STALKER® LIDAR XS

Compact Speed Measurement Laser

Operator's Manual

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Dear Valued LIDAR Customer:

Thank you for choosing the ***STALKER LIDAR XS*** System. We sincerely appreciate you purchasing the ***STALKER XS*** and giving us the opportunity of serving you and your department. You will find the ***LIDAR XS*** 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 XS***.

Applied Concepts, Inc. believes that the ***STALKER LIDAR XS*** offers more than superior performance and versatility. It 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 XS 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 XS 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.

The 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 XS 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 of 905 nanometers.

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 disperse 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 XS*** 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 XS*** 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. The ***STALKER LIDAR XS*** 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 are the number of waves or cycles that occur in one second. With laser it is more convenient to look at its 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 XS*** 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 XS 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 XS operation is achieved.

The beamwidth of the ***STALKER LIDAR XS*** 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 XS*** 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 XS** 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 XS** 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 XS unit, it starts a timer and allows the LIDAR XS 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 XS 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 XS 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 XS** 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 XS** 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 XS** measures the round-trip time of flight of the LIDAR XS 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 XS** 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 XS** 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 XS** 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 XS 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 XS 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 XS gives a speed reading of zero. On the other hand, if the trailer is stationary but the LIDAR XS is smoothly rotated so that the beam sweeps along the flat surface, the LIDAR XS 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 XS 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 XS 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 XS** 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 XS** 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 XS** 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 XS beam and by obtaining a proper tracking history. Using Tracking mode, **STALKER LIDAR XS** 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 XS** 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 XS** 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 XS beam interacts with the environment but with greatly different results than a radar beam. The LIDAR XS beam will reflect very easily off almost any object, therefore the beam will reflect back to the LIDAR XS 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 XS. These obstacles would not cause an incorrect reading but would either stop the LIDAR XS 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 XS beam directly back to the LIDAR XS unit. This could either prevent readings or readings at shorter distances. We suggest that the LIDAR XS beam be aimed low on the vehicle, at the grill and front license plate area. The license plate is almost a perfect LIDAR XS reflector and targeting it should produce the best results. Vehicles without license plates will result in the LIDAR XS having shorter effective range. The shape and color of the vehicle can have an effect on the LIDAR XS. A light colored vehicle will produce a better return signal than a dark colored vehicle.

LIDAR XS devices may be operated both in daylight and nighttime; however care at night must be taken. In daylight, the operator can see the entire 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 XS 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 XS.

An Inclement Weather Mode feature allows **STALKER LIDAR XS** to track through interfering weather phenomena such as fog, snow, and rain which would otherwise cause **STALKER LIDAR XS** 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.

The LIDAR XS can be used through the windshield but you may notice a reduction in targeting range. The angle of the windshield will often reduce the effective range of the LIDAR XS. Some windshields contain elements or coatings, which make LIDAR XS 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 XS**. However, for greatest range, resting the LIDAR XS 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 XS as steady as possible.

COSINE OR ANGLE EFFECT

The cosine effect while using LIDAR XS 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 XS 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 XS 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, LIDARR devices are generally not affected by RFI. The ***STALKER LIDAR XS*** 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 XS*** from operating and displays "RFI".

EYE SAFETY

The ***STALKER LIDAR XS*** 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.

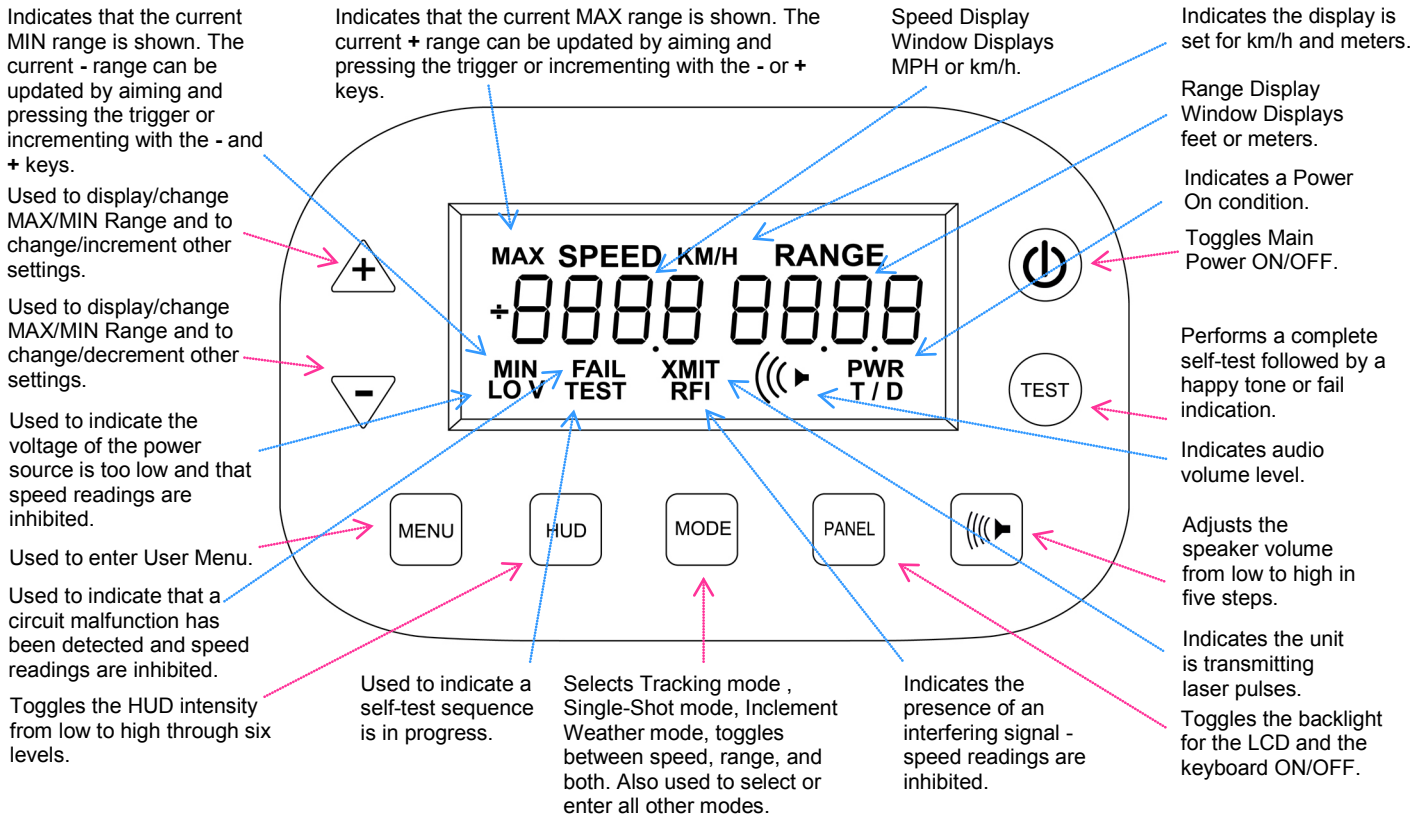
To prevent inadvertent exposure to potentially hazardous laser radiation, all servicing of the ***STALKER LIDAR XS*** must be performed at the manufacturer.

