

Cardan shaft alignment

Machine alignment without shaft removal



- Unique and patented solution powered by ROTALIGN® Ultra iS
- Intelligent and time-saving

Alignment solutions for all types of cardan shafts

Cardan shafts are common types of couplings in many industries such as pulp and paper, marine and shipping, steel, automotive, cement. They can be either fully rotatable, partially rotatable or non-rotatable, very large and heavy, and difficult to access. Usually, a combination of these configurations applies, making many cardan shaft alignment applications unique and challenging.

PRUFTECHNIK offers intelligent solutions designed to deal with the alignment of various kinds of cardan shaft configurations.

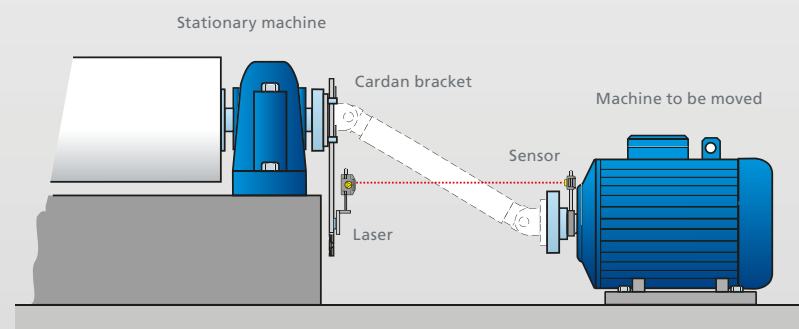
Our laser-based alignment systems guarantee unparalleled accuracy and repeatability in a fraction of the time required by conventional methods.

Cardan shafts are used to compensate for parallel misalignment (offset) between the driving and driven shaft. However, they cannot absorb angular misalignment between the shafts. Angular misalignment typically causes the driven shaft to rotate unevenly during operation, which results in increased vibration.

Precise alignment reduces the rotational forces of the cardan shaft to a minimum. If the cardan shaft is precisely aligned, the second joint converts "irregular" rotational movement of the spacer shaft into a regular movement of the driven shaft. As a result, the uneven bearing loading during cardan shaft rotation is minimized, the service life of the components is extended and machine failures reduced.

Common cardan shaft alignment with laser

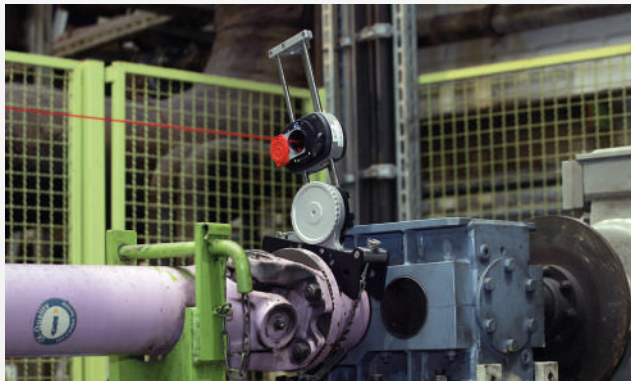
The cardan shaft is removed and a long-arm bracket is used to overcome the offset between the machine shaft centerlines. The laser is mounted on a rotating frame which simulates the centerline of the non-moveable machine. The sensor is attached to the shaft of the moveable machine by means of standard chain or magnetic brackets. This method can also be used when the shafts cannot be rotated.



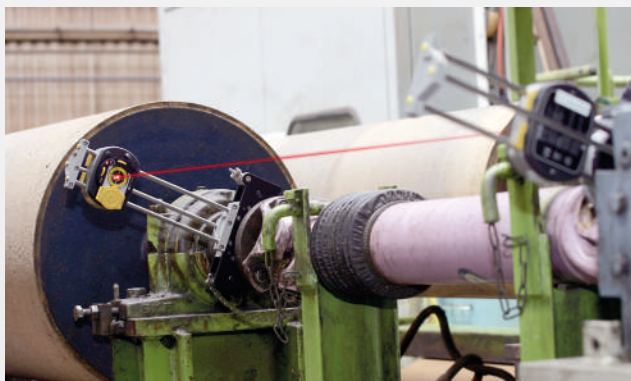
Cardan shaft alignment using a long-arm bracket assembly to overcome the offset.

