

PRO LASER III



REFERENCE MANUAL


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KPN 006-0605-00

Rev. 4

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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 ProLaser III 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

Reduced size and weight

Waterproof to IP 67 and NEMA 6

Optional self-contained, removable long-life battery pack

Improved power management features with a low voltage warning and a “sleep” mode to conserve battery power

Square reticle to define the laser beam size

Inclement weather operating mode that improves performance in fog, rain, snow, and dust.

Rubber bumpers to protect the unit’s critical areas

Ergonomically designed handle for reduced arm and wrist fatigue

Backlit LCD for unit set-up, control and operator displays

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 ProLaser III, since it comes from a company with over 28 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 ProLaser III, 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:

ProLaser III lidar speed detection system
with corded handle

1 ea. Operator's Manual on CD

Eye safety certification

Accuracy calibration certification

Options available include the following:

Battery pack handle with charger

Tripod mount

Cable to PC

Cable to palmtop

Carrying case

Contact the Kustom Signals Customer Service department at 620-431-2700 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 ProLaser III is a versatile instrument that measures both the range and velocity of selected targets. The advanced technology of the ProLaser III provides pinpoint aiming capability, allowing the operator to isolate a single vehicle out of a group. In addition, operation of the ProLaser III is completely invisible to conventional radar detectors, used by many motorists to avoid enforcement. The technology employed in the ProLaser III also renders laser detection devices relatively ineffective due to the pinpoint accuracy of the system.

Rather than microwave transmission employed by traditional traffic radar systems, the ProLaser III 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 ProLaser III travels in a straight line of sight, as opposed to the "fringing" effect that is characteristic of microwave emissions.

The technology used by the ProLaser III to measure distances and speeds is referred to as lidar, which stands for *light detection and ranging*. When the trigger is pulled, the ProLaser III sends out hundreds of invisible infrared laser light pulses per second. As each pulse is transmitted, a timer is started, and when the energy of a laser pulse is reflected from a target and received by the ProLaser III, 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 ProLaser III, 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

Operation of the ProLaser III primarily involves using the integrated LCD/keypad located on the back panel of the unit. The only function not controlled by the LCD/keypad is the trigger used to fire the device. Figure 1 illustrates the external controls that are used to operate the instrument. These controls are briefly described as follows:

- A. **Liquid Crystal Display (LCD):** Window displays speed, range, and command menus and unit status in a text format.
- B. **Power (PWR):** turns on and off primary power.
- C. **MENU/ESC:** MENU 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.
- D. **MODE/Up ARROW:** MODE allows the user to select the speed measuring mode or range measuring. The ARROW allows the user to navigate among the text menu items on the LCD.
- E. **BRT/VOL/Down ARROW :** Single menu allows user to adjust the Head-Up-Display brightness to accommodate varying ambient light levels; VOL allows the user to adjust the volume of the unit's audible alerts; LCD backlight can be activated. ARROW permits the user to navigate among text menu items appearing on the LCD.
- F. **TEST/ENTER:** TEST activates the self-test function; ENTER activates the text menu item selected on the LCD.
- G. **Heads-Up-Display (HUD):** displays the sighting reticle and the speed or range of a target.
- H. **I/O Connector:** contains conductors for the external signal output and optional RS-232 port (UART).
- I. **Trigger:** activates the range/speed measurement function, and locks and releases speed and range displays.

