Reference Manual
January 2019

- Access Point
- Sensor Hub
- Sensors (4)
- Brackets (4)
- Sensor cables (2 short, 2 medium, 2 long)
- Couplers (2)
- Antenna
- Antenna extension cable
- USB charging cable (2)
- #8 wood screws (20)
- Velcro (2)
- Calibration targets (2)

- Shots of any caliber will be detected which:
    - Arrive within the sensor area
    - Have supersonic velocity at the target
    - Arrive at an angle within 20 degrees
    - Do not hit a solid material mechanically attached to the sensors (such as the frame itself, or a backing material that is too stiff)

- All components are sealed and will function in the rain.

- Parts are available at theshotmarker.com.

A set of brackets allow you to install the system on a second target frame.

The white sensor is intended to replace any color.
Unscrew the white sensor base and reattach so that the sensors point inwards, matching the sensor you are replacing.

The sensor cables are standard 3.5mm stereo audio cables.

The antenna extension cable is standard RJ-174.

All parts are warranted to function as intended for two years with normal wear and tear. Warranty does not cover damage to due to shooting or dropping the components, or cosmetic damage. If there are any problems, contact adamjmac@gmail.com and we will help keep your system up and running.

Installation

- Frame construction
  - The target frame can be any size square or rectangle.
  - Ensure the frame is not warped so the brackets lay flat in plane.
  - Ensure the frame is rigid enough to not flex in the wind.
  - Do not install any solid materials within the sensing area where the bullets may impact (ie. cross pieces or stiff backer).

- Backing material
  - Use a soft material such as corrugated plastic or cardboard.
  - If the bullet impacts the frame or a solid object, it may cause a sharp vibration and the shot may not be recorded.
  - Do not use a stiff foam or any rigid material that will transfer vibration from the bullet impact to the frame.

- Frame installation
  - Secure the frame so it does not move excessively in the wind.
  - If using a carrier, wedge the frame and secure the carrier so it cannot rock back and forth.


Accuracy considerations

- **Low shot quality** is caused by crooked sensor placement.
  - Calibration will fix the center, but there will be some error towards the edges of the frame.
  - Check the shot quality to validate a new frame (see page 8).
- **Random error** is caused by sensor movement.
  - Ensure the frame does not flex and shake in the wind.
  - If the wind seems to cause low shot quality, the target frame could probably be more secure.

Installation

- Install the sensor brackets on your target frame.
  - Use #8 flat head screws and <u>do not over tighten</u>.
  - Ensure the brackets are flat and in plane with the target.
  - Measure diagonally to ensure your sensor area is rectangular.
  - Observe the brackets from the side to ensure they appear to be laying flat so that the sensors will all point the same direction.
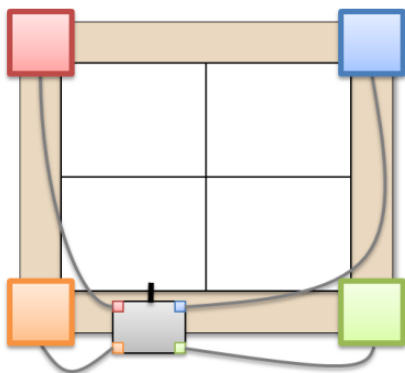
- Measure **width** and **height** in millimeters.
  - Measure "left to left" or "right to right" of each sensor bracket, NOT the outer extent.
  - Measure both sides and take the average, if close.
  - Mark the correct values on your frame for future reference.
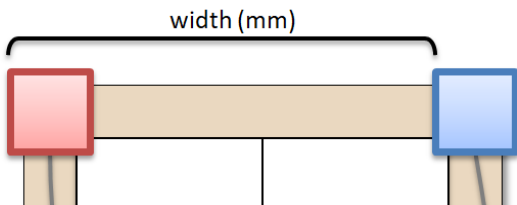
Sensor Hub

1. Place the Sensor Hub on your target frame.
   - Mount as high as possible without risk of being shot.

2. Press the red button to turn on the Sensor Hub.
   - The Sensor Hub will connect to the Access Point immediately.
   - The Sensor Hub will automatically turn off after 12 hours if not connected to an Access Point.

