

## STATOGRAPH® DS 6.440



- ✓ Eddy current testing system subject to EN 12084 with digital systems technology. For automatic, high-resolution, multi-channel online flaw testing of components at automotive and machine industry.
- ✓ Universal testing system, adaptable for individual applications and requirements
- ✓ Real-time visualization of the test process with original signal display
- ✓ Comprehensive test documentation for each component and each flaw
- ✓ Continuous monitoring of operating safety
- ✓ Clearance compensation with automated adjustment

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## Features

- ✓ Simplified device adjustment based on data of material and test mechanics
- ✓ Sensitivity adjustment can be automated with test flaw or noise level as reference parameters
- ✓ Gain correction of test channel via clearance compensation at geometric tolerances or excentricity
- ✓ Tested adjustment sets can be stored on the hard disk or centrally in the network
- ✓ Independent enable signal for the single channels by IO-control
- ✓ Work instructions for the operator can be defined with the adjustment set
- ✓ Comprehensive adjustment and function tests with multi-channel synchronous signal display
- ✓ The test results are saved in a database. Additional evaluations can be implemented easily using standard software, e.g. MS ACCESS
- ✓ Continuous process control with display and monitoring of the noise level response
- ✓ Operator interface protected against unauthorized access by an access code
- ✓ The operating software is based on WINDOWS and provides TCP/IP interfaces to other WINDOWS programs
- ✓ The FOERSTERNET enables free access to the CIRCOGRAPH DS by any number of computers
- ✓ An Ethernet interface and TCP/IP protocol enable unrestricted network integration in existing production and quality systems
- ✓ The specified test report in accordance with EN12084 can be adapted to meet customer-specific requirements
- ✓ Dialogue language of the operator interface can be extended by loadable translation files
- ✓ Context-sensitive online help with additionally loadable languages

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## Application

- Eddy current testing of ferrous, austenite and non-ferrous components with surface probes in accordance with EN 12084
- Material surface devoid of scale and bright if possible
- Scanning speed in the range 0.01 m/s unto 100 m/s
- Flaw depth resolution from 50 µm depending on surface quality and microstructure
- Test frequency from 1 kHz to 3 MHz
- Multichannel system with application dependent number and type of probes

## Typical application

Fully automated crack detection in the production line by the use of integrated handling systems. These are positioning and rotating the test parts as well as positioning and proceeding the probes. Using static, moved or rotating surface probes it's

possible to scan several test zones in parallel or sequential for surface cracks. Following the parts are sorted into groups automatically according to the respective test result.

