

Contour XLRi

Operator's Manual



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Attention:

Surveyor Prisms and Corner Cubes should only be used with a brush filter attached to the Contour receiver lens. Please contact your LaserCraft dealer to purchase a brush filter.

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GENERAL INFORMATION

INTRODUCTION

Congratulations! You have invested in the latest generation of the most technologically advanced instrument available for distance measurement and other surveying and mapping uses. In a compact, handheld package, the Contour XLRI offers the versatility of direct range measurement without the use of prisms or retro reflectors. The system also includes an integrated, digital compass/inclinometer module combined with powerful software providing a variety of preprogrammed mapping and surveying functions. The unit offers a number of improved operating features and specifications, which make it easier to employ, service, and train personnel in its use. These improvements include:

- Improved range accuracy and resolution.
- Reduced size and weight.
- Waterproof to IP 67 and NEMA 6.
- Self-contained removable, long-life battery pack.
- Improved power management features with a low voltage warning, and an user selectable “Power Off” mode to conserve battery power.
- Square reticle to define laser beam size.
- Increment 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 keypad for unit set-up, control and operator displays.

Operators who are familiar with the use of conventional surveying or laser systems will find it a simple matter to become accustomed to the Contour XLRI. 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 surveying and mapping systems.

UNPACKING

When you first receive your Contour XLRI, carefully inspect the shipping carton for signs of damage. Any damage evident should be immediately reported to the carrier and to LaserCraft Inc.

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

1. Contour XLRI LIDAR Laser Rangefinder system
2. 1 ea. Operator's Manual
3. 1 ea. Battery Pack
4. 1 ea. Battery Charger
5. Hard Carrying Case

If any of the above is missing, contact the LaserCraft Customer Service department at 770-409-9660 or via e-mail at techsupport@lascraftinc.com. Having the order number from your packing list will expedite the call. Please note that separately ordered accessories will be itemized on the packing list.

CARRYING CASE

The Contour XLRI comes with a durable, water-resistant Hard Carrying Case. The case is custom made for storage of the Contour, spare batteries, cables, etc. The case has a removable containment tray for yolk assembly storage underneath. The custom compartments in the hard case are used to limit the amount of movement of the Contour, thus reducing chances of damage to the Contour during transit.

FUNCTIONAL DESCRIPTION

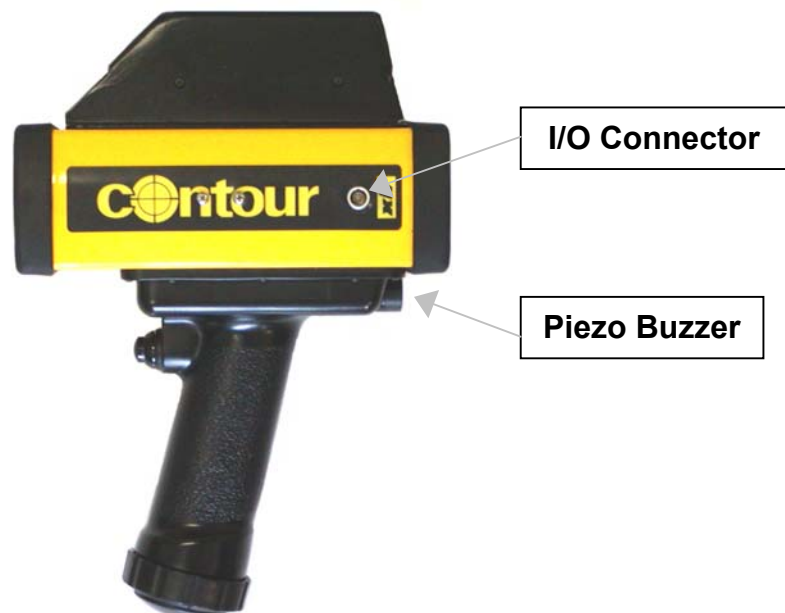
The Contour XLRI is a versatile instrument that measures the range, bearing and inclination of selected objects. The advanced technology of the Contour XLRI provides pinpoint aiming capability, allowing the operator to isolate a single object.

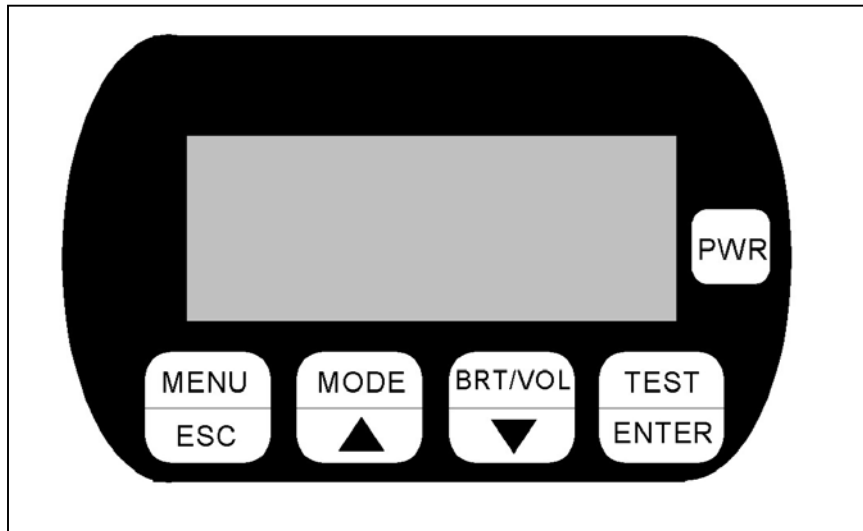
The technology used by the Contour XLRI to measure distances is referred to as **LIDAR**, which stands for *light detection and ranging*. When the trigger is pulled, the Contour XLRI sends out hundreds of invisible infrared laser light pulses per second. As each pulse is transmitted, a timer is started, and when the energy of a laser pulse is reflected from an object and received by the Contour XLRI, the timer is stopped. From the elapsed time taken for the laser pulse to strike and return from the object, the distance to the object is calculated using the known speed of light through the atmosphere. Integrated to the system is a precision magnetometer and inclinometer providing azimuth readings relative to magnetic or true north and elevation readings relative to the level horizontal plane.