3. Connect each sensor to the color-coded port.
   - Choose the shortest cables possible to minimize slack.
   - Ensure the green light is solid.
   - If the light is blinking continuously, check that all cables are fully inserted. One cable may be partially connected.

4. Connect the antenna.
   - The antenna extension cable is optional. Check signal strength first without it and only use it if necessary.
   - Do not use the antenna as a handle. If the antenna cover is detached, carefully slide it back into place.

- Battery lasts for 100 hours.
- Charge from any USB power source.
- Blue light while charging; off when fully charged
- Can charge while running. Reported battery level will be higher while charging.

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Access Point

1. Press the red button to turn on the Access Point.

   - After 1 minute, the light will remain solid.

   - To shut down, press the button. Press again within 5 seconds to cancel the shutdown.

   - The Access Point will automatically turn off after 3 hours if no Sensor Hubs are connected.

2. Connect to the **ShotMarker** Wifi network on your tablet, smartphone, or PC.

3. Open a web browser and navigate to **192.168.100.1**

   - This address is printed on the rear of the Access Point for reference.

   - With Chrome for iOS or Android, you can add a shortcut to your home screen which will start full screen mode.

4. Position centrally to ensure a strong Wifi signal for everyone in the area.

   - A repeater is also available which will extend the Wifi range across a wide firing line. Contact us for more info.

- Battery lasts for 18 hours.

- Charge from any USB power source.

- Blue light while charging; off when fully charged.

- Can charge while running. Reported battery level will be higher while charging.

Target Configuration

Sensor Hub **#24**

100% remaining
est. 4 days 4 hr

RSSI: -100, SNR +9
tap to refresh

Sensor Monitor

Target Frame

Name: MR-4 LR-4 +

Measure the center-to-center distance between sensors in millimeters.

Width: 1742 mm **Height:** 1815 mm

Calibrate the target to account for the position of your physical paper target.

Calibrate **Δ X:** +7 mm **Δ Y:** +12 mm

Measurement Quality

Estimate from 3 shots: **Excellent!**
You've likely over-engineered your target frame. Good job!

- Enter the sensor area **width** and **height** as measured.

- Verify signal strength.
  - RSSI between -100 and -120 is a reliable, strong signal.
  - If your signal is weak, try raising the Sensor Hub antenna and the Access Point off the ground.
  - Be sure to refresh a few times for a true reading. Find a position that works and the signal should be reliable.

- Press + to create additional profiles for installing this Sensor Hub on multiple target frames.

Calibration & Verification

- Tap **Calibrate** to enter calibration mode.

  1. Attach a calibration sheet centered on your aiming point.

  2. Fire two or three shots which impact the sheet.

  3. Zoom in as needed and drag the reported shots to their true positions (it doesn't need to be perfect!).
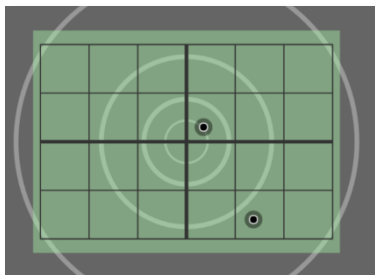
Note: The objective of calibration is to shift the center of the virtual target to align with your physical paper target. You only need to do this once, even if you change distance or shooting location.

You can adjust the calibration offset at any time as long as there is a shot on the target.

- **IMPORTANT:** Always use the **Sensor Monitor** to validate a new frame and ensure shots are being recorded accurately.

