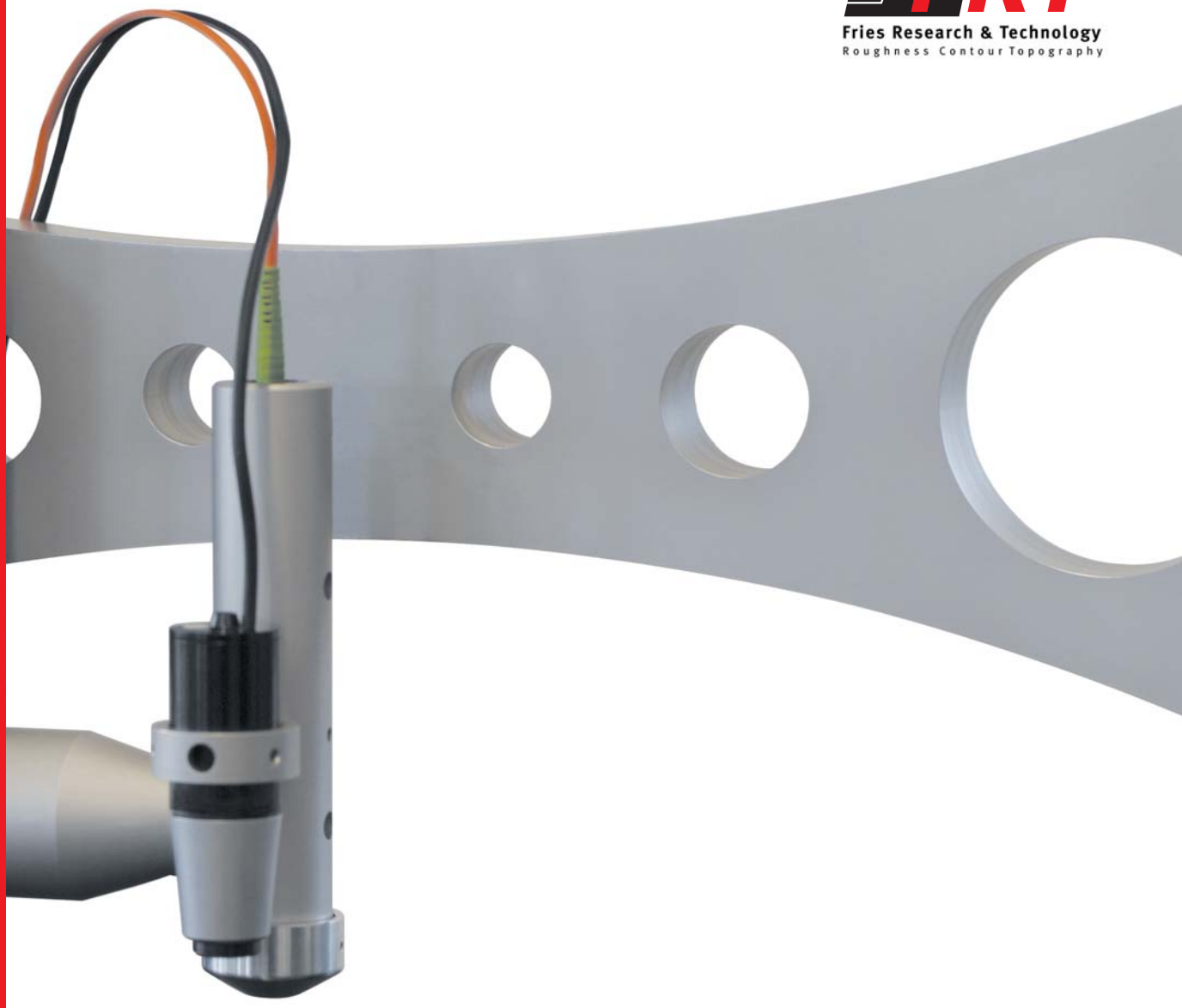
ROUGHNESS ■ CONTOUR ■ TOPOGRAPHY ■ FILM THICKNESS

FRT
Fries Research & Technology
Roughness Contour Topography



Optical Surface Measuring Systems

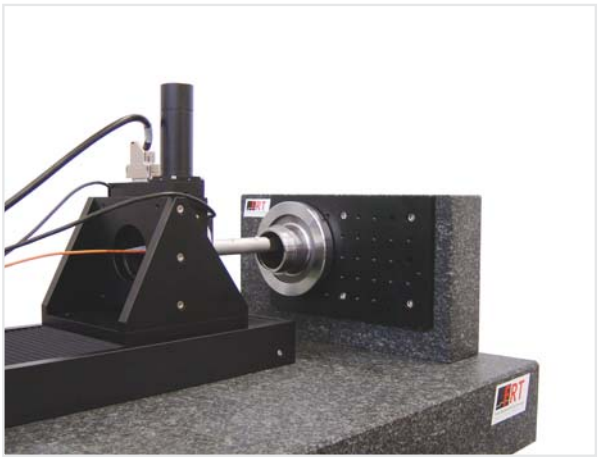
Non-Contact Profilers

Laser and White Light Sensors

Film Thickness Sensors

Scanning Probe Microscopes

MicroProf® Mobile ■ portable device ■ page 7



MicroProf® Twist ■ roundness measurement ■ page 8

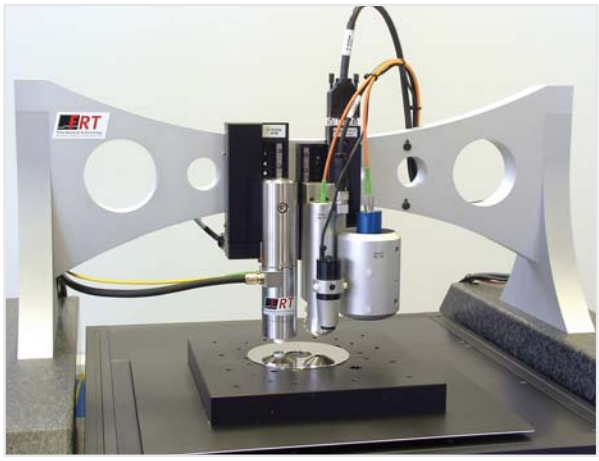
MicroProf® TTV ■ total thickness variation ■ page 6

MicroProf® ■ roughness, profile, film thickness, topography ■ page 4

Unique, Non-Contact,

Measurement of

- roughness
- step height
- profile
- contour
- pitch
- trench
- bumps
- topography
- total thickness variation (TTV)
- bow, warp
- coplanarity
- parallelism
- angle
- critical dimensions (CD)



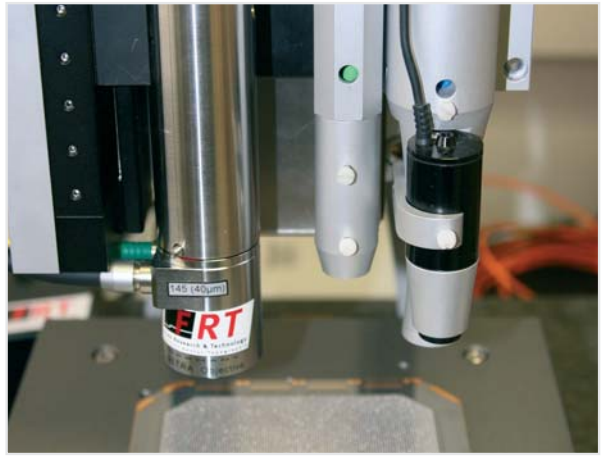
MicroGlider® ■ roughness, film thickness, topography ■ page 12

Custom Designs ■ integration and automation ■ page 14

Multi-Sensor Metrology

Metrology for

- automotive
- semiconductor
- optics
- MEMS
- steel
- paper
- plastics
- biotech
- nanotech



FRT Sensors ■ for multiple applications ■ pages 16-18

FRT MFE ■ from front end to back end ■ page 19

Whatever you are producing or manufacturing, regardless of the material and quantity – perfect results can only be achieved through product inspection and constant quality control. FRT is a global supplier of metrology systems and on-demand surface inspection services. As one of the leading metrology companies, FRT is an experienced, competent partner to help you meet your quality goals.

