

Application Tip



ROUGHNESS

MEASUREMENT ON SHAFTS

APPLICATION TIP ROUGHNESS MEASUREMENT ON SHAFTS

You measure roughness and waviness on shafts
fully automatically

This is what **EXACTLY** means to us.

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EXACTLY

Fully automatic roughness measurements on shafts

Introduction

Every day, we use objects that make our lives more convenient and comfortable, usually unconsciously. Many of them are motor driven to perform the expected function. These items may be household appliances such as refrigerators, washing machines, vacuum cleaners, hair dryers, PCs, circulation pumps or other vehicles such as cars, motorcycles, bicycles, railway, construction machinery, trucks or buses. Axes and shafts are essential for the functionality of all these devices and objects. Without shafts and axles, these devices, systems and vehicles would not work. Our everyday life would be inconceivable without these useful helpers.

Extensive tests are essential to ensure functionality, reliability and durability. In addition to the dimensional measures and the shape and positional deviations, roughness measurement plays a key role in particular. Defined and tolerated roughness and straightness on shafts or axles are responsible for quiet running behavior, tight bearing fits, low bearing friction, high stability due to low notch effect, long life and minimal wear.

The roughness and waviness tolerances defined in the drawings are often tested in the production line with standard measuring stations in which the operator positions manually on the individual measuring points. Mechanical stops or scales facilitate positioning to the respective measuring locations, but the measurements must also be manually started and carried out in this case so that the time required for the operator is correspondingly high.

Measuring station MarSurf XR 20 CNC with GD 120 for fully automatic roughness and waviness measurements on shafts

With the MarSurf XR 20 CNC, the roughness, the waviness and the straightness can be measured fully automatically on the bearings of shafts. The operator only has to clamp the shaft and start the measuring program. Afterwards, all measurements are carried out automatically at the selected measuring locations and the programmed features are evaluated.

