STALKER® LIDAR

Ranging Speed Measurement Laser

Operator's Manual

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Dear Valued LIDAR Customer:

Thank you for choosing the **STALKER LIDAR** System. We sincerely appreciate you purchasing the **STALKER** and giving us the opportunity of serving you and your department. You will find the **STALKER** to be an invaluable tool in controlling speed violators and making your streets and highways safer. Most importantly, we care about you, our customer, and want you to be completely satisfied. Our success as a company depends upon your satisfaction and experience with the **STALKER LIDAR**.

Applied Concepts, Inc. believes that the **STALKER LIDAR** offers more than superior performance and versatility. **STALKER** is backed 100% with reliable, professional, and experienced sales and service support, ready to assist you at your request. We also offer nationwide factory authorized repair centers to assure you of fast and efficient service.

We wish you the greatest success in your speed enforcement program. Please do not hesitate to let us know if there is anything we may do to add to your product satisfaction.

Thanks again!

Applied Concepts, Inc.

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INTRODUCTION

STALKER LIDAR is a laser device that measures the speed of vehicles, indicates the distance of the vehicle and whether the vehicle is coming toward or going away from the device. It can be operated hand-held or mounted in a stationary position.

STALKER LIDAR is a small, lightweight and well-balanced device that has a built-in HUD (Heads Up Display) that allows the operator to track the target vehicle while observing nearby traffic.

STALKER LIDAR's electronic design is microprocessor based with signal processing and precision cast optics. This allows the unit to be upgraded with future performance features by simply installing new computer software using a laptop computer, which prevents obsolescence and insures the Customer the ability to benefit from future enhancements.

STALKER LIDAR provides both Single Shot mode and Tracking mode. Tracking mode provides continuous tracking and immediate, real-time speed updates as long as the trigger is depressed. This coupled with our unique Target Speed Tone gives the operator excellent tracking history and target identification. It sends out 130 pulses per second and operates at a wavelength 905 nanometer.

HISTORY OF LASER

Albert Einstein, in 1917, developed a theory that a single frequency light could be created which could be transmitted over great distances and would not dispense laterally from the source of origin. This theory showed that molecules that were energized gave off a monochromatic light. Monochromatic light occupies only a small portion of the light spectrum and is thought of as "one-color light." This was the theory of laser, but actually the first laser was not developed until 1957 by a Columbia University graduate student named Gorden Gould. This design was on paper only. The first working laser was developed by Theodore Maiman in 1960. The first laser developed for speed detection was introduced in 1989.

There are many different types of lasers and they are used for many different applications. Since a laser can deliver energy with great accuracy, it can be used in industry for welding and cutting and in the medical field for surgery. It is also used for such things as surveying, laser light shows, and can read bar codes at the local grocery store or retail outlet. Laser technology is growing at a very fast pace and there are constantly new developments being discovered for lasing materials and lasing methods. The type of laser being utilized in the **STALKER LIDAR** is a semi-conductor laser.

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with this instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.
Any changes or modifications to the **STALKER LIDAR** not expressly approved by Applied Concepts, Inc. could void the user's authority to operate the equipment.

WHAT IS LASER

Laser is an acronym for **L**ight **A**mplification by **S**timulated **E**mission of **R**adiation. Speed detection devices using this technology are referred to as Lasers or **LIDAR**. These units measure both speed and distance and the word **LIDAR** stands for **Li**ght **D**etection **A**nd **R**anging. Light is what allows us to see. When light reflects off an object it makes the object visible to us. Light transmitted by a speed detection laser, or LIDAR, is a form of electromagnetic radiation and is composed of waves similar to the radio or microwave waves transmitted by radar. Stimulated emission is a method that allows light from a single frequency to be greatly amplified.

The difference between laser and radar is the wavelength and frequency of transmission. Radar is measured by it's frequency in gigahertz. Laser is measured by it's wavelength in nanometers. Laser operates on a much higher frequency than radar or microwave. Laser has a frequency 13,000 times higher than K-Band radar and 9,500 times higher than Ka-Band radar.

All electromagnetic waves, including radar or microwave and light from a laser, travel at the SPEED of LIGHT, 186,000 miles per second, or about one foot in one billionth of a second. In discussing radar or microwave, it is described in "hertz" or "cycles per second," which is the number of waves or cycles that occur in one second. With laser it is more convenient to look at it's wavelength. The wavelength is "the distance between two points in a periodic wave that have the same phase."

Most laser cavities are constructed using a specific optical gain medium (solid, liquid, or gas) held between two external mirrors. Laser mirrors are separated at fixed distances, and the gain medium pumped by an external optical or electrical energy source. Light is emitted by the medium and bounces between the mirrors. Since only specific resonant frequency modes of the light are amplified, the laser output has a narrow frequency spectrum, called monochromatic ("single color"). The wavefronts of light emitted by a laser also maintain a high degree of phase relationship over extended time intervals. With the wavefronts traveling at the speed of light, this translates to an extremely accurate correlation between successive laser wavefronts which have traveled extended distances. Therefore, laser sources are ideal for ranging and speed detection.

The ***STALKER LIDAR*** uses a compact laser diode as the transmitting light source. The diode chip is manufactured using an ultra-pure semiconductor process, and the chip itself acts as the complete laser cavity. The manufacturing process and chip dimensions are tuned for laser output in the infrared region of the optical spectrum, so that the LIDAR beam is not visible to the human eye. As current is pulsed through the chip, a series of correlated light pulses emerge from the laser diode. The transmitted wavefront is collimated with high precision laser optics to a very narrow transmitted beam, which allows for accurate target selection. Light reflected from the target is gathered by a second set of high precision laser optics and concentrated on a fast, high gain semiconductor detector diode. A custom optical filter tunes the detector diode to the exact wavelength region of the laser diode. With this approach, extraneous optical radiation from sunlight, headlights, and other sources is blocked. Thus, daytime as well as nighttime LIDAR operation is achieved.

The beamwidth of the ***STALKER LIDAR*** is 0.172°, sometimes referred to as 3 milli-radians. This produces a beam whose width is 0.003 times the range to the target. Using the beamwidth formula (.003 x Range to Target) we find that the beam width of the ***STALKER LIDAR*** is 3.6 inches at 100 feet, 1.5 feet at 500 feet and 3.0 feet at 1000 feet.

PRINCIPLE OF OPERATION

In the most simple terms, the **STALKER LIDAR** determines speed by measuring the time of flight of very short pulses of infrared light.

Since the speed of light is a constant (approximately 186,000 miles per second), the time it takes the laser pulse to travel to the target and back is directly proportional to the distance of the target. By sending two pulses a known time apart, two distances can be calculated. The change in distance, divided by the time interval between the two pulses, gives the speed of the target. Laser utilizes two laws of physics, speed of light and the time-distance formula S = D/T, which is: Speed = Distance/Time.

When we point the **STALKER LIDAR** at a target and squeeze the trigger to transmit, the unit sends out infrared light in a series of predetermined pulses. Each pulse is traveling at the speed of light, 186,000 miles per second or about a foot every billionth of a second. As each pulse of light leaves the LIDAR unit, it starts a timer and allows the LIDAR to determine how long the pulse is gone until it returns. When it returns, the timer is turned off and the elapsed time is fed into a computer processor. The processor then divides the elapsed time by two (since only a one-way distance is needed) and converts the result into distance. Once we know the distance of travel and the time it took to travel the distance, speed can be calculated. If the distance is getting greater, then we know the target is traveling away from the LIDAR so we display a (-) sign next to the speed indicating the target is going away. If the distance becomes shorter, we know the target is coming toward the LIDAR so we display a (+) sign.

In theory, it is possible to make a speed measurement by comparing only two pulses. For law enforcement applications, this is not enough redundancy to eliminate possible errors. To eliminate errors, the **STALKER LIDAR** looks at a series of pulses and applies various independent tests to the data before it determines and displays an accurate speed.

First, the actual speed calculation that the **STALKER LIDAR** uses is much more complex than the simple distance divided by time formula. The unit actually computes the movement of the vehicle as change in time of flight instead of change in distance. Timing circuitry in the **STALKER LIDAR** measures the round-trip time of flight of the LIDAR pulse. The round-trip distance is twice the target distance, so the target range can be calculated by the following formula: $d = c \times t / 2$. Where d is the target distance, c is the speed of light in air, and t is the round-trip time of flight.

An Example is:

If t = 2034 ns (nanoseconds) and c = 983,286,229 feet/sec

$$d = c \times \frac{t}{2} = 983{,}286{,}229 \times \frac{2034 \times 10^{-9}}{2}$$

$$d = 1000 \text{ ft}$$

Secondly, the processor takes all of this data and averages it over the number of pulses received. This method is referred to as the average of least squares and it gives the best possible result and the least chance of error.

