PERMALIGN®

and
PERMALIGN®
for Windows
software

Operating Instructions

Dear Customer,

If you have any suggestions for improvement or corrections (not only to this manual, but also to software or hardware), please drop us a line! We would be glad to make improvements wherever possible. We look forward to hearing from you!

Foreword

Thank you for choosing PERMALIGN to monitor all machine movements, from thermal growth and machine alignment to tracking long-term machine drift!

PERMALIGN - the system for non-contact displacement measurement

Thermal growth, foundation settling, piping forces and overloading are the most common causes of machine displacement - which can in turn lead to decreased efficiency due to increased loading or even to machine breakdown. PERMALIGN lets you measure up to 16 mm of relative vertical and horizontal machine displacement during operation - without contact, over distances up to 10 m (32 ft.).

The built-in monitor display lets you read off angular and parallel displacement as well as temperature in 'stand-alone' operation with its built-in LCD display and only a simple battery as the power supply. Or connect as many as 16 PERMALIGN monitors at a time to a PC with PERMALIGN for WINDOWS software to produce clear alignment diagrams and to list complete details of current or stored alignment conditions, even over extended periods of time. Graphics software allows you, for example, to relate vertical growth to operating temperature over time and produce corresponding documentation on paper or on file. The same PERMALIGN system can be used to measure other types of displacement such as that of outboard bearings, attached piping or even loading deflection of cranes, to name but a few simple examples.

What's new?

The PERMALIGN monitor was developed and launched back in 1986, and like all good designs has remained virtually unchanged, proving to be extremely rugged, reliable, stable and accurate.

The PC software to store, display and analyse the measurements has of course changed dramatically over the last ten years, from the introduction of a DOS (v.2) -based program with CGA graphics running from a floppy disk, to our latest offering, PERMALIGN for Windows with all the latest bells and whistles that one expects today.

Please ask your PRÜFTECHNIK representative for his solution to your own specific measurement tasks. We look forward to hearing from you and wish you much success in your alignment endeavors!

Ismaning, July 1996
P R Ü F T E C H N I K A G

Contents

Laser safety

PERMALIGN uses a Class I laser beam. Class I lasers comply with the requirements outlined in the USA's FDA specification 21 CFR Ch. 1, Parts 1040.10 and 1040.11. This system also also fulfills the British standard BS 4803 (Part 1 to Part 3) as well as ANS standards and the German Industrial Standard DIN JEC 76 (CO) 6. This Class I laser operates at 780 nm wavelength (typical), with a maximum pulse duration of 200 μsec., maximum radiant power of 1.7 mW and maximum radiant energy per pulse of 0.34 μJ. No maintenance is necessary to keep this product in compliance with the above specifications.

The diagram below shows the location of laser safety labeling on the PERMALIGN transducer housing.
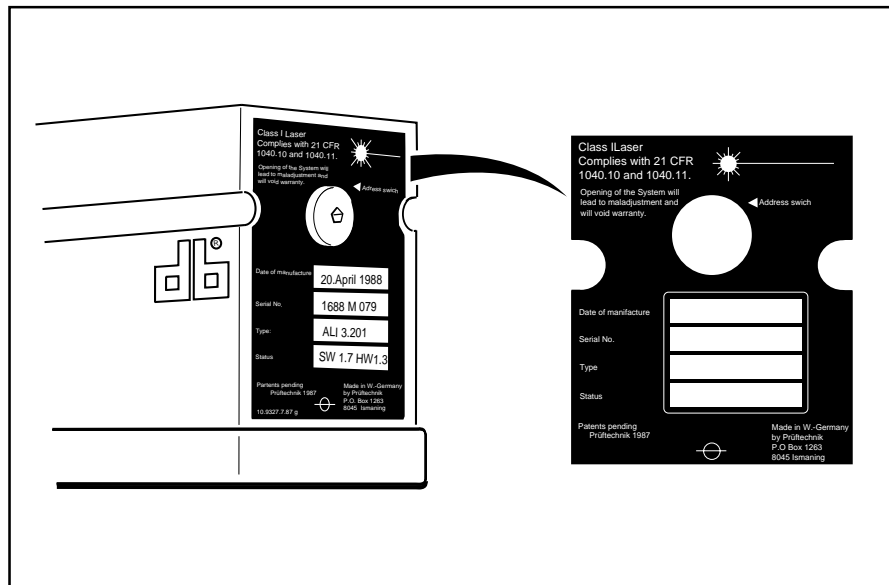
Caution: Use of controls or adjustment or performance of procedures other than those specified herein may result in hazardous radiation exposure.

Welcome to PERMALIGN and PERMALIGN for WINDOWS!

What is PERMALIGN?

The name PERMALIGN is a compound formed from the words "PERManent ALIGNment."

Over ten years ago PRÜFTECHNIK first applied laser optics to perform shaft alignment with the OPTALIGN system, eliminating the need for dial indicators. Soon thereafter, several inventive customers suggested affixing the same laser-optical measurement components to the machine housings for long-term alignment monitoring. The original components were not designed to fulfill that task, but new hardware was then produced especially for this purpose, allowing users to measure machine position changes with high accuracy while saving most of the time and effort required by conventional measurement methods.

What is PERMALIGN for WINDOWS?

Computers.. they are rather humorless things, but they do excel in manipulating numbers - machine alignment measurements in our case. They are ideally suited to the laborious task of reading-in, storing and processing thousands of measurements over a long period of time.

PERMALIGN for WINDOWS PC software transforms your thousands of raw measurements into meaningful colored graphs so that you can see in an instant what's been going on and by how much! PERMALIGN for Windows can monitor simultaneously from up to 16 PERMALIGN monitors bolted around your machines so you can make every conceiveable conclusion and deduction about the changes in shape, size and position of your equipment once you've switched them on!

Important notes

Laser

The PERMALIGN monitor incorporates an infra-red (invisible) laser transducer which is completely harmless to the human eye and no safety precautions are required for use. Please see the Laser Safety notice on page 4 for details.

Intrinsic safety and explosive environments

The standard version of PERMALIGN is not certified as intrinsically safe and therefore its use in hazardous conditions must be cleared with plant safety departments.

An intrinsically safe version of PERMALIGN is available which meets Germany's EEx ib IIc T4 Zone 1 standards (generally regarded to be among the world's most stringent) for alignment of machines located in explosive environments. Note that the PC that is used with PERMALIGN must be operated outside the hazardous area, with extra long cables if necessary.

Precautions

Avoid working with PERMALIGN in the immediate vicinity of strong, hot light sources, and be careful that point light sources do not shine directly into the monitor lens.

Do not operate mobile radio communication equipment near the system, as it may, in rare cases, interfere with measurement, requiring that they be repeated.

The recommended temperature ranges are as follows:
PERMALIGN Monitor operation   :   0 - 50°C   (32° - 122° F)
   "   with cooling (page 22) :   0 - 70°C   (32° - 158°F)
PERMALIGN Prism operation   :   0 - 160°C (32° - 320°F)
PERMALIGN System storage   : -20 - 80°C (-4° to 176° F).

Warranty

A 1-year warranty is provided for the system (2-year warranty for the laser diode). For inspection, repairs or calibration send the system to the central distributor. Contact your local distributor for details.

This is a precision measuring instrument! Avoid subjecting any parts of the system to dropping or other abuse, such as pulling or twisting of the cables. This system requires careful handling to avoid damage. It should preferably be put in charge of one or a few responsible persons who will restrict its use to those who will treat it with due care.
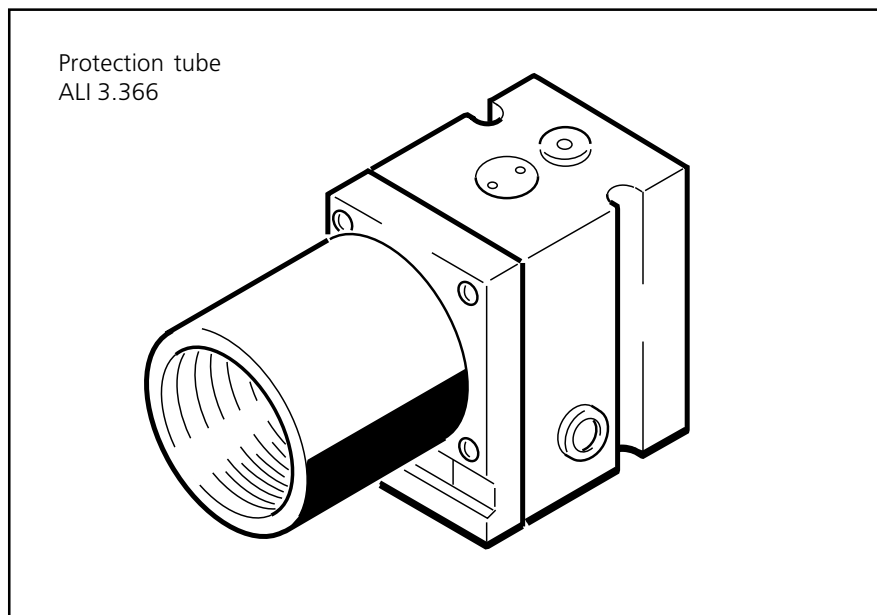
Should the correct functioning of the system be in doubt, the connecting cables between monitor, battery and computer should be checked first. The troubleshooting guide on page 84 offers additional advice on malfunction diagnosis and correction.

Care

The PERMALIGN monitor requires no maintenance as such. However, the following considerations should be observed:

The lens and reflector surface must remain clean in order to ensure reliable measurement. Therefore they should be checked regularly for excessive contamination and, if necessary, cleaned using the ALI 2.905 cleaning set or a fine dusting brush such as that normally used to clean other optical devices. Extreme contamination of the optical surfaces (e.g. with oil, grease, etc.) may be removed using any good optical cleaning fluid. The industrial-grade glass surfaces are extremely scratch resistant.

If the work area is by nature extremely dusty, the optional dust protection tube (order no. ALI 3.366) should be mounted on the front of the monitor to reduce the frequency of cleaning necessary:

The PERMALIGN monitor housing may be opened for servicing only by PRÜFTECHNIK or its authorized customer service representatives.

Any unauthorized service attempt will invalidate the warranty and may result in costly additional damage.

Protection tube
ALI 3.366

The bracket and monitor housing can be cleaned using a damp cloth and a mild soap solution (such as dishwashing liquid).

The internal function of all electronic components is checked automatically each time the monitor switched on.

Conformance with monitor operating temperature specifications should be checked regularly. Operation beyond this temperature range may jeopardize the specified system accuracy.

An extra set of connecting cables held in reserve may save time and frustration in case of breakage, but no other spare parts should be required.

PERMALIGN measurement principle

The PERMALIGN system is an optical measurement system for detection and display of relative positional change between two points in terms of direction and magnitude. Its operating principle may be easily grasped using the following analogy:
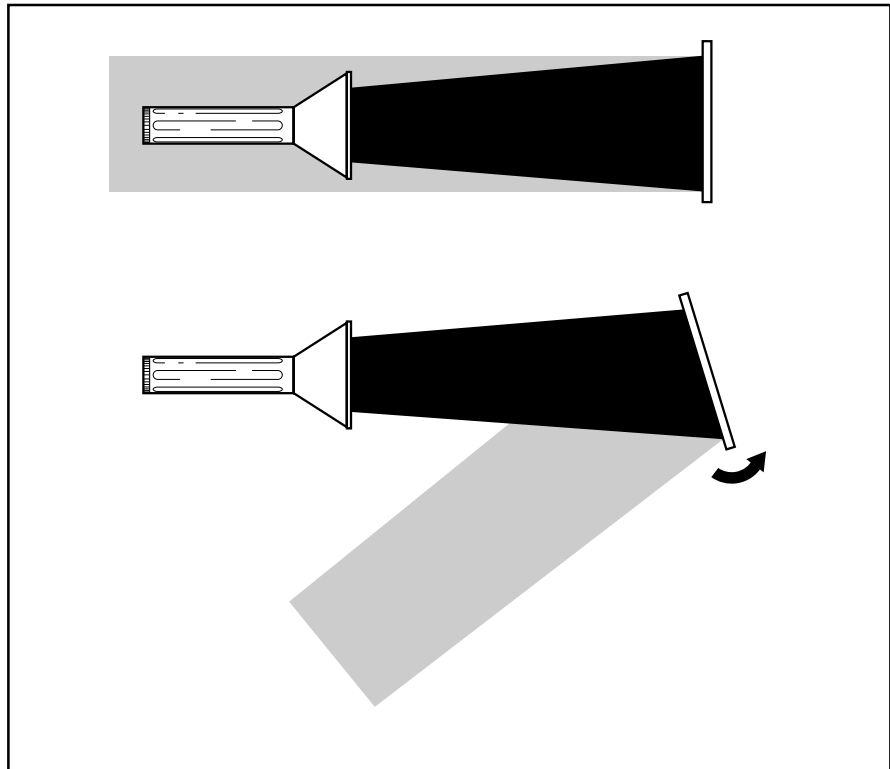
The direction of the reflected light beam changes with the position of the mirror.

When directed toward an ordinary mirror, a flashlight beam may be reflected straight back toward the flashlight (provided the mirror is situated as shown). If the mirror then is tipped, the light beam is reflected in a different direction.

The PERMALIGN monitor detects and measures this change in the position of the mirror and calculate the exact magnitude and direction of the movement. This information is useful for monitoring any object to which the mirror is attached. In fact you may notice that the beam angle changes by TWICE the angle of the mirror. The PERMALIGN monitor compensates for this by dividing the detected displacements by two, and thus shows the actual mirror movement.

Of course, the PERMALIGN does not use an ordinary beam of light, but instead takes advantage of laser light properties to attain extremely high precision. Likewise, the reflector used is no ordinary mirror, but rather a 90° roof prism.

How are these components then actually used? The laser beam emitted from the PERMALIGN monitor is reflected from a prism or mirror back into the monitor and strikes a detector within. Whenever the position of the reflector changes, the direction or location of the laser beam changes, as does its point of incidence into the detector.

Electronics

Unit ID Number
Code Switch

Infrared Filter

Position Detector

Laser Diode

Collimator

Semitransparent Half-Silvered Mirror

Front Lens

Laser beam

LCD Display

Reflector

This change due to reflector displacement is indicated in the PERMALIGN monitor LCD display in terms of millimeters (or inches) of laser beam travel in the detector. The detector coordinates are passed to the computer, which uses them to calculate the alignment diagram.

PERMALIGN components

The PERMALIGN system consists of the following components:

Monitor: produces the beam of light for measurement
Prism: returns the light beam
Position detector: determines the location of the reflected light beam
Electronics: transform the detected measurement signal into a clear information display

### PERMALIGN monitor   ALI 3.201

The PERMALIGN monitor utilizes a semiconductor laser to produce the light beam used in measurement. The pulsed infrared light beam (wavelength 780nm: invisible) is completely harmless to the human eye. No safety precautions are required for use.

PERMALIGN monitor
ALI 3.201
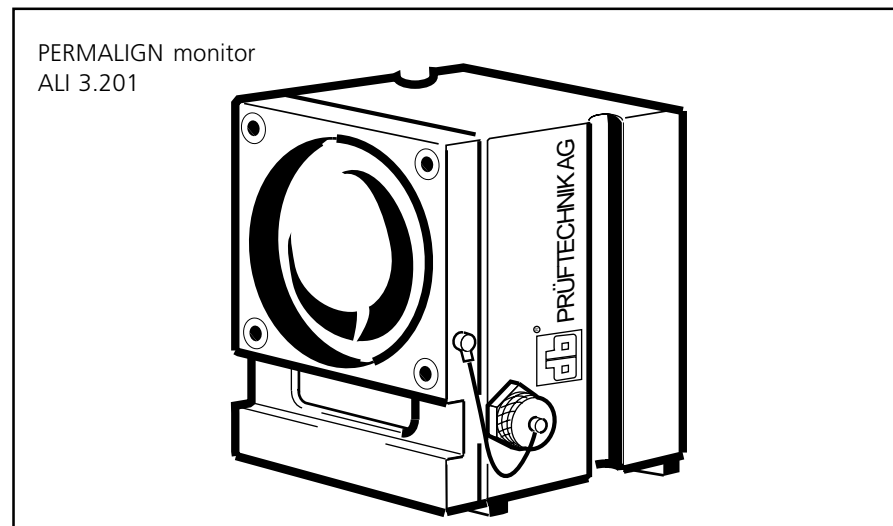
The monitor also contains a biaxial analog photoelectric semiconductor position detector with a resolution of $1\,\mu$m. This is a particularily rugged device normally used for permanent monitoring: its response is exceptionally stable over time within a broad operating temperature range, and its mechanical measurement range is very large. There is also an LCD display under the lens informing of the monitor's status.

90° roof prism   ALI 3.202

The reflector serves to return the laser beam back into the sensor housing. The wide variety of application to which the PERMALIGN system lends itself requires a range of reflectors having different reflective properties, but for the purpose of shaft alignment monitoring, a 90° roof prism is used to detect rotation about one axis and parallel motion along the same axis. The motion coordinates are then displayed in the LCD window of the monitor and passed along to the computer.

90°roof prism
ALI 3.202
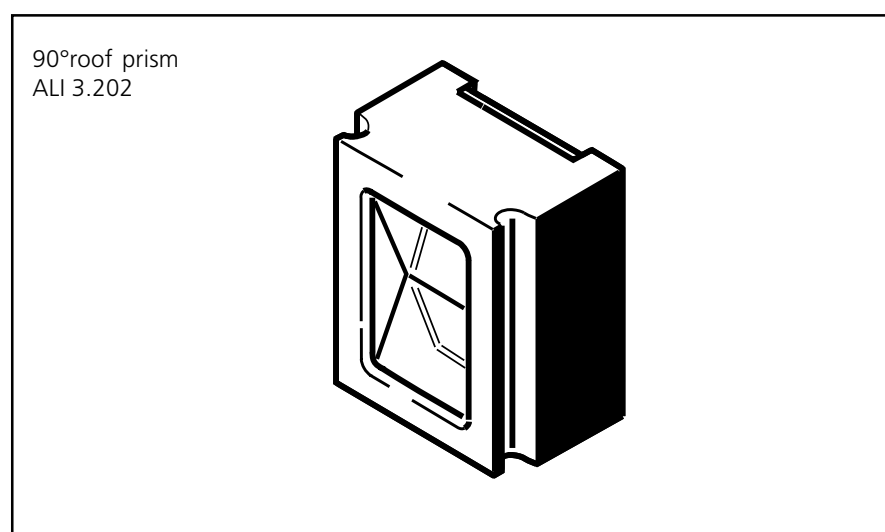
A 90° roof prism reflects the laser beam toward the sensor in such a way that both parallel motion along its vertical axis and rotational movement about the same axis may be detected as follows (see also page 17):

When the prism is **rotated** about a vertical axis **toward** the observer, the reflected beam is **deflected toward** the observer.

When the 90° roof prism is **shifted parallel upward**, the reflected beam **shifts upward**.

When the 90° roof prism is **rotated about its horizontal axis**, the reflected beam **does not move** at all.

When the 90° roof prism is **shifted parallel sideways**, the reflected beam **does not move** at all.

Reflector systems

There are several different types of reflector available for different types of applications.

