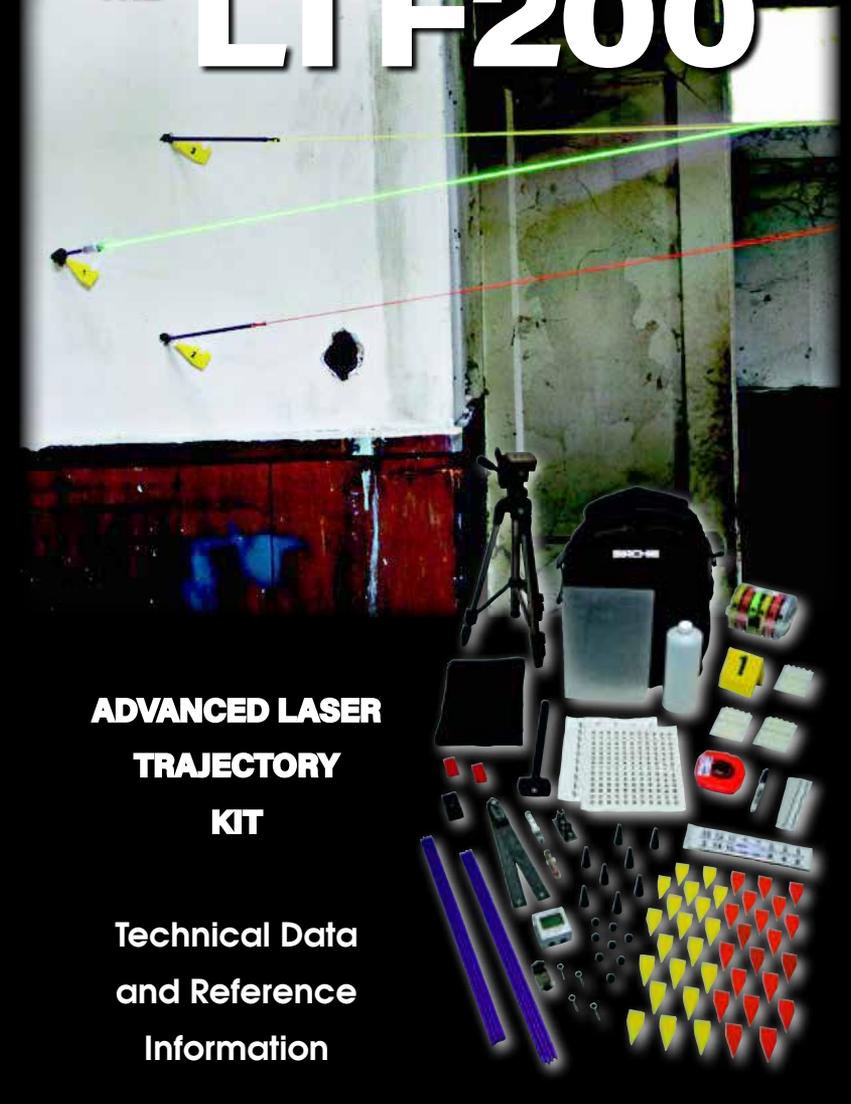


THE LTF200



ADVANCED LASER TRAJECTORY KIT

Technical Data
and Reference
Information

OPERATOR'S MANUAL



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INTRODUCTION

Shooting reconstruction is a process utilized to determine the trajectories of the shots fired in an incident, and to provide the position of the shooter and a visual interpretation of the scene. Traditionally, penetration rods and strings were used in conjunction with the resulting projectile holes at the scene to “map” and photograph the bullet trajectories. In the early 2000’s, laser levels and pointers were first used in shooting reconstructions for more accurate depiction of bullet trajectories. This eliminated the sagging effect of stringing, and provided a cleaner and more accurate picture of the scene to investigators, attorneys, and jurors. In 2010, Sirchie introduced its first Laser Trajectory kit, the LTF100, based on proven technology at that time.

Ongoing research, coupled with input from ballistics reconstruction experts in the field, led Sirchie’s product development group in a new direction that expanded the capability of this basic kit by adding additional hardware and digital measuring devices. The Advanced Laser Trajectory Kit (LTF200) improves overall accuracy and includes tools which allows a single investigator to complete a full reconstruction.

