

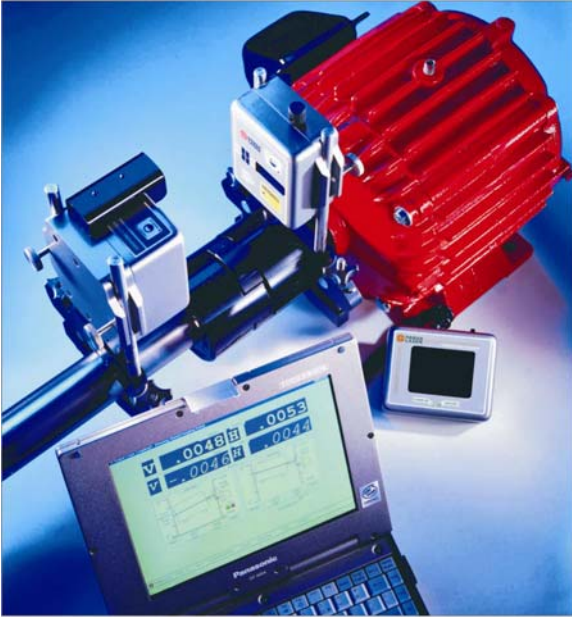
Application Notes

Rotating Equipment Alignment

System Recommendations

Shaft Alignment

- S-650 Wireless 5-Axis Coupling Alignment System
- S-640 4-Axis Coupling Alignment System



The need to make shafts parallel to one another, both opposing shafts (coupled) and side-by-side (sheave or pulley) is common in many industries. It is becoming more and more critical to use lasers for alignment, as motors are more powerful and run at higher RPMs. After years of successful use, it is now an established fact that lasers are simply the best tools for performing the most accurate shaft alignments in the shortest time possible.

Hamar Laser developed the very first 4-axis live alignment system in the early 90's. It quickly became the standard by which other systems were judged. With the introduction of our new S-650 Wireless Coupling Alignment System, there is a new standard. With features like a robust wireless data link, 5-axis target with automatic sweep function, sub-micron resolution, the largest cell range on the market, and large color graphics, the S-650 is rapidly becoming the choice for coupling/shaft alignment applications.

The S-650 Wireless 5-Axis Coupling Alignment System

Properly aligned motors and pumps will last longer, perform better and use less electricity. The S-650 is an extremely fast and highly accurate tool to align motors to pumps. Not only will you perform motor/pump alignment in record time, but you will also increase the life of your motor bearings and seals, saving you thousands of dollars annually in reduced maintenance costs. And depending on how many motors you have, the S-650 will probably pay for itself in the first year.

Lasers Are Simply Faster

After 10 years of laser shaft alignment, it is now an established fact that lasers are simply faster than indicator based methods. The bigger the motor, the more time saved during alignments. We had one customer tell us that they reduced the alignment time on one motor from 2 days to 4 hours! This time saving can be especially helpful on critical machinery where downtime is very costly.

Live Data in 4 Axes and Shim Values Speed Alignments

The S-650 provides real time data for horizontal and vertical misalignment (both angle and center) simultaneously. Our Windows-based software calculates the shim values for you, taking the guesswork out of horizontal moves.

Indicator Methods Not Accurate Enough

With the advent of vibration analysis and thermal imaging, it is becoming clear that indicator-based methods are no longer good enough. To reduce vibrations and bearing-destroying heat, motors must be aligned very accurately. Indicator methods do a reasonable job of aligning the centers of the shafts but a poor job of making them parallel; large angular misalignments are common. By contrast, the S-650 provides the needed accuracy to reduce excess vibrations and heat so the motors last as long as the salesman says they should!

PM Programs More Efficient with S-650

Whether you are changing a worn-out motor or simply performing a preventative maintenance check, the S-650 will help you perform alignments faster and more accurately than before. It literally takes about 5-10 minutes to set up the S-650 and display misalignment data. You will know instantly whether you have to align a motor or not. And with our computer-based laser system, generating reports and saving alignment data have never been easier.



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Automatic Sweep Function Saves Even More Time

The S-650 uses an accelerometer to provide rotation angle measurements, eliminating the "clock method" many other systems still use today. This rotation sensor automatically detects "start" and "stop" points, and works with a sweep angle of as little as 60°, which is especially useful in cramped conditions.

