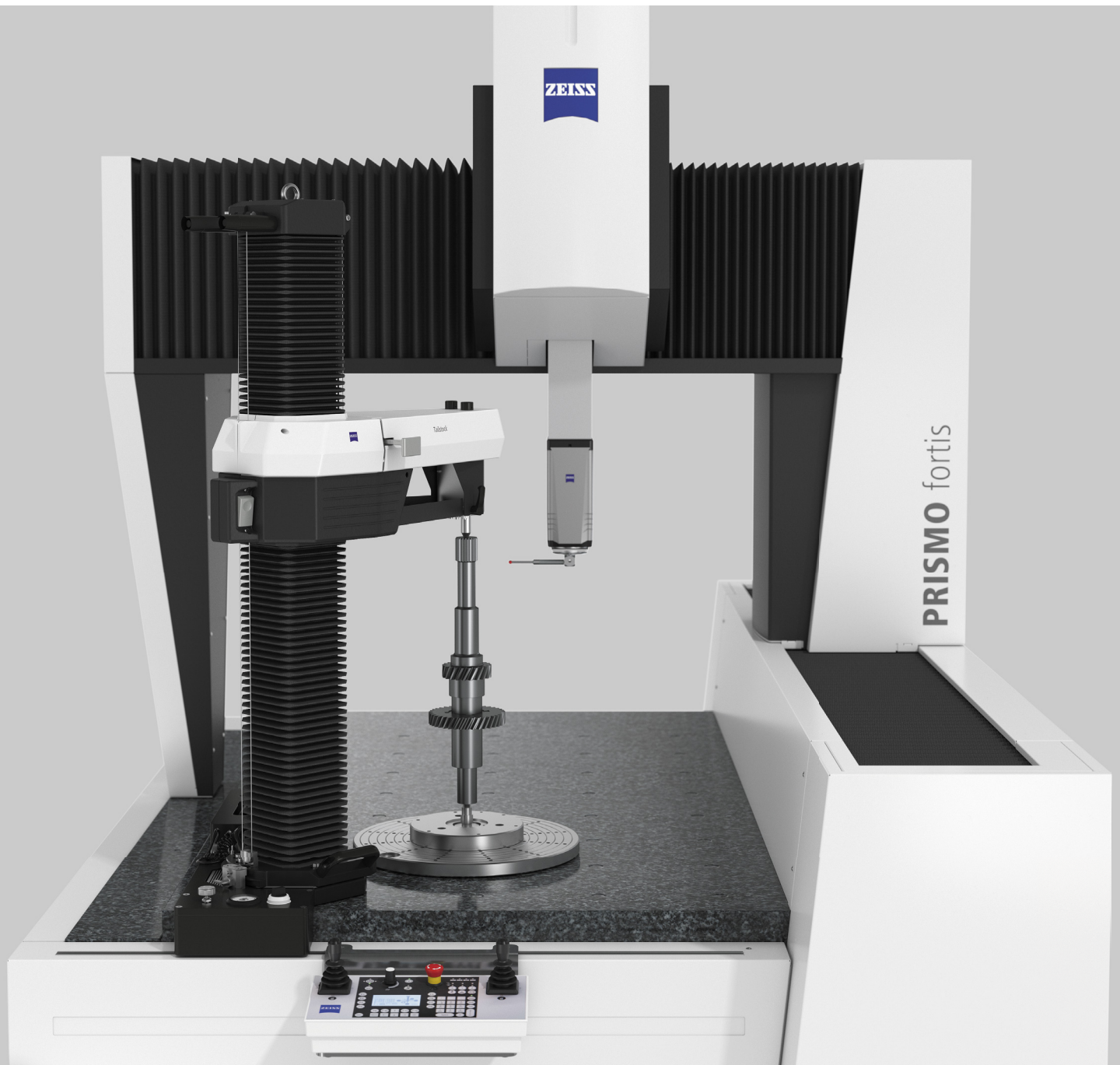


# Technical paper

Flexible tailstock solutions from ZEISS

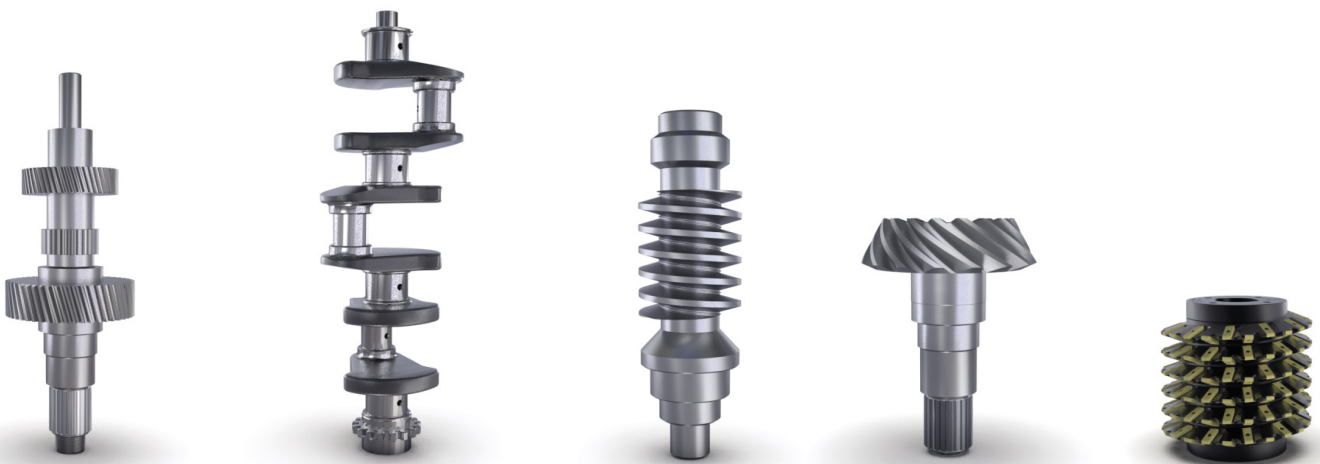


# ZEISS TS tailstock for ZEISS PRISMO Family delivers unique flexibility

Clamping between centers offers considerable advantages for the measurement of shaft-like measuring objects, since this method can handle many rotationally symmetrical workpieces such as gears, camshafts, crankshafts, and screw compressors in a highly effective manner. As unique tailstock solutions that enable clamping between centers on a wide variety of ZEISS PRISMO Family CMMs, the TS-7 and TS-10 from ZEISS help CMM operators tap into these benefits for added flexibility and cost-effectiveness. Unlike the gear or shaft measuring machines typically used for such workpieces, universal CMMs equipped with a ZEISS TS tailstock single-handedly cater to a much broader range of workpieces and measuring operations. Suitable for particular ZEISS PRISMO CMMs featuring the ZEISS rotary table RT-AB-600, the ZEISS TS tailstock is ideal for enjoying the speed and accuracy that comes with clamping between centers – and the versatility of measuring more than just rotationally symmetrical workpieces. Promoting short setup times and swift alignment via the close interplay of hardware and software, this 2-in-1 concept is exclusive to ZEISS.

The major upside of clamping between centers in particular – and measurement with a rotary table in general – becomes clear when compared to other solutions such as measurement without rotary table and star stylus systems. Star stylus systems for gear metrology without rotary table typically use a total of 8 styli in a complex process that involves substantial travel and occupies a large area of the measuring volume. As all styli are responsible for the result, these must interact perfectly and may be compromised by any fluctuations in temperature. In contrast, the method of clamping between centers requires only one single stylus because the rotary table is responsible for repositioning the workpiece. It also features very little travel in the measuring volume and supports the use of reduced stylus systems.