## Brake disc testing, wheel hub testing

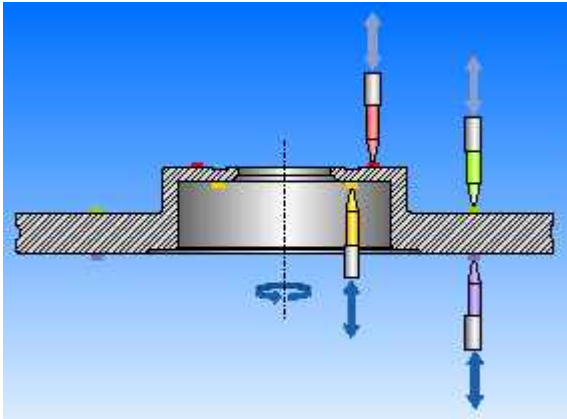


Fig. 1: Four probes are scanning the relevant zones of the brake disc



Fig. 2: Probe pusher puller unit with two probes

## Ball pin testing

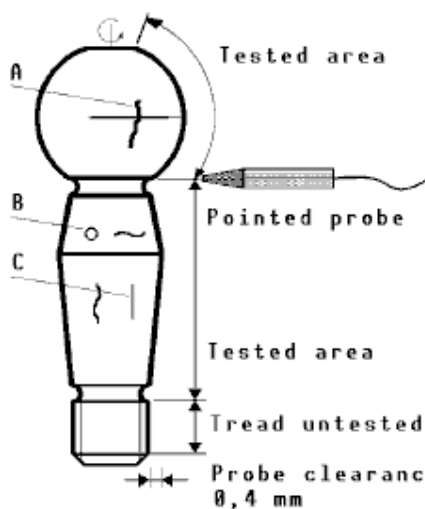


Fig. 3: One probe is following the outline of ball pins with constant gap

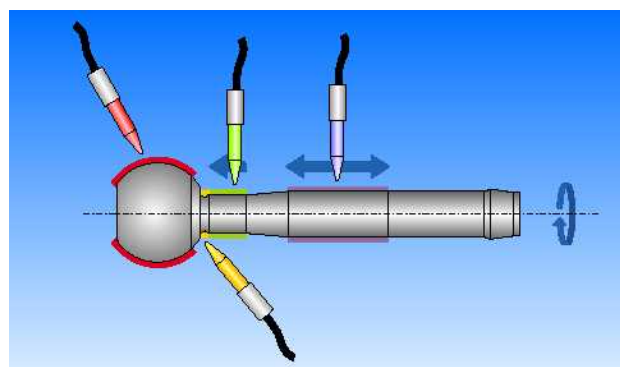


Fig. 4: Four surface probes are scanning different test zones in parallel to increase the throughput

## Valve testing

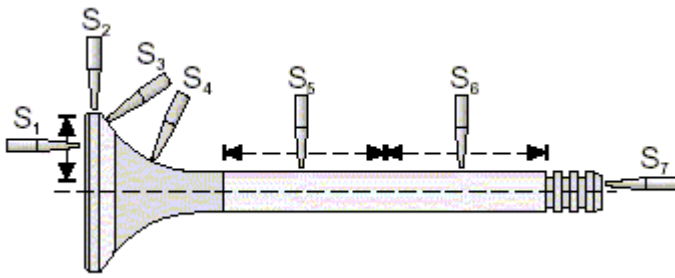


Fig. 5: High testing rate by multi-channel system. Some probes are stationary, others are proceeded.

## Drive shaft testing

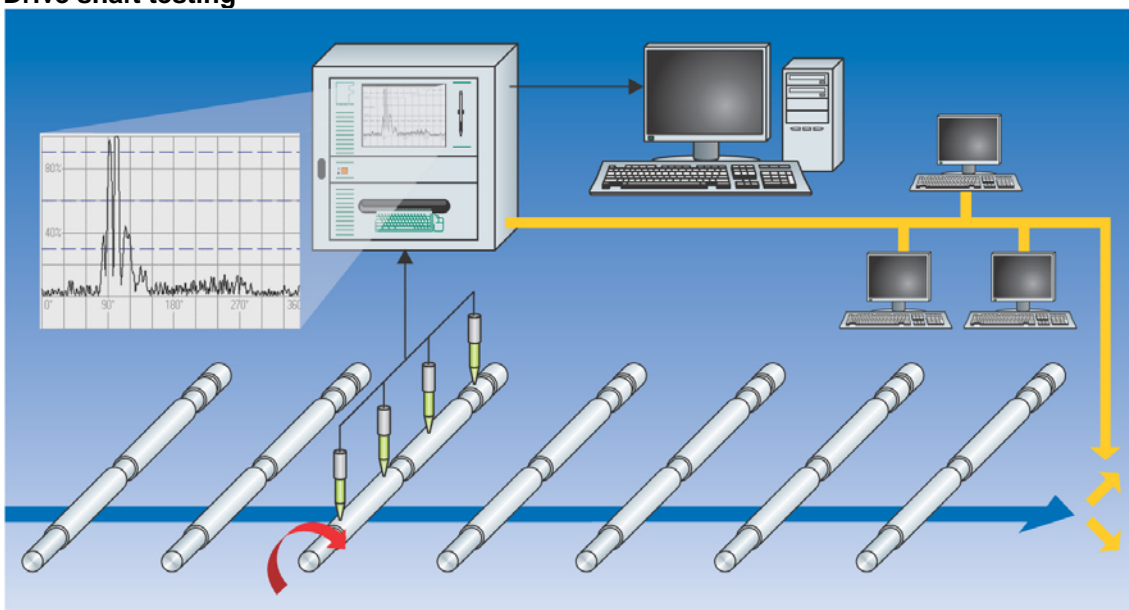


Fig. 6: Schematic diagram of an automated testing process with network connection for evaluation and saving of test data

## Operating principle

For crack detection the surface of the part to be tested is scanned contactless by one or more eddy current probes. Thereby the "punctiform" acting surface probe records only a small area of the whole material surface at any given moment. Thus, a smallest material flaw crossed by the probe represents a large disturbance with respect to this small section. From this the high resolution for crack detection results .

