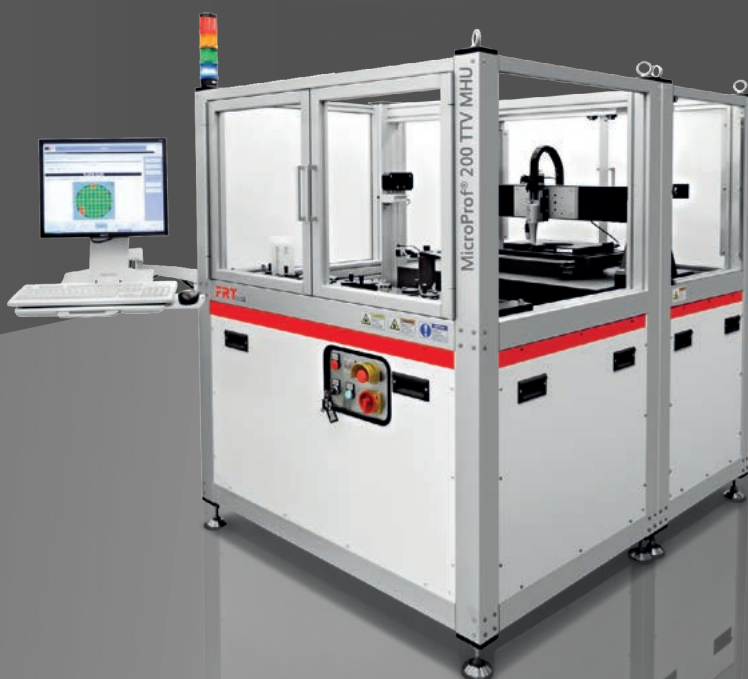
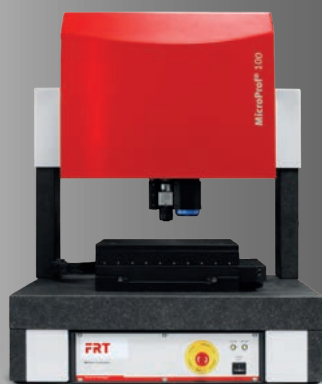


3D SURFACE METROLOGY
SYSTEMS FOR RESEARCH
AND PRODUCTION

FRT
THE ART OF
METROLOGY™

The MicroProf®- Series

non-contact and non-destructive measurement of
roughness, profiles, topography and film thickness





ONE TOOL FOR ALL MEASURING TASKS

MULTI-SENSOR TECHNOLOGY CREATES MAXIMUM FLEXIBILITY

In modern 3D surface metrology, the **MicroProf®** by FRT is established as the standard measuring tool. It can be used to perform a wide range of measurement tasks quickly, efficiently and intuitively.

The **MicroProf®** has been used for many years in the semiconductor, microelectronics, medical and automotive industries. Topography, step height, roughness, layer thickness and other parameters can be measured contactlessly and non-destructively.

With the multi-sensor technology developed by FRT, different optical measuring methods can be combined in one tool. Depending on the requirements, the **MicroProf®** enables a fast overview measurement of the entire sample as well as high-resolution detail measurements - this is made possible by the combination of point, line, surface and layer thickness sensors, as well as scanning force microscopy. The measuring ranges can vary from meters to sub-nanometers.

With FRT software, the measuring tasks are individually configured and implemented either manually or fully automatically.

The **MicroProf®** is a high-precision measuring tool that can be flexibly retrofitted and is also space-saving.

| MEASURING TASKS | | | | |
|-----------------|-----------------|-------------------------------|-------------|--------------------|
| Topography | Roughness | Film Thickness / Layer Stacks | 3D Map | Profiles |
| Thickness | TTV | Bumps | Coplanarity | Vias / TSV |
| Trenches | Bow | Warp | Waviness | Flatness |
| Geometry | Slope | Radius of Curvature | Angle | Parallelism |
| Thermal Load | Membrane Bow | Stress | Overlay | Critical Dimension |
| Saw Marks | Roll-off Amount | Defect Size | Grain Size | Nanotopography |
| ... | | | | |

POINT SENSORS

- > extremely flexible
- > any scan range
- > fast on large areas

FIELD OF VIEW SENSORS

- > highest resolution
- > large areas via stitching
- > fast on small areas

ATOMIC FORCE MICROSCOPY

- > nm resolution
- > large scan area
- > easy handling

FILM THICKNESS SENSORS

- > highest resolution
- > large measurement range
- > measurement of multi layers



SUITABLE FOR ANY SAMPLE SIZE WHETHER SMALL OR LARGE

The measuring system can be provided in different versions. Depending on the sample size, the sample holder and the travel range are configured.

