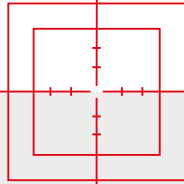


CENTRALIGN[®] Ultra RS5

Alignment of bores, bearings and diaphragms



CENTRALIGN® Ultra – new modular power



Proper repair and reconditioning of turbines, combustion engines, compressors and pumps require an exact alignment measurement of rotors, crankshaft and camshaft bores, cylinder bores and crosshead guides.

CENTRALIGN® Ultra is a laser alignment system designed for the measurement and alignment of bores and internal elements of rotating machines such as bearing rings, diaphragms, nozzles, inner shells and turbine casings with upper halves installed or off. It offers a far more convenient and accurate alternative to the traditional methods using piano wires, micrometers and cumbersome theodolite telescopes.

The CENTRALIGN® Ultra measurement method uses a laser emitter which is mounted at one end of the machine and shoots through the approximate center of the bores. The laser beam serves thereafter as the measurement reference line. The sensor is mounted in the bore to be measured using the patented universal pointer brackets. The exact rotational centerline of the bore is then determined by simply rotating the sensor and the bracket head around the inside of the bore. The sensor records positional deviations relative the laser and sends the measured data to the ROTALIGN® Ultra computer. The computer processes this information along with the machine dimensions involved to calculate the exact centerline position.

CENTRALIGN® Ultra uses a modular concept, the standard version is extendable to include powerful options to handle increased alignment requirements. Special upgrades and accessories are available, depending upon the alignment application, the bores and machine sizes: Long Range Laser, Large Bore Brackets and additional control sensor to monitor the laser drift.

Advantages at a glance

- ▶ Exclusive brackets and measurement technology for true bore center measurement
- ▶ Relative bore centerline measurement – eccentricity error is determined
- ▶ Ability to measure more than 3 points over the bore guarantees highest accuracy
- ▶ Universal pointer brackets, large bore brackets and customized brackets for bore diameters ranging from 45 mm (1.77") to 4.230 m (166.5")
- ▶ Laser range distances up to 50 m (1,968.50") with the Long Range Laser
- ▶ Measurement of both magnetic and nonmagnetic bores
- ▶ Integrated inclinometer: measurement can be started at any angular position and performed in any direction
- ▶ Control sensor (option) for automated compensation of potential laser drift
- ▶ View results through optimized or fixed point center lines and obtain minimum corrections required
- ▶ Enter the reference line position, the rotor sag and the thermal growths
- ▶ Convenient wireless data transmission between the sensor and the handheld device
- ▶ Built-in splice function maximizes measurement flexibility and extends measurement range



Computer

CENTRALIGN® Ultra utilizes the proven ROTALIGN® Ultra platform which is extendable to a wide range of alignment applications.



RS5 sensor and RS5 laser

The RS5 sensor contains two fully-linearized biaxial position detectors and a precision MEMS inclinometer. It can precisely register the rotational angle and the laser beam in terms of two displacements and two angular movements to the nearest micron.



Transportation case

CENTRALIGN® Ultra is delivered in a robust PELICAN Storm case for storage and transportation. All standard components (computer, RS5 sensor/laser, brackets) are stored safely in this premium quality casing.



Universal pointer brackets

These patented brackets are specifically designed for ease of use, flexibility and extremely high accuracy. A fixed base keeps the bracket frame in place within the bore while a rotating sensor holder enables the sensor to be quickly centered and freely rotated within the bore. This unique feature combined

with the system's ability to measure more than 3 points at any angular position inside the bore, ensures high accuracy and reveals the potential bore out of roundness. The universal pointer brackets can be used for measuring both magnetic and non-magnetic bores.



