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**USER'S MANUAL
FOR SHOOTING CHRONY® CHRONOGRAPHS,
MODELS: BETA and GAMMA SHOOTING CHRONY®S and
BETA and GAMMA MASTER CHRONY®S**

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INTRODUCTION (** Please Read These Instructions Carefully Before Using The Chronograph)

SHOOTING CHRONY INC. assumes no responsibility, either directly or indirectly, for any action or consequences of any actions associated with the use of its products.

Every Shooting Chrony® measures the speed of bullets, arrows, shotgun-pellets, airgun-pellets and paintballs, etc.- from 30/FPS to 7000/FPS and with better than 99.5% accuracy. Your Chrony will go with you anywhere. Just unfold, mount on a tripod or place on a table, insert Diffusers (if needed) and shoot in less than 2 minutes. All Chronys come with a 3 year limited warranty. The Master Chronys have the same capabilities as their respective Shooting Chrony counterparts. In addition to that, the Master Chronys have a LCD Monitor which brings the LCD (Liquid Crystal Display) readout right up to your bench, away from the bullets path. It also doubles as a Remote Control.

FEATURES

BETA and BETA MASTER 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 temporary working memory; + Has 60 shot permanent memory (divided into 6 numbered strings of up to 10 shots each, with one set of Statistics for each string); + Delete individual shots (with automatic adjustment of Statistics); + Delete the content of a whole string or all data from memory; + Can be switched off, taken home & switched on again (as long as this is done within 40 years) for reviewing and information retrieval; + Memory will stay even without battery; + Moves instantly from string to string, interrupts shooting on any string without memory loss, returns to any string to continue where you left off; + Change string size; + Stereo Jack for optional Printer or Remote Control; + Forget Button: To clear individual strings instantly; + Upgrade to 1000 shot memory; + Upgrade to Gamma or Gamma Master Chrony; + And more...

GAMMA and GAMMA MASTER CHRONY

All the features of the Beta Chrony . . . . PLUS: Includes one Ballistic Chrony Printer that prints Velocity data, Timer data and Statistics on regular paper; Place anywhere on shooting bench; It prints as you shoot; It also prints from Chrony memory; and acts also as a Remote Control; + 500 shot memory (divided into 50 numbered strings of 2 to 10 shots each); + Timer Button; + Memory for 500 individual Timer readouts; + The Gamma (at all times) measures & stores not only shot velocities but also time elapsed between shots, including total time. To make Timer-Data visible, press the Timer Button; + Plus much more.

HOW IT WORKS
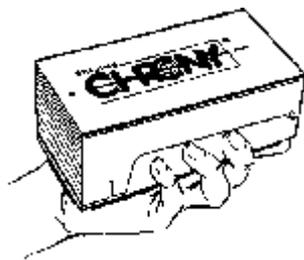
Fig.1. Closed Chrony

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 like 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.

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 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.

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 a *Beta Master* or *Gamma Master Chrony* place the LCD Monitor near you on the bench, well away from muzzle blast.

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10. With a *Beta Master* or *Gamma Master Chrony* place the LCD Monitor near you on the bench, well away from muzzle blast.
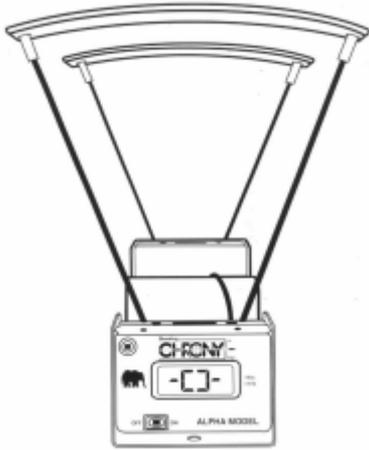
11. Have a notebook and pen with you to record your results and to make notes.

Fig. 2. Shooting Chrony, front view

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.

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.

Fig.4. Protective Shields

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 with any chronograph.

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. A Beta Chrony will display BE with flashing symbols on each side; a Gamma Chrony will display GA with flashing symbols on each side. These flashing symbols indicate that the Chrony is working and is ready for use. Because of the limitations of the LCD, the BE symbol for the Beta Chrony can also be read as 8E. For Chronys that are set to read in MPS, it will display a dot between the two letters (e.g., G.A), with the same flashing symbols on each side; without the dot (e.g., GA), the unit read out is in FPS.

3. The Beta or Gamma Chrony may have data stored in it from factory tests. You will need to remove any such data, so that this data is not mixed with your data. If you find data on a string you want to use, press the FORGET button to clear the string, and proceed to shoot (see p.6).

   The Chrony is now ready to record a string of up to ten shots. 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 ten shots, it will display the number ten (10) and then the velocity. The tenth shot will alternately flash three times with =Ln=, which means that the Last Number in this string has been used (Ln actually stands for LiNear mode). If you keep shooting on this string, the first shot in this string will be replaced by the next shot you fire. The display will flash =SO=, telling you that you have lost data from the first shot of this string, and had it replaced with the last shot. It is time to change strings when you see =Ln=. (Your unit may flash Ci which, for all practical purposes, means the same thing.) We will discuss the minor differences between Ln and Ci later. We will also discuss how to throw out any shots that you may have accidentally fired into the string (page 5).

