

Laser Systems for Geometric Alignment L-730/740 Series

Single-Axis/Multi-Axis Lasers for
Precision Alignment and Analysis



High-Accuracy Machinery Alignment since 1967

Why Hamar Laser Alignment?

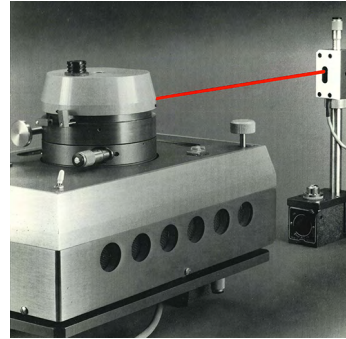
Sooner or later everything goes out of alignment. Machinery and process lines, when properly aligned, run better, last longer, require less maintenance, lower production costs and improve productivity.

At Hamar Laser, precision is measured in microns, and customer loyalty is measured in decades. The company is constantly engineering improvements into its lasers. In fact, our quality standards are so demanding, it's not unusual for a Hamar laser to provide ten times the accuracy required by an application and for our systems to last 10, 15 or even 20 years.

Hamar Laser systems offer significant advantages over traditional alignment devices:

- Up to 70% faster
- Simultaneous multi-axis alignment
- Ultra high accuracy and reduced setups
- Data displays automatically update with each adjustment

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.



The Model L-711 laser alignment system was the first such system to feature a pentaprism that created a manually sweeping precision laser plane. The ground-breaking alignment device was accurate to less than 0.5 arc-sec (0.0025 mm/m)!

Hamar Laser's flagship Triple-Scan® alignment system debuted as the Model L-723. Its successor, the Model L-743, is still the only such system on the market featuring 3 automatically rotating laser planes – a must have for quickly aligning large machining centers.



See our timeline of over 50 years
of unsurpassed accuracy in
LASER ALIGNMENT

Discover our history here

Testimonials

"I want to give you some feedback on our first alignment with our new Hamar system [L-743 Ultra-Precision Triple Scan laser]. We used it to install and align a new bridge mill. It worked better than we expected and was so much easier than the levels [and granite squares] we've been using in the past. We leveled and squared the bridge mill with the L-743 in 1.5 days instead of the 4-5 days it would have taken using our old equipment! Based on this time savings, we think we will get a payback in 9-12 months!"

*Josh M.
Service Manager, Exact Machine Service*

"Our new L-733 Precision Triple Scan® Laser has been working great in the saw mill. Our main application is to align machine centers. Our alignment consists of making sure our machine line is level, straight (in-line) and square to itself within .005".

"I like that the L-733 lets us shoot straight, elevation and square measurements in just one or two steps, and that it gives us real-time numbers. This is extremely helpful when having to move something back in line. I also like your R-1308 plug-in digital readout that attaches to the target for taking measurements, especially when we are moving something, because there is no delay. I can see the data right away. Overall the laser is a really great tool."

*Jacob H.
Head Filer, Idaho Forest Group LLC*

L-743/L-733 Geometric Alignment Capabilities

Flatness (Level)

- Tables and Separated Surfaces
- Machine Beds and Lines of Motion
- Machine Bed and Vertical Axis Twist
- Surface Plates
- Pitch and Roll Angular Measurements

Squareness

- Columns to Tables or Rails
- X to Y Axis, Z to X Axis and Z to Y Axis
- Rotary Axes to Main Machine Axes

Straightness

- Machine Beds and Lines of Motion
- Column Travel
- Yaw Angular Measurement
- Beams or Other Structures

