



## **TOOL TEST**

# Laser Distance Meters

These compact, precise measures complement traditional tapes

by Bruce Greenlaw

**L**eica Geosystems introduced the first hand-held laser distance meter in 1993. Although there are now at least 17 brands and 42 models on the market, most of us still exclusively use our familiar steel tape measures. But recent articles in *JLC* and forum postings at [jlconline.com](http://jlconline.com) indicate that the mindset among pros is gradually changing as they gain trust in laser-measuring technology and realize the benefits.

Laser distance meters, or LDMs, work by bouncing a visible laser beam off a stationary surface. They receive the reflection through a lens, calculate the phase shift or time of flight, and translate the results into a digital measurement. The simple point-and-click operation normally delivers a measurement in less than a second and allows you to measure by yourself with minimal walking and climbing.

LDMs can quickly measure existing architecture for preparing floor plans and

elevations, and some are ideal for estimating and takeoffs. Finish carpenters have discovered that well-equipped models are faster and more accurate than tapes when running baseboard, crown moldings, chair rail, and long top casings, or when squaring up jambs for wide or tall doors. Some models can find the angles for stair skirts and handrails.

The meters have limited value for framing, but they do make it easier to frame

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# Laser Distance Meter Specs

							
	<b>Bosch GLM 50</b> boschtools.com	<b>Bosch GLM 80</b> boschtools.com	<b>Hilti PD 5</b> us.hilti.com	<b>Leica Disto D2</b> leica-geosystems.us	<b>Leica Disto E7300</b> leica-geosystems.us	<b>Leica Disto E7400x</b> leica-geosystems.us	
<b>Origin</b>	Malaysia	Malaysia	Germany	Hungary	Hungary	Hungary	
<b>Range</b>	2 in. to 164 ft.	2 in. to 262 ft.	14 in. to 230 ft.	2 in. to 197 ft.	2 in. to 328 ft.	2 in. to 328 ft.	
<b>Accuracy</b> (± inches)	1/16	1/16	1/16	1/16	1/25	1/25	
<b>Smallest fraction</b> (in.)	1/32	1/32	1/16	1/16	1/32	1/32	
<b>Continuous beam</b>		●			●	●	
<b>Area</b>	●	●		●	●	●	
<b>Volume</b>	●	●		●	●	●	
<b>Addition/subtraction</b>	●	●		●	●	●	
<b>Tracking</b>	●	●	●	●	●	●	
<b>Minimum/maximum</b>		●		●	●	●	
<b>Stake-out</b>				●	●	●	
<b>Indirect measuring</b>	●	●		●	●	●	
<b>Inclinometer</b>		●				●	
<b>Memory</b> (# of results)		20*		10	10	20	
<b>Dust/water protection</b>	IP54	IP54	IP55	IP54	IP54	IP65	
<b>Tailpiece</b>		●		●	●	●	
<b>Timer</b>		●		●		●	
<b>Tripod socket</b>	●	●				●	
<b>Web price</b>	\$115	\$175	\$200	\$180	\$200	\$280	

\* Also stores one constant

\*\* Operates only with indirect measurement, not tracking

## LDM Terminology

### Continuous beam

Reduces clicks needed to record a series of dimensions (for more information, see page 48)

### Area, Volume, Add/Subtract

Automatically calculate area or volume; add or subtract results (p. 45)

### Tracking

A continuous reading while moving toward or away from a target (facing page)

### Minimum/maximum

Ability while tracking to capture the minimum and maximum distance measured (facing page)

### Stake-out

Mark recurring spacing along a line (facing page)

### Indirect measuring

Uses geometry to measure vertical or horizontal dimensions from a distance (p. 44)

### Inclinometer

Used to measure slopes and angles; improves indirect measuring (p. 44)

### Memory








Storage of successive measurements or calculations in order (p. 46)

### Tailpiece

Enables accurate inside-corner measurements to check diagonals (p. 47)

### Timer

Delays recording of dimension (p. 48)

