



OPERATING INSTRUCTIONS

PROCHRONO LTD™



Please read this manual!

This manual contains setup information necessary to achieve proper performance from your chronograph.

Look inside
for accessories to use
with your ProChrono LTD!

PROCHRONO LTD

USER MANUAL / OPERATING INSTRUCTIONS

Thank you for purchasing our product! It is important to read and understand this manual before trying to use your new chronograph.

We are here to help. If you have any questions or comments, please contact us at 815-874-8001 or www.competitionelectronics.com. The ProChrono LTD is designed and built in the USA, and with proper use and care it will give you many years of trouble free service.

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How It Works

The ProChrono LTD operates on the principle of measuring the time it takes for an object to travel from the first projectile sensor to the second projectile sensor. The sensors, mounted internally in the case, monitor light through the two rectangular openings in the top of the case. These sensors are specially designed electromechanical devices that can detect the small changes in light intensity that occur when a projectile interrupts light rays shining into the sensor opening.

If you can imagine looking up at the sky through a tube, you will gain an understanding of what the sensors see. The only light they see is what is directly above them. Any change in light caused by an object passing over them is converted to a signal that is detected by the chronograph circuitry. It then measures the elapsed time between the light interruptions, converts this time into velocity, and displays it on its LCD screen.

Lighting Considerations

Lighting Conditions

As mentioned above, the ProChrono LTD is a light sensing device. In the course of use it must cope with a multitude of different lighting conditions... sunny clear skies, overcast days, low light situations, reflections, different colors and shapes of projectiles, etc. Although the ProChrono LTD works flawlessly over a very wide range of conditions, there are times when the environment can affect chronograph performance.

Diffuser Use

It may be counterintuitive, but the best natural conditions for using the ProChrono LTD are overcast, or cloudy days. This is because the ProChrono LTD works best with a diffused light source.

For this reason, white plastic diffuser hoods are provided with the unit for use on clear, sunny days. This will insure that the light that the chronograph sensors see from above is homogenous and scattered and will greatly reduce errors in velocities and missed detection.

On an overcast day, it is generally better to remove the diffusers. This is because the clouds act as diffusers, so no further diffusion is needed and is advantageous to allow more light into the chronograph.

Some Common Conditions that May Cause Problems

You can encounter a wide variety of lighting conditions if you use your chronograph outside. The following are some things to look out for:

Reflections

On sunny days, reflective projectiles may cause “glints” which can induce velocity errors. This phenomenon is minimized by using the diffuser hoods. However, depending on the position of the sun, further setup adjustments may be necessary. If false readings occur with the diffuser hoods in place, you can correct the problem with one or more of the following steps:

- Change the position of the chronograph relative to the angle of the sun
- Color the bullet tip with a black, permanent marker
- Move the chronograph to a location in the field of a shadow cast by a building or an opaque wall. Make sure the sensors have a clear view of the sky but the chronograph itself is within the shadow. An alternate method for this is to use shields taped on the sides of the guide rods to create the shadow. Be sure to use cardboard or something similar that will not cause any problems with ricochets. This will eliminate reflections from direct sunlight, while still assuring that the chronograph has a direct view of the sky. In some cases, doing this may reduce the incoming light level too much and make the chronograph less sensitive

Trees

You should not locate your chronograph in the shadow of a tree since the movement of leaves and branches can cause instability in the lighting environment.

Sunrise and Sunset

The lighting conditions at sunrise and sunset can cause errors due to reflections (glints), skewed shadows, or low light levels because of the extremely low angle of the sun.

(Some Common Conditions that May Cause Problems continued...)

Electrical Interference

It is unlikely but possible that use of the chronograph in close proximity to a radio tower, microwave tower, or large power facility could cause errors and functional problems. Avoid use in these areas if you encounter these problems.

Using the Chronograph Indoors

Common problems that occur indoors include the following:

Not Enough Light

Indoor lighting is often not suitable for use with the chronograph. Most common incandescent lamps positioned directly above the chronograph are not a good light source because they provide an uneven amount of light over the sensing area. A white background with even amounts of light over the sensing area works best, (such as an incandescent flood lamp shining up onto a white surface above the chronograph)

Wrong Kind of Light

Florescent lamps will not work as a light source for your chronograph, because although we cannot see it with our naked eye, they are pulsing many times per second and the chronograph can detect this which renders it useless because the cycle rate is similar to the speed of projectiles.

