

# Roll Alignment

### System Recommendations

#### Printing Presses/Paper Machines

*L-742 Ultra-Precision Roll Alignment System*

#### Rubber Mills/Textiles

*L-732 Precision Roll Alignment System*



Whether you have a paper mill, printing press or textile mill, your business can benefit from laser alignment. Most roll-type machines that are poorly aligned will produce a product that has wrinkles and other quality problems. The material will also wander or "walk" to one side of the roll or the other. This means a lot of down time and scrapped product.

Our patented, state-of-the-art laser alignment systems are up to six times more accurate than and twice as fast as a theodolite. The system can align one roll of a mill to another that is 200 feet away to within .004". And unlike theodolites, only one technician is needed to run the laser system, freeing up critical maintenance staff during shutdowns.

## L-742 and L-732 Dual Scan® Roll Alignment System

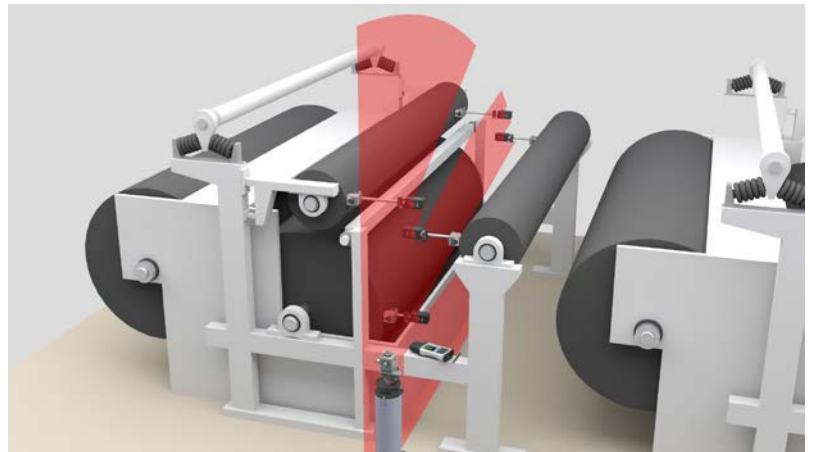
The L-742 and L-732 Dual Scan® Roll Alignment systems have been designed specifically for roll alignment applications. They are very affordable yet powerful tools to not only measure but also *fix* roll misalignment on almost any kind of paper mill or process mill, all in a fraction of the time needed with conventional methods. The systems are so accurate and easy to use that you can get the alignment right the first time, saving enormous costs in reduced downtime, scrapped product and quality problems.

### Two Laser Accuracy Grades

The L-742 Ultra-Precision Dual Scan® Laser has plane flatness of .00003 in/ft (0.0025 mm/m) and a roll-parallelism measuring accuracy of .00006 in/ft (0.005 mm/m). For limited budgets and lower accuracy applications, the L-732 Precision Dual Scan® Laser has plane flatness of .00012 in/ft (0.01 mm/m) and a roll-parallelism measuring accuracy of .00024 in/ft (0.02 mm/m).

### Laser Planes Have 200-Foot Range Vertically and Horizontally

The L-742/L-732 Lasers offer two automatically rotating laser planes with 100-foot (30.5 meters) range in radius. That means rolls, at almost any elevation, can be measured simultaneously without having to move the laser vertically. This also allows the laser to be moved to more sections without having to change the location of the reference targets.



## Wireless Targets and Readout Speeds Setup



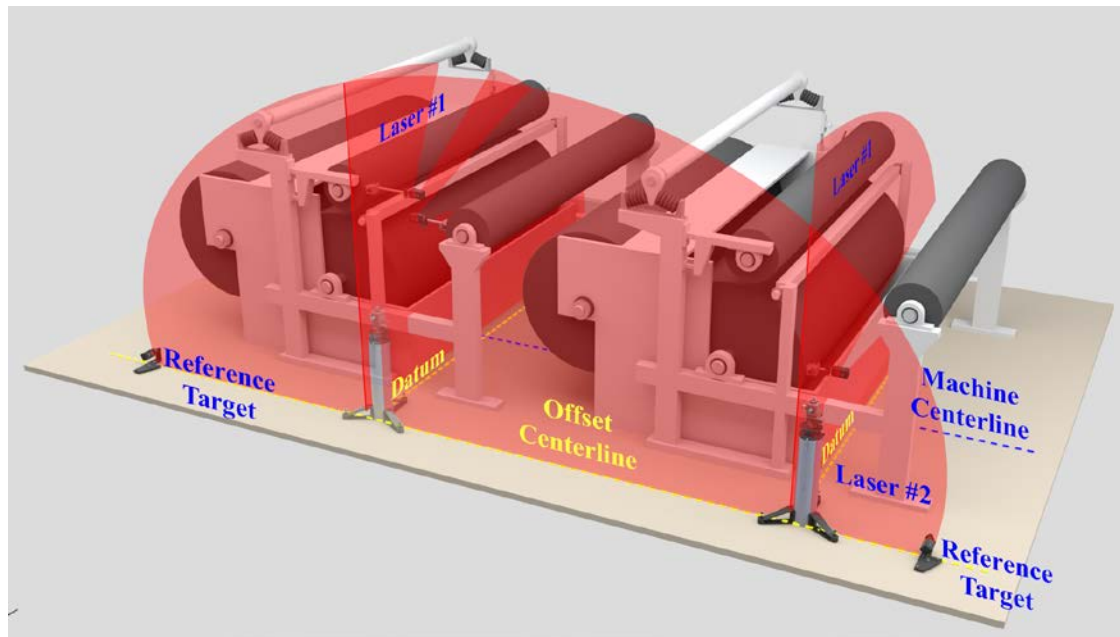
With the A-1519-2.4ZB Wireless Targets, there is no need to string long extension cords to reference targets. The targets have up to a 1.1" (28 mm) measuring range and can be used up to 100 feet (30.5 meters) from the laser.

The A-1519-2.4ZB target uses the R-1355-2.4 ZB PDA Readout, providing up to .00001" (0.001 mm in metric mode) resolution, color software and a wireless PDA data receiver to display up to eight targets. The R-1308, a single-axis readout that connects directly to the wireless targets may also be used for roll measuring. Other features like electronic zeroing and target averaging help to speed setup.



## Less Manpower Needed for Alignments

The L-742 Roll Alignment System's wireless targets and automatically rotating laser planes make setting up the laser at each machine section easier and reduce alignment team manpower. Our laser systems usually require only one operator. The wireless readout displays both targets simultaneously, allowing the user to quickly reference the benchmarks. Traditional optics usually requires at least one man holding a reference target in both reference locations.



