

Application Note

Aligning Continuous Casters and Steel Mill Rolls

System Recommendation

Continuous Casters
L-740 Ultra-Precision Leveling Laser

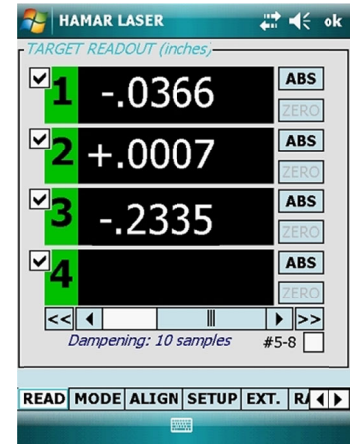
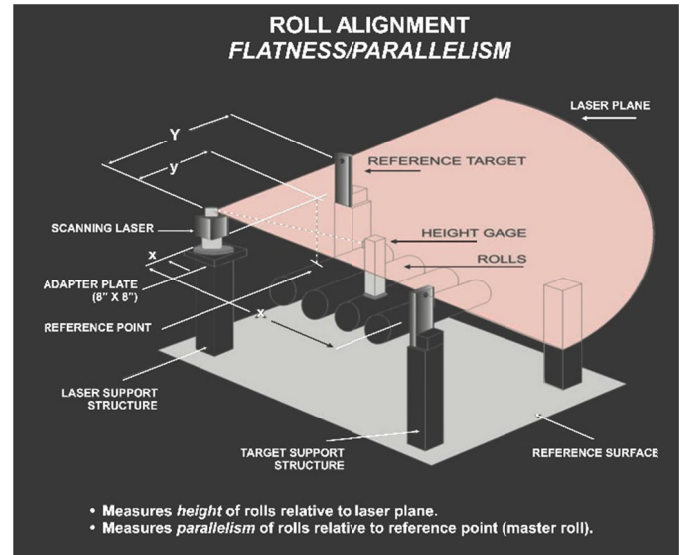
Steel
L-743 Ultra-Precision Triple Scan Alignment System

How the Alignment System Works

Setting Roll Pass Lines

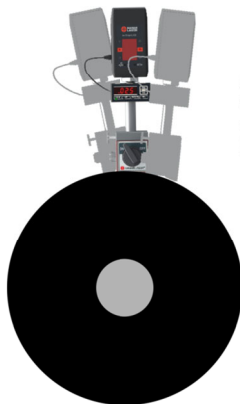
Assuming the caster segment is level to earth, the following method can be used for checking the elevation of the rolls (i.e., checking the pass line) of a caster segment.

1. Place the laser on an instrument stand so that the laser plane is approximately 6 in. higher than the highest elevation of the roll and level using the built-in level vials.
2. Place an A-1519-2.4ZB Single-Axis Scan Target on one end of the roll and find the Top Dead Center (see graphic, below) value. Zero the display by pressing the Zero Button in Read9. If more than one target is going to be used for the measurements, then zero those targets on the same exact point as the first target.
Note – the use of a level vial on the roll measuring base can also be used to find TDC during the measurement
3. After zeroing the A-1519-2.4ZB Target (or targets), place it on another roll or point on the same roll and again, find the TDC where the elevation relative to the first roll will be displayed. This is a very quick way of checking both the actual elevations and the parallelism of the rolls to each other. The A-1519-2.4ZB can detect up to 1.2 in. of elevation changes. Since the readings are live, the rolls can be adjusted to the correct elevation using the readout as a digital indicator.