- While the sensor monitor is open, all sensor readings are recorded, not just readings that seem like real shots. You can troubleshoot most sensor and cabling issues with the Sensor Monitor.
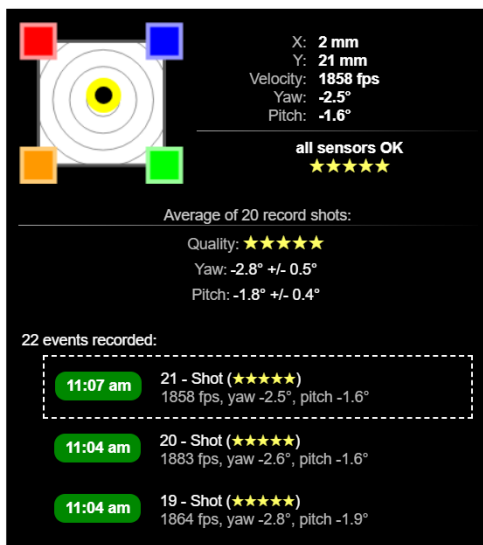
Interface Overview

hidden shot
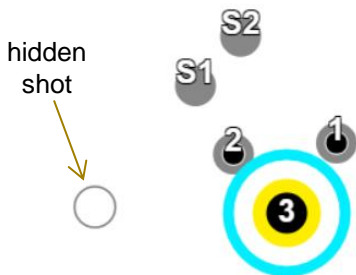
Tap to select a shot.
New shots have blue highlight.

Drag to pan, pinch to zoom.
Zoom in for all shot numbers.

shot # **5** **X** fps **2421**

Selected shot details.
Tap to strike the shot, or to
insert or modify a score.

Access Point status and
system configuration.

Sensor Hub status and
target frame configuration.

NRA MR-63FC
at 300 yards

Target face and distance.

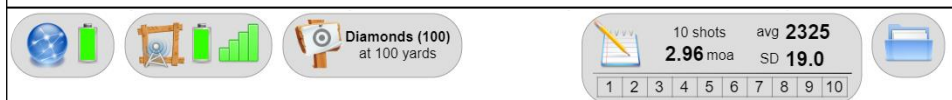5 shots avg **2431**
2.98 inch SD **6.1**
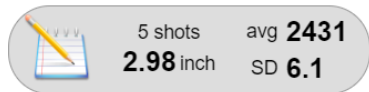
Tap to save / clear the target.
Displays stats for all record shots.

Archive of saved strings.

Tip: Try the Shot Simulator to create some fake shots
and explore the interface before you start shooting.

Top target (NRA SR at 200 yards):

shot # **2** **X**

7 shots
69-3X

| 10 | 9 | 10 | 9 | | | |
| 10 | X | X | 9 | 10 | 10 | X |

NRA SR at 200 yards

Tap to modify score or remove shot from record

Tap to save/clear the target

Tap to select an individual shot

ShotMarker

Bottom target (Diamonds (100) at 100 yards):

Diamonds (100) at 100 yards

10 shots   avg **2325**
2.96 moa   SD **19.0**

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
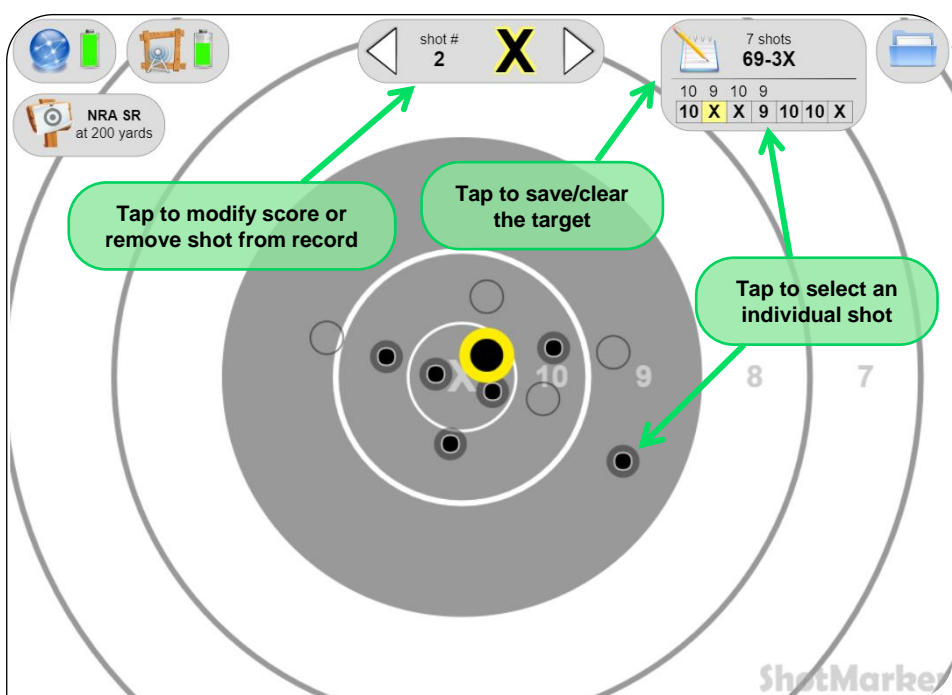
Zoom in to see shot numbers