Intelligent cardan shaft alignment

Unique patented solution eliminates the need for cardan shaft removal



Rotating arm bracket for restricted rotation areas.



Bracket set for 180° rotation requires only two readings.

With specially designed brackets and new measuring methods, the ROTALIGN® Ultra iS platform allows cardan shafts to be aligned without removing the shaft.

Depending on the shaft configuration, one of the two available methods can be used.

With the first method, the sensor is mounted on a bracket with a rotating arm. As shafts are turned to a new measurement position, the bracket's arm is rotated and the sensor moved up or down the posts to intersect the laser beam. This method is used when rotation areas are restricted.

The second method uses a bracket set designed for a 180° rotation and only requires two reading positions.

Benefits:

- ▶ No cardan shaft removal
- ▶ Quick measurement setup
- ▶ Save hours of work and manpower
- ▶ Avoid crane use or rental and tricky manoeuvres in constrained spaces
- ▶ High-quality measurement based on the actual rotation axis of the shaft
- ▶ Improve safety of operators and assets.



In the Result screen the cardan angle and foot position are displayed as well as the tolerance status through a 'Smiley'.

If adjustments are necessary, the moveable machine may be repositioned with the help of the MOVE function.

Technical data

Cardan bracket (ALI 2.893 SETIS)	Cardan length up to 10 m (33 ft) and shaft offsets of up to 1000 mm (39 3/8 in.)
Cardan bracket lite (ALI 2.874 SETIS)	Cardan length up to 10 m (33 ft) and shaft offsets of up to 400 mm (15 3/4 in.)
Cardan bracket with rotating arm (ALI 2.450)	Cardan length up to 10 m (33 ft) and shaft offsets of up to 400 mm (15 3/4 in.)
Cardan bracket with 180° rotation (ALI 2.460)	Cardan length up to 10 m (33 ft) and shaft offsets of up to 300 mm (11 5/6 in.)



ALI 2.450



ALI 2.460

PRUFTECHNIK offers products and services in the following areas:



Alignment Systems



Condition Monitoring



Nondestructive Testing



Service & Support



Approval of Air Carrier Security Programmes

www.pruftechnik.com

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Geometric Alignment

Solutions for machine geometry



• Straightness

• Flatness

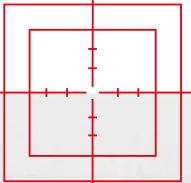
• Level, inclination and plumbness

• Parallelism

• Perpendicularity

Looking at your machinery from every angle

Geometric measurement solutions



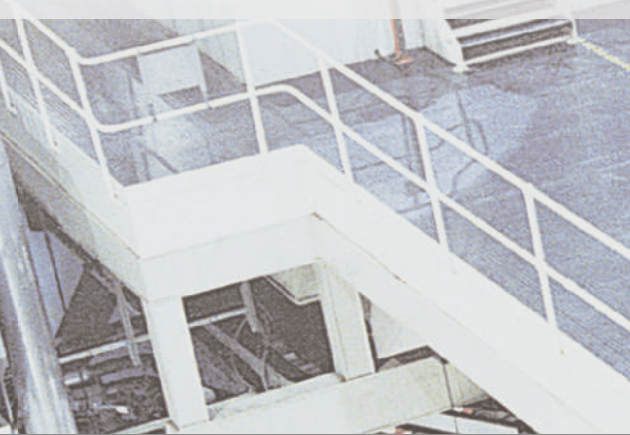
To satisfy the increasing demands of the industry, machines must run faster. At the same time, the manufacturing specifications and tolerances are becoming stricter. In order to meet these requirements, the demand for precise and user-friendly measurement equipment with comprehensive reporting capabilities is increasing.

As an independent solution provider, PRUFTECHNIK has been continuously developing and updating state-of-the-art systems to meet the ever-increasing market needs.



Our measurement systems are easy to use and quickly deliver results for flatness, level, straightness, inclination, parallelism and perpendicularity applications with a very high accuracy and over long distances.