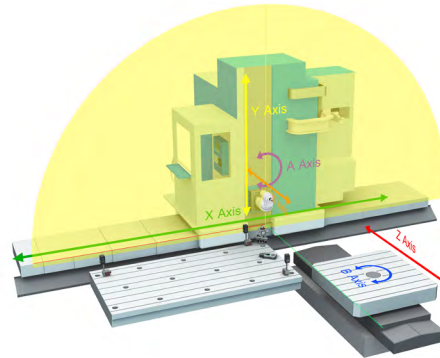
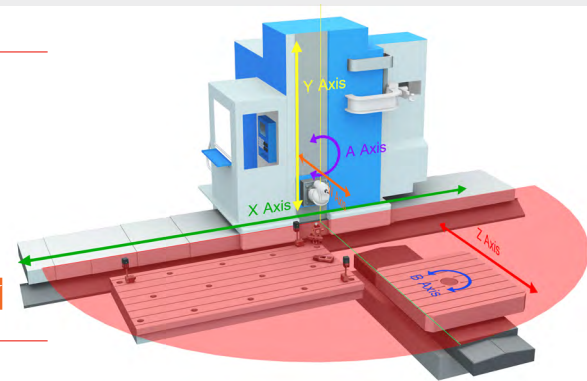
Parallelism

- Master Rail to Slave Rails on Gantries
- A, B, C & W Axes to Main Machine Axes
- Roll-to-Roll
- Platen to Platen, Ram to Ram

Capabilities Example: 6-Axis Horizontal Floor Mill One Setup Does it All!

Red Laser Plane Measures:

- X-Axis Flatness (Straightness in Y)
- W-Axis Flatness (Straightness in Y)
- Z-Axis Flatness (Straightness in Y)
- X - Z Axis Parallelism
- B-Axis Rotation Axis Parallelism to X & W

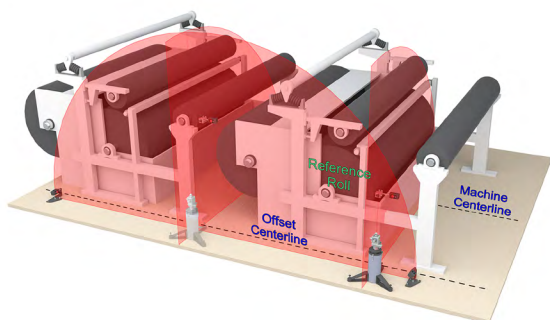
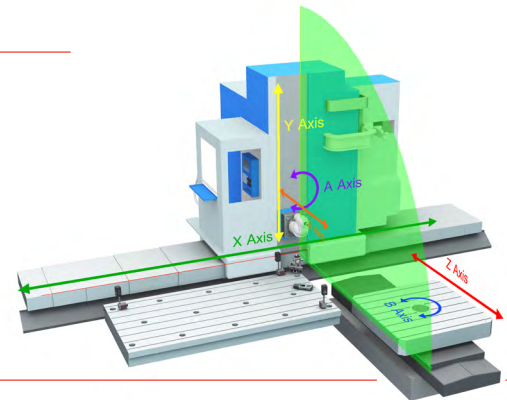


Yellow Laser Plane Measures:

- X-Axis Straightness in W
- Y-Axis Flatness (Straightness in W)
- Y - Z Axis Squareness
- A-Axis Rotation Parallelism to X & Y

Green Laser Plane Measures:

- W-Axis Straightness in X
- Y-Axis Straightness in X
- Z-Axis Straightness in X
- Y - X Axis Squareness
- W - X Axis Squareness
- Z - X Axis Squareness



Roll Parallelism

We have been making laser systems for aligning rolls in all kinds of different applications, including aluminum mills, continuous casters, paper & converting machines, plastic extrusion film lines, printing presses, steel mills, and textile mills. Proper roll alignment is essential to maximize machine efficiency and reduce scrap. Our systems are 3x more accurate than theodolites and 2x faster, and yet only require 1 technician to operate. [For more information, click here.](#)

A Hamar Laser System For Every Alignment Need



Machine Tool

- Floor and Spar Mills
- Gantries
- Horizontal and Vertical Boring Mills
- Horizontal and Vertical Machining
- Centers
- Large-Lathe Beds
- Machine Tool Assembly and Calibration
- Roll-Forming Machines
- Transfer-Line Wing Bases
- Vertical and Horizontal Presses
- Vertical-Turning Lathes



