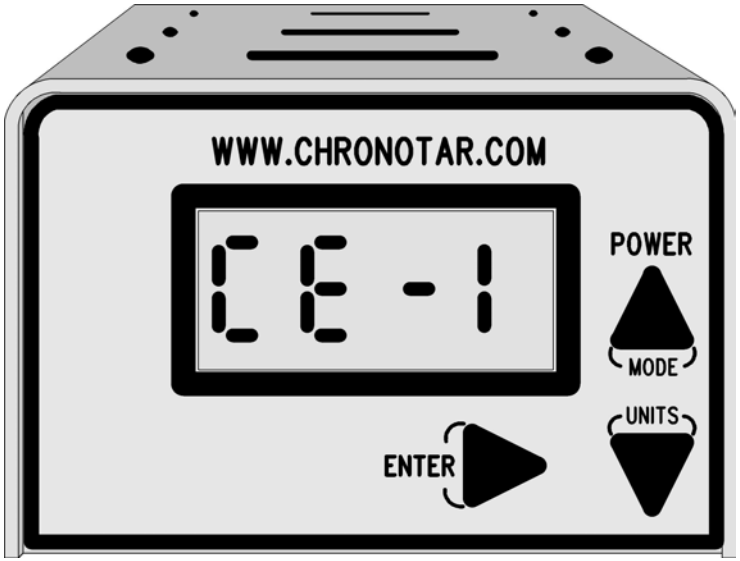
# CHRONOTAR

## CHRONOGRAPH

# CE-1 MANUAL

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**Version 1.00**

## Warning

Before you use this product you must follow all safety instructions as recommended by manufacturer of your firing device, no mater what that device may be. Irrespective of who the manufacturer of your firing device may be, you alone are ultimately responsible for using correct safety precautions. That is, no one else but you and you alone, is responsible for using correct safety procedures.

## Liabilities

This product is a passive optical instrument. It does not emit any radiation in order to measure projectile velocities.

It is your sole responsibility to safeguard yourself and other people against any injury or property damage when firing projectiles near the unit or accidentally into the unit. You must also use correct safety procedures for your firing device.

This product relies heavily on complex hardware, software and operating system. Because of its complexity, a finite probability exists that a software module or a hardware component may fail to function properly. This failure may result in a loss or change of data which could produce erroneous velocity measurement. For example, a simple LCD-element failure may display number **8** as number **9** or **6**. There are thousands of possible failure modes; therefore this product is not a fail-save product. If fail-save velocity measurements are required, then this product must not be used without our written approval. Approval requests will be considered only if setup is based on “multi-chronograph-majority-vote” design and it must be accompanied by failure analysis.

We assume no responsibility for the injury to any person or persons whether be consequential or inconsequential as a result of using this product. We also assume no responsibility for the damage to any property or loss of profit as a result of using this product.

This product and all its associated hardware and software design are ©Copyright property of Chronotar Micro.

If you do not agree with any of the above statements then you must not use this product. Instead, you must return it immediately and intact to the place of purchase for a full refund.

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# IMPORTANT NOTES

## Muzzle blast & noise control

User set muzzle blast & noise control provides reduction range settings from **00%** to **98%**. Unfortunately high muzzle blast reduction settings also reduce sensitivity. It is better to move the unit farther back rather then using muzzle blast control. For archery, paintball and all quiet devices use **00%**.

## Flashing colon or decimal points

Flashing colon or decimal points indicate that the unit will ***no longer accept shots*** because environment conditions have changed. To remedy this it is necessary to turn the unit **Off** and **On** again; this forces the unit to recalibrate itself. If the conditions are really bad, then nothing will help. Please note that the unit will not accept shots unless it is calibrated again.

## Splash Guards

Some units, CE-1A and CE-2A , will accept transparent guards, that are placed over the optical slots to ***protect*** against ***black powder*** and ***paintball*** debris. When you clean these do not scratch the surface because it will affect velocity measurements. If scratched, it must be replaced.

## Reset shot count

CE-1 model counts shots from **1** to **10** as you shoot. When it reaches shot number **10**, all subsequent shots are then numbered as shot number **10**. To clear memory and start from shot number **1**, the unit must be turned **Off** and then **On** again. Turning the unit off clears the memory.

# Quick Reference

## Adaptive Calibration

This unit must be calibrated after it is set up or light conditions have changed or it was relocated. Calibration is done by turning the unit ***off*** and then ***on*** with ***<POWER>*** key. Calibration is over when flashing CAL: is displayed. If a **decimal point** or **colon** appears, it indicates that calibration failed (see ***"Run Calibration"***). Calibration completion must be ***acknowledged*** by pressing ***<ENTER>*** key or else the unit ***will not work***. It will simply flash calibration results ***forever***. For example; flashing -S.t.t and CAL: indicates fluorescent lights overhead. If environment is ***unstable*** for a period of **60** seconds, or any ***key is pressed*** while calibration is active, then all calibration ***alarms*** are turned ***on***. You must try to calibrate again, fix environment problem or relocate the unit.