LTF200 COMPONENTS:

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|--|---|
| 1-DMANGLE Digital Angle Finder | 1-SEM20N SIRCHMARK™ Orange Acrylic Evidence Marker, Bag of 20 |
| 1-DRP10 Digital Protractor | 1-SEM20Y SIRCHMARK™ Yellow Acrylic Evidence Marker, Bag of 20 |
| 1-Angle Bracket | 1-SKC20 StikkiCLIPS® White Plastic, Pack of 20 |
| 1-Protractor Laser Mount | 1-SKC50 StikkiDOTS® Reusable Wax Dots, Pack of 50 |
| 1-Sunpak Model Tripod | 1-PEN15VS Short Plastic Photo Numbers (1-15) |
| 1-Tripod Adapter | 1-PPS401 Vinyl Photo Evidence Scale, Gray, 10 each |
| 1-Tripod Extension Rod | 1-PIM700 Photo ID Markers, Blank w/scale, 50 x 4 sheets |
| 2-Mounting Magnets | 1-PNBR100 Label Circles, A-D, 0-9, 4 sheets, 11 ea. label |
| 1-Counter balance bottle, 32 oz. | 1-SK900 Steel Tape Measure, Manual (100ft./30m) |
| 1-LTF201 Trajectory Rod Set (4 Penetrating, 4 Photography) | 1-Marker Sharpie® Fine Point Black |
| 1-LTF200EC Elastic Cord Set, 6 Spools (LTF200Y - 2 Yellow; LTF200N - 2 Orange; LTF200S -1 Reflective Silver; LTF200 G - 1 Fluorescent Green) | 1-LTF200C 5.11 RUSH 24 Backpack |
| 1-LTF208 Centering Cone Set, 8 Cones & Grommets | |
| 4-Threading Tips | |
| 1-LTF102 Red Laser 5mW | |
| 1-LTF200GL Green Laser 5mW | |
| 1-Acrylic Photo Card | |

EXPLANATION OF PRINCIPLE COMPONENTS

Ballistic Laser (Green)

This Class IIIb laser diode provides an output of <5mW and operates at a frequency of 532nm and is powered by 1 AAA Lithium battery.

Ballistic Laser (Red)

This Class IIIb laser diode provides an output of <5mW and operating at a frequency of 630-680nm. Three L1154 batteries power the laser.

Both lasers have a momentary ON/OFF switch with a moveable collar, which, when moved into position, permits constant ON. These lasers may be mounted on the Penetration Rod or Extension Rod and they may be attached to the Tripod Adapter for use with a photographic tripod.

Trajectory Rods

Four aluminum Penetration Rods and four Extension Rods are supplied in the kit. These rods equal the diameter of a .22 caliber projectile. Penetration rods are inserted into bullet holes to give a visual approximation of bullet trajectory. To facilitate entry into the bullet hole, one end of the rod is machined with a bullet-like tip. To gain a more accurate gauge of trajectory, Centering Cones are slipped onto the rod, one at the point of entry and one at the exit hole. These cones are then held in place by grommets. The taper of the cones provides a snug fit for larger caliber and angled entries, thus providing more stable positioning of the rod. Extension rods are joined to penetration rods for elongating the rod, typically used for determining bullet passage through furniture and automobile interiors.

Tripod Adapter

This device provides a means for mounting the laser to a photographic tripod. Using this configuration, the laser beam may be directed into the bullet hole(s). The mount is fabricated from steel to compliment the Ballistic Angle and red mounting magnets.

Ballistic Angle Finder

Using the Universal Tripod Mount and the unit's built-in magnets, or the mounting adapter for the rods, the Ballistic Angle determines the angle of trajectory from the vertical plane using digital circuitry and a Liquid Crystal Display (LCD).

Digital Protractor

This device provides an accurate digital angle measurement from a plane surface such as a wall, floor, door, etc.

Stringing Tips and Colored Trajectory String

Once a Penetration Rod is positioned into the bullet hole, a Stringing Tip may be attached to the rod. A length of Colored Trajectory String may then be attached to the Stringing Tip.

PRECAUTIONS

- Laser light may cause permanent eye damage. Do not look directly into the laser beam or direct it toward others present at the scene.
- Do not look directly into the laser beam reflection if it is directed toward a mirror or other highly reflective surface.
- Do not connect more than two rods together as this added weight may damage the bullet hole.

Special Note: Prior to using any of the processes contained in this information sheet, it is vital that measurements and photographs of bullet holes be taken. Photos must be taken at right angles to these holes and the scales to avoid perspective distortion.

Component Operation

Digital Protractor

ON/OFF: Power on, Power off button

ZERO: Fold both blades together on the same flat surface, press ZERO button to set zero.

HOLD: Press <HOLD/Rev> button, "H" will appear in upper left corner of the display to hold the reading. To return to normal and release the hold, press Hold again and the "H" will disappear.

REV: Press <HOLD/Rev> for 3 seconds and the display will reverse.

Note: The protractor always reads from the blade with the digital display attached. This is the zero plane, and this is the plane of reference when zero is set.