The excitation current  $I$  excites a primary magnetic field, which generates eddy currents in the test surface. This eddy current is influenced by cracks and is evaluated via secondary voltage  $U_s$ .

To be able to test a large area in spite of the small coverage of the probe a dynamic mode is used. It means a relative movement between surface probe and test material is necessary.

- Applying static probes like STATOGRAPH standard probes 6.421 the test part has to be rotated by an appropriate mechanics. With every turn of the test part a new track is tested.
- Using rotating sensor systems like CIRCO-SCAN H 6.482 the probes are rotating with high revolution speed close to the surface of the test part. With every turn of the rotating probe a new track is tested.

The width of the tested track is dependent on the used type of probe. Standard values are between 1 and 5 mm. Width of coverage is increased by the use of two, four or more probes. If there is an additional feeder unit for probe or test part with an appropriate feed rate, the whole test zone of the test part may be tested adding track by track.

The signals picked up by the probes are transferred from sensor system to the electronic test unit for evaluation.

The excitation current for rotating probes and secondary signals are transmitted contactless by rotating transformers.

The electronic unit consists of a process controlled electronic test and evaluation unit featuring interactive operation and convenient display and documentation possibilities.

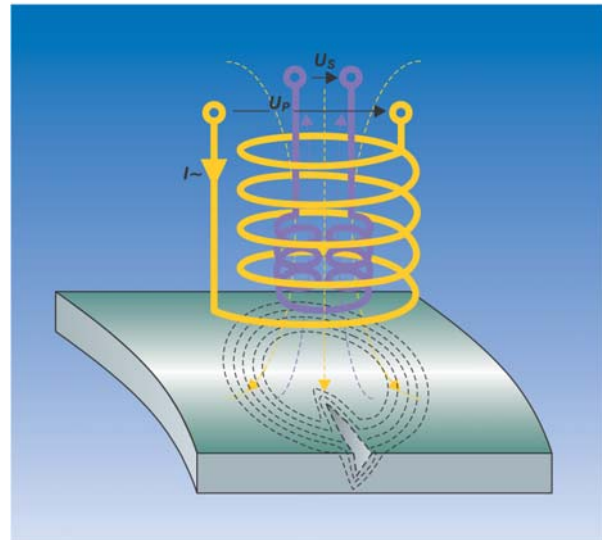


Fig. 7: Rotating probe on material flaw

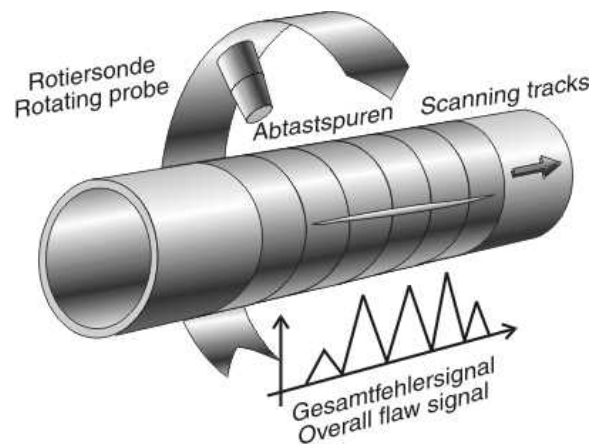


Fig. 8: Scanning track and flaw signals

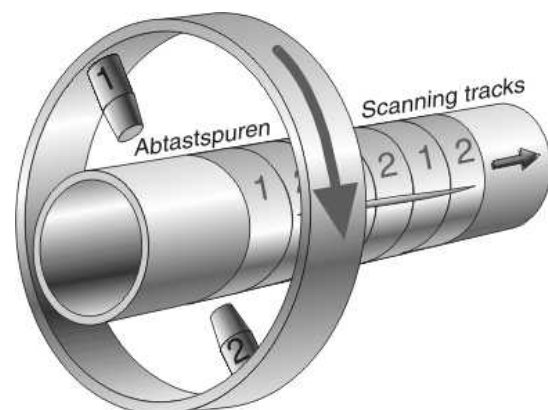


Fig. 9: Scanning tracks, two probes offset by 180°

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## Device structure

A complete testing system consists of the following component devices:

- Electronic test unit
- Operating computer
- Software
- FOERSTERnet (Option)
- Housing
- Surface or rotating probe with adaption
- Accessories and options

### Electronic test unit

19" card rack in compact housing (12 HU) or cabinet (37 HU) to accommodate the functional units. The equipment varies depending on connected sensors.

- One or several test channels (max. 32)
  - 8 switch-selectable test frequencies  
1-3-10-30-100-300-1000-3000 kHz  
