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 defects 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.



Testing with CIRCOGRAPH®



Bringing your quality to light

Do your customers expect ever higher surface quality? If so, then you need a reliable way to test your semi-finished products!

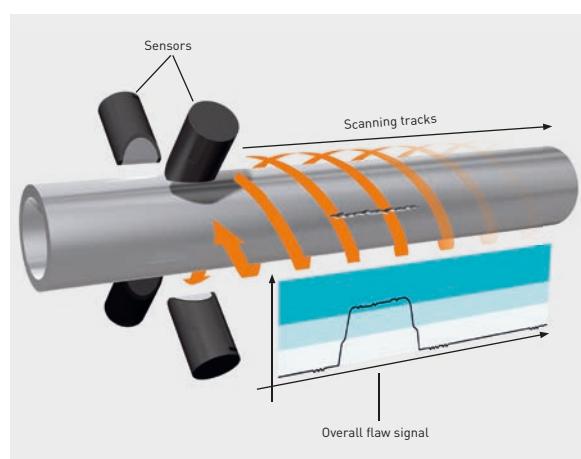
One of the gold standards for continuous quality assurance is the eddy current method. It lets you inspect your materials quickly and non-destructively for surface defects. The modular CIRCOGRAPH test systems are based on this method and guarantee reproducible inspections. Plus, they can be installed in almost any production line.

Proven FOERSTER sensors make the quality of your material surfaces visible. And after testing, you can evaluate the results quickly and easily: A wide range of documentation and analysis options are available to assist you.

Our focus: your individual requirements for reliable material testing.

How does eddy current testing work?

In eddy current testing with rotating probes, the test material is moved longitudinally through the system as the sensors quickly rotate around the semi-finished product. Spiraling along the length of the sample, they scan the surface completely without ever touching it. Longitudinal defects can thus be displayed in their full extent. Since they're quite small, our sensors are extremely responsive and can reveal even the tiniest of defects.



The principle of eddy current testing with rotating sensors

CIRCOGRAPH® DA



Advantages

■ Simple operation and easy-to-use software

The user-friendly interface makes the instrument simple and intuitive to operate; access rights can be managed individually via the user settings.

■ New, simplified setting of distance compensation (AdjustC)

A wizard guides you through the required settings quickly and easily. The error signal and the distance signal are displayed simultaneously.

■ Representation of the surface as C-scan

The visual error display provides additional information.

■ Interfaces for Industry 4.0

These offer you full flexibility and open up new possibilities.

■ Searchable archive

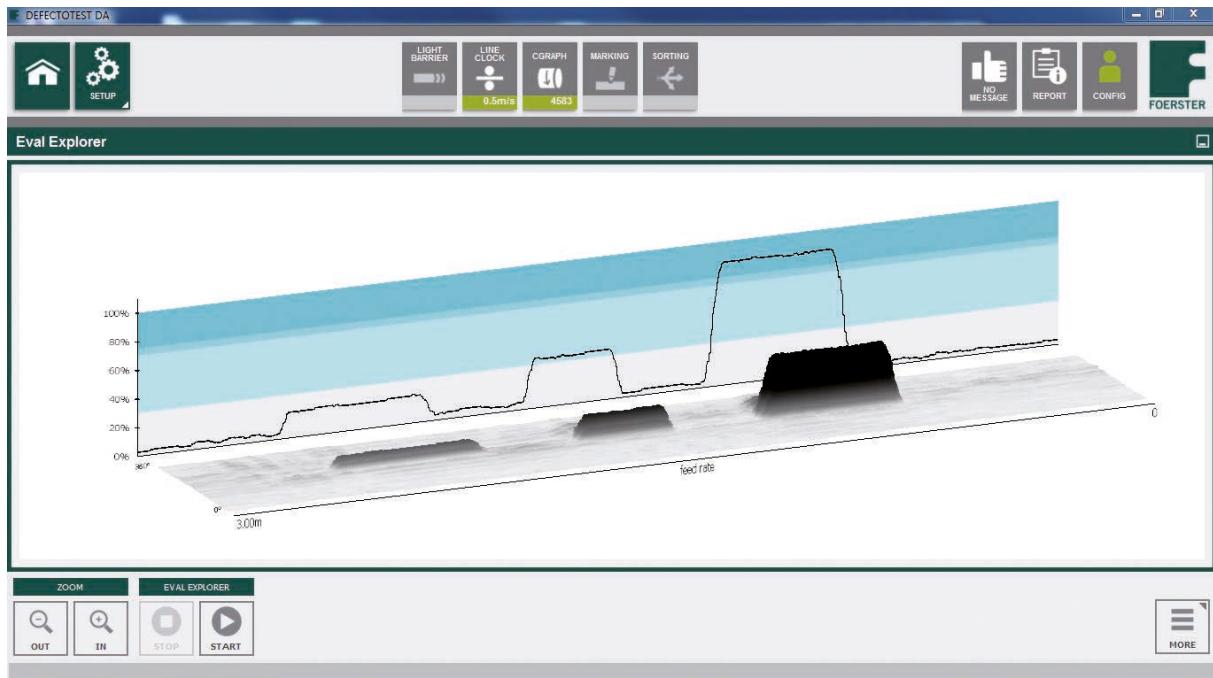
Recognize error patterns later.

