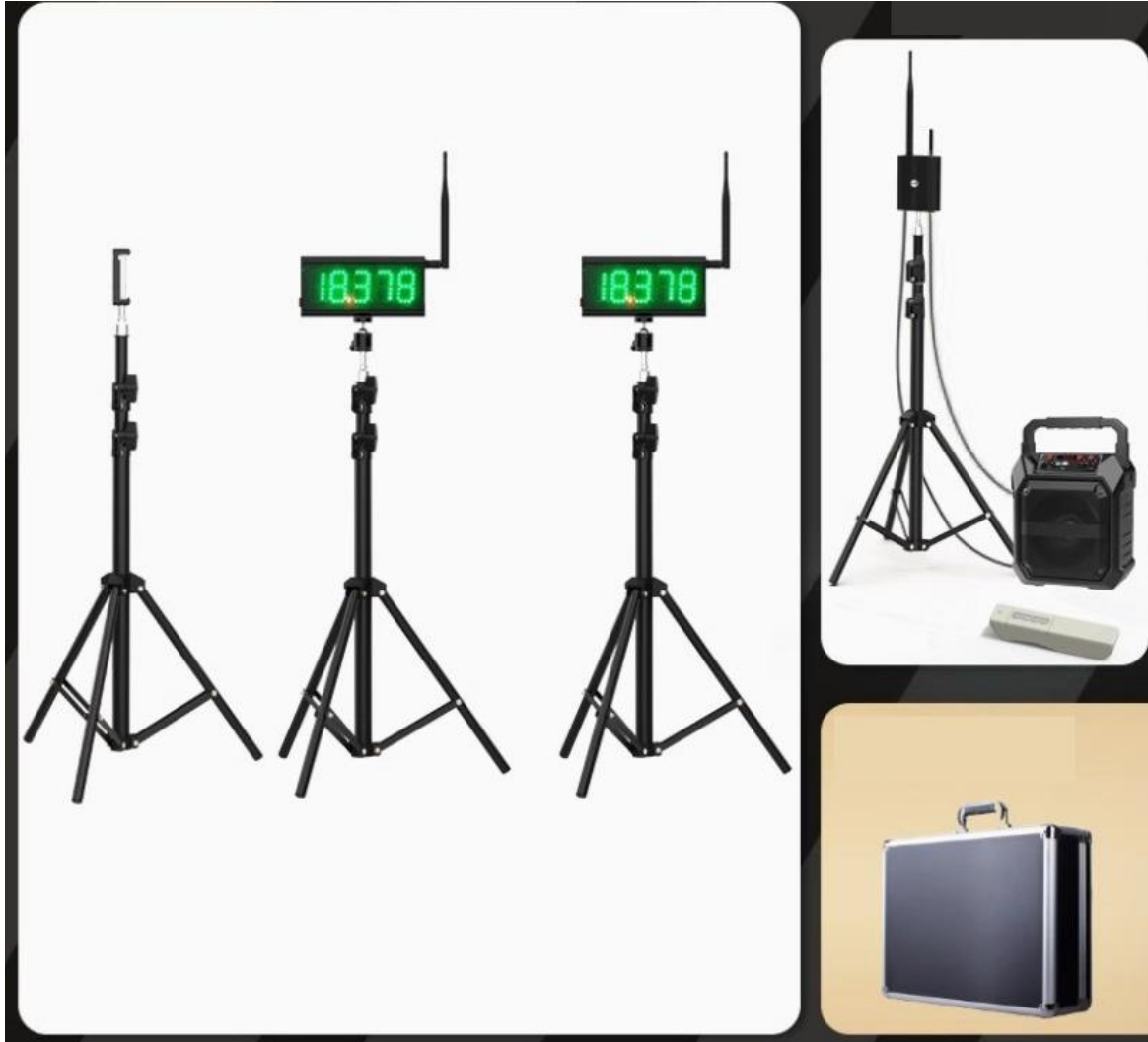


Initial Set-up

(Instructions show example set-up for 2 gates. More gates would mean more stands and timers.)



Warning: Do not look directly into the lasers. Do not allow children to look into the lasers. Do not aim it wildly, but aim it at the reflectors.