other frequencies on request
  - Automatically adapted filters in rotating mode
  - Phase adjuster
- Clearance channel per test channel or common
- Digital signal processing
  - Signal evaluation with 3 amplitude thresholds  
Vector signal or Y component
  - Alternatively phase-dependent sector evaluation with up to 4 sector areas, each with 3 amplitude thresholds
- Evaluating computer
  - Test evaluation in test or feed direction with a resolution corresponding to the internal or external feed clock.
  - Flaw designation with maximum amplitude, phase angle, flaw threshold
  - Direct 3-way sorting with polling signal
  - Automatic test operation control with test readiness signal and noise signal
  - Device and sensor monitoring: Continuous noise level monitoring,
  - All line connections with screw terminals for 24V DC on the rear panel of the electronic test unit, floating, selectable polarity, inc. 24V supply

## Operating computer

PC with WINDOWS operating system, Ethernet plug-in card, operating software installed and operational.

- Integrated PC
  - Display and operation in cabinet/housing
  - Powerful Pentium computer, all operating elements located in cabinet/housing
  - TFT tilting colour display
  - Hinged keyboard
  - Touch screen operation: All mouse functions are triggered by touching the screen directly with fingertips or a pen
  - Standard mouse parallel to the touch screen

- Built-in PC
  - Monitor and keyboard separate
  - Powerful Pentium computer installed in cabinet/housing
  - 12" TFT, touch screen
  - Industrial keyboard and mouse separate for operation on a desk
- Stand alone PC
  - Installation on a desk next to the electronic testing unit or as an additional computer for additional operating stations
  - Powerful Pentium computer in the desktop housing
  - 15" TFT-display
  - Industrial keyboard and mouse

## Software

- Base software
  - Operating software on WINDOWS for one operator terminal
  - Guided device adjustment
  - Adjustments can be saved
  - Automatic adjustment procedures
  - Original signal display
  - Test result display and logging
  - Positionally accurate flaw marking (using external feed clock)
  - Direct 3-way sorting
  - All test results are stored in an open database
  - Automatic administration of the database size to prevent hard disk overflow (holds the last 500,000 pieces)



