Operations Manual

Couple6

Alignment Software for Coupled and Uncoupled Rotating Shafts

STEALTH SERIES™

December 2017
Revision O

HAMAR LASER®
ALIGN WITH THE BEST

HAMAR LASER INSTRUMENTS, INC.
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WARRANTY

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This warranty is not applicable to instruments or other articles of equipment manufactured by other companies and limited by a warranty extending for less than one year. In such an event, the more limited warranty applies to said instrument or article of equipment.

This warranty shall not apply to any instrument or other article of equipment which shall have been repaired or altered outside the Hamar factory, nor which has been subject to misuse, negligence, or use not in accord with instructions furnished by the manufacturer.

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5 Ye Older Road, Danbury, Connecticut 06810

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The Stealth™ Series Shaft Alignment Systems and Couple6

Hamar Laser's new Stealth™ Series, including the S-660 3-Axis Shaft Alignment System, the S-670 3-Axis Shaft Alignment System and the S-680 5-Axis Shaft Alignment Systems, offers the latest in super-linear PSD technology, wireless communication and innovative design for aligning coupled or uncoupled rotating shafts (both standard and vertical). The newly-designed Couple6 alignment software for these systems runs on any standard Microsoft Windows® Version 7/8 laptop or tablet/laptop computer. Easy-to-follow screens lead the user through the step-by-step alignment process and display misalignment results instantly.

The Stealth™ systems feature Bluetooth® Wireless Communication, with a range from target to PC of up to 33' (10 M). The new lasers and targets incorporate the most sophisticated electronics available and use lithium polymer battery technology for over 14 hours of continuous use.

Standard system components for the S-660 Wireless 3-Axis Shaft Alignment System include:

- L-780 Laser with Dual-Fan™ technology, allowing the measurement of offset and angle simultaneously.
- T-1280 Target with 1.0 micron offset resolution, 0.014mm/M angular resolution and an angular measuring range of ±3.5 degrees.
- Standard Bracket kit for 1.5" to 6" (25.4 mm to 152.4 mm) shaft diameters.
- Smart Phone data platform.
- Couple6 Software with the following features: Auto Clock™, Manual Clock, Recommended Tolerances, Thermal Growth/calculator at Coupling, Soft Foot Check/Shim Calculator, and a save limit of 500 files. Additional features (see The System 680 on Page **10**) can be activated by purchasing the upgraded license.
- Cleaning cloth, Operations Manual, Calibration Certificate, Report software for the PC and shipping case.

Standard system components for the S-670 Wireless 3-Axis Shaft Alignment System Tablet Version include:

- L-785 Laser with Dual-Beam™ technology
- T-1285 Bluetooth Wireless 3-Axis Shaft Alignment Target, with a resolution of 1.0 micron (center offset) and 0.02 mm/M (angle) and an Angular Measurement Range of ± 5.0 degrees
- Standard Bracket kit for 1" to 6" (25 mm to 152 mm) shaft diameters and 4.5" (117 mm) and 8.88" (226 mm) posts
- Ruggedized Tablet PC
- Couple6 Software with the Basic Feature License, which includes: Auto Sweep™, Thermal Growth/calculator, Recommended Tolerances, Spacer (Jack) Shaft and the ability to save up to 500 files
- Shipping Case

Standard system components for the S-680 Wireless 5-Axis Shaft Alignment System Tablet Version include:

- L-790 Laser with Dual-Beam™ technology
- T-1290 Bluetooth Wireless 5-Axis Shaft Alignment Target, with a resolution of 0.5 micron (center) and 0.01 mm/M (angle) and an Angular Measurement Range of ± 5.0 degrees
- Upgraded Bracket kit for 1" to 12" (25 mm to 304 mm) shaft diameters and 4.5" (117 mm), 6.88" (175 mm), 8.88" (226 mm), and 12.88" (327 mm) posts
- Ruggedized Tablet PC
- T-240 tablet/laptop PC or T-241 PC serial port backup cable
- Couple6 Software with the All-Features license, which includes: Auto Sweep™, Thermal Growth/calculator, Recommended Tolerances, Spacer (Jack) Shaft, Bolt Bound™, Vertical Machines, Point Mode, Uncoupled Mode, Arc Mode™, User-Defined Tolerances, Results Table and History, Templates, and the ability to save 500 or more files
- Shipping Case

Operating System Requirements:

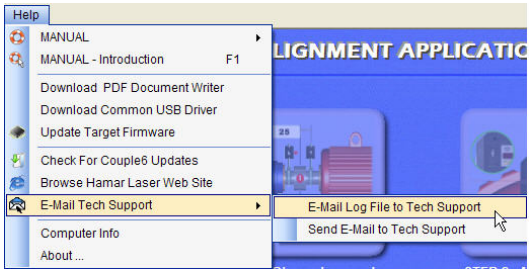
- Microsoft Windows Version 7/8
- Microsoft .NET 4.5 Framework

Computer Requirements:

- Physical memory (RAM): 2 GB recommended
- Processor: Intel Pentium4 or later version or AMD equivalent, 1.3 GHz minimum speed
- Available Hard Drive space: 6 GB minimum, 10 GB or better for more adequate file storage space
- Video Resolution: 1024 x 600 minimum (32-bit color) with hardware acceleration and dedicated video memory.

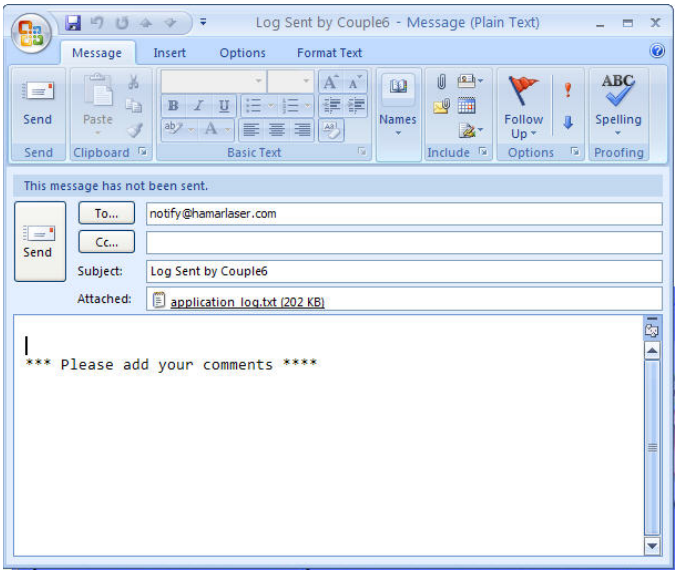
Contacting Technical Support

If you run into a problem, particularly a software crash or other serious error, e-mail our software development team and attach your application log file. This log is a simple text file (readable with any text editor such as Notepad, WordPad or Microsoft Word®) that helps us diagnose and correct software problems by listing the Couple6 steps, connection information and errors. It may also contain computer hardware information.



Privacy notice: *Couple6 only collects information that is necessary for diagnostic purposes. No other data is collected or transmitted to our servers unless the customer specifically initiates the data transfer as described below.*

1. From the Couple6 **Help Menu**, select **E-Mail Tech Support** and scroll right to **E-Mail Log File to Tech Support**. Couple6 opens your e-mail editor with the log file attached and the recipient information filled out.
2. In the body of the message, add as much information regarding the sequence of events that caused the problem, along with any other pertinent information.
3. If you do not have an Internet connection or if you do not have an e-mail client installed on the Couple6 computer, transfer the log file to a storage device such as a USB drive and e-mail it to us from another computer with that has Internet and e-mail access.
4. Send log files to: **notify@hamarlaser.com**. The log file is located in **documents/couple6/logs** and the filename is **application_log.txt**.



Useful Links

Hamar Laser Website: www.hamarlaser.com
Hamar Laser Support Forum: www.hamarlaser.com/Forum/
Hamar Laser Blog: www.zeroinginonalignment.com
Worldwide Local Support and Maps: http://www.hamarlaser.com/index.php/contact-us.html
Technical Support: email amy.smith@hamarlaser.com

The System 660 Hardware

The L-780 Laser

The L-780 Laser with patented Dual-Fan™ technology allows the measurement of center and angle simultaneously. Unlike 2-beam, 2-detector systems that have a restricted angular measuring range when the distance between the laser and target is greater than 3 feet, the two laser fans and two PSDs provide full angular measuring range over the full operating range between the laser and target.

Figure 1 – *L-780 Laser*

Dual-Fan™ technology works as follows:

1. Fan 1 blinks on and hits the PSD, measuring the center offsets.
2. Fan 1 blinks off for background light correction.
3. Fan 2 blinks on, bounces off two prisms and hits a second PSD that is in the same measuring plane as the first PSD. The angle is calculated by subtracting the second measurement from the first and dividing the result by the distance the beam travels.
4. Fan 2 blinks off for a second background light correction.

The lithium polymer battery provides power for over 14 hours of continuous use.

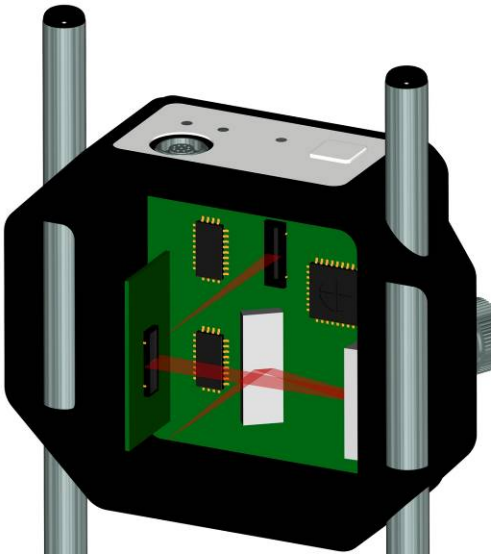


Figure 2 – *L-780 Laser with Dual-Fan™ Technology*

What the Laser LEDs Mean

Status LED
No light: Normal operation
Blinking green: Low battery
Solid yellow: Laser is charging
When the LED turns off while the laser is plugged in, the laser is fully charged.

Laser-On LED
LED ON: Laser is powered on and operating normally

Power Button
Toggles power ON/OFF

Note: *You must **press and hold** the power button for four seconds to power down the System 660 laser and target.*

Figure 3 – *L-780 Laser (top view)*

The T-1280 Target

The T-1280 Target has an offset resolution of 1.0 micron, an angular resolution of 0.014 mm/M and an angular measuring range of ±3.5 degrees. The target is also powered by a lithium polymer batter, providing 14 hours of continuous use with Bluetooth communications. The target may also be plugged into a power source during use.

Figure 4 –*T-1280 Target*

Note: *You must **press and hold** the power button for 4 seconds to power down the System 660 laser and target.*

What the Target LEDs Mean

Status LED

Solid green: Power on and operating normally
Blinking green: Low battery
Solid yellow: Target is charging. When LED turns off while plugged in, target is fully charged.

Figure 5 – *T-1280 3-Axis Wireless Target (Top View)*

On-Target LED

Red: Laser beam **OFF TARGET** or not detected
Green: Laser beam **ON TARGET** or detected

Link LED

OFF: Target is not connected to the tablet/laptop PC
Green: Target is linked to the tablet/laptop PC but is not communicating with Couple6 (tablet/laptop PC and target are powered on, but Couple6 is either not loaded or has stopped communicating).
Blinking yellow: Tablet/laptop PC and target are connected. Data is being transmitted to Couple6 (Couple6 has been loaded and is operating correctly).

Power Button

Press once to power the target ON.
Press and hold for 4 seconds to power the target OFF.

The A-970 Bracket Set

The A-970 standard bracket and chain set allows alignment of 1.5" (37.6 mm) to 6" (152.4 mm) diameter shafts. The bracket set comes with 6" (152.4 mm) posts.

Additional bracket options to accommodate specific needs may be purchased separately and include:

- A-970A Chain Bracket Upgrade with 12" posts and extra chain
- A-970B Small Shaft Adapter
- A-970C Extra Chain set for 1.5" to 12" shaft diameters
- A-980NRA Non-rotating Small Shaft Bracket
- A-980NRB Non-rotating Large Shaft Bracket
- A-980OF Offset Bracket

Figure 6 – *A-970 Standard Bracket and Chain Set*

The System 670 Hardware

The L-785 Dual-Beam™ Laser

Our Dual-Beam™ technology allows the L-785 Laser to measure center and angle simultaneously with one PSD, eliminating potential measurement errors that can occur when using 2 PSDs. This results in a 50 percent more accurate measurement over "dual laser/sensor" technologies.

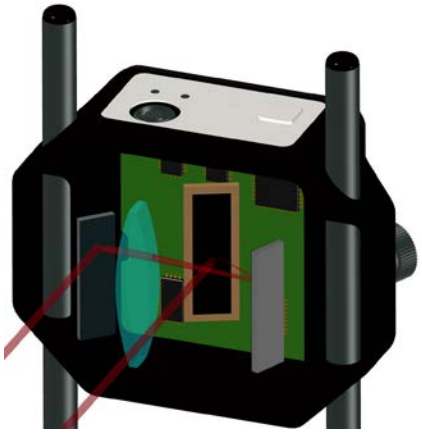


Figure 7 – *Hamar Laser's Dual-Beam™ Technology*

Dual-Beam™ detector technology works as follows:

1. Beam 1 blinks on and hits the PSD, measuring the center offsets.
2. Beam 1 blinks off for background light correction.
3. Beam 2 blinks on and bounces off one prism, passes through a lens, bounces off a second prism and hits the PSD, measuring the angle.
4. Beam 2 blinks off for a second background light correction.

The lithium polymer battery for the laser provides 60+ hours of continuous use. Icons in the Status area of the laser indicate the battery status for both the laser and T-1285 Target (see **Figure 8**).

Figure 8 – *L-785 Dual-Beam™ Laser (top view)*

What the Laser LEDs Mean

Status LED
No light: Normal operation
Blinking green: Low battery
Solid yellow: Laser is charging
When the LED turns off while the laser is plugged in, the laser is fully charged.

Laser-On LED
LED ON: Laser is powered on and operating normally

Power Button
Toggles power ON/OFF

The T-1285 Bluetooth Wireless 3-Axis Shaft Alignment Target

The T-1285 Target features a resolution of 1.0 micron (center) and 0.02 mm/M (angular), with an Angular Measurement Range of ±5.0 degrees. The target communicates with the data analyzer via wireless Bluetooth technology at 2.4 GHz radio frequency. See Appendix C on Page 132 for the procedure to establish a Bluetooth link between the laptop/tablet and the target. See Appendix D on Page 134 for information about updating the target firmware.

The lithium polymer battery provides 14+ hours of continuous use when using Bluetooth and provides 15.5+ hours when using the serial backup cable. The target may also be plugged into a power source during use (see Appendix A on Page 129 for the target battery discharge curve). Icons in the Status area of the target indicate the battery status for both the target and the L-785 Laser.

What the Target LEDs Mean

Status LED
Solid green: Power on and operating normally
Blinking green: Low battery
Solid yellow: Target is charging. When LED turns off while plugged in, target is fully charged.

Figure 9 – *T-1285 3-Axis Wireless Target (Top View)*

On-Target LED
Red: Laser beam **OFF TARGET** or not detected
Green: Laser beam **ON TARGET** or detected

Link LED
OFF: Target is not connected to the tablet/laptop PC
Green: Target is linked to the tablet/laptop PC but is not communicating with Couple6 (tablet/laptop PC and target are powered on, but Couple6 is either not loaded or has stopped communicating).
Blinking yellow: Tablet/laptop PC and target are connected. Data is being transmitted to Couple6 (Couple6 has been loaded and is operating correctly).

Power Button
Press once to power the target ON.
Press and hold for 3 seconds to power the target OFF.

The A-980 Bracket Set

The A-980 standard bracket and chain set clamps on to 1" (25 mm) to 6" (152 mm) diameter shafts. The set comes with 4" (101.6 mm) and 8" (203.2 mm) posts (see **Figure 10**).

Additional bracket options to accommodate specific needs may be purchased separately and include:

- A-982 Magnetic Bracket adapter
- A-980A Chain Bracket upgrade, with 6" and 12" posts and extra chain for up to 12" (304 mm) shaft diameters
- A-980C Extra Chain set for 1" to 12" shaft diameters
- A-980B Small Shaft Adapter for ¼" to 1" shafts.
- A-980NRA Non-rotating Small Shaft Bracket
- A-980NRB Non-rotating Large Shaft Bracket
- A-980OF Offset Bracket
- A-984 Bolt Hole Bracket

Figure 10 – *A-980 Bracket Set*

The R-1242T Rugged Windows7/8 Tablet
The R-1342 Ruggedized Laptop with Couple6 Alignment Software

The standard display hardware for Couple6 is either a ruggedized tablet (Figure 11) or a ruggedized laptop computer (**Figure 12**), both of which feature Microsoft Windows, a high-resolution TFT display, ruggedized design and 7-12-hour battery life. The Couple6 alignment software is pre-installed. Data is transmitted from the target to the tablet/laptop PC via Bluetooth wireless communication, with a range from target to tablet/laptop PC of up to 33' (10 M).

Figure 11 – *R-1242T Rugged Windows 7/8 Tablet*

Figure 12 – *R-1342 Ruggedized Tablet/Laptop*

The System 680 Hardware

The L-790 Dual-Beam™ Laser

Our Dual-Beam™ technology allows the L-790 Laser to measure center and angle simultaneously with one PSD, eliminating potential measurement errors that can occur when using two PSDs. This results in a 50% more accurate measurement over "dual laser/sensor" technologies.

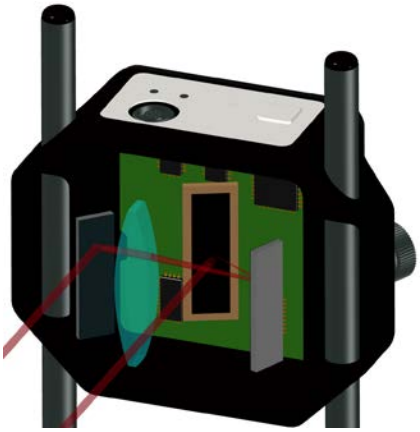


Figure 13 – *Hamar Laser's Dual-Beam™ Technology*

Dual Beam™ detector technology works as follows:

1. Beam 1 blinks on and hits the PSD, measuring the center offsets.
2. Beam 1 blinks off for background light correction.
3. Beam 2 blinks on and bounces off one prism, passes through a lens, bounces off a second prism and hits the PSD, measuring the angle.
4. Beam 2 blinks off for a second background light correction.

The lithium polymer battery for the laser provides 60+ hours of continuous use. Icons in the Status area of the laser indicate the battery status for both the laser and T-1290 Target.

Figure 14 – *L-790 Dual-Beam™ Laser*

What the Laser LEDs Mean

Status LED
No light: Normal operation
Blinking green: Low battery
Solid yellow: Laser is charging
When the LED turns off while the laser is plugged in, the laser is fully charged.

Laser-On LED
LED ON: Laser is powered on and operating normally

Power Button
Toggles power ON/OFF

The L-1290 Bluetooth 5-Axis Shaft Alignment Target

T-1290 Bluetooth Wireless 5-Axis Shaft Alignment Target has a resolution of 0.5 micron (center) and 0.01 mm/M (angle) and an Angular Measurement Range of ± 5.0 degrees. The target communicates with the data analyzer via wireless Bluetooth technology at 2.4 GHz radio frequency. See Appendix C on Page 132 for the procedure to establish a Bluetooth link between the laptop/tablet and the target. See Appendix D on Page 134 for information about updating the target firmware.

The lithium polymer battery provides 14+ hours of continuous use when using Bluetooth and provides 15.5+ hours when using the serial backup cable. The target may also be plugged into a power source during use (see Appendix A on Page 129 for the target battery discharge curve). Icons in the Status area of the target indicate the battery status for both the target and the L-790 Laser.

Figure 15 – *T-1290 5-Axis Wireless Target*

What the Target LEDs Mean

Status LED
Solid green: Power on and operating normally
Blinking green: Low battery
Solid yellow: Target is charging. When LED turns off while plugged in, target is fully charged.

Figure 16 – *T-1290 5-Axis Wireless Target (Top View)*

On-Target LED
Red: Laser beam **OFF TARGET** or not detected
Green: Laser beam **ON TARGET** or detected

Link LED
OFF: Target is not connected to the tablet/laptop PC
Green: Target is linked to the tablet/laptop PC but is not communicating with Couple6 (tablet/laptop PC and target are powered on, but Couple6 is either not loaded or has stopped communicating).
Blinking yellow: Tablet/laptop PC and target are connected. Data is being transmitted to Couple6 (Couple6 has been loaded and is operating correctly).

Power Button
Press once to power the target ON.
Press and hold for 3 seconds to power the target OFF.

The A-980A **Upgraded Bracket Kit**

The upgraded bracket and chain kit for the S-680 system includes enough chain to align 1" to 12" (25 mm to 304 mm) diameter shafts and 4.5" (117 mm), 6.88” (175 mm) 8.88" (226 mm) and 12.88" (327 mm) posts.

Additional bracket options to accommodate specific needs may be purchased separately and include:

- A-982 Magnetic Bracket adapter
- A-980A Chain Bracket upgrade, with 6" and 12" posts and extra chain for up to 12" (304 mm) shaft diameters
- A-980C Extra Chain set for 1" to 12" shaft diameters
- A-980B Small Shaft Adapter for ¼" to 1" shafts.
- A-980NRA Non-rotating Small Shaft Bracket
- A-980NRB Non-rotating Large Shaft Bracket
- A-980OF Offset Bracket
- A-984 Bolt Hole Bracket

The R-1242T Rugged Windows7/8 Tablet with Couple6 Alignment Software Installed

Data is transmitted from the target to the tablet or laptop PC via Bluetooth wireless communication, with a range from target to tablet/laptop PC of up to 33' (10 M).

Preparing for an Alignment

There are several preparations that need to be made before beginning a measurement or alignment process. Ensure that accurate records are kept for all procedures.

Hardware Mounting

- Determine the hardware setup needed for the machine to be aligned.
  - The bracket set supplied with the S-670 system accommodate shafts from 1 inch to 6 inches (25 mm to 152 mm) with 4-inch and 8-inch posts. Optional bracket sets are also available.
- Ensure the laser, target and tablet (laptop) batteries are fully charged. See Page **38** to check the status of the target battery. The laser battery lasts approximately one week with continuous use, so it is not as critical to check.

Maintenance and Cleaning

- Check all hardware to ensure that it is working properly. Clean mounting surfaces thoroughly.
- Gently clean target and laser windows with a clean soft cloth. Avoid scratching the glass window as this can affect accuracy of the measurement.

Tools and Equipment

- Determine all the necessary tools and equipment needed, such as torque wrenches, shims, tape measure and equipment manuals.

Other Preparations

- Take the measurements specified for your alignment procedure as indicated in *Entering Machine Dimensions*, beginning on Page **51**.
- Have thermal growth data or offsets ready to enter if required (see *Step 1: Setting Up a New Machine – Thermal Growth tab* on Page **59**).
- If a test or measurement takes more than 3-4 hours, ensure that all batteries are fully charged.

Warning: ***Attempts by the user to adjust the internal mechanism of the laser and/or target can cause damage and void the warranty.***

Setting up the Hardware

The Stealth™ Shaft Alignment Systems are designed to be easy to use and setup. The brackets quickly connect to the shaft and an alignment tool on the target helps to set the laser to the center of the detector.

Couple6 uses a step-by-step checklist for each alignment procedure. Each step in the procedure displays instructions, options, and a graphic showing the setup and the action to be taken during that step. In the last step, the screen shows views of the machine that move as the machines are adjusted, providing a real-time view of the alignment.

Figure 17 – *S-680 Wireless 5-Axis Shaft Alignment System*

Assembling and Mounting the Brackets

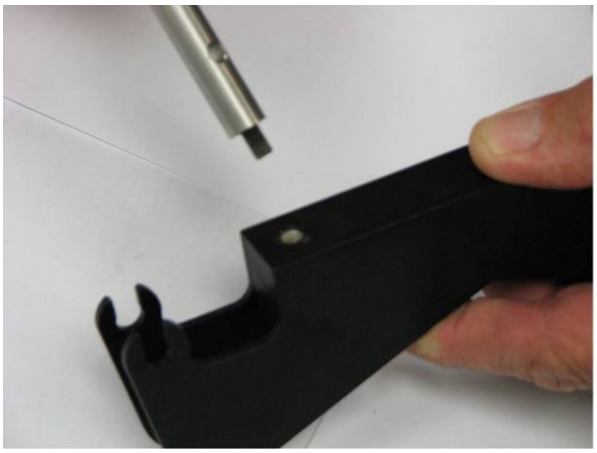
The systems include a set of brackets for mounting the laser and target to the coupled shafts. The A-980 standard bracket and chain set allows alignment of 1" (25 mm) to 6" (152 mm) diameter shafts. Shafts larger in diameter are accommodated by replacing or lengthening the chain. The formula for determining custom chain length is:

Chain length = shaft diameter (in inches) x 3.14

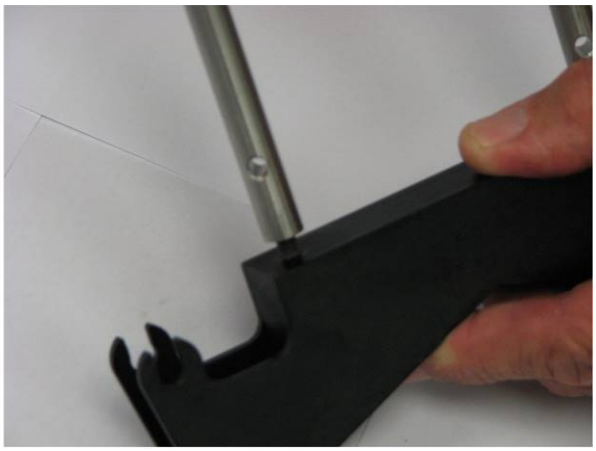
Two sets of posts, 4 inches (101.6 mm) and 8 inches (302 mm) tall, are supplied with the A-980 coupling brackets. This is usually sufficient to clear the coupling to provide the laser and target a line of sight. 6-inch (152 mm) and 12-inch (304 mm) posts are also available as options.

The tutorial on the following pages provides instructions for setting up the coupling hardware.

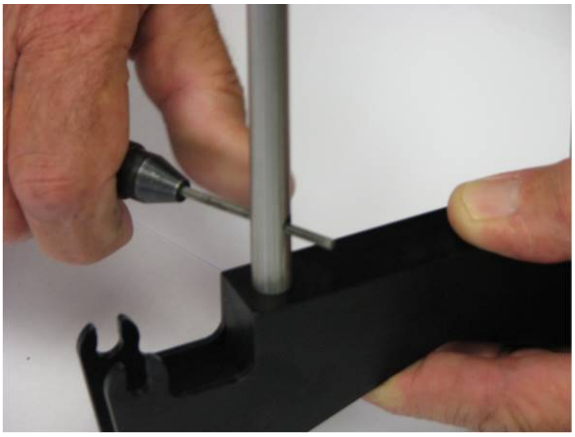
Using the A-970 Bracket System



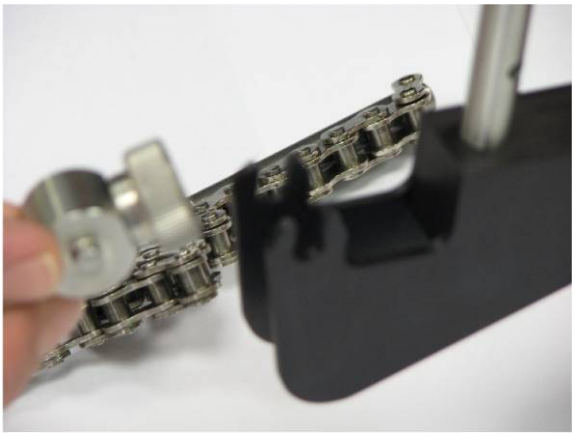
Install bracket post



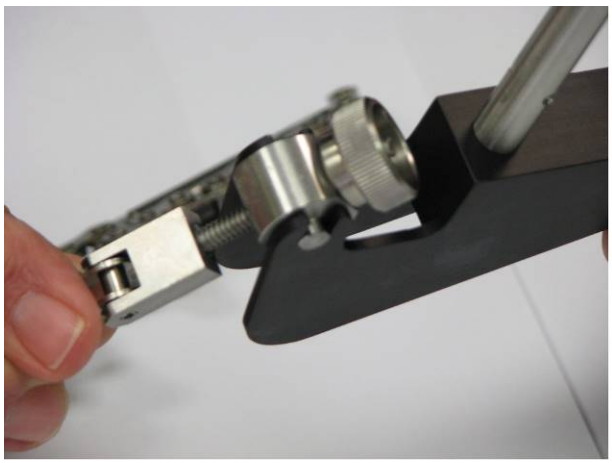
Screw post into bracket



Ensure posts are tightly secured on brackets



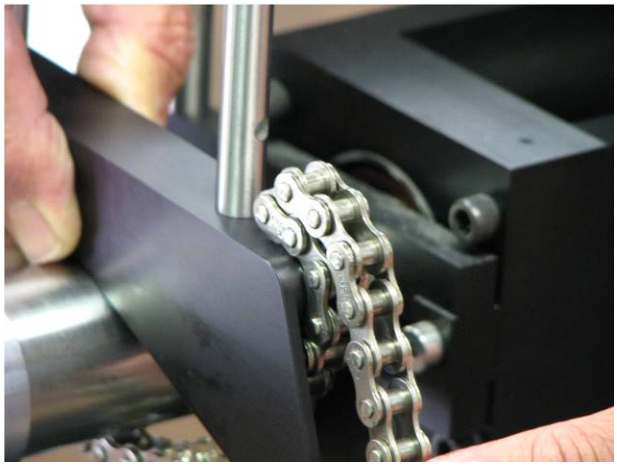
Attach chain to A-970 bracket (1)



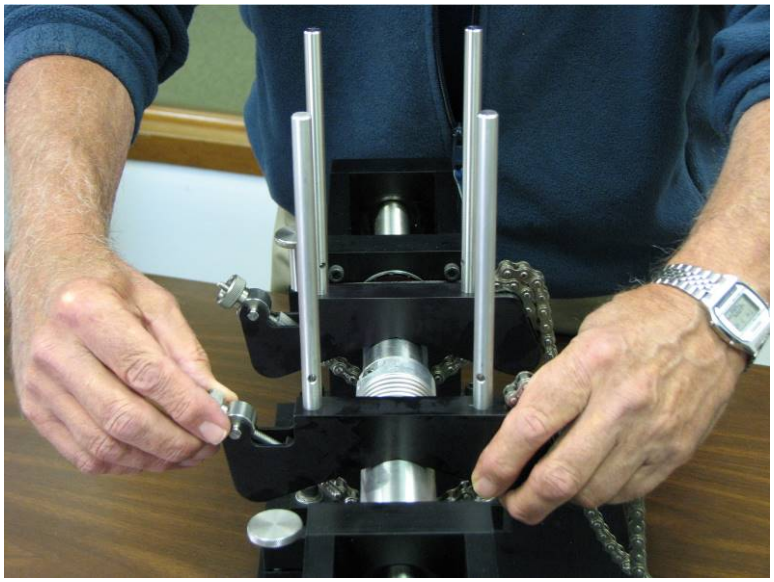
Attach chain to A-970 bracket (2)

Wrap chain around the shaft

Attach chain to pin on A-970 bracket



Chain properly attached to pin



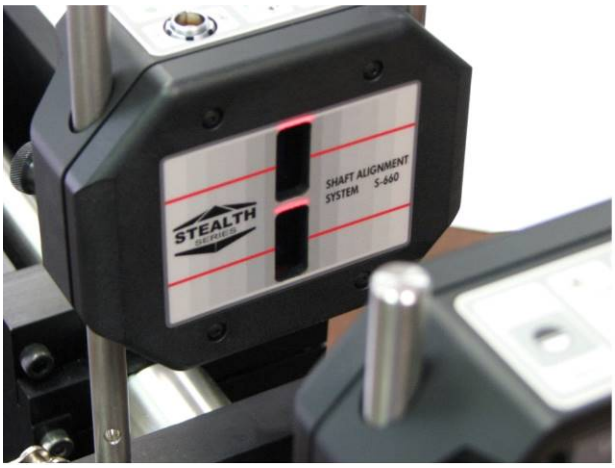
Align brackets to each other

Brackets *not* aligned

Brackets aligned properly

Tighten knob and fold chain (see 2B and 2C on Page 21)

Slide target on A-970 bracket



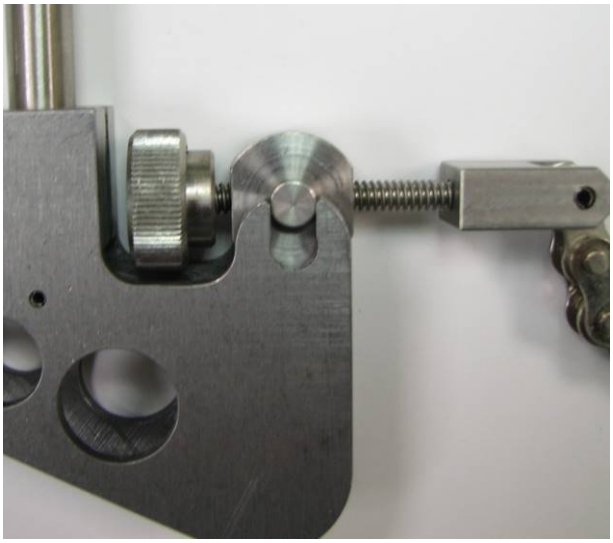
Adjust target height to center laser lines

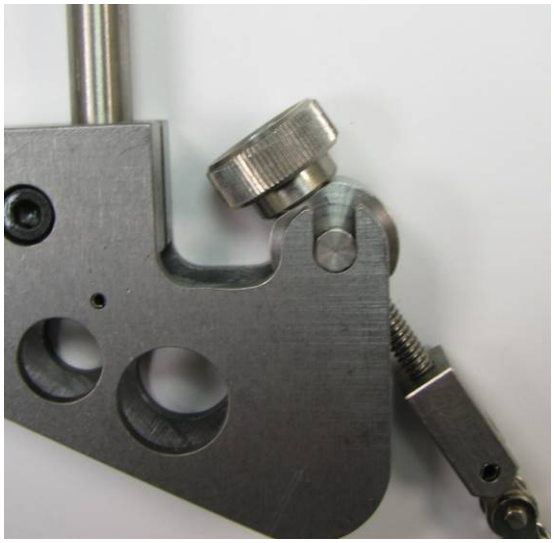
Laser lines too far to left

Laser lines too far to right

Laser lines centered in window

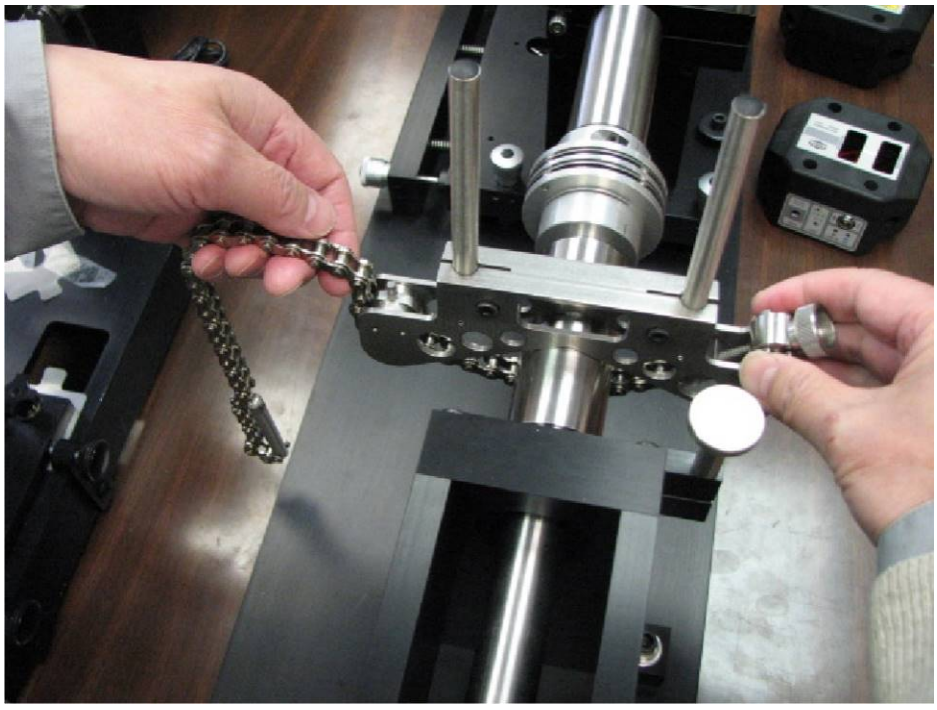
Using the A-980 Bracket System





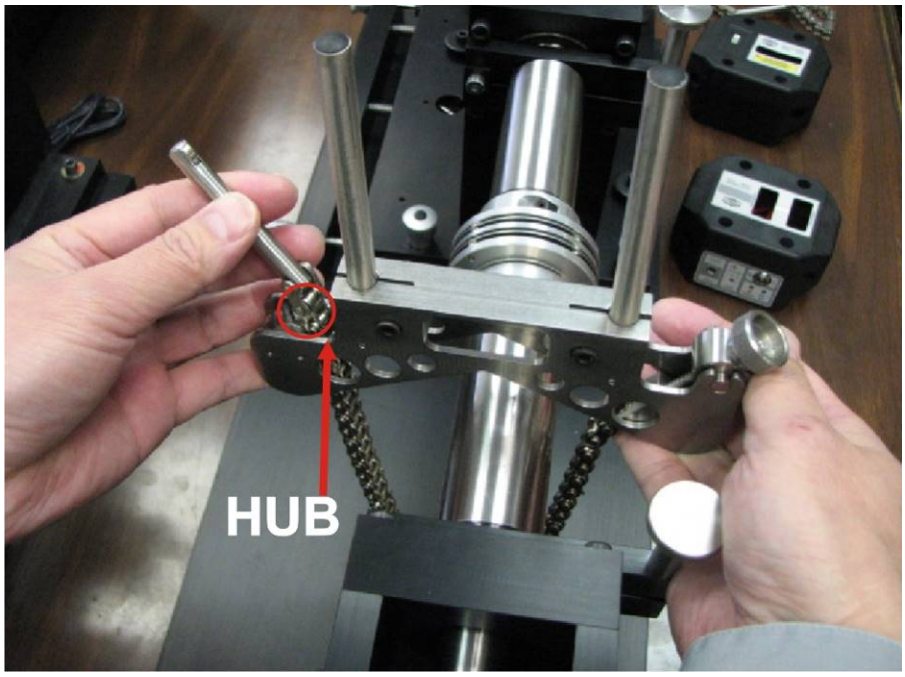
1A

Insert the Chain Hub into the groove of the A-980 Bracket as shown below. Make sure to align the flat sides of the pin to the groove.

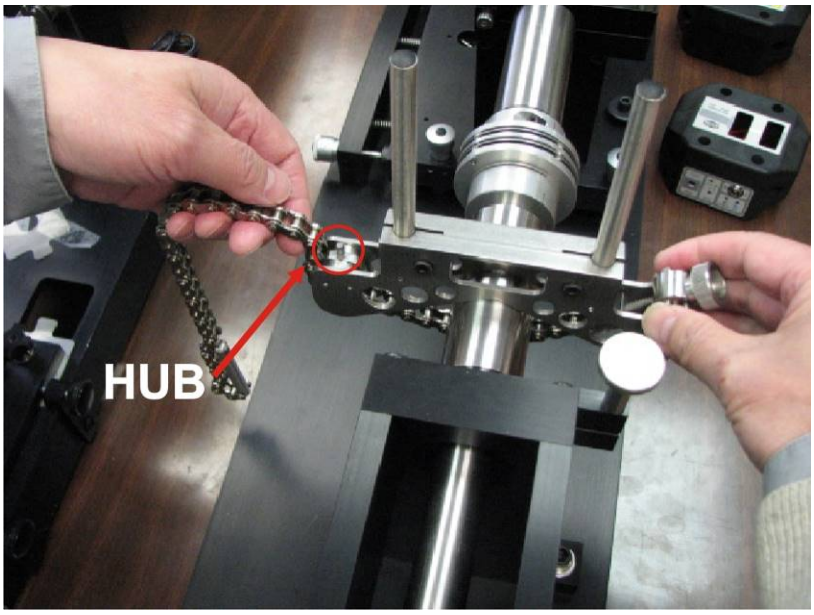


1B

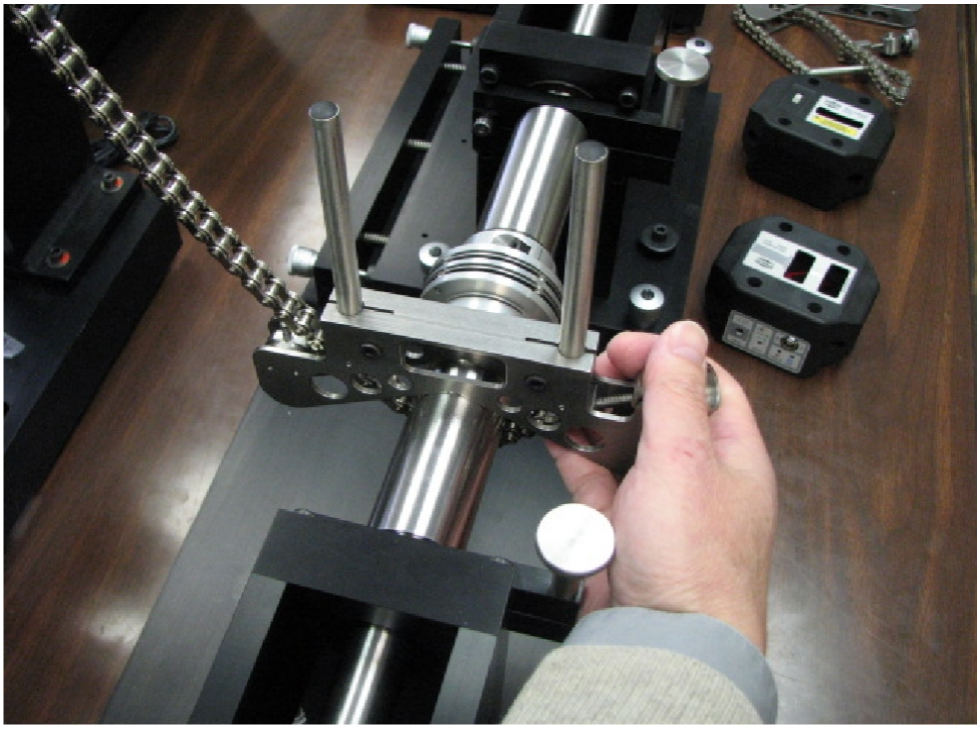
Wrap the chain around the shaft and over the pin in the hub. The chain goes on the inside of the hub for shafts of 1-3 inches diameter and on the outside for shafts of 3-12 inches diameter (see 1B and 1C).



1C
Insert chain inside the hub for 1-3 inch diameter shafts.

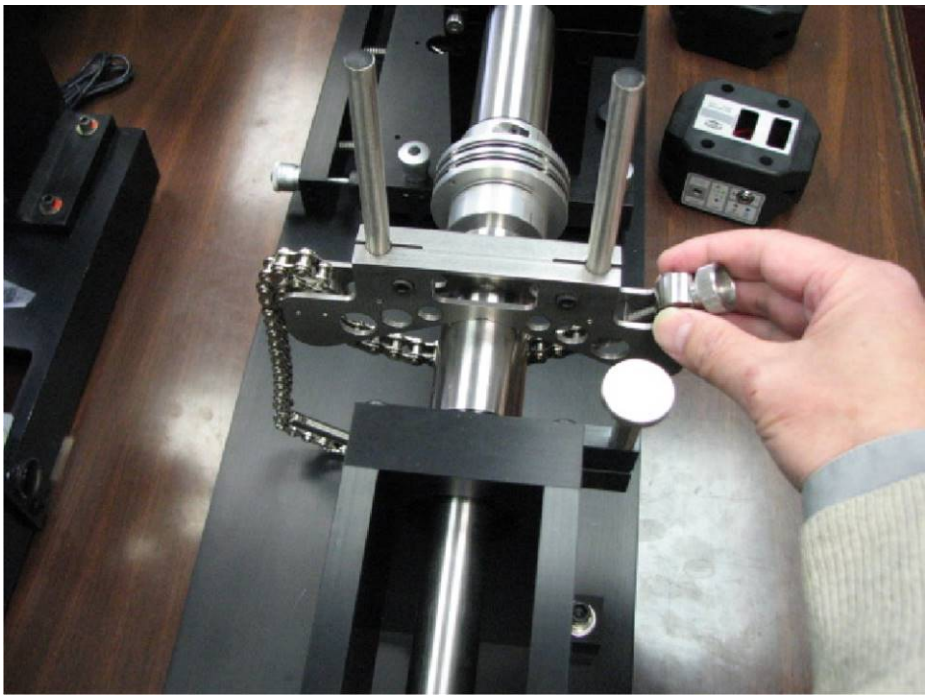


1D
Chain goes outside the hub for 3-12 inch diameter shafts.



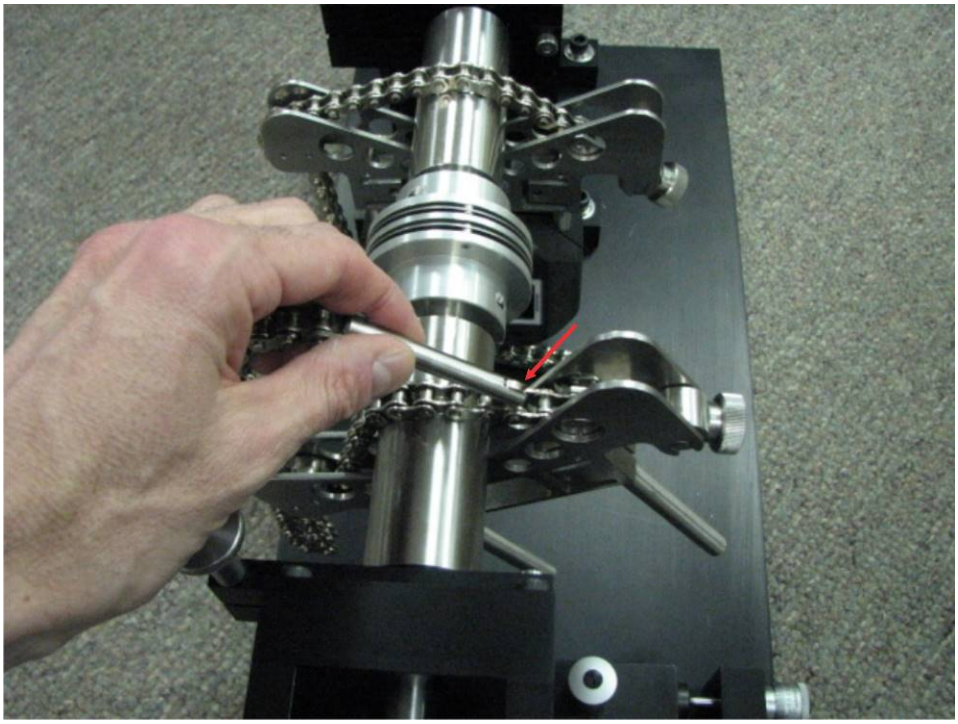
1E

Pull chain through or around the hub, ensuring that the last link is over the pin.



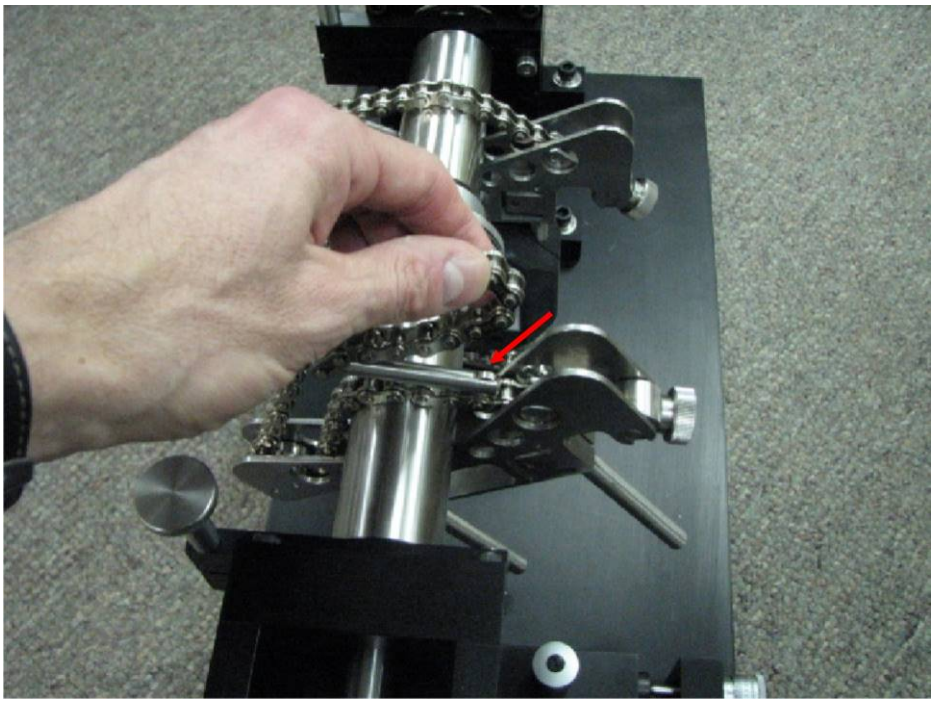
2A

With the last link over the pin, hand-tighten the knob as tight as possible. Do not use pliers.



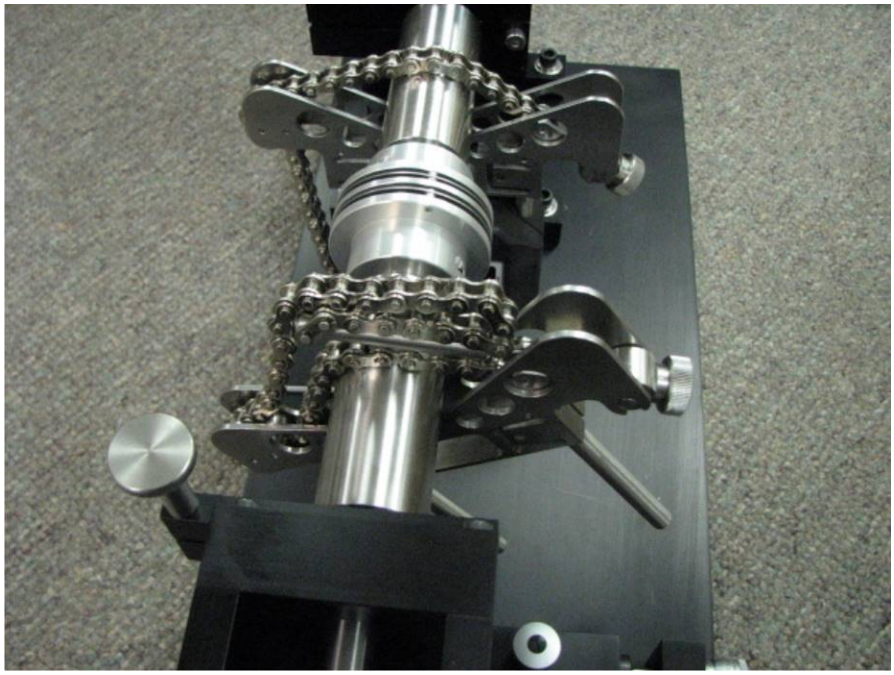
2B

Place the magnetic end of the rod on the opposite end of the chain. The magnet holds it in place.



2C

Fold the chain in half and place the remainder of the chain against the other half of the magnet at the end of the rod.

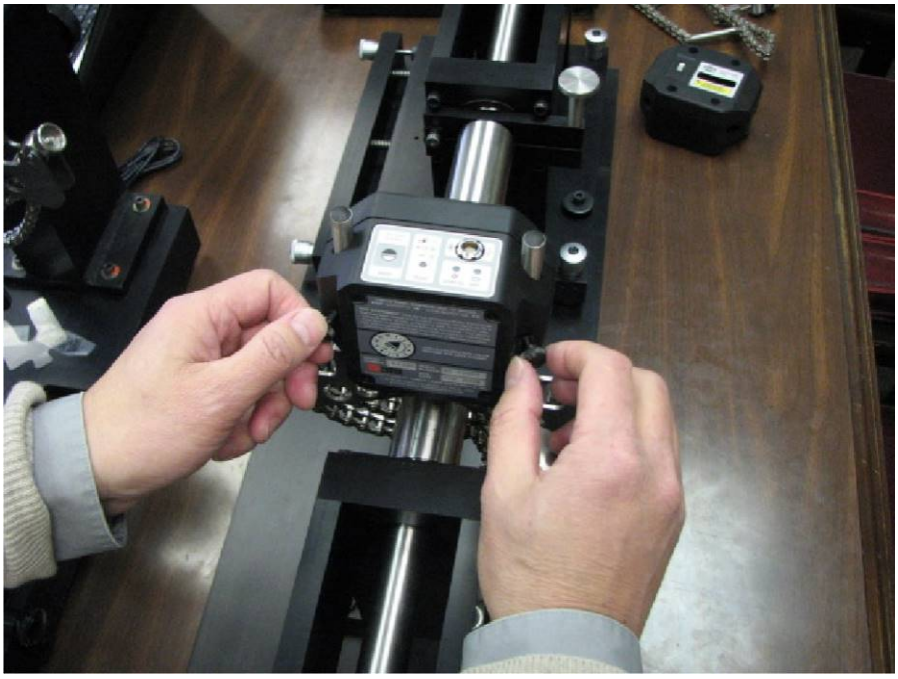


2D

The chain is now folded and out of the way and stays in place for a full rotation of the shafts.

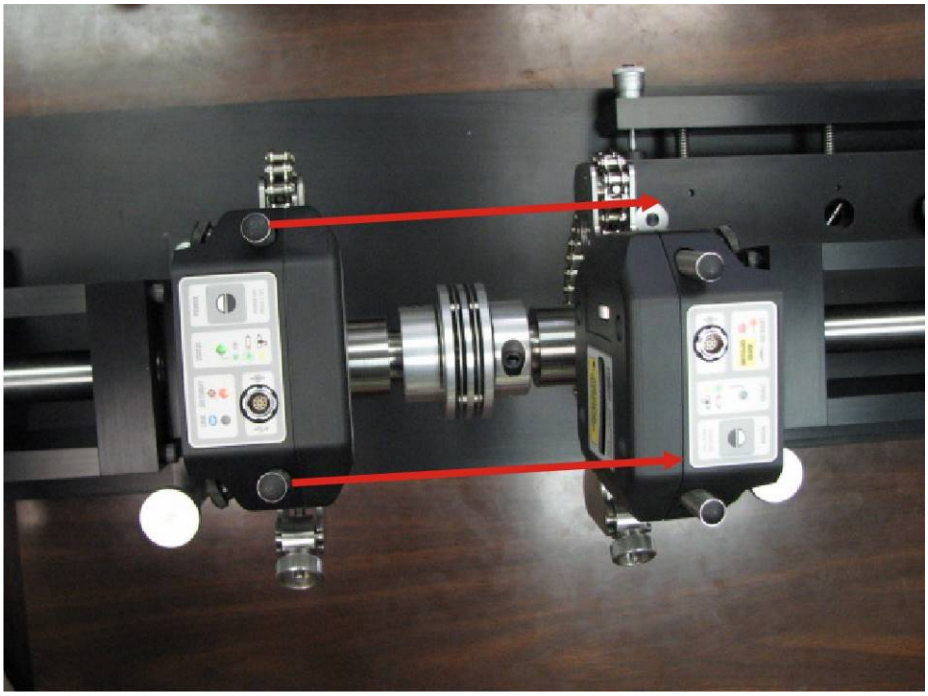
3

Slide the target on the posts of the moveable unit (usually the motor side). The laser goes on the stationary side.