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 XS*** 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) in whole numbers or tenths.

SPEED: The left, four-digit LCD window is the speed window. The speed window displays the target speed in **MPH** (**KPH** for metric operation) in whole numbers or tenths (Note: For special applications, the target speed displayed in **Knots** is available, with the range displayed in feet). 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. Blinking at one-second intervals indicates 15-30 minutes of battery power remaining. (The remaining battery time may be less in cold temperatures.)

XMIT: The **XMIT** icon indicates that ***STALKER LIDAR XS*** 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. No bars 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.

KM/H: The **KM/H** 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

+: The + key is used to display/update the maximum range for Time/Distance mode. Press the + 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 + key is also used to increment the setting while in the Max Distance, Min Distance, or Menu modes.

-: The **-** key is used to display/update the minimum range for Time/Distance mode. Press the **-** 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 **-** key is also used to decrement the setting while in the Max Distance, Min Distance, or Menu modes.

MENU: The **MENU** 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** 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** key will toggle Time/Distance on and off.

HUD: The **HUD** 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**.

MODE: The **MODE** 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 **MODE** key for two seconds will cause the unit to enter the Inclement Weather mode. Press the **MODE** key to exit Inclement Weather mode, MAX/MIN set mode, or TIME/DIST mode.

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

: The key is used to adjust the volume of the speaker from low to high in five steps. The number of speaker bars changes (zero bars to four bars) to indicate the setting. Zero bars turn 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.

⏻: The ⏻ 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 XS** section.

HUD FEATURES

The Heads Up Display (HUD) is the viewfinder on the top of the LIDAR XS 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 XS** section for a full description of these modes.

AIMING RETICULE: The aiming reticule consists of a hollow red square 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, unless the tenth's speed display is selected, in which case whole number speed will be shown in the HUD and tenths on the rear display. 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 XS

The following tests check for proper display, aiming and accuracy of the ***STALKER LIDAR XS***.

POWER-ON SELF TEST

A complete self-test is performed at power-on. The unit goes through a self-test sequence and displays 250 1500, then displays the LIDAR XS unit's serial number, for example: Lr07 9229. Successful completion of this 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.

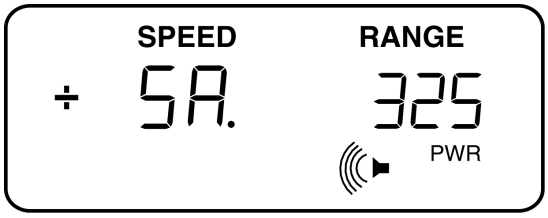
NOTE: If the **FAIL** icon appears in the Display Window of your ***STALKER LIDAR XS***, the unit must be turned OFF and then back ON to reset the FAIL mode.

SIGHT ALIGNMENT TEST

This test is designed to ensure the operator that the IR light beam of the LIDAR XS is aligned properly with the Red Square aiming reticule in the HUD. If the HUD alignment is not correct, it may 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 testing of 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 pole or overhead power wire. A tone sounds when the laser pulses are being reflected by the target. Verify that the target square is symmetric with the target both horizontally and vertically.
2. Select a pole or sign at some distance away. (At least 100 feet away)
3. Aim the Red Square directly at the pole or sign and press the trigger to transmit. A distance reading should appear.
4. Continue to press the trigger and slowly move the Red Square across the target. You will hear an audio tone.
5. As the Red Square 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 Square from the right to left and left to right. Again the distance should disappear and the audio will stop whenever the Red Square 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 XS 90 degrees and move from side to side again.

Note: You may notice that the audio tone continues briefly after the Red Square 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" or other mark on the pavement where the officer should stand with the ***XS***. 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 ***XS*** to range mode. Obtain a reading to each known distance and verify the ***XS*** 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 XS actually computes the known distance by timing the time of flight of the transmitted and received light pulses.

KNOWN SPEED TEST (OPTIONAL)

Testing the ***XS*** 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 ***XS*** and 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 XS while the driver of the target vehicle verifies the speed using either a radio or cell phone.
3. Although the XS 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 XS at a stationary object. The object needs to be directly in front of the patrol vehicle so the cosine effect does not affect the readings. Since the XS is looking through the windshield, the range may be reduced. Verify the speed on the XS against the vehicle's speedometer.