Average of least squares is a sophisticated mathematical algorithm formula that determines that a group of data is consistent. The **STALKER LIDAR** looks at all of the data and determines the speed based upon the entire group of data. It tracks and plots the data and averages it to establish a straight line. If it receives data that is too far removed from the best-fit line, the data is disregarded. If too much data is out of fit then no speed is displayed and an error message would appear. This method of calculation assures the operator a very high degree of accuracy.

BEAM WIDTH

The ***STALKER LIDAR*** produces a very narrow beam width, which when properly used, allows the operator to monitor individual targets to the exclusion of others.

However, because the size of the beam width is directly proportional to the distance of the target, it is important to understand the relationship between distance and beam width. The ***STALKER LIDAR*** produces a beam whose width is 0.003 times the range to the target. The following table shows the Beam Width vs. Range to Target for a number of distances.

Range to Target	Beam Width
100 feet	0.3 feet (3.6 in.)
300 feet	0.9 feet (10.8 in.)
500 feet	1.5 feet
1000 feet	3.0 feet
1500 feet	4.5 feet
2000 feet	6.0 feet
3000 feet	9.0 feet
5000 feet	15.0 feet

As this table shows, the narrow beam width permits a single vehicle to be selected at shorter distances. However, depending on the width of the vehicle, the beam becomes wide enough that some separation between targets is necessary to insure accurate target identification at longer distances. The beam does get proportionally wider as distances increase. It is suggested, in heavy traffic and multi-lane usage, that speeds be obtained at the shorter distances to assure proper target identification.

SWEEP EFFECT

A condition known as sweep effect can occur when using LIDAR devices. This will happen when the sequence of range measurements obtained by the LIDAR are not measured from the same spot on the target.

Suppose, for example, that a long rectangular semi-trailer passes by and a tripod-mounted LIDAR is sighted along a line nearly parallel to the roadway, toward the trailer's side. The trailer has some speed, but the range to the point where the laser beam hits the side of the trailer is constant, so the LIDAR gives a speed reading of zero. On the other hand, if the trailer is stationary but the LIDAR is smoothly rotated so that the beam sweeps along the flat surface, the LIDAR receives data that the distance to the target is changing, and a non-zero speed may be indicated. These are extreme cases, but they illustrate the point that LIDAR speed measurement is based on the assumption that a series of ranges to the same small area on a target has been obtained. If the measurements do not fit this assumption, then sweep effect has occurred.

A more meaningful example of sweep effect can occur when aiming at the front or rear of a passenger vehicle. If the aim of the LIDAR device is permitted to wander between the license plate and the top of the passenger compartment, an inconsistency of about 4 feet in the range data (the length of the hood or trunk) can occur. Depending on the sequence of events, this can cause the vehicle to appear to have traveled either 4 feet further or 4 feet less than the true distance. If this sweep effect goes undetected, it could cause the calculated vehicle speed to be as much as 8 miles per hour higher or lower than the true speed. The ***STALKER LIDAR*** target recognition processing software includes tests for this condition, and potentially erroneous readings are suppressed. In addition, the continuous tracking capability of the ***STALKER LIDAR*** permits an operator to see that an erroneous speed has briefly occurred and to ignore that speed. Other possible sweep effect conditions are due to two or more targets intercepting the laser beam during one measurement. This can occur because of

intervening objects interrupting the beam, or because of poor aiming allowing the beam to sweep between two side-by-side targets. The **STALKER LIDAR** also provides screening for this type of effect and suppresses potentially erroneous readings.

Properly trained operators can eliminate the sweep effect by understanding reflective properties of the LIDAR beam and by obtaining a proper tracking history. Using Tracking mode, **STALKER LIDAR** performs continuous tracking (speed and distance updating) as long as the trigger is depressed. Using Single Shot mode, a tracking history may be obtained by taking multiple readings for a single target. Either of these methods allow the operator to track the vehicle and easily recognize any invalid readings should they occur.

The **STALKER LIDAR** also employs a Target Speed Tone, much like the Doppler tone heard on radar. This tone is in direct proportion to the speed, i.e., the higher the speed, the higher the pitch of the audio. The audio can be heard whenever the **STALKER LIDAR** is tracking and displaying a speed. If the sweep effect occurs, the operator can hear an irregular tone for the vehicle being tracked, thus alerting the operator to the possible sweep effect.

BEAM REFLECTION

The LIDAR beam interacts with the environment but with greatly different results than a radar beam. The LIDAR beam will reflect very easily off almost any object, therefore the beam will reflect back to the LIDAR rather than going around, through or being absorbed like a radar beam. Because of this, care has to be taken by the operator to make sure objects such as signs, trees, and other obstacles are not between the target and the LIDAR. These obstacles would not cause an incorrect reading but would either stop the LIDAR beam from "hitting" the targeted vehicle or simply give a distance reading to the object.

It is also important to remember the reflecting properties of vehicles. The hood and windshield of many vehicles are sloped and may not reflect the LIDAR beam directly back to the LIDAR unit. This could either prevent readings or readings at shorter distances. We suggest that the LIDAR beam be aimed low on the vehicle, at the grill and front license plate area. The license plate is almost a perfect LIDAR reflector and targeting it should produce the best results. Vehicles without license plates will result in the LIDAR having shorter effective range. The shape and color of the vehicle can have an effect on the LIDAR. A light colored vehicle will produce a better return signal than a dark colored vehicle.

LIDAR devices may be operated both in daylight and nighttime, however care at night must be taken. In daylight, the operator can see all of the subject vehicle and it is easier to target the front grill or license plate. At night, the operator may only see the headlights and the dark area between them, and targets may need to be closer to obtain a reading. It is also more difficult to see obstructions between the LIDAR and the vehicle, such as posts, signs, rain, snow, fog, etc. All of these effects have the result of shortening the range of the LIDAR.

An Inclement Weather Mode feature allows **STALKER LIDAR** to track through interfering weather phenomena such as fog, snow, and rain which would otherwise cause **STALKER LIDAR** to attempt to process reflections from the weather phenomena as targets, preventing processing of the intended target. This mode works by inhibiting processing of any target closer than approximately 250 feet. Reflections from weather phenomena beyond 250 feet are normally too weak to cause interference. All **STALKER LIDAR** units manufactured with serial number 70400 and higher contain the Inclement Weather Mode feature.

The LIDAR should not be used through the windshield or any other glass surface. The angle of the windshield will often reduce the effective range of the LIDAR. Some windshields contain elements or coatings, which make LIDAR operation through them impossible. Operation through the side glass is better than the windshield although some loss of range may be experienced. Hand-held operation is possible, especially by the lightweight and balanced design of the **STALKER LIDAR**. However, for greatest range, resting the LIDAR on the glass, using the shoulder stock or a tripod or monopod, will produce the best results. Care should be taken to hold the LIDAR as steady as possible.

COSINE OR ANGLE EFFECT

The cosine effect while using LIDAR is the same as that seen using radar. A large cosine angle to the target will cause the device to read lower than the true speed. The speed displayed will always be less than the actual speed of the vehicle.

Therefore, it is recommended that the LIDAR be operated at the least angle possible (relative to the direction of travel of the target vehicle). This will also provide a better return signal to the LIDAR and resulting in better sensitivity. Care should be taken for the operator's personal safety in regards to passing traffic.

RADIO FREQUENCY INTERFERENCE

Due to the inherent properties of the LIDAR (highly collimated coherent light) and the vast differences from radio waves, LIDAR devices are generally not affected by RFI. The ***STALKER LIDAR*** has been shielded against RFI entering the device and also has an RFI detector circuit. If RFI is present and causes interference, the RFI detector disables the ***STALKER LIDAR*** from operating and displays "RFI".

EYE SAFETY

The ***STALKER LIDAR*** is designed and tested to meet the F.D.A (Federal Drug Administration) eye safety requirements for a Class I laser device, and thereby complies with CFR 1040.10 and 1040.11. Class I levels of laser radiation are not considered to be hazardous.

