Oregon State University
Advantage Impact

Climate Solutions Consulting

FUEL

USER MANUAL

FUEL Sensor SPECIFICATIONS

- Size: 8.3*7.6*4cm
- Weight: 645g
- Measurement rate: 1 minute
- Log rate: 1-30 minutes
- Measurement range: from 2g to 50,000g
- Resolution: 2g for the 50kg version/5g for the 100kg version
- Non Linearity: ±10g
- Zero Temperature drift: ±20g between 20°C and 50°C
- Repeatability: ±10g
- Battery life: 5 years of usage (10 years of shelf life)
- Maximum number of samples recorded: 10,560
- Easy start/download in the field: no computer needed with the wireless touchscreen launcher

Introduction

The FUEL sensor is a real time data logging scale designed for the purpose of monitoring fuel consumption in households. FUEL can be used to monitor any fuel type like firewood, charcoal, LPG, kerosene or ethanol.

The FUEL sensors are available tensile hanging scale rated for up to as 50kg (110 lbs) or 100kg (220 lbs) and as a compressive scale rated for 50kg (110 lbs).

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Figure 2: Compressive version (rated for 50kg)

Figure 1: Tensile Version (rated for 50kg or 100kg)

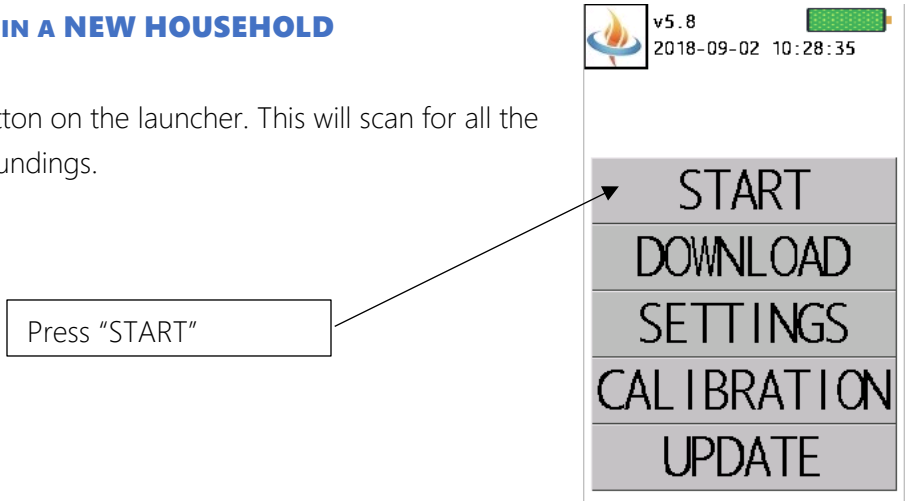
When the data is being downloaded in the household, a summary of up to 20 sensors is displayed. This quantitative data is instantly available as one enters the household. This allows the surveyor to build upon it and to collect more qualitative data and explanations from the cook about the different usage patterns. All the meta-data is input in the field (fuel type, household number, study arm) during deployment.

Launcher Description

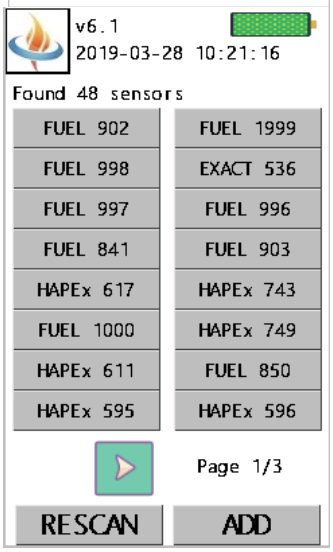
Sensor Description

LAUNCHING THE SENSORS IN A NEW HOUSEHOLD

- Press the START button on the launcher. This will scan for all the sensors in the surroundings.

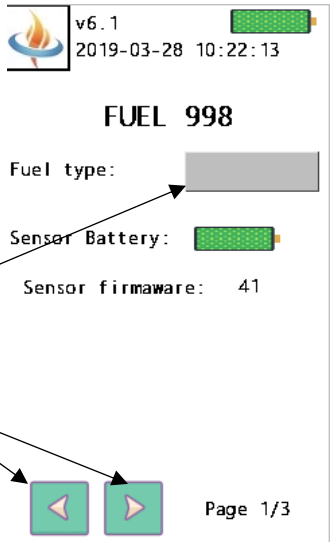


- Select then the sensors you want to add to this household. And then press "ADD"



N.B: the launcher can list up to 128 sensors. If there are more than 128 sensors around, they will not be all listed. Keep the sensors you don't want to launch far away (10m or more) from the launcher.