Plastics

- Blown-Film Lines
- Film Lines
- Injection Molding Machines



Leveling

- Machine Bed Leveling
- Split Joints On Steam Turbines

Roll Alignment

- Aluminum Mills
- Continuous Casting Machines
- Paper Mills
- Printing Presses
- Steel Mills
- Textile Mills



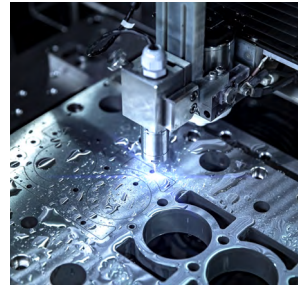
Quality Control

- Calibration of Large Fixtures
- Checking Flatness when
- Large-Part Flatness, Straightness
- Surface Plate Calibration and Jigs and Squareness Checks
- Scraping Machine Rails



Fabricating Machinery

- Laser-Cutting Machines
- Routers
- Saw Mills
- Tube-Bending Machines
- Water-Jet Machines
- Woodworking Machines



Fabrication Alignment

- Large Construction Machinery Assembly
- Locomotive Assembly
- Truck Bed Assembly
- Wind Turbine Flange Parallelism



Aerospace

- Aircraft Interior Alignment (Storage Bins, Gallies, etc.)
- Body-to-Body Join Assembly
- Floor Beam Alignment
- Jig/Tooling Calibration and Leveling
- Seat-Track Alignment
- Wing-to-Body Joining Alignment



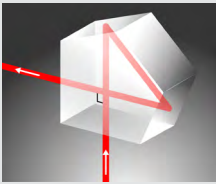
Ship Building

- Gun-Bearing Alignment
- LNG Tanker Hull Construction
- Section Alignment and Layout



How Lasers Work: Principles of Operation

LASER is an acronym for Light Amplification by Stimulated Emission of Radiation. Lasers radiate in a single wavelength, in one direction and in a straight line, and are detected by position sensing detectors (PSDs) to convert the center of energy of the laser spot into a calibrated digital reading for output to a hand-held readout or computer interface.



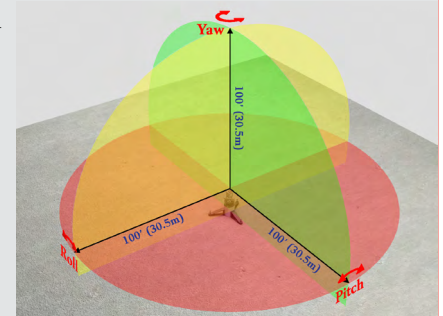
Continuously sweeping laser planes are produced by bending a laser beam precisely 90° using an optical pentaprism. Hamar Laser applies a patented correction process to the pentaprisms to produce ultra-flat, continuously sweeping laser planes.

To measure flatness, straightness or squareness, laser planes need to be aligned or “bucked in” to reference points, either on a surface or along a machine’s axis. Three reference points are necessary to make the laser plane parallel to a surface. Only two points are needed to measure the straightness of an axis or a machine way. The laser plane is bucked in to a surface or line of motion by adjusting the pitch, roll

or yaw of the laser base, tilting the laser plane until the target displays the same reading at each reference point.

The targets are then used to measure the deviation from the reference points up to 100 feet (30.5 meters) away from the laser. Data provided by the targets is automatically and instantly updated so the machine can be adjusted and the readout will show the movement. When it shows zero, it’s aligned!

Hamar’s multi-plane lasers all feature laser planes that are orthogonal to each other and thus can be used to measure the squareness between surfaces or machine axes. In most cases with one setup, the laser can measure the squareness between all the axes of the machine tool.