We future-proof your testing line

With the CIRCOGRAPH DA, FOERSTER has set a new standard in non-destructive eddy current testing of long products like tubes, rods and wire. The CIRCOGRAPH DA offers you maximum reproducibility at very high test speeds. Equipped with state-of-the-art digital electronics and a sophisticated system architecture, the instrument displays surface defects both as a test signal and as a two-dimensional C-scan, offering new possibilities for quality monitoring in the production process. Due to its modular design, the system is easily expandable and ensures flexibility in the face of ever-changing test requirements.

Because the test signals are digitized very close to the sensor in the TEST SYSTEM DA, the analog paths have been reduced to a minimum. This significantly reduces interference. The system modules are connected via industrial-grade ethernet cables. And I/O interfaces to the line can be configured and extended as required. The graphical user interface of the CIRCOGRAPH DA enables intuitive and safe operation of all essential instrument functions.

Discover the new CIRCOGRAPH® DA



Optimizing processes with the C-scan

The nature of the error can provide clues about the source of a flaw, such as systemic problems in the production process. In addition to the normal signal, the CIRCOGRAPH DA displays the defects as a C-scan. You also get information on the defect's exact position and structure, the condition of the material's surface and possible interference signals. This allows you to take early intervention steps to improve production processes and avoid material wastage.

Multi-channel system with simple extension

Additional sensor systems can be easily connected to the system. With 256 test channels, you can even use several sensor systems at the same time. So you're already set for future applications!

Task-oriented control

When setting up, checking or evaluating, there are always a few buttons that one seems to need over and over again. For this reason, the display can be customized to your specific tasks and the settings saved. The context help screens explain the available parameter options. You can control the user access rights in the administration via individual, role-based settings.

Modular and compact system

We've kept the number of different modules in the CIRCOGRAPH DA to a minimum. This significantly reduces downtime during servicing. The individual modules can be swapped out via plug & play so your instrument is quickly ready for use again.