90° Prism   ALI 3.202

90° prism, metal-silvered, non-reflective coated glass, aluminum housing; marking allows exact distance measurement. Reflector cap ALI 3.218 included.
Planarity: better than 1 ring*
Angular accuracy: better than 5 sec.*
Reflectivity: > 95%
Dimensions: approx. 64 x 70 x 38 mm
                    (2 1/2 " x 2 3/4 " x 1 1/2 ")
Weight: approx. 310g (11 oz.)
Max. operating temperature:160°C (320°F)

Plane mirror   ALI 3.219

Glass mirror, metal reflective coating, antiglare multicoated, aluminum housing. Reflector cap ALI 3.218 included.
Planarity: better than 1 ring*
Reflectivity: > 95%
Dimensions: approx. 64 x 70 x 38 mm
                    (2 1/2 " x 2 3/4 " x 1 1/2 ")
Weight: approx. 280g (10 oz.)
Max. operating temperature:160°C (320°F)

Corner cube prism   ALI 3.220

Glass prism, metal reflective coating, antiglare multicoated, aluminum housing. Reflector cap ALI 3.218 included.
Planarity: better than 1 ring*
Angular accuracy: better than 5 sec.*
Reflectivity: > 95%
Dimensions: approx. 64 x 70 x 38 mm
                    (2 1/2 " x 2 3/4 " x 1 1/2 ")
Weight: approx. 280g (10 oz.)
Max. operating temperature:160°C (320°F)

*Higher accuracy available optionally for certain applications.
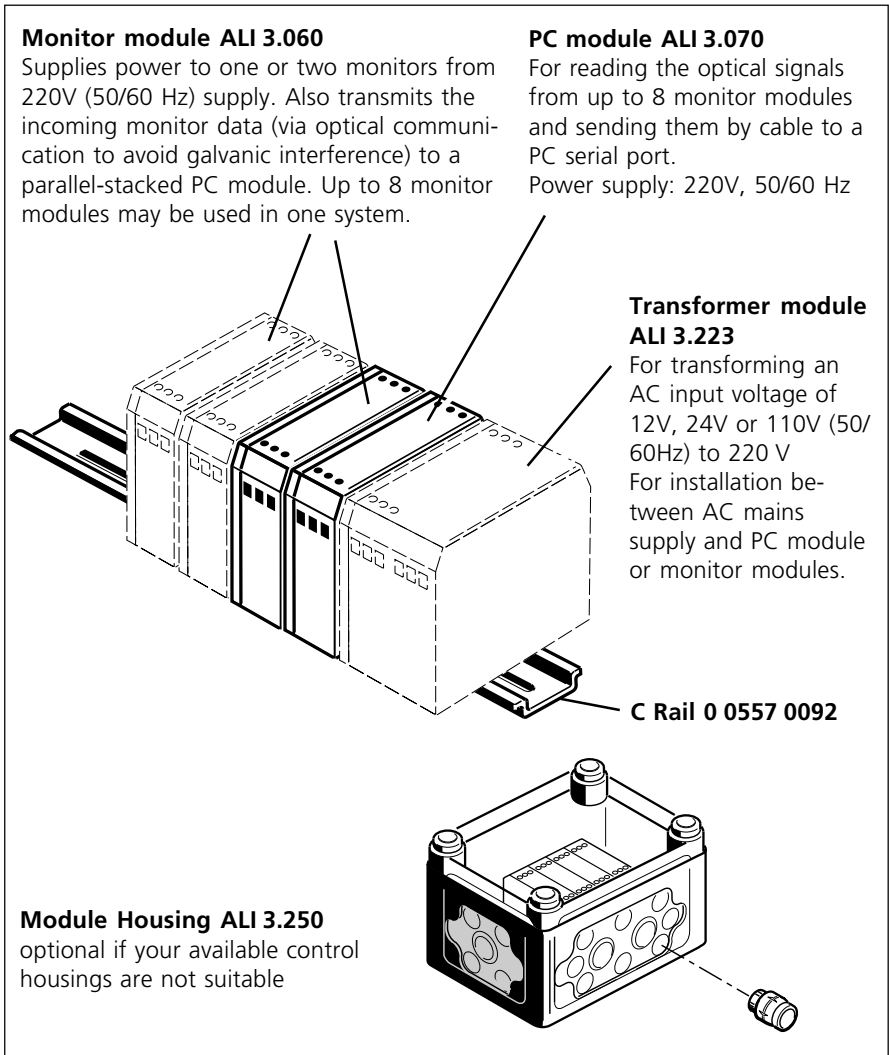
External battery with RS232   ALI 4.610

The monitor can be powered by an external rechargeable battery unit. This unit also interfaces the monitor to the serial port of the PC. To recharge, use the mains adapter SYS 2.032.
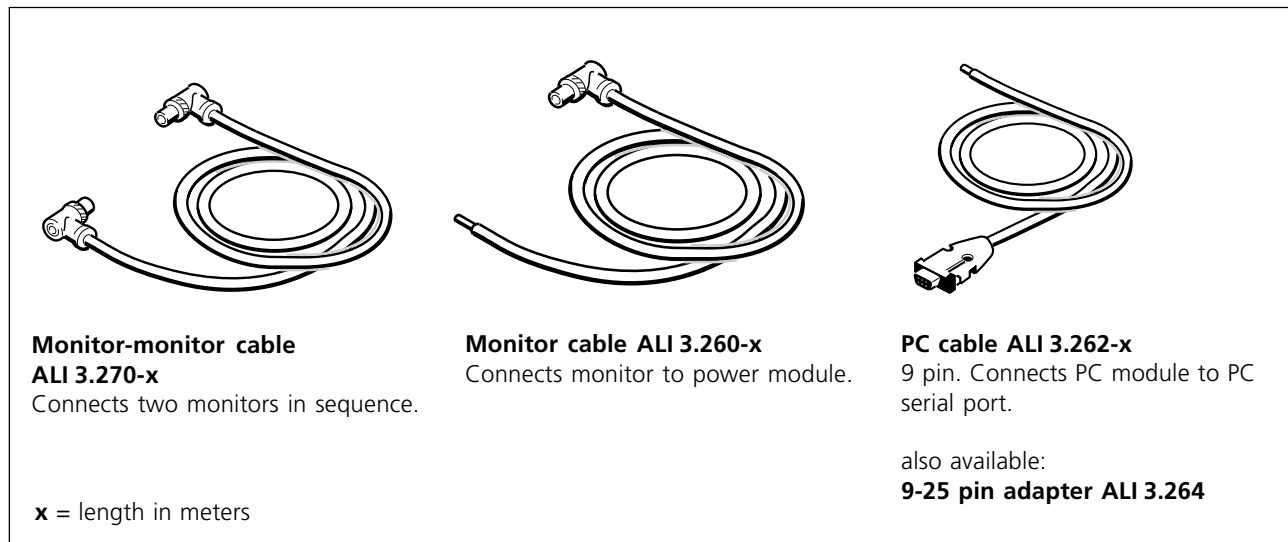
**External Battery
ALI 4.610**

To Monitor
or Charger

To PC Serial port
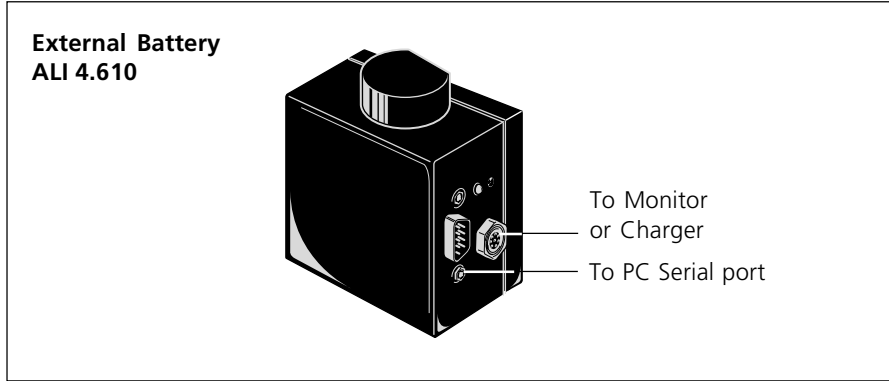
Power modules

See pages 24 and 87
for wiring details

For multiple monitor setups and/or mains operation, a modular system is available:

Monitor module ALI 3.060
Supplies power to one or two monitors from 220V (50/60 Hz) supply. Also transmits the incoming monitor data (via optical communication to avoid galvanic interference) to a parallel-stacked PC module. Up to 8 monitor modules may be used in one system.

PC module ALI 3.070
For reading the optical signals from up to 8 monitor modules and sending them by cable to a PC serial port.
Power supply: 220V, 50/60 Hz

Transformer module ALI 3.223
For transforming an AC input voltage of 12V, 24V or 110V (50/60Hz) to 220 V
For installation between AC mains supply and PC module or monitor modules.

C Rail 0 0557 0092

Module Housing ALI 3.250
optional if your available control housings are not suitable

Cables

Monitor-monitor cable
ALI 3.270-x
Connects two monitors in sequence.

Monitor cable **ALI 3.260-x**
Connects monitor to power module.

PC cable ALI 3.262-x
9 pin. Connects PC module to PC serial port.

also available:
9-25 pin adapter ALI 3.264
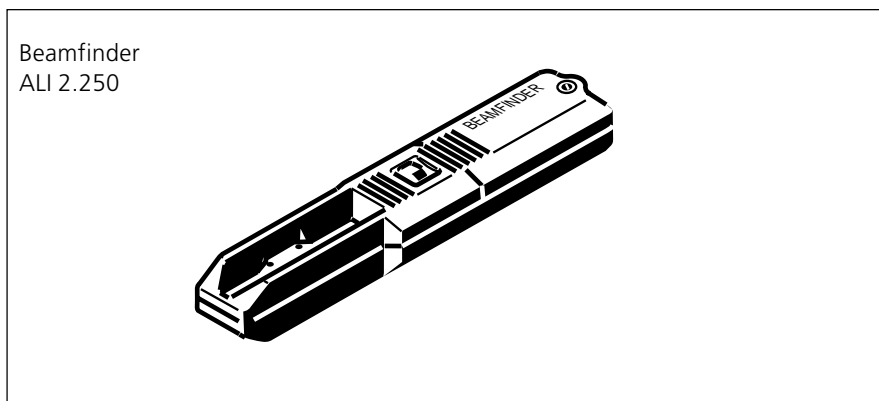
x = length in meters

Beamfinder   ALI 2.250

This hand-held device detects the invisible infra-red laser beam with an array of sensors. The position of the beam can be determined both with its pattern of green/red LEDs and audiably.

Beamfinder
ALI 2.250

Switch on and hold the beamfinder with the sensor array facing the emitted laser beam. Four control lamps indicate, with green or red lights, the location at which the laser beam strikes the array. The laser beam is located in the exact center of the array when all four LED's flash green and a beeping sound is heard. The unit switches off automatically in the dark e.g. when replaced in the case, and is powered by a standard 9V battery.

Mounting PERMALIGN

General notes

In order to determine misalignment of coupled machines resulting from thermal growth, sinking foundations, etc. the user fastens a PERMALIGN monitor to one machine and the reflector onto the other; the magnitude and direction of any motion of one machine with respect to the other will then be reported by the system based upon the operating principle described earlier.

One sensor system may be used to observe two parameters simultaneously: each 90° roof prism allows detection of a relative parallel displacement of up to ± 8 mm (± 5/16 in.) and relative displacement of up to ± 8 mm (± 5/16 in.) resulting from angular rotation about the same axis.

Generally, two systems are used in conjunction for close observation of all four alignment parameters (degrees of freedom) which describe the alignment condition of coupled machinery (see opposite). This is why two systems are shown below mounted perpendicularly to one another.

max. 10m (30 ft)
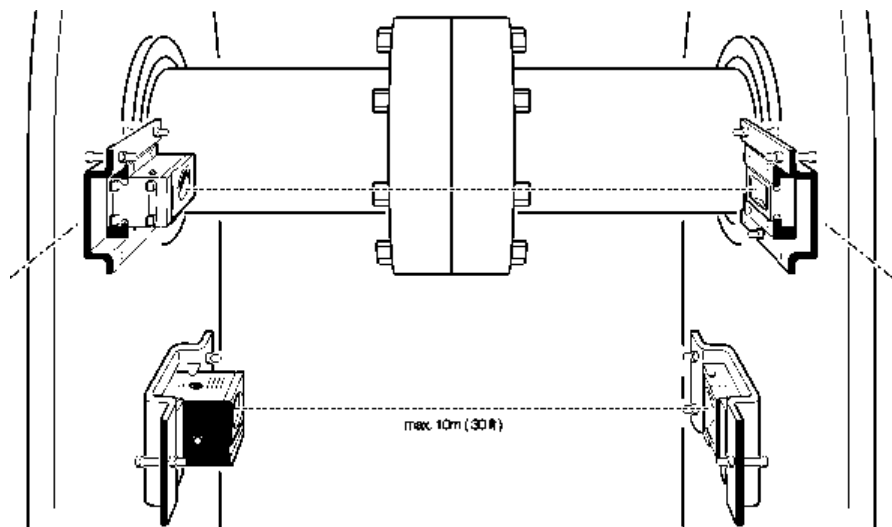
Additional monitors may be used for absolute measurements as opposed to relative movements between machines e.g. by measuring between the machine and a solid foundation.

Of course, use of the PERMALIGN system is by no means limited only to monitoring the positions of shaft-coupled machinery. As a generally applicable measurement system, the PERMALIGN allows simple yet precise monitoring of an extremely wide variety of structures, such as those encountered in steel mills, machine tool fabrication, or building construction.

Alignment measurements

Measuring alignment between machines (usually across the coupling) is probably the most common monitoring application; this is performed with 2 monitors mounted at 90° to each other. Here are some notes on alignment:

Two machines are 'aligned' to one another when the rotational axes of both shafts are colinear during operation.

The following chart shows the possible deviations from this ideal condition:
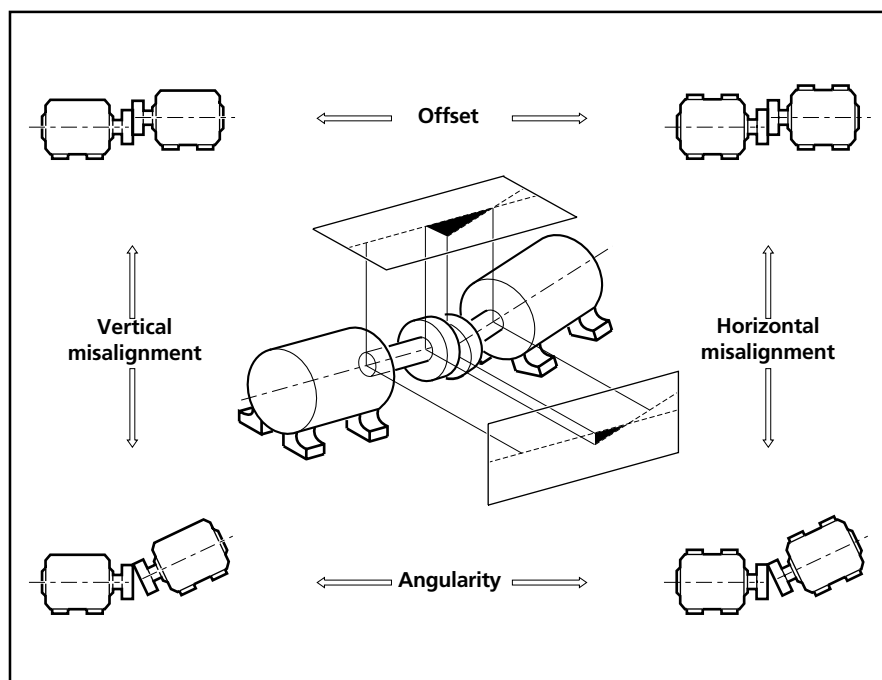
Any misalignment between the two machine shafts, as shown above, may be considered in terms of four basic alignment parameters:

        Vertical offset   Vertical angularity

        Horizontal offset   Horizontal angularity

These four degrees of freedom must be measured in order to achieve correct alignment. PERMALIGN for Windows can be setup to display these four values and even the movements in the machine feet so that direct corrections can be made.

Precut shims available from PRÜFTECHNIK such as PERMABLOC® or LAMIBLOC® can reduce greatly the time and effort needed for vertical alignment adjustments.

Two PERMALIGNs = four parameters

Why are two PERMALIGN systems needed in order to monitor the four alignment parameters?

Take a look at the chart opposite showing the effects of prism movement on the beam reflection, and the diagram on page 14 showing the recommended setup.

The monitor and reflector are usually mounted opposite each other with the distance markers 'o' pointing in the same direction as shown right in the top view.
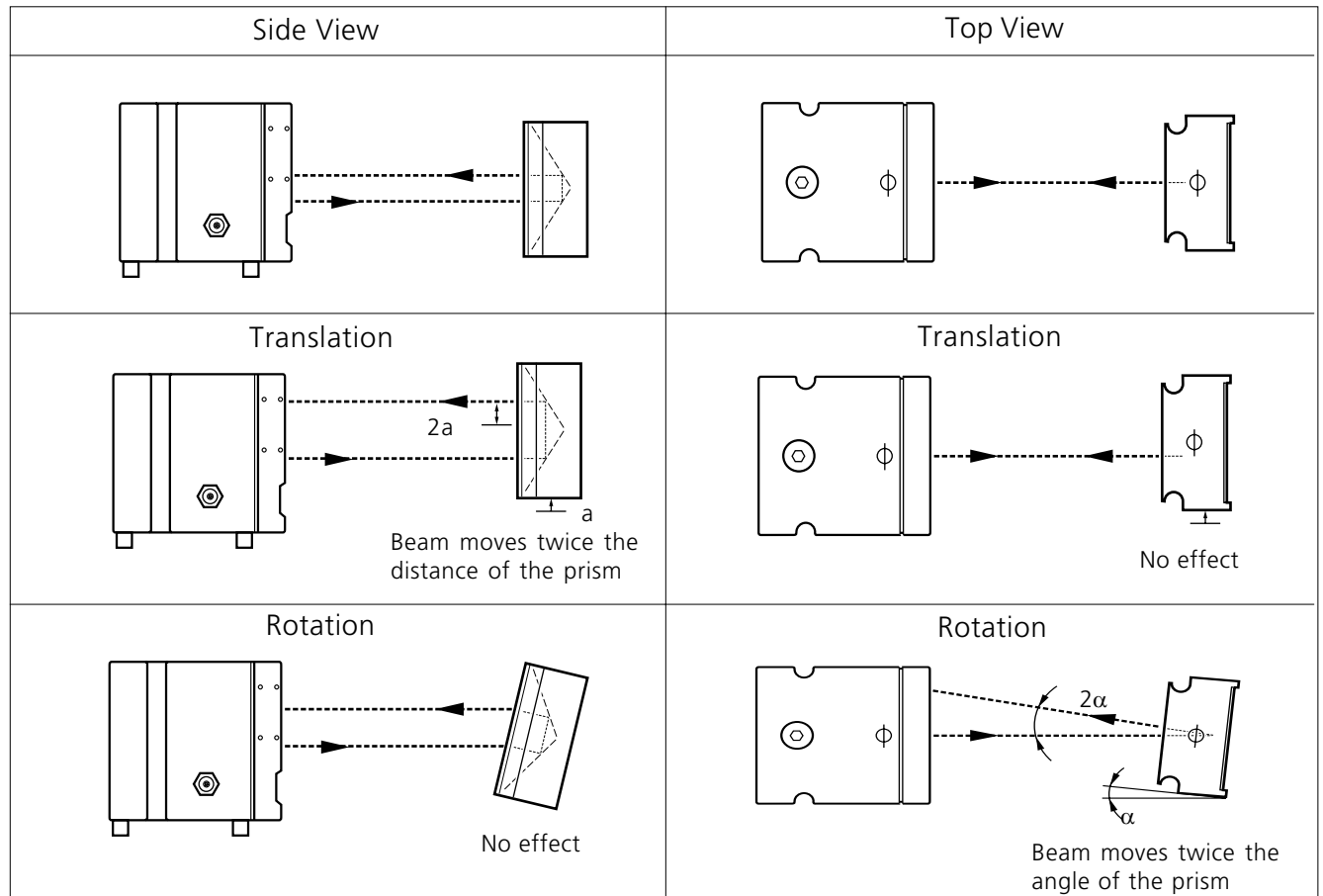
Any vertical movement of the reflector will cause the reflected beam to shift by twice the amount of actual movement. The detected displacement is then **halved** in order to determine the actual parallel movement of the detector. Horizontal reflector displacement exerts no influence upon the path of the reflected beam.

If the prism is rotated (twisted) about the vertical axis, the angle between incident and exit beams changes. The actual amount of angular displacement is equal to **half** the angular change detected by the monitor. Tipping the prism about the horizontal axis exerts no influence upon the path of the reflected beam.

This means that in order to monitor, for example, both angular and parallel displacement about the same axis, two systems must be mounted with their major axes perpendicular. Two systems, then, allow complete observation of all four types of motion, which in turn allows simultaneous monitoring of all four alignment parameters previously mentioned.

The only dimensions such an arrangement would leave unchecked are rotation about the machine shaft and axial distance between machines; however, the former has little practical effect on machine alignment, while the latter may be checked quite easily.

Summary of the action of 90° prism translation and rotation on the reflected beam

Side View	Top View
Translation	Translation
2a a Beam moves twice the distance of the prism	No effect
Rotation	Rotation
No effect	2α α Beam moves twice the angle of the prism

Note, PERMALIGN automatically divides measurements by 2 so that it outputs the actual positional changes of the prism.

Monitor Locations

All machine parts are suitable for mounting monitor and reflector **as long as they serve to rigidly connect the front and rear bearings of the machine**, so that their movements are transmitted directly to the system; for example, all vertical surfaces on the machine housing or on the nameplate may be used.

For shaft alignment measurement applications mounting points for monitors should generally be close to bearings and rigidly connected to the bearings, so as to show the true movement of the shafts. Placement should be chosen so that the major axis of each system intersects the shaft centerline. This arangement eliminates effects of housing distortion due to thermal changes.

An **unobstructed path** must be provided for the laser beam; i.e. no machine or coupling parts may extend into the beam path or interrupt it.

Use a spirit level to ensure exact vertical and horizontal positioning of the mounting brackets.

Setting up PERMALIGN for other applications

PERMALIGN can be used for a diverse range of applications as well as shaft alignment measurement. Here are two further monitoring examples:
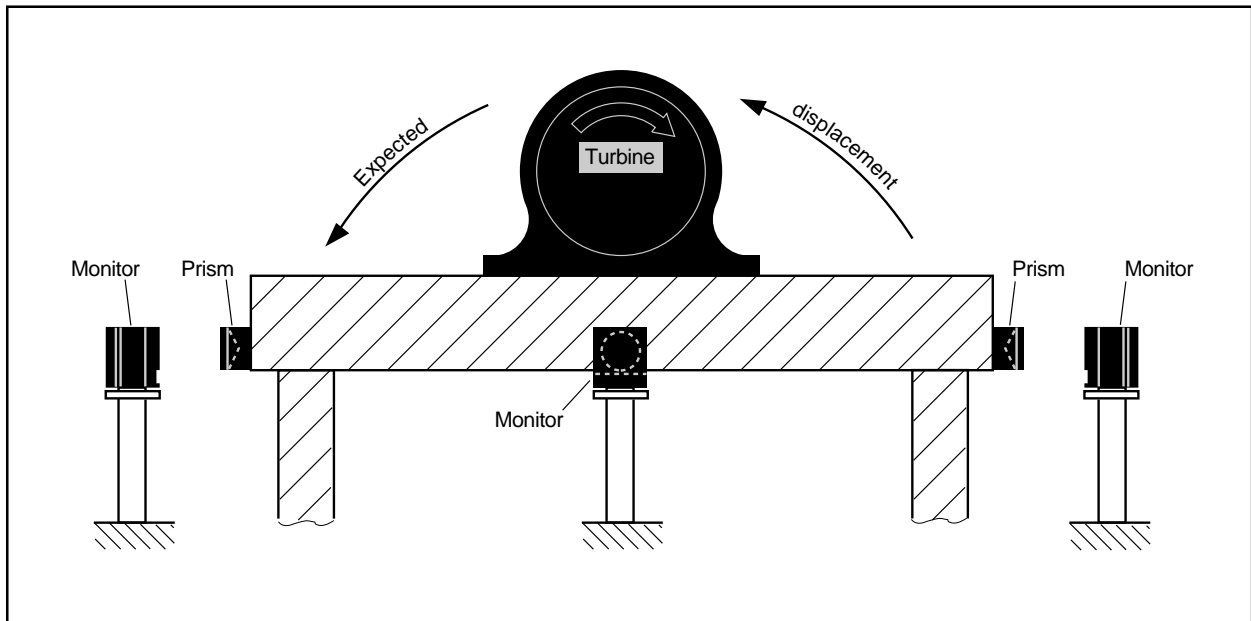
PERMALIGN monitors were setup around this turbine base to continuously monitor its position. Alarm levels were setup in PERMALIGN for Windows to warn that alignment was exceeding allowable limits.
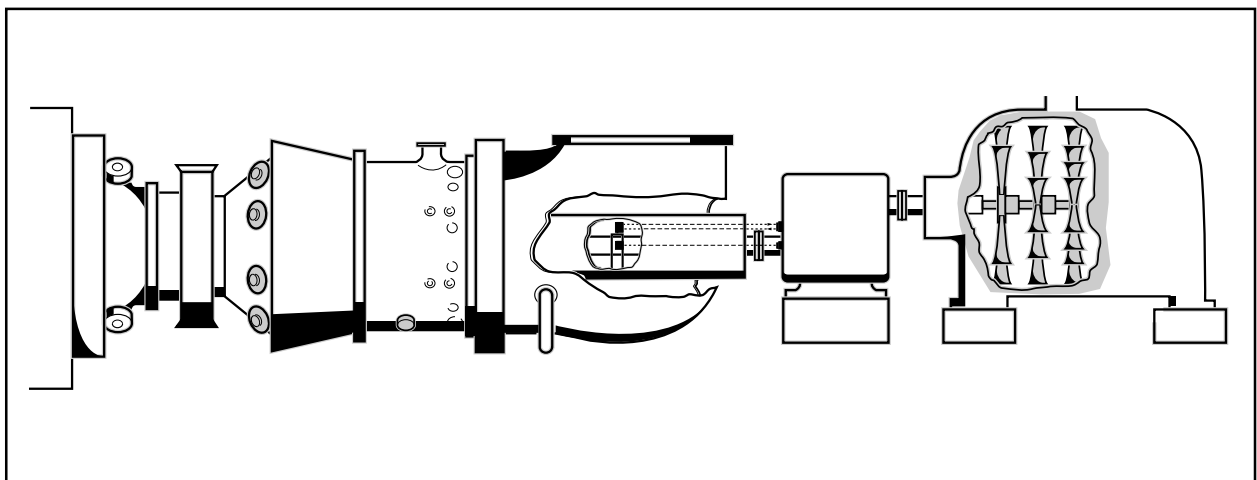

PERMALIGN monitors were setup inside this turbine to try to solve a vibration problem. It was found that vibration increased with the measured deviation. See page 75 for details.

