

Laser Systems for Flatness and Leveling L-730/L-740 Series

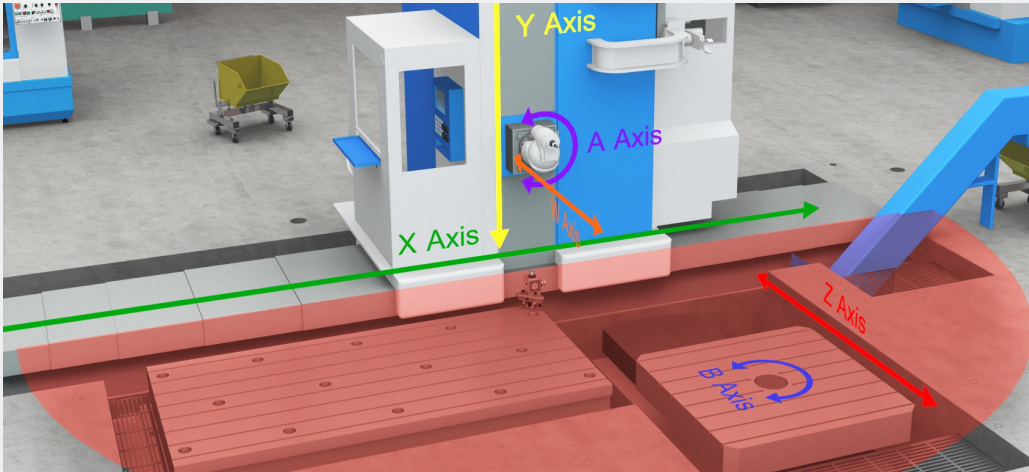
Single-Axis Lasers for Flatness
and Leveling Applications



**HAMAR
LASER**®
ALIGN WITH THE BEST



Why the L-730/L-740 Flatness Leveling Systems are Better



L-730/L-740 Measuring Capabilities

- Flatness and level of surfaces up to 100 feet (30 m) in radius, such as
 - Machine guideways
 - Machine tables
 - Large parts
 - Flanges
 - Surface plates
 - Steam turbine half joints
 - Press & molding machine platens
- Machine bed guideway twist
- Pitch and roll angular measurements
- Parallelism of multiple surfaces
- Flange flatness of wind turbine towers

Sooner or later everything goes out of alignment. Machinery and process lines, when properly aligned, run better, last longer, require less maintenance, lower production costs and improve productivity.

As the leader in laser alignment technology, we introduced the world's first flat laser plane in 1974, and the first automatically sweeping laser plane in 1985. Today, no one can match our innovative systems for accuracy, versatility, fast setup, ease of use and the immediate, real-time generation of alignment data.

Advantages of L-730/L-740 Scanning Lasers over Tradition Methods

- Up to 10 times higher accuracy
- Up to 70% faster than optics and levels
- Only requires 1 technician
- 3 times less training required
- Wireless real-time data automatically updates with each adjustment

Industry's Highest Accuracy. Period

The L-740 Ultra-Precision Leveling Laser offer the highest accuracy in the industry with a plane flatness of 0.5 arc seconds (.00003 in/ft or 0.0025 mm/m), up to 10 times better than the competition. For lower accuracy applications, the L-730 Precision Leveling laser offers a laser plane flatness of 2 arc seconds (.00012 in/ft or 0.01 mm/m).

Automatically Rotating Laser Planes

The L-730 and L-740 Lasers offer automatically rotating laser planes, unlike some competitive "point-and-shoot" lasers. This saves a tremendous amount of time since you don't have to point the laser at the target every time you want to take a data point. The lasers have a range of 100 feet (30 M) in radius.



Reduced Downtime

Up to 70% faster than optics or levels, the L-730/L-740 lasers significantly reduce downtime. By using multiple targets simultaneously, several technicians can be used at the same time to level machinery, saving even more time.

Reduced "Do-Overs"

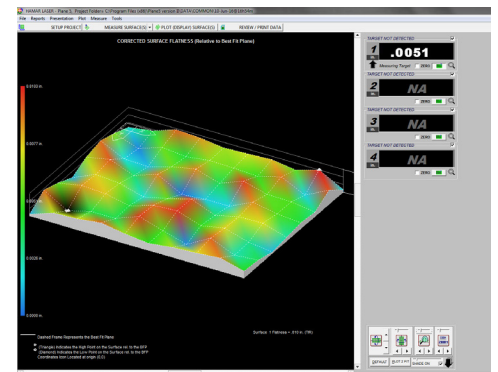
With the capability of seeing the data from multiple targets simultaneously, reference targets can be used to monitor laser drift on long-distance applications, another time-saving feature that reduces "do-overs."