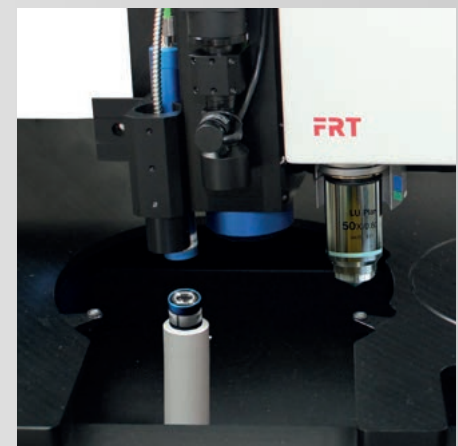
The smallest version is the **MicroProf® 100**, a table-top tool. Two larger stand-alone systems, the **MicroProf® 200** and **MicroProf® 300**, differ mainly in the travel range size. The Material Handling Unit (MHU) is also available for these two systems. From manual measurement and evaluation to fully automatic execution with sample handling, you can determine the degree of automation yourself. An overview of the corresponding software and hardware components follows.

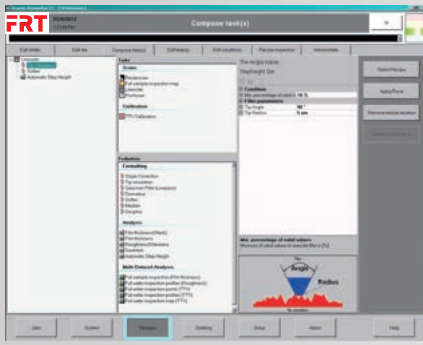


| | MicroProf® 100 | MicroProf® 200 | MicroProf® 300 |
|----------------------------|-----------------|-----------------|-----------------|
| xy-travel | 150 mm x 100 mm | 250 mm x 200 mm | 415 mm x 305 mm |
| multi-sensor configuration | X | X | X |
| TTV-option | X | X | X |
| tabletop unit | X | | |
| stand-alone system | | X | X |
| automation (optional) | X | X | X |
| sample handling (optional) | | X | X |
| thermo unit (optional) | X | X | X |

CONSIDERATION OF BOTH SIDES OF THE SAMPLE FROM ABOVE AND BELOW

With the TTV option, double-sided sample testing is possible. The upper and lower sides of the sample can be measured during the same measuring procedure and the sample thickness can be determined, too. The output of the total thickness variation (TTV) and other surface parameters such as roughness, waviness, flatness of both surfaces or the parallelism of both sides is possible. The TTV option can be easily retrofitted.

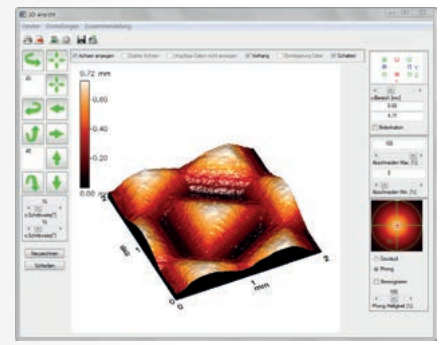




recipe creation – process definition in Acquire Automation XT



automated measurement procedure sequence in Acquire Automation XT



3D view of a measurement in Mark III

SOFTWARE MADE BY FRT

INTUITIVE USER GUIDANCE – ACQUIRE

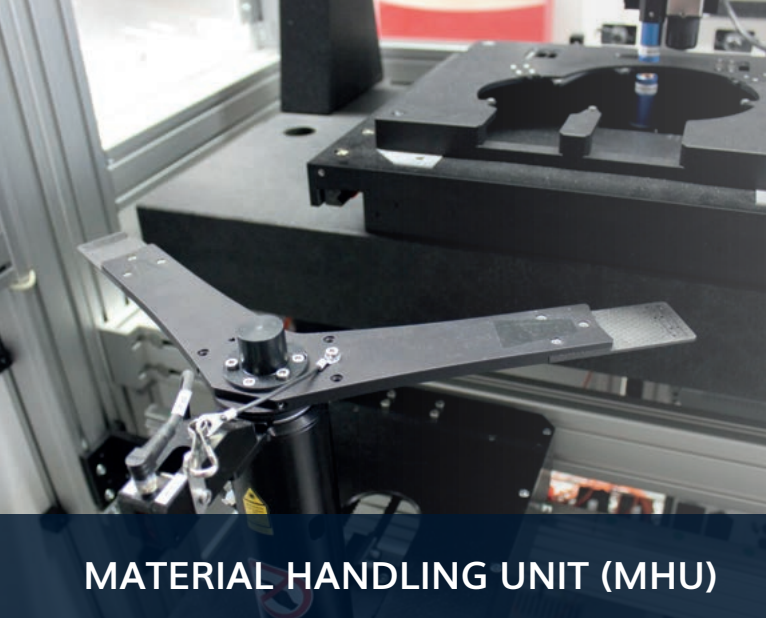
In simple steps, the FRT software **Acquire** guides you through manual measurements, from switching on the tool to executing the measuring process. With the structured user guidance, you can easily perform all kinds of manual measurements. All sensors used can be controlled via the software user interface. Whether point, profile or 3D measurements: Set the optimum measurement parameters, monitor them with the intuitive live display and save your measurement data afterwards.