Precision alignment in three steps – quick and straightforward

DIM Set-up

- ▶ Choose your laser viewpoint and sign convention
- ▶ Choice of different bore types
- ▶ Input compensation values for thermal growth or rotor sag
- ▶ Add bores to new or existing bores to the configuration

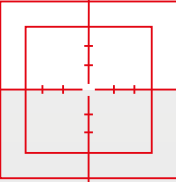
M Measurement

- ▶ On-screen guidance for laser set-up – no need to center laser before starting measurement
- ▶ Graphics guide you through the measurement procedure
- ▶ Measurement table to review repeatability, and used with standard deviation to confirm accuracy and shape of bore

RES Results

- ▶ Set the centerline relative to any fixed reference
- ▶ Results displayed in color provide a clear understanding
- ▶ Instantly displayed corrections for each bore
- ▶ Monitor real time corrections

Demanding jobs – one tool to do them all



Diesel engine camshaft bore alignment

Modern diesel engines are precision engineered high-tech motors requiring a maximum of accuracy and precision in installation and maintenance. Especially the camshaft bore must be aligned precisely to meet the tight tolerances for optimum circulation. Smallest deviation may lead to unexpected bearing wear and energy consumption.

CENTRALIGN® Ultra delivers all necessary measurement tools for a precise alignment job of the camshaft bore. Due to a multitude of specialized brackets the CENTRALIGN® Ultra application delivers the most precise results to assure best camshaft circulation within smallest tolerance.



Stern tube alignment

The alignment of the stern tube, as well as that of the propulsion shaft is crucial to the safe and efficient operation of any vessel. If not done properly, it can result in undesirable vibrations and higher operating costs. Damage to the stern-tube bearings or other main parts of the vessel's propulsion equipment could lead to the ship immobilization for long duration.

A wide assortment of brackets makes CENTRALIGN® Ultra system suitable for many different bore applications. Furthermore, a control sensor can additionally be fixed at the end of the machine train to monitor the laser drift. Position changes of the laser are automatically taken into account specially when working over long distances and long measurement periods. The combination of appropriate brackets, a stable laser and an automatic control sensor helps ensure highest accuracy.



Turbine alignment

Steam turbines are important machines for power generation. More than half of electricity produced worldwide is generated using steam turbines. They exist in a wide range of sizes. Steam turbine efficiency is closely related to the air gap between the turbine components and the rotor. This is why the installation position of the rotor relative to the internal housing is extremely important. It should be checked closely, not only when first installed but also when the turbine is overhauled.

The CENTRALIGN® Ultra measurement system developed by PRÜFTECHNIK has been in use to align turbine shells to rotors for many years around the world.

The system is designed for the precise alignment of internal elements of rotating machines such as bearing rings, diaphragms, nozzles, inner shells and turbine casings. Unlike the traditional methods, CENTRALIGN® Ultra saves a lot of time and delivers unequalled accuracy with its laser-optical measurement procedure.

The use of a long range laser extends the working range up to 50 m without sag. An additional control sensor permanently monitors the measurement setup for changes and compensates laser drift. It automatically secures the measurement accuracy over long distances and long measurement periods when the laser stability is more subject to impact by variations of air density, temperature or light. The combination of a precise and stable laser, and an automatic control sensor helps ensure highest accuracy.

The system calculates the center of each individual element and displays their locations, relative to each other on the screen. The desired centerline may be adjusted to determine the best-fit line and minimize corrections. Vertical and horizontal values or left/bottom/right values can be preset.