## No Need for Optic's Time-Consuming Recalibration after Plumb Measurements

Unlike optics that usually require recalibration of the levels each time plumb is checked, the L-742 can simultaneously check level and plumb from a single setup. The levels usually only require calibration once a month or so and can easily be checked in the field with a simple 10-minute procedure.

## High Accuracy Reduces Optics' Guesswork

Hamar Laser's L-742/L-743 Roll Alignment System's parallel accuracy is .00006" in/ft (0.005 mm/m) under good atmospheric conditions. The L-732's parallelism accuracy is .00012 in/ft (0.015 mm/m). This high accuracy is far better than optics' accuracy, which is subject to much higher variability due to each operator "seeing" the readings differently. In fact, it is rare that any two optics operators will get the same numbers. With the L-742/L-732, this operator-to-operator variability is significantly reduced because the target electronics determine the alignment reading, which is very repeatable from one operator to the next.

### Recommended System Configuration

- L-742WW Ultra-Precision Dual Scan® Laser
- A-1519-2.4ZB Single-Axis Wireless Target w/1" range and .0005 mm resolution (qty 3)
- T-1500 Floor Fixture for reference targets (qty 2)
- R-1355-2.4ZB Readout w/Read 9 software
- R-1308 Single-Axis Readout for A-1519
- L-106 Instrument Stand
- L-106XY Translation Stage for L-106
- A-809XL3 Airline Shipping Case

### Optional Accessories

- T-1600 Non-Magnetic Roll Fixture
- T-1601 Tight Space Tram Bar for T-1600
- Alternative Lower Accuracy Laser  
L-732WW Precision Dual Scan® Laser

## Reference Roll and Laser Transfer Method Reduces Laser Error

We recommend using a reference roll as the datum for the L-742 setup because when using our Laser Transfer Method, the squareness error between the laser planes is eliminated. If absolutely necessary, our T-1500 Floor Fixtures can also be used to pick up offset-centerline, benchmark, and “prick marks” to use as the reference for the laser, but they are often subject to significant errors due to poor maintenance and cracks in the floor that cause the benchmarks to move.



## L-742/L-743 System Features

- Two continuously rotating laser planes with operational range of 100' (30.5 meters) in radius.
- Completely self-contained.
- Backlit levels accurate to 1 arc second (.00006 in/ft or 0.005 mm/m). The L-732 is accurate to 2 arc seconds.
- Laser planes flat to 0.5 arc second (.00003 in/ft or 0.0025 mm/m). The L-732's laser planes are accurate to 2 arc seconds (.00012 in/ft or 0.01 mm/m).
- A-1519-2.4ZB Single-Axis Wireless Target with 1.1" (28 mm) measuring range and .00002" (0.0005 mm) resolution.
- Factory-built benchmark fixtures and laser translation slide are included in system.
- The L-742 WW Laser includes Pitch/Roll/Yaw adjustment base with coarse and fine adjustments. The L-732WW Laser includes a Pitch/Roll/Yaw adjustment base with coarse adjustments.
- Instant ON with virtually no warm-up.
- Battery or AC powered.
- Typical setup time 15 minutes or less.

## The R-1355-2.4ZB Readout

The R-1355-2.4ZB Readout uses Hamar Laser's Read9 alignment software on a wireless, ruggedized PDA data receiver. The R-1355-2.4ZB can display data for up to eight A-1519-2.4ZB Single-Axis Wireless Targets, (four targets in two user-selectable screens) making multiple readouts unnecessary and allowing the user to perform many alignment functions with the convenience and portability of a handheld computer.

The Read9 software can toggle between **Absolute** (indicating exactly where the laser plane hits the target cell) and **Relative** modes. In Relative mode, the readout shows the measurement relative to the user-determined zero point.

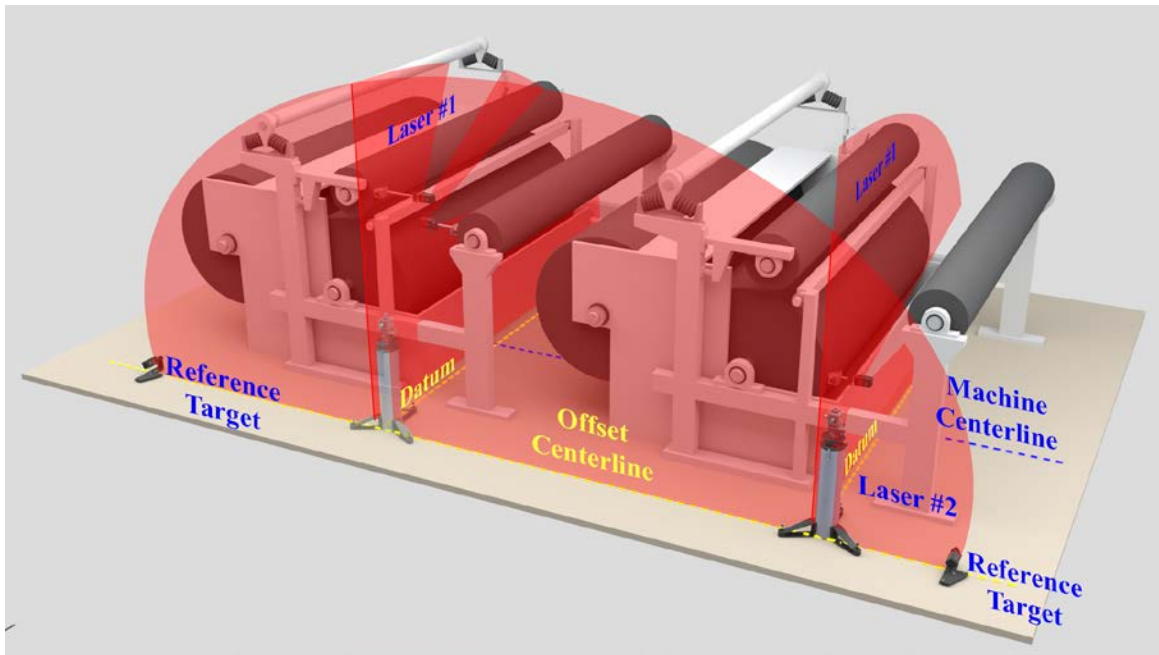




## How the Laser Alignment Systems Work

### Horizontal Roll Parallelism

When aligning rolls for paper mills, printing presses or film lines, the most difficult alignment is the horizontal parallelism (vertical parallelism or levelness can easily be checked using a machinist level). The following section provides suggestions for choosing a reference and step-by-step procedures for equipment setup and performing an alignment.