CIRCOGRAPH® CI / DI



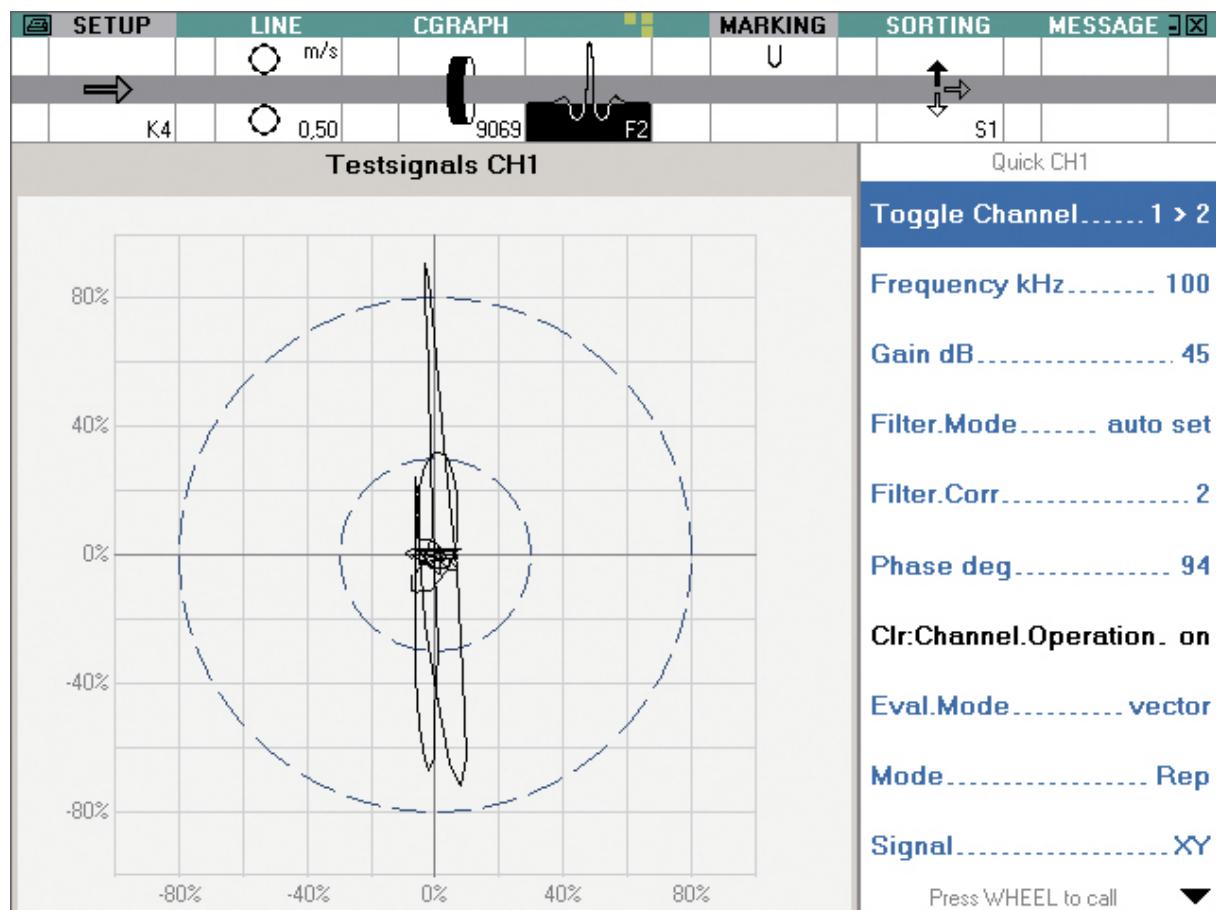
Advantages

- **Economical test solution with compact dimensions**
Test your material with two test channels and a frequency range between 30 kHz and 1 MHz.
- **High functional variety**
The compact test systems are equipped with distance compensation and optimized filters.
- **I/O interface**
To sort and select material, connect the tester directly to the test line via the I/O interface.
- **Ready for Industry 4.0**
The ethernet connection allows easy integration into higher-level systems.

Economical test systems for applications with low feed rate

CIRCOGRAPH CI and DI are two compact test systems from FOERSTER. They're perfect for when low test speeds and two channels suffice. These test instruments are often combined with the Ro 20 P rotating head, which allows you to check rods and tubes 2–20 mm in diameter directly in the production process. The material is inspected for surface defects before cold forming. The high functional diversity and compact dimensions of these instruments mean they can be used flexibly in almost any production environment.

Our compact, entry-level instruments for eddy current testing



Simple operation for fast results

The two test systems CIRCOGRAPH CI and DI differ mainly in how they're operated. The CIRCOGRAPH DI is run and set up via an external computer. Thus, the testing electronics can be installed close to the line while operation takes place from the control station. The test results are archived on the computer that runs the system.

The CIRCOGRAPH CI is operated via a user interface directly on the instrument itself. There's also an intuitive turn-and-push button, as well as built-in function keys. All relevant test parameters can be set up simply and easily. You can even connect a keyboard, a mouse and a screen to the instrument. A higher-level process computer is connected via ethernet for data exchange.

Test protocols for documentation of quality

For each individual test part or across multiple parts, you can create test logs with the respective settings and results. The test reports can be customized and automatically printed for complete documentation.