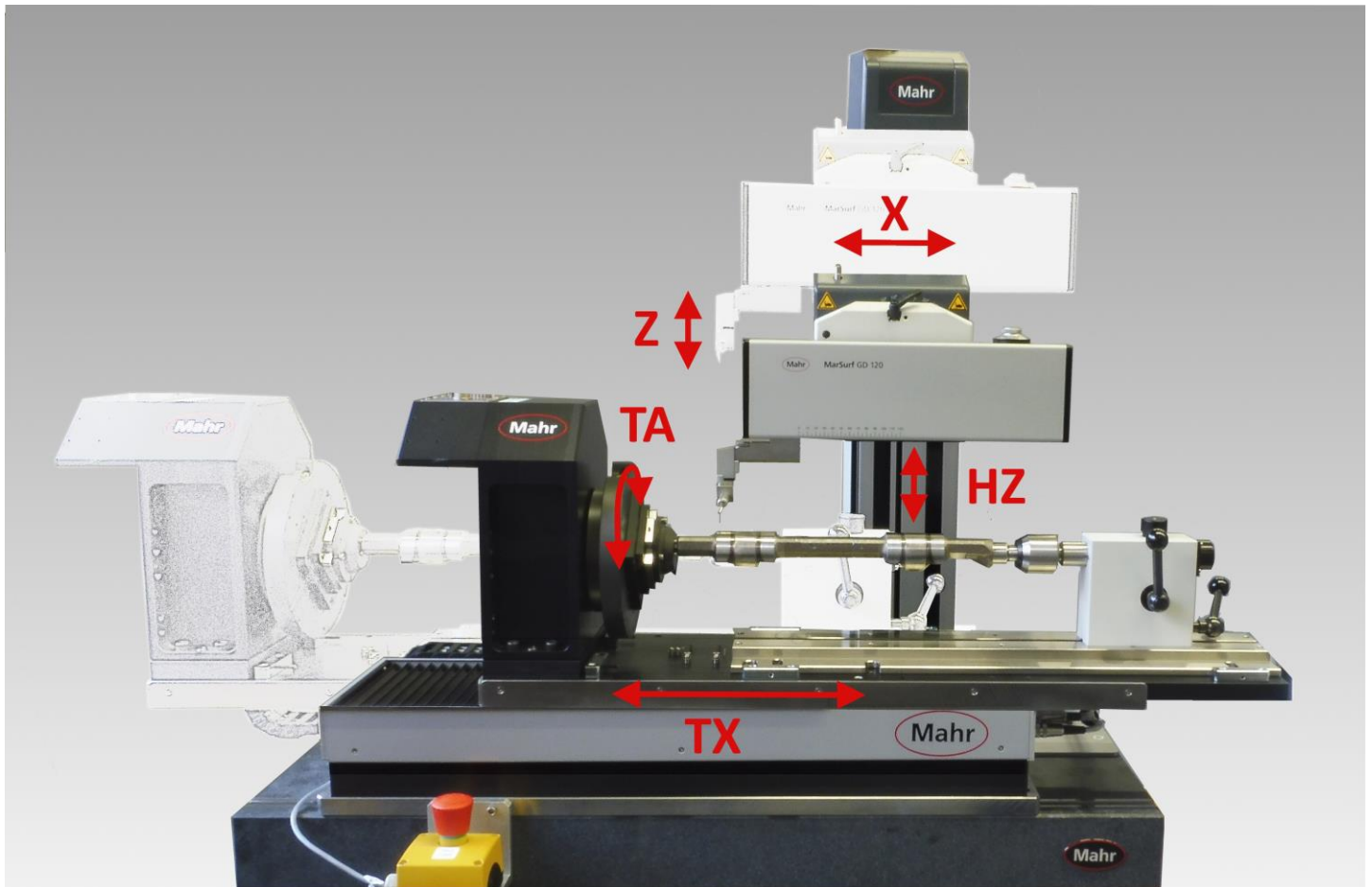


Figure 1: Measuring station MarSurf XR 20 CNC with GD 120 for fully automatic roughness and waviness measurements

