Competition Electronics

OPERATING INSTRUCTIONS

PROCHRONO PAL

part# CEI - 3900

Please read this manual. It contains setup information necessary to achieve proper performance from your chronograph.

Look inside
for accessories to use
with your chronograph!

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Congratulations!

You have purchased a fine quality shooting chronograph. This chronograph is designed and manufactured in the USA. Its quality and accuracy are built in. With proper use and care, it will give you many years of pleasant, trouble free service.

How It Works

The ProChrono Pal chronograph 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, gather light through the two rectangular openings in the top of the case.

The sensors are actually specially designed electromechanical devices that can detect changes in light intensity that occur when a projectile interrupts light rays shining into a sensor when it passes over the opening above.

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 light blockage caused by an object passing over them is converted to a signal that is detected by the ProChrono Pal. The chronograph measures the elapsed time between the light interruptions a projectile makes as it travels over the front, and then the rear sensor. It then converts this time into velocity and displays it on it's front-mounted LCD screen so that you can read it.

Before You Start, (Or if You Encounter Problems) Consider The Following

Lighting Conditions

As mentioned above, the ProChrono Pal chronograph is a light-sensing device. In the course of use, the chronograph 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 Pal works flawlessly over a very wide range of lighting conditions, there are times when the lighting environment can affect chronograph performance.

Diffuser Use

It may be counterintuitive, but the best natural conditions for using the ProChrono Pal chronograph do not occur on a clear, sunny day, but rather on overcast, cloudy days. This is because the ProChrono Pal needs a diffused light source to work properly.

You can understand what diffused light is by considering two light bulbs. One light bulb has a clear glass envelope, and one is frosted. The clear light bulb appears to be brighter when you look at it, but it is also glaring and gives off uneven light coverage and causes shadows, so it is not as good for lighting use in most situations. The frosted bulb appears to our eyes as a round glowing orb of homogenous light. The frosted coating causes the light to disperse and scatter so that it illuminates in a more even way, providing better coverage and less shadows. (Note: This is not to say that a frosted incandescent bulb, by itself, is a good light source when you use your chronograph indoors. It is not).

On bright sunny days, you should always use the white plastic diffuser screens so that the light that the chronograph sensors see from above is homogenous and scattered. This 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 and so no further diffusion is needed; rather in this case it is more 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, shiny, light colored or smooth projectiles may cause reflections which can induce velocity errors. Be sure to use your diffusers on sunny days. However, this may not be enough, by itself, to correct the problem.

You can 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.
If you are having problems with reflections from shiny bullets or arrows, another remedy you can try is to take a black marker and color your projectiles with it. This will greatly reduce glare and may be needed if you have to use the chronograph in less than ideal lighting conditions.

Trees

Trees do not provide a suitable shadow and in fact you should not locate your chronograph in the shadow of a tree as it is likely to cause more problems than it could ever solve.

Sunrise and Sunset

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

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 bare incandescent lamps 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.

Wrong Kind of Light
Florescent lamps are not at all suitable, because although we cannot see it with our naked eye, they actually vary in intensity many times a second and the ProChrono Pal can detect this, which renders it useless as long as it's sensors fall under the influence of it.

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 and Accuracy

Adverse lighting conditions can cause accuracy issues, and having read the above, you should be able to understand why. Any change in light intensity that a sensor detects other than the actual passing over the sensor of the leading edge of the projectile will give errors.

Using the ProChrono Pal with Different Projectile Types

Pistols and 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. You may also encounter velocity errors with certain types of shiny ammunition. Try coloring the bullet tip with a black permanent marker to correct this type of problem. If you are using a scope, be sure to check the boreline-to-scope distance and aim the crosshairs on the scope that much higher than the middle of the shooting area.

Shotguns

To chronograph shotgun loads, stand back at a distance of 5 feet from the chronograph to the muzzle of the gun. If you stand too far away, the shot will spread out too far causing inaccurate velocity readings. Also, the wad will separate from the shot column and may hit and possibly damage the chronograph. When using sabots or gas checks, there is a chance they may depart from the projectile path and hit the chronograph. This may *damage the display. See the CEI Debris Shield in the accessories section of this manual; it can provide an additional measure of protection*

Bow and Arrow and 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 still accelerating when it reaches the chronograph, otherwise your velocity readings may be inconsistent. Be aware of shiny arrows and shafts, etc if you encounter problems.