Digital Angle Finder

1. To read absolute level O/LEVEL button. LEVEL will appear in the upper left corner.
2. Place the Angle on a flat level surface or the surface to be measured from and press the ZERO button; then move it to the second surface. The Angle will accurately measure the angle between surfaces. Press the HOLD/Tilt% button to lock the reading. Press it again to release the reading. Remove the 4 screws on the back of the unit to replace the 9V battery,

See below for various mounting methods.



USAGE—Stringing the Trajectories

Penetration Rods: Note: The most reliable data obtained on the angles of trajectory will be gained when a bullet passes through two or more surfaces, such as: an interior or exterior wall, a hollow door, a piece of furniture (padded chair or couch or a vehicle interior). The Advanced Laser Trajectory Kit contains four Bul-

let Penetration Rods that are used as the initial step in determining bullet trajectory through a wall, door or other surfaces. These rods also serve a point for attachment of string. These rods are machined to a diameter of a .22 cal. Bullet. Larger bullet holes are accommodated by using the centering cones and Grommets as depicted below.

Note: When using the included elastic string, the bullet must have passed through with an exit and entry point. The rod must be anchored to prevent the elastic cord from pulling the rod out of the hole.



1. One end of each Extension Rod has a threaded end. Attach a Penetration Rod to the threaded end (Fig. 1). (Figures from LTF100 TI)
2. Maneuver the bullet-tipped end of the rod into the bullet hole. Slip a Centering Cone onto the extension rod and insert it into the hole as deeply as it will go without undue force. Push the rod through until the extension rod clears the exit end (Fig. 2).

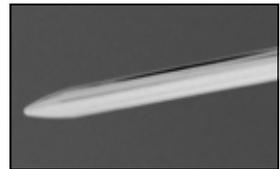


FIGURE 1

3. Remove the penetration rod, and place a centering cone on the exit end of the penetration rod. Place the hex nut, from the stringing tip, onto the threads of the extension rod (Fig. 3).

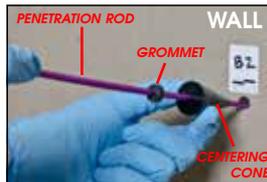


FIGURE 2

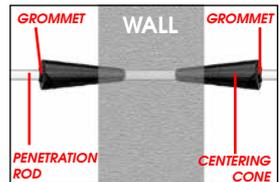


FIGURE 3

4. Screw a Threading Tip into the entry end of the extension rod, gently pull the rod and reset the centering cone until the rod is stable in the projectile hole and attach the desired colored string to the eyelet.
5. Use the string to trace the determined angle of trajectory by aligning the string with the rod. Put tension on the string to eliminate sag. Use a tripod to secure the string at the determined point of the projectile's origination (shooter's position).

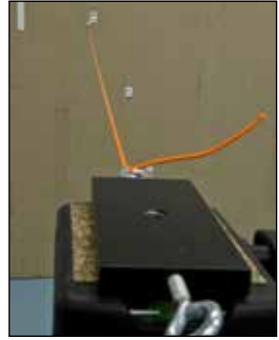


String types:

Bright Orange and Yellow: Use for high contrast photographs

Reflective Silver String: Use in combination with a white light or flashlight to reflect in low lighting conditions, or to create higher contrast with dark backgrounds.

Neon Green: Use with UV lighting to greater contrast any multi-colored background giving a "laser-like" effect.

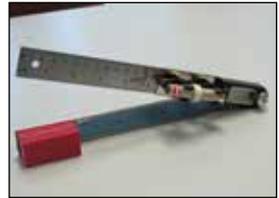


USAGE – Ballistic lasers

Note: The green laser produces significantly more power. Experience and each application will determine which laser will serve best.

The ballistic lasers may be used in a variety of mounting applications. Special adapters make this possible. Each laser is equipped with a screw on the back end of the unit. This facilitates attachment to the Tripod Adapter or it may be screwed into one end of the penetration or extension rods.

Depicted below are various deployment methods for the lasers.



**Determining Trajectory Angle
Calculating by Measurement of the Entry Hole**

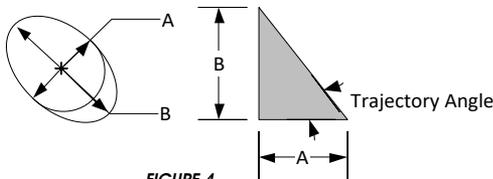


FIGURE 4

The trajectory angle in reference to the ground/floor can be determined by measuring the entry hole of the projectile. Most projectile holes, unless entering perpendicular to the surface (90 degrees), form an ellipse. The difference in the length versus width can be used to determine angle. As shown in Figure 4, the width of the ellipse is one leg of a right triangle and the length is the other leg. The trajectory can be determined with the following formula.

$$\text{Trajectory angle} = \text{TANGENT (B/A)}$$

This angle can now be used to determine trajectory path and align strings when rods are not available, or not practical for the location.