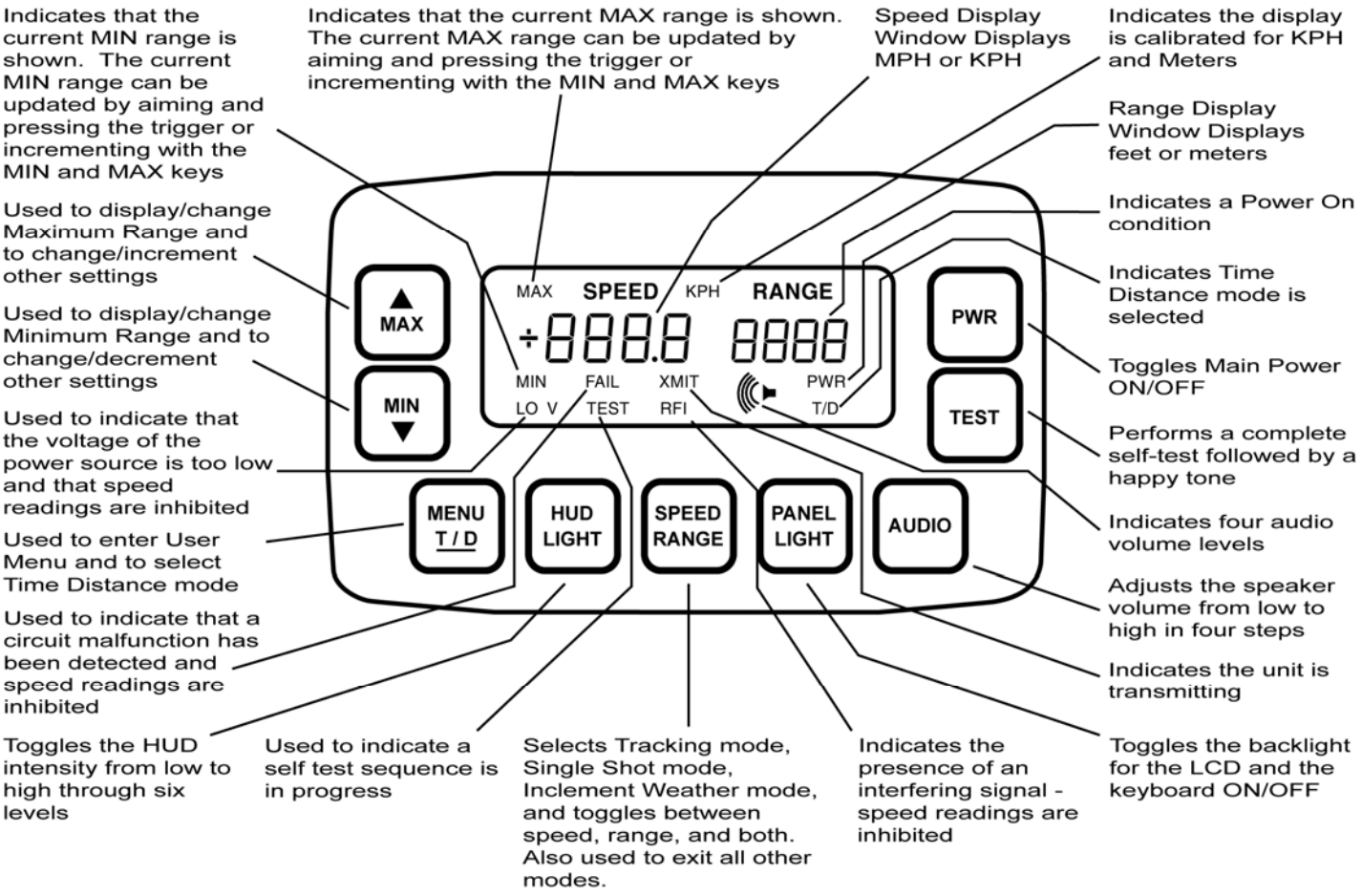
To prevent inadvertent exposure to potentially hazardous laser radiation, all servicing of the ***STALKER LIDAR*** must be performed at the manufacturer.

We do, however, recommend that certain reasonable precautions be taken when operating the unit. A person should not stare directly into the lens for an extended time, especially at close distances.

CAUTION – The use of optical instruments with this product will increase eye hazard. Therefore do not point the LIDAR at an observer using instruments such as binoculars, telescopes, or cameras.

OPERATOR CONTROLS

REAR PANEL DISPLAY



REAR PANEL DISPLAY FUNCTIONS

RANGE: The right, four-digit LCD window is the range window. This window displays the range of the last target measured in feet (or meters for metric operation).

SPEED: The left, three-digit LCD window is the speed window. The speed window displays the target speed in **MPH** (**KPH** for metric operation). The "sign" character in the left side of the speed window indicates target direction. A "+" indicates the target is approaching, while a "–" indicates the target is receding.

PWR: The **PWR** icon indicates that the unit is on.

XMIT: The **XMIT** icon indicates that ***STALKER*** ***LIDAR*** is transmitting.

TEST: The **TEST** icon indicates that a self-test sequence is in process.

The icon is used to adjust the volume up or down. One bar indicates "off" and four bars indicate loudest.

FAIL: The **FAIL** icon indicates that a circuit malfunction has been detected, in which case speed readings are inhibited and the unit should be removed from service and

repaired. **FAIL** will remain in the LCD along with an error code until reset by being powered off.

Lo V: The **LoV** icon illuminates when the battery voltage is too low. Operation is inhibited while this icon is displayed, but normal operation will resume automatically when the input voltage is restored to a normal voltage.

RFI: The **RFI** icon indicates the presence of an interfering signal. Operation is inhibited during an **RFI** indication. Normal operation will resume automatically when the RFI condition ceases.

KPH: The **KPH** icon indicates that the unit is measuring using kilometers.

T/D: The **T/D** icon indicates that Time/Distance mode is selected.

MAX: The **MAX** icon indicates when maximum range is shown. When **MAX** is shown on the LCD, the current maximum range can be updated by aiming at the new target and pressing the trigger, or incremented and decremented with the **MAX** and **MIN** keys.

MIN: The **MIN** icon indicates when the minimum range is shown. When **MIN** is shown on the LCD, the current minimum range can be incremented and decremented with the **MAX** and **MIN** keys.

KEYBOARD FUNCTIONS

▲ │ MAX: The **▲ │ MAX** key is used to display/update the maximum range for Time/Distance mode. Press the **▲ │ MAX** key to light the **MAX** icon. When the **MAX** icon is on, the current maximum range will appear in the distance window, and a new distance can be updated by aiming and pressing the trigger.

The **▲ │ MAX** key is also used to increment the setting while in the Alarm Speed, Max Distance, or Min Distance set modes.

MIN │ ▼: The **MIN │ ▼** key is used to display/update the minimum range for Time/Distance mode. Press the **MIN │ ▼** key to light the **MIN** icon. When the **MIN** icon is on, the current minimum range will appear in the distance window, and a new distance can be updated by aiming and pressing the trigger.

The **MIN │ ▼** key is also used to decrement the setting while in the Alarm Speed, Max Distance, or Min Distance set modes.

MENU │ T / D: The **MENU T / D** key is a dual-function key. It is used to enter the User Menu and to select Time/Distance mode.

A short press of the **MENU T / D** key will enter the User Menu and step between parameters within the User Menu. A long key press will exit the User Menu and return to normal operation.

During normal operation, a long key press of the **MENU T / D** key will toggle Time/Distance on and off.

HUD LIGHT: The **HUD LIGHT** key toggles the HUD intensity from low to high through six levels when pressed. The first key depression displays the current intensity. Subsequent depressions toggle the intensity from **1** (lowest intensity) through **6** (highest intensity), then back to **1**.

SPEED/RANGE: The **SPEED/RANGE** key is used to select Tracking mode, Single Shot mode, Inclement Weather mode, and to toggle between SPEED only display, RANGE only display, and simultaneous SPEED and RANGE display. The current mode is indicated by " - - - - " or " - - **SS**" in the SPEED or RANGE windows.

Pressing and holding the **SPEED/RANGE** key for two seconds will cause the unit to enter the Inclement Weather mode. Press the **SPEED/RANGE** key to exit Inclement Weather mode, MAX/MIN set mode, or TIME/DIST mode.

PANEL LIGHT: The **PANEL LIGHT** key toggles both the LCD backlight and the keyboard backlight on and off.

AUDIO: The **AUDIO** key is used to adjust the volume of the speaker from low to high in four steps. The number of speaker bars changes (one bar to four bars) to indicate the setting. One bar turns off the Target Speed Tone but leaves other tones enabled at low volume.

TEST: The **TEST** key performs a complete self-test, including verification of crystal accuracy. A "happy tone" and the message **PASS** on the LCD Range display are used to indicate successful completion.

PWR: The **PWR** key is the main On/Off power switch.

AUDIBLE INDICATORS

Self-Test tones - A 4-beep "happy" tone indicates the successful completion of a self-test operation. A failure is indicated by a repeating beep code consisting of one to eighteen beeps. The self-test operation is explained in the **TESTING THE *STALKER* LIDAR** section.

