ALIGNMENT NEWS
February 2003

Products highlights

To help our customers get the edge over the competition and at the same time make a useful contribution to the world of shaft alignment, we are proud to introduce four new products, and an updated version of the BORALIGN® Explorer. These products can be delivered immediately. Pricing details on these and all PRÜFTECHNIK Alignment products can be obtained from either your country point of contact or from Ms Claudia Franz at the following e-mail address - claudia.franz@pruftechnik.com.

At a glance

- **Cardan shaft bracket lite**

- **ROTALIGN PRO/BORALIGN PC simulation**

- **BORALIGN Explorer version 1.30**

- **ROTALIGN PRO mini CD**

- **ROTALIGN PRO SD upgrade**

Taking care of large offsets

Cardan shaft bracket lite
ALI 2.874 SET

The cardan shaft bracket lite ALI 2.874 SET is not a replacement of the original cardan shaft bracket ALI 2.893 SET. It is designed for convenient and accurate alignment of machines joined by cardan shafts over distances of up to 5 m (16 ft) and shaft offsets of up to 400 mm (15 3/4 in.) using either ROTALIGN® PRO, ROTALIGN®, smartALIGN®, OPTALIGN® PLUS and the MASTERLIGN® family. As the name suggests, the bracket is lightweight and practical. It comes in a 530 x 390 x 100 mm case. The bracket is supplied with M8 bolts for mounting the face plate onto the coupling flange.

If using ROTALIGN® PRO or ROTALIGN®, the measurement procedure remains unchanged. (You may refer to technical notes #34 and #35, both available for download from our website.) Added to this kit is a specially designed beam adjustment cap ALI 3.606 UN to be used in multipoint. The adjustment cap used with smartALIGN®, OPTALIGN® PLUS and the MASTERLIGN® family is ALI 5.115 UN and is part of ALI 2.874 SET.

How often do you hear the remark - "I don't need any alignment tool because I am using a universal Joint". Could this remark be attributed to the fact that the customer is unaware that the angular misalignment should be set to ensure sufficient lubricant circulation to prevent the shafts from seizing or is the customer aware of this requirement, but does not have the capability to set the necessary angle?

Cardan drive theory

Cardan drives are spacer shafts with universal joint couplings. When only one universal joint is considered, the mathematical formula below defines the angular rotation (refer to figure).

$$\omega_b = \frac{\cos\theta_1}{1 - (\sin^2\alpha \cdot \sin^2\theta_1)} \cdot \omega_a$$
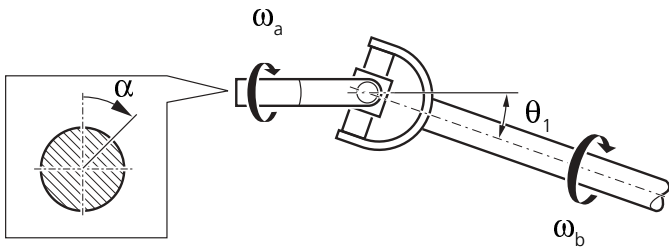

For the given operating angle, the output velocity fluctuates, even though the input velocity is constant. These fluctuations result in the output gaining, then lagging, with respect to the input, twice in each revolution to an extent governed by the operating angle. The fluctuation is predictable and is a function of angular velocity and operating angle.

In industry two universal joints are used to link two machines. They are installed and operate with a large offset between the driver and the driven shaft.

The following figures show the two ways in which cardan drives can be installed.
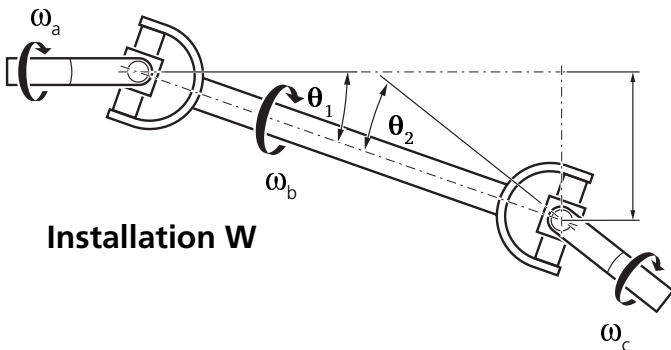

Installation W
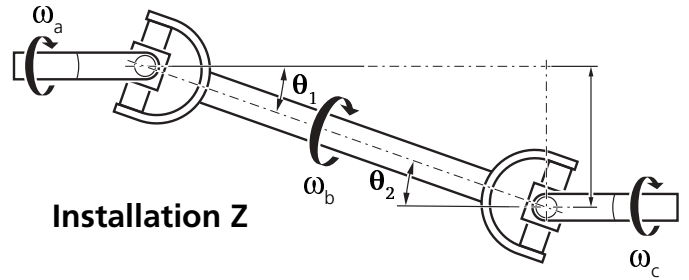
Installation Z

For optimal running, the operating angles θ_1 and θ_2 should be equal in both installations W and Z. In the given configuration, when $\theta_1 = \theta_2$, $\omega_a = \omega_c$. The difference between θ_1 and θ_2 has an influence on the life time of the machine elements and the cardan shaft itself.

