

V2 Ballistic Chronograph

- Advanced strapping system
- Recommended Barrel Diameters: 0.5-2.0"
- Muzzle Brakes up to: \varnothing 2.5" x 3.0"L



- Spacer/Alignment Guide
- Instruction Manual
- Technical Specifications
- Troubleshooting Guides

Spacer Guide

Rubber pad
(use thick or thin)



screws to attach spacers
to inserts in V-block
(short screws shown)



0.375" spacer

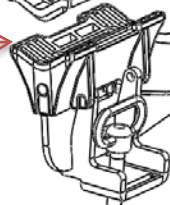


0.250" spacer



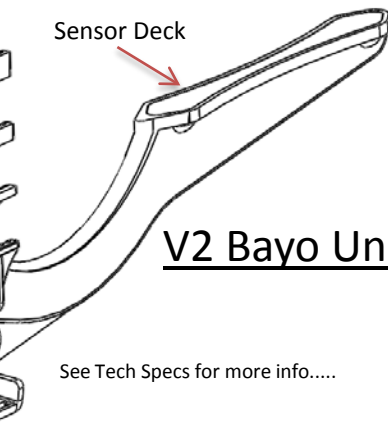
0.125" spacer
(only fits V-block)

V-block



Basic Idea: Use spacers and rubber pads to align sensor deck near bullet path edge but not in way of bullet. Screws can be used to secure spacers to V-block for a more permanent setup.

Sensor Deck



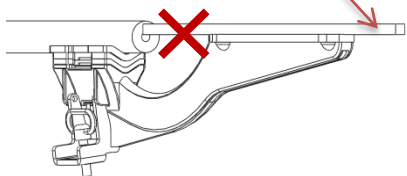
V2 Bayo Unit

See Tech Specs for more info.....

Alignment Guide

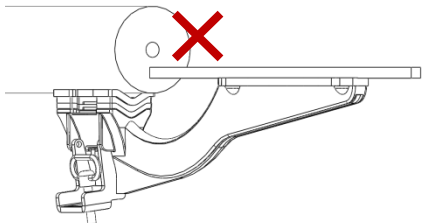
Basic Idea: Use alignment tool (square plastic rod) to help determine number of spacers to use. Place alignment tool on sensor deck, check to see that top of alignment tool sits just below the bore.

alignment tool



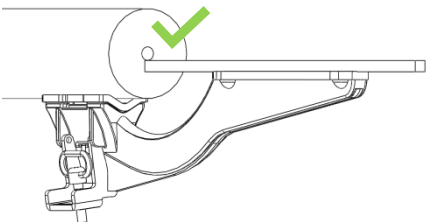
Improper alignment

- Sensor Deck too high
- Bullet will hit Bayo
- Add spacers or use thick rubber pad



Improper alignment

- Sensor Deck too low
- Poor sensor signal
- Remove spacers or use thin rubber pad
- If still too far, adjust Display Unit settings



Proper alignment

- TOP of alignment tool tangent to BOTTOM of bore
- If not picking up shots, remove 1/8" of spacer material.
- Always sight down-bore to verify bullet will clear Sensor Deck

Instruction Manual

Basic Operation

To turn display unit on:

- Plug one end of the data cable into bayo jack **A**
- Plug other end of data cable into display unit jack **B**
- Make sure connections are flush

To turn display unit off:

- Unplug data cable from the display unit jack

Display switch operation:

- Press switch in to access menus, select options, or change features (units, S-D- & ES, etc) **C**
- Rotate up or down to scroll data and options

To remove microSD card:

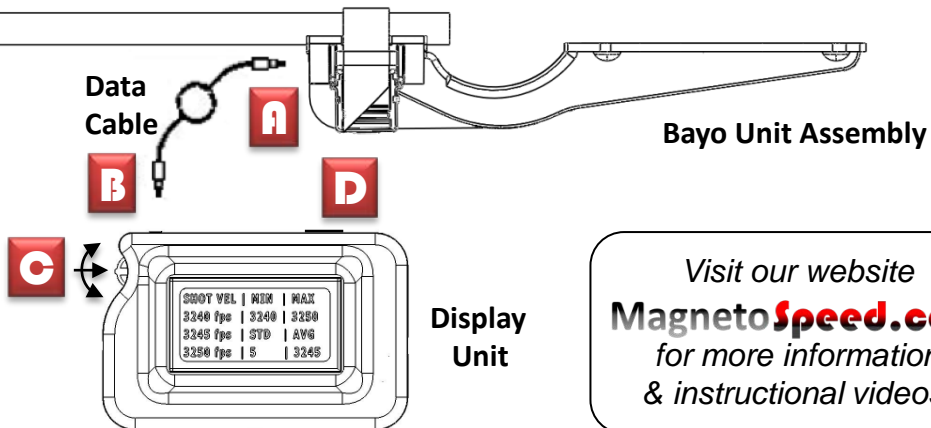
- Push in on card edge; card will unclick and pop out **D**
- Pull out

To extend/retract data cable:

- Pull ends away from each other and then let slack

To change out batteries:

- Remove 2 screws on back of case
- Pull case halves apart
- Swap out the 4 AAA cells
- Close case halves
- Replace screws and fasten (do not over tighten)

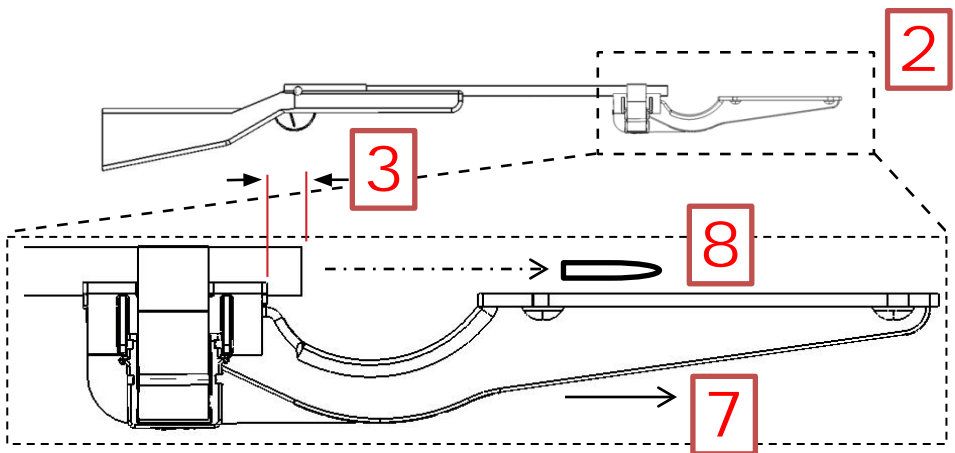


Visit our website
MagnetoSpeed.com
for more information
& instructional videos!