1995	August 07, 1995; founding of Fries Research & Technology GmbH, Germany
1996	market introduction of the MicroGlider® industry award for technological innovation
1998	market introduction of the MicroProf® founding of FRT of America, LLC, USA
2001	founding of FRT Suisse AG, Switzerland introduction into the automotive industry
2002	worldwide distributor count: 16 established supplier into the semiconductor industry
2004	award for excellent human resources - and company organizational development
2006	opening of the southern branch office in Munich, Germany

Thomas Fries, Ph.D., and his team of world-class scientists, engineers, software developers, technicians, and sales- and support staff

This brochure has been designed to give you an overview of our products and services.
Please do not hesitate to contact us should you have further questions. Our friendly staff is looking forward to hearing from you. Also, you may want to visit us on the Internet at www.frt-gmbh.com or www.frtofamerica.com for further information.

Yours, Thomas Fries, Ph.D.

FRT has been designing, building, selling metrology systems and supporting customers for more than 10 years. We are the competent partner for metrological measuring systems for various industrial sectors and research centers worldwide. FRT metrology systems are multi-sensor platforms, which measure roughness, profile, topography, step height, film thickness and more. Apart from its core systems business, FRT also offers on-demand measuring services to its customers by employing the most efficient, state-of-the-art scientific methods.

Furthermore, FRT provides expert knowledge in designing customized solutions and in integrating automated metrological measuring solutions into existing production environments.

FRT tools primarily use optical sensor technologies that allow completely non-destructive measurements. Also, it is possible to expand the bandwidth of certain applications with the additional atomic force microscopy (AFM). Overall, a broad product range of base systems and sensors ensures a multitude of possible applications, that will suit your needs and requirements.

Each measuring system is delivered with a control and analysis software package that controls the tool and supports the user in the analysis of the generated measured data with 2D and 3D visual imagery. A variety of different input and output data formats ensures a flawless exchange between third-party applications. Of course, it is also possible to customize the software in order to suit your specific automation and analysis needs.

FRT exhibition booth

The MicroProf® is a very versatile and modular measuring tool that is suited for a wide range of applications. No matter what you are planning to measure, whether it is profile, roughness, topography or film thickness, this system is a true all-rounder. Most importantly, it is very easy to use, expandable, can be automated and provides instant visible results through a time and cost efficient operation.

Features

- non-destructive measurement
- excellent resolution
- outstanding repeatability and reproducibility
- automated measuring cycles
- sample positioning with CCD camera
- versatility through modular conception
- multi-sensor capability
- see pages 16-18 for additional sensors

Hardware

- chromatic white light or AFM sensor
- compact x,y stage for perfect orthogonality
- high precision mechanical axes
- high resolution linear glass scales
- backlash-free, re-circulating ball spindles
- rugged and stable granite mount
- industrial computer, monitor, electronics, and manual

Software

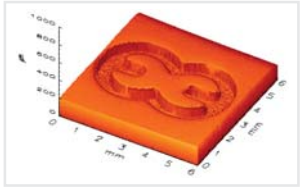
FRT Acquire Measuring Software

- macro collection for typical measuring applications
- automation of complex measurements
- intuitive user interface design

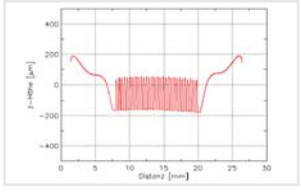
FRT Mark III Analysis Software

- complete analysis of the generated data (2D and 3D)
- logging of analyzing steps and results
- customizable reports
- various data import and export formats
- English and German language sets
- free updates

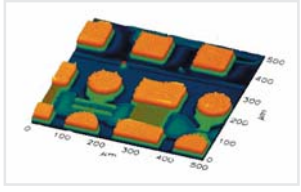
MicroProf® 200 mm



measurement of metal surface



profile of an embossed structure



structures on a semiconductor part

	MicroProf® 100	MicroProf® 200	MicroProf® 300	MicroProf® 600
scan range*	100 mm x 100 mm	200 mm x 200 mm	300 mm x 300 mm	600 mm x 600 mm
scan speed max.	100 mm/s	100 mm/s	100 mm/s	100 mm/s
sample height*	max. 50 mm	max. 50 mm	max. 50 mm	max. 50 mm
stage traverse	rotary encoder	Heidenhain linear scales	Heidenhain linear scales	Heidenhain linear scales
stage	x,y with DC-motors	x,y with DC-motors	x,y with DC-motors	x,y with DC-motors
design	cantilever design	gantry design	gantry design	gantry design

* other sizes upon request.

The MicroProf® Vision combines the well-known accuracy and reproducibility of the MicroProf® series with the ability to fully automate surface inspection in production environments. By utilizing a high resolution, telecentric, illuminated CCD-camera and a pattern recognition software, the MicroProf® Vision automatically detects different parts and measurements sites and thus saves you valuable time for routine, repetitive measurements. The tool comes with a full enclosure and is therefore well suited for harsh production environments.

Features

- suited for use in production environments
- automatic pattern recognition
- excellent resolution
- outstanding repeatability and reproducibility
- automated measuring cycles
- multi-sensor capability
- non-destructive measurement
- see pages 16-18 for additional sensors

Hardware

- full enclosure for protection
- chromatic white light or AFM sensor
- high resolution, telecentric, and illuminated CCD camera
- compact x,y stage for perfect orthogonality
- high precision mechanical axes
- backlash-free, re-circulating ball spindles
- rugged and stable granite mount
- industrial computer, monitor, electronics, and manual

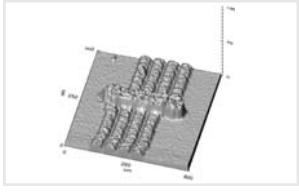
Software

FRT Acquire Measuring Software

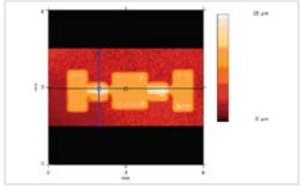
- controllable through recipes (with device editor)
- macro collection for typical measuring applications
- automation of complex measurements
- intuitive user interface design

FRT Mark III Analysis Software

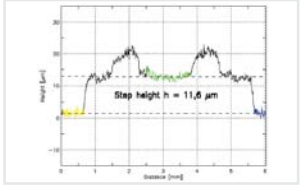
- complete analysis of the generated data (2D and 3D)
- logging of analyzing steps and results
- customizable reports
- various data import and export formats
- English and German language sets
- free updates



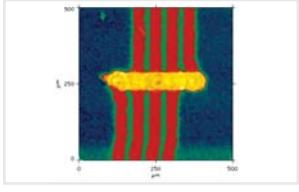
silk screen printing on ceramics



measurement of an electronic part



determination of step height



top view of a structure

	MicroProf® Vision 200	MicroProf® Vision 300	MicroProf® Vision 600
scan range*	200 mm x 200 mm	300 mm x 300 mm	600 mm x 600 mm
scan speed max.	100 mm/s	100 mm/s	100 mm/s
sample height*	max. 50 mm	max. 50 mm	max. 50 mm
stage traverse	Heidenhain linear scales	Heidenhain linear scales	Heidenhain linear scales
stage	x,y with DC-motors	x,y with DC-motors	x,y with DC-motors
design	cantilever design	cantilever design	cantilever design

Application Sheets www.frt-gmbh.com

* other sizes upon request.