							
	<b>Milwaukee 2280-20</b> milwaukeeetool.com	<b>Spectra Precision QM55</b> spectra-productivity.com	<b>Spectra Precision QM75</b> spectra-productivity.com	<b>Spectra Precision QM95</b> spectra-productivity.com	<b>Stabila LD 400</b> stabila.com	<b>Stanley TLM 165</b> stanleytools.com	<b>Stanley TLM 330</b> stanleytools.com
	Hungary	China	Germany	Germany	Hungary	Hungary	Hungary
	2 in. to 197 ft.	15 in. to 164 ft.	13 in. to 230 ft.	2 in. to 656 ft.	2 in. to 197 ft.	4 in. to 164 ft.	2 in. to 328 ft.
	1/16	1/16	1/16	1/25	1/16	1/16	1/25
	1/16	1/16	1/16	1/32	1/16	1/16	1/32
							●
	●	●		●	●	●	●
	●	●			●	●	●
	●	●		●	●	●	●
	●	●	●	●	●	●	●
	●	●			●	●**	●
	●	●			●		●
	●	●			●	●	●
							●
	10	50			10	5	20
	IP54	IP54	IP55	IP54	IP54	IP54	IP54
	●	●		●	●	●	●
	●				●		●
		●					●
	\$180	\$145	\$150	\$230	\$250	\$125	\$265

## LDM Features

**Tracking, min/max, stake-out.** All of these tools can take a continuous reading while moving toward or away from a target, which is called “tracking.” Eight tools can also freeze the minimum and maximum distance measured, which makes the function far more useful. For instance, you can check a room or door jamb for square by sticking the laser’s tailpiece into a corner, sweeping the beam across the opposite corner, reading the maximum length, then repeating for the other diagonal. Tracking the minimum read-

ing between two surfaces is also useful — for fitting built-ins between two out-of-plumb walls, for example. (For some reason, the new Stanley TLM 165 min/max mode only works with indirect measuring, not tracking.) Seven models offer a “stake-out” mode, used for laying out a series of equal intervals by setting the spacing dimension and moving the laser away from a fixed target. A change in tone pitch or frequency indicates when each interval has been reached. It’s reasonably accurate but slower than using a tape.



## Laser Distance Meters

### LDM Features



**Inclinometers.** The Bosch GLM 80, Leica Disto E7400x, and Stanley TLM 330 have built-in tilt sensors, or inclinometers, that not only measure slopes and angles, but raise indirect vertical and horizontal measuring to the next level. Say you need to measure the horizontal distance to a wall, but there's a couch in the way. You

can angle the meter up until the laser dot clears the couch and hits the wall, click once, and get the precise horizontal measurement (assuming the wall is plumb). Bosch's optional R60 attachment (shown) instantly converts the GLM 80 into a 24-inch electronic spirit level to make the inclinometer even more versatile.

**Indirect measurements.** When poor access, obstacles, or the lack of a dependable target prevent direct measurements, units with inclinometers can use internal trig functions to calculate various dimensions indirectly from a distance. Several models can use Pythagorean geometry instead to indirectly calculate certain measurements like wall heights, requir-

ing two or three shots taken from a distance. But you only get precise results with Pythagoras functions if you always pivot the meter off a fixed point and ensure one 90-degree angle. Leica, Milwaukee, Stabila, and Stanley allow you to use the min/max function when taking these measurements, which helps. But in any case, careful free-hand shots are fine for estimating.



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walls in place, fit tall posts, and measure between rim boards to size long joists. You can also use them to plan staging, determine which of your ladders will reach a roof, measure between deck posts for infilling top and bottom rails, and so on. Tapes are still required, however, for taking very short measurements, transferring dimensions to your stock at the cutting station, and measuring to a layout mark, an edge, or an outside corner (unless you put a target there).

You can buy a basic LDM for around \$100 (or less) that's accurate to within  $\frac{3}{32}$  inch. At the other extreme, \$350 to \$800 buys advanced features, such as built-in scopes or cameras that make it easier to aim at distant targets or in bright light, and integrated Bluetooth for transmitting data to Excel, AutoCAD, and other programs.

For this article, I evaluated 13 state-of-the-art models that cost about \$115 to \$280 and are accurate to within  $\frac{1}{16}$  inch or better. In my opinion, that's the sweet spot for most residential and light-commercial work. I used the tools for several weeks, then compared their features, performance, and ease of use.

### Range

The spec chart on the previous two pages lists the range and accuracy for each model. To measure at the *maximum* distance, though, you need to aim the laser at a target plate like the ones sold by Bosch, Hilti, and Leica. These plates increase the measuring range and effectively magnify and brighten the dot for easier viewing. Aiming at typical building materials can reduce the range by 20% or more. Bright light, high temperatures, and unpredictable surfaces such as shiny metal can all cause measuring problems, but you'll normally receive an error alert rather than an incorrect measurement when conditions are unfavorable.

