

Pro-Lite+



REFERENCE MANUAL



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GENERAL INFORMATION

Introduction

Congratulations! You have invested in the latest generation of the most technologically advanced instrument available for speed detection and other law enforcement applications. In a compact, handheld package, the Pro-Lite+ offers the versatility of direct range and speed measurement. The unit offers a number of improved operating features and specifications, which make it easier to use and service, and easier to train personnel in its use. These improvements include:

- Improved range, accuracy, and resolution.
- Water-resistant.
- Self-contained, replaceable "AA" batteries.
- Improved power management features, with a low voltage warning and "sleep" mode to conserve battery power.
- Single shot or full tracking history versions.
- Optical square aiming reticle to define the laser beam size and speed digits.
- Inclement weather operating mode that improves performance in fog, rain, snow, and dust.
- Integral rubber cover to protect the unit's critical areas.
- Ergonomically designed for reduced arm and wrist fatigue.
- Backlit LCD for unit setup, control and operator displays.
- Available in two models -- One tested to CDRH eye safety and the other carrying a CE mark with eye safety, tested to IEC 60 825.

Operators who are familiar with the use of conventional traffic safety radar or laser systems will find it a simple matter to become accustomed to the Pro-Lite+, since it comes from a company with over 36 years of experience in the industry. Similarly, first-time operators will be surprised at how easy it is to operate, because the technology employed overcomes some of the drawbacks and operational idiosyncrasies of conventional traffic radar.

Unpacking

When you first receive your Pro-Lite+, carefully inspect the shipping carton for signs of damage. Any damage evident should be immediately reported to the carrier. Kustom Signals, Inc. is not responsible for damage sustained during shipping.

Upon opening the carton, check the contents against the following list of included items:

- Pro-Lite+ laser speed detection system
- Reference manual on CD
- Eye safety certification
- Accuracy calibration certification
- Two (2) AA batteries

Options available include the following:

- Tripod
- Lanyard/neck strap
- Cable to PC
- LaserStat statistical software
- Soft case

Contact the Kustom Signals Customer Service department at 800-835-0156 (620-431-2700 outside the U. S.) if any of the standard items (or options which you have ordered) are missing. Having the order number from your packing list will expedite the call.

FUNCTIONAL DESCRIPTION

The Pro-Lite+ is a versatile instrument that measures both the range and velocity of selected targets. The advanced technology of the Pro-Lite+ provides pinpoint aiming capability, permitting the operator to isolate a single vehicle out of a group. This target specific speed-measuring device will greatly reduce your time in court by eliminating the defense argument of multiple vehicles. The technology employed in the Pro-Lite+ also renders laser detection devices relatively ineffective due to the pinpoint accuracy and small beam size of the system.

Rather than microwave transmissions employed by traditional traffic radar systems, the Pro-Lite+ uses invisible light waves that are much higher in frequency. Because the wavelength of these light waves is so much shorter than microwaves, they can readily be collimated (or focused) into an extremely narrow beam for absolute target identification. The signal transmitted by the Pro-Lite+ travels in a straight line of sight, as opposed to the "fringing" effect that is characteristic of microwave emissions.

The technology used by the Pro-Lite+ to measure distances and speeds is referred to as **lidar**, which stands for **light detection and ranging**. When the trigger is depressed, the Pro-Lite+ sends out hundreds of invisible infrared laser light pulses per second. As each pulse is transmitted, a timer is started. When the energy of a laser pulse is reflected from a target and received by the Pro-Lite+, the timer is stopped. From the elapsed time taken for the laser pulse to strike and return from the target, the distance to the object is calculated with the known speed-of-light through the atmosphere. If the target is moving with respect to the Pro-Lite+, a sophisticated algorithm is used to derive the speed of the target from a successive number of range calculations. This speed determination is then displayed to the operator.

CONTROL LOCATIONS

NOTE: This manual describes both the single-shot Heads-Up-Display (HUD) version and the tracking history HUD version. Please refer to the descriptions of the optical sight to better understand the model you have purchased.

Operation of the Pro-Lite+ primarily involves using the integrated LCD located on the back panel of the unit and the four pushbutton switches located on the top of the unit. Figure 1 illustrates the unit's features and the external controls that are used to operate the instrument. These controls and features are briefly described below:

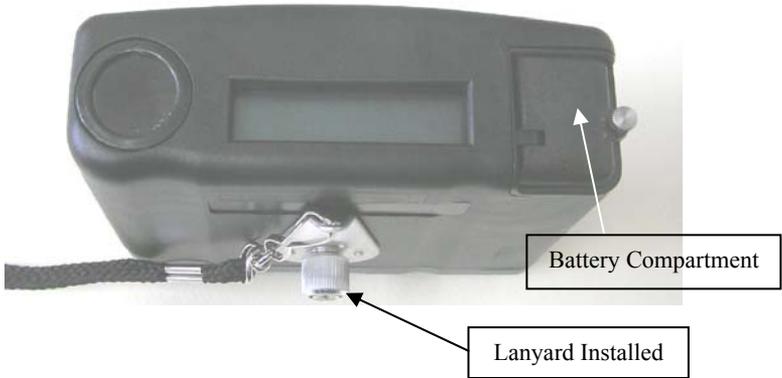
- A. **Liquid Crystal Display (LCD):** window displays speed, range, command menus, error messages and unit status in a text format.
- B. **Fire/On/Enter:** *Fire* - activates the range/speed measurement function, locks and releases speed and range displays. *On* - turns on primary power. *Enter* - activates the text Menu item selected on the LCD.

- C. **TEST/▼ ARROW:** dual function pushbutton switch. *Test* - activates the test mode where the unit runs an internal self-test routine. *Down ARROW* - permits the user to navigate within the Menu items appearing on the LCD.
- D. **MODE/▲ ARROW:** dual function pushbutton switch. *Mode* - enables the user to select the speed measuring mode or range measuring. *Up ARROW* - enables the user to navigate within the Menu items on the LCD.
- E. **MENU/ESC:** displays the unit's programmed text Menu items on the LCD. *ESC* - permits the user to exit the Menu and return to the speed or range-operating mode.