Fig. 10: Dialogue screen

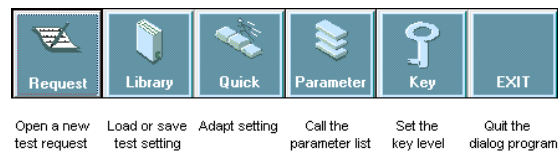


Fig. 11: Guided operation



## Software-Options

- Result Investigation
  - Graphical research mode using the stored results with every part and every flaw displayed
  - Printout of the stored results in every level of detail
  - Copies of Test Request Results into a MS ACCESS database for saving purpose or for additional evaluations
  - With FOERSTERnet option possible from every PC in the network
- Result archiving on CD
  - Possibility of archiving all test results in an open database via second hard disk and CD burner.
- Result export
  - Possibility to export test results automatically at the end of a test request into a MS ACCESS or SYBASE database.
- Report design
  - The design of test reports can be chosen freely by the powerful SW program Cristal Report
  - All test results, adjustment data and constant texts can be used
  - Type size and format can be selected freely
  - Log templates can be saved and used to make a log printout at any time
- FOERSTERnet
  - Operation of one electronic test unit at several PC or access to several electronic test unit at one PC using Ethernet connection; max cable length 180 m
  - Each operator terminal has fully functional access, can be configured and operated independent of the other operator terminals
  - Setting mode can be delegated to every PC in the network
  - Connection to any TCP/IP-capable network (e.g. Internet) via gateway

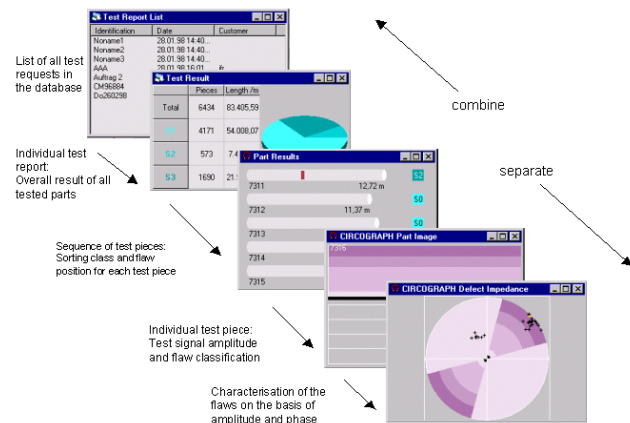



Fig. 12: Hierarchical structure of result display

**EDELSTAHLWERK FOERSTER**  
**Test Protocol**  
**Eddy Current Flaw Test**

  
 Date: 21.10.1998

TEST EQUIPMENT: CIRCOGRAPH DB		Test Setting: 305mm/18WD/005	
Test Order Number: 159-20000-365		Customer: VoLkswagen	
Tester: Rddy W.LabeL@t.com		SHIFT: 03	
TEST START: 21.10.1998 08:23		TEST STOP: 21.10.98 10:17	

TEST INSTRUMENT PARAMETERS:			
FREQUENCY: 550 KHz	PHASE: 59	SENSITIVITY: 57 dB	
LOW PASS FILTER: 9	HIGH PASS FILTER: 14	CUT OFF: 82	
THRESHOLD NOISE: 15%	THRESHOLD A: 35%	THRESHOLD B: 70%	

	Piece Counter	Defect Counter	Defect Density
<b>Total</b>	<b>923</b>	<b>235</b>	<b>0,08</b>
without Defect	850	---	---
<b>Threshold A</b>	<b>17</b>	<b>52</b>	<b>3,08</b>
<b>Threshold B</b>	<b>56</b>	<b>183</b>	<b>3,56</b>

Comments:  
Nothing special

Events / Error Messages:

	No <input checked="" type="checkbox"/>	Yes <input type="checkbox"/>
• Test Result Monitoring:	No <input checked="" type="checkbox"/>	Yes <input type="checkbox"/>
• Test Electronic:	No <input checked="" type="checkbox"/>	Yes <input type="checkbox"/>
• Test Line Control:	No <input checked="" type="checkbox"/>	Yes <input type="checkbox"/>
• Wall Thickness Control:	No <input checked="" type="checkbox"/>	Yes <input type="checkbox"/>
• Size Control:	No <input checked="" type="checkbox"/>	Yes <input type="checkbox"/>
• Others:	No <input checked="" type="checkbox"/>	Yes <input type="checkbox"/>