We also offer geometric measurement services with our teams of specialists using our own systems. Our experts can also offer onsite staff training for the optimal utilization of your system based on your specific requirements.



Shorter installation and longer service life

Compared to traditional measurement methods like the piano wire, dial gauge or plumb wires, our measurement devices speed up the process of checking and correcting machine geometry. This helps you start up your machinery sooner.

Many machine manufacturers already use our systems to check machine geometry not only during the manufacturing process, but also during the installation of the machine on site.

The necessary periodical verifications can be considered as part of a condition monitoring programme. They help optimize service life and avoid failures, which can lead to machine downtime and production disruptions.



Straightness



Flatness



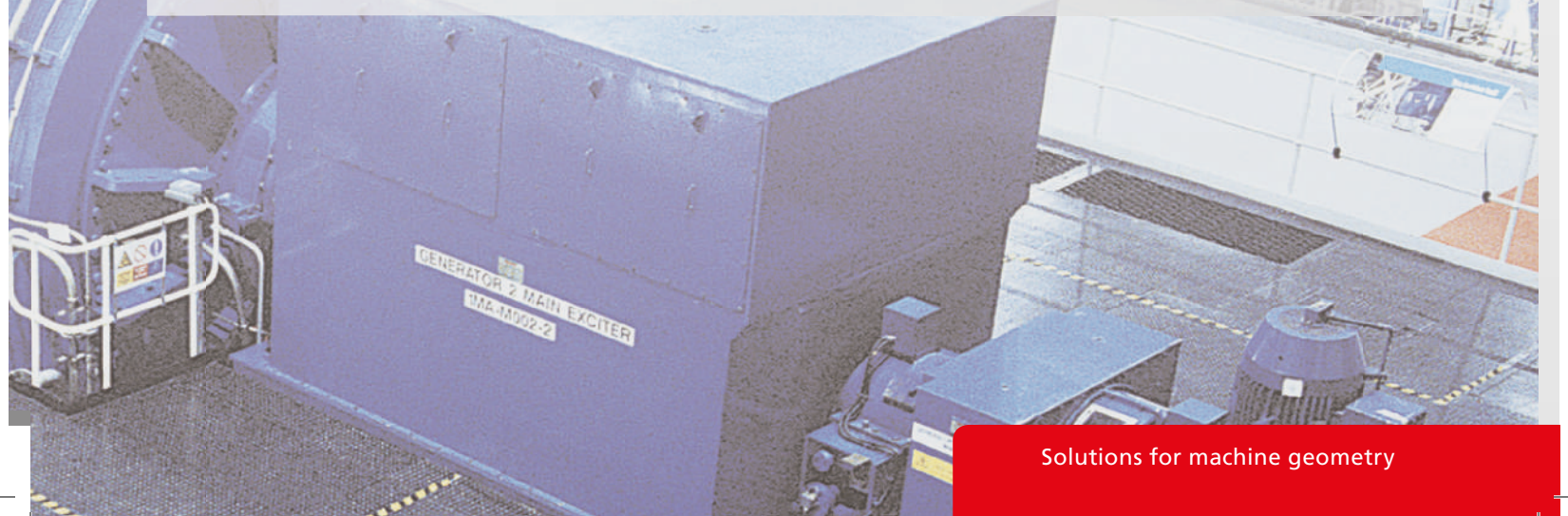
Parallelism



Perpendicularity



Angularity



Straightness

Measurement comfort and precision

What is straight on one axis might be bent on another. Damages due to external factors such as a hit, a weak foundation or equipment wear, may result in defects, scrap and even production losses.

To check how straight the guideways of a machine are, both axes must be measured. With only one set of measurements, ROTALIGN® Ultra and OPTALIGN® smart can measure two dimensions over up to 50 meters. The sensor is moved from one position to the next detecting and recording the deviations along the line. The results can be evaluated in relation to the laser or to a reference point taken from the measurement.

Our precision electronic inclinometer, INCLINEO®, provides a similar solution. With this tool, you can measure on one axis over virtually any distance. The measurement can be vertical, horizontal or at any angle. All systems support live monitoring of the corrections of any position.