HUD FEATURES

The Heads Up Display (HUD) is the viewfinder on the top of the LIDAR gun. It is used to sight the desired target in LIDAR mode. The alignment of the HUD is verified in Sight Alignment Mode by panning past test targets while listening to the sight tone. See the **TESTING THE *STALKER* LIDAR** section for a full description of these modes.

TARGET RETICULE: The target reticule consists of a red spot in the middle of the HUD viewfinder. This reticule approximates the size of the transmitted beam and is used for targeting

TARGET RANGE: The upper, four-digit LED that appears in the HUD window. This window displays the same distance information that appears in the Rear Display's Range field unless tenth's range display is selected, in which case whole-number range will be shown on the HUD and tenth's on the Rear Display.

TARGET SPEED: The lower, three-digit LED that appears in the HUD window. This window displays the same speed information that appears in the Rear Display's Speed field. The "sign" character in the left side of the speed window indicates target direction. A "+" indicates the target is approaching while a "–" indicates the target is receding.

HUD SWITCH: As described in the previous Keyboard Functions section, this switch allows the HUD LED brightness to be adjusted through six levels from **1** (lowest intensity) to **6** (highest intensity).

TESTING THE *STALKER* LIDAR

The following tests check for proper display, aiming, calibration, and computations in the ***STALKER*** ***LIDAR***.

POWER-ON SELF TEST

A complete self-test is performed at power-on. The unit goes through a self-test sequence and displays 10 20, 1500 250, 2000 1000, then displays the LIDAR unit's serial number, for example: Ld07 9229. Successful completion of self-test is indicated by the display of **PASS** and an audio "happy" tone. Self-test fail is indicated by a repeating beep code consisting of one to eighteen beeps. If the unit fails upon power-on, please listen and note the number of beeps (one to eighteen). The unit should be taken out of service and the factory should be contacted for further instructions.

MANUAL SELF-TEST

A self-test can be run at any time by pressing the **TEST** key. Successful completion of self-test is indicated by the display of **PASS** and an audio "happy" tone. If the test is unsuccessful, the **FAIL** icon appears instead.

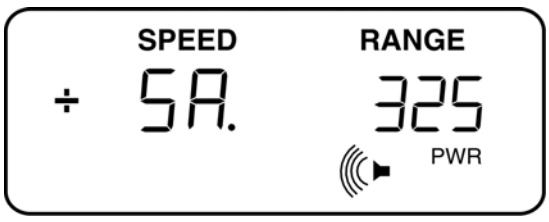
NOTE: If the **FAIL** icon appears in the Display Window of your ***STALKER*** ***LIDAR***, the unit must be turned OFF and then back ON to reset the FAIL mode.

SIGHT ALIGNMENT TEST

This test is designed to ensure the operator that the light beam of the LIDAR is aligned properly with the Red Dot in the HUD. If the HUD alignment is not correct, it will cause improper sighting of targets and will produce difficulty in tracking vehicles resulting in display error messages. We suggest this test be performed before each shift or at the beginning of the day. Some departments may want to perform this test at the end of operations as well, much like the tuning fork test for radar.

To perform this test, follow these simple instructions:

1. To enter Sight Alignment Mode, press the **TEST** key and release while holding the trigger. **SA** appears in the Speed Display Window indicating Sight Alignment mode. You now can pan the unit across a test target, such as a sign. A tone sounds when the unit has the target in sight and recognizes it. Verify that the target dot is symmetric with the target both horizontally and vertically.
2. Select a vertical pole or sign at some distance away. (At least 100 feet away)
3. Aim the Red Dot directly at the pole or sign and press the trigger to transmit. A distance reading should appear.
4. Continue to press the trigger and <u>slowly</u> move the Red Dot across the pole. You will hear an audio tone.
5. As the Red Dot goes off the target, the distance reading should disappear and the audio tone will stop. This checks the horizontal alignment.
6. Slowly move the Red Dot from the right to left and left to right. Again the distance should disappear and the audio will stop whenever the Red Dot is off the target.



7. When targeting a sign, go from top to bottom and bottom to top to check the vertical alignment. When targeting a pole, simply rotate the LIDAR 90 degrees and move from side to side again.

Note: You may notice that the audio tone continues briefly after the Red Dot moves past the pole or sign. Remember that the beam gets wider as distance is increased. The Audio tone gives you an indication of the beam width at the target distance.

DISTANCE TEST

1. Locate two known distances in a convenient location; i.e., to a sign and to a pole.
2. Mark an "x" on the pavement where the officer should stand with the ***STALKER LIDAR***. Measure each of the two distances from the "x". Make sure one distance is greater than the other, i.e. 150 feet (to sign) and 200 feet (to pole).
3. Set the ***STALKER LIDAR*** to range mode. Obtain a reading to each known distance and verify the ***STALKER LIDAR*** is reading the measured distance within specification.

Accurate distance measurement insures the operator that the unit is operating properly and will display both accurate distance and speed readings. The LIDAR actually computes the known distance by timing the time of flight of the transmitted and received light pulses.

KNOWN SPEED TEST

Testing the ***STALKER LIDAR*** using a target traveling at a known speed further serves as verification of accuracy.

This test can be performed several ways:

1. Test using a ***STALKER LIDAR*** and ***STALKER*** Radar at the same time. The speed of a moving vehicle can be checked with both the Lidar and the Radar operating simultaneously.
2. Have a patrol vehicle drive at a constant speed directly towards (or away) from the LIDAR while the driver of the target vehicle verifies the speed using either a radio or cell phone.
3. Although the LIDAR should only be operated while stationary, it is possible to obtain a speed reading from a moving vehicle while driving the vehicle and aiming the LIDAR at a stationary object. The object needs to be directly in front of the patrol vehicle so the cosine effect does not effect the readings. Since the LIDAR is looking through the windshield, the range will be very short. Verify the speed on the LIDAR against the vehicle's speedometer.

STALKER LIDAR SETUP

The **STALKER LIDAR** offers a number of user-configurable settings that are accessed through the **User Setup Menu**.

USER SETUP MENU

To access the **User Setup Menu**:

1. Briefly press the **MENU | T/D** key. Subsequent short presses cycle through the 6-item User Setup Menu.
2. Exit by pressing and holding the **MENU | T/D** key.

While in the User Setup mode, the ▲ & ▼keys are used to cycle possible choices for each menu item.

USER SETUP MENU VALUES

The table below describes the parameters that can be set according to the user's preference. The factory default for each setting is indicated by the bold underlined setting.

Menu Step	Description	Speed Display	Range Display (**bold** indicates factory default)
1	Speed decimal or units display	SPd	0.1, **1**
2	Distance decimal or units display	dIS	0.1, **1**
3	Serial Port Format	For	For **0**, 1, 2, 3, 4, 5, 6
4	Baud Rate	bAU	3, 6, 12, 24, 48, **96**, 192, 384
5	Alarm Speed	ASPd	**60**
6	Printer Time & Date	Pt-d	

OPERATING THE STALKER LIDAR

OPERATING LOCATION

In choosing an operating location it is important to keep the following in mind.

1. Officer safety. LIDAR devices are usually utilized in areas of high traffic density where radar cannot be utilized. Selecting an area where the officer is safe and vehicles can be stopped, out of harms way, is an important consideration.
2. Clear line of sight to the targeted traffic. Make sure there are no obstacles such as trees, signs, and telephone poles between the LIDAR and the traffic.
3. If working from the patrol car, locate the vehicle where the LIDAR can be used through an open side window.
4. Greater sensitivity can be achieved by monitoring traffic traveling away from (rather than towards) the LIDAR. This type of operation, however, usually will require more than one officer.

GENERAL FUNCTIONING OF THE LIDAR

Several operating and setup modes are available with the ***STALKER LIDAR*** to provide versatility of use. The modes and their uses are described in the next section, **MODES AVAILABLE IN THE LIDAR**. The LIDAR provides several features to make it easier to use. A back light feature is accessible by pressing the **PANEL LIGHT** key. This key lights both the rear LCD display and the keyboard for use at night. The **HUD LIGHT** key provides adjustment of the LED intensity of the HUD display characters. The **AUDIO** key provides adjustment of the speaker volume for use in a variety of surroundings. Every 10 minutes, the internal microprocessor automatically runs a self-test on all critical components. For more information on the self-test, see the section **TESTING THE *STALKER Lidar***. To prolong battery life, the microprocessor automatically goes into a low power mode 10 seconds after release of the trigger or last key depression. During low power mode, all signal processing, back lighting, and the display of HUD digits are temporarily turned off. Only the rear panel LCD and the HUD's Red Dot remain on.