Simultaneous Measurement on Both Sides

The MicroProf® TTV quickly measures both sides of a part simultaneously for total thickness, total thickness variation (TTV) as well as the roughness, contour and topography. This is realized by two opposing sensors, which are situated above and below an open frame raster x,y stage. Exchangeable part holders can be used to measure different samples such as wafers, dies, optics, foils, sheet metal, etc. Equipped with pattern recognition software, the MicroProf® TTV can be fully automated with measuring sequences and part handling.

Features

- measurement of total thickness variation (resolution ‹ 10nm)
- simultaneous two-side measurement of roughness, contour and topography
- suited for use in production environments
- automatic pattern recognition
- excellent resolution
- outstanding repeatability and reproducibility
- automated measuring cycles
- multi-sensor capability
- non-destructive measurement
- see pages 16-18 for additional sensors

Hardware

- protective enclosure
- two chromatic white light sensors
- high resolution, telecentric, and illuminated CCD camera
- compact x,y stage with open frame
- customized part holder (i.e. wafer holder)
- stage size x,y: 420 x 310 mm² or 250 x 200 mm²
- larger stage sizes available upon request
- high precision mechanical axes
- backlash-free, re-circulating ball spindles
- high resolution linear encoder systems
- rugged and stable granite mount
- industrial computer, monitor, electronics, and manual

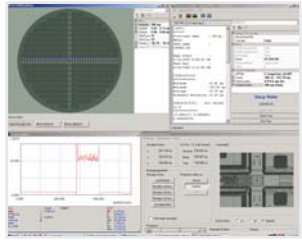
Software

FRT Acquire Measuring Software

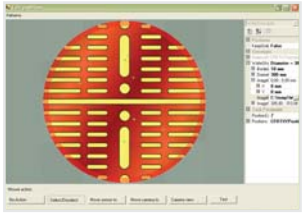
- controllable through recipes (with device editor)
- macro collection for typical measuring applications
- automation of complex measurements
- intuitive user interface design

FRT Mark III Analysis Software

- complete analysis of the generated data (2D and 3D)
- logging of analyzing steps and results
- customizable reports
- various data import and export formats
- English and German language sets
- free updates

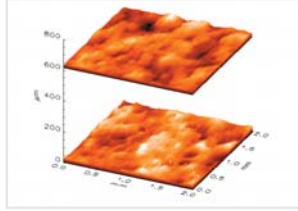


automation software



editing of measuring positions

TTV sensor configuration



simultaneous measurement of upper- and lower surfaces

The MicroProf® Mobile is, as a portable unit, perfectly suited for direct surface measurement on heavy machinery, vehicles, cylinders, glass panes and so forth. This measuring system enables you to perform non-destructive, high-resolution surface analysis on-site and provides you with valuable additional information such as wear, bearing curve, and volume data. Alternatively, the MicroProf® Mobile can be used to measure smaller parts by directly placing them on the system table.

Features

- suited for use on large and small surfaces
- excellent resolution
- outstanding repeatability and reproducibility
- non-destructive measurement
- two handles and adjustable rubber feet
- low weight (approx. 5kg)

Hardware

- chromatic white light sensor
- high precision mechanical axes
- backlash-free, re-circulating ball spindles
- manual z-axis
- compact x,y stage with open frame
- 50 x 50 mm² stage travel
- 300 or 600 µm height measuring range
- industrial computer, monitor, electronics, and manual

Software

FRT Acquire Measuring Software

- macro collection for typical measuring applications
- intuitive user interface design

FRT Mark III Analysis Software

- complete analysis of the generated data (2D and 3D)
- logging of analyzing steps and results
- customizable reports
- various data import and export formats
- English and German language sets
- free updates

Application Sheets
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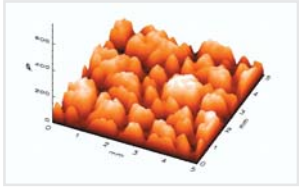
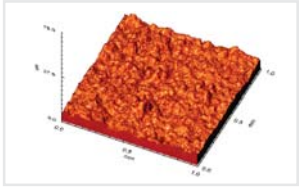
MicroProf® Mobile



measurement of an artificial leather surface

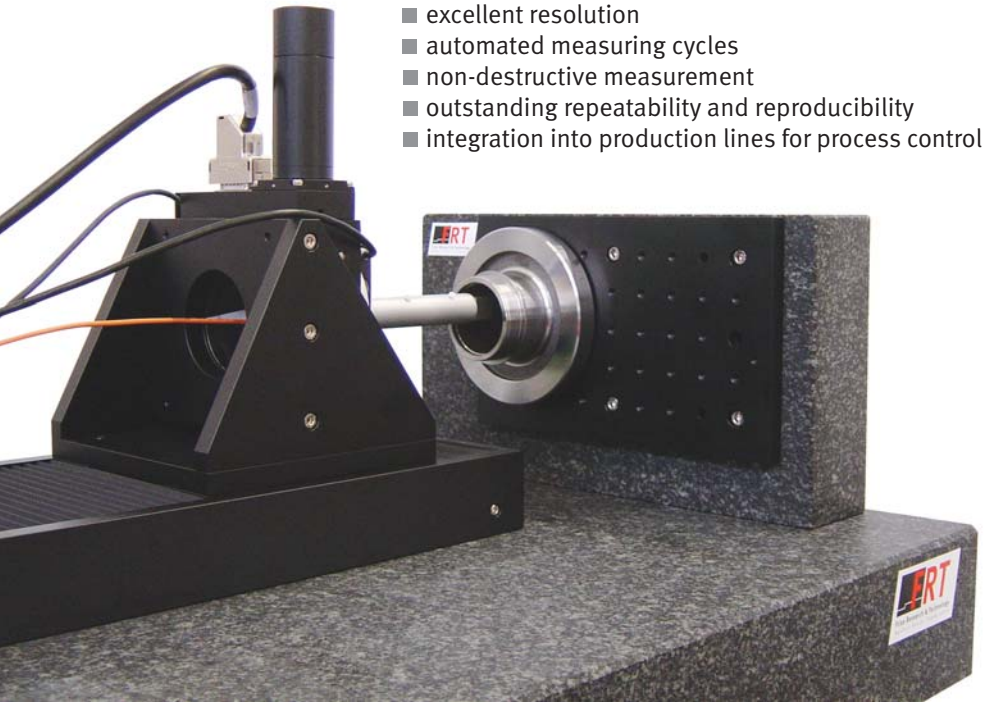


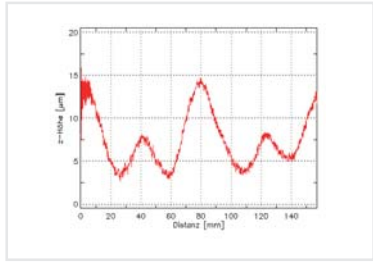
roughness of a steel surface

The MicroProf® Twist was especially designed for the metrological measurement of cylindrical parts such as axes, cam lobes, cylinder sleeves, bearing sleeves (inside and outside), valve tappets, crankshafts, piston rods and other similar samples. Measurement is automatically performed using a high precision rotary axis and an additional linear axis in combination. The sensor is introduced to the part along the cylindrical axis and then rotated for measurement. Since this measuring system is capable of automated measurements, it can be easily integrated for process control into your existing production lines.