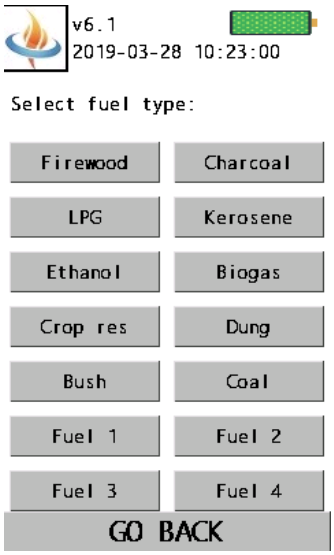
- For each sensor selected, select the location on which they will be placed. A predefined list of 14 fuel type is available.



Press here to select the fuel type monitored by the sensor

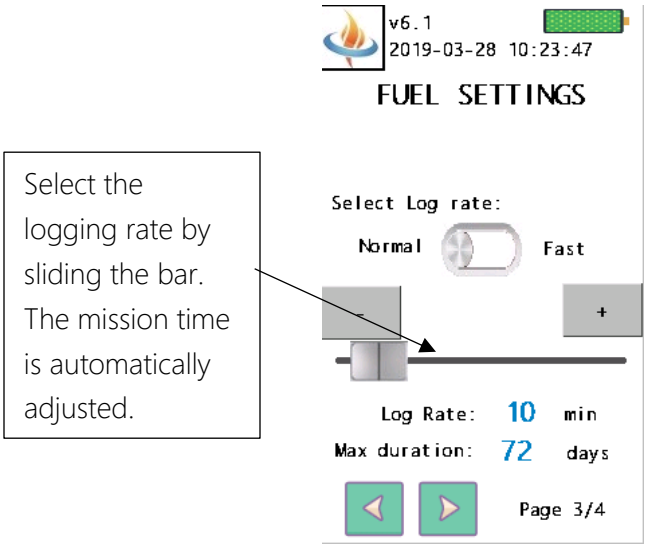
Press here to navigate between sensors

The fuel type does not change the operation of the sensor. It is just useful meta data that will appear in the header of the file containing the data.



Select the type of fuel monitored by the sensor.

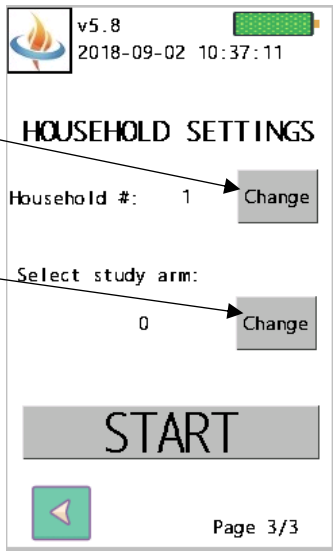
- Select then the log rate, this will determine how long the mission can last before the memory is full, make sure to leave some room here.



N.B: The "fast" mode is a special mode that is useful to test the sensor. In this mode, the sensor will log data every 4 seconds. However, in this mode, the internal memory will be full in about 6 hours, so it is not useful for long term deployment.

NB: The log rate is different from the measurement rate. The measurement rate is always one minute even when the log rate is higher. For example, if you have a 10 minutes log rate, the sensor will take 10 measurements (once per minute) and record the maximum of those 10 measurements in the internal memory. The maximum of the measurement is logged in order to detect fuel addition to the holder.

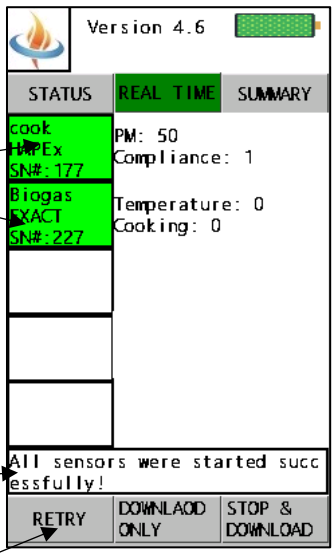
- Provide then the information for the household: household #, study arm (control/intervention).



