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**THE  
CED M2  
CHRONOGRAPH**

# Chronograph Accessories

The CED Millennium Chronograph has a complete line of accessory and replacement parts available. There is no need to replace an entire chronograph system, as some brands require. If a specific part is damaged in use, in most cases it is available for purchase, saving the expensive cost of replacing the entire system.

## Replacement Sensor

Packaged individually, each sensor comes with 20 ft. of shielded cable attached.



**CED M2  
Replacement  
Sensor  
M2002**

**CED Millennium  
Replacement  
Sensor  
MC002**



## CED Chronograph Main Unit

The main unit (CPU) for the Millennium & M2 Chronographs is available by itself as a replacement or as a second unit. The Millennium Chronograph CPU will hold up to 220 velocities and the M2 Chronograph CPU will hold up to 1,000 velocities. For those who do large amounts of chronographing, an additional unit may be just the solution!



**CED Millennium  
Chronograph  
Main Unit  
MC015**



**CED M2 Chronograph  
Main Unit  
M2015**

## Infrared Screen Set

With incredible accuracy, the Patented Infrared Screen Set eliminates the need for sunlight when using the CED Millennium Chronograph system, and gives you the freedom to record velocities under any lighting condition, or if you choose, no light at all! Connects to the standard sensors that come with the CED Millennium Chronograph system, and uses its own AC power source (included) or optional NiMH battery pack. The Infrared Screen Set includes Infrared Screens, sidearms, AC Adapter, and instructions.



**MC012**

## NiMH Rechargeable Battery Pack

Provides up to 8 hours of continuous field use for the Infrared Screen Set. Ideal for locations where AC electrical connections are not available. The "no-memory" Battery Pack can be recharged 500 to 1,000 times. Comes with complete Battery Pack, AC Charger, and connection cables. Instructions included.

(Note – The NiMH Battery Pack and Charger can also be used to power the CED2000 External Horn Set)



**MC013**

# CED M2 Chronograph Instruction Manual

CED proudly introduces the new CED M2 Chronograph System. Building on the original CED Millennium Chronograph, which has been an industry standard for the past eight years, the new CED M2 Chronograph begins where its predecessor leaves off.

New advanced technology enabled us to DOUBLE the operating speed of the CED M2 chronograph incorporating a microcontroller that runs at 48 MHz while expanding the operation range from 50 fps to 7,000 fps.. Memory storage has been expanded 500% from 220 velocities to over 1,000 stored velocities. Stored string size can range from a single velocity up to 500 velocities and up to 500 different strings. Expanded digital chip design now gives the CED M2 the ability of reading velocities at much lower light levels. On clear days, this means the ability to chronograph from early morning till almost sunset.

A new keypad has been designed in calculator-style layout. In fact, we have added a built-in calculator as well. Further, the CED M2 now includes a “Hi-Average” function which provides “one touch” calculation of the average of the three highest velocities in a string. This new function is ideal for calculating Power Factor at IPSC & IDPA matches. With the new built-in calculator, the results are easy and fast! In addition, the CED M2 Chronograph adds even more new features like Single function string removal, 2 ft. mounting bracket for ALL uses, the ability to recall specific strings from memory or to remove specific strings from memory, and a new USB interface. Now it is easier than ever to connect your chronograph to your PC and download your saved data into the newly designed and updated CED Data Collector software program.

## Features of the CED M2 Chronograph System:

- \* Sleek, lightweight, and compact design
  - \* Advanced software & digital circuitry = extremely fast performance!
  - \* Over 1000 shot capacity with up to 500 string permanent memory
  - \* Records velocities from 50 fps to 7,000 fps
  - \* High, Low, Average, & Hi-Average velocity readings
  - \* Extreme Spread & Standard Deviation
  - \* Edit & Omit functions
  - \* Built-in Calculator
  - \* IPSC / IDPA Power Factor Function
  - \* 10X Mode – records velocity in decimeters
  - \* Meter or feet recording
  - \*Voice Chip technology – Results can be heard as well as seen
  - \* “Advanced Error Warning” system
  - \* USB interface
  - \* New Data Collector Software program included
  - \* 9-Volt battery operation (not included)
  - \* Operating Temperature range (0°C to +50°C)
- 
- The optional Infrared upgrade set allows usage of the CED Millennium Chronograph under any light conditions, even in total darkness. The NiMH Battery Pack provides up to 8 hours of field use where no electricity is available. Now, it is possible to chronograph velocities in the evening or on heavily overcast days when there is insufficient sunlight. No longer be dependent on good weather. The CED infrared upgrade set provides total flexibility of use. It is the only one of its kind on the market today!

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## **Symbols / Abbreviations – Descriptions for use**

- E0 - Missed Start Sensor  
This means that a bullet went over the Stop sensor but not over the Start sensor.
- E1 - Missed Stop Sensor  
A bullet went over the Start sensor but never went over the Stop sensor.
- SP - Speaker  
The speaker is enabled.
- RE - Review  
Shots are being reviewed.
- SS - Saving String  
The currently active shot string is being saved.
- CS - Creating String  
The shot string number that is being shown in the Shots digits is being created and will become the "active" shot string.
- LS - Load String  
This shows up when the STR button has been pressed. The number the user enters will be the shot string that is loaded for review or editing.
- ST - String  
This comes as a confirmation message. The string number shown in the Shots digits is being acted on when the ST message is displayed.
- OR - Out of Range  
The velocity being shown is not within plus/minus 7% of the current average velocity.
- PF - Shown during Power Factor calculations
- HI - Highest Velocity  
The highest velocity in the shot string is displayed
- LO - Lowest Velocity  
The lowest velocity in the shot string is displayed
- AV - Average  
The average velocity is being displayed