Though CMMs are of course already capable of measuring rotationally symmetrical parts, those without a tailstock extension typically perform clamping with a chuck. While this approach permits universal clamping of various measuring objects, it is unable to clamp interfering contours on the shaft ends. In providing deformation-free clamping between centers, the ZEISS TS tailstock ensures stable handling of such contours and thus complete measurement of shaft-like measuring objects in a single clamping position. And as the chuck can be stacked on top of the rotary table center unit, both clamping methods – clamping between centers with the tailstock and clamping via a chuck without the tailstock – can be supported. All this combines the benefits of clamping between centers with the familiar flexibility of the ZEISS PRISMO Family.

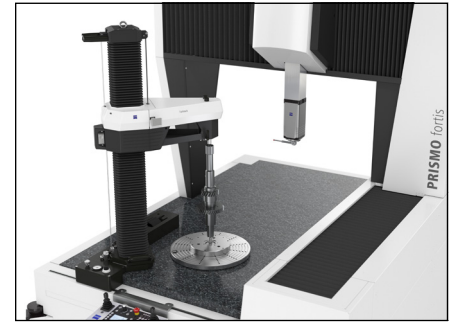


*Typical applications: gears/gear shafts, crankshafts, worm shafts, bevel gears, gear hobs*

## ZEISS TS tailstock expands CMM scope of performance

The task of clamping between centers is traditionally undertaken by gear or shaft measuring machines, which are specialized devices that can only measure rotationally symmetrical parts and permanently feature a tailstock as a fixed component. The TS-7 and TS-10 are flexible extensions that can

be quickly assembled and adjusted, or disassembled if not required. Thanks to these extensions, clamping between centers can now be performed by certain ZEISS PRISMO types featuring a Z-axis of 700 or 1000 mm, the ZEISS rotary table RT-AB-600, and faceplates with a diameter of  $D \leq 400$  mm. The maximum permissible workpiece weight in all cases is a substantial 40 kg.



ZEISS TS tailstock installed on ZEISS PRISMO fortis

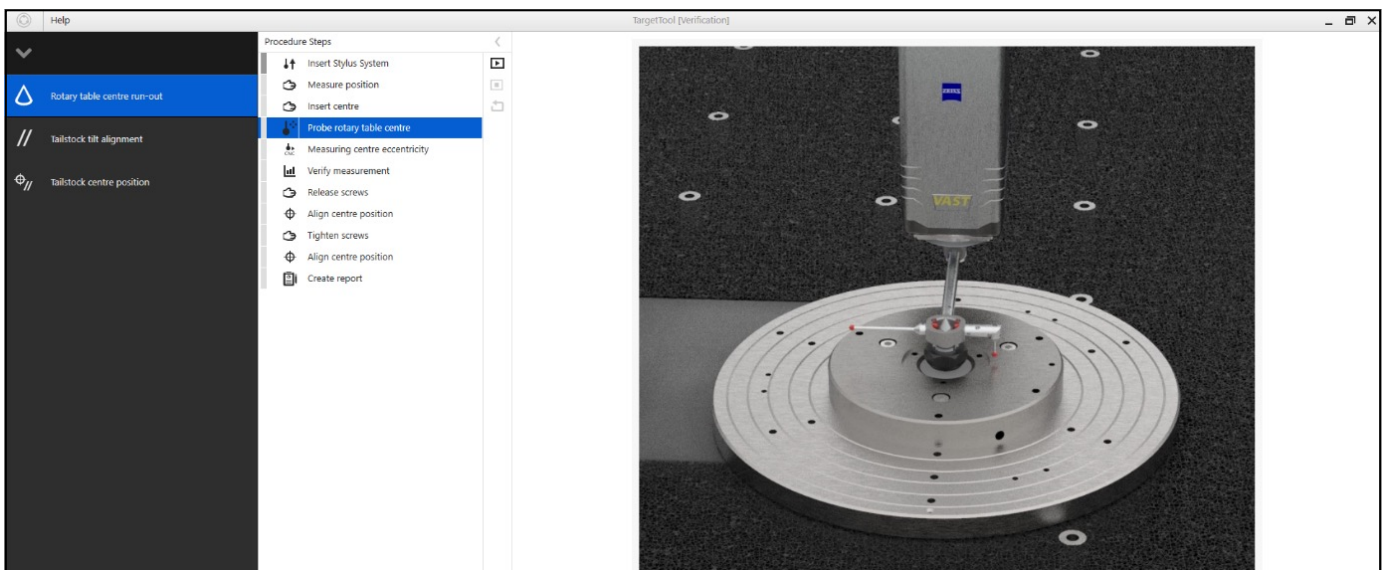
## Software support for dynamic alignment of centers