Select the household #.

Select the study arm in which the household is.

- Then press "START". You will receive a confirmation that each sensor has been started successfully (they turn green).



The name of the sensor turns green when it is successfully launched

If for some reason some sensors have not been started successfully, press the retry button until they have all succeeded.

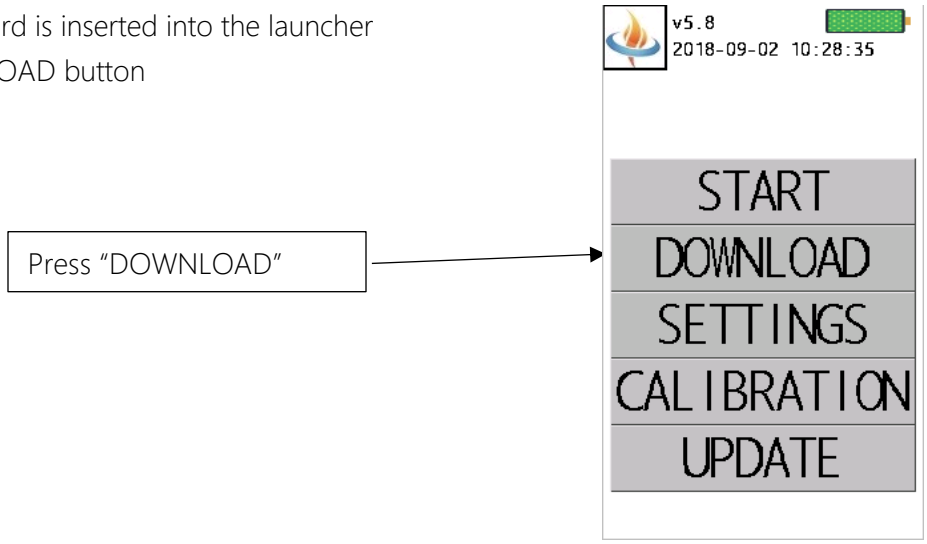
A summary of the action taken is displayed here

Press the "RETRY" button to execute again the latest action

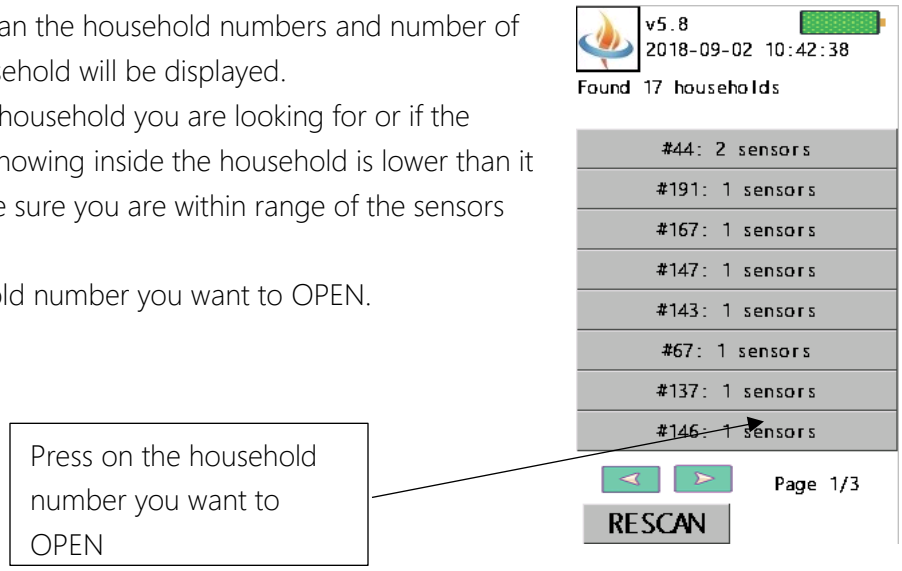
N.B: when you start a new mission, the sensor reset them-self and all the data from the previous mission is erased. So be sure to download the data you need from the sensor before you start a new mission.