- F. **Aiming Sight:** displays the sighting reticle and, with the Optional display, the speed or range of a target in a HUD (Heads-Up-Display).
- G. **I/O Connector:** contains conductors for the external signal output and optional RS-232 port (UART).
- H. **¼" x 20 Mounting Screw:** provides a mounting point for a tripod, monopod connection or lanyard.

Figure 1. Control Locations





CONTROL DESCRIPTIONS

The preceding section of this Reference Manual introduced you to the locations of the operating controls and features of the Pro-Lite+. This section provides detailed descriptions of the function of each control.

CAUTION: Use of controls or adjustments or performance of procedures other than those specified is not recommended. Adherence to the instructions contained in this manual will insure the device works at peak performance.

FIRE/ON/ENTER

The Fire trigger of the Pro-Lite+ performs three functions. When the trigger is depressed, it activates the firing of laser pulses for the range and/or speed measurement functions of the system. When the trigger is released, the last displayed range and speed-reading are retained on the displays. The locked range and speed displays can be cleared by momentarily pressing the trigger a second time. For those states or agencies where automatic unlock is required, the speed and range will automatically unlock after 14 minutes.

The "ON" function is used to turn on primary power to the Pro-Lite+. The unit automatically turns off after 20 minutes from the last function or button push.

The "ENTER" function: Pressing the trigger button when a Menu or Menu option is displayed on the LCD accesses the selected Menu or selects the displayed option.

TEST/ ▼ ARROW

This is a dual function pushbutton switch. On the initial push of the button, a unit Self-Test is performed. When in a Menu screen, the button functions as the "down" selector. When in a Differential Distance Menu item, it also selects the distance displayed.

MODE/ ▲ ARROW

This is a dual function pushbutton switch. The Mode switch toggles between Speed and Range Modes. While in Menu screens, this switch functions as an "up" selector. Upon initial power up, the unit defaults to Speed Mode.

MENU/ESC

This is a dual function pushbutton switch. In the Speed Mode or the Range Mode, the primary setup Menu is displayed when the pushbutton is depressed. In Menu Mode, pressing this button exits or escapes to the Default-Operating Mode unless you have already entered a sub-menu by pressing ENTER. Pressing this button while in a sub-menu will return to the Main Menu. Pressing this button a second time exits or escapes to the Default-Operating Mode.

DISPLAYS AND INDICATORS

The LCD, located on the rear panel, is the unit's primary display. In addition to speed and range data, the display provides setup menus, user alerts, and self-test status. The LCD is a 2 line x 16 character, extended temperature, backlit display designed for long life and maximum viewability. All operator setup menus and alerts are communicated via this display in text format.

HEADS-UP-DISPLAY

The Heads-Up-Display, or HUD, performs two critical functions in the operation of the Pro-Lite+. First, it provides the aiming reticle which the operator uses to aim the unit at the desired target. Secondly, it displays the current speed or range of the target as the operator continues to observe the target, updating four (4) times per second, creating a tracking history that is useful as court evidence. As an option, the Pro-Lite+ can be ordered in a single-shot version. In this configuration, the unit takes one speed or range reading for each trigger depression.

The aiming reticle is an illuminated square that approximately replicates the laser beam spot size. As seen from the rear of the instrument, the aiming reticle is located in the center of the HUD reflecting glass, and defines the area where the laser pulses are transmitted. The reticle is illuminated when the Pro-Lite+ is powered up. The intensity of the reticle is adjusted along with the intensity of the characters, by selecting the HUD BRIGHTNESS Menu function of the unit.

HUD (Heads-Up-Display)

1. Upon the activation of the self-test function, the HUD display will first go through a display segment test. The first display will briefly read "**8888**".

2. When the trigger is depressed and laser pulses are being transmitted, the HUD will display four dashes "----" indicating that the laser is being fired and that the instrument's range and speed measurement functions are activated. Display of the dashes in the HUD occurs simultaneously with the illumination of LCD characters directly beneath the "Speed" and "Range" text on the rear display panel. This confirms that laser activation has taken place, and the operator's attention is not diverted from the HUD.
3. When the speed of a moving target has been determined, the speed will be displayed on the HUD. The speed of a receding target will be displayed with a "-" prefix, and the speed of an approaching target will be displayed with no prefix.

When status messages arise, the HUD will read, "HELP", referring the operator to the rear panel displays for further information. Examples of such status messages occur during Low Voltage or error conditions, or when self-test failures are detected.

These indications in the HUD allow the operator to track vehicle speeds and to monitor critical operating conditions without having to divert attention from the target vehicle and its surroundings.

Pro-Lite+ HUD Full Tracking Version (Standard)

NOTE: If your unit has "+" in the upper right corner of the rear panel LCD, it is the full tracking history Pro-Lite+.

The standard functions of the Pro-Lite+ are with features of Full Tracking History on vehicles and greater targeting range. After depressing the trigger and the first speed reading has been displayed in the HUD, if the operator continues holding the trigger depressed, the Pro-Lite+ will update the HUD speed

display three (3) times per second as long as valid speed data is being received by the unit.

Pro-Lite+ HUD Optional Single-Shot version

1. When the trigger is depressed and laser pulses are being transmitted, four dashes "----" will be visible below the reticle, indicating that laser activation has taken place. The operator's attention is not diverted from the HUD.
2. When the speed of a moving target has been determined, the reticle will flash indicating a locked speed and the speed will be displayed below the reticle.

STATUS DISPLAYS

The Pro-Lite+ provides user alerts on the LCD back panel. They are listed below:

- **Low Voltage Alert-** Internal battery voltage has fallen below approximately 2.0 volts. When the "LV Alert" appears and an internal battery installed, it is an indication the unit will shortly exhaust the battery. This alert appears approximately every two minutes until the battery is exhausted. HELP will appear in the HUD alerting the operator to check the rear panel LCD for further information.
- **Low Voltage Warning-** Internal battery or external power voltage is below approximately 1.8 volts. This warning appears after the low voltage alert and indicates the units can no longer function and a new power source must be used. The unit will automatically turn off after a few seconds.