High-Accuracy Level Vials

The L-730 and L-740 have 2 level vials built into the laser that are accurate to 3 arc seconds. The calibration of levels can be easily checked in the field, using an easy 15-minute procedure, and if they are out, they are user-adjustable, so no need to send it back to the factory! For high-accuracy leveling applications, the L-740 offers the L-740SP Split-Prism Level upgrade, which delivers accuracy to 1 arc second (.00006 in/ft or 0.005 mm/M).

Windows®-Based Flatness Software Program

Our Plane5 software is designed to run on any Windows®-based laptop or tablet. No need for an expensive proprietary data box to run our software!



At a Glance – Features and Benefits

L-730/L-740 Lasers

Different applications require different levels of accuracy, which is why we developed 2 accuracy levels for our leveling lasers: **L-730 Precision Leveling Laser** Ideal for precision-level work but where tolerances are not as critical, such as simple fabrication alignment checks, fabrication machinery beds, soles plates, etc.

L-740 Ultra-Precision Leveling Laser Our most accurate and ultra-precise laser, the L-740 is used for more demanding “mission critical” tasks, such as: leveling machining centers, gantries, large-bed lathes, surface plates, presses, turbine split joints, etc. where the 4 times greater accuracy is required.

L-730 Precision Leveling Laser



- Flatness capability to .00006 in/ft (0.005 mm/m) in 90-degree sweep
- Standard leveling capability of .00018 in/ft (0.015 mm/m)
- 100 ft. (30 m) radius operating range
- Pitch/Roll Coarse Adjustment Base
 - Coarse tilt resolution of .010” in 100 ft. (0.25 mm in 30 m)

- Capabilities:
 - Flatness single & interrupted surfaces
 - Levelness
 - Parallelism vertical/horizontal surfaces
 - Straightness
 - Machine-bed guideway twist
 - Pitch and roll angular measurements
- Applications
 - Fabrication machinery beds & guideway
 - Sole plates
 - Platen parallelism – small presses & injection molding machines
 - Tablet glass flatness

L-740 Ultra-Precision Leveling Laser



- Flatness capability to .000015 in/ft (0.0013 mm/m) in 90-degree sweep
- Split-Prism leveling capability of .00006 in/ft (0.005 mm/m) with upgrade
- 100 ft. (30 m) radius operating range
- Pitch/Roll Coarse/Fine Adjustment Base
 - Coarse tilt resolution of .010” in 100 ft. (0.25 mm in 30 m), and
 - Fine tilt resolution of .001” in 100 ft. (0.025 mm in 30 m)

- Capabilities:
 - Flatness single & interrupted surfaces
 - Levelness
 - Parallelism vertical/horizontal surfaces
 - Straightness
 - Machine-bed guideway twist
 - Pitch and roll angular measurements
- Applications
 - Machine tool guideways
 - Surface plates
 - Sole plates
 - Steam turbine split joints
 - Platen parallelism – large presses & injection molding machines
 - Tablet glass flatness

HLI vs. the Competition

Feature	HLI L-730	HLI L-740	Swedish Company #1	Swedish Company #2	German Company #1	German Company #2	USA Company #2
Auto Rotating Laser Planes	Yes	Yes	Laser #1 No Laser #2 Yes	No	Yes	Yes	No
Laser Plane Flatness	.00012 in/ft (0.010 mm/m)	.00003 in/ft (0.0025 mm/m)	Not published	.00048 in/ft (0.040 mm/m)	.00012 in/ft (0.050 mm/m)	.00024 in/ft (0.020 mm/m)	Not published
Laser Plane Step Error	± .0003 in (± 0.008 mm)	± .0001 in (± 0.003 mm)	Not published	Not published	± .0010 in (0.025 mm)	± .0020 in (±0.05 mm)	n/a
High-Accuracy, Split-Prism Level Upgrade	Yes	Yes	No	No	No	No	No
Operating Distance	100 ft. (30 m)	100 ft. (30 m)	133 ft (40 m)	164 ft (50 m)	328 ft (100 m)	164 ft (50 m)	150 ft (45 m)
Wireless Targets	Yes	Yes	Optional	Optional	Yes	Yes	No
Use Multiple Targets Simultaneously	Up to 15	Up to 15	No	No	No	Yes	No
Analysis Software Runs On Windows® PCs	Yes	Yes	No - Proprietary Display Box	No - Proprietary Display Box	No - Proprietary Display Box	No - Proprietary Display Box	No - Proprietary Display Box
Software Required	No, optional Uses PDA Display	No, optional Uses PDA Display	Yes	Yes	Yes	Yes	Yes