STALKER LIDAR XS SETUP

The ***XS*** 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** key. Subsequent short presses cycle through the 7-item User Setup Menu.
2. Exit by pressing and holding the **MENU** 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	d IS	0.1, **1**
3	Serial Port Format	For	**0**, 1, 2, 3, 4, 5, 6, 7, 8
4	Baud Rate	bAU	11, 15, 30, 60, 120, 240, 480, 960, 1920, **3840**, 5760
5	Printer Time & Date (See printer addendum 011-0018-00 for description)	Pt-d	
6	Charger Status	CH99–"charging" Ch9d–"charged"	
7	Inactivity Power Down Time (minute)	P-dn	**0**-60 (0 disables power down)
8	Internal Frequency Check	CLoC oFF	**OFF** – On
9	Tilt Sensor Adjustment	t ILt 40	OFF, 20, 30, **40**, 50, 60
10	Display Speed in HUD	HUdS	OFF - **On**
11	Display Range in HUD	HUdr	OFF - **On**

OPERATING THE *STALKER* LIDAR XS

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 harm's 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 XS and the traffic. The XS has other modes that can be used if there are weather or obstruction concerns.
3. If working from the patrol car, locate the vehicle where the LIDAR XS can be used through an open side window for maximum targeting range.
4. Greater sensitivity can be achieved by monitoring traffic traveling away from (rather than towards) the XS. This type of operation, however, usually will require more than one officer.

LENS CONDENSATION

If you transport the ***XS*** from an air conditioned (cool) location to a warm humid location, the outside lens surfaces may fog with condensation for a few minutes. It is best not to clean off the condensation. The condensation will clear in a few minutes once the unit warms up to the temperature of the new location.

GENERAL FUNCTIONING OF THE LIDAR XS

Several operating and setup modes are available with the ***XS*** to provide versatility of use. The modes and their uses are described in the next section, **MODES AVAILABLE IN THE XS**. The XS provides several features to make it easier to use. A back light feature is accessible by pressing the **PANEL** key. This key lights both the rear LCD display and the keyboard for use at night. The **HUD** key provides adjustment of the LED intensity of the HUD display characters. The key provides adjustment of the speaker volume for use in a variety of surroundings. 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 aiming reticule remain on.

MODES AVAILABLE IN THE XS

STALKER XS has three operating modes available (Tracking mode, Single-Shot mode, and Time/Distance mode), two setup modes (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 depending on operating weather and obstruction 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.

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). 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.

RANGE MODE - The XS is designed to display both speed and target range (distances). When in SPEED mode, the unit will not display any speeds or distances less than 15 meters from the unit. To measure distances shorter than 15 meters, press the MODE key until only the 4 dash lines are visible in the RANGE window. The unit will not measure speed in this mode, but will display distances down to about 8 meters. To exit RANGE mode, press the MODE key until you observe 4 dash lines in both the SPEED and RANGE displays.

INCLEMENT WEATHER/OBSTRUCTION MODE - The Inclement Weather/Obstruction Mode feature allows ***STALKER XS*** to track through interfering weather phenomena such as fog, snow, and rain or shoot through trees, grasses and fences which would otherwise cause ***STALKER XS*** to attempt to process reflections from the rain drops or other reflections 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.

TO PLACE THE XS INTO OPERATION:

The ***XS*** features snap-in/snap-out handles. It can be powered by either a rechargeable battery handle or a dry cell handle. Choose which handle/power source you want to use and insert in the bottom of the unit. Verify the handle is "locked" into place.

To use the ***XS*** in either Tracking mode or Single-Shot mode. (For speed enforcement, tracking mode is recommended.)

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 and **PASS** will be displayed. 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 ***XS*** 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 ***XS*** also has a Target Return Tone. This helps the operator properly aim the XS. 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 **MODE** 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 Square 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 blank 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 Square, and the Speed Display (bottom numbers). By moving one's head (or the XS) 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 ***XS*** 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 XS 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.

SHOOTING THROUGH WINDSHIELDS

The XS Lidar allows the operator to shoot through windshields much easier than other Lidar units. Created in the software and hardware of the unit, this prevents laser reflections within the patrol vehicle from being detected and allows the unit to obtain speeds of target vehicles at much greater distances than seen before in other Lidar units. In the SPEED mode, the minimum operating distance is 50 feet.
If the operator is mapping an accident scene or needs to make distance measurements with the XS LIDAR, press the **MODE** switch to place the unit in RANGE mode only, shown on the rear LCD with "- - - -" seen only in the RANGE window. This will reduce the minimum operating distance to less than 5 feet.

SELCTING TILT SENSOR ANGLE

To activate the tilt sensor, repeatedly press the MENU key until "tILt" appears. To the right of tILt, is displayed either OFF or a number. The number represents the angle (down or when rotating the unit on its side) before the trigger is not active. The default angle is 40°. Using the "+" or "-" keys on the left side of the rear panel, you can increment or decrement the numbers or turn off the tilt function. This is seen as OFF, 20°, 30°, 40°, 50° and 60°.

The purpose of the tilt sensor is to prevent any false trigger presses, which might clear a locked speed/range reading due to the unit being placed in the car seat and the trigger pressing against the seat belt buckle. With a locked speed/range, once the angle of the unit exceeds the selected tilt angle, the trigger is no longer functional. If the trigger is pressed, the locked information on the rear LCD will flash indicating the trigger has been pulled, but the unit is not allowed to clear the readings. To clear any locked speed/range reading, hold the unit in a normal operating angle and the trigger becomes active again.

CHARGING THE BATTERY

The ***STALKER LIDAR XS*** has 3 different methods to charge the rechargeable battery. These are illustrated in the table below:

	
200-0819-01 Rechargeable battery handle	**200-0839-00** Battery quick charger

	
Lidar XS multi-pin connector	**200-0844-00** Inline AC battery charger

	
Lidar XS multi-pin connector	**200-0845-00** Inline cigarette plug battery charger

(Note: the following procedures are only applicable if one is using the rechargeable battery handle. A full charge takes approximately 2 to 3 hours.)