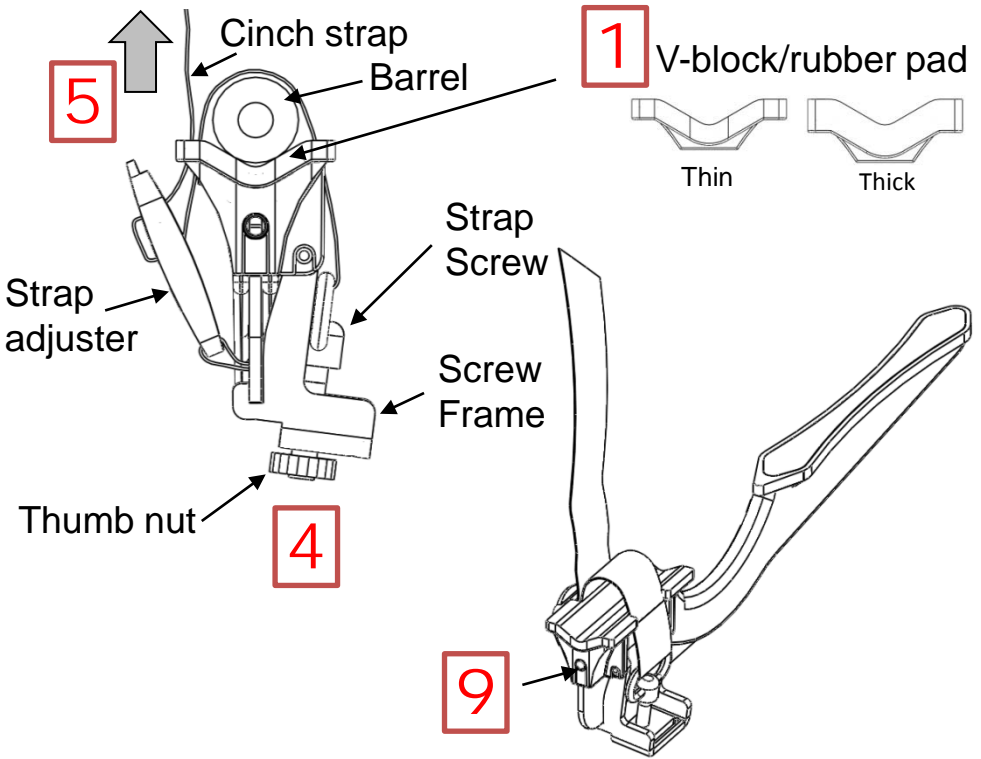
Setup: Bayo

V2 Bayo Installation/Removal

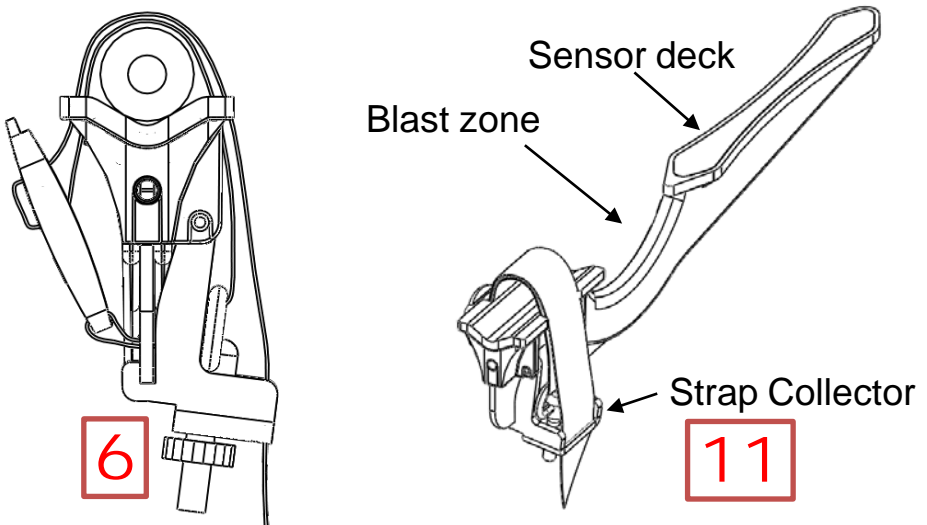
- 1) Seat muzzle end of barrel in V-block groove under strap. Use proper spacers along with a thick or thin rubber pad as spelled out on previous page. Also, make sure to use rubber strap protector between strap and suppressors.
- 2) Make sure sensor deck is down-range from muzzle.
- 3) Make sure muzzle is 0.25-2.50 inches down-range from front of V-block (overhanging into blast zone).
- 4) Make sure Thumb Nut is "unscrewed" almost all the way but still attached to end of Strap Screw.
- 5) Pull cinch strap up through strap adjuster until ALL slack is taken up around barrel.
- 6) Tighten Thumb Nut against Screw Frame until tight.
- 7) Test grip of strap by tugging on the bayo; if unmovable then proceed. If not, continue tightening Thumb Screw.
- 8) Remove bolt from gun (if possible) and look down the barrel towards the muzzle; make sure the bayo sensor deck cannot be seen through barrel to ensure bullet will not encounter bayo. **MAKE SURE BAYO SENSOR DECK IS NOT IN THE PATH OF THE BULLET!**
- 9) Plug data cord into bayo jack and display unit jack (see Basic Operations). You are now ready to shoot. Continue to check muzzle location with reference to the V-block. If bayo is creeping off, retighten strap with muzzle in proper position (some creep per shot is normal).
- 10) To remove, simply unscrew Thumb Nut to let off tension, pull back strap adjuster, slide off muzzle.
- 11) Note: Loose strap end can be placed in strap collector slot in Screw Frame during storage/use.