4

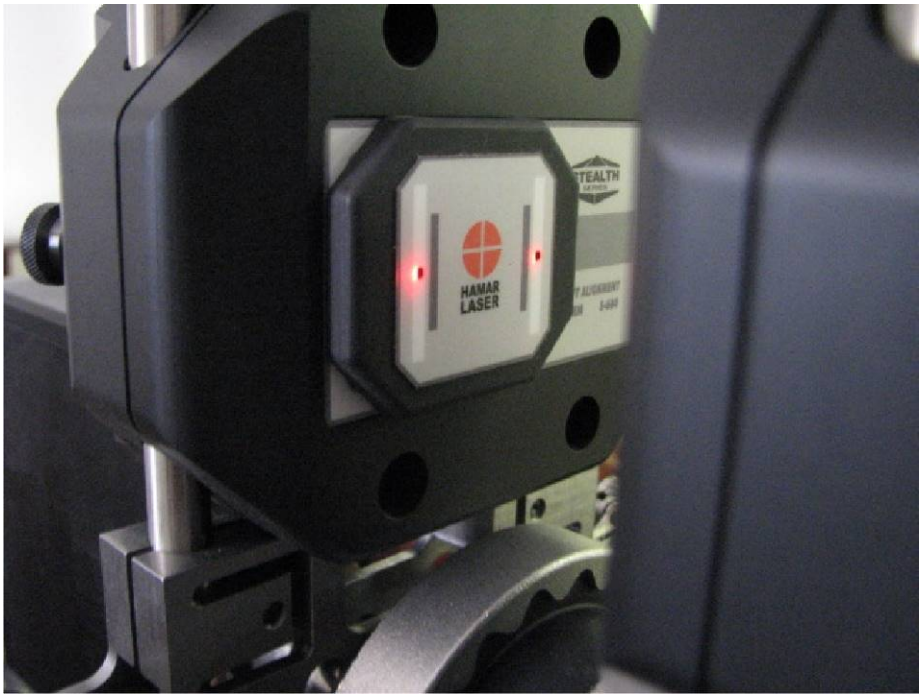
Tighten the knobs on the back of the laser and target (finger tight). Do not use pliers. Wiggle the laser and target to ensure the clamps are tight.



5A (Incorrect)

5B (Correct)

Ensure that the two brackets are lined up. If necessary, loosen 1 bracket and rotate it so it lines up with the other.



6

Power on the laser and ensure that the laser beams are in the holes of the dust cover. Move the laser up or down on the posts for vertical adjustment. Turn the wheel on the front of the laser to adjust horizontally.

7

When the laser beams are properly aligned, they nearly disappear into the holes in the dust cover. This is a rough alignment of the laser to target. Remove the dustcover. See **Step 2** of the Couple6 Checklist beginning on Page **68** to align the laser beam.

Installing Couple6

Note: *The Couple6 software is pre-installed on the tablet/laptop PC when an alignment system is purchased with a tablet PC.*

Installing a New Version of Couple6

1. Insert the USB flash drive or SD card supplied with the system into the USB port or SD card reader slot on the laptop or tablet PC.
2. Click **Start**>**Run.** Click **Browse**>**My Computer** (see Figure 18). Select the USB Flash drive or SD card. Click **setup.exe** to begin the installation.
3. After installation completes, locate the Couple6 icon on the desktop. Double-click the icon to run the program.
   Note: *If you have difficulty running Couple6 after it is installed on a Windows7 tablet, run Couple6 as an administrator as described in the following section.*

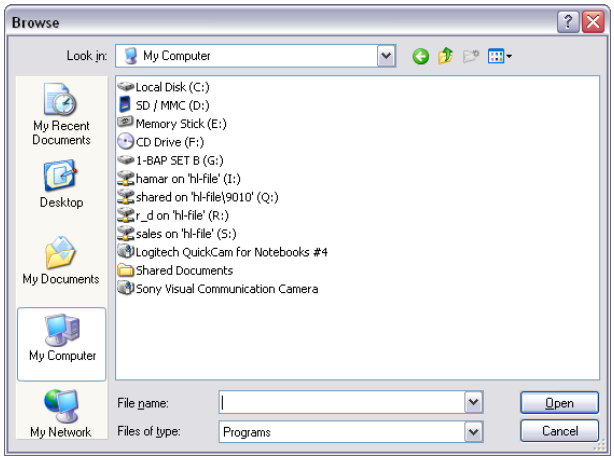
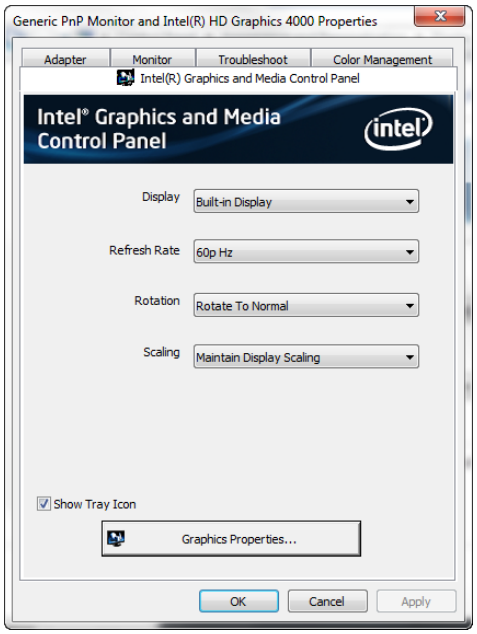


Figure 18 – *Browse* ***My Computer***

Disabling Screen Rotation

Note: *Some tablets have a button that allows disabling of the auto-rotate function. Check your manual to see if one of the buttons is meant for that function.*

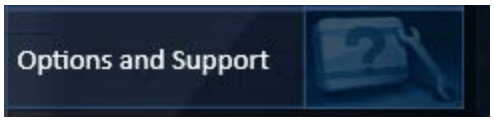
Windows 7 Auto-Rotate: Intel® Graphics Card



1. Open the Windows 7 Control Panel and select **Display**.
2. Select **Change Display Settings**.

Note: *You may also right-click the Desktop and select* **Screen Resolution**.

3. Select ***Advanced Settings***.
4. Select the **Intel graphics and Media Control Panel** tab.
5. Select **Graphics Properties**.
6. When the dialog box displays, click **Options and Support**.

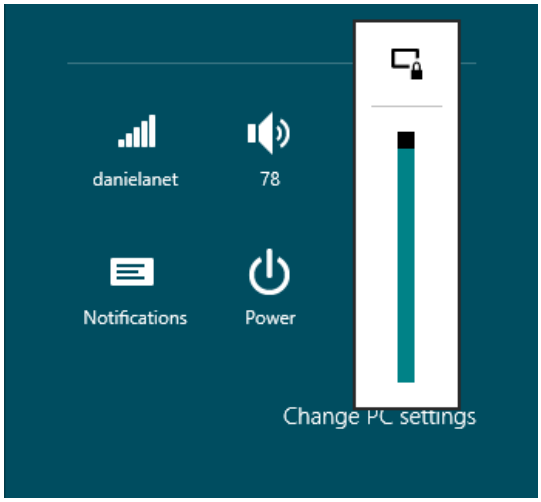


7. Disable the **Hot Key Functionality** option and click **OK**.

Windows 8 Auto-Rotate

Using the Slide Bar

Open the Charms Bar Settings option or use the WIN + I keyboard shortcut and use the **Brightness Control** to lock the screen.

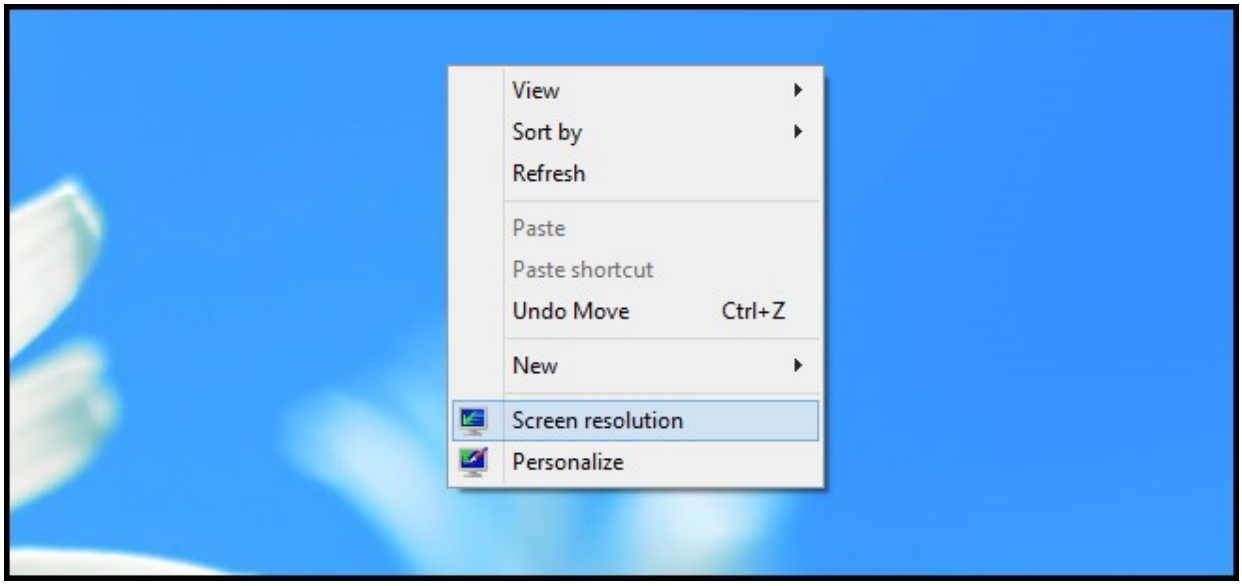


Using the Keyboard

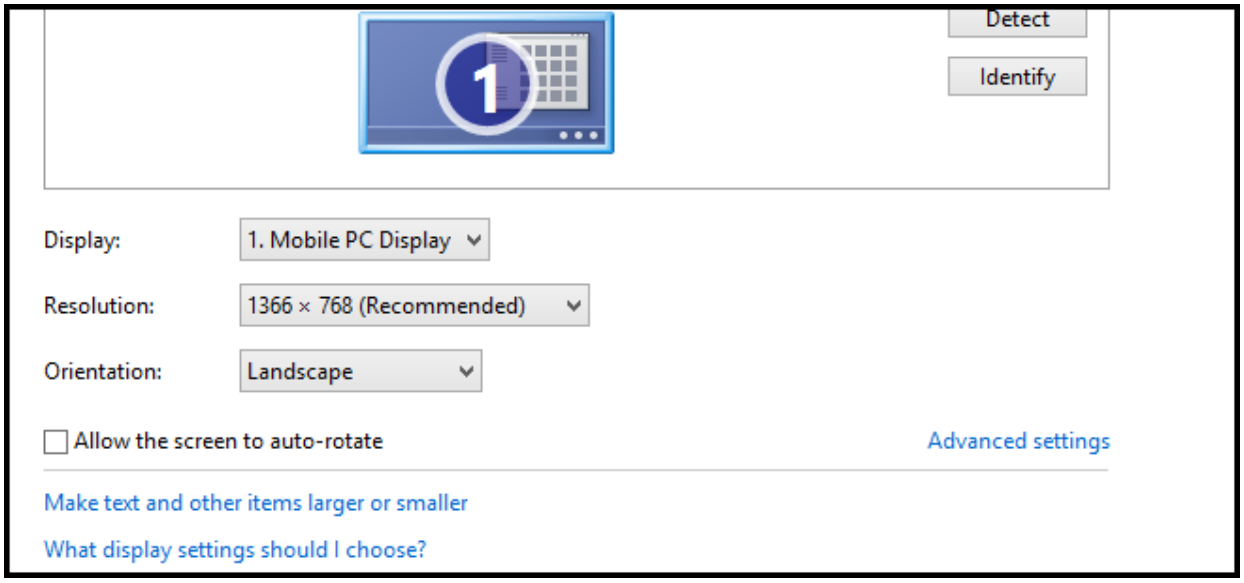
If your device has a keyboard attached, press **Winnow** to toggle auto-rotation on or off.

Using the GUI

Right-click the Desktop and select **Screen resolution** from the menu.

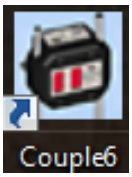


When the Control Panel applet loads, uncheck **Allow the screen to auto-rotate** and then click **OK**.

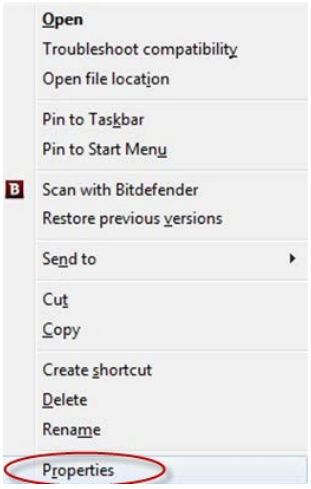


Running Couple6 as an Administrator (Windows7)

If you install Couple6 on a system running Windows7, it is advisable to run the program as an administrator to ensure smooth operation of the software. This procedure need only be performed once.

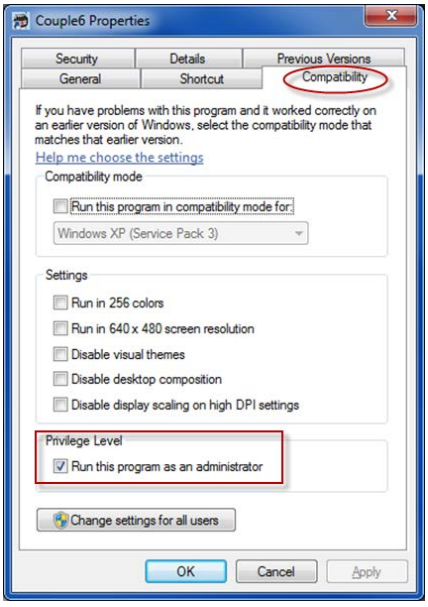


1. Right-click the Couple6 icon on the desktop.



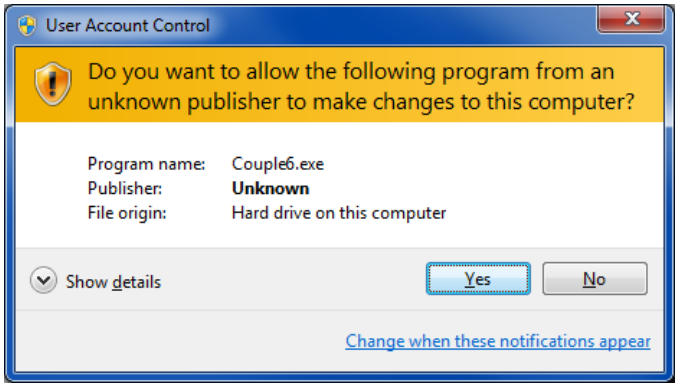
2. A dropdown list displays. Select **Properties**.

3. Click the **Compatibility** tab.



4. Under **Privilege Level**, check **Run this program as an administrator**.

5. When Couple6 starts, a User Account Control popup displays. Click **Yes** to allow Couple6 to open.



Using a USB Backup Cable with the Stealth™ Systems

In the event of a Bluetooth communication failure, a backup USB cable can be used to establish communication between the target and tablet/laptop PC. This cable can also be used to perform target firmware updates (see Appendix D on Page 134 for information about updating the target firmware).

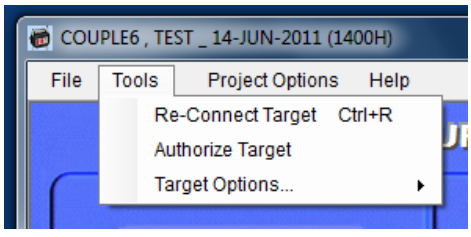
Installing the Device Driver for Use with the USB Backup Cable

Note: *This driver **must** be installed **before** plugging in the USB Backup Cable.*

1. Insert the USB flash drive that came with your system into an empty USB port.
2. Select **My Computer** and click the **Removable Disk** icon.
3. Select the **Common USB Drivers** folder.
4. Locate the **CP210x_VCP** folder and select the appropriate installer for your operating system (CP210xVCPInstaller_x86 for 32-bit systems or CP210xVCPInstaller for 64-bit systems). The **Install Driver** dialog box displays.
5. Click **Install** to install the driver in the default folder, or click **Change Install Location** to select a different folder.
6. Once the installation is complete, the **Installation Successful** message displays.

Connecting the USB Backup Cable

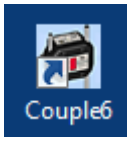
1. Connect the USB cable to the target and tablet/laptop PC.).
2. Line up the *red* dot on the serial cable with the *red* dot on the target and press down. Plug the USB cable into the tablet/laptop PC.
3. In the Couple6 **Tools Menu**, click **Re-Connect Target (Ctrl+R)** to reconnect the software to the target. The connection is indicated on the status bar at the bottom of the screen where the target serial number (SN) is displayed.



Getting Started with Couple6

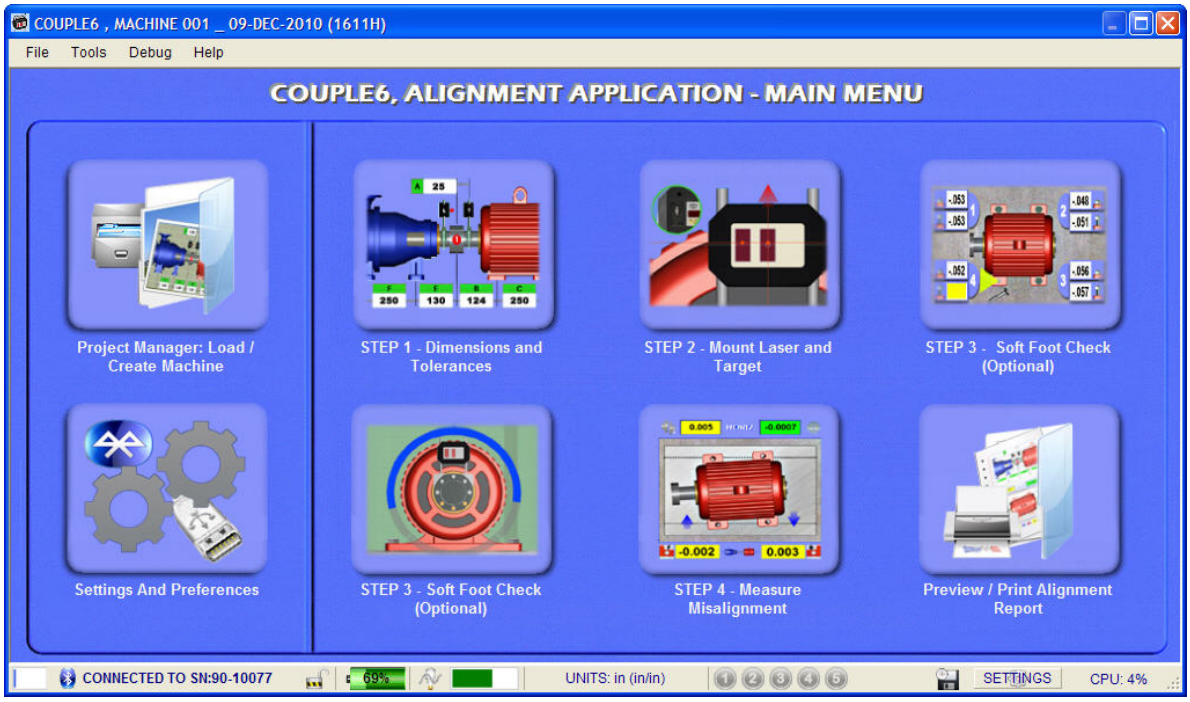
The Couple6 Checklist provides five easy-to-follow steps to accomplish a coupling alignment. In addition to the alignment checklist, a **Main Menu** provides help, hardware status information, and allows the user to enter personal settings and change program options.

Opening Couple6



The Couple6 Installer automatically places a shortcut on your desktop. Click the **Couple6** shortcut to start the application**.**

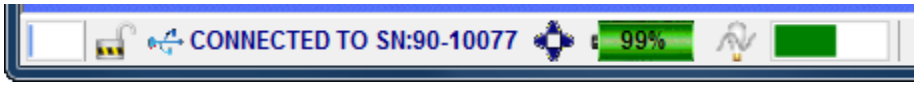
The **Main Menu** displays.



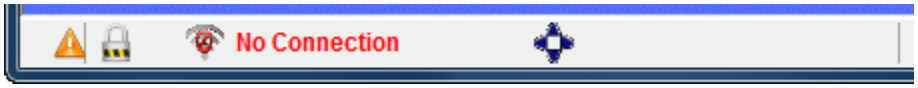
Note: *If the Couple6 screen does not fill the entire PC screen, click the maximize button in the upper right-hand corner of the Couple6 window to fill the PC screen.*

Establishing a Connection to the T-1285 or T-1290 Targets

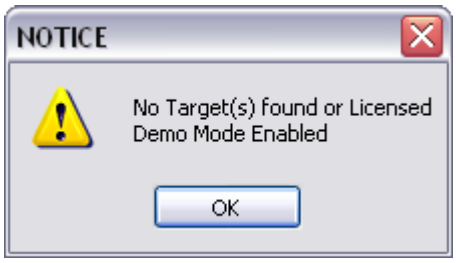
When Couple6 is opened, it automatically searches all available COM ports for the T-1285/T-1290 target connection, either through the Bluetooth radio or the USB cable. The status bar at the bottom of the screen indicates if there is a connection.



If Couple6 cannot find a connection, the following is displayed in the status bar:



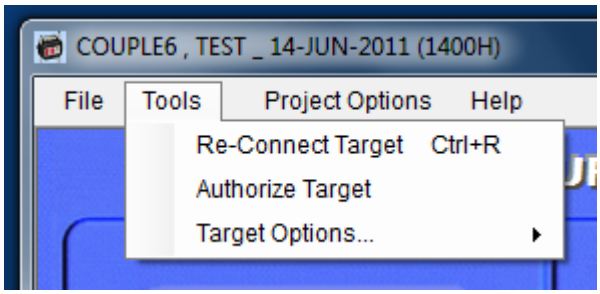
If Couple6 cannot make a connection to the target, the *NOTICE* dialog box displays. Click **OK** to enter Demo Mode, where Couple6 generates random numbers in the data display boxes and the software can be used for training purpose.



Note: *All of the optional features are enabled for Demo Mode so each feature of the software may be viewed before purchasing a license key.*

If you wish to make a connection to the target and **NO CONNECTION** displays in the status bar, ensure that:

1. The target is turned on;
2. The Bluetooth radio on tablet (laptop) is turned on; or:
   the USB cable is connected and the driver installed.



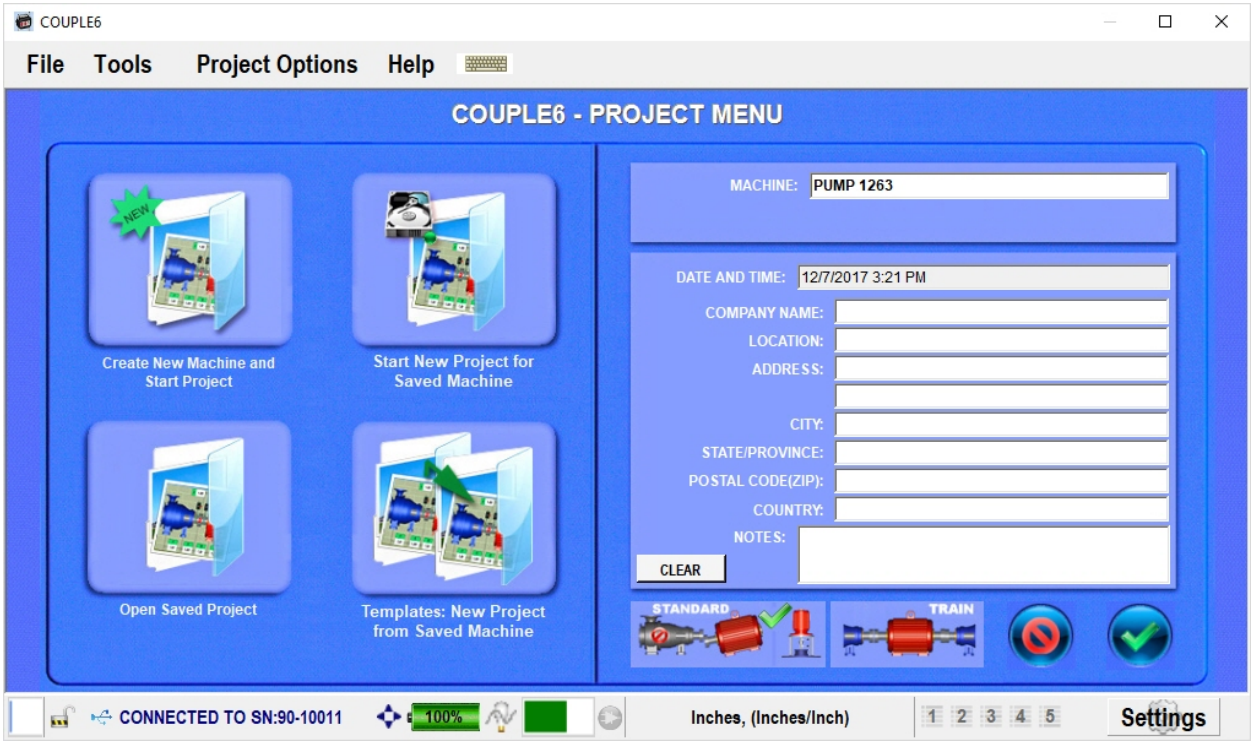
To try to reconnect to the target, select **Re-Connect Target (Ctrl+R)** from the **Tools Menu**. Couple6 then checks each COM port for the target, and if found, connects to the target.

Starting an Alignment Project

Click the **Project Manager: Load/Create Manager** button in the **Main Menu** to start a new project or open a saved project.

When starting a new project, Couple6 creates a folder based on the machine (motor) name or serial number. When a file is saved, Couple6 appends the date to the machine name and saves it in the folder. This allows for organizing the history of the machine by the alignment date. Couple6 automatically saves data with each click on the screen, preventing data loss.

After selecting **Load/Save Project**, the **Project Menu** window displays.



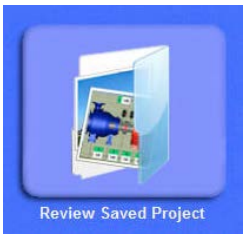
Select Alignment Type: Standard or Train

To begin a project, from the Project Menu first select the type of alignment:

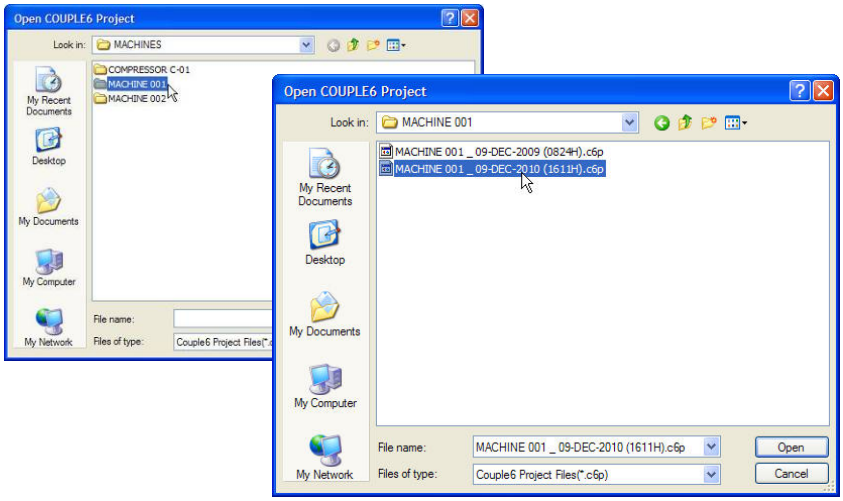
- ***Standard Mode*** – select for all 2-component (motor and driven unit) alignment projects
- ***Train Mode*** – select for alignment projects with three or more components that form a machine train. Selecting **Train Mode** brings up additional screens to accommodate the multiple machine types and other tasks needed to align machine trains.

For a detailed description of the Train feature, see Appendix E beginning on Page **136**.

Choosing a File Option

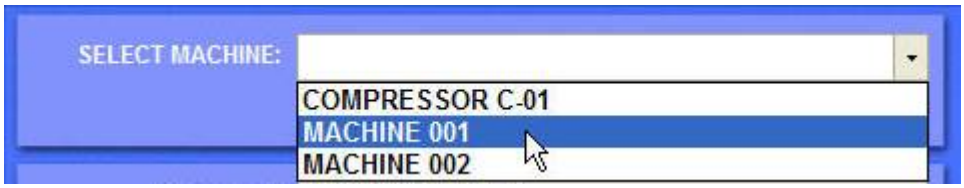


- **Review Saved project** opens a window showing all the existing Machine Folders. Click a folder and then on a filename to open it.

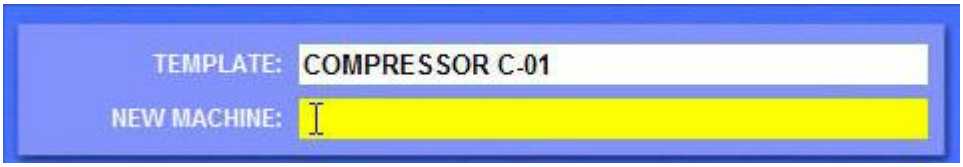


- **Create New Machine and Start Project:** creates a new Machine Folder, starts a new alignment job and opens a window to enter the Machine Name, Company Information, (company information displays at the top of all reports) and any notes to be included in the report.

- **Start New Job for Saved Machine:** Select an existing Machine from the drop-down list to start a new job for that machine.



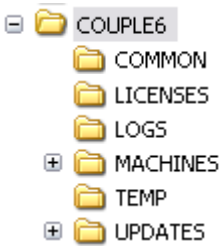
- **Templates: New Project from Saved Machine:** starts a new Job using a Saved Machine as a Template to create a new Machine. Select a previously saved Machine file to use as a Template, then type a New machine name.



Saves and closes the **Project Menu**

Cancel and Return to the Previous Project (if open)

Saving Data in Couple6

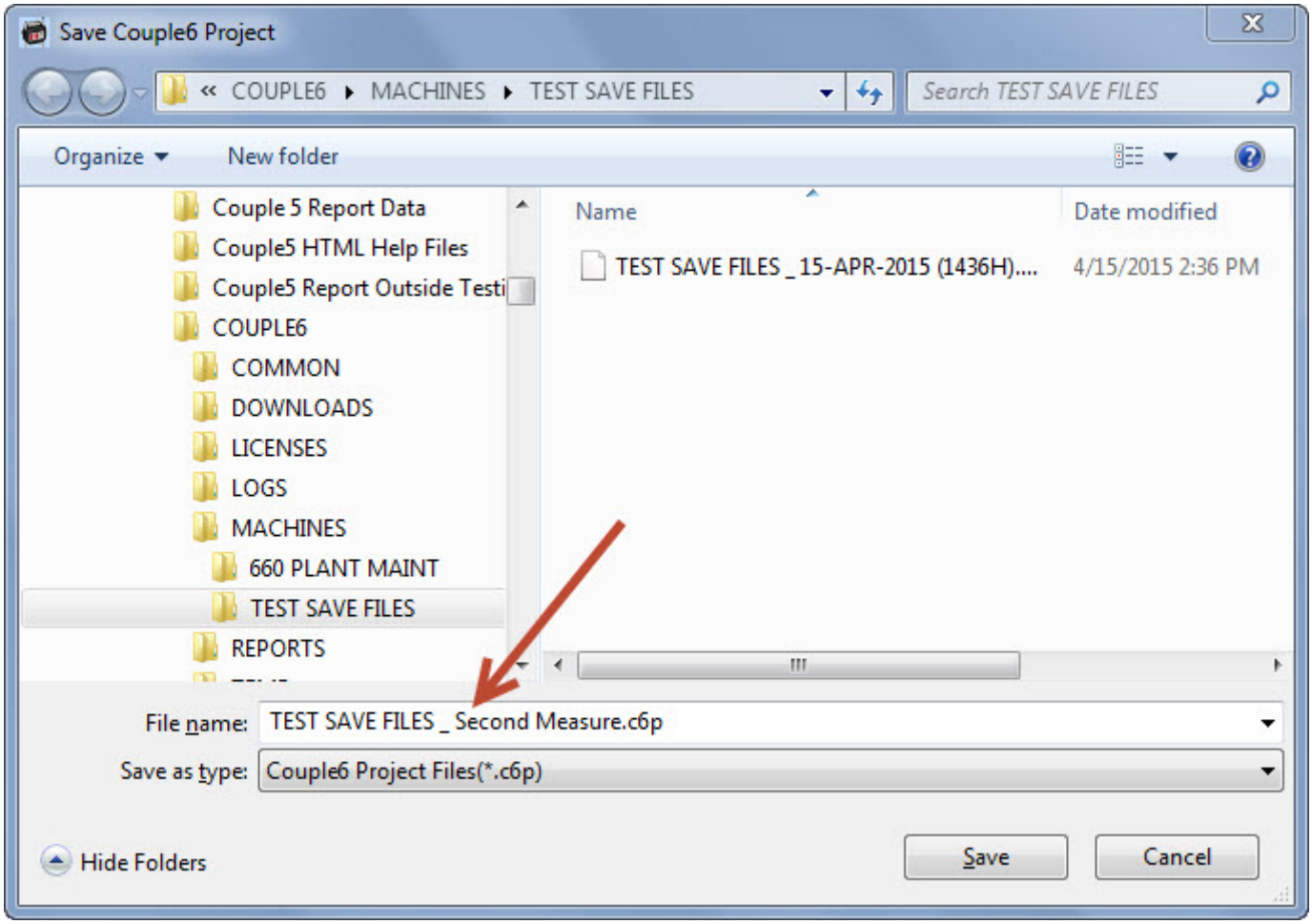


Once a data file has been created, Couple6 automatically saves data to a backup file with each step that is completed in the software. When you exit the program, Couple6 asks if you want to save the data to the file you created when the program was started. Click **Yes** to save the new data. Click **No** to keep the existing file data and exit the program.

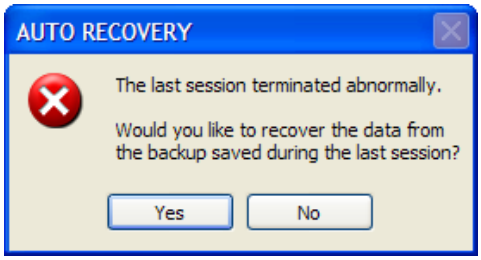
Saving a file in Couple6 When Adding Comments to a File Name

Couple 6 expects the file prefix to be the same as the machine name. Any comments added by the customer must be separated by an underscore.

For example, a file name can be either **MY MACHINE.c6p** or **MY MACHINE_my comments.c6p**. In the example below, the file name **Test Save Files_15-Apr-2015 (1436H).c6p** indicates the original saved file (saved for the first time). The new file name (**TEST SAVE FILES_Second Measure.c6p**) indicates the second time the file was saved with the added comment **Second Measure**.



Recovering a Data File

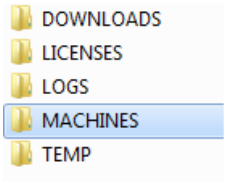


If the computer crashes during the alignment job, the backup file can be opened to recover the data. Couple6 automatically detects that the previous session terminated abnormally and prompts you to recover data from the auto-backup the file.

Other Folders Created by Couple6

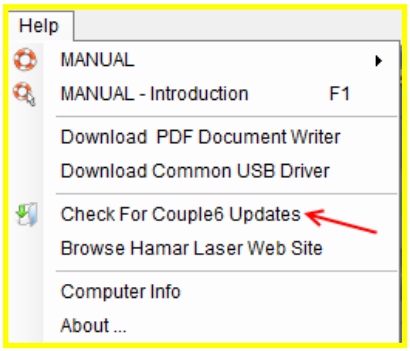
- **Machines Folder** is used to store data files. When a machine is created, Couple6 creates a folder for that machine in the Machines Folder.
- **License Key Folder** contains a file containing the license key for your target. The key is matched to the serial number of the target and cannot be used with any other target. See *License Information* on Page 47 for more info on license keys.
- **Update Folder** – When *Check for Couple6 Updates* is clicked in the **Help Menu**, Couple6 sends the update to the Updates Folder.

Saving the MACHINES Folder to an External Storage Drive

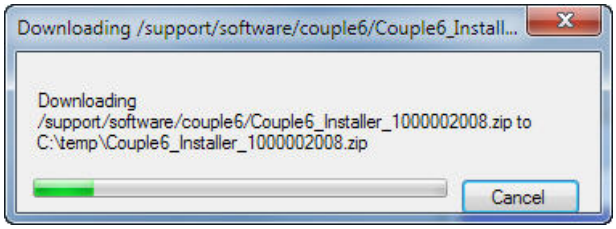


Hamar Laser recommends a periodic backup of the Couple6 MACHINES folder. In the event of a system failure, backing up projects up to an external storage device allows you to restore your previously saved projects. There is a MACHINES backup folder on the USB flash drive that came with your system or these files may be saved to a network drive if your company requires you to do so.

Checking for Software Updates

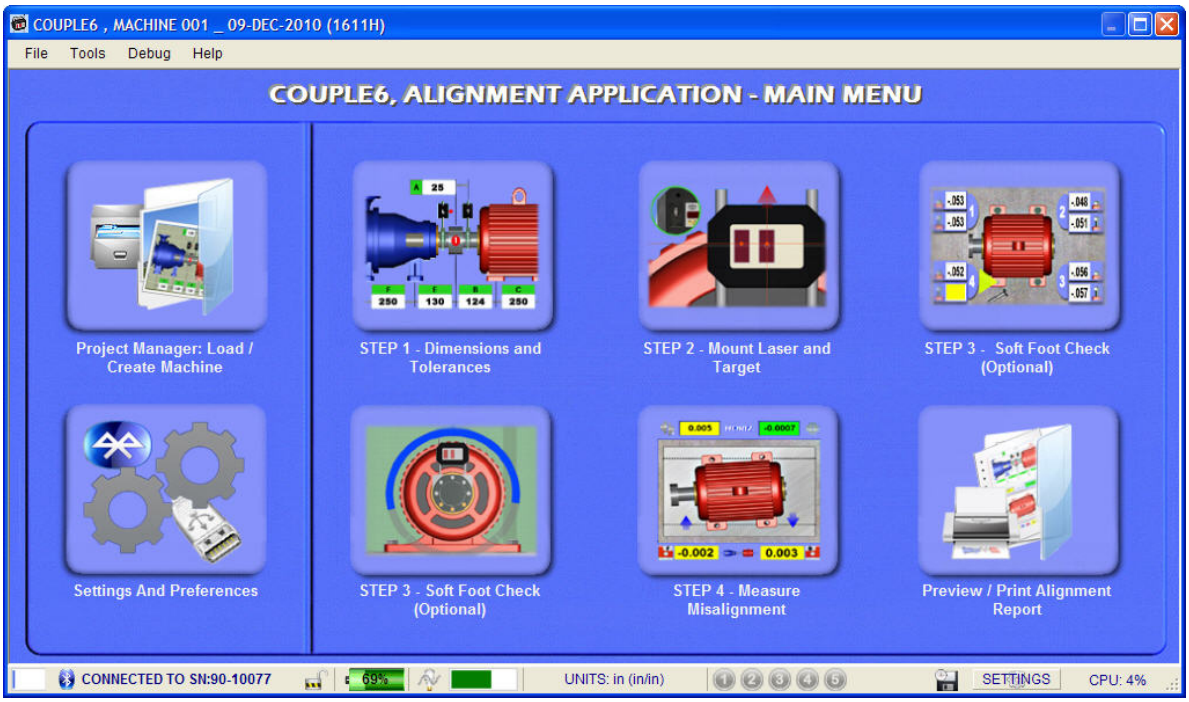


Click ***Check for Couple6 Updates*** in the **Help Menu** and Couple6 automatically checks for updates. If an update is found, you are prompted to download it. Click **Yes** to download the update and follow the on-screen instructions to install the new version.



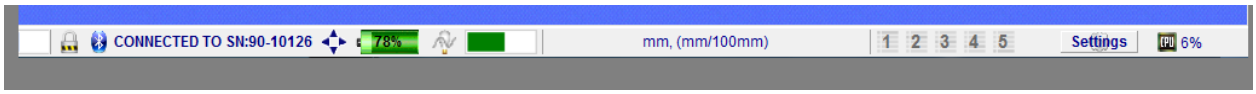
The Main Menu

The **Main Menu** displays the 5 alignment steps and is the main navigation page. The **Main Menu** can always be displayed by clicking the **Home Page** icon in any screen.



The icon for each step is grayed out until that step has been completed. **Steps 1-4** may be navigated without taking data, however **Step 5** is not enabled until data is taken in **Step 4**.

Couple6 Status Bar



Located at the bottom of the Couple6 screens, the Status Bar displays the following information:

- **Lock –** Indicates the license key is valid when unlocked.

- **Communication Status –** when the software has successfully detected the target (T-1285 or T-1290) and has established a connection, the status bar displays *Connected to S/N…*with the serial number for the target.

- **Axis Indicator** – Four arrows indicate a 4-axis target it in use. Two arrows indicate a 2-axis target is in use.

- **The Target Battery Status Indicator –** shows the target battery life left as a percentage of full charge. The icon changes color from *green* to *yellow* to *red* to indicate the amount of battery life left. Place the cursor over the battery icon to view more details on the battery status.

- **Units** – Displays the currently selected measurement units: inches, mils or millimeters. It also displays the angular units selected.

- **Background Light Indicator –** displays the amount of background light for the target and changes in color from:
  - **Green –** normal background light (indicator displays 7 to 11)
  - **Yellow –** warning background light levels are getting too high, but the data is still accurate (indicator displays 11 to 12)
  - **Red –** background light too bright and readings are not accurate (indicator displays a value of 13 or higher)**.**

  Place the cursor over the light icon to see the details of the background light scale from 1 to 15.

- **Settings Shortcut Button** – Click to display the **Settings (Preferences)** screen.

- **CPU** – indicates how much of the computer's processor is being used by Couple6. If this number is higher than 50 percent, select **Settings** and reduce the *Graphics quality* and the *Display Update Rate* described on Page 41.

The Settings and Configuration Screen

The **Settings and Preferences** screen is opened by clicking the icon from the **Main Menu**. It is used to personalize the software with data such as user information, units of measure to be used, and communication parameters.

Couple6 automatically detects the unit settings (mm or inches and decimal format) of your computer and selects them in the **Settings and Configuration** screen. If those selections are changed in the **Settings and Configuration** screen, Couple6 overrides the default settings and saves them to a file in the **Temp** folder (see Page 35 for the location of the **Temp** folder).

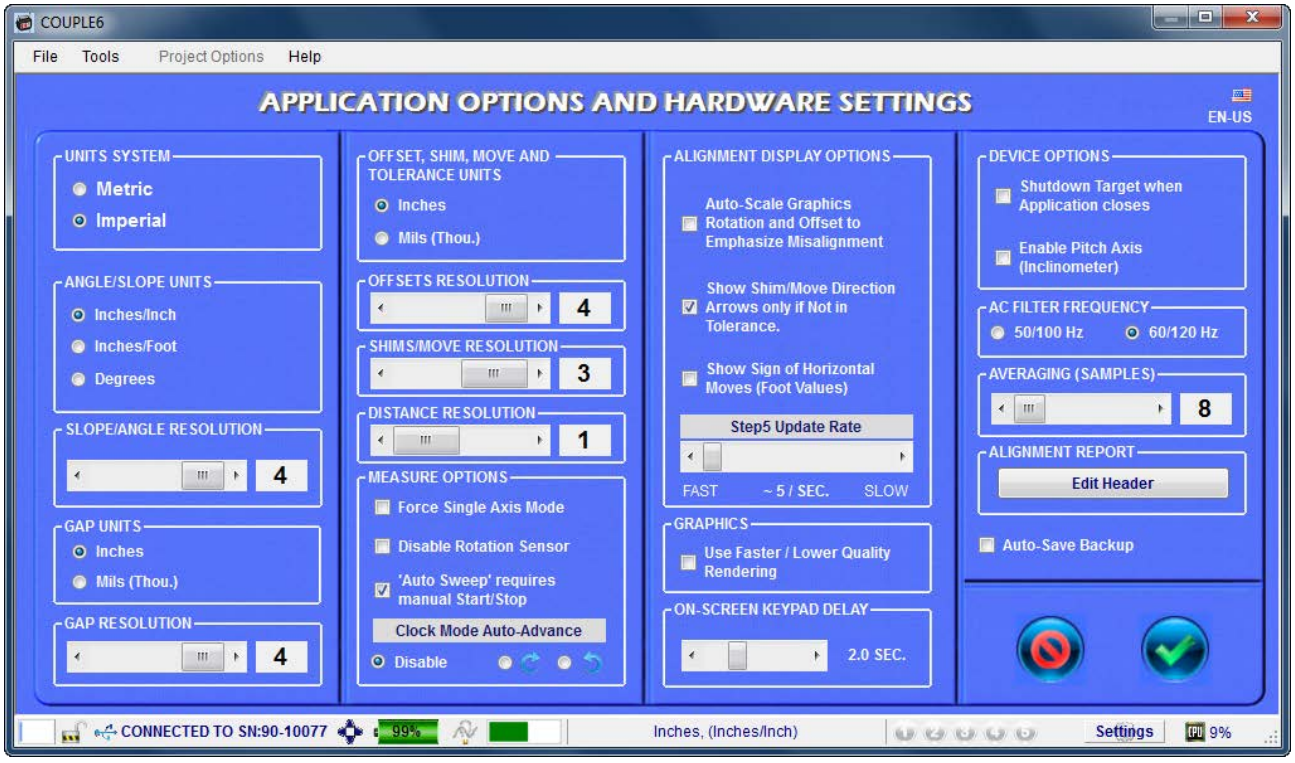


Figure 19 – *Couple6 Settings & Configuration Screen*

Units and Decimal Places

Select **Metric** (mm) or **Imperial** (inches) units for the data displays and reports. Angular units are displayed as:

Inches: inches/inch, inches/foot or degrees
Millimeters: mm/100 mm, mm/M or degrees

The number of decimal places can be changed for Angular/Slope and Gap. The maximum number of digits for inches is 4. The maximum number of digits for millimeters is 3.

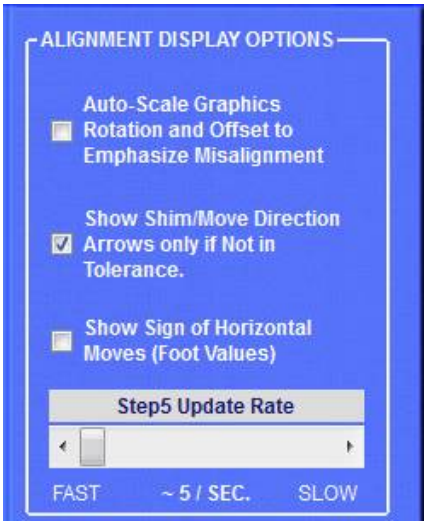
Inch offset values can also be shown as **Mils** (Thou.), which takes the offset value and multiplies it by 1,000. The first decimal place in Mils is equal to .0001 inches

The number of decimal places can also be changed for Offset, Shim/Move and Distance (dimensional) values. The maximum number of digits for inches is four. The maximum number of digits for millimeters is three. The maximum number of digits for dimensional measurement is two for inches and 0 for millimeters.

.

Graphics and Device Options

Graphics Options



- **Auto-Scale Graphics Rotation and Offsets to Emphasize Misalignment** The display of the machine graphics is scaled to emphasize the misalignment, clearly showing the direction of misalignment. Un-check the box to use fixed scaling. Fixed graphics scaling de-emphasizes the misalignment but shows a greater range of movement.
- **Show Shim/Move Direction Arrows only if Not in Tolerance** Click to turn off the display of the arrows in **Step 5: Move Screens** if the alignment is in tolerance. The arrows always display when the alignment is outside the selected tolerance.
- **Show Sign of Horizontal Move (Foot Values)**
  Click to see the signs on the horizontal (only) foot values in addition to the arrows. The signs (±) change depending on which view (coupling on left or right) is selected.
- **Step 5 Update Rate**
  The **Step 5 Update Rate** slider bar controls the update rate for the number displays in **Step 5**. On older laptops, Couple6 may cause the computer to become sluggish while using the **Move** screens. Sliding the bar toward **SLOW** reduces the graphics update rate to twice per second, lowering the stress on the computer's CPU. Sliding the bar to **FAST** increases the update rate to five times per second.

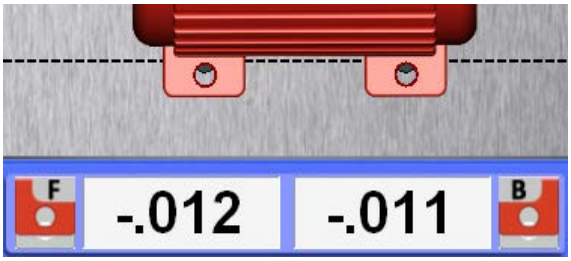


Figure 20– *Step 5: Horizontal Move Screen Foot Values*

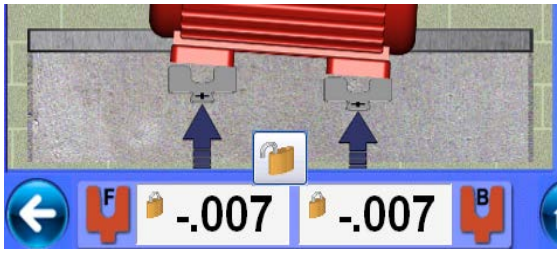
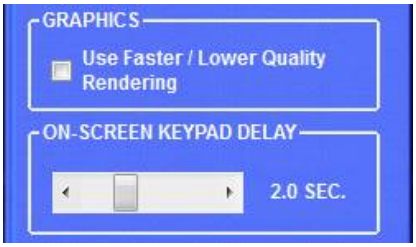


Figure 21 – *Couple6, Step 5 Vertical Move Screen Shim Values*

Use Faster/Lower Quality Rendering



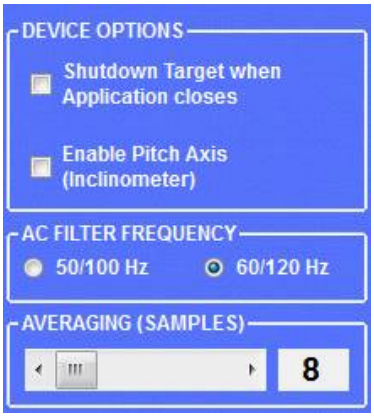
Click the checkbox if your computer takes a long time to display moving images, which is common in older laptops. This setting lowers the resolution of the graphics and allows lower-powered computers to display graphics movement at suitable speeds.

On-Screen Keypad Delay

For tablets without keyboards, press and hold the mouse button over an entry box (*Step 1: Dimensions* or *Machine Info*, *Company info*, etc.). Couple6 pops up a keypad to use with the touchscreen. Using the slider bar, adjust the length of time required to click and hold the cursor to pop up the key pad. The following keyboard displays for typing text into an entry box.

The following keyboard displays for typing numerals into an entry box.

Device Options



- **Shut Down Target when Application closes**
  Click to send a command to the target to automatically shut it down when Couple6 closes.
- **Enable Pitch Axis (accelerometer)**
  Click to have Couple6 automatically sense if the motor/pump is tilted more than 30 degrees relative to earth level, which significantly degrades the rotation sensor and effectively disables all the data taking modes except **Auto Clock™ Mode**.

AC Filter Frequency

When a target is built, it is set to 50 or 60 Hz internally to match the electrical frequency of the country where it is used. This setting affects the target's background light correction capability. The *internal* target setting can only be changed by using the Target Utility program; however, Couple6 has the capability to temporarily override this setting by providing the option to select the electrical frequency specific to your country. This selection (50/100 Hz or 60/120 Hz) can be saved in the program's preferences to start the target with the selected frequency. Typically, 60/120 Hz electrical frequency is found in all countries in North America, Central America, the northern part of South America and some areas of Japan. All other countries usually use 50/100 Hz. If you are unsure of your electrical frequency, see the following website for more information:
http://www.kropla.com/electric2.htm

If the wrong frequency is selected, the background light correction feature of the T-1285/1290 targets does not operate correctly. This causes the target readings to become excessively noisy (data fluctuates by about.003-.005" or 0.075 mm to 0.125 mm).

Averaging (Samples)

This changes the number of data points Couple6 averages before it displays a value in the data displays. The minimum is 8; the maximum is 64. Increase this number if there is excess vibration on the motor that causes the target readings to fluctuate too much.

Note: *Increasing the number of averages slows the target's response to movements of the motor. In the* **Step 5: Move Screens**, *the target transmits data at about eight readings per second, so an average of eight means the software takes approximately one second to show the final value of a movement of the motor. If the value is increased to 16, it takes about two seconds to see the movement of the motor.*

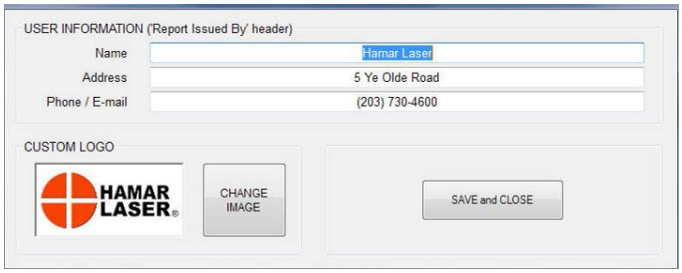
Measure Options

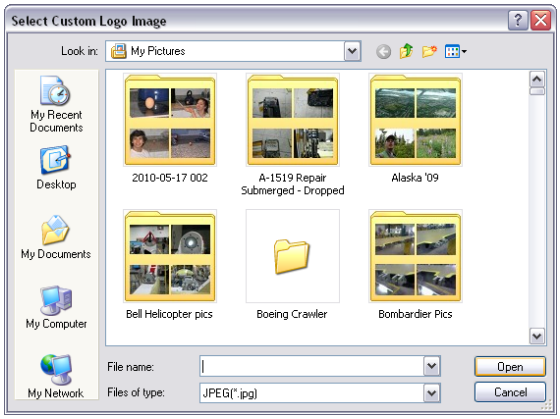
- **Disable Rotation Sensor**
  Click to disable the rotation sensor (accelerometer), which is the device that measures the rotation angle of the target. Disable the rotation sensor when the motor is mounted vertically or when the angle of the motor's shaft is greater than 30 degrees relative to earth level.
  Note: **Auto Clock™ Mode** *is the only data taking mode where the accelerometer is disabled. The default setting is* **unchecked**.
- **Auto Sweep™ Requires Manual Start/Stop**
  If this box is checked, the **Start** button must be clicked in **Auto Sweep™ Mode** to tell Couple6 to start taking data when the target senses rotation. Use this mode when there is excessive vibration in the motor and the **Accept Measurement Results** screen does not automatically display. If this box is unchecked, in **Step 4: Auto Sweep™,** Couple6 automatically begins taking data as soon as the rotation sensor senses rotation and stops taking data (**Accept Measurement Results** automatically displays) when the rotation sensor detects the rotation has stopped. The default setting is **checked**.
- **Auto Clock™ Mode Auto Advance**
  When using **Auto Clock™ Mode**, if either CW *(clockwise)* or CCW *(counterclockwise)* is selected, Couple6 automatically advances the target icon to the next point in the circle after **Record** button is selected or the spacebar is pressed.

