

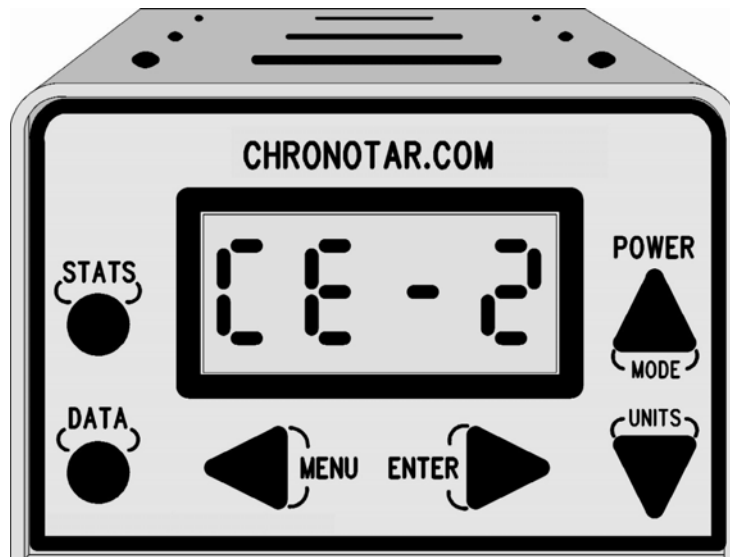
CHRONOTAR

CHRONOGRAPH

MANUAL

CE-2

Version 1.02



Quick Reference is on page 6

This and other manuals are posted on

<http://www.chronotar.com>

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This product is sold by

<http://www.chronotar.com>

Warning

Before you use this product you must follow all safety instructions as recommended by manufacturer of your firing device, no matter 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. You should not use this product to get combustion pressure for your firearm.

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 not use this product to determine firearm combustion pressure.

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.

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 than using muzzle blast control. For archery, paintball and all quiet devices use **00%**.

Turning off sensors and alarms

Special function has been provided that turns off detection electronics to save battery power and stop environment alarms. The key sequence to do this is,

<MENU+POWER>

This function is used only when data and statistics review are needed. To activate velocity measurement again you **must** turn the unit **Off** and **On** again. Do not **forget it**, because the unit will **stop** accepting shots. To check if sensors are turned off press **<MENU>** key; this activates pending alarms again.

Change Battery without losing data

First you turn the unit **Off**. While the unit is **Off** you must **not touch** any of the **keys**. The system software will stay alive, in hibernation, without battery for up to **8 minutes** (max 20). You have about 8 minutes to replace the **old** battery with a **new** one. If the battery is installed **backwards** then memory-data may be lost.

Flashing colon or flashing decimal points

Flashing colon or decimal points indicate that the unit will **no longer accept shots** because environment conditions have changed. You can either turn sensors off and use the unit for data review only, or you can calibrate it again. Please note that the unit will not accept shots unless it is calibrated again.

Splash stickers

Some units, CE-1A and CE-2A , will accept transparent stickers, 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 effect velocity measurements. These stickers must be replaced if scratched.

Quick Reference

Adaptive Calibration

This unit **must be calibrated** before you start your shooting session, 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**"). When Adaptive Calibration is finished you must **acknowledge** it by pressing **<ENTER>** key or else the unit **will not work** it will simply flash calibration results **forever**. For example: alternate flashing of **[S.L.]** and **[CAL.]** indicates fluorescent lights are 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> Turns the unit on or off, unconditionally
<UNITS> Flips between meters and feet on the fly
<ENTER> Displays the least significant digits
<MENU> Displays model number, in CF Mode selects menu
<STATS> Sets Stats Mode and reviews statistics
<DATA> Sets Data Mode and reviews shots stored in memory

Two-key functions

This requires that you press two keys in sequence as shown in the table below. For example; **<MENU+DATA>** requires that you press and hold down **<MENU>** key, while you hold down **<MENU>** key press **<DATA>** key. To end this function you must release both keys at the same time.