## One Key functions

- ***<POWER>***–turn the unit on or off, unconditionally
- ***<UNITS>***—flip between meters and feet on the fly
- ***<ENTER>***—display the least significant digits

### Two-key functions

This requires that you press two keys. Press and hold down first key and then press the second key while the first is held down.

- ***<ENTER*** + ***POWER>***–Display battery power level in %.
- ***<ENTER*** + ***UNITS>***—Set Muzzle blast control value

### Three-key functions

This requires that you press three keys. Press and hold down first key and then press the second key while the first is held down, and finally press the third key while the first and second are held down.

- ***<ENTER*** + ***POWER*** + ***UNITS>***—Flip archery mode On or Off



## USA and Metric display identifiers

When ***<UNITS>*** key is pressed display will identify units used.

- _mE_ Indicates Metric units are selected, **meters/sec**
- _FE_ Indicates USA units are selected, **feet/sec**
- _.08._ Two dots on each side of **08**, indicate Metric velocity
- _08_ Absence of dots indicates USA units for velocity

## Archery control

When archery mode is changed, the display will identify selected mode, which is either **on** or **off**.

- Arc0 Archery mode is turned off.
- Arc1 Archery mode is turned on.

## Muzzle blast control

When muzzle blast control is changed, display will identify selected currently set range, which can be from **00%** to **98%**.

- nc00 Example of muzzle blast & noise reduction of 00%
- nc30 Example of muzzle blast & noise reduction of 30%
- nc80 Example of muzzle blast & noise reduction of 80%

## Errors and alarms

Alarms are displayed as a flashing message. The message will flash for 10 seconds and then disappear. Pressing **<ENTER>** key makes the alarm disappear. **CH** models have advanced alarm control settings.

Flashing **dots** and flashing **colon** are special alarms that do not go away they indicate bad light conditions. These only go away if you fix the problem or turn sensors off, see***"Turn Sensors Off"***.

- Flashing ***colon***, sensors are off, unit will not accept shots
- Flashing ***decimal points***, calibration failed, bad conditions
- Flashing ***decimal points*** and/or **colon** requires recalibration
- Flashing ***last digit***, displayed number is greater then **9999.99** you must press ***<ENTER>*** key to see the rest of the number.

## Battery Alarms

Battery alarms come on when battery voltage goes through the alarm threshold. After it has been acknowledged or it times out, the alarm stops. It only comes on again if battery conditions change or when reminder alarm comes on. These alarms come on when battery power drops below 35%; the unit will no longer calibrate properly or measure the velocities correctly.

Battery power level is low, performance will degrade

Battery power level is too low for detecting velocities

Battery is dead, only data and stats review possible

## Chronograph Alarms

Chronograph alarms time out after 10 seconds or they can be cleared by pressing **<ENTER>** key.

Front sensor was missed

Rear sensor was missed

Rear sensor was missed

Possible muzzle blast

Possible EMI Interference

## Displayed value has no decimal point

If there is no decimal point showing, even when **<ENTER>** key is pressed, then this implies that the decimal point is at the end of the display or beyond. For example; numbers **1000.00** to **9999.99** and **1000.000** to **9999.999** will have no decimal point displayed.

## Calibration Status Results

Calibration status number is indicated by the flashing display that follows calibration completion. For example, if calibration status number was **+135** then the display will flash between 

and 

.



**Indoors calibration status numbers**

- From -450 to -511, fluorescent light overhead, or strong EMI.
- From -001 to -400, florescent and incandescent lights mixed.
- From +001 to + 350, functional range.
- From +400 to +511, too dark, must provide some light.

**Outdoors calibration status numbers**

- From -300 to -511, man-made interference nearby.
- From -001 to -250, EMI or bright sun (try diffusers).
- From +001 to +350, functional range.
- From +400 to +511, too dark, diffusers might help. This value may change from 495 to 511 when the battery power level exceeds 75%. Check battery power level.

**Marginal calibration status results**

- From +400 to +511 indicates marginal conditions.
- From -001 to -511 indicates bad conditions.

**Calibration problems**

If the unit takes too long to calibrate, (more then 50 seconds) this indicates that the battery is dead or there is interference nearby. Just in case you missed battery alarms, please check the battery power, see **Battery Power Level** function.

# How the chronograph works

Our chronograph is based on optics and it does not emit any harmful radiation, such as a radar chronograph would.

The principle of operation is very simple; two optical sensors look through the slots on top of the unit. The two sensors are located deep down in the box. When the bullet passes over the first sensors it blocks the light that shines down through the first slot.

When this happens a clock is started. When the bullet passes over the second slot, which is the rear slot, then the clock is stopped. The internal computer knows the exact spacing between the front and the rear slot therefore it can calculate the speed of the bullet using the elapsed time. The elapsed time tells the computer how long it took the bullet to travel from first slot to the last slot. This is how most of the chronographs operate.