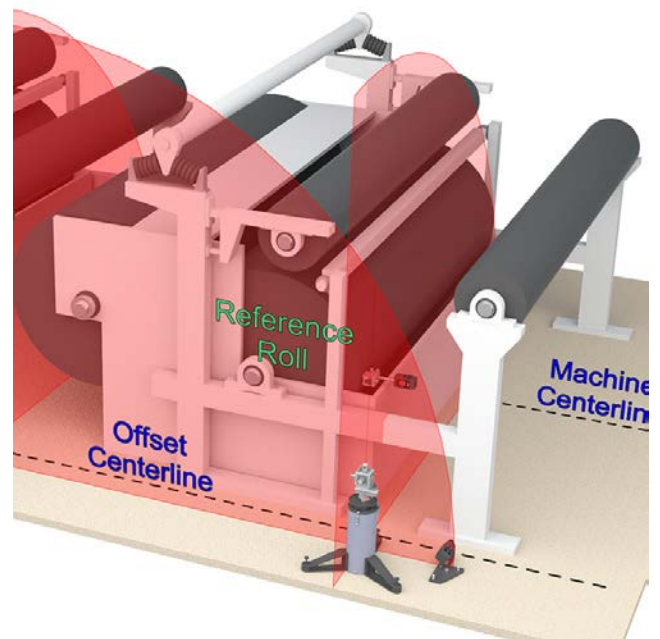
*L-742 Roll Alignment System Showing Laser Transfer Method*

### Choosing a Reference for Roll Alignment

Conventional methods of roll alignment usually use floor benchmarks (monuments) at the side of the machine as references. The L-742/L-732 offer the versatility of using these benchmarks or of picking up a reference roll, such as a cooch roll on paper mills. We strongly believe that using a reference roll provides the most accurate reference and results in better alignments.



Benchmarks are usually set in a thin concrete floor, are rarely covered, and are routinely run over and nicked. More importantly, they move with the slab of concrete and rarely hold their position relative to the mill itself. Most floors in a typical plant have multiple slabs and are usually cracked throughout, creating instability of the monuments. Unless checked every time they are used, the use of the benchmark probably will result in significant alignment errors.



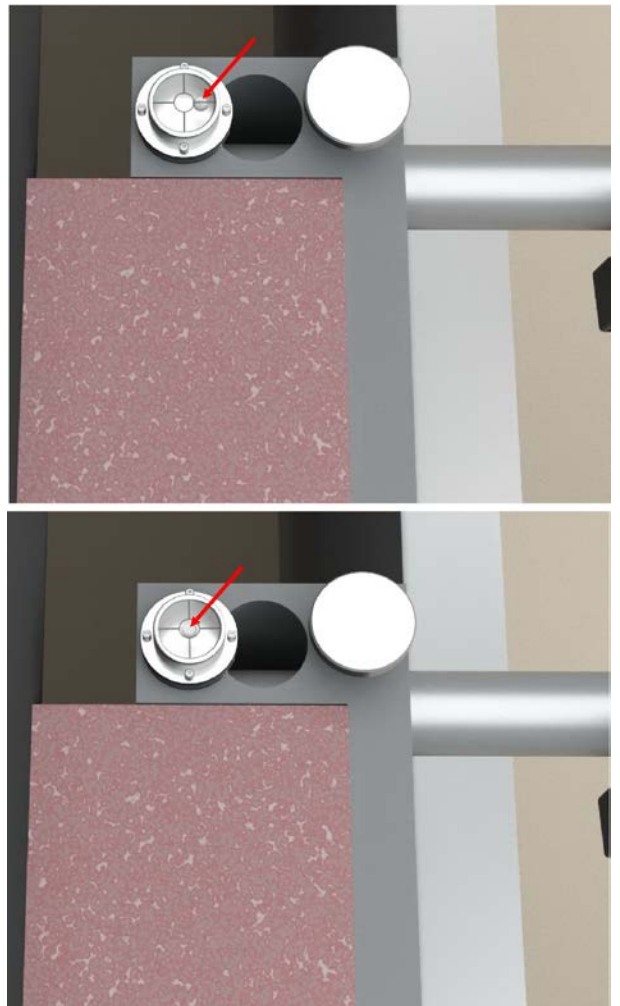
## **L-742 Roll Alignment Procedure**

Here's how the process works for picking up a reference roll: (keep in mind that using the L-742W or L-732W is like having two walls, both perpendicular to each other, 100 feet (30.5 M) in radius and very flat).

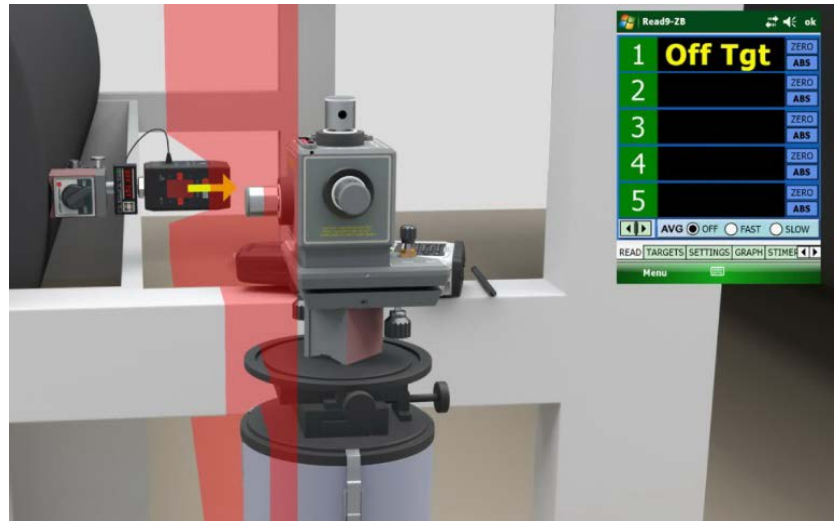
1. Place the L-742 on the L-106 stand outside the machine near the reference roll, at the side of the machine and level it. The L-742's Laser Plane #1 (LP#1) should be about 5" from the side of the roll to allow space for the A-1519-2.4ZB Targets to measure the roll.