USING THE BATTERY QUICK CHARGER 200-0839-00:

Connect the supplied AC power cord to the inline power supply. Plug the 2.5mm connector of the inline power supply into jack labeled "12V AC/DC" of the Stand Alone High Capacity Charger base unit.

Remove the rechargeable battery from the ***STALKER LIDAR XS***

Attach the rechargeable battery to the base unit by inserting it such that the curved feature of the battery matches the curved feature of the base (see photo). The CHARGING LED illuminates while the battery is charging and becomes extinguished when the charge is completed.

USING THE INLINE AC BATTERY CHARGER 200-0844-00:

Connect the supplied AC power cord to the inline power supply. Plug the 2.5mm connector of the battery charger into the charge adapter. (Note: European customers additionally receive an AC plug adapter)

Power down the ***STALKER LIDAR XS*** Plug the multi-pin end of the charge adapter into the external serial port connector on the side of the unit, and then insert the AC plug into a standard 110V 60Hz wall outlet.

The charging status may be determined by powering up the unit, then entering the charging menu (after the Pt-d menu).

The charging status is displayed as CH99 for Charging or CH9d for Charged. If desired the display can be forced to update by pressing either the MAX or MIN key.

USING THE CIGARETTE PLUG BATTERY CHARGER 200-0845-00:

Plug the 2.5mm connector of the charge adapter into the 2.5mm connector of the cigarette lighter cable.

Power down the ***STALKER LIDAR XS***. Plug the multi-pin end of the charge adapter into the external serial port connector on the side of the unit, and then insert the cigarette lighter plug of the now assembled cable into the cigarette lighter of the automobile.

The ***STALKER LIDAR XS*** may be operated while using the cigarette lighter cable or the cable may be used to charge the rechargeable battery while attached to the ***STALKER LIDAR XS***.

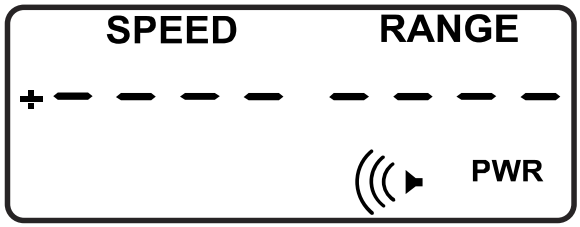
The charging status is displayed as CH99 for Charging or CH9d for Charged. If desired the display can be forced to update by pressing either the MAX or MIN key.

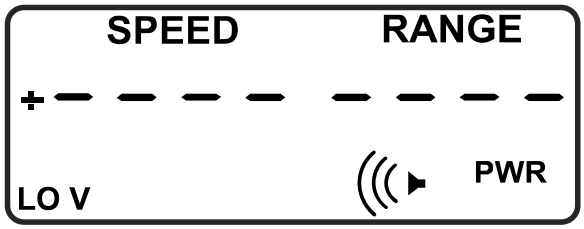
LOW BATTERY CHARGE INDICATOR

The LIDAR XS indicates a low battery by flashing the PWR icon in the LCD at one-second intervals. When the PWR icon begins flashing, 15-30 minutes of normal operation remain. (The remaining time may be less in cold temperatures.)

The PWR icon will continue to flash until the low voltage icon LOV illuminates and disables the unit.

Attaching another fully charged battery handle or connect the inline battery charger will restore normal operation.

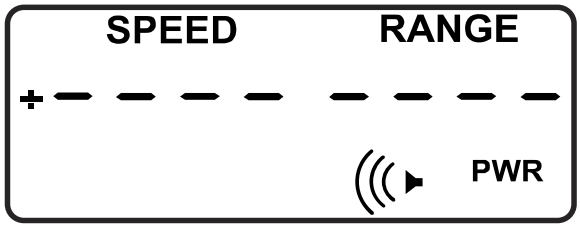


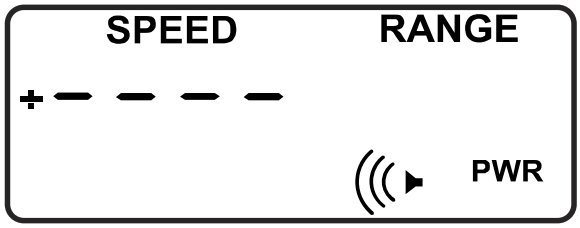


OPERATING IN TRACKING MODE

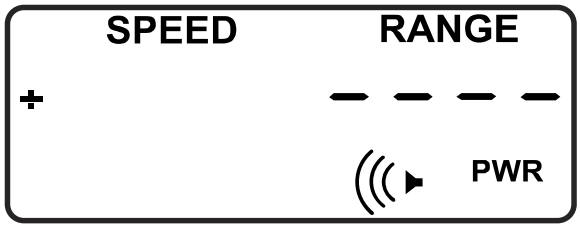
Tracking Mode uses LIDAR technology to track objects. When in this mode, it is important to get a clear shot at the desired vehicle so that you can track it for several seconds. For maximum performance, it is recommended that the unit be used through an open window of the vehicle or outside of the vehicle. Targeting range will vary depending upon how steady the operator can hold the XS. Typical handheld targeting range on approaching vehicles is up to 2000 feet maximum. 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 **MODE** key. The current mode settings are now displayed:

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





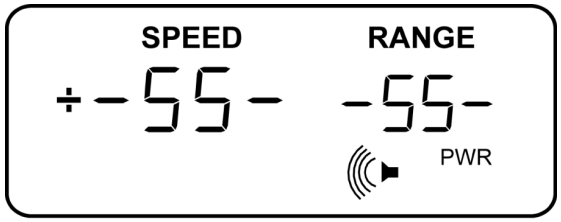
Press the **MODE** key to move between Tracking mode and Single-Shot mode and to select Speed-only, Range-only, or simultaneous Speed and Range. The three settings using " - - - - " indicate Tracking mode. The three settings using " - **SS** -" indicate Single Shot mode.