Bayo (loose)



Bayo (tight)

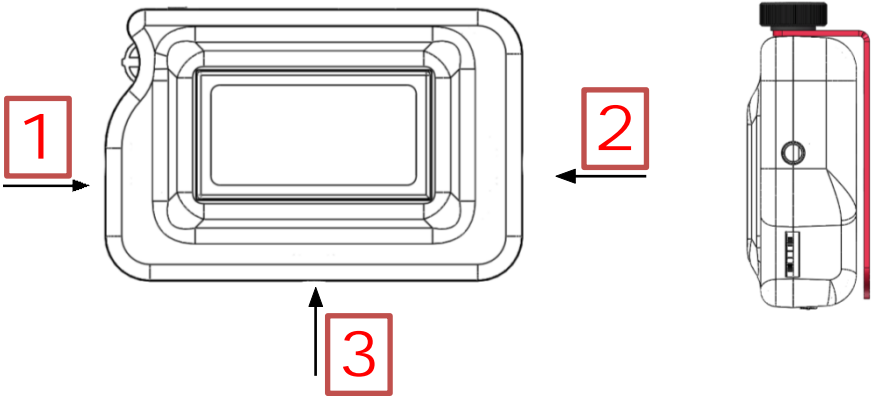


Disclaimer: The bayo is designed to fit tapered and bull barrel muzzles between 0.50 and 2.00 inches in diameter. It is the responsibility of the user to make sure that the bayo is mounted correctly with the sensor deck away from the bullet path.

Setup: Display

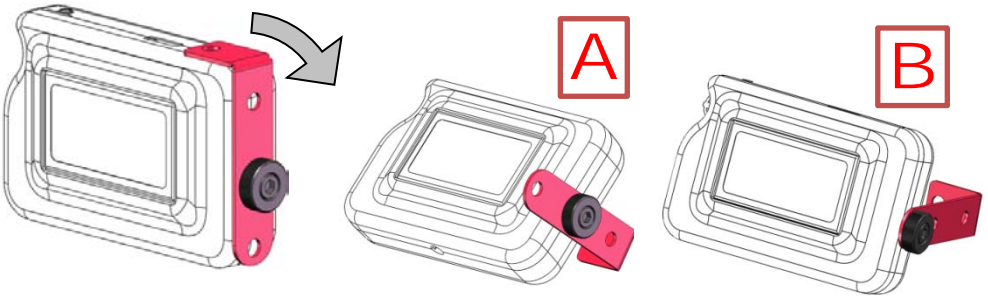
Belt-mount Clip

- Mounting locations 1, 2, and 3
- Slide into belt, pocket, etc.



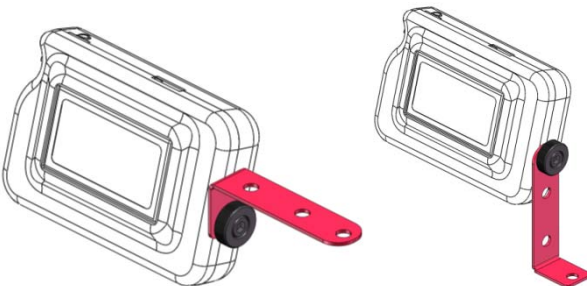
Kickstand

- Mounting locations 1 and 2
- Kickstand configurations A and B



Mounting Options

- Clamp to bench, gun, etc.