TRAJECTORY ROD MEASUREMENT

Angle Cube mounting

Using the angle cube mounting bracket, place the bracket onto the secured penetration rod. Zero the Angle Cube to the surface of measurement, either the floor or the wall, and then place the Angle onto the bracket as in figure above. The cube is magnetic on three sides and will display in any orientation. The zero reference is always in the plane of the bottom of the Angle Cube.



Digital Protractor

Using the digital protractor, place the bottom edge of the protractor on the surface of measurement and zero. Unfold the arm of the protractor until it aligns with the penetration rod that you are measuring. Read the angle on the display.



Note: If the angle of the penetration is measured in reference to the wall, the angle must be recalculated to the floor/ground by subtracting from 90 or 180 degrees depending on the orientation of measurement.

Photographing With The Laser:

Note: In order to do photography with the laser, a camera with a B (bulb) shutter setting is required. For laser photos over shorter distances, a camera with a shutter delay of 30 seconds may be sufficient.

1. Place the laser onto the tripod adapter or attach to a penetration rod.
2. If using a tripod, align the laser with the projectile hole from the point of the determined origination.
3. If using the red laser, the area must be almost completely dark. If using the green laser, subdued or shade level lighting should allow a good photograph.
4. Set the camera in either orientation, towards the projectile hole or towards the origination point (for perspective of shooter or prospective of the target).
5. Use the Acrylic Photo Card to block the laser beam (as shown in Fig. 6).

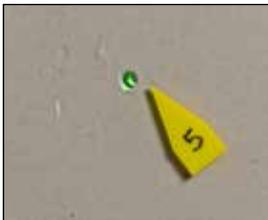


FIGURE 5



FIGURE 6



FIGURE 7

6. Starting at the point closest to the camera, open the camera shutter, and “walk” the laser to the opposite point and back maintaining the bright laser spot on the Acrylic Photo Card.
7. When complete, step out of view and shut camera shutter (if on Bulb setting)
8. Most photos can be captured in 20-30 seconds.

Notes:

- If photographing more than one laser, cover the camera lens with shutter open, set-up the next trajectory, and repeat steps 5-7.
- To get a good perspective of the scene with the lasers without overlaying two photographs, a “flash” technique can be used. Use a timer during the “walking” phase, and at the last second, turn a flashlight on and off in the scene to take a “flash” photo. The lasers will be visible, and the scene will be captured without overexposure.

MARKING COMPONENTS

Acrylic Markers

Bright colored acrylic markers that provide contrast in photographing the scene. These can be used in conjunction with the wax dots to mark bullet penetration points.



Blank Scales

2mm scales on adhesive labels are used for marking and documenting bullet penetration points. There is space to allow identification of the bullet holes by any scheme the examiner wants to use.

Marking Tents

Used to mark sites of bullet casings or other evidence locations on the ground at the crime scene.

Clear Circles with Numbers and Letters

These can be used with the acrylic markers to create unique identifiers for various evidence documentation.

LIMITED WARRANTY on SIRCHIE® CRIME SCENE INVESTIGATIVE PRODUCTS

SIRCHIE® warrants to the original purchaser that this Product shall be free from all defects, both in materials or workmanship, for a period of ninety (90) days from the date of shipment to the purchaser. At its option, SIRCHIE® will repair or replace any Product or part(s) that proves to be defective, free of charge including shipping cost to purchaser during the stated warranty periods.

This limited warranty shall not apply if the Product and/or any part has been damaged or caused to be defective by unreasonable use, accident, negligence, service or modification by anyone other than SIRCHIE® or a SIRCHIE® authorized agent, or by any causes unrelated to defective materials or workmanship. Additionally, this warranty does not apply to batteries or damage caused by their failure.

To receive in-warranty service, a defective Product and/or any part must be received at SIRCHIE® no later than one (1) week after the end of the warranty period and must be accompanied with proof of date of purchase satisfactory to SIRCHIE®. A RMA (Return Merchandise Authorization) number issued by SIRCHIE® must accompany all returned items. To obtain a RMA number and information for return shipment contact SIRCHIE® Customer Service, 100 Hunter Place, Youngsville, NC 27596, (919) 554-2244. All items returned must be properly packaged and insured prior to shipment. SIRCHIE® assumes no liability for loss or damage incurred during shipment to SIRCHIE®.

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state (or jurisdiction to jurisdiction). All expressed and implied warranties for the Product, including, but not limited to, any implied warranties and conditions of merchantability and fitness for a particular purpose, are limited in time to the term of the limited warranty period.

SIRCHIE®'s warranty obligations and purchaser's remedies thereunder are solely and exclusively as stated herein. In no case will SIRCHIE® be liable for consequential damages or any loss incurred because of interruption of service.