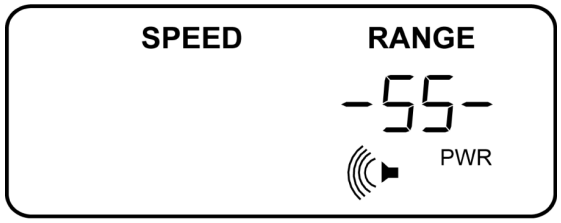
Depending on how your unit is configured at the factory, tracking a vehicle in Tracking mode is performed by either:

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

OPERATING IN SINGLE-SHOT MODE

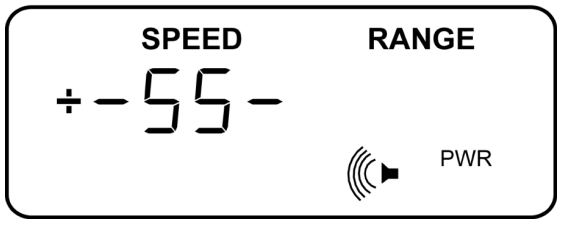


Single-Shot mode uses LIDAR technology to track a moving target for a fraction of a second and then "LOCKS" the speed (indicated by a BEEP).
The unit will power on in either: Tracking mode, Single-Shot mode, or Time/Distance mode; whichever was last selected. To enter Tracking Mode when the unit is another mode, press the **MODE** key. The current mode settings are now displayed:



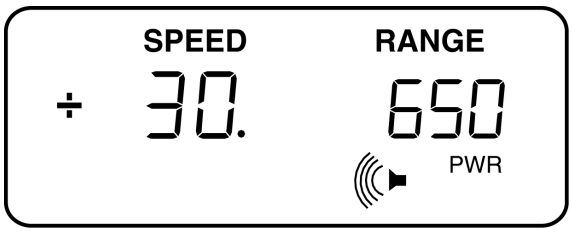
(" - - - - " or " - **SS** -" appear in the Speed and Range fields).

Press the **MODE** 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 XS 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 XS 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 ***XS***, 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 XS 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: 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 XS.

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.

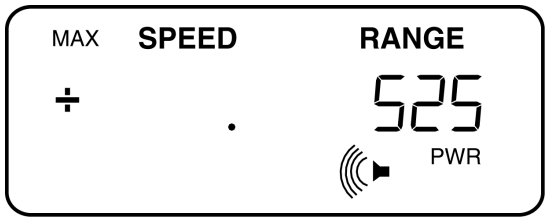
ENTERING DISTANCE FOR TIME/DISTANCE

There are two methods that can be used for entering distances into the ***XS***. This information is entered by using the + and - Keys on the XS.

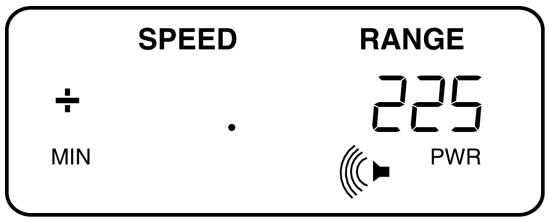
First, it is important to remember that the XS makes its calculation based upon the "difference' between the two distances entered. One method of entering distance is to measure the distance with the XS.

To measure and enter distance, follow these steps:

1. Power on the XS
2. Briefly press the + 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 **MODE** key to exit Maximum Mode.
4. Press the - 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.

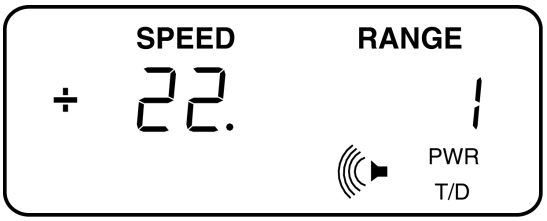
Press and hold the **MENU** key to enter Time/Distance mode.

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.



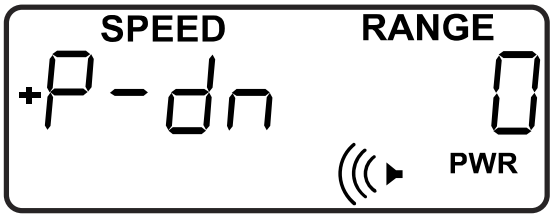
The distance between the Maximum Distance and Minimum Distance is 525 minus 225 = 300 ft. (meters). Because the LIDAR XS is only calculating the distance (300 ft.) between the two points the clock can be started from either point or target where you got your distance. Care must be taken when entering 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.

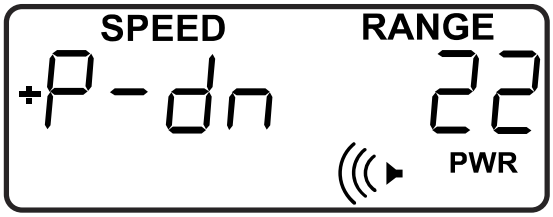
The second method of entering the distances requires that you already know the exact distance between the two measurement points. Enter these distances using the + | key and - key as follows:

1. Power on the LIDAR XS.
2. Briefly press the + key, the **MAX** icon appears in the display window. To enter a number, press the + key to increment up or press the - 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 **MODE** key to save this distance and exit the maximum mode.
4. Press the - key, the **MIN** icon appears in the display window. Repeat the above instructions.
5. Once the desired range is reached, press the **MODE** key to save this distance and exit the minimum mode.