OPERATION

NOTE: The following guide to operating the Pro-Lite+ LIDAR system is not intended to be a training program. Before operating this unit or any other speed measuring system, Kustom Signals urges all operators to have prior training in LIDAR speed monitoring devices. Such courses are offered by Kustom Signals, various state and local agencies, and either IPTM (Institute of Police Technologies and Management) or Northwestern University. Contact your District Manager or Kustom Signals at 1-800-4KUSTOM for further details.

Setup

There are several factors to consider when setting up to take speed or distance measurements with the Pro-Lite+. They have to do with the location of the instrument relative to the roadway upon which traffic is moving, and with the actual setup in or around the patrol car or motorcycle.

In selecting a location for monitoring traffic, be aware that the Pro-Lite+ is subject to the *cosine effect* in the same manner as conventional microwave radar and other laser-based speed measuring systems. The cosine effect is a principle that states the apparent measured speed of a target will decrease from its actual speed depending upon the angle between the direction of observation and the true direction of travel.

The amount of error is defined by a trigonometric relationship known as cosine. From a judicial standpoint, the measurement inaccuracy introduced by the cosine effect is always in favor of the motorist, since it has the effect of reducing the measured speed. Cosine effects will never raise the target vehicle's speed when using a stationary measurement device.

The greater the angle between the Pro-Lite+ and the direction of traffic, the greater the cosine error produced. For small angles, the cosine effect is relatively insignificant. For example, at angles of less than 8° , the cosine error is under 1%, and at angles of less than 14° , the error is under 3%. As a general guideline, if you select a location where the distance to the target vehicle is at least ten times greater than the Pro-Lite+'s perpendicular distance from the roadway, this corresponds to an angle of 5.7° or less, and the amount of cosine error will not exceed $\frac{1}{2}\%$. This is called the 10:1 rule. For example, setting up 20 feet off the roadway and measuring targets at a range of 200 feet or further away, assures the cosine effect produces no more than $\frac{1}{2}\%$ error in the speed measurement. Again, it is important to remember that any cosine error introduced always reduces the indicated speed reading, thus favoring the motorist.

Another factor in selecting a setup location is for *normal* operation; you should have a clear line of sight to the target vehicle during the entire measurement interval. Intervening objects such as signposts, utility poles, fences and tree branches may prevent the instrument from gathering sufficient valid measurement data to display a speed-reading. It is also better to select a setup location where minimum movement of the Pro-Lite+ is required in order to keep it aimed on the desired target.

Visibility conditions may also affect the performance of the Pro-Lite+. Although the laser emissions used by the device are not in the visible spectrum, they are close enough in wavelength that atmospheric or climatic conditions that impair vision may also adversely affect the unit's ability to obtain range or speed-readings. This impact is mitigated to some degree by choosing "Poor" on the Pro-Lite+'s Environment Menu. However, rain, smoke, fog, and airborne dust particles, if sufficiently dense, may prevent its operation. The unit's accuracy is not affected, just the ability to obtain a speed-reading. The instrument is not affected by ambient light conditions.

Equivalent performance should be obtained whether operating in bright daylight or in darkness.

To obtain maximum operating range at the setup location, the instrument ideally should be positioned so that it is not operating through any glass in the patrol vehicle. The oblique angles of most windshields often reduce the effective range of the system and some windshields are treated with a coating that blocks the infrared emissions, making operation impossible. While it is possible to operate the unit through most windshields, operating the unit through the side glass is preferred, although this may also result in some loss of range performance. Speed accuracy is not affected by windshield or side glass, only targeting range.

Due to the extremely narrow beam width of the Pro-Lite+ that makes precise target identification possible, it may be difficult to aim at long ranges if operated handheld. For those situations, using a monopod or tripod to assist in stabilizing the instrument is helpful. Using the unit handheld or with a monopod or tripod are standard, normal operating modes. The unit may be rested on the patrol vehicle for additional support, if necessary, for stability. If the vibration of the patrol vehicle is too great, the Pro-Lite+ will not display a speed reading.

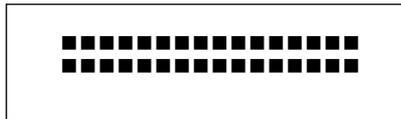
SELF-TEST Sequence

Test Messages

Upon power up or a user-initiated test using the TEST/▼ Button, the unit performs the following tests:

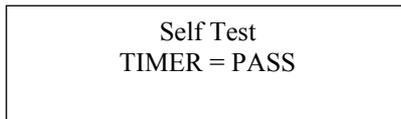
Indicator Test:

Checks all digits of the LCD and the HUD for correct operation.



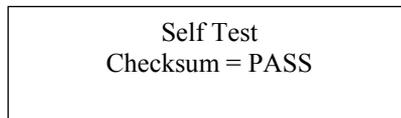
Accuracy Test:

Performs a comparison between two independent timing circuits to verify that the range and speed determination circuits are operating properly.



Program Memory Test:

Checks the unit's programmable memory for validity.



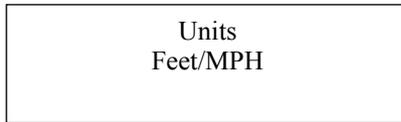
Program Version:

Displays the version of software installed in Pro-Lite+.



Units of Measure:

In addition to the self-test, the unit briefly flashes the units of measure before entering the Default-Operating Mode. The screen is displayed below:



The displays indicate "**Feet/MPH**" for English units, or "**km/h**" for metric units.

Default Display :

Upon initial power up, the unit defaults to Speed Mode and displays the following:



If the user wishes to leave the unit in the Speed Mode, no further operator action is required.

Mode/Option Selection

Mode/▲ Arrow

The Mode/Arrow pushbutton switch is used to toggle between Speed and Range Mode. The default is Speed Mode. To select this option, no action is required.

NOTE: It is not necessary to press the ENTER push button to select Speed or Range Mode.

Pressing the Mode switch erases Speed, leaving only the Range text displayed. The unit is now in the Range-Only Mode. This also changes the display in the HUD from Speed to Range. The ARROW segment of the push button becomes functional when an operator Menu item is selected as outlined in the MENU/ESC pushbutton switch description. To return to the Speed Mode, press the MODE switch again. Both Speed and Range display again on the LCD, and the HUD displays speed measurements.