If you would like to use your chronograph in an area where improper lighting conditions exist, Competition Electronics offers a specially designed indoor lighting system. More information on this is found in the "accessories" section of this manual.

Lighting & Accuracy

Adverse lighting conditions can cause accuracy issues, and having read the above you can understand why. Any change in light intensity that a sensor detects other than the shadow of the intended projectile will result in errors.

Using the ProChrono LTD with Different Projectile Types

Pistols & Rifles

The main consideration here is probably **muzzle blast**. Make sure you stand back far enough from the chronograph to avoid the muzzle blast triggering the sensors and introducing velocity errors.

- For pistols, the muzzle to chronograph distance should be 5 to 10 feet.
- For rifles, we recommend a muzzle to chronograph distance of 10 to 15 feet.

If muzzle blast is affecting your readings, move back to resolve the problem.

If you are using a scope, be sure to check the boreline-to-scope distance and raise your aimpoint to accommodate this measurement, otherwise the projectile may hit the chronograph.

Shotguns

To chronograph shotgun loads, do not install the guide wires and diffuser hoods under any type of lighting conditions or they may be hit by the shot mass. Due to the size and shape of a shot mass, diffused light is not necessary.

Start by standing at a distance of 5 feet from the muzzle of the gun to the chronograph and aim about 6 inches above the unit.

You may have to experiment with shot placement and muzzle distance to find the right spot to measure your particular load. If you stand too far away, the shot can spread out too far causing inaccurate velocity readings, and the wad can separate from the shot column and may hit and possibly damage the chronograph.

See the CEI Debris Shield in the accessories section of this manual, it can provide an additional measure of protection.

Bow and Arrow & Crossbow

Make sure that you stand a little more than one arrow's length away from the chronograph when shooting to assure that the arrow is not accelerating when it reaches the chronograph, otherwise your velocity readings may be inconsistent. Regarding the arrow tips, we recommend using dark colored field points for best results.

(Using the ProChrono LTD with Different Projectile Types continued...)

Paintball Guns

Muzzle to chronograph distance is not a factor with paintball guns, however paint buildup on the unit may affect its performance. See the CEI Debris Shield in the accessories section of this manual, it can provide an additional measure of protection.

Airguns, BB Guns, Pellet Guns & AirSoft Guns

Muzzle to chronograph distance is not a factor with these types of guns. The main issue is that BB's are probably one of the most difficult projectiles to measure using light-based techniques because they are small and shiny. However, with proper setup and lighting conditions the ProChrono LTD will measure them reliably.

Miscellaneous

You may think of other uses for the chronograph. For example, some have used it to measure the speed of sporting clays. If you can get it to pass over the sensors, you can probably measure the velocity.

Battery Installation

Begin by installing a new 9 volt alkaline battery in the chronograph battery compartment. There is also space to store a spare. You can expect at least 20 hours of operation from a new alkaline battery.

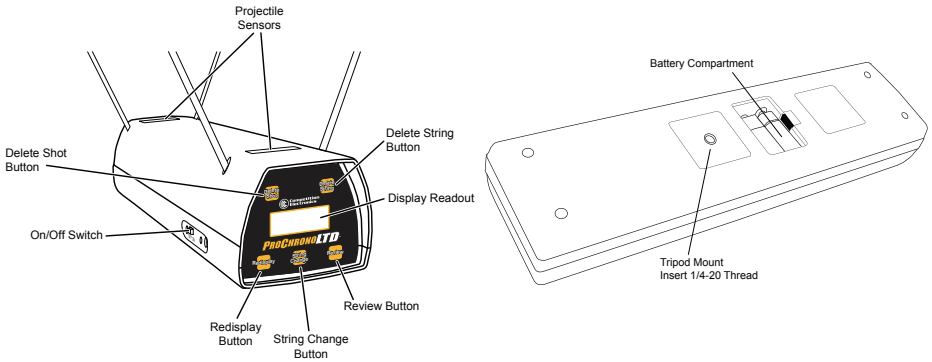
Mounting the Chronograph

The chronograph may be placed on a sturdy table or mounted to a tripod using it's molded-in 1/4-20 threaded insert. Be careful to prepare adequately for windy conditions, especially if you are using a tripod. The diffusers make the chronograph susceptible to wind gusts.