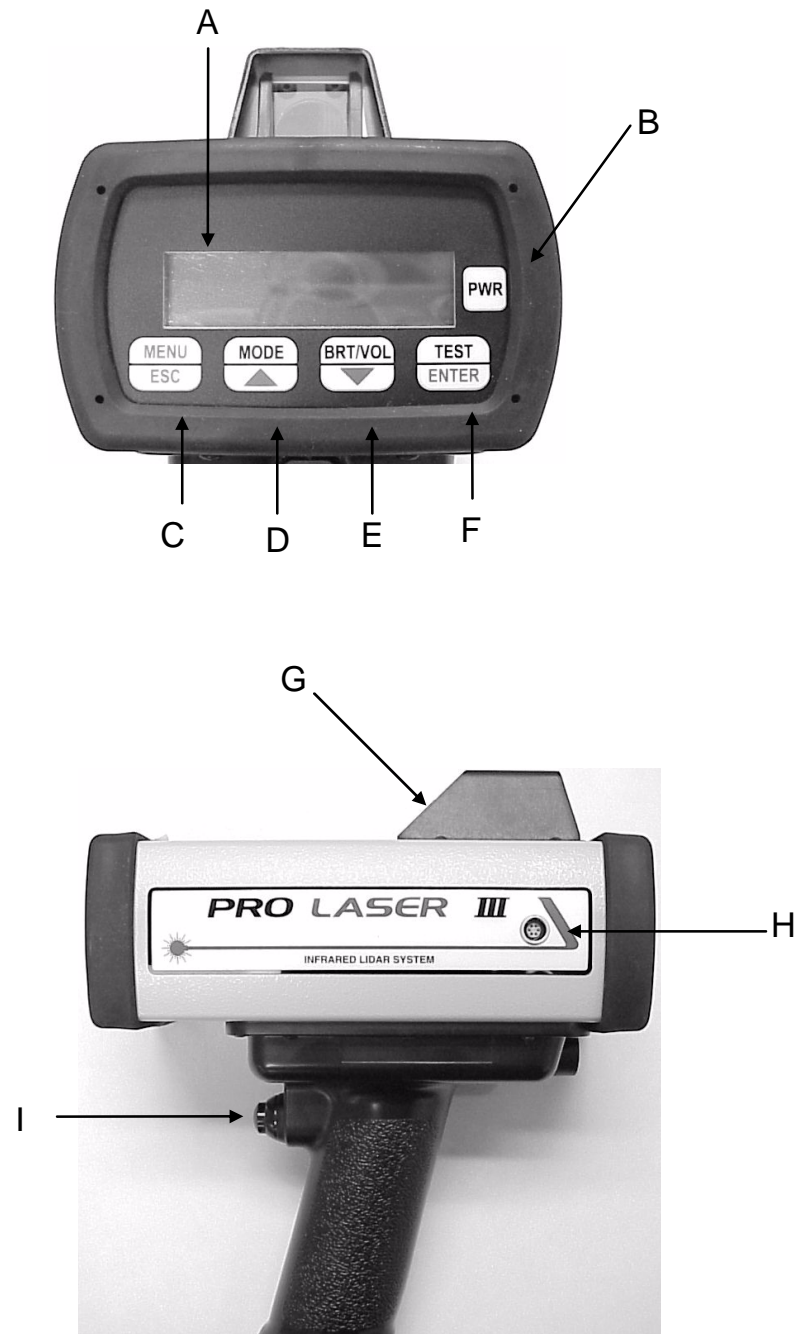


Figure 1

CONTROL DESCRIPTIONS

The preceding section of this Operator's Manual introduced you to the locations of the operating controls on the ProLaser III. This section will provide 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.

PWR (Power)

The power ("PWR") switch located on the back panel is used to turn off and on primary power to the ProLaser III. Press once to turn the unit on. Press and hold for one second to turn the unit off..

Trigger

The trigger of the ProLaser III performs two functions. When the trigger is pulled, it activates the firing of laser pulses, and the range and speed measurement functions of the system. When the trigger is released, the last displayed range and speed readings obtained are retained on the displays. The locked range and speed displays can be cleared by momentarily depressing the trigger a second time.

TEST/ENTER

This is a dual purpose switch. Pressing the TEST/ENTER push button when the unit does not have a menu displayed on the LCD initiates the unit's self test. Pressing this button when a menu is displayed on the LCD enters the user's menu selection.

BRT/VOL/Down ARROW

This is a dual function switch. On the initial push of the switch, a set-up menu for the unit's displays and audio alerts will appear on the unit's LCD. When in Menu Screen, this switch functions as the "down" selector.

MODE/Up ARROW

This is a dual function switch. The Mode switch will toggle between Speed and Range Modes. While in menu screens, this switch functions as a "up" selector. Upon initial power up, the unit will default to speed mode.

MENU/ESC

This is a dual function switch. In the Speed mode or the Range mode, the primary set-up menu is displayed when the push button is depressed. In any menu mode, depressing the button will allow the user to escape (ESC) to the default operating mode.

DISPLAYS AND INDICATORS

The unit's primary display is the LCD located on the back panel of the unit. In addition to speed and range data, the LCD provides set-up menus, user alerts, and self-test status. The LCD is a 2 X 16 character, extended temperature, back-lit version designed for long life and maximum legibility. All operator set-up menus and alerts are communicated via the LCD in text format.

HEADS-UP-DISPLAY

The Heads-Up-Display, or HUD, performs two critical functions in the operation of the ProLaser III. First, it provides the aiming reticle by which the instrument is aimed at the desired target. Secondly, it displays the current speed or range of the target as the operator continues to observe the target, creating a tracking history that is vital for admissible court evidence.

