

POINT-AND-SHOOT Measuring Tools



Out-of-reach and complex measurements are no problem for laser measuring devices

by David Haines

As a remodeler doing several additions, basements, and kitchens a year, I always prepare accurate floor plan and elevation drawings as part of a written proposal. Before I can make any drawings, however, I have to measure up the house, which typically takes a half day or more. Besides taking a lot of time, the process can be a real challenge. You have to assume that your tape is touching a wall under the living room furniture and hope that the pile of junk in the basement won't fall on your head as you measure above it. And there are some things you simply can't measure, like a two-story foyer or gable end.

That's why I decided to buy a laser measuring device, which allows you to take measurements simply by aiming a laser and pushing a button. This makes measuring a room efficient and painless and allows you to measure spots from the floor that previously required an extension ladder. In addition, lasers can measure surface area, calculate square footage, and perform useful geometric functions like taking three-point measurements.

My first exposure to laser measuring tools was at a trade show in Atlantic City two years ago. They looked neat, but I lost interest when I heard the price. More recently, I read some postings on a CAD users group that described how great the tools are for architects and designers, and I started thinking how such a tool could make my life easier. I tried one and was impressed, but with a minimum investment of \$500, I wanted to make an educated choice, so I set about testing them.

I tested five of the most popular laser measuring devices: the PLS1 from Pacific Laser Systems; the Trimble Spectra HD150; the Stabila LE100; and two units from Hilti, models PD22 and PD28. There's another popular laser measuring tool from Leica Geosystems, the Disto Classic 5. I didn't test it because the PLS and Stabila lasers are virtually the same tool. Leica makes the tools and licenses them to those two companies.

Basic Operation

A laser measuring device is a walkie-talkie-sized box with a laser generator at one end. You point it at the object you want to measure, press a button, and it shoots a red laser beam at the object. The visible beam is used to aim the device; when you press the button again, the device takes the measurement and displays it on a small LCD screen.

How they work. The red laser beam uses several wavelengths of light traveling at different frequencies. The tool measures the phase difference between the wavelengths and uses that information to calculate the distance. It's truly amazing how fast all that happens — the readings are almost instantaneous.

The devices are all pretty much alike in size and shape, and they all run on two AA batteries. I didn't keep track, but manufacturers say the tools can make thousands of measurements

before the batteries are spent.

Durability. I'm always nervous about the durability of measuring instruments, especially expensive electronic ones. I knew I wouldn't have the devices long enough to test their long-term accuracy, so I asked the product manager at Hilti about recalibrating the device and how accurate they are long term. She told me that the units are drop tested, that they're very rugged, and that most users won't ever need their units recalibrated. If calibration is required, adjustments can be made at a factory service center. She also said that a severe impact is more likely to render the unit inoperable than to cause inaccurate readings.

Simple measuring. To get a feel for the tools and to test their most basic functions, I measured the interior of my house. Using the tool is as simple as holding it against one wall, aiming the laser dot at the opposite wall (or object), and hitting the measure button. I had no problem seeing the laser dot when working inside. Users can select either decimal or fractional readings, and accuracy is to the nearest 1/8 or 1/10 inch. All the units except the Trimble Spectra have small spirit levels to help level the unit. I didn't find the levels necessary, but I can see the advantage for longer distances. After measuring the whole house, I checked the measurements with a tape. All of the units performed accurately.

One feature that I found especially handy for inside work is the hook or stop used for holding the unit on an outside corner or window casing. Hilti's version (on both models) is a foldout plastic tab. Trimble's Spectra has a hook end similar to that on a tape measure (see Figure 1). The PLS and Stabila are the only tools without such a feature; you have to line up the end of their tools with your finger or eyeball it.

You can locate window and door



Figure 1. Measuring from an outside corner or locating a window is easier with a hook for outside measurements. The Trimble Spectra HD150's computer automatically compensates for length when you attach the hook (left). The Hilti PD22 and PD28 use a foldout hook for outside corners (right).

openings (or anything else) by first measuring the length of the wall where the window is located. You then move the unit to the opening and use the subtract button on both sides of the opening to determine the distance to the opening and the opening width.

Laser Estimating

Taking “tapeless” measurements in a room filled with furniture is great, but the devices can do much more. Plane geometry functions like calculating the square footage and volume of basic shapes are programmed into the units. The Hilti PD28 offers more functions than the others, but all of the tools I tested perform the basic equations that builders and remodelers use regularly.

Square footage and volume. Measuring square footage for paint, flooring, or drywall is straightforward. Measure a wall, hit the multiply button, measure an adjacent wall, hit the “equals” button, and the square footage is calculated for you. Volume is calculated by multiplying the room height by the square footage. You can store the room measurements for totaling later.