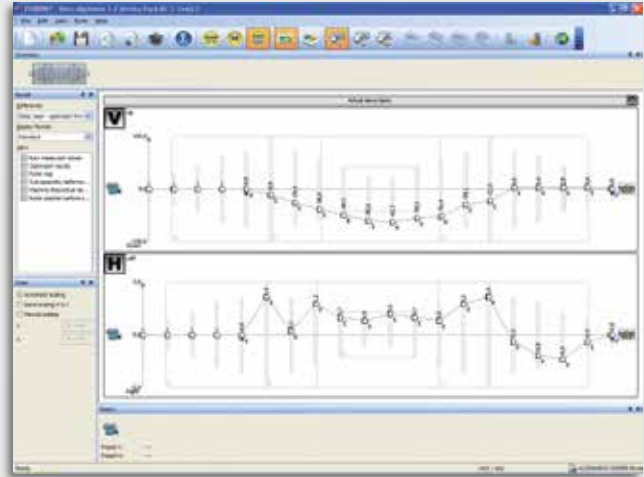
ALIGNMENT Center

Document your job the most convenient way



ALIGNMENT CENTER is a Windows™ based software platform for all PRUFTECHNIK shaft and geometrical alignment applications.

It provides the perfect solution for preparing, analyzing, organizing and archiving the measurement files. The PC Software bore application supports the full functionality of CENTRALIGN® and offers exclusive turbine specific functions such as choice of different turbine elements, laser trend monitoring and specific correction methods. Furthermore, the software generates professional colour reports including photos, logos and company-specific information.



Set-Up

- ▶ Create user-specific templates to fit the measurement job
- ▶ Set up file information to include file and user names, company, plant, area and machine train
- ▶ Prepare file in advance on a PC and transfer to the instrument via the two-way communication

Archiving

- ▶ Create a backup of measurement files
- ▶ Restore files saved in the backup
- ▶ Organize files in a tree structure with an unlimited hierarchy
- ▶ Any type of document can be stored in the tree structure
- ▶ Comprehensive database search
- ▶ Ability to import and export data
- ▶ Management of measurement files and any other file type

Analysis & Reporting

- ▶ Display results in either 2D or 3D graphics depending on the application
- ▶ Evaluate the alignment results
- ▶ Optimize the corrections by redefining the reference positions
- ▶ Customize measurement reports to include company information and logo

CENTRALIGN® Ultra RS5 technical data

Computer	
CPU	Marvell XScale Processor running at 520 MHz
Memory	64 MB RAM, 64 MB Internal Flash, 1024 MB Compact Flash Memory
Display	Type: Transmissive (sunlight-readable) backlit TFT colour graphic display Resolution: Full VGA, 640 x 480 Pixel Dimensions: 5.7" (145 mm) diagonal Keyboard elements: Navigation cursor cross with up, clear and menu keys; Alphanumeric keyboard with dimensions, measure and results hard keys
LED indicators	4 LEDs for laser status and alignment condition 2 LEDs for wireless communication and battery status
Power supply	Operating time: 25 hours (using Li-Ion rechargeable battery) 12 hours (using disposable batteries) typical use (based upon an operating cycle of 25% measurement, 25% computation and 50% 'sleep' mode) Disposable batteries: 6 x 1.5 V IEC LR14 („C“) Lithium-Ion rechargeable battery: 7.2 V / 6.0 Ah (optional)
External interface	2 x USB host for printer or keyboard 1 x USB slave for PC communication RS232 (serial) for sensor I-Data socket for sensor Integrated Bluetooth® Class 1 wireless communication, transmitting power 100 mW AC adapter/charger socket
Environmental protection	IP 65 (dustproof and water spray resistant), shockproof Relative humidity 10% to 90%
Temperature range	Operation: 0°C to 45°C (32°F to 113°F) Storage: -20°C to 60°C (-4°F to 140°F)
Dimensions	Approx. 243 x 172 x 61 mm (9 9/16" x 6 3/4" x 2 3/8")
Weight	1 kg / 2.2 lbs (without battery)
CE conformity	Refer to the CE compliance certificate posted on the PRÜFTECHNIK website: www.prufttechnik.com
RS5 Sensor	
Particulars	5-axis sensor: 2 planes (4 displacement axes and angle) Environmental protection: IP 67 (submersible, dustproof) Ambient light protection: Yes Storage temperature: -20°C to 80°C (-4°F to 176°F) Operating temperature: -10°C to 60°C (14°F to 140°F) Dimensions: Approx. 105 x 74 x 53 mm (4 9/64" x 2 29/32" x 2 3/32") Weight: Approx. 220 g (7 3/4 oz.) Measurement area: Unlimited, dynamically extendible (U.S. Patent 6,040,903) Resolution: 1 µm (0.04 mil) and angular 10 µRad Accuracy (avg): > 98% Measurement rate: Approx. 20 Hz Inclinometer resolution: 0.1° Inclinometer error: 0.3% full scale
RS5 Laser	
Particulars	Type: Semiconductor laser diode Beam divergence: 0.3 mrad Environmental protection: IP 67 (submersible, dustproof) Beam power: < 1 mW Wavelength: 670 nm (typical) (red, visible) Safety class: Class 2 according to IEC 60825-1:2007 The laser complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 50, dated June 24, 2007. Safety precautions: Do not look into laser beam Power supply: Batteries 2 x 1.5 V IEC LR6 (AA) Operating temperature: -10°C to 50°C (14°F to 122°F) Storage temperature: -20°C to 80°C (-4°F to 176°F) Dimensions: Approx. 105 x 74 x 47 mm (4 9/64" x 2 29/32" x 1 27/32") Weight: Approx. 227 g [8 oz.] including batteries