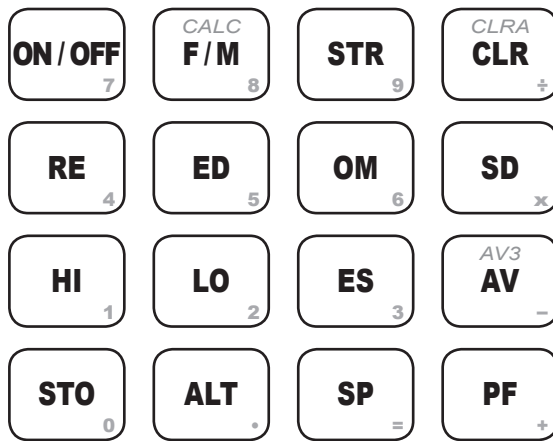
## Symbols / Abbreviations – Descriptions for use (Continued ...)

- A3 - High Three Shot Average  
The High Three Shot Average is being displayed
- ES - Extreme Spread  
The difference between the Highest and Lowest velocities is being displayed.
- SD - Standard Deviation  
The Standard Deviation is being displayed. (See U5 below)
- U5 - Under 5 shots captured in the string  
This will be displayed when the user has requested the Standard Deviation but there have not been sufficient shots captured to perform the calculation.

### Keypad Layout

**Custom Key Pad - No toggling required!**

**"Easy to read" format and moisture resistant display**



**Gray numbers** indicate the function of the key while in calculator mode  
*Italic text* indicates the shifted functions of a key. Pressing and holding the Alt key then pressing the desired key accesses the function. This works just like a Shift key on a keyboard. Black text indicates the normal function of a key.

## Keypad Explanation

Button	Function	Description	Calc
<b>On/Off</b>	Power Button	Turn the unit on and off	<b>7</b>
<i>Alt-Calc</i> <b>FM</b>	Calculator Feet/Meters	Enter and exit the calculator Toggle between FPS and MPS modes	<b>8</b>
<b>STR</b>	Select String	Allows the user to select a string for review or omitting	<b>9</b>
<i>Alt-CLRA</i> <b>CLR</b>	Clear All Memory Clear String	Clears all stored shots from non-volatile storage Clears the shot string currently in use.	/
<b>RE</b>	Review shots	Allows the user to step through the individual shots in either the current string or a stored string.	<b>4</b>
<b>ED</b>	Edit shot	Remove the current shot from shot string calculations	<b>5</b>
<b>OM</b>	Omit shot or string	Remove the current shot from shot string calculations or mark the shot string as omitted	<b>6</b>
<b>SD</b>	Standard Deviation	Report the SD of the current or selected string	<b>x</b>
<b>HI</b>	Highest velocity	Report the highest velocity in the string	<b>1</b>
<b>LO</b>	Lowest velocity	Report the lowest velocity in the string	<b>2</b>
<b>ES</b>	Extreme Spread	Report the velocity range of the string	<b>3</b>
<i>Alt-AV3</i> <b>AV</b>	High 3 point average Average	Report the High 3 point average of the string Report the average of the string	-
<b>STO</b>	Store current string	Mark the current shot string as complete, prepare the next shot string for use.	<b>0</b>
<b>Alt</b>	Shift key	Access the shifted functions	.
<b>SP</b>	Speaker	Toggles the speaker on and off	=
<b>PF</b>	Power Factor	Use the value displayed in the velocity digits to perform a power factor calculation	+

## Quick Steps to easy use-

The CED Millennium Chronograph has been designed to provide the user with accurate results through very "easy to use" functions that do not require an extensive amount of reading to learn or understand. However, to fully appreciate and enjoy the extensive array of features the CED Millennium offers, we do strongly suggest that this instruction manual is read completely at your leisure.

In the meantime, we offer the following "**Quick Steps**" to allow you fast, easy and satisfying results with your new CED Millennium Chronograph.

\* Using the 2' foldable mounting bracket included with your purchase, mount the bracket to a tripod (standard camera screw mount). Attach both sensors onto each end of the bracket, pushing them on as far as they will go until the end of the bracket is firmly against the back wall of the sensor. Adjust the plate screws on each to tighten them in place. It may be necessary to loosen the screw plate on the bottom of the sensor in order to allow it to slide onto the mounting bracket easily. Once the sensor is on the bracket completely, tighten the screw plate to secure the sensor and keep it from moving during use. Now install the diffuser Skyscreens supplied to each sensor. The silver arms slide into each side of the sensor and the white diffuser top screens fit onto each sidearm.

\* Position the tripod approximately 7 to 10 feet in front of your shooting position for pistol use and 10 to 12 feet for high powered rifle use. (This must be adjusted depending on the muzzle blast of the rifle in use. Some may allow closer positioning and others may require greater distance). **Make sure that you have an unobstructed downrange view to insure complete safety at all times.** Remember that each shot fired should be directed through the center of the diffuser screens. Try to always align your trajectory so that the projectile passes evenly over the top of both sensors. If you place the tripod on a slope or uneven ground, which in turn then causes the bullet to pass unevenly over the two sensors, it may affect the accuracy of the readings you receive. If you plan to shoot a shotgun or archery arrows, read the appropriate section for further details.

\* Attach the shielded cables from the sensors to the CED M2 Chronograph. Remember that the front sensor (closest to the user) is plugged into the "START" jack and the rear sensor into the "STOP" jack. Place the 2 ft. mounting bracket so that the fixed end is facing forward (the portion of the arm with the hinge that folds up should be facing away from you). Open the CED M2 Chronograph and press the "ON/OFF" button to activate the chronograph. You will see "0000" along with "0" shots and "2.0 F" or "0.6M" which stands for the foot or meter distance that the sensors are to be positioned at. This is the standard default setting and the CED M2 Chronograph is only designed to function with a 2 ft. mounting bracket. The high speed, digital circuitry and advanced firmware are designed to eliminate the need for longer spacing of the sensors in order to achieve greater accuracy.