PERMALIGN brackets

Check the monitor addresses, preferably before mounting. See page 31.

The monitor and reflector fit into special brackets which are mounted onto the machine housing using three threaded rods. This configuration allows the brackets to be tilted in any direction for easy adjustment during installation by varying the height of the individual bolts.
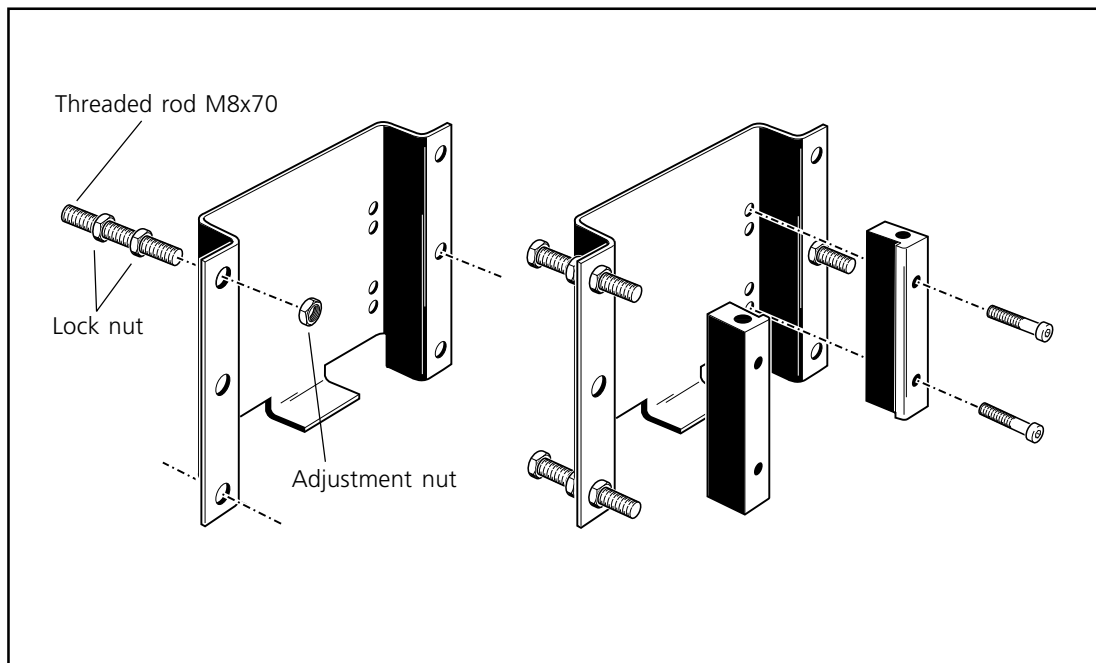

Washers and spacers must not be used when mounting brackets!

See also the new PERMAFIX bracket described on page 78 for quick temporary applications.

1. Use a spirit level to ensure exact vertical and horizontal positioning of brackets on the machine housing. The back plates are then mounted using three threaded rods in alternate holes for stability as shown.

2. For delicate measurements you may be advised to apply thermal conduction paste to the inner surfaces of the chocks which contact the monitor housing. This will reduce any minor distortions from differing temperatures between the machine and monitor.

3. Line up the guide pins on the chocks with the corresponding holes in the back piece and fasten the chocks **loosely** into place using the supplied Allen wrench (hex key).

4.   Now slide the PERMALIGN monitor into the bracket from above and tighten down the four hex bolts onto the back plate.

The reflector is mounted in exactly the same manner, using the same parts and tools. Make sure it is mounted perpendicularily opposite the monitor.
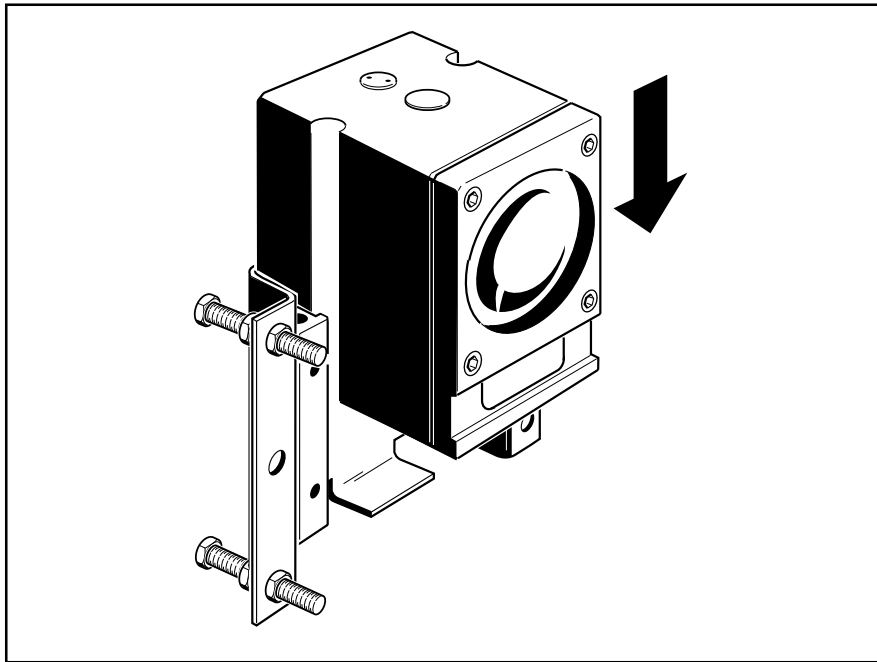

Using other brackets
When other brackets are to be used to fasten the PERMALIGN components to machine housings, they must be sufficiently rigid to withstand a maximum torque of 10000 Nm without deflecting.

Base mounting the monitor
The base plate of the PERMALIGN Monitor is provided with four M5 screw holes, allowing simple yet rigid attachment to any suitable surface.

Controlling monitor temperature

The temperature range within which the monitor is to be operated must lie within the values given in the specifications (see page 88). Reliable operation may be ensured under extreme temperature conditions by circulating cooling or heating fluid through flange tubing. The use of thermal conductive paste (copper paste or another thermal coupling medium) is recommended in such cases to achieve efficient heat transfer between the monitor and the fluid.

Flange Tubing
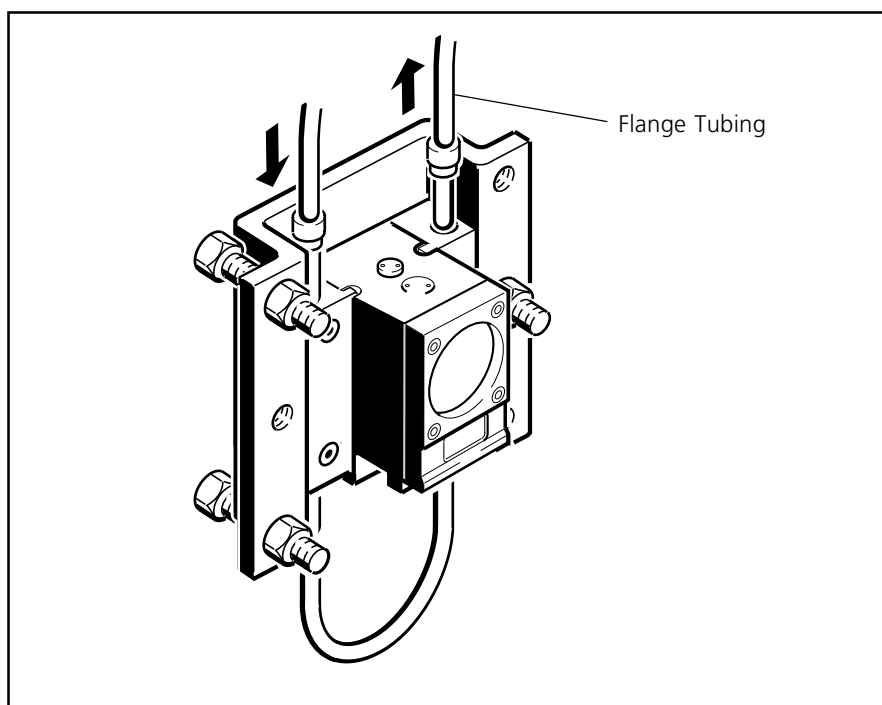
When external cooling is used, condensation must be avoided so that the lens does not fog over, as this would interrupt the laser beam. In fact, condensation can occur when the temperature difference between the monitor and environment exceeds 15 - 20 C (59° - 68°F).
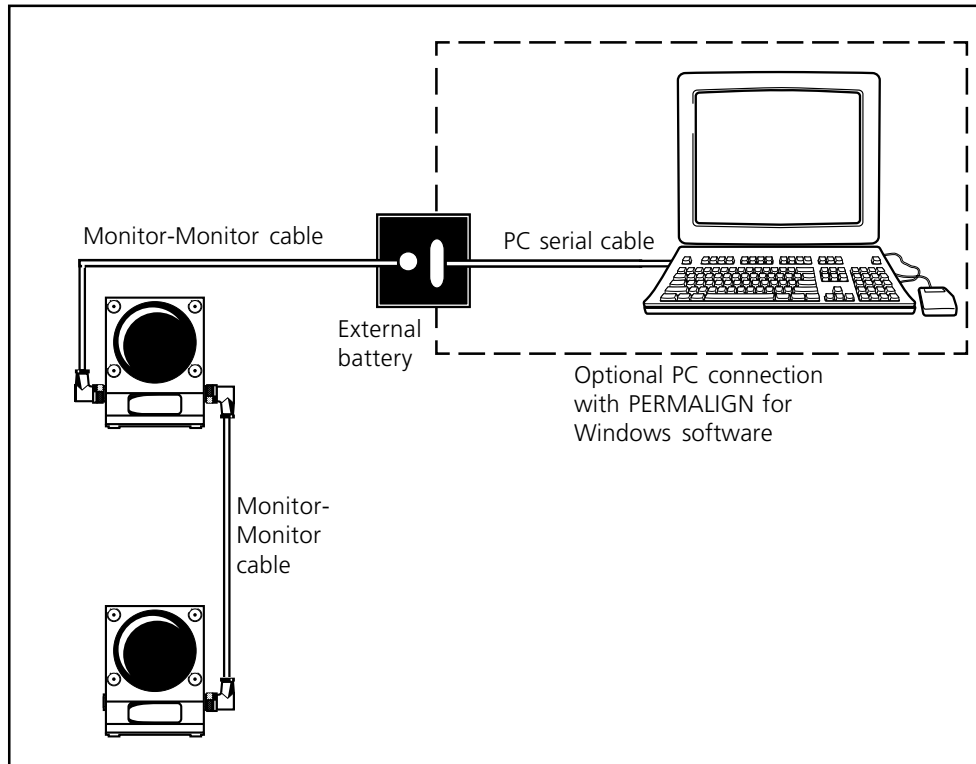
External cooling or heating allows the application of the PERMALIGN monitor in environments where temperatures lie beyond specifications.

Since the machines do not usually operate at exactly the same temperature, the monitor is best mounted on the machine whose temperature most closely fulfills the temperature specifications mentioned above; the reflector may be subjected to more extreme temperatures with no ill effects.

In extremely dusty or damp surroundings, additional tubing may be mounted to supply a steady flow of filtered air to protect the optical surfaces (i.e. lens and prism) from undue contamination.

PERMALIGN connections

Battery connection

Monitor-Monitor cable

PC serial cable

External battery

Monitor-Monitor cable

Optional PC connection with PERMALIGN for Windows software

a)   Connect the monitor to the external battery unit with the round socket cable. Note that this immediately powers the monitor, so to reduce battery drain keep them disconnected when not performing measurements.
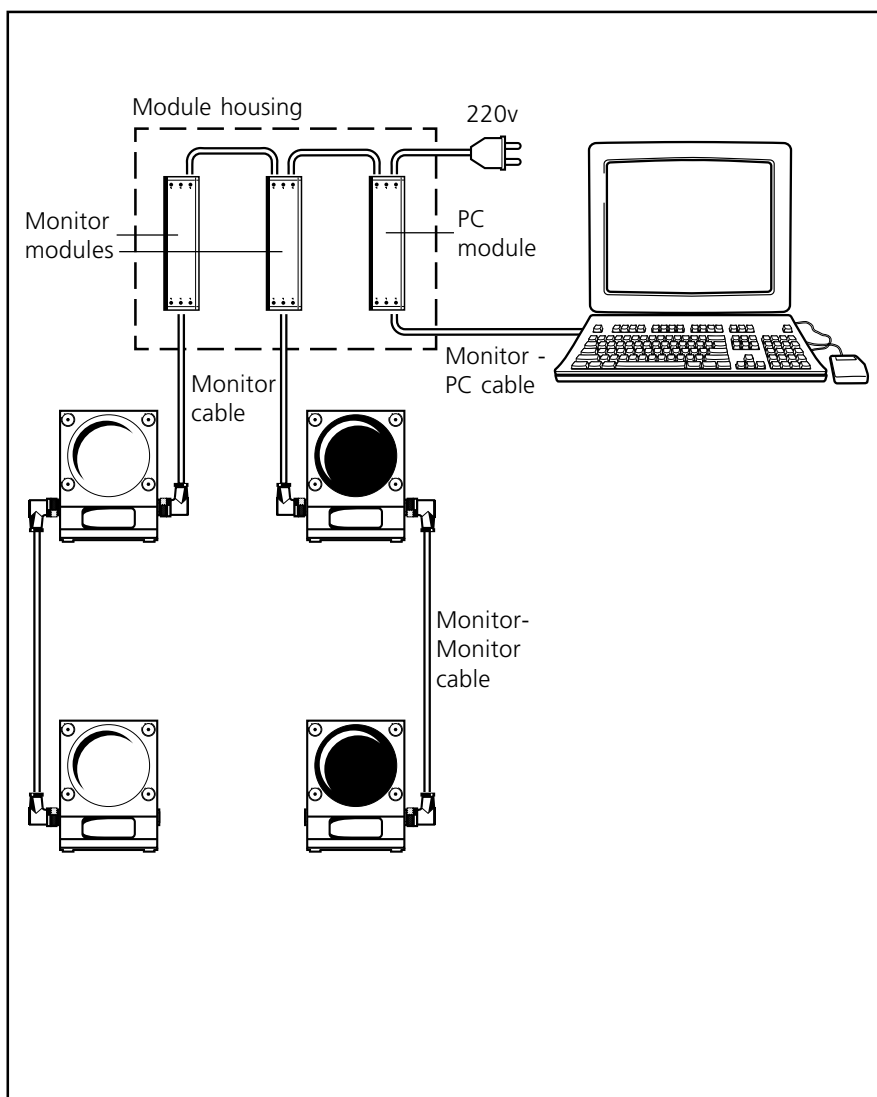
Connect the battery to a spare serial (COM) port on the PC with the 9-pin socket cable. See the troubleshooting software checklist, page 82, for further details concerning the serial port.

b)   If the battery is charged then some symbols will appear on the small LCD display behind the lens on the monitor. If the symbols show '**Batt**' then the battery needs to be recharged. Disconnect the monitor and serial cable and connect the charger supplied.

c)   The system is now complete, and it remains to align the laser to the mirror. This will be carried out during the operation of the computer program, as the detector coordinates are clearly shown on the computer screen.

Mains connection of up to 16 monitors

If more than two monitors are used or if you prefer to use mains power then the PRÜFTECHNIK modular system should be used to power the monitors and to transfer the data to a PC. On page 12 is given the details of the individual modules required. Here is a typical setup:

One 'Monitor module' is required for each pair of monitors, and a 'PC module' is required to interface up to 8 monitor modules to a PC serial (RS232) socket i.e. up to 16 monitors can be used in one system.

Optical coupling: Mask off the ends of the block of monitors so that there is no possibility of interference from external light sources.

The modules are mains (220V) powered and an inverting transformer is available to other lower supplies (see page 12). The modules communicate with each other optically. The modules mount on a 'C' rail which can fit in your existing control housings or in its own separate housings. See page 87 for a detailed wiring plan.

Adjusting the monitor and reflector

Position the monitor by turning the adjustment bolts so that the laser beam strikes the reflector as close to its center as possible. The beamfinder may be of help here as the infra-red laser beam is invisible. Using the Beamfinder:

Short distances

Over short distances up to about 1m (~3') you can trace the beam along its path from the monitor to the prism, then adjust the monitor direction and/or slide it up & down in its bracket. Then trace back to the monitor and similarly adjust the prism:
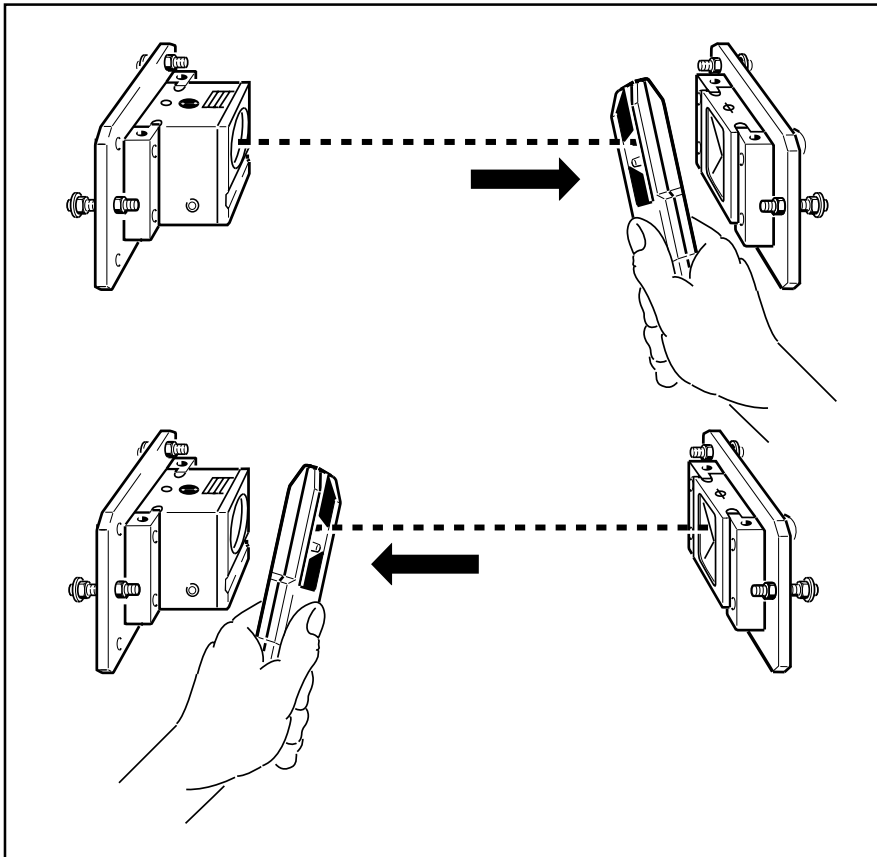
Note that changing the vertical angle of a 90° prism does not alter the angle of the return beam! (See page 17) To adjust the beam vertically you must slide the prism up/down.

Longer distances

Over distances greater than about 1m (~3') it becomes increasingly difficult to trace the beam along its path. In this case it is recommended to 'hunt' for the beam in the same plane as the reflector. Start at the center of the prism and move the beam finder in a spiral until the beam is found. Then ask your able assistant to adjust the monitor slowly into line with the prism, as you follow the beam movement. When the monitor angle is correct you can repeat the procedure for the reflected beam, holding the beamfinder in the plane of the monitor and adjusting the prism angle and/or sliding it up and down in its bracket.

Once the monitor and reflector are properly positioned, all mounting, positioning and lock nuts should be locked into place using a liquid thread sealant.

The computer display may also be of help when adjusting the components: see page 54 for instructions on the adjustment screen.