Straightness applications



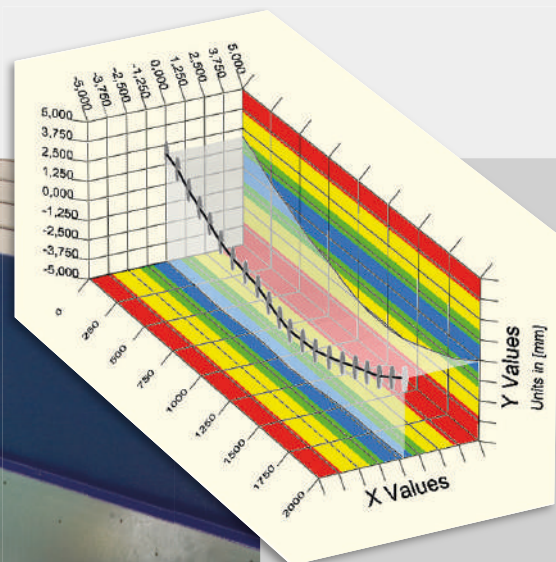
Straightness measurement of a port crane rail

Straightness applications

- ▶ Aligning headbox lips, suction sections and roll profiles of paper machines
- ▶ Measuring straightness of rails
- ▶ Measuring machine foundations of CNC machines
- ▶ Measuring straightness of long machine beds
- ▶ Checking for runout on moving slides
- ▶ Positioning bearings and shaft supports over long runs
- ▶ Monitoring surface deflections and bending in long structures
- ▶ Aligning long rail and track sections
- ▶ Measuring deflection on rams, actuators and extrusion presses



Straightness measurement of machine tool guideways



Results view in the ALIGNMENT CENTER software

Flatness

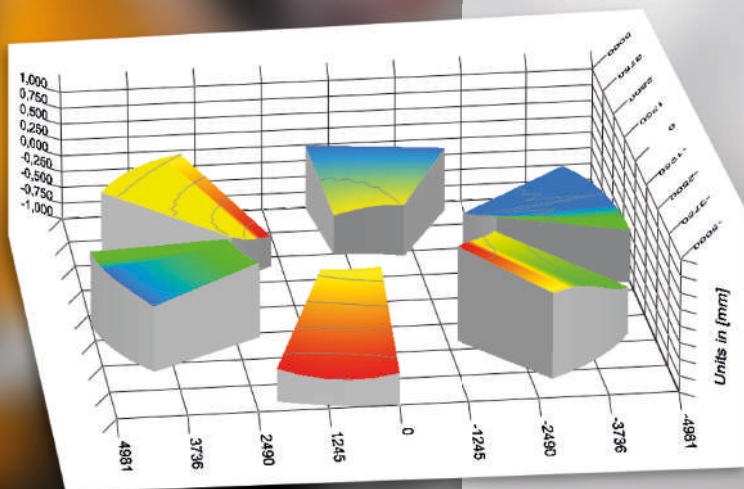
Getting surface flatness within your tolerances

Flatness measurement is one of the key factors for determining the uniformity of a surface. A surface is perfectly flat when all points on the surface lie in the same plane. This is however only theoretically possible. Therefore, the first element to determine is the flatness tolerance, defined as the distance between two parallel planes, within which all measured points on a surface must lie. If the surface does not lie within the specified tolerance, malfunction or an early, uneven wear of the machine parts will occur.

Depending on the surface characteristics, PRUFTECHNIK offers three systems for flatness measurement, with a different measurement range each. With all three systems, it is possible to compare the flatness between two or more surfaces as well as their levelness. With the use of the ALIGNMENT CENTER software, it is possible to splice areas, so that there are almost no size limitations. For flatness measurement on vertical surfaces, both LEVALIGN® systems can be used.

Customized brackets allow to accurately measure points of only a few millimeters, which may be of special interest for a particular application.

To find out which system is best suited to your specific needs, please contact your PRUFTECHNIK partner.