Report Options

Edit Header – Click to open a popup box and enter the header information for the report. Enter the name, address, email and phone number to be displayed in the header of the report. This information prints on every report until it is changed.

Click the **Change Image** icon to use a different logo for the report.
The **Select Custom Logo Image** screen opens. Select a logo image and click **Open** to use that logo for the Couple6 report. Select **Save and Close** to save the header and new logo image for the report.

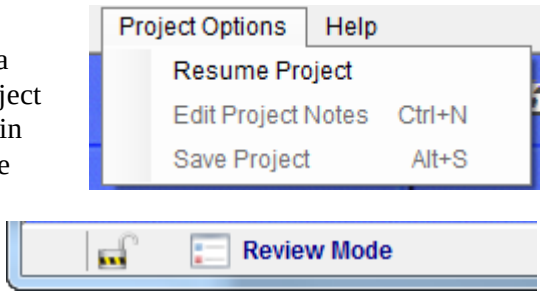




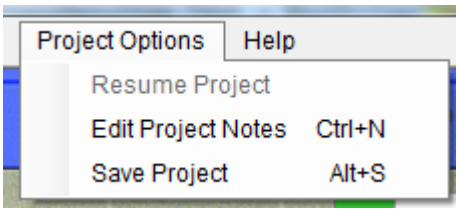
Project Options

This menu is disabled until a project is loaded. A project may be loaded in one of two modes:

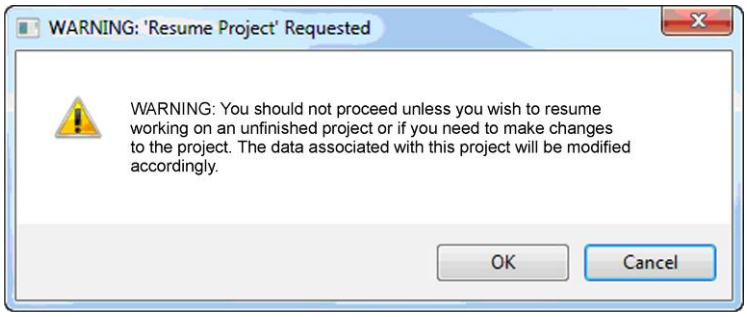
Review Mode: This mode is automatically activated when an existing project is loaded. It is also activated following a Backup recovery (after a program crash). Note that the project options allowing changes to the project are disabled while in this mode. Also, the R**eview Mode** indicator appears on the status bar.



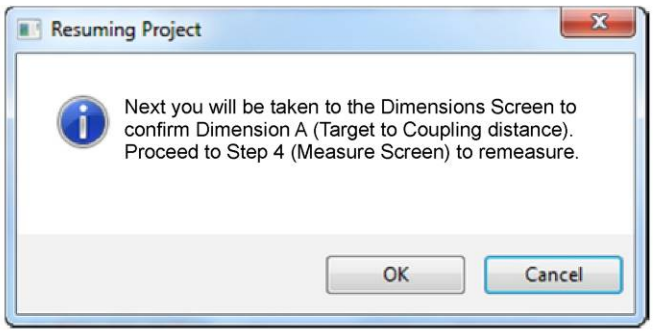
Live Mode: This mode is active when a target is connected and an active project is loaded. In this mode the Project Options *Edit Notes* and *Save Project* are enabled.



When switching from **Review Mode** to **Live Mode**, select *Resume Project* from the **Project Options** menu. The following confirmation message displays. Note that *Resume Project* was titled *Go Live* in previous versions.



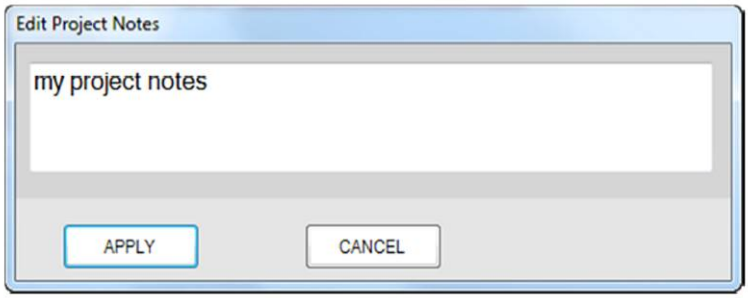
Click **OK** to display the following:



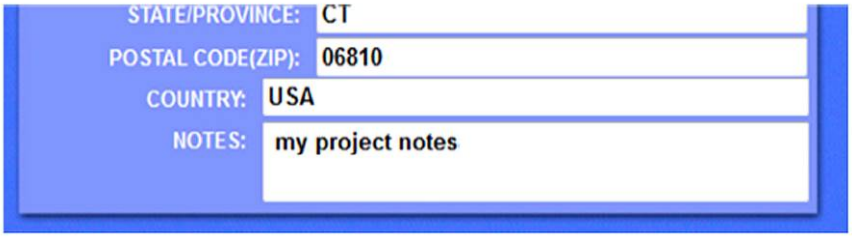
Data for an active project may be saved at any time by selecting **Save Data** from the **Project Options** menu or by pressing **Alt-S**.

Project Notes

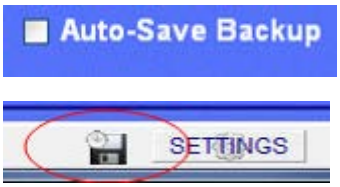
Project notes may be edited any time a project is active by selecting **Edit Project Notes** from the **Project Options** menu or by pressing **Ctrl-N**.



Project notes may also be entered from the **Projects Options** screen.

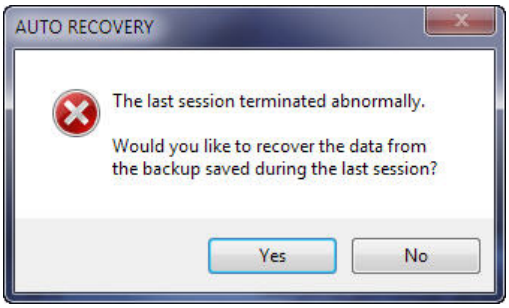


Auto-Save Backup



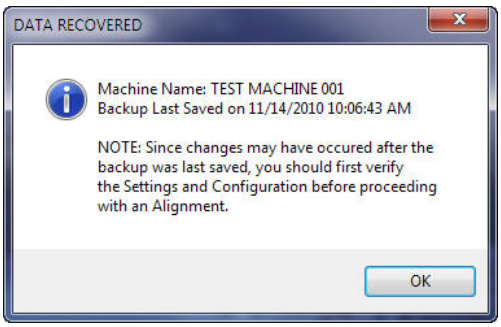
Check to automatically save a backup every 2 minutes.

Note: Auto-Save *(every 2 minutes) is disabled in* **Step 4: Take Data** *to avoid potential problems when interrupting the data taking process. When Auto-Save backup is checked, a diskette icon displays in the taskbar.*



If **Auto-Save Backup** is unchecked, Couple6 only saves data to the backup file each time a step is completed.

If the computer crashes during an alignment, re-open Couple6. The *Auto Recovery* dialog box displays. Click **Yes** to restore the data. After clicking **Yes**, the *Data Recovered* dialog box displays, indicating the last time the data was saved in the backup file.



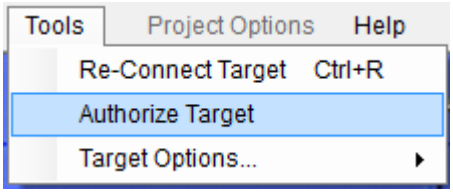
Other Configuration Selections

Target Communication with a Tablet or Laptop

Serial Port

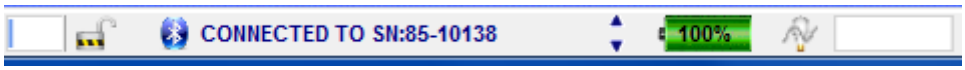
Each tablet or laptop uses a different COM port for either Bluetooth radio or the backup USB cable. While Couple6 should automatically find the COM port to which your target is connected, it may occasionally be necessary to determine the COM port number manually. See *Appendix B, Determining COM Ports of Devices* on Page 130 for more information.

License Information

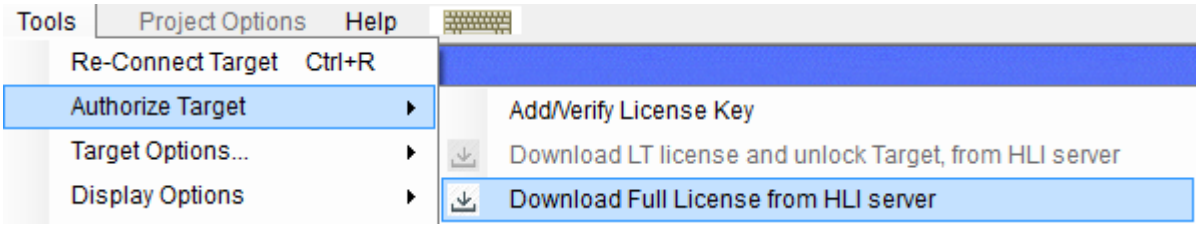


If optional features are purchased after delivery, a new license key is sent to you to enable the features. To download and install the new license key from the HLI server, follow this procedure:

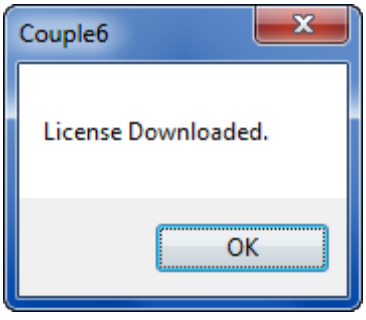
1. Start Couple6 and connect your target. When Couple6 is opened, it automatically searches all available COM ports for the T-1280/T-1285/T-1290 target connection, either through the Bluetooth radio or the USB cable. The status bar at the bottom of the screen indicates if there is a connection. If there is no connection, check that your target is paired through the Bluetooth settings in your computer/tablet. For more information, see Appendix C, beginning on Page 132.



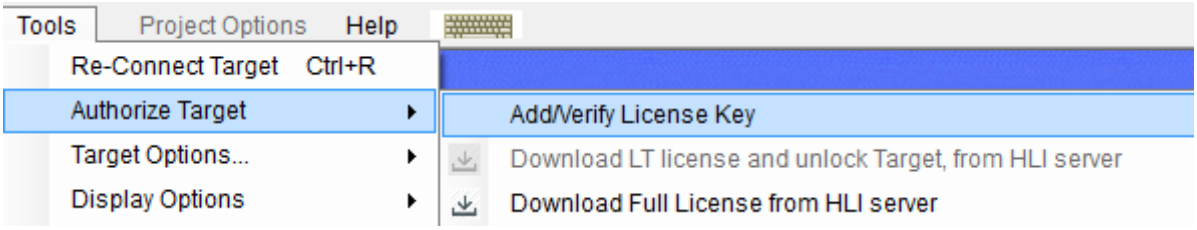
2. To download your license, click **Tools>Authorize Target>Download full license from HLI server**. The license file automatically downloads and installs.

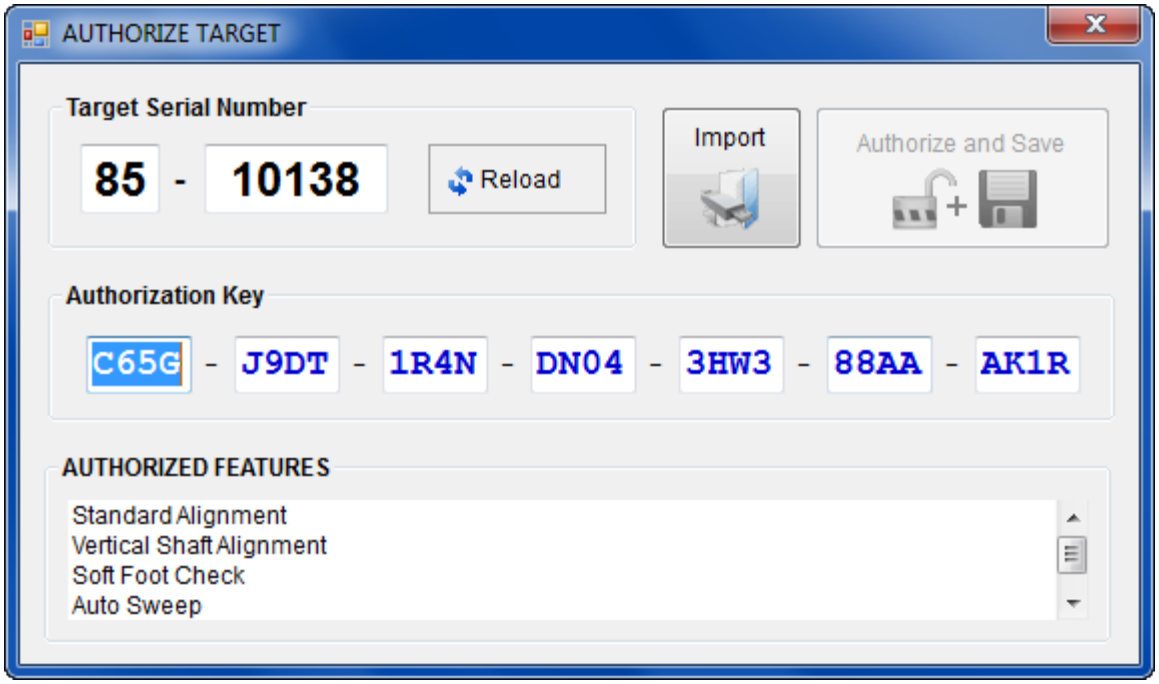


3. Once the file is downloaded, Couple6 begins to scan for COM Ports again and reconnects. A pop-up message displays to confirm the license download. Please wait for the pop-up to display.



4. To verify the license and features, click **Tools>Authorize Target>Add/Verify License Key**.





5. Scroll through the AUTHORIZED FEATURES to verify that you have all the features you requested. Click the red X to close the window.

Manual Entry

1. Connect the target to the tablet/laptop and power it on.
2. Click **Tools**>**Add/Verify License Key>Authorize Target**. A popup window displays.
3. Enter the target serial number in the appropriate area and then enter the Authorization Key (not case sensitive).
4. Click **Reload** to check an existing license key against the target serial number being provided by the target.
5. Click **Authorize and Save** to save the license key and close the window.
6. Scroll down the list of **Authorized Features** to view the features that are enabled with the license key entered.

A. Import License File

1. Obtain a new license key file from Hamar Laser. The file format is *90-10077.key (example)*
2. Click **Import**
3. Find the folder containing the license file and open the file.
4. If valid, the License is automatically verified and authorized.

Note: *To purchase an optional feature or to solve a problem with a feature that was purchased, contact your local distributor.*

In North and South America, Europe or Australia, contact *Hyatt Industries at* www.hyatt-ind.com (+1-604-736-7301).

For all other countries, contact *Hamar Laser Instruments* www.hamarlaser.com (+1-203-270-3644).

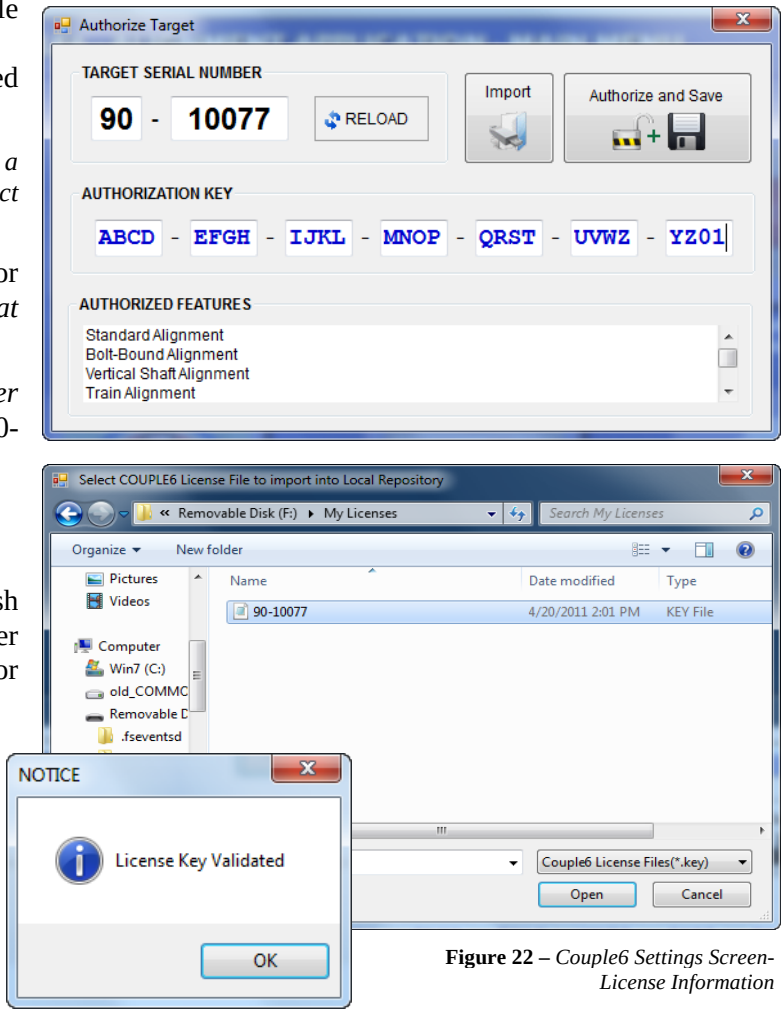


Figure 22 – *Couple6 Settings Screen-License Information*

International

Language

Select the language for the text displays. English is currently the only available language, however French, German and Spanish are scheduled for future releases of Couple6.

Number Format

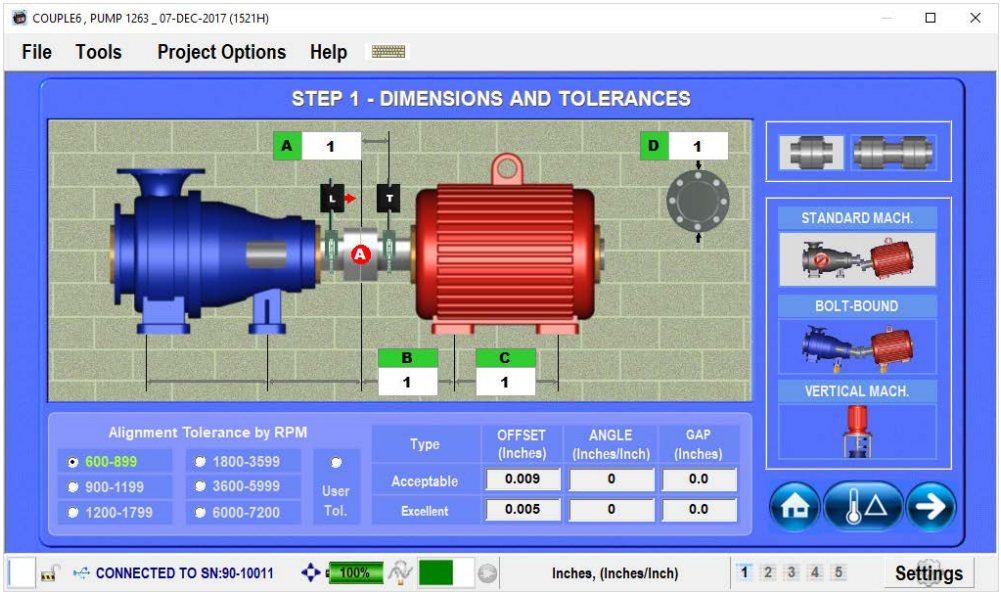
American format is .001 and 1,000. European format is 0,001 and 1.000.

Soft Foot Tolerance

This tolerance prompts the software to detect and correct a soft foot problem if the *foot change* (difference between tight bolt and loose bolt) is greater than the selected tolerance. The default is set to ± .0025" (0.0643 mm).

Performing an Alignment

Step 1: Dimensions and Tolerances

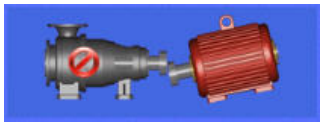


Note: *If the movable machine is on the left, then the machine configuration image can be flipped to the left by double clicking on the motor image. The same feature is available in* **Steps 2, 3** *and* **5**.

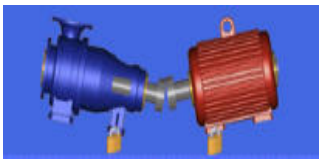
Step 1: Setting Up a New Machine – Select Machine Type

Machine Type

Select the type of alignment (move the scroll bar to see all options).



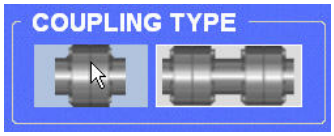
Standard – Standard horizontal alignment with the motor as the movable unit.



Bolt Bound™ – Select **Bolt Bound**™ if the either or both motor feet cannot be shimmed or moved (bolt bound) due to mechanical limitations, such as the motor being pushed all the way to one side. This feature allows the user to click any combination of pump and motor feet to recalculate the shims and moves and align the motor using the selected combination of feet.

Vertical – Select **Vertical** for flange-mounted, vertical motors that have a circular, flange-type mounting (non-standard feet) between motor and pump. Note that the alignment method and dimension screens are customized to flange-mounted vertical motors. For a vertically-mounted standard motor type, use the Standard machine type, and disable the rotation sensor in Preferences.

Coupling Type



Select the type of coupling, as described below:

Flexible – Select **Flexible** if the motor has a standard flexible coupling.

Spacer (Jack) Shaft) – Select **Spacer** (Jack) **Shaft** if the motor has a spacer shaft between two couplings. Couple6 has 7 different display formats for Spacer Couplings.

Step 1: Entering Machine Dimensions – Standard Machines

For best results, enter dimensions to within ¼ inch (6 mm).
Note: *When using a saved file as a template for a new alignment, the* **A Dimension** *is the only dimension that needs to be re-measured.*

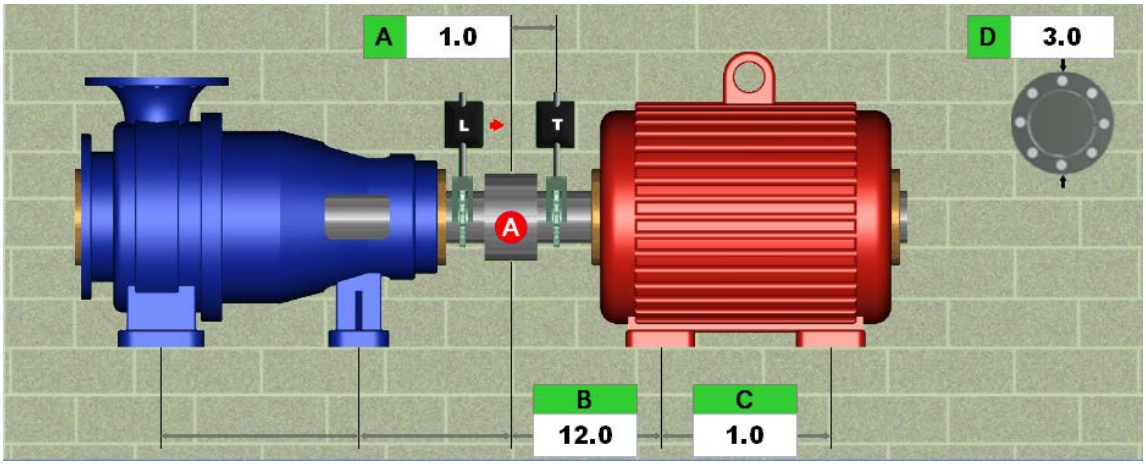
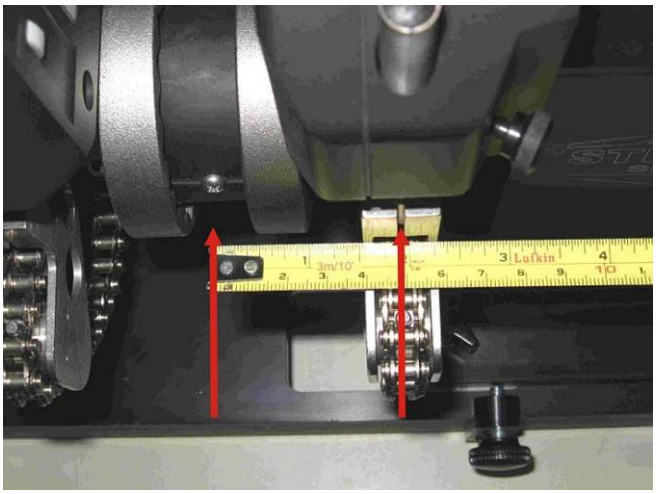


Figure 23 – *Entering Machine Dimensions for Standard Machine*

A Dimension

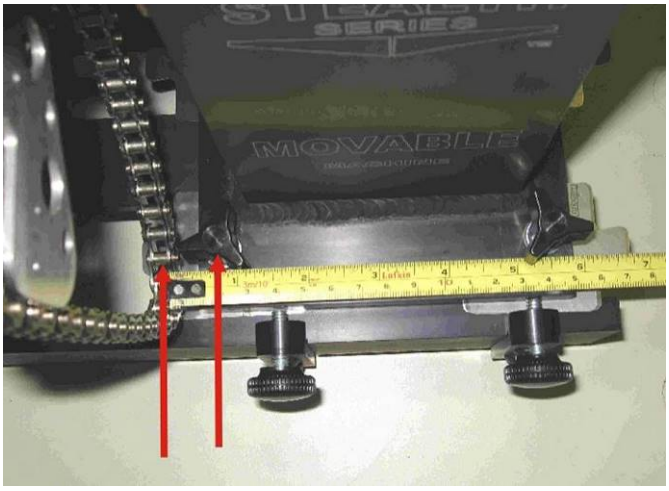
Measure from the center of the coupling to the center of the A-980 Bracket. If **Spacer Shaft** is selected, measure from the center of the A coupling to the center of the A-980 bracket.



B Dimension

Measure the distance from the center of the coupling to the center of the front foot bolt hole. For a more accurate B dimension measurement, allow the chain to hang from the bracket, measure from the center of the chain to the front foot bolt hole, and then add this value to the **A Dimension** measured in the previous step. Enter the result in the B Dimension box.

If **Spacer Shaft** is selected, measure from the motor's front foot to the center of the A coupling.

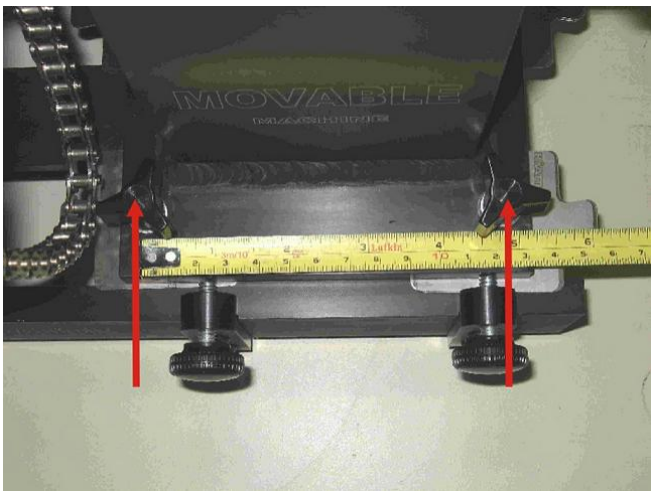


C Dimension

Measure from the center of the front foot bolt hole to the center of the back foot bolt hole.

D Dimension

The D dimension is the coupling diameter.



Step 1: Entering Machine Dimensions – Bolt Bound™ and Spacer (Jack) Shafts

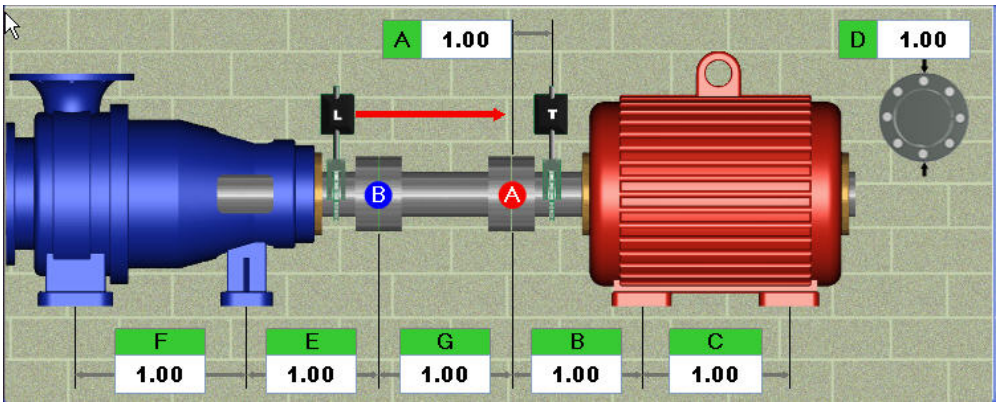


Figure 24 – *Step1: Entering Dimensions for Bolt Bound™ and Spacer Shafts*

E Dimension – Measure from the center of the coupling to the center of the pump's (stationary unit) front foot bolt hole. If **Spacer Shaft** is selected, then measure from the pump's (stationary unit's) front foot bolt hole to the center of the B coupling.
F Dimension – Measure from the center of the front foot bolt hole of the pump to the center of the back foot bolt hole of the pump.
G Dimension (Spacer Shafts Only) – Measure from the center of the A coupling to the center of the B coupling.

Changing Data Formats for Spacer Shafts

By selecting **Spacer Shaft** in **Step 1**, the data format is automatically changed to the Spacer Shaft data format, with the default being Gap A/Gap B. The shim/move values are not changed.

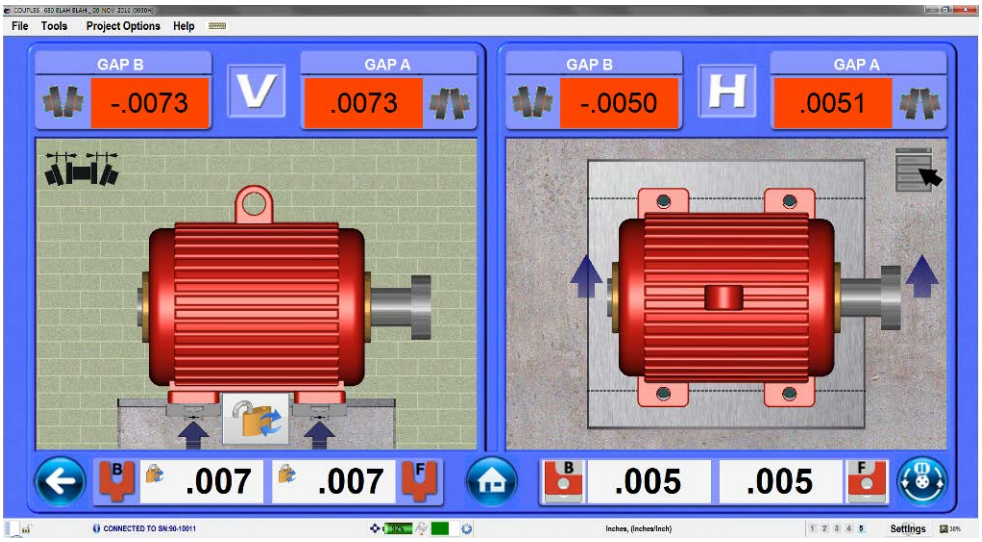


Figure 25 – *Step 5: Move Screen showing Gap A/Gap B Spacer Shaft Data Format*

As explained on Page 55, there are 7 different space shaft data formats. To change the type of the format while in **Step 5**, click the **Spacer Shaft Coupling** icon to bring up the Spacer Shaft Data Format Popup and select the format you want.

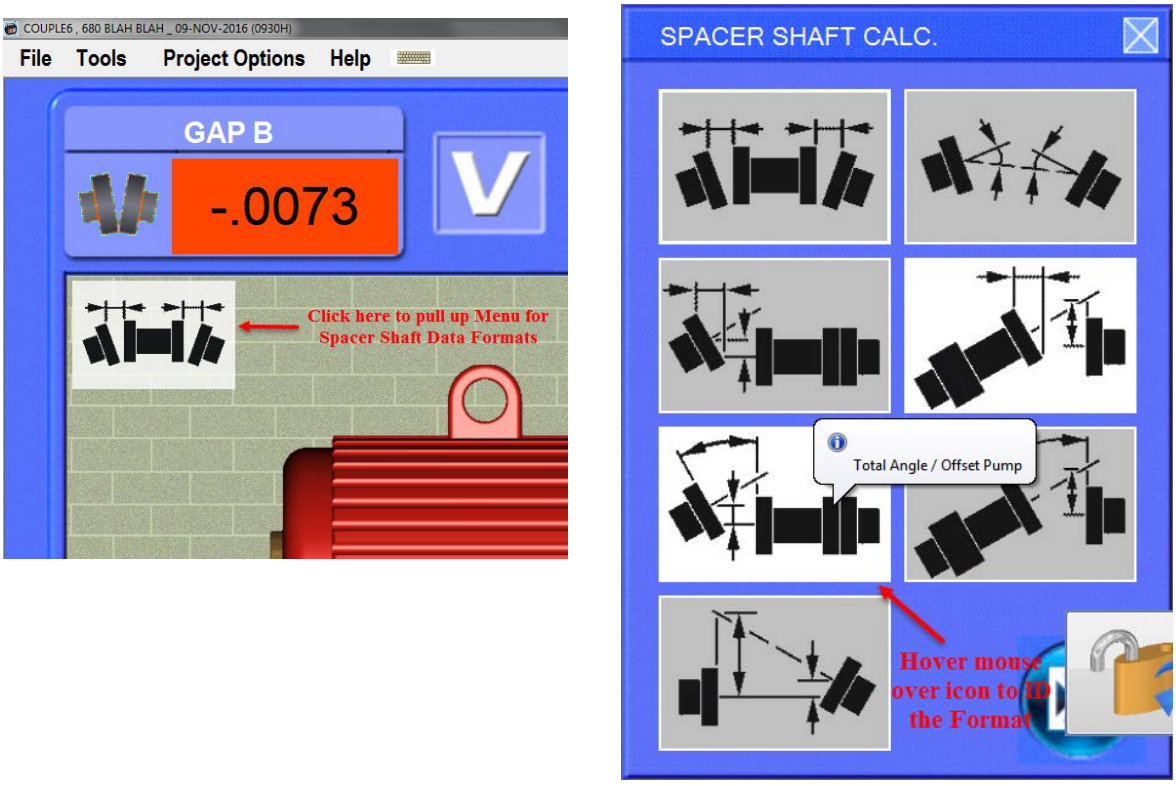


Figure 26 – *Spacer Shaft Data Format Popup*

Click the format you want and the data format changes.

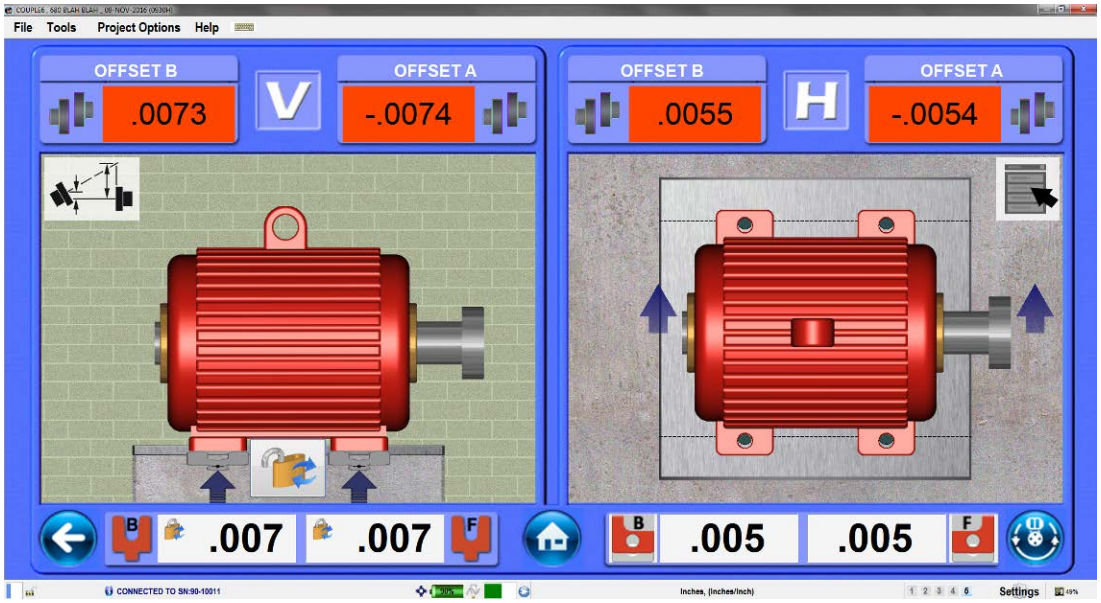
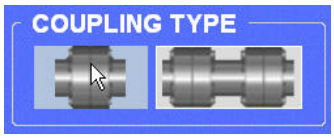


Figure 27 – *Step 5: Move Screen showing Offset A/Offset B Space3r Shaft Data Format*

Spacer Shaft Formats

There are 7 different spacer shaft formats to best match your tolerance specs. Couple6 automatically changes the way the data is displayed by clicking on the Coupling Icon in **Step 5**.

Coupling Type



Select the type of coupling, as described below:

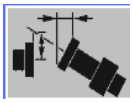
Flexible – Select **Flexible** if the motor has a standard flexible coupling.

Spacer (Jack) Shaft) – Select **Spacer** (Jack) **Shaft** if the motor has a spacer shaft between two couplings. Couple6 has 7 different display formats for Spacer Couplings.

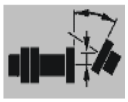
Gap A/Gap B
This format shows the misalignment as a gap at Coupling A (motor side) and gap at Coupling B (pump side).

Alpha and Beta Angles
This format shows the misalignment as a combination of an angle (Alpha) of the motor to the spacer shaft and an angle (Beta) of the spacer shaft to the pump.

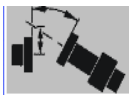
Total Gap - Offset Right
This format shows the misalignment at the right (motor) coupling only in Gap/Offset format.



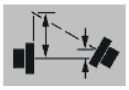
Total Gap - Offset Left
This format shows the misalignment at the left (pump) coupling only in Gap/Offset format.



Total Angle - Offset Right
This format shows the misalignment at the right (motor) coupling only in Angle/Offset format.



Total Angle - Offset Left
This format shows the misalignment at the left (pump) coupling only in Angle/Offset format.

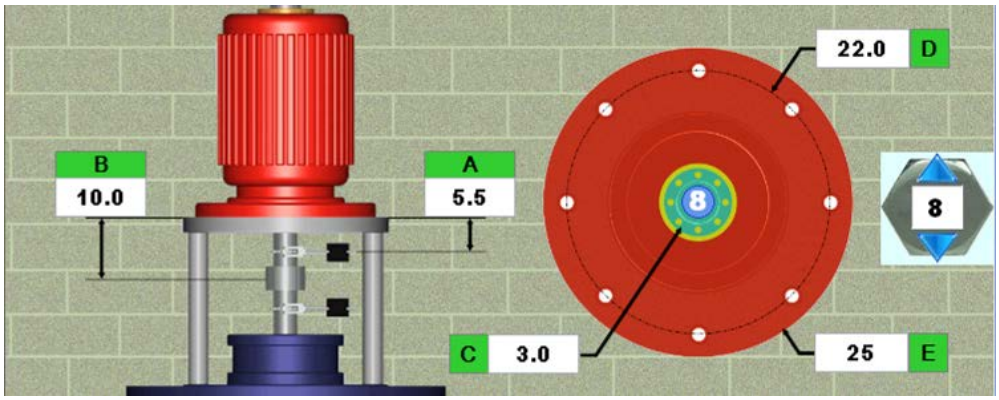


Offset A – Offset B
This format shows the misalignment as an offset at Coupling A and an offset at Coupling B.

Saving Offsets and Closing the TG Screen

To save (apply) the TG offsets to the alignment in **Step 5**, click the back arrow to return to **Step1: Dimensions**.

Step 1: Entering Machine Dimensions – Vertical Machines



A Dimension – Measure from the center of the top of the target to the point where the motor flange touches the mounting surface.
B Dimension – Measure from the center of the coupling to the point where the motor flange touches the mounting surface.
Note: *Dimension A cannot be less than Dimension B.*

C Dimension – The diameter of the coupling.
D Dimension – The diameter of the bolt hole circle, measured from the center of the bolt holes.
E Dimension – The outside diameter of the motor flange.

Click to select 4, 6 or 8 bolts for the Vertical Motor.
Note: Step 3: Soft Foot *is disabled when Vertical Motor is chosen as the machine type.*

Step 1: Setting Up a New Machine – Tolerances Table

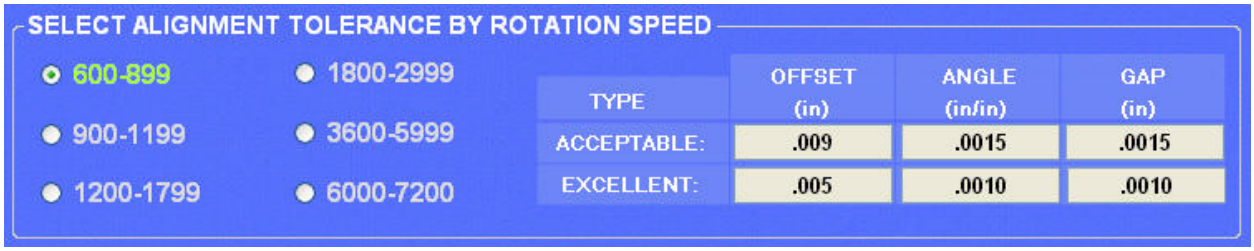
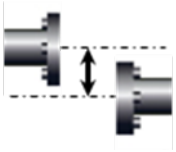


Figure 28 – *Step 1:Tolerances*

Recommended tolerance values are based upon industry-standard *Excellent* and *Acceptable* tolerances. Select the RPM of the machine to be aligned and the appropriate tolerances are applied to the alignment screens.

Optional User Defined Tolerance Feature
If the **User-Defined Tolerance** feature is enabled, click **Offset** or on a **Gap** display box to change the tolerance to the desired value.

Offset Tolerance
Offset Tolerance specifies the vertical and horizontal offset from one coupling to another, as illustrated below.



Gap Tolerance
Gap Tolerance is the amount of allowable vertical and horizontal gap at the top or bottom of the coupling. It is calculated by taking the angular tolerance and multiplying it by the **D Dimension** (coupling diameter), as illustrated below.

Standard Coupling Alignment Tolerances Used in Couple6

Standard ACCEPTABLE Tolerances			Standard EXCELLENT Tolerances		
Motor Speed RPM	**Offset** In. (mm)	**Angular** In/In (mm/100mm)	**Motor Speed RPM**	**Offset** In. (mm)	**Angular** In/In (mm/100mm)
600-899	.009 (0.23)	.0015 (0.15)	**600-899**	.005 (0.13)	.001 (0.12)
900-1199	.006 (0.15)	.001 (0.12)	**900-1199**	.003 (0.08)	.0007 (0.07)
1200-1799	.004 (0.10)	.0008 (0.08)	**1200-1799**	.0025 (0.06)	.0005 (0.05)
1800-2999	.003 (0.08)	.0005 (0.05)	**1800-2999**	.002 (0.05)	.0003 (0.03)
3600-5999	.0015 (0.04)	.0003 (0.03)	**3600-5999**	.001 (0.03)	.0002 (0.02)
6000-7200	.001 (0.03)	.0002 (0.02)	**6000-7200**	.0005 (0.01)	.0001 (0.01)

Spacer Shaft Angular Tolerances – Gap A/Gap B

Note: *Tolerances are displayed as Gap A and Gap B. Couple6 multiplies the angular tolerance below by the D dimension and divides the result by 2 to formulate the Gap A and B values.*

Spacer Shaft Angular Tolerances (Gap A/Gap B)		
Motor Speed **RPM**	**Excellent** In/In (mm/100mm)	**Acceptable** In/In (mm/100mm)
600-899	.0018 (0.18)	.0030 (0.30)
900-1199	.0012 (0.12)	.0020 (0.20)
1200-1799	.0009 (0.09)	.0015 (0.15)
1800-2999	.0006 (0.06)	.0010 (0.10)
3600-5999	.0003 (0.03)	.0005 (0.05)
6000-7200	.0015 (0.02)	.0003 (0.03)

Step 1: Setting Up a New Machine – Thermal Growth

Click the **Thermal Growth** icon in **Step 1: Dimensions** to open the **Thermal Growth** screen.

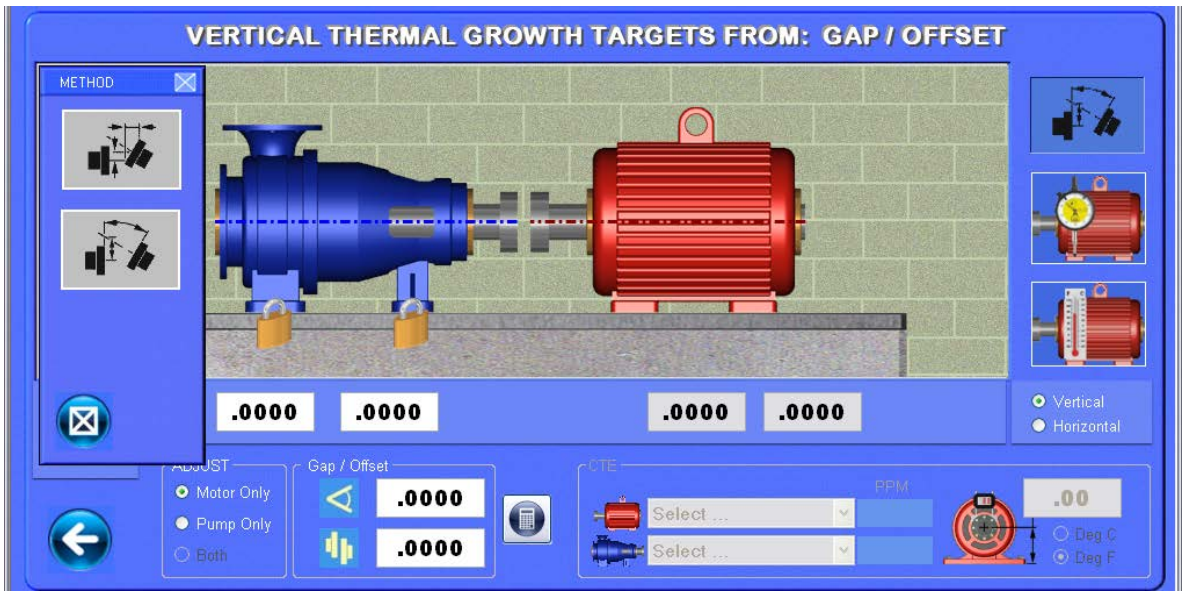


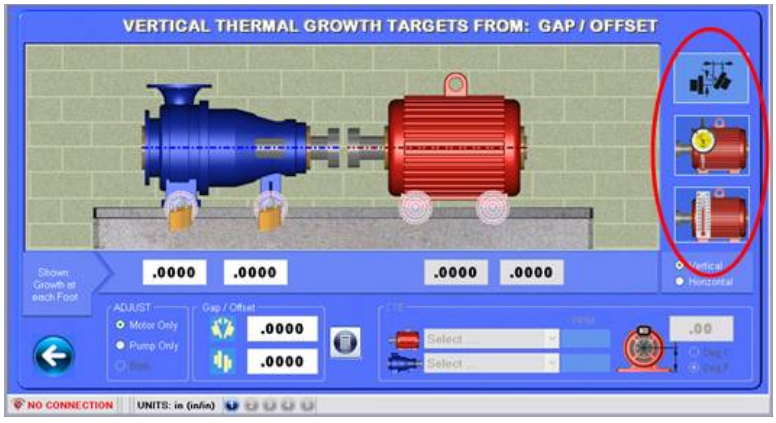
Figure 29 – *Step 1: Thermal Growth at the coupling*

Thermal growth (TG) values are either supplied for the coupling or calculated at the feet (see *Calculating TG Offsets at the Feet* on Page 63). These values represent the amount that a motor's alignment changes from a cold start-up to warm/hot normal operation. Values entered here cause the alignment software to "misalign" the motor by the amount entered (this is an intentional misalignment) so that when the motor warms up to operating temperature, it "grows" into alignment.

The TG values can be either entered for either the Vertical or the Horizontal Axis of the machine.

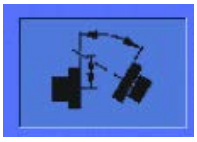
Thermal Growth Modes

There are three Thermal Growth modes described below: **TG at the Coupling, TG at the Feet, or TG Foot Calculator**.

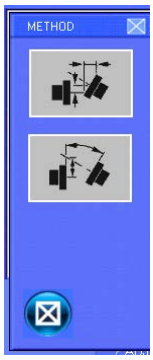


TG at the Coupling – Flexible Coupling

When the **Thermal Growth** screen displays, the default TG mode is **TG at the Coupling**.



TG at the Coupling. There are two modes for the angular part of the alignment (gap or angular). Click this icon to open the popup box and select which angular method to use.



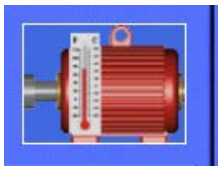
← Click to view the TG angle as a coupling gap.

← Click to view the TG angle as an angle (slope) of the motor.


This icon displays in the data entry box to indicate Gap Mode.


This icon displays in the data entry box to indicate Angular Mode.

TG at the Feet
Click to enter the TG values at the feet to calculate the TG offsets at the motor. Values can be entered at the motor feet, the pump feet, or both. If values are entered at both the pump and motor feet, Couple6 consolidates them into one TG value at the coupling and applies this value to the motor.



TG Foot Value Calculator
Click to enter the temperature change at the front and back foot of the motor and/or pump. Couple6 calculates the amount the motor or pump grows at each foot.

Entering Thermal Growth Signs (±)

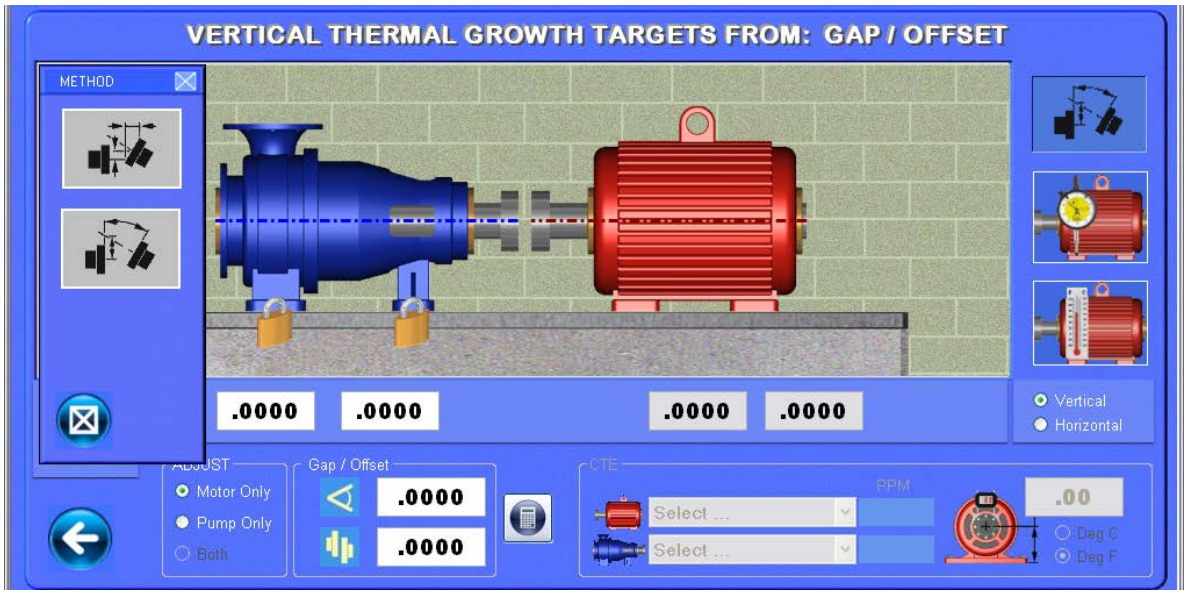
Vertical Axis

- ***Negative Parallel Offset Values****:* a *minus* (-) TG Offset for *Vertical Axis* misaligns the motor *lower* than the driven unit.
- ***Positive Parallel Offset Values****:* a *plus* (+) TG Offset for *Vertical Axis* misaligns the motor *higher* than the driven unit.
- ***Negative Angular Value****:* a *minus* (-) Angular Value for the *Vertical Axis* misaligns the motor with the back feet *lower* than the front feet (gap at the *top* or shaft pointing *up*).
- ***Positive Angular Value****:* a *plus* (+) Angular Value for the *Vertical Axis* misaligns the motor with the back feet *higher* than the front feet (gap at the *bottom* or shaft pointing *down*).

Horizontal Axis

- ***Negative Parallel Values****: a minus* (-) TG Offset for *Horizontal Axis* misaligns the motor *left* of the driven unit (as viewed by looking *into* the front of the motor).
- ***Positive Parallel Values****:* a *plus* (+) TG Offset for *Horizontal Axis* misaligns the motor to the *right* of the driven unit (as viewed by looking *into* the front of the motor).
- ***Negative Angular Value***: a *minus* (-) Angular Value for the *Horizontal Axis* misaligns the motor with the back feet to the *left* of the front feet (gap at the *right* or shaft pointing *right* as viewed by looking *into* the front of the motor).
- ***Positive Angular Value****:* a *plus* (+) Angular Value for the *Horizontal Axis* misaligns the motor with the back feet to the *right* of the front feet (gap at the *left* or shaft pointing *left*, as viewed by looking *into* the front of the motor).

Thermal Growth at the Coupling – Flexible Coupling



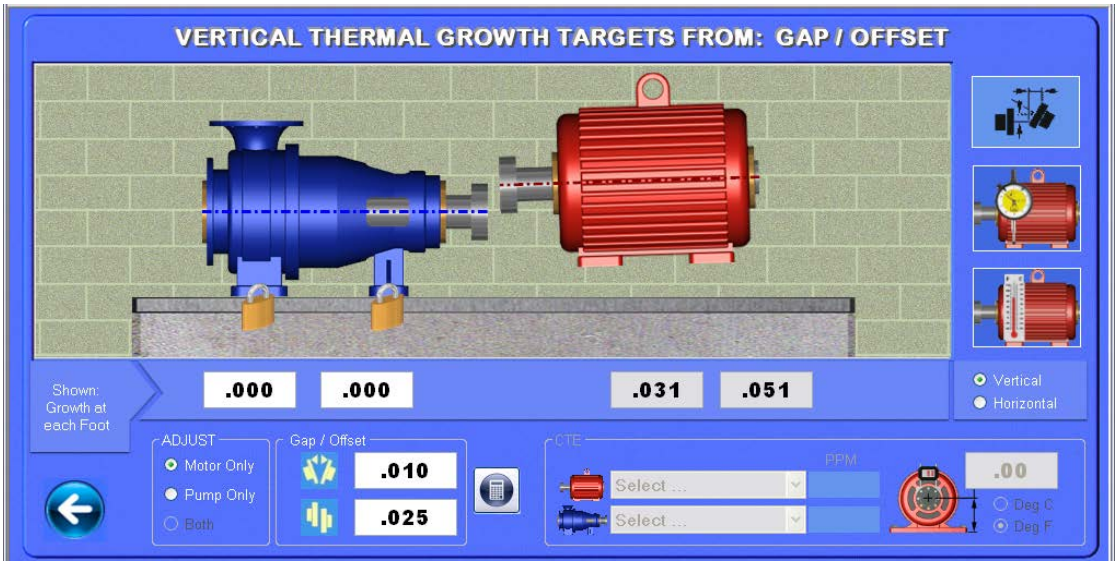
Enter TG values at the coupling using either of the angular formats with the signs described on Page **61**.