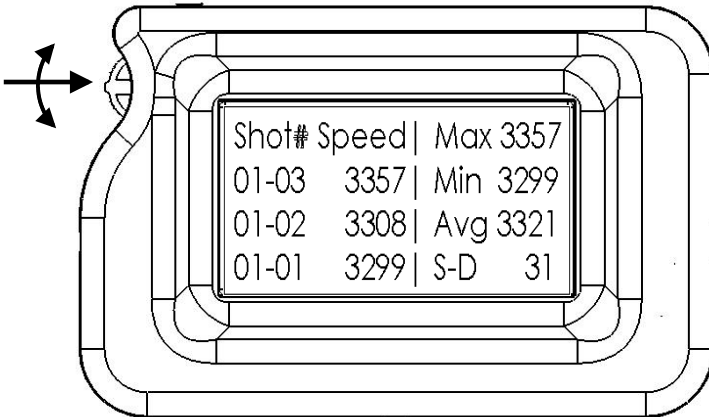
Operation & Menu

Display Definitions

- Max: Maximum
- Min: Minimum
- Avg: Average
- S-D: Standard deviation
- ES: Extreme Spread
- ft/s: Feet per second (default)
- m/s: Meters per second

Home Screen

The home screen is displayed by default. The left side of the screen displays the individual shots, while the right side shows statistics. Moving the display switch down, as seen on the right, scrolls the left side of the display to show earlier shots. Moving the display switch up scrolls the left side of the display up to show more recent shots. In the home screen, pressing in on the display switch brings the menu screen.



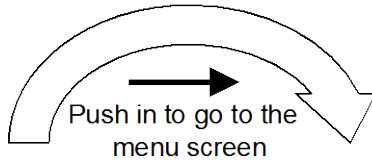
Display Unit

Shot Series/
Shot String

Shot Speed
(default: ft/s)

Shot Number

Shot Statistics



Home Screen

Shot#	Speed	Max	3357
01-05	3301	Min	3299
01-04	3323	Avg	3321
01-03	3357	S-D	23
01-02	3308		
01-01	3299		



Push down to scroll the shot velocities down

Shot#	Speed		
01-05	3301	Max	3357
01-04	3323	Min	3299
01-03	3357	Avg	3321
01-02	3308	S-D	23
01-01	3299		

Menu Screen

->Go Back
Delete a Shot
Set Bullet Type
Reset Series to 1
Archive Series
Clear Series Shots
Diagnostic Mode
Switch S-D & ES
Switch ft/s & m/s
View Archived Data
Set Backlight Mode
Reset System

Menu Screen

As with the home screen, moving the display switch up and down scrolls the display. Pressing in on the display switch performs what ever action the cursor (->) is pointing to

Go Back

Returns to the home screen.

Delete a Shot

Displayed on the home screen, deletes shot from current series.

Set Bullet Type

(See Bullet Type on next page)

Reset series to 1

Deletes all shots and starts series back at 1.

Archive Series

Saves current series to micro SD card and starts next series.

Clear Series Shots

Deletes all shots from current series.

Diagnostic Mode

Displays additional shot info to help diagnose issues.

Switch S-D & ES

Changes what statistic is displayed on the home screen, standard deviation or extreme

Switch ft/s & m/s

Changes between ft/sec & m/sec.

View Archived Data

Shows data saved to SD card.

Set Backlight mode

Choose between no-backlight, backlight always on, and having the backlight turn on only when the switch is moved.

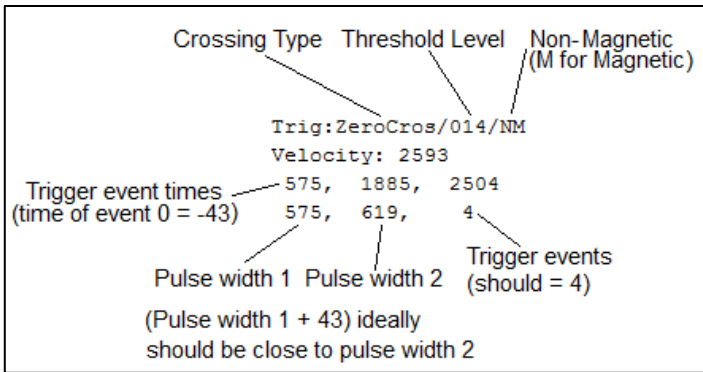
Reset System

Reverts all options back to default.