Key to accuracy for clamping between centers is performing coaxial alignment of the top and bottom centers. On gear or shaft measuring machines the centers must be aligned manually in multiple iterations performed using a dial gage. The ZEISS TS solves this issue by combining its hardware features with the dedicated ZEISS TargetTool

software, which integrates the CMM into the alignment process to achieve ideal positioning of the centers.

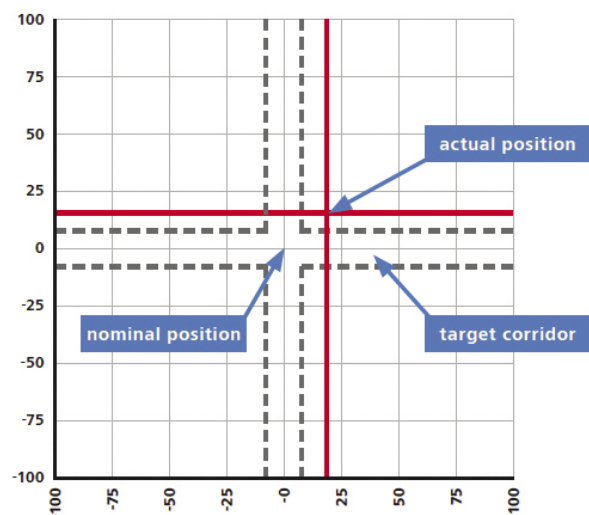
This remains a mechanical process at heart, but one that is supported by a software interface to guide the user. Although the centers are still aligned manually, the ZEISS TS makes this process a breeze thanks to a live view of the alignment process in ZEISS TargetTool that even provides step-by-step

instructions for greater user-friendliness. This interactive aid from ZEISS ensures successful alignment in a single iteration and improves precision by encouraging more frequent alignment for accurate measurement. And as a further benefit, the rotary table center and the tailstock center can easily be exchanged using a morse cone taper MK 2 interface for greater operational freedom.



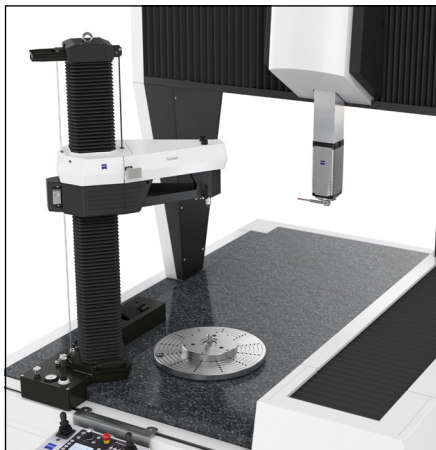
ZEISS TargetTool software prompts the user to probe the rotary table center...

...and provides a live view for precise alignment in a single iteration



## Ergonomic handling for greater ease of use

The ZEISS TS tailstock is connected to a dedicated base unit that is in turn installed on the granite plate of the ZEISS PRISMO. Weighing 39 and 42 kg respectively, the ZEISS TS-7 and TS-10 can be attached to this base unit manually by two persons or using a crane. The alignment of the tailstock and the process of changing from a universal CMM to a system for shaft-like measuring objects

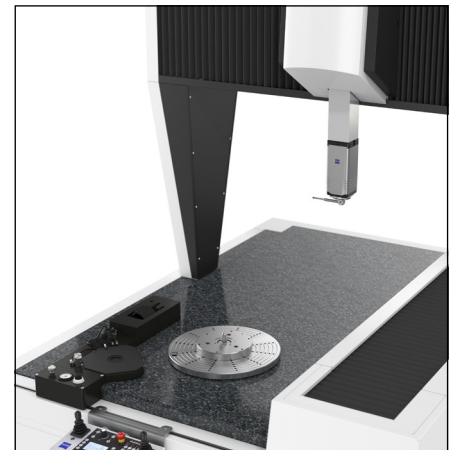


can be performed in well under an hour. The ergonomic and pneumatic tailstock can easily be moved up and down using a single hand, making it straightforward for all users to adjust the height of the tailstock arm.