MENU/ESC

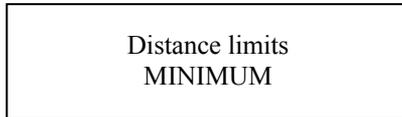
The MENU display is used to provide access to setup and operating features of the Pro-Lite+. Enter this mode after the unit has been powered up and completed self-test. Using the MENU pushbutton switch enables the operator to refine the setup for a particular situation. Pressing this switch once displays the following screen:



Press ENTER to confirm your selection.

Minimum and Maximum Distance/Range (DIST)

The distance control sets the minimum and maximum ranges at which target vehicle speeds are displayed. When the Distance Menu selection is activated, the input screen appears as:



Minimum Distance Display and Control

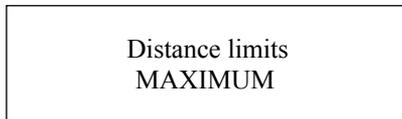
Upon selection of the Min Menu item, the following screen appears:



The arrow switches on the unit are then used to increase and decrease the minimum range setting. The distance changes in one foot or one meter increments. When the desired minimum distance setting is achieved, press the ENTER switch. This action returns you to the Main Menu.

Maximum Distance Display and Control

From the Distance Menu, use the arrow to display the following screen:



Upon selection of the Maximum Menu item the following screen appears:

Set Max Range Dist MAX

The arrow switches are then used to increase or decrease the maximum range setting. The distance changes in one foot or one meter increments. When the desired maximum distance setting is achieved, press the ENTER pushbutton switch. This action returns you to the Main Menu.

Each time the Pro-Lite+ is powered up, the maximum range control setting defaults to its last setting selected by the operator.

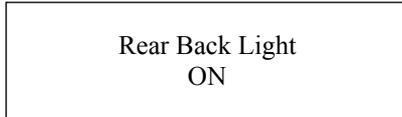
NOTE: The Pro-Lite+ will remember any change to this feature. If you select a different max or min distance, the next time you use the unit, that distance will still be operational. To return to different MAX or MIN distances, select them in the usual manner. The Pro-Lite+ will then remember those distances.

Backlight

Press the MENU/ESC switch until the following screen is displayed:

MENU LCD BACKLIGHT

The LCD backlight (BKLIT) selection is used during night operations and enables users to operate the device as they would during daylight. This function illuminates the LCD, and the Menu to select this option appears as below:

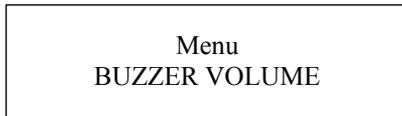


The user simply chooses between turning the backlight OFF or ON. Use the arrow switches to choose an option and confirm this selection by pressing ENTER.

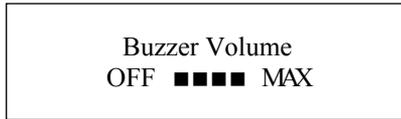
Audio Volume

The audible tone provides feedback to assist the operator in aiming the Pro-Lite+. The aiming tone is activated when the trigger is depressed and a staccato or chirping tone is heard when no valid target is in range, such as aiming the unit at the sky. As the quality of range data from a target improves, the "chirp rate" increases, indicating proper aiming of the Pro-Lite+. When a range or speed is actually displayed, the chirping simultaneously changes to a solid tone.

The audio transducer is also used to alert the operator to certain conditions such as an internal test failure, existence of low battery voltage or confirmation the unit is powering down. Press MENU/ESC until the following screen is displayed:



The audible alert volume can be adjusted in the same manner as the HUD brightness. The screen appears as below:



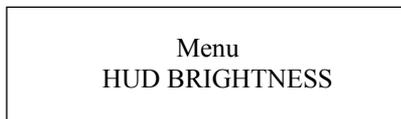
There are six (6) LCD blocks corresponding to the volume level of the audio annunciator. Use the arrows to adjust the volume. The arrow pointing downward lowers the volume; the arrow pointing upward increases the volume. Each time an arrow is pressed adjusting the volume, the audio briefly sounds, indicating the audio level the user will hear at the selected level. Once the desired level is achieved, press ENTER to confirm the selection.

NOTE: The Pro-Lite+ will remember any change to this feature. If you select a different volume level, the next time you use the unit, that level will still be operational. To return to a different volume, select that volume in the usual manner. The Pro-Lite+ will then remember that volume.

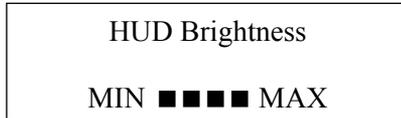
Brightness

The Brightness control should be adjusted to permit comfortable viewing of the aiming reticle and optional HUD displays for targeting purposes. To adjust, press ENTER at the BRT/VOL Menu while HUD is selected.

Press MENU/ESC until the following screen is displayed:



There are eight (8) LCD blocks between the MIN and MAX text on the LCD screen. This corresponds to eight brightness levels in the HUD. HUD brightness can be increased by pressing the arrow pointing upward or decreased by pressing the arrow pointing downward. Once the desired brightness level is achieved, press ENTER.



Avoid using excessively bright settings for lower level ambient light conditions, as this makes target identification more difficult. Upon being powered up, the Pro-Lite+ automatically defaults to the last brightness level set by the user.

NOTE: The Pro-Lite+ will remember any change to this feature. If you select a different brightness level, the next time you use the unit, that level will still be operational. To return to a different brightness, select that level in the usual manner. The Pro-Lite+ will then remember that brightness level.

DIFF DISTANCE (Differential Distance Test) - Optional

The Differential Distance Test feature is used as an optional accuracy check to insure the unit is calculating target speeds within stated limits. Details of this test are found in the Accuracy Testing Section.

Stopwatch Feature

The Stopwatch feature enables the user to calculate average speed based on the elapsed time taken by a vehicle to travel a predetermined distance. Details of the Stopwatch feature are described in the Stopwatch Mode Section.