COMPREHENSIVE ANALYSIS – MARK III

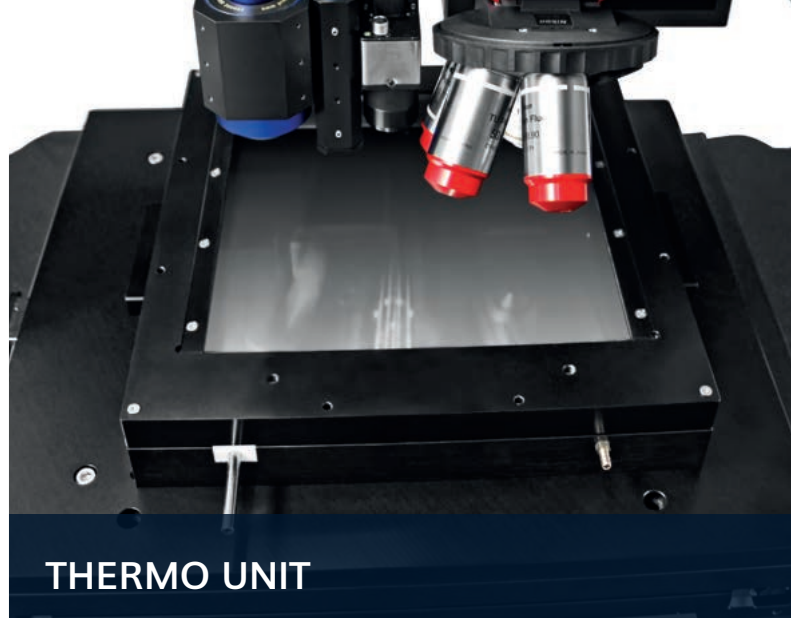
The **Mark III** analysis software (developed by FRT) offers a comprehensive package for processing, evaluating and presenting your 2D or 3D measurements. The latest standards, including the calculation of roughness and waviness, as well as many processing and filtering functions are implemented. Choose the right analysis function for your application from a wide range of options, e.g. flatness, step height, layer thickness and many more. Present your results in 3D, profile view or top view and design your own measurement reports. This user-friendly software also includes various import and export functions and can automatically perform several processing and evaluation steps in one measurement series.

AUTOMATIC MEASUREMENT AND EVALUATION – ACQUIRE AUTOMATION XT

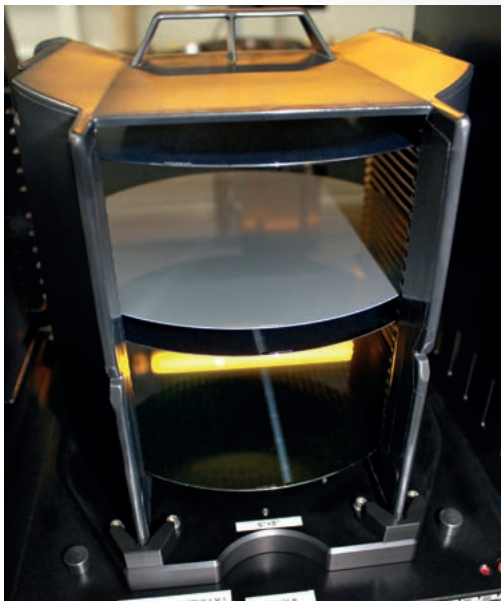
The fully automatic execution and evaluation of the measurements is possible with the recipe-based FRT software **Acquire Automation XT**. This software offers comprehensive possibilities, from manual to fully automatic measurement in one-button operation and the integration into production control systems, e.g. via a SECS/GEM interface. Select from a variety of packages the suitable measuring and evaluation routine for your measuring task. For recurring structures, a layout assistant can support you in learning the measuring positions with a graphical user interface (GUI). Optionally, an exact sample alignment via pattern recognition is also possible. You can configure different measurement tasks with different sensors to run them one after the other as a measurement sequence. This can include performing measurements, processing and analysis with intelligent algorithms, outputting and visualizing results in the form of reports, and exporting results in different data formats. Of course, the current DIN-EN-ISO and industry-specific standards such as SEMI are adhered to. With its SEMI-compatible user interface, **Acquire Automation XT** meets all requirements for use in production and laboratories. And, of course, the software includes user administration functions including the assignment of individual user rights.



