

## Application Note 1

# Extruder Alignment

### System Recommendations

L-705 Laser Borescope for Extruders  
L-700 Twin Barrel Extruder  
Alignment System



The L-705 Laser Borescope is unparalleled for ease of use and fast extruder alignments. It is also highly accurate, which can help to triple the life of extruder barrels and screws. With barrels costing up to \$5,000 and screws even higher, the L-705 Laser Borescope alignment system can pay for itself very quickly. It can further save money by reducing the electrical consumption of the motor. We've had one customer use a forklift to pull out the screw from one extruder and after laser alignment, slide it back in by hand!

Any bore from 1.5 in. (38 mm) to 14 in. (356 mm) can easily be measured with our L-705 Laser Borescope. The heart of the system is our patented A-510 2-Axis Self-Centering Target that automatically finds the center of the bore with no moving parts. This allows nearly instantaneous bore measurements for alignment or straightness.



## The L-705 Laser Borescope Alignment System

In most cases, an extruder can be completely aligned in less than 1½ hours, including setup! With simplified fixturing and self-centering targets, the alignment system can be set up and misalignment data taken in as little as 10 minutes. And in most cases, bore straightness data can be taken and analyzed in 15 minutes or less using our Bore9 software. Compared with optics that can take 2 hours just to set up, the L-705 can bring your extruders back on line, producing parts in record time.

### Simple Fixturing for Fast Setup

The L-705 Laser has been designed with a .750 in. (19 mm) mounting stud and flat face, with magnets to hold it flush to fixturing. Since the laser beam is concentric to the OD to within .0005" (0.01 mm), a simple flat face and .750 in. (19 mm) hole on center is all that is needed to hold the laser (the extruder package includes a self-centering chuck fixture). In fact, the laser replaces the first reference target that a typical borescope would need.

### Long Range and High Accuracy

The L-705 Laser Borescope has a range of 100 feet (30 m), and under good environmental conditions, it is accurate to .003 in. (0.08 mm) over the whole range. By carefully following the NORMIN procedure described below, accuracies of .0002 in. (0.005 mm) in 10 feet (3 m) can also be achieved.



L-705 Laser Bore Alignment Laser



R-1307 2.4ZB Target Readout



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## Replaceable Adapter Legs for Each Barrel ID

Give us each extruder barrel ID and we make a set of legs customized to that ID. The legs insert into the A-510STA or A510LTA Bore Adapter Hubs to self-center the target in the barrel.

## Patented, Self-Centering Target Bore Adapters

Hamar Laser has developed the world's first self-centering target (A-510) and bore adapter (A-510STA/A-510LTA) that uses no moving parts. It takes just seconds to position the target in the barrel for an accurate measurement down to .0005 in. (0.01 mm). See *How the Alignment System Works* for more information.



A-510 2-Axis Bore Target

A-510LTA/STA Adapter Hubs with M-705CL Legs

## Barrel Wear Measurements

The A-510STA (or LTA) Bore Adapter can be placed on the A-510 Target in two ways. With the adapter placed on the target in Self-Centering Mode, it will center itself into the barrel. By inserting the A-510STA (or LTA) in Measuring Mode, the adapter will measure diameter changes in the bore. To measure barrel wear/diameter changes, a measurement is taken with an inside micrometer of a reference bore, usually at the free end of the barrel. The target and adapter in Measuring Mode are inserted into the reference bore. A measurement is taken with the target in the NORMAL position and in the INverted position. The two readings are averaged and the result is the starting measurement for the laser. At each subsequent measuring point, two sets of readings, NORMAL and INverted, are taken and averaged. Subtract the result from the reference measurement to produce the diameter change.