MODES AVAILABLE IN THE LIDAR

STALKER Lidar has three operating modes available (Tracking mode, Single Shot mode, and Time/Distance mode), three setup modes (Speed Alert Set Mode, Minimum mode, and Maximum mode), and one test mode (Sight Alignment mode). For the two Lidar measurement modes (Tracking mode and Single Shot mode), Inclement Weather mode can be selected (or not selected) depending on operating conditions. The operating mode chosen depends on the purpose of the gun, as well as the needs of your department.

TRACKING MODE - Tracking mode continuously tracks a moving target as long as the trigger is pressed, using LIDAR technology.

SINGLE SHOT MODE - When the trigger is pressed, Single Shot mode tracks a moving target for a fraction of a second and then "LOCKS" the target speed (indicated by a BEEP) using LIDAR technology. Tracking history may be obtained in Single Shot mode by taking multiple readings of a single target.

TIME DISTANCE MODE - Time/Distance mode allows you to enter a minimum and a maximum distance, then determine the average speed of a vehicle by clocking the amount of time it takes for the vehicle to travel between these two points. Since both Maximum and Minimum Modes are used in conjunction with Time/Distance Mode, these two setup modes are explained in the **ENTERING DISTANCE FOR TIME/DISTANCE** section.

INCLEMENT WEATHER MODE - The Inclement Weather Mode feature allows ***STALKER Lidar*** to track through interfering weather phenomena such as fog, snow, and rain which would otherwise cause ***STALKER Lidar*** to attempt to process reflections from the weather phenomena as targets, preventing processing of the intended target. This mode works by inhibiting processing of any target closer than approximately 250 feet. Reflections from weather phenomena beyond 250 feet are normally too weak to cause interference. All ***STALKER LIDAR*** units manufactured with SN 70400 and higher contain the Inclement Weather Mode feature.

TO PLACE THE LIDAR INTO OPERATION:

The ***STALKER LIDAR*** features snap-in/snap-out handles. It can be powered by either a rechargeable battery handle or a coiled cigarette plug handle. Choose which handle/power source you want to use and insert in the bottom of the unit. Be sure to check and make sure the handle is "locked" into place.

To use the ***STALKER LIDAR*** in either Tracking mode or Single Shot mode:

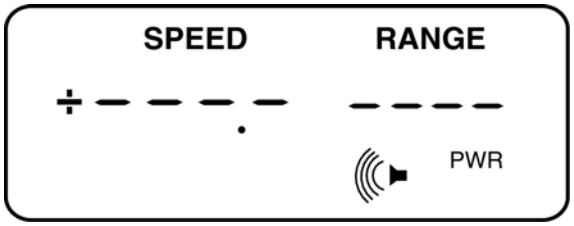
1. Power the unit on by pressing the "**PWR**" key. The unit will go through a Power-On Self Test followed by a "happy" tone. It will display **PASS**. The LCD backlight will "light" and then turn off in approximately ten seconds unless the trigger is depressed. The unit is still on and operational. The unit will power on in either Tracking mode, Single Shot mode, or Time/Distance mode, whichever was last selected.

2. The "**TEST**" key can be pressed at anytime to initiate a Manual Self-Test.
3. Choose the level of audio. During Tracking mode, the exclusive Target Speed Tone in the ***STALKER LIDAR*** will be heard when a target is being successfully tracked, just like Doppler audio in radar. There will be a higher pitch as the speed increases and a lower pitch as the speed decreases. The ***STALKER LIDAR*** also has a Target Return Tone. This helps the operator properly aim the LIDAR. No Target Return Tone is heard when the beam is off the target. Tone repetition increases as the beam strikes the Target and signal quality increases. Once a target speed is acquired, the Target Speed Tone overrides the Target Return Tone.
4. Press the **SPEED/RANGE** key to select one of the six possible settings for either Tracking mode or Single Shot mode: SPEED only display, RANGE only display, or simultaneous SPEED and RANGE display. See the next two Operator Manual sections, to further clarify these settings.
5. Adjust the HUD brightness to user preference using the "**HUD LIGHT**" key. Normally set the HUD light to 6 for daylight usage.
6. Select Inclement Weather mode if weather conditions or other operating conditions demand it.
7. While the unit is powered on, the Red HUD Dot allows target selection prior to transmitting.
8. Once the target is selected, squeeze the trigger to transmit. To "lock" a target in Tracking mode, simply release the trigger. To "lock" a target in Single Shot mode, simply press the trigger and wait a moment for the BEEP. The "locked" LCD display will stay on until the trigger is squeezed again. The "locked" HUD display will clear in 10 seconds.
9. Because of the HUD Optical Eye Relief, the operator should position his eye near the HUD to insure that he can see the Distance Display (top numbers), the Red Dot, and the Speed Display (bottom numbers). By moving one's head (or the LIDAR) away from this optimum position, the operator may not be able to see all of the HUD display. Once the operator is familiar with the HUD operation, eye position is not a problem.

Note: Operating the ***STALKER LIDAR*** when trying to read targets at a long distance, you may see a distance reading before you see a speed reading. You will also hear the Target Return Tone. No tone indicates the beam is off target or too weak to produce a signal. A slow beeping tone indicates a weak signal. As the signal increases in strength, the beeping tone repetition increases. This indicates correct targeting and the LIDAR has been able to make a distance calculation, but has not received a strong enough signal or the proper validation data to display speed. Continue to track the target and a speed reading should display momentarily.

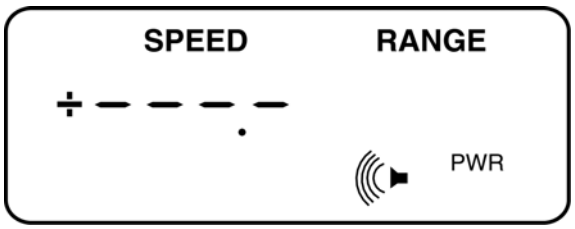
OPERATING IN TRACKING MODE

Tracking Mode uses LIDAR technology to track objects. When in this mode, it is important to get a clear shot at the desired vehicle so that you can track it for several seconds. For best performance, it is recommended that the unit be used through an open window of the vehicle or outside of the vehicle using a tripod.

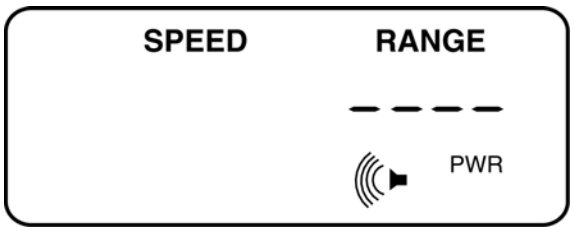


The unit will power on in either: Tracking mode, Single Shot mode, or Time/Distance mode; whichever was last selected. To enter Tracking Mode when the unit is another mode, press the **SPEED/RANGE** key. The current mode settings are now displayed:

(" **- - - -** " or " **- SS -**" appear in the Speed and Range fields).



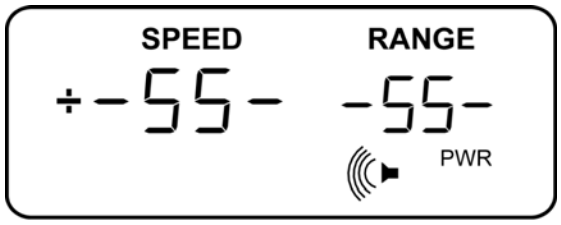
Press the **SPEED/RANGE** key to move between Tracking mode and Single Shot mode and to select Speed-only, Range-only, or simultaneous Speed and Range. The three settings using " **- - - -** " indicate Tracking mode. The three settings using " **- SS -**" indicate Single Shot mode.



Depending on how your unit is configured at the factory, tracking a vehicle in Tracking mode is performed by either:

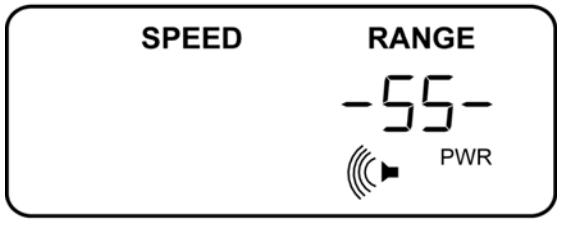
1. Pressing and holding the trigger down for constant transmitting (normal factory setting), or by
2. Pressing the trigger to indicate the beginning and pressing again to end transmitting (optional factory setting).

OPERATING IN SINGLE SHOT MODE



Single Shot mode uses LIDAR technology to track a moving target for a fraction of a second and then "LOCKS" the speed (indicated by a BEEP).