Fully automatic roughness measurements on shafts

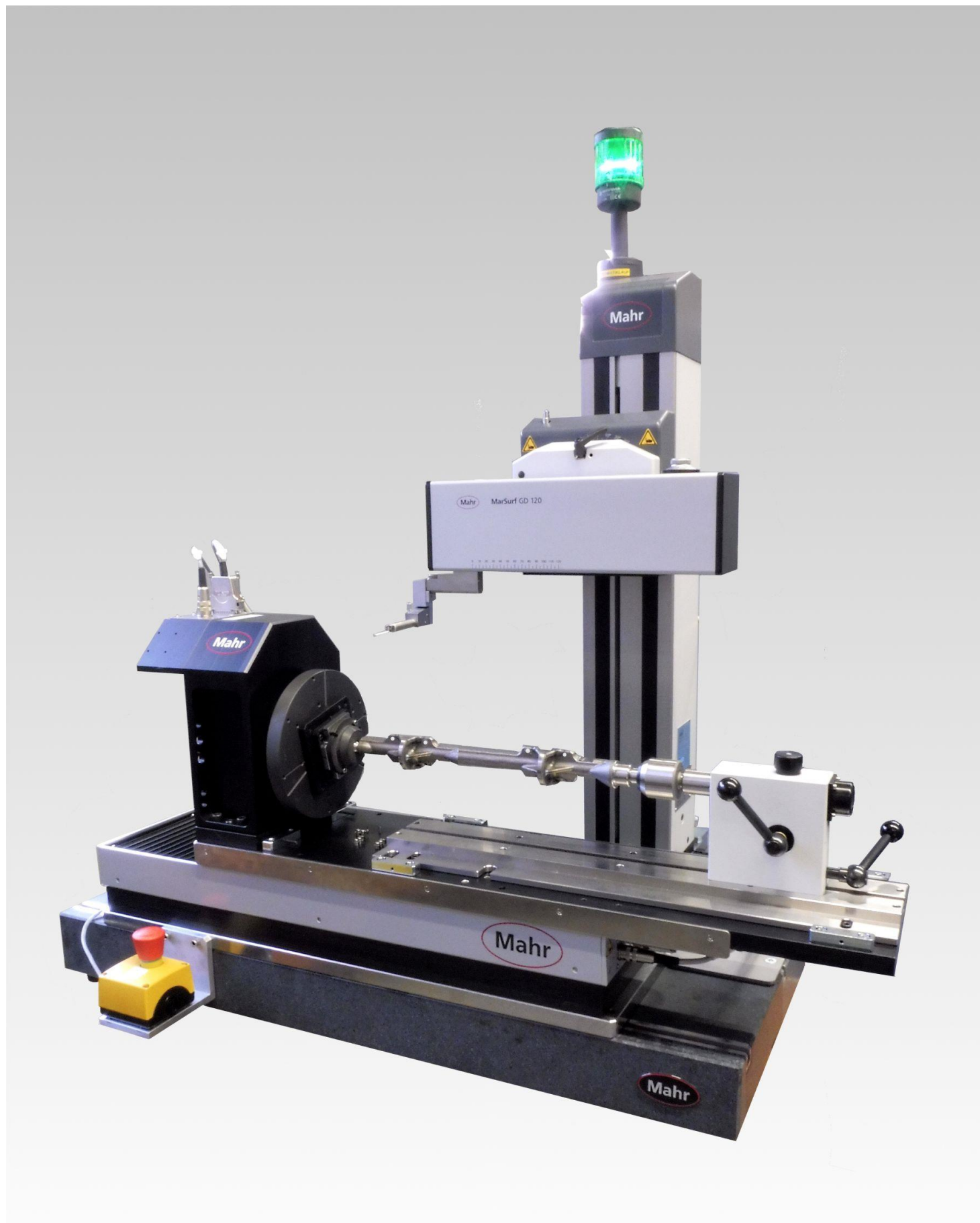


Figure 2: Measuring station MarSurf XR 20 CNC with GD 120 drive unit and a countershaft

Fully automatic roughness measurements on shafts

After the measurement program has been started, the operator is shown a photo of the shaft to be measured and its clamping on the measuring station as well as additional instructions (Fig. 3). The angular position is defined by a dog on the tailstock and a bore in the shaft.