Outdoors. Outdoor estimating tasks like measuring for siding materials are a natural match for these devices. Based on experience with my rotary laser, I wanted to know how easy it would be to locate the dot outside. There was a big difference compared with inside measuring. Once you get more than 30 feet away, that dot is hard to see in bright sunlight, making it more difficult to know exactly what you’re measuring. This is where some of the accessories become valuable.

Telescopic scopes can make the red dot easier to see over longer distances or when you’re in bright sunlight. All of the models except the PLS use an external scope. The PLS has a built-in scope that’s designed to show you where the red laser dot is aiming. It’s a good idea in principle, but I found it



Figure 2. The side-mounted internal scope on the PLS unit is more awkward than an external scope because you have to look into the side of the unit and feel around for the measure button. On the plus side, it’s always handy and it’s not an additional expense like the other scopes are.

awkward to use. The viewer is on the side of the unit, so you have to hold the device sideways and feel around for the measuring button (Figure 2). PLS offers an optional scope that looks easier to use (\$235 for scope and the required mount), but it wasn’t supplied for testing.

The Stabila, while nearly the same tool as the PLS, lacks a built-in scope, so you’ll need to get the optional 4x external scope for \$250 if you’re planning to use it over longer distances. It mounts easily with strong magnets that hold it in place, and I found that it works well. A red filter makes the red dot more visible; it works like the red glasses included with a laser level.

The Hilti PD28 kit includes a nice scope with adjustable crosshairs that makes a huge difference in seeing faraway targets. Using the reflector target, I could locate the laser dot almost 500 feet away and still see what I was aiming at. The Hilti scope also has a red filter that slides over the lens. The same scope is available as an option for the PD22 for \$189.

When I was testing, a scope wasn’t yet available for the Trimble Spectra, but the manufacturer is expected to have one available by the end of April. The price is still up in the air.

Using the Laser Like a Tape

Although these tools are useful for estimating, they also have advantages in applications where you’d normally use a tape measure — for example, taking baseboard measurements. The tool makes it possible to measure crown by yourself — no more hooking your tape on a nail and repositioning a stepladder eight times. Although you’ll still need your tape for measuring the stock, the laser will save you time and make taking measurements by yourself a lot easier. I found all of the tools provided measurements accurate enough for coped joints.

Complex Measurements

All of the devices can give an immediate reading while moving away from or toward a target. This function is called tracking. For instance, you can place the device on the floor at the bottom of a partition and use it for squaring the partition or aligning it parallel to another wall. The Hilti PD28 goes one step further. If you program a target measurement and start moving forward or back, the device will begin to beep as you approach the desired dimension, increasing in frequency until a constant tone sounds when the

TOOL TEST



● Hilti PD22

Keypad: Menu navigation is less intuitive than on other devices tested.

Long-range capability: Designed for 300 feet maximum.

Memory: Holds last 3 measurements and 1 constant.

Tripod mount: Two brass inserts on back and side of unit.

Other features: Has flip-out stop for tight spots, diagonal, and end measuring. Back-light display. Includes cloth carrying case with shoulder harness and belt loop.

Available option: Attachable scope.

Comments: Measures long distances well with reflective target.



● Hilti PD28

Keypad: Numeric keypad allows input of dimensions for setting preset step-backs, such as marking a distance 2 feet back, then repeating in 4-foot increments; calculator for all functions (add, subtract, multiply, divide, square root).

Long-range capability: Designed for 300 feet maximum.

Memory: Holds last 9 measurements and 1 constant.

Tripod mount: Two brass inserts on side and back of unit.

Other features: Allows measurement of circles from radius or diameter, odd angles, and spaces with an incline such as a lean-to roof. Can transfer data (1,000 entries maximum) via serial cable into a Microsoft Excel spreadsheet on a computer.

Comments: Complete kit includes attachable scope, tripod swivel mount, reflective target, cloth carrying case with belt loop, and plastic carrying case for everything.



● Pacific Laser Systems PLS1

Keypad: Easy to navigate, similar to Stabila LE100.

Long-range capability: Best of devices tested, with a target.

Memory: Holds last 15 measurements and 10 constants.

Tripod mount: Plastic.

Other features: Measurement reference can be set from front, rear, or tripod thread of unit. Red end piece swivels to create stand for ceiling shots. Has illuminated back light. Includes wrist strap and cloth carrying case with belt loop.

Available options: 4x scope and scope mounting plate.

Comments: Side-mounted scope is awkward to use but is included with the unit.



● Stabila LE100

Keypad: Easy to navigate, similar to PLS.

Long-range capability: Very good, but longer measurements are easier with the optional scope.

Memory: Holds last 15 stored and 10 constants.

Tripod mount: Plastic.