4. If you now turn off the Chrony, the data will be lost. It is in TEMPORARY (working) MEMORY only.

5. To save the data, first make a note of the string number that you are saving (for later retrieval and reference). Now press and hold the (right, red) ST button until you see the next higher string number, then release the button and you will now see how many shots you have on this string (if any!). The next higher string number should appear while you have the button pressed and -# #- should appear when you release it. This tells you, that the data is saved and that you are ready to use the next string. At this point, it is possible to turn the Chrony off and retrieve the saved data later. Attention BETA OWNERS: If you filled up your Chrony memory (with 60 shots) and, let's say you are at the end of string #6, you must press and release the ST button to save that string. You are now on string #1 again. If you now turn off the Chrony, you will not loose string #1, provided, you switched from string #1 to string #2 since the Chrony was turned on during that shooting session. If in doubt, press and release the ST button six times and you will save everything for sure.

   Before retrieving data, turn off the sensors to keep them from contaminating stored data. The presence of fluorescent lights (when sensors are on) will always contaminate data as such lights are flashing imperceptibly and, fool the sensors into believing, that shots are being fired. To turn off sensors, press and hold the ST button while turning the unit on. When using a Master Chrony, you need only use the LCD Monitor. Attach a 9-volt alkaline battery to the short cable provided, plug it into the LCD Monitor and read the data (Fig.4). Data contamination will not occur when a Master Chrony is not attached to the sensors. The above procedure must be used for turning off the sensors when reviewing the data from Master Chronys with the LCD Monitor attached to the sensors.

6. If you press and hold the **ST** button, the next higher string number appears; when you release the button, the number of shots registered in this string (if any) is displayed. Anytime you change from one string to the next higher string by using the **ST** button, you have permanently saved the lower string and switched to the next higher numbered string. You can do this after any number of shots fired in any string.

7. To scroll down to a lower string number, press and hold the **ST** button. While holding the ST button, press and release the (left, black) **FU** button. Every time you press and release the FU button (while holding the **ST** button), you will scroll down to the next lower string number.

8. Every time the Chrony is turned ON, it will search for the first empty string available.
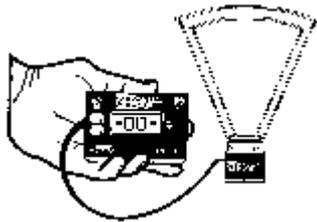

Fig.4. Master Chrony.

9. Anytime you wish, you may review the data you have produced. To do this, simply press the 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 as shown in the table below. The Beta and Gamma Chronys have a build-in delayed message feature, which will delay the message between pushing the FU button and (for instance) seeing a velocity readout. This feature makes it easier to learn and understand the system. To bypass this feature, press & hold FU button first, before you press & hold ST button. Then release FU button, quickly followed by releasing the ST button

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 *Chrony* was turned on.	The number of shots fired.
-10-	# of last shot fired	velocity of 10th shot
-09-	# 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 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, just press the **ST** button once or, stop pressing the **FU** 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 an advanced function mode. Just wait a little while; it will return to normal by itself. The good thing about a Chrony is this: when you want it to work, and you think you may have done something wrong, just take your hands off all buttons, and it will come back to the working mode all by itself. Features like this make the Chrony very forgiving and easy to use.

Starting with warranty number 140,000, all Beta units have the **Forget button**, and all *Gamma* units have the **Timer button** and the **Forget button**.

HOW TO DELETE CHRONY MEMORY

Deleting a Single Shot:
Press & release the **FU** button until the desired shot number is displayed (NOT the velocity). Hold the button in until display flashes. Release immediately when it flashes.

Deleting any String:

On Beta and Gamma Chronys with the **Forget button**: select string using the **ST** button, then press the **Forget button**. The Forget Button will not delete permanent memory.

For *Beta and Gamma* units with no Forget Button: Select string, then press & release the **FU** button until **-Hi-** is displayed. Hold button in until the display changes to **-CL-,** then release the button (**-Clr-** is now displayed). Press & release the **FU** button until the display changes to **-CLS-**, then press and hold the **FU** button in until the display flashes. Release immediately as it begins to flash.

Deleting Entire Permanent Memory:

(NOTE: does not erase working memory.)

Press & release the **FU** button until **-Hi-** appears. Hold the button in until **-CL-** appears. Release the button and **-CLr-** appears. Press and release the button twice and **-CLE-** appears. Now press and hold the button down until the display flashes. Release the button immediately when the display flashes.

To erase Working Memory: Turn Chrony **OFF** and then **ON** again.

CHRONY QUICK REFERENCE TO COMMON FUNCTIONS

CHANGING FROM FACTORY DEFAULT FPS to MPS or VICE VERSA:

Turn unit **OFF**; press and hold **FU** button while turning unit **ON**. Release button. Record in FPS, retrieve in MPS and/or vice versa.

To save the alternate setting as a permanent setting, press and release the **FU** Button until you see **ES** and hold down until message changes to *EP,* then release 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.

TO TURN OFF PHOTO SENSORS:

To retrieve saved shots from memory, turn **OFF** photo sensors as follows:

Turn unit **OFF**; press and hold **ST** button while turning unit **ON**. Release button.

Photo Sensors disable /enable while in operational mode:

Press & release **FU** button until **-Av-** displays; hold button until **-SE-** displays. Release button and **=FE=** or **=ME=** displays. Press & release the **FU** button. When **=ON=** displays, press and hold **FU** button until the display begins to flash, then release immediately. (The Screen is disabled.) When **=OF=** displays, press and hold **FU** button until the display flashes **=ON=** to enable the screen again.