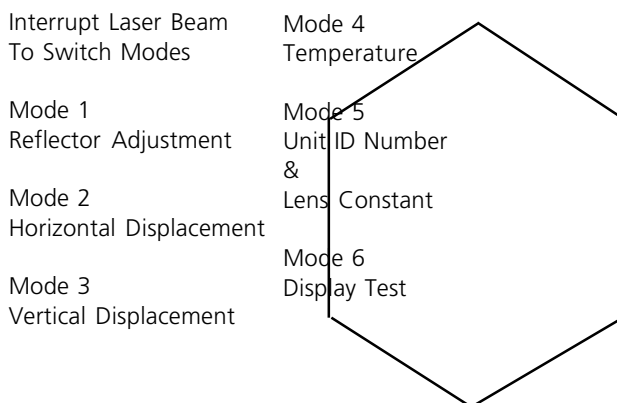## Measuring with the PERMALIGN System

Switching On the Monitor

The system is supplied with power and switched on when the angled plug is inserted into either one of the two power jacks located on the sides of the monitor housing. The display on the front of the monitor immediately shows various figures and characters. Since the prism is initially not yet adjusted to reflect the laser beam properly, the display will most likely show an error message at first.

The PERMALIGN monitor indicates all necessary information (for example, parallel offset in the y axis direction and displacement due to angularity in the x axis direction when using the 90° roof prism) directly through its built-in LCD display. The different types of information are called up in sequence by switching display modes as illustrated below.

When the angled plug is inserted into the power jack, the display initially shows Mode 1 (that is, as soon as the monitor and prism have been correctly adjusted). The monitor then switches its display to Mode 2 when the laser beam is interrupted momentarily. Subsequent interruption switches the display to Mode 3, then to Mode 4, etc. until Mode 1 is reached again.
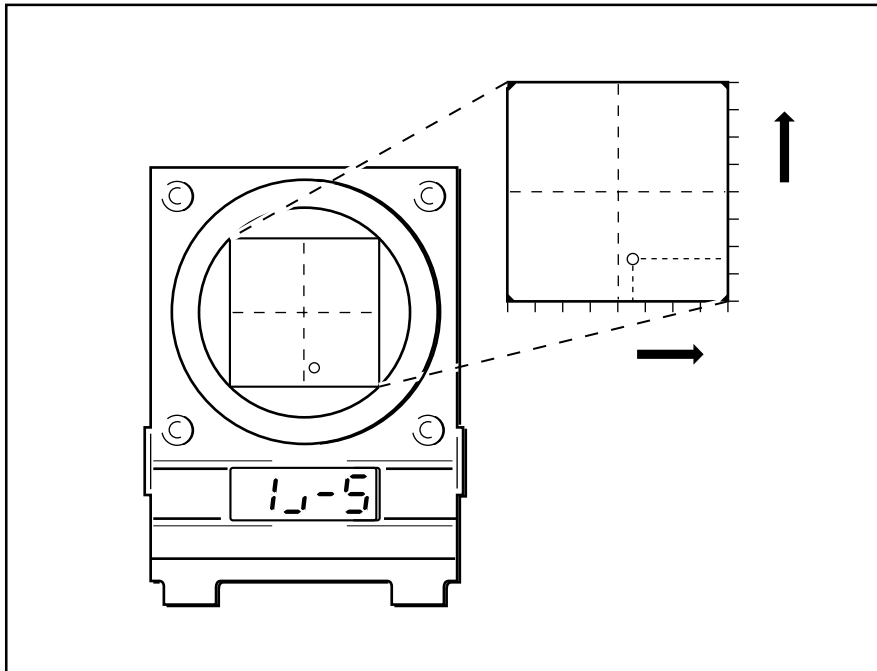
Resetting to Mode 1

The monitor automatically resets the display to Mode 1 whenever the laser beam is interrupted for approximately three seconds or longer.

Interrupt Laser Beam
To Switch Modes

Mode 1
Reflector Adjustment

Mode 2
Horizontal Displacement

Mode 3
Vertical Displacement

Mode 4
Temperature

Mode 5
Unit ID Number
&
Lens Constant

Mode 6
Display Test

Description of display modes

Mode 1: Reflector adjustment

Display mode 1 is useful when adjusting the reflector. In this mode the x and y coordinates of the laser beam in the position detector are rounded to single digits, (always in millimeters) with x at the left, y at the right. In order to utilize the full available range of displacement detection, the reflector should be positioned during setup so that the reflected laser beam strikes the position detector as close as possible to its center. This may be achieved by sliding the prism up or down in its bracket and adjusting the bracket's 3 adjustment screws. The small corner symbol appearing between the x and y values indicates the current position of the laser beam in the detector; for example, the symbol ⌐ indicates that the laser beam is currently striking the detector within its lower right quadrant, which corresponds to the positive x and negative y values displayed.

When the laser beam is adjusted close to the center of the detector, the corner symbol disappears and the display shows 0 0. However, slight deviations from the center will in no way effect measuring performance.

Display mode 1 showing the laser beam striking the detector at (x,y) = (1,-5) in millimeters.

(1 ⌐ - 5)

Mode 2: Indication of horizontal displacement

(1.25=)

Mode 2 displays the detector x coordinate in 1/100 mm (or mils, see page 32). The display shown here stands for a value of 1.25 mm along the x axis.

If this system is mounted vertically and was initially adjusted to display detector coordinates of (0,0), this positive value then indicates that the laser beam has traveled to the right. If a 90° roof prism is being used, it has rotated toward the right. Similarly, with the system mounted horizontally, a positive x value would indicate reflector movement upward.

Angular displacement must often be specified as measured in arc seconds, for example, when using a 90° roof prism as a reflector. This conversion of the linear displacement measured by the detector into arc seconds of reflector rotation is performed automatically by the computer.

Mode 3: Vertical Displacement

(-5.08'')

Mode 3 displays the detector y coordinate in 1/100 mm (or mils, see page 32). The display shown here stands for a value of -5.08 mm displacement along the y axis.

If the system is mounted vertically and was initially adjusted to display detector coordinates of (0,0), this negative value then indicates that the laser beam has traveled downward. If a 90° roof prism is in use, the whole prism has moved downward. Similarly, with the system mounted horizontally, a negative y value would indicate reflector displacement toward the right.

Angular displacement must often be specified as measured in arc seconds, for example, when using a mirror or 90° roof prism as a reflector. This conversion of the linear displacement measured by the detector into arc seconds of reflector rotation is automatically performed by the computer.

Mode 4: Temperature Display

(23°C)

The temperature within the monitor housing is displayed in mode 4. This temperature must be held within the given tolerance in order to ensure measurement accuracy (see also the instructions and illustrations on page 22). See page 32 for conversion to °F.

Mode 5:   Unit Identification Number and Lens Constant

The mode 5 display alternates between the unit identification number and the lens constant of that particular monitor unit.

no. 2

L360

The unit identification number is used only when the monitor is connected to a computer, in order to distinguish between several monitors operating simultaneously and interfaced to the same computer (for example, when monitoring an entire train of coupled machines). A small pointer dial located beneath the threaded cap on the top of the monitor housing allows setting of this ID number to a numerical value from 1 to 9 or a letter from A to F (for a total of 16 different settings), so that the unit may be addressed by the computer thereafter by 'calling' the appropriate ID value. This means, then, that a single PC computer can receive data from up to 16 different PERMALIGN monitor/reflector sets simultaneously and display results for each individual set as desired.

See page 31 for detailed instructions on setting the monitor ID number.

The lens constant is based upon information regarding the unique optical characteristics of each individual PERMALIGN monitor; it indicates the optical distance between the measurement marking on the top of the monitor and the effective detector location as illustrated in the figure below:

$$\alpha = \frac{P(n,X)}{D_{LP} + LC} \quad \text{radians}$$
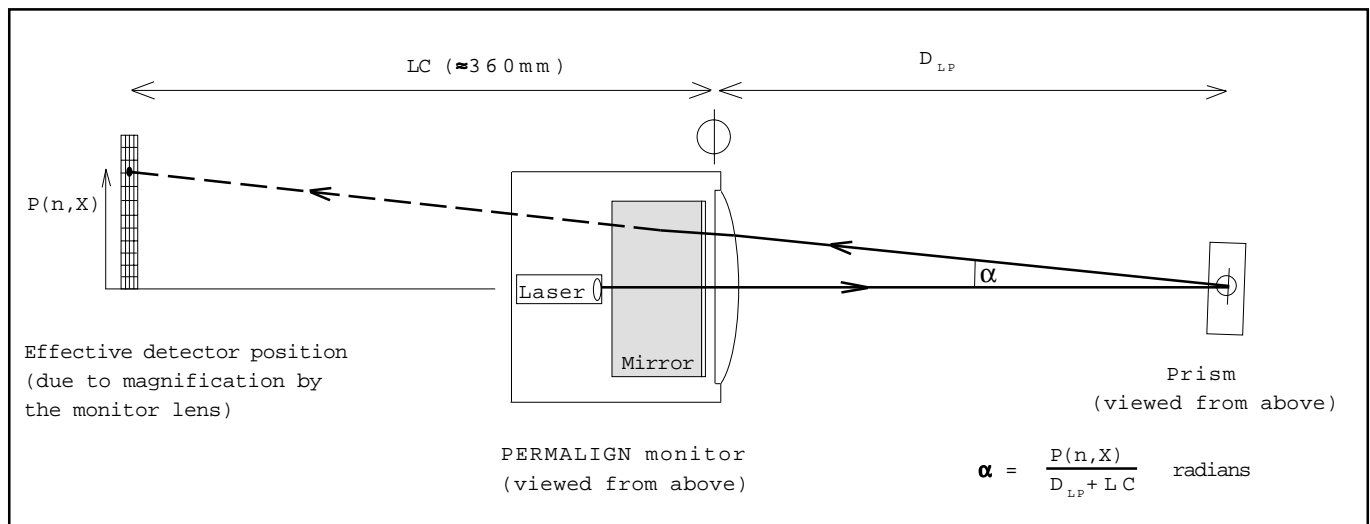
Mode 6: Display Test

-8.8.8.8

In Mode 6 all segments of the 4-digit display, including decimal points and the minus sign, are activated simultaneously in order to check for proper function.

Monitor Error messages

The PERMALIGN monitor is equipped with self-diagnostic software, enabling it to recognize error conditions automatically. If an error is suspected then the following messages can appear on the monitor's LCD display:

O F F

- The laser beam is not being reflected into the monitor lens or the laser beam is interrupted.
  Align the beam or check if the lens is dirty.

E r r

- Excessive ambient light is entering the monitor lens. Darken the surroundings or shade the lens.

E ⌐ - 5

- With the display operating in mode 1 (see opposite), the laser beam is striking the detector outside the linear range of the x axis. Adjust the monitor along the x axis.
  The 'E' would be on the right for the y axis.

- E n d

- The laser beam is striking the detector outside the linear range of the detector. Adjust.

c l n

- The intensity of the reflected laser beam is too weak. Clean the monitor lens and the mirror.

  or

- The laser beam has left the END range. Adjust.

-b a t t

- The external battery is running low. Recharge.

Setting the monitor address

The monitor address is set with a rotary switch mounted under a cap at the rear of the unit. Place the monitor on a table with the manufacturer's black label and a removeable cap facing upwards. This is important because the monitor housing is filled with inert gas which may flow out if the monitor is opened with the cap facing downwards or sideways. Use the hex key supplied to remove the cap and check the switch setting inside. The address is a single character from 0 to 9 or from A to F. Write this down, preferably here in the margin, and replace the cap.

If you forget it later on, then it can be read from the monitor's LCD display, but only when the laser beam is on and aligned.
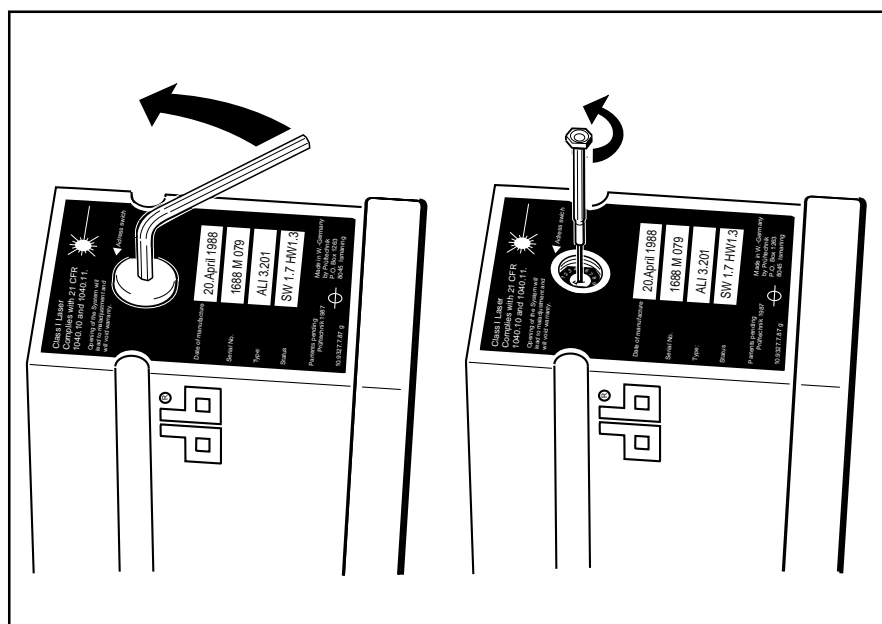
Switching the monitor display to inch / °F

The X/Y coordinates (except mode 1, page 27) and temperature displayed in the monitor LCD may be converted to mils (1/1000") and degrees Fahrenheit simply by screwing a conversion plug into any available monitor socket as shown below.

Conversion
plug
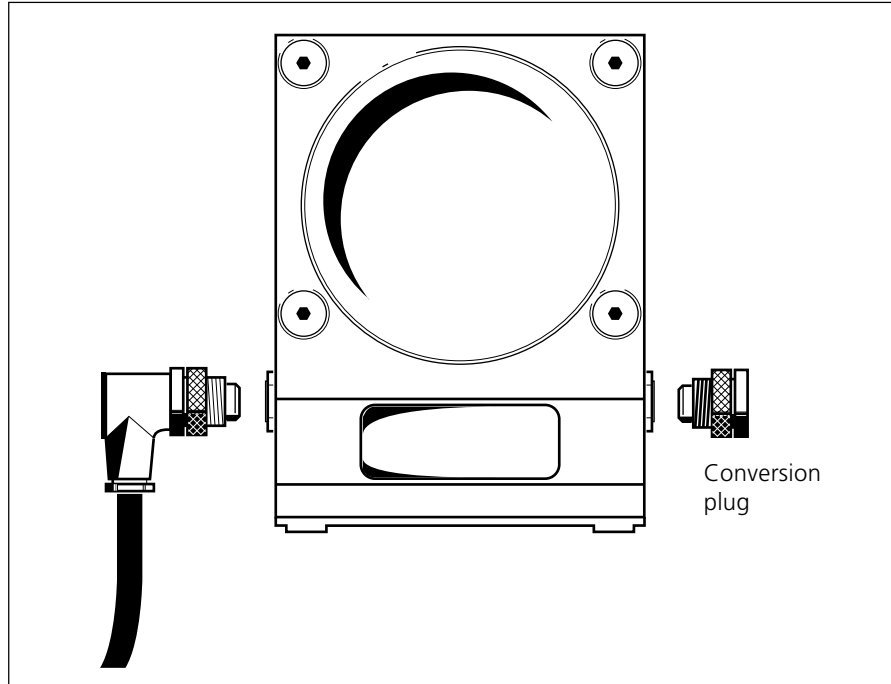
(Blank page)

PERMALIGN for Windows: Getting Started

To the computer novice...

Many of our customers may be unfamiliar with computers, and may be apprehensive about getting started! This is a very common situation. We would like to be able to say that computers are easy, but unfortunately modern computer programs look terrifyingly complicated to the beginner. And the whole idea of having anything to do with those computer boffins who click their mice around the screen with their eyes shut can be further off-putting!

We want everyone to get PERMALIGN for Windows running successfully without problems, so we have attempted to write this manual for the computer novice, keeping the fancy jargon to a minimum!

If you are a computer novice, we would strongly suggest you ask someone to spend some time explaining the basics of a PC i.e.

·   Filenames and directories
·   Memory: RAM, hard and floppy disk drives
·   DOS commands e.g. C: A: DIR CD [directory] CD\ CD..
·   Loading Microsoft Windows™
·   Basics of Windows

Setting up PERMALIGN for Windows

1. Check that the PC you want to load the program onto has the required specifications, see overleaf.

2. If you don't have Password Certificates for your PERMALIGNs then fax PRÜFTECHNIK a note with your details and up to 2 PERMALIGN serial numbers. See page 51.

3. If you are unfamiliar with Microsoft Windows then read the section starting page 37.

4. Install PERMALIGN for Windows onto your PC, page 40.

5. Check the program configuration settings, page 50.

6. Register PERMALIGNs, page 51.

7. Create/open a project, page 52.

8. Set PERMALIGN addresses, page 53.

9. Setup and adjust PERMALIGN monitors, page 54.

10. Set measurement intervals and duration, page 55.

PERMALIGN for Windows is now ready and set to start some serious monitoring!

Program computer requirements

Before you proceed further, check that your PC will run PERMALIGN for Windows:

Minimum requirements

For PERMALIGN for Windows to run with a modest number of measurements you need the following:

Computer	PC with 80386 processor @ 20MHz
Operating system	DOS v.4.0 or later and Microsoft Windows™ v.3.1 or later.
RAM	4MB free. (Use the DOS command 'MEM' to find out current RAM usage status.)
Hard disk	5MB free. Large numbers of measurements will require more space.
Floppy disk	3½" required for installation.
Graphics	VGA compatible color.
Mouse	Recommended but program can be used with keyboard alone.
Serial port	A spare RS-232C (COM) port is required to communicate with your PERMALIGN(s). Your mouse may be connected to one. If you don't have a spare port then buy and install one or try the solutions in the appendix, page 85.

Improved performance

For frequent use and large numbers of measurements the following improved specifications are recommended:

Computer	PC with 80486DX2 @ 66MHz or better.
RAM	8MB free.
Hard disk	20MB free.
Graphics	VGA compatible color with at least 800x600 resolution and 17" diagonal.

Windows™ is a trademark of Microsoft, Inc.

| **Working with Windows**™ | |

The PERMALIGN software works in conjunction with the popular Microsoft Windows™ operating system. Most PCs today have Windows and most programs are now written for Windows. Despite this alarming monopoly it does have its advantages in that different Windows programs behave similarily and have a certain compatibility with each other.
...so your displays, results, reports and text-files in PERMALIGN for Windows are instantly compatible with the vast range of Windows text processors, statistical and graphical packages that you may already have.

If you are completely unfamiliar with Windows then do ask someone to show you the basics of how it works. Wading through the Windows manuals and attempting the tutorials is pretty daunting, and ten minutes with someone who knows is far more productive.

Some of you may be familiar with DOS programs and have been putting off learning Windows. Now's the time! Mastering all those gimmicky colorful icons really saves a lot of time and effort.

What is Windows™?

Most PCs today have Windows. It's either set to come on automatically when the PC is switched on or is usually started at the C:\> prompt by typing: WIN <ENTER>. The ubiquitous PROGRAM MANAGER appears (shown here for Windows version 3.1):
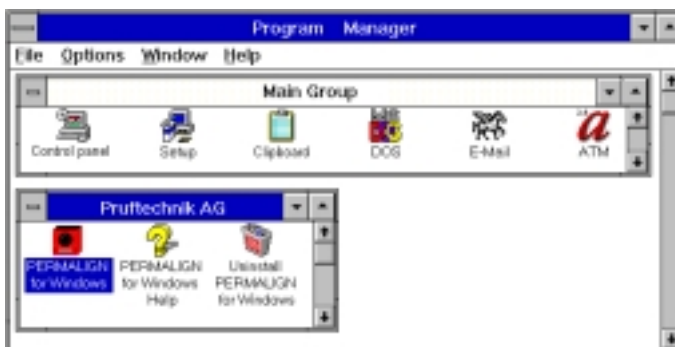
Windows is two things:

1. a program 'organiser' which lets you run your PC programs by clicking the mouse on little colored symbols rather than laboriously typing in program names.

2. a screen display 'format' which displays your programs in boxes or 'windows' on the screen. These windows can be made any size and moved around the screen so that you can have several different things in different windows all displayed at once.

Overleaf is a summary of working your way around Windows...

Using the mouse

One of the most appealing features of Microsoft Windows™ for new users is that it allows you to make selections simply by pointing at the desired elements on screen, then clicking the left key of the mouse (or other pointing device such as a track ball). Here are some tips for using the mouse with PERMALIGN for Windows:

Use the left-hand mouse key unless specifically stated. A single-click on the left key selects menu symbols and commands like S<small>AVE</small> & C<small>LOSE</small>. A double-click (two clicks in quick succession) starts an action usually connected with the disk drives i.e. selecting drives, directories and filenames. Here's a summary of the main functions:

Operation	Mouse action
To activate a visible window:	Click anywhere in the window. The active window has the highlighted title bar.
To close the active window:	Double-click in its top left corner box. If this is the main program window then you will exit the program.
To reduce the active window to an 'icon':	Click on the 'down' arrow key in the top right corner. The window becomes an icon shown left (which could be obscured behind other windows)
To convert an icon into a window:	Double-click on the icon.
'Drag & Drop':	Click the left mouse key onto an object, hold the key down while dragging the object across the screen, then release the key to drop the object in a new position.
To move the active window:	Drag & Drop the window title bar
To change the active window size:	Drag & Drop the window borders
To select items from a list e.g. in FILE MANAGER:	To select a group click on first item, hold down the SHIFT key and click on the last.
	To select individual items hold down the CTRL key and click on each.