Control Locations

Operation of the Contour XLRI 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. **Figures 1 & 2** illustrate the locations of the external controls that are used to operate the instrument. The four, keypad buttons located near the bottom of the rear panel have *dual* functions and have an upper and lower label. The upper label functions are active until you enter any menu at which time all lower label functions become active. These controls are briefly described below:

1. **Power (PWR)**: turns on and off primary power.
2. **Trigger**: activates the range / angle measurement function, and locks and releases the range display.
3. **Liquid Crystal Display (LCD)**: displays data, command menus and unit status in a text format.
4. **TEST | ENTER**: TEST activates the self-test function; ENTER activates the text menu item selected on the LCD.
5. **BRT/VOL |** : BRT/VOL displays a menu allowing the user to adjust the HUD brightness, audio volume and backlight control through additional submenus. Pressing this button activates the lower label button functions. The key permits the user to navigate among text menu items appearing on the LCD.
6. **MODE |** : Pressing the MODE key toggles through the various measuring modes; the key allows the user to navigate among the menu items appearing on the LCD.
7. **MENU | ESC**: MENU displays the unit's main menu items on the LCD and activates the lower label button functions. Pressing the ESC button exits the menu and returns to the operating mode.
8. **Head-Up Display (HUD)**: displays the sighting reticle and the range to the target.
9. **I/O Connector**: Connector for RS 232 data logging and communications.





HEAD-UP DISPLAY

The Head-Up Display, or HUD, performs two critical functions in the operation of the Contour XLRi: (1) it provides the aiming reticle by which the instrument is pointed at the desired target; (2) it displays the current range or measurement result as the operator continues to observe the target.

The aiming reticle is an illuminated hollow 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 whenever the Contour XLRi is powered up and in ready mode. The reticle is turned off when the unit goes into sleep mode. The intensity of the reticle is adjusted along with the intensity of the HUD digits, using the BRT/VOL key 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 three types of information to the operator:

1. When the trigger is pulled and laser pulses are being transmitted, the HUD will first display four dashes "----" indicating that the laser is being fired and that the instrument's range measurement function is activated. Display of the dashes in the HUD occurs simultaneously with the display of dashes directly beneath the "Range" text on the rear LCD panel. This confirms that laser activation has taken place, and the operator's attention is not diverted from the HUD.
2. When a target is acquired, the four dashes will change to the actual target range.
3. 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. If status messages other than low voltage alert or warning are displayed, please record them as they will assist the service department should repairs be required.

REAR PANEL DISPLAY

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

CONTROL DESCRIPTIONS

The preceding section of this Operator's Manual introduced you to the locations of the operating controls on the Contour XLRI. This section will provide detailed descriptions of the function of each control.

CAUTION: USE OF THE 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 OPERATES AT PEAK PERFORMANCE.

Power

The power ("PWR") membrane switch located on the back panel is used to control primary power to the Contour XLRI. The unit is activated by pressing the membrane switch once and is turned off by pressing and holding the key for two (2) seconds.

Trigger

The trigger of the Contour XLRI performs two functions. When the trigger is pulled, it activates the firing of laser pulses and the range measurement function of the system. When the trigger is released, the last displayed range reading is retained on the displays.

MENU | ESC

Like all the keys on the control keypad, except PWR, the MENU | ESC key is designed to accomplish two functions. Pressing this button when the unit is in any normal operating mode (i.e. no menu on LCD) displays the main menu on the rear panel LCD. From this main menu, various submenus are available to control the general setup parameters of the unit. Pressing this button while any menu or submenu is displayed will exit or escape (ESC) the menu and return to the previous operating mode.

MODE | ▲

This is a dual function pushbutton. Pressing this button when the unit does not have a menu displayed on the LCD will cycle the Contour through its various operating modes. This button serves as an up-arrow, ▲, and function when a menu is already displayed in the LCD. The ▲ function is used in various menus to navigate forward through selections or increase settings such as volume or brightness.

BRT/VOL | ▼

This is a dual function pushbutton. Pressing this button when the unit does not have a menu displayed on the LCD will initiate the brightness and volume control menu. From this menu the operator can select submenus to adjust the brightness of the HUD, volume of the audio transducer and the on/off status of the LCD backlight. This button serves as a down-arrow, ▼, and function when a menu is already displayed in the LCD. This function is used in various menus to navigate backward through selections or reduce settings such as volume or brightness.