Typical applications are to be found in the metal industry, paper mills, in marine propulsion, in the food industry and in the automobile industry. Universal joints have proved practical in

situations where space is limited (e.g. the motor driven rolls of a conveyor belt) or in situations where machines have to be frequently replaced as in test benches.
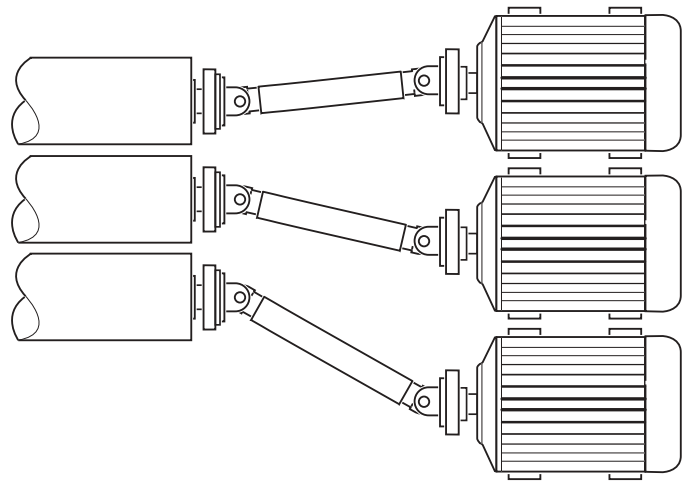
The above diagram illustrates how machines could be positioned in an area of limited space.

NB Technical notes containing full instructions on how to use this bracket with ROTALIGN® PRO, ROTALIGN®, smartALIGN®, OPTALIGN® PLUS and the MASTERLIGN® family will be made available for download from our website shortly. ∎

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The ideal presentation aid

ROTALIGN PRO / BORALIGN PC simulation kit

ALI 3.710 USB
ALI 3.710 PAR

This full application ROTALIGN® PRO / BO-RALIGN® PC simulation kit consists of the ROTALIGN® PRO / BORALIGN® PC software ALI 3.711 CD, the blue ROTALIGN-PC training cable ALI 3.598-4 and either a USB dongle or a parallel dongle. The simulation software allows the projection of the display of the instrument onto a larger screen. This feature enables the user to demonstrate all ROTALIGN® PRO / BORALIGN® applications which include shaft alignment, bore alignment and straightness to bigger audiences.

Used in this way, the program can be used to present 'live' measurements including both vertical and horizontal MOVE. Detailed information of how to carry out this particular presentation will be made available in a technical note.

The PC simulation kit can also be used in presentations to show shaft alignment, straightness and bore alignment files that have been stored on a PC as would appear on ROTALIGN® PRO or BORALIGN®. Stored alignment files are copied from their directory to the respective 'PRO Simulation' data directory. Alternatively files can be transferred using drag and drop. When used for presentation in this way, all that is required after the installation of the software is the provided dongle and nothing more. In this case, either the USB dongle is connected to the USB port of the PC or the parallel dongle is connected to the parallel port of the PC.