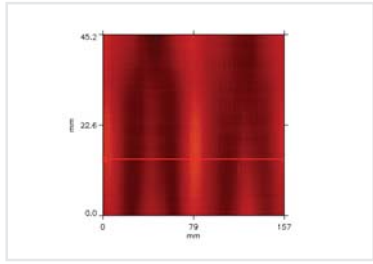
Features

- measurement of cylindrical parts
- excellent resolution
- automated measuring cycles
- non-destructive measurement
- outstanding repeatability and reproducibility
- integration into production lines for process control

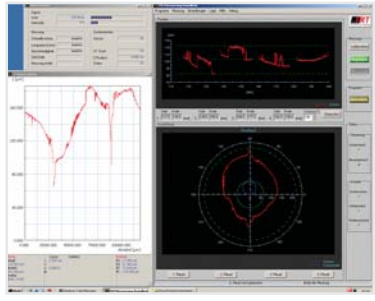




profile of a housing bore



generation of a reference surface



measurement of a bearing surface

Hardware

- chromatic white light sensor
- 300 or 600 µm height measuring range
- high precision mechanical axes
- high resolution traverse measurement
- backlash-free, re-circulating ball spindles
- rugged and stable granite mount
- industrial computer, monitor, electronics, and manual

Software

FRT Acquire Measuring Software

- automation of complex measurements
- intuitive user interface design

FRT Mark III Analysis Software

- complete analysis of the generated data (2D and 3D)
- logging of analyzing steps and results
- customizable reports
- various data import and export formats
- English and German language sets
- free updates

The MicroProf® Cylinder Measuring Station is a specialized system for the automotive industry. It enables you to perform non-destructive measurements in engine block cylinder bores. Due to its portability and ease of use, this tool helps you to optimize an engine's performance during the development stage or to monitor the quality of your production output "in-situ", all with the powerful performance of the MicroProf® series. Naturally, this system can measure profiles and surface sections as well entire radial profiles and surfaces to provide information on topography, roughness, honing structure, bearing curve, oil retention volume, wear volume and more.

Features

- surface measurement in cylinder bores and liners
- non-destructive measurement
- excellent resolution
- outstanding repeatability and reproducibility
- automated measuring cycles
- self-adjusting
- automated data evaluation
- low weight (approx. 10kg)

Hardware

- chromatic white light sensor
- linear axis with 100 mm traverse range
- automatic sensor approach with motorized axis
- two handles
- industrial computer, monitor, electronics, and manual

Software

FRT Acquire Measuring Software

- macro collection for typical measuring applications
- automation of complex measurements
- intuitive user interface design

FRT Mark III Analysis Software

- complete analysis of the generated data (2D and 3D)
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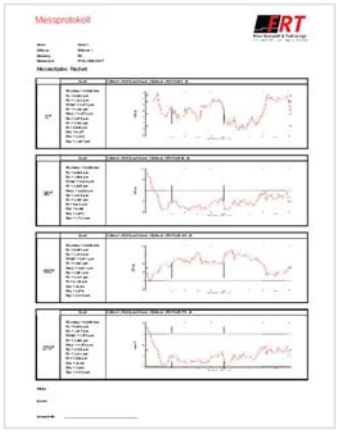
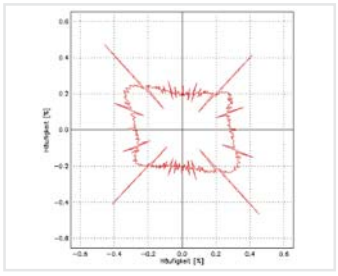
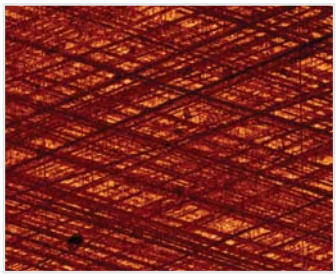


measuring report



distribution of the honing angle

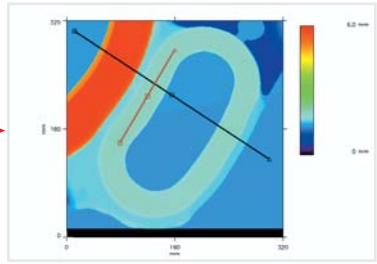


measurement of honing structure

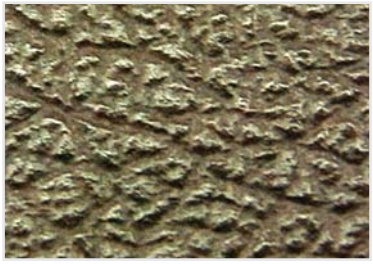
Application Sheets
www.frt-gmbh.com

Many well known companies have already put their trust in us – our capability and our support – and this makes us very proud. We are very much looking forward to adding your company to our customers. Here you will find a selection of applications from many different industrial sectors. Please, also refer to the downloadable application sheets on our homepage. Should you have any further questions about your specific applications, please do not hesitate to contact our staff for additional information.

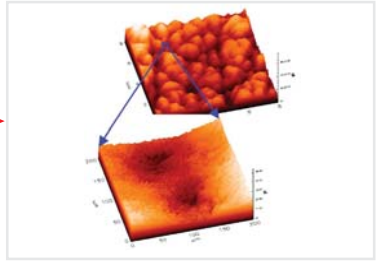
automotive: pump housing



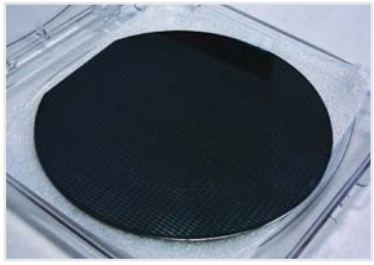
structure and flatness of a pump housing



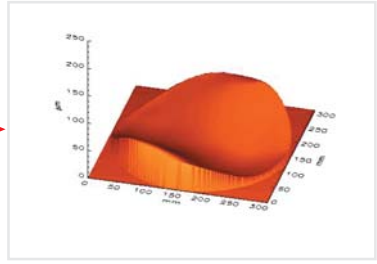
artificial leather



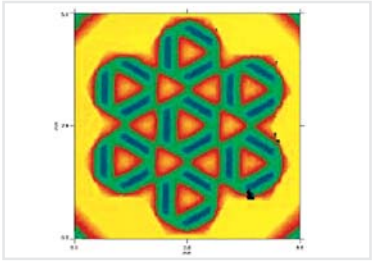
characterization of very fine structures