TEST | ENTER

This is a dual function pushbutton. Pressing the TEST | ENTER 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 accepts and activates the user's menu selection.

SLEEP MODE

The Contour XLRI comes preset from the factory to go to sleep in 60 seconds. This is a power saving feature that significantly increases the battery life. If there is no activity from the back panel switches, the trigger switch or the RS232 connection for 60 seconds, the unit will go to sleep. In sleep mode the HUD turns off, while the LCD display retains the displayed message. To return from sleep mode press any back panel switch once. The unit clears the displays and resumes operation in the current mode. Pressing the trigger switch will wake up the unit, clear all displays and begin ranging.

POWER DOWN MODE

The Contour XLRI comes preset from the factory to power down in 5 minutes. This is a power saving feature that significantly increases the battery life. If there is no activity from the back panel switches, the trigger switch or the RS232 connection for 5 minutes, the unit will power off.. To return from power down mode press the PWR back panel switch. The unit resumes operation in the last mode that was selected. Pressing the trigger after the end of Self Test will begin ranging.

BATTERY AND CHARGER

The Contour XLRI comes equipped with a battery pack and charger assembly. The battery pack fits into the base of the Contour handle and is secured with the knurled lock ring on the battery pack. Notice that the handle and battery pack are "keyed" to ensure insertion in the proper orientation. The lock ring will not screw onto the handle if the battery is inserted improperly. **Do not force the battery into the handle!** The lock ring should easily thread on the handle when the battery is inserted properly.

CHARGING

Simply plug the charger assembly into a standard AC wall outlet. Then insert the battery back into the charger stand. Notice that the charger stand is keyed exactly like the Contour handle. The red light on the charger unit will illuminate indicating that charging is underway. Full charge is obtained in 4-6 hours. (Note: With 120 V chargers the red light will turn off after the 4-6 hour period and then periodically turn back on to maintain charge. With 240 V chargers the red light will remain on after the 4-6 hour charge period indicating a trickle maintenance charge.)

NOTE: WHEN USING THE SYSTEM FOR THE FIRST TIME, IT IS IMPORTANT TO ENSURE THAT 1) THE BATTERY IS FULLY CHARGED FOR 6 HOURS AND 2) THE BATTERY IS USED IN THE CONTOUR UNTIL THE "LOW VOLTAGE ALERT" IS GIVEN (BEFORE CHARGING AGAIN). REPEATING THIS SEQUENCE FOR THE FIRST THREE CHARGE CYCLES WILL CONDITION YOUR BATTERY PACK FOR OPTIMUM PERFORMANCE.

BATTERY OPERATION

The battery charge lifetime will vary depending upon your application and how often the laser is fired during the day. Typically a full charge should last for 1 or 2 days of standard use. The Contour XLRi will issue a "low voltage alert" when the battery is nearly exhausted indicating you should change batteries or switch to the power cord option as soon as possible. A "low voltage warning" is issued when the battery voltage drops to an unusable level. The unit will then cease operation.

The battery lifetime will slowly degrade if the unit is left idle with the battery inserted. When not in use for extended periods, it is wise to leave the battery in the charger if possible.

CAUTION: ALL BATTERIES CAN CAUSE PROPERTY DAMAGE, INJURY OR BURNS IF CONDUCTIVE MATERIAL, SUCH AS JEWELRY, KEYS OR BEADED CHAINS, COME IN CONTACT WITH EXPOSED TERMINALS. THE MATERIAL MAY COMPLETE AN ELECTRICAL CIRCUIT AND BECOME QUITE HOT. TO PROTECT AGAINST SUCH UNWANTED CURRENT DRAIN, EXERCISE CARE IN HANDLING ANY CHARGED BATTERY, PARTICULARLY WHEN PLACING IT INSIDE YOUR POCKET, CARRYING CASE OR OTHER CONTAINER WITH METAL OBJECTS.

OPERATING THE CONTOUR XLRI

POWER-UP SELF TEST

Test Messages

Upon power up or a user-initiated self-test, the unit will run the self-test routine. This self-test routine takes approximately 3 seconds to complete and consists of the following text message displayed on the rear panel LCD.

Self Test

A return to the selected operating mode such as RI or 2 shot Height indicates a successful completion of self-test.

If the unit has failed self-test, the following information is displayed.

End of Self Test
XXXX FAIL

Power the unit off and then on again. If the self-test failure persists, record the value of “XXXX” and contact LaserCraft for repair.

BRIGHTNESS / VOLUME ADJUST

It is sometimes necessary to adjust the intensity of the HUD and volume of the audio transducer. For optimized nighttime operations there may also be a requirement to activate the back light feature of the LCD. These tasks are accomplished by pressing the BRT/VOL button after the unit is powered up. The following display appears:

Setup
(HUD) VOL BKLIT

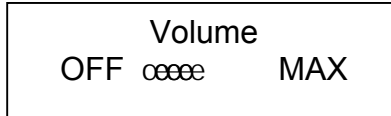
After entering the “BRT/VOL menu, the lower (BLUE) functions of the membrane switches are active.