Advanced Settings

Diagnostic Mode

Diagnostic Mode brings up a screen that shows additional data after each shot. This screen shows the trigger mode that is currently set and the velocity. The two pulse widths are the duration of the positive part of the bullet's passage. They need not be exactly the same, but a large mismatch may indicate a problem. The number of trigger events should be 4. Additional triggers indicate noise pickup. The times of the first trigger events are listed on the fourth line (trigger event 1 is at time -43).



Set Bullet Type

This menu lets you change the type of bullet the unit is set to detect. These settings are saved if the unit is turned off. If the unit is set to a non-default bullet type, the unit notifies the user as such with the display is powered on.

Copper+Lead Core

This is the default setting and works with the vast majority of bullets. If the bullet you are shooting is copper jacketed and does not stick to the magnetic sensors on the bayo, set the bullet to this type. If the bullet sticks to a sensor, it shows that the bullet contains ferromagnetic material. We will refer to this as a "magnetic bullet" although it does not have a permanent magnetic field.

Copper+Steel Core

If the bullet is copper jacketed and sticks to the sensors on the bayo, set the bullet type to this mode. The unit will still detect steel core bullets in Copper+Lead Core mode, but setting the unit to this mode will improve the accuracy.

Shot/Slug

When using a shotgun or a slug gun, set this as the bullet type. This is especially important if you use the thicker rubber pad in the V-block (to decrease the likelihood of the sensor deck getting shot) because this results in weaker signals that the above modes may not detect. A second screen asks if the bullet is magnetic or not; do the same test with the bullet and a sensor on the bayo to figure out if the bullet is magnetic or not.

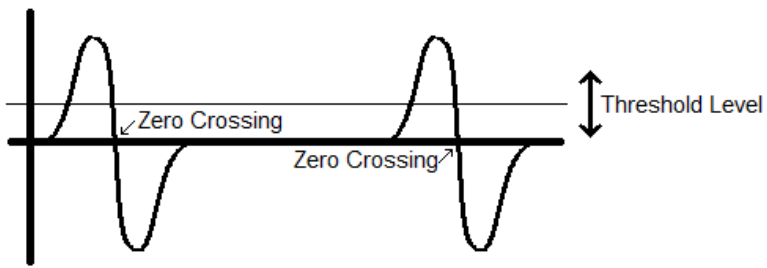
Custom Trigger

The above three bullet types work for the vast majority of bullets, but in some special cases the Custom Trigger option may be necessary.

The first screen in the custom trigger menu asks if the bullet is magnetic or not. If the bullet is not magnetic, the next screen allows selection between Zero Crossing mode and Level Crossing mode. Both modes sense voltage produced by the sensors passing through a threshold level in the positive direction (see waveform sketch on next page). However, in Zero Crossing mode, the device senses the next zero crossing rather than the crossing back through the threshold level. Detecting the zero crossing improves accuracy; however, it is more complex and may cause some problems at extremely low threshold level settings. In those cases, try level crossing. Zero Crossing mode is not available for magnetic bullets because the signal is inverted. The sharp crossing (the one you want to detect for high accuracy) happens before the slow crossing, so there is no way for the device to arm.

Custom Trigger (continued)

The threshold level in the waveform sketch below has been raised for illustration purposes; the threshold level is normally very close to the axis and would be hard to see.



Sketch of the signal from a standard copper-jacketed, lead bullet.

The last screen sets the threshold level. The minimum value is zero and the maximum value is 120. However, mostly values of 14 or lower should be used. Higher values make the unit less susceptible to spurious noise, which usually comes from static electricity discharges or vibrations in the bayo (like hitting it on something, or if it is struck by a sabot). Lower threshold level values let the unit pick up weaker signals.