Defining Flatness & Level

Most people say “I want to measure level” when they really mean they want to measure flatness, using a level. The proper definition of flatness is: *a surface is said to be flat to a tolerance if all the points on that surface fall within 2 parallel lines, or planes, separated by the tolerance value.*

For example, if the flatness tolerance is .0030 in. TIR, then all the points must deviate from zero by no more than +/- .0015 in.

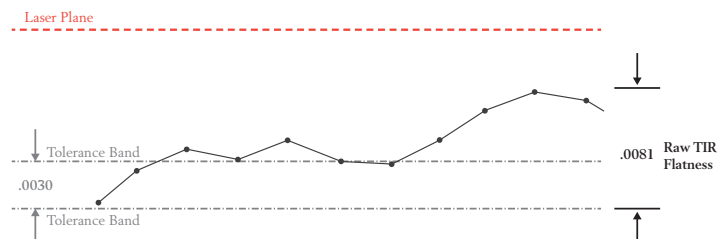
There are 2 ways to measure flatness using our lasers:

- Level the laser, using our high-accuracy, built-in level vials, and measure the surface relative to the level laser plane
- Use 3 reference points on the surface, align the laser (we call it “bucking-in”) to those points and measure the flatness relative to those 3 points.

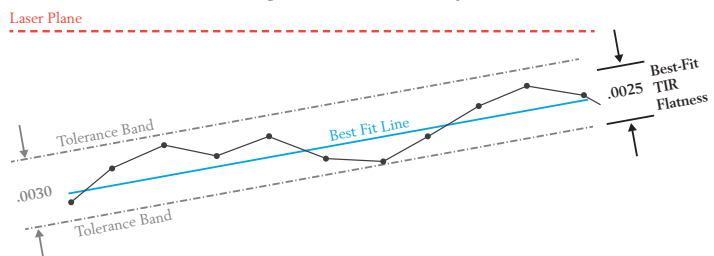
After recording the data, it is best to use our Plane5 Software to analyze the data using the Least-Squares, Best-Fit algorithm, which removes any slope error if the laser plane is not parallel to the surface, or if the surface is not level but the laser plane is.

Why It's Best to Use Data Analysis

Raw Flatness Error (No Data Analysis): .0081



True Flatness Error Using Best-Fit Analysis: .0025



In this case, the laser was level to earth but the surface was not level. By using the Least-Squares, Best-Fit analysis, which calculated a line that “best fits” the data and then compared the data points to the line, we can see that the Best-Fit (true) TIR flatness error is significantly less than the raw flatness error and is “in-tolerance”.

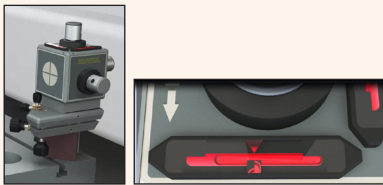
How the L-730/L-740 Systems Work

The L-730/L-740 lasers offer 2 ways of checking flatness on a surface:

- **Levels** - Using our built-in level vials and using earth-level as a reference to measure the surface for flatness.
- **Reference Points** - Using 3 reference points on the surface and aligning the laser to those points (we call it “bucking-in”) to measure the surface for flatness.

Checking Flatness Using Level Vials

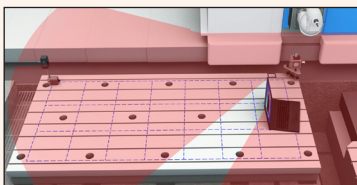
1. To check flatness using the level vials, put the L-730/L-740 laser on an instrument stand or stable mounting surface and level it in two axes.



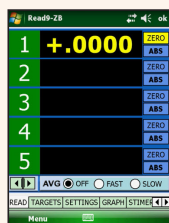
2. Place an A-1519-2.4ZB target on one reference point, mark an outline around the magnetic base, and electronically zero the target by tapping the Zero button in the Read9 Software on the PDA.



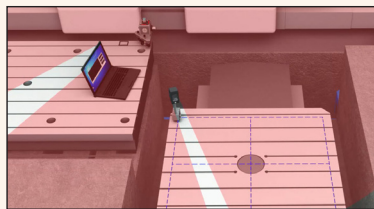
3. Move the target to a measurement point on the surface. A “+” reading means the point is higher, and a “-” means the point is lower, than the reference point.