Hamar Laser vs. Competing Methods

Feature	Hamar Laser	European Geo. Laser Manufacturers	Interferometers (Linear Distance Laser)	Laser Trackers	Traditional Methods (Straight edge, levels, squares, etc.)
Automatically rotating laser planes?	Yes, 6 models	Yes for 2 mfrs. Others use “Point & Shoot technology”	No, laser line only	No laser line only	No
Can be used for alignment?	Yes	Yes	No, measurement only	No, measurement only	Yes, for some
Number of setups for machine tools	Usually 1-2	3-4	8+	1-3+	5+
Number of auto-rotating laser planes	3 with L-733/L-743	1	N/A – laser line only	N/A	N/A
Estimated Slower Alignment Time vs. L-733/L-743	n/a	40-50% slower	70-80% slower	40-50% slower	60-70% slower
Real-time target data?	Yes	Yes	No	No	Some, yes
Number of machine axes measurable with 1 setup	Up to 6	Up to 2	No	Up to 6 but at lower accuracy	Up to 2
Measure multiple machine axes simultaneously?	Yes, up to 6	Yes, up to 2	No	No	Yes, up to 2
Targets used simultaneously	Up to 15 in PC software	1	1	N/A	N/A
Wireless data delivery?	Yes	1 - yes; the rest, no	No	N/A	N/A
Number of setups for flatness of a surface	1	1	8 setups	1	8 setups
Measurement resolution	0.00025 mm	0.001 mm	0.0001 mm	0.0001 mm	Varies up to 0.001 mm
Measure parallelism of gantry mill rails?	Yes	Yes, but difficult setup and not to machine tool specs	No	Yes, but not to machine tool specs	Yes, if rails are <1 M apart but at low accuracy
Measure bed twist?	Yes	Yes, but very slowly and not to machine tool specs	No	Yes, but not to machine tool specs	Yes with difficulty and low accuracy
Accuracy of laser plane	0.0013 mm/ m ±0.0025 mm	0.02-0.03 mm/m ±0.05 mm	n/a	0.02 mm + 0.005 mm/m	n/a
Squareness measurement capability	Up to 0.005 mm/m	Approx. 0.02 mm/m laser to beam	Not published	0.02 mm + 0.005 mm/m	Approx. 0.005 mm/m
Range of laser	30.5 m in radius	20-60 m in radius	40 m	40 m in radius	1 m
Display equipment for target data	Wireless PDA or PC interface – up to 15 targets simultaneously	Wired/wireless proprietary display box. Must transfer data to PC for analysis	Laptop only. No handheld device	Desktop computer only-no handheld device	n/a
Machine tool alignment software?	Yes. 3D Plot runs on Windows PC	Yes but limited	Yes, for linear compensation	No	No
Measure roll angular error for each machine axis?	Yes, very easily	Possible, but difficult and time consuming	No	Possible, but difficult and time consuming	
Measure roll angular error of vertical axes?	Yes, very easily	Possible, but difficult and time consuming	No	No	
Cost factor index	1.0	0.75	1.8	3.0	0.1-0.25

Which Laser System Is Right For You?

Laser System Options

Different applications require different levels of accuracy which is why we developed two basic families of laser alignment systems:

L-730 Series

Ideal for precision-level work but where tolerances are not as critical

(e.g. simple fabrication alignment checks, etc.)

L-740 Series

Ultra-precise, used for more demanding “mission critical” tasks

(e.g. aligning complex machine tool geometry, etc.)

Each family of lasers is available in single, dual and triple-plane versions. Many of the features and accessories within the two families are the same. The key difference is the degree of accuracy. For example, with the L-730 Series, laser plane flatness is accurate to 2 arc seconds (.00012 in./ft. or 0.01 mm/M). With the L-740 Series it's a more stringent 0.5 arc-sec (.00003 in./ft. or 0.0025 mm/M).

As would be expected, the tighter the tolerances and greater the accuracy level, the higher the price. Accordingly, the L-730 Series is an economical choice perfectly suitable for a wide range of alignment applications that do not require the ultra precision attainable in our L-740 Series lasers.

L-730 & L-740 Series Features

- Real-time data output to measure, then fix misalignment while watching moves continuously update.
- Continuously sweeping laser planes with a range of 100 ft. (30.5 m) in radius.
- Built-in squareness measuring capability of up to .00006 in./ft. or 0.005 mm/m (multi-plane lasers only).
- Multiple targets displayed simultaneously for faster alignment and setup.
- Collect vertical and horizontal straightness data simultaneously.
- Work up to 70% faster than interferometers, theodolites, transits and other conventional methods.
- Easy to learn how to use, simple to operate.
- Able to collect complete geometry data on most machines in under 90 minutes.