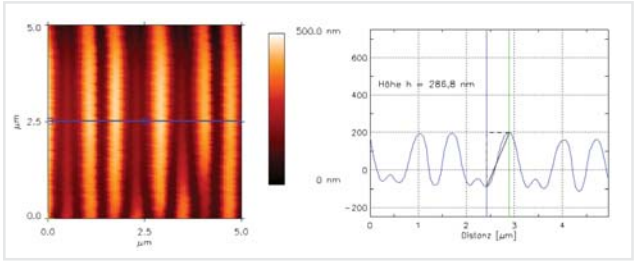
semiconductor: wafer



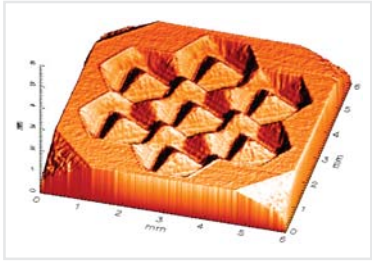
measurement of bow, warp, and flatness



MEMS: embossed structure

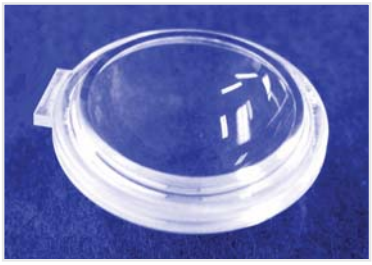


measurement of a microlens system in the nanometer-scale

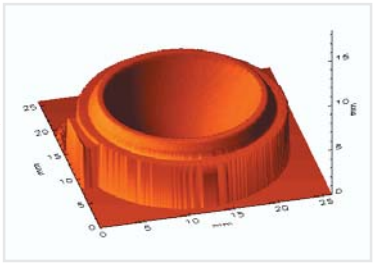


3D topography measurement

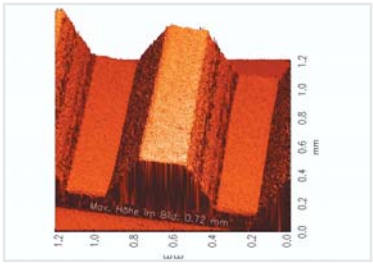
Please view and download application sheets from several industries at our websites, www.frt-gmbh.com or www.frtofamerica.com for specific examples.



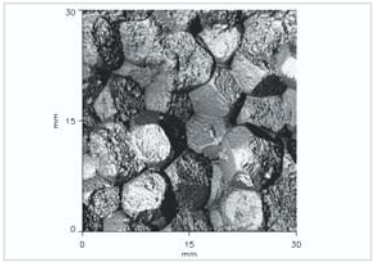
optics: lens



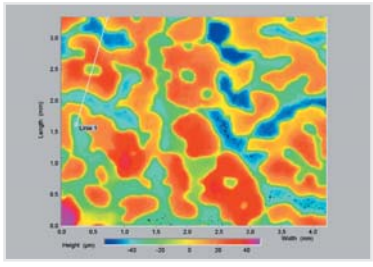
determination of radius, geometry, and roughness



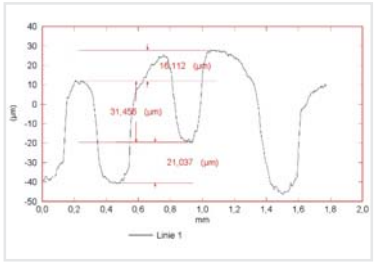
measurement of a sprocket



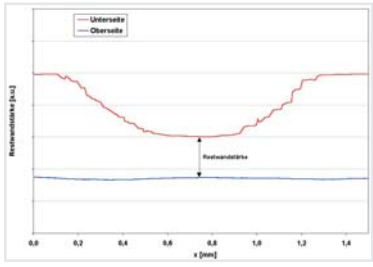
characterization of Styrofoam™



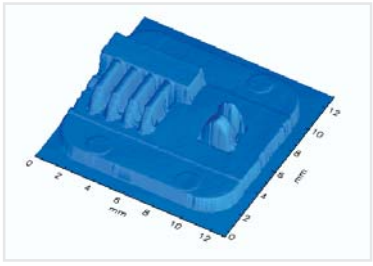
etched metal structure



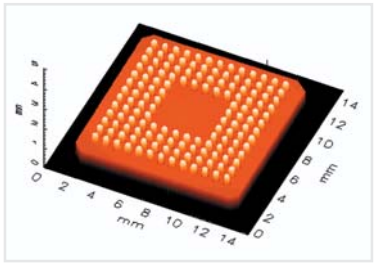
quantification of an etched structure



determination of residual thickness



quality control of injection moulding



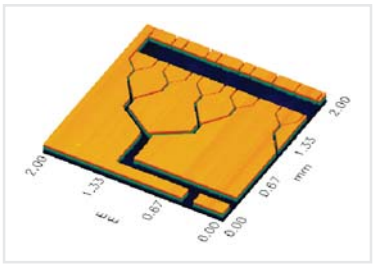
measurement of an electronic part

Application Sheets
www.frt-gmbh.com

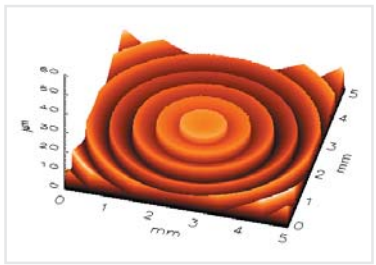
The MicroGlider® is the highly precise, multi-sensor platform measuring system from FRT intended for especially accurate measuring applications. A linear motor driven, non-contact air bearing x,y stage guarantees superior guiding precision during stage movement. Hence the MicroGlider® measures profile, topography, roughness, and film thickness with further enhanced accuracy. The MicroGlider® is also equipped with a CCD camera for easy sample positioning and can automatically perform predefined measurements.

Features

- increased measurement accuracy
- non-destructive measurement
- excellent resolution
- outstanding repeatability and reproducibility
- automated measuring cycles
- CCD camera aided sample positioning
- multi-sensor capability
- see pages 16-18 for additional sensors



measurement of a microfluidic part



topographical measurement of an optical part

multi-sensor configuration

Software

FRT Acquire Measuring Software

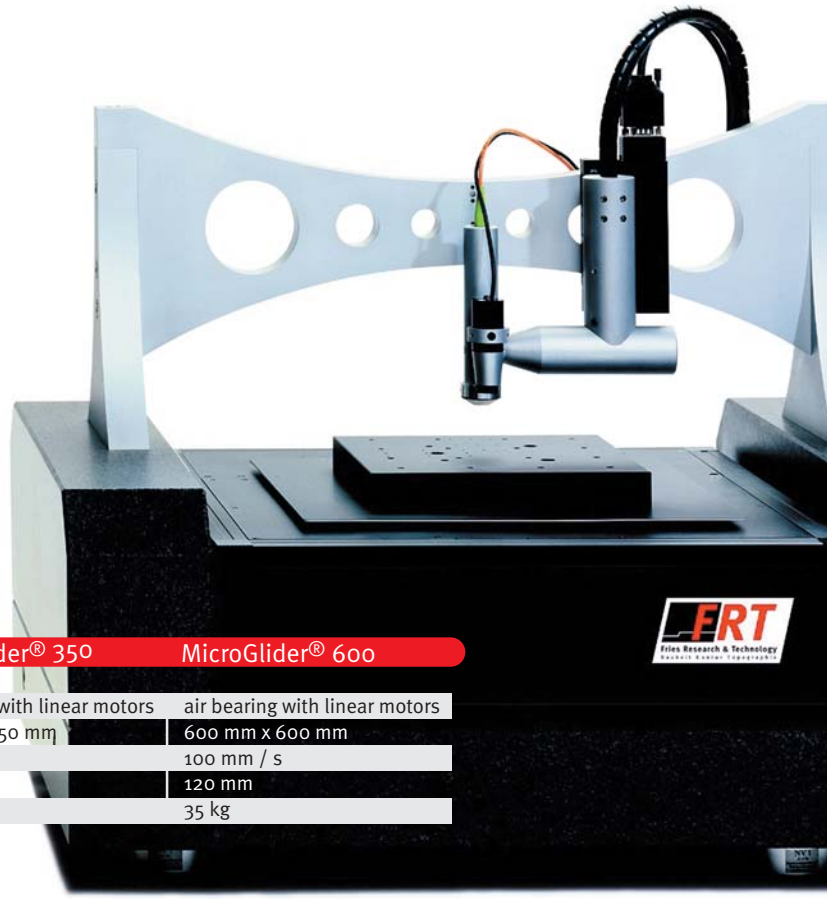
- macro collection for typical measuring applications
- automation of complex measurements
- intuitive user interface design