Select which side of the coupling to apply the TG Offsets: the pump (driven unit) or the motor. Since the TG Mode is **TG at the Coupling**, the motor *or* the pump side may be selected (not both). In **TG at Foot Mode** and **TG Foot Calculator Mode**, both may be selected.

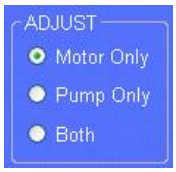
Enter TG values at the coupling using either of the angular formats with the signs described on Page **61**. Enter the values in the *Data Entry* box:

Select the **Calculator** icon (it flashes yellow) to show the effect the TG offset has on the motor's alignment and to covert these values to the motor's (or pump's) feet. These values may be applied to the motor or to the pump (driven unit) if values were entered in the **Step 1: Dimensions** screen for E and F dimensions.

In the example below, a .01" gap and .025" offset were entered as an offset at the coupling. Couple6 converted those values to show how much the front (.031") and back (.057") feet would have to grow (or shrink) to produce the TG values at the coupling. The motor graphic also illustrates the effect thermal growth has on a motor.



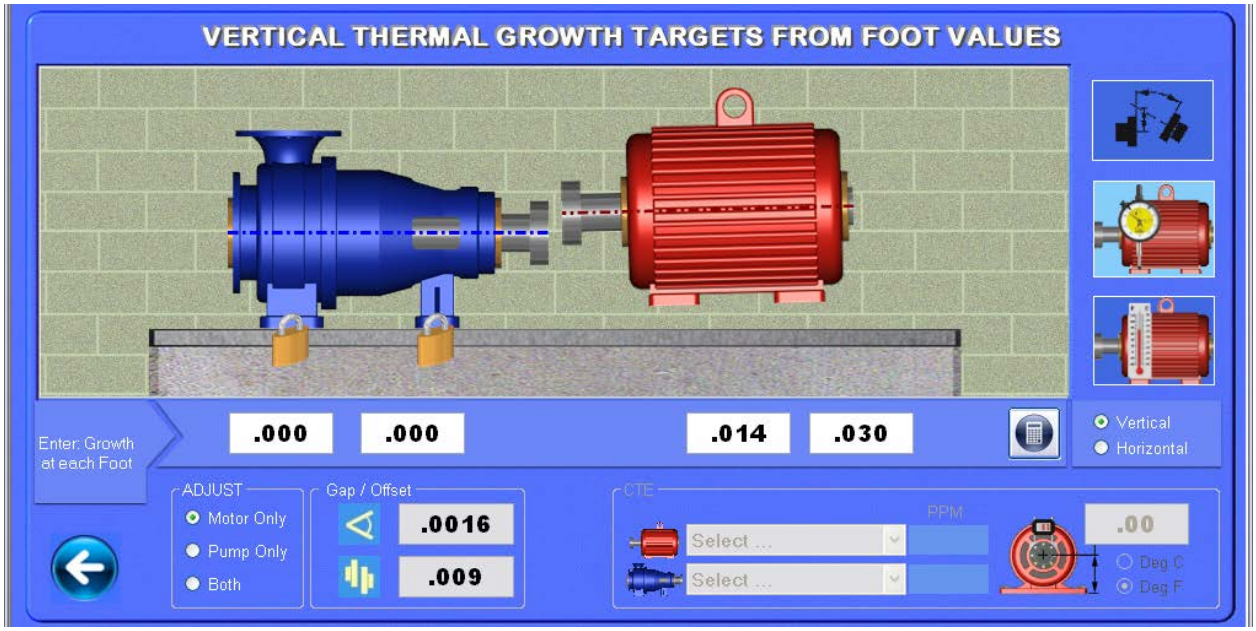
Calculating Thermal Growth Offsets at the Feet



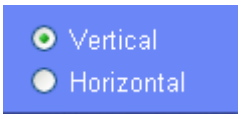
Select which side of the coupling to enter foot values. If you select **Both**, Couple6 combines the effects of the foot values for both motor and the pump into one TG at the Coupling value and applies these values to the motor in **Step 5**.

Enter foot values for the pump, motor or both. Click the **Calculator** icon to convert the values to the coupling and to see the effect of the foot values on the motor's alignment.

In this example, .014" was entered in the front foot of the motor and .030" was entered in the back foot. The values were converted to .0016" in Vertical Angle and .009" for the Vertical Offset.

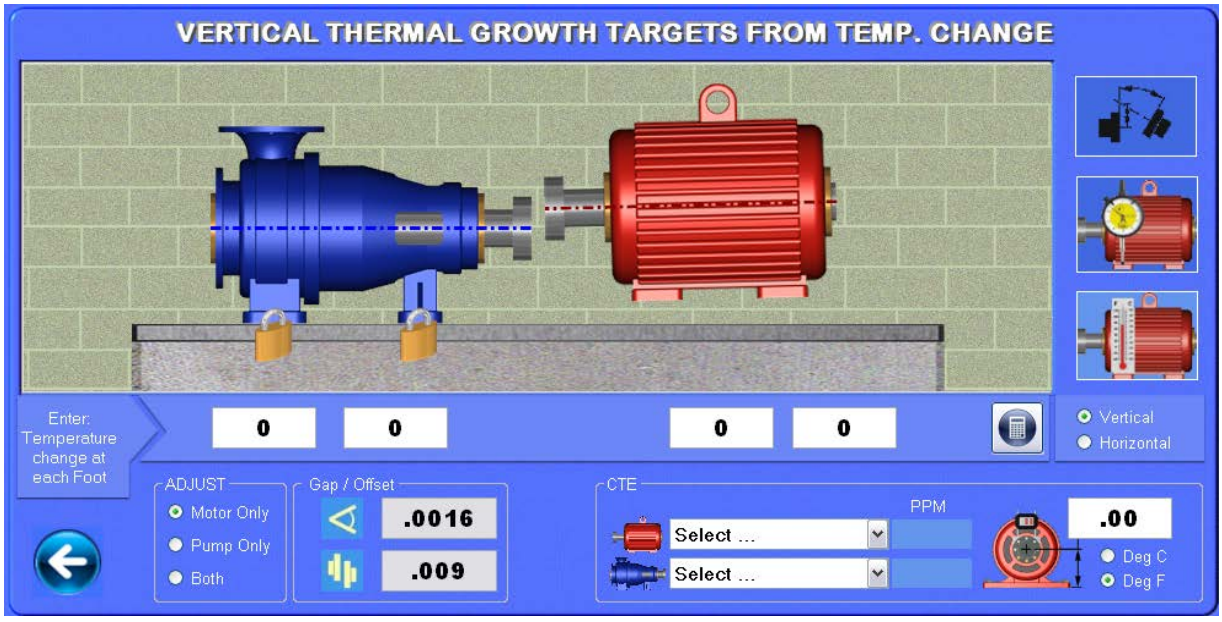


Applying Thermal Growth Offsets to the Pump (Driven Unit) side of Alignment

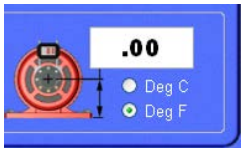


Click to apply the TG offsets to either the Vertical or Horizontal Axis.

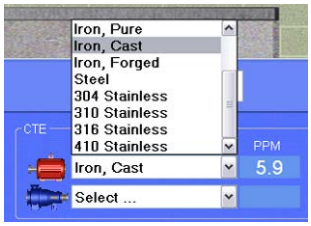
Calculating Thermal Growth Values Using Foot Temperature Changes



Thermal growth offset values can be calculated at the feet of either the pump (driven unit), the motor, or both by entering the temperature change at each foot, the dimension of the shaft centerline from the machine base, and choosing the type of metal for each unit.



Enter the height from machine base to shaft centerline and select the units for the temperature change.



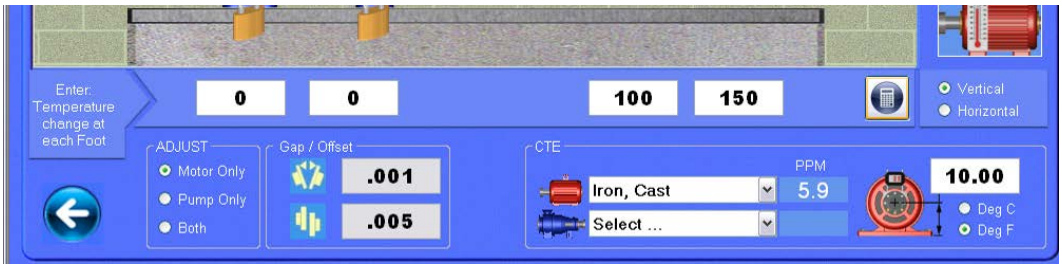
Select the metal type for motor or pump (driven unit).

Enter the temperature change (degrees F or C) in the front and back feet.

Click the **Calculator** icon to calculate the TG values at the coupling.

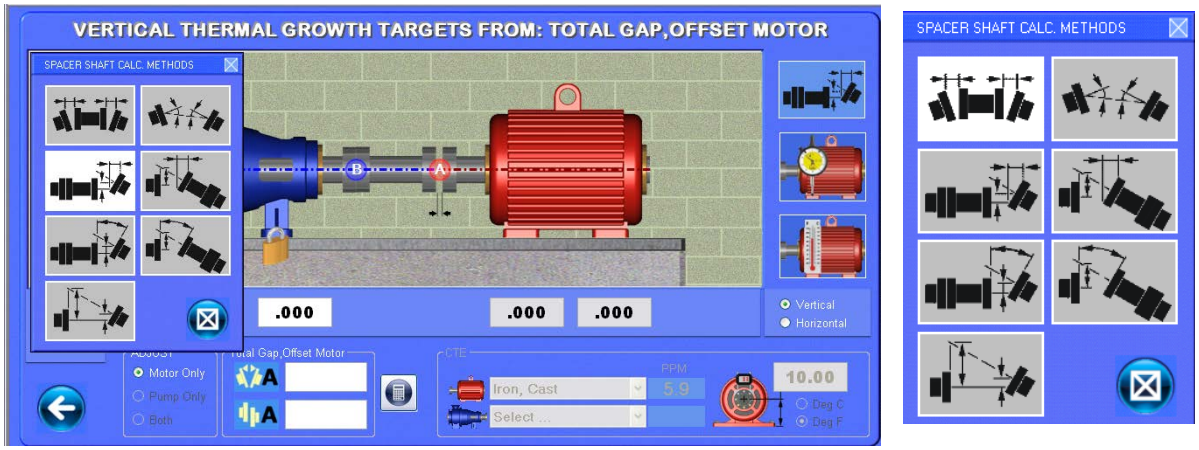
Click to switch to **TG at the Feet Mode** to view the foot values calculated with the TG Calculator.

In the example below, 100° F was entered in the front foot, 150 ° F in the back foot, 10" as the height of the shaft from the base, and Iron (cast) was selected as the material type. This was converted to a gap of .001" and an offset of .005".



Clicking the **TG at the Feet** icon indicates the values at the feet are .006" in the front and .009" in the back.

Thermal Growth – Spacer (Jack) Shafts

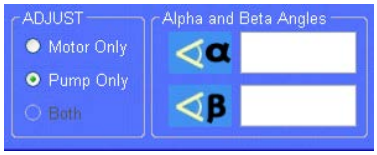


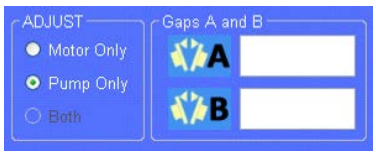
Note: Step 4 *shows the misalignment in Gap A/Gap B format only.*

The text in the **Coupling Values Display** box updates with the selected format type to confirm the selection.

Spacer Shaft Formats

There are 7 different formats to choose from for Spacer (Jack) shaft applications. Click the **TG Offset at the Coupling** icon to bring up the **Spacer Shaft Calc Methods** popup box. When using the **TG at the Foot Mode** or the Thermal Growth Temperature Calculator, Couple6 converts the foot values to the selected Spacer Shaft format coupling values. The offsets are applied to the misalignment values in **Step 5** in the same format that is chosen here.

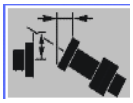




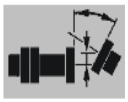
Gap A/Gap B
This format shows the misalignment as a gap at Coupling A (motor side) and gap at Coupling B (pump side).

Alpha and Beta Angles
This format shows the misalignment as a combination of an angle (Alpha) of the motor to the spacer shaft and an angle (Beta) of the spacer shaft to the pump.

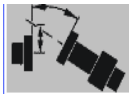
Total Gap - Offset Right
This format shows the misalignment at the right (motor) coupling only in Gap/Offset format.



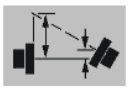
Total Gap - Offset Left
This format shows the misalignment at the left (pump) coupling only in Gap/Offset format.



Total Angle - Offset Right
This format shows the misalignment at the right (motor) coupling only in Angle/Offset format.



Total Angle - Offset Left
This format shows the misalignment at the left (pump) coupling only in Angle/Offset format.



Offset A – Offset B
This format shows the misalignment as an offset at Coupling A and an offset at Coupling B.

Saving Offsets and Closing the TG Screen

To save (apply) the TG offsets to the alignment in **Step 5**, click the back arrow to return to **Step1: Dimensions**.

Step 2: Mount Laser and Target

Step 2: Laser Setup – Coarse Adjusting the Laser and Target

Figure 30 – *Laser beams not aligned (left); Laser beams aligned (right)*

The alignment system comes with a dust cover/alignment tool. With the dust cover attached and the target installed on its bracket, slide the laser over the bracket posts until the laser beams line up with the holes in the dust cover (see **Figure 30**). For the horizontal axis, adjust the wheel on the front of the laser until the beams "disappear" into the holes. This should align the laser beams to +/- .030" (0.75 mm).

Step 2: Laser Setup – Initial Alignment, Adjust Target and Laser

Checking and Centering the Laser Beams

The Vertical and Horizontal Center numbers indicate the location of the laser beam on the target and how close it is to the electronic center of the target. To maximize the 1" (25.4 mm) measurement range of the sensor, (the amount of misalignment the sensor can detect) the values should be less than ± .040" (1 mm). However, the system can still be used with centering values greater than +/- .040" (1 mm).

Note: *For maximum measurement accuracy, ensure the V and H values are within ± .040" (1 mm).*

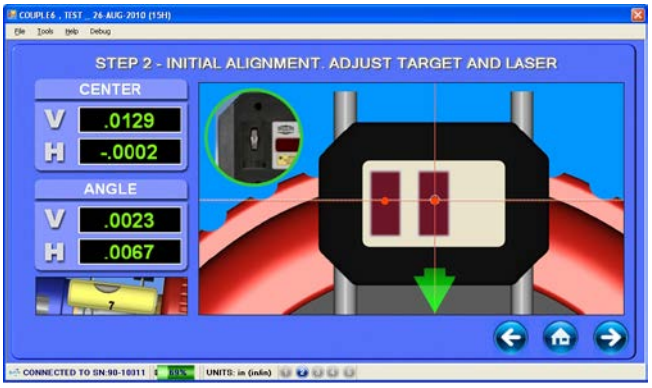


Figure 31 – *Step 2: Laser Setup, Center and Angle adjustment*

Vertical Adjustment

If the Vertical Laser Centering is not in tolerance, adjust the laser up or down on the posts until the V display is less than +/- .040" (1 mm). The **Center** and **Angle** display and the target "cross hair" graphic updates automatically as the target is moved in either axis. The dotted white line indicates the center of the target.

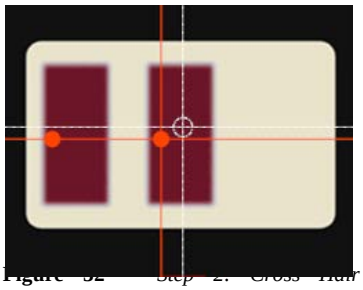


Figure 32 – *Step 2: Cross Hair alignment indicator*

A large arrow displays on the face of the target graphic to illustrate which direction to move the target in the vertical axis (see **Figure 33**). The color of the arrow changes from *red* (< +/- .040" or 1 mm) to *yellow* (between .040" and .020") *or green* (between .020" and .010") to indicate how far from center the laser beam is. A *yellow* or *green* arrow indicates the setup is in tolerance. If the arrow graphic disappears, the target setup alignment is less than .010" (0.25 mm).

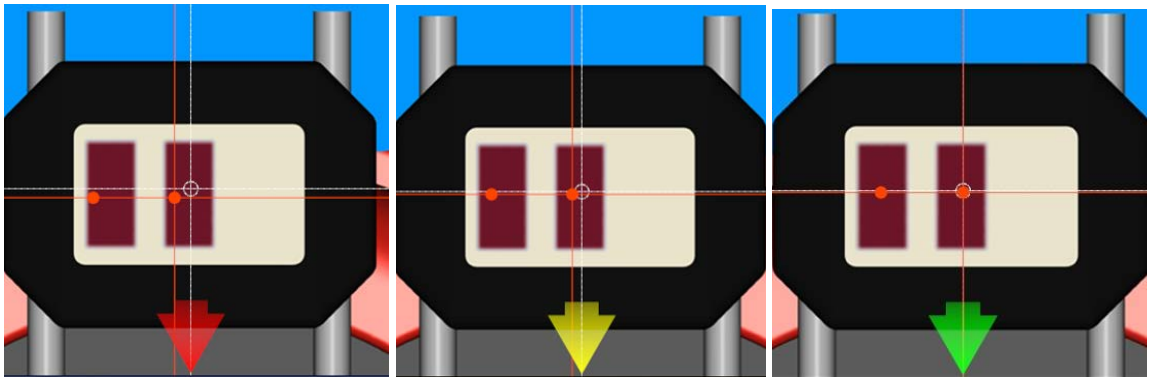


Figure 33 – *Vertical Target Adjustment showing color-coded arrows*

Horizontal Adjustment – T-1290 5-Axis Target Only

The T-1290 5-Axis Target (S-680) has a horizontal axis in addition to the vertical axis. When using the T-1290, the horizontal axis can be adjusted in **Step 2**. If the Horizontal Laser Centering is not in tolerance, adjust the wheel on the laser until the value is less than ± .040" (1 mm). An arrow displays on the target graphic near the horizontal adjustment wheel to show which direction to turn the wheel. The arrow changes color in the same way described for the Vertical Adjustment.

For the T-1285 target, use the dust cover/alignment tool to help align the horizontal axis (see **Figure 30**) by loosening the laser bracket and rotating it until the laser dots go into the alignment holes on the dust cover.

Step 2: Laser Setup – Vertical and Horizontal Angle

For applications with less than 5 feet between laser and target

Vertical and Horizontal Angular displays show the angle (slope) of the target relative to the laser. The values are displayed in in/inch or mm/100mm. These values are the *approximate* angular misalignment values of the motor relative to the pump (stationary unit). These are not the true angular misalignment values because of bracket mounting errors, mostly due to the dirty, poorly machined mounting surfaces of most shafts. For most alignments, where the distance between laser and target is less than 5 feet (1.5 M), Vertical and Horizontal values up to .015 in/inch (1.5 mm/100 mm) are allowable. A *green* display indicates the values are in angular tolerance, where a *red* display indicates out of tolerance.

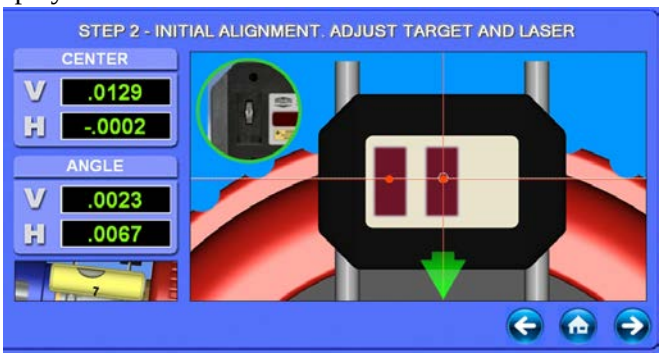


Figure 34 – *Step 2: (Laser Setup, angular view)*

For applications with more than 5 feet between laser and target

If the distance between laser and target is greater than 5 feet (1 M), *roughly* align the motor in angle (gap) so the angular values are closer to .010 in/inch (1.0 mm/M). This is to avoid the laser moving off the target during the data taking rotation in Step 4. The larger the distance between laser and target, the lower these values should be.

Rough Alignment for New Motor Installation

The Angular Displays can be used to roughly align a new motor during installation. The values are in in/inch, so it is easy to calculate the shims to roughly align the motor. For example, if the Vertical angular value is .010", the back of the motor is higher than the front by .010 in/inch. If the distance between front and back feet is 5 inches, simply add .050" (.010 in/inch * 5 in = .050 in/inch) of shim to the front feet (or remove that amount from the back feet) to roughly align the motor in the Vertical Axis.

Note: *After adding shim, the target may no longer detect the laser. Adjust the target or laser up or down on the posts until the target detects the laser.*

Higher Accuracy Rough Alignment

For a more accurate Rough Alignment, do the following:

Vertical Axis

1. Set the laser/target at 12:00 and note the *vertical* angle value.
2. Rotate the laser/target to 6:00 note the vertical angle value.
3. Average the 12:00 and 6:00 values. This is the true vertical angular misalignment.
4. Multiply the averaged angular value by the C Dimension and add/subtract shim as needed.

Horizontal Axis

1. Set the laser/target to 3:00 and note the *vertical* angle.
2. Rotate the laser/target to 9:00 and note the *vertical* angle.
3. Average the two readings. This is the true horizontal angular misalignment.
4. With the target at 9:00 or 3:00, adjust the motor until the vertical angle display is equal to the number calculated in **Step 3**.
   Note: *This technique may be used to align the offsets using the Center display in* **Step 2**, *but the angular alignment must be completed first.*

Step 3: Soft Foot Check

Soft Foot is a condition where the four feet of the motor are not parallel to the machine base. This causes the motor casing to distort in an unpredictable way when all four bolts are tight. What usually happens when a motor has soft foot is that the motor appears to be aligned in **Step 5**, but when the data is re-taken, the motor is still misaligned. This continues until the soft foot is detected and corrected.

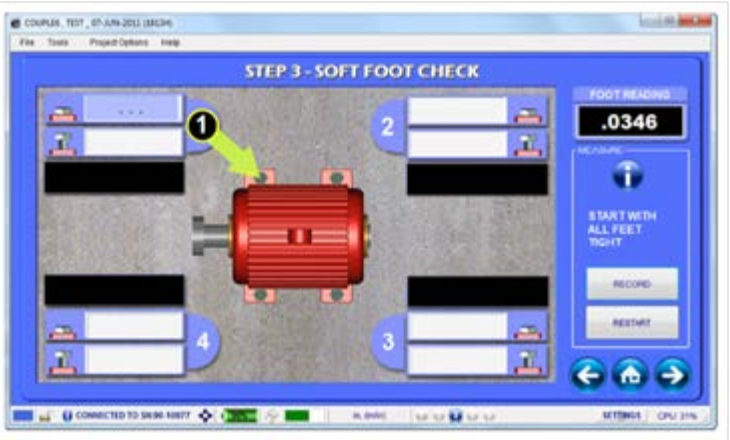


Figure 35 –*Step 3: Soft Foot Check*

The Soft Foot Check program can detect most soft foot problems; however. it cannot detect problems such as:

- **Rigidly Mounted Couplings:** where the coupling does not allow much shaft movement. It is difficult to detect soft foot at the shaft with any laser system, so it is better to use indicators or feeler gauges.
- **Angular Soft Foot (bent foot):** Couple6 may detect an angular soft foot problem, but it typically cannot recommend the proper solution.

Foot Reading Display

A live display shows the Vertical Offset Value projected to the foot. Couple6 uses the V-Offset and V-Angle to calculate the foot value.

Tight Foot

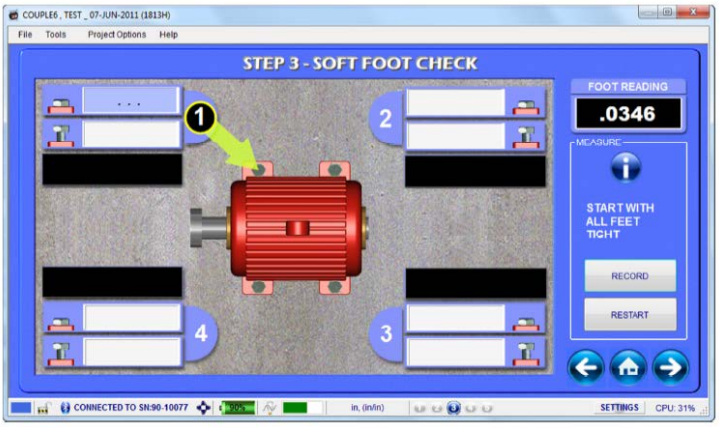
Records the value for the foot when the bolt is tight.

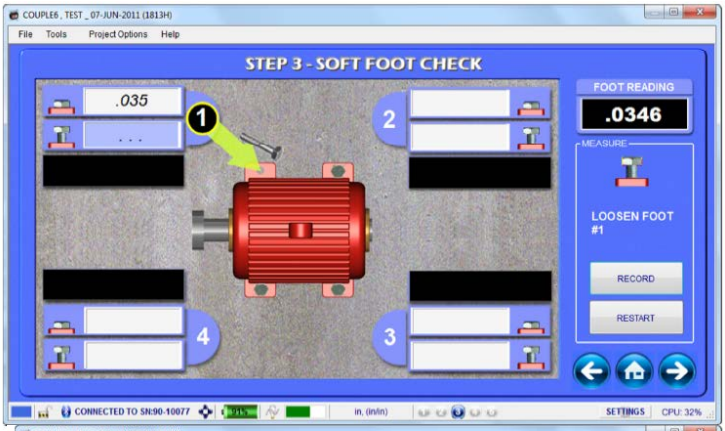
Loose Foot

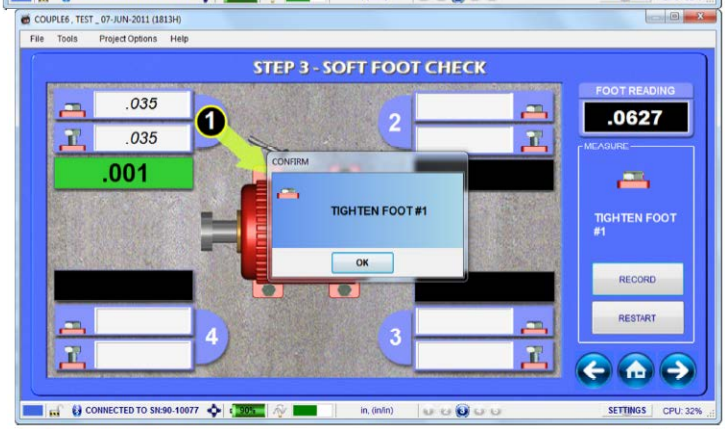
Records the value for the foot when the bolt is loose.

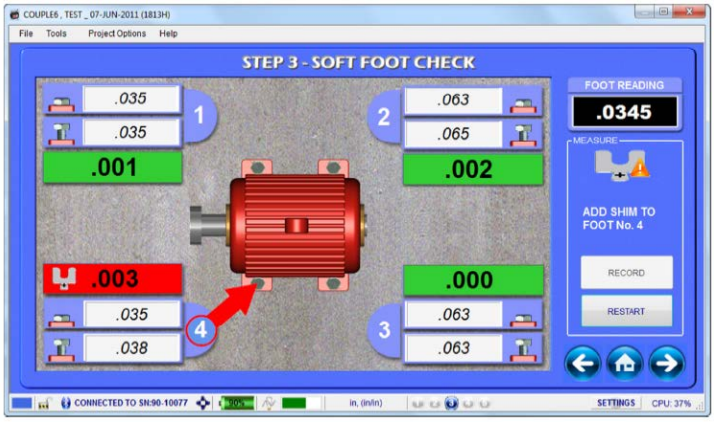
Soft Foot Procedure

1. Beginning with Foot 1 (a *yellow* arrow points to motor foot to indicate which foot Couple6 is ready to record), press the **Spacebar** or click **Record** to record the *Tight* Value. Dashes on the upper readout indicate that the application is waiting for the user to press **Record** to save the Foot 1-tight condition.
2. Loosen the bolt and wait five seconds, then press the **Spacebar** or click **Record** to record the *Loose* Value.
3. When both values are recorded and displayed (with numbers other than zero), click **OK** in the **Confirm** popup to go to the next foot.
   Note: *Ensure that the bolt is tightened for Foot 1 before clicking* **OK**.
4. After clicking **OK** in the **Confirm** popup, Couple6 moves to Foot 2 to take the next set of data. Repeat **Steps 1-3** until all four feet have been recorded.
5. After data for all four feet is recorded, Couple6 compares the difference between *Tight* and *Loose* values. The display is *red* if the value is out of tolerance and *green* if the value is in tolerance. The tolerance for soft foot is .0022" (0.06 mm).
6. Add the recommended shim to the foot shown with the *red arrow* and tighten all bolts.
7. Repeat **Steps 1-5** to confirm the soft-foot problem has been fixed.
8. Click the forward arrow to proceed to **Step 4**. A message displays, prompting to tighten all bolts before continuing.

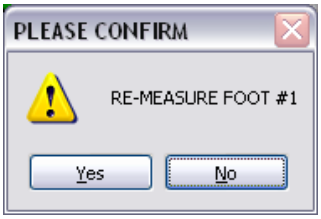








Re-Recording Data for a Single Foot



Click the data display for any foot to re-record the data. Couple6 asks for confirmation to re-measure the foot data. Click **Yes** to clear the data and re-record it.

Restarting the Soft Foot Procedure

Click **Restart** in the right-hand dialog box to erase all recorded data and start over at Foot 1.

Figure 36 – *Step 3: Completed Soft Foot check.*

Step 4: Take Data

All shaft alignment methods use some form of shaft rotation when taking data for an alignment to correct for mounting errors, which are always present due to various factors such as dirty, painted shafts. By rotating the shafts and recording the data at each point, Couple6 can measure and correct these mounting errors.

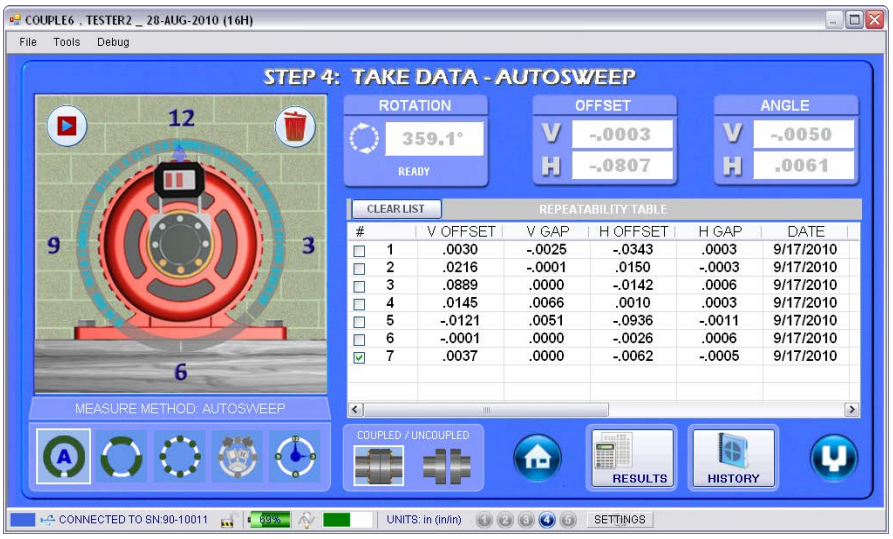


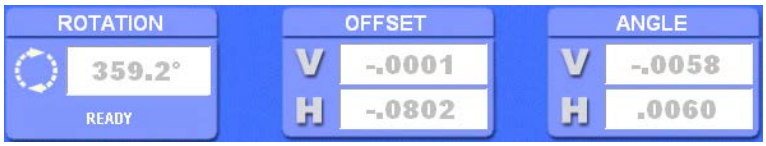
Figure 37 – *Step 4: Auto Sweep™ screen with Repeatability/History License enabled*

Couple6 uses the Vertical Offset and Vertical Angular values to calculate the misalignment of the motor shaft axis of rotation (AOR) relative to the driven unit's AOR. By using only the Vertical Axis for taking data, Couple6 is insensitive to coupling backlash and it takes a severe case of backlash to produce a measurable impact on the accuracy of the data. In almost all cases, backlash does not affect the accuracy to any measurable degree. After taking the data, Couple6 uses a sophisticated curve-fitting algorithm that determines the misalignment. The software then uses this information to calculate display offsets and applies them to the raw data to show the true misalignment.

The data in **Step 4** is taken at a rate of up to 16 readings per second. Couple6 allows up to 1,000 points to be recorded for one set of data.

Data Displays

The data displays at the top of the **Step 4: Take Data** screen show the raw values being used to record the data.



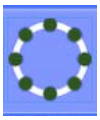
Rotation – The rotation angle of the target in degrees.
V Offset –The Vertical Axis Coupling Offset value (inches, mils or mm)
H Offset –The Horizontal Axis Coupling Offset value (inches, mils or mm)
V Angle –The Vertical Axis angular value (inches/in., inches/ft., mm/100 mm)
H Angle –The Horizontal Axis angular value (inches/in., inches/ft., mm/100 mm)

Measurement Modes

Auto Clock™ Mode (standard)
Mainly used for vertical applications where the accelerometer (measures rotation angle) cannot be used. Click one of eight clock positions, rotate the laser/target to that position, and click **Record**. A minimum of three points in a 90-degree arc is required for Couple6 to calculate results.

Auto Sweep™ (standard)
Start at any point (clock position) in the rotation of the motor and sweep to any other point. The minimum sweep that Couple6 accepts to caclulate the misalignmet results is 60 degrees, as long as the sweep (arc) crosses one of the polar coordinates (12:00, 3:00, 6:00, 9:00 or 0°, 90°, 180° or 270°). For example, if you sweep from 3 degrees to 65 degrees, Couple6 does not accept the data; however, if you sweep from 359 degrees to 60 degrees, Couple6 accepts this arc since the data crosses a polar coordinate (0 degrees).

Arc Mode™ (optional)
Start and stop at any point in the motor's rotation circle multiple times. Use this mode if there are obstructions that block the laser beam or prevent a full rotation. For example, start at 12:00 and sweep to 2:00, then start again at 4:00 and sweep to 6:00. If the arcs add up to 60 degrees and one of them crosses a polar coordinate, Couple6 accepts the set of data and calculates alignment results.



Point Mode (optional)
Rotate laser/target to any clock position in the motor's rotation and click **Record** to take a data point at that location. A minimum of five points is needed, with one point within 10 degrees of a polar coordinate for Couple6 to calculate the misalignment results.

Uncoupled Mode (optional)
For uncoupled applications, rotate the laser to any clock position and then slowly sweep the target past the laser. Couple6 automatically records a data point. A minimum of five points is needed, with one point within 10 degrees of a polar coordinate for Couple6 to calculate the misalignment results.

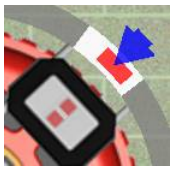
Step 4: Take Data – Auto Clock™ Mode

Auto Clock™ Mode is the primary data taking mode for the S-660 System. It allows the user to record up to eight data points. When the laser/target are rotated to a clock location, Couple6 *automatically* rotates the target icon to match the clock position.

Click the **Clock** icon to enable **Auto Clock™ Mode** and then click **Record** to start the program. To record alignment data, rotate the laser and target together (see Page **91** for uncoupled shafts) to a clock location until the white areas turn green (see **Figure 38**). Click **Record**. Repeat until at least three points are taken (five points are preferred). For high tolerance alignments, record eight points. Try to leave the laser/target at 12:00 when finished recording data.

Note: *It is not required to leave the laser/target at 12:00, but this is the preferred method. If the laser/target are left at any other location, Couple6 automatically rectifies the readings in* **Step 5** *so that it appears that the laser/target are at 12:00.*

When the target is in the data-taking range for that point, a blue arrow appears, indicating Couple6 is ready to take a data point.



When a data point has been recorded, the white areas partially fill with a color-coded mark to indicate the data point has been recorded (see **Figure 39**). The color of the mark indicates the quality of the data. If you do NOT see a color-coded mark after pressing **Record**, try rotating the laser/target a little more toward the center of the white area.

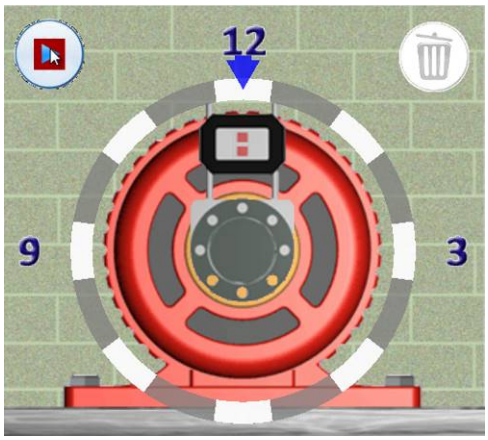


Figure 38 – *To record data, rotate laser/target until the blue area appears in the white areas*

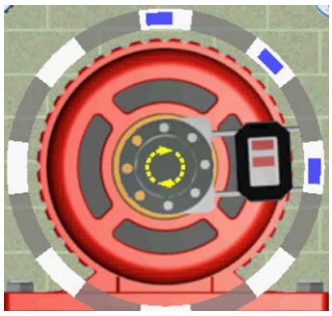


Figure 39 – *Recorded data point*

When the data point indicators turn dark blue, the minimum amount of data has been taken. Red indicates that insufficient data has been taken. Light blue indicates the data quality is good. Green indicates the data quality is excellent.

To re-record a data point, rotate the laser/target to a clock position and click **Record**. Couple6 records *over* the data point.

When you are ready to see the results, click **Done**.

Step 4: Take Data – Auto Sweep™ Mode

To record alignment data in **Auto Sweep™ Mode**, rotate the laser and target together (must be coupled) to sweep an arc of data. Start or stop at any clock location if there is a minimum 60-degree sweep. Accuracy can be affected if a sweep of less than a 360° is taken, although the decline in accuracy does not become significant until the sweep arc is close to 90°. If using the S-680, we recommend leaving the laser/target at 12:00 when finished rotating, although this is not required. If the laser/target are left at any other location, Couple6 automatically rectifies the readings in **Step 5** so that it appears that the laser/target are at 12:00.

Auto-Start Mode

If ***Auto-Start*** is enabled, Couple6 automatically begins taking data when the target's rotation sensor detects rotational movement greater than 5°. The target transmits data at a very high rate (up to 16 readings per second).

Note: *To enable* **Auto-Start Mode**, *uncheck* **Auto Sweep™ requires manual Start/Stop** *(the default setting) in the* **Preferences** *(settings) screen.*

Manual Start Mode

For applications where there is excess vibration, it is recommended that Auto Sweep™ be put into **Manual Start Mode**. This mode requires the user to click the **Play** button (or press the spacebar) to start the data taking process.

After finishing the sweep, Couple6 automatically detects that target rotation has stopped and processes the data. The **Accept** screen displays, showing the misalignment results.

Note: *If excess vibration exists, the rotation sensor thinks it is still rotating and the* **Accept s***creen does not display. In this case, click the* **Stop Sign** *icon (or press the* **Spacebar***) to force Couple6 to stop taking data and start the calculation process. Within a few seconds, the* **Accept s***creen displays with the results.*

Accept Measurement Results Screen

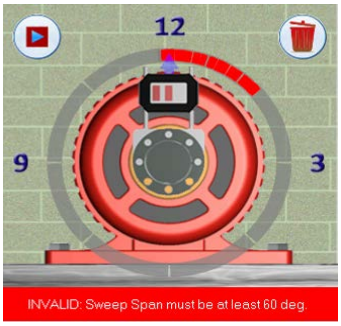
After Couple6 completes taking data, the **Accept Measurement Results** screen displays. Click **Accept** to accept the sweep data and Couple6 adds it to the Repeatability Table. Click **Repeat** to accept the data and add it to the Repeatability Table, clear the rotation data from Auto Sweep™, and return to take another set of data. Click **Reject** to erase the set of data and return to Auto Sweep™ to take a new set of data.

The coupling icons show the misalignment at the coupling. The left half of the coupling is the pump (stationary unit).

Figure 40 – *Accept Measurement Results Screen for S-670: Basic License on left and Results Screen for the S-680 with Repeatability/History License enabled on the right.*

Measurement Data Point Indicator

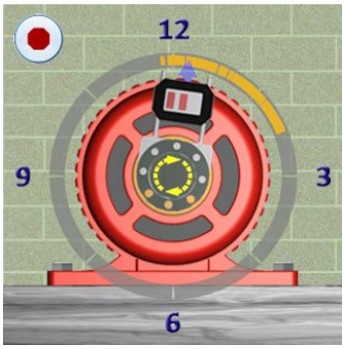
The **Measurement Data Point Indicator** displays how much data Auto Sweep™ has taken during the current sweep. Each data point is represented by a line in the circular indicator area. The data points are displayed in several different colors to indicate *insufficient*, *acceptable*, *good*, *very good* and *best* sets of data.



Insufficient Data

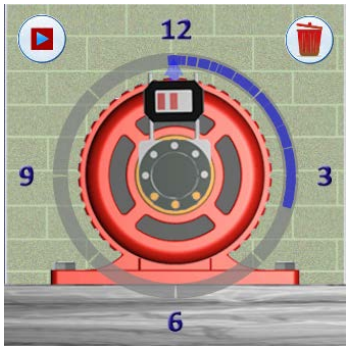
An insufficient set of data displays as *red lines* in the circular Data Point Indicator display. This means either less than 60° of data was taken or the data did not cross a polar coordinate (12:00, 3:00, 6:00 or 9:00).

Note: *Couple6 allows the data to be calculated down to a 40-degree arc of data. The dots are still red, but if you click* **Stop**, *it calculates the results. This should only be used in extreme cases where no other data can be taken.*



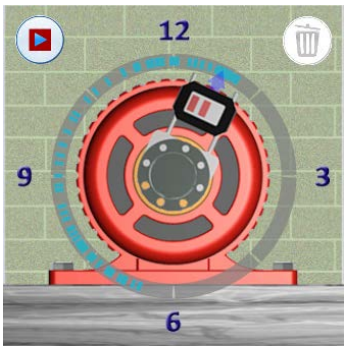
Acceptable Data

Acceptable data is represented by *orange lines* in the Data Point Indicator. This means the amount of data collected is acceptable but not optimum, since it is always best to collect 360° of data. *Acceptable* data indicates that more than 60° but less than 90° of data was taken and the data crossed a polar coordinate (12:00, 3:00, 6:00 or 9:00).



Good Data

When the Data Point Indicator turns *dark blue*, a good set of data has been taken. This indicates that more than 90° but less than 180° of data was taken. This produces more accurate alignment results than a set of Acceptable Data.



Very Good

When the sweep data exceeds180° but is less than 270°, Couple6 turns the Data Point Indicator *light blue* to indicate a very good set of data.

Note: *For high-RPM applications, we strongly recommend that 360° of data be taken.*

Best Data

When the sweep data exceeds 270°, Couple6 turns the Data Point Indicator *green* to show the best set of data. While it is ideal to record 360° of sweep data for the highest accuracy, for most lower-RPM applications the reduction in accuracy (of less than 270° but more than 180° of data) is minimal.

Note: *For high-RPM applications, we strongly recommend that 360° of data be taken.*

Accepting the Measurements

Reject Button

Click **Reject** to erase the current set of data, return to the data taking screen (**Auto Sweep**™, **Point Mode**, **Uncoupled**, etc.) and re-record the data.

Repeat Button

Click **Repeat** to save the set of data in the *Repeatability Tab* and return to the **Auto Sweep**™ screen to take another set of data.

Note: *The Repeat button is not activated unless the Repeatability/History license key has been purchased.*

Accept Button

S-680/S-670 Repeatability/History License - Click **Accept** to save the current set of data and go to the *Repeatability Tab* to compare the results to other sets of data taken.

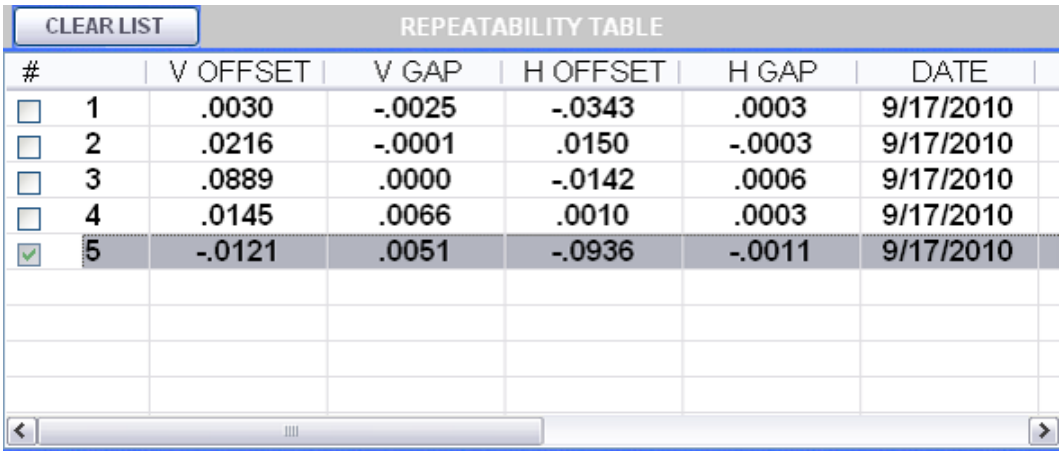
S-670 Basic License - If the Repeatability/History license has not been purchased, the **Accept** button saves the data into the Repeatability Table. However, only one set of data can be recorded.

Excess Backlash Detector (S-680 T-1290 Target Only)

If **Excess Backlash Detected** displays at the bottom of the Measurement Results Screen, Couple6 has detected excess backlash in the coupling. This could cause problems aligning the Horizontal Offset in the **Move** screen because the T-1290 (or *any* other laser alignment system) cannot detect the difference between a Horizontal Offset Move and a slight rotation of the motor shaft relative to the pump shaft.

When aligning a motor with this condition, a message displays in the **Step 5: Move Screens** if Couple6 detects a >3° rotational move. The message directs the user to rotate the laser/target to 3:00 or 9:00 for the Horizontal Move or retake the data and leave the laser/target at 3:00 or 9:00.

Step 4: Take Data – Repeatability Table

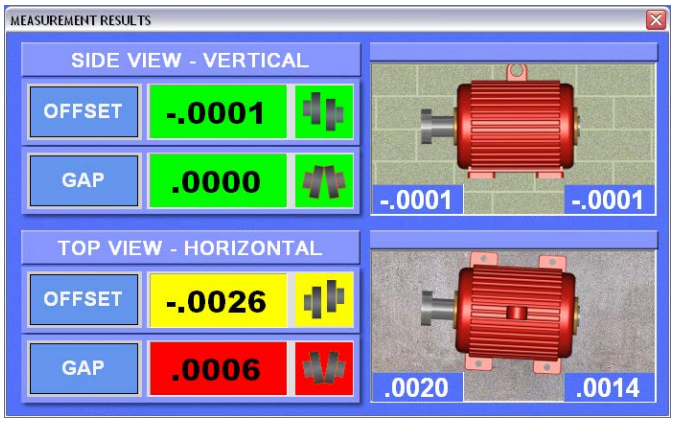


#	V OFFSET	V GAP	H OFFSET	H GAP	DATE
1	.0030	-.0025	-.0343	.0003	9/17/2010
2	.0216	-.0001	.0150	-.0003	9/17/2010
3	.0889	.0000	-.0142	.0006	9/17/2010
4	.0145	.0066	.0010	.0003	9/17/2010
5	-.0121	.0051	-.0936	-.0011	9/17/2010

When data is recorded in any of the data taking modes *(***Auto Sweep™ Mode, Arc Mode™, Point Mode, Uncoupled Mode,** or **Auto Clock™ Mode***)*, click **Accept** to store the misalignment data in the *Repeatability Table*. Couple6 can store results for up to 99 alignment results in the *Repeatability Table* if the Repeatability/History License Key has been purchased.

Viewing Measurement Results with Tolerances

To view the alignment results against the alignment tolerances, click the set of data to view and highlight the row. Click **Results** to display the **Measurement Results** window, showing the alignment results for both the Vertical and Horizontal axes and whether the alignment is in or out of tolerance. The shim values are also displayed near the front and back feet of the motor.



Data Display Colors

The color of the data displays changes to reflect values that are in or out of tolerance, as defined in **Step 1**.

A red display box indicates the alignment value is greater than the *Acceptable Tolerance* (see *Step 1: Setting Up a New Machine – Tolerances Table* on Page 56).

A yellow display box indicates the alignment value is less than the *Acceptable Tolerance* but greater than the *Excellent Tolerance*.

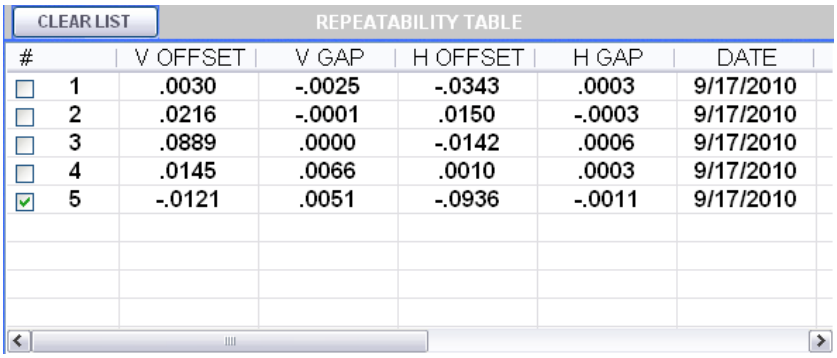
A green display box indicates the alignment value is less than the *Excellent Tolerance*.

Selecting Results for Step 5: Move Screens

A single set of data or an average of multiple sets of data can be selected from the **Repeatability Table** to use in the **Step 5: Move Screens**.

Single Set of Results
Click the checkbox next to a set of alignment results (see **Figure 41**) for Couple6 to use for the **Move** screens.

Warning: ***Only the alignment results from the current session can be used in the Move screens. Choosing previously recorded data can produce incorrect results.***



#	V OFFSET	V GAP	H OFFSET	H GAP	DATE
1	.0030	-.0025	-.0343	.0003	9/17/2010
2	.0216	-.0001	.0150	-.0003	9/17/2010
3	.0889	.0000	-.0142	.0006	9/17/2010
4	.0145	.0066	.0010	.0003	9/17/2010
5	-.0121	.0051	-.0936	-.0011	9/17/2010

Figure 41 – *Selecting a single set of results*

Multiple Sets of Results
Click the checkboxes next to multiple sets of alignment results (see **Figure 42**) for Couple6 to average the values selected. This average is preceded by an **A** and Couple6 uses these average values for the **Move** screens.

#	V OFFSET	V GAP	H OFFSET	H GAP	DATE
1	.0030	-.0025	-.0343	.0003	9/17/2010
2	.0216	-.0001	.0150	-.0003	9/17/2010
3	.0889	.0000	-.0142	.0006	9/17/2010
4	.0145	.0066	.0010	.0003	9/17/2010
5	-.0121	.0051	-.0936	-.0011	9/17/2010
6	-.0001	.0000	-.0026	.0006	9/17/2010
A...	.0228	.0029	-.0273	.0001	9/17/2010

Figure 42 – *Selecting multiple sets of results*

Opening the Step 5: Move Screens

Once the data set has been selected, click **Move** (shim icon) to go to the **Step 5: Move Screens** and begin the alignment process.

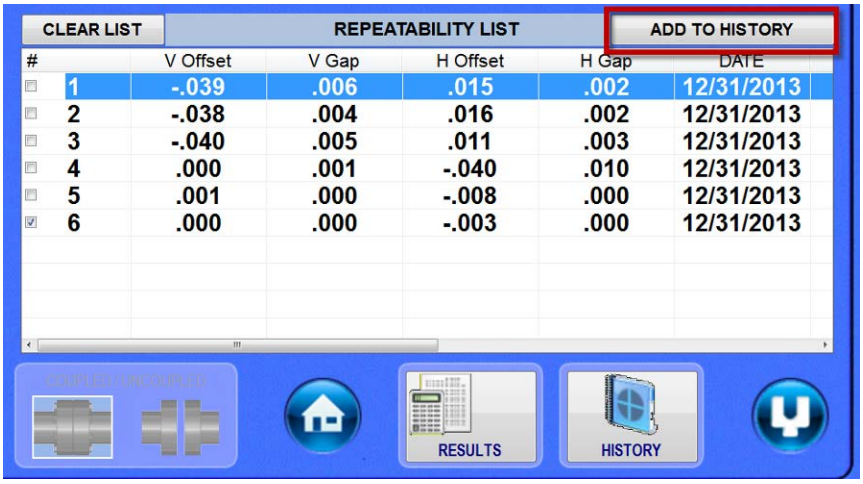
Deleting/Archiving Data Points in the Repeatability Table

To delete data:
Right-click the row of data (or press and hold the row of data on the touch screen) and click **Delete.**

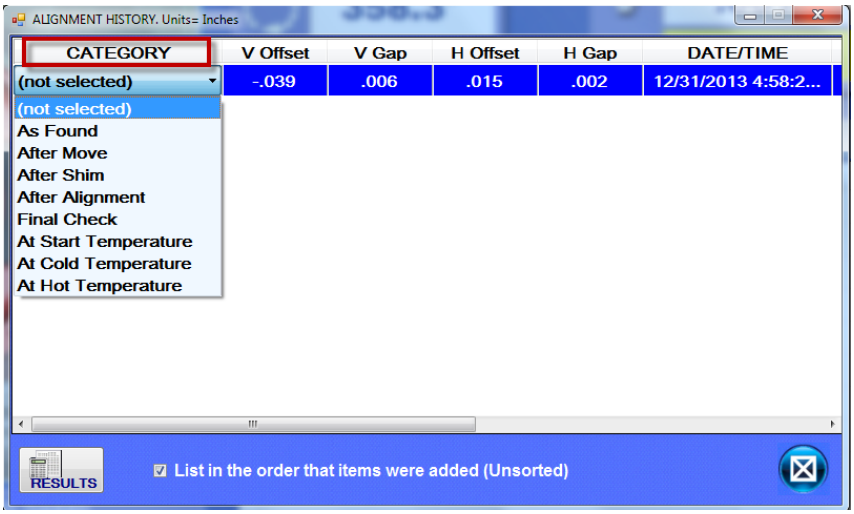
To archive data:
When archiving data, the data is saved but cannot be used for averaging sets of data or for the **Move** screens. Data should be archived only *after* an alignment is completed. See *Archiving Data Points* on Page **83** for the archiving procedure.