1. Unpack parts. (Carry case shown before and after removing plastic sleeves from internal parts)



2. Expand all stands to similar heights, using the 3 knobs on the sides.



3. Insert the reflector into its clamp.



4. Screw the swivel piece into the back of the clamp.



5. Screw the clamp onto one of the stands. (Reflector stand is complete.)



6. Screw the timer displays onto the stands **carefully and gently**. Do not force it. If the threading is not seating properly, then unscrew and try again. It only needs to be attached a **little tightly**.



7. Remove the yellow protective cap (keep it in the carry case), then install a large antenna into this position. Gently change it to an upward rotation. (Timer stands are complete, except for charging.)



8. Screw the signal box onto a stand **carefully and gently**. Do not force it. If the threading is not seating properly, then unscrew and try again. It only needs to be attached a **little tightly**.



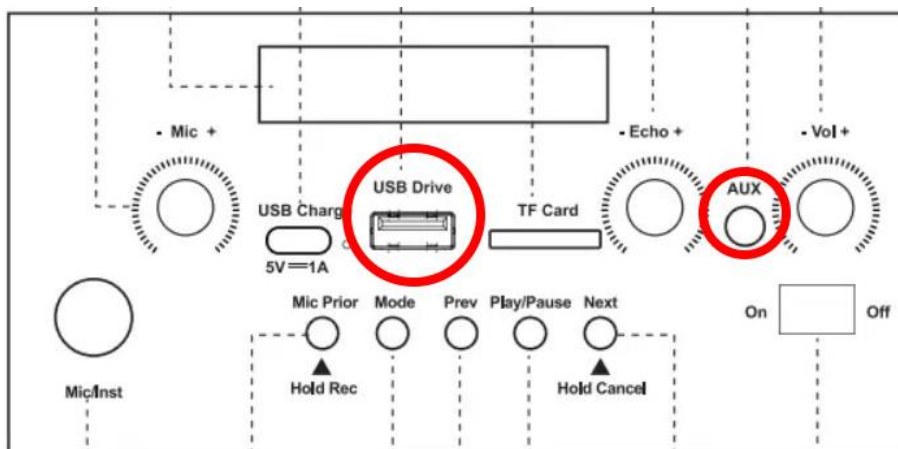
9. Remove the yellow protective caps (keep them in the carry case), then install a large antenna into the 2.4GHz position, and a small antenna into the 433MHz position.



10. Insert the small audio cable and larger power cable into the base of the signal box. (Signal stand is complete. These 2 cables will later attach to the speaker.)



11. The 2 cables attach to the speaker via the USB and AUX plugs. If you turn on the speaker, the signal box will become powered via USB cable from the speaker, and the green light will show. (The speaker and signal box are a pair, to stay together when in use.)



12. **Initial assembly complete.** The pieces may be left in this state until ready to charge them or use them. Continue on to the charging section (you may disconnect the red circled pieces for convenient charging).



Charging

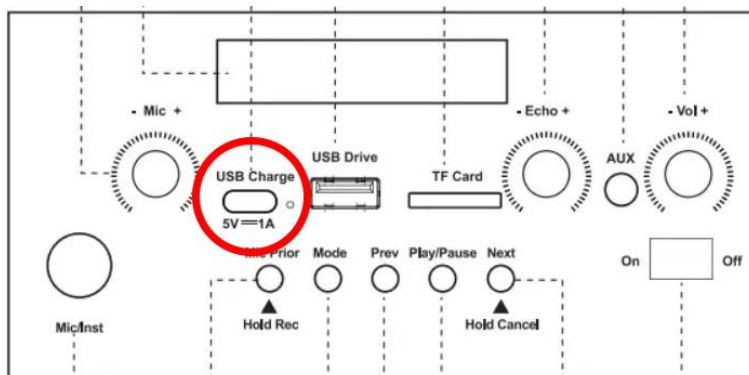
1. These are the pieces which are battery powered, and need charging.



2. The timer displays are charged via USB-DC power cables. If they are charging, they'll show a red light. Once charged, they'll show a green light. If you switch on the display, the display will quickly show the battery charge (50% and 100% shown below). Time to full charge is approximately 3 hours.



