



Metric User's Manual

 **LASER^{TECH}
TECHNOLOGY**
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Section #2 - Speed Measurements

When you power ON the TruSpeed, the instrument will perform the Self Test. Figure #12 shows successful completion of the Self Test. See page 31 for more information about the Self Test.



Figure #12

The next screen is automatically displayed and should look similar to Figure #13.

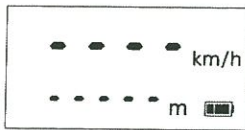


Figure #13

- The dashes that appear in the upper display indicate where the speed measurement will appear.
- "km/h" means the speed will be measured in kilometers per hour.
- The dashes that appear in the lower display indicate where the distance to the target vehicle will appear.
- "m" means the distance will be measured in meters.
- The Battery Icon indicates the approximate battery voltage level (page 9).

Taking a Sample Measurement

1. Ensure that the TruSpeed is powered ON and that the Speed Mode is active.
2. Use the sighting scope and aiming reticle to aim the instrument to a convenient target. An interior wall will do.
3. To fire the laser:
 - Press and hold the TRIGGER. The laser will fire after a short delay (about one-half of a second).
 - or-
 - Press the TRIGGER twice.
The 1st press turns on the in-scope aiming reticle.
The 2nd press takes the measurement.
4. Continue to press the TRIGGER and keep the instrument sighted on the target:
 - A low-pitched growl means that the instrument is attempting to lock onto the target.
 - 1 Low-Pitched and 2 High-Pitched Beeps mean that a measurement error occurred. An error code will be displayed (page 15).
 - A high-pitched single beep means that a speed was captured. The measured speed will be displayed on the LCD screen and will be projected in the scope, just below the aiming reticle.

After you release the TRIGGER, the instrument will display the most recent speed reading and the distance at which it was captured. The display screen will look similar to Figure #14. If you did not capture a speed, an error code will be displayed (page 15).



Figure #14

Choosing a Roadside Location

When choosing a spot on the side of the road for measuring moving vehicles, you will need to consider:

- Is the location safe?
- Do you have a clear line of sight?
- What is the approximate angle between the instrument's position and the target vehicle's direction of travel?
- What is the approximate distance to the target vehicles?
- How is the weather? Will you need to use the Weather Mode?

Line of Sight

Ideally, you should have a clear line of sight to the target vehicle.

- *If there is a momentary break in the beam*, the instrument will accumulate data and may be able to capture the target vehicle's speed. The instrument will display an error code if it cannot capture the target vehicle's speed.
- *If there is an extended break in the beam*, the instrument will display an error code.

The Cosine Effect

If the target vehicle is moving directly toward or away from you, the speed measured by the TruSpeed is identical to the vehicle's true speed. However, the instrument is usually set up on the side of the road for safety. This results in an angle between the instrument's position and the target vehicle's direction of travel. When the angle is significant, the measured speed is less than the target's true speed. The phenomenon is known as the cosine effect. Cosine is the trigonometric function that relates to this phenomenon.

The difference between the measured speed and the true speed depends upon the angle between the instrument's ideal position- the position where targets would be moving in direct line with the instrument- and its actual position.

- The larger the angle, the lower the measured speed.
- The effect always works to the motorist's advantage.
- Loosely speaking, the cosine effect is not significant as long as the angle remains small. The table below shows this effect.

Measured Speed by Angle: The Cosine Effect

Angle (degrees)	True Speed				
	50 km/h	70 km/h	90 km/h	110 km/h	130 km/h
Measured Speed (km/h)					
0	50.00	70.00	90.00	110.00	130.00
1	49.99	69.99	89.99	109.98	129.98
3	49.93	69.90	89.88	109.85	129.82
5	49.81	69.73	89.66	109.58	129.50
10	49.24	68.94	88.63	108.33	128.02
15	49.30	67.62	86.93	106.25	125.57
20	46.98	65.78	84.57	103.37	122.16
45	35.36	49.50	63.64	77.78	91.92
90	00.00	00.00	00.00	00.00	00.00

The cosine effect decreases as the range to the target vehicle increases.

