

FEATURES of the ALPHA and ALPHA MASTER CHRONY



If it doesn't unfold, it's not a Chrony!

Fig. 1. Closed Chrony.

Gives Numbered Shot Velocities; + Velocity stays on display until you shoot again; + Uses 9 Volt Alkaline Battery with 48 hours of continuous use; + With flip of finger switch from FPS (feet per second) to MPS (meter per second); + Delivers Measurements and Statistics such as: High, Low and Average Velocities, Extreme Spread and Standard Deviation; + Retrieve individual Shot Velocities and Statistics; + Has 32 shot memory; + Delete individual shots (with automatic adjustment of Statistics); + Has Stereo Jack for optional **Ballistic Chrony Printer** or **Remote Control**; + Accepts **Timer Mode** option; Can be upgraded to **Beta and Gamma Shooting Chronys** and respective **Master Chronys**.

HOW IT WORKS

The *Chrony* has two eyes (or photo sensors) located in each of the black plastic housings at the front and back of the main unit. They are located under the Twin Lenses at the bottom of these housings and they detect the passage of a bullet over them by sensing the change in the amount of light. (They detect a momentary change in light intensity.) As the bullet passes over the first detector, it trips a counter, which begins to count very rapidly (much as a super-fast stop watch). The counter is shut off by the second photo sensor when the bullet passes over it. The computer in the Chrony then converts this information into feet per second (FPS) or metres per second (MPS), whichever mode it is operating in.

After the first shot, it computes all statistical information, such as **Hi**((gh), **Lo**(w), **Av**(erage) velocities, Extreme Spread and Standard Deviation, following each new shot.

The *Alpha Chrony* has a temporary (working) memory. This allows the erasing of part or all of the data stored. Only the *Beta*, *Gamma*, *Beta Master* and *Gamma Master Chrony* units have a permanent memory, which allows the unit to be turned off without losing data.

GETTING STARTED

THE BEST WAY TO LEARN TO USE THE SHOOTING CHRONY

It is not necessary to understand all the functions of the instrument immediately. It is best to proceed slowly, safely and have fun doing it.

Getting the *Chrony* ready to use:

1. First, unfold the unit, making certain that the unit is FULLY OPEN. The base of a tripod may prevent full opening, in which case the chronograph will read higher (faster) than true velocities because the space between the points where the bullet crosses the photocells is shorter than is the distance for which the unit is calibrated.
2. Attach a **9 Volt Alkaline Battery** to the short cable inside the front housing and tuck it under the spring. If it is not Alkaline, the Chrony may not work properly. With a standard model Chrony, the unit is ready to turn on with the switch on the face. With a Master Chrony model, attach the long telephone cable into the LCD (Liquid Crystal Display) Monitor and to the inside terminal of the front black sensor housing of the unit. Do not drag plugs (at the ends of Master Chrony cable) on the ground. If sand particles get stuck between

the leads, Chrony will malfunction . It is now ready to be turned ON.

Steps on Setup at the Range.

3. The first step is to ensure a **safe** backstop. A chronograph should never be used without a safe and certain backstop that stops the projectiles (bullets, shot, arrows), and prevents ricochets.
4. To safeguard the *Chrony* and to prevent missing the backstop, any firearm used must be fired from a good rest. A bench with sandbags is the best type of rest.
5. For the best use of chronographs, velocity measurements should be combined with target shooting (that is, you are chronographing the same bullets that are being shot at the targets). Set up a suitable target against the backstop.
6. To safeguard the instrument (and to obtain the best results), the projectile must pass between 6 and 4 inches (15 and 10 cm) directly OVER the Twin Lenses in the black plastic boxes at the front and back of the chronograph. These are the chronograph's "eyes". Attaching pieces of dark-coloured tape on the guide rods (wire rods) at these heights will help you to aim your shots accurately.
7. **THE SHOOTING AREA**

Every *Shooting Chrony* and *Master Chrony* comes equipped with an adjustable-size, triangular shooting area (actually an upside down trapezium) from 8" X 8" to 14.5" X 14.5" (Fig. 2). All Chronys come equipped with four 9.25" wire rods as well as four 6.5" wire rods with brass connectors attached. The 9.25" wire rods are to be inserted at an angle into the outer holes visible on the black plastic boxes of the unit. On bright, sunny (blue sky) days, install the white plastic diffusers on top of the wire rods (to simulate clouds). **The photo-sensors are pointed at the diffusers, which create a white background. The diffusers provide a good contrast between the bullet and the background (clouds or diffusers).** On cloudy days, use the wire rods for alignment but without diffusers.