# Getting Started

This device is an optical instrument, therefore dust and dirt will affect its operation. We strongly recommend that you treat it with the same respect as you would a digital camera.

**Unpack** the unit and install a new **9-Volt** battery.

***Battery*** voltage must not exceed ***10*** Volts at any time, because this may ***destroy*** the unit.

If the unit does not start, remove the battery then press and hold down ***<POWER>*** key while you count from ***1*** to ***30.*** Then release the key and install the battery again. If this does not work then ***check battery voltage***. See ***"Troubleshooting"..."Dead unit"***

The unit detects shots **properly** only if the battery voltage is **above *7***-Volts. Below ***7***-Volts the performance is reduced. Most chronographs appear dead if the battery voltage drops below **6.5**-Volts whereas our unit still functions but not within specified performance.

***Please note: when battery power alarms come on***
***It is necessary that you replace the battery because the unit will no longer detect shots as intended.***

***Battery power alarms:*** 



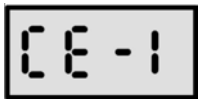
# Turning the unit on

After battery is installed, the unit goes through a self test. This test is only performed once or when the unit is reset. It takes approximately 12 seconds to complete. During this time all the elements of LCD are displayed as follows,

These elements are then cleared one by one, until LCD is blank as shown below,

This is done slowly, to allow the eye to observe and inspect each element as it is cleared. There are other internal tests but are not noticeable. If any key is pressed during the LCD tests, then LCD test is aborted immediately.

When the unit is ready for the first time, it will display the model number. For example ***CE-1*** will be displayed as follows,



# Verify Operation

After all the tests are done, a quick internal calibration makes the unit ready for shooting. If the light conditions are not right then the unit may give one of the following flashing error messages,  or .

These errors generally appear if the calibration command has not been executed yet, or the light conditions are bad. For now these messages can be ignored.

There is another set of error messages that may appear, the list is as follows, Prr1, Prr2, Prr3. These alarms are very ***serious*** and cannot be ***ignored***. They indicate battery voltage status and have the following meaning,

| | |
|---|---|
| Prr1 | Battery is dead. |
| Prr2 | Battery is to low for normal operation. |
| Prr3 | Battery is low, performance will degrade. |

For further details see ***"Alarms & Errors"…"Battery"***.

If the unit has previously been used and it still has a battery in it, then you just press ***<POWER>*** key to awake up the unit. If the unit does not wake up see ***"Troubleshooting"…"Dead Unit"***.

It is easier to check the unit before it is set up. It is also a good practice to check battery power level before you start shooting session. The battery power level is checked by pressing and holding down ***<ENTER>*** and then pressing ***<POWER>*** key. The value is displayed only while you hold down both keys. The number displayed represents percent of power left. The battery should have more than ***34%***, in order for you to proceed. At ***34%*** percent the battery has reached the end of its useful life.

For example if the battery power level was ***43%*** percent, then the display will show 43 .

There is nothing to stop you from running on a low battery as long as you keep in mind that at ***34%*** the "***Battery Alarms"*** begin to appear. See ***"Alarms & Errors"…"Battery"***.

## Special Power-Up Feature

This unit **Clears All Memory** when turned on using two keys. This is done by pressing ***<POWER>*** key in conjunction with ***<ENTER>*** key. For example, you must press and hold down ***<ENTER>*** key first. While you hold down ***<ENTER>*** key you then press ***<POWER>*** key. If you are successful then display will show nCLr message indicating that the memory was cleared. If you are not successful then HELO message is displayed.

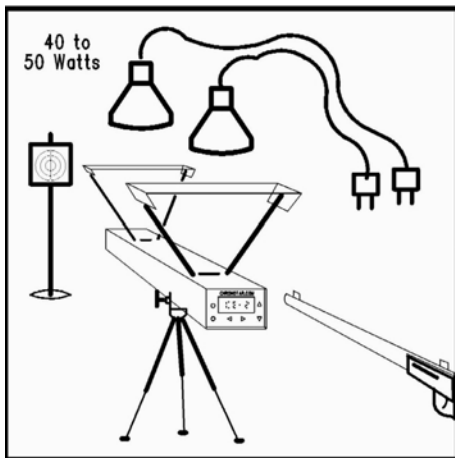


## Quick setup

You are now ready to set up the unit, choose any of the setting below that matches your needs. If you do not have a tripod then you can use any surface, a table, a stool etc. The only requirement is that the unit be aligned with your shooting sight. Whatever you do, do not shoot the unit, because it will be destroyed. You have to shoot 4 to 12 inches above the unit. Use the black rods as a guide. Loud firearms generate a muzzle blast which may cause a problem, see ***"Muzzle Blast"***.

## Indoors Setup

If you are not using our solid state ***"LED Array"***. then you must set up the unit as shown on this picture.



