

Olivet Nazarene University
SAE Baja
Data Acquisition System

User Guide

Table of Contents

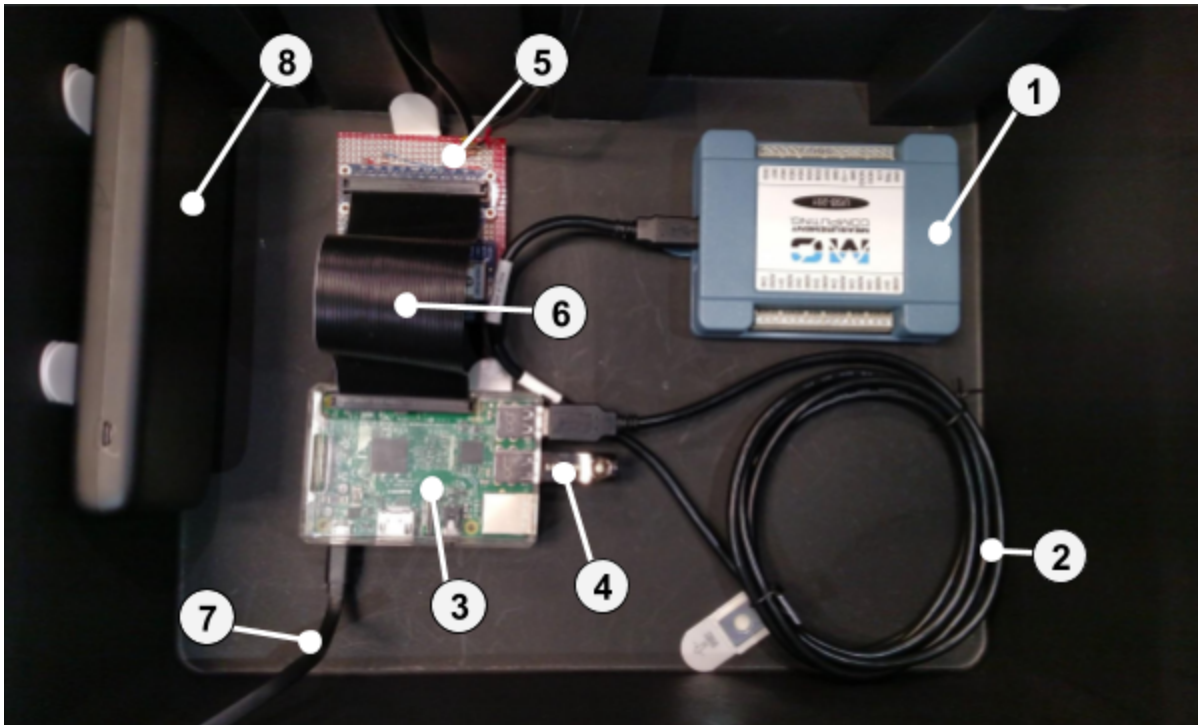
User Guide	1
Table of Contents	2
Sensor Diagram	3
Installation	4
Operation	5
Starting a logging session	5
Terminating a logging session	5
Analyzing data	5
The Software	5
Removal	6
Maintenance	7
Sensors	7
Wiring	7
Main Enclosure	7
Logger	7
Resources	8

Sensor Diagram



Installation

Main Enclosure



1. Place all of the main enclosure components in the positions shown in the above diagram by pushing together the command strip(s) attached to the component and the command strip(s) in their locations.
2. Once all components are in place, attach all peripheral sensors to the MC USB-201 interface device (1).
3. Use the USB A to B cable (2) to connect the MC USB-201 interface device to the Raspberry Pi (3). Any of the USB ports on the Raspberry Pi can be used.
4. Plug the removable storage (4) into any other USB port on the Raspberry Pi.
5. Connect the GPS/Accelerometer Module (5) to the GPIO pins on the Raspberry Pi using the black ribbon cable (6).
6. Insert the micro end of the short USB power cable (7) into the Raspberry Pi, and insert the other end into one of the three ports on the RavPower battery bank (8). **Note: this will power on the system.**

7. Ensure that all components are tightly fastened and will not be loosened by the jostling of the car.
8. Once all components in the main enclosure are in place, place the sensor wires on the rubber seals on the bottom side of the container and place the lid on top of the enclosure, ensuring that the rubber seals on the lid are lined up with those on the body of the enclosure. Once the lid is firmly in place, use the clamps on either side of the enclosure to seal the container tight.
9. Before installing the system on the car, ensure that the LED ring on the button is blue. If it is red, ensure that all of the above instructions were followed correctly. Before attempting to redo any of the above instructions, disconnect the Raspberry Pi from the battery bank.