3. The speaker is charged via USB to USB-C power cable. If it is charging, a red light will appear. Once charged, the light will turn off. (English translation of the display shown below)



4. The signal box **will not** require charging, as it draws power via the speaker.



5. The remote uses a 9V battery, and is **not** rechargeable.



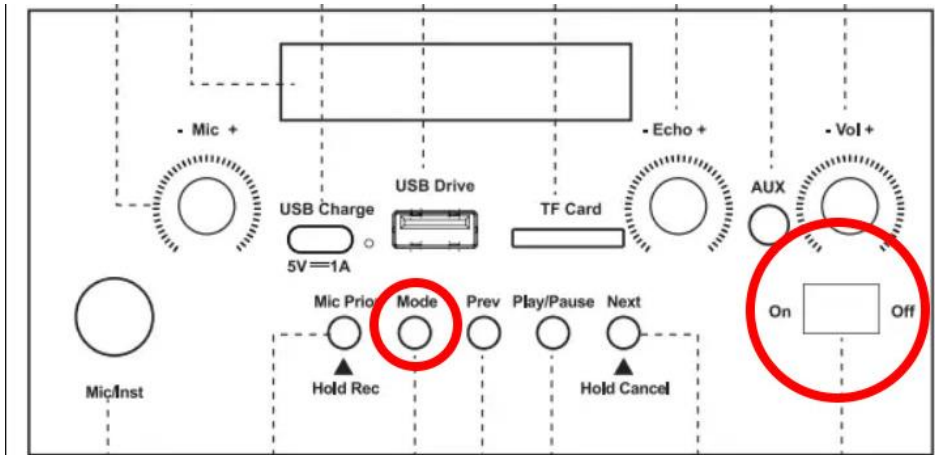
6. If all items are charged, then you're ready to use the equipment wirelessly. Continue to the Usage section.

Usage / Alignment

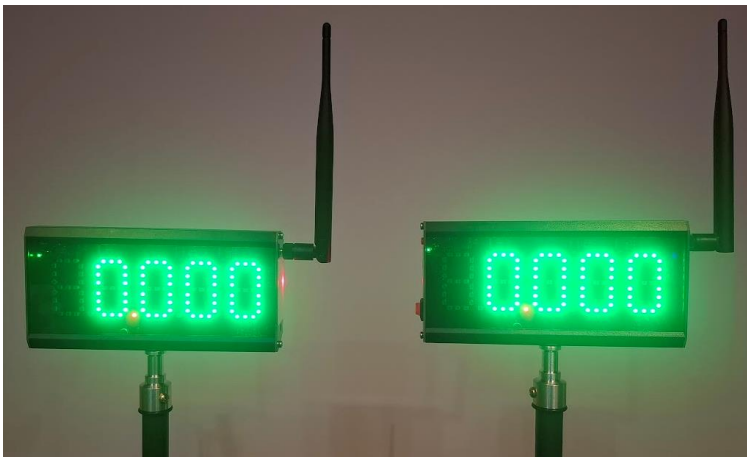
1. Your equipment will look like this and be fully charged. (Plus the remote)



2. Switch on the speaker, and press the Mode button (to change it to AUX mode, so it can receive audio from the signal box). The signal box will show a green light. If wanting to adjust the volume, then rotate the Volume knob on the right. If your remote is turned on, and can press the B button to make a sound and test the volume.



3. Switch on the displays. (Red switch)



4. One timer should have its laser aimed at the reflector of the next timer. The final timer should have its laser aimed at the reflector on a stand. (You can decide whether to have the timers facing the racers, or away from them, by rotating the displays and having the reflector on the right instead.) These will act as the finishing line, so space them out at a safe distance for people to pass through (noting that the legs of the stands will not be tripped over).



5. The signal box and speaker are to be placed near the starting line. The speaker will act as the starting gun, and upon firing, the timers will begin from 0.000.



6. Take the remote. Switch it to the N 'On' position. You can press a button and note the red light at the top of the remote, to check that the battery is working.

A – “On Your Mark”

B – “Set”

C – (gun fires)

D – (resets all times back to 0) **Do not press by mistake.**

Press A, Press B, Press C. “On Your Mark, Set, (gun fires, timers start)”.



7. Upon passing through each gate, the respective timer will stop. Below shows 6.225s and 3.829s.



8. The system is now working. You can write down your race times, then turn off the remote, displays and speaker.

Advanced Settings / Changing Modes

1. Hold the Key button for 5 seconds to enter the settings menu. Press it again to swap between F1, F2, F3, F4 (see further details below). Turn the device off then on again to lock in your selection. When it turns on, it'll ask for your sub-setting selection (see further details below). Turn it off and on again to lock in your selection.