Clear representation of your production process

All production-relevant data are clearly displayed on the screen or in the software. The status bar shows, for example, the current line speed as well as line outputs for marking and sorting. You can quickly find all the information from the current inspection. Test signals and events are output in structured form in real time for the line speed. Depending on your need, choose between V, |Y| or XY display modes to present the test signal.

CIRCOGRAPH® standard rotating heads



Advantages

■ A range of sizes for optimum inspection results

The probes are designed for materials with a diameter of 2–130 mm. Track widths up to 10 mm are possible.

■ Suitable for a wide range of materials

The rotating heads can check ferromagnetic, austenitic and non-ferromagnetic tubes, wires or rods.

■ Flexible and safe testing

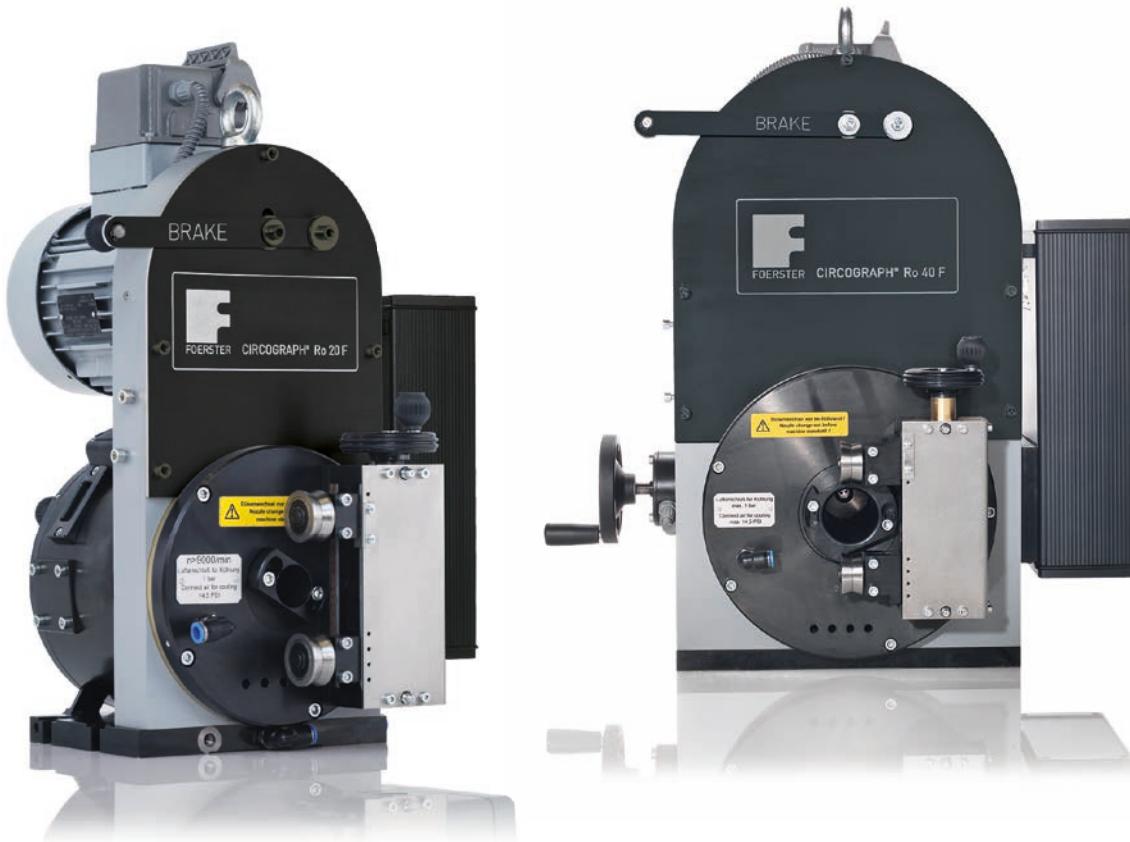
Levered versions are available for better sensor protection.

Rotating heads – for the most demanding test requirements

Our CIRCOGRAPH rotating heads are available in various sizes to ensure the best fit for your needs. From fine wire just 2 mm in diameter through to sturdy rods 130 mm thick, a range of materials can be reliably and reproducibly tested with the CIRCOGRAPH rotating heads. Our highly dynamic distance compensation enables continuous testing even of materials with special geometries or eccentrically guided materials.

