

**Spacer Shafts with Obstructions to the Laser Beam  
(The 'Two-Step' Procedure)**

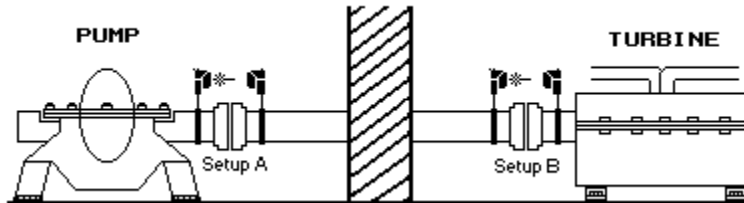


Figure 1

**Introduction**

The purpose of this TechNote is to provide you with a simple procedure for using your ROTALIGN<sup>®</sup> PRO on machines where line-of-sight for the laser beam across the spacer couplings or jackshaft is interrupted, preventing use of the traditional 'single-shot' setup. Examples of this situation include large cargo pumps on oil tanker ships where the pump and turbine are separated by a fireproof bulkhead which may not be breached, through which the spacer shaft runs through a seal. Another example is an ordinary cooling tower drive where the jackshaft connecting the gearbox and motor runs through the fan shroud. This procedure may also be used any time extremely long spans, or very gross misalignment between the machines exists, making the 'two-step' procedure preferable to the 'single-shot' approach.

**Overview**


The basic idea is to use the ROTALIGN<sup>®</sup> PRO's machine train capability to create a three-machine train whose middle machine represents the jackshaft. Take readings across each coupling individually, entering dimensions to the fictitious foot of the non-existent middle machine, such that the distances add up to the actual spacer length between couplings, and obtain results for the third machine, the machine to be moved (MTBM). To monitor moves, place the laser on a secure foundation (not the spacer shaft) facing the receiver mounted on the MTBM's shaft, and use the Move Function normally. This defeats the obstruction in the middle. See the detailed procedure which follows for a full explanation.

**The 'Two-Step' Procedure**

- 1) Mount your brackets across the left coupling, installing the laser on the shaft of the Stationary Machine. Install the receiver on the spacer shaft. (See Figure 1, Setup A.) Turn on the laser and remove its dust cap.

*Note: It is suggested that you note the exact location of the receiver bracket on the spacer shaft so you can set up in the same place again when rechecking the alignment. If, however, the receiver bracket position changes between sets of readings, you can edit this dimension individually for each set of readings on page 2 of the Measure Table.*

- 2) Turn on your ROTALIGN<sup>®</sup> PRO  ON / OFF .

- 3) After boot up, start the 'Align Shafts' application in the Program Manager by pressing the  softkey if necessary. This takes you to the Dimensions screen.

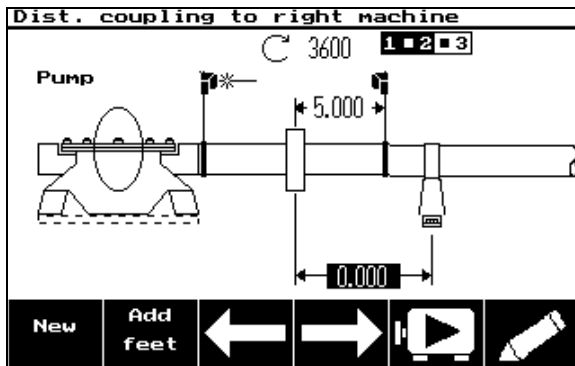


Figure 2

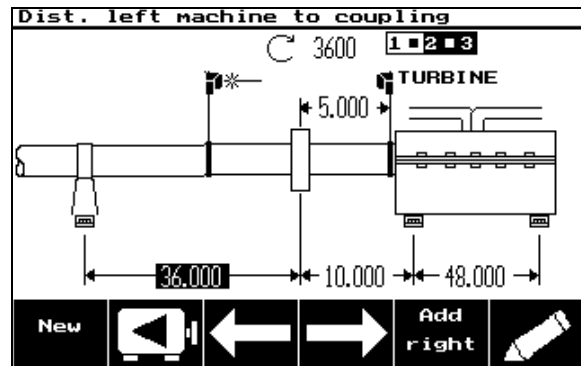




Figure 3

- 4) In the Dimensions screen, set up a three-machine train configured as follows:
- Machine 1 (the left machine) is your Stationary Machine.
  - Machine 2 (the middle machine) should have "Two Feet" Fixation (support).
  - Machine 3 (the right machine) is your Machine To Be Moved (MTBM).
  - Both couplings should be of the "Single Plane" Type. Also select your preferred Results Display Format (angle or gap).