The aiming reticle is an illuminated rectangle 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 whenever the ProLaser III is powered up. The intensity of the reticle is adjusted along with the intensity of the displays, by the BRT/VOL switch on the rear panel of the unit.

Directly below the aiming reticle is a four-character LED numeric display. This display is used to present four types of information to the operator:

1. Upon power-up or the activation of the 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 pulled 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.
4. 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.

STATUS DISPLAYS

The ProLaser III provides user alerts on the LCD back panel. They are listed below-

Low Voltage Alert- if internal battery voltage falls below 9.2 volts. When the "LV Alert" appears and an internal battery installed, it is an indication the unit will shortly exhaust the battery. This alert will appear approximately every two minutes until the battery is exhausted. This alert is also given when using an external battery.

Low Voltage Warning- if internal battery or external power voltage is below 8.6 volts. This warning will appear after the low voltage alert and indicates the units can no longer function and a new power source must be used.

OPERATION

NOTE: The following guide to operating the ProLaser III 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 be taken into account when setting up to make speed or distance measurements with the ProLaser III. 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.

In selecting a location for monitoring traffic, be aware that the ProLaser III 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 which states that the apparent measured speed of a target will be decreased 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 the 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.

The greater the angle between the ProLaser III and the direction of traffic, the greater the cosine error produced. For small angles, the cosine effect is relatively insignificant. For examples, 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 ProLaser III'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 1/2%. For example, setting up 20 feet off the roadway and measuring targets at a range of 200 feet or greater, will assure that the cosine effect produces no more than 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 that you must have a clear line of sight to the target vehicle during the entire measurement interval. Intervening objects such as signposts, utility poles, and tree branches, will prevent the instrument from gathering sufficient valid measurement data to display a speed reading. It will also assist in setup if you select a location where minimum movement of the ProLaser III is required in order to keep it aimed on the desired target.

Visibility conditions also affect the performance of the ProLaser III. 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 also adversely affect the operation. This impact is mitigated to some degree due to the new “poor” weather operating feature available on ProLaser III. However, rain, smoke, fog, and airborne dust particles, if sufficiently dense, may prevent its operation. The instrument is not affected by ambient light conditions, however, and equivalent performance should be obtained whether operating in bright daylight or in total darkness.

To obtain maximum operating range at the setup location, the instrument should ideally be positioned so that it is not operating through any glass in the patrol vehicle. The oblique angles of most windshields will often reduce the effective range of the system, and in addition, some windshields are treated with a coating that blocks the infrared emissions, making operation impossible. Operation through the side glass is preferable to operation through the windshield, although this may also result in some loss of range performance.

Due to the extremely narrow beamwidth of the ProLaser III that makes precise target identification possible, it may be difficult to aim at long ranges if operated handheld. For those situations, use of a monopod or tripod to assist in stabilizing the instrument may be helpful.

POWER-ON SEQUENCE

Test Messages

Upon power up of the unit or a user-initiated self-test, the unit will run self-test. This self-test consists of the following text messages:

Self Test
Int RAM = PASS

Screen 1

Self Test
Ext RAM = PASS

Screen 2

Internal/External Memory Tests: performs a check of the contents of the memory chips in which the microprocessor programs reside.

Self Test
EEPROM = PASS

Screen 3

Programmable Options Test: Checks for corruption of the unit's configuration memory

Self Test
TIMER = PASS

Screen 4

Accuracy Test: performs a comparison between two independent timing circuits to verify that the range and speed determination circuits are operating properly.

Self Test
Checksum = PASS

Screen 5

Program Memory Test: Checks unit's programmable memory for validity.

End of Self Test
0000

Indicates unit self-test is complete.

Units of Measure

In addition to the self-test displays the unit presents upon power up, the unit briefly flashes the units of measure before entering the default operating mode. The screen is displayed below:

Units
Feet/MPH

The displays will indicate "Feet/MPH" for English units, or "KM/H/M " for metric units.

Unit Mode and HUD Display Selection

Following the units of measure display, the unit will briefly display the speed/ranging mode and HUD display selection. The screen appears as:

MODE: Speed HUD: Speed

This display indicates that the unit is in the normal speed measuring operating mode and the HUD will display speed data.