<MENU+DATA> Deletes current shot number
<MENU+STATS> Clears memory string
<MENU+POWER> Turns sensors off
<MENU+UNITS> Flips between **CE** and **CF** mode
<ENTER+POWER> Displays battery power level in % Power
<ENTER+UNITS> Sets Muzzle blast control value
<DATA+STATS > Finds shot position of the current Stats







Three-key functions

This requires that you press three keys in sequence as shown in the table below. For example: **<MENU+ENTER+DATA>** requires that you press and hold down **<MENU>** then **<ENTER>** and finally **<DATA>** key. To end this function you release all the keys at the same time.

<MENU+ENTER+DATA>	Undo “delete shot”
<MENU+ENTER+STATS>	Undo “clear memory”
<MENU+ENTER+POWER>	Recover all data from trash
<ENTER+POWER+STATS>	Muzzle blast control-2, advanced
<ENTER+POWER+UNITS>	Flip archery mode On or Off
<ENTER+POWER+DATA>	Load demo shots
<DATA+MENU+UNITS>	Reset the unit



USA and Metric display identifiers

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

	Indicates Metric units are selected, meters/sec
	Indicates USA units are selected, feet/sec
	Two dots on each side of 08 indicate Metric velocity
	Two dots on each side of Lo indicate Metric Stats
	Absence of dots indicates USA units for velocity
	Absence of dots indicates USA units for Stats

Archery mode control



When archery mode is changed, display will identify current mode. The keys to do this are **<ENTER+POWER+UNITS>**.

	Archery mode is turned off.
	Archery mode is turned on.

Muzzle blast control

When muzzle blast control value is changed, the display will identify current value. Available range is from **00%** to **98%**.

The keys to do this are **<ENTER+UNITS>**.

	Example of muzzle blast & noise reduction of 30%
	Example of muzzle blast & noise reduction of 00%

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. The **CF** mode has advanced alarm control settings, see CF Manual.

Flashing **dots** and flashing **colon** are special alarms that do not go away they indicate bad light conditions. These go away only 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 than **9999.99**, you must press **<ENTER>** key to see the rest of the number.








Battery Alarms

Battery alarms only come on once and it happens when battery voltage goes below alarm value. After it has been acknowledged, or it times out, it no longer comes on until conditions change or reminder timer, 60-sec interval, activates it again.

	Battery is dead, only data and stats review possible
	Battery power level is too low for detecting velocities
	Battery power level is low, performance will degrade

Chronograph Alarms

Chronograph alarms always time out. These alarms may be turned by **Off** by sensors off function, see **”Turn Sensors Off”**.

	Front sensor was missed
	Middle sensor was missed
	Rear sensor was missed
	Possible muzzle blast
	EMI or other Interference, must recalibrate
	
	

Operator Errors

Operator errors come on when an illegal function is attempted. This is due to access violation, improper use of functions etc.

Err 1	Undelete shot not possible, trash bin empty or lost
Err 2	Memory is not empty, cannot load test shots
Err 3	Access denied, you do not have access privileges
Err 8	General access violation

Memory Overflow Errors

When the string is almost full, a warning alarm comes on. This is user option that must be set within **CF** mode first. **CE** default at start-up is a simple interface with these alarms disabled. The unit tracks data history and only the oldest shots are overwritten first.

Err 0	Memory is full, there is no more room. If you fire any more shots then the oldest one will be lost.
Err 1	You have room for one last shot in this string

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 after the fourth digit. For example; numbers **1000.00** to **9999.99** and **1000.000** to **9999.999** will have no decimal point displayed.

CF Series mode

CF Mode is an advanced mode that provides full control over data manipulation and environment settings. This mode uses scroll keys and menus, a far better system than multi-key operations. This mode is selected with **<MENU+UNITS>** key and it provides over 50 functions. **CF-Mode** has access to multiple strings, cross string statistics, power factor, energy and more. CF Manual is not ready yet for publication only a draft copy will be available on our website after Aug/2003. We strongly recommend that you download and read CF Manual before using this mode. This mode is provided as an experimental added bonus. **If you get stuck in CF Mode**, press **<DATA+MENU+UNITS>** to reset the unit; this unconditionally returns to **CE-Mode**.