The FORGET Button

The *Beta Shooting Chrony*, the *Beta Master Chrony*, the *Gamma Shooting Chrony* and the *Gamma Master Chrony* come with an extra push button, located next to the **FU** button, which is called the **Forget button**. This button is for clearing or deleting a String. Select the String you wish to clear, press & release the **Forget button** and the message **-CL-** will show, followed by the symbol **-00-** and the Ready-to-shoot symbol **-[ ]-**. This String is now empty and ready to accept new shots. If no new shots are recorded on that String, the old data will be restored when you move on to another String, or, if the Chrony is turned **OFF** and then **ON** again. The Forget button will also clear Strings when in Timer Mode.

The TIMER Button

The *Gamma Shooting Chrony* and the *Gamma Master Chrony* have a fourth Button, next to the *ST* button, which is called the Timer button. This button will convert the *Chrony* into a **Timer / chronograph**. Move to the String you wish to use as a **Time**r, press & release the **Timer button**, and the message **=rr=** will show, followed by the symbol **=00=** (if the String you chose is empty), and the Ready-to-shoot symbol **=[ ]=**.

NOTE: when in **Timer Mode**, all symbols are flanked by horizontal double bars. To get out of **Timer Mode**, just press & release the **Timer button**.

How to use the TIMER:

The *CHRONY 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 memory. The only difference is this: when in **Timer Mode**, only **Time** is displayed, and when in **Velocity Mode**, only **Velocity** is displayed. You can switch from **Timer Mode** to **Velocity Mode** and vice versa at any time without loss of data. When in **Timer Mode**, the *Chrony* is automatically also in **Rapid-Fire Mode**, and able to record **Time** and **Velocity** at a rate of 1800 rounds/minute.

In *Gamma Chrony* units, the memory is divided and holds both time-elapsed and velocity readouts. Whether or not the *Gamma Chrony* is in **Timer Mode**, it will always measure and retain both: the time-elapsed and velocity readouts. Therefore, in a *Gamma Chrony* with a 1000-slot memory, 500 memory slots are used for time-elapsed readouts, and 500 memory slots are used for velocity readouts.

The **Timer Mode** is available as an option for the following models: the *Alpha Shooting Chrony*, the *Alpha Master Chrony*, the *Beta Shooting Chrony* and the *Beta Master Chrony*.

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 for instance 985.7 FPS or 43.69 FPS, etc.; The display will show velocities in FPS or MPS, depending on factory default setting and operator overrides.

STEREO JACK

On the left-hand side near the front of the Beta and Gamma Chrony is a **Stereo Jack** that will accept the 16' (5 m) cord for the optional two-button **Remote Control**. The Push Buttons on the Remote Control are color-coded: The black button activates the **FU**-button functions, and the red button activates the **ST**-button functions. This **Remote Control** gives you access to all Chrony functions from the shooting bench.

The **Stereo Jack** also accepts the **IBM/PC Interface patch cord**, or the **Ballistic Chrony Printer**. In conjunction with our **Shooting Chrony Ballistics** (for Windows Ballistics Program), the **IBM/PC Interface** lets you download all data stored in your Chrony memory into your IBM/PC compatible computer. This data can be automatically downloaded into a file on your computer for further manipulation by our optional **PC-BULLET** ballistics program. With **Shooting Chrony Ballistics** you can generate charts and graphs, and calculate down-range performance and tons of other data. The **Remote Control** is optional for the Beta Chrony.

Please note: The **Remote Control**, **IBM/PC Interface** and **Shooting Chrony Ballistics** are optional accessories. They are available directly from *Shooting Chrony Inc*. only. (See ACCESSORIES).

The **CHRONY BALLISTIC PRINTER** also functions as a **Remote Control**.

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 ten rounds of one kind, change the load and continue firing, ignoring the flashing Ln or Ci. You will begin replacing existing data with the new data, thus mixing them together in the string.

   In addition to mistakes you might make, errant data sometimes occur for reasons that are difficult to identify. Accidental shadows, Powerlines, Radar and other electro magnetic phenomena may cause wild velocity reading. Such things are uncommon, but must be rectified if they do occur.

   In order to "clean up the data", you must remove the unwanted shots contaminating your string of data. See page #6.

3. If you fired MORE THAN TEN shots, you must now learn the difference between Ln (Linear Mode) and Ci (Circular Mode). The difference is in the way the unit has numbered and will replace the unwanted shots (i.e., shots #11 and upward).

   First, record each shot (SHOT NUMBER and bullet speed) on a piece of paper.

   You will remove the shots by the number of the shot. Look at the list and choose the SHOT NUMBERS you wish to remove. If the unit is in Ln (Linear) mode, it will number shot 11 as shot 10, and delete the first (oldest) shot. Shot 2 was demoted to become shot 1. If you fired 12 shots, shot 12 becomes shot 10 (shot 2 is deleted, former shot 3 is demoted to become shot 1, and shot 11 is demoted to shot 9), and so on. This renumbering process continues, always making the last shot you fired number 10, and always making the earliest (oldest) shot as shot 1. The lost (deleted) shots are lost forever.

4. If the unit is in Ci (Circular) mode, it will renumber the shots as follows: shot 11 will delete shot 1 (just as in Ln mode). However, in Ci mode, shot 11 becomes shot 1, and the very first (oldest) shot you fired is deleted. If you fire 12 shots, shot 12 becomes number 1, and shot 11 is promoted to become shot 2, deleting old shot 2, and so on.