Archiving Data Points

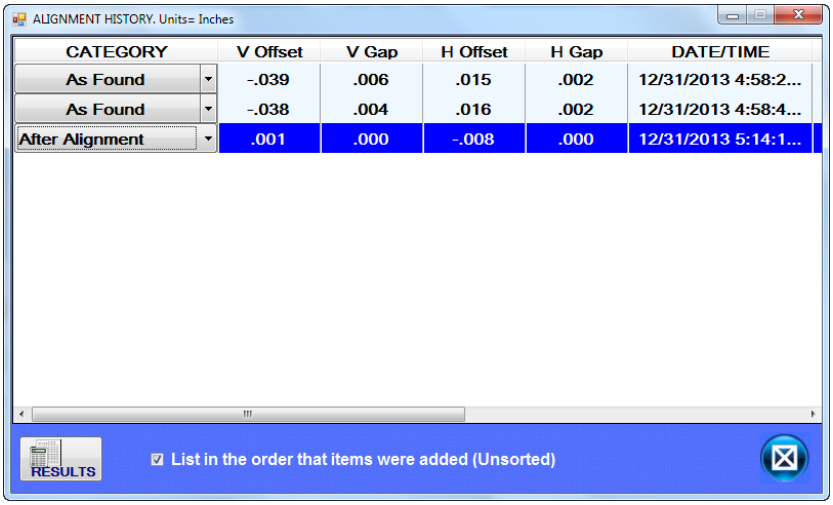
To archive a data point and save it to the History Table, click or tap a line of data in the **Repeatability Table** to highlight it Click or tap **Add to History.**



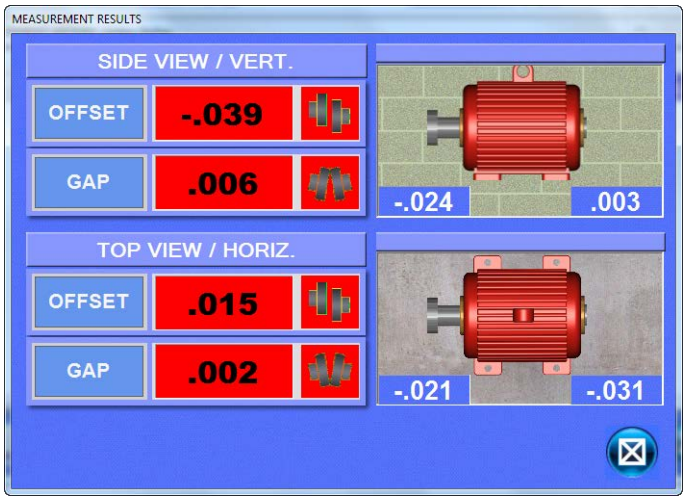
The **History Table** displays with the data set already loaded. Choose a **Category** from the dropdown list (As Found, After Move, etc.) to identify it.



You can repeat this process for more sets of data and add up to 100 sets to the **History Table**. When a report is printed, the **History Table** prints showing all the data.



To view a set of alignment data, shims and moves with tolerances applied, click **Results** to open the **Measurement Results** screen.



Click **Close** to close the **Measurement Results** screen. Click **Close** again to save the data point to the **History Table** and close the window.

Other Information in the Repeatability/History Tab

TIME	SPAN	POINTS	MODE	METHOD
4:37 PM	179.5°	128	COUPLED	AUTOSWEEP
4:37 PM	220.6°	138	COUPLED	AUTOSWEEP
4:37 PM	210.4°	125	COUPLED	AUTOSWEEP
4:38 PM	242.0°	154	COUPLED	AUTOSWEEP
4:38 PM	232.0°	113	COUPLED	AUTOSWEEP
4:52 PM	151.1°	108	COUPLED	AUTOSWEEP
5:42 PM	208.9°	125	COUPLED	AUTOSWEEP

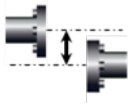
Move the scrollbar to the right to view other information in the Repeatability Tab.

Time: Indicates the time the data was taken.
Span: Indicates the total number of degrees of rotation for **Auto Sweep**™ or **Arc Mode**™.
Points: Indicates the number of data points taken in an alignment set.
Mode: Indicates the measurement mode used for the set of data.
Method: Indicates the measurement method used for the set of data.

Clearing Data from the Repeatability Table

To clear *all* the data from the Repeatability table, click **Clear List**.

Measurement Results Definitions



V Offset: the amount of parallel misalignment of the coupling in the Vertical Axis
H Offset: the amount of parallel misalignment of the coupling in the Horizontal Axis

V Gap: the amount of angular misalignment (gap) in the coupling in the Vertical Axis.
H Gap: the amount of angular misalignment (gap) in the coupling in the Horizontal Axis.

Interpreting Misalignment Values Signs (+ or -):

- ***Negative V Offset*:** the motor coupling is *below* the pump coupling. **(1)**
- ***Positive V Offset:*** the motor coupling is *above* the pump coupling. **(2)**
- ***Negative V Gap*:** the gap is at the *top* of the coupling (front feet are *above* the back feet). **(4)**
- ***Positive V Gap*:** the gap is at the *bottom* of coupling (front feet are *below* the back feet). **(3)**
- ***Negative H Offset*:** the motor coupling is to the *left* of the pump coupling when looking from the pump *into* the motor. **(2)**
- ***Positive H Offset*:** the motor coupling is to the *right* of the pump coupling when looking from the pump *into* the motor **(1)**.
- ***Negative* H Gap:** the gap is on the *right* side of the coupling when looking from the pump *into* the motor (the front feet are to the *right* of the back feet). **(3)**
- ***Positive* H Gap:** the gap is on the *left* side of the coupling when looking from the pump *into* the motor (front feet are to the *left* of the back feet). **(4)**

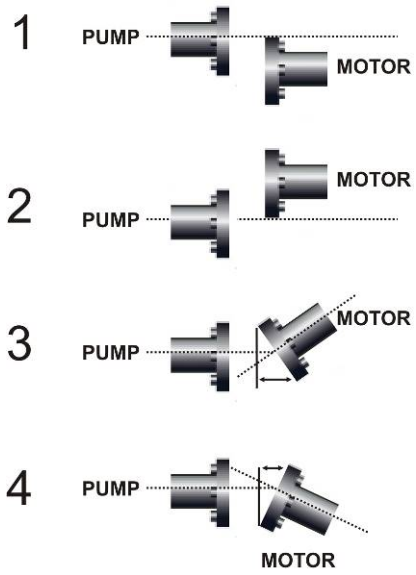
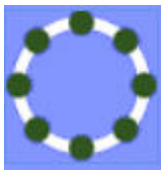


Figure 43 – *Interpreting Misalignment Values*

Step 4: Take Data – Point Mode



When using **Point Mode** for horizontally mounted motors, the laser and target can be rotated to any point in a circle and a data point can be recorded by clicking **Record** or pressing the **Spacebar**. At least four points are needed in a 60° arc to obtain valid results. For good results, take at least seven points in at least a 180° sweep arc. For the best results, take at least nine points in at least a 270° sweep arc.

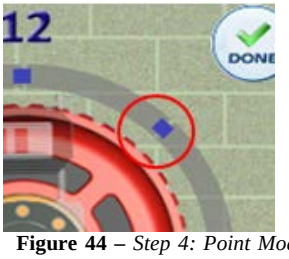


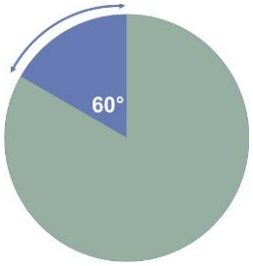
Figure 44 – *Step 4: Point Mode showing a data point on Data Point Indicator*

Procedure

1. Rotate the laser/target to any point in the circle.
2. Click **Record** or press the **Spacebar** to record the data point.
3. A single point appears in the *Data Point Indicator* for each point recorded. Rotate to another clock position and repeat **Steps 2** and **3**.
4. Keep taking data points until the desired number of points and the sweep arc (90°, 180°, etc.) are achieved.
5. Leave target at any clock position when done, although12:00 is preferable.
6. For best results, make sure to include several points in between 12:00 and 3:00 and 6:00 and 9:00.
7. When finished, click **Done** to display the **Accept Measurement Results** screen.

Note: *The laser/target do not have to be left at 12:00, but this is the preferred method. If the laser/target are left at any other location, Couple6 automatically rectifies the readings so that it appears that the laser/target are at 12:00.*

See Page 78 for a description of the **Accept Measurement Results s**creen**.**



Using Point Mode for Uncoupled Alignment

While it is preferable to use **Uncoupled Mode** for doing uncoupled-shaft alignments, **Point Mode** may be used to take data for uncoupled shafts by following this procedure:

S-660 System (T-1280 3-Axis Target)

1. Rotate the laser to 3:00 and hold in place.
2. Slowly rotate the target until the laser beams disappear into the window (or are centered in the window) as shown at right. In the top picture, the laser lines are too far to the left. In the bottom picture, the laser lines are centered in the window. Support the target and laser so they remain steady.

3. Click **Record** or press the spacebar to record the data point.
4. Repeat **Steps 2** and **3** for the 6:00, 9:00, and 12:00 clock positions.
5. Record at least one more data point at any rotation angle. For best results, include several points in between 12:00 and 3:00, and 6:00 and 9:00. The same minimum number of points described for Point Mode for Horizontally Mounted Motors (see Page 86) is required.

6. When finished taking data, click **Done** to display the **Accept Measurement Results** screen.

When ready to proceed to **Step 5: Move Screens**, ensure the target is at 12:00. Use the alignment tool to line up the laser and target as described in **Step** 2, then remove the tool and click the **Shim** icon.

See Page 78 for a description of the **Accept Measurement Results s**creen**.**

S-670 System (T-1285 3-Axis Target)

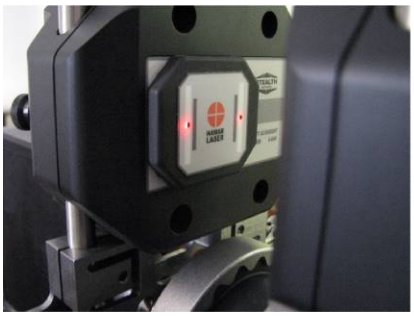


Figure 45 -- *Aligning laser beams with S-670 to take uncoupled shaft data in Point Mode using the dust cover/alignment tool.*

1. Rotate the laser to 3:00 and hold in place.
2. Attach the dust cover / alignment tool to the target. Slowly rotate the target until the laser beams align to the holes on the alignment tool (see **Figure 45**). Support the target and laser so they remain steady.
3. Remove the alignment tool and click **Record** or press the spacebar to record the data point.
4. Repeat **Steps 2** and **3** for the 6:00, 9:00 and 12:00 clock positions.
5. Record at least one more data point at any rotation angle. For best results, include several points in between 12:00 and 3:00 and 6:00 and 9:00. The same minimum number of points described for **Point Mode for Horizontally Mounted Motors** (Page 86) is required. When finished taking data, click **Done** to display the **Accept Measurement Results** screen.

6. When ready to proceed to the **Step 5: Move Screens**, ensure the target is at 12:00. Use the alignment tool to line up the laser and target as described in **Step 2**, then remove the tool and click the **Shim** icon.

See Page **78** for a description of the **Accept Measurement Results** screen**.**

S-680 System (T-1290 Target)

1. Rotate laser to 3:00 and hold in place.
2. Slowly rotate the target until the H offset value is less than .020" (0.5 mm). Hold the laser/target so the values remain steady. Click **Record** or press the spacebar to record the data point.
3. Repeat **Step 2** for 6:00, 9:00 and 12:00.
4. Take at least one more data point at any rotation angle. For best results, include several points in between 12:00 and 3:00 and 6:00 and 9:00 and take a point at 6:00. The same minimum number of points described for **Point Mode for Horizontally Mounted Motors** (Page 86) is required.

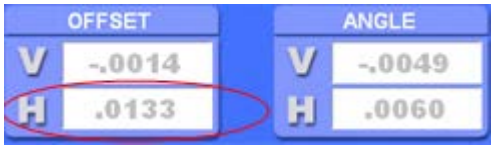


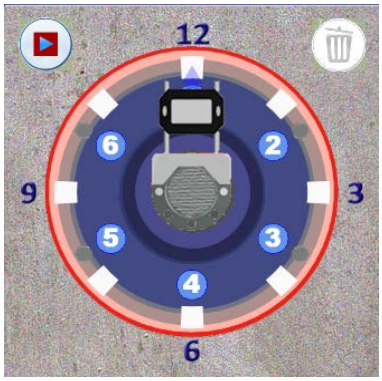
Figure 46 – *Rotate target until H offset value is less than .010"*

5. When finished taking data, ensure the laser and target are at 12:00 and the H Offset value is less than ± .050" (1.25 mm). Click **Results** to bring up the **Accept Measurement Results** screen.

Note: *For maximum accuracy, try to get the H Offset value less than .010" (0.25 mm).*

See Page **78** for a description of the **Accept Measurement Results** screen**.**

Step 4: Take Data – Vertically Mounted Motors (Auto Clock™ Manual Mode)



Taking data with vertically mounted motors is a little more difficult than horizontally mounted motors because the rotation sensor does not work. **Auto Clock™ Manual Mode** is used to tell the software where the target is located when recording a data point. For flange-mounted motors, it is best to begin the alignment task by numbering the flange with clock numbers (3:00, 6:00, 9:00 and 12:00) to give yourself a reference to use with Couple6 during the alignment procedure (use 12:00 as the starting location).

To begin taking data, ensure the **Vertical Motor** icon was selected in **Step 1**. This opens a dialog box that asks if you want to disable the rotation sensor and sets the data taking mode to **Auto Clock™ Manual Mode**. Click **Yes** to disable the rotation sensor.

Selecting Clock Location

On the data taking screen, the numbers in the blue circles represent the bolt holes. The clock location numbers are located outside of the orange circle. Select the clock location from which to take data. Click the white box near the clock location or click and rotate the **Target** icon to the desired clock location.

When a data point has been recorded, a red dot displays in the white box at the selected clock location. When the data points turn *blue* (3 points in 90 degrees), this indicates acceptable measurement data. When they turn *light blue* (5 points in 180 degrees), this indicates good measurement data. When they turn *green* (7 points in 270 degrees), this indicates the best measurement data.

Note: *When using points instead of arcs, 3 points in a 90-degree arc produces acceptable results but the data is very sensitive to each data point taken. If there is one bad point (out of 3), the results can be affected significantly. Extra care should be taken to make sure there are no problems with repeatability when using fewer than 5 points in 180 degrees.*

Auto-Advance Data Taking

If enabled, Couple6 automatically advances the **Target** icon to the next data point location after **Record** is clicked (or the S**pacebar** is pressed) and prepares to record the next data point. This mode is the default and it can be turned off in the **Settings/Preference s**creen**,** where you may also select which direction to advance the **Target** icon: CW (Clockwise) CCW (Counter Clockwise).

Vertical Motor Data-Taking Procedure (Coupled)

1. Rotate the actual laser/target to 12:00 and click the 12:00 box (or rotate the **Target** icon to 12:00) on the data taking screen.
2. Click **Record** or press the spacebar. If Auto-Advance is selected, Couple6 automatically advances the **Target** icon to the next point in a clockwise (or counter-clockwise) direction and prepares to record the next point.
3. Repeat data taking until the desired number of points is recorded.
4. When enough data is taken, the **Done** button is enabled. Click **Done** to display the **Accept Measurement Results** screen (see Page 78).

Vertical Motor Data-Taking Procedure (Uncoupled)

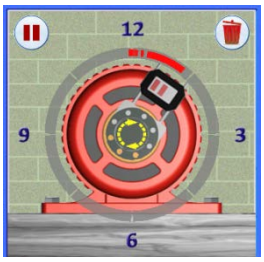
Use the **Point Mode** procedure for uncoupled motors on Page 86. Position the **target** icon in **Auto Clock**™ **Manual Mode** to tell Couple6 which data point to take.

Step 4: Take Data – Arc™ Mode

Arc Mode allows you to take sweep data for any number of arcs in the 360-degree circle. To record alignment data in **Arc™ Mode**, rotate the laser and target together (must be coupled) to sweep an arc of data. Start or stop at any clock location to take the arc of sweep data. If using the S-680, we recommend leaving the laser/target at 12:00 when finished rotating, although this is not required. If the laser/target are left at any other location, Couple6 automatically rectifies the readings in **Step 5** so that it appears that the laser/target are at 12:00.

Procedure

1. To record data, click **Start**.
2. Begin rotating the shafts and dots display on the recording ring. Each dot is a data point.
3. When you reach an obstruction, click **Pause**  . This stops the recording.



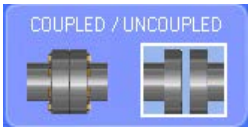
4. Rotate the shafts past the obstruction and click **Record** to continue taking the data.

5. Repeat until you get enough data to get results.
6. Click **Done**  to open the **Results** screen.

Step 4: Take Data – Uncoupled (Swipe) Mode

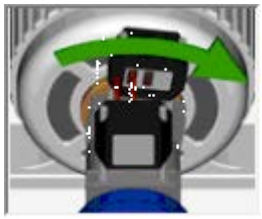
When it is necessary to remove the coupling, use **Uncoupled Mode** to align the motor by performing the following steps:

1. Click the **Uncoupled** icon in **Step 4: Take Data**.



2. Click the **Swipe Mode**™ data taking icon

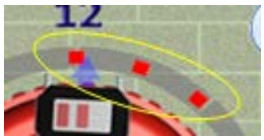
3. A popup graphic displays to show the direction the target should be swiped past the laser.



4. Rotate the laser to any clock position and hold it in place (by hand if the shafts rotate easily). It is advisable to start at 3:00 or 9:00.

5. Click **Record** to begin recording data.

6. Slowly rotate (Swipe) the *target* completely past the laser. A single dot displays in the **Data Point Indicator** for each point recorded.



7. Repeat **Step 3** until the desired number of data points is recorded. When the minimum number of points is recorded, **Done** is enabled.
   Note: *At least 4 points in a 60° (minimum) arc are required and the arc must cross one polar coordinate (3:00, 6:00, 9:00 or 12:00). For best results, spread the data points over 360° with at least one point near 12:00, 3:00, 6:00 or 9:00.*

8. Click **Done** to display the **Accept Measurement Results** screen.

9. Proceed to the **Step 5: Move Screen**:
   a. **S-680 System** – Rotate the laser to 12:00 and then rotate the target while watching the H Offset value in **Step 4: Data Displays** until the value is less than ±.050" (1.25 mm).
   b. **S-670 System** – Rotate laser to 12:00 and then rotate the target to 12:00 using the target alignment tool to align the laser dots in the center of the holes on the tool. Remove the alignment tool and click the **Shim** icon.

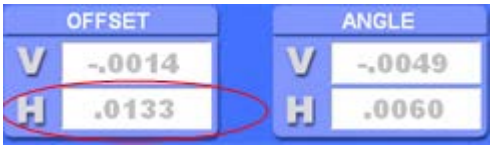
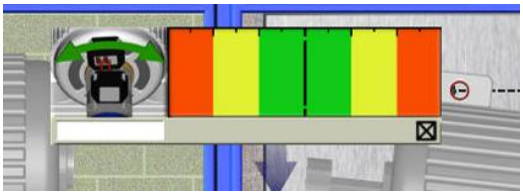


Figure 47 – *Step 4: Data Point Display showing data point*

   Note: *For maximum accuracy, leave the target in a position where the H offset value is < ± .025" (0.6 mm). For the S-680, the target can be left at 12:00 and both alignment axes (V and H) can be aligned in* **Step 5**. *For the S-670, leave the target/laser at 12:00 to align the vertical axis. Leave the target/laser at 3:00 or 9:00 to align the horizontal axis.*
   See Page 78 for a description of the **Accept Measurement Results s**creen**.**

Uncoupled Re-alignment Indicator in Step 5 (Move Screen)

In Uncoupled mode, if the target and laser are moved to another clock position (for example, from 12 o'clock to 3 o'clock), you must re-align the target to the laser. The indicator, shown in the following image, appears when a change of clock position is detected.



Note: *This indicator is only applicable to the S-680 system with a T-1290 target, With an S-670 system, you must manually re-align the target and laser as shown in* **Figure 46**.

The Alignment indicator bar is scaled as follows:

Green Area:	Horizontal offset within ± .025" (± 0.6 mm)
Yellow Area:	Horizontal offset within ±.050" (± 1.3mm)
Read Area:	Horizontal offset within ± .075" (± 1.9mm)

When the laser is on-target, a blue arrow displays. This arrow is not visible when the laser is off-target. For best accuracy, re-align the laser and target so that the arrow points inside the green zone, as close to the center line as possible. Click the re-alignment indicator to hide the arrow, which remains hidden until the target and laser are rotated to another clock position.

Step 5: Move and Shim

Step 5: Combined View

By default, the **Combined Move** screen is displayed in **Step 5**, showing both the **Vertical and Horizontal Move** screens simultaneously. For the S-670, if the target is at 12:00, then the *Vertical Move* side of the screen is enabled (the H-axis is disabled and grayed-out). If the target is rotated to 3:00 or 9:00, the Horizontal Axis is activated (the V-axis is disabled and grayed-out).

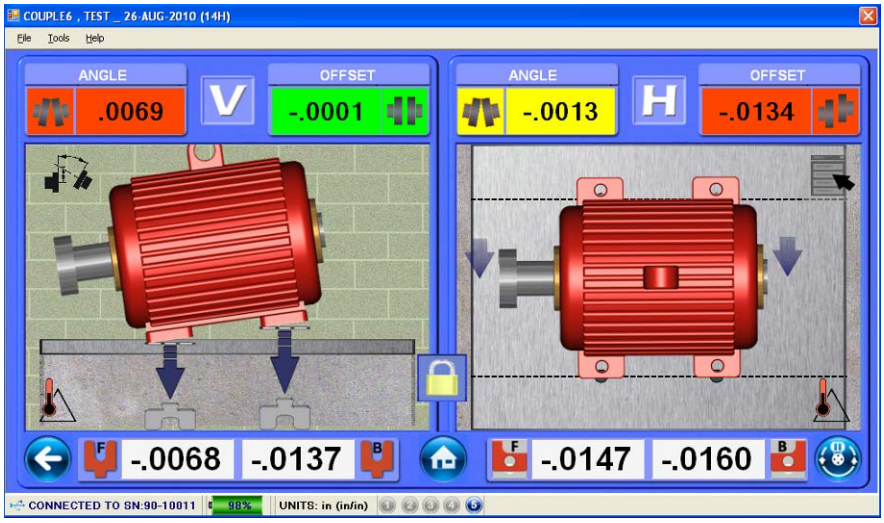


Figure 48 – *Step 5: (Vertical move)*

Offset Display

- **Vertical Axis** – The offset misalignment of the motor and pump shafts at the coupling. A *minus* (-) sign indicates that the motor coupling is *below* the driven-unit coupling. A *plus* (+) sign indicates that the motor coupling is *above* the driven unit coupling.
- **Horizontal Axis** – A *minus* (-) sign indicates that the motor coupling is to the *left* of the driven-unit coupling. A *plus* (+) sign indicates that the motor coupling is to the *right* the driven unit coupling.

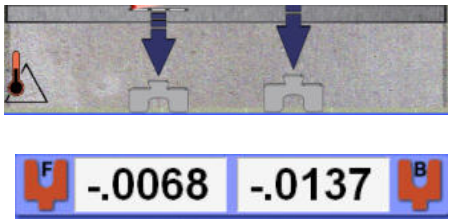
Angular Display

- **Vertical Axis** – Shows the slope or angle of the motor (in units of in/inch or mm/100 mm) relative to the driven unit. A *plus* (+) sign indicates that the back feet of the motor are *above* the front feet (the motor shaft is pointing downward). A *minus* (-) sign indicates that the back feet of the motor are *below* the front feet (the motor shaft is pointing upward).
- **Horizontal Axis –** A plus (+) sign indicates that the back feet of the motor are to the right of the front feet (the motor shaft is pointing to the left) when looking into the motor's coupling. A minus (-) sign indicates that the back feet of the motor are to the left of the front feet (the motor shaft is pointing to the right).

Gap Display

- **Vertical Axis** – Shows the angular misalignment at the coupling. A gap at the top (12:00) has a *minus* (-) sign and a gap at the bottom (6:00) has a *plus* (+) sign. This gap is calculated by multiplying the angular value (slope) of the motor times the diameter of the coupling (the *D Dimension* entered in **Step 1**).
- **Horizontal Axis** – A gap at the left side of the coupling (9:00) has a *plus* (+) sign and a gap at the right side has a *minus* (-) sign.

Recommended Shim Values



Based on the dimensions entered in the **Step 1: Dimensions** tab, Couple6 calculates the recommend amount of shim to add or remove from the front and back feet of the motor or the pump/stationary machine. UP arrows (↑) indicate shim should be *added* (the shim display has a *plus* (+) sign); DOWN arrows (↓) indicate shim should be *removed* (the shim display has a *minus* (-) sign).

Shim Lock

The **Lock** icon next to the shim values locks or unlocks the live update for the shim values. By default, the shims are locked to allow addition of the recommend shim. After adding the recommended shim, click the **Lock** icon to unlock the shims and Couple6 updates the values based upon the new Vertical Offset and Angular Values to determine if more shims are required. The icon displays a locked image to indicate the lock feature is ON and an unlocked image to show the lock feature is OFF.

If the user adjusts the motor, the Gap and Offsets displays change along with the motor image, but the shim values won't change until the **Unlock** button (open padlock with refresh arrows) is clicked.

Verify Alignment After Aligning Motor

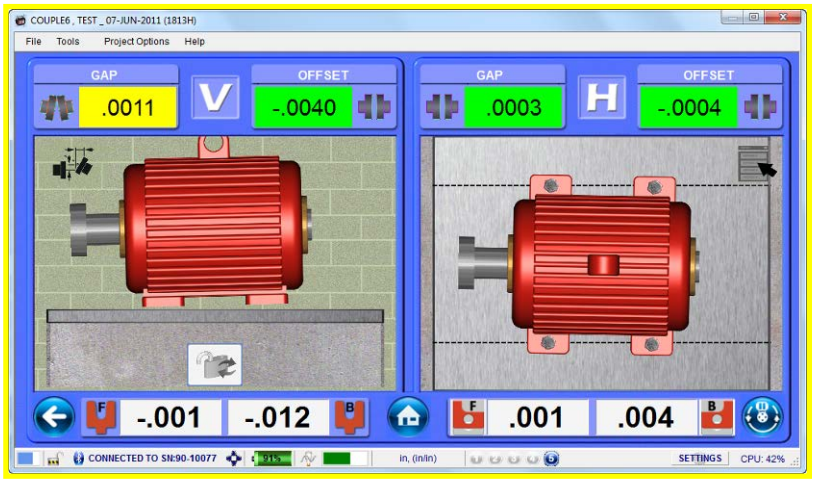
After aligning the motor, it is important to verify the alignment. Click **Remeasure** to return to **Step 4**, clear the data, and prepare **Step 4** to take a new set of data.

Back Button

The **Back** button returns to **Step 4** *without* clearing the data. Use the **Back** button to use a different set of previously recorded data in **Step 5: Live Move Screen**.

Note: *If you press **Back** after either shimming or moving, you MUST retake the data. If you do not, then the old display offsets are applied to the new raw data and it creates an error in* **Step 5**.

Live Graphics Screen – T-1290 5-Axis Target (S-680) – Duo-Plane™ Mode



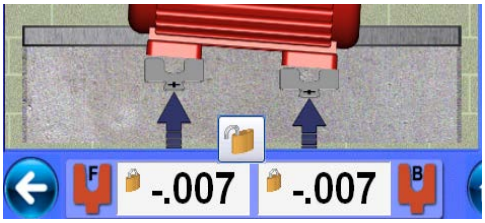
The motor graphic updates with each shim added or foot moved horizontally. The up/down screen location of the motor is determined by the amount of the front shim or move. When using the T-1290 Target, Couple6 is set to **Duo-Plane™ Mode,** where the four alignment values (V- Offset, V-Gap, H-Offset and H-Gap) update continuously as the motor is shimmed and moved horizontally. If the target is rotated by more than 5°, Couple6 automatically switches the target to **Single Axis Mode** (see Page 95).

When the horizontal axis values are less than the *Excellent Tolerance* values, the bolt holes of the motor are aligned to the holes on the motor base and bolt heads display on the feet (see the chart on Page 95). When the alignment is within *Excellent Tolerances* for the vertical axis, the **Shim** icons do not display, indicating no more shim is needed (see the chart on Page 95).

Resetting Duo-Plane™ Live Move Screen (T-1290 Target)

When using the T-1290 5-Axis Target and performing **Step 5**, Couple6 automatically puts the display into Duo-Plane™ Mode, which shows both the alignment planes (four alignment *axes*) updating with live data simultaneously. However, if the shafts are rotated while in Duo-Plane™ mode, the dual display is switched to Single Axis Mode (see Page 95). To return to Duo-Plane™ mode, click the **Back** button. This returns to **Step 4** without clearing the display offset data. Click **Next** to return to **Step 5** and the Duo-Plane™ view is re-enabled.

Foot Display – Vertical Axis



Alignment out of tolerance. Add shim.

Alignment in tolerance. Shims do not display.

Foot Display – Horizontal Axis

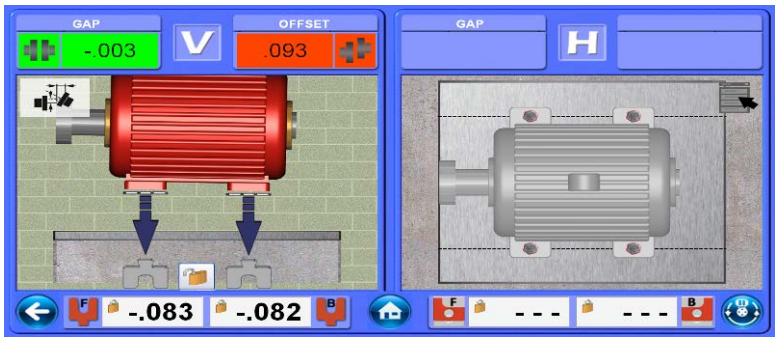
Alignment out of tolerance. Motor needs to be moved down (*toward* the user).

Alignment in Excellent Tolerance, showing the bolt heads in place

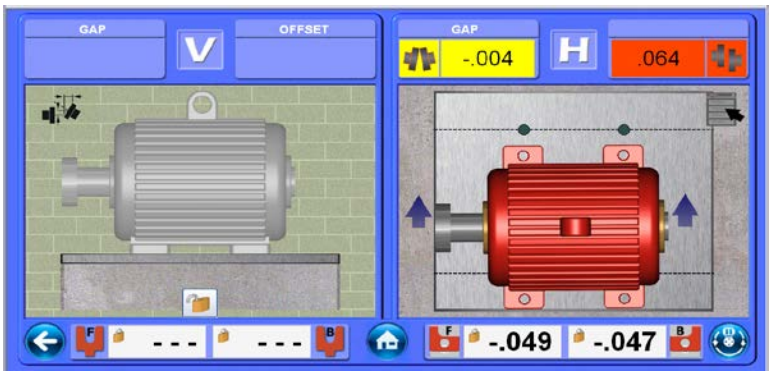
Live Graphics Screen – T-1285 3-Axis (S-670) – Single Axis Mode

The motor graphic updates with each shim added or foot moved horizontally. The up/down screen location of the motor is determined by the amount of the front shim or move. When using the T-1285 Target, the two alignment values for either the horizontal or the vertical axes (*V-Offset/V-Gap or H-Offset/H-Gap*) update continuously as the motor is shimmed or moved horizontally.

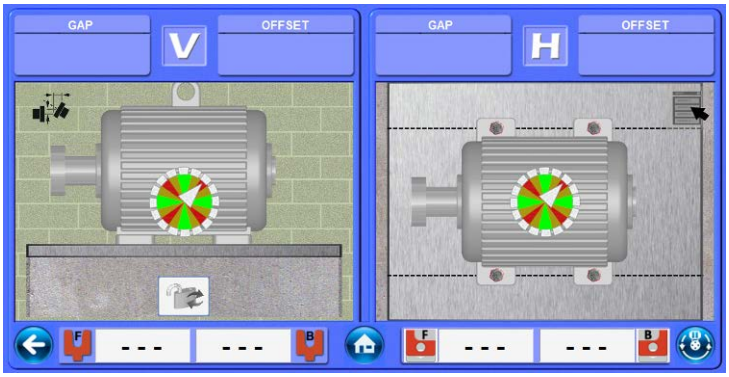
When the target is located at 12:00 or 6:00, the Vertical Axis is enabled and the Horizontal Axis is disabled (grayed out).



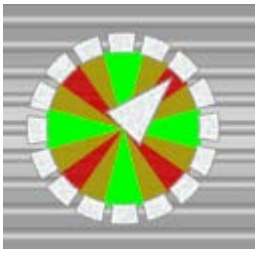
When the target is at 3:00 or 9:00, the Horizontal Axis is enabled and the Vertical Axis is disabled (grayed out).



When the target is at or near the 1:30, 4:30, 7:30 or 10:30 clock positions, Couple6 disables both V- and H-axis displays, since the orientation of the target's measuring axes is out of phase to the motor's alignment axes. This makes it extremely difficult to do the alignment, because, for example, a move in the horizontal axis of the motor is detected by both the horizontal *and* vertical axes of the target. Therefore, for a .005" move of the motor, the target shows only .0025".



When the target is rotated and is between polar coordinates (12:00, 3:00, 6:00 and 12:00), an alignment tool displays on top of the motor graphic. The triangular image in the center of the graphic shows the current rotation angle of the target. The *red* areas indicate the "dead zones" and the *green* areas are the "live zones".



Step 5: Changing Views

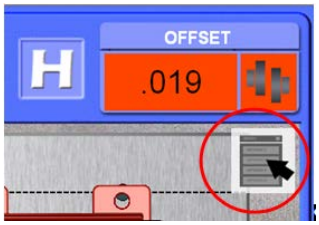


Figure 49 – *Step 5: Move Screen showing the Menu icon*

Couple6 provides the ability to change views in the **Move** screens, depending on the optional features that are enabled. To display the **Change View Menu**, right-click the icon (see **Figure 49**). When using a touch screen, press and hold the **Menu** icon on the **Move s**creen. A window displays with six view choices.

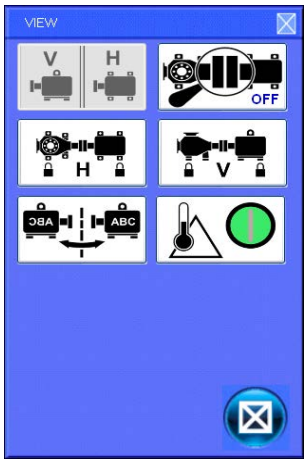
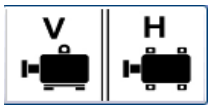


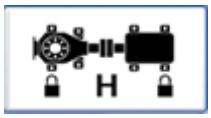
Figure 50 – *Step 5: Move Screen showing View popup for changing screen views*

View Menu Screen Display Selections

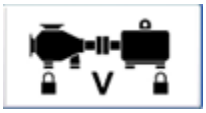


Click to display the **Split Screen Foot** view, which shows the Vertical and Horizontal Axis on the same screen.
Note: *If using the T-1290 5-Axis target (S-680), the* **Split Screen** view *displays the data from both the Vertical and Horizontal axes at the same time. If the T-1285 3-Axis Target (S-670) is used, Couple6 only displays the data from one alignment axis at a time.*

Click to display the **Coupling Zoom** view, showing the alignment at the coupling. Click again to zoom out to **Split Screen v**iew or **Bolt Bound**™ view.



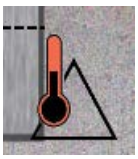
Click to view the **Bolt Bound**™ screen (an optional feature) for the Horizontal Axis.



Click to view **Bolt Bound**™ screen (an optional feature) for the Vertical Axis.

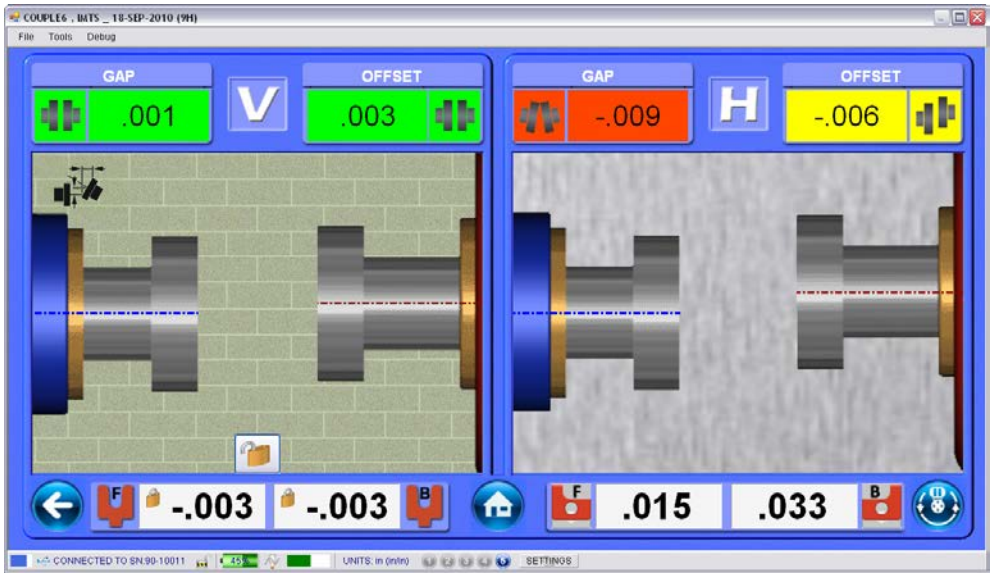
Click to flip the motor image (coupling on the left or right) to match the orientation of the motor to the software.

Select to turn off the Thermal Growth Offsets entered in the **Step 1: Thermal Growth** screen. A **Thermal Growth** icon (see below) displays in the **Step 5: Move Screens** to alert you that Thermal Growth Offsets have been entered.



The **Thermal Growth** icon that displays in **Step 5** when Thermal Growth values have been entered.

Step 5: Coupling Zoom View

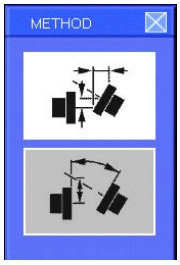


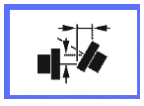
Click the **Coupling Zoom** icon to zoom the **Move** screen into **Coupling Only** view. This shows the current alignment at the coupling. The graphics update the alignment of the coupling as the motor is shimmed and moved. Click the **Split Screen Foot** icon to return to **Foot Screen** view. See Page 93 for a description of what the signs mean in the alignment and shim displays.

The *blue* dotted line on the shaft indicates the pump (driven unit) side of the coupling. The *red* dotted line on the shaft indicates the motor side of the coupling.

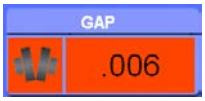
Changing Angular Format in Step 5

Couple6 displays the angular axes of the alignment in either *Gap Format* (angular value times the D Dimension - coupling diameter) or *Angular Format* (slope of the motor's alignment). Click the **Coupling** icon in the upper left-hand corner of the screen to pop up the **Method Menu** and choose the angular format.





Click to display **Gap** view.



Click to display **Angle** view.

Where to Leave the Target During Move (Alignment)

- **T-1290 5-Axis Target** : It is best to place the target at 12:00 (within ± 10°) during the move since the T-1290 is a 5-axis target and provides both vertical and horizontal simultaneously. If the target is rotated by more than 5°, Couple6 automatically switches the software into **Single Axis Mode**.
  Note: *If the target is in a "dead zone," (± 10 degrees of 45 degrees, 135 degrees, 225 degrees and 315 degrees), the motor graphc displays gray out and the coupling value displays are blank. This indicates the alignment should not be performed at these clock locations.*

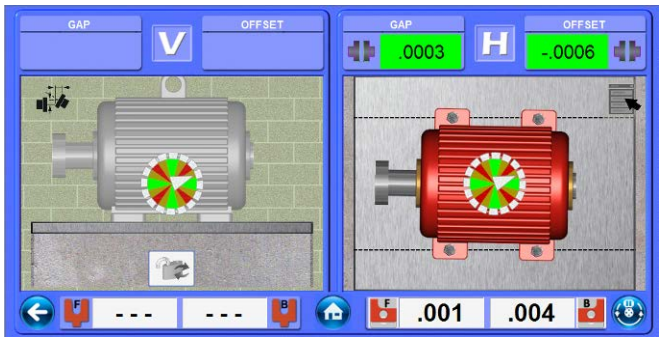
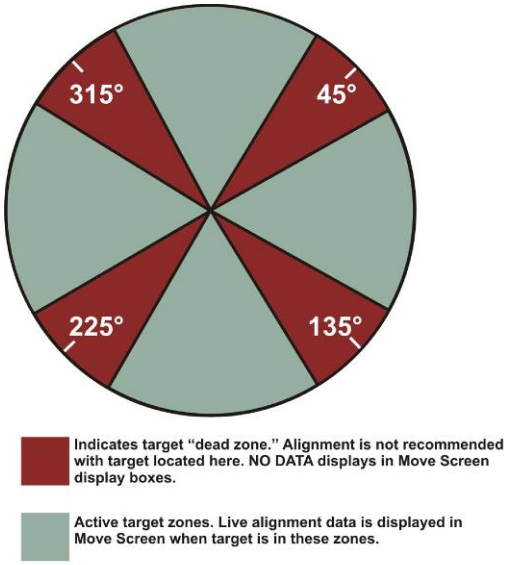


Figure 51 – *Step 5: Move Screen showing target left at 45°. No values display for the rotation tool, indicating the proximity to a "live zone."*

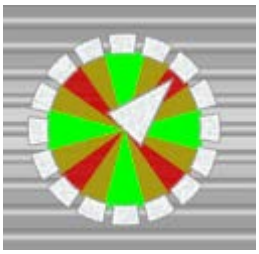


When the target is rotated and is between polar coordinates (12:00, 3:00, 6:00 and 12:00, an alignment tool displays on top of the motor graphic. The triangular image in the center of the graphic shows the current rotation angle of the target. The *red* areas indicate the "dead zones" and the *green* areas are the "live zones."

- **T-1285 3-Axis Target (S-670)**: Since this is a 3-axis target, Vertical Shims must be added at 12:00 or 6:00 and Horizontal Moves must be performed at 3:00 or 9:00. The **Vertical and Horizontal Move** screens switch automatically, depending on the target clock position (rotation angle).

Backlash Detector (T-1290 Only)

The T-1290 target offers the capability to detect backlash at the coupling. During **Step 4: Auto Sweep™** data collection, Couple6 determines if there is too much variability in the Horizontal Offset value (an indicator of coupling backlash). If so, Couple6 monitors the rotation angle in the **Step 5: Move Screens** to determine if it is necessary to perform the Horizontal Move while the laser/target are at 3:00 or 9:00. If Couple6 detects too much of a change in the rotation axis (more than ± 5 degrees) during the Vertical Move, a warning message displays, indicating rotation to 3:00 or 9:00 is necessary to perform the Horizontal Move. The other option is to retake the data in **Step 4**, leaving the laser/target at 12:00, and retry the horizontal part of the alignment.



The reason for the Excess Backlash Detected message is that the T-1290, or *any other laser system*, cannot detect the difference between a Horizontal Offset move and a slight rotation of the motor shaft relative to the pump shaft. This could cause errors aligning the Horizontal Offset in the **Move** screen. This potential Horizontal Offset error does not occur when the laser/target are at 3:00 or 9:00.

Vertical Move Procedure with Coupled Shafts -- T-1290 or T-1285

1. Select the data to use from the Repeatability Table in **Step 4** (use only a previously recorded set of data).
2. Place the laser/target within 10° of 12:00 or 6:00.
3. Ensure that the motor is oriented (coupling on the left or right) in the same way it is viewed (double-tap the **Menu** icon to flip the image, as shown on Page 97).
4. Add the recommended shim to the front and back feet. The *blue* arrows indicate whether to add (positive shim values) or remove shim (negative shim values). See *Recommended Shim Values* on Page 94 for more information. The motor graphic, Vertical Offset and Vertical Angle values automatically update as shim is added. Click **Shim Lock** to unlock the shim display and determine if more shim is necessary. The coupling displays turn *yellow* when the alignment is in *Acceptable* tolerance and *green* when it is in *Excellent* tolerance. If any displays are *red*, add shim until they turn *yellow* or *green (see* Data Display Colors *on* Page 81).

Vertical Move with Uncoupled Shafts

Performing an uncoupled alignment requires some target setup to position the laser beam near the horizontal center of the target (H-Offset). This ensures optimal accuracy of the move. When the **Find Target Center Wizard** displays, position the laser so the H-Offset value is less than ± .050" (1.25 mm).

Notes:

- *For maximum accuracy, ensure the H-Offset value is less than .020" (0.5 mm).*
- *For freely rotating shafts that are uncoupled, vertical alignment must be performed at 12:00 or 6:00. Horizontal alignment must be performed at 3:00 or 9:00.*

Uncoupled Move Procedure -- T-1290 5-Axis Target (S-680)

1. Record data using **Uncoupled Mode** in **Step 4**.
2. Perform the Vertical Move first, with the laser positioned at 12:00 (360°) or 6:00 (180°).
3. Click the **Move** icon to display the **Move** screen. When the **Move s**creen displays, the **Find Target Center Wizard** helps to position the laser beam near the center of the T-1290.
4. Leave the L-790 Laser stationary, rotate the T-1290 Target (***do not touch the laser adjustment wheel***) and watch the Wizard readout. When the live display turns from *red* to *green*, the T-1290 Target is ready to perform the move.
5. Select **Close** and add the recommended shim to align the Vertical Axis of the motor. If the display boxes remain *red*, unlock the shims to see how much more shim is required to bring it into alignment.
6. When the Vertical Axis is aligned, rotate the laser to 3:00 or 9:00 and repeat **Steps 2**, **3** and **4** to ready the system for the Horizontal Axis alignment.
7. Perform the moves as recommended by the **Horizontal Move** screen.
8. Tighten all bolts and go to **Step 4: Take Data** to retake the data and confirm the alignment.

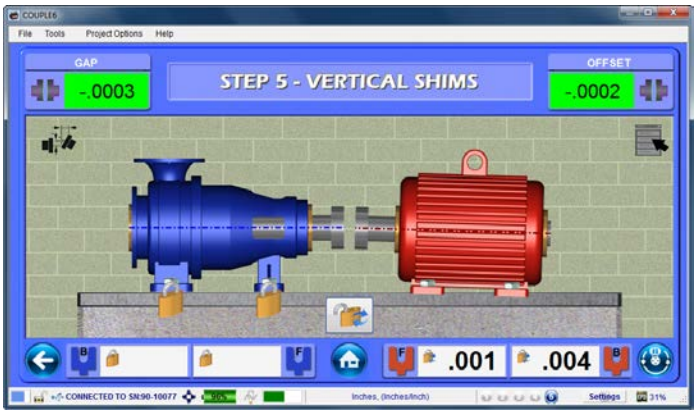
Uncoupled Move Procedure- T-1285 3-Axis Target (S-670)

Since the T-1285 Target has no horizontal axis, the Dust Cover/Alignment Tool should be used to align the laser to within ±.050" (1.25 mm) of ZERO in the horizontal axis.

Figure 52 -- *Aligning laser beams with S-670 to take Uncoupled Shaft data in Point Mode using the dust cover/alignment tool.*

1. Install the Dust Cover (Alignment Tool), making sure it is securely held in the window.
2. Rotate the laser to 12:00.
3. Rotate the T-1285 Target (***do not touch the laser adjustment wheel***) until the laser beams nearly disappear into the holes (or are centered on the vertical white line if the laser beam is higher than the holes)
4. Remove the Alignment Tool.
5. Add the recommended amount of shim and ensure all values are in tolerance.
6. When the Vertical Axis is aligned, rotate the laser to 3:00 or 9:00.
7. Install the Alignment Tool
8. Rotate T-1285 Target until the laser beams nearly disappear into the holes in the Dust Cover/Alignment Tool.
9. Remove the Alignment Tool and perform the horizontal part of the alignment.
10. Tighten all bolts and retake the data in Couple6, **Step 4** to confirm the alignment.

Step 5: Move Screen – Vertical Move Bolt Bound™



When it is determined that no more shim can be added/subtracted to bring the motor into alignment, the **Bolt Bound™ Move s**creen can be used to see if adding/subtracting shim to the front and/or back feet of the pump/driven unit brings the alignment into tolerance.

To enable this screen, click the **Menu** icon and select the vertical axis. If not already completed, go to **Step 1: Dimensions and Tolerances** and click the **Bolt Bound™** icon. The screen displays the **E** and **F** dimensions for the pump/driven unit (see **Step 1: Dimensions – Bolt Bound™ and Spacer Shaft** on Page 53) After entering those dimensions, return to **Step 5** and the **Bolt Bound™ Move** screens display.

Recommended Shim Values

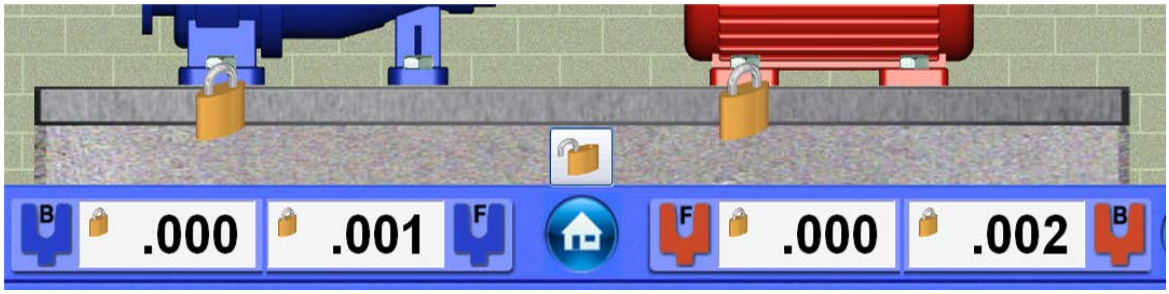
Based upon the A, B, C, E and F Dimensions entered in the **Step 1: Dimensions** tab, Couple6 calculates and recommends the amount of shim to add or remove from the front and back feet of the motor or the pump/stationary machine. *Blue* UP arrows (↑) indicate to *add* shims and *blue* DOWN arrows (↓) indicate to *remove* shims.

Locking/Unlocking Motor/Pump Feet

When the **Bolt Bound™ Move s**creen first displays, the feet for the pump are locked and **Lock** icons display on the feet to indicate which feet are locked.

To unlock the feet, click the **Lock** icon and it changes to a question mark, (?) indicating Couple6 is waiting for two feet to be unlocked.

Click an *unlocked* foot (?) to lock the foot. When two feet are locked and two are unlocked, the shims are recalculated for the unlocked feet to bring the motor into alignment. The graphics update, displaying which direction the feet are misaligned.



When the Coupling displays turn *green*, the alignment is in *Excellent* tolerance. When the Coupling displays turn *yellow*, the alignment is in *Acceptable* tolerance (*see* Data Display Colors *on* Page **81**).

Vertical Bolt Bound™ Move Procedure (T-1290 or T-1285)

1. Place the laser/target within 10 degrees of 12:00 or 6:00.
2. Ensure that the motor is oriented (coupling on the left or right) in the same way it is viewed. Double-tap **Menu** icon (see Page **97**) to flip the image (the direction arrows also change).
3. Add the recommended shim to the unlocked feet on the motor and/or pump (driven unit). The *red* arrows indicate whether to add or remove shim (see *Recommended Shim Values on* Page **94**). The motor graphic, Vertical Offset and Vertical Angle values automatically update as shim is added.

4. If the software requests that more shim be removed and there are no shims left, lock that foot and unlock a foot on the pump/stationary side to determine how much shim to add to the pump foot. Two feet must be locked and two feet must be unlocked for the shims to recalculate.
5. Repeat **Step 4** until the alignment is in tolerance.

Remove Offsets

If Thermal Growth Offsets have been entered, the motor is misaligned by those offset values. To view the alignment without the Thermal Growth Offsets, click the **Menu** icon (see *Changing Views in* **Step 5** on Page 97*)* and click **Thermal Growth on/off**.

Saving the Alignment Data

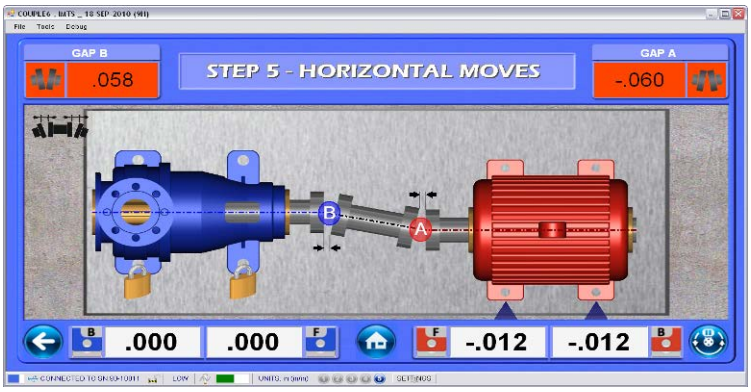
Couple6 automatically saves data as backup file created at startup, so there is no need to periodically save data. However, upon exiting, Couple6 asks if you want to save data to the file created at startup. This updates the alignment file with the latest data and deletes the backup file. See Page 35 for instructions to access the backup data if the computer crashes during an alignment session.

Step 5: Spacer Shaft Formats

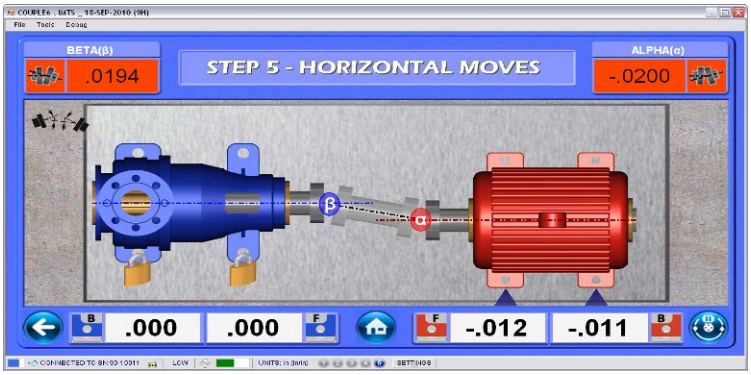
When the **Spacer** icon is clicked in **Step 1: Dimensions and Tolerances**, Couple6 enables 7 different Spacer formats (see *Thermal Growth – Spacer (Jack) Shafts* on Page 66) in **Step 5: Bolt Bound**™, **Step 5: Split Screen Vi***ew* and **Step 5: Coupling View**. To change the format, click the **Spacer Coupling** icon in the upper left corner of the **Move** screens. A popup displays to select the Spacer Shaft formats available for **Step 5**.

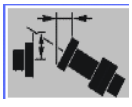
The screens below show how the format is changed for each Spacer Shaft. These changes to the display value formats (for example, Gap A/Gap B) apply to any of the **Step 5: Move Screens**.