Statistics List

Statistics needs more than one shot it does not need a full string.

.Lo.	Low	The lowest value found
.Hi.	High	The highest value found
.Av.	Average	Average value
.ES.	Extreme Spread	Highest value minus lowest
.Sd.	Standard Deviation	Uses population (n-1)
.Pd.	Percent STD	Percent standard deviation (n-1)
.fo.	Total shots	Total shots in the current string
.PF.	Power Factor	Power factor, CF-Mode only
.EN.	Energy	Energy, CF-Mode only

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 **CAL:** and **135**.

Indoors calibration status numbers

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

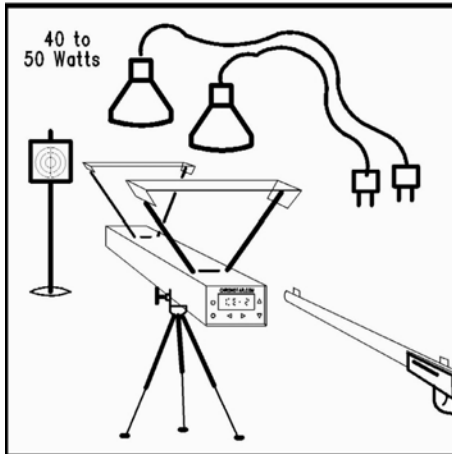
Outdoors calibration status numbers

- (-300 to -511) man-made interference nearby.
- (-001 to -250) EMI or bright sun, try using diffusers.
- (+001 to +350) functional range.
- (+400 to +511) too dark, diffusers might help.

Marginal calibration status results

- (+400 to +500) indicates marginal conditions, needs light
- (-001 to -511) indicates bad conditions, must fix problem.

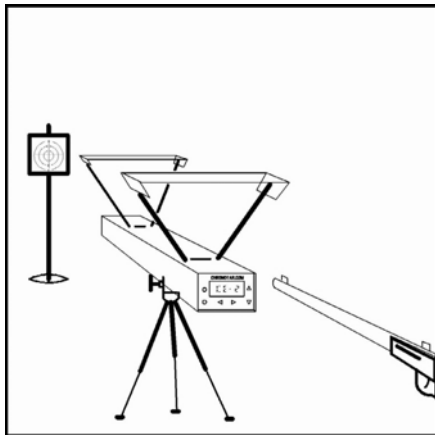
Indoors Setup



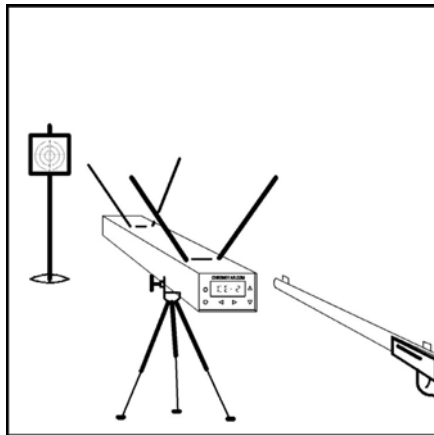
Install diffusers as shown and two 40 to 60 Watt light bulbs about 2 to 4 feet from the diffusers. You can also use single 100-Watt floodlight 4-feet above the center of unit. If you have a white ceiling, use two 150-Watt flood lights pointing up into the ceiling. The ceiling should not be more than 10-feet high. Avoid using solid state dimmers, see "**Indoors Setup**".

When finished with setup do not **forget** to run **calibration** by turning the unit **Off** and **On**. Avoid using **archery** mode indoors, see "**Archery Mode**"

Outdoors Setup



With Diffusers



Without Diffusers

After setup is completed, **run calibration** to determine if diffusers are required. Only adaptive calibration will confirm if you need **diffusers**, because light conditions can be deceiving to the naked eye. If calibration number is not between **-300** and **+450** then you must use diffusers. For further details see "**Outdoors Setup**".

Before you use archery mode please see "**Archery Mode Notes**" first. Our units, even in normal mode, outperform competing units that have specially modified hardware for archery.