Outdoors, the biggest issue is being able



to spot the laser dot from a reasonable distance or in bright light. Using a target plate is one solution, but you have to position it and account for its thickness, which is extra work.

Laser-enhancement eyeglasses, on the other hand, make it easier to spot the dot without adding any extra steps. Wearing Hilti's optional PUA 60 glasses, I could (with plenty of concentration) find the dot from more than 150 feet away when measuring to shaded yellow metal siding, virtually doubling my viewing range. When I tried to measure to a sunny section, I could barely see the dot at 10 feet without the glasses, but with them I could pick it out of the glare at 50 feet. Prices for laser-enhancement glasses start at about \$10.

Five of the meters I tested can mount to a tripod, which also makes it much easier to hit a distant target.

I found that most of these LDMs can measure lengths down to about 2 to 4 inches, but three of them needed more than a foot of separation to record a measurement.

## Accuracy

According to Stanley Tools, short FatMax tapes are accurate to  $\frac{1}{16}$  inch, not counting sag or temperature fluctuation. Long tapes are typically less reliable, declining to  $\frac{1}{2}$ -inch accuracy at just 33 feet. By comparison, nine of the LDMs are supposed to be accurate to  $\frac{1}{16}$  inch, and four to  $\frac{1}{25}$  inch.

Some manuals recommend that you periodically verify the accuracy by setting up a fixed target at a known distance from the meter (Hilti recommends about 3 to 15 feet) and measuring the distance 10 times to check for deviation. I clamped a 2-by-stop to one end of a kitchen island and used my FatMax tape to position a hardwood block 11 feet away to serve as a target, then took 30 shots with each model. I repeated the test another day with a white target plate. All 13 models passed the tests, straying within limits only occasionally.

## Units of Measurement

All 13 models can measure in fractional inches, feet and inches, decimal feet, and metric units. The Leica Disto E7300 and E7400x and the two Stanley models also display decimal inches, while the Bosch GLM 80, Hilti PD 5, and Spectra Precision QM75 and QM95 can show decimal inches and yards. For finish carpentry, I appreciate the models that display fractions down to  $\frac{1}{32}$  inch. Six of the models do that, while the rest go down to  $\frac{1}{16}$  inch.

## Tester's Comments

### Bosch GLM 50

At the moment, this model has the lowest price in the group. It's also the most intuitive, with no baffling key combinations. But although it shows fractions down to  $\frac{1}{32}$  inch, calculates areas and volumes, can add and subtract, and can measure indirectly, there's no timer, memory, or tailpiece, and tracking doesn't register minimum and maximum lengths. The display's backlight is controlled by a light sensor with no manual override. This sometimes left me in the dark — for instance, it dimmed and then turned off while tracking. Also, there's so much ghosting when viewing the display from below that it can be hard to read. The laser clicks when it records a measurement, but it doesn't beep to confirm operations like the other models do, which might be a problem on a noisy site.

### Bosch GLM 80

The rechargeable GLM 80 is the only model under \$200 that has an inclinometer. It isn't the most rugged model, but it displays fractions down to  $\frac{1}{32}$  inch, can handle direct and indirect measuring with ease, and has all the other perks I would want, from a timer to an erasable memory. For \$250, you can buy a kit that includes Bosch's R60 attachment, which quickly expands the meter into a 24-inch digital box-beam spirit level. I found that this combo isn't as convenient as the advanced 24-inch Stabila



**Target Accessories.** Laser-enhancement glasses make it much easier to see the laser dot on distant targets or in bright light. Target plates (above right) maximize the measuring range and brighten the dot. The two items shown above are Hilti accessories. In a pinch, a Post-it note (below) makes a quick and easy target at edges and outside corners.



**Area, volume, +, -.** Eleven of the models can compute square footage, and can also add and subtract dimensions and results. To find the area of a wall, for instance, you measure length and height, then read the result on the display. You can also measure a series of walls this way and add the results as you go. Better yet, the Bosch GLM 80 can store a common ceiling height, then apply it to any number of wall lengths to calculate the total area. The Stanley TLM 330 and the Leica Disto E7300 and E7400x essentially do the same thing, but you have to press the "+" button between the length measurements. Ten of the models can also measure volumes, which can be especially useful for hvac calculations.

## Laser Distance Meters

### LDM Features



**Memory.** Lasers with memory store measurements even while the power is off. Nine can store the last five to 50 dimensions or results in order. The Bosch GLM 80, Stanley TLM 330, and Leica Disto E7300 and E7400x let you delete the memory so you can start a new list. Except for the Leica E7300, these also store complete calculations, as does the Spectra Precision QM55.