Read9 Real-Time Displays for Targets 1-3

Arc Measurement Sweeping Through the Arc



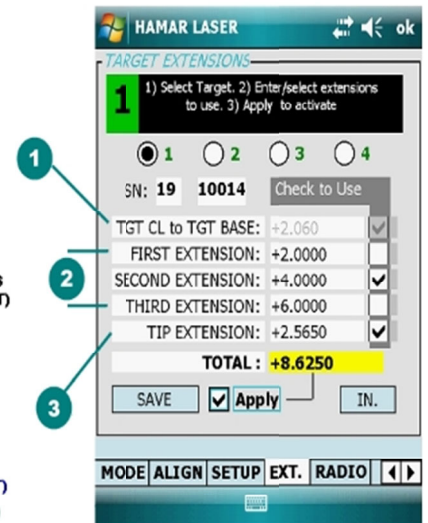
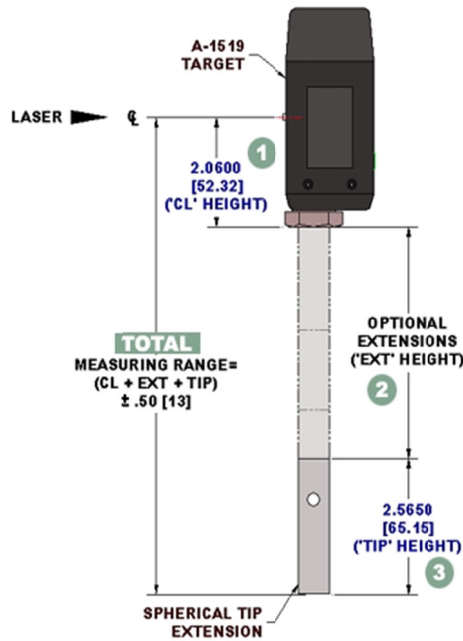
As the roll is rotated, when the readings stop changing, you are at Top Dead Center.

If there are elevation changes greater than 1.2 in., the EXT mode in Read9 can be selected, which will add a pre-determined spacer length to the target value and display the actual reading from the base of the target to where the laser beam hits. Precision spacers, either provided by Hamar or the user, are used to span the distance from the roll or other surface to the laser plane.

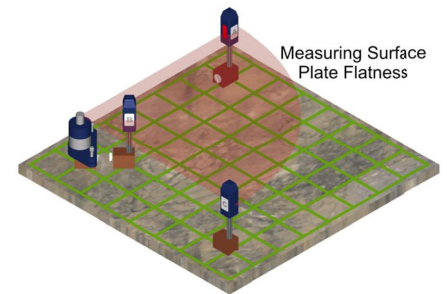
3-Point Buck-In Method (not level)

If the segment has not been leveled, then the L-740 can still be used to check the elevations. Instead of using earth level as a reference, we use a process called “bucking-in” using 3 reference points, usually the caster-segment mounting pads. This bucking-in method is very similar to the process used by optical methods for checking flatness.

1. Put an A-1519-2.4ZB on the closest locating pad on the segment and zero it in Read9.
2. Repeat Step 1 with 2 more A-1519-2.4ZB Targets.
3. Place targets #2 and #3 on the other 2 pads.
4. Adjust the pitch and roll axes on the L-740 Laser base until all 3 target values are the same. This means the laser plane is now parallel to the 3 segment mounting pads.
5. Move 1 A-1519-2.4ZB to the closest roll and zero it using the TDC Method described above.
6. Move the target to the other rolls to measure the deviation from the laser plane.



Read9 Target Extension Tab



Checking Parallelism of Caster Segment Location Pins

This procedure is for checking the upper and lower locating pins for the segments in the mill itself.

