CRR TESTING MODEL OPERATING INTRUCTIONS

OVERVIEW

VERSION 1.0 **RELEASE DATE: SEPT. 8, 2018**

AeroLab Engineering Sensor

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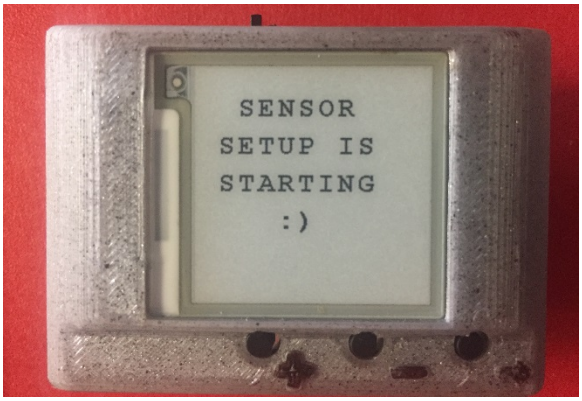
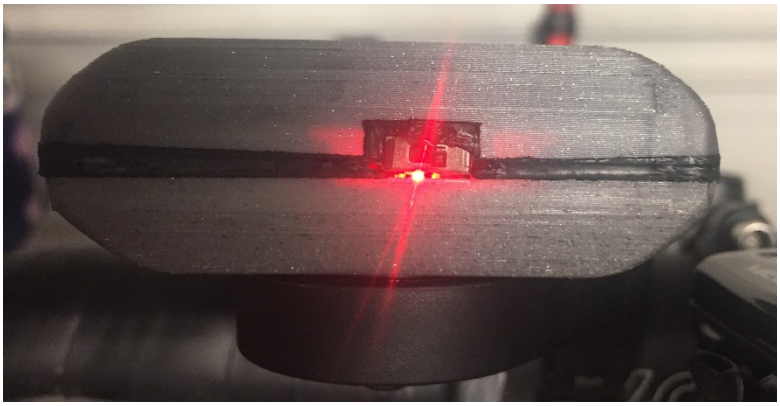
Crr Testing Model Operating Instructions:

(1) Mounting: The AeroLab Sensor can be mounted using a 3rd party purchased go-pro style mount. A custom extension for the go-pro style mount is included with the Engineering Sensor. Ensure that the pitot tube is level (within about 1 or 2 degrees) relative to the bicycle. This can typically be done 'by eye'. See the photo below for examples. The aero sensor should be oriented such that it is not obstructed from receiving a direct wind pressure (i.e., brake cables, water bottles, hands, etc. should not be touching the sensor or located in its immediate vicinity)

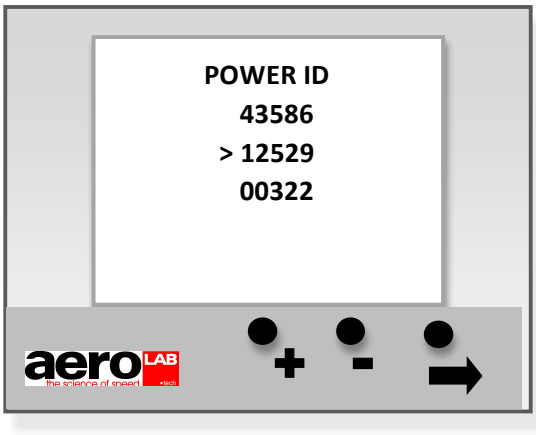
(2) Spin wheels and turn crankshaft to activate speed sensors and power meters for pairing. Ensure for steps 4-12, you are in a wind-sheltered area outside and in the operating environment.

(3) Turn on power to the AeroLab wireless e-ink screen and turn on power to the AeroLab sensor. Red LED indicators should be visible when the system is powered. If the red LED is not present, there the battery needs charging.