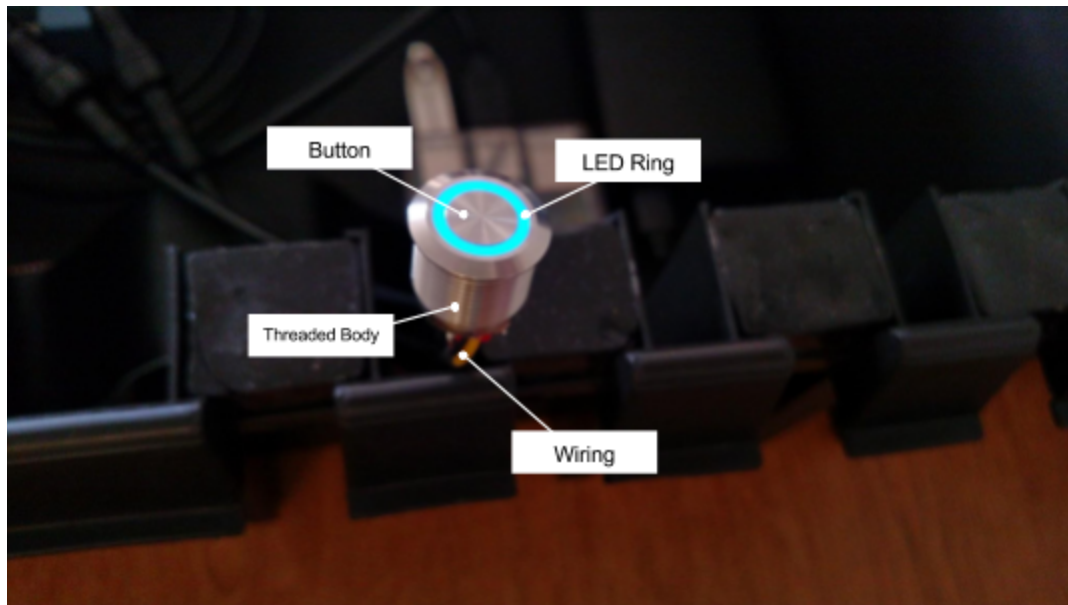
10. Attach the main enclosure to the mounting brackets on the rear of the car.

Sensors and Button

1. If the sensors are not already in place, attach/fasten all sensors to their designated locations on the car, as shown in the [sensor diagram](#). Remove any parts of the car that will obstruct this process.
2. Connect the sensors and button to the wiring by screwing on the connectors.
Note: Sensor installation may require disassembly of parts of the car. Only baja team members should perform system installation.
3. Connect each wire to its corresponding sensor according to the label on the wire.
4. Secure all wires to car frame with hook-and-loop straps. Ensure that there are no hanging or loosely-connected portions of any wire.
5. Re-attach any parts that were removed in step 1.

Operation

Starting a logging session



1. Wait for the LED ring on the button to turn blue.
2. Once the LED ring has turned blue, press the button but do not hold. The LED ring will turn red to indicate that the program is initializing. No measurements will be logged while the button is red.
3. If the LED remains red and reverts to blue after about 10 seconds, then an error has possibly occurred. Attempt to restart the logger by repeating step 2. If the same event occurs, consult the [error table](#) below to determine what might be preventing the system from running normally.
4. If the LED turns green, then the GPS module has a fix and the system has started successfully. All metrics will be logged 10 times per second until the session is ended (see [Terminating a Logging Session](#)).

Note: The battery life is the limiting factor for the length of time that the system can operate during a testing session (assuming the 32 GB flash drive is empty or mostly empty). The four LED indicators on the front of the battery indicate the power level. If all of the LEDs are lit, that means that the battery is full or almost full.

Possible Errors

Error	Solution
No GPS fix	Make sure the system/car is in an unobstructed, outdoor area. If the problem persists, the software may need some maintenance.
Removable storage not found	Ensure that the flash drive is fully inserted in one of the USB ports on the Raspberry Pi.
GPS/Accelerometer module not connected	Check the ribbon cable running from the GPIO pins on the Raspberry Pi to the board. If the problem persists, try reconnecting both ends of the cable.
Software Issue	Use ssh or an HDMI-equipped screen to log-in to the Raspberry Pi. Change the <code>mode</code> variable to <code>\$DEBUG</code> . Run “daq.sh” to see the log information printed to the console.

Terminating a logging session

Press the button but do not hold to end the session. If the data was logged successfully, the LED ring will turn blue indicating that the system is ready for another session.

Note: At any time, the data acquisition program can be stopped completely by holding the button for 3 seconds. The LED ring will turn off and the program can only be started again by cycling the power (unplugging from the battery and plugging back in).

Analyzing data

To view the data collected during a logging session, simply remove the removable storage from the Raspberry Pi and insert it into a computer. Open the device to view its contents and navigate to the folder with the name of the session you wish to view. Folder names are of the format `ddmmyy_hhmmss`, where the hour is in 24-hour clock format (i.e. 2:30 PM = 14:30 PM). When viewing the files stored on the device, double-click on any of the `*.csv` files to open it in the computer's default spreadsheet program. Because of its graph and analysis tools, the recommended program for analyzing data is Microsoft Excel.

Removal

1. Disconnect all of the wires from the sensors and button by unscrewing the connectors.
2. Remove all wiring from the screw terminals on the sensor interface inside the main enclosure.
3. Remove the main enclosure from the mounting brackets on the rear of the car.
4. If sensors must be removed from the car (for competition, maintenance, etc.), do so by first removing any parts of the car that will obstruct this process.
5. Reattach any parts that were removed in the previous step.

Resources

ONU Baja DAQ Repo: <https://github.com/naSm1th/ONUBajaDaq>

Sensor Interface: <http://mccdaq.com/usb-data-acquisition/USB-201.aspx#>

Raspberry Pi: <https://www.raspberrypi.org/forums/>

GPSD: <https://github.com/ukyg9e5r6k7gubiekd6/gpsd>