

DATA SHEET



FOERSTER MAGNATEST® D

Material Properties Test Instrument 3.623



proof.

INTRODUCTION

The FOERSTER MAGNATEST D 3.623 is an electronic instrument for non-destructive testing of conductive materials for their different magnetic and/or electrical properties.

The MAGNATEST technology is founded on years of proven practical applications in many production and manufacturing environments, where testing is performed quickly and reliably.

It is ideal for testing mass-produced components (such as fasteners, shafts, studs, rings, valves, sprockets, gears, forged parts, cast parts, machined parts, sintered parts, and more) for differences in:

- Alloy Composition
- Heat treatment
- Grain Structure
- Hardness
- Case Depth
- Dimensional and Geometrical Differences

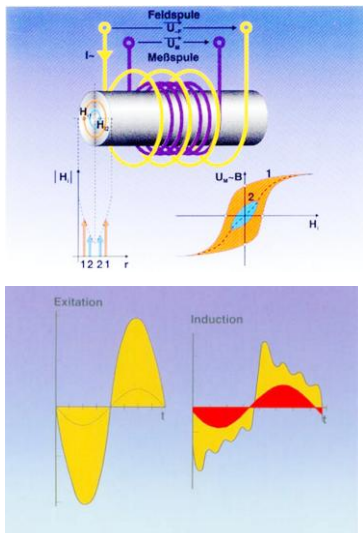
FEATURES & BENEFITS

- PC controlled electromagnetic test electronics for fully automated and rapid testing of every individual component produced (can also be employed manually and offline)
- High magnetic field strength results in the excitation of higher harmonics (electromagnetic noise) which provide increased sensitivity and increased stability when determining the various properties of the test material
- Constant current excitation source generates a consistently powerful magnetic field for the most stable and reliable test results possible
- Up to 24 different tests can be performed with one individual reading, allowing the use of multi-frequency testing, and analysis of higher harmonics to identify material differences
- Single-coil absolute operating mode means that no compensation coil is required (An adapter is available for two-coil differential mode if desired)
- The Application Wizard quickly determines the optimal instrument test settings for effortless setup of the device
- Graphical function keys and an integrated high-resolution display provide an easy to navigate operator interface
- Standard PC connections are provided for flexibility in connecting peripheral devices (external monitor, keyboard, mouse, printer, network, etc.)

MODE OF OPERATION

The part that is to be non-destructively tested is subjected to an alternating magnetic field which is generated within the test sensor. While in the presence of the magnetic field, eddy currents are induced in the electrically conductive component by magnetic induction. If the material is ferromagnetic, the test part is also subject to magnetisation by the alternating field.

Depending on the electrical conductivity and the hysteresis characteristics of the test material, a potential is then transferred from the material to the receiver winding of the test sensor. Analysis of the received signal allows evaluation of many different conductive materials. (Ferromagnetic, Austenitic, and non-ferromagnetic)



Because the hysteresis loop is strongly influenced by material properties such as hardness, alloy content, and grain structure, the properties of the component can be accurately determined by analyzing its electrical conductivity and magnetic permeability.

Harmonics are generated by the flip-flopping of the magnetic domains contained within ferromagnetic materials. At higher excitation field strengths, a non-sinusoidal signal is received that is composed of the fundamental frequency, plus additional higher harmonics (electromagnetic noise).

Analysis of the harmonic content of the received signal shows very accurate information about the mechanical or thermal treatment of ferromagnetic materials. If the material is able to be evaluated by analyzing the harmonic component of the received signal, the resultant test will be extremely stable and very reliable. Batch effect, temperature variations, and part placement variations are also eliminated or greatly reduced by evaluating the harmonics.

Changing the various properties of the material will influence different areas of the hysteresis loop. By varying the excitation field strength, the test can be focused on a specific area of the hysteresis loop which provides the most accurate information about the specific property to be determined.

By selecting the appropriate excitation frequency or range of frequencies, the penetration of the magnetic field into the material can be controlled, allowing both surface and internal properties to be determined independently or simultaneously.

ASSEMBLY

The MAGNATEST D in its standard configuration consists of the following components:

- MAGNATEST D 3.623 testing instrument
- Test cable
- Test sensor

The system can be adapted to specific requirements with the addition of various accessories.