Default Display

Upon initial power up, the unit will default to speed mode and display the following:

Speed	Range
-------	-------

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

MODE/OPTION SELECTION

MODE/Up Arrow

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

NOTE: It is not necessary to depress the ENTER push button to select speed or ranging mode

Depressing the switch will erase the SPEED menu item, leaving only the RANGE text displayed. The unit is now in the range-only mode. This will also change 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 switch description. To return to the speed mode, depress the MODE switch again. Both Speed and Range will again be displayed on the LCD, and the HUD will display speed measurements.

BRT/VOL/Down Arrow

This switch is used to adjust the brightness of the HUD's display, the audio volume, and to turn on or off LCD backlighting. Press the BRT/VOL switch once to get to the setup menu, which appears below:

Setup
[HUD] VOL BKLIT

The brackets around the selection indicate the menu item to be changed. Depressing the BRT/VOL switch with the items above displayed then employs the ARROW to move to the next item. The user then presses the ENTER push button to confirm the display or audio alert item to be adjusted.

If no adjustments are desired, press ESC to return to the Speed or Range mode.

Brightness

The brightness control should be adjusted to allow comfortable viewing of the HUD displays, and sufficient illumination of the aiming reticle for targeting purposes. To adjust, press ENTER at the BRT/VOL menu while HUD is selected.

There are eight 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 depressing the blue arrow switch pointing upward or decreased by pressing the blue arrow switch that is pointing downward. Once the desired brightness level is achieved, press the ENTER switch.



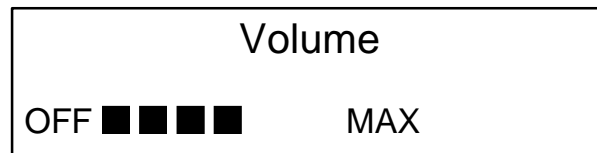
Avoid using excessively bright settings for lower level ambient light conditions as this will make target identification more difficult. Upon being powered up, the ProLaser III will automatically default to the brightness level set at the factory.

Audio Volume

The audible tone provides feedback to assist the operator in aiming the ProLaser III. The aiming tone is activated when the trigger is pulled 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” will increase, indicating proper aiming of the ProLaser III. When a range or speed is actually displayed, the chirping will simultaneously change 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.

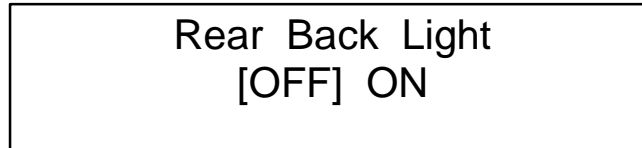
The audible alert volume (VOL) can be adjusted in the same manner as the HUD brightness. The screen appears as below:



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

Backlight

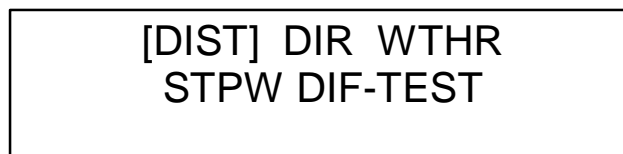
The LCD backlight (BKLIT) selection is used during night operations and enables users to operate the device as they would during daylight. This function illuminates the LCD and the menu to select this option appears as below:



The user simply chooses between turning the back light off (OFF) or on (ON). Use the blue arrow switches to choose an option and confirm this selection by pressing the ENTER switch.

MENU/ESC

The MENU display is used to provide access to additional set-up and operating features of the ProLaser III. The user enters this mode after the unit has been powered up and completed self-test. Using the MENU switch will allow the operator to refine the set-up for a particular situation. Pressing this switch once will display the following screen:



The brackets around the menu choice indicate the item selected. Press the ENTER switch to confirm your selection.

Minimum and Maximum Distance/Range (DIST)

The distance control sets the minimum and maximum ranges at which target vehicle speeds will be displayed. When the DIST menu selection is activated, the input screen appears as:

Set Range (MAX) MIN

Minimum Distance Display and Control

Upon selection of the MIN menu item the following screen appears:

Set Min Range Dist 15

The blue arrow switches on the unit are then used to increase and decrease the minimum range setting. The distance changes in one (1) foot or one meter increments. When the desired minimum distance setting is achieved, press the ENTER switch. This action will return you to the main menu.

Maximum Distance Display and Control

Selecting the maximum distance menu item will display the following screen:

Set Max Range DIST MAX

The blue arrow switches on the unit are then used to increase and decrease the maximum range setting. The distance changes in one (1) foot or one meter increments. When the desired maximum distance setting is achieved, press the ENTER switch. This action will return you to the main menu.