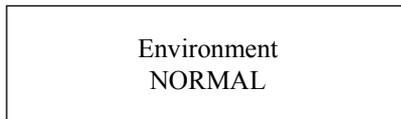
Environment Menu (Weather or Obstruction Mode)

The environment feature is used to improve the unit's sensitivity and performance in adverse weather conditions or when using the Pro-Lite+ through windshields or other obstructions. Fog, rain, snow and blowing dust can sometimes interfere with the performance of the Pro-Lite+. Target ranges less than anticipated may be displayed, typically between 50 and 150 feet. Inability for the unit to display a valid speed is a symptom of this problem in the Speed Mode.

The Environment Mode improves the system performance by setting the minimum range to approximately 150 feet. This dramatically improves both the speed and range performance of the unit in poor weather conditions or when there are visual obstructions between the operator and the intended target.

Note: No speed or range readings are possible inside 150 feet while in the "POOR" Environment Mode.

When this Menu item is selected the following screen appears:



Use the arrow to make the selection between NORMAL or POOR and press ENTER. The Main Menu reappears.

NOTE: The Pro-Lite+ will remember any change to this feature. If you select POOR, the next time you use the unit, POOR will still be operational. To return to NORMAL, select NORMAL in the usual manner. The Pro-Lite+ will then remember NORMAL.

Target Direction Menu

Press the MODE/ ▲ ARROW DIRECTION from the Menu Distance Limits screen is to select the direction of travel for target vehicles. The setup screen appears as:



The arrows enable you to select:

- 1) APPROACHING- approaching targets;
- 2) RECEDING- receding targets;
- 3) BOTH- both approaching and receding targets.

NOTE: "BOTH" is the default selection. Once the selection is made, pressing ENTER confirms the selection and returns you to the Main Menu.

If the APPROACHING Mode is selected, all approaching vehicle speeds are displayed in the normal manner. However, if a receding vehicle is targeted, the letters "Apr" are displayed in the HUD to inform the user that the unit is in the Approaching Target Mode. For the standard unit, this information will be displayed on the rear panel LCD. No speeds are displayed on receding vehicles.

Likewise, if "RECEDING" is selected, the letters "rEC" display in the HUD when an approaching vehicle is targeted.

Note that a continuous, audible tone is still emitted when a vehicle speed is determined in a direction opposite that of the direction mode selected (HUD tracking versions only).

If "BOTH" is selected, the Pro-Lite+ displays speeds for all vehicles.

ACCURACY TESTS

Press and release the FIRE pushbutton on the top of the unit to power on the unit and allow the instrument to complete the self-test sequence. Although the internal test performs a complete check of the Pro-Lite+'s range and speed processing circuitry, you may occasionally want to test the instrument against an external standard.

First, check the alignment of the HUD aiming reticle. Place the unit in the Range Mode. Select an isolated target with a clear background, such as an overhead power wire about 100 or more feet (30 meters) away. Depress the trigger and slowly sweep the Pro-Lite+ from a clear background (such as sky) across the target and observe that the target range is displayed only when the target is within the reticle area, indicating vertical alignment. (Listening to the audio "chirp" indicating reflection of laser pulses is helpful when using overhead wires.) Rotate the Pro-Lite+ so that it is at right angles to its normal operating position, (positioned on its side) and repeat the process to verify horizontal alignment. If any range reading is obtained when the aiming reticle is not directly over the target, or any other test is failed, the unit is to be removed from service and sent in to Customer Service.

Taking range measurements to known, fixed distances is similar to using a tuning fork with a Doppler radar unit. Perform the test as follows:

1. Lay out a test range using a steel tape measure or other means of accurately measuring distances so that target distances between 50 and 500 feet are clearly marked. Normally, one or two distances are used. Distances are measured from the front face of the Pro-Lite+ and should be integer multiples of .1 ft. (i.e. 50.1, 74.6, 200.5, etc.)
2. Place the target on the first mark and position perpendicular to the Pro-Lite+ laser beam.
3. Measure and compare the displayed distance and the absolute distance.

4. Repeat for any remaining target positions.
5. Verify the distance readings are within ± 6 inches of the actual distance measurement.

DIFF DISTANCE (Differential Distance Test) – Optional Test

NOTE: MPH units only—Metric units are NOT EQUIPPED with this feature.

Prepare two flat 1' x 1' or larger targets, preferably painted with a flat white paint. Plywood or particleboard is suitable. Place the targets at two precisely known, integer feet, distances along the same line of sight. You may find it useful to place the further target higher than the closer target. Use whole number distances such as 50 or 75 feet, not 50.26 or 74.87. It is strongly recommended that distances between 50 and 100 feet be used for practical reasons, and that the zero foot point (measurement point) be carefully marked. The minimum target separation should be 10 feet. Position the Pro-Lite+ so that the front face of the unit is precisely placed at the zero foot point. You may find that using a tripod or monopod will be useful, but is not a requirement.

Enter the DIFF-TEST Mode by pressing MENU and selecting the Menu item. The following screen displays:

Diff Distance
Dist1

Carefully range to either of the two targets being sure to hit only that target. The range appears in the area next to "Dist1" text. After a suitable range is obtained, press TEST / ▼ ARROW to confirm this reading.

The following screen displays:

Diff Distance Dist2

Carefully range to the other target. After a second suitable range is obtained, it displays in the area adjoining "Dist2". Press TEST / ▼ ARROW to accept this reading. The following screen displays:

Speed	Test	Dist
50		25.0

The Pro-Lite+ achieves a satisfactory calibration check if the reported speed is within +/- 1 unit (simulated MPH) of twice the actual target range difference. For example, if the targets were placed at exactly 80 feet and 55 feet, with a final separation of 25 feet, the final speed-reading on the Pro-Lite+ must be 49, 50, or 51. This assumes the target has moved this distance in 1/3 second. Other range differences can work. The proper speed is 2 x differential distance.

If the Pro-Lite+ does not pass the test, recheck the target mounts, distances, aiming and repeat the test. If the unit fails, contact Kustom Signals Customer Service.

After completion of the test, press ESC to return to the Default-Operating Speed Mode.

OPERATING PROCEDURES

Speed Mode

After completing the range and HUD tests referred to in the Accuracy Tests Section of this manual, you are now ready to make range and speed measurements.