Generator stator frame pads - flatness measurement results

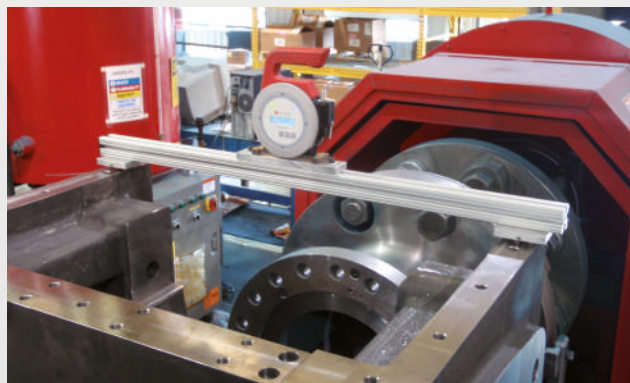
Flatness applications



Flatness measurement of a machine tool table with LEVALIGN® Ultra



Flatness measurement of a wind turbine hub flange with LEVALIGN® Expert



Flatness measurement of a compressor frame with INCLINEO®

Flatness applications

- ▶ Flatness of machine foundations
- ▶ Circular and square flange flatness:
crane flanges, vertical propeller flanges, wind tower
flanges and draft tube cone of vertical turbines
- ▶ Flatness of bed plates
- ▶ Flatness of machine tool tables
- ▶ Comparison of machine half-casings
- ▶ Flatness of machine base frames

Level, inclination and plumbness

High-level machine alignment

Rotating machinery generates energy which is transmitted through vibrations to the different components down to the foundations. Before installing a machine, a key parameter to be checked is the foundation's level. Machine foundations must be level to avoid the deformation of their bases and housing.

These types of measurements can be performed with a water level, but when high precision is required, the job must be performed using a rotating laser system or an electronic inclinometer.

An inclinometer is used to make sure that a machine or parts of it have a required inclination to ensure proper functioning.

In most cases, flatness and level measurements are both necessary. All PRUFTECHNIK systems used for flatness measurement can also be used to determine the level of surfaces or guideways. Since our systems can use the earth gravity as a reference, they can also be used to measure plumbness.

Level, inclination and plumbness applications

- ▶ Level of machine foundations
- ▶ Level of reference surfaces and bases
- ▶ Level of machine half casings (lower part)
- ▶ Level and flatness of drying sections of paper machines
- ▶ Plumbness of vertical shafts or surfaces
- ▶ Machine tool surfaces



Plumbness measurement of a vertical shaft

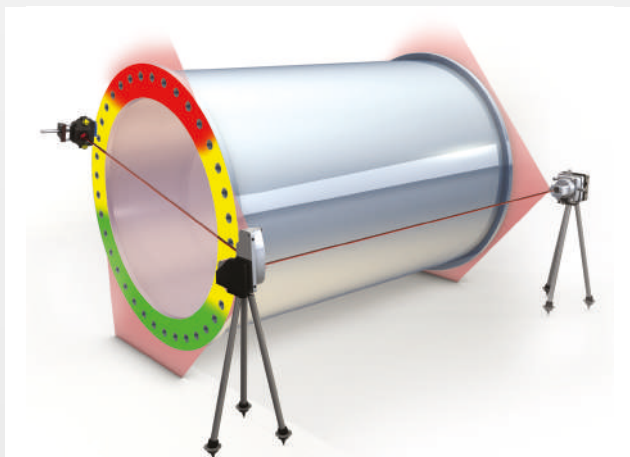
Parallelism

Smooth operations throughout service life

With the use of a rotating laser and a pentaprism or with a high precision inclinometer, it is possible to measure the parallelism of many kinds of machines. Measurements can be performed at the commissioning of the machine or after a few years, to check if it is still running within specifications.

Parallelism applications

- ▶ Rails of a crane to avoid uneven wear of the wheels
- ▶ Flanges of wind tower segments, to prevent the nacelle from tilting
- ▶ Rolls of a paper machine, to avoid uneven thickness, material creases or breaks, all of them causing poor quality or even rejects.
- ▶ Faces of a press, to ensure that the plate being pressed is manufactured within the tolerances
- ▶ Any two surfaces, like the foundations of a motor-pump set, or a ship's propeller lines.



