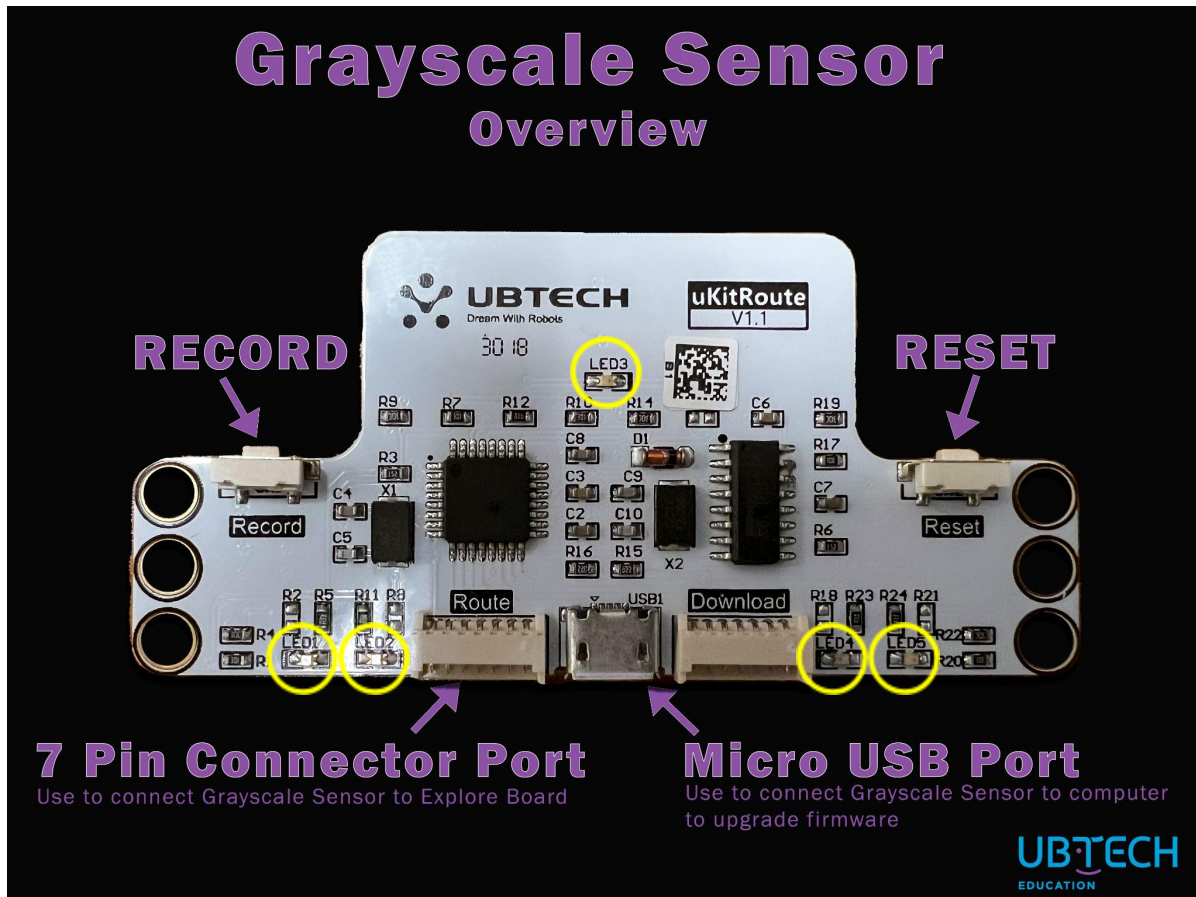# GRAYSCALE SENSOR SETUP

Upon opening your grayscale sensor, you will need to perform a couple of tasks to ensure that it works as well as expected. Understand that several variables can affect the performance of your grayscale sensor. Following these directions and tips will help you minimize these issues.

STEP 1: KNOW YOUR SENSOR

- **Record:** pressed to calibrate color data when calibrating the sensor
- **Reset:** pressed to delete recorded data from previous calibration(s)
- **7-Pin Connector Port:** used to connect sensors to the Explore board; use only the supplied 7-pin connector wire
- **Micro USB Port:** used to connect USB cable to a computer to update firmware and/or supply power to grayscale sensor for calibration.
- **LED lights (yellow circles):** when properly calibrated, will illuminate (red) when the corresponding sensor on the underside of the board is over a dark color
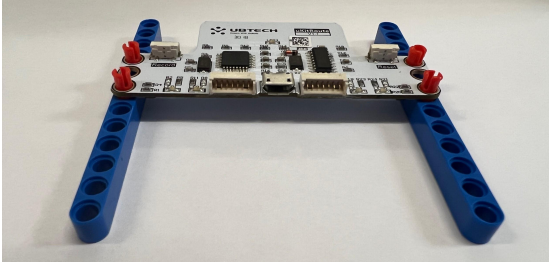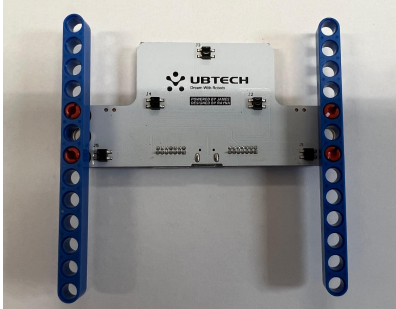
STEP 2: UPDATE FIRMWARE