2. Place A-1519-2.4ZB Target #1 on the reference roll horizontally at the closest point to the laser and mark the location on the roll. Slide the magnetic base slowly up/down (or rotate the roll) until the bubble is centered on the bulls-eye level. This puts the target at the Top Dead Center (TDC) of the roll.



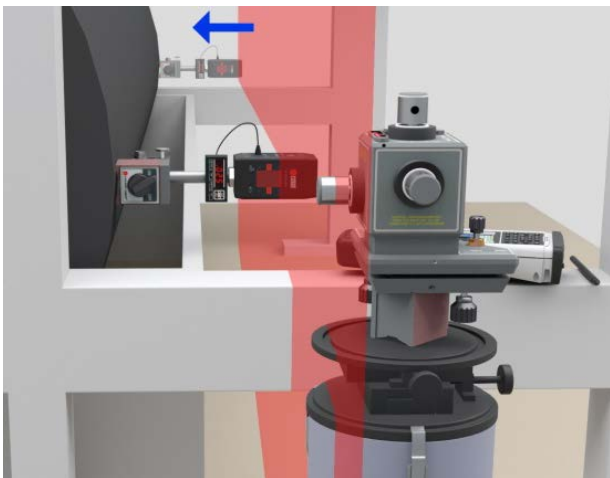
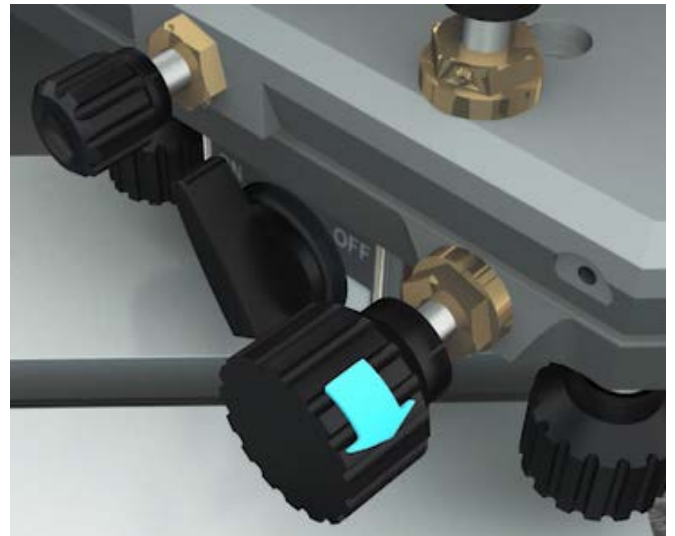
- Adjust the height of the target by loosening the thumb screw and sliding the post in/out of the magnetic base until the target detects the laser plane.



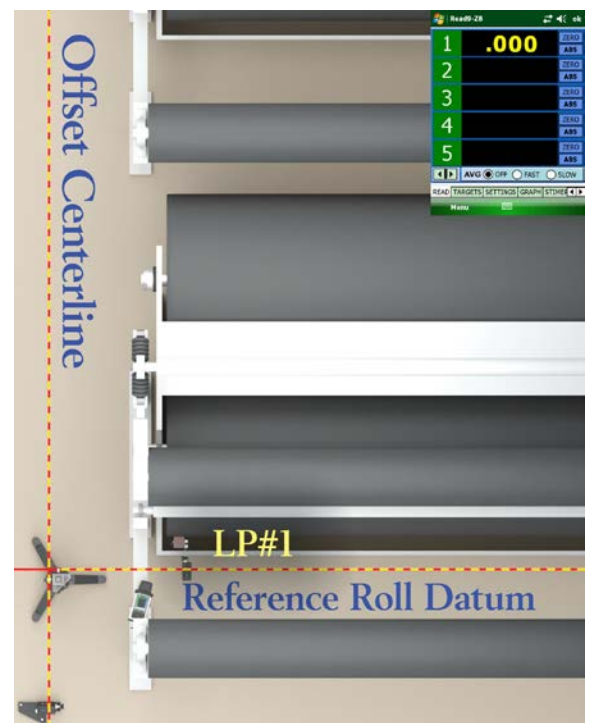
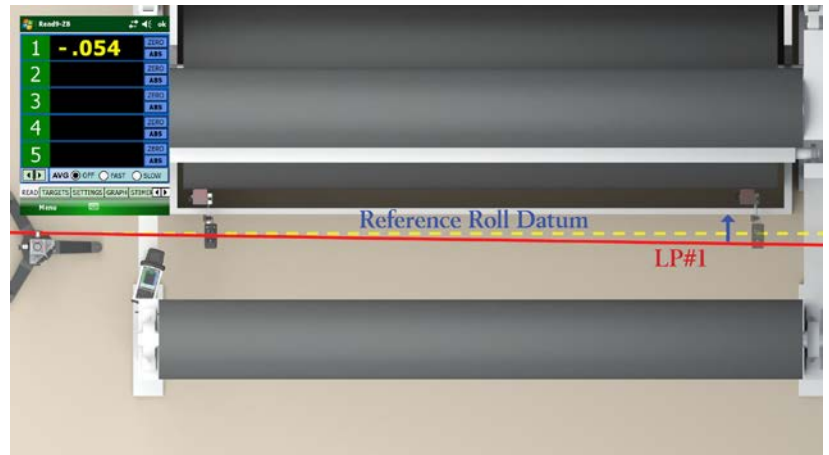
- Zero the value for Target 1 using Read9 in the R-1355-2.4ZB PDA Readout and move the target to the far end of the roll.



- “Buck in” or tilt Laser Plane #1 (LP#1) using the Yaw Adjustment until Target #1 reads zero at the Far Point. Move Target #1 back to the Near Point, re-zero, and repeat the process until the target reads zero at both locations, which usually takes 2-3 tries. If using the Remote Buck-in Formula (see Page 12), this process can be done in one pass.



- The laser plane is now parallel to the reference roll.