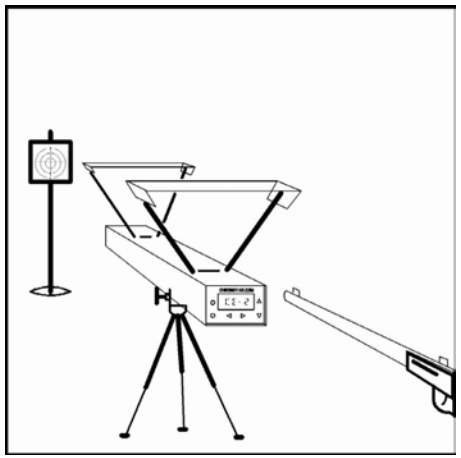

Install diffusers as shown and two 40 to 60 Watts light bulbs about 2 to 4 feet high from the diffusers. If you use flood lights, then a single100-Watt bulb, 4-feet above the center of unit would be sufficient.

If you have a white ceiling then use two 150-Wats flood lights pointing up into the ceiling, above each optical slot. The ceiling should not be over 10-feet high, unless it is very white and reflect the light well. When using this method then diffusers are not required.

Avoid using solid state dimmers because they generate a lot of ***EMI*** that may cause problems. Adaptive Calibration will reduce sensitivity level when E&M radiation is detected from these dimmers.

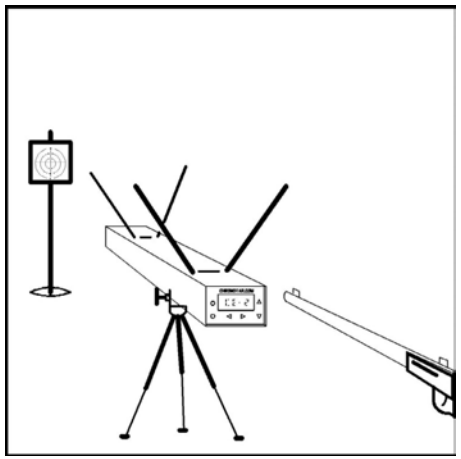
# Outdoors Setup

For outdoors you do not always need diffusers. If diffusers obstruct your view and you prefer not to use them, then you must run calibration function to determine whether you need them or not. This is described below in ***"Run Calibration"***.



## With Diffusers

Set up the unit as shown on this picture. You normally do not need diffusers; however, you should used them if possible. They provide a uniform source of light for accurate velocity measurement.
On a darker day or when the sky is very deep blue, diffusers have the ability to collect light
from surrounding area.



## Without Diffusers

If the sky is overcast and it looks milky white then you do not need diffusers. However you must verify that the unit will function without diffusers.
To verify this please read ***"Run Calibration"*** section below. Calibration results must be between +250 and -250 for the unit to function well without diffusers.



# Run Calibration

After the unit has been setup, you are ready to test the light conditions. If the unit is on, then turn it ***Off*** and ***On*** again by pressing ***<POWER>*** key. The unit will now go through adaptive calibration.

The unit starts calibration process and the display will show rapidly moving number. This number represents calibration status. It can go from ***-511*** to ***+511*** and it may take as long as ***60*** seconds to complete.

This is not an ordinary chronograph but the first generation of smart chronographs.

The unit scans for a broad range of light conditions and interference sources to calculate optimum setup. The calibration process and setup is rather complex and is beyond the scope of this manual.

Typical sources of interference that the unit will track are: fluorescent lights, flickering bulbs, sodium lamps, airborne sand drifts, airborne snow drift, flock of birds, strong RF signals, AC power lines and any EMI source.

If the light conditions are good and there are no sources of interference, the scan is completed in less than ***30*** seconds.

When a significant interference or bad light condition is detected, then the unit needs time to calculate and verify the effect it may have on velocity measurements. Depending on the type of condition, it could take up to ***60*** seconds to complete the job. When conditions are bad, all 3 decimal points on the LCD start to flash.

If you press any key before calibration is finished then the calibration is immediately terminated and ***Calibration Failure*** alarm is turned on. To remedy this you must press ***<ENTER>*** key once to acknowledge the error and then recalibrate again by turning the unit ***Off*** and ***On*** again. If the unit takes too long to calibrate, check the battery power level.

When calibration scan is completed and setup is acceptable for normal operation, the display will flash between a final calibration status-number and calibration-command CAL:.

For example, if calibration status was ***+135***, then the display will flash between 135 and CAL:. If there are no flashing decimal points, then the operation was successful.