Start the PC simulation program from the 'Start' menu. On starting the program, the message 'No sensor detected on any COM port' appears. Click 'OK'. A virtual ROTALIGN® PRO computer appears on the PC screen. This can now be used to simulate the instrument.
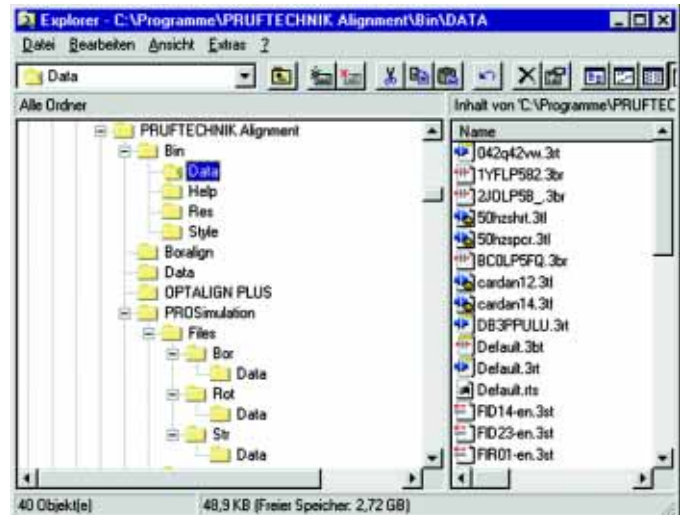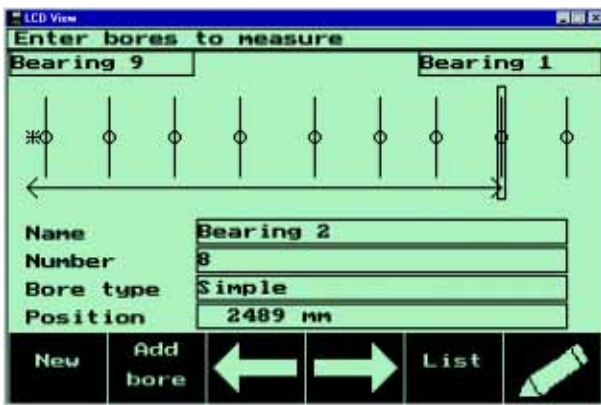

Alignment files can be copied to the PRO Simulation directory via the MS Windows Explorer

Presenting shaft alignment files

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Presenting straightness files

Presenting bore alignment files

Send professional reports

BORALIGN Explorer 1.30
ALI 3.598 CD

Incorporated in BORALIGN Explorer 1.30 is an improved BORALIGN Editor. The languages supported in this version include Czech, Dutch, French, German, Polish, Spanish, Swedish, English and English (American). Useful developments include:

- The HTML report preview and export can be used to send reports by e-mail to customers without BORALIGN Explorer software.
- Dimension, measure and results lists can be exported as CSV spreadsheets format for further analysis with, for example, Microsoft Excel.
- Connect points draws lines between points in 3D and 2D graphs for easy understanding of trend.
- 3D axis labels now correspond to PRÜFTECHNIK convention as used in the instrument.
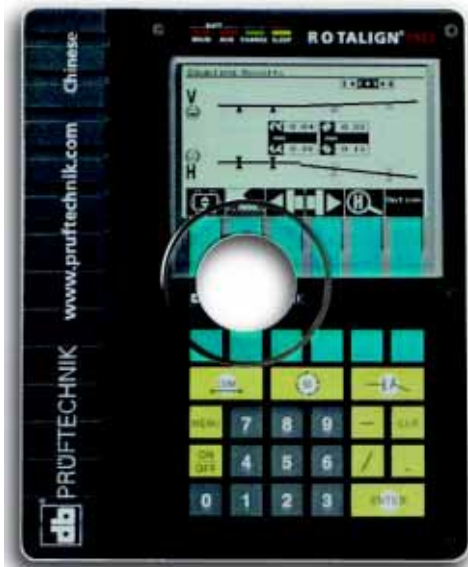- Licence Manager features have been integrated.

A section of the HTML report preview as produced by the improved BORALIGN Editor software.

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Adding impact to sales

ROTALIGN PRO mini CD
ALI 9.698.x

This ROTALIGN® PRO presentation video is available in Chinese (ALI 9.689.C), French (ALI 9.689.F), Spanish (ALI 9.689.E) and English (ALI 9.689.G). The video features ROTALIGN® PRO. It is guaranteed to capture the attention of a prospective customer as the many useful features of ROTALIGN® PRO come to life through video, music, voiceovers, photos and text. This mini CD contains a great presentation and makes a lasting impression. ∎

Tackling sleeve bearings and nonrotatable shafts

ROTALIGN PRO SD upgrade
ALI 3.712

Overview
The SD upgrade incorporates vector tolerances and standard deviation within the ROTALIGN® PRO shaft firmware. The standard deviation values are displayed and can be edited during the measurement. 'Take point' can be accessed within the deviation diagram, and corrected coupling angularity and offset are also displayed by a deviation diagram.

Vector tolerances
Precise alignment occurs when rotational centerlines of two shafts are collinear at the coupling point under normal operating conditions. The alignment condition of two such shafts is determined by the amount of offset and angularity that exists between them. Offset is the distance between the two rotational centerlines at a given point, while angularity is the angle between the centerlines, the angularity being expressed as gap per diameter.