\* **Now you are ready to shoot!** Fire each shot through the Skyscreen windows. With every shot, the current velocity will appear on the LCD display, along with the cumulative number of shots received (shot number). Continue recording shots in the same string but at any time the data received can be reviewed, edited or omitted, by simply pressing the appropriate button. When you wish to store a "string" of velocities or store all the data received, simply press the "STO" button and the data will be stored into memory. When the unit is turned off, the current string of velocities last recorded will automatically be stored into memory.



## **To become more familiar with your new CED M2 Chronograph's various features & functions, read on.....**

### **On / Off**

On / Off button turns the chronograph on and off. The CED M2 Chronograph has an Auto-Shut Off mode, which activates when no activity (input) occurs for a 30-minute period of time. There is no memory loss and the chronograph can be re-started by pressing the ON button once again. Any data entry(s) received prior to the Auto-Shut Off will automatically be stored as a "string" at the time the unit shuts down.

### **Meter / Feet (M/F)**

Selects the mode of calculation the chronograph will use. In "Meter" it will read the speed of the projectile in meters per second and in "Feet" mode, it will read the speed by feet per second. The default mode is set at "feet".

### **Store Current String (STO)**

STO button stores the shot string currently in use. A new shot string will be automatically created and made ready for use with "0000" being displayed on the screen. When you wish to begin a "new" string (group), simply press the STO button to store into memory the current string of velocities and begin to record a new one. There is room for storing up to 1000 shots in the memory. However, a shot string can only contain up to 500 shots. The number of shot strings is also limited to 500. This means you could have two shot strings each containing 500 shots or you could have 500 shot strings each containing two shots. When the MEMORY is filled the Error indicator will flash and the velocity digits will change to "FULL". The user will need to perform either a Clear All Memory, Clear Current String or Store Current String function before taking more shots. Once a shot string has been stored, either by pressing the STO button or by turning the unit off, that shot string cannot be cleared - it can only be omitted. The memory can only be made available again by performing a Clear All Memory function.

### **Clear Current String**

To clear (erase) a current string from memory, the user should press the CLR button. When this function is entered the screen will prompt "CLr". The user will then press the CLR button again to confirm. If the confirmation is not received within 3 seconds the function will be cancelled. Once a shot string has been stored, or the chronograph has been turned off (which action automatically stores the string if it has any shots in it) the string can no longer be cleared. It can only be "omitted" or "edited".

### **Clear All Memory**

If you wish to erase ALL entries (data) stored in the chronograph memory, press BOTH the Alt - CLR buttons once. When entered the screen will prompt "CLrA". The user will press the Alt-CLRA buttons again to confirm. If the confirmation is not received within 3 seconds the function will be cancelled.

### **Recalling a Specific String (STR)**

STR button is used to jump directly to a specific shot string for review without stepping through all the strings. To initiate this function the user will press the STR button, enter the desired string number and then press the "=" key. The user will then press the Review (RE) key to step through the individual values of the string allowing those values to be edited or omitted. The HI, LO, ES, AV, & SD functions can all be activated during this process. If the user selects a string that has been omitted, the display will show the string number and 4 dashes, which will remain displayed until a new string number is entered. If the STR button is pressed with no additional input, the chronograph will jump back to display the last shot in the active string.

## **Recalling a Specific String (STR) (Continued...)**

When the user is reviewing strings it is not necessary to reselect the current string before recording more velocities (firing more shots). When a shot is detected the chronograph will change back to the current string automatically.

## **Omit Entire Shot String (OM)**

The OM button is used to omit a single velocity or an entire string. To initiate this function the user should press the STR button, enter the desired string number and then press the “=” key. The chronograph will jump to that string. The user should then press the OM key to omit the entire shot string. The user will be presented with an “OS” prompt requesting confirmation. Pressing the OM key again within 3 seconds will confirm the action. After the String Selection has been performed, if the user presses any other key than OM the mode will change to disallow omitting the string. This and the confirmation above are safety factors to keep shot strings from being removed accidentally. Once a string number has been used, it can't be reused until a CLRA function has been performed. The omitted string actually stays in memory. It cannot be selected for review but it will show up in a data download as “omitted”.

## **Review (RE)**

At any time after one data entry has been received and up until such time as the memory is full, any / all data entries (velocities received) can be reviewed by pushing the RE button. When pressed, the chronograph will show the first input shot / velocity received during the current string. Every press of the RE button will advance to the next shot / velocity stored. You can review through all of the data entries in the specified "string" up to the last one received, or simply stop at any point along the way. If a new shot / velocity is received, the chronograph will automatically record it from the point where it left off initially in the "string", NOT from where the review function was interrupted at. *(Meaning that if 10 shots / velocities were received, and 6 later reviewed, followed by a new shot / velocity being received, the unit will store the latest data entry in memory as 11 shots / velocities received and add the new data entry to the current string.)*

**\* When reviewing shots / velocities in the current or a previously stored "STRING", each of the other function keys operates based on the data stored in the specific "STRING" in use on the LCD display.**

## **Edit (ED)**

This function allows the removal of any undesirable data entry. The Edit button can be pressed immediately after the undesirable shot / velocity is received, removing it from calculations, or later during the review function. When in the review function and an undesirable shot / velocity is called up on the LCD display, the ED button can be pressed once which will thereby remove (edit) that data entry from all calculations. Edited shots / velocities remain in memory, but are removed from the summary and from the other functions such as average, high, low, extreme spread, or standard deviation. All shots / velocities which are edited will appear on PC downloads, but will not be included in the summary calculations. Each such entry will be indicated by a "-" mark to denote that it has been edited.

