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# Chapter 5: Alignment of vertical machines

This chapter tells how OPTALIGN PLUS transforms alignment of vertical machines from a major measurement challenge to a straightforward and relatively simple task.

## Vertical machine alignment flow chart

SWITCH ON

(Press again to resume horizontal mode)

### DIM Enter Dimensions (page 5-7)

Press ENT after each entry. Cycle through with ◀ and ▶.

1. Transducer to reflector
2. Transducer to coupling center
3. Flange maximum diameter
4. Transducer to flange (flashing feet denotes flange)
5. Coupling diameter
6. RPM (for tolerances, page 6-5)
7. Bolt positions:
    a. Bolt number displayed. Press ENT
    b. Enter angle. Press ENT
    c. Enter equivalent diamter. Press ENT
    d. Repeat for each bolt.

### M Measure (page 5-10)

1. '**Set0**' appears. Adjust laser to about 0,0 (See page 3-18)

2. Turn shaft to first clock measurement position (0°/90°/180°/270°).

3. Press numerical keys (e.g. 0 = 0°, 3 = 90° etc.) to enter first position measurement.

4. Repeat for at least 2 further positions (minimum of 3 measurements; 45° = 1.30, 135° = 4.30 etc.)

## Results (page 5-12)

Press the Results key repeatedly to cycle through the following options:

1. COUPLING GAPS & OFFSETS in 0-6 and 3-9 directions
   Cycle through with ENT

2. SHIMMING VALUES AT BOLTS:
   a. Select bolt number with ◀ and ▶.
   b. Shim to the given value
   c. Repeat for all bolts
   d. Remeasure.

3. HORIZONTAL OFFSETS AT FLANGE in 0-6 and 3-9 directions
   Switch between directions with ENT. Use MOVE to align.

## Alignment correction (page 5-13)

1. Loosen bolts and shim machine according to results (2) above. Take a new set of readings to verify shimming results.

2. Press

3. Rotate shaft to 45° (1:30 o'clock) position and press ENT.

4. Center laser

5. Loosen bolts

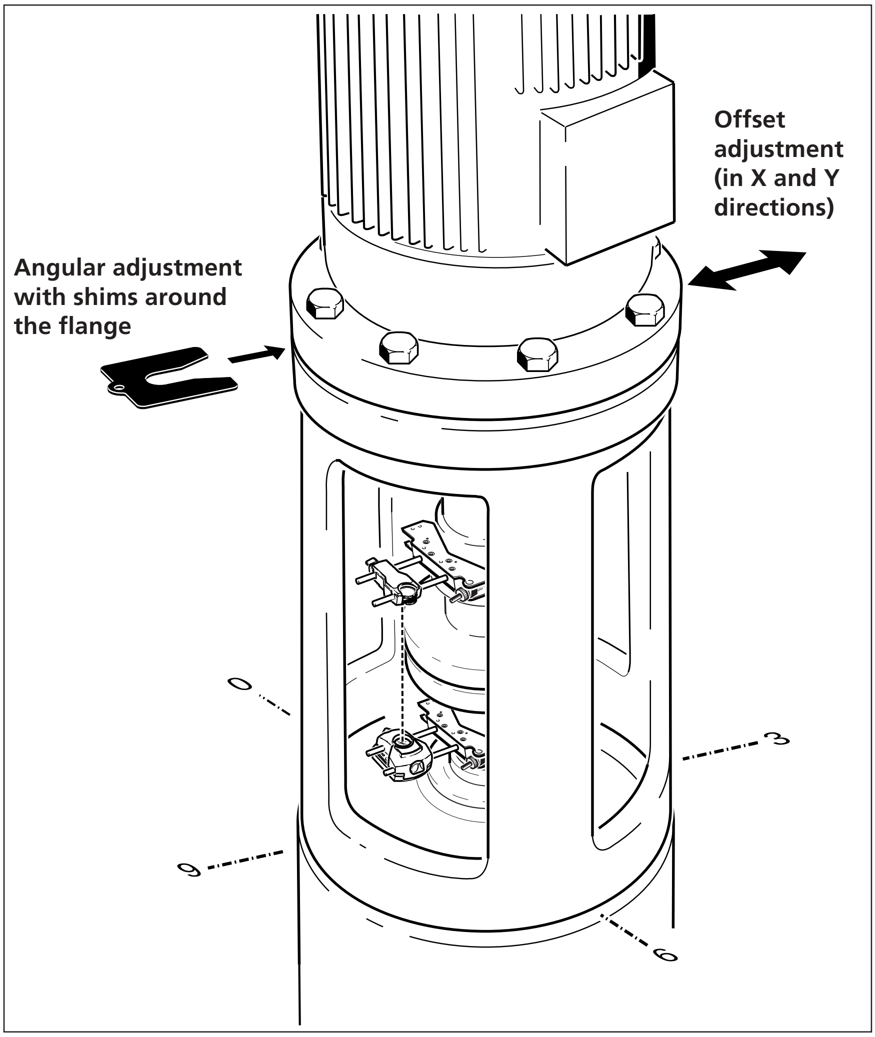
6. Move: Press ENT to switch directions, 0-6 and 3-9