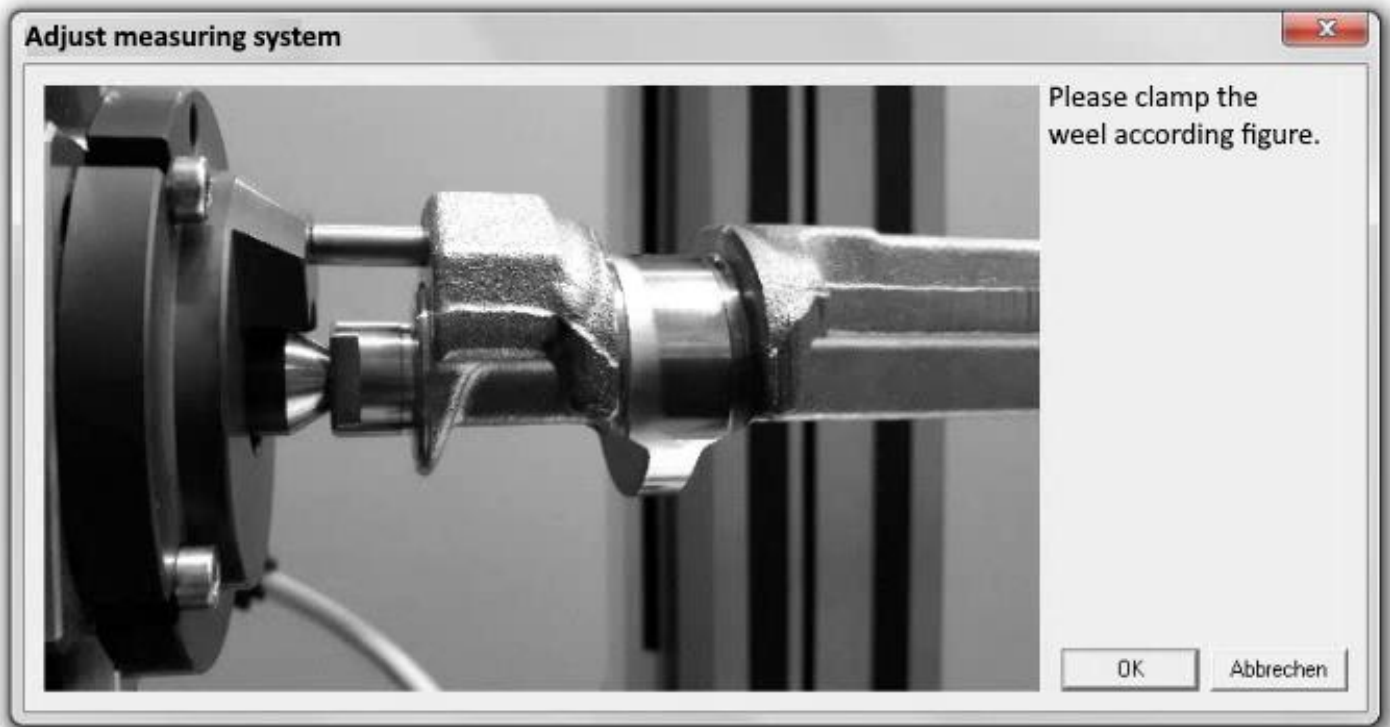


Figure 3: Instructions for inserting the shaft into the fully automatic roughness measuring station

Afterwards, all selectable measuring locations and features are displayed clearly in a graph so that the operator can easily select the positions to be checked (Fig. 4).

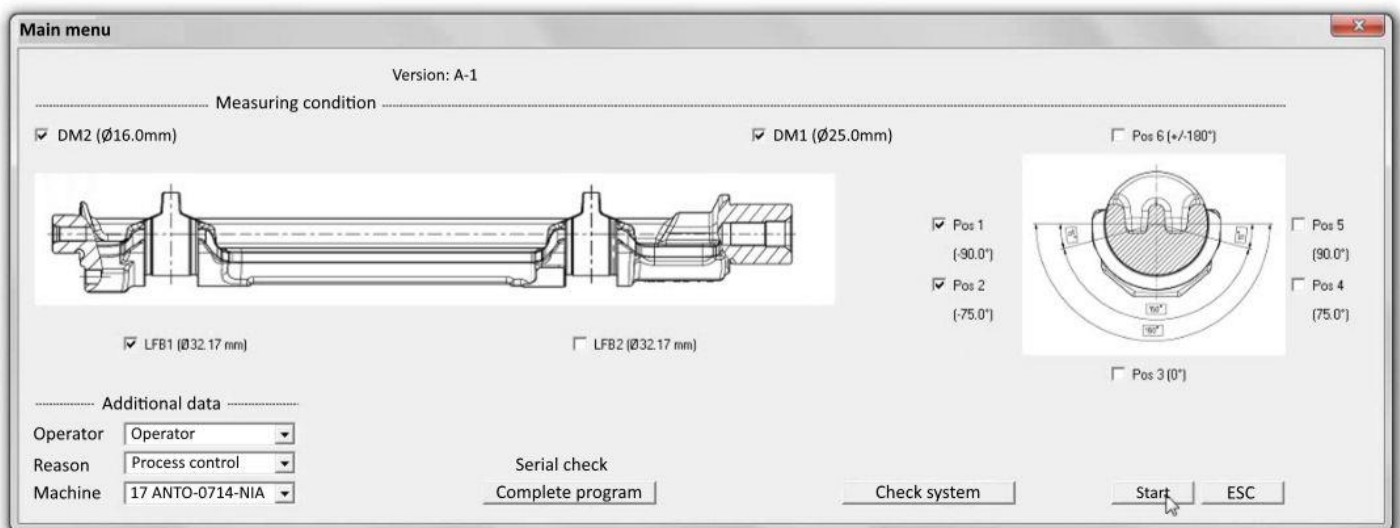
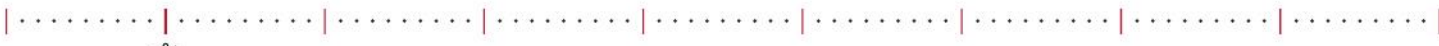