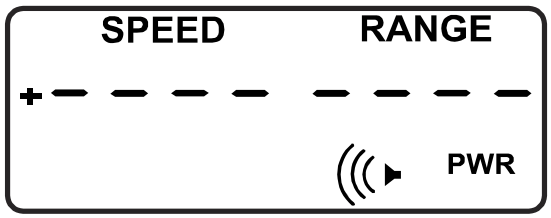
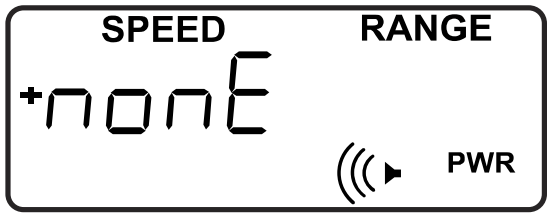
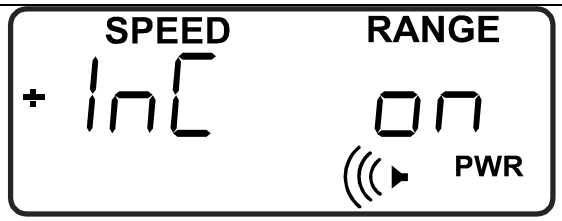
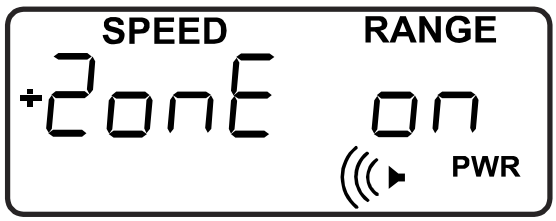
SETTING AUTOMATIC POWER DOWN

1. Briefly press the **MENU** key to enter the User Setup Menu.
2. Press the **MENU** key seven times to reach the Automatic Power Down setup window (shown at right).
3. Using the -- and + keys, adjust the number on the right-hand side of the display window. This number represents the number of minutes of inactivity before automatic power down, the range being 1 minute to 60 minutes. Leaving this number at 0 disables this function and leaves the XS on until it is powered off using the PWR button.
4. Once the desired number of minutes is reached, press and hold the **MENU** key to return to normal operation.





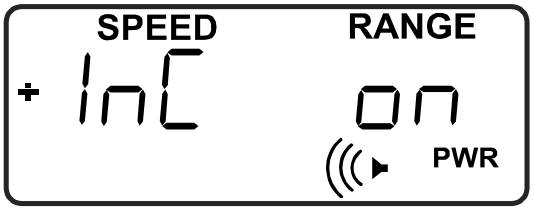
SETTING SPECIAL OPERATING MODES

ACTIVATING THE MODE MENU	
The XS can be set in various modes to enable better operation under specific conditions. Beginning at the main screen, press and hold the **MODE** key until a second beep is heard.	
A new screen containing the word 'none' is displayed, indicating no options have been selected.	
Pressing the + **Key** will cycle through the available selections in the Mode Menu. They are: + **Key** • Inclement Weather/Obstruction Mode + **Key** • Construction/School Zone Mode + **Key** • Exit MODE Menu	 

INCLEMENT WEATHER/OBSTRUCTION MODE

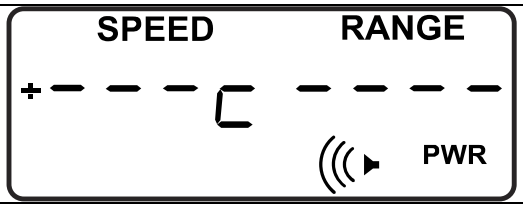
The Inclement Weather/Obstruction Mode feature allows the ***XS*** to track through interfering weather phenomena such as fog, snow, and rain or when there may be obstructions such as tree branches, grass, power poles or wires which would otherwise cause the ***XS*** to attempt to process reflections from these objects 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.

Note: Only one mode can be active at any given time.

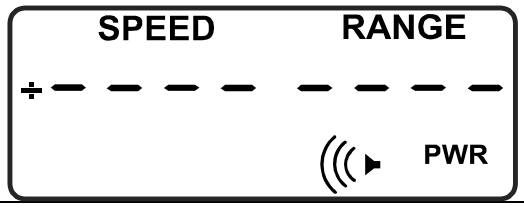


ACTIVATING INCLEMENT WEATHER/OBSTRUCTION MODE

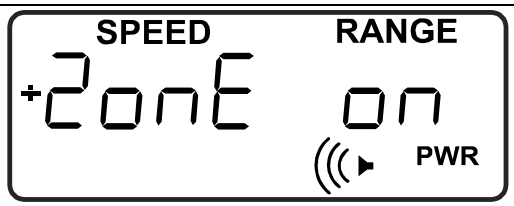
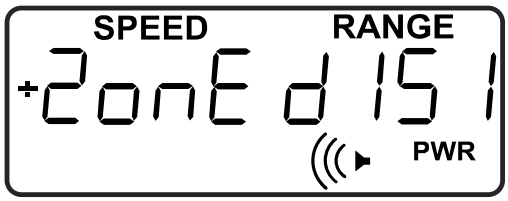
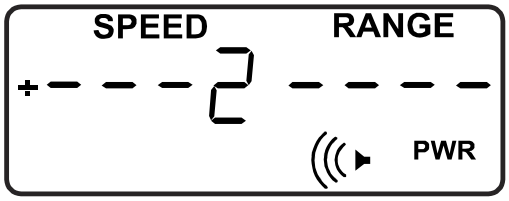
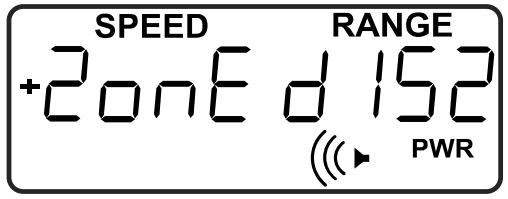
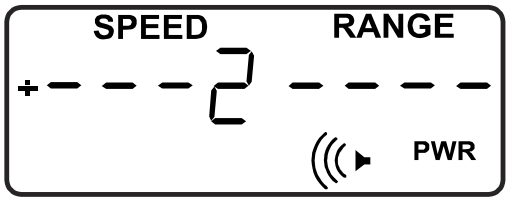
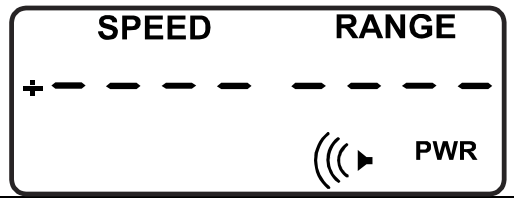
Inclement Weather/Obstruction Mode is selected by pressing and holding the **MODE** key until a second beep is heard A "c" is displayed at the end of the SPEED window as shown on the right.