Since misalignment is the deviation in two different planes (vertical and horizontal), the purpose of alignment is the positioning of machinery such that these deviations are below defined targets or standard tolerances.

In the following standard and rotational tolerance diagrams (overleaf), the acceptable gap tolerance in both planes is 0.04 mm. The measured values of 0.04 and 0.03 mm fall within acceptable tolerances.

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Standard (classical) tolerances
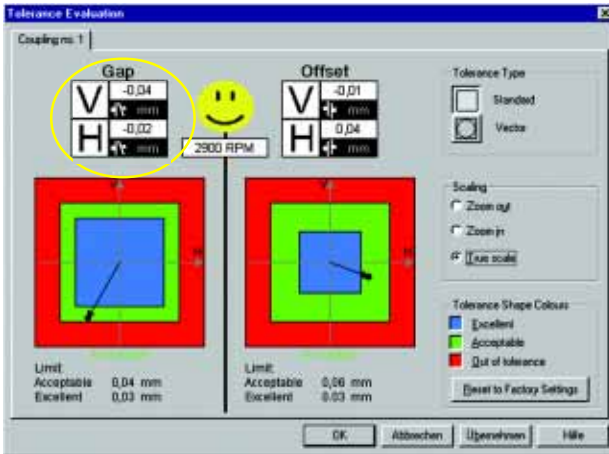
In the above ROTALIGN® PRO Shaft Alignment Editor example, the gap in both the horizontal and vertical planes is within acceptable tolerances.
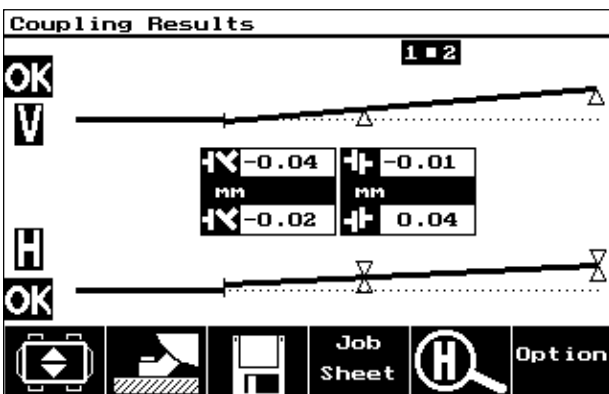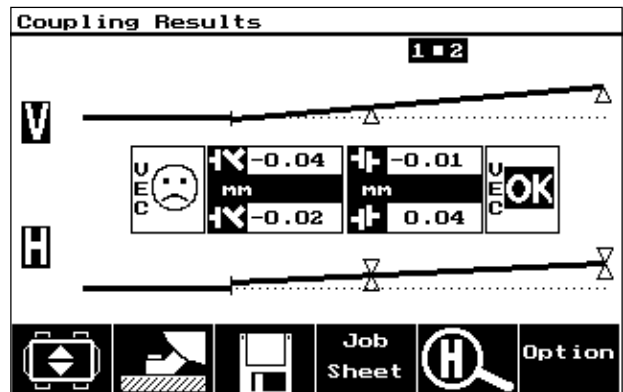

The instrument firmware with standard tolerances selected shows the gap in both the horizontal and vertical planes is within acceptable tolerances.

If however the same measurements are considered in a rotational sense, the values fall out of tolerance as shown in the vector tolerance diagrams below.

Vector ('rotational') tolerances
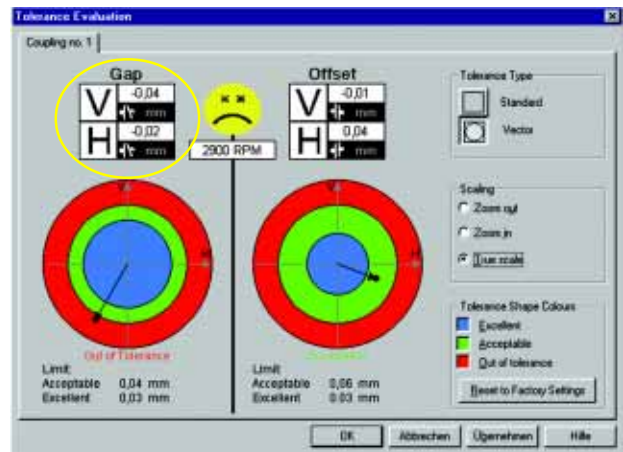
When the tolerances are applied to the same alignment condition in a rotational sense, the vector gap falls out of tolerance as the vector magnitude is greater than 0.04 mm.