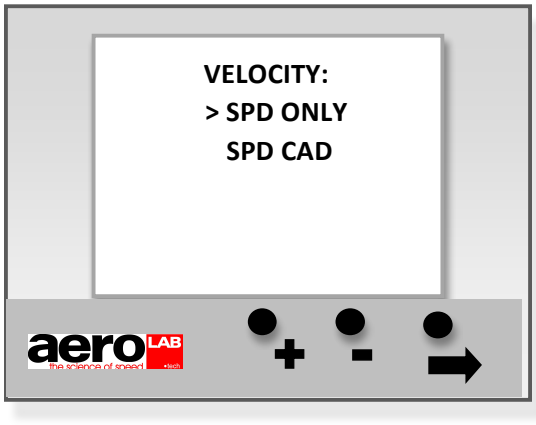




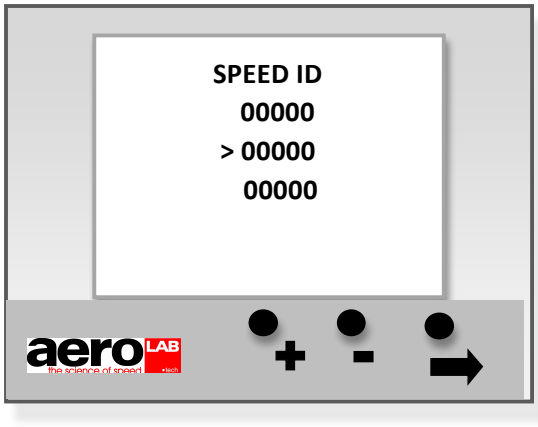
(4) The startup screen will first ask for you to select the power meter you would like to connect to. Use the button selectors to choose your power meter and hit the ENTER/LAP button.

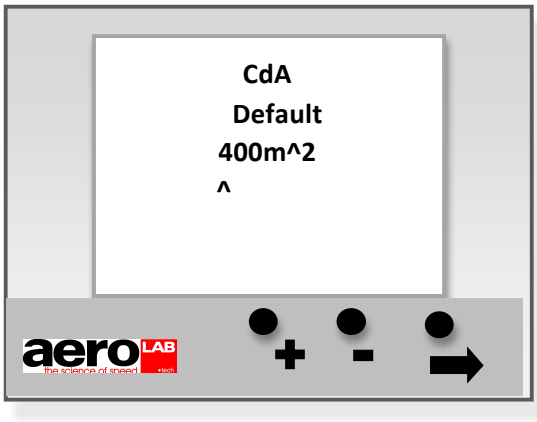


(5) Choose between using a speed sensor with or without cadence for your measurements and hit the ENTER/LAP button. Note: if you do not have a speed sensor, do not worry, our internal GPS will take over and provide the ground speed measurement (works best in an outdoor environment without sharp cornering).



(6) Select the speed sensor ID (note that ID values will be 00000 if you do not have a speed sensor or it is not powered/active. This means the system will default to using GPS for ground speed).



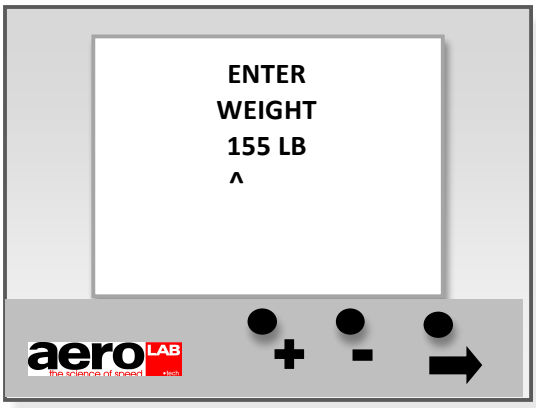


(7) Optional CdA selection:

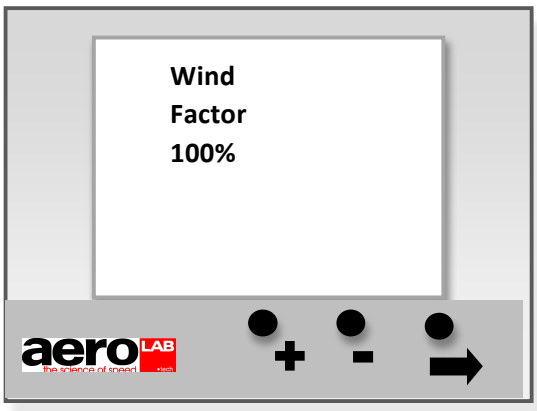
a. Select your desired CdA from which Crr will be computed during testing. This is a custom screen for customers looking to complete rolling resistance testing. Ideal scenarios for rolling resistance testing are to have the rider remain in a known body position for which multiple prior tests have determined a baseline CdA (this can be done in collaboration with AeroLab Engineers). Acceptable CdA's are in the range of 0.151 to 0.650. On screen the CdA value is expressed in integer form by multiplying by 1000 (151 to 650, and the default is 400).

SPECIAL NOTE: If you are not interested in Crr testing and prefer to complete a "free" ride, enter in a CdA value of 150 (0.150). This will remove the Crr computation feature entirely. Note: this does not in any way alter the ride data being saved (the same raw data is saved to the micro-SD card for every ride)

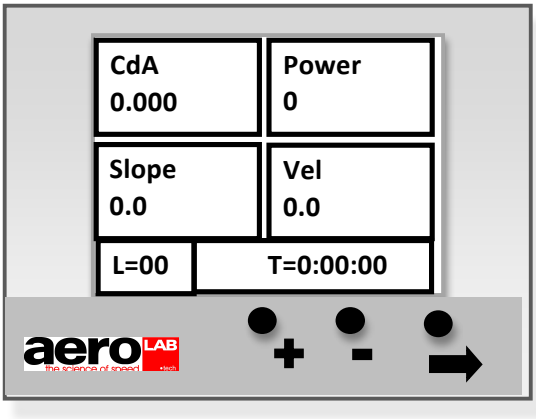
(8) Select your desired wind factor scaling. This step is optional and only needed if the pitot tube mounting location results in significant alteration to the wind data. This can be checked on an easy out and back test ride. The wind scaling is entered as a % from 50 to a maximum of 127%

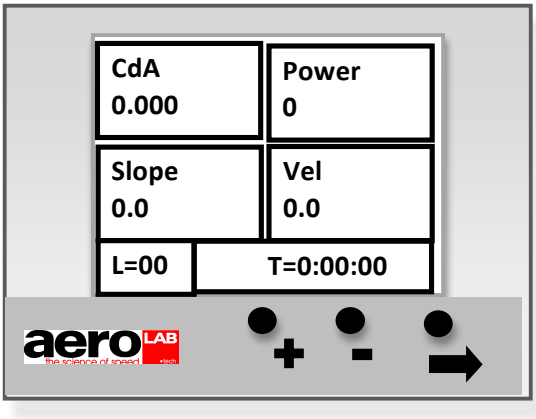


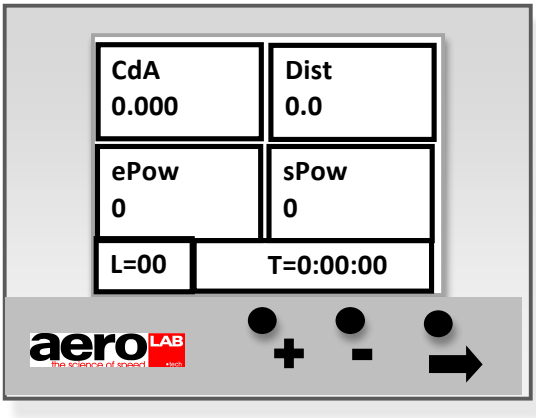
(9) Enter your total weight in lbs including the bike, rider, and any auxiliary equipment including water bottles