Orient the Pro-Lite+ toward the traffic flow in as nearly a parallel direction to traffic flow as the setup location permits. Looking through the HUD, aim the Pro-Lite+ at the desired target, and depress the trigger. You immediately see the four dashes "----" in the HUD directly below the aiming reticle, indicating that the laser pulses are being transmitted and the range and speed processing circuits are operating. If the aiming tone is enabled, an intermittent tone sounds when the instrument begins to receive sufficient reflected laser pulses to accurately process speed-readings. When the instrument is squarely aimed at a moving target and is processing valid speed data, the tone becomes constant. At this point the target speed appears on the HUD in place of the dashes. The speed indication is preceded by a "-" sign if the target is receding, and no sign when the target is approaching. Both the "-" and "+" (for approaching targets) will be shown on the rear panel LCD.

When using the Pro-Lite+, as long as the trigger is depressed, the unit continues to update the displayed target speed with the most recently determined value. This enables the operator to correlate the displayed target speed with visual observations of the target vehicle, thus establishing the tracking history needed for introduction of the evidence in many courts. If the target aiming point is moved or lost during tracking, the Pro-Lite+ notifies the operator by rapidly flashing the speed and range. This occurs for two (2) seconds, then the display blanks, unless the aiming target is reacquired and tracking can continue.

While the speed-reading is still being displayed, releasing the trigger locks the speed and range readings on the displays. To take another speed-reading, depress the trigger pushbutton switch again, and the locked speed and range readings will be erased. These readings cannot be recalled.

For the optional single-shot Pro-Lite+, place the HUD aiming sight on the intended target and depress the trigger. When enough range data has been taken, the red aiming sight will flash, indicating the unit has calculated a speed. You will see the speed and direction indicated below the reticle, the same as the standard Pro-Lite+. The speed and last target distance are also shown on the rear panel LCD. To take another speed-reading, depress the trigger pushbutton switch again and the locked speed and range readings will be erased. Comparing this reading with your visual estimate of speed constitutes tracking history. Comparing several readings to your visual speed estimate is another means of completing tracking history for the courts. These readings cannot be recalled. If the audio function is activated, a single beep tone will be heard also indicating the unit has determined the speed and distance to the target.

If your state or agency requires automatic unlock of speed readings, the unit will be set at the factory to automatically unlock any speed readings (applies to Speed Mode only) after 14 minutes.

Range Mode

On power up, the unit defaults to Speed Mode. For applications where the operator is primarily interested in range information, the Pro-Lite+ can be set to display the target range only by using the MODE pushbutton. The "Speed" text disappears from the LCD and only "Range" is displayed. You are now ready to make range measurements with 0.1-foot (or 0.1 meter) resolution.

Holding the Pro-Lite+ as stationary as possible, use the aiming reticle to point the instrument at the desired target and depress the trigger. You will see a series of four dashes "----" directly below the aiming reticle while the laser is firing and range measurements are being made. After approximately 0.3 seconds, the distance to the target appears both in the HUD and under "Range" on the rear panel LCD. Distances are displayed to the nearest 0.1 feet/meter in the HUD and the rear panel LCD. Simply aim and depress the trigger again to make additional range measurements.

If you are using the standard Pro-Lite+, holding the trigger depressed will continue taking range measurements.

Since the infrared pulses used by the Pro-Lite+ are close to the visible spectrum, you will find the target objects that best reflect light also provide maximum range from the instrument. If you experience trouble getting a range reading to a certain part of a distant object, try a different, flatter surface of the object that may have superior reflective characteristics. The standard Pro-Lite+ has a maximum targeting distance of 2,000 feet. The optional single-shot unit has a maximum targeting distance of 1,500 feet.

If the Pro-Lite+ is aimed at a fairly large, distant object, and then "panned" or swept across the surface of the structure, you may occasionally hear the intermittent aiming tone sound. This occurs because the unit is attempting to interpret a series of changing range measurements as a velocity. Normally, no range reading is displayed because this erratic motion does not fulfill the accuracy criteria of the range determination process.

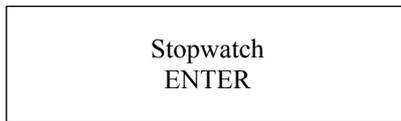
Keep in mind that when making range measurements with the optional single-shot Pro-Lite+, you will display only one range. You will not be able to sweep across the target.

Also, keep in mind that when making range measurements, the instrument does not measure distances shorter than 25 feet (7.62 meters). Aiming the Pro-Lite+ at objects closer than 25 feet will not produce any range or speed displays.

Stopwatch Mode

The Stopwatch Mode of the Pro-Lite+ is used to calculate average speed based on the elapsed time taken by a vehicle to travel a predetermined distance. To use the Stopwatch Mode, press MENU and use the arrows to move to the STPW selection. Press ENTER to access the Stopwatch Menu.

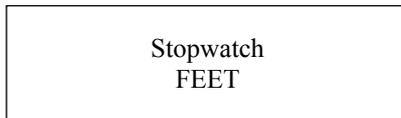
There are three methods that can be used in this mode: 1) use a pre-measured distance, 2) measure a range followed by a second range and use the difference, and 3) measure a range and use your location as the second point. The initial Stopwatch Menu screen appears as:



Stopwatch Enter Mode

The ENTER selection is used to enter the unit of measure to be used in the Stopwatch Mode.

The ENTER screen is shown below:



Use either of the arrows to choose the unit of measure to be used in the Stopwatch Mode. Either selection displays a distance entry screen as follows:

Stopwatch FEET	1320
-------------------	------

Using the arrows, adjust reading to the pre-measured distance the target vehicle will be traveling during the measurement. The minimum range that can be used is 300 feet. Press ENTER to confirm your selection. Once ENTER is pushed, the Audio On/Off screen displays as follows:

Stopwatch Audio	ON
--------------------	----

This screen permits the user to enable or disable the audio alert prompts during the stopwatch function. Use either arrow to make the selection and press ENTER. The "stopwatch ready" screen displays as follows:

Spd Dist	Time
1320	Rdy

When the target passes the first reference point, press and release the trigger once. When it passes the second reference point, press the trigger a second time to stop the timing function. The calculated average speed is shown under "Speed" in the LCD display window and the time (in tenths of a second) is shown under "Time" on the LCD.