- At the maximum range of the instrument, the vehicle is so far away that the angle between it and the instrument is very small indeed. The instrument's perception of the target's speed is identical to its true speed.
- As the vehicle approaches, the angle increases until it becomes large enough to affect the measurement.

i To minimize the cosine effect, keep the angle small. Set up the instrument as close to the road as possible without creating safety risks, and target down the road at ranges sufficient to keep the angular difference small.

The table below shows acceptable parameters for minimizing the cosine effect. The chart indicates the percentage of true speed measured, given the distance from the roadway and the distance from the target vehicle. To find a target's measured speed, multiply the true speed by the number in the chart.

Distance off the roadway (meters)	Range to Target Vehicle				
	30 m	100 m	150 m	300 m	600 m
<i>fraction of the True Speed that will be measured</i>					
3	.9950	.9995	.9998	.9999	1.0000
10	.9682	.9950	.9987	.9997	.9999
15	.8660	.9886	.9950	.9987	.9997
30	.0000	.9539	.9798	.9950	.9987
60	.0000	.7999	.9165	.9798	.9950

The diagonal created by the boldface numbers indicates the boundary between acceptable and unacceptable parameters.

- Numbers *above* the diagonal are acceptable margins of error.
- Numbers *below* the diagonal are unacceptable margins of error.

Remember that the cosine effect is always in the motorist's favor.

i As a general rule, do not exceed 1 meter off the road for every 10 meters shooting down range to the targets. If target vehicles will be 150 meters down the road, set up no more than 15 meters off the road.

Measuring a Moving Vehicle

1. Ensure that the TruSpeed is powered ON and that the Speed Mode is active.
2. Use the aiming reticle to aim the instrument at the target vehicle's license plate area and press the TRIGGER.
3. Continue to press the TRIGGER and keep the instrument sighted on the target.
 - A low-pitched growl means that the instrument is attempting to lock onto the target.
 - A low-pitched beep means that a measurement error occurred. An error code will be displayed.
 - A high-pitched single beep means that a speed was captured. The measured speed will be displayed on the LCD and projected in the scope just below the aiming reticle.

While the instrument is attempting to lock onto the target, as long as the TRIGGER is kept pressed, it will retry the speed measurement.

- In this mode, the instrument will attempt to lock onto the target for up to 5 seconds. Information is accumulated until it gets a good measurement or generates an error code.
- Consequently, it is very important that the aiming point on the target remain constant for the entire measurement time. If you move the instrument off the aiming point, it will generate an error code instead of capturing a speed reading.

After you release the TRIGGER, the instrument will display the most recent speed reading and the distance at which it was captured or an error code. When the most recent speed reading is displayed, the display screen will look similar to Figure #15.



Figure #15

- The speed displays as a *negative number* if the target was going away from you when it was measured.
- The speed displays as a *positive number* if the target was approaching you when it was measured.


Using the Weather Mode

Moisture is reflective. Weather such as rain, snow, or fog can make it difficult for the laser to receive signals back from the target. This is especially true when you are trying to capture speeds at close range. The TruSpeed includes a built-in Weather Mode that is an alternate speed measurement mode. When the Weather Mode is active, the factory-defined gate setting increases the instrument's minimum range from 15 meters to 61 meters. Increasing the minimum range ensures that the laser only acquires targets beyond the range where weather affects the laser's ability to capture a speed reading.

When the Weather Mode is active:

- The Weather Mode indicator appears in the lower left corner of the LCD Screen.
- Targets must be a distance greater than 61 meters.
- The instrument's maximum range is not changed.
- Other than the above items, the TruSpeed operates the same as when the Speed Mode is active and the Weather Mode is not active.

To activate the Weather Mode.