SUMMARY

In **Ln** mode, the next shot after shot 10 always becomes shot 10. As you keep firing, the previous shot is demoted by one number. This occurs all the way down the line with the oldest shot (shot 1) being eliminated each time.

In **Ci** mode, the next (11) shot after shot 10 always becomes shot 1. The oldest shot is lost. Shot 12 becomes shot 1, and shot ll is promoted to become shot 2, etc. In other words, in **Ci** mode, shot 11 will delete and replace shot 1, and shot 11 will become the new shot 1; shot 12 will delete old shot 2, and promotes shot 11 to become the new shot 2, and shot 12 becomes the new shot 1, etc. This continues indefinitely as more shots are fired.

CHANGING BETWEEN Ci and Ln MODES (see page 15-16).

INDOOR USE
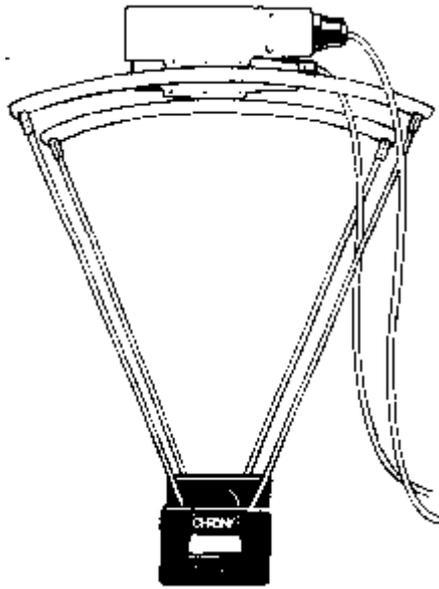
For proper functioning, a Light-Diffuser and an incandescent light source must be located above each photo-sensor (Fig. 5). The optional *Indoor Shooting Light Fixture* enables Chrony users to pursue indoor use. It works on 115 V house current and overpowers any other light in the same room. Neon or 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.

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

To calculate:

Average (Mean) Velocity (-Av-) $\sum V / n$ Where V is velocity and n is the number of shots

Total all shots in a string and divide by the number of shots in the string,
e.g., (2990 + 3010 + 2996 + 3004) ÷ 4 = 3000 FPS

Standard Deviation, population, (-Sd-) $Sd = \left[\left(\sum V^2 - n.Av^2\right) \div (n-1)\right]^{1/2}$

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: [(2990² + 3010² +2996² + 3004² - 4 x 3000²) ÷ (4-1)]½= 9 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 FPS**

Energy Calculation
Average velocity **X** Average velocity **X** Weight of bullet in grains ÷ **450 240** = _____ft. lbs.

THE PROGRAM

ADVANCED FUNCTIONS AND THEIR FEATURES
These advanced functions and features are not needed to retrieve statistics and velocities. This section is included to help those conversant with computer languages to get the most from their *Beta Chrony* or *Gamma Chrony*. Most functions listed here are applicable to the *Beta and Gamma Shooting Chronys,* as well as the *Beta and Gamma Master Chronys*. It is beyond the scope of this USER'S MANUAL to fully explain all information included in this section. You will need a basic understanding of computer languages to understand these features fully. However, you can use them regardless of understanding.

ACTIVATING PROGRAM SUB-MENUS
In order to use the advanced functions and features of the *Chrony*, you must activate the program sub-menu features. To do this, press and hold the **FU** button, identify the code, then press and release until the required code (see below) displays, then press and hold the **FU** button for three (3) seconds (until the displayed message changes or flashes), then release the button.

CHOOSING AND CHANGING PROGRAM SETTINGS
Stepping though the sub-menu selections is accomplished by pressing and holding the left (**FU**) button to identify, and then releasing the left button after you are in the required program sub-menu mode. Changing program settings requires pressing and holding the left (**FU**) button until the display changes, or until it flashes as described below.

READ NEXT SECTION BEFORE USING ADVANCED FUNCTIONS

ENTERING AND EXITING SUB-MENUS

The ***Beta Chrony and Gamma Chrony*** have many advanced features. Understanding and using these features require careful reading and understanding of sub-menu functions listed hereafter.

You do not have to be concerned about having the *Chrony* stuck in some sub-menu where you do not know what to do. Simply keep pressing and releasing the **FU** button until the ready symbol **(-[ ]-)** appears, or do nothing for about 15 seconds (i.e., do not press any buttons). The system will automatically exit all sub-menus and return to operating mode without erasing any data that may be stored in either permanent or working memory.

When you see the ready symbol **(-[ ]-)**, you know that the Chrony is again ready to accept velocity data. If you are in a hurry to return to the operating mode, and do not care about data that may be stored in the working memory, simply turn the Chrony **OFF**, and then back **ON**. Any data in the working memory will be lost!