7. Retighten bolts

8. Remeasure.

## Vertical machine alignment

Here is a typical vertical machine arrangement comprised of one machine mounted on top of the other with a bolt flange:




The OPTALIGN PLUS transducer and reflector are mounted on either side of the coupling as for horizontal machines, with the transducer below and the reflector above. Measurements are then made at a series of 90° or 45° rotational positions.

The computer then calculates the offset correction, performed by sliding the upper machine on its flange.

Enter the bolt positions and the computer calculates the amount of shimming required at each bolt.

The vertical alignment procedure is now described in detail on the following pages. Please acquaint yourself with the horizontal alignment method first.

## 1. Setup OPTALIGN PLUS components

Since the OPTALIGN PLUS electronic inclinometer is unable to detect the rotational position of the vertical shaft, it is necessary to mark out a series of angular positions for measurement. This may be done either by numbering the shaft or the coupling housing. In both cases the shaft will be rotated clockwise during measurement. Choose one of the conventions and adhere to it:

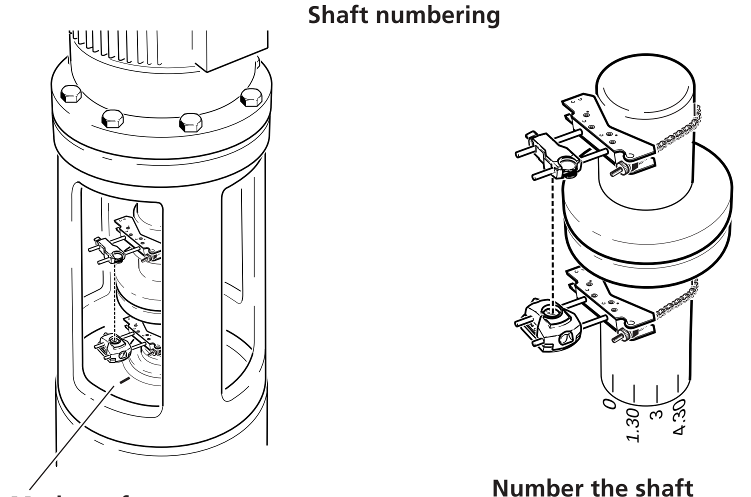
### Shaft numbering

1. Mark a reference position on the coupling housing close to the shaft and in line with one of the pillars or bolts. Likewise, mark a starting point on the shaft. Use a thick felt pen or similar.
2. Measure the circumference of the shaft and divide by four. Use this distance to make four evenly-spaced marks on the shaft beginning at your chosen start point. Number the points *counterclockwise* looking down onto the shaft with '0' as your first followed by 3, 6 and 9. The transducer-prism pair MUST be mounted exactly in line with the mark at number '0'.

> ***Beam deflector:*** (see page 3-17) The experienced OPTALIGN user may find this useful to help position the points, but take care that the beam does not land in anyone's eyes or on any reflective surfaces!

3. ***Restricted movement:*** If you have restricted rotational movement, you can mark out eight 45° positions (dividing the circumference by 8) on the shaft. During measurements you can measure at as few as 3 of these positions. Keep in mind that accuracy increases with the number of points measured—try, therefore, to make the maximum 8 measurements whenever possible.

**Shaft numbering**




**Mark a reference point on the coupling housing**

**Number the shaft counterclockwise 0, 3, 6, 9 (or 0, 1.30, 3, 4.30..)**

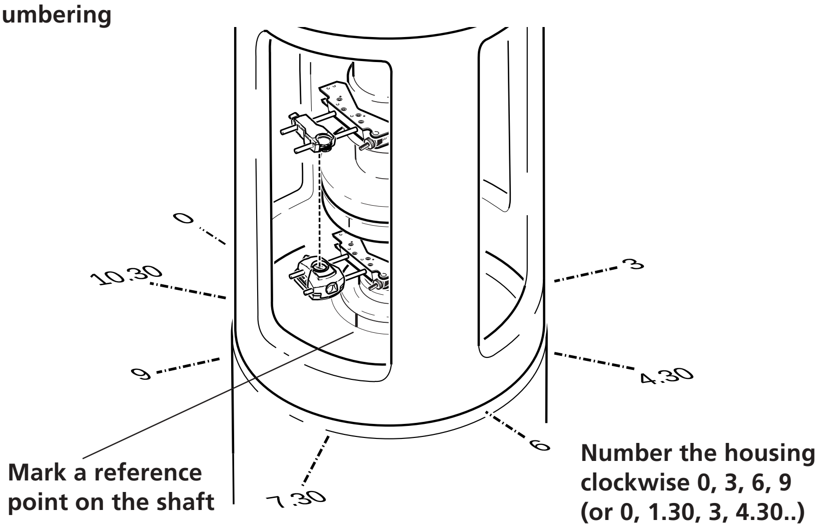
## Coupling housing numbering

For circular housings, the following method may be easier:

1. As for the shaft numbering method on the previous page, mark a starting position on the coupling housing close to the shaft and mark a reference point on the shaft; the transducer and laser MUST be mounted exactly in line with this point.
2. Measure the circumference of the coupling housing and divide by four. Use this distance to make four evenly-spaced marks on the housing beginning at your chosen start point. Number the points *clockwise* looking down onto the shaft with "0" as your first followed by 3, 6 and 9 (see below).

   Again, the beam deflector may be useful, see previous page.
3. If you have restricted rotational movement, you can mark out eight 45° positions (dividing the circumference by 8) as described on the previous page.

**Coupling housing numbering**




## Mount transducer & reflector in-line with shaft marking

Fit the OPTALIGN PLUS transducer and reflector on either side of the coupling, aligned EXACTLY with the '0' or reference mark on the shaft.

See pages 3-8 to 3-12 for mounting details. The transducer mounts on the lower machine which is defined as the stationary machine. Connect transducer to control unit (page 3-13).

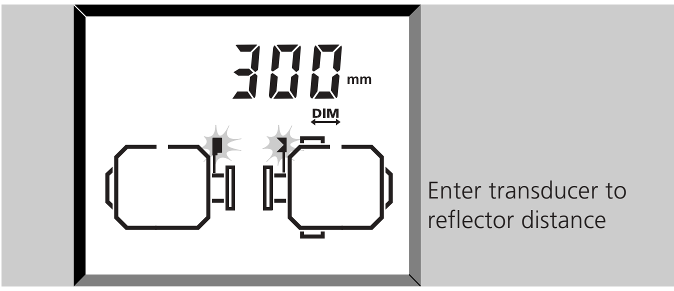
**Note**

| |
|---|
| Important: The mounting brackets MUST be correctly mounted to ensure accurate measurements. |

## 2. Press [key] and enter dimensions

Switch on the system (page 3-14) and press the vertical machine key located beneath the sliding key cover. (To revert to a horizontal machine application press this key again.) Enter the following dimensions, refering to the notes on page 3-15:

### 1. Transducer to reflector




Measure from the marking on top of the transducer housing to the marking on top of the reflector.

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### 2. Transducer to coupling center

Measure from the marking on the top of the transducer housing to the coupling center (the marking is in the same position as the posts and bracket chain).

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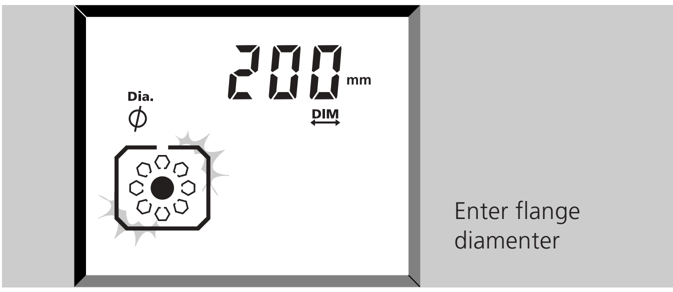
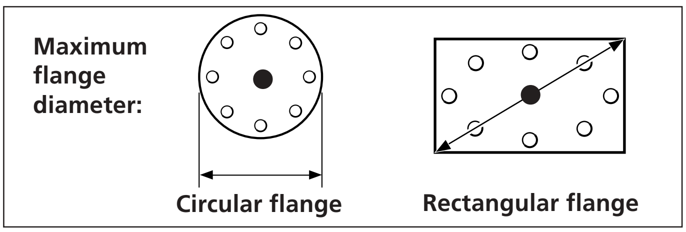
### 3. Flange diameter

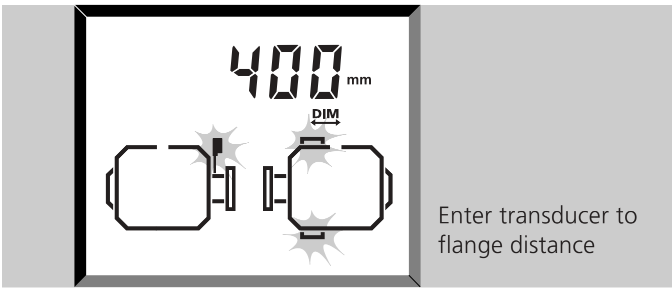



Enter the outer diameter of the flange. This is the point where the upper machine rests and tilts on the lower machine. It is used to calculate the minimum number of shims at each bolt to separate the flange. The bigger the flange, the more shims required.