1. Ensure that the TruSpeed is powered ON and that the Speed Mode is active.
2. Press the  button. The display should look similar to Figure #16.
3. Use the aiming reticle to aim the instrument at the target vehicle's license plate area and press the TRIGGER.
4. Continue to press the TRIGGER, and keep the instrument sighted on the target:

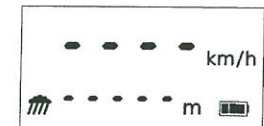


Figure #16

- A low-pitched growl means that the instrument is attempting to lock onto the target.
- A low-pitched beep means that a measurement error occurred. An error code will be displayed.
- A high-pitched single beep means that a speed was captured. The measured speed will be displayed on the LCD and projected in the scope just below the aiming reticle.

While the instrument is attempting to lock onto the target, as long as the TRIGGER is kept pressed, it will retry the speed measurement.

- In this mode, the instrument will try up to 5 seconds. Information is accumulated until it gets a good measurement or generates an error code.
- Consequently, it is very important that the aiming point on the target remain constant for the entire measurement time. If you move the instrument off the aiming point, it will generate an error code instead of capturing a speed reading.

After you release the TRIGGER the instrument will display the most recent speed reading and the distance at which it was captured or an error code. When the most recent speed reading is displayed, the display screen will look similar to Figure #17.



Figure #17


Using the Continuous Mode

Continuous Mode is an alternate speed measurement mode. If you wish to take several successive readings on a target, you can put the instrument in Continuous Mode. In this mode, the instrument takes and displays one reading after another, and continues to take and display readings as long as you hold down the TRIGGER. Release the trigger, and the instrument finishes its latest reading and stops. If an error code is shown when you release the trigger, the instrument will display either the most recent speed reading, or, if the error code has persisted for several tries, the error code will remain.

When the Continuous Mode is active:

- The Continuous Mode indicator appears in the middle left side of the LCD Screen.
- For the best results, do not try to use Continuous Mode to target one vehicle after another. When you wish to change targets, release the trigger, aim to the new target, and retrigger.

To activate the Continuous Mode:

1. Ensure that the TruSpeed is powered ON and that the Speed Mode is active.
2. Press the  button. The display should look similar to Figure #18.
3. Use the aiming reticle to aim the instrument at the target vehicle's license plate area and press the TRIGGER.
4. Continue to press the TRIGGER and keep the instrument sighted on the target:

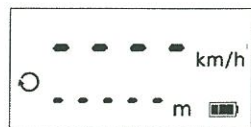


Figure #18

- A low-pitched growl means that the instrument is attempting to lock onto the target.
- A low-pitched beep means that a measurement error occurred. An error code will be displayed.
- A high-pitched single beep means that a speed was captured. The measured speed will be displayed on the LCD and projected in the scope just below the aiming reticle.

While the instrument is attempting to lock onto the target, as long as the TRIGGER is kept pressed, it will retry the speed measurement.

- In this mode, the instrument will try up to 5 seconds. Information is accumulated until it gets a good measurement or generates an error code.
- Consequently, it is very important that the aiming point on the target remain constant for the entire measurement time. If you move the instrument off the aiming point, it will generate an error code instead of capturing a speed reading.
- The instrument will take and display one reading after another as long as you hold down the TRIGGER.

After you release the TRIGGER the instrument will display the most recent speed reading and the distance at which it was captured or an error code. When the most recent speed reading is displayed, the display screen will look similar to Figure #19.



Figure #19

Optional Jam Detect Feature

- ⓘ Your TruSpeed may not include the Optional Jam Detect feature. It is a factory-defined option that is set when the instrument is shipped. The TruSpeed includes hardware-based laser jammer detection. Jam Detect is an integrated software feature that provides, (1) Jammer Defeat, (2) Jammer Detection, and then (3) emits the jam tone to alert the user.

The LTI 20/20 TruSpeed contains advanced circuitry and algorithms that allow the instrument to determine if a laser jammer is being used. The JAM tone (page 14) indicates that the instrument is being flooded by a light source. There are two possible situations:

- You are targeting a strong light source such as xenon headlights.
- or-
- A targeted vehicle is employing a laser jammer.

Regardless of the level of interference, you will never get an erroneous speed reading.