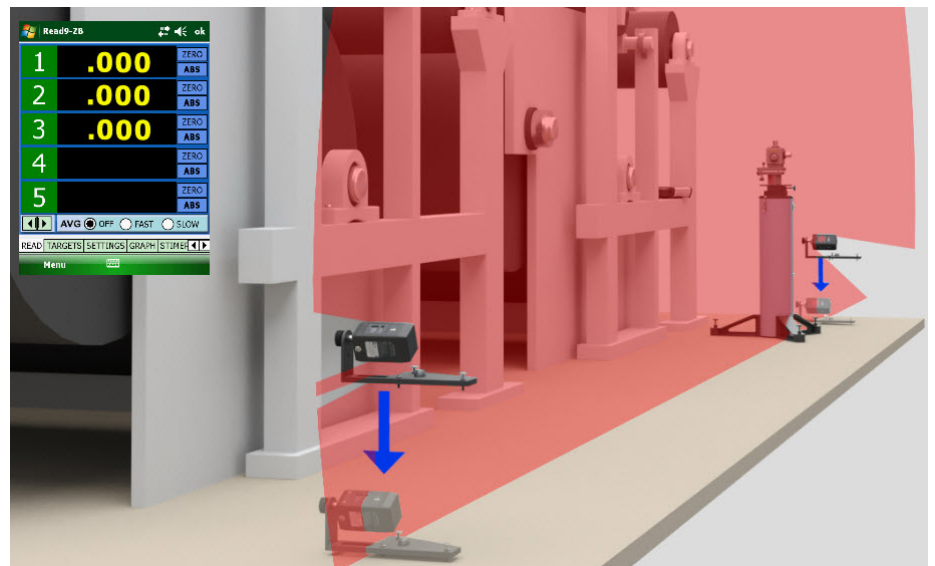




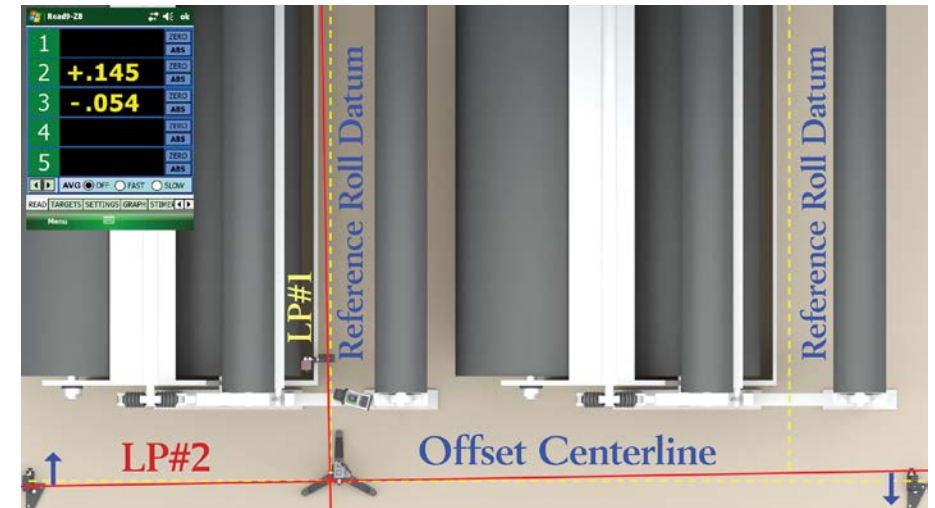
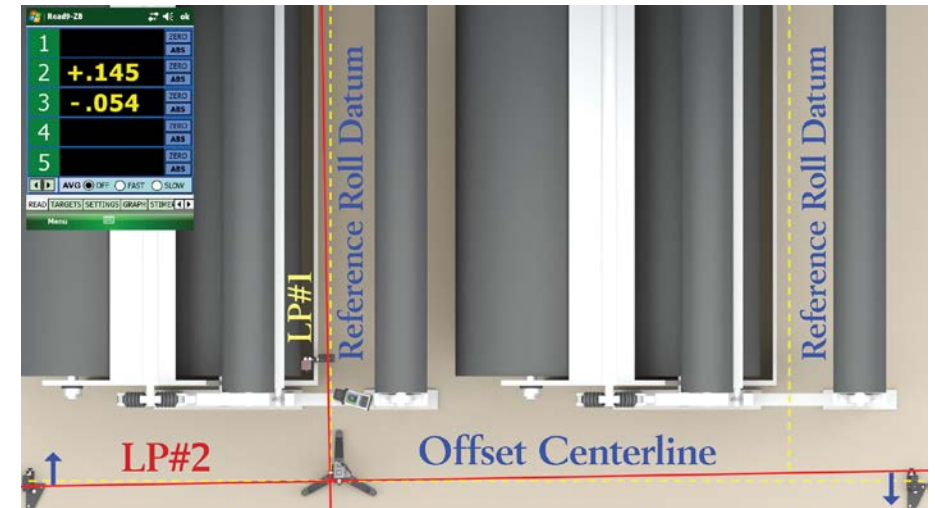
- Since the LP#2 is perpendicular to LP#1, LP#2 becomes the offset centerline of the mill. This offset centerline has a range of 100 feet (30.5 meters) on either side of the laser.



- Place Target #2 and #3 on floor fixtures at both ends of the machine and adjust until the laser beam hits the middle of the target windows. Turn on LP#2 and the values for targets are then zeroed in Read9, establishing the offset centerline. These targets are *not* touched during the remainder of the alignment.



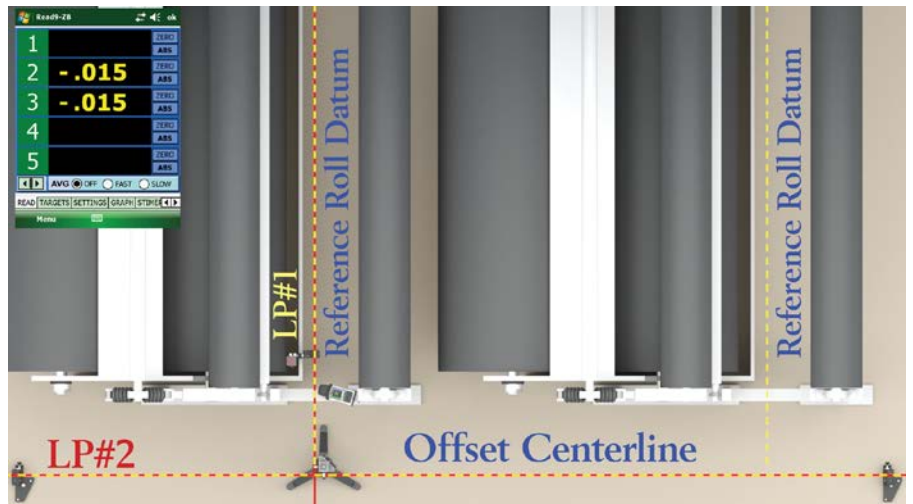
- To check the parallelism of a section of rolls, move the L-742 and L-106 stand along the offset centerline to the desired machine section and position the laser so LP#1 is about 4-5" from the roll to be measured. Level the L-742.