Measurement of flanges flatness and parallelism of a wind tower segment

Roll alignment

More about roll parallelism with our PARALIGN® service for paper, printing, converting and steel production:

www.paralign.info



Perpendicularity

The right angle check

Another critical parameter in structures and machine geometry is the perpendicularity of axes. Typically, some components or structures must have some of their parts at 90° to allow their correct operation, machining or installation.

The most common method to check for perpendicularity is to compare the part to a master square. This allows to check the deviation from a 90° angle by taking two points on each of the axis. In between these two points many parameters may be left out of the measurement, such as straightness. If this is not within the tolerance, the machine will not operate as expected even if the measured axes are at 90°.

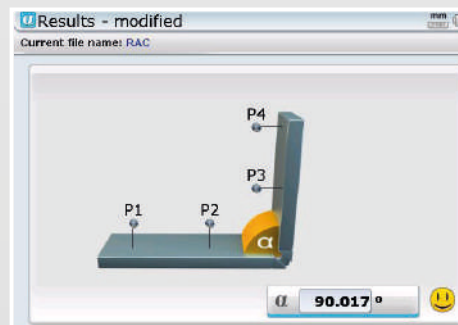
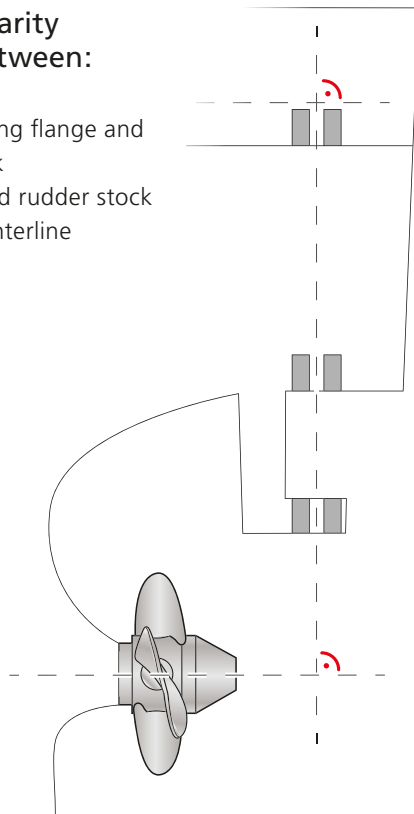
Using the ALIGNMENT CENTER software, our systems allow to measure perpendicularity considering more than two points on each axis.

Perpendicularity applications

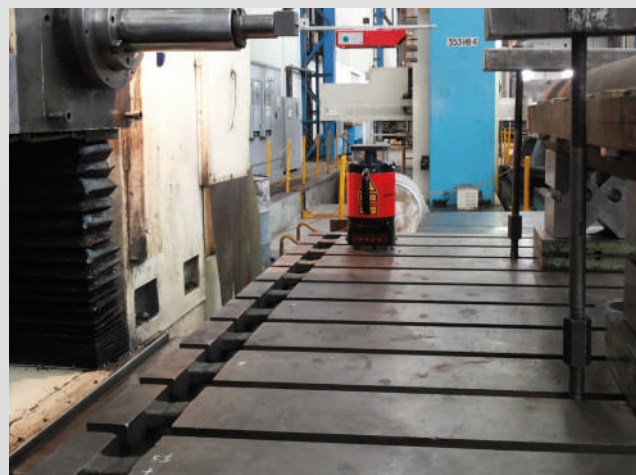
- ▶ Machine tools
- ▶ Ship components and structures
- ▶ Paper machine rolls to the reference line

Perpendicularity required between:

- ▶ Upper bearing flange and rudder stock
- ▶ Propeller and rudder stock bearings centerline



Results view of a perpendicularity measurement in ROTALIGN® Ultra



Perpendicularity measurement between a machine tool table and the spindle at different heights