- If the laser jammer uses "smart" technology, you will hear the jam tone and the measured speed will flash.
- If the laser jammer does not use "smart" technology or if the interference is from a light source other than a laser jammer:
 - At a low level of interference, you will hear the jam tone and a speed may be captured or an E03 error code may be displayed.
 - At a high level of interference, you will hear the jam tone and an E07 error code will be displayed.

Optional Local Speed Limit Edit

- ① Your TruSpeed may not include the Local Speed Limit Edit feature. It is a factory-defined option that is set when the instrument is shipped.

The Local Speed Limit Edit feature allows you to enter the local speed limit into the TruSpeed. For information about entering the local speed limit, see page 32. Once you have entered the local speed limit:

- "SPdLt" will appear in the lower display on the initial Speed Measurement Screen as Figure #20 shows.
- The instrument will emit a high-pitched single beep when it successfully completes a speed measurement that is less than the local speed limit.
- The instrument will emit a high-pitched double beep when it successfully completes a speed measurement that is equal to or above the local speed limit.



Figure #20

Section #3 - Test Mode and Instrument Tests

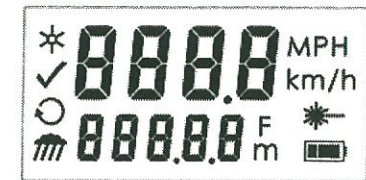
The Test Mode includes 7 options and allows you to verify the TruSpeed's mechanics. These options include:

- Display Integrity Test
- Scope Alignment Test
- Delta Distance Test
 - Fixed Distance Zero Velocity Test
- Instrument Self Test
- Local Speed Limit Edit
- Model and Firmware Version Number Display
- Serial Number Display

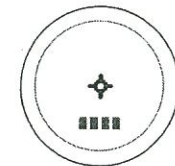
Display Integrity Test

The Display Integrity Test allows you to verify that all display segments are operating. LTI suggests that you do this test periodically.

1. Ensure that the TruSpeed is powered ON.
2. Press the button. The display should look like Figure #21.
 - Compare the instrument's LCD to Figure #21 (A).
 - Compare the instrument's in-scope Heads Up Display to figure #21 (B). The lower portion of the display will flash 5 times. If the display times out before you can complete this test, press the button repeatedly until this screen is displayed again.
3. If any segment fails to display, contact Laser Technology, Inc. to arrange for repair. See the inside front cover for LTI contact information.



(A)



(B)

Figure #21

- ① The display integrity is also tested each time the unit is powered ON. However, the results are only briefly displayed before the results of the Self Test are displayed.

Scope Alignment Test

Scope alignment is set at the factory when the instrument is shipped. A heavy blow is the only reason that the scope might ever go out of alignment. LTI suggests that you do this test periodically.

The Scope Alignment Test uses sound to indicate when the scope is on-target.

1. Select a target. Choose a prominent target with well-defined horizontal and vertical edges. A telephone pole is an excellent choice.
 - Recommended distance to target: 200 meters.
 - The target's reflective qualities and distance should be such that you can clearly hear a change in pitch of the test tone as you pan the instrument over the edges of the target.
 - Make sure there is nothing behind the target that the instrument might detect, so you know without a doubt that any change in pitch is due strictly to the target.
2. Ensure that the TruSpeed is powered ON.
3. Press the button two times to activate the Test Tone display screen. It should look similar to Figure #22.
4. Scan the target. Press and hold the TRIGGER while panning the instrument across the target. The tone changes pitch when the instrument acquires the target. The highest pitch - the on-target tone - should occur when the in-scope aiming reticle is centered on the target. Scan the target both horizontally and vertically.
 - *If the frequency drops off at equal distances from the center of the aiming reticle, the instrument needs no adjustment.*
 - *Otherwise, contact Laser Technology, Inc. for assistance with re-aligning the scope. See the inside front cover for LTI contact information.*

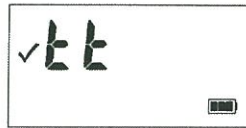


Figure #22

- i** When checking vertical alignment to a close target, be aware of the offset between the center of the scope and the center of the transmit lens, which is 5 centimeters.