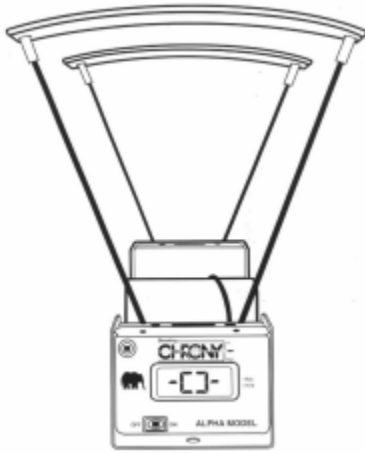


Fig. 2. Shooting Chrony, front view

8. Chronographs should be at least 10 feet (3 m) from the muzzle of high-powered rifles, but can be closer to guns with a lesser blast. Five feet (1.5 m) is about right for .22 rimfire firearms. Shotguns should be fired at 5 feet because of possible damage caused by the spreading pattern of the shot and errant wads.

9. The Chrony may be mounted on a (camera) tripod, or on any adjustable device, having a 1/4 inch by 20 thread that will screw into the hole on the bottom of the unit. It is also possible to rest the Chrony on a table, though this is probably the most difficult type of mounting to adjust properly.

10. With an Alpha Master Chrony place the LCD Monitor near you on the bench, well away from muzzle blast

11. Have a notebook and pen with you to record your results and to make notes.

12. ALWAYS WEAR EYE AND EAR PROTECTION WHEN CHRONYGRAPHING.

STOP! BEFORE YOU FIRE THAT FIRST SHOT!

A. Be Sure that the backstop is adequate.

B. RIFLES: Be aware that the bullet line of travel will be as much as two inches **BELOW** the line of sight on scope-sighted rifles. **Adjust upward in order NOT to hit the Chrony.** If a bullet hits the Chrony, the Chrony will be destroyed, and will endanger you and others because of bullet ricochet and flying parts of the Chrony. Mark the Wire Rods with tape four inches above the Chrony unit for open-sighted rifles, and six inches for scope-mounted rifles.



Fig.4. Protective Shields

C. HANDGUNS: When shooting sub-sonic ammo, the muzzle blast will get to the Chrony before the bullet, which may cause erratic numbers. Increase distance from Chrony.

D. SHOTGUNS: because flying wads may go in any direction, protect the face of the Chrony by taping a thick piece of clear acrylic over the front of the unit. The acrylic must not extend above the face. Shooting Chrony Inc. offers such protection (see Accessories List). NOTE: When shooting without Diffusers one may substitute soda straws or wooden dowels for the Wire Rods. Hitting the Wire Rods with a bullet could break the Sensor Housings, whereas straws and dowels provide a safer sighting guide

E. MUZZLE LOADERS AND OTHER BLACK POWDER FIREARMS: In addition to protecting the face of the Chrony from wads and patches, you may cover the slots (eyes) of the photo sensors with strong and clear tape or Protective Shields (Fig.4) to prevent powder residue from entering these slots. Glass or clear plastic taped over these slots may also be used.

F. ARCHERY: Bow to Chrony distance should be at least an Arrow's length. Blunt-tipped or flat-tipped arrows give more Accurate velocity measurements.

O.K., NOW YOU ARE READY

Until you are familiar with the Chrony, shoot inexpensive ammo, such as airgun-pellets or .22 rimfire bullets. Doing so will save you money.

1. **TURN UNIT ON.** If you purchased the Chrony in the United States, it will automatically record and read in feet per second (FPS). If you purchased it in a country that uses the metric system, it will record and read in metres per second (MPS).
2. An *Alpha Chrony* will display **AL** with flashing symbols on each side. These flashing symbols indicate that the unit is working and is ready for use. For Chronys that are set to read in MPS, it will display a dot between the two letters (e.g., **A.L**), with the same flashing symbols on each side; without the dot (e.g., **AL**), the unit readout is in FPS.
3. The Alpha Chrony has a working memory for up to 32 shots; it has no permanent memory. As you fire each shot, the LCD will display the shot number briefly and then the actual velocity of that shot. When you have fired 32 shots, it will display the number 32 and then the velocity. The 32nd shot will alternately flash with =LN=, which means that the memory is full. LN actually stands for **LiNear** mode. If you keep shooting, the first shot will be replaced by the next shot you fire. The display will flash =SO=, telling you that you lost the first shot and, had it replaced by the last shot.
- 4.