**Power.** Twelve of the meters run on two AA or AAA alkaline batteries that allegedly deliver up to 5,000 to 10,000 measurements. But the Bosch GLM 80 uses a convenient rechargeable 3.7-volt lithium-ion battery that's supposed to deliver up to 25,000 measurements per charge and takes about three hours to recharge. The compact charger plugs the meter into an AC outlet so you don't have to remove the battery. All of the batteries drain faster if the backlights and beeps are turned on or you leave the power on longer than necessary.

electronic level I use (which has more helpful audio signals, for instance), but it was just as accurate after I quickly calibrated the inclinometer. The microsite at [boschtools.com](http://boschtools.com) does a great job of demonstrating all of the GLM 80 features.

#### Hilti PD 5

This two-button laser is designed for installation work, period. It measures distances, has a tracking mode, and is long and slender so you can slip it into a narrow toolbelt pocket and grab it easily. You can also hose it off. But you have to press and hold the on/off button for two seconds to enter the menu and then manipulate both buttons to change the units of measure or control the beep, so it isn't completely intuitive. Also, the display is upside-down when shooting from left to right. Several models have more features for less money, but Hilti has the only lifetime warranty.

#### Leica Disto D2

The D2 offers all the critical measuring options you need for estimating and installing, plus deluxe amenities like a timer, a memory, and a tailpiece. It also fits into small pockets and feels just right in my hand. When it was introduced in 2008, it displayed fractions down to  $\frac{1}{32}$  inch; now it displays 16ths instead.

#### Leica Disto E7300

A step up from the D2, the E7300 is one of four models tested that are accurate to  $\frac{1}{25}$  inch and display fractions down to  $\frac{1}{32}$ . It also has a longer range than the D2, can delete the memory so you can start a new list, allows you to shoot a common ceiling height just once when calculating the total area of a series of walls, and more. It doesn't have a timer, and you have to remember some two-key combinations to set the units, lock the keypad, and control the backlight and beep. With minor refinements, this model would be one of my favorites.

#### Leica Disto E7400x

A video at [leica-geosystems.us](http://leica-geosystems.us) shows this new model being tossed around a job site, dropped from a stepladder into a gravelly puddle, and dunked into a water bucket to clean it off. Besides having a class-leading IP65 rating for dust and water protection and passing Leica's 2-meter drop test, the E7400x is tied for first in accuracy and has a full complement of deluxe features, including an inclinometer. There's a learning curve, but the graphic manual is a big help.

#### Milwaukee 2280-20

This tool has the same engine, display, and endpiece as the Leica Disto D2. But Milwaukee added an extra key and rearranged the keypad so it's slightly more convenient. It also added rubber bumpers and offers a five-year warranty versus Leica's three-year one. One problem I found was that, when measuring flat surfaces with the 2280-20 on its back, I often had to raise the front of the tool to prevent the beam from "scraping" the surface and throwing off the measurement.

#### Spectra Precision QM55

The new QM55 offers the basic options you need for estimating or installing at a comparatively low price. It's the first LDM I've seen that has a signal-strength indicator, which displays up to four bars to help you aim at an appropriate target. It also has the biggest memory, storing up to 50 measurements and calculations. According to Spectra, it's drop-tested from 1.5 meters. On the downside, the tool is heavier than most, requires more button clicks, doesn't have a timer, and makes you insert a separate tailpiece for measuring from inside corners. You also can't turn off the beep, which may only be an issue for work in an occupied office or other quiet zone.

#### Spectra Precision QM75

This new model works just like the Hilti PD 5 and has an identical display. But the

QM75 is shorter, wider, and thicker than the PD 5, so it's a bit less convenient in my toolbelt. Then again, the QM75 has been drop-tested from 1.5 meters while Hilti makes no drop-test claims. The QM75 also costs about \$50 less than the Hilti but comes with a three-year warranty versus a lifetime one.

### Spectra Precision QM95

This new long-range laser is accurate to  $\frac{1}{25}$  inch and displays 32nds. Like the other Spectras, it has been drop-tested from 1.5 meters, so it's rugged. But despite its higher-than-average price, it lacks several useful features such as min/max, a timer, and a memory. It's also the biggest and heaviest of the lot.

### Stabila LD 400

Like the Milwaukee 2280-20, this model is fundamentally the same as the Leica Disto D2, adding a rubber bumper and extra buttons. But Stabila's crowded keypad is the hardest of the three to navigate, and it gives no indication that the memory button also activates the timer. Last time I checked, the Stabila cost \$70 more than the other two models.