Remember, the middle machine does not really exist but will represent your spacer shaft. See Figures 2 and 3, which show the middle machine configured as type "Shaft".

Note 1: For detailed instructions on how to do all of this, see Appendix A.

Note 2: You may also enter target specifications for the MTBM in the same format as the display format you have selected above. See Appendix B for an easy way to convert targets that are of a different format than your selected one.

- 5) Key in all necessary dimensions for Machines 1 and 2 as follows:
- Note that the icon  appears at the top of the Dimensions screen (see Figure 2), indicating that you are in the Dimensions screen for Machines 1 and 2. Key in the distance from the single-plane coupling (the left coupling on your spacer shaft) to the receiver, and press .
  - Enter the distance from the coupling to the foot of machine 2 as **zero**. See Figure 2. Remember, this foot doesn't really exist, so entering a distance of zero will position it at the same location as the left coupling. This makes entering the actual spacer length easier later in step 12.

Note: If you selected 'gap' as the display mode for the single-plane coupling, you will also have to enter a coupling diameter.




- 6) Press , adjust the beam into the center of the receiver's dust cap, then remove the dust cap.



Figure 4

7) Make sure the left coupling is highlighted (see the icon  at top of screen) and adjust the beam until the **Centered!** message appears. The screen then says **Turn shafts**. See Figure 4.


8) Rotate the shafts a minimum of 70 degrees to take readings.

*Note: It is desirable to take another set of readings to establish repeatability. When done press  to view the Measure Table and compare the results. You can then average results together if desired, before proceeding to step 9. You may also use other measure modes (such as Multipoint.)*


9) Replace the dust caps on laser and receiver. Remove your brackets and reinstall them across the right coupling. Mount the laser on the spacer shaft and the receiver on the MTBM shaft. See Figure 1, Setup B.

*Note: It is suggested that you note the exact location of the receiver bracket on the MTBM shaft so you can set up in the same place again when rechecking the alignment. If, however, the receiver bracket position changes between sets of readings, you can edit this dimension individually for each set of readings on page 2 of the Measure Table.*


10) Press .


11) Press  to view Machines 2 and 3.

12) Key in all necessary dimensions for Machines 2 and 3 as follows:


- Note that the icon  appears at the top of the Dimensions screen (see Figure 3), indicating that you are in the Dimensions screen for Machines 2 and 3. Enter the distance from the foot of machine 2 to the right coupling equal to the spacer length.
- Enter distance from the receiver on the MTBM shaft to the right coupling.
- Enter distance from the right coupling to Machine 3's front foot equal to the distance from the right coupling of your spacer shaft to the MTBM's front foot.
- Enter the distance between Front and Back Feet of the MTBM.

*Note: If you selected 'gap' as the display mode for the single-plane coupling, you will also have to enter a coupling diameter.*

13) Press , remove the laser's dust cap, and adjust the beam into the center of the receiver's dust cap; then remove dust cap.

14) Make sure the right coupling is highlighted (see the icon  at top of screen) and adjust the beam until the **Centered!** message appears. The screen then says **Turn shafts**.

- 15) Rotate the shafts a minimum of 70 degrees to take readings.

*Note: It is desirable to take another set of readings to establish repeatability. When done press  to view the Measure Table and compare the results. You can then average results together if desired, before proceeding to step 16. You may also use other measure modes (such as Multipoint.)*

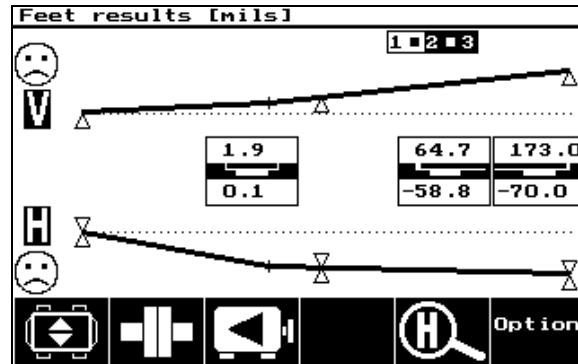
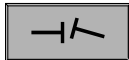






Figure 5

- 16) Press  to obtain foot position results. Note the icon  at the top of the screen to make certain you are in the results screen for Machines 2 and 3. The foot position results for Machine 3 are the actual foot positions of your MTBM (relative to targets, if any). See Figure 5.