## **Omit (OM)**

Functions exactly as the Edit function with one major exception. All shots / velocities which are omitted are removed from TOTAL memory and cannot be recalled later and will not be included in any summary calculations. When a data entry is omitted during a "string" review, it will be removed completely in the same manner from the memory totally!

## **Standard Deviation**

Based on the universal mathematical equation for uniformity, this function uses all the data entries in a string to calculate the Standard Deviation of the combined shots / velocities in that string. The larger the number of data entries in the string, the more accurate the SD becomes. The CED M2 Chronograph requires a minimum of 5 shots / velocities to be received in order to calculate SD. However, it should be noted that the more data entries used in SD calculations, the more reliable the SD will actually be. Statisticians usually recommend 20 shots / velocities for the best reliable results. Edited or omitted entries will not be included in SD calculations.

Standard deviation is very confusing to many people and as such, is not often used. However, in reality, it is the best textbook measure of velocity uniformity available and when used properly and in conjunction with other load data will give very meaningful results. Average velocity has been the standard for years. However, it does not indicate how much the velocities being measured varied above and below the average. The standard deviation actually measures how close each shot velocity will be to the "average". The more uniform you can make the ammunition, the better the odds (no guarantees) that it will produce the exact same results. The mathematical equation for standard deviation is extremely complex and prior to electronic calculation (computers) it was seldom used by shooters. What it means though, is that statistically, it has been proven that 68% of all things measured will fall between one standard deviation above or below the average. Additionally, 95.4% will fall between two standard deviations above or below, and 99.7% will fall between three standard deviations above or below the average.

Example = If you have a standard deviation of 10 fps with an average velocity of 1000 fps, then you can expect that 68% of the shots fired will fall within 990 fps to 1010 fps. Further, it can be determined that 95.4% of the shots fired will fall between 980 fps and 1020 fps and that almost all of the shots fired (99.7%) will fall between 970 fps and 1030 fps.

## **High Velocity (HI)**

When pressed, the highest velocity entry in memory (for the specific "string" on display) will appear. If a data entry has been edited or omitted, it will not be accepted in calculating this function. The total number of valid shots / velocities (data entries) in the "string" on display from which the HI velocity was calculated appears under the SHOTS column.

## **Low Velocity (LO)**

When pressed, the lowest velocity entry in memory (for the specific "string" on display) will appear. If a data entry has been edited or omitted, it will not be accepted in calculating this function. The total number of valid shots / velocities (data entries) in the "string" on display from which the LO velocity was calculated appears under the SHOTS column.

## **Extreme Velocity Spread (ES)**

When pressed, the extreme velocity spread is calculated by subtracting the highest velocity data entry minus the lowest velocity entry from the current "string" on display. If a data entry has been edited or omitted, it will not be accepted in calculating this function. The total number of valid shots / velocities (data entries) in the "string" on display from which the ES velocity was calculated appears under the SHOTS column.

## **Mean or Average Velocity (AV)**

When pressed, an average velocity is calculated by adding together all the velocity entries from the current "string" on display and dividing them by the sum total of entries of that given string. If a data entry has been edited or omitted, it will not be accepted in calculating this function. The total number of valid shots / velocities (data entries) in the "string" on display from which the AV velocity was calculated appears under the SHOTS column.

### **High Three Velocity Average within a String (ALT – AV3)**

The Alt-AV3 button is used to average the highest 3 velocities (values) in the current shot string or the shot string under review and display the result.

### **Calculator Function (CALC)**

This function will implement a Multiplication, Division, Addition, and Subtraction (MDAS) calculator in the chronograph. For the calculator the digits across the top of the screen will be used. This will allow 5 digits plus one decimal digit to be displayed. Numbers will be rounded to the nearest 1/10th before display. The maximum value that can be displayed with this scheme is 99999.9.

If the final calculated value is less than 10000 it will be transferred to the chronograph velocity digits (main display area) when the calculator function is closed. This makes the calculated value available to the Power Factor function. To use the calculated value for a Power Factor calculation, the Calculator function MUST be closed BEFORE proceeding with the Power Factor process. To clear an entry to zero in order to calculate a new number, press ALT-CLRA together which clears the calculator value to zero.

### **Power Factor Function (PF)**

The PF button calculates "power factor" which is used in all IPSC (International Practical Shooting Confederation) and NRA action shooting competitions. The CED Millennium makes this function simple and easy to use. The PF is calculated from the data entry showing on the large digit LCD display. Therefore, PF can be calculated from the current shot / velocity recorded, from any reviewed data entry, or from the HI, LO, AV and AV3 (High Average) modes. It can also be used from a calculated number derived from the Calculator function after it has been transferred to the main display area. Once the desired velocity appears on the LCD display, press the PF button once and enter the bullet weight (3 or 4 digit) using the numerical numbers that appear on the keypad. Finally, press the "=" button to show the results. The power factor will now appear on the LCD display. To enter a new PF, simply bring up the new velocity to be calculated onto the display and repeat the PF procedure once again. The system is designed to accept a four-digit bullet weight providing more precise accuracy to the tenth of a grain level. If the user only inputs three digits, the system will automatically calculate the fourth as zero. If the user wants to input a fourth digit, the decimal point must be entered in the same manner as on a calculator. Therefore, if the actual bullet weight is 130.6 grains, enter 130 and then the "." & then number 6 and press the "=" button. If the user enters 130 only, the system will read it as 130.0.