Figure 4: Instructions to select measuring points

The exact determination of the measuring locations in the horizontal direction takes place with a measurement with the TX axis at the reference bearing and subsequent evaluation of the measured profile for determining the position of the bearing edge (Fig. 5). The roughness and waviness measurements then take place exactly in the required areas of the shaft. This ensures that the measuring locations are reliably and repeatedly approached and a high measuring device capability is achieved. Not least also due to the fact that the operator has no influence on positioning and evaluation.



Fully automatic roughness measurements on shafts

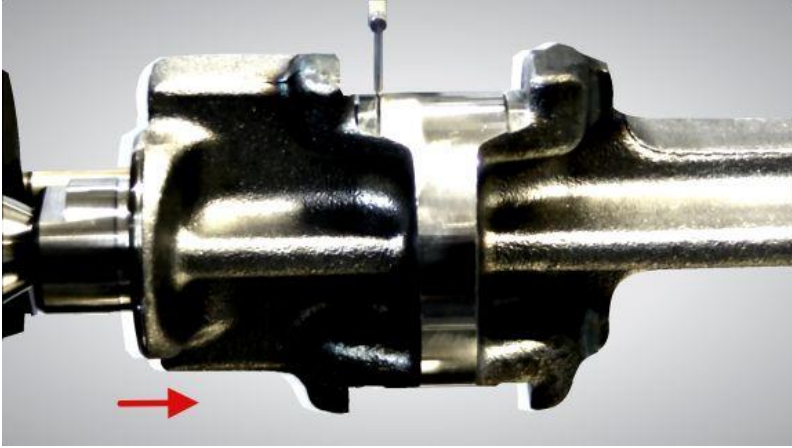


Figure 5: Search for the left edge of the reference bearing with the horizontal table axis TX

The positioning of the probe to the selected measuring locations takes place horizontally with the TX axis and on the circumference of the shaft to be tested with the rotation axis TA. In order to reliably ensure the angular position, the tailstock of the TA axis contains a dog and positioning pin for the shaft. The fast, vertical positioning is carried out with the ST 500 CNC measuring column so that the drive unit with the push button is located at a sufficiently large safety distance when the shaft is changed.