*Note: If coupling results are displayed first, press  to obtain foot position results. If results for machines 1 and 2 are displayed, press  to see Machines 2 and 3.*

- 17) Proceed to align your MTBM as required, using the Move Function as needed.  
**Important Note:** See the Move Procedure (steps 17a and 17b) on page 5 for special instructions on how to use the Move Function in this application.
- 18) When finished shimming and moving your MTBM, tighten the anchor bolts and proceed to recheck the alignment, starting at step 1 and continuing with step 6. 

—Thanks to Bryan Rodgers of Aquip (Australia) and Prüftechnik Alignment for the inspiration for this TechNote!

*Note: ROTALIGN® PRO is a registered trademark of Prüftechnik A.G.*

## Move Procedure

Now that you have obtained alignment results for your Machine To Be Moved (MTBM) you may wish to perform alignment corrections with the assistance of the Move Function. You cannot bridge across the spacer shaft with a 'single-shot' setup due to the obstruction. You cannot leave the laser on the spacer shaft as in Figure 1, Setup B, since the spacer shaft will move as you move the MTBM. Therefore, you must find a secure location independent of the spacer shaft to which you can mount the laser in such a way that it will still face the receiver which is mounted on the MTBM shaft. Perhaps the obstruction itself is a good candidate. For instance in a ship this obstruction is the steel bulkhead separating the two machines, through which the spacer shaft runs. The laser could be mounted directly to this bulkhead using ALI 2.112 Magnetic Brackets and ALI 2.2118 Offset Support Posts. See Figure 6 below for an illustration of this suggestion:

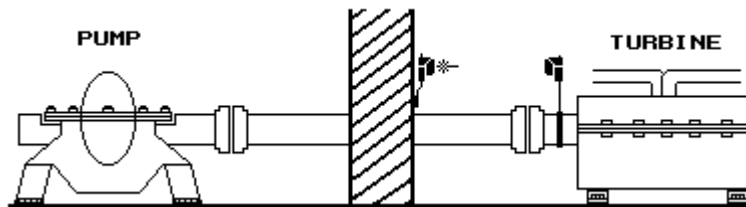





Figure 6

Once the laser is mounted to your satisfaction, proceed with the Move Function as follows:

- 17a) Select the view of the direction in which you wish to move using the  or  keys (or remain in the "both" view) and press .

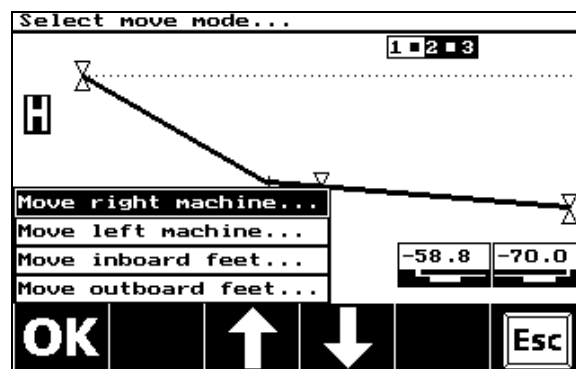




Figure 7

- 17b) A window now appears asking you which Move option you desire (see Figure 7). Select "Move right machine..." and press . Wait for the Move function to autostart and proceed with performing the move.

*Note: If the Move Function does not autostart, the ROTALIGN® PRO will take you directly to the XY View screen where you can center the beam. When done press , and wait for the Move Function to autostart.*

- 17c) Continue at step 18 on page 4 of the TechNote.

## Appendix A

### Configuring the Dimensions Screen for the 'Two-Step' Procedure:

This will describe how to configure a 3-machine setup where the middle machine simulates a spacer shaft. This is done to overcome an obstruction to line-of-sight which prevents setting up in a normal 'single-shot' configuration. Assume you start with an ordinary two-machine setup in the Dimensions screen (see *Figure A1*). Do the following:

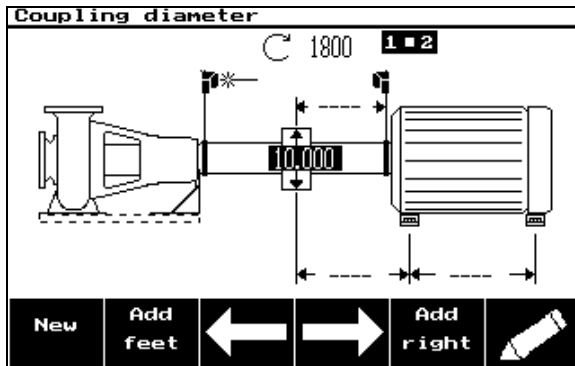


Figure A1

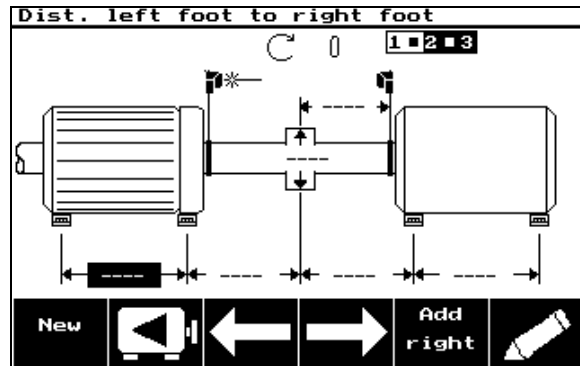


Figure A2

- 1) Press the **Add right** softkey. This adds another machine to the right of the right machine, and in the top right-hand corner of the screen you will see the icon **1 2 3**, indicating that you are in the Dimensions screen for machines 2 and 3. See *Figure A2*.

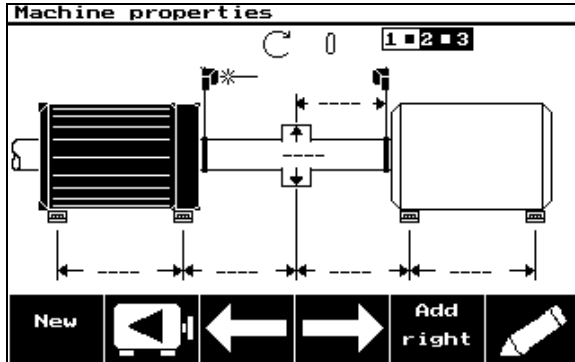


Figure A3

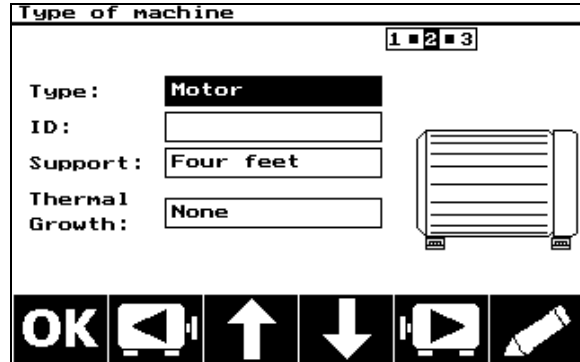


Figure A4

- 2) Using the **←** key repeatedly, highlight Machine 2 (see *Figure A3*) and press **✎**. This opens the screen where you can edit all of the configuration parameters of the machine. See *Figure A4*. Note that the icon **1 2 3** indicates you are editing Machine 2, the middle machine, and the machine parameter "Type" is highlighted.

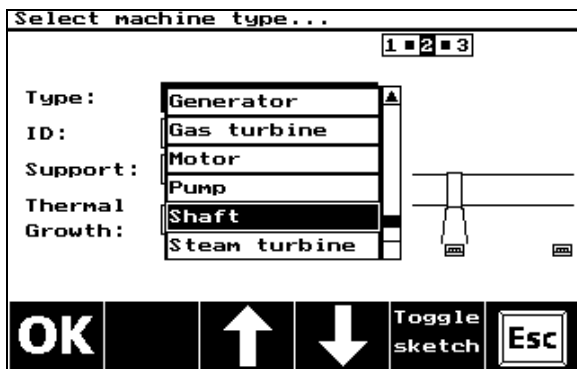


Figure A5

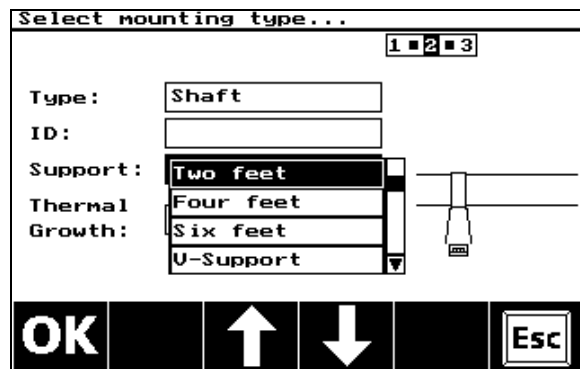










Figure A6

- 3) With “Type” highlighted, press  again, and proceed to edit the type by using the   keys until “Shaft” is selected. See Figure A5. Press . Now the “ID” parameter is highlighted. Use the  key to highlight “Support” and press . Use the  key to select “Two Feet” as the support option for your shaft. See Figure A6. (Unfortunately, a “no feet” option is not available, so we select “two feet” since this will minimize the number of dimension entries required later.) Press  twice to return to the Dimensions screen.