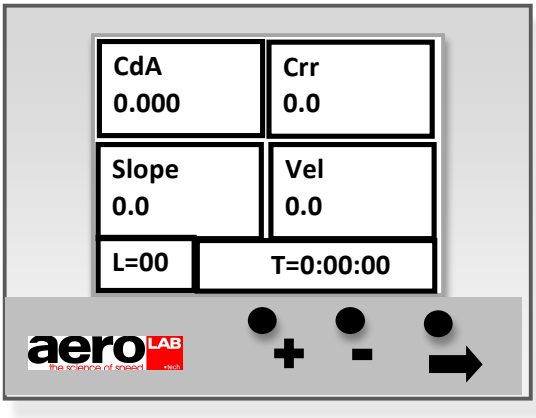


(10) Now the system should automatically start displaying data for wind, CdA, wind angle, etc. within about 5 or 10 seconds. You are now ready to ride. There are 3 screens that you can switch between during a ride using the + or – buttons. These screens are shown below along with a sample of screen information shown during a bright (sunny day), illustrating the utility of the e-ink screen in such conditions.









(11) Note that it may take up to 20 seconds for the GPS to establish a signal lock. When the signal is locked, an LED indicator begins flashing on a 1 second interval at the location shown below

Rider Experience: General

Most riders are looking to establish improvements to CdA. On the other hand, Crr values are course dependent, tire dependent, pressure and temperature dependent, and dependent on the weight of the rider among other factors. For this reason, it is recommended that a user utilizes our online knowledge base for selecting an appropriate tire and pressure for a given race course. In our beta software, the Crr is held as a fixed value unless you are completing Crr-specific testing. Thus, for all rides where you plan to test CdA, it is recommended that you choose a route (out and back for example) and maintain this same route for ALL aerodynamic testing. Moreover, use the same tire and pressure combination for all aerodynamic testing. This is basically a method of intervening variable control – control what you can when performing an experiment.

Ride data and cumulative CdA and Crr:

For engineering testing, out-and-back courses are recommended with a length of about 1km to 4 km. In order to discard data when using the brakes on a turn-around point, use the lap button. The engineering system is designed to cumulatively combine the data from a full out and back and display this data to the user on screen. The best way to describe this process is by example:

A rider begins his ride on Lap 00 (see images under step 10). This data should be ignored in any experimental test as the rider is starting from rest and may need to maneuver before reaching the start point of the out-and-back course.

- At the start of the lap, the rider hits the ENTER/LAP button, and this begins Lap 01.
- When the rider nears the turn-around point, before applying the brakes or changing position, the rider should hit the lap button again. This begins Lap 02. Lap 02 data is not included in CdA and Crr analysis, and so the rider should notice the CdA value remains fixed.
- Once the rider brakes, turns around, and gets back up to speed, he/she hits the lap button again. This begins Lap 03. Lap 03 data is indeed included in the CdA and Crr computation.
- When the rider approaches the start point of the out-and-back, he/she can do a spot check on the converged CdA and Crr values, and then should hit the lap button to end the first test. This begins Lap 04 and would correspond to the end of the first out-and-back, and the beginning of the second. At this stage the CdA and Crr data is reset to zero.

In summary, Laps 1 and 3 are used to compute the CdA and Crr for the first out and back, Laps 5 and 7 are used to compute the CdA and Crr for the second out and back, Laps 9 and 11 are used to compute the CdA and Crr for the third out and back, and so on. All laps in-between are used to enable a rider to turn-around safely and apply brakes without contaminating the CdA and Crr estimates.

Each out and back is considered as one test:

Test 1a: Laps 1 and 3

Test 1b: Laps 5 and 7

Test 1c: Laps 9 and 11

Etc.

For data convergence, it is highly recommended that for each equipment configuration (e.g., 60psi tires vs 80 psi tires), minimums of 4 tests are completed. With a maximum of 49 independent text files being save (one for each lap), this allows one MicroSD card to handle the testing of 4 equipment configurations.

I have a preference of bringing 1 microSD card for each set of 4 equipment configurations, and labeling the microSD card accordingly (before testing).

Question: Feel free to email Support@AeroLab.Tech