44.1 Varget, 10 jump

5 shots
w: 0.41 moa
h: 0.63 moa
v: 2327 fps
sd: 17.0 fps

44.3 Varget, 30 jump

5 shots
w: 0.79 moa
h: 0.74 moa
v: 2323 fps
sd: 20.7 fps
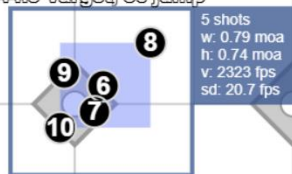
**Double-tap to analyze a group.
Double-tap again to label the group.**

ShotMarker

Administration

Access Point

	100% remaining est. 18 hr 0 min		99% free est. 100k shots		Dec 19, 2018 11:12 am

Display Preferences

Grid: `off` `1 moa` `0.2 mil`

Velocity: `off` `fps` `m/s`

Stats: `off` `score` `inch` `mm` `moa` `mil`

Shots: `all` `recent` `delayed` `delayed & restricted`

Sighters: `none` `one` `two` `two convertible` `unlimited`

Caliber: `224` `243` `264` `284` `308` `338` `408` `510`

Target Row: `hide` `show` `show & highlight`

Admin Lock: `open` `basic` `lockdown`

System Management

`Hide Unused Targets` `Shot Simulator` `Switch Channel` `Export CSV`

`Save Backup` `Restore Backup` `Software Update`

Version 1.08 (December 17, 2018) (1 devices connected)

Time remaining is estimated. Reported battery life will be higher while charging. Remember to charge the Access Point before each full day of shooting.

Storage capacity for saved strings.
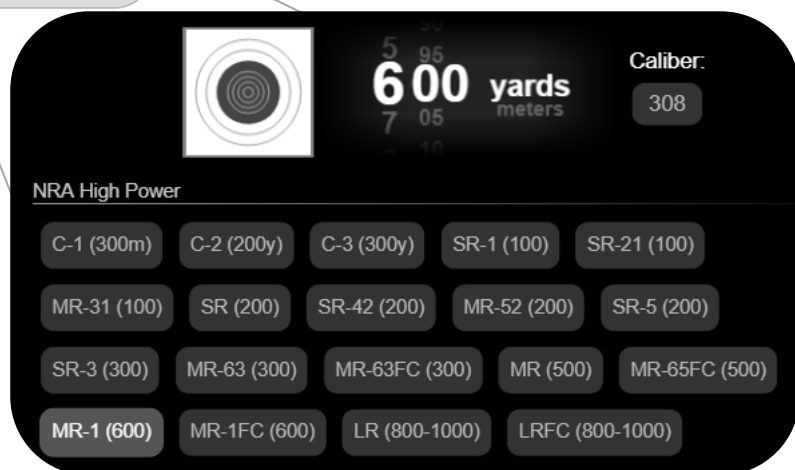Tap to erase older strings and free space.

If the time is incorrect, tap to sync the system time with your device.

- **Grid**: overlay a grid on the target (useful for scope adjustments).

- **Velocity**: display shot, average, and SD of velocity at the target.

- **Stats**: preference for display of total score or group size unit.

- **Shots**: control how shots are displayed on target (useful for competition). See page 16 for details.

- **Sighters**: choose whether the first few shots are interpreted as sighters (useful for competition). See page 16 for details.

- **Caliber:** select the bullet size used for display and scoring (the hole may touch the edge of a scoring ring).

- **Target Row:** display the most recent shot on adjacent targets, with an optional highlight when a new shot arrives.