Spd Dist	Time
60 1320	15.0

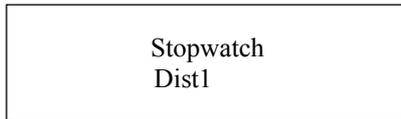
Speed will be displayed as "----" if the elapsed time is less than that needed to be equivalent to a calculated speed of 200 mph or less.

Stopwatch Measure Mode

In addition to the Enter Distance Mode, the unit enables the operator to measure a distance to be used using the unit's ranging capability. To access this mode, the operator should select MEASURE from the STPW Menu:

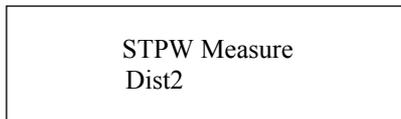


The initial MEASURE screen appears below:



To obtain a range, aim the unit at a target and depress the trigger. The range appears in the area next to "Dist1". After a suitable range is obtained, press TEST / ▼ ARROW.

The next screen appears:



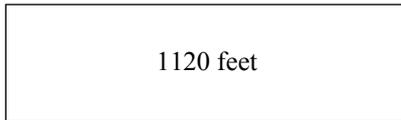
If the second point is the location where the operator is standing, simply press TEST / ▼ ARROW and the Pro-Lite+ uses "Dist1" as the total distance, or you can obtain a second range by aiming the unit at another target and depressing the trigger.

NOTE: You must aim at targets that are in the same plane. Do not aim at a target to the left of your position, then turn 180° and aim at a target to your right.

The range appears in the area next to "Dist2". After a suitable range is obtained, press TEST / ▼ ARROW.

NOTE: "Distance too short" appears if the range difference is less than 300 feet.

The difference between the two ranges displays on the screen as follows:



NOTE: The operator and the two aiming points must be in a straight line for the distance measurements to be accurate.

The user can increase or decrease this range using the unit's arrows. When complete, press ENTER.

The Audio Control Menu, which permits the user to enable or disable the audio alert prompts during the stopwatch function, will appear. Use either arrow to make the selection and press ENTER. The "stopwatch ready" screen displays.

The stopwatch system operates in the same manner as the "pre-measured" ENTER method described earlier in this section.

EXTERNAL OUTPUT SIGNAL

The I/O connector on the front side of the Pro-Lite+ provides a means to connect an external computer, data storage or Giant Display device to the instrument. In a typical application, this might be used to display or store speed-readings from the Pro-Lite+. The connector used for this signal is a 3-pin subminiature stereo jack. If you have trouble obtaining a compatible plug locally, the mating part can be ordered through Kustom Signals' Customer Service Department.

POWER CONSERVATION FEATURES

After approximately 20 seconds with no activity and no locked speed or range readings, the Pro-Lite+ enters "Sleep" Mode. To restore the unit to normal operation, press the FIRE/ENTER switch. If there is a locked speed and/or range reading, it will blank from the HUD, but remain on the rear panel LCD. Depressing the trigger will erase these readings.

The unit also turns off if no activity has occurred after a period of time in the locked Speed Mode. An audio chirp sounds to alert the operator that the unit is powering down.

NOTE: A locked speed or range remains on the display during "Sleep" Mode. Pressing the trigger clears the display.

BATTERY OPERATION

When the battery power becomes too low for operation (the Low Voltage Alert or Low Voltage Warning appears on the display), unscrew the battery compartment door and remove the 2 "AA" batteries. Figures are provided in the battery compartment to assist in the proper orientation of the batteries.

You may use replaceable or rechargeable "AA" batteries.

The pictures below illustrate the correct insertion of the 2 "AA" size batteries.



Figure 2. Insertion of Batteries

Battery Disposal

Please check your local or state regulations on disposal of batteries.

It is a violation of Federal regulations to dispose of rechargeable batteries in a landfill. They must be recycled at an appropriate facility, disposed of in accordance with local ordinances, or shipped back to Kustom Signals for disposal. For more information on disposal facilities near you, contact the Rechargeable Battery Recycling Corp. (RBRC) at 1-800-8-BATTERY, email rbrc@rbrc.com, web page www.rbrc.com.

CARE AND MAINTENANCE

The Pro-Lite+ is designed and constructed so that only a minimal amount of maintenance is required. Maintenance consists of periodic cleaning of the external optical surfaces. This should be done only when necessary, as evidenced by degradation in performance of the unit or by visible contamination on the optics surfaces.

CAUTION: The external optical surfaces are coated glass. Extreme care must be taken when cleaning these surfaces to prevent scratching which will lead to performance degradation.

Surfaces that may be cleaned include the laser output and receiver apertures and the front and rear HUD lens. Gently brush loose debris from the optical surface to be cleaned. Then using a clean, lint-free cloth or lens cleaning tissue dampened with low-residue isopropyl alcohol, gently wipe the optical surface with a circular motion. A cotton swab may facilitate cleaning of the HUD lens and the lower surface of the HUD combiner glass. Repeat the cleaning procedure if necessary.

DO NOT USE A SHIRT OR JACKET TO CLEAN THE LENS.

Note: During the lifetime of the instrument, scratches, pits, and stains may occur on the optical surfaces which cannot be removed by cleaning. Excess rubbing should not be used to attempt to clean these marks: further damage may result. The Pro-Lite+ will operate satisfactorily with a limited amount of cosmetic optical defects.

WARNING! AVOID HIGH PRESSURE SPRAY!

Despite its rugged construction, the Pro-Lite+ is still a precision electronic instrument. Some common-sense handling and storage procedures will help prolong the useful life of the product:

1. Whenever the instrument is not in use, it should be stored so that its lens area and HUD are protected.
2. When momentarily laying the instrument down, care should be taken to keep the optical surfaces from contacting other objects such as seat upholstery, safety belt buckles, and so on, which could scratch the lenses.
3. The instrument should never intentionally be pointed directly at the sun or any other source of intense light. Doing so may cause degradation of the sensitive receiver, resulting in loss of performance.
4. Kustom Signals recommends periodic maintenance of the Pro-Lite+. Please check your local or state requirements for compliance.