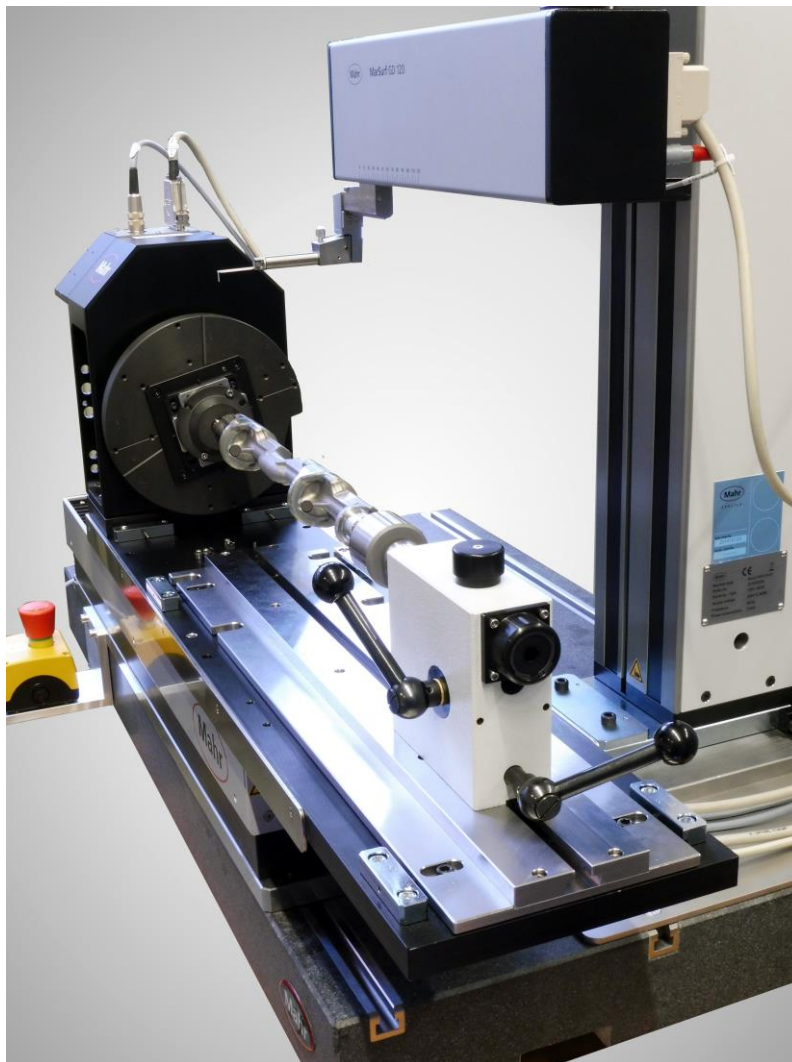


Figure 6: MarSurf XR 20 CNC

The measurement of the **roughness** and the **waviness parameters** is carried out with the MarSurf GD 120 drive unit and the **MFW 250 B probe system** attached at right angles to the measuring X axis. Thus, even larger interfering edges do not form an obstacle in carrying out measurements on shafts or crankshafts.

Time and cost savings with MarSurf XR 20 CNC

If, for example, 18 measuring locations are tested with a manual measuring station, a suitably trained operator will need about 36 minutes. For the same test with the fully automatic measuring station MarSurf XR 20 CNC, the operator only needs 2 minutes for the clamping and unloading of the workpiece and the starting of the measuring program. The fully automatic measuring procedure for measuring all 18 measuring points takes 12 minutes. Thus the operator saves 34 minutes per test cycle. As a result of the automatic measuring sequence, the test time is reduced by 24 minutes. This saves either personnel costs or increases the test capacity by 300%.