It is also possible to set the MAX range value by actually using the ProLaser III to range to a target. At the Set Max Range display, aim the unit at a stationary target and pull the trigger until a range is displayed. The range can be remeasured as many times as desired. The arrow switches can be used to adjust the range value. When the desired value is displayed, press ENTER to set the maximum range.

With these settings, any target that provides an adequate signal return will be displayed, up to a maximum range of 6000 feet. . The distance to the target must be greater than 10 feet for the ProLaser III to display a reading in either Speed or Range Mode. Each time the ProLaser III is powered up, the maximum range control setting will default to its "MAX" setting.

Direction (DIR) Menu

The DIR screen is used to select the direction of travel for target vehicles. The set-up screen appears as:

Set Direction
APR REC (BOTH)

The blue arrow switches will allow you to select: 1) APR- approaching targets; 2) REC- receding targets; 3) Both- both approaching and receding targets. NOTE: "BOTH" is the default selection. Once the selection has been made, pressing ENTER confirms the selection and returns you to the main menu.

If the APR mode is selected, all approaching vehicle speeds will be 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. No speeds will be displayed on receding vehicles.

Likewise, if “REC” is selected, the letters “rEC” are displayed in the HUD when an approaching vehicle is targeted.

Note that a continuous, audible tone will still be emitted when a vehicle speed is determined in a direction opposite that of the direction mode selected.

If “Both” is selected, the ProLaser III will display speeds for all vehicles.

Weather (WTHR) Menu

The weather feature is used to improve the unit’s sensitivity and performance in adverse weather conditions. Fog, rain, snow and heavy dust can sometimes interfere with the performance of the ProLaser III. Target ranges less than anticipated may be displayed, typically between 50 – 250 feet. Inability for the unit to lock a valid speed is a symptom of this problem in the speed mode. The weather mode improves the system performance by setting the minimum range to approximately 250 feet. This dramatically improves both the speed and range performance of the unit in poor weather conditions. Note that no speed or range readings will be possible inside 250 feet while in the “Poor” weather mode.

When this menu item is selected the following screen appears:

Set Weather
(NORMAL) POOR

Use the blue arrow switch to make the selection and press ENTER. The main menu will reappear.

Stopwatch (STPW) Feature

The stopwatch feature allows the user to calculate average speed based on the elapsed time taken by a vehicle to travel a predetermined distance. Details of the Stopwatch Mode are described beginning on page 29.

Differential Distance Test (DIF-TEST)

The differential distance test feature is used as a calibration check to ensure the unit is accurately calculating target speeds based on range differences. Details of this test are found in the “Accuracy Testing” section, next. NOTE: Metric units are not equipped with this feature.

ACCURACY TESTS

Press the PWR switch on the back panel and allow the instrument to complete the self-test sequence. Although the internal test performs a complete check of the ProLaser III'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. Select an isolated target about 100 or more feet (30 meters) away, such as a stop sign, utility pole or overhead power wire. Slowly sweep the ProLaser III across the target and observe that the proper range is displayed only when the target is within the reticle area, indicating lateral alignment. (Listening to the audio “chirp” indicating reflection of laser pulses is helpful when using overhead wires.) Rotate the ProLaser III so that it is at right angles to its normal operating position, (positioned on its side) and repeat the process to verify vertical alignment.

A second test can be made by taking range measurements to known, fixed distances. Perform the test as follows:

1. Lay out a test range using a steel tape measure so that several target distances between 50 and 500 feet are clearly marked. Distances are measured from the front face of the Pro-Laser III 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-Laser III laser beam.

3. Measure and record the reported distance and the absolute distance error “DE” from actual.

4. Repeat for all remaining target positions.

5. Calculate the standard deviation of the errors as follows (T represents the number of target distances selected in #1, above):

$$\text{S.D.} = \sqrt{\frac{\sum (\text{DE})^2}{T-1}}$$

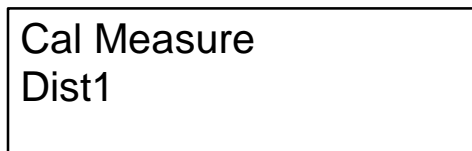
6. The standard deviation shall be less than .5 ft.

Differential Distance Test (DIF-TEST)

NOTE: Metric units are not equipped with this feature.

Prepare two flat targets painted with a flat white paint; plywood or particle board are suitable. Place the targets at two precisely known, integer feet, distances along the same line of sight. 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 be carefully marked. The target separation should be at least 10 feet. Mount the ProLaser III on a tripod (available as an option from KSI) so that the front face of the unit is precisely placed at the zero foot point.