SUB-MENUS AND PHOTO SENSORS

While your are navigating through any of the sub-menus, and while you may be changing the unit's settings within sub-menus, the photo sensors are disabled. This prevents erroneous data from entering and being stored into memory without your knowledge. Photo sensors are automatically enabled when the ready symbol **(-[ ]-)** code displays. If there is no button activity for 15 seconds, the photo sensors are automatically enabled. However, if you turn the photo sensors off via the **SWITCHABLE PROGRAM FUNCTIONS** sub-menu, or if the **SELF-TEST SHOTS FUNCTION** has been activated via the **FIRE TEST SHOTS** sub-menu, the photo sensors will stay off and sensor**-OFF** alarm **(-OF-)** will flash in the display. To turn the photo sensors back on, you must either enter the **SWITCHABLE PROGRAM FUNCTIONS** sub-menu and then explicitly turn them back on, or simply turn the unit OFF and then back ON. Any data in the working memory will be lost!

SUB-MENU ADVANCED FUNCTIONS

MANIPULATING SHOT STRINGS IN MEMORY -Sn- & _SF_

While you are in the OPERATIONAL MODE, press & hold the left (**FU**) button whenever the unit is ready to accept data. After about one second, the **-Sn-** (String) code will display. Continue to hold the left button down until the display changes (approx. 5 sec) to the **_SF_** (String Functions) code. Release the button, and immediately the **=ASP** (Available Strings in Permanent memory) code displays.

=ASP   (**A**vailable **S**trings in **P**ermanent memory) Code Displayed:

> Press and release **FU** button once to bring up **=USP** code or
> Press and release **FU** button twice to bring up **=GEE** code or
> Press and release **FU** button thrice to return to **OPERATIONAL MODE (-[ ]-)**

or   Press and hold **FU** button (approx. 5 sec) until **=ASP** display begins to flash. Release button and the number of empty strings available in permanent (EEProm) memory displays.

=USP   (**U**sed **Sp**ace) Code Displayed:

> Press and release **FU** button once to bring up **=GEE** code or
> Press and release **FU** button twice to return to **OPERATIONAL MODE (-[ ]-)**

or   Press and hold FU button(approx. 5 sec) until =USP display begins to flash.
Release button: The space used by the working string is displayed.
Press and release FU button again to bring up =GEE code.

=GEE (**G**et **EE**Prom) Code Displayed:

Press and release left button to return to **OPERATIONAL MODE (-[ ]-)**

or   Press and hold **FU** button(approx. 5 sec) until **=GEE** display begins to flash.
Release button: next string from permanent memory is duplicated in working memory -
temporary memory - and unit returns to **OPERATIONAL MODE (-[ ]-).**

SAVING WORKING STRING TO PERMANENT MEMORY - Lo- & _SC_

This is done by pressing and holding the **ST** button until you see the next string number, then releasing button. You will see how many shots you have already on this string or while in **OPERATIONAL MODE (-[ ]-)**. Press, release and press the **FU** button until the **-Lo-** code displays. Hold down the **FU** button until the display changes to the **_SC_** (Save Code). Release the button, and the **=SAC** (SAve Code) code will display.

=SAC Code Displayed:
Press and hold the **FU** button until the display flashes. When you release the **FU** button, the *Beta Chrony and Gamma Chrony* will save working memory data into the next available empty string area in permanent memory. The next string from permanent memory (used or unused) is read into the working memory, then that string number is momentarily displayed, followed by the number of shots already contained in that string. Finally, the Chrony returns to the **OPERATIONAL MODE (-[ ]-).**

CLEARING MEMORY -Hi & _CL_

While in **OPERATIONAL MODE (-[ ]-)**, press, release and press the **FU** button until the **-Hi-** code displays. Hold the FU button down until the display changes to **_CL_** (Clear) code. When you release the left (**FU**) button, the **=CLr** (Clear working string) code displays.

=Clr Code Displayed:

Press and release **FU** button once to bring up =CLS code or
Press and release **FU** button twice to bring up =CLE code or
Press and release FU button thrice to return to **OPERATIONAL MODE (-[ ]-)**

or   Press and hold **FU** button until **=CLr** display begins to flash.
Release **FU** button: the current (working) string is cleared from temporary memory and
unit returns to **OPERATIONAL MODE (-[ ]-).**

=CLS **Cl**ear **S**tring memory) Code Displayed:

Press and release **FU** button once to bring up =CLE code or
Press and release **FU** button twice to return to **OPERATIONAL MODE (-[ ]-)**

or   Press and hold **FU** button until **=CLS** display begins to flash.
Release button: the current string is cleared from permanent memory and unit returns to
OPERATIONAL MODE (-[ ]-).

SWITCHABLE PROGRAM FUNCTIONS: -Av- & _SE_

While in OPERATIONAL MODE (-[ ]-), press, release and press the FU button until the -Av- code displays. Hold the FU button down until the display changes to the _SE_ (SElect) code. Release the FU button. One of the following codes is displayed: =FE= (Feet) or =ME= (Metres), depending upon whether the unit is set up in the FPS or MPS display mode.

=**FE**=   Code Displayed:
or   Press and release **FU** button once to bring up either =**ON**= or =**OF**= code or
=**ME**= Press and release **FU** button twice to bring up either =**AU**= or =**n:A**= code or
          Press and release **FU** button thrice to bring up either =**dE**= or =**iE**= code or
          Press and release **FU** button four times to bring up either =**Li**= or =**Ci**= code or
          Press and release **FU** button five times to bring up either =**uu**= or =**tt**= code or
          Press and release **FU** button six times to bring up either =**nr**= or =**cr**= code or
          Press and release **FU** button seven times to bring up either =**SF**= or =**FF**= code or
          Press and release **FU** button eight times to bring up either =**nn** = or =**AA**= code or
          Press and release **FU** button nine times to bring up either =**nL**= or =**SL**= code or
          Press and release **FU** button ten times to return to **OPERATIONAL MODE (-[ ]-).**

(Which of the above code-pairs displays initially depends on the existing program setting for that function. We have listed them here to reflect the default settings, i.e., the first member of each pair is the factory default setting.)