The flashing number represents the quality of your light conditions as well as the type of interference found and how severe it is. Here are typical results for indoors and outdoors,

| ***Indoors Calibration results*** | |
|---|---|
| ***Number Range*** | ***Explanations*** |
| -400 to -511 | Fluorescent lights are overhead or incandescent lights are too strong. |
| -001 to -350 | Fluorescent & Incandescent lights mixed or strong EMI. |
| ***+001 to +350*** | ***Very good condition.*** |
| +360 to + 400 | Incandescent light are too far or the light bulb power is it to low. |
| +400 to +511 | Too dark, there is not enough light available. You must provide some light. |

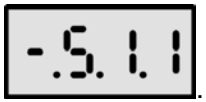
| ***Outdoor Calibration results*** | |
|---|---|
| ***Number Range*** | ***Explanations*** |
| -300 to -511 | RF Interference, Power lines, EMI or sodium lamps near by. |
| -001 to -150 | Direct sunlight shining into the optical slots. Must change angle or use diffusers. |
| ***+001 to 350*** | ***Very good condition.*** |
| +360 to + 400 | Dark or blues skies. Must use diffusers. |
| +400 to +511 | Too dark or very deep blue skies. Diffusers might help. |



| | |
|---|---|
| Any number with flashing dots | This is a general failure indicator with possibility of power lines or powerful radio transmitters nearby. |

If a serious problem has been encountered, ***three dots*** will be flashing very fast indicating ***calibration failure***.

For example, if the unit has detected fluorescent lights, then the display may flash between these two displays,

and



The tree decimal points will flash independently and faster.

If calibration failed, you could try again a few times, and if failure persists then you must remove the source of problem.

When calibration is finished you must acknowledge calibration results by pressing ***<ENTER>*** or any other key. If you do not acknowledge it, then the unit will flash calibration results for ever and it will not accept shots. After you press any key a final environment test is performed, but because it is fast it will not be noticed.

If there is anything wrong with the environment following adaptive calibration, then a flashing ***COLON*** will appear, indicating that the unit will not function under current conditions.

The unit however will, still function if the results of calibration are marginal; it is up to you to decide if you want to proceed.

## Special Diffusers

Our diffusers are made of special material that actually collect light from the surrounding sources, such as reflections from the ceiling walls, clouds etc. This allows you to work in shaded area as long as there are bright clouds around. When diffusers are used indoors, it is quite possible that the light reflecting from the walls or ceiling may cause interference, especially, if there is florescent light nearby.

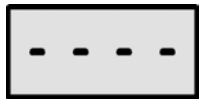
## Marginal calibration results

| | |
|---|---|
| ***-001*** to ***-400*** | Archery mode does not perform well here. Low velocities measurement will be affected. We do not recommend using archery mode here. Diffusers should be used. |
| ***+350*** to ***+450*** | Accuracy and sensitivity are reduced. It will require that you shoot closer to the unit to obtain good results it could be as low as 4". Try using diffusers. |
| ***Flashing DOTS*** | Calibration failure has been detected. Sensors have been turned off to conserve power and the unit will not accept shots. |
| ***Flashing COLON*** | Conditions are changing, the unit detected a problem and it will not accept shots. Sensors are turned off to conserve power. You could try to calibrate again. |

If all is well and you start measuring velocities, the following paragraphs describe how the unit will behave.

If the unit has no shots in it, when you press ***<DATA>*** key to place the unit in data view mode, then this display will appear,


It says that there are ***00*** shots in memory, and you are in a chronograph mode. When the key is released, it displays velocity, and since there is nothing to display it will show as follows,





These four bars will remain displayed until you fire a good shot.

When you fire the first shot, then shot number will be displayed for a period of ½ seconds. In this case it would be shot number ***01*** and the display will show as follows,


If your shot had a velocity of ***938.54***, the display will show as follows, after ½ seconds delay is over,


This number remains displayed until you do something else; review stats, shots or fire a new round.

To view hidden lower digits, you must press and hold ***<ENTER>*** key. To change the units used or check units conversion, just press ***<UNITS>*** key. See **"Changing Units"**.

If you are using loud firearms then you must read the section on ***"Muzzle Blast"*** below.

## Muzzle Blast

Muzzle blast from loud firearms can cause a false reading. This low cost unit does not detect muzzle blast 100% of the time, even with digital muzzle blast & noise control set to maximum of 98%. Therefore, to prevent false triggering, you must place the unit far back from the firearm. Here are some typical distances for various firearms and projectile launchers,

- **0** Feet for **Archery**.
- **1** Foot for **BB-Gun**,
- **1** Foot for **Paint** ball.
- **2** Feet for **Air** rifle.
- **3** Feet for **Rim** fire.

- **4** Feet for **Low caliber** rifles.
- **6** Feet for **Hand guns**.
- **6** Feet for **High caliber** guns.
- **8** Feet for **Shot** gun

If you experience false reading, you must move the chronograph even further away from the firearm. Use digital muzzle blast control as a last recourse, see ***"Muzzle Blast Control"***.

## High readings

This unit will measure velocities that go beyond **10,000 f/s**. All this means is that we do not put restrictions on what you do with the unit. Internal circuits and the software will measure whatever you throw at it, even the speeds in excess of **80,000** feet/sec. Although there may be very little practical application use for it, we still are reluctant to place limits on our products.

### HIGH VALUE WARNING

When displayed number exceeds **9999.99** the last digit on the display will flash, indicating that you ought to look at the remaining low digits. This is true irrespective of the units used. To see the low digits you simply press and hold down ***<ENTER>*** key.