### Stanley TLM 165

Of the 13 models tested, only the Bosch GLM 50 costs less than the new TLM 165. The two models are similar, except the Bosch shows fractions down to  $\frac{1}{32}$  inch and has a tripod socket, while the Stanley has a small memory, a tailpiece, and a ghost-free display. Overall I prefer the Stanley, though I wish it displayed 32nds. Stanley's manual, by the way, didn't mention that you can turn the beep on and off by pressing the function and unit keys simultaneously for a second.

### Stanley TLM 330

In the spec chart (pages 42 and 43), the new full-featured TLM 330 and Leica 7400x appear to be almost identical. But the Leica rates at IP65 rather than IP54



**Reference points.** The Hilti PD 5 and Spectra Precision QM75 both measure from the back end only, while the other models can also measure from the front. Ten models include a tailpiece that allows you to take measurements easily from inside corners to check diagonals. The Bosch GLM 80, the three Leicas (one of which is shown), the Milwaukee, the Stabila, and the Stanley TLM 330 can also hook outside corners for easier measuring from the back end. Five models can mount to a tripod and be set to measure from the center of the socket.



**Helpful display.** All of the models have illuminated displays, but the backlight on the Bosch GLM 80 is the brightest. It's also the only one that can be operated manually or controlled by an ambient-light sensor. What's more, the unique display can be set to rotate automatically for an easy read regardless of the orientation.



**Keypad lock.** The Stanley TLM 330 and the Leica Disto 7300 and 7400x allow you to lock the keypad. That prevents them from accidentally turning on and draining the batteries when riding in a pocket or toolbelt.



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(which means you can hose it off), while the Stanley adds an extra Pythagoras function and a leveling mode that uses beeps to indicate level — handy if you can't see the display. The Stanley also has four more keys for quicker access to several functions, but I think they clutter the keypad without significantly improving the tool. For instance, a new key makes it easier to calculate triangular areas (which I've never done), but you still need to use an obscure key combination to turn the backlight on and off. The Stanley currently costs about \$15 less than the Leica, but comes with a two-year rather than a three-year warranty.

### The Bottom Line

When *JLC* last tested LDMs back in 2004, the cheapest model cost \$360 and was accurate to  $\frac{1}{8}$  inch. Compared to that, every one of these models is a bargain. All are exceptionally accurate, and all will measure lengths with simple pointing and clicking. There are definitely differences in convenience, though. I quickly came to appreciate extra features like timers, memories, estimating shortcuts, and the ability to measure indirectly around obstacles.

My overall favorite is the innovative Bosch GLM 80. It's an especially quick estimator, easily measures indirectly, reads angles, has a bright rotating display, uses a rechargeable lithium-ion battery that delivers up to 25,000 measurements per charge, and is priced below the average. An optional attachment quickly converts it into a 2-foot electronic spirit level. The full-featured but pricier Leica 7400x and Stanley TLM 330 finished a close second.

But not everyone needs the same features. The best choice for you depends on the type of work you do.

*Bruce Greenlaw is a JLC contributing editor.*

### LDM Features



**Durability.** Most of the manufacturers claim that they've tested the shock-resistance of their lasers by dropping them onto a hard surface from a height of one meter. Spectra Precision drop-tests from 1.5 meters, and Leica drop-tests the Disto E7400x from 2 meters.

Nine of the lasers have an IP54 rating, which means that dust intrusion and water splashes have no ill effects. The Hilti PD 5 and Spectra Precision QM75 rate at IP55, while the Leica Disto E7400x rates at IP65; you can drop all three in the mud and wash them off, and the Leica is also completely sealed against dust.

**Continuous beam.** When shooting a series of lengths, such as when installing baseboard, you normally have to press the top button twice per measurement — once to turn on the beam and a second time to take the measurement and turn the beam off. But the Bosch GLM 80, the Stanley TLM 330, and the Leica Disto E7300 and E7400x also let you keep the beam turned on so you only have to press the button once per measurement.

**Signal strength.** Spectra Precision's QM55 is the only LDM in the group with a signal-strength indicator. More bars indicate a stronger signal, which means a faster, more dependable measurement.



**Timers.** Six of the lasers have a programmable timer that delays the shot after you press the measure button. Because you can press then aim (rather than having to press the button while trying to keep the beam on the target) it's much easier to aim the beam precisely in an awkward position or at long distances.