- Adjust the yaw adjustment on the laser base so that LP#2 is tilted until both Target #2 and #3 show the same readings. LP#2 is now parallel to the offset centerline.

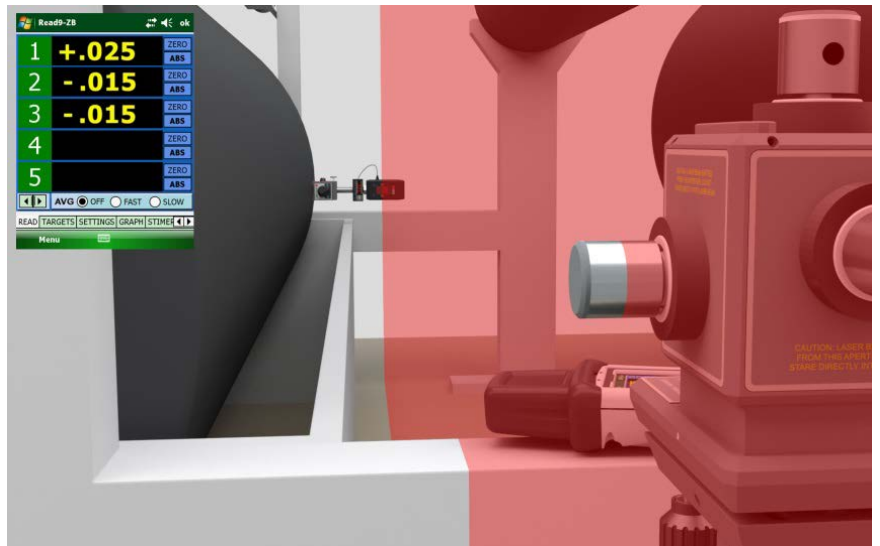
*Note: The readings do not have to be zero, but just the same number and same sign.*



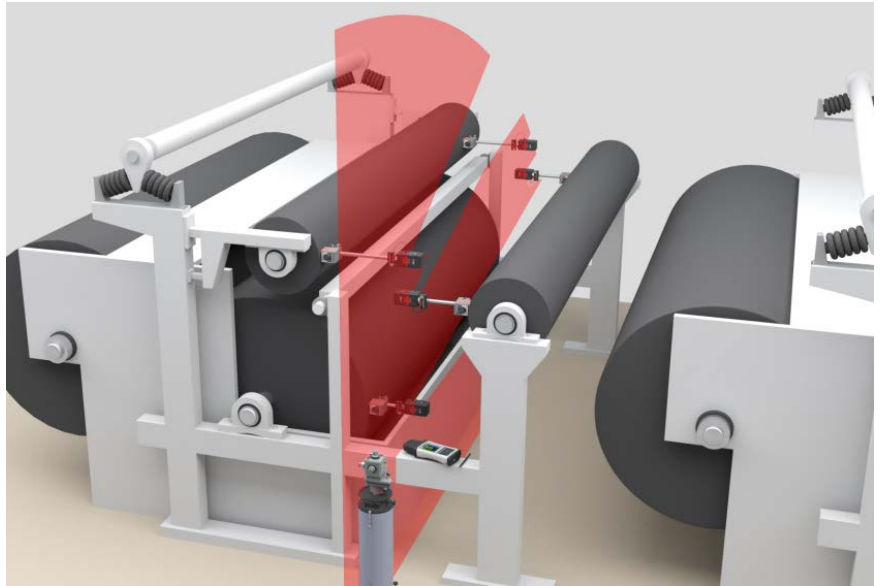
- To measure one of the rolls for parallelism, place Target #1 horizontally on the roll closest to the laser. Adjust the post so the laser plane is near the center of the target. Move the magnetic base up/down the roll until the bubble is level. Zero Target #1 in Read9.



- Move Target #1 to the far end of the roll. The resulting value is a measure of the parallelism of this roll relative to the reference roll. In this case, a plus (+) reading means the far end of the roll is pointing to the right by .025". To align it, adjust the roll until the readout shows zero, which means the roll is aligned and parallel to the reference roll.



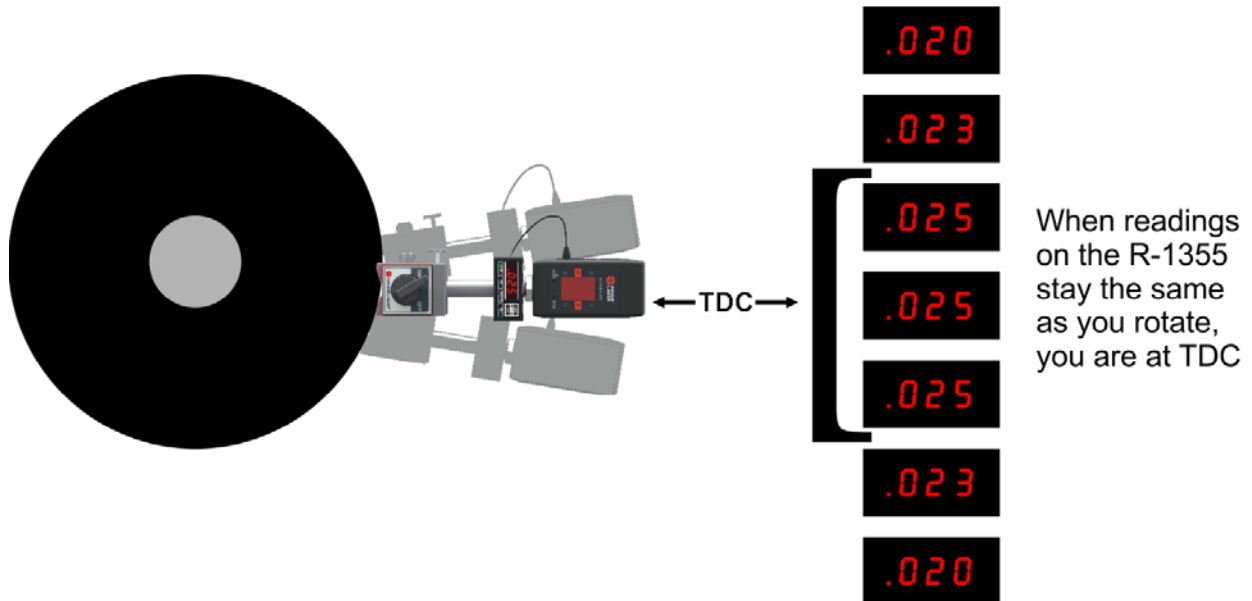
13. Since the laser generates a plane, rolls at any elevation in that section that are within 2 feet (610 mm) horizontally of the laser plane can be measured for parallelism without changing the setup of the laser.