- **Admin Lock**: restrict functionality to shooter and spectators with a password. See page 18 for details.

- **Show / Hide All Targets**: show or hide all targets which are currently disconnected for offline configuration.

- **Shot Simulator**: double-tap to simulate a shot on target (useful for demonstration and training).

- **Switch Channel**: move your Sensor Hub and Access Point to a separate radio channel to operate independently from another ShotMarker system in the area. See page 18 for details.

- **Export CSV**: export saved strings within a recent period of time (day, week, month, etc.) to a formatted spreadsheet.

- **Save / Restore Backup**: export a backup file of everything stored on your Access Point. **Save backups often!**

- **Software Update**: update software regularly to ensure you have the latest features, target faces, and fixes. Visit theshotmarker.com for the latest download and instructions.

Target Face and Distance

NRA MR-63FC
at 300 yards

6 00 yards
5 95
7 05

meters

Caliber:
308

NRA High Power

C-1 (300m)	C-2 (200y)	C-3 (300y)	SR-1 (100)	SR-21 (100)
MR-31 (100)	SR (200)	SR-42 (200)	MR-52 (200)	SR-5 (200)
SR-3 (300)	MR-63 (300)	MR-63FC (300)	MR (500)	MR-65FC (500)
MR-1 (600)	MR-1FC (600)	LR (800-1000)	LRFC (800-1000)	

- Select the target face to be displayed.
  - Choose any target that you would like your shots to be displayed and scored on. Remember, your physical paper target is just an aiming mark and doesn't necessarily have to match.

- Select the distance to the target.
  - Any target can be used at any distance. Tap the number to change the distance, and swap between yards and meters. This will only affect calculations of moa or mil, including the grid.

- If necessary, enter a custom bullet caliber.
  - Only use this if each target should use a different caliber. Otherwise, use the global setting (see page 11).

- Tap the checkmark to apply changes.
  - If the target is part of a group, the entire group will be updated. See page 17 for instructions on grouping targets.

13   Email adamjmac@gmail.com to request additional target faces.

String Archive

- All strings saved with a name are stored in the archive.
  - Saved strings are organized by date and time.
  - **Backup your data regularly!**

- Select a string to display a summary.
  - The summary includes the target number, target face, distance, time of day, number of shots, and total score or group size.

- Tap the checkmark to open the string.
  - You can select and review individual shots, as well as use the Sensor Monitor to check shot quality.
  - You may make changes to saved strings. For example, you may modify which shots are on record or analyze groups after you have finished shooting.

Keeping Score

20 shots
194-9X
X 10 **X** **X** **X** **X** **10** **X** **X** **X** **10** **10**
9 **10** **X** **9** **9** **X** **10** **9** **10** **8**

All shots are displayed in a scorecard. Tap a specific shot to select it.

With a shot selected, tap the shot detail panel: shot # **1**   **X**   fps **2307**

Sighter   or   **Record**

Sighters are valid shots that will remain on the scorecard but not be included in the total score or group measurement.

Hide   or   **Recover**

Hidden shots are shots that you did not fire and should not be counted (crossfires, for example).

Modify

Manually adjust the score to any other value. For example to reduce the value by 1 point.

Insert

Insert a shot of any value after this shot. For example, to insert a miss with zero value.

Shots that have been modified or inserted are highlighted in green:

`10 0 9 X`

Sighters can exist between record shots but are shown in red so you know something isn't quite right.

`10 X 9 X X`

Sighters before record shots

A grey bar indicates hidden shots exist between these record shots

`10 X 10 X 9 10 9 X`

Sighter Modes:

- **None**: All incoming shots are assumed on record. You can still manually declare shots as sighters.

- **One / Two**: The first one or two shots will be assumed non-convertible sighters.

- **Two Convertible**: after firing two sighters, conversion buttons are displayed to the shooter:

- **Unlimited**: All shots are assumed sighters until this button is pressed:

Shot Display Modes:

- **All**: all shots are displayed immediately and remain on target.

- **Recent**: only the most recent shot is displayed.
    - Multiple shots within 20 seconds remain as a group (useful for identifying crossfires).