4. You can leave a target on the measurement point and if you need to level it, you can watch the data update on the PDA in real time while you adjust the machine. When it reads zero, you're done!



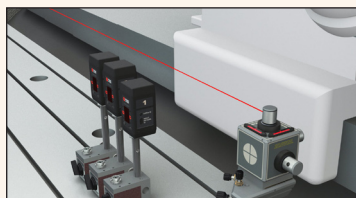
5. You can also check parallelism of a separate surface by moving the target to that surface. Then any deviation from zero is a measure of the elevation difference of the second surface from the first surface. The difference between points on the second surface is a measure of the parallelism to the first surface.



Checking Flatness with the 3-Point Buck-in Method

Sometimes surfaces are flat but not level, so using level as a reference to check flatness may add unnecessary time and make a perfectly flat surface look like it's out of specification. So we recommend bucking-in the laser (make it parallel to) to 3 points on the surface. Here's how:

1. Place the laser on an instrument stand or on the surface you are going to measure.



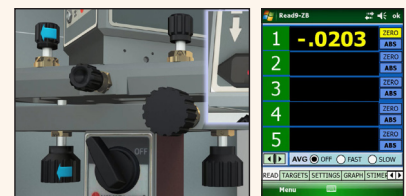
2. Place an A-1519-2.4ZB target on one reference point (#1) right next to the laser, mark an outline around the magnetic base and electronically zero the target by tapping the Zero button in the Read9 PDA Software.



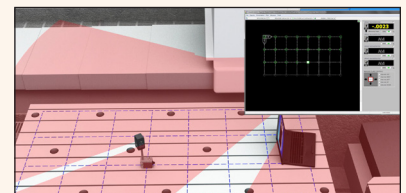
3. Move the target to the farthest point (#2) along the Pitch Axis and mark the outline of the magnetic base.



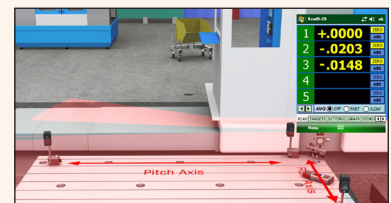
4. Turn the Pitch Axis coarse and fine adjustment knobs until the PDA reads zero. Repeat Steps 3 and 4 until the target reads zero at both Point #1 and Point #2.



5. Now move the target to the farthest Point #3 away from the laser along the Roll Axis. Turn the Roll Axis coarse and fine adjustment knobs until the PDA reads zero. Repeat until the PDA reads zero at Points #1, #2 and #3. The laser is now bucked-in and it's ready to take data. This process usually takes 5-10 minutes.

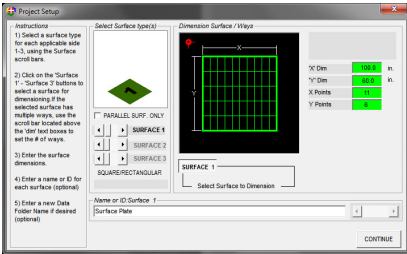


Note – the buck-in can be sped up for larger surfaces by simultaneously using 3 targets, which can also be used to monitor laser drift.

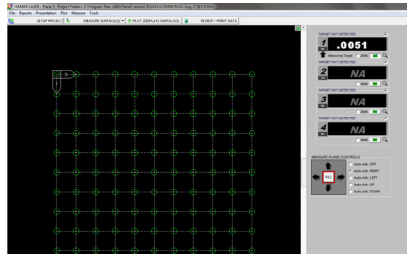


Powerful Data Alignment Software and Accessories

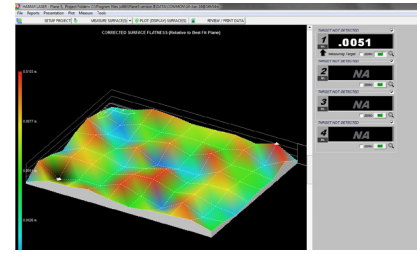
Our Plane5 Flatness Software collects and analyzes alignment data quickly and easily. It provides data displays for up to 5 A-1519 Targets simultaneously. Each display can expand to be seen over long distances. Our software runs on Windows®-based tablets/laptops, and provides large, readable color graphics.