	Precision Series			Ultra Precision Series			
	L-730	L-732	L-733	L-740	L-741	L-742	L-743
# of Laser Planes	1	2	3	1	1	2	3
Measurement Tasks							
Flatness/Leveling	•	•	•	•	•	•	•
Machine Bed Flatness	•	•	•	•	•	•	•
Squareness		•	•		•	•	•
Straightness	•	•	•	•	•	•	•
Parallelism	•	•	•	•	•	•	•
Rail Parallelism		•	•			•	•
Typical Applications							
Machine Tool Geometry					•	•	•
Roll Alignment		•	•			•	•
Injection Mold Machine		•	•			•	•
Aerospace Assembly	•	•	•	•	•	•	•
Surface Plates				•	•	•	•
Large-Part Alignment	•	•	•	•	•	•	•
Fabrication Alignment/Equip.	•	•	•				
Alignment Capabilities							
Laser Plane Flatness	.00012 in./ft. or 0.01 mm/m			.00003 in./ft. or 0.0025 mm/m			
Beam Plane Squareness	n/a	.00012 in./ft. or 0.01 mm/m		n/a	up to .00006 in./ft. or 0.005 mm/m		
Adjustment Parameters							
Coarse Adjustment Range	± 3.0°			± 3.0°			
Fine Adjustment Range	n/a			± .03°			
Course Adjustment Resolution	.010 in. (0.25 mm) in 100 ft. (30.5 m)			.010 in. (0.25 mm) in 100 ft. (30.5 m)			
Fine Adjustment Resolution	n/a			.001 in. (0.025 mm) in 100 ft. (30.5 m)			
Target/Readout Options							
Target:							
A-1519 & A-1520 Wireless	std.	std.	std.	std.	std.	std.	std.
Recommended Qty	1	2-3	3-5	1	1	2-3	3-5
Readout:							
Single-Axis Display	std.	std.	std.	std.	std.	std.	std.
Wireless	opt.	std.	std.	std.	std.	std.	std.
Price Range	\$	\$\$	\$\$\$	\$\$	\$\$	\$\$\$	\$\$\$\$

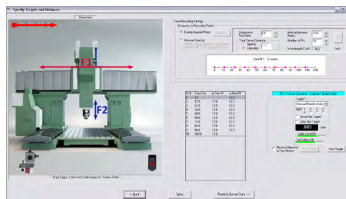
Powerful Data Analysis Software

Hamar's alignment software, combined with wireless interfaces, makes collecting and analyzing alignment data fast and easy. Software is Windows based, running on most laptops or desktops, and provides large, readable color graphics. Shown below is just a sampling of typical data screens.

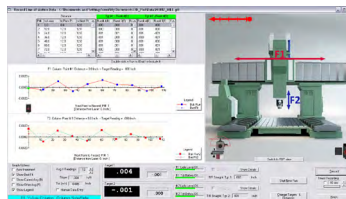
Machine Tool Geometry Software



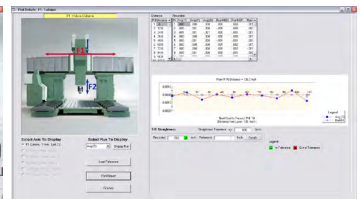
Machine Catalog
Choose from 6 typical machine configurations.



Axis Setup Screen
Set up each line of motion for number of points to be measured.

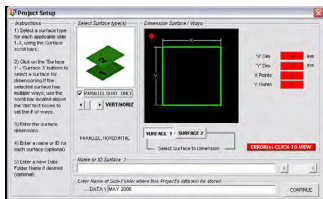


Data Taking Screen
Records up to 10 bi-directional runs for each axis with an auto-plotting graph.

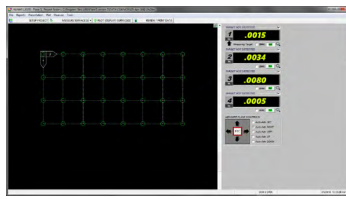


Graph Screen
Shows axis straightness TIRs, parallelism & squareness and straightness graphs for each axis.