If the flange is not circular then enter the maximum diameter across the flange, thus:



**4. Transducer to flange**



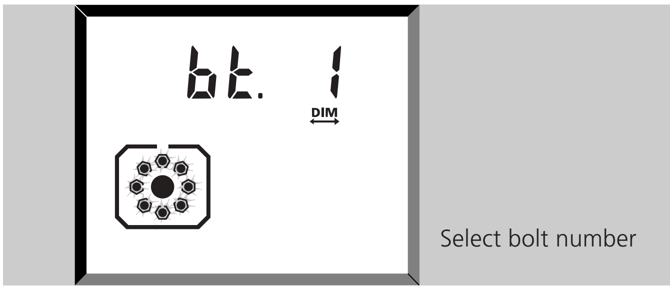

Enter the distance between the marking on the top of the transducer and the center surface of the flange.

**5. Coupling diameter**

The 'Dia Ø' symbol lights. You can measure the coupling circumference and divide by π (pi) (3.142).

**6. RPM (revolutions per minute)**

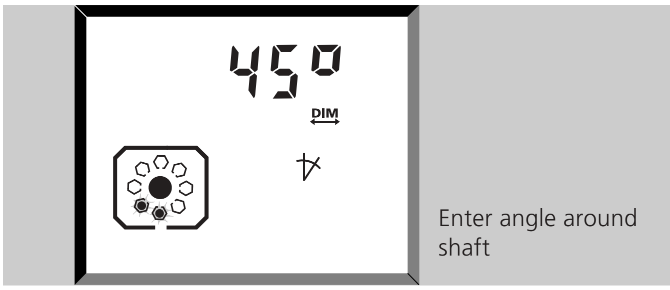
**7. Flange bolt dimensions: Select bolt number**




We now define the positions of the flange bolts in order to calculate their shimming requirements..

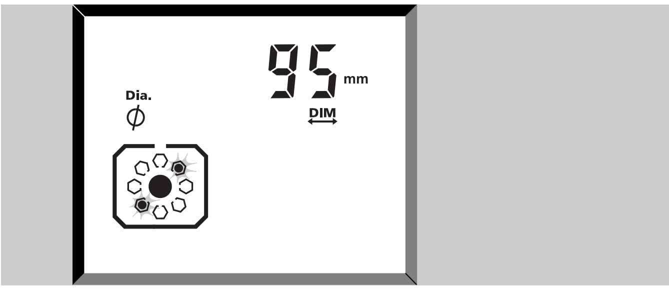
The screen above shows that we are about to define bolt number '1'. Press ENT to proceed.

**8. Bolt angle**




Enter the angular position around the flange of the bolt. The angle is defined clockwise in degrees, starting with ***0°*** corresponding to the ***12 o'clock*** position as defined on page 5-6.

### 9. 'Diameter' at which bolt lies




Type-in the *diameter* at which the bolt lies. This is TWICE the distance from the shaft center to the bolt.

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### 10. Next bolt


Bolt number '2' is now shown. You can use the arrow keys to go back to the previous bolt.

Repeat steps 7. to 9. for each bolt. You will notice that suggested angle and diameter values are offered, based on the previous values. Note that the flashing bolt indicates approximately the bolt's actual position, and that the same bolt symbol may flash for two bolts close together.

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### 11. Finish bolts with DIM

When finished press the DIM button All the dimensions for vertical machine alignment are now entered. You can change them or add more bolts at any time by pressing the DIM key.

## 3. Adjust laser beam

Carry out the laser adjustment procedure described on pages 3-18 to 3-21. This is summarized as follows:

### 1. Press to turn on laser

Remove transducer cap. The screen is now blinking the message 'Set0'. Remember..

WARNING!

| |
|---|
| Don't look into the laser beam! |

### 2. Adjust beam onto prism cap

Rotate the reflector side thumbwheel, and if necessary, loosen and move the bracket slightly. Retighten!

### 3. Remove cap, adjust reflector for slow blinking LEDs

Adjust with the front knob and side thumbwheel so that both LEDs blink slowly.

### 4. Center the beam coordinates

They do not have to be exactly zero as this doesn't affect accuracy.

Note

| |
|---|
| Do not touch the components once the beam is centered! |

You are now ready to measure...