The entered bullet weight will remain in memory until the user changes it or the chronograph is shut-down. Therefore, if a PF is desired for a different data entry using the same bullet weight, the user should bring the new data entry up on the LCD display and then push PF button which will show the previously inputted bullet weight on the LCD display. Press the "=" button and the power factor calculation will appear. If a new bullet weight is desired, simply enter the new weight after the PF button is pressed. To clear the display while in the Power Factor function, press the CLR button once and the display will revert to 0000 allowing the user to then input a new velocity for calculation purposes.

Remember, variations in the performance of ammunition are rarely due to inaccuracy of chronographs. Rather, they are due to weather conditions, altitude, temperature changes & the temperature of the pistol barrel itself, which all have varying effects on powder and barrel performance. Therefore, it is suggested that a safe margin should be allowed for important matches to prevent possible trouble in meeting proper power factor levels.

### **Advanced Error Warning Function (ER)**

The CED M2 Chronograph includes an "Advanced Error Warning" system, which provides notice that the most recent data entry is outside of acceptable tolerance (+/- 7% of string's average). When activated, the "ERROR" word & the symbol "or" both flash on the LCD display. If you feel the entry is suspect or incorrect, simply press the "OM" (omit) button to erase it from memory. Pressing the "ED" (edit) button will remove the entry from the calculations and string data, but the entry will be retained in memory for later print out. Additionally, the Error Warning Function provides details if one of the sensors does not register a projectile, while the other does. No velocity will be shown, but either EO or E1 will appear with the ERROR word and flashing sequence.

- E0 - Missed Start Sensor  
This means that a bullet went over the Stop sensor but not over the Start sensor.
  
- E1 - Missed Stop Sensor  
A bullet went over the Start sensor but never went over the Stop sensor.

### **Speaker Function (SP)**

The SP (speaker) key is to be pressed when the user wishes to hear the data entries in addition to seeing them. Through advanced voice chip technology, the CED M2 Chronograph provides the user with the capability of hearing each data entry (shot / velocity) recorded. The speaker, when turned on (SP), provides the velocity entry appearing on the primary LCD display to be heard as well as seen. The audio has a 1.5 second delay built in to allow time for the muzzle blast noise to subside allowing the user to hear the results. The SP function works in the HI, LO, ES, AV, & SD and REVIEW mode.

### **Low Battery Indicator**

This appears in a flashing mode in the top center of the LCD display when the battery reaches a pre-determined low charged state. The system gives ample warning to allow sufficient time for the battery to be changed. Additionally, the CED M2 Chronograph has a spare battery compartment to allow the user to store an extra battery on hand. It is located next to the battery compartment and can be accessed by removing the panel which separates the two compartments, inserting a spare battery and then replacing the panel. The battery compartment is designed to allow the battery to be inserted in one direction only to prevent error. It is a drop-in compartment with no additional connections needed to the battery leads.

### **Display**

The CED M2 Chronograph has been designed with the largest custom LCD display in the industry. It provides all relative information at a single glance. It features a full function display showing current velocity readings as well as the current function in use, the total number of shots / velocities recorded, and the screen setting distance in meter or feet measurement. Additionally, the LCD has built-in custom indicators (10X, low battery, & error warning) which allow the user to readily know when the 10X function is in use, or the battery needs changing, or when the system detects a possible error.

**As you become comfortable and at ease with your new CED M2 Chronograph, take the time to read the following, which explain in detail more great features of this professional product.**

### **Sensors / Skyscreen Diffusers**

Custom designed and featuring dual lenses for more accurate recording capabilities, precise positioning, and easy installation. A built-in pressure plate means no screws or nuts to be lost! The Sensors slide on the custom 2 ft. mounting bracket precisely to the correct position. A simple quarter turn of the custom plate knob and they are secure and ready to use. 20 ft. of shielded cable come with each sensor. Strong durable diffusers with 5" inch wide by 12.25" inch long top plates provide excellent diffusion of the sun making an artificial cloud above the projectile allowing the sensors to function at their best. Skyscreen sensors want to see a dark projectile against a light background. As a bullet is darker than the sky above, the Skyscreen sensors detect a slight light drop as the bullet passes over them thus allowing the chronograph to record the velocity. When there is not enough light on the diffuser or the bullet is too bright, there is the potential for problems. Additionally, when there is snow or water on the ground, the reflection, which is cast back up on the bottom side of the bullet can prevent the sensors from seeing the bullet causing erratic performance (called "Glints"). Under these conditions, it is best to lay a dark colored tarp on the ground below the tripod, change the location or wait for better conditions on another day. The CED Millennium Chronograph is designed to eliminate most of the problems highlighted above, but can not prevent them in all situations. No chronograph can!

### **Indoor Shooting**

For indoor use of the CED M2 Chronograph artificial daylight must be used. Fluorescent lights WILL NOT work, as they do not imitate natural light. Incandescent lamps shining down on the top of the diffuser or each sensor are required. Commonly found utility reflectors with 100 watt bulbs will work fine if they are positioned high enough to provide uniform illumination of the diffusers. A custom designed Lighting kit is an available option from CED which provides the above in an easy to install and use format. The bulbs measure 11.75" in length providing a full shooting window.

An optional Infrared upgrade set is available, which allows usage of the CED M2 Chronograph under any light conditions, even in total darkness. The optional NiMH Rechargeable Battery Pack provides up to 8 hours of field use for the Infrared Screen Set.