Installing the Guide Wires & Diffuser Hoods

(Note: Diffuser Hoods are intended for sunny conditions only)

Insert the 3/16" rods into the holes on each side of the plastic diffuser. Insert one of the rods into the chronograph. Insert the other rod into the opposite side of the chronograph.



Operating the Chronograph

To turn the chronograph on, move the small black slide switch on the side of the chronograph to the "ON" position. The display will briefly show all segments.

Meters per Second/Feet per Second Selection

If you want to use the chronograph in ft/sec mode, just turn it on. To register velocities in meters/sec mode, hold down the "review" button while you turn on the chronograph until you see the "rdY" message.

You must do this each time you turn on the chrono when meters/sec readout is desired.

Getting Started: Recording Projectile Velocities

Getting a velocity is as simple as turning on the chronograph and shooting over it. You must shoot along the long dimension of the chronograph within the triangle formed by the rods and the diffuser screens (even if they are not installed), being careful not to hit any parts of the chronograph. On detection of the projectile, the display will briefly show the current shot string and updated number of shots in the string, followed by the velocity recorded.

Duplicate Velocities

If the chronograph should record 2 shots of the same velocity one after the other, the “duP” (duplicate) message will appear (Fig. 1), followed by a single digit number representing the duplicate velocity. If subsequent shot velocities are also the same, the number will increment. If 10 sequential duplicate shot velocities are recorded, the number will be reset to 1.



Fig. 1

Low Battery Indication

If the battery voltage becomes low (6.8-7.0 volts), the chronograph will flash the message “bAt” at intervals to signal that it is time to change the battery (Fig. 2). If the battery voltage drops below 6.8 volts, the chronograph will flash the message “CbAt” to let you know it is time to change the battery, and the unit will no longer register velocities.



Fig. 2

Error Indication

In the event a signal is recorded by the first sensor, but no signal is recorded by the second sensor, an error “Err” message will flash momentarily (Fig 3). You should try adjusting your aim position if this occurs.



Fig. 3

Working with Projectile Velocities & Statistics

The ProChrono LTD allows you to observe and work with your velocity data. This is done through the use of the front panel pushbutton controls described below.

String and Shot Navigation

Each time the ProChrono LTD successfully detects a shot, it's velocity is stored at the end of the currently selected string.

The ProChrono LTD can store up to 9 strings of 99 velocities each and retain them in non-volatile memory even if you turn the chronograph off and remove the battery. You can shoot now and the chronograph will store your velocities for later review.

Pushbutton Controls

String Change

When the ProChrono LTD is first turned on, it automatically positions itself at the end of shot string 1 and displays the most recent shot velocity. By pressing the "String Change" button, the user can sequentially select each one of the 9 string memories into which the unit will place the shot velocities as they are detected. When shot string 9 is selected, pressing the "String Change" button will increment back to string 1.

Review Shots and Statistics for a String

The "Review" button will cause the ProChrono LTD to display the previously fired shot velocity within the current string. Upon each subsequent press of this button, the previous shot velocity will be displayed until the user reaches the first shot in the string. At this point, pressing the "Review" button again causes the display to begin showing the statistics. The display will cycle through **High Velocity, Low Velocity, Average Velocity, Extreme Spread, and Standard Deviation**. Finally, pressing it again will reposition the display to show the last recorded shot velocity in the string.

NOTE: Most of the statistics are self explanatory, but the following two statistics may require a bit more explanation:

Extreme Spread(ES)

To get the Extreme Spread, the lowest velocity (for the current string) is subtracted from the highest velocity.

Standard Deviation(Sd)

Consider an example to illustrate the meaning of standard deviation. If for example you have a standard deviation of 10 fps with an average velocity of 1000, 68% of the shots you fire will fall within 990 to 1010 fps. If you double the 10 fps standard deviation to 20 fps, 95.4% of the velocities will fall within 980 to 1020 fps. The more shots you fire, the more accurate the standard deviation. A minimum of 5 shots is necessary.

Delete Shot

While positioned on a velocity, it can be deleted by pressing the "Delete Shot" button. When you do this, the ProChrono LTD will delete the currently displayed velocity, renumber all the shot velocities above it in the string, and reposition the display to the last velocity. It will redisplay the velocity number which has been decreased by 1 due to the deletion just performed. Statistics will be recalculated minus the deleted shot(s). This operation is not reversible.