FRT Mark III Analysis Software

- complete analysis of the generated data (2D and 3D)
- logging of analyzing steps and results
- customizable reports
- various data import and export formats
- English and German language sets
- free updates

Hardware

- chromatic white light or AFM sensor
- air bearing x,y stage
- high resolution traverse measurement
- rugged and stable granite mount
- industrial computer, monitor, electronics, and manual



	MicroGlider® 100	MicroGlider® 350	MicroGlider® 600
system design	air bearing with voice coil drive	air bearing with linear motors	air bearing with linear motors
scan range*	100 mm x 100 mm	350 mm x 350 mm	600 mm x 600 mm
scan speed max.	100 mm / s	100 mm / s	100 mm / s
sample height max.	36 mm	120 mm	120 mm
sample weight max.	5 kg	35 kg	35 kg

* other sizes upon request.

The MicroGlider® Asphere employs a unique method to perform highly precise profile measurements on spherical and aspherical lenses. The lens is fixed by a holder, which is mounted on an air bearing rotary table. The system configuration is such that the sensor is always perpendicular to the lens surface, which is rotated during measurement. The measured data are recorded as polar coordinates (r,φ) and are then visualized with the help of the analysis software. This system is also available as a 3D version.

Features

- measurement of polished and unpolished surfaces
- measurement of spherical and aspherical lenses
- no resolution loss even on lenses with extreme curvature (up to hemisphere)
- customizable parameter sets for measuring different lens geometries
- excellent resolution
- outstanding repeatability and reproducibility
- nominal and actual geometry comparisons
- calculation of compensation values for lens production
- computer aided sample positioning
- 3D measurement (optional)

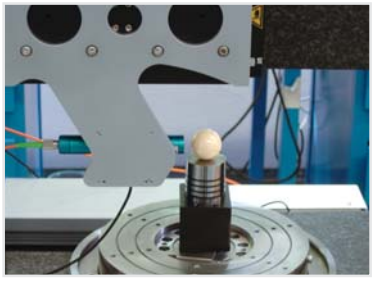
Hardware

- high precision air bearing rotary table with torque-direct drive
- radial axis with high resolution measurement system and backlash-free, re-circulating ball spindle
- automatic detection of lens crown (optional)
- rugged and stable granite mount
- industrial computer, monitor, electronics, and manual

Software

FRT Acquire Measuring Software

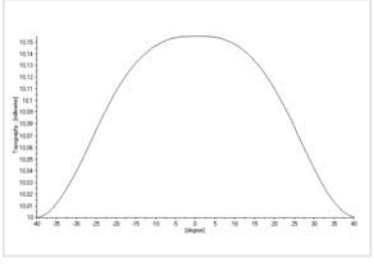
- macro collection for typical measuring applications
- freely programmable measuring routines
- lens database
- aspherical fit
- intuitive user interface design
- English and German language sets
- free updates



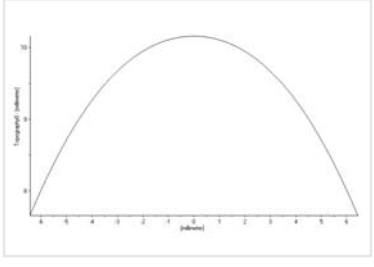
system calibration with a reference ball

Technical Specifications

lens height	2 ... 50 mm
lens diameter	2 ... 100 mm
lens radius of curvature	± 2 ... 50 mm
deviation from sphere-shape	max. ± 300 µm
lateral sensor resolution	‹ 2 µm
radial sensor resolution	20 nm
resolution of measuring system	1/3200°
measuring angle	max. 180°



deviation from a sphere



profile measurement on an aspherical lens

Application Sheets
www.frt-gmbh.com

In addition to our standard measuring systems, FRT designs and manufactures highly specialized solutions for applications in demanding production environments. Over many years, FRT has developed the competence to engineer individual components, to integrate metrological systems into third-party tools, and to design entire process monitoring systems by carefully selecting only the best mechanical equipment and writing tailor-made software. This is what we call "The Art of Metrology™".

Example 1 Process Control System

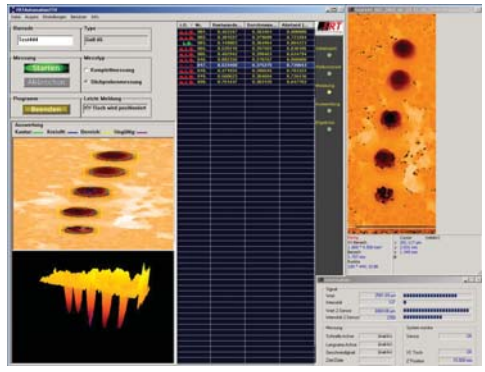
Automatic determination of form deviations
Here, a fully automatic test stand with five highly accurate axes was integrated into the production chain and connected to a QA system for inspecting precision-turned parts with diameters of up to 600 mm and heights of up to 250 mm.

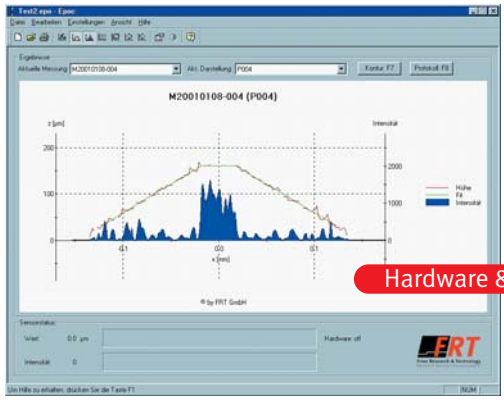
Hardware & Features

- high-end air bearing rotary table
- parts up to 600 mm diameter
- part heights up to 250 mm
- resolution 20 nm
- weights of greater than 50 kg
- 4-axes robotic system for positioning two chromatic sensors
- control console with customized software for analyzing the measured data
- teach-in capability for new parts
- data interface to an existing QA system

Example 2 Integration

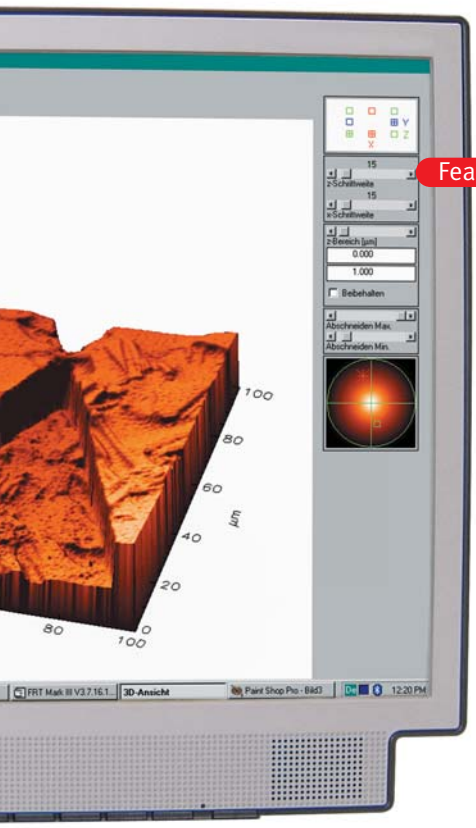
Measuring before, during, and after the machining cycle
In this case, the assignment was to control an existing third-party milling machine with a non-contact metrology system that was able to analyze the contour of high-precision knife-edges before, during, and after the machine cycle. All this had to be performed without the necessity of having to remove the part from the milling machine. This approach led to shorter set-up times and eventually lower costs, because the milling and measuring steps could be successfully integrated into one simple working cycle.