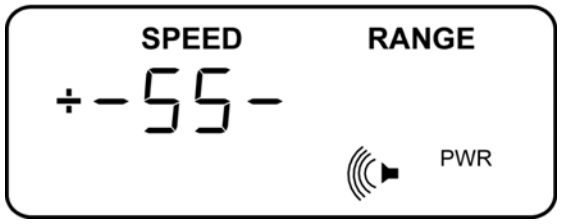
The unit will power on in either: Tracking mode, Single Shot mode, or Time/Distance mode; whichever was last selected. To enter Tracking Mode when the unit is another mode, press the **SPEED/RANGE** key. The current mode settings are now displayed:



(" **- - - -** " or " **- SS -**" appear in the Speed and Range fields).

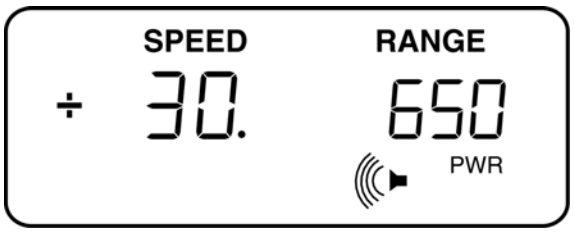
Press the **SPEED/RANGE** key to move between Tracking mode and Single Shot mode and to select Speed-only, Range-only, or simultaneous Speed and Range. The three settings using " **- - - -** " indicate Tracking mode. The three settings using " **- SS -**" indicate Single Shot mode.

When using Single Shot mode, it is important to steady the unit to minimize the shot interval. The shot interval can be as short as 1/3 second (if the return signal is strong and uninterrupted) or as long as several seconds (for a weak or interrupted signal).



LIDAR Example:
A Patrol vehicle is parked in a residential area, monitoring traffic in a school zone. A vehicle enters the school zone.

Point the LIDAR at the vehicle and pull the trigger.



The speed of the vehicle, 30 mph, appears in the Speed field on the LCD display as well as the HUD LED display. The speed remains on the display once transmitting has ended. In addition, the Range, which in this example is 650 feet, is displayed on both the LCD display and in the HUD.

There is no need to clear the speed and range of a vehicle from the display before tracking the next vehicle.

OPERATING IN TIME/DISTANCE MODE

The Time/Distance Mode allows the Operator to determine the average speed of a vehicle as the vehicle passes between two specified points. Once a distance is entered into the ***STALKER LIDAR***, the time it takes a vehicle to pass through this distance is entered by separate trigger depressions which start and stop the timing clock. The LIDAR calculates speed by measuring how much time it takes the vehicle to pass through the pre-set distance and then calculates and displays the speed in MPH or KPH.

Example: 1 mile of distance over 60 seconds of time = 60 mph
½ mile of distance over 30 seconds of time = 60 mph
1 mile of distance over 40 seconds of time = 90 mph

The formula is: $\text{Speed} = \frac{\text{Distance (in feet)}}{\text{Time (in seconds)}}$

This results in speed in "feet-per-second". To easily convert this speed (fps) into (mph), there is a 1.47 conversion factor that can be used. Dividing fps by the 1.47 conversion factor will provide speed in miles per hour.

No hard and fast rule can be established concerning the minimum distance over which a vehicle should be monitored. However, several factors enter into the equation which does establish the fact, that the farther the distance, the less the chance of impact of an error. Three factors that can influence the calculation include:

1. Human error in activating start/stop
2. The distance measured
3. The speed of the vehicle

Human error can occur by the operator not pressing the start/stop trigger at the precise time and place that the vehicle passes the points entered into the LIDAR.

If too short of distance is entered, it increases the chance for error. We recommend a minimum of 300-600 feet.

The greater the speed, the longer the measurement distance should be to reduce the possibility of an error. For example, if you are mostly measuring high speeds you should measure using a longer distance than if measuring slow speeds.

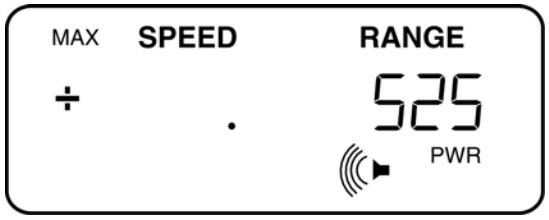
ENTERING DISTANCE FOR TIME/DISTANCE

There are two methods that can be used for entering distances into the ***STALKER LIDAR***. This information is entered by using the Maximum and Minimum Mode Keys on the LIDAR.

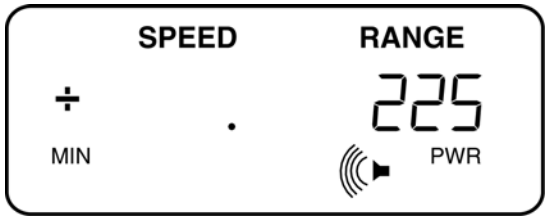
First, it is important to remember that the LIDAR makes its calculation based upon the "difference' between the two distances entered. One method of entering distance is to measure the distance with the LIDAR.

To measure and enter distance, follow these steps:

1. Power on the LIDAR
2. Briefly press the ▲ | **MAX** key. The **MAX** icon appears in the display window. If a number appears in the Range display, this would be the last **MAX** distance entered. To enter a new distance, aim at your new target where you want to have your maximum range and press the trigger. The new distance should appear (i.e. as example 525). This distance is now in memory until a new distance is entered.



3. Press the **SPEED/RANGE** key to exit Maximum Mode.
4. Press the **MIN** | ▼ Key. The **MIN** icon appears in the display window. If a number appears in the Range display, this would be the last **MIN** distance entered. To enter a new distance, aim at your new target where you want to have your minimum range and press the trigger. The distance should appear (i.e. 225). This distance is now in memory until a new distance is entered.



5. Press the **SPEED/RANGE** Key to exit Minimum Mode.

USING TIME/DISTANCE MODE

Once the maximum and minimum values are set, the Time/Distance feature can be used.

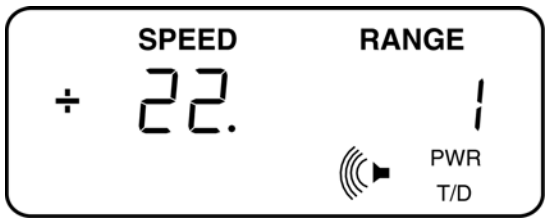
Press and hold the **MENU** | **T / D** key to enter Time/Distance mode.

When a vehicle passes the first measurement point, press the trigger and release. The incrementing elapsed time (.1 second intervals) is shown in the display window and 1 second intervals in the HUD.

When the vehicle passes the second measurement point, press and release the trigger again. Now the speed of the vehicle is displayed in the SPEED window and the total time is displayed in the RANGE window.

Time/Distance Example: A Patrol vehicle is parked in a residential area, monitoring traffic in a school zone. The maximum and minimum points to be used in this example are the school zone signs that demarcate the beginning and end of the zone. Using the Maximum and Minimum Modes, set the maximum and minimum range values.

A vehicle going 22 mph enters the school zone and passes the first school zone sign, press the trigger and release. When the vehicle passes the second school zone sign, press the trigger again. The average speed of the vehicle in the school zone, 22 mph, is displayed in the SPEED field. The total time is displayed in the RANGEe field.



The distance between the Maximum Distance and Minimum Distance is 525 minus 225 = 300 ft. (meters). Because the LIDAR is only calculating the distance (300 ft.) between the two points the clock can be started from either point or target where you got your distance. Care must be taken when entering the distances that you take both measurements from the exact same spot and in as straight a line as possible and as close to the roadway as possible.

The second method of entering the distances requires that you already know the exact distance between the two measurement points. Enter these distances using the ▲ │**MAX** key and **MIN** │ ▼ key as follows:

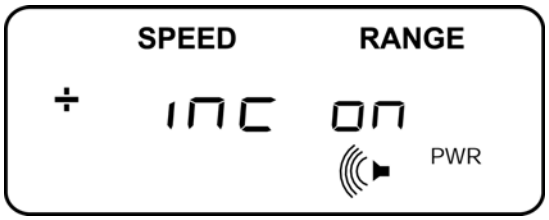
1. Power on the LIDAR.
2. Briefly press the ▲ │**MAX** key, the **MAX** icon appears in the display window. To enter a number, press the ▲ │**MAX** key to increment up or press the **MIN** │ ▼ key to increment down. By continually holding either key down for approximately 2 seconds, the numbers will increment faster.
3. Once the desired range is reached, press the **SPEED/RANGE** key to save this distance and exit the maximum mode.
4. Press the **MIN** │ ▼ key, the **MIN** icon appears in the display window. Repeat the above instructions.
5. Once the desired range is reached, press the **SPEED/RANGE** key to save this distance and exit the minimum mode.