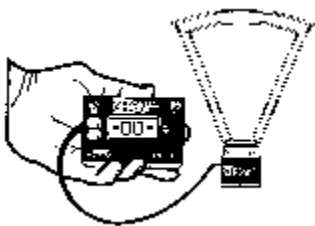


Fig.4. Master Chrony

The *Alpha Chrony* will provide you with summary data such as **HI, LO, Average** and the total number of shots fired, plus **Extreme Spread, Standard Deviation** as well as numbered shots and retrieval of individual shot velocities.

To delete an existing string for any reason, or to start a new string:

a) Turn the *Alpha Chrony* **OFF**, and then **ON** again.

b) If you have the **Remote Control** (and you don't want to get up), see page 5, under "How to delete Chrony memory."

5. If you now turn the *Alpha OFF*, you will lose your data. It has TEMPORARY (working) MEMORY only.
6. Anytime you wish, you may view the data you have produced. To do this, simply press the (left, black) **FU** button, identify the information you are about to receive, release it and read each individual piece of information. Repeat this process for each piece of information shown in the table below:

What you see on press	What it means	What you see on release
-Sn-	String number	Will always be #1 with the F-1 Chrony;
-Lo-	Lowest velocity	velocity of the slowest shot
-Hi-	Highest velocity	velocity of the fastest shot
-Av-	Average velocity	Average velocity of all shots
-ES-	Extreme Spread	Hi velocity minus Lo velocity
-Sd-	Standard Deviation	Standard deviation of string of shots
-To-	Total number of shots recorded since <i>Chrony</i> was turned on.	The number of shots fired.
-10-	# of last shot fired	velocity of 10th shot
-9-	# of next to last shot fired	velocity of 9th shot

etc., etc., repeat until all the shots have been shown, then **-[]-** appears. This means the end of the data and, that you are ready to shoot again. If you press the **FU** button again, you start the viewing cycle over again. Simply pressing and releasing the **FU** button takes you from one piece of data to the next.. If you wish at any time during the viewing process to return to the working mode, stop pressing the button and wait 15 seconds. It returns to the working mode by itself. Sometimes, if you hold the **FU** button down for more than two seconds at a time, the unit will go into a sub-menu. Wait 15 seconds, it will return to normal by itself. When you think that you may have done something wrong, take your hands off, and it will go back to normal by itself. Features like this make the *Chrony* very forgiving and easy to use.

STEREO JACK

On the left-hand side near the front of the Alpha Chrony is a Stereo Jack that will accept a 16' (5 m) cord for the optional one-button *Remote Control*. This *Remote Control* lets you access all Alpha functions from the shooting bench. The Stereo Jack also accepts the *IBM/PC Interface* patch-cord or the *Chrony Ballistic Printer*. Please note: The *Remote Control* is an optional accessory and available from SHOOTING CHRONY INC. direct only. The Push Button on the *Remote Control* activates the **FU** functions. If you have a *Chrony Ballistic Printer*, it will also function as a *Remote Control*.

THE TIMER

Opposite the **FU** button a *Timer Button* can be factory installed as an option. This button will convert the *Chrony* into a *Timer/chronograph*. Press & release the *Timer Button* and the *Chrony* will be in *Timer Mode*. When in this mode, all symbols are flanked by horizontal double bars such as **[]=**, etc.; *The Timer* is shot-activated, not sound-activated. The first shot triggers the Timer to count the time between shots, as well as the total time between the first and the last shot. When done shooting, use the **FU** button to retrieve the *Timer Statistics* and *Time elapsed* between shots. Whether in *Timer Mode* or *Velocity Mode*, both: Time and Velocity are recorded and stored in working memory. The difference is: When in *Timer Mode*, only Time is displayed and, when in *Velocity Mode*, only Velocity is displayed.

DECIMAL POINT

When chronographing velocity readings of less than 1000 FPS, the readout will display a Decimal Point and tenths or tenths and hundreds as fir instance: 985.7 FPS or 43.69 FPS, etc.;

OTHER FUNCTIONS

This chapter will deal with other (commonly needed and useful) functions. It does not deal with advanced functions. Let us say that you brought two different loads of ten rounds each to test (20 rounds in total).