Gap A -Gap B

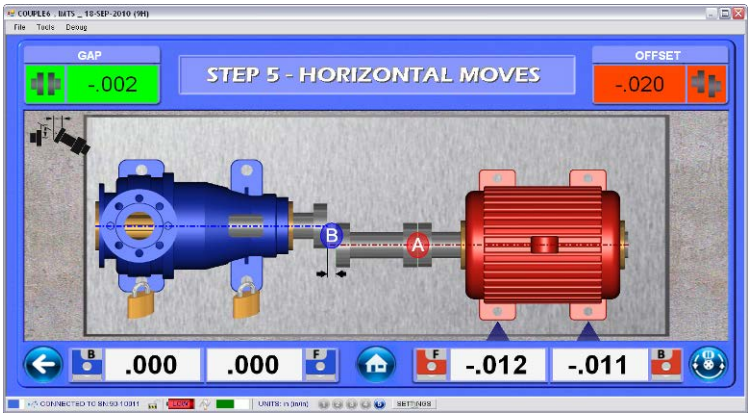


Alpha & Beta Angles

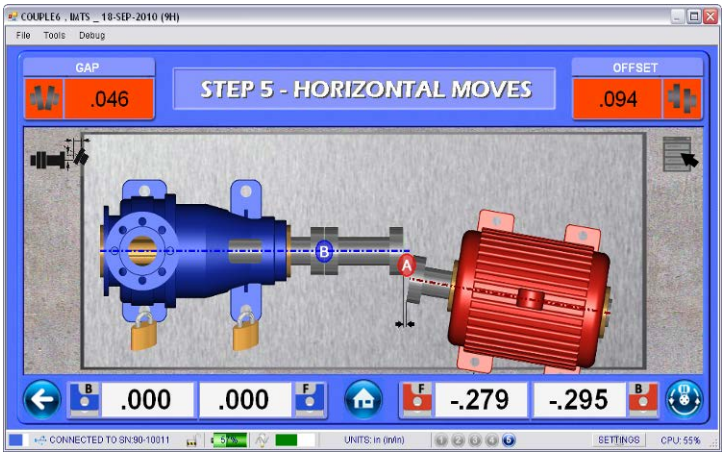




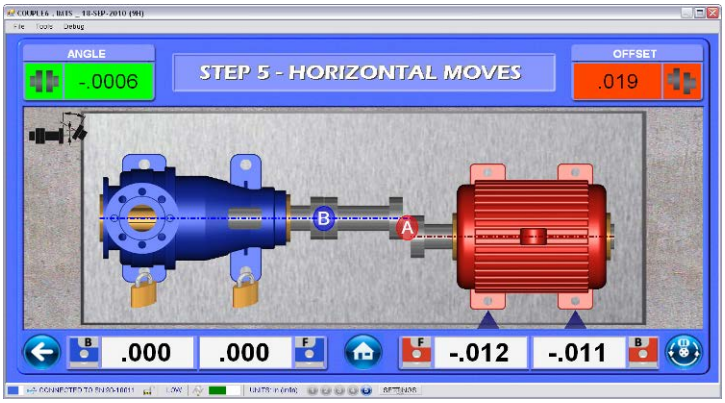
Total Gap - Offset Left

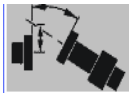


Total Gap - Offset Right

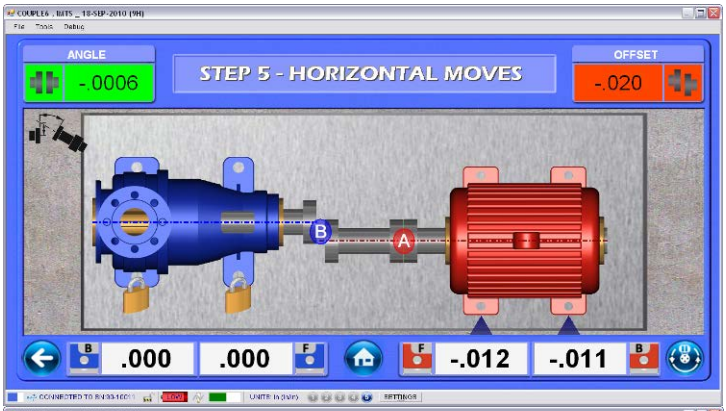


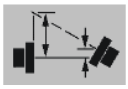
Total Angle - Offset Right



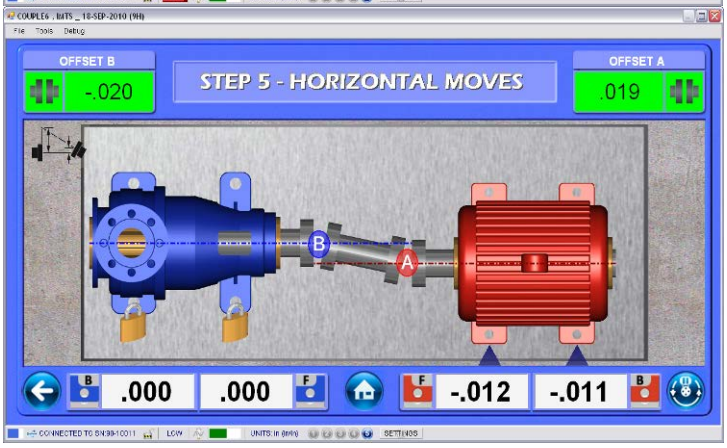


Total Angle - Offset Left





Offset A – Offset B



Step 5: Move Screen – Horizontal Move

After shimming the motor, the horizontal axis should be aligned. In **Split Screen** view, the horizontal axis is automatically updated even as the motor is shimmed and is immediately ready to be used to perform the moves.

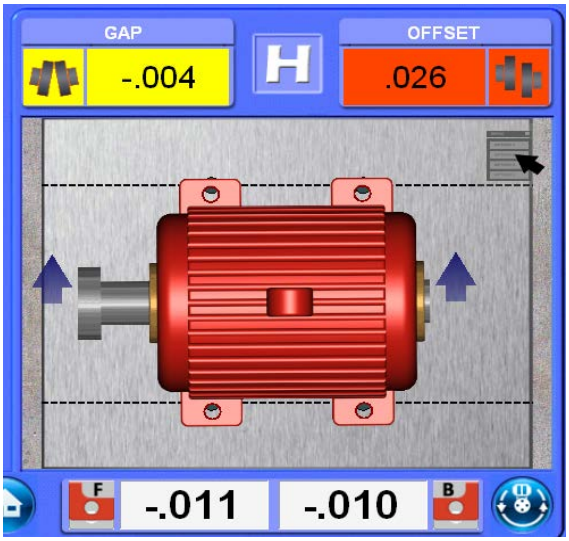


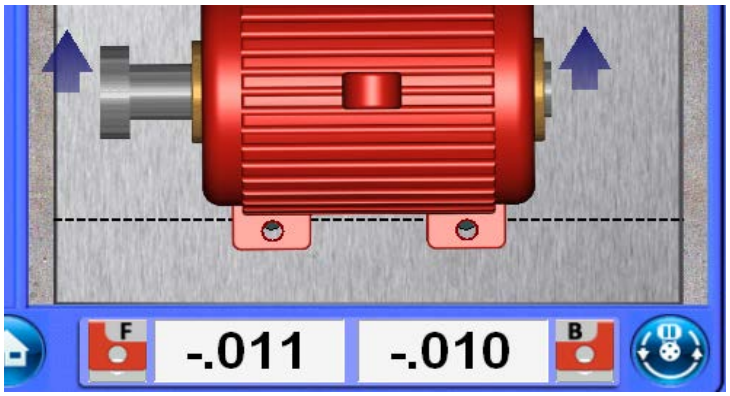
Figure 53 – *Couple6, Step 5 (Horizontal Move)*

Horizontal Offset

This value is the offset misalignment in the coupling for the horizontal axis. A *minus* sign means the motor is to the *left* of the driven unit when looking *into* the motor coupling. A *plus* sign means the motor is to the *right* of the driven unit (see *Measurement Results Definitions* on Page 85 for more information).

Note: *Results shown in green indicate that the value is in less than the Excellent Tolerance defined in* **Step** *1. Results shown in yellow indicate that the value is less than the Acceptable Tolerance, but greater than the Excellent Tolerance. Results shown in red mean that the value is greater than the Acceptable Tolerance (see* Data Display Colors *on* Page 81).

Horizontal Angular Value



This value is the slope or angle of the motor (in units of in./inch or mm/100 mm) relative to the driven unit. A *plus* Horizontal Angular Value indicates that the back end of the motor shaft is to the *right* of the front end (when viewed by looking into the motor) with the motor pointing to the *left* of the driven unit. A *minus* Horizontal Angular Value means that the back end of the motor is to the *left* of the front end of motor (see *Measurement Results Definitions* on Page 85 for more information) with the motor shaft pointing to the *right* of the driven unit.

Recommended Move Values

Based on the dimensions entered in the **Step 1: Dimensions** tab, Couple6 calculates and recommends the amount to move the front or back of the motor. Move the motor *away* from you when the UP arrows (↑) display; move the motor *toward* you when the DOWN arrows (↓) display. If the motor coupling is pointing in the wrong direction, click the **Menu** icon to flip the motor display (see Page 97).

The *Foot Move Values* update automatically as the motor is moved. When the *Alignment Values* turn *green* or *yellow*, the Horizontal Axis of the motor is aligned (*see* Data Display Colors *on* Page 81).

Live Graphics Screen

The motor graphic updates with each move made to the motor. The up/down position of the motor is determined by the *Front Foot Move Value* and the slope/angle of the motor is determined by the *Horizontal Angular (Gap)* V*alue*.

Where to Leave the Target During Horizontal Move (Alignment)

- **T-1290 5-Axis Target (S-680)**: It is best to place the target at 12:00 (within ± 10 degrees) during the move since the T-1290 is a 5-axis target and provides both vertical and horizontal simultaneously. The target may also be left at 6:00, 3:00 or 9:00 to within ± 10 degrees of each clock position. Even though the target may be positioned at 3:00 or 9:00, Couple6 automatically corrects the display values to make it appear as if the target is located at 12:00. This helps avoid confusion when the targets's axes switch relative to the motor when you rotate to 3:00 or 9:00.

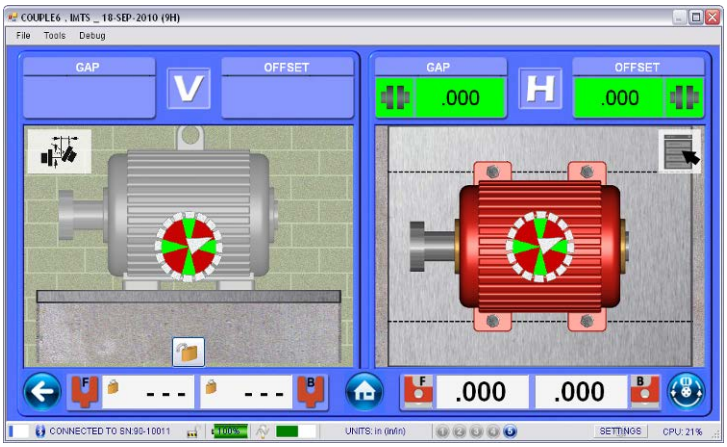
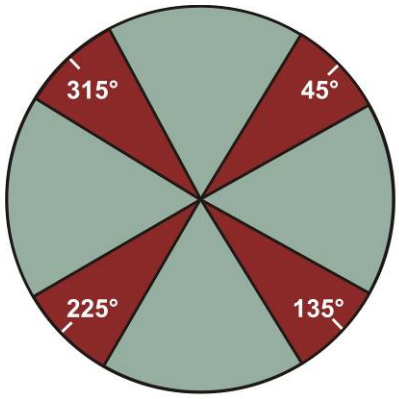


Figure 54 -- *Step 5: Move Screen with target left at 45 ° showing the displays blanked out and the rotation tool indicating the proximity to a "live zone."*

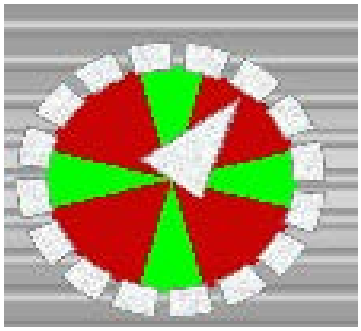
Note: *If the target is in a "dead zone," (± 10 degrees of 45 degrees, 135 degrees, 225 degrees and 315 degrees), the display shows* **No Data**. *This indicates the alignment should not be performed at these clock locations.*



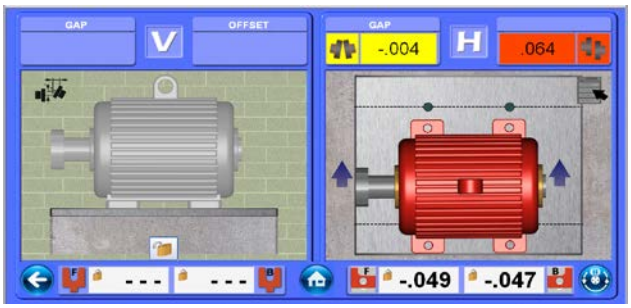
Indicates target "dead zone." Alignment is not recommended with target located here. NO DATA displays in Move Screen display boxes.

Active target zones. Live alignment data is displayed in Move Screen when target is in these zones.

When the target is rotated and is between polar coordinates (12:00, 3:00, 6:00 and 12:00), an alignment tool displays on top of the motor graphic. The triangular image in the center of the graphics shows the current rotation angle of the target. The *red* areas indicate the "dead zones" and the *green* areas are the "live zones".

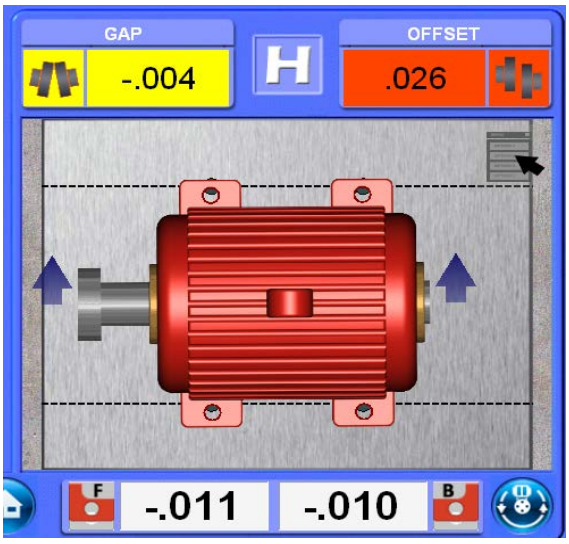


T-1285 Target (S-670): Since this is a 3-axis target, Vertical Moves must be performed at 12:00 or 6:00 and Horizontal Moves must be performed at 3:00 or 9:00. The **Vertical and Horizontal Move** screens switch automatically to **Live Mode**, depending on the target clock position (rotation angle).



Backlash Detector (T-1290 Only)

The T-1290 5-Axis target offers the capability to detect backlash at the coupling. During **Step 4: Auto Sweep**™ data collection, Couple6 determines if there is too much variability in the horizontal offset value, an indicator of coupling backlash. If so, Couple6 monitors the rotation angle in the **Step 5: Move Screens** to determine if it is necessary to perform the Horizontal Move while the laser/target are at 3:00 or 9:00. If Couple6 detects too much change in the rotation axis (more than ±5 degrees) during the Vertical Move, the rotation symbol pops up over the motor image and the Move Display is set to **Single Axis Mode** (see Page 95). Either rotate to 3:00 or 9:00 to do the Horizontal Axis or return to **Step 4**, leave the laser/target at 12:00, and return to **Step 5** to restore **Duo Plane Mode**.

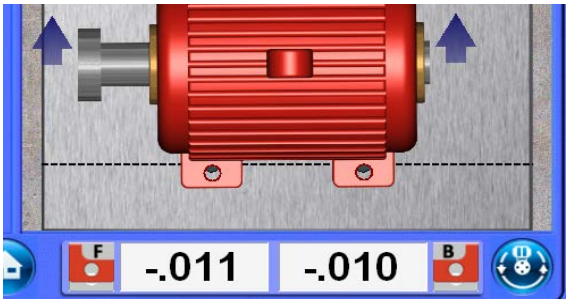


The reason for the Excess Backlash Detected message is that the T-1290, or *any other laser system*, cannot detect the difference between a Horizontal Offset move and a slight rotation of the motor shaft relative to the pump shaft. This could cause errors aligning the Horizontal Offset in the **Move** screen. This potential Horizontal Offset error does not occur when the laser/target are at 3:00 or 9:00 or when the laser/target are at 12:000 or 6:00 for the Vertical Axis.

Horizontal Move Procedure with Coupled Shafts – T-1290 5-Axis Target

1. After performing the vertical axis alignment (it is highly recommended that this be done first) you can switch to the Horizontal Axis *without* rotating the laser/target. However, if the message *Excess Backlash Detected* displays, the **Move** screen displays **Single Axis Mode** and the laser/target must be rotated to 3:00 or 9:00 to perform the Horizontal Move.
2. Ensure that the motor image in **Step 5** is oriented (coupling on left or right) in the same way it is viewed. If it is not oriented correctly, then *right-click* (or press and hold on touch screen) the **Menu** icon (see *Changing Views in Step 5* on Page 97) to flip the image (the direction arrows also change).
3. Move the motor *away* from you when the UP arrows (↑) display. Move the motor *toward* you when the DOWN arrows (↓) display. The Move Values indicate how much to move the motor to bring it into alignment.
4. The motor alignment graphic and the Move Values update automatically with each move. The Move Values turn *green* or *yellow* if in tolerance. If any of the displays are *red*, continue moving the motor until they turn *green* or *yellow (see* Data Display Colors *on* Page 81).

Horizontal Move Procedure with Coupled Shafts – T-1285 3-Axis Target



1. Rotate the laser/target to within 10° of either 3:00 or 9:00.
2. Ensure that the motor is oriented (coupling on left or right) in the same way it is viewed. If it is not oriented correctly, double-tap the **Motor** icon to flip the image (the direction arrows also change).
3. Move the motor in the direction indicated by the *red* arrows. The Move Values and alignment values update automatically as the motor is moved.
4. The Move Values turn *green* or *yellow* if in tolerance. If any of the displays are *red*, continue moving the motor until they turn *green* or *yellow* (*see* Data Display Colors *on* Page **81**).

Horizontal Move with Uncoupled Shafts

Performing an uncoupled alignment requires some target setup to position the laser beam near the horizontal center of the target. This ensures optimal accuracy of the move. The laser should be within .050" (1.25 mm) of ZERO in the horizontal axis of the T-1290 target.

Note: *For freely rotating shafts, the vertical alignment must be performed at 12:00 or 6:00. Horizontal alignment must be performed at 3:00 or 9:00. For hard-to-rotate shafts, both the H and V axes can be aligned with the laser/target left at 12:00.*

Uncoupled Move Procedure – T-1290 5-Axis Target (S-680)

1. Record data using **Uncoupled Mode** in **Step 4**.
2. Perform the Vertical Move first, with the laser positioned at 12:00 (360°) or 6:00 (180°). If the shafts are difficult to rotate, then it is safe to perform the horizontal moves with the laser/target positioned at 12:00 (*see Horizontal Move Procedure with Coupled Shafts – T-1290 5-Axis Target* on Page **109** *for the Horizontal Move procedure).*
3. If the shafts rotate freely:
   a. Rotate to 3:00 or 9:00 and Couple6 automatically enables the **Horizontal Move** screen. The **Find Target Center** popup wizard displays to assist in positioning the laser beam near the center of the T-1290.
   b. Leave the L-790 Laser stationary, rotate the T-1290 Target (***do not touch the laser adjustment wheel***) and watch the **Find Target Center** wizard readout. When the live display turns from *yellow* to *green*, the T-1290 Target is ready to perform the move.
   c. Select **Close** and move the horizontal axis of the motor by the amount recommend in the foot displays until the displays turn *yellow* or *green*, indicating the alignment is in tolerance (*see* Data Display Colors *on* Page **81**).
4. Tighten all bolts and go to the **Step 4: Take Data** screen to retake the data and confirm the alignment.

Uncoupled Move Procedure – T-1285 3-Axis Target (S-670)

Since the T-1285 Target has no horizontal axis, the Dust Cover/Alignment Tool should be used to align the laser to within ±.050" (1.25 mm) of ZERO in the horizontal axis.

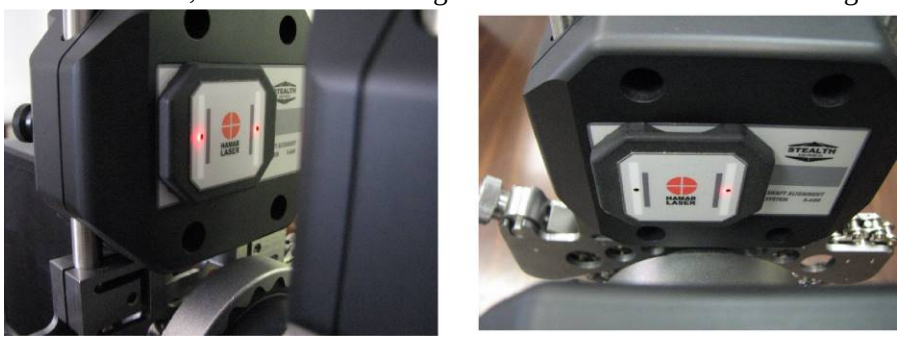
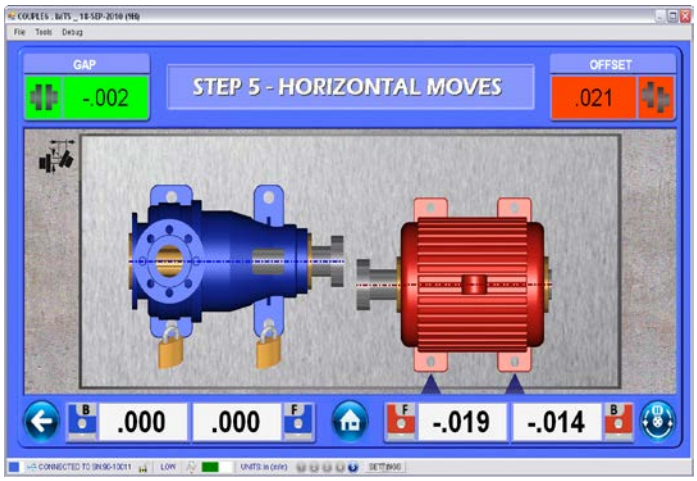


Figure 55 -- *Aligning laser beams with S-670 to take Uncoupled Shaft data in Point Mode using the dust cover/alignment tool*

1. Align the Vertical Axis first (see *Vertical Move with Uncoupled Shafts* on Page **100**).
2. Install the Dust Cover/ Alignment Tool, ensuring it is securely held in the window.
3. Rotate the laser to 3:00 or 9:00.
4. Rotate the T-1285 Target (***do not touch the laser adjustment wheel***) until the laser beams nearly disappear into the holes (or are centered on the vertical white line if the laser beams are too high) in the Dust Cover/Alignment Tool (see **Figure 55**).
5. Remove the Alignment Tool.
6. Move the motor by the amount recommended in the foot displays until the displays turn *yellow* or *green*, indicating the alignment is in tolerance (*see* Data Display Colors *on* Page **81**).
7. Tighten all bolts and retake the data in Couple6, **Step 4** to confirm the alignment.

Step 5: Move Screen – Horizontal Move Bolt Bound™

When it is determined that no more shim can be added/subtracted to bring the motor into alignment, use the **Bolt Bound™ Move** screen to see if adding/subtracting shim to the pump/driven unit brings the alignment into tolerance. To enable this screen, click the **Menu** icon (see Page 97) and select the vertical axis. If not already completed, go to *Step 1: Dimensions and Tolerances* and click the **Bolt Bound™** icon (see *Entering Machine Dimensions* on Page 51). Enter the **E** and **F** dimensions for the pump/driven unit. Return to Step 5 and the **Bolt Bound™ Move** screens display.



To switch to the **Horizontal Move** screen from the **Vertical Move** screen, *right-click* the **Menu** icon (see *Changing Views in Step 5* on Page 97) and select the **Bolt Bound™ Horizontal** icon to view the **Horizontal Move** screen.

Recommended Move Values

Based upon the A, B, C, E and F dimensions entered in the *Step 1: Dimensions* tab, Couple6 calculates and recommends the amount to push (or pull) from the front and back feet of the motor or the Pump/Stationary Machine. *Blue* UP arrows (↑) indicate to *push* the feet away from you. *Blue* DOWN arrows (↓) indicate to *pull* the feet toward you.

Locking/Unlocking Motor/Pump Feet

When the **Bolt Bound™ Move** screen first displays, the feet for the pump are locked and **Lock** icons display on the feet to indicate which feet are locked. To unlock the feet, click the **Lock** icon and it changes to a question mark, (?) indicating Couple6 is waiting for a foot to be unlocked.

Click an *unlocked* foot (?) to lock the foot. When two feet are locked and two are unlocked, the shims are recalculated for the unlocked feet to bring the motor into alignment. The graphics update, displaying which direction the feet are misaligned.

When the Coupling displays turn *green*, the alignment is in *Excellent* tolerance. When the Coupling displays turn *yellow*, the alignment is in *Acceptable* tolerance (*see Data Display Colors* on Page 81).

Remove Offsets

If Thermal Growth Offsets have been entered, the motor is misaligned by those offset values. To view the alignment without the Thermal Growth Offsets, click the **Menu** icon (see *Changing Views in Step 5* on Page 97) and click **Thermal Growth on/off**.

Saving the Alignment Data

Couple6 automatically saves data a backup file created at startup, so there is no need to periodically save data. However, upon exiting, Couple6 asks if you want to save data to the file created at startup. This updates the alignment file with the latest data and deletes the backup file. See Page 35 for instructions to access the backup data if the computer crashes during an alignment session.

Step 5: Vertical Pump Program - Shim and Move Screen

For vertical machines, the Move Screen in **Step 5** is very different. Vertical machine graphics display the misalignment in both angle (gap) and offset, however in the **Vertical Machine Move** screen, the angular values are shown on the left side in a *Side View* and the offset values on the right side in a *Top View* with matching graphics.

Since the motor is in the vertical orientation, the concept of "vertical" and "horizontal" differs from the standard horizontal motor, so we need to redefine them. To better understand the displays and graphics, we need to return to the concept of the clock face and bolt-hole orientation used in **Step 4**. We'll use this same clock face as way of identifying which direction to move the motor.

For example, we normally recommend making Bolt 1 the 12:00 location in **Step 4** when taking data. This means (in this case) that the Vertical Axis (V Gap/Angle and V Offset) in *Vertical Pump Move Display* shows the misalignment in the 6:00 to 12:00 direction of the motor (see **Figure 56**) and the Horizontal Axis (H Gap/Angle and H Offset) shows the misalignment in the 3:00 to 9:00 direction. We refer to these two "clock face" directions when talking about the direction the motor is moving.

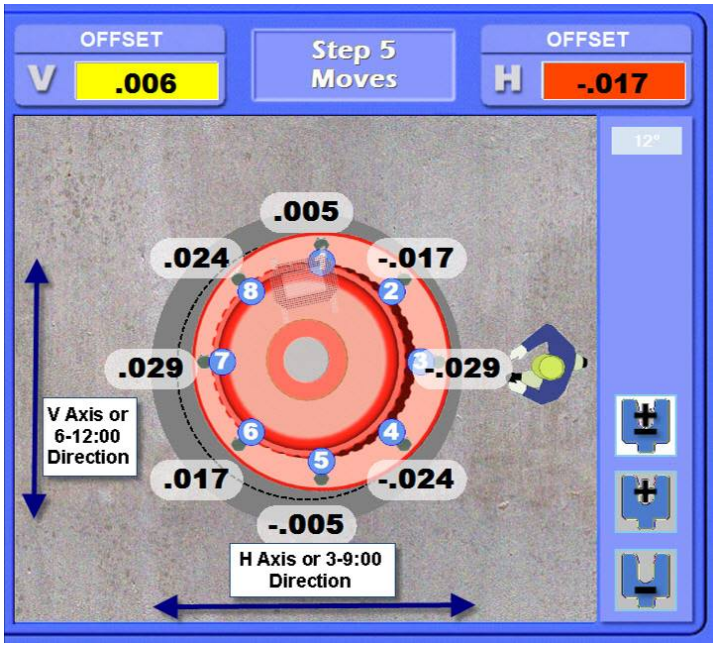


Figure 56 – *Vertical Pump Misalignment Offset View*

Target Hardware Differences for Vertical Machines – Where to Position Laser/Target

The Couple6 software is affected slightly in the Vertical Pump Program mode depending on the target in use. There are two types of targets:

- The T-1290 5-Axis Target.
- The T-1280/1285 3-Axis Targets.

When using the T-1290, the laser/target can be left at one "clock" location (typically 12:00) and the entire alignment can be performed without having to rotate the shafts. However, when using the T-1285 3-Axis Target, the shafts must be rotated to 3:00 or 9:00 to align the motor in the 3:00-9:00 direction (horizontal) or to 12:00 or 6:00 for the 12:00-6:00 direction (vertical).

Target Hardware Differences for Vertical Machines – Data Displays

The T-1290 5-Axis Target has a 2-axis PSD. This allows it to display all four alignment axes simultaneously, so there is data for V Angle/Gap, H Angle/Gap, V Offset and H Offset (see **Figure 57**).

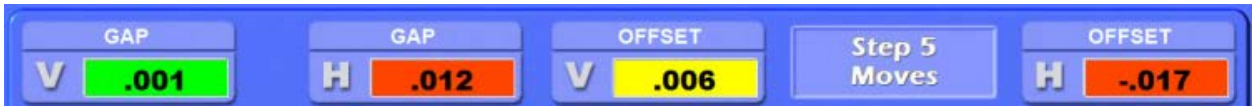


Figure 57 – *Step 5: Vertical Machine Data Display for T-1290 Target at 12:00*

The T-1280/T1285 targets have a single-axis PSD. Therefore, the data displays change depending on where the laser/target are left and only two data displays show data.

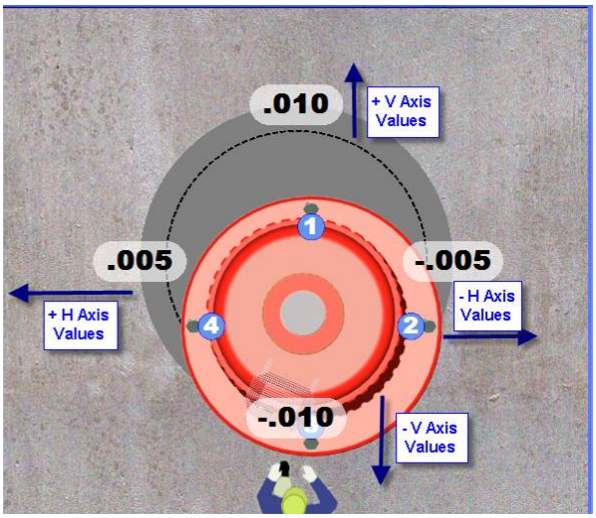
- If the laser/target are at 12:00, the V-axis data displays show the data for the 12:00-6:00 direction and the H-axis display is blank (see **Figure 58**).
- If the laser/target are at 3:00, the H-axis data displays show the data for the 9:00-3:00 direction and the V-axis displays are blank (see **Figure 59**).

Figure 58 – *Step 5: Vertical Machine Data Displays for T-1280/T-1285 Target at 12:00*

Figure 59 – *Step 5: Vertical Machine Data Displays for T-1280/T-1285 Target at 3:00*

Interpreting the Data – Offset Displays for the T-1290 Target

Couple6 groups the V and H axis offsets together with the Top View of the motor graphic to aid in aligning the offset axes of the motor (which is best understood using a top view). When using a T-1290 Target located at 12:00, the signs are interpreted as follows:



- **V-offset** – A *plus* (+) sign indicates that the motor coupling (flange) is offset closer to 12:00 relative to the pump coupling (flange). A *minus* (-) sign indicates that the motor coupling (flange) is offset closer to 6:00.
  - When viewing the Side View from 3:00, a *plus* (+) sign indicates that the motor coupling (upper half) is to the *right* of the pump coupling (lower half). A *minus* (-) sign indicates that the motor coupling is to the *left* of the pump coupling.
- **H-offset** – A *plus* (+) sign indicates that the motor coupling (flange) is offset closer to 9:00 relative to the pump coupling (flange). A *minus* (-) sign indicates that the motor coupling is offset closer to 3:00.
  - When viewing the Side View from 6:00, a positive (+) sign indicates that the motor coupling (upper half) is to the *left* of the pump coupling (lower half). A minus (-) sign indicates that the motor coupling is to the *right* of the pump coupling.

Interpreting the Data – Offset Displays for the T-1280/T-1285 Targets

When using the T-1280 or T-1285 targets, the laser/target must be rotated to 12:00-6:00 or 9:00-3:00 to view the data and only one display shows data. When the target is at 12:00, a *plus* (+) sign means the motor flange is closer to 12:00 and a *minus* (-) sign means the flange is closer to 6:00. When the target is at 3:00, a *plus* (+) sign means the motor flange is closer to 3:00 and a *minus* (-) sign means the flange is closer to 9:00.

Interpreting the Data - Angular Displays for the T-1290 Target

The Angular Displays show the slope or angle of the motor (in units of in/inch or mm/100 mm) relative to the driven unit. When using a T-1290 Target at located at 12:00, the signs are interpreted as follows:

- **V Angle** – A *plus* (+) sign indicates that the motor is tilted to the *right* when standing at 3:00 and viewing the Side View. A *minus* (-) sign indicates that the motor is tilted to the *left* when standing at 3:00.
- **H Angle –** When viewing the Side View, a *plus* (+) sign indicates that the motor is tilted to the left when standing at 6:00. A *minus* (-) sign indicates that the motor is tilted to the right when standing at 6:00.

Interpreting the Data – Gap Display for the T-1290 Target

The Gap Displays show the angular misalignment of the pump/motor at the coupling and displays the gap of the coupling The Angular Displays show the slope or angle of the motor (in units of inches or mm) relative to the driven unit.

- **V Gap** – When viewing the Side View, a *plus* (+) sign indicates that the gap in the coupling is open in the 6:00 (left) side of the coupling when standing at 3:00. A *minus* (-) sign indicates that the gap in the coupling is open on the 12:00 (right) side when standing at 3:00. This gap is calculated by multiplying the angular value (slope) of the motor times the diameter of the coupling (the *D Dimension* entered in **Step 1**).
- **H Gap –** A *plus* (+) sign indicates that the gap in the coupling is open in the 3:00 (right) side of the coupling when standing at 6:00. A *minus* (-) sign indicates that the gap in the coupling is open on the 9:00 (left) side when standing at 6:00.

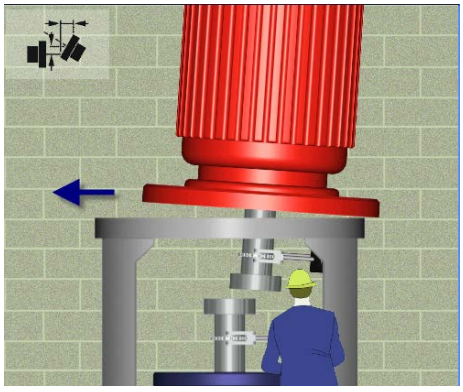


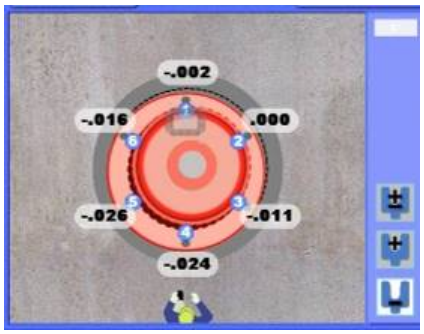
Figure 60 – *Side View show the motor tilted to the right (+V Angle/Gap) with T-1290 Target at 12:00*

Interpreting the Data – Gap/Angular Displays for the T-1280/T-1285 Targets

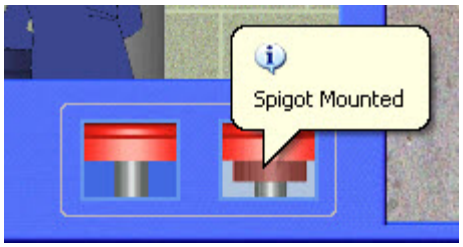
When using the T-1280 or T-1285 targets, the laser/target must be rotated to 12:00-6:00 or 9:00-3:00 to view the data. With the target at 12:00, a *plus* (+) sign means the top of motor is tilted closer to 12:00 and a *minus* (-) sign means the top of the motor is tilted closer to 6:00. With the target at 3:00, a *plus* (+) sign means the top of the motor is tilted closer to 3:00 and a *minus* (-) sign means the top is tilted closer to 9:00.

On-Screen Display Controls

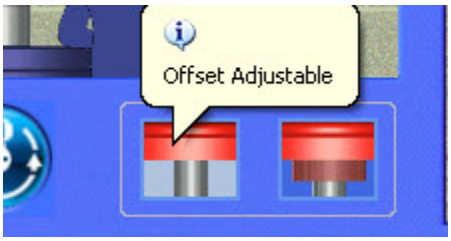
Step 5: Vertical Pump Moves & Shims Add Mode



Step 5: Vertical Pump Moves & Shims Remove Mode



Step 5: Vertical Pump Moves & Shims Spigot Mount



Shim Value Controls

The shim values at each bolt-hole location are automatically calculated and displayed on the screen. The bolt-hole number is also displayed to show you where to shim. The default display for the shims is ±, which means Couple6 calculates to minimize the amount of shim to add or subtract from each bolt-hole location.

Click to put the shim display in Min/Max Mode.

Click to put the shim display in Add Shim Mode, which takes the biggest *minus* (-) shim and makes it zero and then adds this value to all the other shim locations. This means you can only *add* shim to align the motor.

Click to put the shim display in Remove Shim Mode, which takes the biggest positive (+) shim and makes it zero and then subtracts this value from all the other shim locations. This means you can only *remove* shim to align the motor.

Other Screen Controls – Spigot

Clicking this icon turns off the offset axes in the graphical display since the spigot-mounted flanges cannot be adjusted to align the offset. The V and H Offset values still update, however.

Adjustable Offset

Click Offset Adjustable for non-spigot mounted flanges where the offset can be adjusted to make the offset display screen live.

Matching Screen Graphics to Where You Are Standing at the Machine

Couple6 gives you the ability to alter the view of the graphics to match your location relative to the vertical machine and to show you how the alignment looks (which way the motor is tilted and offset from the pump flange) from that location.

To adjust the graphics, move the "technician" icon by clicking and holding the mouse button on the icon and moving it around the machine. The graphics automatically adjust to show you how the alignment looks from your location. See **Figure 61** and **Figure 62** to see the views from the clock positions.

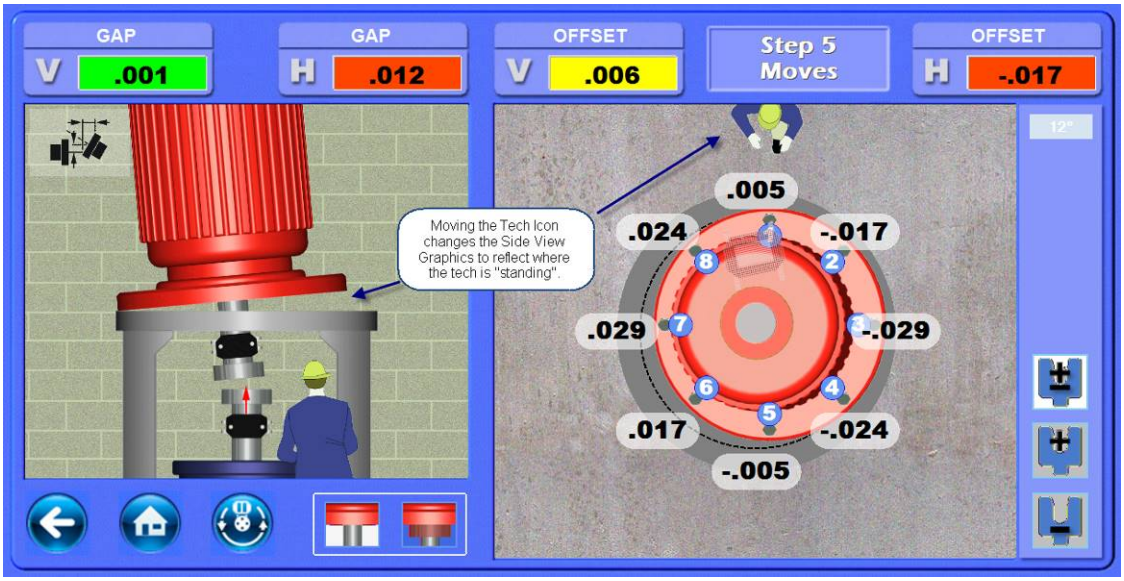


Figure 61 – *Step 5: Vertical Pump Moves and Shims View from 12 o'clock*

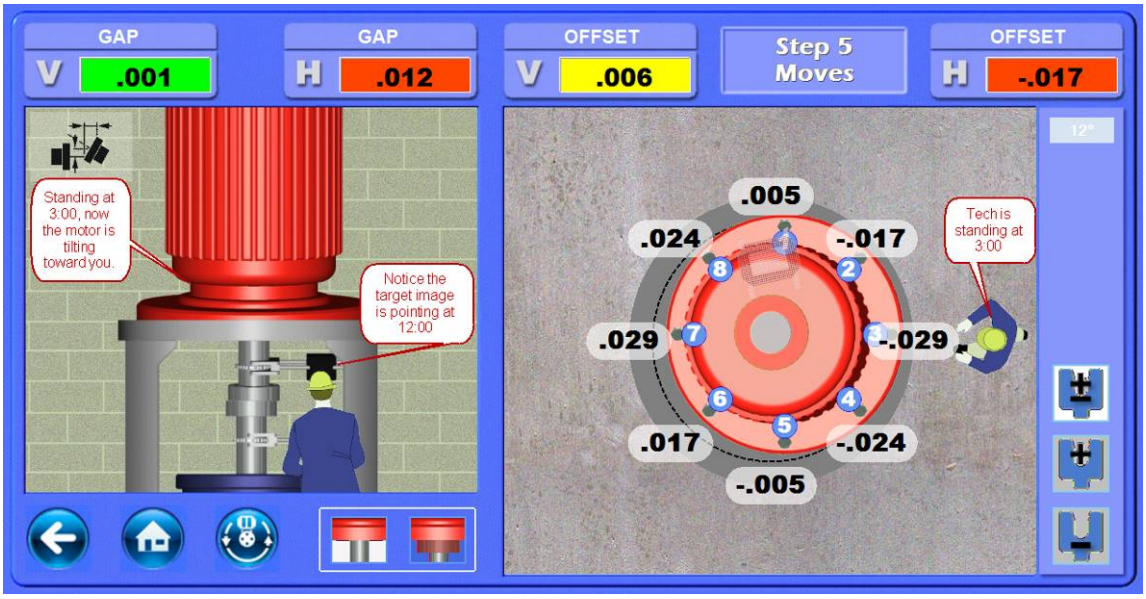


Figure 62 – *Step 5: Vertical Pump Moves and Shims from 3:00*

Step 5: Interpreting the Vertical Pump Move Graphics

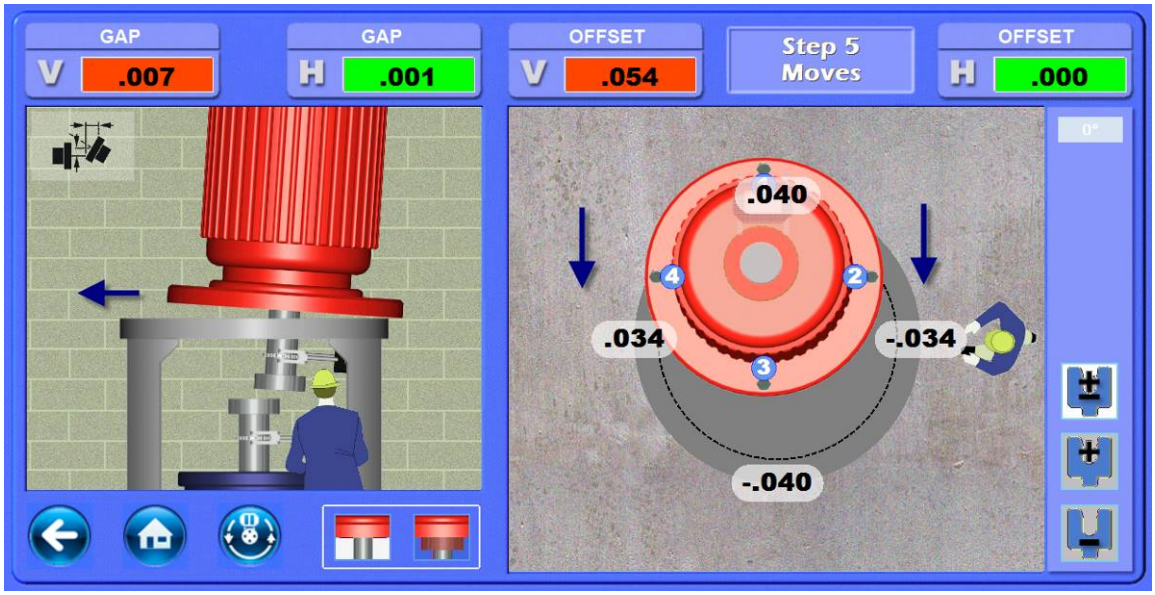
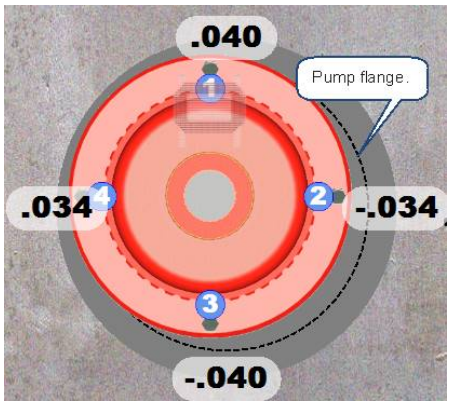
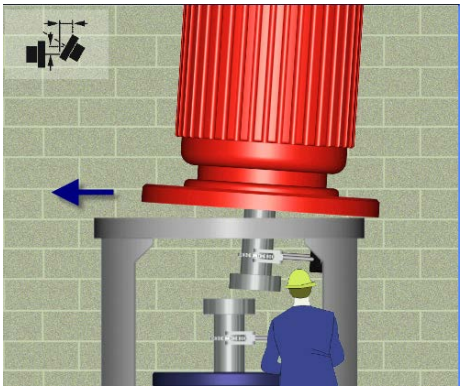


Figure 63 – *Step 5: Vertical Pump Move Screen*

Shown in Figure 63 is the **Step 5: Vertical Pump Move** screen with the technician standing at 3:00, looking primarily at the Vertical (12-6:00) axis. To align the V-axis, the flange must be moved to the Tech's left, which is shown in both the Top and Side Views. The motor is tilted to the right, so shim must be added to Bolt 1 and taken out of Bolt 3. The arrows (not visible in the software) illustrate which way to move the flange.



This Top View graphic shows the flange (offset) misalignment and the shim values at each bolt location. The dotted circle represents the pump (lower) flange. Align (center) the motor image in the dotted circle and the motor is aligned to the pump in the V and H Offset axes. Notice the target image is at 12:00.

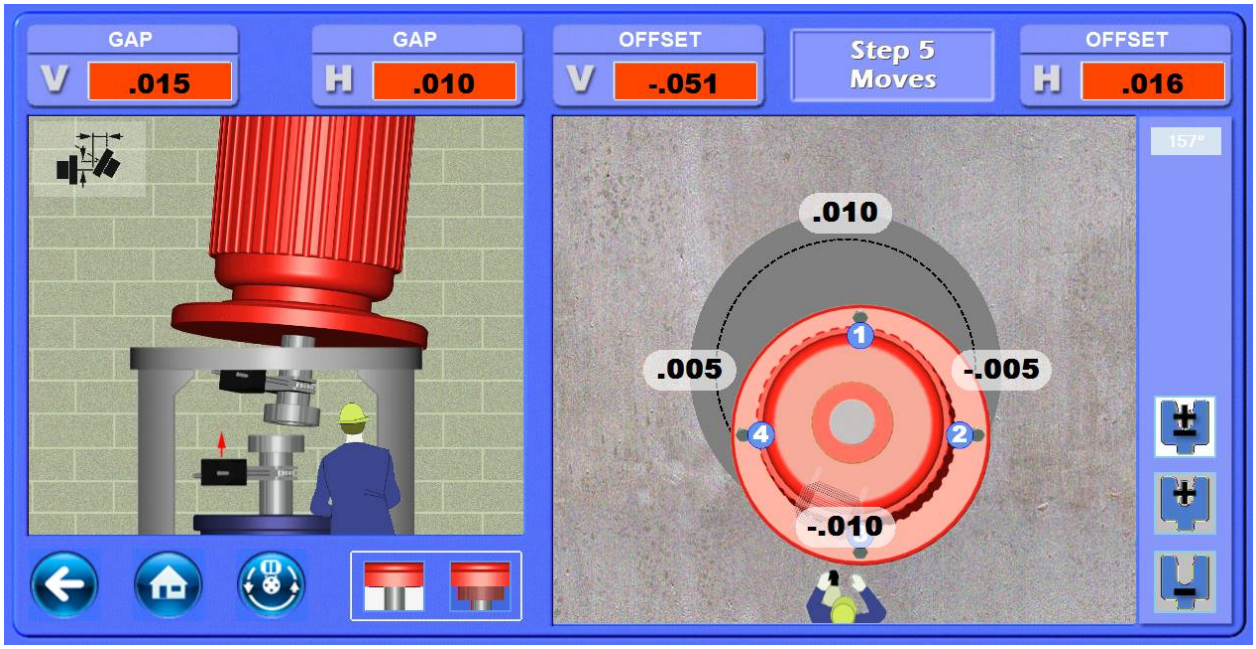


This is the Side View of the motor with the technician standing at 3:00. Notice the motor is tilting to right, showing the V Gap (6-12:00) misalignment (positive value). Also notice that the motor flange is not centered to the pump flange, which means the V Offset is not aligned. Both the tilt and centering of the flange update as you move/shim the motor. Notice the target image is pointing to right of the tech toward 12:00 (Bolt 1).

Vertical Pump Move Screen Alignment Procedure with a T-1290 5-Axis Target

Using the powerful Duo-Plane™ Feature of the T-1290 5-Axis Target, the entire alignment can be performed by leaving the laser/target at 12:00 (Bolt 1). The only thing that may need to be changed is the Tech Icon to help you to better understand the misalignment.

Procedure:



1. Start by adding/subtracting the shim to each bolt hole as indicated. This aligns the vertical (12:00-6:00) and horizontal (9:00-3:00) angular misalignment.
2. To align the V-axis Offset (12:00-6:00 axis), begin with the laser/target at 12:00 (usually Bolt 1). This is typically done by leaving the target at 12:00 (Bolt 1) in **Step 4** after data is taken. To ensure that Side View Graphics update and illustrate the Vertical Axis (12:00-6:00) alignment, move the **Tech** icon to 3:00.
3. Adjust the motor flange (up or down on the Top View Screen) in the 12:00-6:00 direction to center it to the pump flange. View the V Offset display to see the V offset data update.
4. When the V offset is aligned, move the **Tech** Icon to 6:00 and adjust the motor flange (left or right on the Top View Screen) in the 3:00-9:00 direction (H-offset) to center it to the pump flange. View the H Offset display to see the H-offset data update.
5. Check the V-offset data to verify it did not change. Since the flanges are round, it may require several adjustments to the V and H axes to bring it into alignment.
6. If both the V and H offset displays are yellow or green, tighten the bolts and check the displays again to ensure that nothing has moved. If so, click the **Remeasure** icon to take a final set of data and verify the alignment.

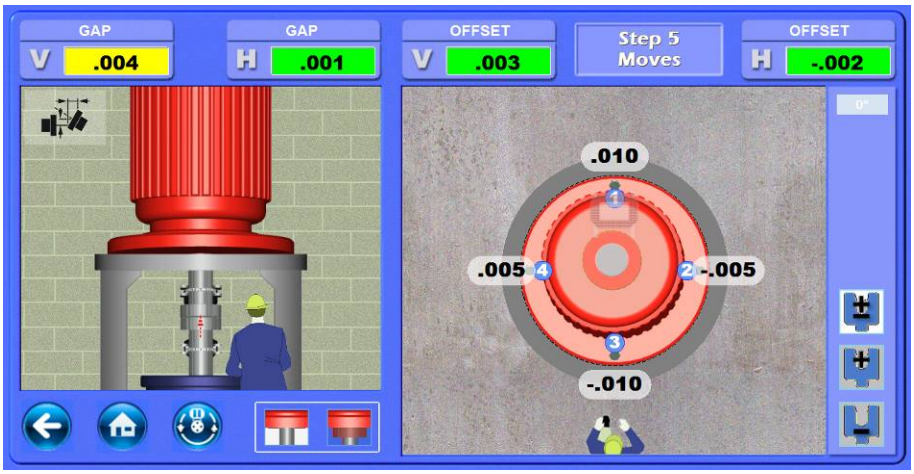


Figure 64 – *Step 5: Vertical Pump Move Screen showing both axes aligned*

Using the Vertical Pump Move Screen with a T-1280 or T-1285 3-Axis Target

To use the T-1280 or T-1285 3-Axis Targets for aligning Vertical Pumps, rotate the laser/target to switch the alignment axes from Vertical to Horizontal. Since these targets can only measure in one direction (V-axis on the PSD), the laser/target must be rotated to either 12:00 or 6:00 to align the V-axis (12:00-6:00 axis) of the motor, and then to 9:00 or 3:00 to align the H-axis (9:00-3:00 axis). Couple6 needs to know the correct location of the laser/target so it can update the graphics orientation to accurately display the misalignment.