**Arc Measurement Method - Sweeping Through the Arc**

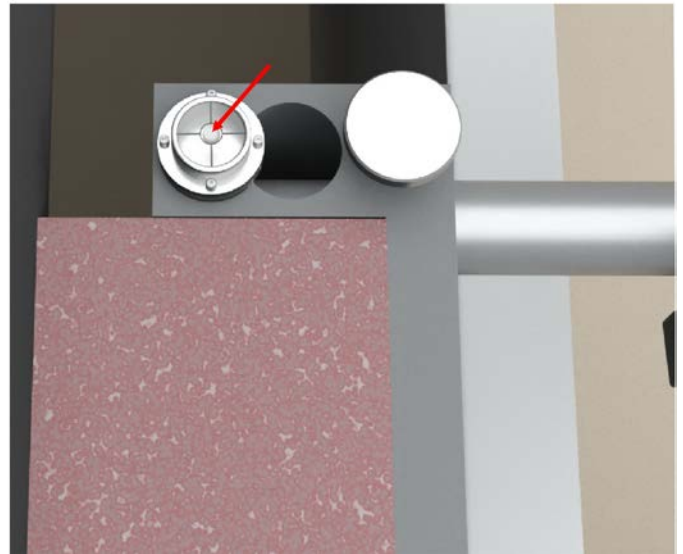
For hard-to-reach rolls that are farther than 2 feet (610 mm) from the laser, or where the roll radius is greater than 2 feet, the Arc Measurement Method must be used to get accurate results. In this method, instead of using the bullseye level, the target is swept through an arc to find the Top Dead Center (TDC), or the highest point on the arc that is tangent to the laser plane. To do this, the target is attached to the roll and it is slowly rotated (or slid around it) until the highest value is determined (see procedure below).

**Arc Measurement Method**  
Sweeping Through the Arc



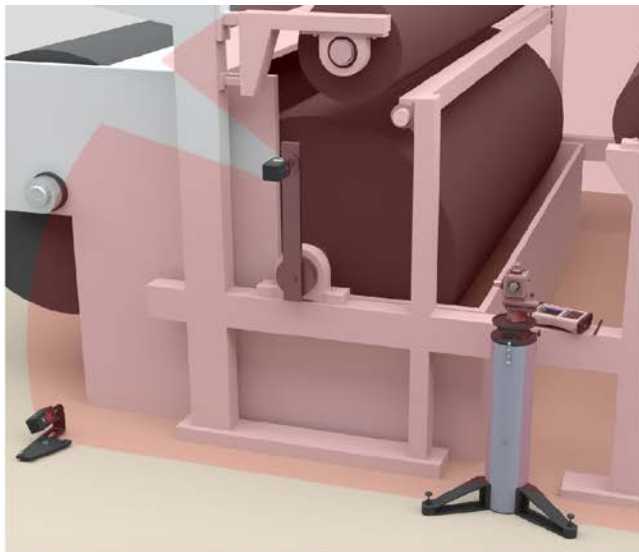
### Arc Measurement Method Procedure

1. Set up the A-1519-2.4ZB Target magnetic base (or use the T-1600 as described below). Ensure that the level on the magnetic base or fixture is centered, indicating you are close to TDC.
2. Slowly slide (or rotate the roll) the target magnetic base (or T-1600 fixture) around the roll in one direction while watching the R-1355 display. If you see the target reading *decreasing* in value, stop and rotate in the opposite direction. You will then see the target value *increasing*. As you continue to sweep through the arc, you will notice the value stops increasing for a short time, and if you continue to rotate in the same direction, then you will notice the value will start to decrease again.
3. The highest reading (most positive) occurs when the target is at the TDC. This is the value to record as the measurement for that point.
4. This method should work for roll diameters or target rod lengths up to 6 feet or 2 meters.

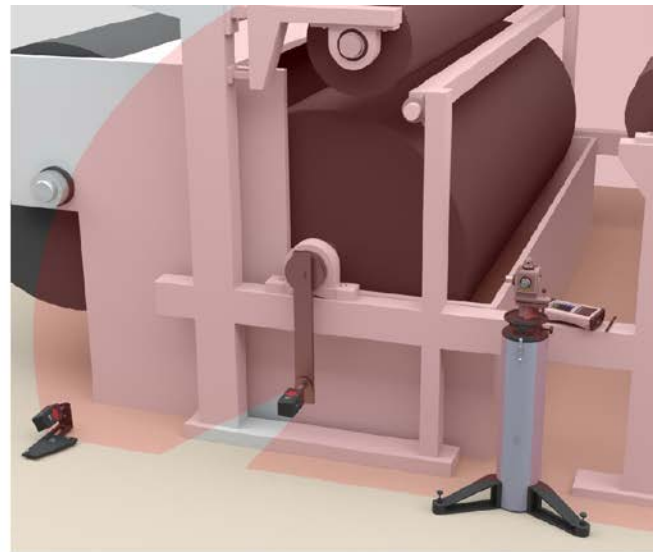


### Tramming Method for Hard-to-Reach Rolls

1. There are times when the side of the roll is impossible to reach with the target. In this case, we can attach a tram bar to the end of the shaft and put the A-1519-2.4ZB Target on it. Rotate the shaft to 12:00 and zero it in Read9. Then rotate it to 6:00 and the deviation is a measure of how out of level the roll is *relative to earth level*.