You could contaminate or ruin your data in one of two ways:

1. You might forget to start a new string when changing your load after any number of shots; or,
2. You might fire 32 of one kind, then change the load and continue firing, ignoring the flashing Ln or Ci. When you do this, you replace existing data with new data, thus mixing data together in the string. In addition to mistakes you might make, errant data sometimes occur for reasons that are difficult to identify. Powerlines, accidental shadows, and other phenomena may cause a wild velocity reading to appear. Such things are uncommon, but must be rectified if they do occur.

In order to "clean up the data", you must know how to remove the unwanted shots contaminating your string of data.

HOW TO DELETE CHRONY MEMORY

DELETING DATA WHILE IN OPERATIONAL MODE:

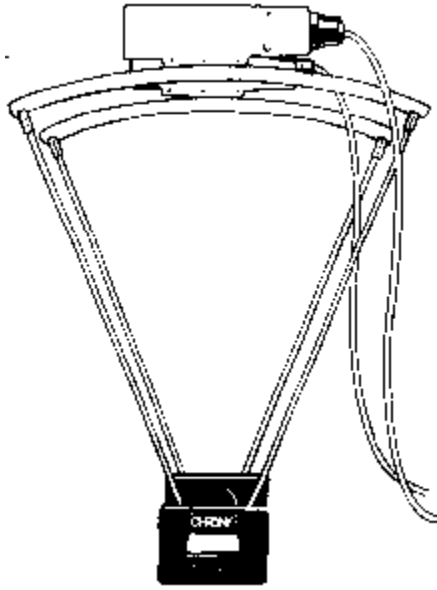
1. **Deleting Single Shot:**
Press and release the FU button repeatedly until the desired shot number is displayed (NOT the velocity). Press and hold the FU button until display flashes. Release immediately when it flashes.
2. **Starting a new String:**
Turn the *Alpha Chrony* OFF then ON, or: Press and release the **FU** button until **-Hi-** is displayed. Hold the button in until the display changes to **-CL-**, then release the button. **-Clr-** is now displayed. Press and release the left **FU** button until the display changes to **-CLS-**, then press and hold the **FU** button in until the display flashes. Release immediately when it flashes.

CHANGING FROM FACTORY DEFAULT FPS to MPS or VICE VERSA

Turn unit **OFF**. Press and hold **FU** button while turning unit **ON**. Release button. If you now turn the Chrony OFF and then ON again, the readout will be as it was, when set at the factory.

To save the alternate setting as a permanent setting, press and release the **FU** button until you see **ES** and hold down until the message changes to **EP**, then release the button. After releasing Button **LEN** will be displayed. Press and release one more time and **SSE** will be displayed. Press and hold until **SSE** flashes, then release immediately. Now you have changed the setting permanently.

INDOOR USE



For proper functioning, a Light-Diffuser and an incandescent light source must be located above each photo-sensor (Fig. 5). The optional **Indoor Shooting Light Fixture** enables Chrony users to pursue indoor use. It works on 115 V house current and overpowers any other light in the same room. Neon or other fluorescent lights cannot be used as a Chronograph light source, because they flicker at twice the AC (alternating current) power frequency, and cause false readings.

SO FAR: You have learned to set up and operate the *Chrony* safely. You have learned how to record data, how to retrieve data, how to clear an individual shot and a string of shots. During the operation, you may encounter symbols or problems not yet explained. They may include the following:

Fig.5. Indoor Shooting Lights

TROUBLE SHOOTING

A) PROBLEM: =Lb=flashing. Cause & Remedy:

Battery is low and must be replaced.

B) PROBLEM: No LCD display. Cause & Remedy:

1. No battery: connect battery;
2. Unit is not turned on; turn unit -ON-;
3. Bad connection: tighten battery snaps;
4. Battery is dead: replace battery;
5. Battery NOT Alkaline: replace with ALKALINE battery.

C) PROBLEM: No reading after shooting. Cause & Remedy:

1. not using diffusers on blue sky, sunny day; add diffusers;
2. using diffusers on a cloudy day; remove diffusers;
3. unit too close to muzzle; move unit farther away;
4. not shooting directly over photocells; aim more carefully;
5. unit not properly aligned with bullet path; realign rifle to point directly at target; and,
6. shooting too early or too late (poor light conditions); wait for better light, or end chronographing session.