Technical Specifications

Bayo Mounting

Barrel Diameter Range: 0.5-2.0"

Strapping: 1" wide x 0.06" thick (polypropylene)

Cable clearance: 1.1" (retractable), 2.0" (non-retractable)

Muzzle Brake Accomodation

Muzzle Brake Length: 4.0" (max possible, but not recommended)

Muzzle Brake Diameter: varies

For ~1.0" Diameter barrels (shown below)

Max Brake Diameter = 2.5"

Max Brake Length for max diameter = 3.0"

Display

Screen: 20x4 Character LCD (backlight)

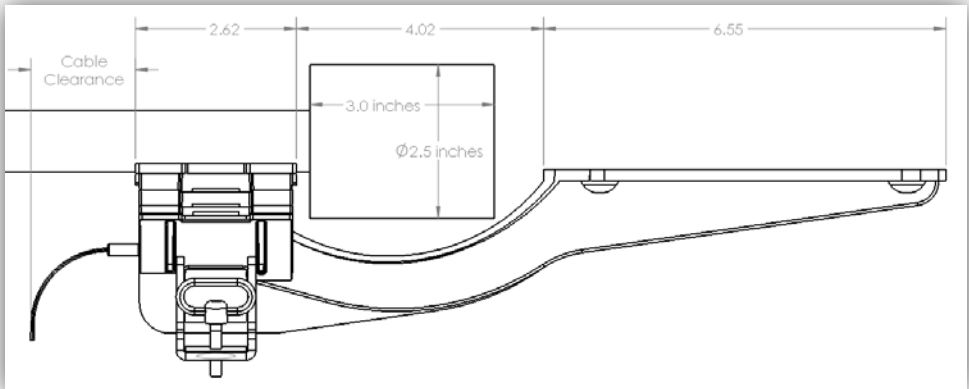
Mounting threads: 1/4-20 UNC (3x)

Bayo Dimensions (shown below)

Overall Length: 12.2"

Sensor Spacing: 5.0"

V-block Length: 2.62"



Suggested Spacer Configurations (always check alignment)

Barrel/ Suppressor Diameter (in)	Caliber (in)	0.125" Spacer	0.25" Spacer	0.375" Spacer	Thin Rubber	Thick Rubber
0.5	≤ 0.400	x	x	x		x
0.75	≤ 0.458		x	x		x
1	≤ 0.50	x		x		x
1.25	≤ 0.50			x		x
1.5	≤ 0.50		x			x
1.75	≤ 0.50	x				x
2	≤ 0.50					x
NOTES						

Troubleshooting Guide (full)

(quick guide on next page)

-Check both the bayo and display cable connections. It is possible to get the display to turn on without the 3.5mm plug being inserted far enough for both sensors to be connected. Even 1/16" of a gap can cause problems. This is the #1 problem we have seen! Please check those connections.

-Check for bayo lean. Is there any obstruction at the muzzle that is causing the bayo to lean away from the shot-line? Straps for iron sights, steps in the barrel diameter, and muzzle breaks are a few examples. You can use a cleaning rod to check alignment. Make sure to rotate the cleaning rod to check its straightness.

-Low signal setup? -> Decrease threshold level. Start with 6, then 4, then 2.

Some setups don't give nearly as much signal to the system as others. Usually this problem can be solved by setting a custom trigger that has a low threshold setting, this makes the device more sensitive. Several conditions influence the signal strength; here is a list in roughly the order of importance.

-1: distance from sensors (closer = more signal farther = less signal)

0.25" is a good distance for the gap between the bullet and sensor deck. Barrels as thick as 1" can generally be used, but the trigger threshold setting may need to be adjusted.

-2: composition of bullet

-thick copper jacket = lots of signal

-all lead, or thin copper coating (like a 22 LR) = way less signal

-Steel core (magnetic) = high, inverted, signal (there is a special mode since the signal is inverted)

Lead is only about 8% as conductive as copper, which makes it much harder to detect. Essentially any other material used in bullets (copper, tungsten, steels) is easier to detect.

-3: speed of bullet (fast = more signal slow = less signal)

This system was designed to work with guns shooting bullets over 1000 fps. It is often possible to pick up bullets traveling slower than 1000 fps by reducing the trigger threshold.

-4: bullet size (bigger = more signal smaller = less signal)

14 and 17 caliber bullets have been used successfully with the MagnetoSpeed V1.