Fully automatic roughness measurements on shafts

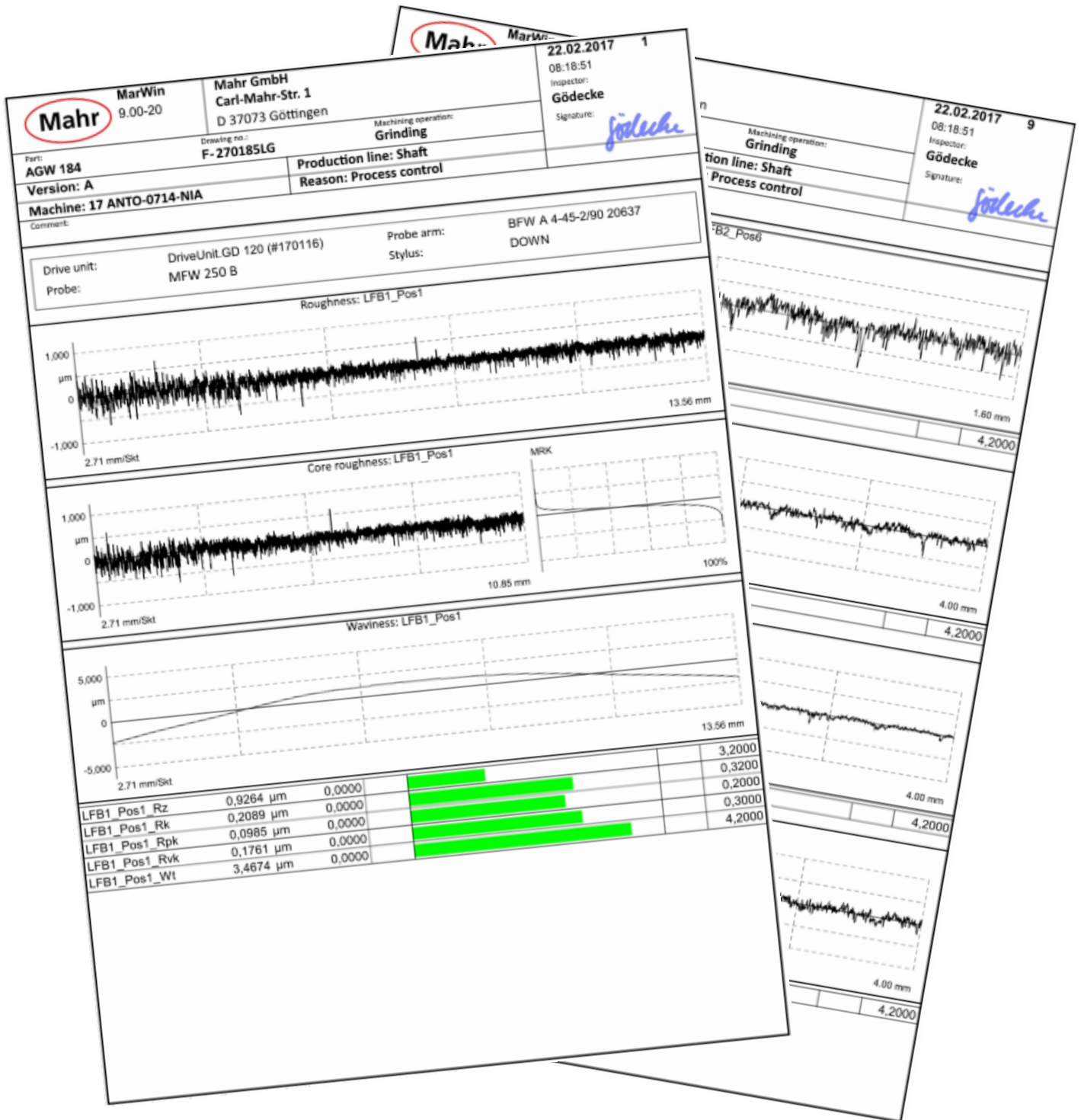


Figure 7: Comprehensive and meaningful logging of the measurement results with MarSurf XR 20 CNC

Comprehensive and meaningful measuring records

The measuring records are automatically generated according to the drawing inputs and the selected measuring locations. They can be printed out or exported automatically as a PDF file.

Automatic data export with or without demand

The measured results can be exported with or without demand into automatically generated file paths in the QS-Stat format. The manufacturing steps can therefore be monitored and controlled in a process-safe manner.

Fully automatic roughness measurements on shafts

Roughness measurements on shafts in production

Due to the microstructure of surfaces to be measured, vibrational influences in roughness measurements have a not negligible influence on the measurement results. For this reason, **an air damping system** is integrated below the measuring station in order to passively isolate ambient vibrations.

The **patented magnetic holder of the MFW 250 B inductive probe** with its ceramic probe arm and its diamond probe tip ensures a fast, tool-free probe exchange, and on the other hand for **collision protection in case of faulty operation** by leveraging the probe arm after exceeding the magnetic holding force. The **safety concept** of the GD 120 drive unit ensures a **fast emergency stop of all axes** in order to protect man and measuring machine against damage in the event of a collision.