D) Err 1 shows on screen; the first sensor did not detect the passage of the bullet. This means either that the shot was not fired directly over the centre of the first sensor, or, that there are poor light conditions. Be sure that the Chrony is aligned with the line of fire.

E) Err 2 shows on screen; the second sensor did not detect the passage of the bullet. Same as above: poor light or poor alignment.

F) Err 3 through Err 9 shows on screen; the exact number relates to internal codes, and is of no significance to the user. May indicate poor light condition. Installation of Diffusers may help.

G) Low velocity reading. Light conditions not right; try diffusers. You may be shooting during poor light conditions.

H) False reading (usually high); can result from very strong light, or by operation near electric motors, radar, powerlines, electric fences, static electricity, radio transmitters, etc. It may also be caused by the Chrony being too close to the gun's muzzle. Remedy: try using diffuser, moving away from electrical interference, moving unit farther from the muzzle, or all of these.

I) Very high velocity readings: **1)** can result from muzzle blast; move Chrony farther from muzzle; **2)** Chrony is not fully open; check for interference from tripod or base.

J) Dead display in cold weather; replace battery with a warm battery.

OTHER TIPS AND HINTS

Make allowances for temperature differences between chronographing your loads and their use in competition. In cold weather, powders burn more slowly and will produce lower velocities than they will at higher temperatures. Different altitudes may also affect velocity. Loads developed which are near maximum velocity during cold weather may produce dangerously high pressures and be unsafe during hot weather. Always try to match conditions while chronographing with those conditions you will face when shooting or hunting. That is, if you hunt in late autumn, do the chronographing in late fall.

ALWAYS WEAR EYE AND EAR PROTECTION WHEN CHRONOGRAPHING.

On sunny days, at certain angles, light may reflect from the bullet and cancel the bullet's shadow. Mark the bullets all the way around with a dark-coloured felt marker if this seems to be happening.

On sunny days, the Chrony may be tilted sideways toward the sun, so that the Diffusers are between the sun and the photocells. Be sure that the Chrony unit remains fully open, and that it is perfectly aligned with the target. Using diffusers on cloudy days may shut out too much light.

Using diffusers on cloudy days is not necessary, since you have the clouds as a white background for contrast.

HOW TO TURN OFF PHOTO SENSORS

Turn *Chrony* off. Press & hold ST button while turning *Chrony* on. Release button.

SENSORS disable/enable while in operational mode

Press and release left button until **-Av-** displays; hold the left button until **-SE-** displays, release button and =FE= or =ME= will display. Press and release the left button. When =ON= displays, press and hold the left button until the display begins to flash, then release immediately. (The

Screen is disabled.) When =OF= displays, press and hold the left button until the display flashes =ON= to enable the screen again.

FORMULAS: Your Chrony calculates data similar to formulas shown below:

To calculate:

$$\sum V / n \text{ Where V is velocity and n is the number of shots}$$

Average (Mean) Velocity (-Av-)

Total all shots in a string and divide by the number of shots in the string,
e.g., $(2990 + 3010 + 2996 + 3004) \div 4 = 3000 \text{ FPS}$

Standard Deviation, population, (-Sd-)

$$Sd = \left[\left(\sum V^2 - n \cdot Av^2 \right) \div (n - 1) \right]^{1/2}$$

Multiply the square of the average velocity by the number of shots and deduct it from the sum of the squares of all shot velocities, then divide this total by the number of shots minus 1, and then take the square root of this figure.

For example: $[(2990^2 + 3010^2 + 2996^2 + 3004^2 - 4 \times 3000^2) \div (4-1)]^{1/2} = 9 \text{ FPS}$

Standard Deviation is a measure of how close each shot's velocity will be to the "average" shot. It is called STANDARD because it is computed in such a way that it has a standard meaning when compared to the NORMAL CURVE. Nearly all things we measure fit a normal curve [such as the height of people, the diameter of (supposedly) identical motor pistons, and the velocity of (supposedly) identical cartridges]. The NORMAL CURVE shows that all variables occur more frequently at or near the average, and less frequently as they deviate further from the average. We use a STANDARD Deviation measure so that all things we measure can be compared with each other and to this curve [68% of all things we measure falls between one standard deviation above or below average, 95.4% falls between two Standard Deviations above and below the average, and 99.7% falls between three Standard Deviations above and below the average]. Thus, Standard Deviation is a universal method in statistics and measurement for dealing with and interpreting data.