To return to normal operating mode, press and hold the MODE key until a second beep is heard and the "c" is removed from the display.



CONSTRUCTION/SCHOOL ZONE MODE

The **XS** allows the operator to easily set the minimum and maximum operating distance. This is helpful when operating in a construction or school zone where the speed limits may be reduced. Construction/School Zone Mode allows the operator to simply shoot the back of a construction or school limit sign, then shoot the second sign, thus allowing speed readings only when the target vehicle is within this zone. The operator can also use the **+ Key** and **- Key** buttons on the rear panel to change the minimum and maximum distances, *Note: Only one mode can be active at any given time.*	 
Enter Menu mode, then use the **+ Key** and **- Key** arrows to display ZonE on. Press and hold the **MODE** switch to select. The display will read ZonE d 15 1. Aim the unit at either the closest or furthest sign and pull the trigger. Once a distance has been obtained, you may accept this distance or use the **+ Key** and **- Key** arrows to adjust this value to ensure the target vehicle was well within the "zone". Once the proper distance is obtained, use a long press of the **MODE** button to accept this reading. The display will read ZonE d 15 2. Again, aim and pull the trigger to obtain a distance to the second sign. Adjust using the **+ Key** and **- Key** arrows as necessary. Once you are satisfied the reading is correct, use a long press of the **MODE** button to accept.	 
A 2 will appear at the end of the SPEED window indicating the unit is in ZONE mode. The Range window will display the distance between the two signs. Now simply aim at intended targets. The unit will display speeds only while the target vehicle is within the reduced speed zone.	
To return to normal operating mode, press and hold the MODE key until a second beep is heard and the 2 is removed from the display.	

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 ***XS'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

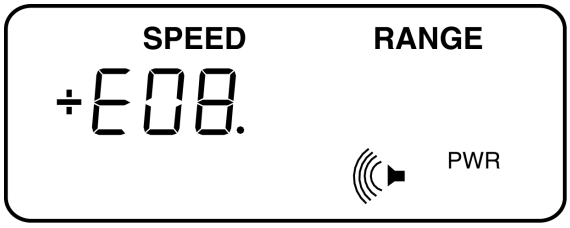
E02 = APD bias voltage error

E04 = Jamming signal detected

E08 = Sweep error detected

E16 = Insufficient signal quality

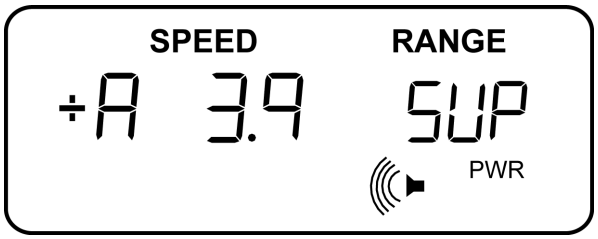
E24 = Combination of E08 and E16



DISPLAY VERSION NUMBER

To determine the version of the software used in your unit, power the XS 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.



I/O PORT

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

Pin	Signal
1	Alarm Output
2	External Power input
3	Ground
4	Transmit data out
5	No Connect
6	Ground
7	Switched Voltage output (50 mA max)
8	Receive data in
9	Ground
10	Test Clock
11	External trigger input
12	No Connect

SERIAL COMMUNICATIONS PROTOCOL

A RS-232 serial cable is required for data communications to external devices.

Baud Rate 110 to 57,600 BAUD (see USER SETUP MENU VALUES table) – default =38,400 BAUD.

Data Format 8 Data Bits
No Parity
1 Stop Bit

SERIAL PORT FORMATS

The serial port formats are listed in the USER SETUP MENU VALUES table, and are selected using the previously described menu system.

Format 0 (No serial data sent)

Format 1 (Send Speed) – Resolution = ones

Byte #	Content
1	Speed hundreds digit (ASCII)
2	Speed tens digit (ASCII)
3	Speed ones digit (ASCII)
4	Carriage return (value13 decimal)

Format 1 (Send Speed) – Resolution = Tenths

Byte #	Content
1	Speed hundreds digit (ASCII)
2	Speed tens digit (ASCII)
3	Speed ones digit (ASCII)
4	Decimal character (value 46 decimal)
5	Speed tenths digit (ASCII)
6	Carriage return (value13 decimal)

Format 2 (Send Speed and Range Data) – Resolution=ones

Byte #	Content
1	Speed indicator '+' or '-', space (value 32 decimal) for blank or dash LCD displayed
2	Speed hundreds digit (ASCII)
3	Speed tens digit (ASCII)
4	Speed ones digit (ASCII)
5	Space character (value 32 decimal)
6	Range thousands digit (ASCII)
7	Range hundreds digit (ASCII)
8	Range tens digit (ASCII)
9	Range ones digit (ASCII)
10	Carriage return (value 13 decimal)

Format 2 (Send Speed and Range Data) – Resolution=tenths (speed only)