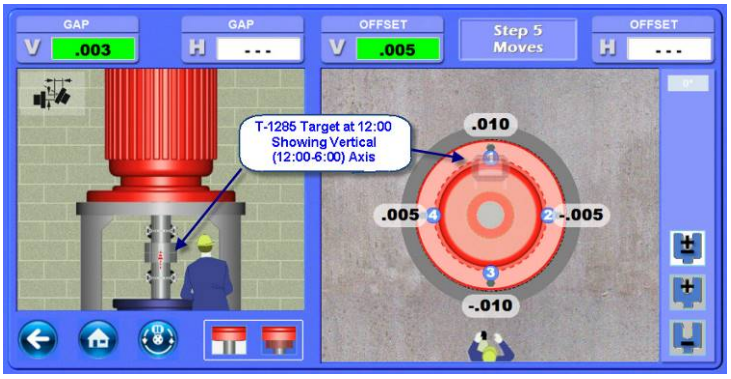


Figure 65 – *Step 5: Vertical Pump Move Screen using the T-1285 Target at 12:00, showing Vertical Axis*

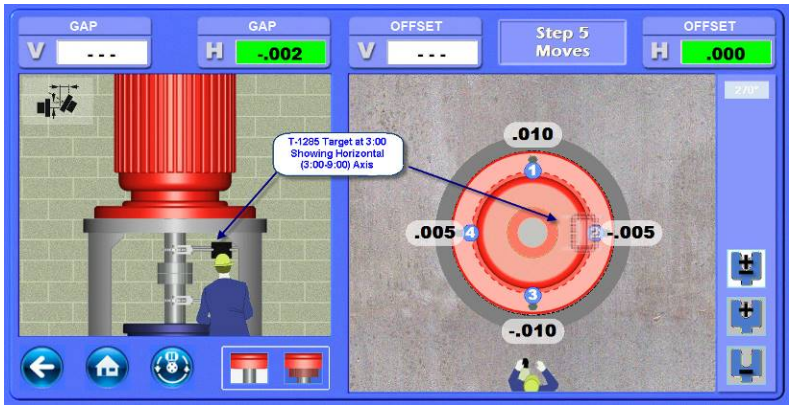
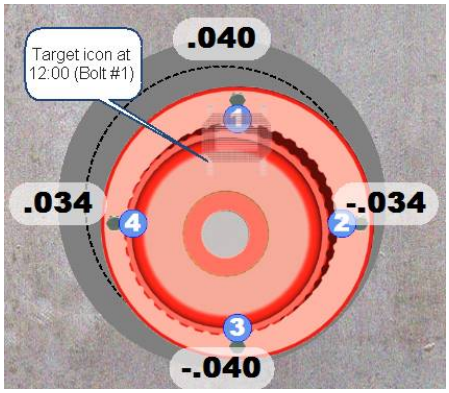


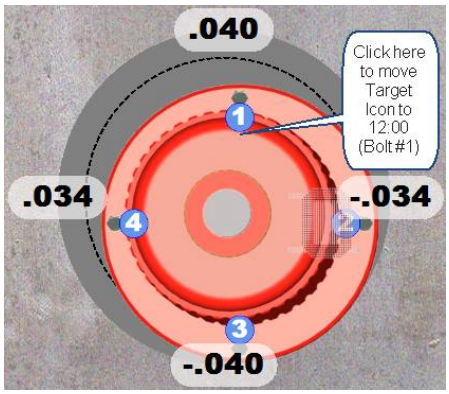
Figure 66 – *Step 5: Vertical Pump Move Screen using the T-1285 Target at 3:00, showing Horizontal Axis*

Procedure:



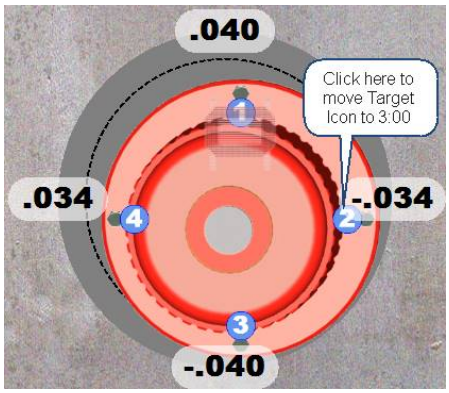
1. Add/subtract the shim to each bolt hole location as displayed on the screen. When finished, start to align the V and H offset.
2. To align the V-axis (12-6:00 axis), rotate the laser/target to 12:00 (usually Bolt 1). This is typically done by leaving the target at 12:00 (Bolt 1) in **Step 4** after data is taken. To ensure the Side View graphics illustrate the Vertical Axis misalignment, move the **Tech** icon to 3:00.

Note: *If the **Target** icon is not at 12:00 (Bolt 1), click the Top View Graphic at 12:00 (Bolt 1) to move it there. This tells Couple6 the location of the laser/target and is VERY IMPORTANT.*



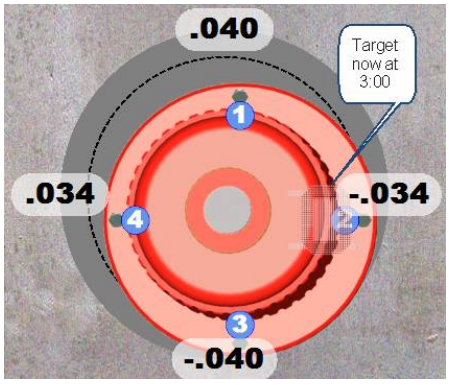
3. Adjust the motor flange (up or down on the Top View Screen –your left/right when standing at 3:00) to center it to the pump flange. View the V-offset display to see the Vertical flange misalignment data update in the 12-6:00 direction. When it turns green or yellow, it is aligned.

4. When the V-axis is aligned, rotate the laser/target to either 3:00 or 9:00 and click the Top View Graphic at 3:00 or 9:00 to move the **Target** icon to the matching location. To ensure the Side View graphics reflect the 9:00-3:00 axis misalignment, move the **Tech** icon to 6:00.



5. The **Target** icon is now at 3:00. Adjust the flange (left/right on the Top View graphic – your left/right when standing at 6:00) to align the offset. Watch the H-offset display as the flange is adjusted. When it turns green or yellow, it is aligned.

6. Rotate the laser/target back to 12:00. Click the **Target** icon to bring it back to 12:00 to verify the V-axis alignment did not change. Since the flanges are round, it may take several rotations of the laser/target between 12:00 and 3:00 and aligning the V and H axes to bring it into alignment.



7. If both the V and H Offset displays are yellow or green, tighten the bolts and check the displays to ensure nothing has moved. If so, click the **Remeasure** icon to take a final set of data and verify the alignment.

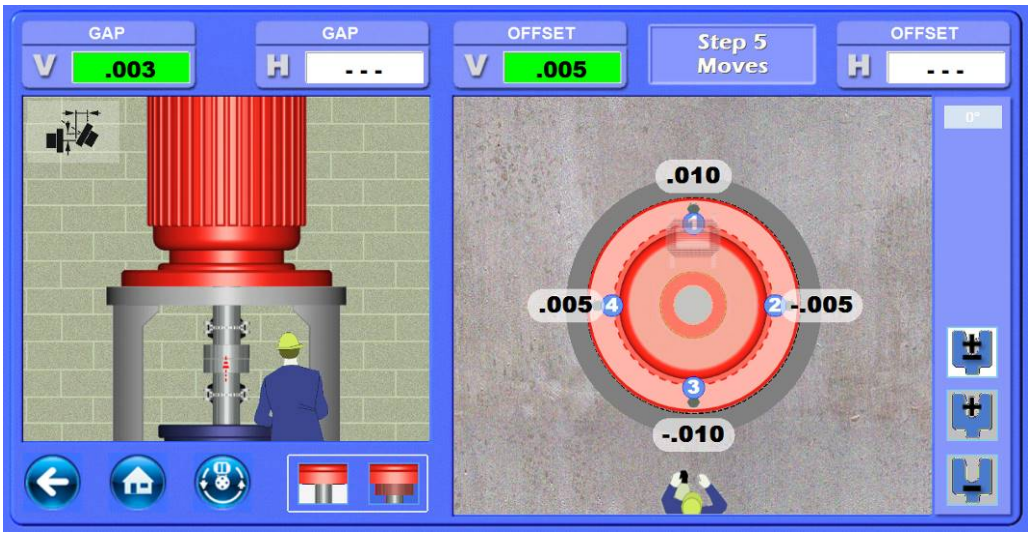


Figure 67 – *Step 5: Vertical Pump Move Screen with Vertical Axis aligned*

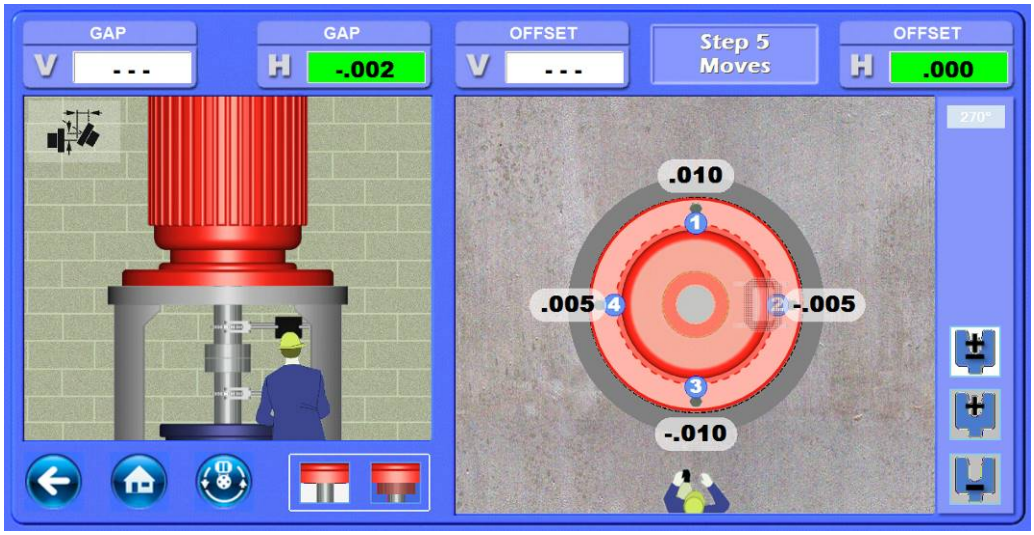
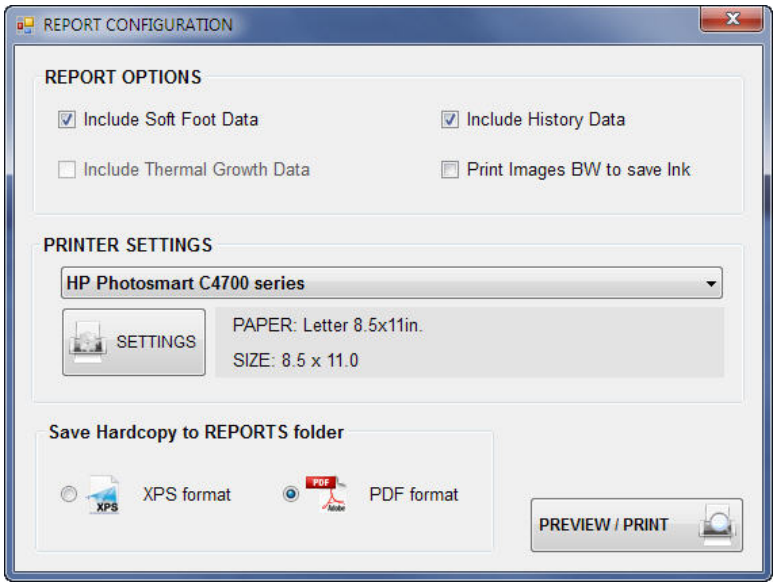


Figure 68 – *Step 5: Vertical Pump Move Screen with Horizontal Axis aligned*

Couple6: Printing Reports

To print a report in Couple6, click the **Alignment Report and Data Export i**con in the **Main Menu** to access the **Report Configuration** popup window**.**

- **Report Options** – Select which parts of the report to include: Soft Foot, Thermal Growth, and/or History. These sections of the report will not print unless the check box is checked. **Print Images BW to Save Ink** may be selected to print the report in black and white.
- **Printer Settings –** Click to select the printer, page size and other printer settings.
- **Save Hard Copy to REPORTS Folder** – The report can be saved as either an **.xps** file (for use with an MS XPS Document Printer, which allows the user to open the file in Explorer to view and print) or in **.pdf** format for use with Adobe Acrobat. This allows the report to be emailed or transferred electronically to users who do not have Couple6 to view the report.



- Click **Preview/Print** to preview and to print the report (sample alignment report below). See the following pages for a sample Shaft Alignment report).

Couple 6 Sample Alignment Report

STEALTH SERIES™

COUPLE6
ALIGNMENT REPORT

HAMAR LASER®

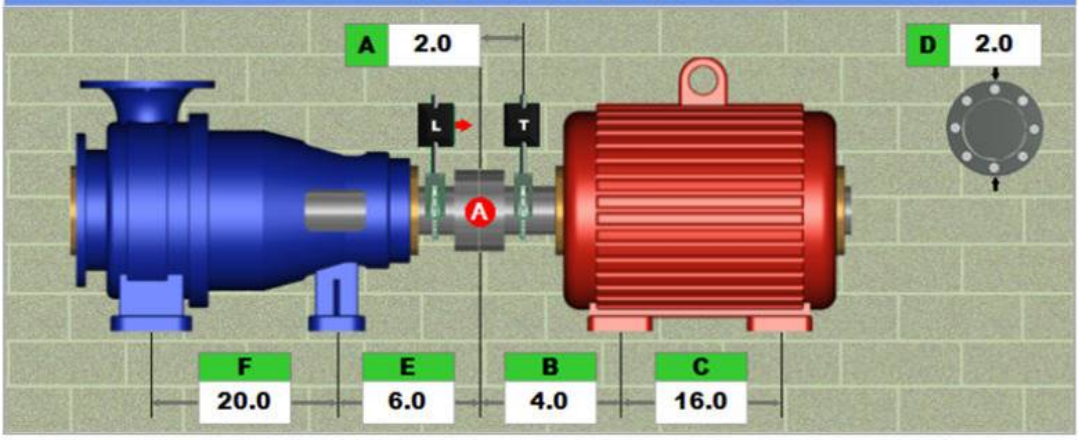
REPORT ISSUED BY:

Hamar Laser
5 Ye Olde Road
(203) 730-4600

COMPANY / JOB INFORMATION

Machine Name	TEST MACHINE 001
Company	Hamar Laser
Location	5 Ye Olde Road
Address	
City	Danbury
State / Province	CT
Postal (ZIP) Code	06810
Country	USA
Notes	www.hamarlaser.com

MACHINE SETUP



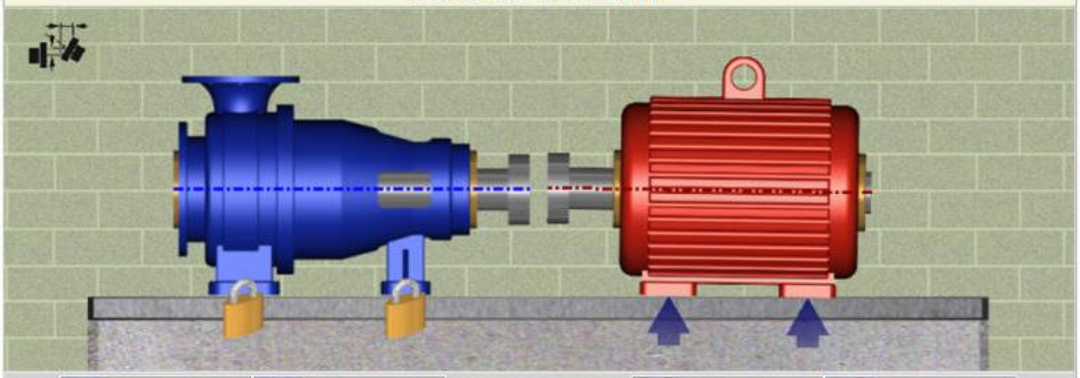
UNITS	OFFSET = in, ANGLE = in/in

TARGET INFORMATION

MODEL NUMBER : T-1290	SERIAL NUMBER : 90-10061
CALIB. DATE : 4/28/2009	FW REV. : 1.24

ALIGNMENT RESULTS

VERTICAL - SIDE VIEW



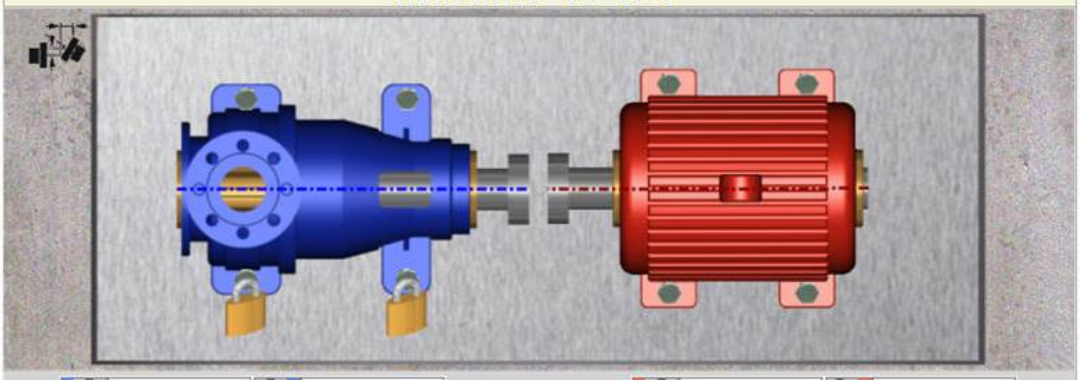
B		F		F	.005	B	.027

GAP -.0028

RPM	TOLERANCES	
900+	ACCEPT.	EXCEL.
OFFSET	.0060	.0030
ANGLE	.0010	.0007
GAP	.0020	.0014

OFFSET .0009

HORIZONTAL - TOP VIEW



B		F		F	.001	B	.003

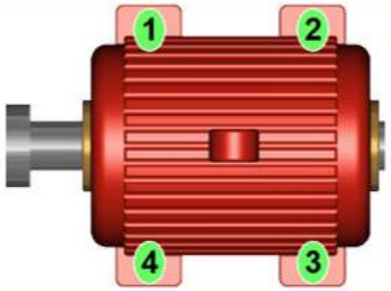
GAP -.0003

RPM	TOLERANCES	
900+	ACCEPT.	EXCEL.
OFFSET	.0060	.0030
ANGLE	.0010	.0007
GAP	.0020	.0014

OFFSET -.0004

SOFT FOOT

FOOT #	TIGHT	LOOSE	SHIM
1	.0236	.0236	.000
2	.0366	.0385	.002
3	.0386	.0387	.000
4	.0241	.0243	.000



REPEATABILITY

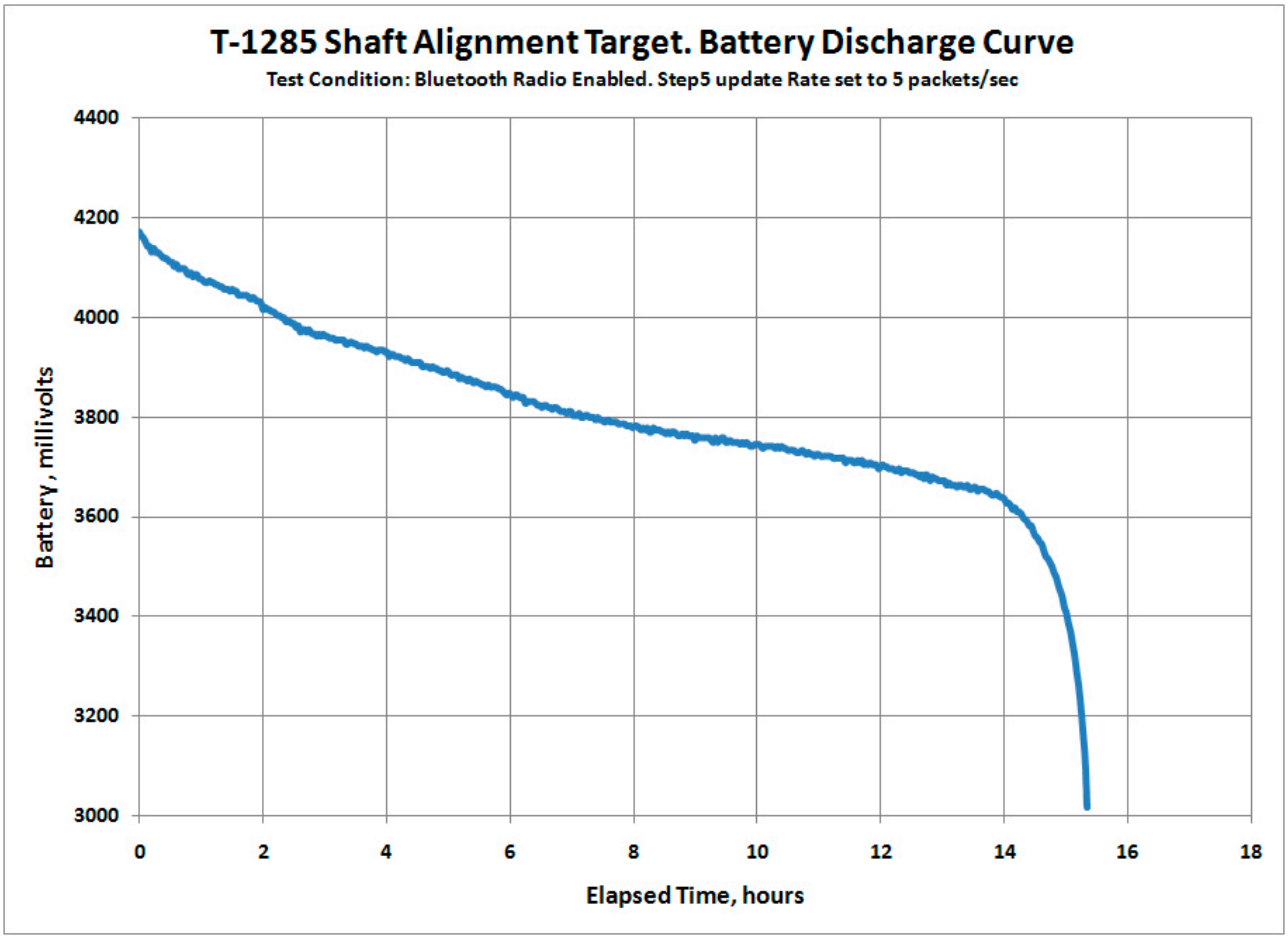
#	V OFFSET	V GAP	H OFFSET	H GAP	DATE	TIME	SPAN	POINTS	MODE	METHOD
✓ 1	.0009	-.0028	-.0004	-.0003	11/14/2010	10:17 AM	200.4°	210	COUPLED	AUTOSWEEP

HISTORY

CATEGORY	V OFFSET	V GAP	H OFFSET	H GAP	DATE/TIME	SPAN	#POINTS	MODE	METHOD
As Found	.0009	-.0028	-.0004	-.0003	11/14/2010 10:17:56 AM	200.4°	210	COUPLED	AUTOSWEEP

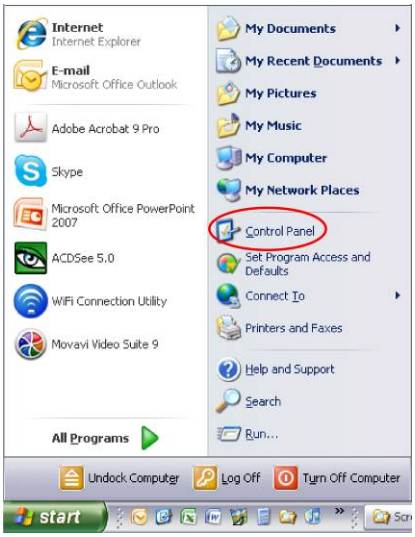
Appendix A – Coupling Battery Discharge Curve

This is the typical battery life curve for the T-1285 and T-1290 targets, transmitting the data via the Bluetooth transmitter. The target typically shuts down at about 3100 millivolts, which equals about 15 hours of battery life. Each target varies slightly and some may shut down at higher voltage levels. As a rule, the older the battery, the shorter the battery life.

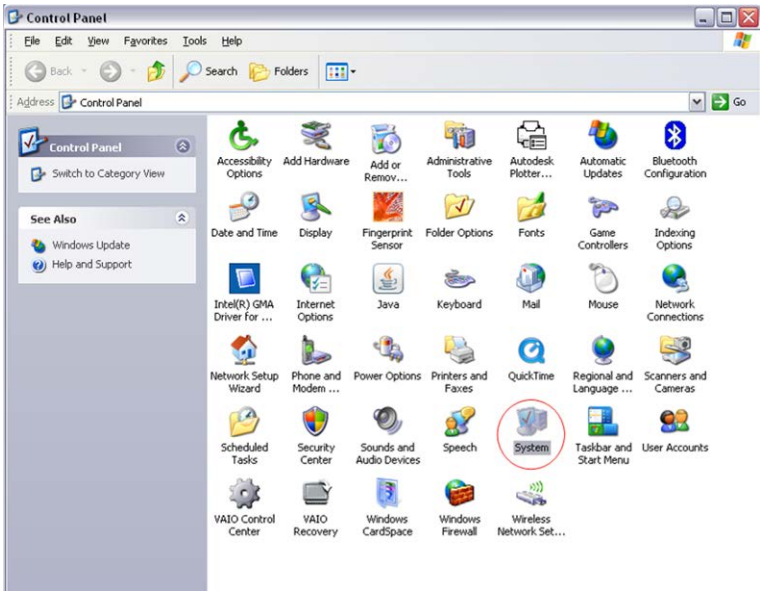


Appendix B – Determining Device COM Ports

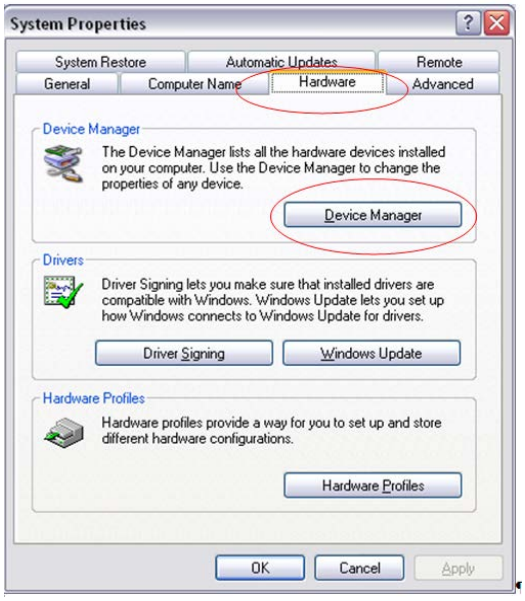
To determine the COM port for a device, open the Windows Control Panel.



Select the **System** icon.



Select the **Hardware** tab and then select **Device Manager**.



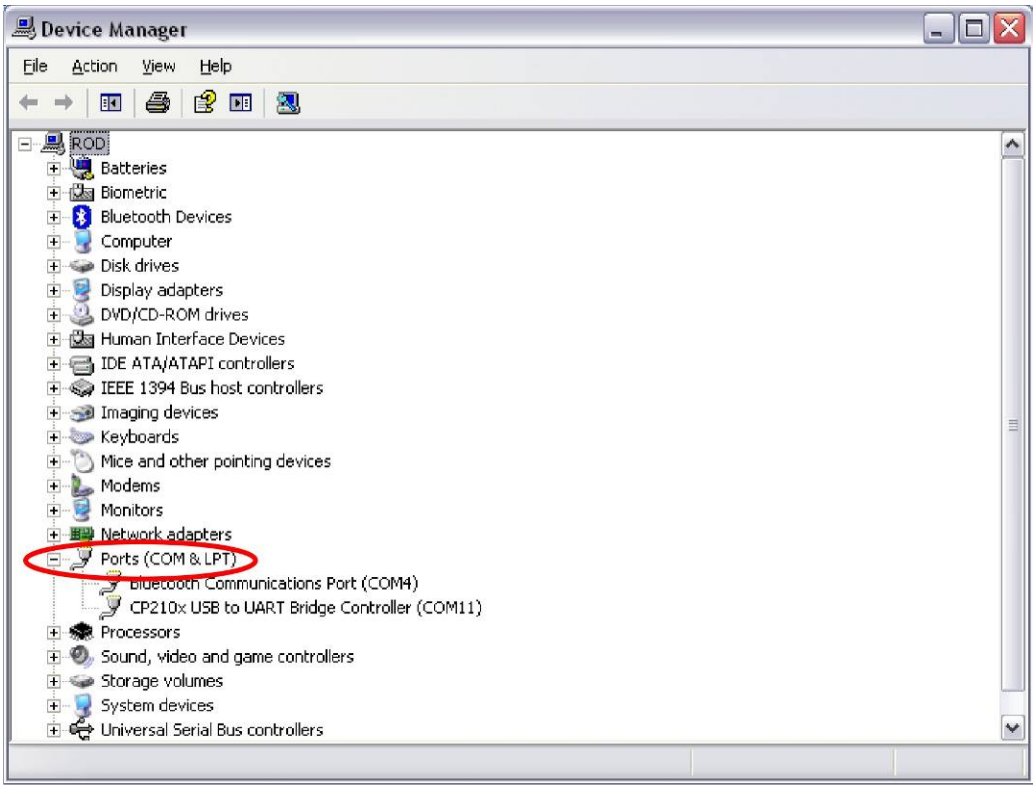


Figure 69 – *Windows Device Manager displaying the COM ports*

Click the plus sign (+) next to **Ports** to expand the list and display the COM port to which the Bluetooth radio and USB cable are connected.

Note: *The USB cable provided with the S-680 kit displays as* **CP21X USB to UART Bridge Controller**. *The Bluetooth radio in the tablet/laptop also displays in this list. In Figure 69, the Bluetooth is connected through COM4 and the USB cable is connected through COM11.*

Appendix C – Pairing the T-1285/T-1290 Target with the Tablet Bluetooth Radio

When a complete S-670 or S-680 system is purchased with a tablet/laptop computer, Hamar Laser pairs the target with the device. If a system crash occurs and the Bluetooth link needs to be re-established, or if a system is purchased without a laptop/tablet, follow these procedures to establish a link to the target. *This must be done prior to running the Couple6 software.*

1. Click **Start>All Programs>Bluetooth** and select **Bluetooth Settings** (see **Figure 70**).
2. When the **Add New Connection** Wizard displays, select **Custom Mode** (see Figure 72). The software searches for Bluetooth devices. Select your device and click **Next**.
3. Enter **Passkey 1280** to pair the target.
4. Highlight **Bluetooth Serial Port** and click **Next**.
5. Select **COM8** from the dropdown list and remove the check from **Use Default COM Port**. Leave the **Auto Connect** box checked. When the warning message displays, click **OK** (see **Figure 71**). Click **Next**.
6. Enter a name and icon for the Bluetooth connection (optional). Click **Next**.
7. Click **Finish** to complete the Bluetooth setup.

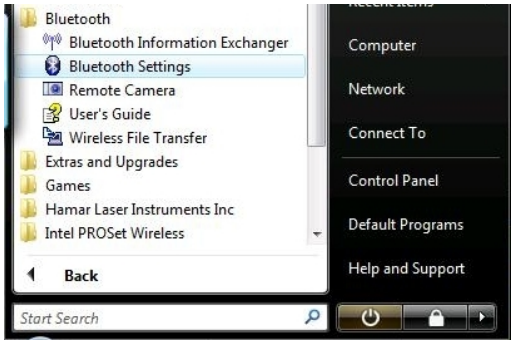


Figure 70 – *Bluetooth Settings*

Figure 72 – *Custom Mode*

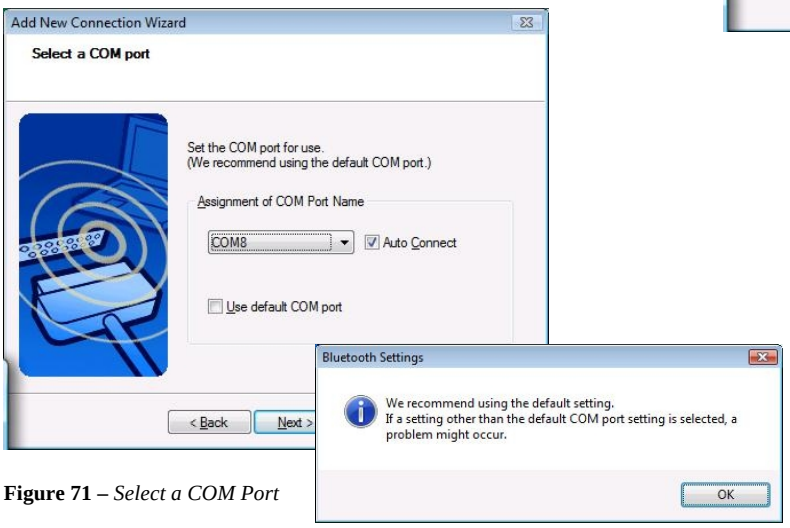


Figure 71 – *Select a COM Port*

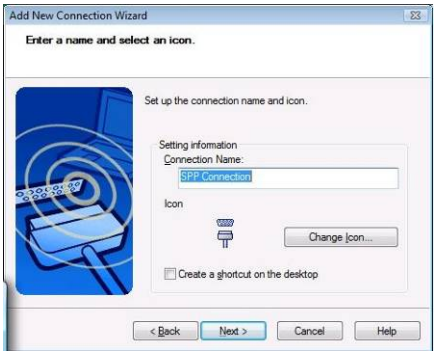


Figure 73 – *Assign name and icon to Bluetooth setting*

Adding a Bluetooth Device to Your Personal Computer

When a Bluetooth device is added to a personal computer, address information and access keys are exchanged. This process is known as *pairing* or *bonding* the two devices. When a device is added, one of the devices must be "discoverable." This discovery feature may be turned on or off for some devices and others, such as a computer mouse, are always discoverable.

To add a device to your personal computer:

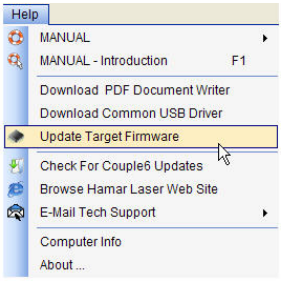
1. Click **Start>Run** and type **bthprops.cpl.** Click **OK**.
2. In **Bluetooth Settings**, click **Add**.
3. When the **Add Bluetooth Device** Wizard displays, click **My device is set up and ready to be found**. Click **Next**. Note that you cannot click **Next** until **My device is set up and ready to be found** is enabled. A device that has "discovery" turned off cannot be detected during a search. Your computer searches for any discoverable devices in range and they display in the Wizard.
4. Select a device to add. Click **Next**.
5. Add a passkey for the device if required. A passkey is a code that controls access to a device and helps improve the security of your connection (for example, the passkey for the Stealth™ Targets is 1280). Your computer tries to connect to the device to verify the passkey.
6. After a device is added, it displays in the Bluetooth Devices listing. You can view device properties to examine the services provided, change the name of the device, gather other information or establish a connection.

Appendix D – Updating the Target Firmware from Within Couple6

Firmware is a set of instructions programmed into a hardware device, such as the T-1285 target. It provides the necessary instructions for how the device communicates with other hardware and is typically stored in the flash ROM of a hardware device. The procedure for updating the target firmware is described below.

Before updating the target firmware, ensure that the target battery and the laptop battery (if using a laptop) are fully charged. Disable Sleep/Hibernation modes or set them to occur at least 10 minutes after the last user input. The optional USB cable is necessary to update the firmware and the Common USB driver must be installed if you have not already done so (the USB driver can be downloaded from the Help Menu). Over-the-air updates via the Bluetooth radio are not allowed.

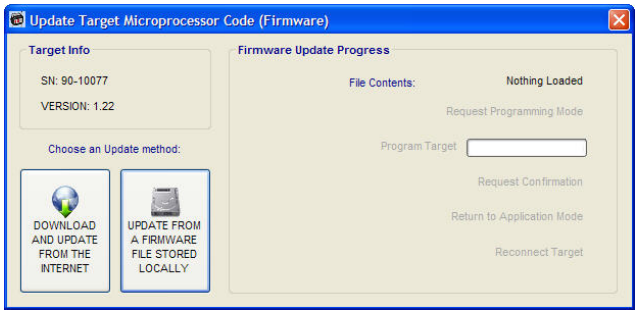
1. Connect the target to the computer with the USB cable.
2. Load Couple6 and wait for the target to connect, making sure it connects through the USB cable and not through Bluetooth. You should see the USB icon in the task bar as shown below, just before the word CONNECTED.



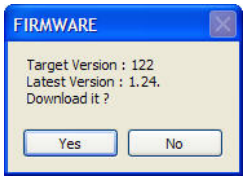
3. From the **Help Menu**, select *Upload Target Firmware*.

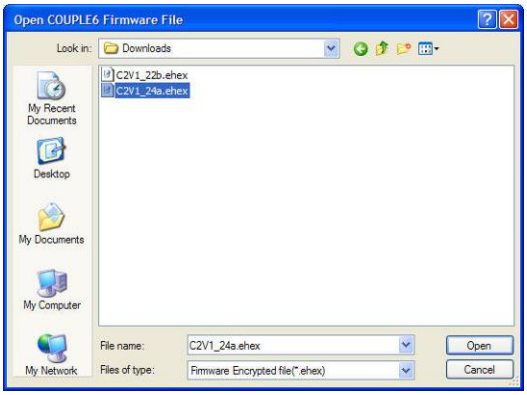
4. The *Update* dialog box displays. The target can be updated using one of two methods:

- Update from a firmware file stored locally (on your computer)
- Download and update from the Internet. This method requires an unrestricted Internet connection. Strict network security and Internet firewall settings may prevent this option from working. Contact your System Administrator for further assistance.

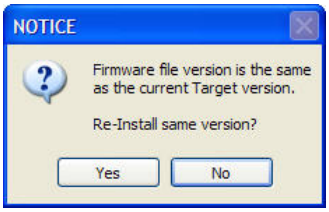


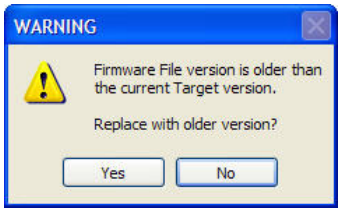
5. If you choose to download and install the latest version, a message displays confirming the firmware version currently installed on your target and the latest version available on the Internet server. Click **Yes** to proceed and open the firmware file.



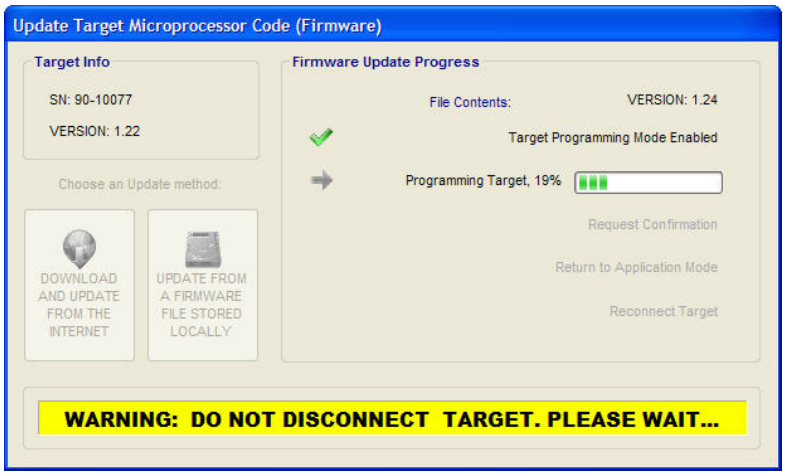


Note: *With either update method (local or Internet), a message displays indicating if your version is up-to-date or if the version you are trying to install is older than the existing version.*

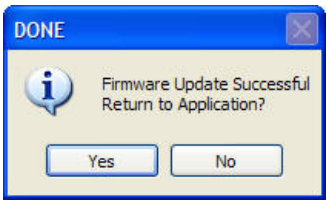


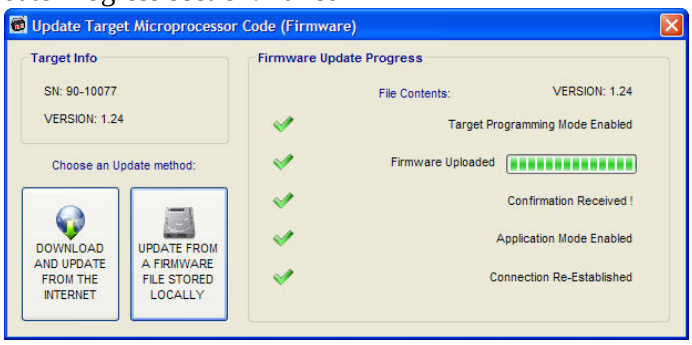


6. Click **Yes** to begin the update process or **No** to abort. The update process starts immediately after clicking **Yes**. *It is very important that this process not be disturbed. Do not use other applications while the update is in progress and do not shut off or disconnect the target cable until all steps are checked off and* **Done** *displays. Interrupting this process may render the target unusable.*

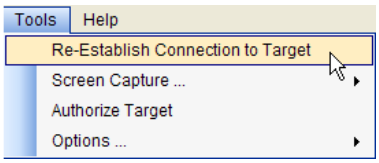


7. Once the **DONE** message displays, click **Yes** to close the Update Dialog and return to the main application or **No** to remain in the Firmware Update Dialog. When a firmware update is successful, all update steps are marked with green checkmarks. The most critical steps are the first 3 in the Firmware Update Progress section. Failed steps are indicated with a red "X". If any of the first three steps fail, **DO NOT UNPLUG THE TARGET!** Try running the update again. The 4th and 5th steps restore the target to running mode (Application Mode). Failure of these steps is not critical, as they occur after the update is completed and verified. However, do not disconnect the target until all steps have completed.

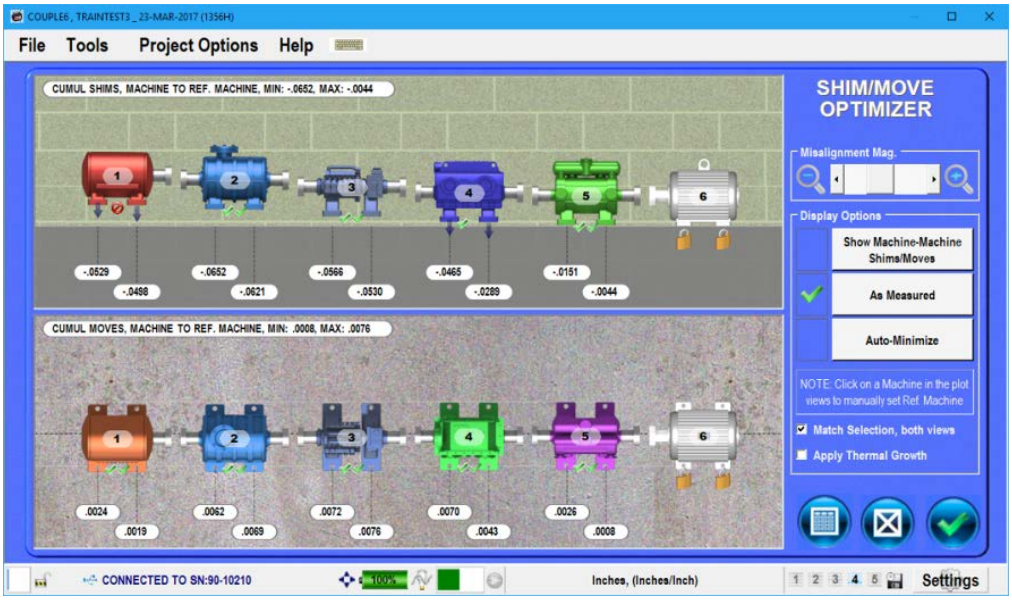




8. Reconnect the target via the Bluetooth link by shutting off the target, unplugging the USB cable and re-establishing the connection via the **Tools Menu**.



Appendix E – Couple6 Machine Train Program Module



For complex alignment projects where there are more than two machines in a shaft alignment job, the Couple6 Machine Train Module is a powerful tool to keep track of all the alignment data and help analyze the data to plan how to align all the components in the train.

There are two licenses available for Couple6 Train:

- Three machines – this license allows for three machines in the train. This is a typical train application.
- Ten machines - this license allows for 3-10 machines, where the user selects the number of machines in the train.

All the procedures below apply to both licenses with the machine limitation noted above.

Below is the general procedure on how the Machine Train Module works, with details on how to do each step following.

General Procedure Summary:

1. Go to **Step 1: Dimensions and Tolerances**
2. Select the number of machines.
3. Select the machine number that is the Reference Machine. All other machines are aligned to this machine.
   Note: *After taking all the machine alignment data, the Reference Machine can be changed in* **Step 4: Shim/Move Optimizer**.
4. Select the matching graphic for the type of machines used in each component.
5. Enter the dimension for each machine as shown on the screen. An accuracy of .13" (3 mm) is needed.
   Note: *Measurement accuracy is much more important on machine train applications since the overall dimensions can be quite long and inaccurate measurements can have a big impact on shim/move values for the last machines in the train.*
6. Go to **Step 1: Train Spec** and select the machine tolerances for each machine. Enter the thermal growth values (if any).

7. Go to **Step 2: Laser Setup**, attach brackets and set up the laser/target (see Page 15 for the S-660 or Page 18 for the S-670/680).
8. Check soft foot for each machine in **Step 3: Soft Foot**. See Page 72 for details.
9. Go to **Step 4: Measure Misalignment** to take data.
    a. Enter the **A Dimension** (this is the dimension from the center of the coupling to the target bracket).
    b. Take data for that machine. It is usually a good idea to take 2-3 sets of data to check repeatability.
    c. Click **Machine Selector** to select the next machine.
    d. Enter the **A Dimension** for the new machine and take data.
    e. Continue for all the machines in the train.
10. When all the data is taken in **Step 4**, press **Alignment Optimizer** to bring up the data for all machines. There are two modes:
    a. ***As Measured Mode*** – This mode shows the shims and moves required to bring each machine into alignment relative to the Reference Machine. The shims and moves are *cumulative*, so if there is another machine between the current machine and the Reference Machine, those shims are added/subtracted to the current machine.
    b. ***Minimize Shims/Moves*** - Couple6 selects the best machine that minimizes all the shims and moves. You can select any other machine to use as a reference and Couple6 updates the shim/move values. Again, all shims and moves are *cumulative*.
11. After selecting the Reference Machine, select the machine that is next to it, retake the data and prepare to align it.
12. Go to **Step 5: Shims and Moves**. Add the shims and perform the moves.
13. Retake the data to verify the alignment.
14. Click **Machine Selector** to select the next machine in the train.
15. Take the data as shown in 9a and 9b and repeat Steps 11-13 for the rest of the machines.
16. Ensure the data is saved after taking each set.
17. Print report.

Getting Started

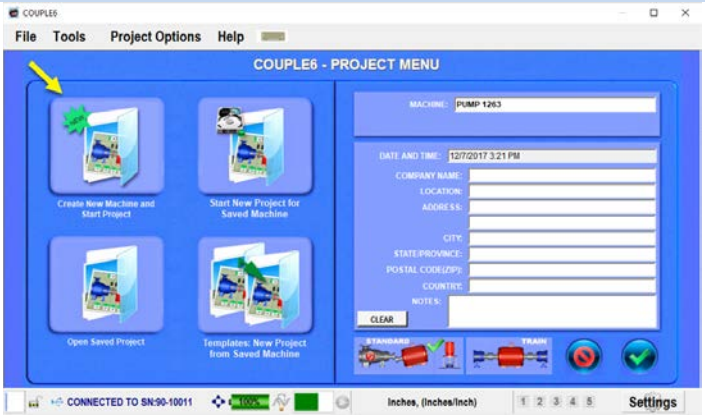
The goal of the Train Module is to determine, prior to moving and shimming the machines, if there is going to be a shim problem or a bolt-bound situation where additional equipment might be needed to successfully perform the alignment. This is because the shims and moves are cumulative and by the time you get to the last machine in the train, the shims or moves required could very likely require modification of the support plates or the motor feet.

You will need the following items to perform a machine train alignment:

1. **An S-660/S-670/S-680 Stealth Series™ shaft alignment laser system with the train license enabled.** Contact HLI customer service to find out which license you have.
2. **Machine Dimensions** for each machine in the train, including:
    a. Coupling to front foot
    b. Front foot to back foot
    c. Back foot to back coupling
    d. Coupling diameter (this is optional)
    e. Coupling to target bracket mounting location.
    If this information is not available, the dimensions can be obtained by measuring them with a tape measure to .13" (3 mm) accuracy.

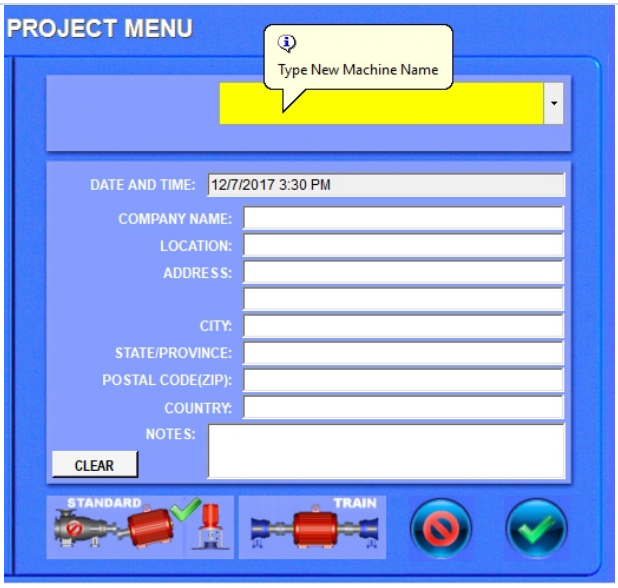
3. **Alignment tolerance for each machine**. User-defined tolerances can be entered in the **Train Spec** screen in **Step 1** (see Page 139). Couple6 offers a tolerance table depending on shaft RPM, which can be used instead.
4. **Thermal growth factors, if available**. Knowing how much each machine component grows or shrinks with temperature change greatly increases the accuracy of the alignment when the machinery is up to operating temperature. Note that in standard Couple6 Mode, there is a Thermal Growth module that can help to estimate the thermal growth (see **Step 1: Thermal Growth** on Page 59).
5. **Tools**. Various tools to loosen and tighten bolts as well as inserting shims.

Starting a Train Project

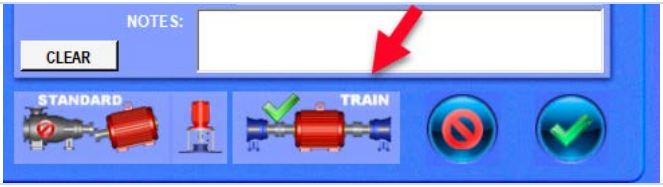


Project Menu

Select **Create New Machine and Start Project**



Enter the filename in the yellow box. Also enter any information for the project, such as Company Name, Address, etc.

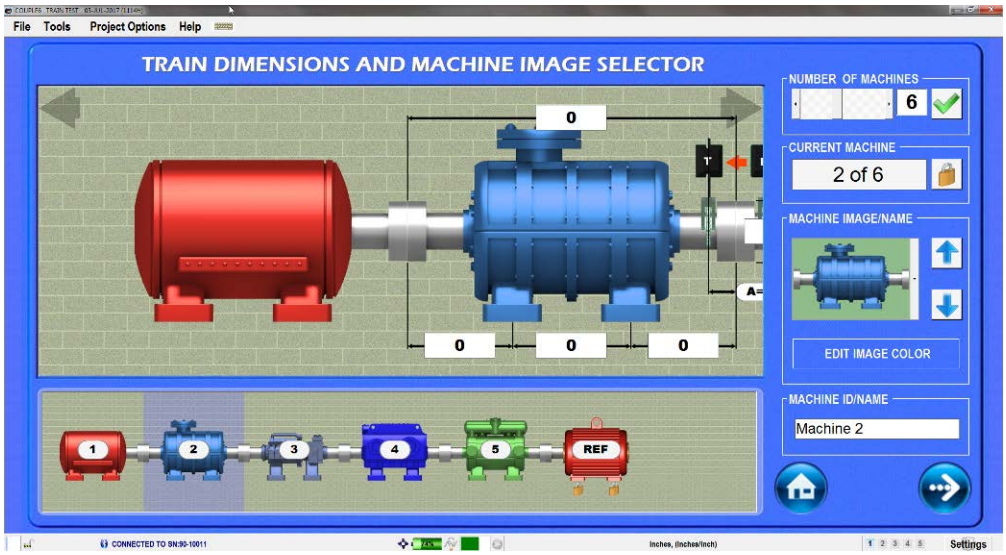


Click the **Train** icon to start the project. *Note the Standard Machine is the default. If you don't click the* **Train** *icon, you will get the Standard Machine Mode.*

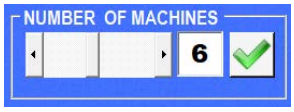
Click the Check Mark to go to **Step 1: Dimensions**.

Step 1: Dimensions and Tolerances – Machine Train

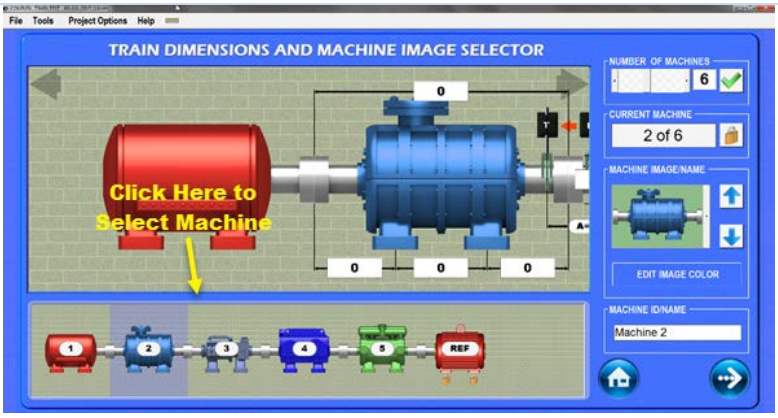
In this screen, select or enter the number of machines, the graphic to match type of component, the dimensions for each machine and the Reference Machine (if known) that the other machines will be aligned to.



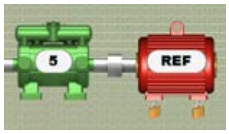
Step 1A: Setting Up the Project



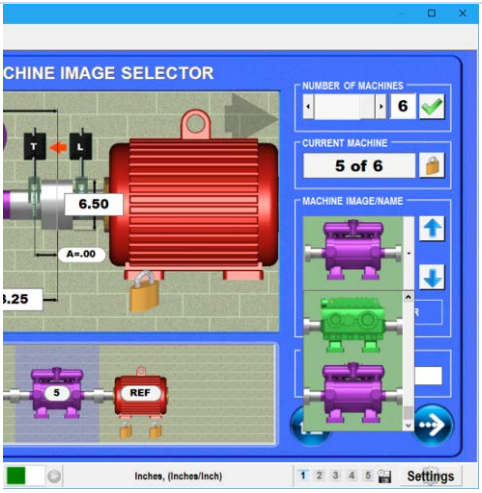
Number of Machines
Select the number of machines for the job by using right/left arrows. The minimum is three and the maximum is 10 machines (requires a 10-Machine software license). Click/tap the green check mark to select the number.



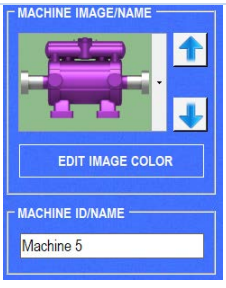
Selecting a Machine to Enter Dimensions
Click **Machine Selector** to select the machine type and enter the dimensions. The selected machine has a blue background and the Current Machine Image panel updates to indicate which machine is chosen.



Lock Machine for Reference
Select the Reference Machine by tapping a **Machine** icon on the lower *Machine Selection* panel and then clicking the **Lock** icon in the *Current Machine* area. Entering dimensions is disabled for this machine, the word "REF" displays on the image, and it is used as the reference for data analysis. *Note: All **As Measured** alignment data in the **Step 4: Summary** screen is shown relative to the Reference Machine.*

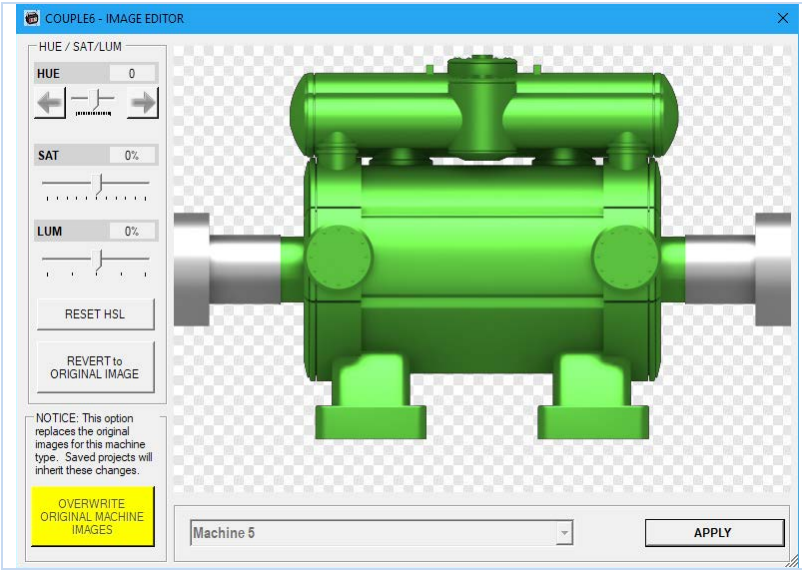


Machine Image/Name Panel
Click/Tap on the machine icon in *Machine Image/Name* to display a drop-down list of machines for this specific machine in the train. Scroll down to select the type of machine and click/tap it.