*Note: You can configure your Stationary Machine on the left and Machine To Be Moved on the right in similar manner, according to the particulars of your real machines.*

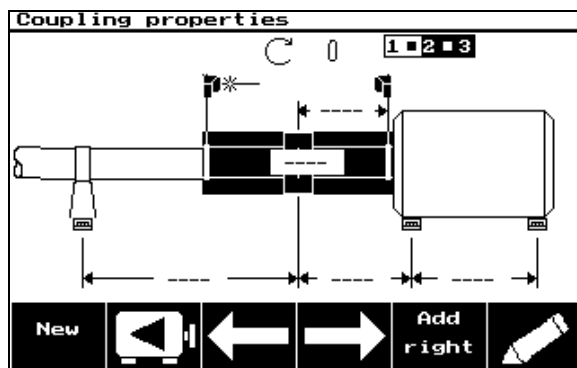


Figure A7

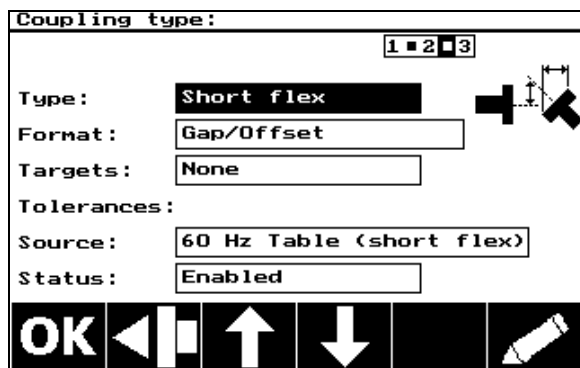





Figure A8

- 4) Now use the  key repeatedly as needed to highlight the coupling between machines 2 and 3, (see Figure A7) and press  to open the screen where you can edit the coupling properties (see Figure A8). Note that the icon  means you are editing the properties for the coupling between machines 2 and 3 (the coupling on the right-hand side of your spacer). The coupling parameter “Type” is now highlighted.

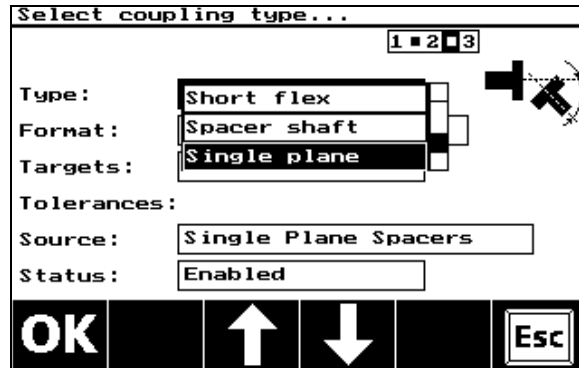






Figure A9

- 5) With “Type” highlighted press , then use the  key to select “Single plane” and press  (see Figure A9.) (This is the correct type to use since a spacer shaft only has a single flex plane coupling at either end; also, this will minimize the number of dimensions you have to input later. “Format” is now highlighted. You may now proceed to edit in like manner the results display format (either “angle” or “gap”), as well as target specifications and selection of the appropriate tolerance table to use.

*Note 1: Neither the standard “Short Flex” nor “Spacer” tolerance tables should be selected, since you are working with single plane couplings that actually represent the individual single flex couplings at either end of your spacer shaft. In order to have the proper tolerance values active, you must first create a special tolerance table with the proper values using the Tolerance Editor software utility in your PC, then upload that table to your ROTALIGN® PRO. Figure A9 shows such a custom tolerance table called “Single Plane Spacers” already loaded and selected for use. (The Tolerance Editor software utility is available free of charge from our website: [www.ludeca.com](http://www.ludeca.com) .)*

*Note 2: For more information on target specifications, see Appendix B.*

- 6) Once all parameters for the right coupling have been edited press  and proceed to configure the parameters for the left coupling in like manner.
- 7) Continue at step 5 of the TechNote.