PRUFTECHNIK
AG

You may also want to consult your Microsoft Windows™ handbook for complete information on standard mouse operating procedures.
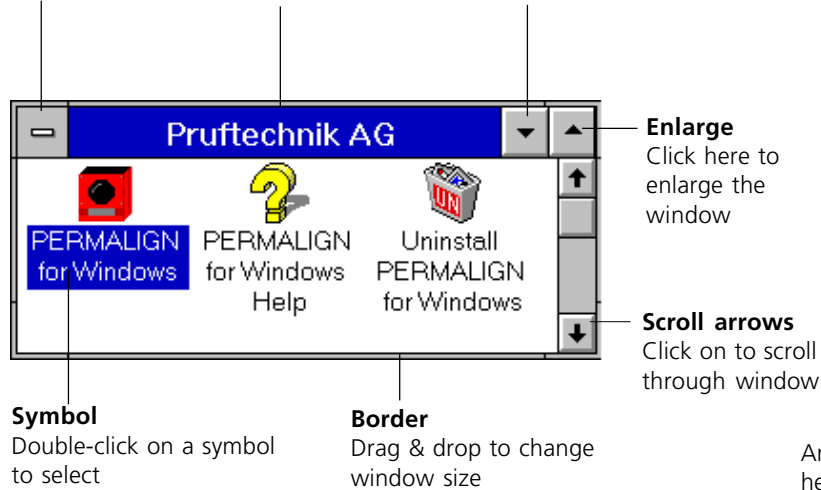
Close
Double-click here to close the window. If it is the main program window then the program itself will be closed.

Title bar
Drag & drop to move window. Double-click to expand/contract

Iconize
Click here to shrink the window into an 'icon' (double-click on the icon to bring it back)

Enlarge
Click here to enlarge the window

Scroll arrows
Click on to scroll through window

Symbol
Double-click on a symbol to select

Border
Drag & drop to change window size

An example of a window, shown here for Windows version 3.1. (please see your Windows manual for details)

Keyboard operation

You can use the keyboard instead of the mouse for most operations. Here's a summary of the main functions:

Key(s)	Function
ENTER	confirms a selection or entry. Note, in some windows containing editable text and numbers ENTER will activate the OK button and close the window. It is not neccessary to press ENTER after changing a value.
ALT	switches to the command line from where you can select all options.
ALT + C etc.	selects e.g. the term CANCEL with an underlined character. (Hold down the ALT key, then press the corresponding character key.)
TAB	skips to the next field or option.
SHIFT + TAB	skips to previous field or option.
↑ ↓ ← →	the arrow keys move within a field.
F6	switches between 'split' windows e.g. in the FILE MANAGER.
ALT + TAB	together switches between programs, e.g. to the PROGRAM MANAGER.
CTRL + F4	Closes active window

Installing PERMALIGN for Windows

The PERMALIGN for Windows software is provided on diskette(s) for installation on your PC. Please check first that your PC matches the configuration requirements listed on page 36.

Installation procedure:

1. Insert installation disk 1 in drive A (or B) of your computer.

2. Start Windows™, then from the PROGRAM MANAGER command line,
    i. select FILE
    ii. select RUN (or START in Windows '95)
    iii. enter A:\SETUP (or B:\SETUP) and confirm with OK.

3. The Welcome screen appears. Follow the on-screen instructions. 'Next>' and '<Back' step between screens.
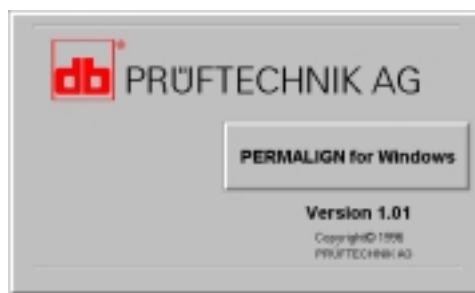
LANGUAGE:
In future versions of PERMALIGN for Windows you will be asked to select the language you would like the program to be installed.

4. SELECT DIRECTORY:
    You must first specify the drive and directory under which you wish to install the program. If the suggested default is not to your liking then press 'Browse' to show the following window for selecting another location. You can enter a new directory name which will be created for you:

NETWORKS:
If you want the program to run via your network then specify the required network drive and directory e.g.
P:\USERS\MAINTNCE\PERMA



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5.   SELECT PROGRAM GROUP:
     The next screen asks for the Program Group name where the
     icons will be placed in Windows. The default is PRUFTECHNIK
     AG. You may already have this group if you have other
     PRÜFTECHNIK software products.

6.   SELECT COM PORT:
     The next screen asks for the COM (serial or RS232) port used to
     connect the PERMALIGNs to the PC. Your mouse may be
     connected to COM1 in which case select COM2. If you have
     only one serial port then see the appendix page 85.

7.   SELECT DIMENSIONS UNITS:
     Now select the units for dimensions, either mm or inch (mils).
     Note that 'Mils' is american for 1/1000 inch, also known as
     Thou's by our British and former Commonwealth customers!

8.   SELECT TEMPERATURE UNITS:
     Now select °C or °F. (the PERMALIGN monitors have a built-in
     temperature sensor).

9.   Installation now commences:
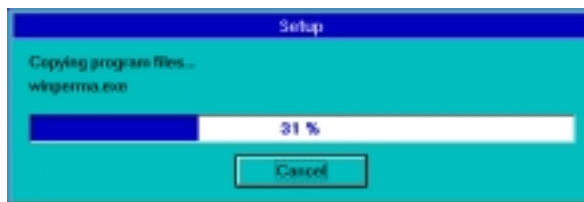
Existing program found?
If an existing copy of PERMALIGN
for Windows is found it will be
automatically overwritten!!
(unless the setup program
detects that the existing files are
actually newer than the ones it's
trying to install)

     Your copy of PERMALIGN for Windows may (for certain
     markets) be supplied on two or more diskettes in which case,
     swap diskettes as directed:
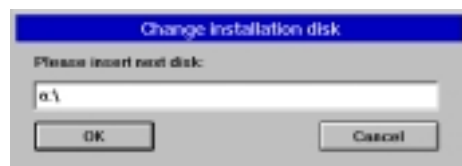
10. After installation a message screen appears where you can select:
i) to view a 'Read-me' file with any important last-minute release info,
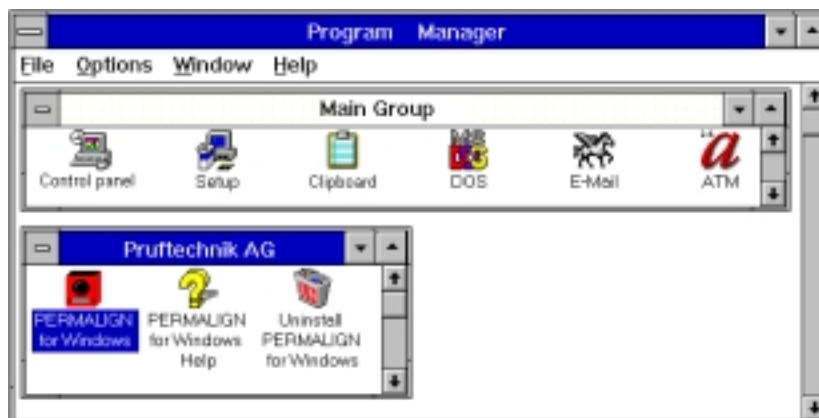ii) to immediately start the PERMALIGN for Windows program.

Click on 'Finish' to end the setup program.

11. In the Windows PROGRAM MANAGER you can see that the installation program has created a new 'PRUFTECHNIK AG' program group similar to that shown below (for Windows version 3.1), including a PERMALIGN for Windows icon. You can run the program by double-clicking onto this icon.

There is also a Help icon, described on the opposite page, and an Uninstall icon should you wish to remove all the PERMALIGN for Windows files from your PC (a confirmation is given before you do so!)

Networks
The PRÜFTECHNIK window and PERMALIGN for Windows icon will appear only on the PC where the installation took place. To run the program on the network via a different PC you might like to setup a PRÜFTECHNIK program group and PERMALIGN for Windows icon on that PC - see Windows Manual for details.
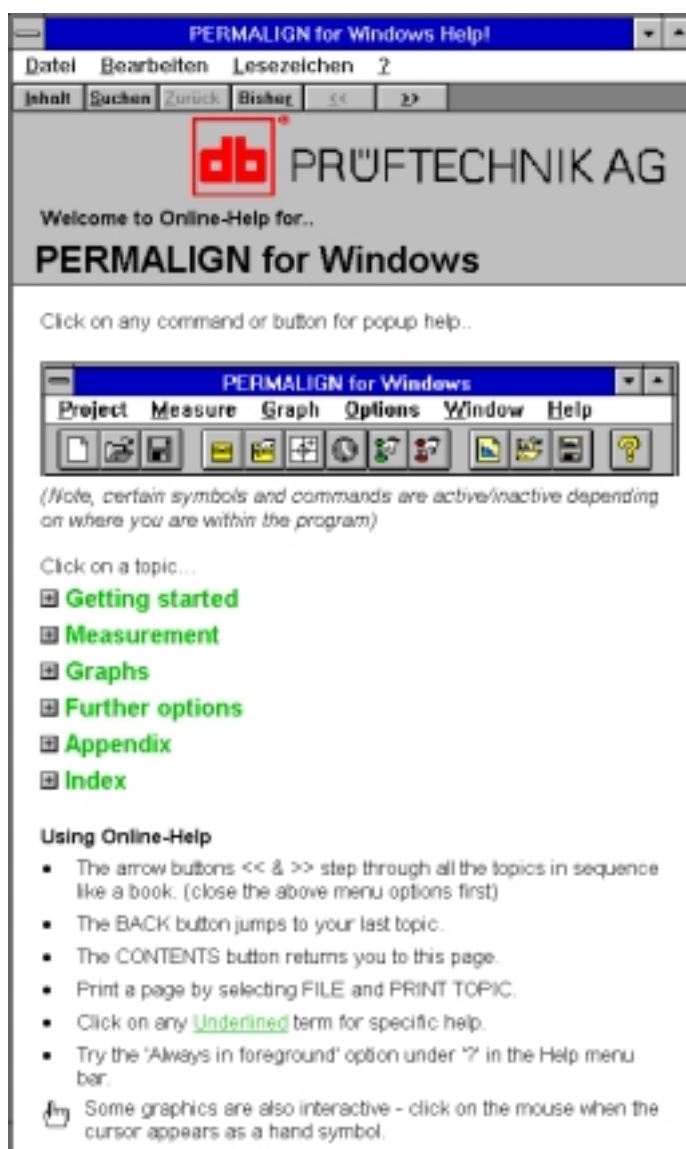
Help !

Together with the PERMALIGN for Windows icon you will see a
'Help' icon. You can double-click on this to open a comprehensive
Windows Help file on how to use the program:

Click the mouse onto any of the keywords, and the relevant
information appears. You can click on the two arrow key symbols to
leaf through the help screens, or click on CONTENTS to go back to the
first page. Some pictures can be clicked onto to obtain popup info.
Remember, press the ALT and TAB keys at the same time to switch
between e.g. PERMALIGN for Windows and the Help file.

This file is context sensitive - When you are using the program you
can select any '?' symbol to open the help file at the corresponding
page.

Start PERMALIGN for Windows

From the Program Manager open the PRÜFTECHNIK window and double-click on the PERMALIGN for Windows symbol to start the program.
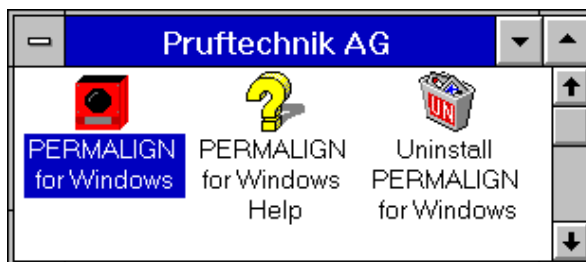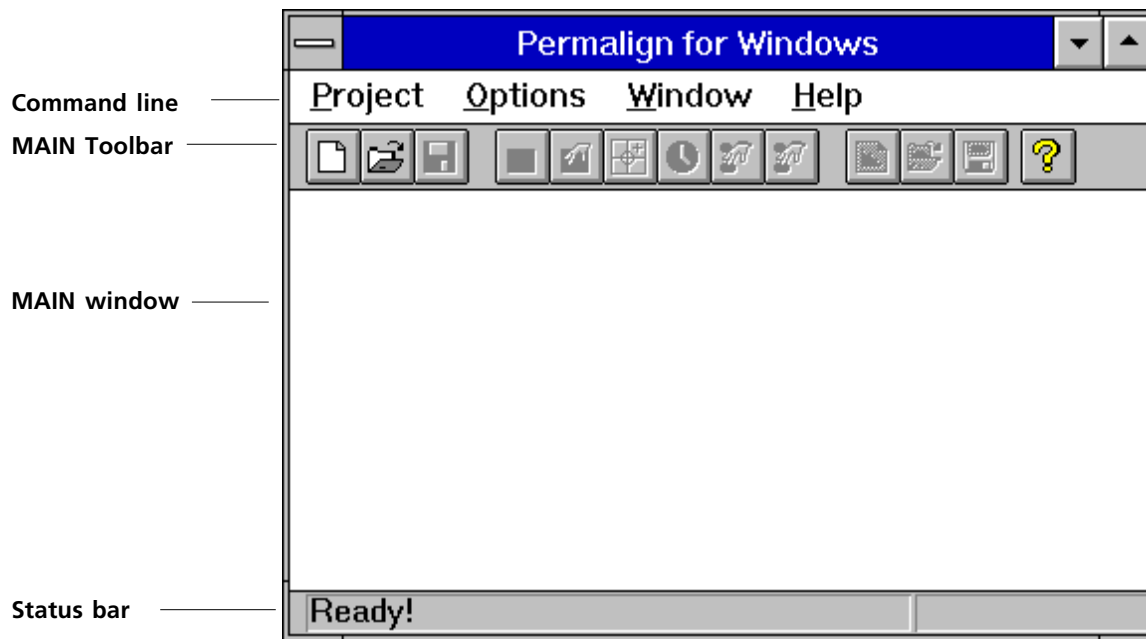
Uninstall
If at some point you want to delete the PERMALIGN for Windows files from your computer use the 'Uninstall' icon.

Read me
There is a 'Read-me' file installed with PERMALIGN for Windows which gives latest release info. View this with any text editor. (Normally simply double-click on the 'README.TXT' in the Windows File Manager or the 'Explorer' in Windows '95).

The Main Window

Here is the opening main window:

Command line —————

MAIN Toolbar —————

MAIN window —————

Status bar —————

Permalign for Windows

Project   Options   Window   Help

Ready!

Help!
Holding the mouse pointer steady
on any of these buttons displays
a short description of its function

When you start PERMALIGN for Windows you see the main window
with a command line, a toolbar containing a series of buttons, and at
the bottom of the screen the Status bar.

The COMMAND LINE contains all the program functions. The terms
in the command line can be selected with the mouse, which then
show pull-down menus from which a particular function can be
selected. You can also use the keyboard by pressing the ALT key to
highlight the command line, then use the arrow keys and ENTER to
pull down the menus and select any function.

The TOOLBAR contains a series of buttons for the most fundamental
functions. These are clicked onto with the mouse; only those
illuminated are active depending on where you are in the program.
Certain 'sub' windows e.g. a graph window have their own toolbars.
When you position the mouse pointer on any button and hold it still
for one second a small definition is displayed.

The STATUS BAR displays infomation depending on where you are
in the program.

To exit PERMALIGN for Windows

To exit the program either:
a) double-click in the top-left corner box, OR
b) select PROJECT from the command line, then EXIT, OR
c) press ALT + F4 simultaneously.
After a confirmation you will return to your last Windows application
e.g. the Windows PROGRAM MANAGER.

Before embarking further here is a quick explanation of the useful
HELP and WINDOW functions in the command line:

Help

CONTENTS calls up the program Help Contents shown on page 43

SEARCH calls up the standard Windows Help Search function to locate
a topic you are interested in.

ABOUT PERMALIGN FOR WINDOWS shows the Info Window on page 45. OK
clears.

Window

CASCADE overlaps all open windows in a stepped pattern so that each
title bar is visible. Click on the title bar of the window you want to
activate it and bring it to the front.

TILE places all the open windows next to each other, either vertically
or horizontally. Here you can see them all, but each is probably
rather narrow.

ARRANGE ICONS displays and lines up the icons of any iconized
windows in a neat line.

SELECT WINDOW Below these options is a list of all the opened
Windows. Click on any one to bring it to the front.

Project

New creates a new project file (page 52)

Open opens an existing project file (page 52)

Close closes current project file (page 52)

Save As.. saves project under selected name (page 52)

Print Setup select Windows printer (see Windows manual)

Exit exits program (page 47)

Measure (Project open)

Permalign Addresses:

Autodetect (page 53).

Userdefined (page 53).

Adjusting toggle 'Adjust mode' for setting up PERMALIGNs (page 54).

Interval Setup set interval between measurements and duration (page 55).

Start measurement 'Adjusting' must be OFF. (page 58).

Stop measurement (page 59).

PERMALIGN values display addresses and Time relative/absolute (page 72).

Export exports graph data to text file (page 70).

Notepad write notes on current project (page 72).

Graph (Graph open)

New create new graph file (page 56)

Load existing graph file (page 61)

Change edit current graph file (page 61)

Save current graph with current name (page 61)

Save As saves under different name (page 61)

Print prints current graph (page 69)

Copy to Clipboard (page 69)

Zoom:
Zoom In select area with mouse (page 69)

Zoom Out to normal size (page 69)

Options:
Line cursor toggle cursor on/off (page 69)

Markers toggle point markers on/off (page 69)

Grid toggle background grid (page 69)

Legend toggle graph titles on/off (page 69)

Axis set axis titles, time rel./abs. (page 69)

Additional Information enter notes (page 69)

Cursor Values toggle mini window showing cursor val. (page 69)

Edit activity note create flag in graph (page 69)

Synchronise multi-graph timebases (page 69)

Partial time View during measurement, display latest x points (page 58)

Options

Settings set COM port and units (page 50).

Registration register PERMALIGNs (page 51).

View Toolbar (page 50).

View Status line (page 50).

Window

Cascade display windows one on top of the other (page 47).

Tile display windows next to each other (page 47).

Arrange Icons arrange icons of iconized windows (page 47).

select window activate a window from the list (page 47)

Help

**Contents** displays Help contents (page 43).

Search displays Windows Help Search function (see Windows Manual)

About... Shows the Info Window (page 45)

PERMALIGN for Windows demo files

Your installed copy of PERMALIGN for Windows contains a series of demo files with sample measurements. Proceed as follows:

1. Select PROJECT and OPEN (or click on the button shown right). Select the file called DEMO.PPJ (you may have to change directory to find it). When this is loaded you will see one or more PERMALIGN icons at the bottom of the screen. These show you which PERMALIGN monitors were used to make this particular set of measurements.

2. To view the measurements we must open a graph file. Select GRAPH and LOAD (or click on the button shown right). Select a demo graph file with a name DEMO_RAW.PGR, or similar (you may have to change directory to find it). The GRAPHIC WINDOW SETTINGS window appears, showing the names of each graph that will be displayed. Select OK to show the graph similar to this:
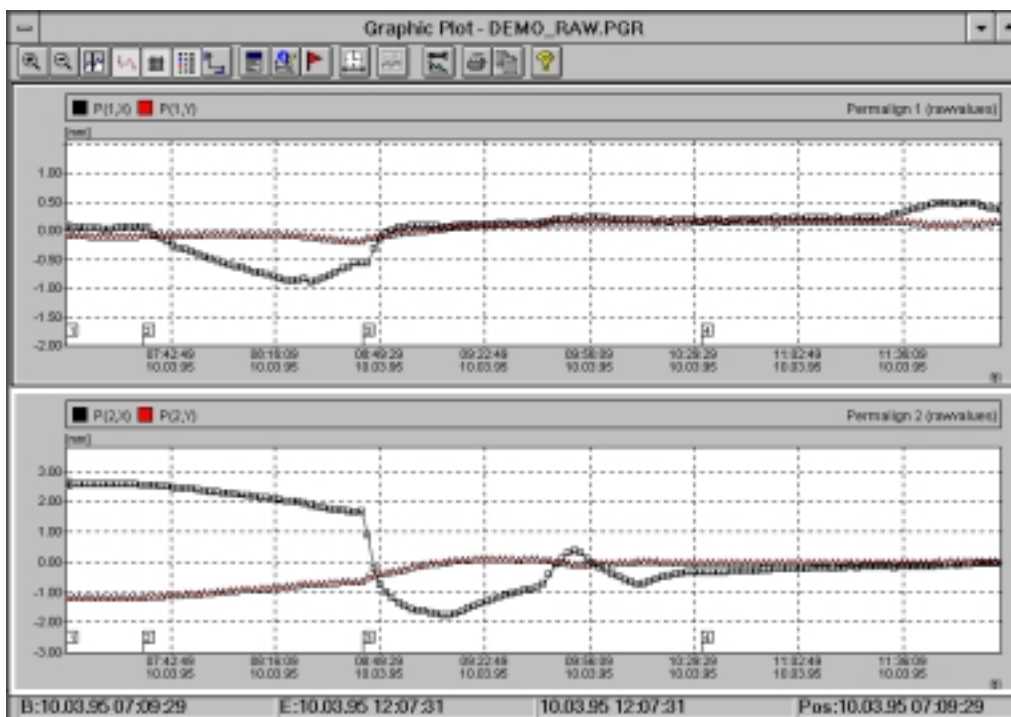
3. You can experiment with the various graph options, and display graphs of your own choice using the same demo measurement data - see page 61 for details.

4. When finished, close the graph by double-clicking in its top left hand corner. If you changed any settings you will be asked if you wish to save the changes or not. Finally, close the main project by selecting PROJECT and CLOSE. Now proceed through this manual to setup the program for your requirements and make your own measurements.

DEMO_RAW.PGR shows the raw data for an example alignment application - see pages 76-77 for details.

Configuration

Before using PERMALIGN for Windows you should check its configuration settings, especially for setting the COM port for PERMALIGN communication. Select OPTIONS in the main menu command line and then SETTINGS to show the following window (If using the keyboard press ALT to select the command line then use the arrow keys and ENTER to select options):

If using the keyboard to change selections, use the TAB key to select the term and press e.g. '1' for COM1, '2' for COM2, 'm' for mm etc.)