-Try the other cable. We check all cables before we ship them, but cables can have intermittent problems that we cannot find 100% of the time. Also, the cables wear out over time, so problems can develop. We include two cables so that you have a back up.

-If you have a multimeter, check cable + bayo for opens

Plug in the cable to the bayo, then measure the resistance from the tip of the plug to the base of the plug, this should be a few tens of ohms. Then measure the resistance from the middle section of the plug to the base of the plug, that should also be a few tens of ohms. Display units with software versions 3.051 and later do this automatically when the unit is powered on. If you find an open, check the cable for continuity.

-If you have a multimeter, check cable for reversed cable. We have found that some cable manufacturers are not careful with keeping the left and right audio cables straight. Check to make sure the cables are connected properly.



Bad ones are connected like this

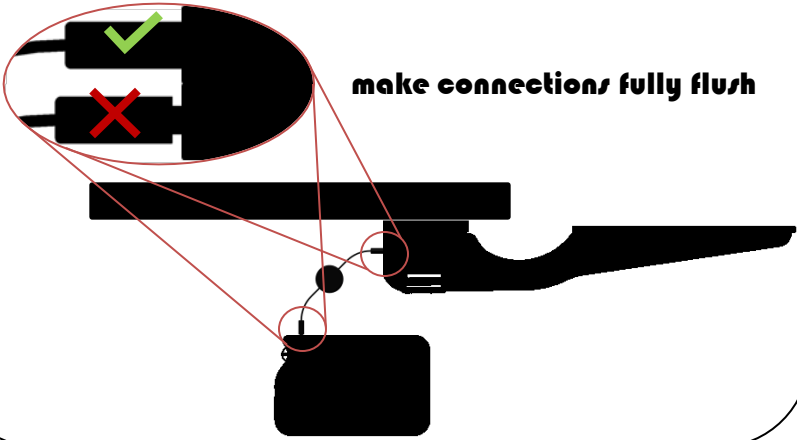


Good ones are connected like this

-If you are still having trouble, contact MagnetoSpeed.

Troubleshooting Quick Guide

1: Check Cable Connections



2: Check Sensor Spacing



Use a cleaning rod to check the spacing of sensor 1 and sensor 2 from bottom bullet edge. Distances should be between 1/8" and 0.375" and they should be within 1/16" of each other.

Common Issues

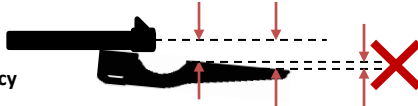
- Lean in

- Bayo damage
- Reduced velocity accuracy



- Lean out

- Shot pickup error
- Reduced velocity accuracy



- Thick muzzle/barrel

- Low signal
- Reduced velocity accuracy
- Shot pickup error



- Muzzle too close to Sensor 1

- Signal gets noisy
- Reduced velocity accuracy
- Shot pickup error



- V-block overlaps muzzle

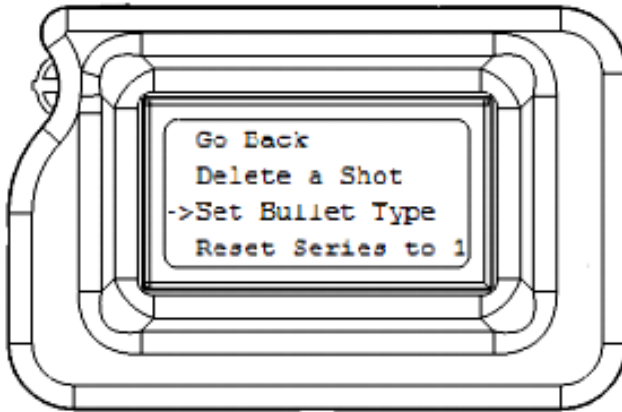
- Bayo/strapping damage



3: Use a Custom Trigger

Setups with.... -lead (Pb) bulletsproduce low signals
-thick muzzles
-slow bullets
-small bullets

Use a threshold of between 2 and 6 for these setups. Lower threshold settings are MORE sensitive; use settings of <2 only for setups with minimal muzzle blast.



Visit our website
MagnetoSpeed.com
for more information
& instructional videos!