1. Download and install Arduino IDE.
   - **Arduino IDE**: Latest version
2. Download the firmware that corresponds to your grayscale sensor. The version number is located in the top-right corner of the sensor. Extract the files from the downloaded ZIP file.
   - **V1.1**: Direct link
   - **V1.0**: Direct link
3. Double-click the **route 3.X.ino** file to open in the Arduino IDE. The X is either a 3 or 5 depending on which file you downloaded in Step 2. If Arduino IDE does not open when you double-click the file, then you should manually start Arduino IDE and open **route 3.x.ino** manually through the file menu.
4. Connect the grayscale sensor to your computer with the supplied USB cable.
5. In the Arduino IDE, go to the **Tools** menu and ensure that the following options are selected:
   - Go to the board option and select **Arduino Nano**.
   - Make sure that the proper port is selected for your board.
   - For the processor, select **ATmega328P (Old BootLoader)**.
6. Click on the **Upload** button (arrow) to pass the firmware information to the grayscale sensor. The Arduino console at the bottom should confirm that the upload was completed successfully.
7. If the Upload was not successful, some systems or Arduino versions may require you to use the ATmega328P processor rather than the one that says Old BootLoader. Try switching the processor and clicking **Upload** again.
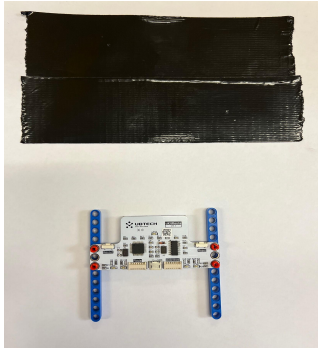
STEP 3: CALIBRATE YOUR SENSOR

Calibrate the sensor often; many environmental factors can affect the readings of your sensor. These factors include lighting, distance of the sensor to the ground, and surface finish, among others. The recommendation is to calibrate your sensor in a matching environment in which your robot will be used.

1. Create space between your sensor and the calibration surface by a thickness of +/- .5 inches. Use components to create space. Be sure not to block any of the five sensors (J1 through J5) on the underside of the board. *See Figures 1 and 2.*

	Figure 1 This sensor has been prepared with a one-block clearance between the sensors and the surface.
	Figure 2 The underside of the grayscale sensor shows that blocks should not cover the J1 - J5 sensors.

2. Prepare the surface by creating a black area and a white area. Each area should be larger than the grayscale sensor. *See Figure 3*.
   - Examples include:
     - Strips of black electric tape on white paper
     - A black sheet and a white sheet of paper
     - A piece of white fabric and black fabric

	Figure 3 This sheet of paper has been prepared for calibration. In this example, black duct tape was used to create the black area on a white sheet of paper.

3. Plug your grayscale sensor into your computer by using the supplied USB cable. Lights should flash to indicate power.

4. Click the **RESET** button to clear any previous sensor data that was stored. You should notice a brief flash of the LEDs.

5. Place your sensor over the black area that was prepped in Step 2. Set the sensor on the surface. There should be clearance between the sensor and the surface.

6. Double-click the **RECORD** button. LEDs should blink. Wait one second.

7. Click the **RECORD** button once. This enters the sensor into RECORD mode. Wait one second.

8. With the sensor still placed over the black area, click the **RECORD** button. LED #3 should briefly flash. Wait one second.

9. Move the sensor to the white area and click the **RECORD** button. LED #3 should again briefly flash followed by all five LEDs flashing. This is an indication that the calibration is completed.

10. Move your sensor in and out of the black and white areas. When individual sensors are over the black area, the corresponding LED on top should illuminate. *See Figure 4.*
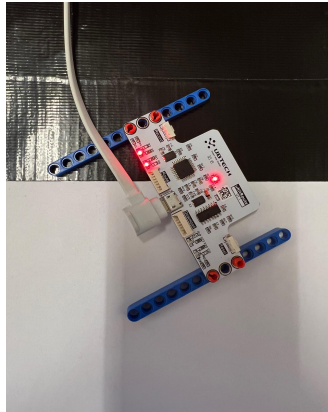

Figure 4

After calibration is complete, red lights will illuminate to indicate a dark color being sensed. In this example, the J1, J2, and J3 sensors are over the black duct tape. However, the J4 and J5 sensors are over the white area, therefore the corresponding LEDs are not illuminating.