### **Shotgun / Bows**

The CED M2 Chronograph can be used for shotshells. The system measures the velocity of the front pellets in the shot string. A closer screen spacing of the tripod of 3 to 4 ft. from the muzzle of the shotgun should be used. This means that the FIRST Skyscreen sensor should not be further than 4 feet from the end of the shotgun. In the case of bows, make sure that the Skyscreen sensors are far enough away to allow the arrow to fully leave the strings of the bow before the tip of the arrow reaches the first sensor. Blunt arrow tips (rounded or flatter nose) work best! Remember, the sensors need to see a change of light in order to read the arrow.

### **PC Download Set-up**

A CD-ROM, containing the "CED M2 Data Collector" software is currently included with every CED M2 Chronograph system. System requirements & the installation process are outlined on the following page.



## USB Installation (Continued...)

There might be multiple sets of other devices already installed. Many Human Interface Devices (HID Devices) have the same entry titles. To find the chronograph device you need to concentrate on the USB Human Interface Device entries.

Find the first USB Human Interface Device entry. Double click on the entry and a properties window will open up. The properties window for the chronograph will look like this. (Highlighting added)



Once you've found this properties window and verified it's contents click on the Details tab. The window will change to show this: (highlighting added)



If these properties screens show the correct contents then Windows has correctly installed the USB chronograph.



## Windows 98 and Windows ME

### Program Installation

Program installation will be essentially unchanged from installation under Windows XP. The difference is that the user may have to reboot the computer at the end of the installation.

### USB Installation

The USB installation procedure for Windows 98 is essentially the same as for Windows XP. The biggest difference is that at one point the user will probably be asked to insert their Windows 98 CD.

The other difference has to do with checking the USB installation. Windows 98 does not have as much detail in the properties screens. What that means is that you can't open a properties screen and see that the CED Chronograph is installed.

The only thing you can do is to have the Device Manager opened up, then plug in the USB cable and see if another entry appears under the Human Interface Devices. That entry should go away when the cable is unplugged.

### Un-installation Process

The CED USB Data Collector is un-installed by using the Add or Remove Programs utility in the Windows Control Panel.

When you have started the Add or Remove programs utility scroll down until you find the entry for the CED USB Data Collector. Select it and click the Change/Remove button. Confirm your choice in the window that will pop up by clicking the OK button. The CED USB Data Collector will be removed from the computer.

**ALL NEW RELEASES** of the CED M2 Data Collector software program are also available for FREE download from <http://www.shootingsoftware.com> or <http://www.CEDhk.com> web sites. Check these periodically for the latest releases. By downloading this new software, the user's computer is automatically set-up for easy and convenient transfer of data from the CED M2 Chronograph.

### Specifications:

**Velocity readings** - from 50 ft. / sec. up to 7000 ft. / sec.

### Temperature operating range:

0° to 50° Centigrade

32° to 122° Fahrenheit.

System should operate down to 0° F or -18° C.

**Battery** - Nine-volt NEDA 1604 alkaline battery recommended.

## IN CASE OF TROUBLE

### Things to check -

- a. Unplug the "start" & "stop" jacks and plug them in once again, making sure they are completely inserted and tight in their fitting.
- b. Check the sensor bracket to confirm it is pushed all the way into each sensor. The sensor bracket is designed to fit precisely into the back wall of each sensor cavity. When mounted correctly, the distance between the sensors will be precise. If mounted incorrectly, it will result in the velocities being recorded inaccurately. If it is difficult to push the bracket all the way into a sensor, loosen the tension adjustment at the bottom of the sensor.
- c. Check to see what is being shot through the Chronograph. If it is a small projectile such as a BB or pellet or a small fast bullet such as a .223 Rem., then re-position the point of aim to allow the shot to be closer to the sensor and not too high above it. Muzzle blast ahead of a subsonic bullet can cause incorrect readings. Re-position yourself farther away from the front sensor and try again.
- d. If the projectile is too bright or shiny, or if a strong reflection is cast off the ground, "glints" can occur. The reflection of light illuminated onto the bottom of the bullet prevents the sensors from reading it. Try using a black marker to paint the shiny surface of the bullet black. Also, make sure that the ground under the chronograph does not cast a strong reflection back up onto the chronograph. Conditions such as snow or water on the ground can cause such a reflection.
- e. In some cases when the sunlight reflects directly off shiny bullets, erratic recordings can occur. Try positioning a sunscreen so that the bullet while passing over the sensors is in a slightly shaded area.
- f. Inadequate Lighting or too much light can cause problems. In the case of too much light, try relocating the chronograph into an area that provides more shade from direct sunlight, but does not create inconsistent shade over the sensors themselves. In the case of inadequate lighting, you must either use the indoor lighting kit, the CED Millennium IR Screen upgrade, or wait until a better day!
- g. If the LCD display does not respond to shots fired, it means that the "start" sensor did not pick up the projectile and no signal was received. This could be due to inadequate lighting, or the projectile passing the sensors too close to the top screen or off to the side.
- h. Sporadic recordings of velocities that seem way too high or are recorded by the chronograph prior to shots actually being fired can be caused by electro- magnetic interference or excessive electrical static (noise) in the area of use. Such occurrences can be a result of weather conditions, nearby power lines, electric fences, radar, electric motors, cellular telephones, or transmitters. All photo-electric sensors are sensitive to the static electricity or interference that these types of things can generate the same way an AM radio is when it crackles. In cases where this occurs, check your immediate area to determine the cause, move the chronograph to a different location, rearrange or straighten the sensor cables or wait for a better day.
- i. Insufficient light through the diffusers. On overly cloudy days, try removing the top diffusers from the Skyscreens and use the sidearms for proper aim and positioning. On bright sunny days, always use the top diffuser screens in order to provide sufficient diffusion of the direct sunlight.