## Appendix B

### Entering Target Specifications for the 'Two-Step' Procedure

You have two machines with a spacer shaft between them. Your target specifications are probably expressed in the "offset-offset" format or "angle-angle" format. If they are given in the angle-angle format you can enter these values directly for the left and right couplings of your three-machine train. If they are given in the offset-offset format (or any other format) you must first convert them to the equivalent angle or gap values according to the display format you selected in step 4 of the TechNote (or step 5 of Appendix A).

The easiest way to do this is to use a two-machine setup in your ROTALIGN® PRO with a spacer coupling between them, and enter your target values in the format given. Then simply convert these to your chosen format!

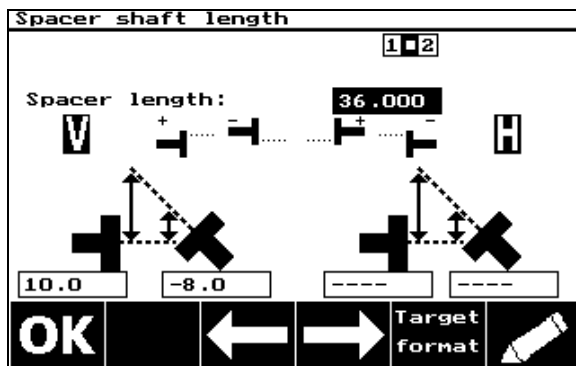


Figure B1

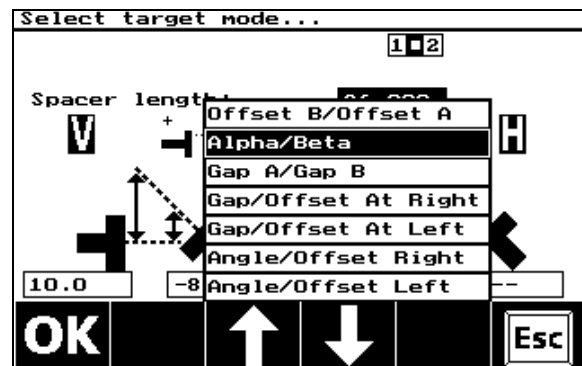


Figure B2

If, for example, you are given targets in the offset-offset format requiring you to position the MTBM high by +10 mils at the left side of the spacer and low by -8 mils on the right side, you would enter these values for each side of the spacer as given, using Offset B/Offset A as the target format. See Figure B1.

Now simply change the target format by pressing **Target format** and select "alpha/beta" (the angle-angle format) or "Gap A/ GapB", according to your preferred display format. See Figure B2.

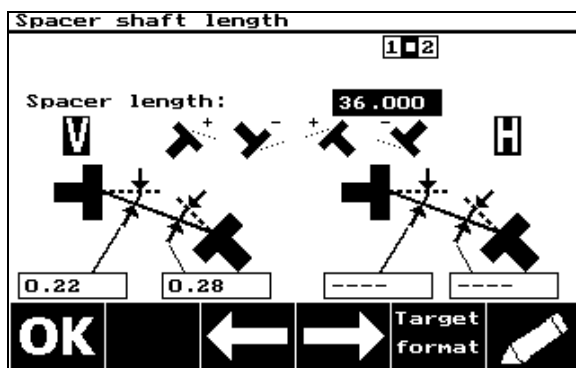


Figure B3

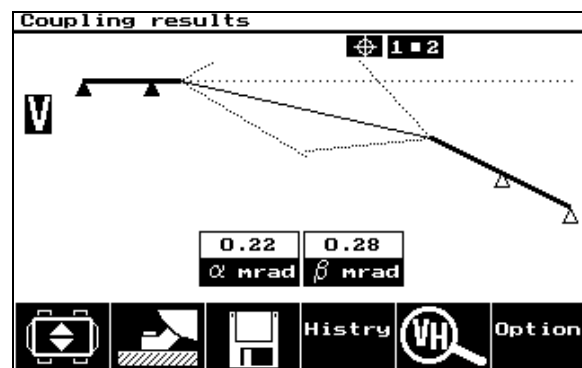


Figure B4

Upon pressing **OK** the ROTALIGN® PRO instantly converts your entered targets to the equivalent values for the angle-angle format as shown in Figure B3. Thus your desired alignment would look as shown in Figure B4 (target view option). (The example illustrated is for a spacer 36 inches long.) Now that you have derived your angle/angle or gap/gap target values, simply enter them individually for the left and right couplings in your two-step procedure. Note the sign convention and observe signs carefully!