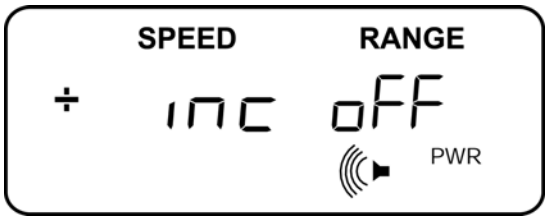
INCLEMENT WEATHER MODE OPERATION

The Inclement Weather Mode feature allows ***STALKER LIDAR*** to track through interfering weather phenomena such as fog, snow, and rain which would otherwise cause ***STALKER LIDAR*** to attempt to process reflections from the weather phenomena as targets, preventing processing of the intended target. This mode works by inhibiting processing of any target closer than approximately 250 feet. Reflections from weather phenomena beyond 250 feet are normally too weak to cause interference.

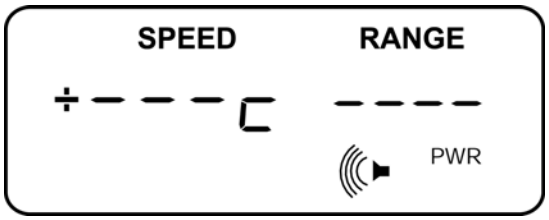
SELECTING INCLEMENT WEATHER MODE

Inclement Weather Mode is selected by pressing and holding the **SPEED/RANGE** key until a second beep is heard. This will toggle the Inclement Weather Mode on and off, and the display will indicate the selected mode by showing "**+ inc on**" or "**+ inc oFF**" as shown in the figures on the right.

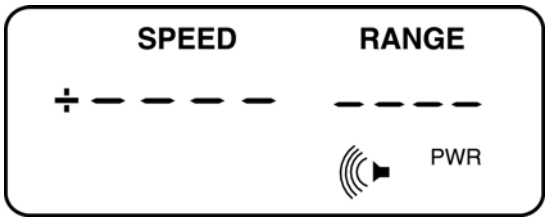




Whenever Inclement Weather Mode is selected, a letter "**c**" will be shown at the end of the SPEED display as shown on the right.



Whenever Inclement Weather Mode is deselected, the end of the SPEED display will be blank or a "**-**" will be shown.



DISPLAY MESSAGES

EXX: (Where XX is an error number) This message indicates that an error has occurred. Below are the definitions for error messages that can appear on the ***STALKER LIDAR'S*** display.

NOTE: If the message number received is not listed below, then the message is a combination of two errors. For example, if the error message is E-03, this indicates that both errors 1 and 2 exist.

The following is a list of errors and their meaning:

E01 = laser high voltage pulse error

E02 = APD bias voltage error

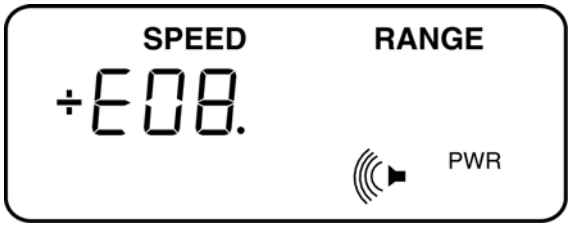
E04 = Jamming signal detected

E08 = Sweep error detected

E16 = Insufficient signal quality

E24 = Combination of E08 and E16

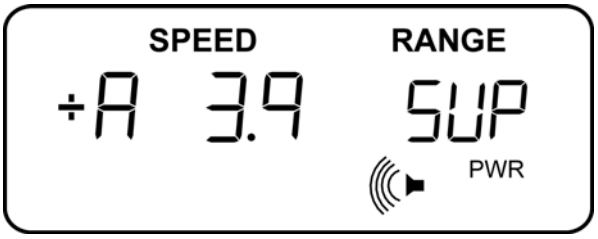
E33 = Invalid Time/Distance combination



DISPLAY VERSION NUMBER

To determine the version of the software used in your unit, power the LIDAR on by momentarily pressing the **PWR** key while holding down the **TEST** key until the unit beeps.

The version number appears in the Speed field, and the code **SUP** (for Setup), appears in the Range field. Press the trigger to return to LIDAR mode.



SPEED ALARM SET MODE

Speed Alarm Mode may be used to activate a signal when a targeted vehicle exceeds a specified speed. This mode may only be used when the signal is attached to an external alarm mechanism through the I/O connector.

Speed Alarm Set Mode is accessed by briefly pressing the **MENU** | **T / D** key to enter the User Menu.Press the **MENU** | **T / D** key an additional five times to cycle to the Speed Alarm Set Mode. Use the ▲ | **MAX** and **MIN** | ▼ keys to increase or decrease the speed that will set off the alarm.

Once the desired speed is set, press and hold the **MENU** | **T / D** key to save this speed and exit Alarm Speed Set Mode.

I/O PORT

STALKER LIDAR has a 6-pin RS-232 serial port (bi-directional). Signals are:

Signal	Pin

Transmit data	1
External alarm	2
receive data	3
External trigger	4
Switched battery voltage	5
Ground	6

INTERFERENCE SOURCES AND REMEDIES

A variety of sources, both natural and man-made, can cause misleading indications or poor performance. The operator should note the symptoms described below, and take steps to avoid the problem, or ignore the misleading indications.

TERRAIN

LIDAR signals will not pass through most solid objects, including sign posts, power lines, or tree foliage. Make certain the path between the LIDAR and target vehicle is unobstructed. Successful speed measurements require uninterrupted visual tracking of the target. A glass window is a partial reflector of LIDAR; therefore, some reduction in range will be experienced when aiming through vehicle windows, and/or the glass may be recognized as a target.

RAIN

Rain absorbs and scatters the LIDAR signal. This reduces the range and increases the possibility of obtaining readings from the speed of the raindrops.

ELECTRICAL NOISE

Electrical noise sources include neon signs, radio transmitters, power lines, and transformers. These influences may cause reduced range or intermittent readings. When electrical noise interference is present, the RFI indicator should come on and suppress all readings.

VEHICLE IGNITION NOISE

An extremely noisy vehicle electrical system may cause erratic operation. If this condition occurs, it is recommended that a two conductor shielded cable be run directly from the vehicle battery to the cigarette lighter plug on the dash. This should eliminate any problems from vehicle electrical noise.

REQUIRED MAINTENANCE

Other than periodic cleaning, no user maintenance is required on the **STALKER LIDAR**. However, if any problems are experienced during testing procedures or normal operation, the unit should be taken immediately to your department's LIDAR specialist to determine the extent of the problem. If a malfunction has occurred, the unit will require servicing. Since there are no user serviceable parts inside the **STALKER LIDAR**, only the manufacturer can service the **STALKER LIDAR**. Servicing by untrained personnel can result in exposure to high voltage and potentially hazardous laser radiation as well as affecting overall performance. Normal care should be taken by the user in handling the **STALKER LIDAR** to preserve the life and usefulness of the equipment.

OPTICAL SURFACES

All of **STALKER LIDAR's** optical surfaces have optical coatings and care should be taken to protect these surfaces from scratches or damage, which can reduce effective range and ease of use. In particular, the front lens surfaces should be clean and dry.

All optical surfaces may be cleaned in the following manner:

1. Place a few drops of either pure alcohol or lens cleaning solution on either a lint-free cotton cloth or a lens cleaning tissue. These cleaning materials are inexpensive and are readily available at retail photographic supply stores. Never use items harmful to the coated optical surfaces (e.g., paper towels, abrasive cleaners, household "glass" cleaners, or sharp instruments).
2. Gently wipe the surface using a circular motion.
3. Repeat using a clean portion of the cloth or new tissue, until the surface is free of contamination.

TROUBLESHOOTING

PWR key does not function:

- ❑ Check with two different power sources and two different handles.
- ❑ If using a battery handle, make sure it is charged
- ❑ If a cigarette plug handle is available, make sure receptacle is clean and the cigarette plug fits snugly
- ❑ Check the fuse in the cigarette plug

Low or no speaker volume:

- ❑ Check to insure that the volume control setting is not in the "OFF" position.

LIDAR has short range:

- ❑ Check the HUD alignment. Refer to the **SIGHT ALIGNMENT TEST** section.
- ❑ Contact the factory.

NOTE: Vehicles with missing or dirty license plates, different color vehicles, poor weather conditions, etc. can all affect the sensitivity of the LIDAR resulting in short range. Try the LIDAR in different vehicles and perhaps different weather conditions.

STALKER LIDAR includes extensive self-test routines at power-on and operator-initiated using the **TEST** key. A self-test failure will be indicated by one of two types of error codes.

1. During the power-on self test, all failures are indicated by a beep code which repeats until the unit is powered off. The number of beeps between pauses indicates the type of failure.

2. During the other test modes, a failure is indicated by an error code on the LCD rear panel display. The form of the error code is EXX, where XX will be a two-digit number.