S-650 Even Works in Direct Sunlight

With our new internal light meter, the S-650 actually provides a display of how sunlight is affecting the readings. In most cases, the S-650 will actually work in direct sunlight without having to put up tarps or other shade devices.

Universal Brackets Eliminate Bulky Accessories

One set of mounting brackets is all that is needed to align 95% of the motors out in the field. The brackets accommodate shafts from ½" to 12", without modification, and the can be easily expanded to fit larger shafts to 18". They even have built-in magnets for extremely large shafts. About the only bracket accessories that are needed are offset brackets used for very short shafts.

S-650 System Features

- 4-axis simultaneous live graphics in a large, concise, color display.
- Robust, infrared-based wireless communication.
- With optional PCMCIA portable color printer, reports can be generated in the field quickly and easily.
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- Rugged laptop computer is designed for shop
- System can store a virtually unlimited number of alignment reports and set
- Target and laser are pre-aligned to brackets. Many flexible mounting configurations available.
- 40mm target measuring range handles large thermal offsets.
- Sub-micron resolution (angular accuracy is 10 micro radians).
- Up to 30-foot operational range between laser and target.
- Automatic target sensing of "start" and "stop" points. Sweep angle can be as little as 60°.
- Live alignment data shows corrections of all 4 axes (vertical center and angle and horizontal center and angle) as they are being made.

The S-640 4-Axis Coupling Alignment System

The S-640 Coupling Laser System is for those with limited budgets but high-accuracy shaft alignment needs. It is the only system on the market at its price level with live 4-axis display of the motor's alignment. Only the competition's top systems provides this.

The S-640 is our original alignment system with redesigned brackets, computer interface and software. Designed to be a mid-level coupling system, it has all the accuracy and speed of use of the S-650 but without the wireless and automatic sweep features. It also has a smaller measuring range of +/- .200". It is a very reliable system that has been field tested and proven for over 10 years.

S-640 System Features

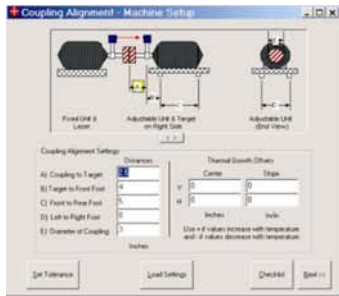
- Four-axis dynamic display of motor's shims and moves
- Rotation sensor automatically adjusts screen for clock position
- Quick-set brackets for ½" to 18" diameter shafts
- Target has center resolution of .00002" (.0005 mm) and angular resolution of .000015"/in (.01 mm/M)
- Target and laser are pre-aligned to brackets
- Coupled or uncoupled shaft alignment capabilities
- Soft-foot routine
- Optional PCMCIA portable color printer allow reports to be generated in the field quickly
- Vertical pump capability
- Windows-based software with large color graphics
- Large digital display eliminates long cables
- Up to 30-foot operational range between laser and target
- Portable and rugged

How the Alignment System Works

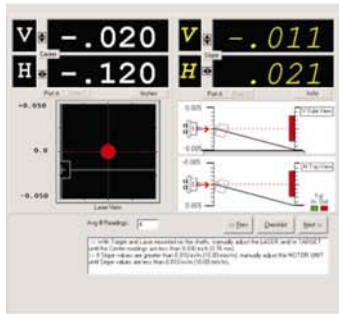
With any shaft-to-shaft alignment, it is important to find the axis of rotation of one shaft relative to the other to eliminate the effects of mounting errors on the measurement. Traditional methods, like the rim and face method, attempt to do this, but in reality still rely on machined faces and rims for accuracy. It is easy to see that an error in the flatness of a coupling face or the concentricity of the rim can affect the measurement.

The S-650 (and S-640) takes care of this problem by using software to perform a procedure that is similar to our NORMIN method. By rotating the laser and target together through 180° and recording multiple points along the way, the mounting errors can be calculated and programmed out of the alignment numbers.