The basic unit of the MAGNATEST D includes all the components necessary to carry out basic effective testing:

- Resilient instrument housing with integrated fan, power supply unit, integrated screen, touch keys, and two USB ports on the front
- PC plug-in unit with processor module, mass storage device, and peripheral interfaces on the back (1 x serial, 1 x parallel, 1 x USB, 1 x PS/2, Ethernet, VGA)
- Advanced Power Amplifier
- Opto I/O interface
- Analog signal electronics
- Signal processing electronics

FUNCTION

The testing instrument has the following features:

- Single or multi-frequency testing; with a maximum of 24 parameter sets
- Calculated sorting fields: circle, ellipse, box regression, and freely adjustable rectangle
- Manual, internal, and external trigger modes, as well as cross hairs
- Test cycle time depends on the selected test frequencies
(approx. 10 parts/second at 1 kHz)

ACCESSORIES

TEST SENSORS



All test coils as well as the LF probes of the MAGNATEST S system can be used with the MAGNATEST D.

TEST CABLES

Sensor cables are available in various lengths and with different connectors. The available cables are listed in the following table.

Coil cable	Type no.
Coil cable 3 m	3.625.11-9911 M3
Coil cable 5 m	3.625.11-9911 M5
Coil cable 10 m	3.625.11-9911 M10
Coil cable 3 m, with angled instrument plug	3.625.01-9914 M3
Coil cable 10 m, with angled instrument plug	3.625.01-9914 M10

MULTIPLEXER

The MULTIPLEXER is for connecting several sensors to the MAGNATEST D.



Up to four test sensors can be connected when using the standard version of the MULTIPLEXER. An optional expansion of up to eight channels is possible (4, 6 or 8 channel configurations).

In a MULTIPLEXER with four connections, the channels are normally switched by signals sent through the sensor cable, so no additional I/O is necessary.

In a MULTIPLEXER with more than four connections, the channels are switched by signals sent through the opto I/O interface.

A maximum of two MULTIPLEXERS utilizing 16 sensors can be connected to the MAGNATEST D.

See the separate "MAGNATEST D 3.623 MULTIPLEXER" data sheet for a more detailed description.

FOOT SWITCH AND SORTING LIGHT



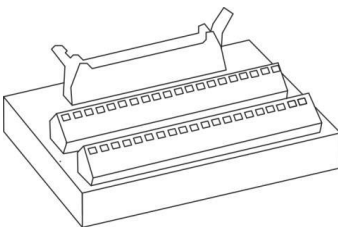
The sorting light is for visual indication of the test results. Two signal lights (red and green) are available to display the sorting result. In addition, the sorting light has a horn that can be switched on and off via a switch. The horn will also sound (if enabled) when the red signal light is activated.

The sorting light is connected to the opto I/O port of the MAGNATEST D via a 37-pin D-sub cable and enables the direct connection of a foot switch via a second plug-in contact.

The foot switch replaces the manual test push button on the MAGNATEST D, or the external test initiation by a PLC. This allows the operator to use both hands while working with the components. It is connected directly to the sorting light.



TRANSFER MODULE



An opto-coupled interface is used to connect the testing instrument to a PLC. This is a 37-pin D-sub connector, which is connected to the PLC. A breakout board can be used to connect the individual wires in the control cabinet. A 37-pin cable is available to connect the MAGNATEST D to a PLC.

I/O ADAPTER 3.623



The I/O adapter is a versatile connection box for the easy integration of additional components. The basic version of this box is for the connection of external signals (e.g. from the PLC) via the 37-pin breakout board. Several expansion stages enable its adaptation to most installation situations. See the separate “MAGNATEST D I/O adapter 3.623” data sheet for a more detailed description.

OPTO I/O TESTER



The opto I/O tester is a testing instrument for easily checking function of the opto I/O interface on the MAGNATEST D. The unit is connected to the MAGNATEST D instead of other peripherals, and allows you to display the output signals on the MAGNATEST D by means of LEDs as well as generate input signals for the MAGNATEST D by means of toggle switches. See the separate “MAGNATEST D opto I/O tester” data sheet for a more detailed description.