The brackets surrounding (HUD) indicate the selection to be adjusted. This action is confirmed by pressing the ENTER button. Use the blue arrow keys to navigate and ENTER to select the item to be adjusted. If HUD is selected the following screen will appear:

HUD Brightness
MIN ☺☺☺☺ MAX

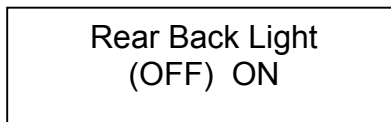
There are eight LCD blocks between the MIN and MAX text on the LCD screen. This corresponds to eight brightness levels in the HUD. Pressing the blue arrow key pointing upward or decreased by pressing the blue arrow key that is pointing downward can increase HUD brightness. Once the desired brightness level is achieved, press the ENTER key.

The audio transducer 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 transducer. Use the blue arrow keys to adjust the volume. The arrow pointing downward lowers the volume; the arrow pointing upward increases the volume. Each time an arrow key is pressed adjusting the volume, the audio will briefly sound, indicating the audio level the user will hear. Once the desired level is achieved, press the ENTER key to confirm the selection.

The (BKLT) selection is used to control the LCD back light feature, which is useful for night operations. 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 keys to choose an option and confirm this selection by pressing the ENTER key.

MEASURING RANGE & INCLINATION

This section will explain the basic operation of the Contour XLRI in what is called the “standard” or R/I mode. The standard mode is the default power-up mode. In this mode the Contour XLRI will display range and inclination to your selected target. Automatic calculation modes such as horizontal distance, area, etc. are discussed in the following section. Taking measurements with the Contour XLRI is quick and easy. Set the unit's controls for volume, brightness, environment, etc., as described in the previous sections. Make sure the unit is in R/I mode by using the MODE key to toggle the LCD display unit you see “Incl Range” on the first line.

Holding the Contour XLRI steady and a few inches from your sighting eye, use the HUD reticle to aim the instrument at the desired object, and pull the trigger. You will see a series of four dashes "----" directly below the aiming reticle while the laser is firing and range data is collected. After approximately 0.3 second, the distance to the object will appear both in the HUD and under the “Range” heading in the rear panel LCD. The rear panel display will also show the inclination to the target. Distances are displayed to the nearest 0.1 feet/meter in the HUD and the rear panel LCD. The trigger can be held down continuously as the Contour is moved from target to target; the range readings will update accordingly. When the trigger is released the last range and inclination readings are locked in the displays. After 60 seconds of no activity, the Contour will go to "sleep" to conserve battery power. At this time the HUD will turn off, however the rear panel display will retain its displayed data. Simply aim and pull the trigger again to make additional range measurements. **Note: The Contour will take approximately 0.5 seconds to transmit RS232 data to the port after the trigger is released. During this time the trigger is deactivated.**

Keep in mind that when making range measurements; the instrument does not measure distances shorter than 10 feet or longer than 6100 feet. You will experience some variation in the Contour XLRI's

performance. This is natural and is due to variations in the target environment. Some of these issues are addressed below:

Target Characteristics

The size and surface characteristics of the target can affect both the maximum range performance and to a lesser extent, the accuracy of the Contour XLRi. Typically, targets that reflect sunlight well (white or shiny metal) will make great targets. Other items such as trees with foliage and red brick buildings are good targets. You will find that any surface that is retro reflective, such as road signs, license plates and surveyors prisms are easily shot at 5000+ feet. **Surveyor Prisms and Corner Cubes should only be used with a brush filter attached to the Contour receiver lens. Please contact your LaserCraft dealer to purchase a brush filter.** Conversely, small, black targets will yield shorter ranges. Also, mirrored surfaces or windows can be difficult. Range accuracy is typically only adversely affected on the weakest of targets. You can tell when a target return signal is very weak by the lack of a steady audible tone and/or a steady range display reading.

Poor Weather

Visibility conditions affect the performance of the Contour XLRi. 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 ranging operation. In most conditions, the Contour's "poor" environment setting will restore good range performance. However, very dense rain, snow, smoke, fog, and airborne dust particles may degrade performance.

Day vs. Night Operation

The Contour XLRi has a sophisticated automatic gain circuit to ensure maximum range performance for the given environmental conditions. Bright sunlight or other bright light sources on or near the target may reduce range performance somewhat. You will also notice longer-range performance at night and with overcast conditions as the auto-gain circuit does not have to deal with solar "noise".

Pointing Stability

The extremely narrow beam width of the Contour XLRi makes precise targeting possible. However the same narrow beam may, in some cases, cause difficulty when targeting very small targets at long ranges if operated handheld. For those situations, use of a monopole or tripod to assist in stabilizing the instrument, may be helpful.

OPERATING MODES (MODE BUTTON)

After the unit has powered up and completed self-test, the following display appears indicating the system is ready to provide range and inclination:



The MODE button is used to select the desired measurement mode of the Contour XLRI. Pressing the MODE button toggles through the following modes of operation:

1. Standard (Range and Inclination display)
2. 2 Shot Height
3. 3 Shot Height
4. Horiz Distance (horizontal distance)
5. Slope

Each mode is explained in detail below.