Other features: Measurement reference can be set from front, rear, or tripod thread of unit. End piece swivels to create stand for ceiling shots. Has illuminated back light. Includes wrist strap, soft-sided case with belt loop, and plastic case large enough for the target and optional scope.

Available options: 4x scope, target holder, tripod.

Comments: The Stabila and PLS are almost identical, but the Stabila doesn't have an internal scope.



● **Trimble Spectra HD150**

Keypad: Very simple to use, easy to understand.

Long-range capability: Good without reflective target, though scope is recommended when measuring in sunlight.

Memory: Holds last 20 measurements, and they can be recalled to add or subtract.

Tripod mount: Yes, with brass threaded insert.

Other features: Has flip-out alignment guide for end and diagonal measurements. Automatically compensates for which end is attached to base of unit. Unit can be mounted on camera tripod for stabilizing. Includes cloth carrying case with belt clip and shoulder harness.

Comments: Great unit if you don't need three-point measuring capability.

Laser Measuring Comparison

	Hilti PD22	Hilti PD28	Pacific Laser Systems PLS1	Stabila LE100	Trimble Spectra HD150
Accuracy	.10 inch	.10 inch	+/- 1/8 inch	+/- 1/8 inch	+/- 1/8 inch
Maximum range*	492 feet	492 feet	244-720 feet	163-716 feet	256-508 feet
Smallest display unit	1/32 inch	1/32 inch	1 mm, 1/16 inch	1mm, 1/16 inch	1 mm, 1/16 inch, .005 foot
Numeric keypad	no	yes	no	no	no
Built-in scope	optional attachable	optional attachable, inc. w/ kit	yes	no	optional attachable by 4/04
Built-in level	yes	yes	yes	yes	clips on
Positioning clip or probe	yes	yes	no	no	yes
Tracking function	yes	yes	yes	yes	yes
Downloads data from PC	no	yes	no	no	no
Pythagorean functions:					
Right angle	yes	yes	yes	yes	yes
3-point measurement	no	yes	yes	yes	no
Angled area & slope	no	yes	no	no	no
Area of circle	no	yes	no	no	no
Price	\$450	\$850	\$450	\$360	\$399

*Varies with light and use of reflective target

target measurement is reached.

Foundation layout. The Hilti PD28 proved its merit when I was laying out a foundation for a new room addition. I started by determining where the addition would go on the existing foundation wall, then placed batter boards beyond the planned excavation. After setting a level reference line on

the batter board and existing foundation wall with a rotary laser, I used the Hilti PD28 with the scope to mark the batter boards for the foundation walls (Figure 3, next page). It was a lot easier than trying to hold a tape by myself and read diagonals.

Three-point measurements. Three-point measurements are used for meas-

uring things like the partial height of a wall or when an object blocks a direct line-of-sight measurement (Figure 4, next page). The PLS, Stabila, and Hilti PD28 are programmed to make three-point measurements. While the need doesn't come up everyday, it's an ideal application for a laser when it does.

Though good enough for estimating,

three-point measurements aren't perfect, mainly because of user error. The problem is that all three distances must be measured from exactly the same spot — even a minute change in position can throw off the results. The tracking function comes in handy here.

When making three-point measurements, a camera tripod or the Hilti mount really improves accuracy. The tripod allows you to turn or angle the

unit while it stays in the same relative position. The Hilti mount fits on any standard transit tripod, which works better than using a camera tripod because adjustment screws allow you to fine-tune the aim (Figure 5, next page).

A Final Test

My final test was meant to determine the tools' maximum range and their accuracy over longer distances. I

taped the reflective target that's included with the Hilti PD28 onto the side of my house and kept stepping back until I couldn't get a reading. There's a big difference in the visibility of the laser beam in bright sunlight and at dusk, so I ran my tests in peak sunlight first and then again at sunset. I took one set of measurements holding the laser in my hand and another using a tripod.

The shortest maximum distance was recorded with the Stabila LE100. I managed about 163 feet in bright sun while steadying the unit by hand. The nearly identical PLS went a little over 243 feet in sunlight on a different day. I think the disparity resulted from different lighting conditions, and it indicates that the units will perform differently based on how bright it is outside. Interestingly, the PLS and Stabila also recorded the longest distances (720 and 716 feet, respectively) when mounted on a tripod at dusk.

The next shortest distance in sunlight was with the Trimble unit. I got 256 feet holding the laser and 272 with the tripod. Once again, I had more range at dusk; I was able to get 508 feet against my home's vinyl siding without a reflector.

The Hilti units first measured the same distance at 492 feet, which was the longest range in sunlight. According to Hilti, the unit is only designed for 300 feet, so I guess anything more is a bonus. The scope dramatically improved my ability to find and focus on a target. I didn't check the Hilti unit at dusk since it had already exceeded its maximum range in bright sunlight.