Delete String

If desired, you may delete all the velocities in the current shot string at once by pressing the "Delete String" button. This operation is not reversible.

Redisplay

Because the ProChrono LTD momentarily displays the string and shot information before listing the associated velocity, you may want to view this information again. The "Redisplay" button will briefly show you either the string and shot number, or the string and statistic ID. This allows you to get a second look at the data without scrolling through the string again.

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Specifications



Velocity Range:	20-9,999 feet per second
Temperature Range:	20-100 degrees Fahrenheit
Size:	16x4x3-1/4 inches
Weight:	2.1 lbs
Battery Required:	One 9-volt alkaline battery
Battery Life:	Approx. 20 hours of operation
Current Consumption:	Approx. 20mA
Mounting Hole Thread:	1/4x20
Guide Wire Size:	3/16x16 inches
Memory Capacity:	Up to 9 strings of up to 99 shots each
Minimum Time Between Shots:	500 mSec
Shot Timing Resolution:	31 nSec (8000 counts @ 4,000fps) Crystal Controlled
Accuracy:	+/- .5% of measured velocity or better

LIMITED WARRANTY

COMPETITION ELECTRONICS, INC. warrants the ProChrono LTD manufactured by it to be free from defects in material and workmanship for a period of 2 years from date of purchase by the original purchaser for use. COMPETITION ELECTRONICS, INC., at its option, will repair or replace without charge, or refund the purchase price of, any product which fails during the warranty period by reason of defect in material or workmanship found upon examination by COMPETITION ELECTRONICS, INC. to have been the cause of failure. This warranty does not cover any failures attributable to abuse, mishandling, and failure to follow operating instructions, alteration or accident.

To make a claim under this warranty, the purchaser must return the product to COMPETITION ELECTRONICS, INC. at the address shown above, properly packed and with shipping charges prepaid. All claims must be made within 30 days after the product failure, and in any event, within 30 days after the expiration of the 2 year warranty. All claims must be accompanied by the sales receipt or other written proof of date of purchase.

TO THE EXTENT PERMITTED BY LAW, ANY AND ALL IMPLIED WARRANTIES, INCLUDING MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE EXCLUDED. ANY IMPLIED WARRANTIES NOT EXCLUDED ARE LIMITED IN DURATION TO 2 YEARS FROM DATE OF PURCHASE. INCIDENTAL AND CONSEQUENTIAL DAMAGES ARE EXPRESSLY EXCLUDED FROM THE REMEDIES AVAILABLE TO THE PURCHASER, AND THE REMEDIES PROVIDED IN THIS WARRANTY SHALL BE EXCLUSIVE TO THE EXTENT PERMITTED BY LAW.

(Note: Some states do not allow limitations on how long an implied warranty lasts or the exclusion or limitation of incidental or consequential damages, so the foregoing limitations and exclusions may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.)

If any product returned by the purchaser is found by COMPETITION ELECTRONICS, INC. to require service not covered by warranty, COMPETITION ELECTRONICS, INC. will so advise the purchaser and request further instructions.

COMPETITION ELECTRONICS, INC. will recondition to working order any ProChrono LTD returned to it regardless of condition, upon the purchaser's remittance of payment of 1/2 of current retail price, if it is still manufactured by COMPETITION ELECTRONICS, INC.

SERVICE FOR YOUR PROCHRONO LTD

For assistance with your Pro Chrono LTD, use the information below.

Competition Electronics, Inc.
3469 Precision Dr.
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Phone: 815-874-8001

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Accessories

Indoor Lighting *Model # CEI-4100*

This durable and compact lighting accessory provides optimum lighting for indoor use or under low light conditions.

System includes: two light bars, AC power adapter, and instructions.



Replacement Diffusers *Model # CEI-2526*

Replacement set of four guide wires and two diffuser hoods for outdoor use on sunny days.



Debris Shield *Model # CEI-2519*

Competition Electronics offers an optional Debris Shield which can help to protect your chronograph from flying debris and paint. However, we offer no guarantee that it will protect your chronograph from damage. This item is shipped with a protective film to be removed before use.



Padded carrying case *Model # CEI-4715*

This handy case will protect your chronograph during transport and storage. It features a hook and loop divider compartment with enough room for storage of guide wires, diffuser hoods, spare battery, and an indoor lighting system. Dimensions: (L) 17" x (W) 7" x (H) 4.5"



ProChrono not included.

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