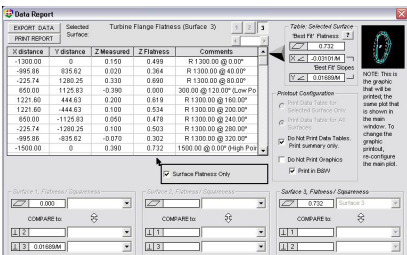
Plane5 — Projects Setup Screen
Select from 1 of 7 different surface types, enter dimensions and number of points for taking flatness data.



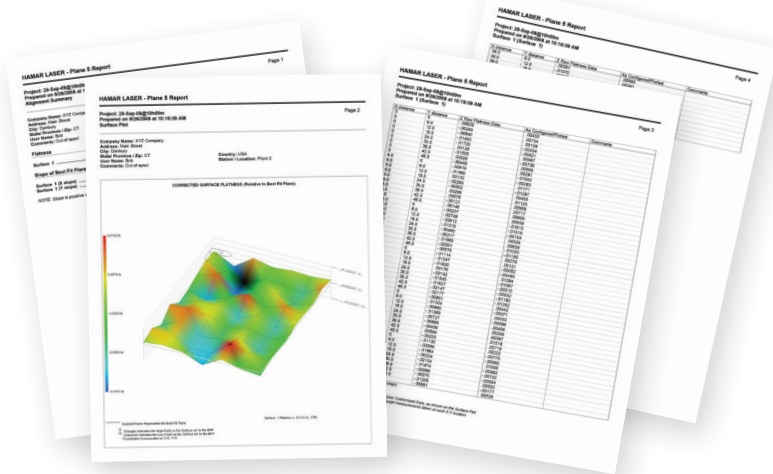
Plane5 — Data Taking Screen
Press the spacebar to record data point and Plane5 automatically moves to the next point. Taking data is easy and fast.



Plane5 — Plot View Screen
Shows a 3D plot of surface flatness of up to 3 surfaces. The TIR flatness of the data is calculated using the least-squares, best-fit algorithm.



Plane5 — Report Screen
Complete report showing TIR flatness, flatness data for each surface, squareness and parallelism between the surfaces. Data can be exported to Excel or printed to a emailable PDF report.



R-1355-2.4ZB
Rugged PDA Readout with Read9 Software and 2.4GHz Wireless communication - displays up to 8 targets.



L-106 Instrument Stand
Lightweight, rigid and variable height settings for most leveling applications.



A-1519XLS Sunlight Filter
Light shield with a narrow-band sunlight filter for A-1519/1520 Targets



A-1519/A-1520 Universal Targets
2.4GHz Wireless data transmission with up to .00001 in. (0.00025 mm) resolution and ± 0.55 in. (±14 mm) measuring range.



A-910-2.4ZB Computer Interface
2.4GZ wireless data receiver for laptops to display data in Plane5 or other HLI program.

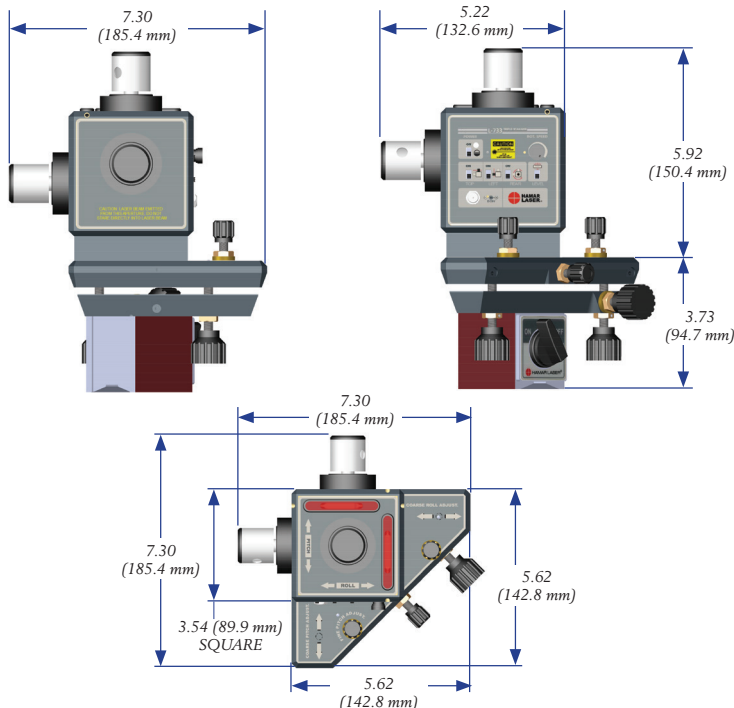


M-1519SP Surface Plate Measuring Base
Specially designed, high-accuracy, flatness measuring base for applications such as surface plates.