Therefore, if the bullets are traveling at an average velocity of 3000 feet per second, and there is a Standard Deviation of 20, then 68% of the shots you fire will fall between 2980 and 3020 fps, and 95.4% will fall between 2960 and 3040 fps. Nearly all of them (99.7%) will fall between 2940 and 3060 fps.

Since Standard Deviation is the most important information your chronograph can give you, it is useful to understand the reason for this. At least ten (10) shots are required to obtain a reliable average and Standard Deviation. Fewer shots (such as 3 or 5) are typically "small samples", and are considered unreliable when measuring anything variable.

Extreme Spread (-ES-)

Hi - Lo

Subtract the slowest shot from the fastest. **For example:** $3010 - 2990 = 20 \text{ FPS}$

Energy Calculation

Average velocity X Average velocity X Weight of bullet in grains $\div 450 \text{ 240} = \text{_____ ft. lbs.}$

GLOSSARY OF DISPLAY CODES

FROM OPERATIONAL MODE

-01-: or other #. REPRESENTS A RECORDED SHOT'S ASSIGNED NUMBER.

- Lo-: LOWEST VELOCITY SHOT OF ACTIVE STRING
- Hi-: HIGHEST VELOCITY SHOT OF ACTIVE STRING
- Av-: AVERAGE VELOCITY OF ALL SHOTS IN ACTIVE STRING
- ES-: EXTREME SPREAD FOR ACTIVE STRING (-Hi- minus -Lo-)
- Sd-: STANDARD DEVIATION FOR ACTIVE STRING (STATISTICAL MEASURE OF UNIFORMITY)
- To-: TOTAL NUMBER OF SHOTS RECORDED SINCE CHRONY WAS LAST TURNED ON
- nn-: (Used in this manual to represent an unspecified shot number)
- nn-1-: (Used in this manual to represent an unspecified shot number 1 less than previously displayed shot number)
- []-: END OF MENU AND READY STATE (UNIT IS IN OPERATIONAL MODE/READY TO ACCEPT DATA)
- =FE=: UNIT IS IN FPS DISPLAY MODE
- =ME=: UNIT IS IN MPS DISPLAY MODE

TECHNICAL SPECIFICATIONS

The *Chrony* reads velocity in feet-per-second (or metres-per-second) and works in a velocity range from 30 fps to 7000 fps (10 mps to 2134 mps). Operating Temperature range: 32o Fahrenheit to 110 o Fahrenheit (0 o Celsius to 43 o Celsius), non-condensing. (Ambient temperature must be above dew-point temperature and not fall below dew-point temperature while *Chrony* is being used.) Storage Temperature range: 14o Fahrenheit to 120o Fahrenheit (-10o Celsius to 50o Celsius) non-condensing. (Ambient temperature must be above dew-point temperature and not fall below dew-point temperature where the *Chrony* is being stored, unless the *Chrony* is sealed in an air-tight container.)

Accuracy: 99.5% or better. Displayed velocity will not differ from actual velocity by more than 1 part in 200, i.e., ± 10 fps on a velocity reading of 2000 fps. Typical performance is generally better, and shot-to-shot repeatability is always more accurate, i.e., Reported Mean Instrumental Velocity may differ by as much as 0.5% from actual mean instrumental velocity, but Standard Deviation calculated from data gathered with a *Chrony* will always be closer than 0.5% to actual Standard Deviation for a string. This is an important fact because an accurate measurement of a load's uniformity is of considerably more importance than is an exact measure of its average velocity.

PHYSICAL/FUNCTIONAL SPECIFICATIONS

LCD Display: 0.5" (1.37 cm) high; Weight: 2.5 lbs (1.2 kg).

Battery life: 48 hours of continuous use. Photo sensors have wide sensitivity range, and are electronically calibrated to obtain maximum accuracy.

Should you have to return your *Chrony* because of a malfunction, do not return it to the Dealer, Distributor or Mail-Order House you bought it from. It must be returned directly to SHOOTING CHRONY, INC.

US residents, please return your CHRONY to:

SHOOTING CHRONY INC.

3840 East Robinson Rd., PMB # 298

Amherst, NY 14228 USA

CANADIAN residents and other Non-U.S. senders please return your CHRONY to:

SHOOTING CHRONY INC.

2446 Cawthra Rd, Building 1, Unit 10

Mississauga, Ontario

CANADA, L5A 3K6

Phone: 1-(905) 276-6292; FAX: 1-(905) 276-6295