FEET

The 19-inch housing makes the MAGNATEST D suitable for installation in a 19-inch equipment cabinet. On request, a desktop version of the unit can be supplied with feet for desk and tabletop use.

INSTALLATION KIT FOR THE 19-INCH EQUIPMENT CABINET

A complete kit for the installation of the MAGNATEST D in a 19-inch equipment cabinet is available. This includes the mechanical components (rails, installation material, and strain relief) as well as the opto I/O interface components (breakout board, 37-pin connection cable).

Please ensure that you order the MAGNATEST D together with the appropriate accessories and installation kit.

TECHNICAL SPECIFICATIONS

MAGNATEST D

Designation	Value
Test frequency	2 Hz to 128 kHz in 17 steps
Throughput	Depending on the test frequency, approx. 10 parts/second at 1 kHz
Test trigger	Manual, external, internal, cross hairs
Sorting gates	Circle, ellipse, box regression, and fully adjustable rectangle
Sorting test	Group analysis
Number of definable groups	6
Number of sorting groups	8
Excitation	Single-frequency, multi-frequency
Output amplifier	Current-driven Max. 4 A Max. 36 V
Test	Single-coil absolute operation Two-coil differential operation is possible with an adapter if desired
Evaluation	Fundamental, harmonics up to the 11th harmonic for test frequencies up to 8 kHz
Interfaces	Serial, USB, printer (parallel), mouse (serial), external keyboard (PS/2), external screen (VGA)
Inputs	8 (galvanically isolated)
Outputs	8 (galvanically isolated)
Permitted supply voltage	AC 115 V/230 V -5/+10%, 50 Hz or 60 Hz AC 100 V/200 V (only in Japan) (Please observe the mains frequency when ordering)
Dimensions (H x W x D)	4U: 177 x 481 x 410 mm 6U: 289 x 463 x 449 mm
Weight	4U: approx. 18 kg 6U: approx. 19.3 kg
Temperature range	0 – 50 °C
Relative humidity, non-condensing	8 % to 80 %

PRODUCT INFORMATION

STANDARD FUNCTION SETS

Designation	Type no.	Order no.
MAGNATEST D 50 HZ MATERIAL TESTING 4U	3.623.01-1014	188 366 6
MAGNATEST D 60 HZ MATERIAL TESTING 4U	3.623.02-1014	188 230 9
MAGNATEST D 50 HZ MATERIAL TESTING 6U	3.623.04-1014	188 546 4
MAGNATEST D 60 HZ MATERIAL TESTING 6U	3.623.05-1014	188 566 9

All of these items are for installation in a 19-inch cabinet. If you intend using the unit on a desktop, please order the feet together with the unit.

STANDARD COMPONENTS

Designation	Type no.	Order no.
MULTIPLEXER	3.623.01-1111	188 095 0
FOOT SWITCH	3.623.01-9704	188 070 5
SORTING LIGHT	3.625.69-0485	042 649 0
TRANSFER MODULE, 37-PIN D-SUB		030 999 0
I/O ADAPTER 3.623	3.623.01-9801	188 006 3
OPTO I/O TESTER		151 148 3
CONNECTION CABLE, 37-PIN ST-ST 1M		038 590 5
CONNECTION CABLE, 37-PIN ST-ST 2M		038 573 5
19-INCH INSTALLATION KIT FOR MAGNATEST D	3.623.01-0491	167 628 8

PUBLICATION DATA



Reg.-Nr. 001159 QM08

MAGNETISCHE PRUEFANLAGEN GMBH

In Laisen 65
72766 Reutlingen
Germany

t +49 7121 1099-0
f +49 7121 470 370
info@mp-ndt.de

MAGNATEST® D 3.623, V3.00
Material Testing Instrument (Index A)
Order no.: 280 197 3
Issue: 03/2015
Author: Schmidt

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MAGNATEST® ECM

Material properties test module

3.621



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Application

MAGNATEST EMC is the line-ready compact module for simple testing tasks. The unit simply and reliably performs testing tasks such as material mix and deviation testing as well as deviations in surface hardness and case-hardening depth. MAGNATEST ECM is designed to be used as the core component in quality assurance systems during series production and for installation in production systems. It is particularly suitable for applications that primarily focus on profitability and less on multiple functions.