Specifications

L-730/L-740 Leveling & Flatness Alignment Systems

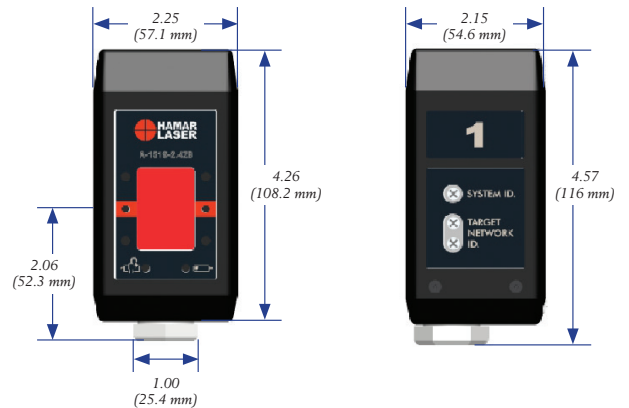
Weight	Laser: 3 lbs. (1.3 kg) Base: 4.8 lbs. (2.2 kg) Battery Pack: 1 lb. (0.45 kg)
Material	Laser: Aluminum and stainless steel Base: Aluminum
Laser Type	Class II visible diode, 635 nM wavelength (class 1 in Scanning Mode); .160" (4.06 mm) beam diameter
Beam Power	0.9 mW per straight beam
Laser Plane Flatness	<u>L-730 Series:</u> <ul style="list-style-type: none"> • 180/360° Sweep: 2.0 arc sec (.00012 in/ft. or 0.01 mm/m), plus translational error of $\pm .0003"$ (± 0.008 mm) • 90° Sweep: 1.0 arc sec (.00006 in/ft or 0.005 mm/m), plus translational error of $\pm .00015"$ (± 0.004 mm). <u>L-740 Series:</u> <ul style="list-style-type: none"> • 180/360° Sweep: 0.5 arc sec (.00003 in/ft or 0.0025 mm/m), plus translational error of $\pm .0001"$ (± 0.0025 mm) • 90° Sweep: 0.25 arc sec (.000015 in/ft or 0.0013 mm/m) plus translational error of $\pm .00005"$ (± 0.00013 mm).
Operating Range	100 feet (30.5 m) in radius
Operating Modes	1 beam or 1 continuously rotating laser plane
Power Supply	9V DC external battery pack (2 cells) or 115V Ac adapter. Battery life approximately 2-3 hours.
PRY Base:	<u>Coarse Adjustment (L-730 & L-740):</u> Range: ± 3 degrees Resolution: .010" (0.25 mm) in 100 feet (30.5 meters) <u>Fine Adjustment (L-740 Only)</u> Range: ± 0.3 degrees Resolution: .001" (0.025 mm) in 100 feet (30.5 meters)



A-1519/A-1520 Wireless Targets

Resolution	A-1519: .00002" (0.0005 mm) A-1520: .00001" (0.00025 mm)
Linearized Accuracy	A-1519: $\pm .00015"$ (± 0.0038 mm) over ± 14 mm of PSD A-1520: $\pm .00006"$ (± 0.0015 mm) over ± 2 mm of PSD
Detector Size/Type	A-1519: 2-Axis PSD 1.3" x .51" (33x13 mm) A-1520: 2-Axis PSD .39" x .39" (10x10 mm)
Operating Range	100 feet (30.5 m) from laser to target
Target Angle Acceptance Range	$\pm 10^\circ$
Battery Life	11.5 hours continuous duty
Operating Temperature	5° F to 140° F (-15° C to 60° C)
Power Supply	7.5-12vDC, 500mA
Size	2.00" W x 4.11" H x 1.75" D (50.8 mm x 104.4 mm x 44.5 mm)
Weight	13.5 oz. (383 grams)
Wireless Range	150 feet (46 m)*
Magnetic Base Size	2.00" W x 3.09" H x 4.14" D (50.8 mm x 78.5 mm x 105.2 mm)
Magnetic Base Weight	2.78 lb. (1.26 Kg)

* Wireless range may be limited by obstructions, antenna type and orientation. Outdoors line-of-sight range, with dipole antenna, may be greater.



Hamar Laser Instruments, Inc.
5 Ye Olde Road, Danbury, CT 06810
Phone: +1-203.730.4600 • Fax: +1.203.730.4611
Int'l: +1.203.730.4600
E-mail: sales@hamarlaser.com
www.hamarlaser.com