DOWNLOAD THE DATA FORM RUNNING SENSOR

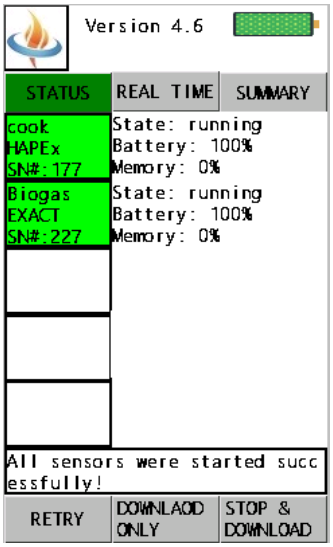
- Make sure a SD card is inserted into the launcher
- Press the DOWNLOAD button



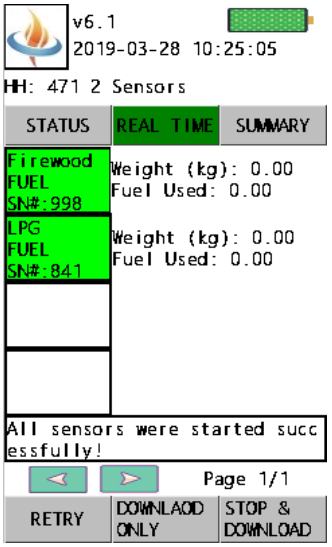
- After a 20 second scan the household numbers and number of sensors in each household will be displayed.
- If you don't find the household you are looking for or if the number of sensors showing inside the household is lower than it should be then make sure you are within range of the sensors and press "RESCAN"
- Choose the household number you want to OPEN.



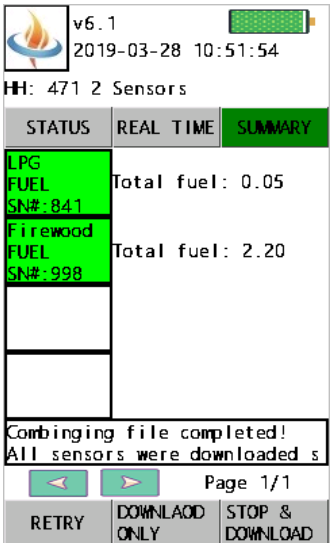
- You will see a summary of up to 20 sensors present in this household. At the top you have three options:



  - STATUS: shows if the sensors are active or not and display their battery level and their memory level (a sensor automatically stops when its memory is full)



  - REAL TIME: shows the current weight and the accumulated fuel used since the sensor started.



  - SUMMARY: shows a summary of the average PM2.5 and of the average compliance value. For personal exposure, compliance value of 100% are not expected since the sensor is not worn at night, but if the compliance is below 50% that probably means that the subject has not worn the sensors throughout the day.

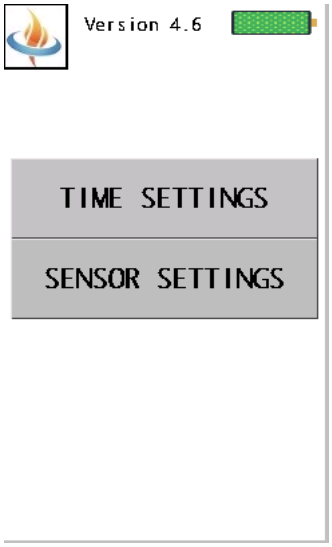
At the bottom, you have two options:

- DOWNLOAD ONLY if you want download the data but keep the sensors running.
- STOP & DOWNLOAD if you want to download the data and stop the sensors as well.

When the box turns green, that means that the sensor data has been downloaded successfully. If some of the download have not been successful then press the RETRY button. Once the data from all the sensor have been downloaded, the launcher combine all the data into one file, please don't turn off the launcher during this operation.

N.B: To make sure the data is written to the SD Card correctly, never remove the SD Card when the Launcher is powered ON. Turn OFF the launcher first, then remove the SD Card.
When you insert the SD Card back into the launcher, make sure it powered OFF first, insert the SD Card, then power ON the launcher.
Those simple steps will insure that the data is written reliably to the SD Card.