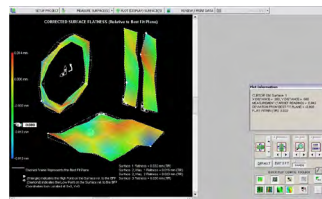
Plane5 Flatness Software



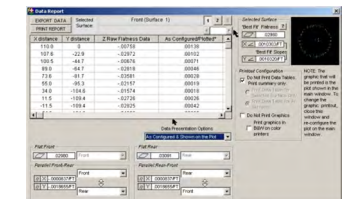
Projects Setup Screen
Configure shape and number of points for up to 9 surfaces.



Plane5 — Data Taking Screen
Data grid where the data points are recorded with up to 5 real-time target displays



Plane5 — Plot View Screen
3-D plot of surface flatness of 3 or more surfaces.



Plane5 — Report Screen
Complete report showing flatness, squareness and parallelism of all surfaces measured.

Accessories



A-1519/A-1520 XBee® Wireless Single-Axis Measuring Targets
For laser setup and data taking, we offer 2 target options:

- A-1519-2.4XBE has 13x33 mm PSD with .00002 in. resolution and +/- .00015 in. accuracy.
- A-1520-2.4XBE has 10x10 mm PSD with .00001 in. resolution and ± .00006 in. accuracy.



R-1357-2.4XBE Rugged PDA
Readout with Read16 Software and 2.4GHz Wireless communication displays up to 5 targets.



A-910-2.4XBE USB 2.4GHz Radio
Receiver for tablets and laptops.



L-106 Instrument Stand
Lightweight, variable-height stands for flexible setup.



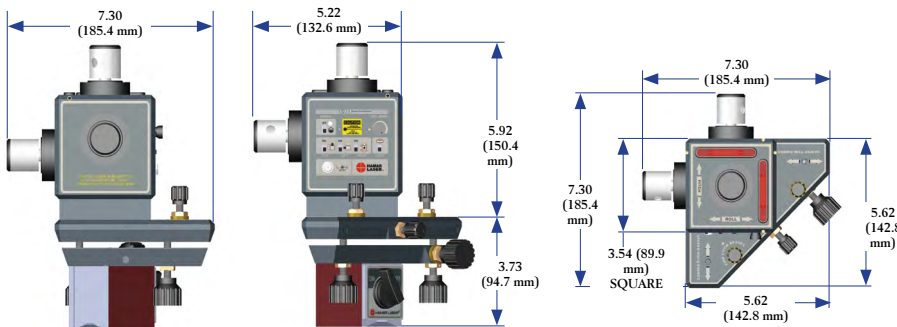
R-1308 Single-Axis Readout
The R-1308 connects to the targets via an AUX port. Designed to mount on the standard 5/8 in. diameter target extension posts.



A-1519CS 4-Port Charging Stations
4-target charging station designed to mount on the wall.