=**ON**= (photo sensors ON) Code Displayed:
          Press and hold FU button until =**ON**= display flashes.
          Release button. Display changes to =**OF**= and photo sensors are turned off. Sensors will stay off until the unit is switched OFF and back ON again, or until you explicitly turn sensors back on (see below).

=**OF**= (photo sensors Off) Code Displayed:
          Press and hold **FU** button until =**OF**= display flashes.
          Release button. Display changes to =**ON**= and photo sensors are turned on.

=**AU**= (Automatic mode) Code Displayed:
          Press and hold **FU** button until =**AU**= display flashes.
          Release button. Display changes to =**n:A**= and unit is set in manual mode. In manual mode, photo sensors are automatically disabled after each shot to positively prevent false readings between shots. In manual mode to enable photo sensors, you must push and release the FU button before each shot. A colon will display in velocity reading, as 12:34 (for 1234) to indicate that the Chrony is in manual mode.

=**n:A**= (Manual mode) Code Display:
          Press and hold FU button until =**n:A**= display flashes.
          Release button. Display changes to =**AU**= and unit is in automatic mode. It is always ready to accept input while in **OPERATIONAL MODE (-[ ]-).**

=**dE**= (display alarm modE) (Code Displayed:
          Press and hold FU button until =**dE**= display flashes.

Release button. Display changes to **=iE=** and all alarms except low battery indicator are ignored. Error messages will still display.

=iE=   (disable alarms modE) Code Displayed:
Press and hold **FU** button until =iE= display flashes.
Release button. Display changes to **=dE=** and alarms display.

=Li=   (Linear mode) Code Displayed:
Press and hold FU button until =Li= display flashes.
Release button. Display changes to **=Ci=** and temporary memory is in circular mode. In circular mode, when string capacity is exceeded, each new shot replaces the oldest shot in memory. Shot 11 deletes shot 1 (shot 11 becomes 1); then shot 12 becomes shot 1, shot 11 shifts to become shot 2 (and the old shot 2 is deleted), etc. (see p.4, #5)

=Ci=   (Circular mode) Code Displayed:
Press and hold **FU** button until =Ci= display flashes.
Release button. Display changes to **=Li=** and temporary memory is in linear mode. In linear mode, when string capacity is exceeded, each new shot replaces the oldest shot in memory. Shot 11 becomes shot 10 (shot 1 is deleted, shot 2 demotes to become shot 1, and former shot 10 demotes to become shot 9); shot 12 becomes shot 10 (new shot 1 is deleted, and shot 10 is demoted to become shot 9), etc. (see p.4, #5)

=uu=   (velocity only mode) Code Displayed:
Press and hold **FU** button until =uu= display flashes.
Release button. Display changes to **=tt=** and statistics are calculated and reported in times of flight only.

=tt=   (times of flight only mode) Code Displayed:
Press and hold FU button until =tt= display flashes.
Release button. Display changes to **=uu=** and statistics are calculated and reported in velocity only.

=nr=   (no time) Code Displayed:
Press and hold FU button until =nG= display flashes.
Release button. Display changes to **=cG=** and both velocities and times of flight are stored. Memory capacity in this mode is 30 shots with the Beta Chrony and 510 shots with the *Gamma Chrony*.

In this mode each string is duplicated. The first string is the velocity string and the second string (with the same number) is the Timer string. To go to the Timer string, just press and release the ST button.

=cr=   (capture Time) Code Displayed
Press and hold **FU** button until =cr= display flashes.
Release button. Display changes to **=nr=** and only velocities are stored. Memory

capacity in this mode is 60 shots with *Beta Chrony* and 1020 shots with *Gamma Chrony*.

=**SF**=   (Slow Fire) Code Displayed:
Press and hold **FU** button until =**SF**= display flashes.
Release button. Display changes to =**FF**= and the Chrony is set in Fast Fire mode. In this mode, 30 shots per second (even more in SLAVE MODE, see below) can be recorded. In this mode, and with rapid enough rate of fire, error messages and alarms cannot be observed. If you are using a machine gun, be especially careful to position the *Chrony* far enough from the muzzle to avoid interference from echo effects.

=**FF**=   (Fast Fire) Code Displayed:
Press and hold FU button until =**FF**= display flashes.
Release button. Display changes to =**SF**= and the Chrony is set in Slow Fire mode. Shot number will be displayed for about a ½ second before velocity is displayed. Bad Shots and error messages are also displayed for a ½ second before the next shot is allowed. Therefore, no more than two shots per second can be recorded.

=**nn**=   (save Manual Mode) Code Displayed:
Press and hold **FU** button until =**nn**= display flashes.
Release button. Display changes to =**AA**= and Chrony is set in Save Automatic mode. In this mode (after each default-size shot is completed), the Chrony automatically saves the string into permanent memory and calls up the next string number. For rapid-fire use, we recommend a maximum default string size of 32. It is important to at least record ammunition type for each string number.... This way (when you later recall strings from memory) you will know which is which.