Standard(R/I) Mode

This mode provides the basic data for the selected target. Range, and inclination are displayed on the rear panel while range is displayed in the HUD. Hold the trigger down to continuously update readings; release the trigger to lock in readings after you have accurately located your target.

IMPORTANT: TO ENSURE THE MOST ACCURATE ANGLE READINGS, BE SURE TO POINT AT YOUR DESIRED TARGET FOR 1 - 2 SECONDS BEFORE RELEASING THE TRIGGER TO LOCK READINGS. THIS ALLOWS THE SENSITIVE ANGLE MEASURING DEVICES TO SETTLE TO THEIR MOST ACCURATE POSITIONS.

2 Shot Height Mode

Press the **MODE** button until “**2 shot Height (f)**” is displayed on the top line of the LCD. The unit is now in the height measurement mode. This is a two-point measure procedure used to determine the overall height of a selected target (technically, the total vertical distance between any two points). Measure #1 is displayed on the bottom line of the LCD. Point the Contour at the top or bottom of the object to be measured. Press and hold the trigger until a range is displayed and you are satisfied with your aim position. Release the trigger. Measure #2 is displayed on the bottom line of the LCD. Now point the Contour to the opposite end of the object to be measured. Press and hold the trigger until a range is displayed. Release the trigger. The vertical height between the two points on the object that you have measured is displayed on the HUD and on the bottom line of the LCD. To perform another height measurement, click the trigger once and the Contour will prompt you for “Measure #1”. If you wish to change modes, simply press the MODE button. Notes on height measurement:

1. Be sure to keep the Contour at the same height between measurement of points 1 & 2. Any movement will add that much error to the measurement. A monopole is helpful here.
2. Remember this operating mode measures total vertical height from any two points. Although primarily used for tree or pole height measurement, the points need not be directly above or below each other.

3 Shot Height Mode

Press the **MODE** button until “**3 shot Height (f)**” is displayed on the top line of the LCD. The unit is now in an alternative height measurement mode that is extremely useful for objects such as trees in cluttered environments. This is a three-point measurement procedure used to determine the overall height of a selected target when the top and/or the bottom of the object to be measured is not clearly visible or is partially obscured by other objects such as underbrush. Measure #1 is displayed on the bottom line of the LCD. Point the Contour at any clearly visible portion of the object to be measured. Press and hold the trigger until a range is displayed and you are satisfied with your aim position. Release the trigger. This establishes the horizontal distance to the object. Measure #2 is displayed on the bottom line of the LCD. Now point the Contour to the top or bottom end of the object to be measured. Press and hold the trigger until a range is displayed. Release the trigger. The angle from horizontal to the top/bottom is established. Measure #3 is displayed on the bottom line of the LCD. Now point the Contour to the opposite end of the object to be measured. Press and hold the trigger until a range is displayed. Release the trigger. The angle from horizontal to the opposite end of the object is established. The vertical height between the top and bottom of the object that you have measured is displayed on the HUD and on the bottom line of the LCD. NOTE: FOR MEASURE POINTS # 2 AND #3, YOU DO NOT NEED TO OBTAIN THE CORRECT RANGE TO THE AIM POINT, ONLY THE CORRECT ANGLE. HOWEVER, A RANGE READING MUST BE DISPLAYED TO ALLOW THE ANGLE READINGS TO BE REGISTERED. To perform another height measurement, click the trigger once and the Contour will prompt you for “Measure #1”. If you wish to change modes, simply press the MODE button. Please review the “Notes” following the “2 shot Height” section as they apply to 3 shot height measurements as well.

Horizontal Distance Mode

Press the MODE button until “Horiz Dist (F)” is displayed on the top line. Horizontal Distance is a one-point measurement function that reports the distance along a horizontal line from the Contour to the selected target. See Figure 3. This feature is useful, for example, when the level distance to a pole is desired but the bottom of the pole is obscured from view.

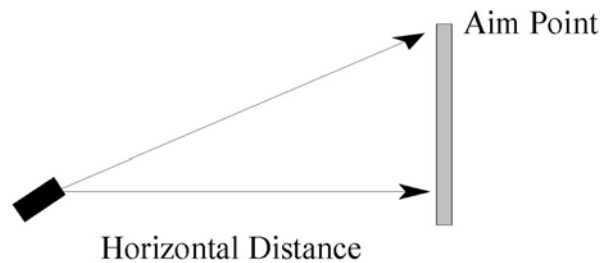
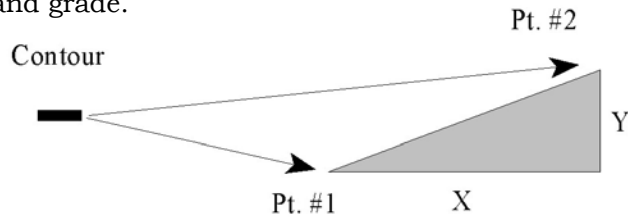


Figure 3

Simply pull the trigger and aim at any exposed surface of the vertical target. While pulling the trigger the HUD will show the actual range along the line of sight, sometimes referred to as “slant” range and the rear panel will show the range, bearing and inclination for reference. When the trigger is released, the slant range reading will instantly be converted to a horizontal range and displayed in the HUD and on the LCD.