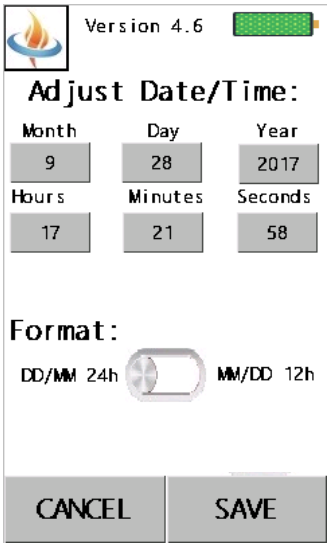
Settings



You change the settings by pressing the "SETTINGS" button on the home screen.
You can then, choose between the "time settings" and the "sensor settings"

Time Settings:

Before using the launcher in a time zone, make sure that the local time has been set on the launchers. This will assure that the time stamps are accurate. The clock inside the launcher may drift so make sure to check it from time to time.
The timestamp may be displayed in MM/DD/YYYY 12H AM/PM or DD/MM/YYYY 24H format. Please choose the most convenient format for your needs.

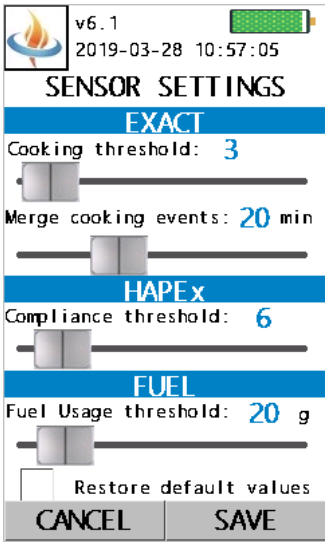


N.B: Once the starting time has been sent to the sensor, it keeps a very accurate track of time. The time drift of the sensor should be less than 10 minutes per year.

Sensor Settings

You can change the threshold above which fuel usage is detected. With low threshold, smaller usage will be detected while with a higher threshold it will take larger usage before the sensor consider it a use. This is useful to prevent small drift due to temperature or creep to be detected as legitimate fuel use.

You can restore default value by checking the box at the bottom of the screen.



CHARGING THE LAUNCHER BATTERY.

The battery is recharged via the micro USB port. In two hours, the battery will be fully charged. The battery level is displayed on the top right corner of the screen when the device is powered.
When the charger is plugged in, a lightning symbol is displayed nearby the battery gauge.
A fully charged battery should last a couple of days of intensive use.

Calibrating the FUEL sensor

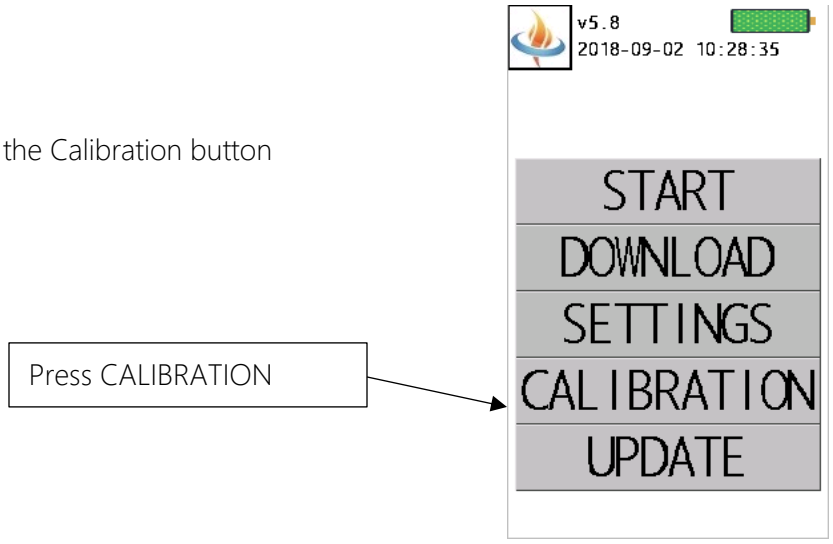
Every FUEL sensor is factory calibrated with a reference weight of 20 kg by default. We can use a different reference weight if you would like us to. The sensor will provide the greatest accuracy if it is calibrated around the weight they are expected to be exposed to.
In any case, the FUEL sensors feature low non-linearity, repeatability and zero drift error and can be used at full scale (10g to 100kg) with the default 20kg calibration.