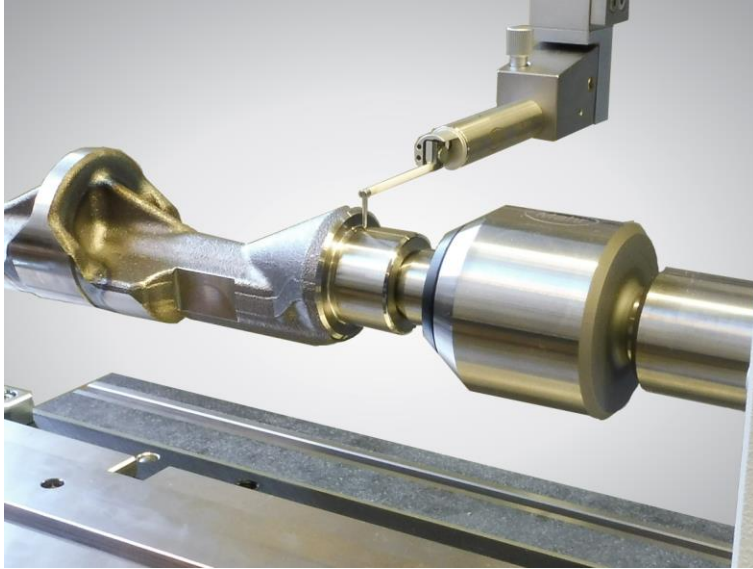


Figure 8: Roughness measurement of a shaft bearing

Technical data

Shaft length:	max. 445
Shaft \varnothing :	max. 190
Shaft weight:	max. 15 kg
Vertical axis HZ	500
Table axis TX	400
Rotation axis TA	360°
Drive unit	
MarSurf GD 120	120
Probe measuring ranges	$\pm 250 \mu\text{m}$

Deviating dimensions upon request

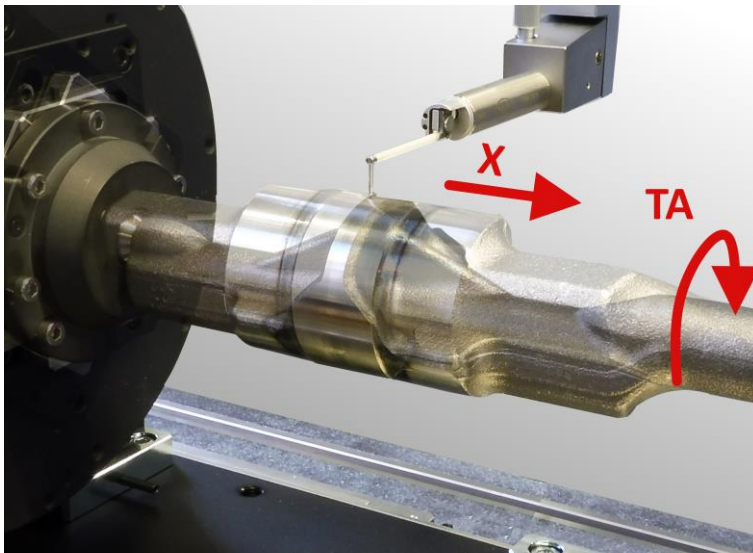


Figure 9: Measurement of a bearing at different points on the circumference

MarSurf XR 20 CNC: Fully automatic roughness measuring station for shafts, countershafts, camshafts and crankshafts

- High testing capacity thanks to fully automated, fast testing of the measuring points on shafts, even in different locations on the circumference
- Very good reproducibility of the results of the measurements by means of a fully automatic search system for testing at exact measuring positions
- Minimal operator training needed due to simple menu navigation
- Fully automatic measuring sequence reduces the personnel effort on changing the shafts and starting the program
- Measurement directly in the production environment
- Part-specific holders clamp the shafts reliably and reproducibly
- Optional: Straightness measurement with MarSurf XCR 20

To receive further information on other fully automatic measuring stations from Mahr, please contact:

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Application tips and videos can be found here:

<http://www.mahr.com/en/Services/Production-metrology/Know-how/Application-Tips/General-Application-Tips/>



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