## **IN CASE OF TROUBLE (Continued...)**

- j. Verify your sensors are mounted so that the front sensor and screen cannot swing upward. The hinged portion of the mounting bracket should be positioned between the tripod head and the furthest sensor. The skyscreen side supports may move due to muzzle blast, but for best results the sensors must not move.
- k. If your Millennium is equipped with the IR upgrade option and the weather is extremely humid or foggy, moisture in the air can diffuse the infrared light emitted by the IR array so that insufficient light is provided to the sensors. The only solution is to wait until the fog or moisture “burns off”, or for a better day.
- l. The IR upgrade option is not required for normal operation on bright sunny days. If however the IR upgrade option is used on an extremely bright day it is possible to provide too much light to the sensors. Placing a brown paper target or other solid material on top of the diffuser screens will reduce the amount of natural sunlight that can interfere with the IR emitters and sensors. If using the IR upgrade indoors under fluorescent lighting, the same situation applies. Fluorescent lights will interfere with All chronographs producing incorrect / inaccurate readings.
- m. All chronographs require the bullet to travel nearly parallel to the sensor bracket. Shooting high to low or low to high through the screens can produce errors. If several people of different height use the chronograph from a standing position you may need to adjust the tripod so the bracket and sensors are held parallel to the shooter’s firearm bore line.

## **Chronograph Results and variables that affect readings.....**

Variables that will affect results are as follows:

1. Temperature, altitude, & the effects these have on different powders
2. Temperature of the barrel and the ammunition itself. A cold barrel will produce different results from a very hot one. This is the same with the ammunition.
3. Lighting - MUST be balanced on both sensors. If the sun changes position, you must maintain a balanced condition on both sensors. Whether in bright sunlight (using the top screens) or on shady days (in which the top screen is optional), it is critical to maintain a balanced situation on both sensors.
4. Muzzle blast - If the muzzle blast reaches the first sensor before the projectile, your results will be skewed or won’t even register. If the muzzle blast causes your screens to shake, the readings could be skewed. Suggestion - start back and work forward with the handgun or rifle in use until you find your closest position.
5. The CED Infrared screens are designed for use when mother nature is not cooperating or for times and locations where insufficient light persists. If they are used under bright sunlight, the sunlight will over power them anyway. It is critically important on ALL chronographs to maintain a BALANCED light condition on both sensors.

## **Chronograph Results and variables that affect readings..... (Continued...)**

6. Spacing. Make sure that your sensors are properly positioned and tightened. If they are off by even 1/16" it will cause incorrect readings.
7. Glints - If there is water, sand, snow, or bright concrete on the ground below your tripod / chronograph set-up, the sunlight will bounce (reflect) off the surface shining back up on the projectile preventing the sensors from detecting a light drop (shadow) and thus result in a poor or no reading situation.
8. Indoor - Fluorescent lighting is the kiss of death to any chronograph system. Their light does not allow the sensors to "see" the bullet. Cover the top of the screens if this type of lighting is near your set-up. Also make sure that no additional light is penetrating on one or the other sensor creating an unbalance of light on the two of them. Some ranges are designed with small bays or short distances which cause excessive sound waves and muzzle blasts. These have been known to cause problems with chronograph system results. Last, when using the CED Infrared on an indoor range with AC, make sure the AC itself is a full 110V. If the range is located a great distance from the power transformer, it is possible the output is less than 110V and this may prevent proper performance. In such cases, it is better to use the NiMH Battery Pack instead.
9. Other variables - Depending on the quality of the chronograph & sensors, other variables such as mobile phone transmissions and high tension poles or electrified fencing can all have effects on chronograph performance. Even high static from summer thunder storms in the area of use can result in problems.

### **Q & A Sheet for the CED M2 Chronograph**

- Q. I recently used my CED M2 Chronograph for the first time. It would not register any shots I fired with my 30.06 rifle. I set it up according to the book and stood a couple of feet behind it. Nothing happened. The display continued to show "0000". Can you help me?
- A. The CED M2 Chronograph is designed to prevent error readings due to muzzle blast reaching the front sensor before the bullet does. When this occurs, the display will not present a reading! Therefore, it say "0000" only. In the case of large caliber rifles, you must position the end of the barrel a minimum of 7 to 10 feet behind the first sensor. This will prevent the muzzle blast from creating any problems. In the case of large caliber rifles, you can position yourself even further away or design a blast shield. REMEMBER, to always mount the first sensor onto the arm, which contains the tripod screw hole. This will eliminate any possibility of the "mounting bracket" shifting upward from heavy muzzle blasts.
- Q. I love my new CED M2 Chronograph, but I damaged one of the sidearm screens the first day I used it. Can I get a replacement?
- A. Yes! A complete line of accessories are available including sensors and skyscreens, mounting brackets, indoor lighting set, USB cable, custom carry case, and infrared upgrade screens are all available through CED distributors or direct from Competitive Edge Dynamics USA