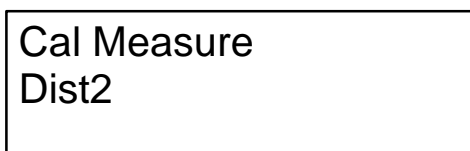
Enter the DIF-TEST mode by pressing MENU and selecting the menu item. The following screen will appear:



Cal Measure
Dist1

Carefully range to either of the two targets being sure to hit only that target. The range will appear in the area next to "Dist1" text. After a suitable range is obtained, press ENTER.

The following screen will appear:



Cal Measure
Dist2

Carefully range to the other target. After a second suitable range is obtained, it will appear in the area adjoining "Dist2". Press ENTER. The following screen will appear:

Speed	Test	Dist
50		25.0

The ProLaser III will have achieved a satisfactory calibration check if the reported speed is within +/- 1 unit (simulated MPH) of twice the actual measured target range difference. For example, if the targets were placed at exactly 79 feet and 39 feet, with a final separation of 40 feet, the final speed reading on the ProLaser III must be 79, 80, or 81.

If the ProLaser III does not pass the test, recheck the target mounts, distances and 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 mode.

OPERATING PROCEDURES

Speed Mode

After completing the range and HUD tests referred to in the ACCURACY TEST section of this manual, you are now ready to make range and speed measurements.

Orient the ProLaser III toward the traffic flow in as nearly a parallel direction to traffic flow as the setup location permits. Aim the ProLaser III at the desired target, and pull the trigger. You will 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, you will

hear an intermittent tone when the instrument is beginning 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 will become constant. At this point the target speed will appear on the HUD in place of the dashes, and on the rear panel under the "Speed". The speed indication will be preceded by a "-" sign if the target is receding, and by a "+" sign (in the rear panel display) or no sign (in the HUD) if the target is approaching.

As long as the trigger is pulled, the ProLaser III will continue to update the displayed target speed with the most recently determined value. This allows 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 into court. If the target aiming point is moved or lost during tracking, the ProLaser III will notify the operator by rapidly flashing the speed and range. This will occur for two (2) seconds, then the display will blank, unless the aiming target is reacquired and tracking can continue.

While the speed reading is still being displayed, releasing the trigger will lock the speed and range readings on the displays, and they will begin flashing.

Range Mode

When the ProLaser III is first powered up, the HUD is programmed to display target speeds. For applications where the operator is primarily interested in range information, the ProLaser III can be set to display the target range in the HUD by using the MODE push button to switch to Range mode. The "Speed" text will disappear from the LCD and only "Range" will be displayed. You are now ready to make range measurements.

Holding the ProLaser III as stationary as possible, use the aiming reticle to aim the instrument at the desired target, and pull and hold 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 second, the distance to the target will appear both in the HUD and under the "Range" text in the rear panel LCD. Distances will be displayed to the nearest 0.1 feet/meter in the HUD and the rear panel LCD. Simply aim and pull the trigger again to make additional range measurements.

Since the infrared pulses used by the ProLaser III 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.

If the instrument 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 ProLaser III is attempting to interpret a series of changing range measurements as a velocity. Normally, no range reading will be displayed because this erratic motion does not fulfill the accuracy criteria of the range determination process.

Keep in mind that when making range measurements, the instrument does not measure distances shorter than 10 feet. Aiming the ProLaser III at objects closer than 10 feet will not produce a range or speed display.

Stopwatch Mode

The stopwatch mode of the ProLaser III 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 the MENU switch and use the blue arrow switches to move to the STPW selection. Press ENTER to access the stopwatch menu.

There are three methods that can be utilized in this mode- 1) measure a range, followed by a shorter range and use the difference; 2) measure a range and use your location as the second point; 3) use a predetermined distance. The initial stopwatch menu screen appears as:

STPW Distance
(ENTER) MEASURE

Stopwatch Enter Mode

The ENTER selection is used to enter the unit of measure to be used in the stopwatch mode (Option 3). The ENTER screen is depicted below:

STPW Distance
(FEET) YARDS

Use either of the blue arrow switches to choose the unit of measure to be used in the stopwatch mode. Either selection will summon a distance entry screen that appears below:

Enter Distance (FEET) 1320

Using the blue arrow switches, enter the distance the target vehicle will be traveling during the measurement. The minimum range that can be used is 300 feet. Depress ENTER to confirm your selection. Once the ENTER switch is pushed, the Audio On/Off screen will appear. The screen looks like:

Audio (ON) OFF

This screen allows the user to enable or disable the audio alert prompts during the stopwatch function. Use either blue arrow switch to make the selection and press ENTER. The “stopwatch ready” screen will appear. It is depicted below:

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 will be shown under “Speed” in the LCD display window and the time (in tenths of a second) will be shown under “Time” on the LCD. Note that the time elapsed is shown in the HUD until the speed is calculated and then the calculated speed is shown in the HUD.