Instrument Confidence Checks

There are several ways to verify the measurement accuracy of a Lidar instrument. You can verify it directly by measuring the speed of an object traveling at a known speed, but this is seldom practical. The nature of Lidar is such that it cannot be tricked by a vibrating object, such as a tuning fork, into displaying a velocity. For these reasons, LTI has designed the Fixed Distance Zero Velocity Test and the Delta Distance Test. LTI suggests that you do one of these tests each time the instrument is taken on duty.

These tests verify the accuracy of the two key elements of Lidar speed measurement:

- Precise time measurements
- Ability to make mathematical calculations

When setting up an area for these tests, LTI recommends:

- Permanently installing the test area in a convenient location. The test area must establish a permanent, known distance between a shooting mark and a target (Fixed Distance Zero Velocity Test) or between a shooting mark and two targets (Delta Distance Test).
- Using a metal tape to measure the distance; this will ensure that the measurement is accurate.

Other considerations:

- The shooting mark is where you stand to do the test, and it can be an "X" painted on the pavement.
- A target can be any flat, permanent structure—a sign or wall, for example—painted with a bull's eye or other aiming point.
- The shooting mark and the target must form a straight line.
- The manner in which you stand and hold the instrument both affect the test measurements. For exact readings, carefully hold the instrument so center of the TruSpeed is directly over the middle of the X.

Fixed Distance Zero Velocity Test

- ❗ The Fixed Distance Zero Velocity Test is not one of the options included in the Test Mode. In order to perform the Fixed Distance Zero Velocity Test, the Speed Mode must be active.

The Fixed Distance Zero Velocity Test requires one target:

- LTI recommends that the target should be 60 meters from the shooting mark. See Figure #23. If there is not enough space available, that specific distance is not crucial. However, the distance between the target and the shooting mark must be a multiple of 1 meter, not a fraction of a meter.

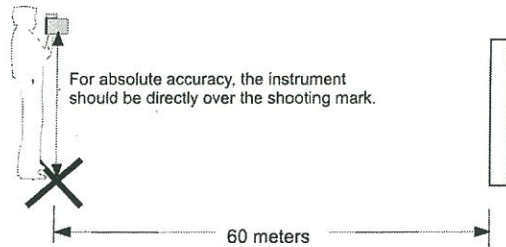


Figure #23

1. Stand on the shooting mark.
2. Ensure the TruSpeed is powered ON and that the Speed Mode is active.
3. Use the aiming reticle to aim at the target.
4. Press the TRIGGER.
5. Check the display.
 - The speed reading should be zero km/h. A reading of zero verifies the timing accuracy of the instrument and is identical in nature to an accurate velocity reading of a vehicle moving at any speed.
 - The displayed distance should read from 59.8 to 60.2 meters if your fixed distance was 60 meters.



Figure #24

- ❗
 - Speed accuracy = ± 2 km/h.
 - Distance accuracy = ± 15 cm or 0.2 meters (rounded).
 - If you need assistance, contact Laser Technology, Inc. See the inside front cover for LTI contact information.

Delta Distance Test

- ❗ Your TruSpeed may not include the Delta Distance Test. It is a factory-defined option that is set when the instrument is shipped.

The Delta Distance Test requires two targets. LTI recommends that the first target should be 45 meters from the shooting mark, and the second should be 55 meters from the mark. See Figure #25. If there is not enough space available, that specific distance is not crucial. However, the distance between the target and the shooting mark must be a multiple of 1 meter, not a fraction of a meter.

Refer to Figure #25 as a guide for positioning the targets and the shooting mark.

1. Install the farther target.
2. Measure 55 meters to the shooting mark and mark the shooting spot.
3. Measure from the shooting mark 45 meters to the second target.
4. Mark that spot and install that target.

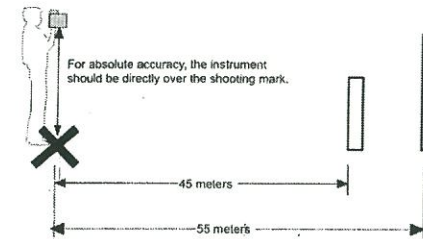




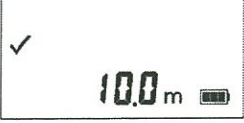


Figure #25

To conduct the test, refer to the table below.