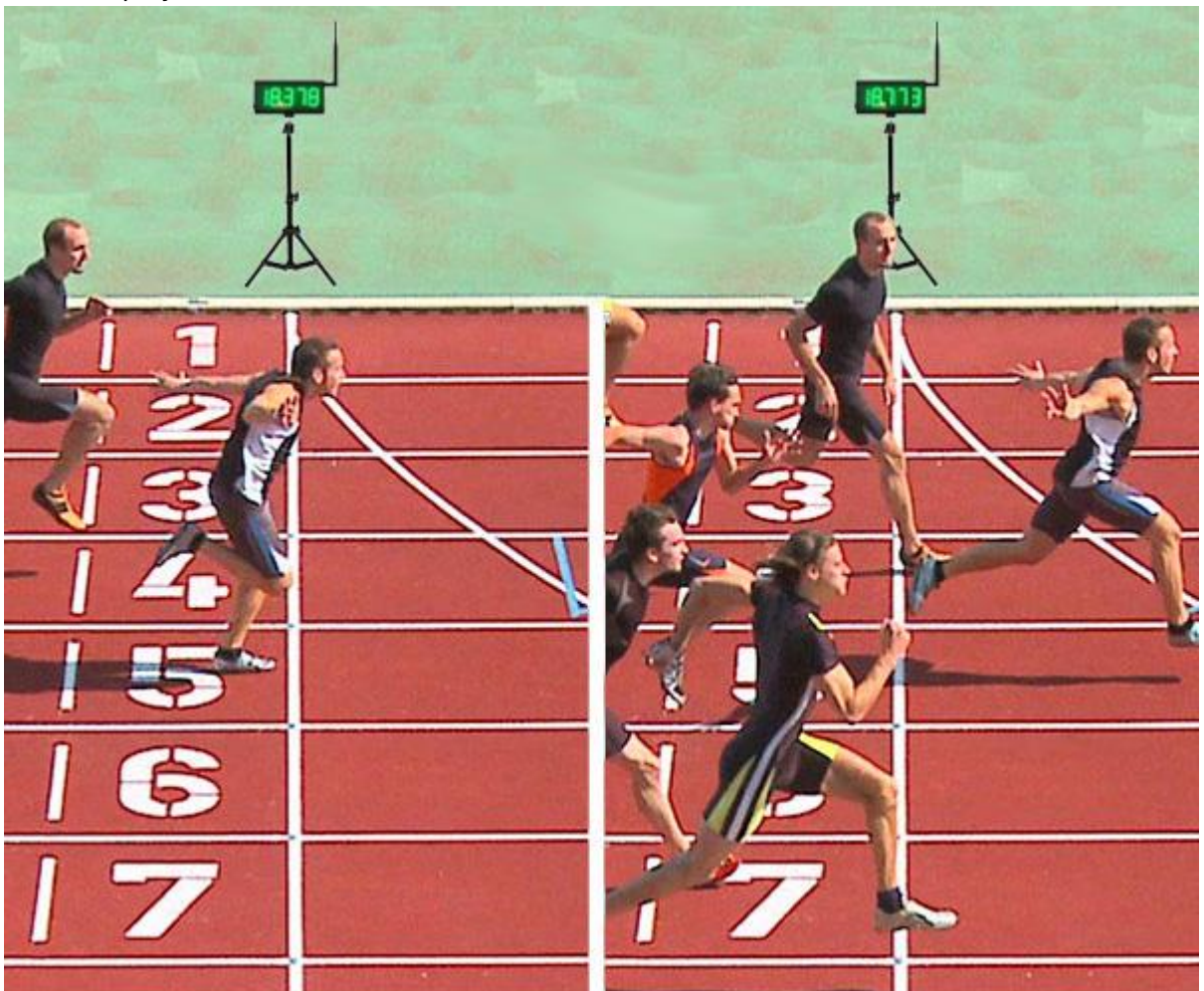


2.

F1: Device number, 1-10. (No changes needed)

F2: Select mode.