TROUBLESHOOTING PROCEDURES

In the event of suspected instrument malfunction, double-check the setup and operational procedures, as well as the power source. If all these appear satisfactory and the Pro-Lite+ still does not perform properly, it should be returned to the Kustom Signals factory for service. Visit www.kustomsignals.com and click on the Parts & Returns Forms tab; choose the Returns Order Form icon. Fill out the form & submit. You will automatically receive a return authorization number immediately. Clearly mark this number on your return shipping label or box. The instrument should be returned in its original shipping container.

There are no user-serviceable parts within the Pro-Lite+. Furthermore, attempts to service the instrument by removing the top cover and defeating safety interlocks could expose the service technician to Class III levels of laser radiation, which are potentially hazardous to eye safety.

REGULATORY COMPLIANCE

Manufacture and operation of the Pro-Lite+ is subject to the regulations of two governmental agencies, the Center for Devices and Radiological Health (CDRH), and the Federal Communications Commission (FCC). The following sections describe the requirements of these two agencies, and the manner in which the Pro-Lite+ complies with their regulations.

Eye Safety

Please be aware there are two models of the Pro-Lite+. Go to the appropriate following section for the model you have purchased:

1. Standard unit – designed and tested in accordance with CDRH.
2. CE mark unit – designed and tested in accordance with IEC 60 825.

Standard Unit

CDRH is an agency of the Federal Food and Drug Administration that has the responsibility of ensuring the safety of all laser products sold in the US. The Pro-Lite+ is certified as a Class I device in accordance with the safety standards of CDRH. Class I is the lowest classification of laser product in terms of relative potential risk. A good description of this category is provided by the Laser Institute of America as follows:

Class I - A Class I laser is considered eye safe based upon current medical knowledge. This class includes all lasers or laser systems which cannot emit levels of optical radiation above the exposure limits for the eye, under any exposure conditions inherent in the design of the laser product. There may be a more hazardous laser embedded in the

enclosure of the Class I product, but no harmful laser radiation can escape the enclosure.

While the Pro-Lite+ is certified as a Class I laser device and is inherently eye safe, certain reasonable precautions should be taken in its operation. As in the case of a movie projector, a person should not stare directly into the beam for extended periods of time. Since the beam is so narrow, normal random eye movements will generally prevent this from occurring. A person should also not stare directly into the beam within 50 feet of the instrument using binoculars, telescope, or other optical gain devices for any extended period of time. Prescription eyeglasses, bifocals, and so on are not considered optical gain devices, because they serve only to correct the focus of the eye to normal human vision. In all respects of normal operation, excluding intentional abuse, the Pro-Lite+ is completely safe for human exposure.

Persons interested in receiving further information regarding laser safety regulations are encouraged to contact one of the following organizations for assistance:

Laser Institute of America
12424 Research Parkway
Suite 130
Orlando, FL 32826

US Department of Health and Human Sciences
Center for Devices and Radiological Health
Food and Drug Administration
Rockville, MD 20852

American Conference of Governmental Industrial Hygienists
P.O. Box 1937
Cincinnati, OH 45201

EMC Directive for CE Mark Unit

This is a class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

INVISIBLE LASER RADIATION.
DO NOT VIEW DIRECTLY WITH OPTICAL INSTRUMENTS.

CLASS 1M LASER PRODUCT
This product complies with
IEC 60825-1:1993+A1:1997+A2:2001

FCC \ CE Information

The Pro-Lite+ is not designed to transmit RF (radio frequency) radiation. The Pro-Lite+ does employ internal high frequency digital circuitry to perform its functions, and is classified as an unintentional radiator in accordance with Part 15.3 of FCC Rules and Regulations, thus an FCC station license is not required for device operation.

The Pro-Lite+ is a digital device marketed for use in a commercial environment, not intended for use by the general public or use in the home therefore is classified as a Class A digital device in accordance with Part 15.3 of FCC Rules and Regulations.

The Pro-Lite+ has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of FCC Rules and Regulations. These limits are designed to provide reasonable protection against harmful interference in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the 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 or her own expense.

WARNING: Changes or modifications to this device not expressly approved by Kustom Signals Inc. could void the user's authority to operate the equipment.

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions:
(1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

SPECIFICATIONS

Nominal Power Requirements	Voltage (VDC)	Current (ma)
Speed mode, laser firing	3.0	350
Range mode, laser firing, backlight on	3.0	355
Idle	3.0	190
Sleep	3.0	96
Power Down	3.0	0.05
ALERT! (Low voltage)	2.0 VDC nominal	
WARNING! (Low volt)	1.8 VDC nominal	
Battery	2 each 1.5 VDC nominal, "AA" size batteries	
Operating Temperature	-30 to +60°C (-22 to +140°F) 90% relative humidity @ 37°C non-condensing	
Dimensions	4.87"L x 5.73"W x 1.92"H	
Weight	19 oz with batteries	
Eye Safety (Standard Unit)	CDRH Class 1 Eye safe	
Eye Safety (CE Unit)	IEC 60 825-1 Class 1M Eye safe	

OPERATIONAL

Speed Range	5 to 200 mph (8 to 320 km/h)
Speed Display Accuracy	+/- 1 mph (+/- 2 km/h)
Target Range HUD unit	25 feet min., up to 2000 feet (7.62 m up to 609.6 m)
Wavelength	905 nm +/- 10 nm
Pulse Repetition Rate	200 Hertz
Range Resolution	0.1 foot/0.1 m
Range Display Accuracy	+/- 6 inches (+/- .15 m) (one standard deviation), when targeting a flat surface
Beam Width	< 3 ft X 3 ft at 1000 feet < 1 m X 1 m at 304.8 meters 3.0 mr. vertical x 3.0 mr. horizontal
Acquisition Time (typical)	0.3 second for 60 mph target typical
Auxiliary Output	Outputs speed and range data RS-232
Operational Speed Accuracy Test	Press the trigger just before the target reaches the first baseline and release it just before it reaches the second baseline.