Spd	Dist	Time
60	1320	15.0

Stopwatch Measure Mode

In addition to the “enter distance” mode, the unit allows the operator to calculate 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:

STPW Measure
Dist1

The operator obtains a range by aiming the unit at a target and pulling the trigger. The range will appear in the area next to “Dist1”. After a suitable range is obtained, press ENTER.

This action activates the second screen which appears below:

STPW Measure
Dist2

If the second point is where the operator is standing, simply press ENTER and the ProLaser III will use Dist1 as the total distance. The operator obtains a second range by aiming the unit at a target and pulling the trigger. The range will appear in the area next to "Dist2". After a suitable range is obtained, press ENTER. Note that "Distance too short" appears if the range difference is less than 300 feet. The difference between the two ranges will appear on a screen as below:

1120 feet

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 arrow switches. When complete, press ENTER. This will activate the Audio control menu, which allows the user to enable or disable the audio alert prompts during the stopwatch function. Use either blue arrow switch to make the selection and press ENTER. The "stopwatch ready" screen will be displayed.

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 will be shown under “Speed” in the LCD display window and the time (in tenths of a second) will be shown under “Time” on the LCD. Note that the time elapsed is shown in the HUD until the speed is calculated and then the calculated speed is shown in the HUD.

EXTERNAL OUTPUT SIGNAL

The I/O connector on the left side of the ProLaser III 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 ProLaser III. The connector used for this signal is a 6-pin DIN-style circular connector; 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 one minute with no activity, the ProLaser III will enter a “sleep” mode. The display will blank, and the message “Sleeping” will blink on the display. To restore to normal operation, press any rear panel switch (except PWR). The unit will also turn itself off if no activity has occurred after a period of time in the Sleep Mode. An audio chirp will sound to alert the operator that the unit is powering down.

A locked speed or range will remain on the display during “Sleep” mode, but the blink rate will be much slower than when active. Pressing the trigger will clear the display.

CORDLESS OPERATION

The ProLaser III may be operated with the supplied corded handle plugged into a 12 VDC power source, or it may be operated with the optional cordless battery handle. To change to the battery handle, unscrew the end of the corded handle by turning counterclockwise with a “push and turn” motion. Insert the battery pack into the handle and screw in with a “push and turn”. There is only one way the pack will fit into the handle so that the cap will screw down, thus assuring proper power connections.

When the battery pack’s power becomes too low for operation (the Low Voltage Alert or Low Voltage Warning will appear on the display), unscrew from the handle of the ProLaser III and recharge by inserting it into the charger and attaching it the same way as is done in the handle. Plug the charger into a wall outlet and allow to charge for 4-5 hours (standard charger). When the battery pack is fully charged, the charger will cease charging in order not to harm the battery pack.

It is a violation of Federal regulations to dispose of dead batteries in a landfill. They must be recycled at an appropriate facility or otherwise disposed of in accordance with local ordinances, or they may be 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, e-mail rbrc@rbrc.com, web page www.rbrc.com.

CARE AND MAINTENANCE

The ProLaser III is designed and constructed so that only a minimal amount of normal 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 aperture, the HUD combiner glass, and the 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.

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 ProLaser III will operate satisfactorily with a limited amount of cosmetic optical defects.

Despite its rugged construction, the ProLaser III 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, 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. Contact KSI for periodic calibration requirements.

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 ProLaser III still does not perform properly, it should be returned to the Kustom Signals factory for service. The instrument should be returned in its original shipping container, and should be accompanied by a note describing the problem and the circumstances under which it occurs.

There are no user-serviceable parts within the ProLaser III. 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 ProLaser III is subject to the regulations of two governmental agencies, the Center for Devices and Radiological Health (or CDRH), and the Federal Communications Commission. The following sections describe the requirements of these two agencies, and the manner in which the ProLaser III complies with their regulations.