Machine ID/Name
Enter the name of the machine for the report.

Edit Machine Colors
Edit the colors of the machine icon currently selected by clicking **Edit Image Color**.



Edit Machine Color Window

Move the slider bar for Hue, SAT and LUM to adjust the color of the machine. Click **Apply** to save the colors.

Click **Revert to Original Colors** to return the colors to the original.

Click **Overwrite Original Machine Images** to make the colors permanent.

Click **Apply** to save the changes for this project only.

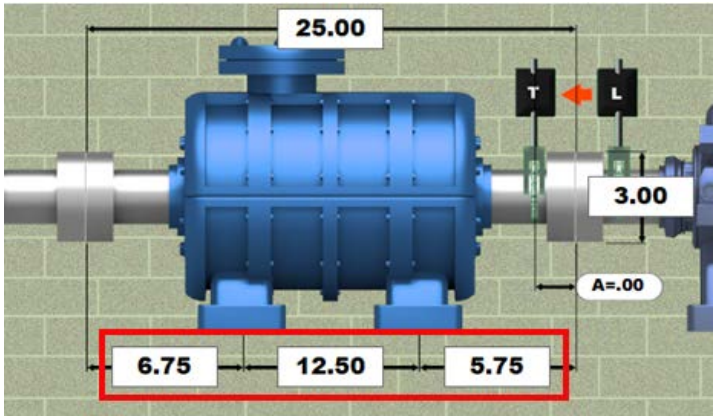
Step 1B: Entering Machine Dimensions

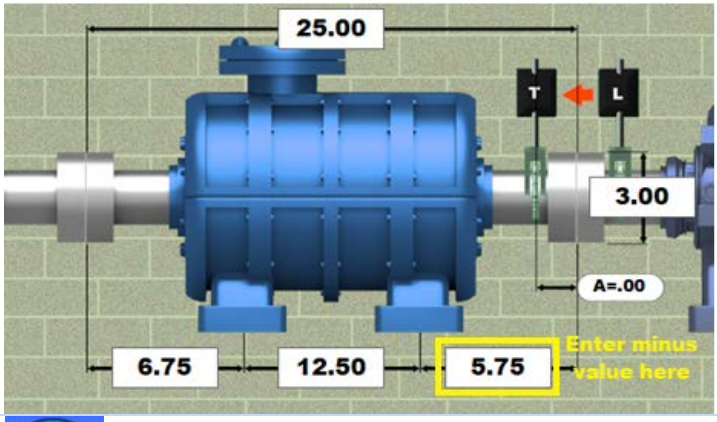
To enter machine dimensions, select the machine on the **Machine Selector Panel** and enter dimensions. For best results, enter dimensions to within .13". (3-4 mm).

Note: *Measurement accuracy is much more important on machine train applications, since the overall dimensions can be quite long and inaccurate measurements can have a big impact on shim/move values, especially for the machines at the end of the machine train.*

Time saving note: *If you already know the machine dimensions, press* **Next** *and go to the* **Train Specs** *screen. Enter the dimensions, tolerances and thermal growth values in a table format (see Page 1435).*

Entering Machine Dimensions for Train Machine





Entering Dimensions

Enter the dimensions in the lower entry boxes by clicking/tapping on the box itself. For the two outer dimensions, measure from the center of the coupling to the center of the closest foot. For the middle dimension, measure from the center of the bolt hole (head) of the front foot to the bolt hole (head) center of the back foot.

The upper display box will calculate the overall dimension from coupling to coupling. Do not enter values here. This is for the Optimization Analysis table in **Step 4**.

When using a laptop, the tab key will toggle between the entry boxes for a given machine.

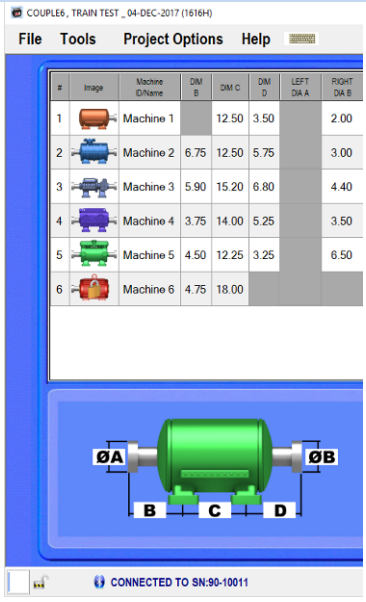
Notes:

1. ***Dim A**, is read only. This dimension is entered in the Measurement Screen.*
2. *If the coupling is behind the foot, enter a negative value for the yellow highlighted dimension box.*

When done selecting the machine types and entering the dimensions for all the machines, click **Next** to go to the **Train Specs** screen to select tolerances and enter thermal growth values if needed.

Step 1C: Train Specs Screen

Editing Dimensions, Selecting Tolerances and Entering Thermal Growth Values

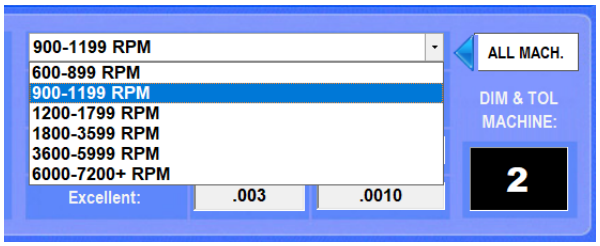


Entering/Editing Dimensions and Tolerances

The **Train Specs** screen allows the entering or editing of all the dimensions, as well as the tolerances and thermal growth offsets. To edit a dimension or tolerance, click the appropriate box in the table and enter the new value.

Note: *The tab key moves the cursor to the next box in the row.*

The location of the **B, C** and **D** Dimensions for each machine are shown in the machine drawing at the bottom of the screen. The diameter location for the left or right coupling are also shown, depending on which machine was selected as the reference.



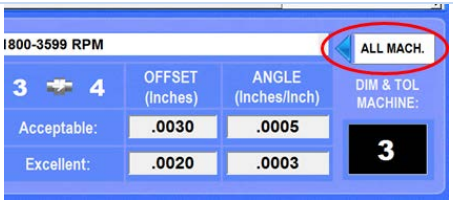
Entering Tolerances
To select a tolerance for a machine, select the **Machine** icon in the left column in the table. Then click the dropdown menu in the lower panel to choose the RPM.

Tolerances can be overridden by editing the values in the table. Instead of using the dropdown menu, enter your own tolerances into the boxes in the table for the machine.

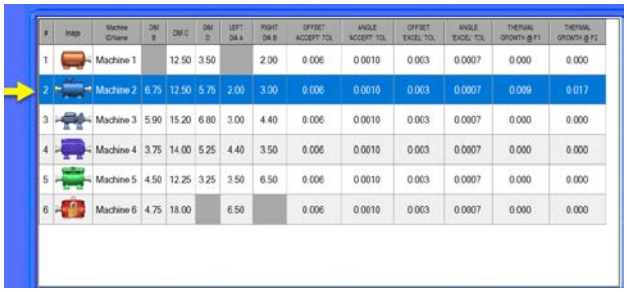
Note: *The boxes for the* **A Diameter** *and* **B Diameter** *are greyed out, depending on which machine has been selected as the reference. This is to keep track of which side of the machine the target will be placed. Couple6 automatically updates the table so you know which column to enter the tolerance in if needed.*

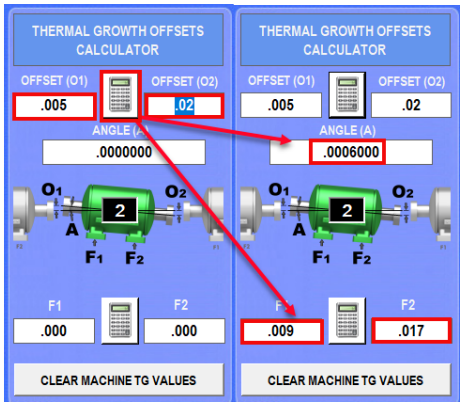
What the Columns Headers for Tolerances Mean:

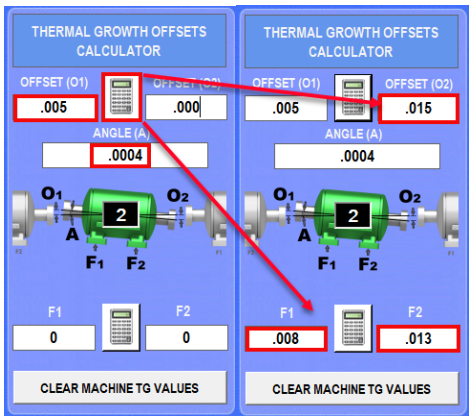
***Offset 'Accept'tol* –** Acceptable Offset Tolerance
***Angle 'Accept'tol* –** Acceptable Angular Tolerance
***Offset 'Excel'tol* –** Excellent Offset Tolerance
Angle 'Excel'– Excellent Angular Tolerance
Thermal Growth @FF – Thermal Growth value at the Left Foot.
Thermal Growth @RF – Thermal Growth value at the Right Foot.

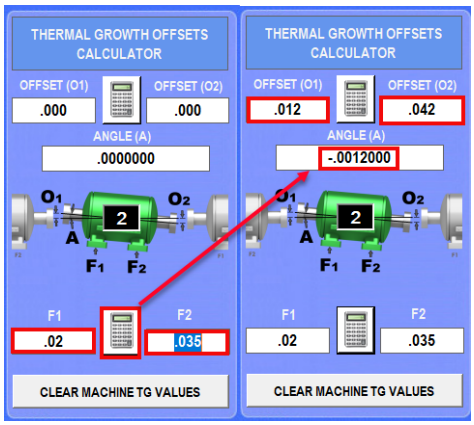


Entering Tolerances for All Machines
To save time, if all tolerances for the project are the same, select the RPM for the job from the dropdown list and click **ALL MACH.** The same tolerance will be applied to all the machines.







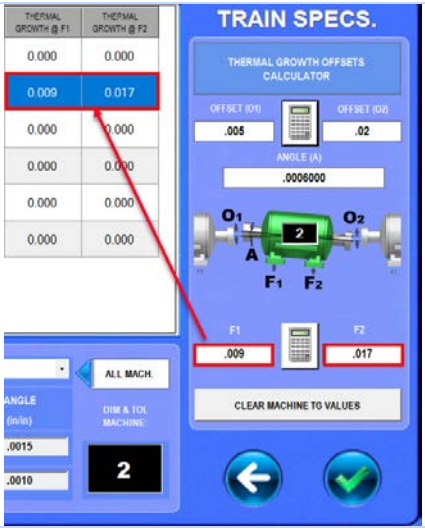


Thermal Growth Offset calculator
There are three ways to enter thermal growth (TG) values to be applied to the **Step 4: Results** and **Step 5: Move Screen**. Click the **Machine** icon in the left column to select the machine for which you want to enter or calculate TG values.

1. **Enter the TG values at the Feet** – enter *offset* for the *O1* coupling *and* the *O2* coupling and click the *upper* Calculator Button. The *Angle* TG value is calculated based upon the dimensions entered in **Step 1**. These values are converted to foot values and entered in the table.
   F1 = the left foot of the machine
   F2 = the right foot of the machine

2. **Enter Coupling Offset and Angle** – enter offsets for the *O1 or O2* coupling *and* for the **Angle (A)**. Click the *upper* Calculator Button. The *offset* is calculated for the opposite coupling based on the dimensions entered in **Step 1**. These values are converted to foot values and entered into the table.

3. **Enter the Foot Values** – enter foot offset in the *F1* and F2 boxes and then click the *lower* Calculator Button. The offsets at the *O1* and *O2* couplings will be calculated based upon the dimensions entered in **Step 1**. The *Foot Values* are entered into the table.
   Note: *The angle units for the TG calculator is either in/in or mm/mm. These numbers are converted before being transferred to the table.*



By clicking the **Calculator** button, Couple6 calculates the *front* and *back foot* values and automatically enters them into the **Train Specs** table for the matching machine. In this case, Machine 2 foot values are entered into the Machine 2 row in the table.

Entering Thermal Growth Signs (+/-)

Vertical Axis

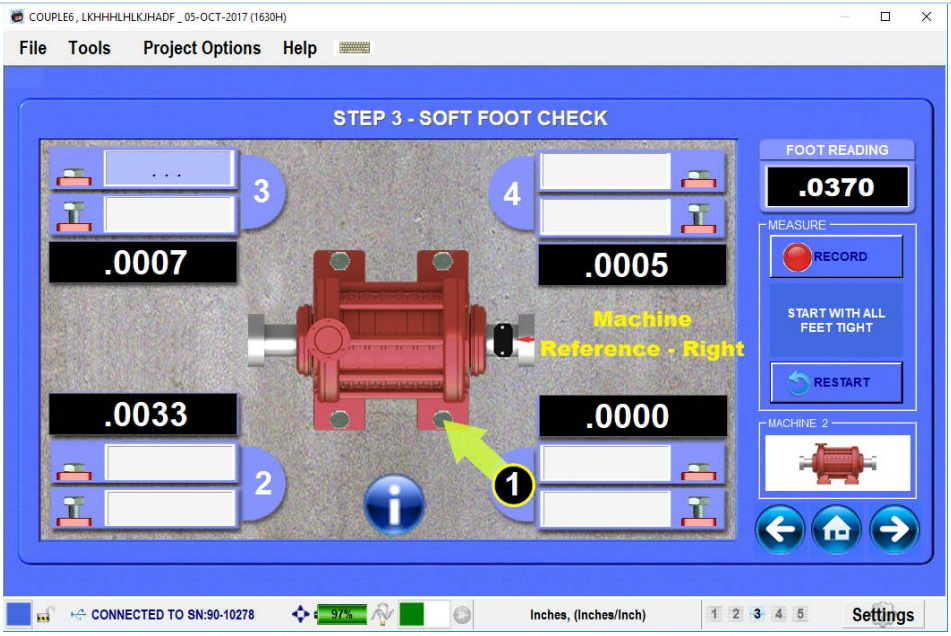
- ***Negative Parallel Offset Values****:* a *minus* (-) TG Offset for *Vertical Axis* misaligns/offsets the motor *lower* than the driven unit.
- ***Positive Parallel Offset Values****:* a *plus* (+) TG Offset for *Vertical Axis* misaligns/offsets the motor *higher* than the driven unit.
- ***Negative Angular Value****:* a *minus* (-) Angular Value for the *Vertical Axis* misaligns/offsets the motor with the back feet *lower* than the front feet (gap at the *top* or shaft pointing *up*).
- ***Positive Angular Value****:* a *plus* (+) Angular Value for the *Vertical Axis* misaligns/offsets the motor with the back feet *higher* than the front feet (gap at the *bottom* or shaft pointing *down*).

Step 2: Laser Setup

Please see Page 14 for the complete procedure for setting up the laser and targets.

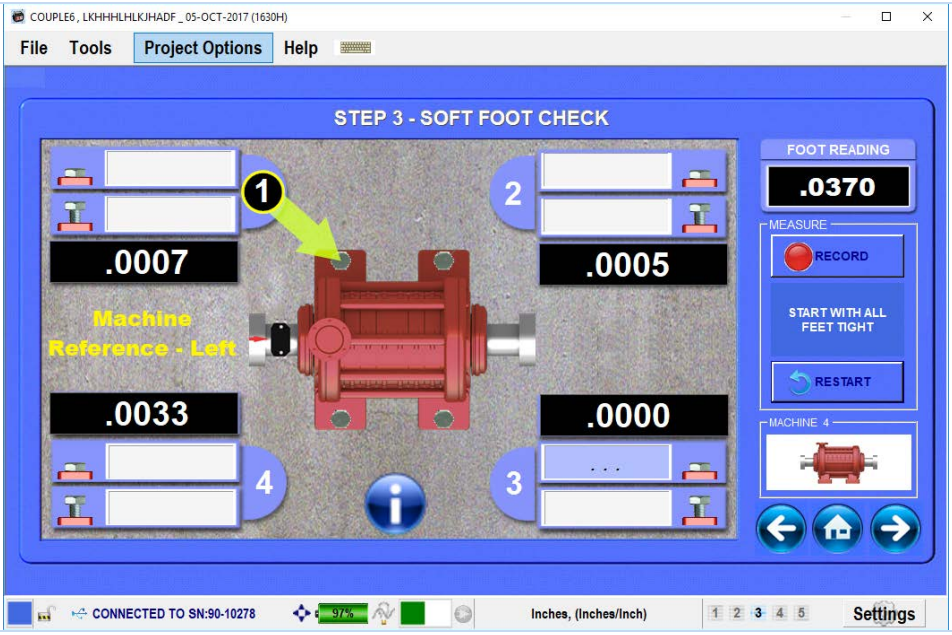
Step 3: Soft Foot

Please see Page 72 for the complete soft foot procedure. For the Train Module, however, the order of the taking the data will change depending on whether the Machine Reference is on the left of the component you want to measure or the right.



Machine Reference - Right

Be careful to follow the order shown on the screen. When the Machine Reference is on the *right* of the component, you will start with the lower-left foot.



Machine Reference - Left

When the Machine Reference is on the *left* of the component, you will start with the upper-right foot.

Step 4: Measure Misalignment

What the Buttons Mean

Click to display the **Machine Selector** screen to change machine. This also identifies for which machine C6 will be taking data.

Click to go to the **Home Screen**.

Click to open the **Shim/Move Optimizer** screen after taking data for all machines.

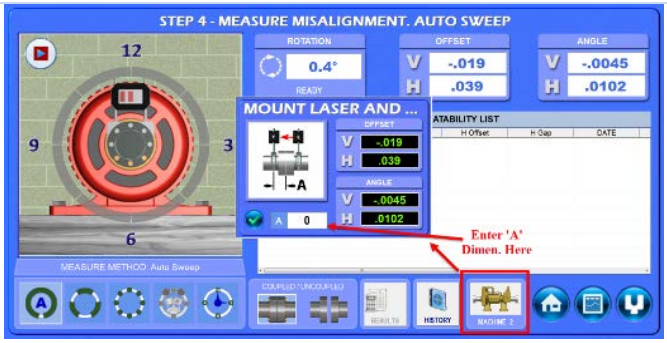
Click to go to the **Step 5: Shim/Move** screen.

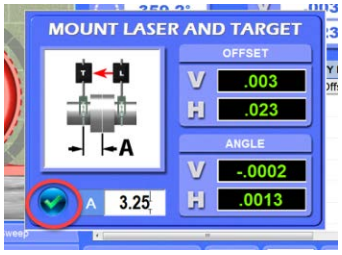
Click to review the measurement results after taking data to see if it is in or out of tolerance.

Click to add the alignment values to the History Table.

For the Measure Method buttons, please see Page 75.

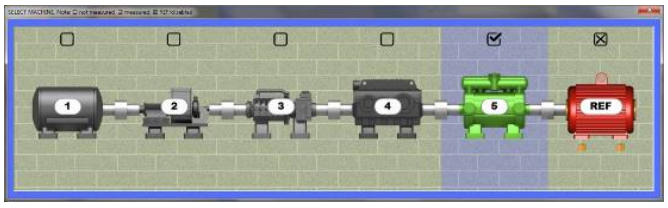
Data Taking Procedure





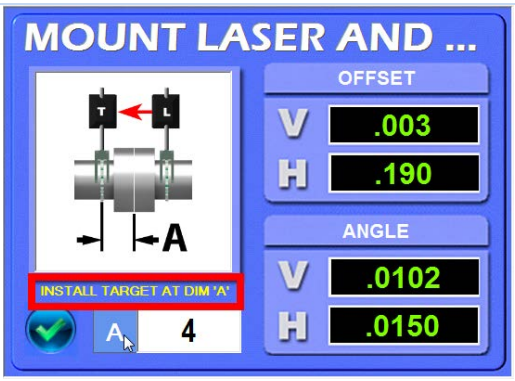
1. When beginning **Step 4**, Couple6 automatically selects the machine next to the Reference Machine and the ***Mount Laser And...*** popup window displays. Enter the **A** dimension (the dimension between the coupling center and the posts on the target – see the graphic). The *raw* alignment data values also display, so the laser and the target can be lined up without going to **Step 2**.
2. Measure the **A** dimension and enter it in the entry box. Click the check-mark to close the window.
   Note: *For close-coupled applications using an offset bracket that puts the target and posts on the laser side of the coupling, use a **negative** value for the **A** dimension.*

3. Couple6 is ready to take data for this machine.
4. Follow the instructions on Page 77 for taking data.



5. When done taking data for the machine, click the **Machine Icon** to bring up the **Machine Selector** screen.

6. An ☑ appears on the machines where data has been recorded. An ☒ appears on the pre-selected Reference Machine.
7. Click the icon for the next machine in the train to take the data (in this example, #4 should be selected next). The **Mount Laser And..** window pops up again, waiting for the next **A** dimension for Machine #4 to be entered. When the dimension is entered, click the check mark.

	8. Move the brackets, laser and target to the next machine and roughly align them as already shown in **Step 2** on Page 68. 9. Take data for that machine (#4). 10. Continue taking data for all machines.
	**Note about the A Dimension:** *The V & H offset values calculated in* **Step 4** *are "projected" to the center of the coupling by multiplying the V & H angular values times the* **A** *dimension. It is very important to re-measure the* **A** *dimension each time the bracket is re-installed. This is the purpose of the* **Mount Laser And..** *popup window.* *If data has been taken for a machine, the* **Machine Selector Popup** ***is*** *clicked and another machine is selected, then the* **Mount Laser And..** *popup opens displaying the previously entered* **A** *Dimension. A flashing note displays:* **INSTALL TARGET AT DIM A** *to remind you what the previous* ***A*** *dimension was.* ***You*** *can either install the target/bracket at that dimension or enter a new* **A** *dimension and Couple6 updates the results.*

Step 4: Shim/Move Optimizer

After the data is taken for all the machines, decide which machine to use as the master reference for the alignment phase of the project. There are two ways to view the data:

1. *As Measured Mode* – In this view, the shims and moves for all the machines are shown. These values show how much the machines need to be shimmed (Vertical Axis) or moved (Horizontal Axis) to align them to the previously selected Master Reference machine from **Step 1**. Lock Icons show which machine was selected as the reference.

   The shim values are cumulative, so, for example, the shims shown for machine #3 show the total amount that this component needs to be moved to be aligned to the Master Reference Machine (#6 in our example below).

2. *Minimize Shims Mode* – In this view, Couple6 Train selects the best machine that minimizes the number of shims and moves for the machines. Couple6 gives 2 choices (one for shims and one for moves) and they are independent of each other.

   The user can also select any of the machines in each machine train to be the new Master Machine and Couple6 will recalculate the Shims and Moves. Once **Master Reference Machine** is selected and the user confirms the shims and moves will not require machining bolt holes or base plates, then the user can proceed to the **Step 5: Move Screen** phase of the alignment.

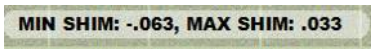
What the Icons Mean

A double-check mark means the machine is in *Excellent* tolerance (from **Step 1**) relative to the machine next to it and is between it and the reference machine.

A single-check mark means the machine is in *Acceptable* tolerance (from **Step 1**) relative to the machine next to it and is between it and the reference machine.

A red circle with line means the machine is out of tolerance (from **Step 1**) relative to the machine next to it and is between it and the reference machine.

A double-lock icon shows which machine was selected as the reference from **Step 1**.

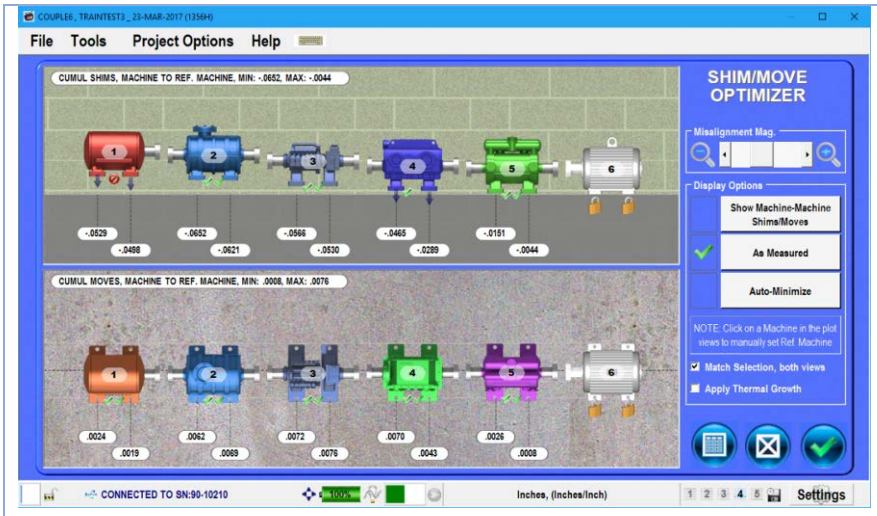


This shows the minimum and maximum of the shim values for all the machines.

Check Button

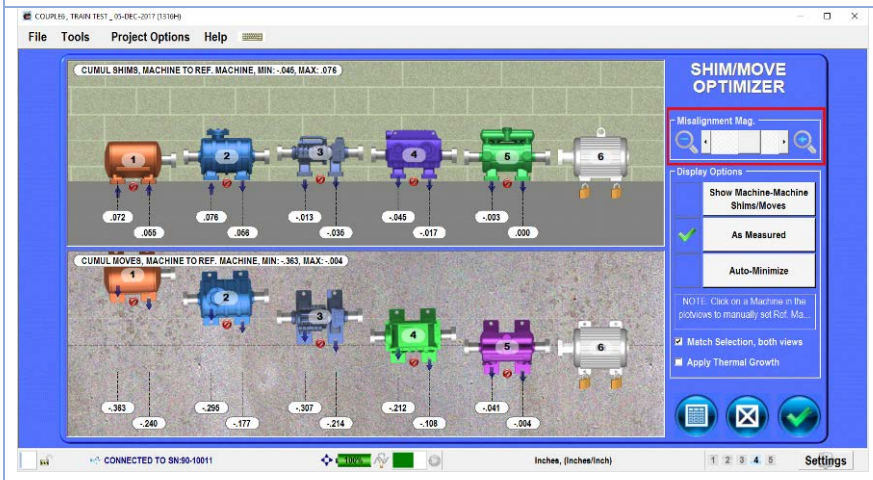
- *Minimize Shims/Move Mode* - saves the **Reference Machine** that either Couple6 chose or was selected and closes down the Optimizer.
- *As Measured Mode* – Closes down the Optimizer but does *not* change the **Reference Machine** chosen in **Step 1.**

Cancel Button - closes the Optimizer window without changing the **Reference Machine**.

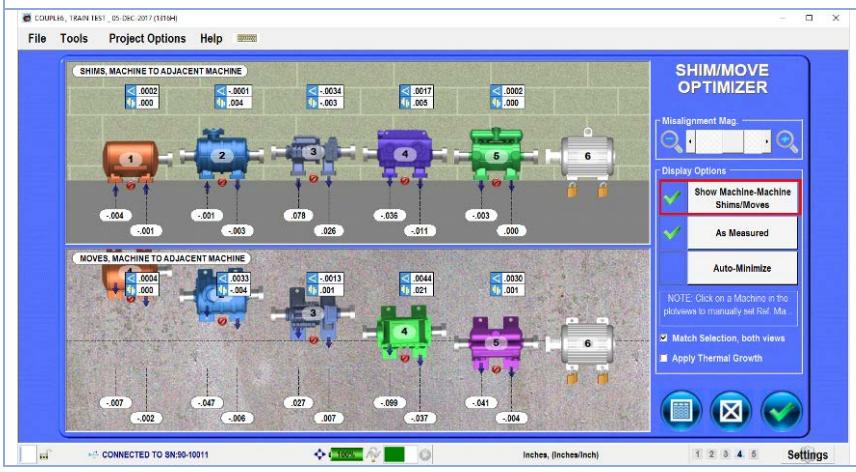


Shim Optimizer - *As Measured* Mode

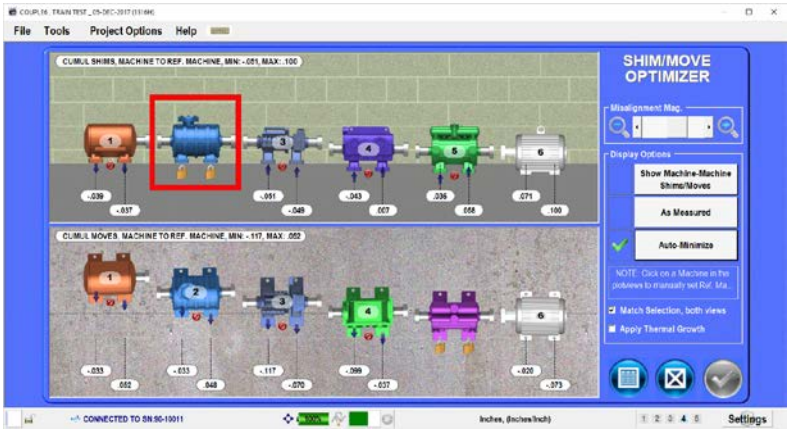
In this example, Machine #6 was selected as the Reference Machine in **Step 1**. The shims (V axis) and moves (H axis) are shown for each machine to align that machine to the *Reference* Machine, based upon the measurement of the machines before it. *Note that this means that the shim/move values are cumulative (stack up).*

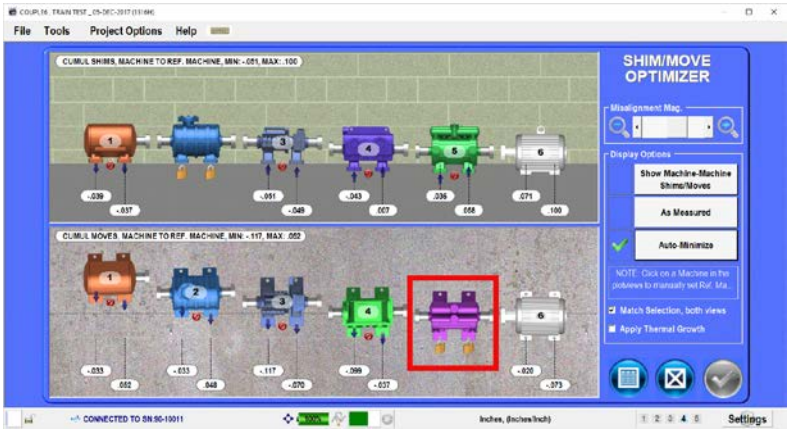


To have the machine icons magnify their position to better see the misalignment, click the **Misalignment Mag**. slider bar, which updates the graphical depiction of the alignment to better see it relative to the **Reference Machine**.



To see machine-to-machine shim/move data (instead of cumulative), click ***Show Data*** and the shim/moves will update to show the amount required to align each component to the one next to it in the train. It will also show the Offset and Angular values at the coupling for each machine.





Shims Optimizer – Auto *Minimize* Mode

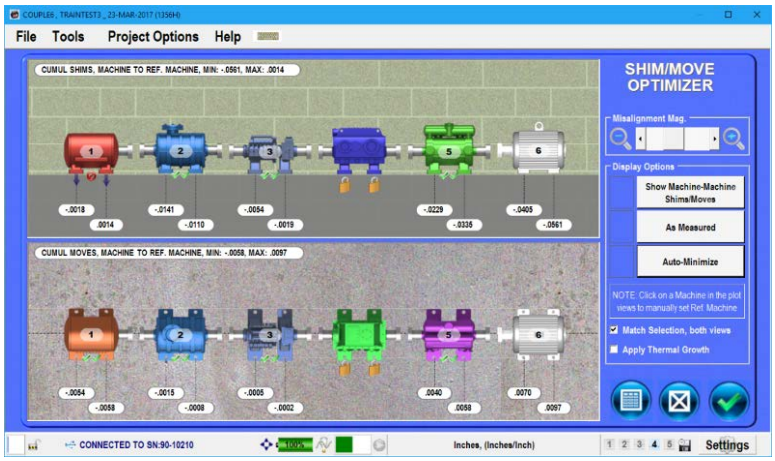
Click **Auto-Minimize** to have Couple6 select the machine that minimizes the shims and moves.

Vertical Axis

In this example, Machine #4 was selected as the Reference Machine that minimized all the shims. The shims shown for each machine are the amount to add/subtract to align that machine to the *newly selected* Reference Machine, and are cumulative based upon the measurements of *ALL* the machines before it.

Horizontal Axis

For the components' Horizontal Axis, Couple6 selected Machine #5 as the Reference Machine to minimize all the horizontal moves. The horizontal moves are shown for each machine to align that machine to the *newly selected* Reference Machine, and are cumulative based upon the measurements of *ALL* the machines before it.

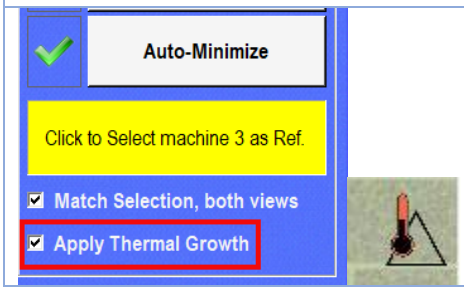


Choosing Other Components as the Machine Reference

In **Auto Minimize** mode, double-clicking a machine icon selects it as the Reference Machine and recalculates the Shim, and also whether the machine is in or out of tolerance relative to the new machine. Here Machine #4 was chosen as the Reference machine.

Uncheck the **Match Selection, both views** box to experiment with independently selecting different machines for each Vertical and Horizontal axis.

However, before you proceed with the alignment, you must select the same machine for both axes.



Click **Apply Thermal Growth** to apply the thermal growth (TG) offsets entered in **Step 1**. An icon displays in the upper right part of the **Shim/Move Optimizer** screen, notifying that TG offsets have been applied to the data.

With the Machine Reference now chosen, click the checkmark to save the selection, Now the alignment phase (**Step 5: Move Screen**) can begin.

Steps 4 and 5: Measure Misalignment and Aligning Motors

Now that the reference machine selection has been finalized, here are the basic steps to align each machine:

1. In **Step 4**, select the machine that is next to the Reference Machine. If the Reference Machine is in the middle, then choose which side (left or right) of the Reference to start the alignment. Click the **Machine** icon that is next in the train to select that machine.
2. The **Mount Laser and..** will open and the previously entered **A** Dimension displays.
3. Install the bracket and target at the **A** dimension. Install the bracket and laser on the opposite side of the coupling. *Note that the* **A** *dimension can be changed if necessary.*
4. **Take Data** is explained on Page **74**.
5. Check repeatability by taking 2-3 sets of data.
6. If satisfied with the repeatability, click the **Shim i**con (lower right corner) to open the **Step 5: Shim/Move Screen** to align the component.
7. After adding the shims and performing the moves, retake the data to confirm the alignment is in tolerance.
8. Save the data.
9. Select the next machine component in the train. For example, if Machine #3 is the reference and Machine #2 was just aligned, then select Machine #1 for the next alignment. Repeat the above steps.

What the icons mean in the Step 5: Shim/Move Screen

Identifies which machine in the train is being aligned

Displays Gap or Angular alignment value

Displays Offset value at the coupling

Shim values for the Back (B) and Front (F) feet to realign the component.


Unlocks the shim values so they update as the Vertical Axis is being aligned. Used when there are vertical adjustment bolts instead of shims.

Move values for the Back (B) and Front (F) feet to realign the component.


Re-Measure button -- click when alignment is done to return to **Step 4** to take a new set of data to confirm the alignment.


Home button – click to return to the **Home Screen** to print reports, open new files, etc.

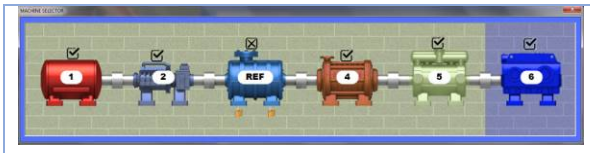

View Change button – click to switch to H Axis or V axis. Can also select coupling zoom and other functions. See Page **97** for more details.


Angular Axis Format button – click to toggle between Angular Format or Gap Format for the motor's angular axes– see Page **98** for more details.

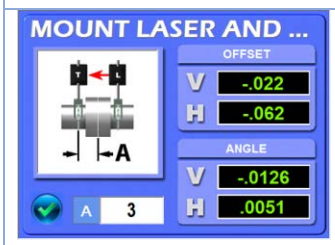
Aligning a Component - Procedure

The procedure below will show how to use **Steps 4** and **5** to align one of the machines in the train. Here is the dimensions data from **Step 1** for reference:

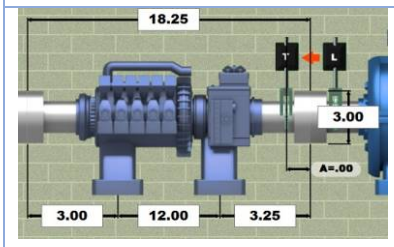
#	Image	Machine ID/Name	DIMENSION B	DIMENSION C	DIMENSION D	[L DIAMETER A	R] DIAMETER B
1		Machine 1		0.00	2.00		2.00
2		Machine 2	3.00	12.00	3.25	2.00	3.00
3		Machine 3	3.50	14.00	3.50	3.00	3.00
4		Machine 4	2.25	15.00	4.15	3.00	5.00
5		Machine 5	2.00	11.50	2.75	5.00	4.00
6		Machine 6	4.00	15.68		4.00	



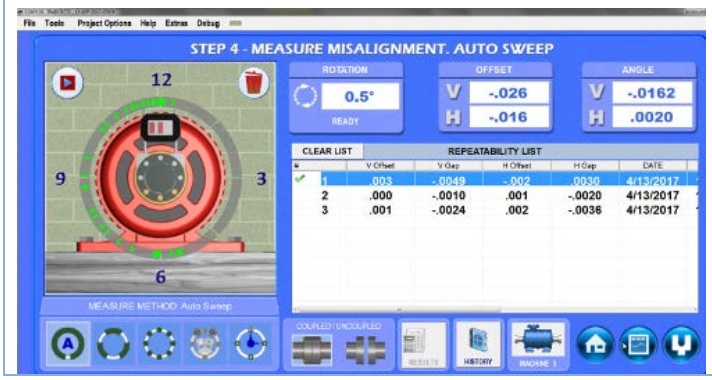
1. In **Step 4**, open the **Machine Selector** and select the machine that is next to the Reference Machine. In this example, Machine 3 is the Reference Machine, so select Machine 2 to align by clicking the Machine 2 icon.



2. The ***Mount Laser and..*** window displays and the previously entered **A** Dimension is shown. Either install the target at the **A** dimension or change it to the *new* **A** dimension.

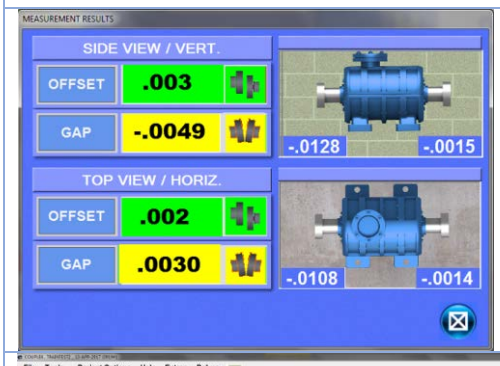
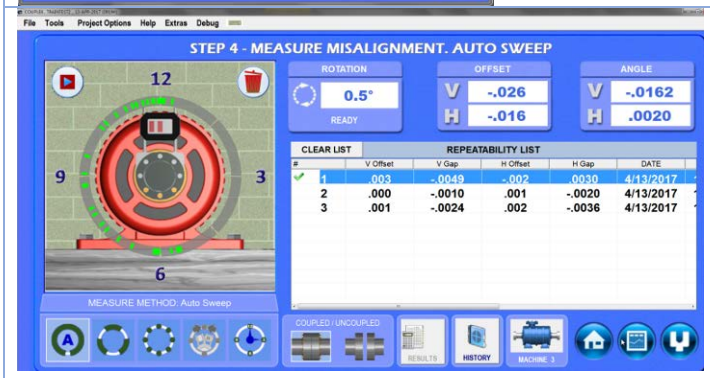


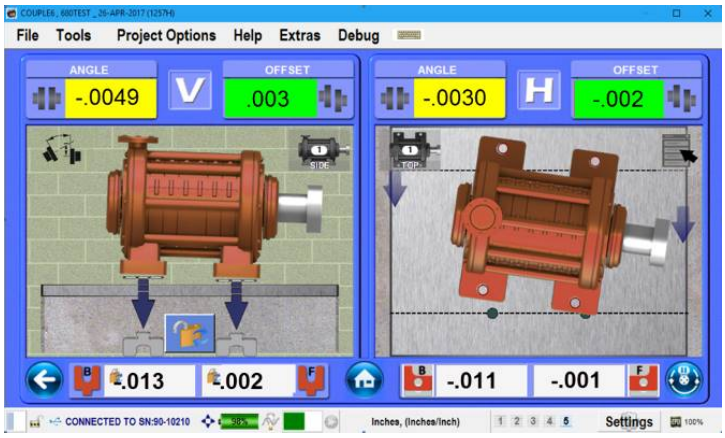
3. Make sure to install the *target*/bracket on the *left* side (moveable unit) of the coupling. Install the *laser*/bracket on the *right* side (stationary unit) of the coupling.

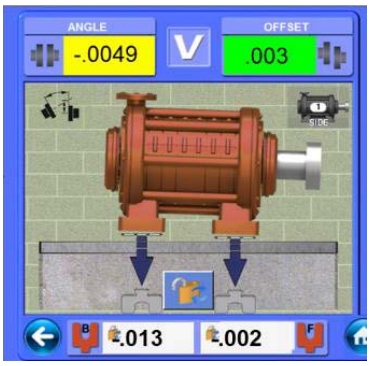


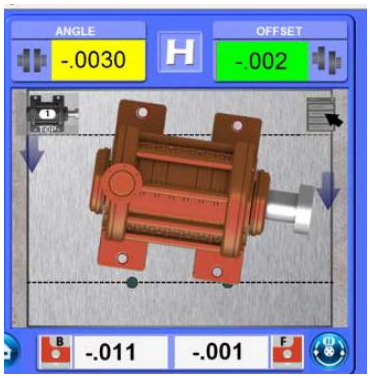
4. Close the ***Mount Laser and…*** window and select the measurement method to take the data. Take 2-3 sets of data to confirm repeatability. See **Step 4: Taking Data** on Page 74 for more details on taking data.

   Here, three sets of data have been taken.

	5. Click **Results** to see the results with the tolerances applied from **Step 1**.
	6. Select one set of data to use for the alignment by tapping the row to highlight it.
	7. With the set of data selected, click the **Shim** icon to go to **Step 5** to align the machine.







8. **Step 5: Vertical Shims Screen - S-680 System**

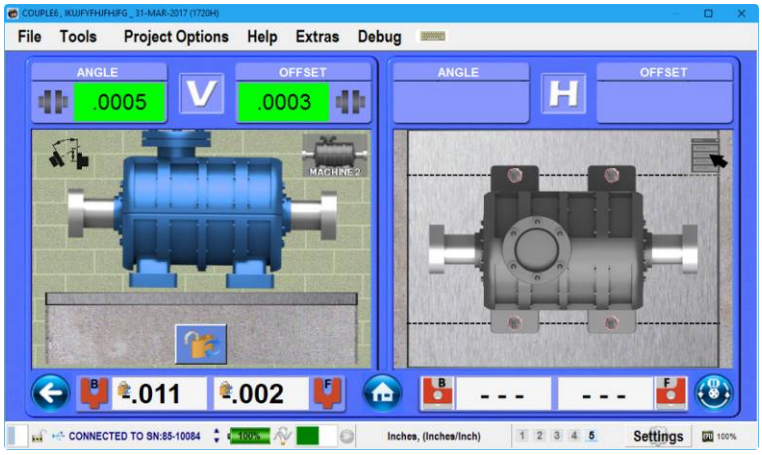
The ***Step 5- Duo-Plane™ Screen*** displays, showing both the Vertical and Horizontal Axes simultaneously. The screen shows the V Angle (Gap) and V Offset values, along with the Front and Back Foot shims, and H Angle (Gap) and H Offset, along with the Front and Back Foot moves. All alignment values update dynamically with each movement of the machine.

For the ***V axis***, add the shims. The motor image and V Angle and V Offset values will update to reflect the moved machine.

Note: The V shim values are locked. If using adjustment bolts instead of shims, click the ***Lock*** *icon to allow the shim values to update dynamically.*

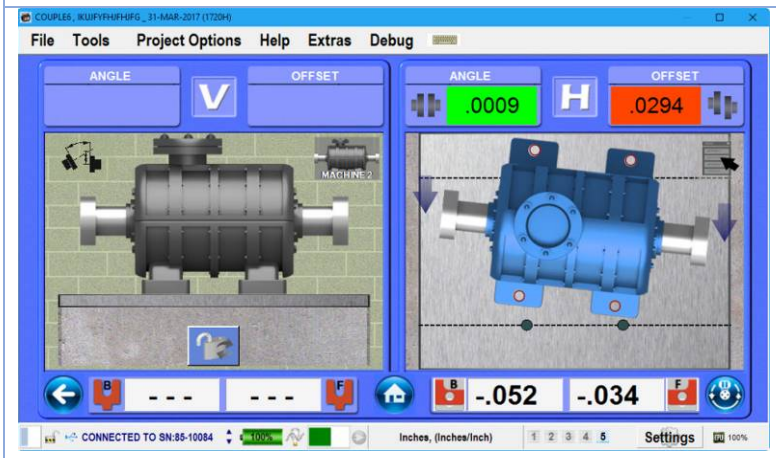
For the ***H axis***, move the machine as directed by the arrows on the screen. *Note that with the Duo-Plane™ screen, you do not have to rotate the shafts.*

Note: *If your coupling has a lot of backlash, we recommend rotating the shafts, which will switch to Single Axis Mode (see the S-670 screens for details). To get back to Duo-Plane™ Mode, go back to* **Step 4** *and return to* **Step 5**. ***If any moves are performed or shims added, the data must be retaken before returning to* Step 5.**



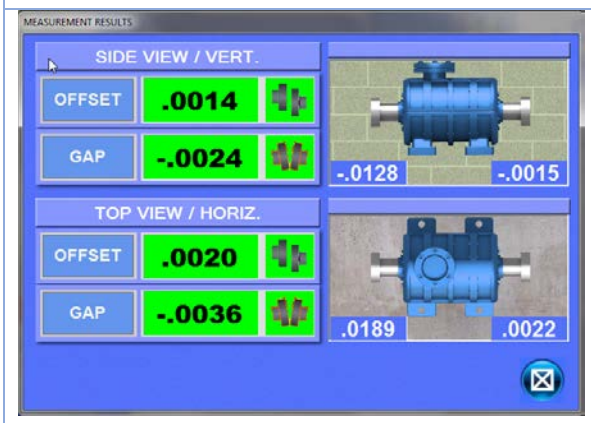
8. **Step 5- Vertical Shims Screen** – **S-660/S-670 Systems**

   Leaving the shafts at 12:00, the **Step 5: Vertical Shims Screen** displays first, showing the V Angle (Gap) and V Offset values, along with the Front and Back Foot shims. Add the shims. The motor image and V Angle and V Offset values update to reflect the moved machine.
   Note: the H axis graphics are grayed out and will not activate until the shafts are rotated to 3:00 or 9:00.



Rotate the shafts to either 3:00 or 9:00 and the **Step 5: Horizontal Move** window activates, showing the Horizontal Axis moves. Align the H axis of the motor by following the arrows on the screen. When the display colors are yellow (Acceptable) or green (Excellent), the motor is aligned.
Note: *The V axis graphics are grayed out and will not activate until the shafts are rotated to 3:00 or 9:00.*

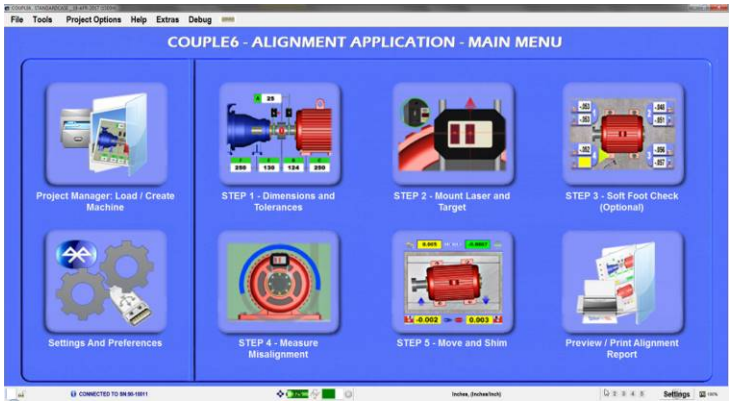
Click ***Remeasure*** to return to **Step 4** and re-take the data to confirm the alignment.

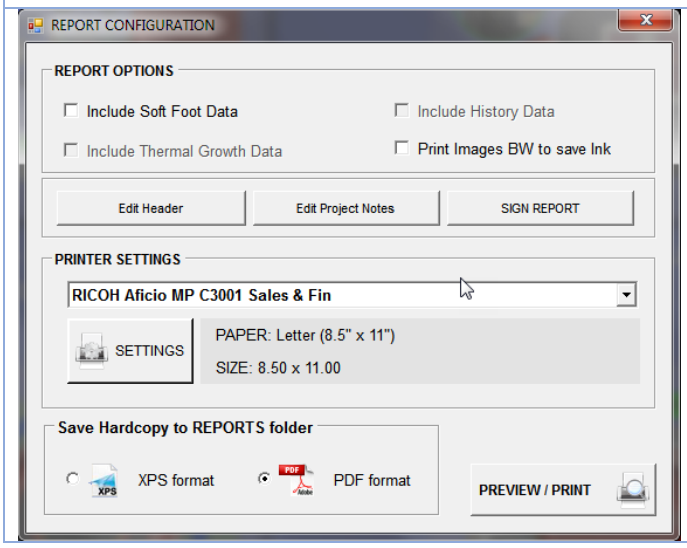


9. Click **Results** to view the alignment data with tolerances applied. If the machine's alignment is in tolerance, click **Save** and move onto the next machine.

10. Click **Machine Selector** to select the next machine. Follow the same steps until all the machines are aligned.

11. When all the machines are aligned, click **Home** to display the **Main Menu**.





12. Click **Review/Print Alignment Report**. The report can be printed on paper or to a .pdf file to be mailed to customers.

Couple6 Train Module – Sample Report

STEALTH SERIES

COUPLE6
ALIGNMENT REPORT

HAMAR LASER

REPORT ISSUED BY:

Hamar Laser Instruments, Inc
5 Ye Olde Road
Danbury, CT 06810

COMPANY / JOB INFORMATION

Machine Name	TRAIN TEST
Company Name	Acme Corp
Location	Cleveland Works
Address	1110 Main St.
City	Cleveland
State	OH
Postal Code(ZIP)	23945
Country	
Notes	

MACHINE SETUP

UNITS OFFSET = Inches, ANGLE = Inches/Inch

TARGET INFORMATION

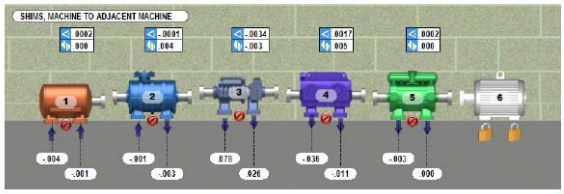
MODEL NUMBER : T-1290 Serial Number : 90-10011
Calib. Due : May 2018 FW REV. : 1.027

SIGNATURE R. Hamar

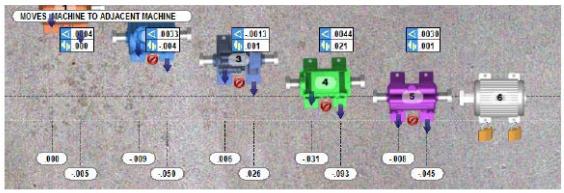
ALIGNMENT RESULTS and TOLERANCES

#	NAME	⌀V OFFSET	∠V SLOPE	⌀H OFFSET	∠H SLOPE	⌀TOL,GOOD	⌀TOL,EXCL	∠TOL,GOOD	∠TOL,EXCL
1	Machine 1	.000	.0002	.000	.0004	.006	.003	.0000	.0000
2	Machine 2	.004	-.0001	-.004	.0033	.006	.003	.0000	.0000
3	Machine 3	-.003	-.0034	.001	-.0013	.006	.003	.0000	.0000
4	Machine 4	.005	.0017	.021	.0044	.006	.003	.0000	.0000
5	Machine 5	.000	.0002	.001	.0030	.006	.003	.0000	.0000
REF	Machine 6	---	---	---	---	---	---	---	---

VERTICAL ALIGNMENT (MACHINE-MACHINE)



HORIZONTAL ALIGNMENT (MACHINE-MACHINE)



WARNING: Thermal Growth Offsets Not Applied

REPEATABILITY - MACHINE 1

#	V Offset	V Gap	H Offset	H Gap	DATE	TIME	SPAN	#POINTS	MODE	METHOD	Dim A
✓ 1	.000	.0004	.000	.0008	12/5/20...	4:03 PM	141.2°	46	Coupled	Auto Sweep	.00

REPEATABILITY - MACHINE 2

#	V Offset	V Gap	H Offset	H Gap	DATE	TIME	SPAN	#POINTS	MODE	METHOD	Dim A
✓ 1	.004	-.0003	-.004	.0066	12/5/20...	3:43 PM	180.3°	163	Coupled	Auto Sweep	3.00

REPEATABILITY - MACHINE 3

#	V Offset	V Gap	H Offset	H Gap	DATE	TIME	SPAN	#POINTS	MODE	METHOD	Dim A
✓ 1	-.003	-.0068	.001	-.0026	12/5/20...	3:42 PM	218.2°	91	Coupled	Auto Sweep	.00

REPEATABILITY - MACHINE 4

#	V Offset	V Gap	H Offset	H Gap	DATE	TIME	SPAN	#POINTS	MODE	METHOD	Dim A
✓ 1	.005	.0035	.021	.0089	12/5/20...	3:41 PM	140.6°	80	Coupled	Auto Sweep	1.50

REPEATABILITY - MACHINE 5

#	V Offset	V Gap	H Offset	H Gap	DATE	TIME	SPAN	#POINTS	MODE	METHOD	Dim A
✓ 1	.000	.0005	.001	.0060	12/5/20...	3:40 PM	141.4°	62	Coupled	Auto Sweep	2.00

REPEATABILITY - REFERENCE MACHINE 6 (NO DATA)

THERMAL GROWTH

#	NAME	TG @ F1	TG @ F2	OFFSET@O1	OFFSET@O2	SLOPE (A)	DIM B	DIM C	DIM D
1	Machine 1	.000	.000	.000	.000	.0000	.000	12.500	3.500
2	Machine 2	.009	.017	-.005	-.021	.0006	6.750	12.500	5.750
3	Machine 3	.000	.000	.000	.000	.0000	5.900	15.200	6.800
4	Machine 4	.000	.000	.000	.000	.0000	3.750	14.000	5.250
5	Machine 5	.000	.000	.000	.000	.0000	4.500	12.250	3.250
REF	Machine 6	---	---	---	---	---	---	---	---