Slope / Grade Mode

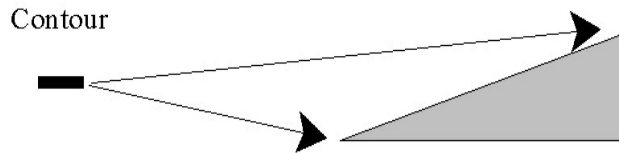
Press the MODE button until “SLOPE” appears on the top line of the LCD. This is a two-point measurement that reports the slope and grade between the respective points. Please refer to Figure 4 for a definition of slope and grade.



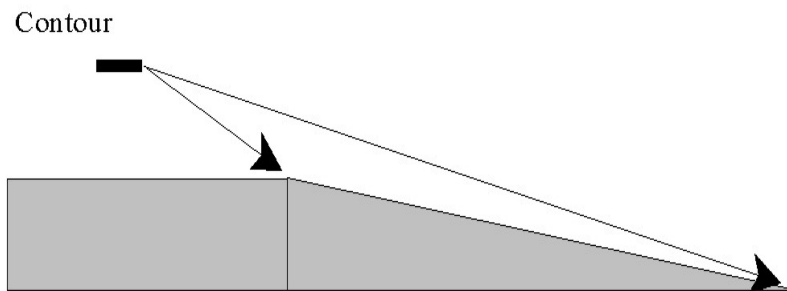
Slope = Y/X
Grade = (Y/X) x 100

Figure 4

The Contour XLRI will report positive and negative slopes and grades. The sign of the slope and grade is defined in figure 5.



Ground rising as distance from Contour increases yields positive slopes and grades.



Ground falling as distance from Contour increases yields negative slopes and grades.

Figure 5

You may shoot either of the two points first. The Contour will automatically determine the slope and the sign of the slope according to Figure 5. Once two valid points are measured, the LCD will alternately display the slope and grade. To take another measurement simply click the trigger once and you will be prompted for measurement #1.

MENU DISPLAY

The MENU display is used to provide access to additional set-up and operating features of the Contour XLRI. Like all the buttons on the membrane switch panel, except PWR, the MENU | ESC key is designed to accomplish two functions. In the operating mode described above, the primary set-up menu is displayed when the MENU | ESC button is pressed. In any menu mode, pressing the button will allow the user to escape (ESC) to the default-operating mode. The MENU screen appears as:

(ENVIRO) SERDATA
UNITS OFF COMP

The brackets surrounding a selection indicate the menu item to be changed. Navigate among the menu items by using the blue arrow keys. Confirm the menu selection by pressing the ENTER key.

Environmental (ENVIRO) Menu

The environmental 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 range performance of the Contour XLRI. Ranges less than anticipated may be displayed, typically between 50 – 200 feet when confronting poor weather. This is caused by the unit receiving range information from particles in the air. The "poor" environment mode improves the system performance by setting the minimum range to approximately 250 feet. (76 meters) eliminating the false signals. This dramatically improves the range performance of the unit in poor conditions. However, no range readings will be possible inside 250 feet while in the "Poor" environmental mode.

When ENVIRO is selected and ENTER is pressed, the following menu is displayed:

Set Environment
(NORMAL) POOR

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

SERDATA

This selection displays the following submenu:

Set Environment
(NORMAL) POOR

These options allow the user to configure the serial data to interface to an external device.

Selecting LOG allows the user to select the "LOGging" device that is connected to the Contour and formats the serial data string accordingly.

Selecting D_XMT allows the user to select when the serial data is transmitted or disables serial transmission.

Selecting the BAUD allows the user to select a baud rate that matches the external device.

This selection displays the following submenu:

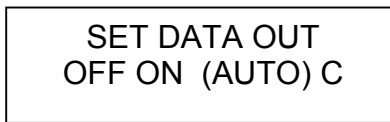


This option formats the serial data accordingly.

The LCI formats the Contour to output the LaserCraft NMEA data string with a pre selected BAUD rate of 19200. Details of this message are provided at Appendix 1. Note that the inclinometer display reference is to display 90 as horizontal, 0 as down & 180 as vertical.

D XMT

This selection displays the following submenu:



These options are related to how the RS232 serial data is transmitted from the Contour XLRi to an external system.

In the default setting of AUTO the RS232 data is automatically transmitted from the unit after each trigger release.

Selecting OFF with the arrows and the ENTER button disables the RS232 data output.

Selecting ON with the arrows and the ENTER button allows RS232 data to be transmitted from the unit only after:

1. The trigger is released and,
2. A confirmation from the operator is entered as follows:

With ON selected, each time the trigger is released, the LCD will have “Transmit Data?” on the top line and “CLR OK” on the bottom line above the ESC and ENTER buttons. Selecting CLR with the ESC button will abort transmission. Selecting OK with the ENTER button will transmit data.

Selecting C for CONTINUOUS by the arrows and the ENTER button will transmit the RS232 data automatically from the unit every update period: typically every 0.3 seconds as long as the trigger is held down.

BAUD

This selection displays the following submenu:



These options allow the user to select the following baud rates:

Selecting 48 configures the Contour's serial port to 4800 baud.

Selecting 96 configures the Contour's serial port to 9600 baud.