Fig. 13: Report design



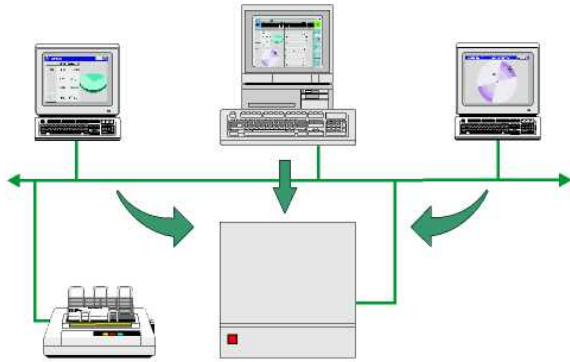


Fig. 14: FOERSTERnet, distributed terminals

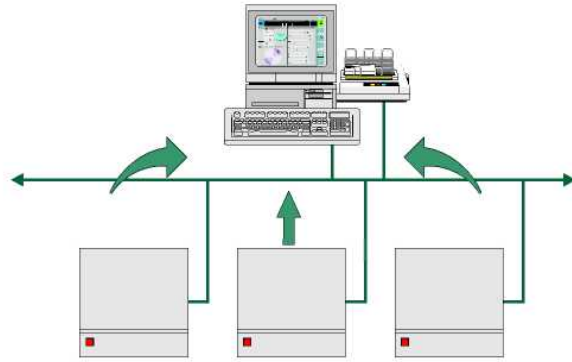


Fig. 15: FOERSTERnet, centralized terminal

- Software interface

- Call-up of operating functions from other WINDOWS applications via TCP/IP commands
- All setting parameters can be read individually or in groups and can be written individually
- Control of the internal setting archive through remote call-ups
- Notification of new test results in the result database for synchronization of the result transfer

### Housing

- Compact housing

- Sheet steel housing (12 height units) for the electronic test unit and integrated PC or built-in PC
- Protection class: IP54
- Lockable front glass door
- W=555 mm D=700 mm H=595 mm
- Weight: 70 ...80 kg dependent on number of channels

- Cabinet housing

- Steel cabinet (37 height units) for the electronic test unit and integrated PC or built-in PC
- free cabinet space (25 height units) can be used e.g. for printer drawer
- Protection class: IP54
- Lockable front glass door
- W=600 mm D=800 mm H=1959 mm
- Weight: 170 ...200 kg dependent on number of channels



Fig. 16: Compact housing 12 height units, electronic test unit, integrated PC, schematic

- 1 Electronic test unit
- 2 TFT-Display
- 3 Operation PC
- 4 Hinged keyboard
- 5 Power supply
- 6 Sensor connection and I/O port
- 7 FOERSTERnet port
- 8 Mains connection

## Technical Specification

- Mains supply 230 V AC, 50 Hz/ 60 Hz
- Power consumption: 420 ... 1400 VA (depending on the equipment)
- Ambient temperature in operation: + 5 °C up to + 40 °C  
Extendable with climate control unit
- Relative humidity in operation: max. 85 %, non condensing
- Storage and transport must only take place in the original packaging at - 20 °C up to +70 °C. Ingress of moisture is not permissible.

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## Accessories

- Laser printer with single sheet feeder
- Printer drawer 19" 6HU for printer up to max. W= 400 mm D= 440 mm H= 260 mm (only for cabinet)
- Voltage adaptation to local mains voltage. All electronic components are designed for 230 V AC  
All power components for 3 x 400 V AC, 50/ 60 Hz
  - Adaptation via isolating transformer for deviating mains voltage, e.g. 3 x 200 V AC, 3 x 440 V AC, 3 x 500 V AC
  - Max. connected load 7.5 kW
- Climate control unit for cabinet
  - For ambient temperature of > 40 °C
  - At high level of air pollution from dust and scale
  - Mounting on the rear door of cabinet W= 320 mm D= 110 mm H= 600 mm
- Adapter and cable  
Separate leaflets are available for the sensors. More detailed information you will find in the leaflets with own order numbers:  
**STATOGRAPH Probes 6.421: 144 728 9**  
**CIRCOSCAN H Rotating probes 6.482: 157 548 1**
  - 2- and 4-channel rotating discs; 1- to 4-channel special design.

The STATOGRAPH DS test system is very flexible to solve different test requirements and to satisfy customer's options. The number of test channels and the amount of accessories is dependent on the test requirements too. It has to be fixed in particular cases.