# *Keys Functions and Display*

The units has 3 keys, some of which have multiple functions when held pressed. The display is a 4-Digits large LCD.


| Key Name | Key Function and Description |
|---|---|
| ***<ENTER>*** | ***ENTER*** key. Displays lower digits. |
| ***<UNITS>*** | ***UNITS*** key. Changes measurement units m-f. |
| <***POWER***> | ***POWER*** key, Turns the unit On or Off. |

The following keys; ***<ENTER>***, ***<UNITS>***, ***<POWER>*** have multiple use. These keys also have different functions when pressed in conjunction with other keys.

## Units select f-m, <UNITS> key

This key switches from USA to METRIC units, and vice versa. This key is always active so that you can use it to do on the fly unit's conversion check. USA units are feet/sec and METRIC units are meters/sec.

## USA-Metric conversion

This key function flips between measurement units. If you were using USA units then it will switch to METRIC units. If you were in METRIC units then it will switch to USA units.

Here is an example of how this is used. Let us assume that you just fired a shot and the number was **08** with velocity of **938.54** and you were using **USA** units.

The display will show


for about ½ seconds. The two lower bars on each side indicate that this is a velocity data mode. The absence of dots on each side of the number **08** indicates that you are in **USA** units.

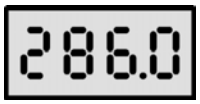
Following ½ seconds delay the velocity value is displayed as follows,


When you press and hold down ***<UNITS>*** key it switches to metric units. This is indicated by the following display,


which indicates METERS mode. The two dots are METERS indicators and are also displayed with shot number and stats identifier.

When you release the key, the conversion value will be shown. In this case it will be **286.06** and the display will show






I you press the ***<UNITS>*** key again then the display will switch to **USA** units. In this case it will show **USA** units identifier as follows,


When you let go of the ***<UNITS>*** key then it returns back to showing the velocity in **USA** units, feet/sec,


You can switch back and forth without affecting the internal results or memory. You can either do a quick on the fly conversion check or you can return to your desired unit.

## Turn unit On-Off, <POWER> key

This key turns the unit **On** if it was **Off**, and **Off** if it was **On**. To save power you should always turn the unit **OFF** while you are setting it up or is not being used. There is an auto power-off but it takes 30 minutes to kick in. **CF-Model** has user selectable Power-Off period that is set from 1-min to about 4 hours, or none.

When the unit is Off and you press ***<POWER>*** key, the display will show PUFF, indicating that it is about to go to sleep and you can release the key now. If you subsequently touch ***<POWER>*** key, the unit wakes up again with the display showing HELO greeting and then goes into Adaptive Calibration. You can continue with your work where you left it, before turning it off.

## View Extended Digits, <ENETR> key

When this key is held pressed, lower digits that do not fit on the display are shown. When this key is released, it returns back to normal display. See also ***High Readings***.

# EXTENDED KEY FUNCTIONS

For advanced users we have provided extended functions. These are accessible when one or more keys are held pressed.

If two keys have to be pressed, you press and hold the first key and then press the second key while you still hold the first key pressed.

When three keys have to be pressed, the first key is pressed and held down. The second key is pressed while the first is still held down. Finally you press the third key while the first two are held down. You cannot waver by letting go of first or second key, they must be all held pressed

## Battery power level, <ENTER+POWER> keys

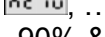
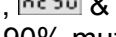
This key combination displays battery power level in %-power remaining. For example if there is 43% of power left, then the display will show  . When battery is new the power level is about **90%** when power is low and battery needs changing then the power level is **34%** or less.

The value is displayed only while you hold down both keys.

## Muzzle Blast Control, <ENTER+UNITS> keys

Every time these keys are pressed muzzle blast sensitivity number is incremented by **10%**. When **90%** is reached then it loops back to **00%**. The range is from **00%** to **90%**.

As these keys are held pressed display will show muzzle blast sensitivity level. For example if sensitivity level is **00%** then display will show

You can only select one of 11 possible levels and they are as follows, from  ,  , …,  &  . These correspond to 00%, 10%, 20%,…, 90% & 90% muzzle blast & noise reduction.



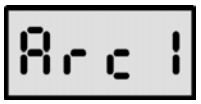
Muzzle blast reduction is hard to define because human hearing does not cover broad spectrum that will impact the unit. For example our chronograph will be affected by the frequencies from 1-Hz to 80,000-Hz. Muzzle blast contains a complex range of frequencies and the chronograph does not “hear” what you hear.

Please note that muzzle blast control will affect chronograph’s sensitivity when detecting projectiles. That is, as you increase muzzle blast & noise reduction, you also decrease velocity detection sensitivity. Therefore we strongly recommend that you use muzzle blast reduction control as a last resort. This low cost unit, like most of the chronographs on the market, uses a PVC based structure which does not resist muzzle blast very well. A unit designed to resist this problem would cost twice as much.