The settings shown above are initially set when the program is first installed, but you can change them here as required:

COM PORT : Select the serial (also called RS232 or COM) PC port for your PERMALIGN(s). In most cases your mouse will be connected to serial port COM1; therefore use a spare port for PERMALIGN e.g. COM2. If you don't have a spare serial port then see page 85.

UNITS Select MM or MILS (thousandths of an inch).

TEMPERATURE Select °F or °C

When you have finished select OK to confirm any changes or CANCEL to ignore any changes.

Further configuring..

View Toolbar & View Status bar
Under OPTIONS are also VIEW TOOLBAR and VIEW STATUS BAR. These toggle on/off the button tool bar or the lower status line in the current active window. You may want to toggle these off when graphs are shown to maximize screen space.

Setting the date format
The date format used by PERMALIGN for Windows is set in the INTERNATIONAL menu in the Windows CONTROL PANEL. See Windows manual for details.

Registering PERMALIGNs

Each PERMALIGN monitor to be used with PERMALIGN for Windows must first be registered, otherwise it will not operate. To show which monitors are currently registered select OPTIONS in the command line, then REGISTER. The following window appears:

Additional monitors may be registered with the program thus:

1. Write to PRÜFTECHNIK (or send off the Registration Card if you have one) and tell them the serial numbers of the monitors you would like to register. The serial number has 8 digits/characters where the 5th character may in some cases be an 'M'. The first two registrations are free; there is a fee for subsequent ones.

2. PRÜFTECHNIK will in turn send you a registration Password Certificate for each monitor with a unique password corresponding to each monitor.

3. Run the program, select OPTIONS and REGISTER. Select the button REGISTER NEW PERMALIGN showing the following window:

4. Select either TYPE 1 or TYPE 2 corresponding to your serial number type, and enter the number. Then enter the REGISTRATION CODE as given on the certificate (capital letters must be entered as capital letters!). Select OK and the serial number appears in the list of registered PERMALIGNs. Finally select OK to return to the main Window. The PERMALIGN monitor is now duly registered and ready to use.

Create Project

Before you can start using PERMALIGN for Windows you must create a project. This is simply chosing a filename with the suffix .PPJ which is used throughout your work to store the details and settings relating to the measurement job.

New project
Click on the NEW PROJECT button (or select PROJECT from the command line and NEW). The standard Windows file selector appears from which you can select a drive, directory and project name with the ending .PPJ.
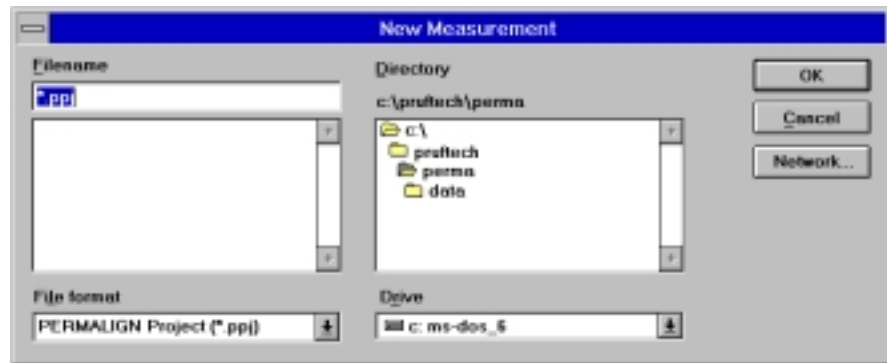
You might be advised to keep your project, measurement and graph files in a separate subdirectory (or directories) to the program files, e.g. create a \DATA subdirectory below the C:\PRUFTECH\PERMA directory. Use the Windows FILE MANAGER to create subdirectories.

Open project
Once you have created a project, in future you can re-open it. Alternatively, the four most recently used files are listed under PROJECT and you can simply click on one to select it.

Save project as..
Projects are automatically saved under their current name, but you can also save one with another name.

Close project
Before opening another project you must first close the current one.

With a project loaded, the other program symbols and functions become available.

Set Addresses

Each PERMALIGN monitor used must have a unique 'address' so that PERMALIGN for Windows can distinguish between each one. These addresses are set via an address switch under a screw cap on the top plate of each monitor (see page 31). You should only have to do this once on installation! Proceed as follows:

Check each monitor address

1. Unscrew the address cap on the top of the monitor (keep the monitor upright to avoid leakage of the inert gas - see page 31). There is a rotary switch which points to the address between 0-9 or A-F, a choice of 16 possibilities.

2. Each monitor used must have a unique address, so change it with a small screwdriver if neccessary. Write the address down and screw the cap back on.

Tell PERMALIGN for Windows the addresses

Now you must inform PERMALIGN for Windows what addresses are in use. The program can find these out for itself automatically, or you can enter them yourself if for example you want one disactivated.

Autodetect mode

Select the AUTODETECT button (or from the command line under MEASURE, PERMALIGN ADDRESSES and AUTODETECT). A small window appears showing the test on each of the possible 16 addresses. Those found are highlighted green.

User defined mode

Alternatively, select the USERDEFINED button. A window appears showing the 16 addresses. Click on those you want active and confirm with OK.

PERMALIGN on-screen adjustment

Before measurement you should check that the laser beams are reflecting correctly into each monitor detector.

Click on the ADJUSTING button (or from the command line select MEASURE, and toggle ADJUSTING on so that a tick appears next to it).

IMPORTANT: 'Adjusting' must be switched OFF before you can start measurement!

The adjustment target

For each connected PERMALIGN a target display window appears indicating the position of the beam on the target. Activate a window by clicking on its title bar:
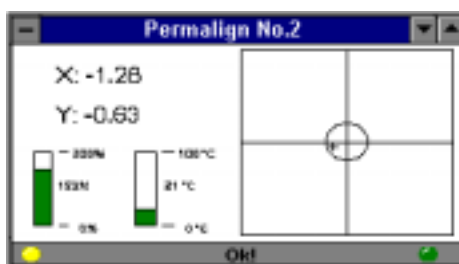
Right is the target display with the coordinates upper left. Lower left is the transmission level and the temperature measured in the monitor. At the foot of the window is the PERMALIGN status:

'OK!' beam is centered in the target,
'LASER END' beam is at the edge of the target
'LASER OFF' beam is off target
'NO ANSWER' PERMALIGN not found - check connections, COM port selection and addresses.

Lower left of this window is a yellow light when the window is active (when you have more than one PERMALIGN). Lower right is a green light when the beam targeting is OK, and red when it's at the end or off.

Select a target window

Activate each target window in turn by clicking on its title bar. These windows cannot be completely closed but you can click on the 'iconize' arrow 'v' in the top right corner of the target window to turn it into an icon. To bring back the window double-click on the icon.

Adjusting

Adjust the position of the prism to bring the cross into the target so that OK! is displayed. Carry this out for each PERMALIGN. When finished you can 'iconize' each window (see above) to put them out of the way. Remember that 'Adjusting' must be switched off before you can start measurement!

Measurement Interval and Duration

When you START measurement the default is to measure continuously approximately every second (per monitor) until you select STOP. Alternatively to economize memory and file sizes you can measure at selected intervals over a selected duration:

Select the INTERVAL button (or from the command line MEASURE and INTERVAL) :
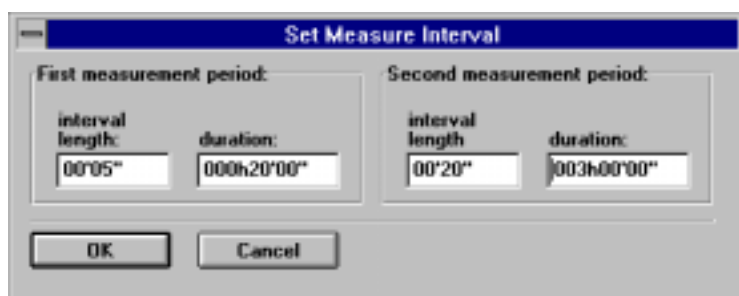
Since machines tend to move most during warmup, there are two time periods you can set: the first with frequent measurements over say half an hour, and after that less frequent measurements over a few hours. In this example we measure every 5 seconds for 20 minutes then every 20 seconds for 3 hours. Select OK to finish.

Setup a basic graph

To display your measurements you need to setup a graph file which determines what you want to look at. You may want to view just the PERMALIGN X-axis values, or even three parameters at once, X,Y-axes plus temperature. There is even a user-defined formula mode where you could calculate and display e.g. the actual alignment corrections in the machine feet. These advanced features will be described in detail later, but for now we shall simply setup a graph displaying the X-axis of one PERMALIGN monitor:

Proceed as follows:

1. Create a new graph file

Select the button shown left, or use the command line under GRAPH and NEW. The GRAPH WINDOW SETTINGS window appears thus:

2. Create and name a new graph

The above list is initially empty. To generate a graph select ADD to show the GRAPH SETTINGS screen. Give a name for the graph thus:
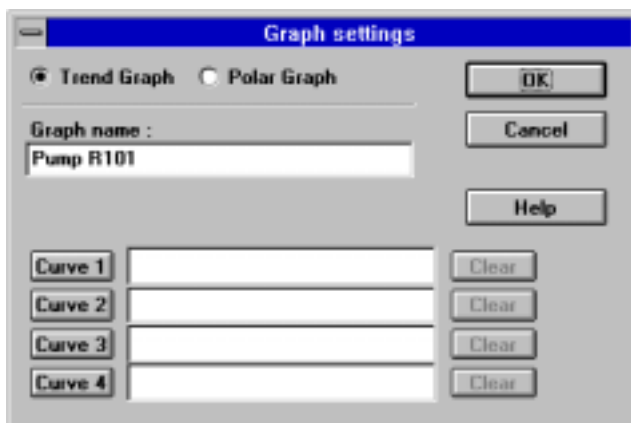
We have here by default a TREND GRAPH (Y vs. time graph) with the option to enter up to 4 curves on the same axes.

3. Define Curve

Select CURVE 1 in the GRAPH SETTINGS screen to show the following:

The simplest graph to setup is a graph of the x-axis of the first of your PERMALIGNs. This is already the default setting as shown above (Monitor P0 is selected, i.e. with address '0' and 'X' is selected). Select OK to accept the defaults.

4. Display graph

Select OK in each subsequent window to confirm all options and display the graph axes thus (with no measurement points yet):

The graph has as yet no name and is not yet saved. You can save it now if wished (or later) with the SAVE button in the main toolbar (or from the command line under GRAPH and SAVE). Save the graph settings as a .PGR file e.g. GR_X0.PGR (X-axis of monitor 0).

Start Measurement

When you have set the COM port, the addresses, adjusted them, and selected a graph types you can start measurement:

Before you can measure, the ADJUST mode must be switched off. Click on this button, or select MEASURE in the command line and deselect the ADJUSTING option.

Start measurement with the button shown left (or from the command line under MEASURE).

The displayed graph starts to show the measurements. When the points reach the end of the available graph space the complete graph is automatically redrawn slightly compressed with the extended timebase.

Partial time view

During measurement you can display all measurements made in one graph or just the most recent. Select the PARTIAL TIME VIEW button to select all or the most recent 'n' points. During measurement you can also alter the graph display with the options on page 69 except for Zooming.

Measurement Protocol file

During measurement a Measurement Protocol file is created which lists when the measurement started, when the measurement was interrupted, when measurements went off scale etc. You can view this file by double-clicking on its 'bell' icon. If measurement is interuped or goes off scale then the ADJUST window will automatically appear until the laser is back on target.

Measurement Protocol	
17:21:06	Measurement started...
17:22:58	Permalign No. e: Laser Off!
17:23:03	Permalign No. e: Laser Off!
17:23:15	Permalign No. f: Laser Off!
17:23:19	Permalign No. f: Laser Off!
17:23:41	Measurement finished!

Frequent measurements

If you have frequent measurements e,g, every 2 seconds, then the program operation will be somewhat slowed down. It is recommended to close as many windows as possible in this case and display no more than one graph.

Stop Measurement

Measurement continues until the end of the measurement period (see page 55) or until you select the STOP button (or from the command line under MEASURE).

The measurement values are stored in a .PDT file with the same name as the project.

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Results : Graphics in detail

Here is a complete description of how to setup graphs to display your results. The options are very comprehensive and may require a little practice! The general procedure is as follows:

1. Create graph file: The file is named *.PGR and contains all the graph details.

2. Define a graph type i.e. Trend (Y vs. time) or polar (XY), and the dimension units associated with the graph.

3. Define a curve in the graph e.g. x-axis output from monitor 1.

When you have done these you can add to the file:

a) Add up to 4 curves displayed simultaneously in one graph.
b) Add separate graphs which are displayed next to each other for comparison.

Here are these options in detail:

1. Create/Load/Save/Change a graph file

The usual file management functions are available with these buttons or from the command line under GRAPH. Opening and saving (an unnamed file) calls up the standard Windows file selector from which you can select a drive, directory and graph file name with the ending .PGR. Alternatively, when opening, the four most recently used files are listed under GRAPH and you can simply click on one to select it.

2. Creating a graph

When you open a graph file the GRAPHIC WINDOW SETTINGS window appears, this example with one already defined graph:

If you have created a new graph file then the above list will be empty. Here are the various possibilities:

Display graph(s)

If graphs are listed as above then click on to select and highlight the one(s) you want to display. Up to 6 graphs can be displayed simultaneously. Then select OK.

Edit selected graph

Click on an existing graph in the list and then on EDIT (or DELETE to delete).

Add new graph

To add a new graph to the list select ADD.

Units

Select either mm or mils (1 mil is one thousandths of an inch) and °C or °F to be used by the graph file. Note, these selections are independent of the main project under OPTIONS and SETTINGS. This is because of the User formula option which could generate nonsense if the units were changed without changing the formula! If you change these units with a formula selected then a warning appears.

3. Defining graphs

When you select a graph in the previous window with ADD or EDIT, the following GRAPH SETTINGS window appears, this one showing a Trend graph with one defined curve:
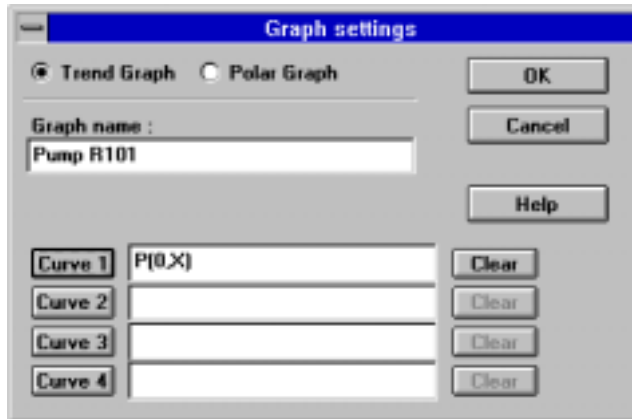
Polar graph
The Polar graph has two parameters defined X and Y instead of the curves 1 to 4. Both X and Y must be defined to display the graph. See page 75 for an example.

Trend graph or Polar graph
You can select Trend graph (time vs. Y) or Polar graph (X vs. Y). The Trend graph is a standard linear timebase graph with up to four curves.

The Polar graph plots any two parameters one against the other. If you plotted X against Y, then if they both moved proportionally you would get a straight line on your polar graph. Since a polar graph does not have a timebase, it is possible that points will overlap each other, especially if you measure a machine warm-up followed by a cool-down. If they didn't overlap in this case then you would be observing a hysteresis effect whereby the movement of one axis is always lagging behind that of the other.

Graph name
Give the graph a name otherwise it will be called 'Unnamed graph'!

Curve definitions
A Trend graph can have between 1 and 4 curves defined on it. A Polar graph must have 2 curves defined. The definitions of the curves are given in the boxes. To define a curve click on the corresponding CURVE N button (see overleaf). To delete a definition click on the corresponding CLEAR button.

Note, after defining the curves you can change their names e.g. to 'Vertical offset' or 'Raw X values' by clicking on the curve definitions next to the CURVE N buttons and editing with the keyboard.

4. Defining curves

When you click on e.g. CURVE 1 the following window appears, this one demonstrating all the options:
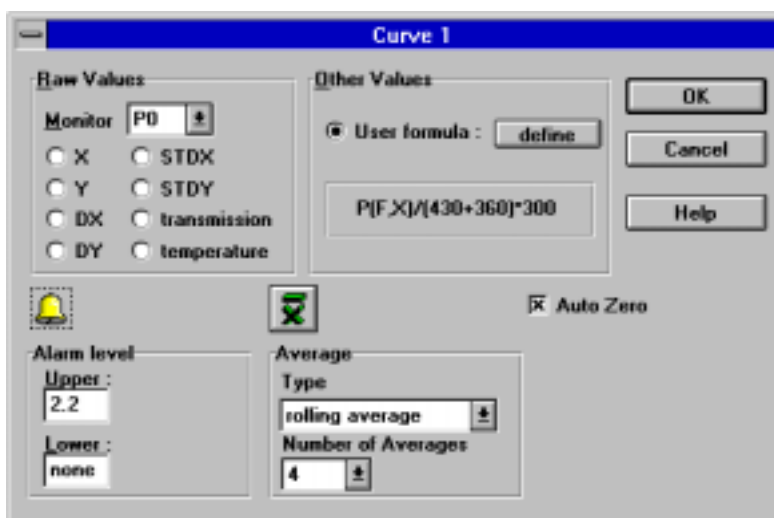
Here you define a curve you would like displayed. The following pages describe this window in detail. When you have completed the definition, select OK to return you to the GRAPH SETTINGS window shown on the previous page. Subsequent OKs step back through the windows eventually displaying the defined graph(s). See page 69 for details on the graph display options.

Raw values

These are the measurement values that come from the PERMALIGN monitor.

MONITOR: Select the monitor number by clicking on the arrow button and selecting from the list.

Select one of the following (if user-defined function not required):

X, Y: The raw X and Y-axes values
DX, DY: The relative values of X and Y
STDX, STDY: The standard deviation of X and Y
Transmission: Value between 0 and 200
Temperature: From sensor built into monitor

The resulting curve definition will be of the form 'P(n,v)' where 'n' is the PERMALIGN monitor number and 'v' is the selected value, e.g. P(2,DX) or P(F,Temperature).

Alarms

Activate alarm settings by clicking on the ALARM button. Enter the upper and lower limits. The levels appear on the graph, and when a measurement goes outside a level a message appears in the Measurement Protocol report (page 58).

Averaging

Activate averaging with the AVERAGE button. Select 'None' or 'Rolling average' (the most recent n points). Then select the number of points averaged: 2,4,8...64. If your raw data has irregular peaks or the occasional missing point then setup a rolling average with say 4 points; the resulting graph will then be smoothed out without gaps. Note, it is not recommended to have Averaging active during measurement as the calculations may delay measurements.

Auto Zero

Select AUTO ZERO to make measurements start from zero. i.e. the first measurement made is defined as zero and all subsequent measurements are adjusted accordingly.

User formula

Instead of simply plotting raw values you can use the 'User formula' function to plot a calculation based on the raw values, for example converting the X-axis value from monitor '0' into an angle (in radians). Here's a quick procedure to do that:

1. Click on USER FORMULA and on DEFINE to call up the formula generator:

2. The formula required for the angular movement of the roof prism in milli-radians (mrad) is P(0,X)/(D+LC) where:

    • P(0,X) means the raw X value from PERMALIGN address '0',

    • D is the distance from the marking on the monitor to the marking on the prism, say 450mm,

    • LC is the monitor's Lens Constant, typically around 360mm but varies between monitors, see page 29.

3. Select the PERMALIGN unit number from the box displaying e.g. 'P(0,'. Click on the arrow to show the list and select the monitor you want to use.

4. Select the 'X' raw data and terminate the PERMALIGN definition with a ')' bracket.

5. Enter e.g. '/(450+360)' to complete the formula.

6. You can correct with the backspace key. When finished select OK. If you have made a mistake 'Syntax error' appears - try again or select CANCEL!

See page 76 for details on the formulae you can use to calculate coupling offset and machine foot corrections.

5. Adding further curves/graphs

If you have selected a Polar graph then you must define both the X and Y axes before you can proceed. For a Trend Graph you can define between 1 and 4 curves to be displayed simultaneously on the same axes.

Furthermore, in the GRAPH WINDOW SETTINGS screen on page 62 you can define up to 6 separate graphs to be displayed next to each other.

6. Display Graph

Here is an example of a graph display, consisting of a polar graph and a trend graph, the trend graph having two curves:

Alarm level
See Curve Definition, page 64

Legend
can be toggled on/off

Polar graph
plots two parameters against each other with NO timebase. Shown here with GRID ON and MARKERS OFF.

Cursor
moved with LEFT and RIGHT arrow keys

Two graphs
defined in the GRAPHIC WINDOW SETTINGS, page 62

Axis title
set with the AXIS option

Alarm level
See Curve Definition, page 64

Active graph
with black border. All buttons and commands change the active graph only. Select active graph simply by clicking on it

Trend Graph with 2 Curves
The two curves are defined in the Graph Settings window, page 63.

Line Cursor
(Trend graphs only) can be toggled on/off. When off, and in Polar graphs, the cursor appears as a small square. Select the cursor position by clicking with the RIGHT mouse key; move with the LEFT and RIGHT arrow keys.

Activity note (flag)
If the cursor rests on a point with a flag, an 'A' appears at the right end of the status bar.

Measurement Start:
Measurement End:
√ last valid measured point
   actual cursor position

Status bar
Click the right mouse key onto one of the 4 status bar fields to display a popup menu. Here you can select a value to be displayed (or toggle off the ticked value) Note, if the Status bar is not displayed, toggle it on under OPTIONS in the command line.