Simple testing of mass-produced components for **differences in:**

- Identification, material differentiation or sorting
- Microstructure
- Strength
- Hardness

Testing of **geometric characteristics**, such as:

- Shape accuracy
- Completeness of assembled parts (bearings, etc.)
- Machining state on all metallic series parts, e.g. hubs, steering system components, connecting rods, sintered carbide balls, chain links, profile shafts, shearing heads

Features of MAGNATEST® ECM

- Low-cost eddy current module for non-destructive material property testing
- Genuine magnetic induction testing using harmonic wave evaluation
- Test parameters can be varied in large ranges
- Very simple device operation
- Sorting of the test pieces into two groups „OK“ and „NOK“
- Unidimensional measured value display using LED bar graph
- Key switch for operation locking

Operating principle

The part to be tested non-destructively is subjected to an alternating magnetic field which is generated within the test sensor. While in the presence of the magnetic field, eddy currents are induced in the electrically conductive component by magnetic induction.

Depending on the electrical conductivity and the hysteresis characteristics of the test material, a potential is then transferred from the material to the receiver winding of the test sensor.

Analysis of the received signal allows evaluation of many different conductive materials (ferromagnetic, austenitic, and non-ferromagnetic).

As the hysteresis loop is strongly influenced by material properties such as hardness, alloy content, and grain structure, the properties of the component can be accurately determined by analyzing its electrical conductivity and magnetic permeability.

At higher excitation field strengths, a non-sinusoidal signal is received that is composed of the fundamental frequency, plus additional higher harmonics (electromagnetic noise).

Analysis of the harmonic content of the received signal shows very accurate information about the mechanical or thermal treatment of ferromagnetic materials. If the material is able to be evaluated by analyzing the harmonic component of the received signal, the resultant test will be extremely stable and very reliable.

Changing the various properties of the material will influence different areas of the hysteresis loop. By varying the excitation field strength, the test can be focused on a specific area of the hysteresis loop which provides the most accurate information about the specific property to be determined. By selecting the appropriate excitation frequency or range of frequencies, the penetration of the magnetic field into the material can be controlled, allowing both surface and internal properties to be determined independently or simultaneously.