Selecting 192 configures the Contour's serial port to 19200 baud.

Note: Selection of any of the above will override the baud rates that have been automatically selected in the LOG menu.

UNITS

This selection displays "SET UNITS" on the top line and "FEET MTRS YARDS" on the bottom line of the LCD. Use the arrows to select the desired *linear* unit of measure and press the ENTER button to confirm the selection.

Set Units
(FEET) MTRS YDS

OFF

This selection displays the following submenu:

Set Power Off
(5)15 30 ON min

These options allow the user to select the amount of time the Contour will stay powered on after the last button press or trigger pull.

Selecting 5 will cause the Contour to turn itself off 5 minutes after the last button push or trigger pull.

Selecting 15 will cause the Contour to turn itself off 15 minutes after the last button push or trigger pull.

Selecting 30 will cause the Contour to turn itself off 30 minutes after the last button push or trigger pull.

Selecting ON will cause the Contour to never turn itself off.

STATUS DISPLAYS

The Contour XLRI provides user alerts on the LCD back panel. They are listed below:

1. **Low Voltage Alert-** if the internal battery or external power supply voltage falls below 9.2 volts a low voltage alert appears indicating the unit will shortly exhaust the battery. This alert will appear approximately every two minutes until the battery is exhausted.
2. **Low Voltage Warning-** if the internal battery or external power supply voltage falls below 8.6 volts, a low voltage warning will appear after the low voltage alert and the unit will cease operation until a new power source is attached.

EXTERNAL OUTPUT SIGNAL

The I/O connector on the left side of the Contour XLRI provides a means to connect an external computer or data storage device to the instrument. In a typical application, this might be used to externally store measurements from the Contour XLRI. The data interface is RS232 with data rates up to 19200 Baud. The connector used for this signal is a 6-pin LEMO-style circular connector. A complete cable assembly is available from LaserCraft.

The Contour XLRI can be configured to output data at different points in the measurement process. Please see the SERDATA subsection under the MENU section in this manual for a description of the output choices. A detailed description of the output data string is given in Appendix 1.

CARE AND MAINTENANCE

The Contour XLRI is designed and constructed so that 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. USE EXTREME CARE WHEN CLEANING THESE SURFACES TO PREVENT SCRATCHING.

Surfaces that may be cleaned include the front apertures, 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 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. **AVOID ACETONE OR AMMONIA BASED CLEANERS AS THEY WILL DISCOLOR PLASTIC SURFACES.**

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 Contour XLRI will operate satisfactorily with a limited amount of cosmetic optical defects.

Despite its rugged construction, the Contour XLRI 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. The unit should be calibrated according to the schedule supplied by LaserCraft.

PERIODIC ALIGNMENT CHECKS

The operator can periodically perform a few simple tests to verify the pointing accuracy and range accuracy of the Contour XLRI. First, check the alignment of the HUD aiming reticle. Select an isolated object at 500 or more feet (150 meters) away, such as a stop sign, utility pole or overhead power wire. Slowly sweep the Contour XLRI across the object and observe that the target range is displayed when the object is within the outer bounds of the square reticle area. (Listening to the audio “chirp” indicating reflection of laser pulses is helpful when using overhead wires.) Rotate the Contour XLRI so that it is at right angles to its normal operating position, (positioned on its side) and repeat the process to verify vertical alignment. You may see some variance as to what part of the reticle square overlays the target when the range is actually displayed. This is normal and will pose no problem in operation. If, however, you notice that the target range is displayed when the entire target is significantly outside of the reticle the unit may have an alignment problem. Re-check the alignment on a different target. If the problem is still noticeable, contact LaserCraft.

PERIODIC RANGE ACCURACY CHECKS

Check the accuracy of the Contour XLRI by setting up a test range to a target at a known distance. For convenience, a range of 50 to 100 feet will suffice. Use a flat, white target, approximately 2 x 2 feet. A piece of plywood painted white should work fine. Carefully measure the distance to the target using a steel tape. Make sure the target is oriented perpendicular to the line of sight of the laser. Mount the Contour on a tripod and position its front face at the zero (0) footmark using a plumb bob. Take several range readings and verify that they are within +/- 6 inches (15 cm) of the actual distance. If the unit does not pass this test, recheck your setup and repeat the test. Contact LaserCraft if the unit continues to fail this test.

REGULATORY COMPLIANCE

Manufacture and operation of the Contour XLRI is subject to the regulations of the Center for Devices and Radiological Health (CDRH). The following section describes the requirements of this agency and the manner in which the Contour XLRI 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 United States. The Contour XLRI 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. The Laser Institute of America provides a good description of this category as follows:

Class I - A Class I laser is considered safe based upon current medical knowledge. This class includes all lasers or laser systems that 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 Contour XLRI 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. 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 Contour XLRI is completely safe for human exposure.

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

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

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 Contour XLRi still does not perform properly, please contact LaserCraft at the address below or your authorized dealer to discuss the problem and arrange for service if necessary. If service is required, the instrument should be returned with all accessories, in the 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 Contour XLRi. 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.