ALIGNMENT CENTER

Always ready for the next job

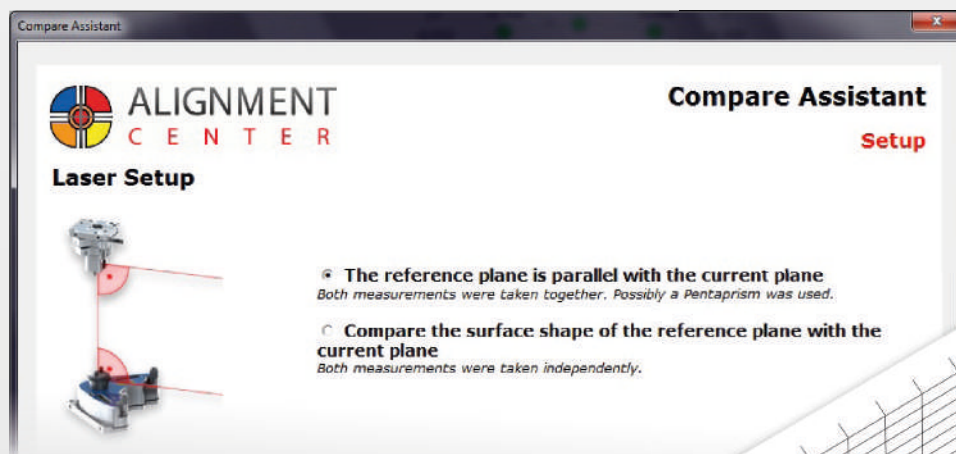
ALIGNMENT CENTER is the common software platform for all PRUFTECHNIK alignment systems and applications. It is the perfect solution for preparing, analyzing, and documenting your alignment jobs. It is also a powerful tool to generate and customize professional colour reports.

The software helps map your sites, plants and assets in a central database allowing users to easily share information. With the unlimited tree structure, you can organize and archive your measurement data and easily retrieve it when you need it.

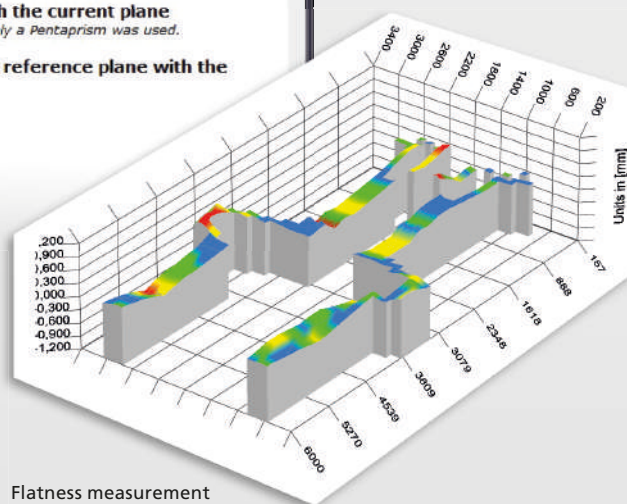
Measurement results can be displayed in 2D or 3D graphics. All alignment and measurement specifications, alignment presets and tolerances are saved for future use. This means that you are always ready for the next job.

Powerful software applications for machine geometry

- ▶ 2D or 3D graphic visualization of all measurement results
- ▶ Display flatness results with regards to the laser plane or to one or more reference points
- ▶ Group function to compare the flatness of two surfaces, i.e. when motor and pump foundations are at different levels
- ▶ Splice function to measure the foundations of machines that are already installed (the surface must be measured moving the laser from its original position)
- ▶ Fix part of a surface to view by how much the rest of it must be corrected
- ▶ Compare function to check the gaps between the frames of the upper and lower machine housings



Assistant for the comparison of surfaces



Flatness measurement results of a gas turbine frame

PRUFTECHNIK

Proven technology for all industries

With our products, processes and services for alignment applications and condition monitoring, we help ensure that your machines run smoothly and generate an output of consistent high quality. This also includes systems for automatic process control and quality assurance that are integrated directly in your production process.

PRUFTECHNIK delivers maintenance solutions worldwide



Alignment Systems

Laser measurement systems and services for optimum alignment of machines and systems.



Condition Monitoring

Vibration measurement systems for machine condition monitoring – including services such as machinery fault diagnosis.



Nondestructive Testing

Systems and services for quality assurance and process control in production.



Service & Support

We offer professional services anywhere in the world to support our customers with alignment and condition monitoring.



Approval of Air Carrier Security Programs

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