Quick start

If you have never used an optical chronograph, or you are not familiar with such a device, then we recommend that you read "**Getting Started**" section first.

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

Note

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

The unit will detect shots **properly** only if the battery voltage is **above 7-Volts**. If the battery is less than **7-Volts** it should **only be used** for Data/Stats retrieval-review even if it still detects shots.

Most chronographs appear dead if the battery voltage drops below **6.5-Volts**. Our unit still functions even when the voltage drops below **4.6** volts.

Please note: when battery power alarms comes on it is necessary to replace the battery because the unit will no longer detect shots as intended.

Battery power alarms:   

The competing chronographs physically change electronic components on their units to achieve a quasi archery mode. We, on the other hand, use digital control to achieve a true archery mode that can measure velocities down to **2.5 f/s**.

One of our units is equivalent to two of the competing units. When you need a true archery, it is available by simply pressing a few keys. In **CF-Mode** you simply select it from a menu.

Error Messages

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. Bellow are some of the possible messages that may be displayed. Urgent or Serious messages have to be acknowledged by pressing **<ENTER>** key. Not so serious one will flash for a while and then disappear.

Calibration Failure

When calibration fails because operator terminated the process or the conditions are bad, then all decimal points 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.

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 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.

Battery

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

Prr1

Power level has dropped below 5.3 Volts. The unit will not be able to calibrate. The battery is considered DEAD. You can only use it for Data and Stats retrieval. You must replace the battery here.

Prr2

Power level has dropped below 6.0 Volts. The unit may still function but the results will not be accurate. You should only use the unit for Data retrieval and Stats review. You should change the battery.

Prr3

Power level has dropped below 7.0 Volts. The unit's performance will start to degrade. You should consider replacing the battery.

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 push your luck because below 3.95 volts you will begin to lose you data.

Velocity Capture

The unit will attempt to differentiate between real shot and muzzle blast or external interference. Because this is a low cost unit, 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,

[rr1]

Front sensor was missed

[rr2]

Middle sensor was missed

[rr3]

Rear sensor missed

[rr4]

External interference or muzzle blast detected

[rr7]

[rr8]

[rr9]

These represent external interference or sensor obstruction. In this particular model, which has only two sensors, these errors are not well defined.

Operator

Operator entries are monitored and when an invalid operation is performed you will get one of the following messages,

[Or1]

Undelete shot not possible because there are no deleted shots in trash bin.

[Or2]

An attempt has been made to load demo shots into memory that is not empty This is a safety measure that prevents the user accidentally overwriting good working data.

[Or3]

The unit has many levels of difficulty. If you attempt to execute a higher level function than your current access permits, this error comes on. This is a common error when operating in **CF-Mode**.

[Or8]

This indicates a general access violation. This is not a bug but it may indicate that you have discovered one of factory-test-functions.

Troubleshooting

Dead Unit

If nothing happens when you replace the battery, 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 when you have problems, you press and hold down the **<POWER>** key for 30 seconds. You do this with the battery removed.

The battery voltage must be at least 4.6 Volts. The unit will not function as a chronograph with such a low 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 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. If you want to use the unit just for data retrieval and stats review, then you should turn **off** sensors by pressing

<MENU + POWER> key

CE-Mode features

CE series are next generation intelligent chronographs that provide unique new features with a simple user interface. There is one key for each simple function. We do not have complicated key sequences that are found in some chronographs. Most of the basic functions and statistics are accessible with a single key operation. CE-2 model has one folder and one ram disk only.

Here are some of the highlights for **CE** models,

- 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.
- 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.
- Remembers shots, even when turned off.
- Auto power shut-off after 30 minutes of inactivity.
- Battery Power level meter, displayed in % power left.
- Extensive alarm and error messages.
- Digitally selectable muzzle blast reduction from 00% to 90%
- True archery mode that is digitally selectable.

Our unit 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. Competing chronographs must change electronic parts to produce a quasi archery mode with severe limitation. One of our units replaces two of theirs; our range is from **2.00** to **9999.99** f/s.

Specifications

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

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 via 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>

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