## Q & A Sheet for the CED M2 Chronograph (Continued...)

- Q. What is the maximum distance the main Chronograph unit can be placed from the infrared screens and sensors?
- A. The sensors are connected to the main unit by a 20 ft. cable. Therefore, the main unit with display can be located anywhere within a 20 ft. range from the sensors themselves. The infrared screens require their own power source, but it does not have to be connected to the main unit. Thus, it can be located close to the screens themselves.
- Q. Will my CED M2 Chronograph register shots if I put it down range further than the specified 7 to 10 feet?
- A. Yes, the CED M2 Chronograph will register velocities at any distance from which you can shoot through it! Many customers put the unit 100 - 200 yards down range. Since the display is the largest on the market, it is easy to read through a rifle or spotting scope without having to walk down range after each shot fired.
- Q. How long does the NiMH Battery Pack last? How many times can it be recharged?
- A. The battery pack provides 7 1/2 to 8 hours of continuous use. The no-memory nickel metal hydride batteries can be recharged a minimum of 500 times, but may provide up to 1,000 recharges.
- Q. How do I know if the infrared screens are functioning? I can not see any light.
- A. Infrared light cannot be seen by the naked eye. However, that does not mean it is not there. The CED Infrared Screen Set has been designed with two indicator lights. When the screens are properly set up and power is supplied correctly, the "green" LED light will be on. If the battery charge falls below the minimum level required when using the NiMH battery pack, the "red" light will come on. If neither light is on, check to make sure the power supply is properly connected. Also make sure that the screens have been set up with the metal contacts from the side arms and the top screens in contact with each other.
- Q. Can infrared screens be affected by sunlight or indoor lighting?
- A. It is possible for very bright sunlight or strong fluorescent indoor lighting to interfere with the use of infrared screens making it hard for the sensors to detect a break in the infrared beam itself. If this occurs, simply change the position of the screens to a shady (less sunny) location or place a piece of dark cardboard paper over top of each screen. If the sun is very bright, it is possible to turn off the infrared and use the screens with natural sunlight only as the diffuser. Infrared screens function with their own light source, which allows them to be used under cover, indoors, during cloudy or overcast days, or in the evening when there is insufficient sunlight or no sunlight at all.

## **GUARANTEE**

**\*\* 30 DAY MONEY BACK GUARANTEE \*\***

We want you to be completely satisfied with our product. If you are not satisfied, simply return it to the place of purchase along with the original receipt of purchase, and in an undamaged condition within 30 days for a full refund.

## **WARRANTY**

**\*\* TWO YEAR LIMITED WARRANTY \*\***

If the CED M2 Chronograph breaks due to defective parts or workmanship, we will replace it for you. This warranty does not cover any failures attributable to abuse, mishandling, failure to follow operating instructions, alterations, or accident. If you accidentally break the Chronograph itself, we will repair it at a cost for you. If you damage the Skyscreens or Sensors, replacement sets are available for purchase. All claims must be accompanied by the original sales receipt or written proof of purchase, and be returned in a properly packed manner with shipping charges prepaid. We are proud of our product and we want you to be too.

Returns or warranty service should be directed to Competitive Edge Dynamics USA for North American customers and to Competitive Edge Dynamics Ltd. for international customers. Should you encounter any problems or wish to correspond on any matter, please write, fax, or email to:

**Competitive Edge Dynamics Ltd.  
GPO Box 10590, Central, Hong Kong  
Phone (852) 2866-6802 Fax: (852) 2866-6505  
Email: [info@CEDhk.com](mailto:info@CEDhk.com)**

**Visit our Web Site at: [www.CEDhk.com](http://www.CEDhk.com)**

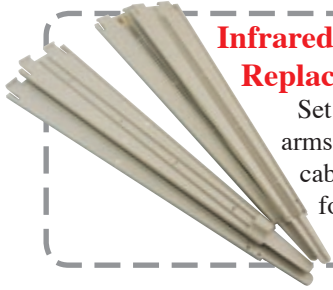
**In the USA,  
Competitive Edge Dynamics, USA  
Phone: (610) 366-9752 Fax: (610) 366-9680  
Or Email: [info@CEDhk.com](mailto:info@CEDhk.com)  
with details of the problem and a return  
address will be provided for shipping purposes.**

## Chronograph Accessories (Continued...)

### Infrared Sidearm Replacement Set

Set consists of four sidearms, two of which include cable and jack connections for the infrared screens.

**MC014**



### Replacement Skyscreen Set

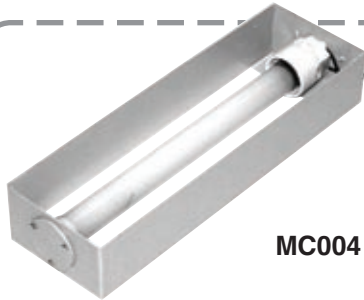
The Replacement Skyscreen set includes two top screens and four sidearms.

**MC003**



### Replacement 2 ft. Mounting Bracket

Custom designed for the CED Millennium Chronograph, this mounting bracket incorporates a central "swivel" arm with camera screw base, that allows the bracket to be folded in half to a maximum length of 13 inches for easy storage and use. (Bracket included in the CED Millennium Chronograph system set) **MC006**



**MC004**

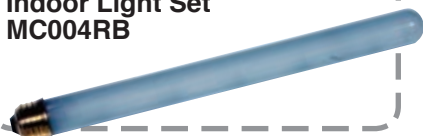
### Indoor Lighting Set

All chronographs require incandescent light, which is normally provided by the sun. However, when any chronograph is used indoors, additional lighting is required. This indoor light set is custom designed to fit the CED Millennium Chronograph Skyscreen Arms. The strong metal frame provides additional protection for the custom light bulbs. Includes an on/off switch and custom 11.75" long bulbs that provide a full complete shooting window.

Available in 110V or 220V models. (Specify voltage when ordering)

### Replacement Bulbs for Indoor Light Set

**MC004RB**



### Table Mounting Plate

Custom designed for use with the CED Millennium Chronograph, this table mounting plate is made of heavy metal construction that provides a strong stable base for positioning the Chronograph mounting bracket and screens on any flat surface. Ideal for use when a tripod is not practical.

**MC010 \$22.95**



### Custom Chronograph Carry Case

This densely padded case was designed specifically for the CED Millennium Chronograph and accessories and includes quick-release padded shoulder strap, adjustable compartment dividers, and adjustable accessory straps for attaching a tripod onto the case. A great way to protect and carry your valuable investment!

19"L x 7"H x 6"D

**MC005**