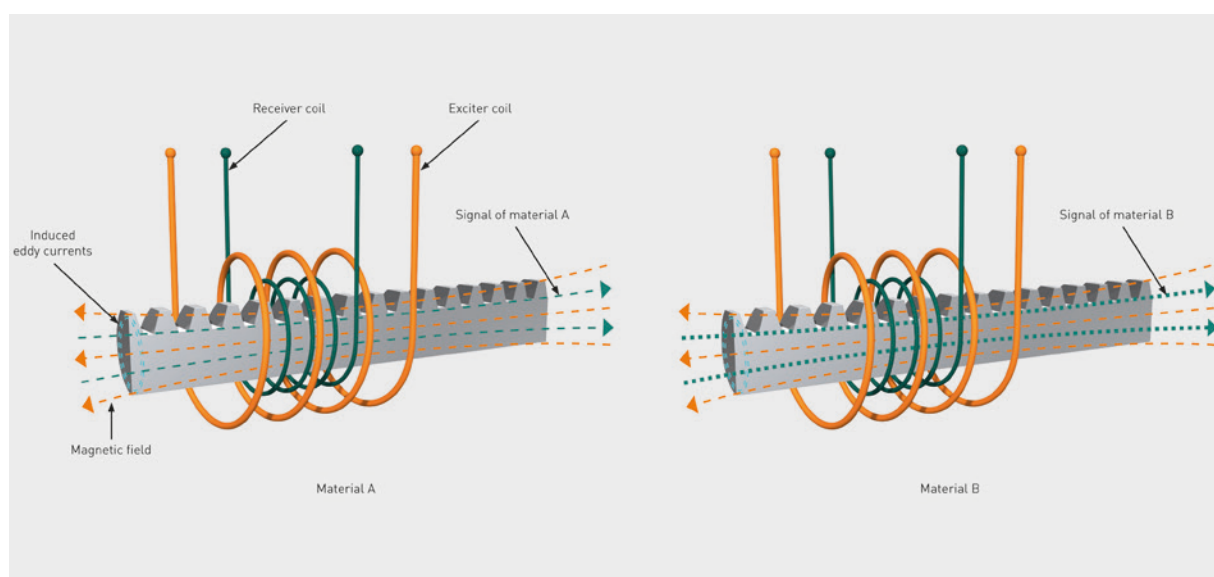


Fig 1: Schematic drawing of the magnetoinductive testing

Mechanical construction

In its standard configuration, the MAGNATEST ECM consists of the components:

- MAGNATEST ECM 3.621
- Mains cable, sensor cable
- Sensor system

The system can be adapted in steps to the specific test situation by adding further components:

- MAGNATEST ECM / LV
- Housing 6 HU
- Configuration adapter
- Combination with additional MAGNATEST ECM, MAGNATEST ECM Compact Edition and / or STATOGRAPH ECM
- 19" equipment cabinet in different configurations
- Remote control, extended display and evaluation by PC program eddyAssist

MAGNATEST® ECM 3.621

The MAGNATEST ECM contains the control elements, the test channel and power supply.

- Input keys for user inputs
- Key-operated switch for locking operating functions
- LC display for plain-text messages
- LED bar graph for measured value and threshold display
- Individual LEDs to display certain conditions



Fig 2: MAGNATEST ECM

Test sensors and probes

All current coils (HF and NF) as well as probes (HF and NF) can be used with the MAGNATEST ECM.



Fig 3: Test sensors and probes

Housing 6 HU

To accommodate one to four ECM modules. Dimensions approx. 365 x 535 x 355 mm (H x W x D).

Configuration ádapter

Plug-on module for automatic configuration of the MAGNATEST ECM. Stores the configuration data for one application.

If required, FOERSTER can determine an application-specific instrument setting in its application laboratory and save it on the configuration adapter. Specimen test pieces must be submitted for this purpose.

MAGNATEST® ECM / LV

MAGNATEST ECM 3.621 output amplifier for certain LF applications with high power requirement (e.g. evaluation of harmonics at test frequencies below 256 Hz).

- Connection socket for MAGNATEST ECM 3.621
- Sensor connection socket
- Mains connection socket
- Dimensions approx. 261 x 106 x 313 mm (H x W x D)
- Weight approx. 5 kg

Connecting cable for output amplifier

Connecting cable between MAGNATEST ECM and MAGNATEST ECM / LV.

Technical data

	MAGNATEST ECM
Test frequency	2 Hz - 128 kHz in 17 steps
Throughput rate	Depending on the test frequency, approx. 10 parts / second at 1 kHz
Test trigger	Manual, external, internal
Sorting thresholds	Circle In combination with the evaluation software eddyAssist also Ellipse and Rectangle
Sorting test	Group analysis
Excitation	Single-frequency, various frequencies adjustable
Sensor output	0.35 Arms, 20 Vpp, Magnetic field strength variable in 1% steps
Digitization of the measured signal	16 bit AD Converter
Input amplifier	Overvoltage protection (± 13 V)
Test	Single-coil absolute operation Two-coil differential operation is possible with an adapter if desired
Evaluation	up to the 7 th harmonic for frequencies up to 256 Hz
Interfaces	Serial interface to additional ECMs or PC Parallel interface to the testing line (inputs via optocouplers; outputs via relays)
Microprocessor	For sequence control, operator prompting self-test etc.
Signal processor	For measured-value acquisition and pro-cessing, fast Fourier transformations (FFT)
Permitted supply voltage	115 / 230 V +10%-15%, 50-60 Hz
Power consumption [VA]	45 VA
Dimensions (H x W x D)	261 x 106 x 313 mm
Weight	approx. 5 kg
Temperature range	5 – 40 °C
Protection class (DIN 40 050)	IP 30

Worldwide Sales and Support Offices



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Institut Dr. Foerster GmbH & Co. KG Business Unit Component Testing

In Laisen 70

72766 Reutlingen

Germany

+49 7121 140 0

info@foerstergroup.com