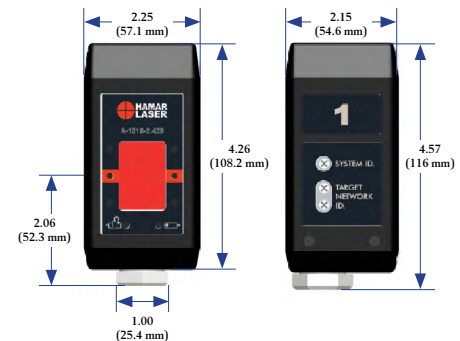
L-733/L-743 Triple Scan® Lasers

Laser Type	Class II visible diode, 635 nm wavelength (Class I in scanning mode); 0.160 in. (4.06 mm) beam diameter
Beam Power	<0.9 mW for each beam
Laser Plane Flatness	<p><u>L-733:</u></p> <ul style="list-style-type: none"> 180/360° Sweep: 2.0 arc sec (0.00012 in/ft or 0.01 mm/m), plus translational error of ±.0003 in. (0.008 mm) 90° Sweep: 1 arc sec (.00006 in/ft or 0.005 mm/m), plus translational error of ±.00015 in. (0.004 mm). <p><u>L-743:</u></p> <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 ±.00015 in. (0.0038 mm) 90° Sweep: 0.25 arc sec (.000015 in/ft or 0.0013 mm/m) plus translational error of ±.00008 in (0.0019 mm).
Plane Squareness	<p><u>L-733:</u></p> <ul style="list-style-type: none"> Top-to-Left and Top-to-Back plane: 2 arc secs (.00012 in/ft or 0.01 mm/m); Left-to-Back Plane: 3 arc secs (.00018 in/ft or 0.015 mm/m) <p><u>L-743:</u></p> <ul style="list-style-type: none"> Top-to-Left and Top-to-Back plane: 1 arc sec (.00006 in/ft or 0.005 mm/m); Left to Back plane: 3 arc secs (.00018 in/ft or 0.015 mm/m);
Operating Range	100 feet (30.5 m) in radius
Operating Modes	3 beams or 1, 2 or 3 continuously rotating laser planes in any combination, individually switched
Operating Temperature	35° F to 95° F (2° C to 35° C)
Power Supply	<ul style="list-style-type: none"> Lithium Polymer rechargeable battery pack with up to 16 hours battery life for all 3 planes 115-240V AC adapter
Course Adjustment Range	± 3 degrees (±.62 in/ft or 51.6 mm/m)
Fine Adjustment Range	± 0.3 degrees (±.062 in/ft or 0.51 mm/m). L-743 only.
Coarse Adjustment Resolution	.010 in. per 100 feet (0.25 mm in 30.5 meters)
Fine Adjustment Resolution	.001 in. per 100 feet (0.025 mm in 30.5 m). L-743 only.
Weight	Laser: 5.0 lbs. (2.3 kg) Base: 4.8 lbs. (2.2 kg)
Material	Laser: Aluminum and stainless steel Base: Aluminum



A-1519/A-1520 Wireless Targets

Resolution	A-1519-2.4XBE: .00002 in. (0.0005 mm) A-1520-2.4XBE: .00001 in. (0.00025 mm)
Linearized Accuracy	<p>A-1519-2.4XBE: ±.00015 in. (±0.0038 mm) over ±.55 in. (±14 mm) of PSD</p> <p>A-1520-2.4XBE: ±.00006 in. (±0.0015 mm) over ±.1 in. (2.5 mm) of PSD</p>
Detector Size/Type	<p>A-1519-2.4XBE: 2-Axis PSD 1.3x.51 in. (33x13 mm)</p> <p>A-1520-2.4XBE: 2-Axis PSD .39x.39 in. (10x10 mm)</p>
Operating Range	100 feet (30.5 m) from laser to target
Angle Acceptance Range	±10 degrees from pointing directly at laser
Auto On/Off Power	Targets automatically turn on when the laser beam sweeps across the target and turn off when the laser stops sweeping.
Battery Life	11.5 hours continuous duty
Operating Temperature	35° F to 140° F (2° C to 60° C)
Power Supply	7.5-12vDC, 500mA
Size	2.00 x 4.11x 1.75 in. (50.8x78.5x105.2 mm)
Weight	13.5 oz. (0.38 kg)
Wireless Range	133 feet (40 m)
Magnetic Base Size	2.00x 3.09x 4.14 in. (50.8 x78.5 x105.2 mm)
Magnetic Base Weight	2.78 lb. (1.26 kg)
Radio Frequency	2.4 GHz, DSSS (Direct Sequence Spread Spectrum)
Certification	Agency Certifications for the XBee® 802.15.4 Series 1 FCC (United States of America) Certification Contains FCC ID: OUR-XBEE IC (Industry Canada) Certification Contains Model XBEE 802.14.4 IC:4214A-XBEE Complies with ETSI (Europe), C-TICK (Australia) and Telec (Japan)



Hamar Laser Instruments, Inc.
5 Ye Olde Road Danbury, CT 06810
Fax: 203.730.4611 Int'l: +1.203.730.4600
sales@hamarlaser.com www.hamarlaser.com