Cursor Values window
Values at cursor in active graph. Can be toggled on/off and moved by clicking on its title bar and using drag & drop.
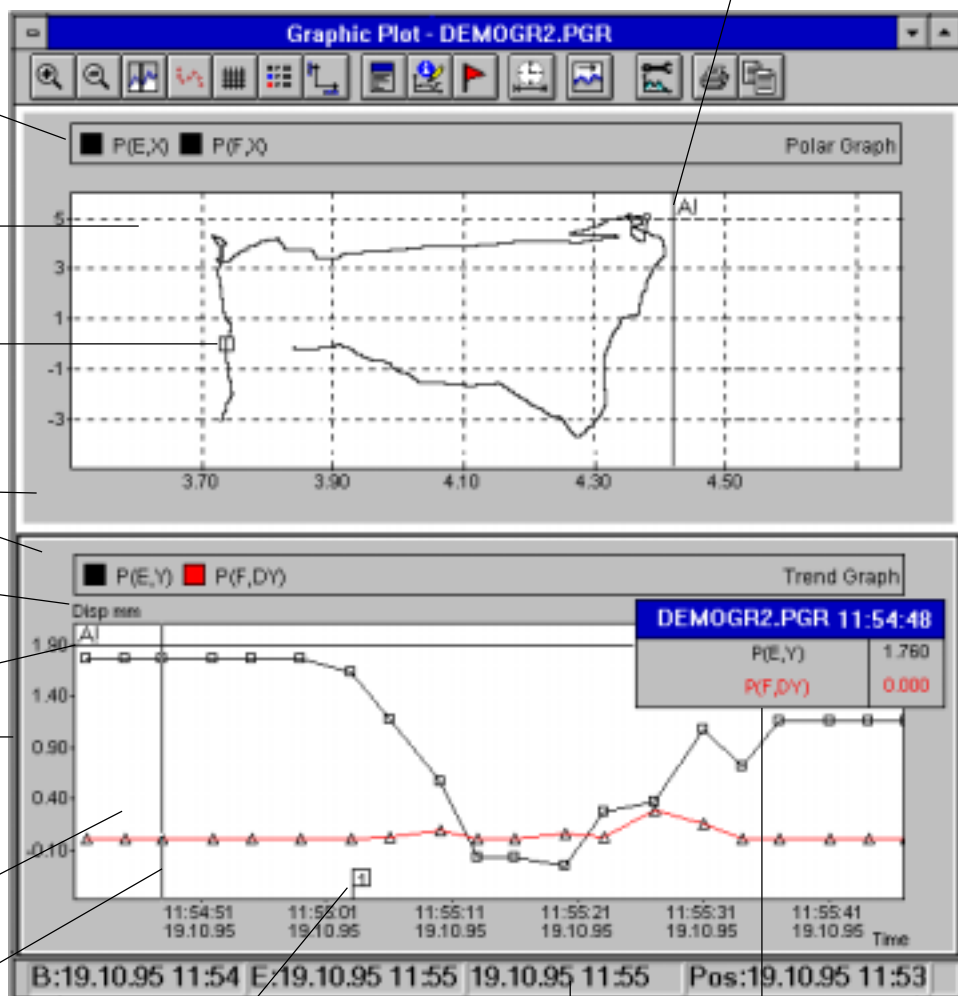
There is a series of buttons displayed with the graph which allow you change its appearance e.g. toggle on/off the grid or the marker points etc. These are all accessible under G<small>RAPH</small> in the command line.

ZOOM (Available *after* measurement; see Partial Time View, below for zooming during measurement) Use the mouse to drag a box across a portion of the graph; Click and hold down on the left mouse key in one corner, drag the box to the opposite corner and release. Then select the (+) ZOOM symbol. (-) UNZOOM returns to normal magnification.

LINE CURSOR displays a vertical line in Trend graphs when you click with the right mouse key on the graph. The value at that point appears below the graph or in the Cursor Values box, see below. You can move the cursor with the LEFT and RIGHT arrow keys.

MARKERS displays marker points at each measurement on the graph.

GRID displays the background grid.

LEGEND displays a bar above the graph showing which color graph line is which. The graph name is also given

AXIS allows you to name each axis and to select either absolute time or relative to the start time.

ADDITIONAL INFORMATION adds a note to the graph.

CURSOR VALUES displays a mini window showing the current cursor values of each graph line.

SET ACTIVITY NOTE displays a marker on the graph of some event. Click the point on the graph with the right mouse key, then select this option. Enter a comment and select OK. A mini flag appears on the graph with a sequential number. An 'A' appears at the right of the status bar when the cursor rests on a point with a flag (useful for polar graphs). Delete a flag with the Notepad option, page 72.

SYNCHRONISE copies the same timebase as the current graph into all other graphs that may be on display. (not available for Polar graphs or when 5 graphs are displayed!)

PARTIAL TIME VIEW (during measurement only) allows you to display the whole graph or the last 'n' points.

PRINT prints the graph.

COPY TO CLIPBOARD copies the graph into the Windows Clipboard from where it can be inserted into e.g. a report in a Windows compatible text editor.

EXPORT measurement data to a text file. See overleaf.

Export

EXPORT under MEASURE in the command line allows you to transfer selected measurement data to a text (ASCII) file.

1. Select graph(s)

The curves are listed from the most recently opened/current graph display. Select curve(s) to export by moving them from the left field to the right. '>' copies the highlighted curves to the right '>>' copies all files, '<' and '<<' copy back again. Select NEXT to proceed..
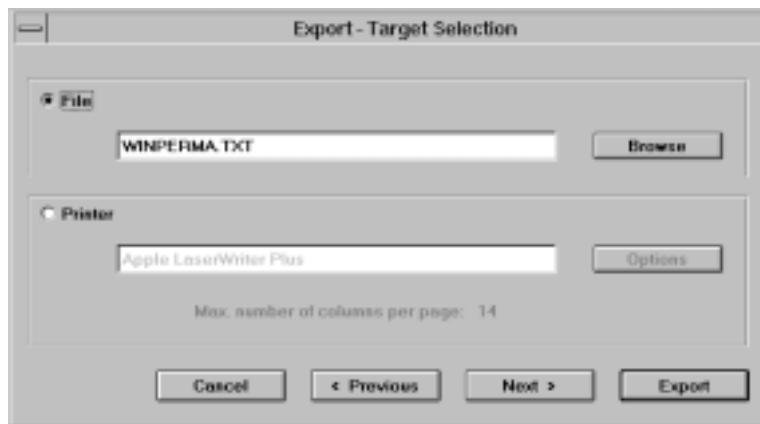
2. Select File or Printer
Select FILE or PRINTER as the target for the export. If you select FILE you must enter a filename and/or select a destination with the BROWSE button. If you select PRINTER you can use the OPTIONS button to call up the standard Windows printer setup options - see your Windows manual for details. Select NEXT to proceed..

Export - Timerange Selection
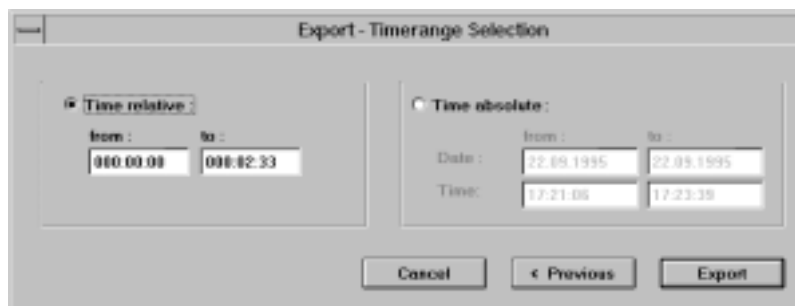
3. Select time span
Select TIME RELATIVE (time starting at t=0 with the first measurement), or TIME ABSOLUTE (actual time), and enter the required times and dates.

4. Export
Finally select EXPORT to export the measurement values.

If sending to a file, the resulting format looks like this:

```
D::HH:MM:SS     P0X      P0Y
0::00:00:10    0.000   -0.340
0::00:00:20    0.020   -0.330
0::00:00:30    0.020   -0.330
0::00:00:40    0.030   -0.320
.
.
AutoZeroValue 0.910   Off
```

The first line gives the title of each column. Then follow the times and values. The last line gives the initial raw value for each curve if Auto zeroing was selected (pages 64-65).

This file can be read and processed by any spreadsheet program e.g. MICROSOFT EXCEL.

PERMALIGN values

The PERMALIGN Values option under M<small>EASURE</small> in the command line shows the PERMALIGN addresses used, and you can select whether graph time is displayed relative, i.e. starting at t=0 for the first measurement, or absolute i.e. actual time:
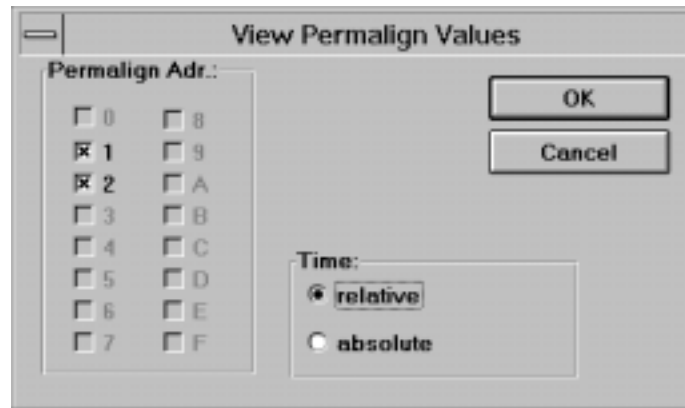
Notepad

N<small>OTEPAD</small> also under M<small>EASURE</small> in the command line allows you to enter notes about the project. You also see all the activity notes (flags) displayed in the current graph. These can be selected and D<small>ELETED</small> if wished:
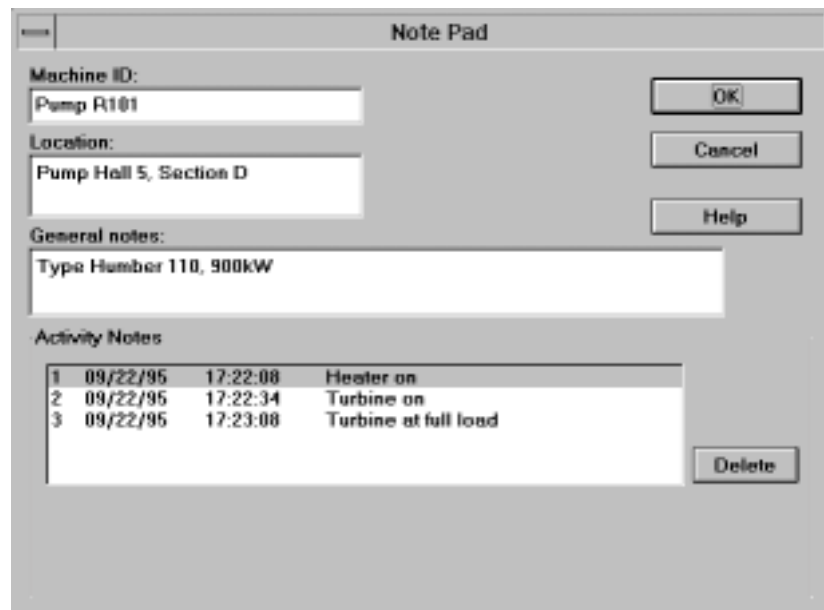
Loading graph files from other projects

Graph files can be used by other/changed projects with different configurations and monitor addresses etc. The problem arises with functions and user-defined formulae (page 63) containing addresses not used by the current project. Should this be detected, the following message appears:
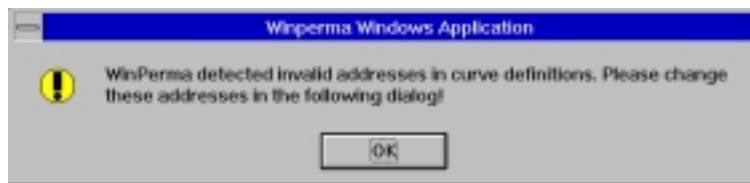
Select OK to show the following table whereby invalid function/user-formulae can be corrected:

1.   Highlight a function, select EDIT to move it to the edit box, right.

2.   Change the 'P(n' addresses for valid ones as given in the VALID MONITOR ADDRESS list (list revealed by clicking on arrow button).

3.   When edited, select READY to move it left and give it a green smiley face. Repeat for all functions and select OK when finished. The graph file can then be used by the new project.

Application 1 : Polar graph

This illustration shows an interesting PERMALIGN for Windows application, demonstrating the use of the polar graph (page 63):

Generator   Gas turbine   Gearbox   Steam turbine
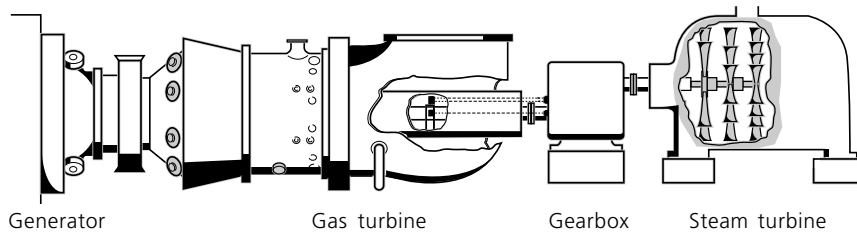
A gas turbine is started and brought up to operating speed by a steam turbine, with a gearbox installed between the two. However, excessive vibration levels were measured on the gas turbine.

In order to ascertain the role played by thermal growth in this vibration behavior, a PERMALIGN system was mounted between the gearbox and the gas turbine.
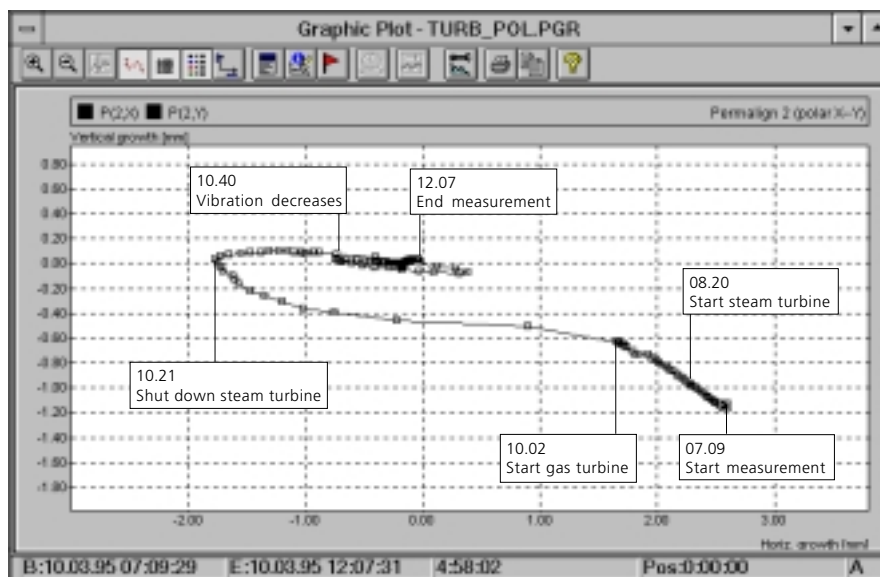
PERMALIGN for Windows polar graph clearly shows the thermal displacements that cause excessive vibration (labels added later)

An example similar to this may be included with your copy of PERMALIGN for Windows:
1) Select PROJECT and CLOSE your current application.
2) Select PROJECT and OPEN TURB.PPJ.
3) Select GRAPH and LOAD TURB_POL.PGR
4) Select OK to show this graph.

This PERMALIGN for Windows diagram shows clearly that the gas turbine begins to 'grow' when started and that vibration levels decrease as the turbine expands. This supports the assumption that thermal displacement was the cause of severe vibration. The measured growth values were then used to determine proper offsets for 'cold' alignment.

Application 2 : Calculating Angles & Offsets

For machine alignment applications you may like to display directly on a graph the coupling angle (page 15), the coupling offset and even the effective movement of the machine feet. To do this the monitors need to be setup as follows, mounted vertically and horizontally on the 'stationary' machine as shown:
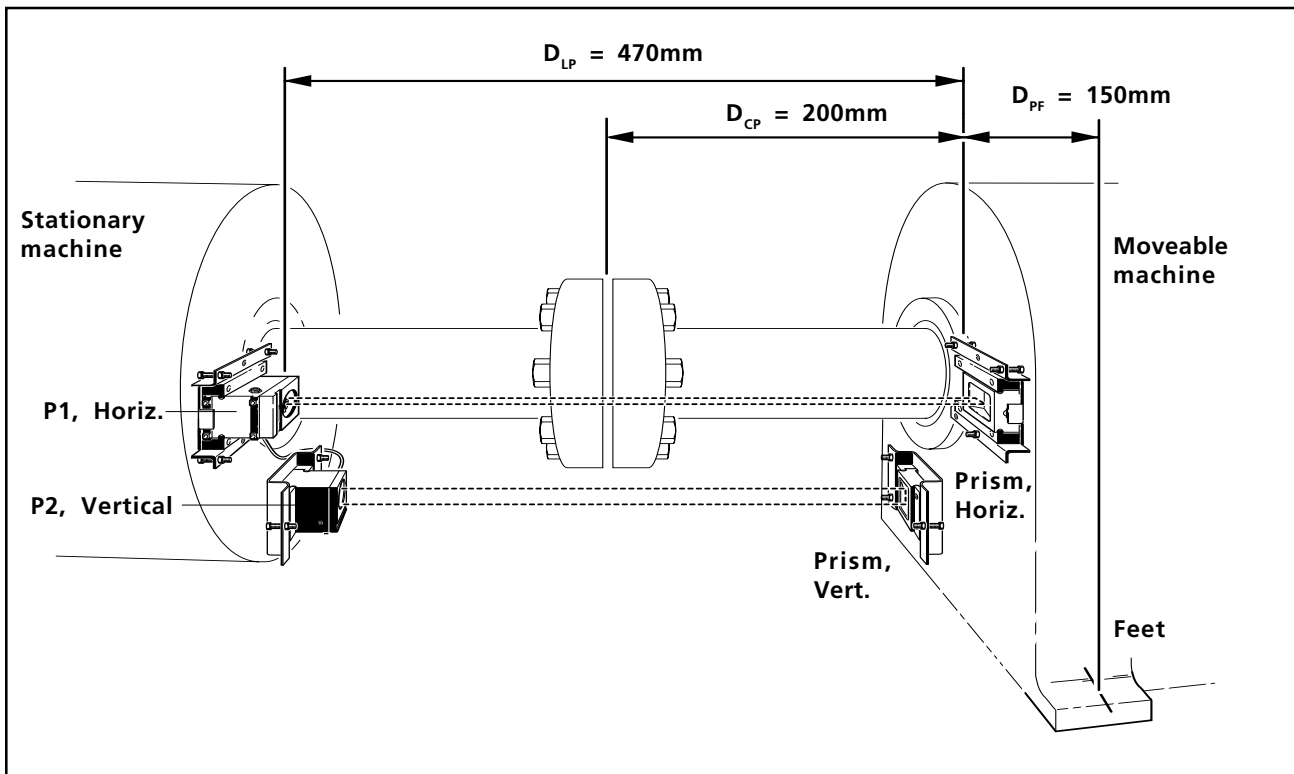
The following formulae are entered in the user-defined formula function on page 66, see diagram opposite.

Horizontal Angle   : $P(V,X) / (D_{LP} + LC)$

Vertical Angle   : $-P(H,X) / (D_{LP} + LC)$

Horizontal Offset   : $P(H,Y) + D_{CP} * P(V,X) / (D_{LP} + LC)$

Vertical Offset   : $P(V,Y) - D_{CP} * P(H,X) / (D_{LP} + LC)$

Horizontal Move   : $P(H,Y) - D_{PF} * P(V,X) / (D_{LP} + LC)$

Vertical Move   : $P(V,Y) + D_{PF} * P(H,X) / (D_{LP} + LC)$

Notes:

- These formulae apply ONLY to the orientations shown in the diagram opposite!

- (V,X) means the raw X values from the vertically mounted PERMALIGN ('V' is the address number e.g. '2' in the example opposite), LC is the Lens Constant for each PERMALIGN, see page 29.

- Positive offsets and gaps are defined upwards or away from the operator (standing at the front of the machine as in the diagram). Positive angles are derived from positive gaps.

- Although the reflected beam moves twice that of the prism, PERMALIGN always divides measurements by 2, so no further correction is required.

An example similar to this may be included with your copy of PERMALIGN for Windows:
1) Select PROJECT and CLOSE your current application.
2) Select PROJECT and OPEN DEMO.PPJ.
3) Select GRAPH and LOAD DEMO_ANG.PGR
   This file contains the horiz. and vert. angular calculations
4) Select OK to show this graph.
5) Similarily, LOAD the 'Offset' and 'Move' graphs, DEMO_OFF.PGR and DEMO_MOV.PGR

Note, DEMO_RAW.PGR contains the raw measurement values (shown on page 49)

PERMAFIX Mounting bracket   ALI 3.207set

The PERMAFIX mounting bracket offers especially quick yet rigid mounting, thanks to its single-bolt positive contour fit.
The bracket set consists of the following parts:
- 1 PERMALIGN monitor bracket
- 1 prism bracket
- 1 hammer jig with service pack
The service pack includes all small parts needed for mounting (such as screws, etc.).

Mounting

Mount the brackets on the machines as follows:

1.   Mark the bracket bolt locations on the machine housing, then drill 4.2 mm pilot hole at each location. (be sure that the hole locations are as consistent as possible from one machine to the other.