Some of the rotating heads are available in pin or levered versions. The levered version is used to protect the probes from undirected ends, e.g. in wire test lines, where the condition of the ends during threading and extension can cause trouble. The levers help avoid contact with the material and thus protect the sensors. Especially robust versions of the protective nozzles are also available for use in drawing lines.

High-speed rotating heads for fast applications



Advantages

■ High test speeds for fast applications

The Ro 20 F rotating head can handle throughput of up to 6 m/s.

■ Responsive detection of longitudinal surface defects

The flaw depth to be verified can be set continuously starting at approx. 30 µm.

■ Modular design for easy replacement

The high-speed rotating heads can be easily installed in existing lines.

■ Testing of different materials

With the high-speed rotating heads, you can test ferromagnetic as well as austenitic or non-ferromagnetic round materials.

High-speed solution for high throughput rates

Applications like rewinding copper tubes or drawing wire require a rotating sensor system with high throughput. We developed the Ro 20 F and Ro 40 F rotating heads especially for such purposes. The four sensors in the probe are mounted at 90° angles. This increases throughput to as fast as 6 m/s, which in turn significantly increases your production output with continuous scanning of the material surface. Because the high-speed and standard rotating heads are the same height in the center, it simplifies upgrades to the test line.

Full-length visualization of longitudinal defects

The high-performance, multi-channel rotating heads are designed for tubes, rods and wires with a diameter of 2–40 mm. These highly sensitive detection heads make it possible to detect longitudinal defects that are ~30 µm deep or more. The defects are displayed in their full length with high resolution.

Overview of CIRCOGRAPH® systems

Diverse applications and different manufacturing specifications call for test electronics that are precisely matched to the respective conditions. FOERSTER provides the following CIRCOGRAPH systems to meet customer requirements:

CIRCOGRAPH	DI	CI	DA
Channels (max.)	2	2	256
DEFECTOMAT channel	-	-	Option
Graphical user interface	-	✓	✓
Database	-	-	✓
Line function	✓	✓	✓
Test report	Option	✓	✓

The functionality of the systems can also be optionally extended to correspond more closely to customer wishes or changing requirements:

CIRCOGRAPH	DI	CI	DA
Analog signal output	Option	✓	Option
Phase selective evaluation	Option	✓	✓
Cutting to length with sorting FIFO	Option	✓	✓
Short flaw suppression	Option	✓	✓
Automatic adjustment	Option	✓	✓
Test report	Option	✓	✓
Result search	Option	Option	Option
Software interface	Option	Option	Option
Result export	Option	Option	Option
FOERSTERnet	-	-	Option

Overview rotating heads

FOERSTER offers a large selection of rotating heads to address a variety of inspection tasks and their associated requirements. This makes it possible to adapt

the system exactly to the material under test, ensuring reliable and reproducible results. Our portfolio of rotating heads includes:

Rotating head	Ro 20 P	Ro 20 F	Ro 35 P	Ro 35 L	Ro 40 F	Ro 65	Ro 130
Diameter range	2 – 20 mm	2 – 20 mm	2 – 38.5 mm	5 – 35 mm	2 – 44 mm	5 – 65 mm	10 – 130 mm
Speed	stepless up to 18,000 rpm	stepless up to 18,000 rpm	4,500 / 9,000 rpm	4,500 / 9,000 rpm	4,500 rpm	3,000 / 6,000 rpm	1,500 / 3,000 rpm
Probes	2 at 180° angles, 1 sensor each	4 at 90° angles, 2 sensor each	2 at 180° angles, 2 sensor each	2 at 180° angles, 2 sensor each			
Track width	1.5, 2.5 or 5 mm	1.5, 2.5 or 5 mm	1.5, 2.5 or 5 mm	2.5 or 5 mm	1.5, 2.5 or 5 mm	2.5, 5 or 10 mm	2.5, 5 or 10 mm
Max. test speed (at 100 % coverage)	3 m/s	6 m/s	3 m/s	3 m/s	3 m/s	4 m/s	2 m/s

Worldwide Sales and Support Offices



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

Subsidiaries

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