Hardware & Features

- software based control of entire machine
- splash water protected housing
- high resolution chromatic white light sensor
- high precision axis with 70 mm range
- user-friendly and automatic measurement
- teach-in capability for new blade types
- process monitoring via workstation



FRT Mark III is a unique software package with a comprehensive feature set for analyzing profiles, roughness, and 3D data. Various industry standard data formats can be analysed. All FRT systems are bundled with Mark III but you may also purchase it as a separate, standalone software package.

Features

- support of various scanning probe microscope and profilometer file formats
- extensive filter- and modification routines
- top view, profile, and 3D viewing mode
- customizable viewing angles with virtual lighting
- comparison function, zoom function
- analysis of distances, areas, volumes, angles etc.
- measuring of profile and dynamic profile
- DIN EN ISO and MOTIF compliant determination of roughness/waviness
- determination of step heights
- determination of bump height and coplanarity
- calculation of flatness
- calculation of histograms, bearing curves, grain sizes, and fractal dimension
- calculation of the power spectrum and autocorrelation
- fit routines, e.g. for curvature and asphere determination
- calibration in x, y, and z, for example from REM or LM plots
- automatic logging of analyzing steps and results
- data import and export of BMP-, JPG-, PNG-, and TIF-files
- English and German language sets
- customer support by phone, fax, and e-mail
- free updates

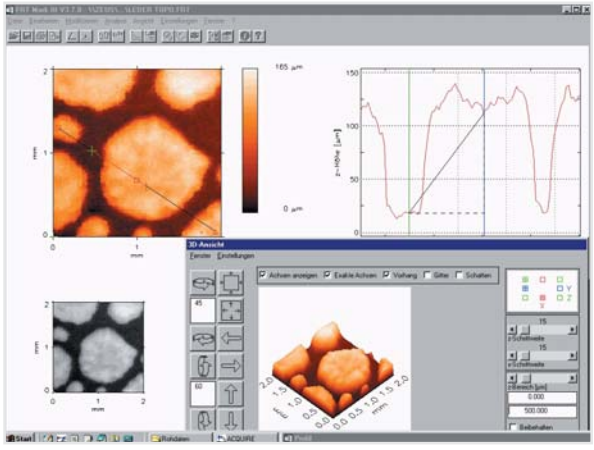
Demo Download
www.frt-gmbh.com

System Requirements

- PC running Microsoft Windows™ 2000/XP
- 128 megabytes (MB) of RAM (256 MB or higher recommended)
- super VGA (800 x 600) or higher-resolution video adapter and monitor
- 35 MB of available hard disk space
- one USB port
- Microsoft Internet Explorer™

Ra:	7,332 µm	Rq:	10,674 µm
Rz:	41,095 µm	Rmax:	65,553 µm
Rp:	39,833 µm	Rv:	25,762 µm
Rt:	65,595 µm	Rsk:	1,254
Rku:	5,620	RPc:	299,273/cm
Rk:	16,389 µm	Rpk:	21,146 µm
Rvk:	9,709 µm	Mr1:	17,706 %
Vo:	0,617 µm³/µm²	Mr2:	87,282 %

example of a roughness evaluation



Mark III analysis example: topview, 3D view and profile with step height

Supported Data Formats

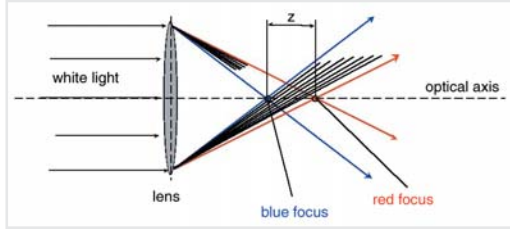
Argus ■ ASCII Text ■ ATOS PLµ ■ Burleigh ■ Fries Research & Technology ■ Hommelwerke ■ Klocke ■ Nanotechnik Klughammer ■ Park Scientific Instruments ■ Perthometer D-Profil und Perthometer Concept (PCD) ■ Mahr RM600 Surface Imaging Systems (S.I.S.) ■ SDF-Format ■ Veeco Metrology Group (Digital Instruments NanoScope, Veeco Dektak)

Other custom formats upon request.

Different measuring tasks require different sensors. The following overview shows a selection of currently available sensors that can be easily combined into FRT measuring systems. Should you have specific questions with regard to choosing the appropriate sensor, please do not hesitate to contact us for assistance. Of course, the next three pages only represent a snapshot of our current sensor portfolio. Please visit us on the Internet for an even wider selection.

Chromatic Sensor CWL The All-Round Sensor

- topography measurement using chromatic white light
- high resolution and accuracy
- extremely fast without edge artefacts
- suited for all types of surfaces, regardless of roughness, reflectivity or color
- precise and small spot size
- durable and wear free due to absence of moving parts
- small measuring head with optical fiber connection
- control electronics compatible with chromatic film thickness sensor CWL FT



measuring principle of the chromatic sensor

Technical Specifications

measuring principle	chromatic white light measurement				
measuring range z*	300 µm	600 µm	3 mm	10 mm	25 mm
measuring distance	4,5 mm	6,5 mm	20 mm	70 mm	80 mm
max. resolution z	3 nm	6 nm	30 nm	300 nm	800 nm
resolution x,y	1 - 2 µm	1 - 2 µm	5 - 6 µm	12 µm	14 µm
measuring angle**	approx. 90° ± 30°	approx. 90° ± 30°	approx. 90° ± 30°	approx. 90° ± 20°	approx. 90° ± 15°

* additional measuring ranges upon request.
** larger angles on light scattering surfaces are possible.

Chromatic Sensor CWL FT Film Thickness, Foil Thickness, etc.

- film thickness measurement using white light
- high resolution and accuracy
- suited for transparent and smooth surfaces
- durable and wear free due to absence of moving parts
- small measuring head with optical fiber connection
- mapping of film thickness in combination with MicroProf® and MicroGlider®
- control electronics compatible with chromatic point-distance sensor CWL

Technical Specifications

measuring principle	interferometric film thickness measurement	
wavelength bandwidth	approx. 400 nm ... 850 nm	
measuring range	2 µm ... 200 µm	
resolution film thickness	10 nm	
resolution x,y	< 40 µm	< 10 µm
measuring distance	26 mm	9 mm
measuring angle of surface	approx. 90 ° ± 5 °	approx. 90 ° ± 5 °

- thickness measurement using infrared light
- high resolution and accuracy
- suited for wafer measurement
- up to five times faster than white light measurement
- up to ten times greater measuring range (up to 3.5 mm)

Thin Layer Sensor FTR — For Semiconductor and High-Tech Products

- spectrally resolved reflection measurement
- multi-layer measurement of separate layers with nanometer resolution
- comprehensive database with parameters of semiconductors, oxides, etc.
- compilation of recipes for every measuring task
- thickness mapping with MicroProf® and MicroGlider®

Application Sheets
www.frt-gmbh.com

Technical Specifications

measuring principle	reflectrometry				
light source	halogen lamp			deuterium halogen lamp	
model	VIS	NIR	VIS/NIR	UV/VIS	UV/VIS/NIR
wavelength range	400 nm ... 850 nm	650 nm ... 1100 nm	400 nm ... 1100 nm	250 nm ... 850 nm	250 nm ... 1100 nm
measuring range thickness	50 nm ... 20 µm	70 nm ... 70 µm	50 nm ... 100 µm*	10 nm ... 20 µm	10 nm ... 70 µm
resolution layer thickness	1 nm				
resolution x,y	200 µm ... 800 µm without optics (better than 10 µm with additional optics)				

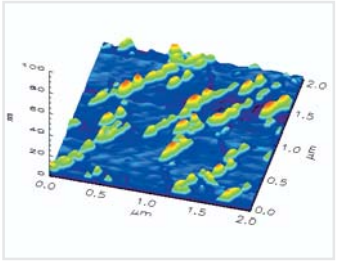
* optionally 1 µm ... 250 µm.