After each test, I marked my distances with a surveying flag and recorded the measurement. Later, a friend of mine, Tom Hendricks of Eastern States Engineering, came out to verify my measurements using his professional surveying equipment. His measurements were within 1 to

Figure 3. Laser measuring devices are great for layout and squaring because you don't need two sets of hands, and neither wind nor a sagging tape will affect the measurements. The author found that having a good scope helped with these tasks because it made aiming the device at a pencil mark much easier.



Figure 4. Three-point measuring is useful when an obstacle prevents a direct line of sight. Tracking functions are handy for finding the triangle's height. The Hilti PD28, the PLS, and the Stabila all have a three-point measurement function.

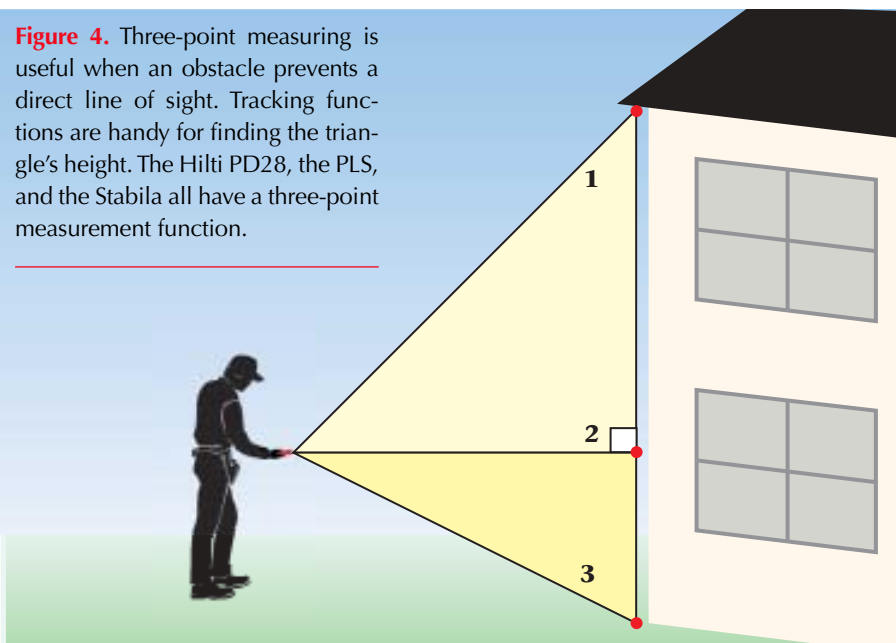





Figure 5. Hilti's tripod has a standard transit mount and fine adjustment knobs for accurate measurements over long distances. The mount is especially useful for three-point measurements.

2 inches of mine. Tom's take is that lasers are very accurate and that the operator causes 98% of errors. This made me realize that to make my comparisons more accurate I should have used a 6-foot level to place the surveying flags in the ground instead of eyeballing their placement. The extra step might have reduced or eliminated the discrepancy between his measurements and mine.

My Pick

Although all the lasers take interior measurements equally well, the Hilti PD28 is the best performer overall. It's the only one with a built-in keypad — which doubles as a calculator — for

inputting measurements. It also features more programmed tasks, better accessories, and even data storage that can be downloaded into Microsoft Excel with a serial cable. At almost \$1,000, it's no small investment, but it's the one I bought. Any of the devices would make estimating and solo measuring faster and easier.

Regardless of which product you choose, spend the extra money to get an external scope and a tripod, especially if you plan to use the laser for precise outdoor measurements. 

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Manufacturers of Tested Tools

Hilti Corp.

Tulsa, Okla.
800/879-8000
www.us.hilti.com

Leica Geosystems

Norcross, Ga.
800/367-9453
www.disto.com

Pacific Laser Systems

Sausalito, Calif.
800/601-4500
www.plslaser.com

Stabila

Chicago, Ill.
800/869-7460
www.stabila.com

Trimble Navigation

Sunnyvale, Calif.
800/538-7800
www.trimble.com



Late Arrival

Leica, which makes the PLS and Stabila laser measuring devices included in the test, introduced a new tool at this year's World of Concrete trade show. Unfortunately, it was introduced too late for testing, but the new Disto Plus has some interesting features. Most notably, it has Bluetooth technology that allows the wireless transfer of measurements to other electronic devices, reducing the likelihood of data-entry errors. Included software allows users to make plan or elevation drawings on their compatible laptop or pocket PC and then import dimensions directly from the measuring device. The Disto Plus does three-point measurements and has an integral 2x scope (like the PLS). The maker claims it's accurate to 1/16 inch out to 650 feet. The price is \$699.