Action	Results
1. Stand on the shooting mark. 2. Power ON the TruSpeed and press the <input checked="" type="checkbox"/> button 3 times until the message -d1- appears in the upper display.	
3. Aim to the far target and press the TRIGGER. 4. Check the display. If necessary, you may repeat step #3.	
5. Press the <input checked="" type="checkbox"/> button. The message -d2- appears in the upper display.	
6. Aim to the near target and press the TRIGGER. 7. Check the display. If necessary, you may repeat step #6.	
8. Press the <input checked="" type="checkbox"/> button. The screen displays the difference between the two distances 10 meters ±30 cm.	
<i>If the targets are shot in reverse order, the display is the same, but the difference appears as a negative number</i>	

- If the difference is 10 meters, the displayed distance should be 9.7 to 10.3 meters.

i If you need assistance, contact Laser Technology, Inc. See the inside front cover for LTI contact information.

Instrument Self Test

Just like when the instrument is powered ON, during the Self Test the microcontroller interrogates the system electronics.

To complete the Self Test:

1. Press the button repeatedly until the screen display looks similar to Figure #26.
2. Press the TRIGGER to complete the Self Test. Figure #27 shows an example of all tests proving positive.
 - If all tests do not prove positive, the appropriate error code will appear in the upper display (see page 15).





Figure #26



Figure #27

i If the instrument fails the Self Test:

1. Press the  button to power OFF the TruSpeed.
2. Press the  button to once again power ON the TruSpeed and repeat the Self Test.
3. Contact LTI if the error repeats and you need assistance. See the inside front cover for LTI contact information.

Optional Local Speed Limit Edit

- i** Your TruSpeed may not include the Local Speed Limit Edit feature. It is a factory-defined option that is set when the instrument is shipped.

To display the Speed Limit Edit Screen, press

the button repeatedly until the screen display looks similar to Figure #28. The current value associated with the local speed limit appears in the upper display. In this example the local speed limit is 30 km/h.



Figure #28



Figure #29

1. Press the button 5 times. The initial screen should look similar to Figure #28.
 2. Press the button to edit the local speed limit. The right-most digit will flash as shown in Figure #29.
- Press the button to add 1 value of the flashing digit.
 - Press the button to subtract 1 from the value of the flashing digit.
 - Press the button to move to the digit to the left of the flashing digit.
 - Valid Values: 0 to 322 km/h.
 - Entering a value of 0 km/h disables this feature.
 - Press the button to store the value as the local speed limit.
 - If you entered a valid value, the instrument will emit a single beep and store the value as the local speed limit.
 - If you entered an invalid value, the instrument will emit a double beep and the previous value will be reset.
- i**
- When factory default settings are restored (page 13), the Local Speed Limit Edit value is set to 0 km/h.
 - See page 24 for information about taking speed measurements after entering a value other than zero for the Local Speed Limit.

Model and Firmware Version Number Display

To display the model number and firmware version number of your TruSpeed, press

the button repeatedly until the model number and firmware version is displayed. The display should look similar to Figure #30. The model number appears in the upper display and the firmware version number appears in the Lower Display. In this example, the model number is "100" and the firmware version number is "1.10".

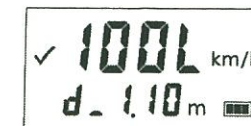


Figure #30

- i** In this example:

- The 'L' that appears as the last character in the upper display indicates that this particular TruSpeed includes the optional Long Range Feature.
- The 'd' that appears as the first character in the lower display indicates that this particular TruSpeed includes the optional Jam Detect feature.

Serial Number Display

To display the serial number of your TruSpeed,

press the button repeatedly until the serial number is displayed. The display should look similar to Figure #31. The serial number has 6 digits and appears in the upper and lower display. In this example, the serial number is "000001".

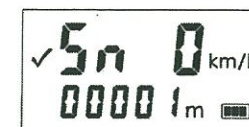


Figure #31