The ZEISS TS provides three operating modes: located in the measuring position, rotated to the parking position, and disassembled. The parking position ensures much greater accessibility of the CMM measuring volume when the



ZEISS TS is not in use – and eliminates the need to disassemble the tailstock each time. If only one operator is present or if the tailstock is used at semi-frequent intervals, this provides a major boost to flexibility. The ZEISS TS can even be removed entirely from the granite plate if necessary, leaving behind only the minor interfering contour of its control unit and base unit in a corner in which no clamping of other workpieces occurs.



*ZEISS TS tailstock in measuring position, in parking position, and after disassembly*

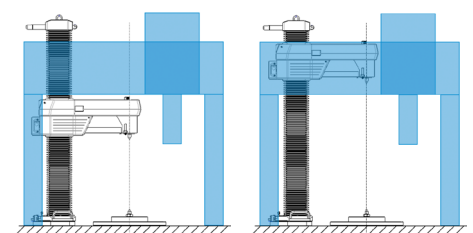
## Safety features, range of accessories, and summary

The workpiece clamping length ranges from 0 to 470 mm for the TS-7 and from 0 to 875 mm for the TS-10, with clamping lengths as high as 685 mm (TS-7) and 1040 mm (TS-10) possible in positions where the CMM bridge cannot travel over the tailstock arm. ZEISS TS features a predefined danger area for safe operation: In the event of a hazard in this danger area, the Y-axis safety switch automatically reduces the speed of the CMM bridge and performs a forced stop when needed. The controller also recognizes the various operating modes of the tailstock – complete disassembly, parking position, and different tailstock arm heights in the measuring position – and enables corresponding measuring ranges for superlative safety, efficiency, and flexibility. A wide range

of accessories is also included in the standard scope of supply for greater ease of use, including centers, adjustment aids, and a dedicated storage trolley that accommodates the tailstock following disassembly.

It should also be noted that clamping between centers with a tailstock consists of two components, namely the tailstock preparation and the tailstock set. The former contains a number of features that prepare the ZEISS PRISMO for tailstock installation, including a modified granite plate for the specific optimized installation position of the rotary table, additional screw sockets for mounting, and safety components for the Y-axis and controller. The tailstock preparation can therefore be purchased with a new ZEISS PRISMO in order to ensure future compatibility – without having to also buy the tailstock set right away.

In enabling the stable and deformation-free clamping of shaft-like measuring objects between centers, the ZEISS TS tailstock delivers complete measurement in a single clamping position. It also uniquely enables users to enjoy these benefits on a variety of types within the ZEISS PRISMO Family. And dynamic software support from ZEISS TargetTool ensures proper alignment in a single iteration via the intuitive live view feature.



*Positions in which bridge can (left) and cannot (right) travel over tailstock arm*

# Overview of ZEISS PRISMO Family types compatible with ZEISS TS tailstock

Tailstock	CMM size	PRISMO	PRISMO verity	PRISMO ultra	PRISMO fortis
TS-7	7/12/7	✗	✗	✗	✓
TS-7	9/12/7	✓	✓	✗	✗
TS-7	9/13/7	✗	✗	✓	✗
TS-7	9/15/7	✓	✓	✗	✓
TS-7	9/18/7	✓	✓	✗	✗
TS-7	9/24/7	✓	✗	✗	✗
TS-10	12/18/10	✓	✓	✗	✗
TS-10	12/24/10	✓	✗	✓	✗

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