Atomic Force Microscope AFM — Discover the Microcosm

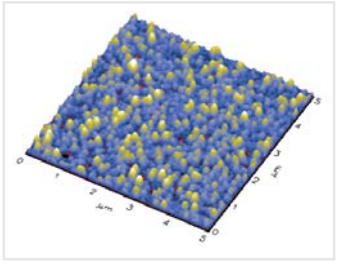
The atomic force microscope (AFM) is a highly sensitive probe head that utilizes a piezo-scanner with very high resolution. This enables you to reach far into the sub-nm-range. Besides surface topography measurement, various available measuring modes enable the determination of many different surface properties. The base configuration features the contact measuring mode. Due to the multi-sensor capability of the MicroProf® and MicroGlider® systems, the AFM sensor can be used in combination with the optical sensors and therefore the measuring range can be extended from a few µm up to 600 mm.

Measuring Modes

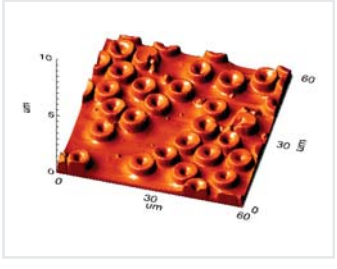
- contact mode
- non-contact mode
- magnetic/electrostatic force
- elasticity mode
- friction/lateral force mode
- Kelvin probe mode
- liquid compatible



AFM measurement on a biological sample



oxide film on a wafer surface

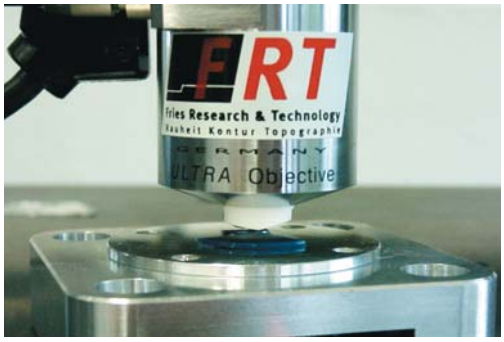


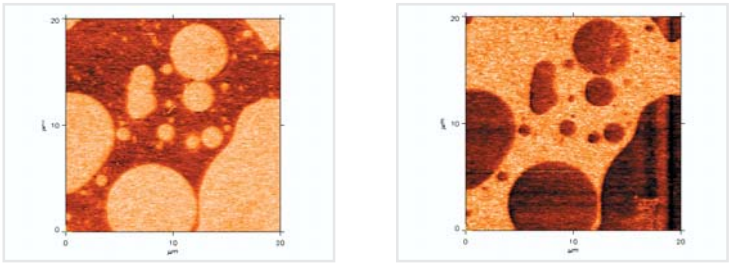
measurement of blood cells

Technical Specifications

measuring principle	atomic force microscopy (AFM)		
measuring range x,y	20 µm x 20 µm	40 µm x 40 µm	80 µm x 80 µm
measuring range z	min. 2 µm	min. 4 µm	min. 6 µm
detection principle	fiber-optic interferometer		
resolution x,y	typ. 5 nm		
resolution z	typ. 2 nm		
scan speed	1-5 lines/s		

FRT





elastic surface properties at different frequencies: left 365 kHz, right 415 kHz

The AFAM probe head is used to determine elastic properties of surfaces, thin films and nanostructures at the nanometer scale, anywhere where conventional macroscopic equipment is limited. Due to its very high spatial resolution the AFAM can analyze even the tiniest failures of material or the thinnest films on a sample. The measurement is performed by inducing an ultrasonic wave into the sample. The elasticity is determined by recording the contact resonance of the system between the sample and the measuring tip.

Confocal Sensor CFP For Special Applications

- fast topography measurement and profile even on sensitive and soft materials
- determination of microstructures
- measurement of ground and polished optical components
- control of electronic components
- inspection of tools and products in the field of plastic injection moulding
- inspection of dimensions, step height, etc. in the field of printed circuit boards

Autofocus Sensor AFL Height Measurement with Laser Light

- suited for glass, plastics and highly reflective surfaces
- fast measurement of roughness, profile, and topography
- measurement is conducted through dynamic focusing
- integrated microscope helps to choose measuring position

Conoscopic Sensor CSL Easily Access Difficult Measuring Positions

- production control for automotive components (interior, cylinders, cam lobes, electronics and more)
- profile measurement for the characterization of sprockets
- topographic measurements at the base of pump housings
- control of depth in blind holes
- measuring of dimensions, step heights, and angles – even on highly structured tools and components

Fringe Projection Sensor FPM Quantitative Measurement via Fringe Projection

- quality assurance in the automotive industry (interior, electronics and more)
- 3D measurement for the determination of waviness, curvature, and dimensions on technical surfaces (tools, rollers, components and more)
- measurement of textiles

The MFE (metrology front end) measuring system series is particularly suited to manufacturers of structured wafers, masks, MEMS and similar products. Because of the very high cleanliness, process and yield requirements in these fields of operation, all tools are especially designed for use in cleanrooms.

MFE systems measure critical dimensions and overlays on the one hand and 3D topography or film thickness on the other. All tools are metrological and comply with the necessary industry standards such as the SECS II / GEM software interfaces. Furthermore, the system is fully automated and equipped with wafer cassettes and part carriers.

An EFEM (equipment front end module) and mini-environment for class 1 cleanrooms rounds off the upper segment of the MFE tool series.

Application Sheets
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Features

- fully enclosed
- class 1 clean room certified
- cassette to cassette handling
- prealignment
- OCR
- systems for 200 mm, 300 mm*

* other systems upon request.

Customers

ASE Inc.
Audi AG
Ball Packaging Europe GmbH
Bayer AG
Beiersdorf AG
BMW AG
Boehringer Ingelheim microParts GmbH
Carl Zeiss SMT AG
DAIMLERCHRYSLER
Dow Benelux N.V.
EKO Stahl GmbH
Fraunhofer-Institute
Freescale
Fuji Magnetics GmbH
General Electric Plastics B.V.
Gillette
HILTI AG
Hoechst Trespaphan GmbH
Human Optics AG
IBM
Infineon Technologies AG
Lexmark International, Inc.
MAN Roland Druckmaschinen AG
Matsushita Electric Works
Nortel Networks Optical Components (Switzerland) AG
Océ-Technologies B.V.
Optische Werke G. Rodenstock GmbH
Philips Electronics Nederland B.V.
Robert Bosch GmbH
Schott Glas
SGL Carbon AG
SIEMENS AG
Sulzer Innotec AG
Texas Instruments
Universities
Voestalpine Stahl GmbH
Volkswagen AG
Western Digital Fremont, Inc.

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