For either error, make a note of the indicated error code and contact the factory for assistance.

CASE LAW

Police Traffic LIDAR was first utilized in 1989. The first documented court cases soon followed, however there is very little case law yet established pertaining to LIDAR. Legal precedence has clearly been established for Radar devices in regards to its accuracy and admissibility as evidence. Many of the same principles used for Radar can and should be applied in LIDAR cases.

First, the court must recognize that a LIDAR is a scientific instrument used to measure speed. This has been established in several courts and is actually upheld every day in courts throughout the world when they accept the LIDAR Speed readings as evidence. This is called Judicial notice, which is a principle of law. This principle applies to facts that are common knowledge and once established states that it is not necessary to introduce evidence to prove what is already common knowledge. The scientific principle used in LIDAR is common knowledge. These principles are such basic concepts as the speed of light (186, 282 miles per second), and the time/distance formula for calculating speed, (S= D/T).

Secondly, operator qualifications were established in a landmark Radar case, Honeycutt vs. The Commonwealth of Kentucky. This case established "that a speed measurement operator need not be able to explain the internal workings of the device." The LIDAR Operator, just like a Radar operator does not and should not have to attempt to describe the scientific principles of LIDAR.

In another landmark Radar case, State of New Jersey vs. Dantonio, it was established that a few hours of training is sufficient to qualify an operator. This landmark case can be used to establish the proper training of a LIDAR Operator.

DOCUMENTED CASES

Goldstein vs. State
Argued April 10, 1995
Ruling issued September 7, 1995
September Team, 1994, #94
Maryland Court of Appeals

City of Dayton vs. Robert Kane
September 23, 1991
Municipal Court of Dayton, Ohio

State of Louisiana vs. Mark A. Marcelle, Sr.
September 1991
Nineteenth Judicial District Court
Parish of East Baton Rouge
State of Louisiana, Section 1
Judge Freddie Pitcher, Jr.

Layton City vs. Brandon Shane Barber
January 1992
Second Circuit Court
State of Utah
Davis County
Layton Department
Judge K. Roger Bean

COURTROOM TESTIMONY

Evidence obtained on LIDAR speed measurement devices, just like radar, is only as good as the Officer's testimony.

We recommend that the Officer (Operator) be prepared to testify to the following points:

1. The operator has adequate qualifications and training on the LIDAR device.
2. The time, place and location of the LIDAR device at the time the offense occurred.

3. The location of the offending vehicle at the time the offense occurred and the speed limit that was in force at that location.
4. The identification of the offending person as the operator of the vehicle.
5. The identification of the offending person's vehicle.
6. The visual observation of the violator's apparent excessive speed and the speed you estimated it was traveling.
7. The LIDAR device was verified and tested per departmental procedures.
8. The LIDAR was operating properly and working normally within the operational range for the device at the time the speed measurement was obtained and that the speed measurement was reasonably close to your estimate.
9. That you established a tracking history on the vehicle before you "locked' the speed and made your final determination that the defendant's vehicle was in fact the vehicle the LIDAR was tracking.

LIDAR TRACKING HISTORY

While many police agencies and others in the industry may believe traffic LIDAR solves all the problems of target identification and tracking history, it is still imperative the operator build a solid case. Proof beyond a reasonable doubt begins with testing the LIDAR before, during and after operation and establishing a complete tracking history of the violator's vehicle. A complete tracking history using LIDAR is very important and much like radar. The ***STALKER LIDAR*** is a continuous tracking LIDAR with simultaneous speed, distance display, speed correlated Target Speed Tone, and a Target Return Tone. These features help the operator gain a complete tracking history.

A complete tracking history using the ***STALKER LIDAR*** is as follows:

Visual Observation

- Identify the target.
- Estimate the speed of the target.
- Confirm the target is in operating range of the LIDAR.
- Check the surrounding area and environment.

LIDAR Verification

- Properly aim and sight in the target, making sure the Red Dot is on the vehicle you observed. Hold the Red Dot on the same area of the vehicle.
- Hold down on the trigger to continuously track the vehicle.
- Track the vehicle until a stable reading is obtained and it matches your visual observation and estimation for both speed and distance.

Target Return Tone

- Listen to the audio. The ***STALKER LIDAR*** has a Target Return Tone which is separate from the Target Speed Tone. This audio indicates the signal strength of the target and assists in aiming.

Target Speed Tone

- Verify that the pitch of the Target Speed Tone corresponds to the speed reading; i.e., the higher the pitch, the faster the speed; the lower the pitch, the slower the speed.

LIDAR TEST AND REVIEW

1.) LASER is an acronym for:
   a.) Light and Safety Environmental Radar
   b.) **Light Amplification by Stimulated Emission of Radiation**
   c.) Light Amplification on Sensing Energy Robots

2.) LIDAR is an acronym for:
   a.) **Light Detection and Ranging**
   b.) Laser Detection and Radar
   c.) Law Enforcement doing Arrests

3.) Police Traffic LIDAR falls into what classification of Laser:
   a.) Class of 1945
   b.) Class 6
   c.) **Class 1**

4.) LIDAR emits a narrow cone of radiation, which enables the instrument to have a:
   a.) wide beam
   b.) **narrow conical beam**
   c.) cigar shaped beam

5.) The LIDAR light pulse travels at the speed of:
   a.) **light**
   b.) sound
   c.) bullet

6.) The speed of light travels at:
   a.) 250,000 miles per minute
   b.) 1 million miles per hour
   c.) **186,000 miles per second**

7.) The best place to aim a LIDAR is at the:
   a.) driver's head
   b.) right front door
   c.) **license plate**

8.) The LIDAR emits in the infrared portion of the electromagnetic spectrum which makes the light beam:
   a.) **invisible**
   b.) visible
   c.) harmful

9). Using the LIDAR through the windshield will:
   a.) burn a hole in the windshield
   b.) cause inaccurate readings
   c.) **shorten the range of the laser**

10.) LIDAR is not affected by the cosine effect:
True or **False**

11.) To get maximum range with the LIDAR:
a.) stand on top of your patrol vehicle
b.) plug into your car and rev your engine
c.) **mount on a tripod, monopod, or rest on a secure stand**

12.) Tracking history is not necessary with a LIDAR:
True or **False**

13.) LIDAR uses the doppler frequency to determine speed:
True or **False**

14.) The LIDAR's time/distance mode keeps track of the day, time, and month:
True or **False**

15.) The LIDAR's time/distance mode is used in much the same way as VASCAR and other time/distance type devices:
True or False

16.) The LIDAR is eye safe as along as the operator wears sun glasses:
True or **False**

17.) Both the Rechargeable Battery Handles and the cigarette plug handle of the ***STALKER LIDAR*** are interchangeable with the ***STALKER ATR*** Radar:
True or False

18.) The ***STALKER LIDAR*** emits how many pulses in a second:
a.) **130**
b.) 1397
c.) 680

19.) The ***STALKER LIDAR*** is a continuous tracking LIDAR:
True or False

20.) Which of the following characteristics of the target will have an effect on the LIDAR:
a.) Color of the vehicle
b.) Finish of the vehicle (shiny, dull)
c.) The size of the vehicle
d.) **All of the above**

WARRANTY

Manufacturer warrants this LIDAR to the original purchaser to be free of defects. At its discretion, the manufacturer agrees to repair or replace all LIDAR components that fail due to defective materials or workmanship for a period of one (1) year from the date of purchase.

During the warranty period, there will be no charge for repair labor or parts. Purchaser shall return the failed unit to the factory or authorized service center, freight prepaid. The manufacturer will pay return shipping.

This warranty applies only to internal electronic components and circuitry. Warranty excludes normal wear-and-tear such as frayed cords, broken connectors, scratched or broken cases, or physical abuse. Manufacturer reserves the right to charge for defects and/or damages resulting from abuse or extraordinary environmental damage to the unit during the warranty period at rates normally charged for repairing such units not covered under warranty.

Seller warrants the LIDAR devices manufactured by Applied Concepts, Inc. are designed to perform the function of determining the speed of motor vehicles. The foregoing warranty is exclusive, in lieu of all other warranties, of quality, fitness, or merchantability, whether written, oral, or implied.

As a further limit on warranty, and as an expressed warning, the user should be aware that harmful personal contact may be made with seller's LIDAR devices in the event of violent maneuvers, collisions, or other circumstances, even though said LIDAR devices are installed and used according to instructions. Applied Concepts, Inc. specifically disclaims any liability for injury caused by the LIDAR devices in all such circumstances.

Note: We have several Factory Authorized Service Centers located throughout the country.

For the Service Center nearest you, call the factory at 1-800-***STALKER*** (1-800-782-5537).