2.   Tap an M5 thread in each pilot hole.

3.   Use an M5 inside hex bolt from the service pack to fasten the mounting bases to their respective mounting locations.
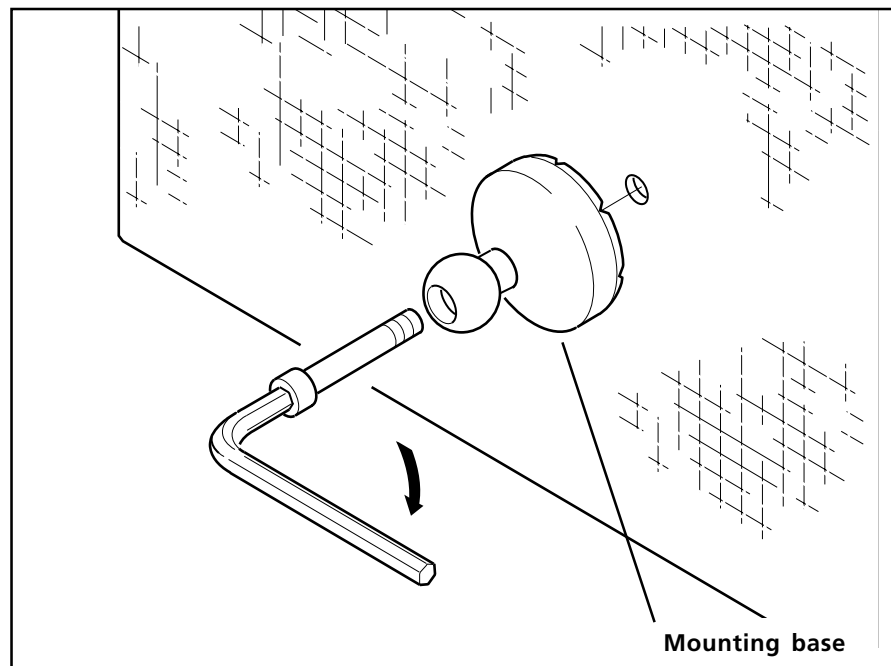
Mounting base

4.   Place the conical hammer jig over the mounting base and strike it with a hammer to drive the mounting base into the machine housing (facing page). Tighten the hex screw and repeat this sequence until the mounting base is firmly embedded in the machine housing. The sharp edges of the mounting base should be 'buried' into the surface of the machine housing.

5.   Insert monitors and prisms into their brackets (see page 20).

Hammer jig
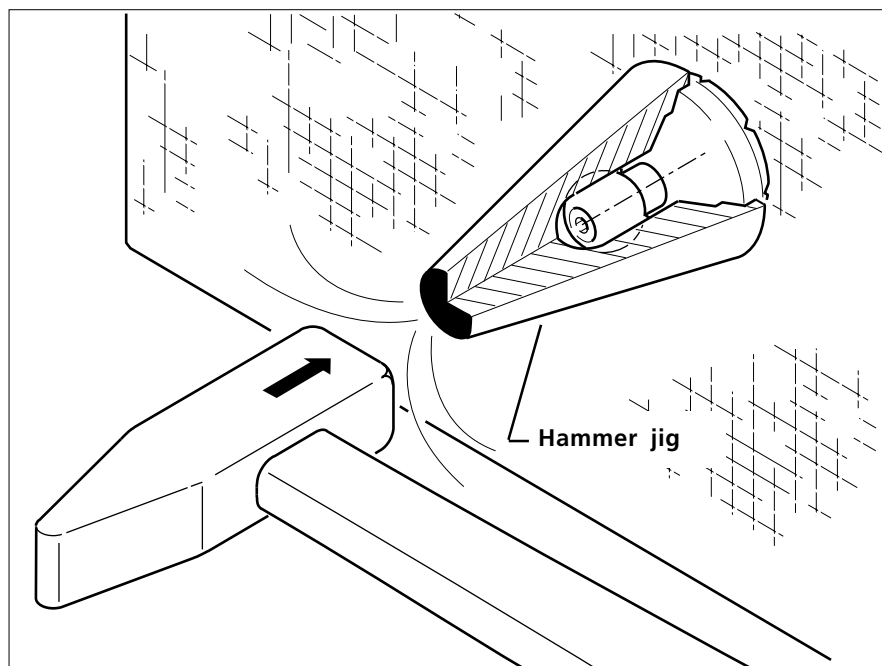
6.   Place the frame bars over the ball of the mounting base, then tighten the entire assembly into place using the clamping levers. The bracket should be folded together as far as possible so that the center of gravity is as close as possible to the machine housing; avoid extending the bracket further than necessary to hold bending moments to a minimum. Check that the clamping levers are firmly tightened. The entire assembly should now be rigid.
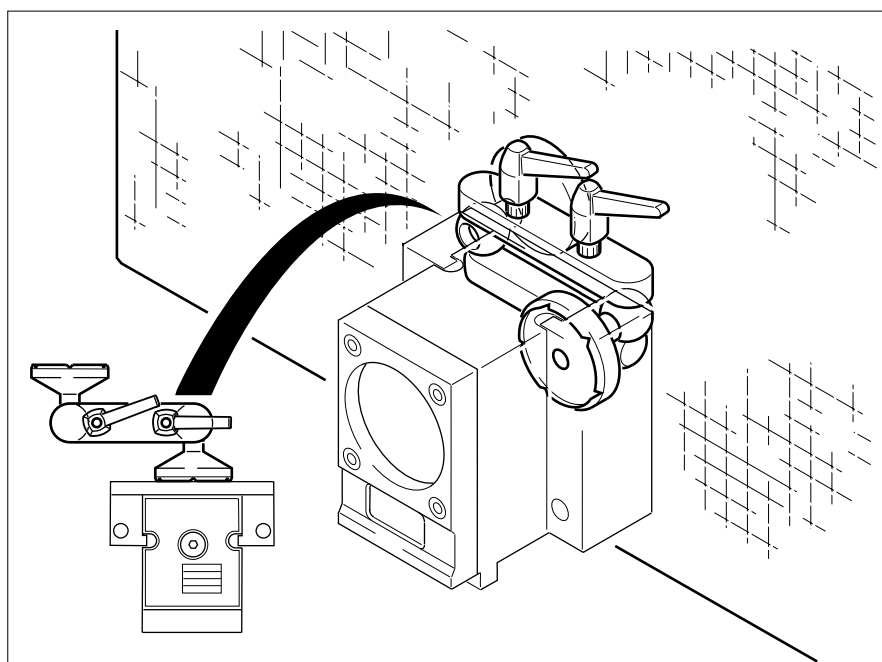
Important:
Mount the bracket horizontally as shown, so that the base is subjected to twisting (torsional) forces rather than ones that would tend to tip it out from the machine housing (as would be the case with vertical bracket orientation).

PERMALIGN for Windows files

PERMALIGN
for Windows

PERMALIGN
for Windows
Help!

After installation the following files appear on your PC:

WINPERMA.EXE	PERMALIGN for Windows program
WINPERMA.HLP	Help file
WINPERMA.INI	Initialization file contains a list of the registered PERMALIGNs, COM port and units settings, and a list of recent Project files.
CTL3DDLL.DLL etc.	Supplementary program file(s)

After running PERMALIGN for Windows the following files may be created. Ideally these should be located in a separate directory to the program files e.g. a subdirectory '\data' :

*.PPJ	PERMALIGN for Windows Project file. The main file for a particular measurement job, contains settings and references to other files.
*.PDT	Data file containing the actual measurements.
*.PGR	Graphics file, contains graphics settings and user defined formulae.
*.PNT	Activity Notes file (see page 72).
*.LOG	Measurement Protocol log (see page 58). This ASCII text file can be read with any text editor.
WINPERMA.TXT	Default filename for exporting measurement values (see page 70).

To view a text file, go into the Windows File Manager and double-click on the file e.g. *filename*.LOG. If a message says that it's 'not linked to an application' then select File, then Link. Type in the LOG suffix and select NOTEPAD.EXE from the application list. Confirm with OK and try again.

Backing up and restoring files

You are strongly advised to backup your measurement files every day or at the least, every week. If your company has a reliable facility of backing-up the network and all the local drives every day or week then that's fine, otherwise proceed as follows:

One method of backing up onto floppy disks is to use the DOS command BACKUP. Here's how to use it (for the default situation of files in c:\pruftech\perma\data):

1. Exit WINDOWS
2. Insert a formatted unused and labeled-up floppy disk in e.g. a:
3. From the DOS prompt type,
   backup c:\pruftech\perma\data*.* a: ENTER
4. Follow the instructions on the screen. You may need extra disks if the files are very large.

The files are now on your floppy disk in a special backup format. The date of creation of the backup file gives the date of the backup (type **dir** ENTER to see this date)

To restore the database in event of a catastrophe,
1. Exit WINDOWS
2. Insert the most recent backup disk in e.g. a:
   (if the backup consists of more than one disk then insert the first of the set)
3. From the DOS prompt type,
   restore a: c:\pruftech\perma\data*.* ENTER
4. Follow the instructions on the screen, inserting the subsequent disks if requested.

The old files are now restored and ready on your hard drive.

Troubleshooting software checklist

Memory problems

If the computer announces 'Out of memory' or a similar memory-related message, then:

a)   The Windows configuration files may not be correctly setup. See the Windows manual or ask your computer specialist.

b)   You need more RAM memory. 4MB is recommended.

c)   You have other programs 'resident' in memory which must be removed.

d)   Your 'smart drive' may be using too much memory. You could reduce its size or temporarily uninstall it, but since this will affect other applications it is advised instead to obtain more RAM.

Data transfer problems

If you have any problems with transferring data between the monitor and the PC then check the following:

a)   Is the cable connected in the correct sockets?

- You may have wrongly plugged into the printer port (LPT) on the PC. Note that the LPT port is usually female and the COM port male (pins poking outward).
- If your serial card on the PC has two different sockets e.g. a 9-pin and a 25-pin, then in some cases it is necessary to use the other one with an adaptor.

b)   Is the PC configuration in PERMALIGN for Windows for the serial port correct?

- Check that the COM number matches your computer i.e. set to COM2 if using COM2 ! A mouse is usually connected to COM1.

c)   Does the monitor address match that in the PC configuration?

- Check under OPTIONS then SETTINGS.

d)   Check the monitor's LCD display to show that the monitor is in order. See page 26.

Mouse problems

Check that the mouse is working in other programs. Is it correctly configured and connected? Is the mouse driver loading correctly?

Printer problems

Printers are always a problem!

Check the usual things: the configuration, port selection, connection cable; Is the printer on? Does it have paper? Some printers have a 'Load' key which must be pressed to load a sheet. Try also switching off and on the printer.

If all else fails, please contact your local PRÜFTECHNIK representative or contact us directly with the fax number on the inside front page, preferably using the error report on page 93.

Troubleshooting hardware guide

PERMALIGN is designed to withstand a rough industrial operating environment. Should you nonetheless encounter difficulty someday, the following checklist of possible problems can be a great help in locating and eliminating the source of trouble.

1. A poorly mounted bracket or loose monitor stage clamp can lead to erroneous results. One sign of bracket looseness is a sudden increase in the standard deviation of measurement X and Y coordinates in the alignment.

2. If there is measurement interference due to vibration from adjacent machinery then increase the Averaging time in the alignment display.

3. Sudden changes in temperature and humidity can temporarily affect the PERMALIGN monitor (for example, if the unit is stored in a cool area, then brought into a hot, humid work area. the optics can fog over). Remedy: allow the PERMALIGN components to reach ambient air temperature before taking measurements.

4. The electronic components used in the transducer may be temporarily affected by excessive temperatures, so protect the system from extended exposure to high temperatures and direct sunlight, and observe the operating temperature range of 0° C to 50° C (32° F to 122° F).

5. In a few rare cases, powerful infrared light sources, welding arcs and direct sunlight can overload the detector. The display will then show 'Err,' and measurements cannot be taken until the infra-red disturbance is eliminated (simply by shading the monitor).

6. Steam, dust particles, soot suspended in the air, etc. can block the laser beam. When the detector no longer receives the beam, it causes the display to show 'cln' or even 'OFF.' But over the relatively short separations involved, this is a rare occurrence.

7. Low battery level does not influence measurement accuracy. As the batteries become depleted, the monitor's display shows '**batt**', giving the user plenty of advance warning to store measurements or finish the job at hand before charging batteries.

No spare COM port?

If your only COM port is connected to a mouse then you have three options:

1. Buy and install a second COM port. Some Notebook PC's have unfortunately no room for an extra port.

2. Switch the PERMALIGN connection cable with the mouse before and after adjustment and measurement. This may not work with certain systems, in which case the mouse may temporarily not work afterwards, requiring a reboot!!

3. Use the trackball or keyboard instead of the mouse. This requires a minor computer reconfiguration! Read on:

Are you using a notebook with a trackball?

If a trackball (or similar) is disactivated then you can reactivate it and use it instead of the mouse. Please see your computer manual for details, but one common procedure is as follows:

1. Save your work and re-boot the notebook with CTRL + ALT + DEL simultaneously.

2. You need to call up the 'BIOS' setup screen which is done either by holding down a key while re-booting or pressing e.g. F1 or DEL.

3. Alter the appropriate field to 'enable' the trackball, then save the setup. Disconnect the mouse leaving the port free for PERMALIGN. Set PERMALIGN for Windows OPTIONS, SETTINGS correctly (usually COM1 in this case, but not always!).

No trackball !!

No trackball, then you must disactivate the mouse driver and work entirely with the keyboard. This requires two things:

• You must be familiar with using Windows programs with the keyboard alone (requires some practice!). See page 39.

• You require the Windows file NOMOUSE.DRV which may need to be loaded from the Windows installation disks. Proceed as follows:

1. While in Windows go into WINDOWS SETUP from the MAIN GROUP. Select OPTIONS and CHANGE INSTALLATION.

2. Change the mouse driver to 'No mouse'. Select OK and load NOMOUSE.DRV if asked. Reboot.

3. When you now run Windows the mouse will no longer work. Disconnect it and the serial port is then free for PERMALIGN connection. Set PERMALIGN for Windows OPTIONS, SETTINGS correctly (usually COM1 in this case, but not always!).

After using PERMALIGN for Windows don't forget to reconfigure the computer back to its original state for other applications!

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Up to 8 modules (16 monitors) in total

Opto-coupling

Opto-coupling

Opto-coupling

Monitor-module

Monitor-module

Monitor-module

PC-module

220 v ~

Transformer-module

110 v ~

PC cable

Monitor-monitor cable

PC computer
(See page 36 for specifications)
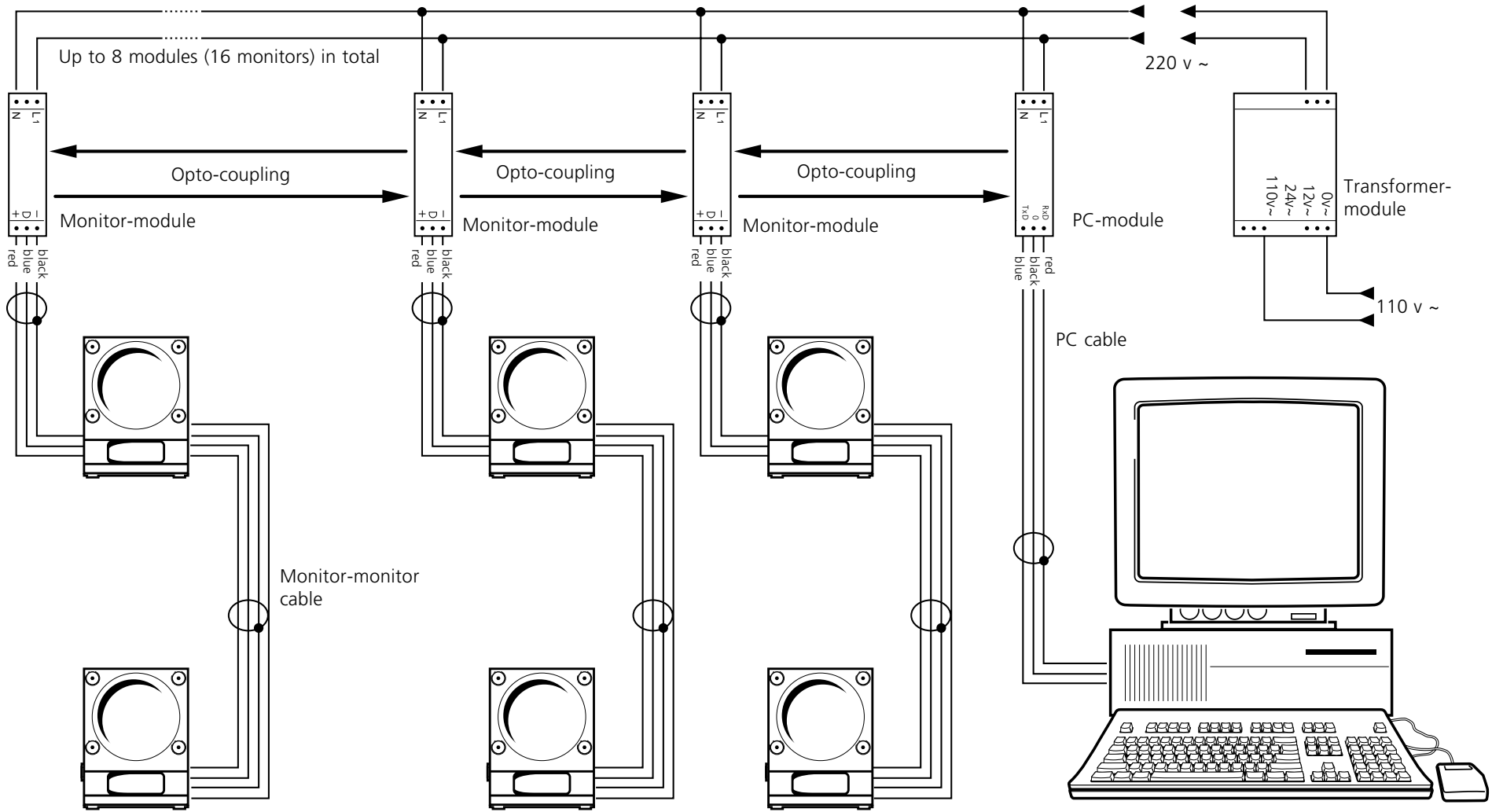
See pages 12 and 24 for further details on the modules and cables

Optical coupling: Mask off each end of the module block to avoid interference from external light sources.

Technical data for PERMALIGN® monitor

Mechanical characteristics
Detector measurement range

Axis 1:   ± 8 mm(± 5/16 in.)

Axis 2:   ± 8 mm(± 5/16 in.) (perpendicular to Axis 1)

(or $x^2 + y^2 = 64$ mm^2 / 0.1 in.^{2})

Accuracy   better than 2% (of displayed value)

Maximum distance between prism and reflector

10 m (30 ft.) (at full measurement range)

Resolution

Display   1/100 mm (1/1000 inch); 1° C; 1° F

Internal   1/1000 mm (0.00004 inch); 0.1° C; 0.2° F

Operating temperature range   10° - 50° C (50° - 122° F)

(w/o external cooling/heating) [0° - 70° C (32° - 158° F) available]

Storage temperature   0° - 80° C (32° - 176° F)

Protection from operating environment IP65: dust- and spray-proof

Dimensions (W x H x D)   65 x 90 x 90 mm

(2 9/16" x 3 9/16" x 3 9/16")

Weight   Approx. 750 g (1 3/4 lb.)

Electrical characteristics
Measurement rate   approx. 1 mean value/sec.

Vibration supression   One mean value is calc'd from 16 individual samples taken at random intervals.

Standard deviation   A useful measure of vibration behavior, also serves as early warning of mounting bracket looseness.

Internal voltage   DC 5V ± 5%

Power consumption   approx. 150 mW

Cable   shielded coaxial,

(Monitor-module $\varnothing_{area}$ = 0.22 mm^2 (0.0003 in.^{2}),

and monitor-PC)   max. length 100 m (308 ft)

($\varnothing_{area}$ = 1.5 mm^2 (0.002 in.^{2}) for greater lengths)

Intrinsic safety (optional) Fulfills EEx ib IIc T4 Zone 1 requirements. Supply module installed outside hazardous area.

Interface   1 conductor, 5V CMOS-Level RS 232,

1200 Baud, 7 data bit, 1 parity bit (even), 1 stop bit, question-answer protocol with parity and check sum.

Optical characteristics
Laser safety   Class I: corresponds to IEC TC 76 (Europe), and 21 CFR 1040.10, 1040.11/ANSI Z.136.1(USA)

Wavelength   approx. 780 nm

Beam diameter   approx. 10 mm (3/8 in.)

Beam divergence < 0.3 mrad

Beam power   < 60 uW (2 mW, pulsed 1/30)

Order numbers

PERMALIGN order numbers

ALI 3.305SET	PERMALIGN for Windows PC software Set: Includes diskettes, Manual, and 2 Password Certificates
ALI 9.526	PERMALIGN Password Certificate
ALI 3.201	PERMALIGN monitor
ALI 3.202	90° Prism
ALI 3.203	Mounting bracket
ALI 2.250	Beamfinder
ALI 4.610	Battery interface (for up to 2 monitors)
ALI 3.060	Monitor module
ALI 3.070	PC module
ALI 3.264	Cable adapter for IBM PC
ALI 3.270-x	Monitor-monitor cable (x=length in meters)
ALI 3.262-x	Monitor-PC cable
ALI 9.527G	Instruction manual

Further details can be found in the OPTALIGN / SYSTEM 2 / PERMALIGN Product Catalogue ALI 9.300, available from your PRÜFTECHNIK distributor.

See also the Function Overview on page 48
CAPITALS refer to program buttons & commands

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for PERMALIGN for Windows software

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PERMALIGN for Windows®
Error Report Per Fax

Company: _____

Name: _____

Dept.: _____

Street/P.O. Box: _____

Town/Postcode: _____

Country: _____

Tel: _____

Fax: _____

Fax: 00 49 89-99616-200

PRÜFTECHNIK AG
P.O. Box 1236
D-85730 Ismaning
Germany

In order to help you as quickly as possible with the error analysis, we need the following details concerning your PERMALIGN-Software and the computer you are using. Please complete this form and send it per fax to PRÜFTECHNIK AG at the above number.

1. The <u>version number</u> of your PERMALIGN®-software is: ☐ ☐ ☐

   (The serial and version numbers can be found on the original diskette or on the screen when you click on the Info-symbol in the main menu.)

2. Briefly describe the error: _____

   _____

   _____

3. Print out a copy of your <u>Autoexec.bat</u>-file and your <u>Config.sys</u>-file and send them together with this fax.

4. Computer details: (either use the MS-DOS command 'MEM' or the 'MSD' command in Windows*).

- which processor? _____

- how much working memory (RAM)? _____

- how much spare capacity does the harddisk have left? _____

5. If the system has crashed, if possible indicate both <u>error codes</u> which appear on the screen:

   _____

6. If the system crash is reproducible, give an exact description of the key sequence or process followed: _____

   _____

   _____

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**Proven
maintenance
technology**

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