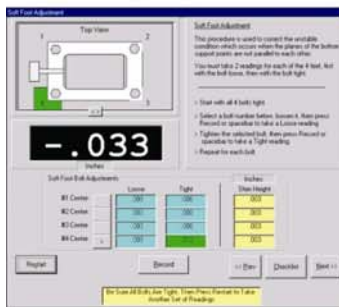
To perform an alignment with our S-650 (the procedure for the S-640 is slightly different) a 5-step procedure is followed using Hamar Laser's Coupling4 Alignment Software:



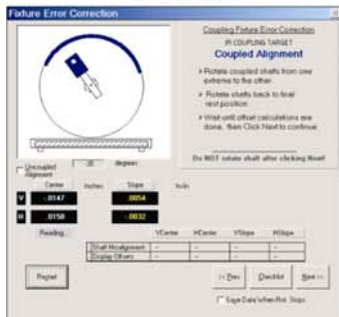
Coupling4 Step 1 - Motor Setup



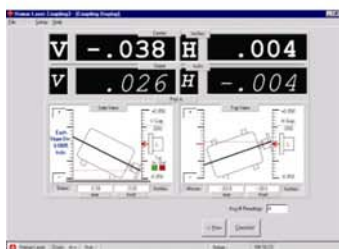
Coupling4 Step 2 - Laser Setup/Rough Alignment



Coupling4 Step 3 - Soft Foot Correction



Coupling4 Step 4 - Taking Data



Coupling4 Step 5 - Alignment Screen with Shim Values

STEP 1 – In the MOTOR SETUP SCREEN the motor's foot dimensions, machine description and desired alignment tolerances are entered. Thermal growth offsets (the amount the motor grows from a cold start to operating temperature) are also entered at this stage.

STEP 2 – The LASER SETUP SCREEN displays and the laser and target are placed on the brackets and adjusted until the readings are within +/- .030" (0.8 mm) of zero. Adjustments to the vertical center are made by moving the laser up or down on the brackets. Adjustments to the horizontal center are made by an adjustment knob on top of the laser. For new motor installations, this screen is used to "rough in" the motor's large angular misalignment.

STEP 3 – After laser and target setup and motor rough-in, the user turns to the SOFT FOOT SCREEN, which displays an easy-to-follow soft-foot routine that finds potential soft-foot problems and recommends corrective action. A note of caution: this soft-foot routine is best used with motor uncoupled to the driven unit. This is because a large pump and rigid coupling can prevent the laser from finding soft-foot problems. The laser measures shaft deflections caused by a soft foot and if the shaft is rigidly coupled to a driven unit it may not move much at all.

STEP 4 – Once the soft foot routine is completed, the alignment can begin. The DATA TAKING SCREEN is displayed, which prompts the user to rotate the laser and target for data collection and analysis of mounting errors. The system (S-650 only) automatically senses when the laser and target are being rotated and when they stop. When rotation stops, the software automatically calculates the mounting errors and subtracts them from the misalignment readings. The user has choice of a coupled or an uncoupled routine.

STEP 5 – Finally the user switches to the MISALIGNMENT SCREEN, which shows a graphical display of misalignment, including center and slope readings corrected for mounting errors and shim values in all four axes. The readings and motor graphics automatically update when moves are made or shims added. The data-updating speed (averaging) can be adjusted to smooth out fluctuations in the readings due to air turbulence or vibration. Shim values displays are replaced by "IN TOL" when the alignment comes into tolerance. The DATA TAKING and MISALIGNMENT screens also show a light meter that warns the user if bright light, such as the sun, is affecting the readings.

For motors with large misalignment, Steps 4 and 5 may need to be repeated. In general, however, one set of shims and moves is all that is needed to perform the alignment.

Recommended System Configuration

L-775 Dual-Beam Adjustable Laser
 T-1275 5-Axis Wireless Target
 A-908 IR Receiver for Laptop Computer
 R-1342 Toughbook Laptop Computer
 S-1393 Coupling4 Software
 A-907 Universal Bracket Set
 A-509D Pelican Shipping Case

Optional Accessories

A-907A Offset Bracket Set
 R-342 Notebook Computer
 R-1342A Backup Battery
 R-1353C PC/MIA Portable Color Printer (4 ppm)

Alternative System: S-640 Coupling Alignment System