## Archery On-Off, <ENTER+POWER+UNITS>

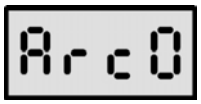
This key combination flips from normal mode to archery mode and vise-versa. This difficult key combination has been chosen on purpose to prevent accidental switch to-from archery mode.

For example, if the unit was in **normal mode** and this function is executed, then display would show,



which indicates that the unit has flipped to **archery mode**.

Similarly, if the unit was in **archery mode** and this function is executed, then the display will show,



which indicates that the unit is now in **normal mode**.

Whenever the mode is changed, the unit will turn on calibration alarms and bad environment alarms. This is; flashing **colon** and flashing all **decimal** points.

## Archery Mode Notes

Archery mode is intended to be used for quiet firearms or devices that are not very noisy. Archery mode does not effect high speed measurement and it can be used for higher velocity firearms just as well. The only problem is that high velocity firearms are loud and the noise may cause false triggering.
For loud firearms the chronograph has to be placed way back from the source of the noise. The chronograph may be placed 10-feet from the firearm to start with. The user must move the unit further back if muzzle blast causes false readings or errors.

Nearby power lines, fluorescent lights, and other artificial lights sources may affect archery mode as well. That is why we do not recommend it for indoor use.
The unit will detect indoor environment by analyzing power line interference. Once this interference is detected it will refuse to accept shots and a flashing colon-alarm will appear. Even if you attempt to fool it by taking it outdoors calibrating it and then slowly bringing it indoors it will still detect your attempt.
It is possible to use archery mode indoors if the power lines and electric appliances are at least 40 feet away and are properly shielded and there are no artificial sources of light in sight.

Another problem is that archery mode will detect arrows and paintballs as high as 8-feet when the light conditions are good. This may be deceiving because this low cost chronograph is only guarantied to meet the accuracy specified at 6-inches above the optical slots. It is quite possible that your unit may be just as accurate above 4-feet, however we do not test for such capability. This is a low cost unit and it is only meant to function up to 12” above the optical slots. In the future we will carry precision machined units that will be accurate at greater heights.

Whenever you change mode from Archery to Normal or vice versa, it is necessary that the unit be recalibrated again.

In indoors or outdoors environment our unit, even in normal mode, outperform competing archery-chronographs any time. Here is a simple test to verify this fact. Take both our unit and the competing unit indoors or outdoors and drag your hands over the skyscreen at about 2.5-feet/sec. You will see that only our unit will detect your hand with such a low velocity.



# Errors & Alarms

The unit uses a multitasking operating system and it continuously monitors all important parameters, such as light conditions, battery status, missed shots etc, while you are shooting. When something goes wrong, it reports the error by flashing a message on the display. Below are some of the possible messages that may be displayed. Urgent or Serious messages have to be acknowledged by pressing ***<ENTER>*** key. Less serious one will flash for a while and then disappear.

## Battery

Battery level is continuously monitored and the following errors are displayed, indicating Power Errors. The message is displayed only once, it is redisplayed again if the conditions change.


Power level has dropped below 7.0 Volts. The unit’s performance will degrade. Consider replacing the battery.


Power level has dropped below 6.0 Volts. The unit will still function but the results will not be accurate. You must replace the battery.


Power level has dropped below 5.3 Volts. The unit will still function but only for data retrieval and review. The battery is considered DEAD.

Please note that data retrieval and review section still functions with crisp clear display, even when the battery is considered dead. However we recommend that you do not use the unit because below 3.95 volts you will begin to lose you data.

**Do not ignore these alarms because when power level is below 30% the unit may fail to calibrate, and will not detect shots properly. Even if the unit works, the velocity values may be incorrect. The display and the keyboard will still work when the power level is below 01%.**

## Velocity Errors

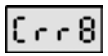
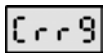
The unit will attempt to differentiate between real shot and muzzle blast or external interference. Because this is a low cost unit the detection of muzzle blast and external interference is not always 100% effective. Therefore here we have provided a limited alarms that indicate when a shot has been misread,


Front sensor missed, interference or muzzle blast.


Middle sensor was missed.


Rear sensor missed.


External interference or muzzle blast detected.




External interference.

## Calibration Failure

When calibration fails because operator terminated the process or the conditions are bad, all decimal point on the LCD will start to flash. To remedy this you must try again by turning the unit off and on again. If this does not work, then you must read the section on **<Calibrating the Unit>.** You may have to remove the source of problem or provide sufficient light. Calibration will also fails if battery alarms are ignored and power level is below 35%. If the battery power is low calibration may fail.

## Setup Failure

Every time you fire a shot the unit takes about 0.3 seconds to test and verify that there are no environment problems. If severe environment changes have been detected that will degrade performance, then the colon starts to flash. The unit will refuse to take more shots until you recalibrate it and correct the problem. The only way to fix this is to run calibration again by turning the unit off and on. The unit will now perform a thorough test to verify that you can still use the unit with considerable reliability.