Long Range Laser	
Type	Ga-Al-As semiconductor laser
Beam divergence	0.2 mrad
Laser range	up to 50 m depending on sensor
Adjustment range	Offset + 3mm in X and Y Angular + 3° in X and Y
Adjustment accuracy	0.002 mm
Environmental protection	Electrical components IP 65 Mechanical components IP 20
Beam power	< 1 mW Wavelength (typical) 675 nm [for ALI 4.100] or 635 nm [for ALI 4.100-IS] (red, visible)
Beam diameter	8 mm
Safety class	Class 2, FDA 21 CFR 1000 and 1040
Safety precaution	Do not look into laser beam
Power supply	9 V block battery housed in the power box
Storage temperature	-20°C to 80°C [-4°F to 176°F]
Operating temperature	-10°C to 50°C [14°F to 122°F]
Dimensions	approx. 90 x 90 x 150 mm [BxWxL]
Weight	approx. 820 g [1.8 lb]
Bluetooth® module	
Particulars	Class 1 connectivity, transmitting power 100 mW Transmission distance: up to 100 m [328 ft.] direct line of sight Complies with FCC rules part 15.247 LED indicators: 1 LED for wireless communication, 3 LEDs for battery status Power supply: Batteries 2 x 1.5 V IEC LR6 (AA) Operating time: 14 hours typical use (based upon an operating cycle of 50% measurement, 50% standby) Operating temperature: -10°C to 50°C (14°F to 122°F)
Environmental protection	IP 65 (dustproof and water spray resistant), shockproof
Dimensions	Approx. 81 x 41 x 34 mm (3 1/8" x 1 11/16" x 1 5/16")
Weight	Approx. 133 g (4.7 oz.) including batteries and cable
Carrying case	
Particulars	Material (body): Injection Molded HPX® high performance resin Dimensions: Approx. 551 x 358 x 226 mm (21 11/16" x 14 3/32" x 8 57/64") Weight (including insert foam and all standard parts: Approx. 11 kg (24.25 lbs)

PRUFTECHNIK

Proven technology for all industries

With our products, processes and services for alignment applications, condition monitoring and availability optimization, we help ensure that your machines run smoothly and generate an output of consistently 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



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

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

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

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



Approval of Air Carrier Security Programs

www.pruftechnik.com

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PRUFTECHNIK Condition Monitoring GmbH
Oskar-Messter-Str. 19-21
85737 Ismaning, Germany
Tel.: +49 89 99616-0
Fax: +49 89 99616-200
info@pruftechnik.com
www.pruftechnik.com

A member of the PRUFTECHNIK Group