- **Delayed**: display only recent shots, and incoming shots are delayed by 7 seconds.
    - Shooters will know that a shot has been detected, but not its position or value until the delay period expires.

- **Delayed & Restricted**: display only recent shots with a delay, and any shots arriving within the delay period are automatically modified to a score of zero.
    - The score can be restored (useful in case of a crossfire).

Managing Multiple Targets

- One Access Point will connect all Sensor Hubs.
  - Target frame profiles (name, width, height, and calibration offsets) are stored on the Access Point, not the Sensor Hub.
  - Each Sensor Hub in the area will appear as a selectable target on the bottom of the display.

- With multiple targets in use, rename your frames to be identifiable to shooters.
  - Add a target to a group by prefixing the group name and '**-**'. Example: **BAT-10** will add target **10** to the group **BAT**.
  - Grouped targets will change target face and distance together.
  - When **Admin Lock** is enabled, the group name is hidden.
  - If the targets are not grouped, then you can select a different target face and distance on each one.

- When multiple targets are connected, the **Target Row** option is available.
  - "Show" will display the most recent shot on many adjacent targets, useful for competition.
  - "Show & Highlight" will also highlight the target for a few seconds when a new shot arrives, helpful for range staff to identify crossfires.

Admin Lock

- **Basic** mode
  - Configuration and target face selection require a password.
  - All shooters and spectators will be able to save strings and modify shots.
  - This mode is recommended for most situations when range staff is limited, especially when shooters bring their own tablets.

- **Lockdown** mode
  - Spectators may only view targets and saved strings.
  - A tablet must associate to a specific target (requiring a password) in order to save strings and modify shots.
  - Once associated, that tablet cannot switch to view another target.

Tap the lock icon to temporarily unlock your tablet.
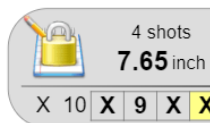
In Lockdown mode, tap the locked notebook to associate to this target.

Switch Channel

Change the radio channel in order to completely isolate your Access Point and Sensor Hub(s) from another active ShotMarker system.
This feature requires firmware from June 17, 2018 or later.

1. **Select a channel** you wish to use (for example, 3).
2. **Tap on each Sensor Hub** in the list to switch it to channel 3.
   - It will disconnect since it is no longer on the same channel as your Access Point.
3. **Tap the checkmark** to switch your Access Point.
   - Reconnect to the Wifi network (for example, ShotMarker3).
   - Now, Sensor Hubs on Channel 3 will be visible.

IMPORTANT: There can only be one Access Point on a given channel.
The Access Point will not power on if there is another one in the area.
When you turn it on, the Access Point or Sensor Hub light will blink to indicate which channel it is currently on.

Troubleshooting

If anything weird happens, please contact adamjmac@gmail.com.
Your feedback helps the system improve.

- If you fire a shot, and nothing happens:
    - Open the **Sensor Monitor** and fire another shot. When the Sensor Monitor is open, all sensor readings are transmitted even if they seem invalid.
    - If you see invalid sensor readings, the target backing material may be too stiff. Fire a shot just off target and the Sensor Monitor should detect it as an off-target shot.
    - If you see no readings at all, check that the Sensor Hub light is solid and not blinking rapidly (see below). Ensure your bullet is passing through the sensor area with supersonic velocity.

- If the Sensor Hub light is blinking rapidly:
    - One of the sensor connectors is partially inserted, or full of water. Disconnect each cable to determine which one is the problem.
    - If the light is blinking even with no cable attached, check that the connectors are clean and free of debris.

- If you have repeated disconnected/missing sensor warnings:
    - Check that the cable is intact and that both ends are connected.
    - Swap in another cable to determine if the cable is broken.

- If you have repeated shot quality or angle warnings:
    - Ensure the target frame is secure and not rocking back and forth.
    - Look at the frame from the side. Ensure the brackets are laying flat so that the sensors will be pointed perpendicular to the frame.
    - Lay a long straight edge across the brackets to ensure they are laying flat.
    - If you see a warning message that the rear sensor fired before the front, the backer material is likely too stiff.