# Troubleshooting

### *Dead Unit*

If nothing happens when you replace the battery then you check the following. Measure the battery voltage. Make sure the battery is installed correctly and not reversed.

To make sure the unit boots up properly, remove the battery and then press and hold down the **<POWER>** key for 45 seconds.

The battery voltage must be at least 4.6 Volts. The unit will not function as a chronograph with such a dead battery, it may only be used for data retrieval and stats review.

The battery may measure way over 4.6 volts on the voltmeter when measured without a load. When installed, the load may bring the voltage below 4.6 volts. A typical characteristic is a quick black display which suddenly disappears.

It must be noted that the chronograph will not detect velocities properly if the battery voltage is below 7.00 volts, under 10-mA load. The unit will begin flashing power level alarms

### *Flashing Decimal Point*

If all **decimal points** are flashing, this means that the unit will not detect velocities unless it is calibrated again. The calibration is done by turning the unit **off** and **on** again.

### *Flashing Colon*

When **colon** is flashing this means that the environment is not suitable for velocity measurements. You must recalibrate the unit. If sensors have been turned off, flashing colon will stop after you begin stats or shots review.
The unit will however remind you every 60 seconds that it needs to be calibrated again. The reminder will be flashing colon which can be suppressed for another 60 seconds by a simply executing stats or data review.

# CE-1 & CE-2 Features

**CE** series chronographs are next generation intelligent chronographs that provide unique new features with a simple user interface. There is one key for each simple function.

Features for **CE-1** model

- Housings are temperature matched using a single large die.
- Digitally compensated temperature expansion, +/-0.001 inch.
- Ambient temperature is recorded, internally, with every shot.
- Sensors are precision mounted with a proprietary process.
- CE-1 clears the memory when turned off.
- Auto power shut-off after 30 minutes of inactivity.
- Battery Power level meter, displayed in % power left.
- Digitally selectable muzzle blast reduction from 00% to 90%
- True archery mode that is digitally selectable.
- Extensive alarm and error messages.

Features for **CE-2** model,

- It has a 40-shot memory.
- Memory string can be cleared or un-cleared.
- Individual shots can be deleted or un-deleted.
- Data recovery for accidental reset.
- Shots may be reviewed one by one, separate from Stats.
- Statistics may be review one by one, separate from Shots.
- Real time statistics permits Stats view as you shoot.
- Stats provided are; Low, High, Average, Extreme Spread, Standard deviation, Percent Standard Deviation and Total Number of shots in the string.
- Uses Adaptive Calibration for environment testing.

This chronograph has digitally selectable "**true archery**" mode, the very first such device on the market. You can switch from normal mode to archery mode, and vice versa, by simply pressing a few keys. On the other hand, competing chronographs must change electronic components to produce a quasi archery mode. Their archery units have severe limitation at low speeds. And if you need archery and regular unit then you must buy two of their units, one of each operation.

One of our units replaces two of theirs. Therefore you no longer have to carry two units round. Also, our chronograph gives you a true archery mode that is able to measures velocities from **2.00** to **9999.99** feet/sec.



# Specifications

| | | |
|---|---|---|
| Computational Range | 1.00 to 80,000.00 | Feet/Sec |
| **Applications Range** | **2.00** to **9,999.00** | Feet/Sec |
| **Accuracy, Low speed**<br>6.0" above the sensors<br>2.5 f/s to 999 f/s | **0.3** | % |
| **Accuracy, High speed**<br>6.0" above the sensors<br>999 f/s to 10,000 f/s | **0.5** | % |
| **Clocking Frequency** | **24,000,000** | Hz |
| **Shooting Area**<br>Low speed range,<br>2.5 f/s to 999 f/s | **60** | Inches Square |
| **Shooting Area**<br>High speed range,<br>1000 f/s to 10,000 f/s | **20** | Inches Square |
| **Operating Temperature**<br>Battery > 7.0 Volts | **- 20** to **+ 70** | Degrees Celsius |
| **Operating Temperature**<br>Battery > 7.0 Volts | **- 4** to **+ 158** | Degrees Fahrenheit |

# Warranty

This product is warranted against all manufacturing defects for the period of 5 years. If the product is found to be defective please return it directly to us for repair or replacement.

# Index





# CHRONOTAR.COM


*Address*

**Chronotar Micro**

936 Monte Carlo Court, Suite #4
Mississauga, Ontario,
Canada, L5C-3M1

*Telephone* 905 803-8719

*Fax* 905 803-8719

*E-mail*

ce@chronotar.com

*or*

servulo@chronotar.com


## Returning the unit

*Before returning the unit, you must give us a call to obtain* return Instructions *or visit our website and click on* Returns *menu. You can also contact us vial email at return@chronotar.com.*

## Technical support

*If you have any problem with the unit, even a minor one, please let us know. You can either, call us, email a note to help@chronotar.com, or contact us directly via our website. Just click on* Contact Us *menu.*

*Main Website*

**http://www.chronotar.com**