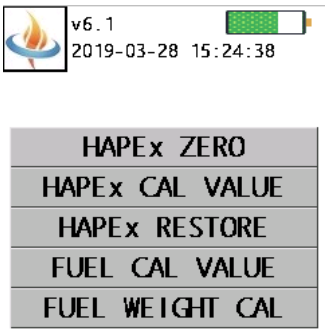
We recommend that you bring a reference weight to the field to check the calibration regularly. If the sensor displays a value that is more the 30g off from the reference weight, another calibration is recommended.

The calibration procedure is straight forward and can be performed in the field by the user. However, if you would like us to perform the calibration and provide you with a calibration certificate, we can do so for a small fee, please contact us.

********** A yearly recalibration of the FUEL sensor is recommended. **********

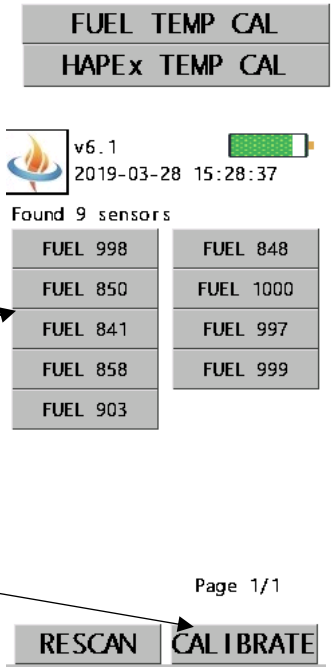
To calibrate the sensor, press the Calibration button





Press FUEL WEIGHT CAL

After you press the FUEL WIGHT CAL button, the launcher will scan for the FUEL sensor around and list up to 128 sensors.



Select the sensor you would like to calibrate. You can select up to 20 sensors.

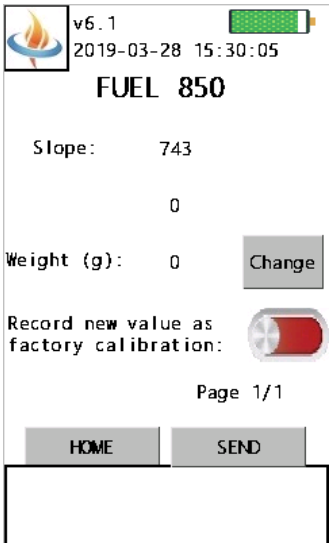
Then, press CALIBRATE

Before you press CALIBRATE, make sure the sensors are in position. When you press CALIBRATE all of the sensors selected are going to be tared.

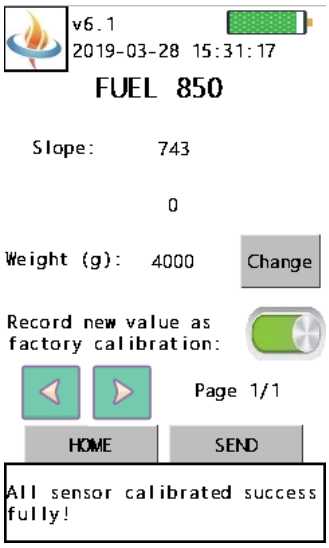
You are then going to see this page for each sensor selected. It will display the current slope of the sensor. In the weight, please indicate the mass of the calibration weight used (in grams).

Toggle the switch if you would like this to be recognized as factory calibration.

Before you press the SEND button, place the calibration weight on the corresponding sensor.



When you press the SEND button the calibration will be performed. A file will be created on the SD Card with the date, the mass of the reference weight and with the new value of the slope corresponding to the calibration.
If you selected several sensors, the page will be updated so that you can calibrate the next sensor. The same reference weight can be used to calibrate several sensor one after the other.



Your FUEL sensors are now calibrated! You can verify that the calibration was successful by stating a mission and placing the reference weight on the sensor.

TROUBLESHOOTING

If you are having difficulty communicating with the sensors you can try the following actions:

- Make sure you are with in 5 meters or less to the sensor
- The internal antenna is on the upper back portion of the launcher enclosure, don't block it with your hand.
- Makes sure the launcher is charged, very low battery level could prevent it for working correctly
- Do not use 2 launchers at the same time to interact with the sensors, they will interfere with each other.

If you still have issue after taking these steps, please contact us. We stand behind our product and have a 48h maximum response time, If we cannot fix the problem remotely, you can send the defective unit back to us and we will provide you with a free replacement.