LASERCRAFT, INC.
5680 OAKBROOK PARKWAY
SUITE 149
NORCROSS, GA 30093

TEL: 770-409-9660
FAX: 770-409-9649

SPECIFICATIONS

Range:	10 - 6100 ft. (3 - 1860 m)
Range Accuracy:	+/- 0.5 ft (.15 m) to white target at 80 meters (1 □)
Range Resolution:	0.1 ft (0.1 m)
Inclinometer Range:	0 - 359.9 degrees (+/- 180 degrees from horizontal.)
Inclinometer Accuracy:	+/- 0.2 degree (0.1 degree typical)
Inclinometer Resolution:	0.1 degree
Power Supply:	Rechargeable NiMH battery pack Optional corded pack with 10-16 VDC cigarette lighter plug
Size:	7.4 x 4.2 x 10.7 in. (18.8 x 10.8 x 27.2 cm)
Weight:	<3.5 lbs (1.47 kg) (with battery)
Laser Class:	Class 1 (US FDA CDRH CFR 21)
Operating Temp:	-30 to +60 °C
Environmental:	Waterproof to NEMA 6 and IP 67

WARRANTY

The Contour XLRi is guaranteed to be free of defects in materials and workmanship for a period of 12 months from date of delivery to the Owner or Lessee. This Warranty applies only to the original registered Owner or Lessee on record at LaserCraft Inc., and cannot be assigned or transferred to a third party.

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 LaserCraft Inc. or its agent, of the Equipment as:

- Is covered by this Warranty
- Is delivered to LaserCraft, Inc. or its agent at the Owner's or Lessee's expense within the term of this Warranty; and
- Upon examination thereof discloses to the exclusive satisfaction of LaserCraft Inc. or its agent to have been defective in material or workmanship. The factory Customer Service Department must perform repairs and warranty service, or the Warranty is void.

The Owner or Lessee shall use the Equipment in accordance with the manufacturer's operational instructions, and shall not permit unauthorized personnel to perform maintenance, attempt repairs, or effect modifications on the Equipment. Failure of the Owner or Lessee to observe any conditions set forth in this Warranty, or flood, fire, act of God or similar event or catastrophe, or tampering, abuse, or misuse of the Equipment by Owner or Lessee or third party will render the Owner or Lessee responsible for the cost of bringing the equipment within the manufacturer's operational specifications.

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

The liability of LaserCraft Inc., if any, with respect to the Equipment, shall be limited as provided in this Warranty. LaserCraft 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. LaserCraft Inc., makes no warranties of any kind other than as herein expressly provided, express 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, which vary from state to state.

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

APPENDIX 1

RS232 MESSAGE

This appendix describes the message that is transmitted when LOG and LCI is selected under the SERDATA menu.

The serial data stream from the test connector is RS 232 data. The message format is a proprietary message registered with NMEA. The details of the message follow. Please note the specific content of the data stream depends on which model you have purchased: XLR, XLRi or XLRi. For example, the range only XLR will output the "range" and "range units" fields only while the other models will have added output for their additional functions. It is important to remember, however, that the number of spaces delimited by commas is always the same for each model.

NMEA string is as follows:

```
$PLCI,rrrr.r,f,bbb.b,d,m,ppp.p,d,ss.ss,ggg.g,aaaaaaaa.a,f,cccccccc.c,f,,,*hh<CR><LF>
```

Field 1: \$PLCI (proprietary identifier for LaserCraft Contour Rangefinder)

Field 2: rrrr.r = Range

Field 3: f = Range units (f = feet, m = Meters, y = yards)

Field 4: bbb.b = Bearing (Azimuth)

Field 5: d = Bearing units (d = degrees)

Field 6: m = Bearing reference (m = Magnetic north, t = True north)

Field 7: ppp.p = Pitch (000.0 = down, 090.0 = horizontal, 180.0 = up)

Field 8: d = Pitch units (d = degrees)

Field 9: ss.ss = Slope

Field 10: ggg.g = Grade

Field 11: aaaaaaaaa.a = Area

Field 12: f =Area units (f=sq. feet, m=sq. meters, y = sq. yards, a=acres, h=hectares)

Field 13: cccccccc.c = Perimeter

Field 14: f = perimeter units (f=feet, m= meters, y = yards)

Field 15: dummy field

Field 16: dummy field

*checksum- hexadecimal, 1byte, Xor'd

Typical Examples:

XLR unit-Range Only (range at 35.2 feet)

```
$PLCI,0035.2,f,,,,,,,,,,,,,*hh<CR><LF>
```

XLR i -Range Inclination (range=35.2 feet, inclin=75.2 degrees)

```
$PLCI,0035.2,f,,,,,075.2,,,,,,,,, *hh<CR><LF>
```

XLR ic Range Bearing Inclination

```
$PLCI,0035.2,f,023.6,d,m,075.2,d,,,,,,,,, *hh<CR><LF>
```

2 & 3 shot Height, horizontal distance, horizontal line & 3d line modes

```
$PLCI,0035.2,f,,,,,,,,,,,,,*hh<CR><LF>
```

Slope/Grade mode

```
$PLCI,,,,,,,,,01.56,156.4,,,,,,,,, *hh<CR><LF>
```

Area/Perimeter mode

```
$PLCI,,,,,,,,,000000256.5,a,000000085.5,f,,, *hh<CR><LF>
```