The standard probes of the 6.421 series are equipped with probe cables of 3 m length and 15 pin connectors to be plugged directly to the electronic test unit. (Fig. 17) Thereby independent clearance compensation of the single channels is practicable.

If longer probe cables are necessary suitable adapters and additional test cables have to be used.

For prevalent test requirements there are following standard adapters and cables:

- Adapter 6.421.01-9703, One-channel for single probes  
Test cable 2.899.52-1110, 15-pin; Length 10 m; Other cable length on request.  
Clearance compensation of single channels possible. (Fig. 18)
- Adapter 6.482.01-9805, Four-channel for 2 up to 4 single probes  
Test cable 6.460.01-9921, 26-pin; Length 10 m; Other cable length on request.  
Common clearance compensation possible. (Fig. 19)
- Adapter 6.482.01-9750, Four-channel for CIRCOSCAN H  
CIRCOSCAN cable 6.482.51-9904, 36/26-pin; Length 2.5 m;  
Test cable 6.460.01-9921, 26-pin; Length 10 m; Other cable length on request.  
Common clearance compensation for rotating discs. (Fig. 20).

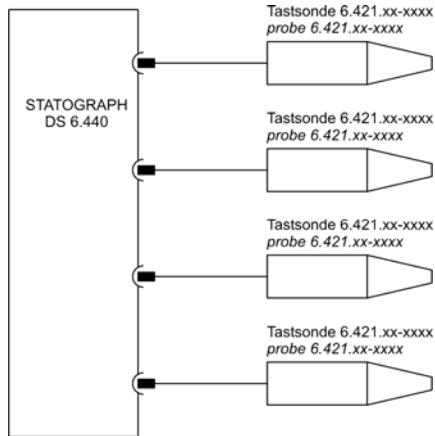


Fig. 17: 4 single probes plugged to test electronic

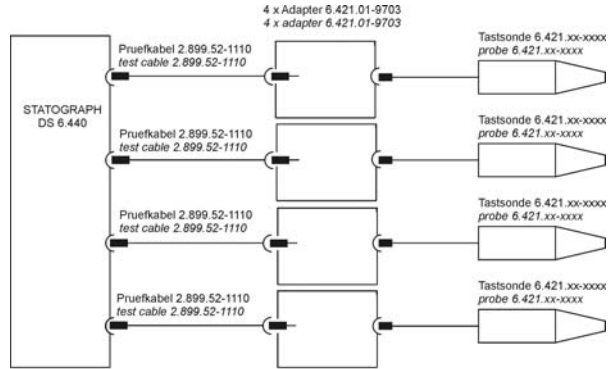


Fig. 18: 4 single probes with 1-channel adapters

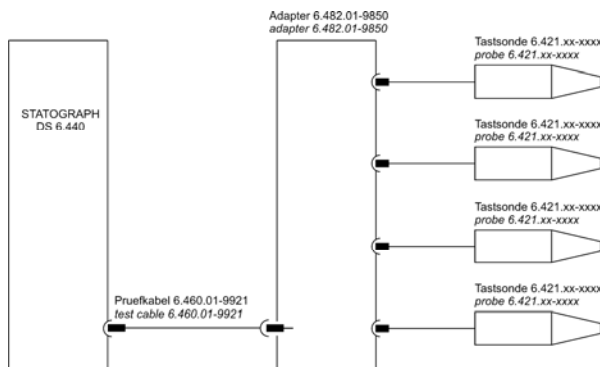


Fig. 19: single probes with 4-channel adapter

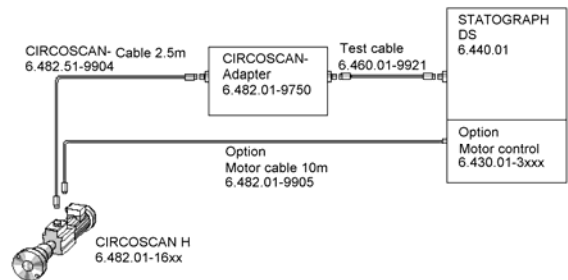


Fig. 20: 2- or 4-channel CIRCOSCAN H

**Should you have any special problems please contact:**

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