=**AA**=   (sAve Automatically mode) Code Displayed:
Press and hold FU button until =**AA**= display flashes.
Release button. Display changes to =**nn**= and Chrony is set in Save Manually mode. In this mode, shot strings must be manually saved; or they can be cleared (with Save & Clear functions); or they can be saved by simply scrolling to the next or previous string by using the **ST** button (in conjunction with the **FU** button to count down).

=**nL**=   (Master computer Link mode) Code Displayed:
Press and hold **FU** button until =**nL**= display flashes.
Release button. Display changes to =**SL**= and Chrony is set in Slave Mode. When in this mode, the unit will record shots, but will respond only to master/slave commands from a connected IBM compatible computer.

=**SL**=   (Slave computer Link mode) Code Displayed:
Press and hold **FU** button until =**SL**= display flashes
Release button. Display changes to =**nL**= and Chrony is set in Master Mode. When in this mode, the Chrony transmits all activities to a connected IBM compatible computer.

MEMORY CONFIGURATION

EEProm FUNCTIONS -ES- & _EP_

While in **OPERATIONAL MODE (-[ ]-)**, press, release and press **FU** button until **-ES-** code displays. Hold button until display changes to **_EP_** (eEProm functions) code. Release button, and -**LEN** (LENgth) code will display.

LEN   Press and release **FU** button once to display **-SSE** code or
                Press and release **FU** button twice to display **-CSE** code or
                Press ST button, current string size (nn) displays, release button.
                Press **ST** button again, string size is incremented by two and new string size displays.
                Each additional press and release of the ST button adds two to the string size until 32
                is reached, then the number cycles to 4. Additional presses repeat the increment-by-
                two process.
                Pressing the **FU** button while the **ST** button is held down, string size displays
                decrements of string size by 2.

(It is most efficient to choose a string size that evenly divides into the number of shots available: 60 for the Beta Chrony, 1020 for the base Gamma Chrony, and 4090 or 8180 for the enhanced Gamma Chrony.)

NOTE: If you change a string size, any existing EEProm shot data is scrambled. This is exactly like a database record. Before changing a string size, record all data from permanent and working memory. After changing a string size, execute the **-CLE-** (see CLEARING MEMORY) function to insure that old data does not corrupt any new data. It is absolutely mandatory that you save your new string size setting via the **-ES.. EP ...-SSE** functions discussed under **SAVE AND CLEAR SETUP** below.

FURTHER NOTE: Unless your intention is to deliberately experiment with data corruption (why?), please save your setup after you have changed the maximum string size. Your Chrony really needs to know what you intend to do in order to properly interpret your data.

SAVE AND CLEAR SETUP: -ES- & _EP_ (cont.)

Any change done to the Chrony settings will be lost if not saved when the *Chrony* is turned **OFF**. To save the settings while in operational mode, press and release the **FU** button until the **-ES-** code displays. Hold the **FU** button down until the display changes to the **_EP_** (cEProm functions) code. Release the **FU** button: **-LEN** (LENgth) code displays. Press and release the **FU** button again. **-SSE** (Store Setup in EEProm) code displays.

-SSE   Code Displayed:
                Press and release **FU** button once to display **-CSE** code or
                Press and hold **FU** button until **-SSE** display flashes.
                Release button. The setup is now permanently stored into the **EEProm** memory until
                you execute **-SSE** again with a new setup configuration.

CSE   (**C**lear **S**etup from **E**EProm) Code Displayed:
                Press and release **FU** button twice to return to **OPERATIONAL MODE (-[ ]-)** or
                Press and hold **FU** button until **-CSE** display flashes.
                Release button. All configuration setups are reset to factory default settings. This can be
                used to recover from unusable or unknown setups that may make the Chrony unusable.
                In this way, you can experiment with advanced features without worrying that you may
                create an inoperable and inescapable condition in the Chrony. You will always be able to
                go to the **-CSE** prompt to execute a return to the factory default settings state.

FIRE TEST SHOTS: -SD & _Fi_

While in **OPERATIONAL MODE(-[ ]-)**, press, release and press the **FU** button until the **-Sd-** code displays. Hold the **FU** button down until the display changes to the **_Fi_** (Fire test shots) code. (If the **FU** button is not released within two seconds after the display changes to **_Fi_** code, the Chrony will return to **OPERATIONAL MODE**.) Release the **FU** button and a number representing a velocity range will display, e.g., 50.
There are ten velocity ranges to choose from:

50/100/200/500/1000/2000/3000/4000/5000/6000 fps

To advance to the next higher range, press and release the FU button while any velocity range (except 6000) is displayed. To activate, press & hold the FU button until the velocity range flashes, then release the button. (When activated, this feature will generate shot strings with average velocities near the chosen range.) If 6000 is displayed, and the FU button is pressed and released again, the Chrony returns to **OPERATIONAL MODE (-[ ]-).**

DESIRED VELOCITY RANGE Displayed:

Press & hold the **FU** button until the display flashes.
Release the **FU** button. The Chrony begins generating artificial test shots at about one per second, and sequentially reporting shot number and velocity to display until 10 shots have been generated and displayed, or until the **FU** button is pressed. If the **FU** button is pressed, it interrupts and stops this process. After ten shots are generated (or **FU** button is pressed) the messages **OF** and Ln or **Ci** alternately flash, to signify that the photo sensors are disabled and that the working memory is full. Statistical data for this artificial string can now be retrieved, just as with a real shot string, by pressing and releasing the **FU** button.
To re-enable the photo sensors, simply switch the Chrony **OFF** and then **ON** again, or enter the **=ON=** or **=OF=** sub-menu and switch from the **=OF=** code to the **=ON=** code.