Paintball Guns

Distance to the muzzle is not a factor with paintball guns, however paint buildup on the unit may affect it's 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 and AirSoft Guns

Distance to the muzzle is not a factor with these types of guns. The main issue here is that BB's are probably one of the most difficult projectiles to measure using light-based techniques, because they are round and shiny. However, at Competition Electronics we achieve good results with BB's all the time. You may need to control and modify the lighting conditions though.

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 it's speed.

Battery Installation

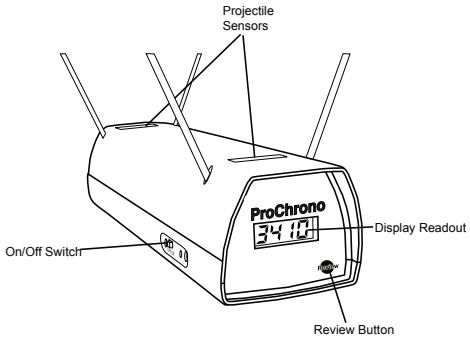
Begin by installing a new 9 volt alkaline battery in the chronograph battery compartment. There is also a space to store a spare. You can expect at least 20 hours of operation from a fresh alkaline battery.

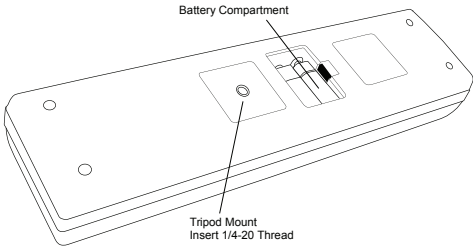
Mounting the Chronograph

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 and 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 plastic 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 on the chronograph normally. To start the chronograph in meters/ sec mode, hold down the “review” button while you turn on the chronograph. It’s readout will be in meters/ sec when you do this. You must do this each time you turn on the chrono to use it in metric mode.

Getting Started: Recording Projectile Velocities

Getting a velocity is a 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 additional 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, the chronograph will flash the word “bAt” at intervals to signal that it is time to change the battery(Fig. 2). If the battery voltage drops below approximately 6 volts, the low battery indicator becomes inoperative.

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 and Statistics

The ProChrono Pal allows you to observe the shot data provided through the use of the REVIEW button located on the front panel.

String and Shot Navigation

Each time the ProChrono Pal successfully detects a shot, it’s velocity is stored at the end of the shot string. This causes the number of shot velocities in the string to increase by 1. The shot string holds a maximum of 99 shot velocities.

Pushbutton Controls

Review Statistics

By repeatedly pressing the “Review” button, the ProChrono Pal will (in turn) display the High Velocity, Low Velocity, Average Velocity, and Number of shots.

CEI Chronograph Accessories

There are a number of useful accessories available to use with your ProChrono Pal chronograph listed in the section below.

Indoor Lighting System

Part # 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.

Debris Shield

Part # 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.

Replacement Diffuser Set

Part # CEI-2526

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

SPECIFICATIONS

Velocity Range:	21-7,000 feet per second
Temperature Range:	32-100 degrees Fahrenheit
Size:	16x4x3-1/4 inches
Battery Required:	One 9-volt alkaline battery (not included)
Mounting Hole Thread:	1/4x20
Guide Wire Size:	3/16x16 inches
Shot String Capacity:	99 shots
Minimum Time Between Shots:	Between 250mSec and 500 mSec
Shot Timing Resolution:	750 nSec Crystal Controlled.
Accuracy:	+/-1% of measured velocity, or better
Current Consumption:	Approx. 15mA

Warranty

ProChrono Pal
*****LIMITED WARRANTY*****

COMPETITION ELECTRONICS, INC., warrants the ProChrono Pal 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 it's option, will repair or replace without charge, or refund the purchase price of any product which fails during the warranty period by reason of a defect in material or workmanship found upon examination by COMPETITION ELECTRONICS, INC., to have been the cause of the failure. This warranty does not cover any failures attributable to abuse, mishandling, failure to follow operating instructions, alteration or accident.

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

TO THE EXTENT PERMITTED BY LAW, ANY AND ALL IMPLIED WARRANTIES, INCLUDING MERCHANTABILITY AND FITNESS FOR 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 Pal returned to it regardless of condition upon the purchaser's remittance of payment of 1/2 of current retail price, plus shipping, if it is still manufactured by COMPETITION ELECTRONICS, INC.

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