When vector tolerances are selected in the instrument firmware, the vector gap falls out of tolerance.

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Standard deviation

The alignment parameters offset and angularity are determined from the calculation ellipse. Standard deviation measures the spread of the measurement points about the mean value. The introduction of standard deviation enables the user to compare sets of measurements which may have the same mean but a different range, and hence establish the best fitting curve.

Standard deviation is important when measuring sleeve bearings in compressors, pumps and turbines, nonrotatable shafts in turbines, gearboxes and diesel engines.
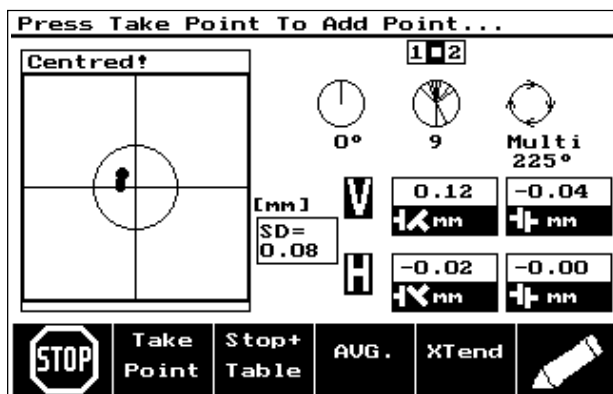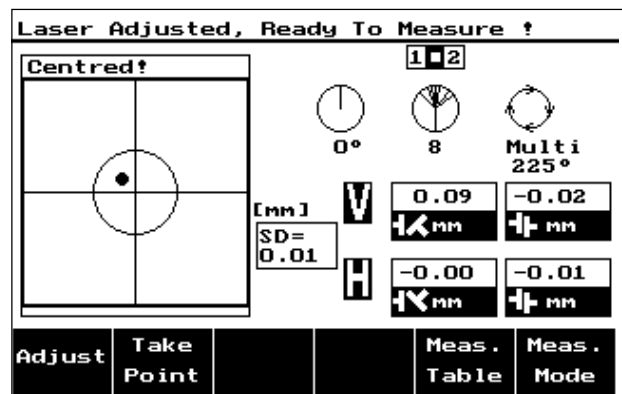

The nine measurement points taken above have a standard deviation of 0.08.
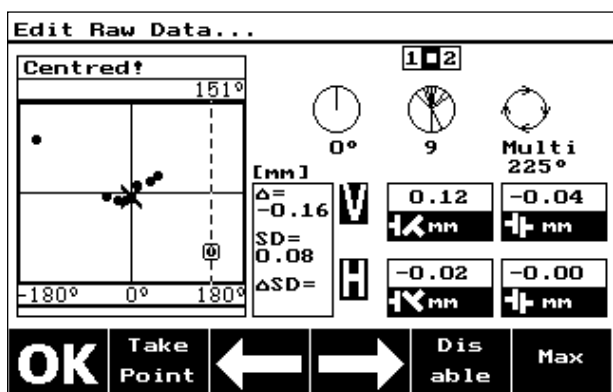
Using the 'Edit' key, an extreme measurement point (with value -0.16 and point taken at 151°) that will influence the standard deviation is disabled.
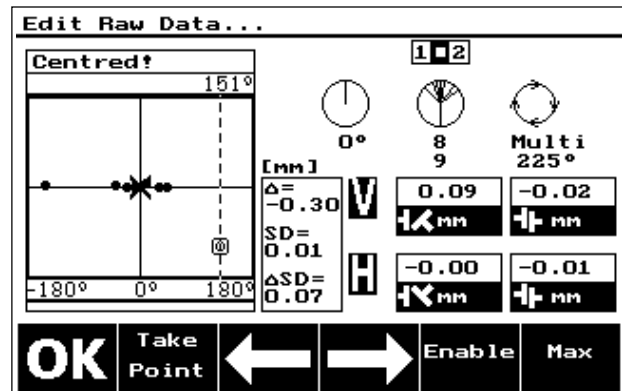
The above calculations are now based on 8 measurement points.

The recalculated standard deviation is 0.01.

From the above example, with just a single measurement point disabled, the standard deviation changes from 0.08 to 0.01, and the vertical and horizontal offset and gap values change by up to 0.03 mm. With this improved standard deviation, problems arising from non-repeatability of measurement results can be avoided and the quality of measurement confirmed.

It should be obvious that this technology can only be utilized in alignment systems that allow more than three measurement points be taken. We are the only players in the market with systems that take more than three measurement points in the multipoint mode. ∎

From the inventors of laser shaft alignment