Byte #	Content
1	Speed indicator '+' or '-', space (value 32 decimal) for blank or dash LCD displayed
2	Speed hundreds digit (ASCII)
3	Speed tens digit (ASCII)
4	Speed ones digit (ASCII)
5	Decimal character (value 46 decimal)
6	Speed tenths digit (ASCII)
7	Space character (value 32 decimal)
8	Range thousands digit (ASCII)
9	Range hundreds digit (ASCII)
10	Range tens digit (ASCII)
11	Range ones digit (ASCII)
12	Carriage return (value 13 decimal)

Format 2 (Send Speed and Range Data) – Resolution=tenths (range only)

Byte #	Content
1	Speed indicator '+' or '-', space (decimal 32) for blank or dash LCD displayed
2	Speed hundreds digit (ASCII)
3	Speed tens digit (ASCII)
4	Speed ones digit (ASCII)
5	Space character (value 32 decimal)
6	Range thousands digit (ASCII)
7	Range hundreds digit (ASCII)
8	Range tens digit (ASCII)
9	Range ones digit (ASCII)
10	Decimal character (value 46 decimal)
11	Range tenths digit (ASCII)
12	Carriage return (value 13 decimal)

Format 2 (Send Speed and Range Data) – Resolution=tenths (speed and range)

Byte #	Content
1	Speed indicator '+' or '-', space (decimal 32) for blank or dash LCD displayed
2	Speed hundreds digit (ASCII)
3	Speed tens digit (ASCII)
4	Speed ones digit (ASCII)
5	Decimal character (value 46 decimal)
6	Speed tenths digit (ASCII)
7	Space character (value 32 decimal)
8	Range thousands digit (ASCII)
9	Range hundreds digit (ASCII)
10	Range tens digit (ASCII)
11	Range ones digit (ASCII)
12	Decimal character (value 46 decimal)
13	Range tenths digit (ASCII)
14	Carriage return (value 13 decimal)

For all format modes, leading zero suppression is employed. Leading zeros are replaced with space characters (value 32 decimal).

Format 3 (Send speed, range, units icons.)

Byte #	Content
1	Character of value 129 decimal, (message type indicator)
2	Character of value 64 to 65 decimal*
3	Character decimal value 64 to 123 decimal*
4	Range hundreds digit (ASCII)

5	Range tens digit (ASCII)
6	Range ones digit (ASCII)
7	Space character (value 32 decimal)
8	Space character (value 32 decimal)
9	Space character (value 32 decimal)
10	Space character (value 32 decimal)
11	Space character (value 32 decimal)
12	Range thousands digit (ASCII)
13	Speed hundreds digit (ASCII)
14	Speed tens digit (ASCII)
15	Speed ones digit (ASCII)
16	Carriage return (value 13 decimal)

* Icon data bytes 2 and 3 contents:
Byte #2,
ICONS:
Bit 7=0
Bit 6=1
Bit 5=0 (Expansion icon)
Bit 4=0 (Expansion icon)
Bit 3=0 (Expansion icon)
Bit 2=0 (Expansion icon)
Bit 1=0 (Expansion icon)
Bit 0=XMIT icon

Byte #3,
ICONS:
Bit 7=0
Bit 6=1
Bit 5=T/D icon
Bit 4=KPH icon
Bit 3=+/- speed icon
Bit 2= (Expansion icon)
Bit 1=LOV icon
Bit 0=RFI icon

Format 4 (Send distance for each shot -- 4 hex ASCII digits and a CR)

Byte #	Content
1	Most significant hex digit
2	3rd hex digit
3	2nd hex digit
4	Least significant hex digit
5	Carriage return (decimal value 13)

Format 5 (Printer output)

This serial format is for communications with the line printer. Refer to the Lidar Printer Addendum (shipped with the printer) Part Number 011-0018-00 for more information.

Format 6 (Send Speed and Range only on valid speed)

The output is identical to the outputs listed under Format 2, but is updated only when there is a valid speed.

Format 7 (Send Speed and Range data, with unit serial number)

The output is identical to the outputs listed under Format 2, but in addition has a space followed by the 8 character alphanumeric serial number of the unit.

Format 8 (Send Speed and Range only on valid speed, with unit serial number)

The output is identical to the outputs listed under Format 6, but in addition has a space followed by the 8 character alphanumeric serial number of the unit.

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 XS 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 XS signal. This reduces the range and in some cases may prevent obtaining any speed readings.

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 ***XS***. 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 ***XS***, only the manufacturer can service the ***XS***. 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 ***XS*** to preserve the life and usefulness of the equipment.

LENS CONDENSATION

If you transport the ***XS*** from an air conditioned (cool) location to a warm humid location, the outside lens surfaces may fog with condensation for a few minutes. It is best not to clean off the condensation. The condensation will clear in a few minutes once the unit warms up to the temperature of the new location.

OPTICAL SURFACES

All of ***XS'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

Low or no speaker volume:

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

LIDAR XS has short range:

- ❑ Check the HUD alignment. Refer to the **SIGHT ALIGNMENT TEST** section.
- ❑ Verify the MAX range setting hasn't been shortened.

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

STALKER LIDAR XS 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 XS 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 XS*** 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 ***XS*** is as follows:

Visual Observation

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

LIDAR Verification

- Properly aim and sight in the target, making sure the Red Square is on the vehicle you observed. Hold the Red Square 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 ***XS*** 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.

WARRANTY

Manufacturer warrants this LIDAR XS to the original purchaser to be free of defects. At its discretion, the manufacturer agrees to repair or replace all XS 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 XS 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 XS devices in the event of violent maneuvers, collisions, or other circumstances, even though said XS devices are installed and used according to instructions. Applied Concepts, Inc. specifically disclaims any liability for injury caused by the LIDAR XS 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).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