MATERIAL HANDLING UNIT (MHU)



THERMO UNIT



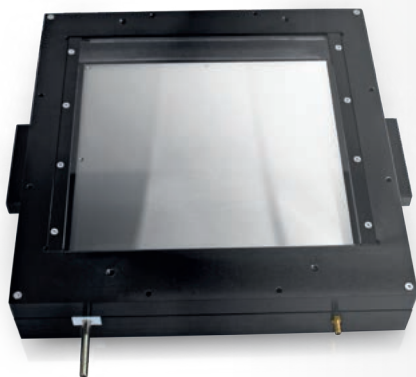
SAMPLE HANDLING

The automatic sample handling enables high throughput rates even in automated measuring processes. Fully automated measurements are particularly in demand in the semiconductor, MEMS and LED industries. With the **MicroProf®** MHU, even fully automated measurements with different samples or wafers can be performed.

From up to four cassettes, the **MicroProf®** fully automatically analyzes wafers with a diameter of two to 12 inches with full integration into the production process.

Optionally, the measuring system can be equipped for sample sorting according to desired criteria.

Other systems for sample handling, e.g. SCARA robots can also be integrated.



SURFACE MEASUREMENTS UNDER TEMPERATURE INFLUENCE

Under thermal load, components change or deform, resulting in malfunctions or even breakdowns. Therefore the topographical evaluation of the samples is indispensable in electronic engineering and materials technology. With the **MicroProf®** TL you can measure the surface topography of different components under controlled thermal load. For this purpose, the samples are placed on a heating and cooling plate in a closed chamber (glass cover) and heated or cooled. The sample temperature can be precisely adjusted and varied with individually configurable temperature profiles. Both fully automatic measurements of the surface topography at different temperatures and dwell times at constant temperatures are adjustable. The thermo unit is available as an extension for all FRT tools and is mounted as a separate module.

MEASURING EXAMPLES

VIAS / TSV

High aspect ratio vias and TSV

Area measurement of a single TSV
 $\phi = 60 \mu\text{m}$
 $t = 250 \mu\text{m}$

Profile measurement of a single TSV (depth, top & bottom CD)

TRENCHES

High aspect ratio trenches

Area measurement of a wafer with trenches

Profile measurement of a single trench

GLOBAL / LOCAL WAFER PARAMETERS

Measurement of global and local wafer parameters

Full wafer thickness map in 3D view

Wafer map with local parameters (LTIR, LTV, LT, LFPD, etc.)

TOPOGRAPHY (SHAPE, STRUCTURE)

Standard topography measurement

3D topography measurement of artificial leather in car interior

Honing structure on a cylinder surface

TOPOGRAPHY (SHAPE, STRUCTURE)

Standard topography measurement

Topography measurement of a micro lens array

NIP-coated substrate with concentric cut-ins of the rotating diamond

TOPOGRAPHY TOP / BOTTOM

Simultaneous topography measurement on both sides

Cylinder head gasket, correlation top and bottom side

Cylinder head gasket, correlation top and bottom side

ANGLE

Angle measurement

Angle of the flanks in dental drills

Area measurement of a cannula, surface roughness and angle

FILM THICKNESS / LAYER STACKS

Thin film and layer stack measurement

Layer thickness of a transparent adhesive film

Layer thickness of a transparent foil

Talk to an expert!

Headquarter
FRT GmbH
 +49 2204 84-2430
 +49 2204 84-2431
 info@frt-gmbh.com

FRT Shanghai Co., Ltd.
 +86 21 3876 0907
 +86 21 3876 0917
 info@frt-china.cn

FRT of America, LLC (West)
 +1 408 261 2632
 +1 408 261 1173
 info@frtofamerica.com

www.frtmetrology.com

FRT partners:

FRT reserves the right to change technical specifications. 03/2019