EYE SAFETY

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 ProLaser III 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 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 ProLaser III is certified as a Class I laser device and is inherently eyesafe, 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 ProLaser III 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

FCC INFORMATION

Since the ProLaser III is not designed to transmit RF (radio frequency) radiation, an FCC station license is not required for operation of the device. However, the ProLaser III does employ internal high frequency digital circuitry to perform its functions, and therefore is classified as a Class A digital device in accordance with Part 15 of FCC Rules and Regulations.

The ProLaser III has been tested and found to comply with the limits for a Class A digital device pursuant to Part 15 of FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a commercial installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. 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

GENERAL

Operating Voltage	8.6 - 16.5 VDC	
Nominal Power Reqm'ts	Voltage (VDC)	Current (ma)
Speed mode, laser firing	13.6	510
Range mode, laser firing, backlight on	13.6	520
Idle	13.6	300
Sleep	13.6	130
Power Down	13.6	3
ALERT! (Low voltage)	9.2 VDC nom	
WARNING! (Lo volt)	8.6 VDC nom	
Battery	9.6 VDC nom, NiMH	
Operating Temperature	-30 to +60°C (-22 to +140°F) 90% relative humidity @ 37°C non-condensing	
Dimensions	7.36"L x 4.21"W x 9.92"H, including handle and heads-up- display	
Weight	3 lb.	
Eye Safety	CDRH Class One Eyesafe	

OPERATIONAL

Speed Range	5 to 200 mph (8 to 320 km/h)
Speed Display Accuracy	+/- 1 mph (+/- 2 km/h)
Target Range	10 feet min., up to 6000 feet
Wavelength	904 nm +/- 10 nm
Range Resolution	0.1 foot/0.1 m
Range Display Accuracy	+/- 6 inches (+/- .15 m) (one standard deviation), when target is on a flat white or gray surface.
Beam Width	< 3 ft X 3ft at 1000feet < 3 m X 3m at 1000 meters 3.0 mr vertical x 3.0 mr horiz.
Acquisition Time (typ)	0.3 second for 60 mph target
Auxiliary Output	Outputs speed and range data
Operational Speed Accuracy Test	Depress the trigger just before the target reaches the first baseline and release it just before it reaches the second baseline.

WARRANTY

The Kustom Signals *ProLaser LIDAR* system is guaranteed to be free of defects in materials and workmanship for a period of one (1) year from date of delivery to the Owner or Lessee.

This Warranty applies only to the original registered Owner or Lessee on file at Kustom Signals, Inc., and cannot be assigned or transferred to a third party.

The Owner or Lessee shall use the Equipment in accordance with the manufacturer's operational instructions.

The Owner's or Lessee's exclusive remedy under this Warranty is limited to repair to the manufacturer's operational specifications or replacement, at the sole discretion of Kustom Signals, Inc. or its agent, of the Equipment as (i) is covered by this Warranty; (ii) is delivered to Kustom Signals, Inc. or its agent at the Owner's or Lessee's expense within the term of this Warranty; and (iii) upon examination thereof discloses to the exclusive satisfaction of Kustom Signals, Inc. or its agent to have been defective in material or workmanship. Warranty service and repairs must be performed by an Authorized Kustom Signals Warranty Service Center or the Factory Customer Service Center or this Warranty is void.

Failure of the Owner or Lessee to observe any conditions set forth in this warranty; or equipment damage arising from flood, fire, vehicle collision, act of God or similar event or catastrophe; or tampering, abuse, or misuse of the equipment by Owner, Lessee or third party will render the Owner or Lessee responsible for the cost of bringing the system within the manufacturer's operational specifications.

This warranty is not intended to supplant normal care and service by the Owner or Lessee, as specified in the Operator's Manual, and shall not apply to Equipment which has been defaced or damaged through normal usage.

The liability of Kustom Signals, Inc., if any, with respect to the equipment, shall be limited as provided in this Warranty. Kustom Signals, Inc. disclaims any obligation or liability for the loss of use of the Equipment warranted, loss of time, inconvenience, commercial loss or other direct, consequential, special or incidental damages. Kustom Signals, Inc. makes no warranties of any kind other than as herein expressly provided, expressed or implied, and specifically disclaims the implied warranties of merchantability and of fitness for a particular purpose. You may have additional rights under this Warranty that vary from state to state.

No action for breach of this warranty may be commenced more than one year after the date of alleged breach.

Equipment Supplied with Consumable Items

Items such as tires, non-rechargeable batteries, light bulbs, transmitter carrying pouch, and microphone cables w/microphone and windscreen are considered consumable items and as such are not covered by this warranty.

SMART Radar

SMART system radar units are warranted for two years, subject to the warranty terms listed above.