- **P1** Normal mode (50m, 100m, 200m, 300m, 400m split)
 - o Option 1: Remote's C button fires and starts the timers. Passing the timers stops them, displaying times.
 - o Option 2: Can be used as a single lane without remote start by: using 2 timers and 2 reflectors. Upon passing timer 1, both will start. Upon passing timer 2, both will stop.
- **P2** Starting point trigger mode (Multi segment sprint timing – **requires additional reflector stands**. No remote or speaker is required.)
 - o Set 1 device to P2, and the rest as P1. No remote or speaker is required, but each device needs a reflector stand. Upon passing P2, the other timers will start. Upon passing the others, they'll each stop.
- **L1** Video Camera timing mode (1 timer for multiple athletes, no laser or reflector needed)
 - o **(Most reliable / lowest error mode for research purposes)**
 - o Place a timer set to L1 beside the finishing line. With a high speed camera, record a video of the athletes passing over the finishing line, with timer visible. Remote's C button fires and starts the timer. Replay the video to note each racer's time, at the sacrum or torso.



- **L2** Single machine, multiple timing mode (**not recommended**. 50-400m. Up to 20 athletes.)
 - o 1 timer and reflector at the finish line. This timer will record all athletes times. Upon finishing, press 'Key' button to stop, then 'Key' button again to view the times. (Chance of recording mistakes eg. 2 athletes finishing together.)

- **L3** Multi-lap long distance running mode (800m, 1000m, 1500m etc. Up to 20 athletes.)
 - A, B, C to start, as usual. This mode is for multi-lap races, so the laser will not activate to lock the time as athletes pass it. Once all athletes are into their final lap, press B. This will activate the laser. As athletes finish the final lap, the timer will record all times. Press 'Key' button to stop, then 'Key' button again to view the times.
- **H1** Multi lap, cumulative timing mode (for multiple turnback runs like basketball dribbling. No remote or speaker is required.)
 - Only requires timer and reflector. Upon passing the timer, the time will start. Each time you pass it again, the timer will update to show the total time (it keeps counting in the background). The results will not be recorded.
- **H2** Lap timing mode
 - Only requires timer and reflector. Upon passing the timer, the time will start. Each time you pass it again, the timer will update to show the time since past pass.

(When you power the device on, your mode code will show for a second)

F3: Channel (**Do not change** – message us if needing to change it. It is only applicable when multiple sets of equipment in the same venue are interfering with each other.)

F4: Laser Brightness, 1-7.

Further Notes and Warnings

1. Only use the include charging cables, to avoid potentially damaging the equipment.
2. Be gentle when screwing timers/signal boxes onto stands, to avoid damage from screwing incorrectly or too strongly.
3. The timers are most effective when the interval between triggers is $>2s$.
4. Placement distance between laser and reflector is best between 0.5m-15m.
5. Keep equipment dry.
6. Avoid collisions between people and stands, or people and equipment.
7. Do not look into the lasers. Be careful of children around the equipment – do not allow them to look into the lasers.

Research Notes

- “For example, in split-1, the cohort's Video Camera SD was ± 0.05 seconds. However, photocell and laser beam SD were ± 0.08 and ± 0.09 seconds, respectively.”
 - Video Camera mode has lower standard deviation, which is particularly apparent over shorter distances.
- “...the longer distance was able to remove or make up for some of the variability that occurs in the early part of the sprint seen in split-1”
 - The 0.09s standard deviation for laser beam mode becomes less significant over longer distances.
- A high speed camera such as Casio ExLim EX-Zr300 can record 120-1000FPS, depending on resolution. Newer models would exist now.
 - 120FPS = 1 frame per 0.008s. 1000FPS = 1 frame per 0.001s. The timing gates have 0.001s accuracy (up to 1 minute), 0.01s accuracy (up to 10 minutes), and 0.01s accuracy above that.

Comparison of Three Timing Systems: Reliability and Best Practice Recommendations in Timing Short-Duration Sprints. Bond, Colin W.; Willaert, Emily M.; Noonan, Benjamin C.

Therefore, if wanting to have the lowest standard deviation for research purposes, the Video Camera mode is most effective. (Mode L1)

For convenience purposes, the laser modes are superior. That is if the slightly higher standard deviation is considered acceptable eg. for longer distances, or for non-academic testing such as team fitness tracking.