## L-705 System Features

- 10-15 minute setup time
- Built-in horizontal and vertical angular adjustments for quick referencing
- Target uses lightweight, customized bore adapters
- Self-centering target, accurate to .0002 in. (0.005 mm), vastly simplifies measurement process
- Easily accommodates bores as small as 1.2 in. (30 mm)
- Wireless transmission of alignment data to Bore9 software
- Hand-held LED readouts show alignment data in 2 axes
- Portable enough to fit into small carrying case. Entire system weighs less than 15 lbs. (6.8 kg)
- Large digital 2-axis display with wireless output to software
- .0002 in.(0.005 mm) accuracy in 10 ft. (3 m) or .004" (0.1 mm) accuracy in 100 ft. (30m)
- Battery operated

## Recommended System Configuration

L-705 Bore Laser  
A-510 2-Axis, Self-centering Target  
A-510STA Extruder Target Adapter Hub (2-5 in. or 50.8-127 mm bores)  
M-705CL Customized Set Legs for each ID for Bore Adapter Hub  
A-705 Chuck-style Gearbox Adapter  
R-1307BC 2-Axis Readout w/ 0.001 mm resolution  
A-510E Pole Extension  
T-231A 25' Target Extension Cable  
A-650 Shipping Case  
A-909B Pole Case

## Optional Accessories

S-1403 Bore9 Software  
A-910-2.4ZB Wireless Computer Interface  
A-705L Large Chuck-style Gearbox Adapter  
A-510LTA Large Bore Adapter Hub (5 to 16 in or 127 to 406 mm)  
R-1307C 2-Axis Cabled Readout

## More Information Online



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## The L-700 Alignment System for Twin-Barrel Extruders



Using components from several different systems, Hamar Laser has developed a package to align twin-barrel extruders as quickly and accurately as possible. Our L-700 Spindle Laser and A-510 2-Axis Self-Centering Bore Target create a powerful package to align twin-barrel extruders up to 70% faster than conventional or optical borescope methods. With an accuracy of  $\pm .0002$  in. (0.005 mm) and our optional alignment software, the L-700 is the perfect extruder alignment tool.

The alignment of the twin-barrel extruders has never been easy. Traditional methods, such as using indicators to line up the outside of each barrel section, are subject to large stack-up errors and make the assumption that the outside of the barrel is parallel to the center line of the bore. Given the long length of the barrel, a slight error of

.001 in. (0.025 mm) to .002 in. (0.05 mm) for each section can add up to .015 in. (0.38 mm) or more misalignment at the free end of the barrel.

The L-700 laser virtually eliminates indicator stack-up errors by projecting the axis of rotation of the gearbox drive shaft out to 100 feet (30 m). This provides a single reference from which each section of the barrel can then be aligned. A target accuracy of .0002 in. (0.005 mm) means very accurate alignment of each section of the extruder can be achieved.

Since the target can simultaneously show a live display of both horizontal and vertical readings, you can start aligning each section of the extruder without changing the setup or moving the laser. When the readout reads zero in the front and back (if desired) of the bore of an extruder section, it is aligned.



### L-700 System Features

- Simple fixturing to mount the laser onto the drive shaft projecting its axis of rotation to 100 (30' M)
- Vertical and horizontal controls for both angle and center for adjustment of laser to shaft's precise axis of rotation
- Self-centering target comes with pole for insertion into long bores
- .0002 in. (0.005 mm) target accuracy with live measurement data in two axes (vertical and horizontal center)
- Visible light beam
- Hand-held LED readouts show alignment data in 2 axes
- Laser runs for up to 8 hours on a standard, replaceable 9-volt battery
- Windows-based software with large, color graphics
- Compact and rugged (4" L x 2.9" H x 1.75" W or 101 mm x 73 mm x 44 mm)

#### Recommended System Configuration

L-700 Spindle Alignment Laser  
A-510 2-Axis, Self-centering Target  
A-510STA Extruder Target Adapter Hub (2-5 in. or 50.8-127 mm bores)  
R-1307-2.4ZB Target Readout  
A-650 Shipping Case

#### Optional Accessories

S-1380 Read8 Software  
A-910-2.4ZB Wireless Computer Interface  
R-342 Laptop Computer or R-1342 Shop-hardened Laptop Computer  
R-307V 2-Axis Large Number Readout  
A-510E Target Pole Extension  
T-231A 25 ft (7.6 m) Target Extension Cable