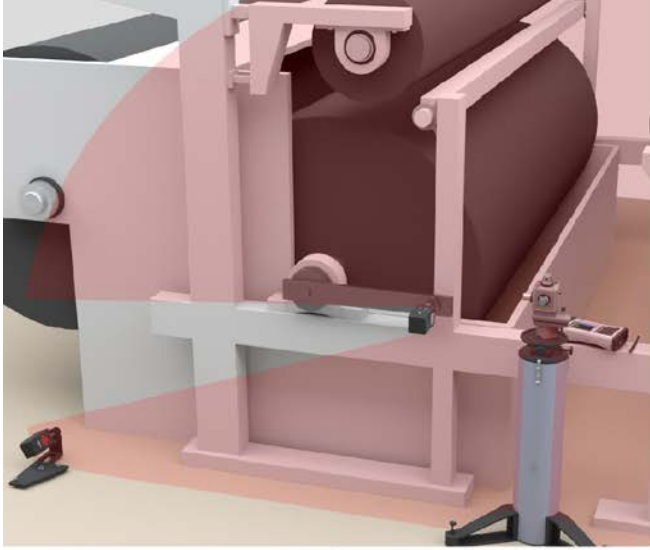


A-1519-2.4ZB Target at 12:00

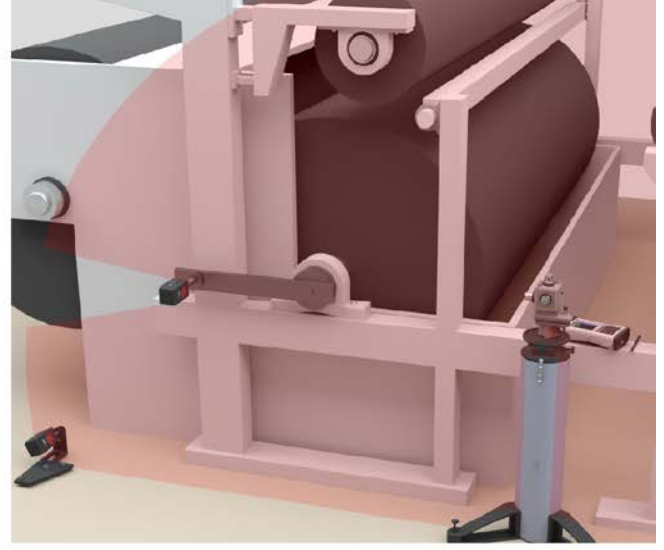


A-1519-2.4ZB Target at 6:00

2. For the horizontal parallelism, rotate the shaft to 3:00 and zero it. Then rotate it to 9:00 and this gives you a measure of how out of parallel the roll is *relative to the reference roll*.



A-1519-2.4ZB Target at 3:00



A-1519-2.4ZB Target at 9:00

**Note:** If the tram bar radius is 18" (500 mm) long and the difference in the reading is .009" (0.23 mm), then that equals a parallelism error of .003 in/ft (0.25 mm/m). If the roll is 15 feet (4.5 m) long, then this means the far end of the roll is out by .045" (1.14 mm) relative to the reference roll.

### Remote Buck-in Formula

Many times in Roll Alignment, the laser has to be far from the edge of the machine. In this case, the normal buck-in process does not work very well. To circumvent this, we use the Remote Buck-in Formula:

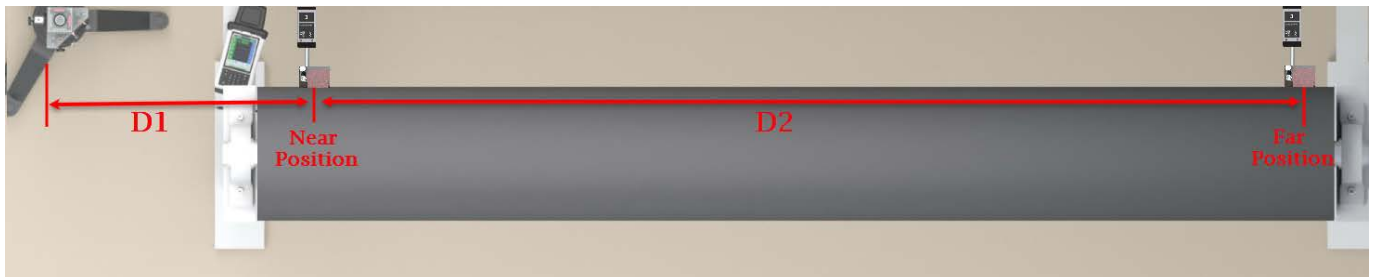
**Set Point = -1 \* (D1/D2) \* Far Reading, where:**

*D1 = distance from laser base to Near Point target location on the roll.*

*D2 = distance from the Near Point target location to the Far Point target location on the roll.*

*Far Reading = the value in the PDA with the target zeroed at the Near Point and moved to the Far Point.*

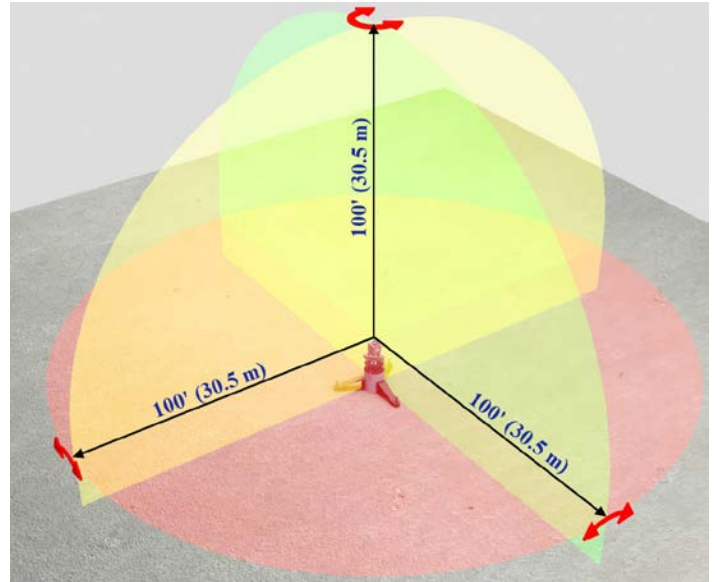
After calculating the Set Point, put the target back on the Far Point. Then adjust the L-742's Yaw Axis until the target value equals the Set Point. When you move the target back to the Near Point, you will see the reading is the same as the Set Point. This means it's bucked in. Taking care with the dimension measurements will result in doing the buck-in in one pass.





## Leveling Rolls

For checking level on applications with multiple rolls in the same horizontal plane, the L-743 or L-733 must be used since they have a horizontal laser plane in addition to the two vertical planes of the L-742W or L-732W. The laser is leveled and a target is placed on one end of the roll and zeroed. The target is then moved to the other end of the roll and the deviation from level is measured. If both readings are zero, then the roll is level. If not, it can be adjusted using the target as an electronic indicator.



## The T-1600 Non-Magnetic Roll Fixture for the A-1519-2.4ZB Targets

The T-1600 Non-Magnetic Roll Fixture is used for aluminum, rubber and stainless steel rolls. Also available is the T-1601 Tight Space Roll Fixture/Tram Bar, which uses two A-1519-2.4ZB Targets to measure alignment in tight spaces. The following procedure describes the setup and procedure for using the T-1600.