COMPUTER INTERFACE

NOTE: Before downloading data into your PC, disable the photo sensors so that contamination of stored data (working memory) is impossible. (Fluorescent lights can trigger false readings and other lighting conditions could allow false readings to enter the data strings if the sensors are active as the unit is turned on.)

MANUAL CONTROL: -ro & _nC_

There are two sub-menu functions for "brute-force" PC communications. To get to this menu from OPERATIONAL MODE, press, release and press the **FU** button until the -ro- code displays. Press & hold the **FU** button until the display changes to **_nC_** (Manual Control) code. Release the **FU** button, and **=SE=** code displays.

=SE= (Send Entire memory) Code Displayed:

   Press and release FU button once to display =PC= code or
   Press and release FU button twice and unit returns to OPERATIONAL MODE (-[ ]-)

or Press and hold FU button until =SE= flashes.
   Release FU button, and Chrony sends all strings, including current RAM (working)
   string to PC. This data transfer is one-way, without handshaking. The Chrony sends
   the data to the PC. If the PC is ready, and if there are no errors, all is well. If the PC is

not ready, or errors occur, this process can result in no data or garbled data in the PC because it cannot "talk" to the Chrony.

Note: older PCs will be unable to keep up with the Chrony transmission in this mode (4800 baud).

=PC=   (PC Control mode) Code Displayed:
Press and release FU button and unit returns to OPERATIONAL MODE (-[ ]-)

or   Press and hold FU button until =PC= flashes.
Release button. Unit enters PC-CONTROL mode and stays in that mode until any button is pressed, or the PC issues an exit command.

These two commands are provided primarily for use with PC Ballistics Software that does not recognize Chrony communications protocol.
Please note: older PCS may not be able to keep up with Chrony transmission rate (4800 baud).

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

PROGRAM MODE SUB-MENU CODES

_SF_:	String Functions, accessed from **-Sn-** (Operational Mode)
=ASP:	Gives # Of Empty Strings available in memory, accessed from _SF_
=USP:	GIVES SPACE USED BY STRING IN WORKING MEMORY, accessed from _SF_
=GEE:	Calls next string from permanent memory into working memory, accessed from _SF_
_SC_:	Save and Clear Strings, accessed from **-Lo-** (Operational Mode)
=SAC:	STORES ALL WORKING MEMORY TO PERMANENT MEMORY, CALLS NEXT AVAILABLE PERMANENT MEMORY STRING INTO WORKING MEMORY,

	accessed from _SC_
_CL_:	CLEAR MEMORY FUNCTION, accessed from **-Hi-** (OPERATIONAL MODE)
=CLr:	CLEAR WORKING STRING, accessed from _CL_
=CLS:	CLEAR CURRENT STRING FROM PERMANENT MEMORY, accessed from **_CL_**
=CLE:	CLEAR ENTIRE CONTENTS OF PERMANENT MEMORY, accessed from **_CL_**
_SE_:	SWITCHABLE PROGRAM FUNCTIONS, accessed from **-Av-** (OPERATIONAL MODE)
=FE= or =ME=:	Displays after _SE_, depends on unit of measure setting
=ON= or =OF=:	PHOTO SENSORS ARE ON/OFF, accessed from **_SE_**
=AU= or =n:A=:	Sensors Automatic/Manual on, accessed from **_SE_**
=dE= or =iE=:	ALARMS ENABLED/DISABLED, accessed from _SE_
=Li= or =Ci=:	MEMORY LINEAR/CIRCULAR, accessed from _SE_
=uu= or =tt=:	STATISTICS IN VELOCITY/TIME, accessed from **_SE_**
=nr= or =cr=:	MEMORY STORES VELOCITY/TIME & TIME, accessed from **_SE_**
=SF= or =FF=:	Chrony in Slow-Fire/Fast Fire Mode, accessed from **_SE_**
=nn= or =AA=:	SAVE FULL STRINGS Manually/Automatically, accessed from _SE_
=nL= or =SL=:	Chrony IN MASTER/SLAVE MODE, accessed from **_SE_**
_EP_:	EEProm FUNCTIONS, accessed from **-ES-** (OPERATIONAL MODE)
(=LEN):	Length of string accessed from **_EP_**
-SSE:	Permanently Store Setup Into EEProm memory, accessed from **_EP_**
-CSE:	RETURN EEProm SETUP TO FACTORY DEFAULT VALUES, accessed from _EP_
_Fi_:	FIRE TEST SHOTS FUNCTION, accessed from **-Sd-** (OPERATIONAL MODE) **50/100/200/500/1000/2000/3000/4000/5000/6000**
	(Numbers chosen by buttons when _Fi_ active. Represents approximate average velocity of artificial shot string. To execute string, press and hold **FU** *button while desired velocity range is displayed until display flashes, then release button.)*
_nC_:	MANUAL CONTROL, accessed from **-ro-** (OPERATIONAL MODE)
=SE=:	SENDS ALL PERMANENT AND TEMPORARY DATA TO CONNECTED PC
=PC=:	SETS UNIT IN PC-CONTROL 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

E-Mail: chrony@shootingchrony.com
Web-Site: http://www.shootingchrony.com