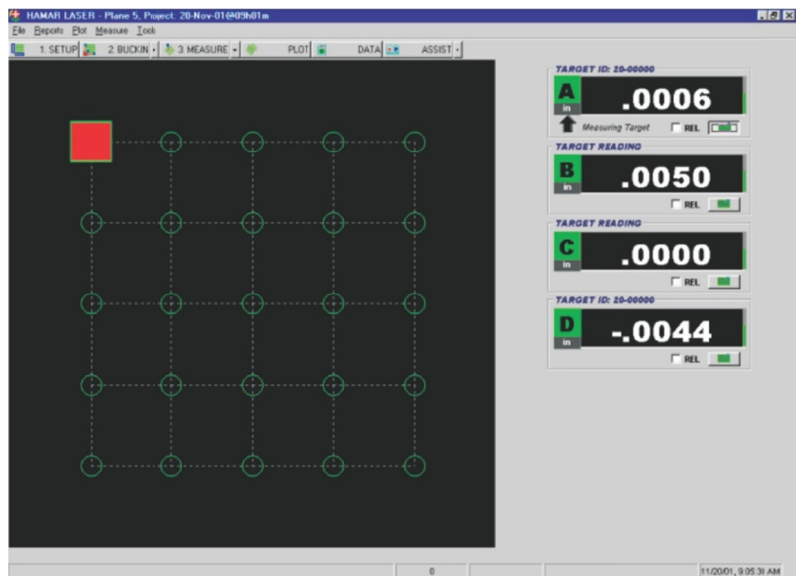
1. Place a fixture for holding the laser over the mill at the top set of pins. Place the laser approximately in the center between the two pins and level.
2. Fixture the targets on the locating pins horizontally and square to one of the vertical laser planes using the Top Dead Center method (see above). Adjust the vertical laser plane using the azimuth adjusting knob so that the same readings appear on both targets. This means the laser is parallel to the locating pins and is also plumb to Earth since the laser has been leveled.
3. Zero a measuring target on one of the reference pins and place on one of the lower locating pins. Use the Top Dead Center Method to square the target to the laser beam, and the resulting measurement of the first lower pin is how far out of plumb it is to the upper pin. The difference between the 2 lower-pin measurements is a measure of how far out of parallel the upper pins are to the lower pins. Since the targets provide live alignment data, they can then be used to adjust the pins, if possible, to bring them into alignment.

Using Plane5 Flatness Software to Collect and Analyze Data

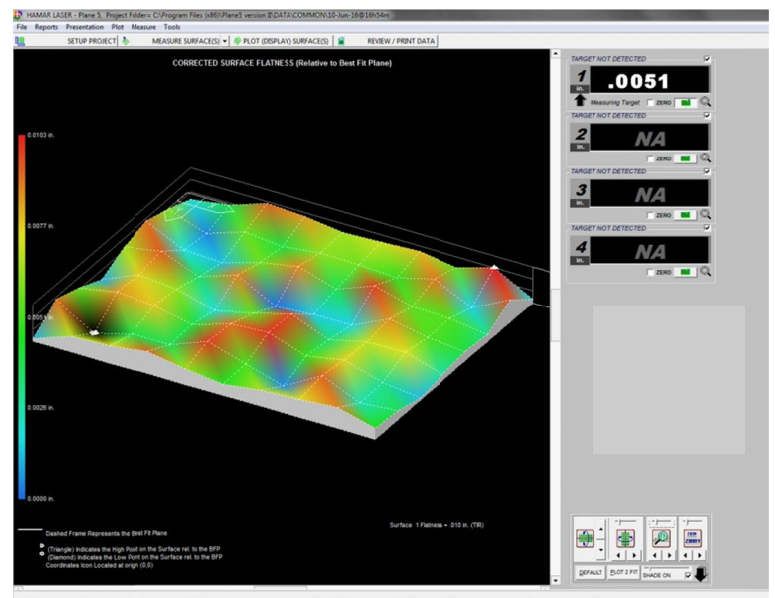
Hamar Laser’s Plane5 software can be used to quickly analyze almost any layout for flatness or straightness (and squareness when used with our squareness lasers). Squares, rectangles, frames, circles, rings, and up to four sets of ways can all be easily analyzed, and the alignment data is automatically downloaded by using our wireless data receiver, the A-910-2.4ZB, for analysis and reporting. If the user is simply taking data, Plane5 uses a least-squares, best-fit algorithm to eliminate any slope errors in the data from the laser not being parallel to the surface. What this means is that you do not have to buck the laser into reference points to check the flatness, which saves about 10 minutes of setup time.

How the Plane5 Flatness Software Works

1. Place the laser on the surface and roughly level, making the laser plane approximately parallel to the surface.
2. Set up the target on one point and zero. The grid pattern is then laid out in Plane5 and on the surface itself. For repeatability, it is important to mark the data points on the surface.
3. Move the target along the surface and press the spacebar to record each data point. The software can be set to average up to 25 readings per data point, however 5 to 10 readings is usually good enough even for the highest grade of surface plates. Once all the points have been taken, the software automatically calculates the flatness data and it can be reviewed in the report section of the software.



Plane5 Software – Data Taking Screen



Plane5 Software – 3D Plot Screen