

# Qwiic Ultrasonic Distance Sensor (HC-SR04) Hookup Guide

## Introduction

The SparkFun Qwiic Ultrasonic Distance Sensor is great for providing non-contact distance readings from 2cm to 400cm. It improves on the classic HC-SR04 distance sensor by adding a pair of Qwiic connectors to it, so now you can communicate over I<sup>2</sup>C and daisy chain any other Qwiic product of your choosing.

If you prefer to bypass the Qwiic connector and I<sup>2</sup>C you can also access the VCC, Trigger, Echo, and Ground pins broken out on the edge of the board. Please be aware that this ultrasonic sensor comes uncalibrated and you will need manipulate the raw output for your specific application. Let's have a look at this fun board!



## SparkFun Qwiic Ultrasonic Distance Sensor - HC-SR04

🕒 SEN-17777

## Required Materials

To follow along with this tutorial, you will need the following materials. You may not need everything though depending on what you have. Add it to your cart, read through the guide, and adjust the cart as necessary.

### **Qwiic Ultrasonic Distance Sensor (HC-SR04) Wish List** [SparkFun Wish List](#)

SparkFun Qwiic Ultrasonic Distance Sensor - HC-SR04  
SEN-17777



USB micro-B Cable - 6 Foot



CAB-10215  
SparkFun Qwiic OLED Display (0.91 in, 128x32)  
LCD-17153

USB 2.0 Type A to micro USB 5-pin. This is a new, smaller connector for USB devices. Micro USB connectors are a...



(2) Qwiic Cable - 100mm  
PRT-14427



SparkFun RedBoard Qwiic  
DEV-15123

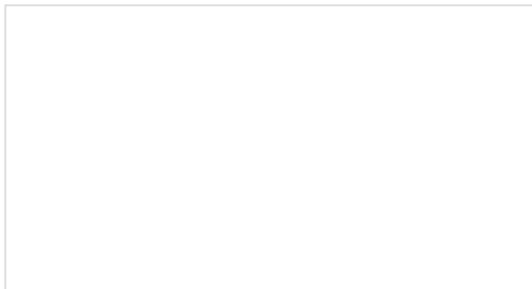
## Suggested Reading

If you aren't familiar with the Qwiic system, we recommend reading here for an overview.



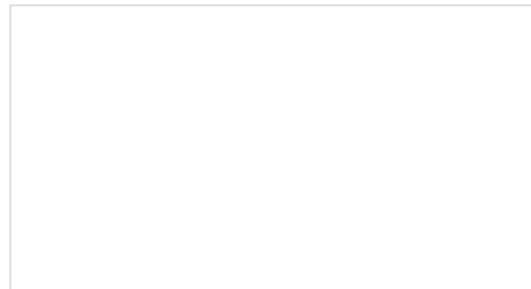
*Qwiic Connect System*

We would also recommend taking a look at the following tutorials if you aren't familiar with them.



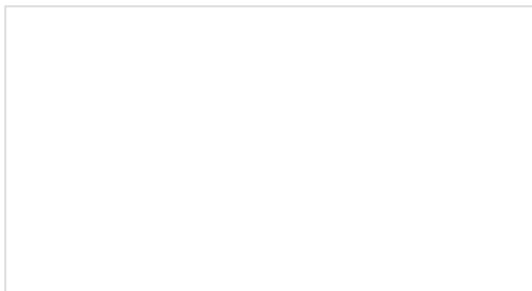
### How to Solder: Through-Hole Soldering

This tutorial covers everything you need to know about through-hole soldering.



### I2C

An introduction to I2C, one of the main embedded communications protocols in use today.



### Serial Terminal Basics

This tutorial will show you how to communicate with your serial devices using a variety of terminal emulator applications.

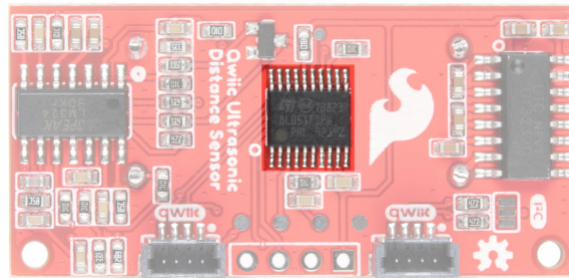
## Hardware Overview

Overall Features:

- Operating Voltage 3.3V
- Detecting Angle: 15 degrees
- Sensor range: 2cm to 400cm
- Accuracy: 3mm
- MCU on board: STM8L051
- Default I<sup>2</sup>C Address: 0x00
- Dimensions: 21.5 x 45.5mm
- Weight 9.2g

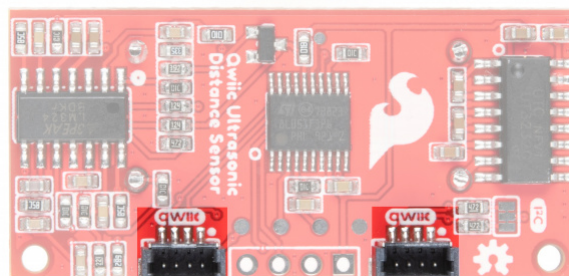
### STM8L051 MCU

The 8-bit ultra-low power STM8 MCU Core provides increased processing power (up to 16 MIPS at 16 MHz) while maintaining the advantages of a CISC architecture with improved code density, a 24-bit linear addressing space and an optimized architecture for low power operations. It also features embedded data EEPROM and low power, low-voltage, single-supply program Flash memory. The device incorporates an extensive range of enhanced I/Os and peripherals, a 12-bit ADC, a real-time clock, two 16-bit timers, one 8-bit timer, as well as standard communication interfaces such as an SPI, an I<sup>2</sup>C interface, and one USART. For more information, refer to the datasheet.



### Qwiic Connectors

Our Qwiic Ecosystem makes sensors pretty much plug and play. There are two Qwiic connectors on the side of the Qwiic Distance Sensor board to provide power and I<sup>2</sup>C connectivity simultaneously.



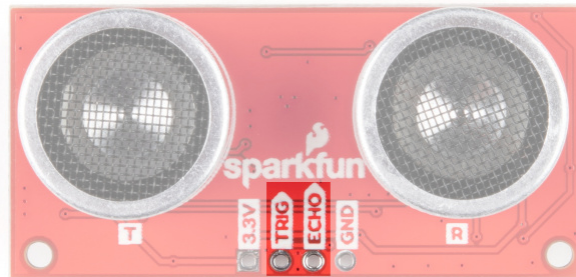
### Power

Ideally, power will be supplied via the Qwiic connectors on either side of the board. Alternatively, power can be supplied through the pins along the bottom side of the board labeled 3V3 and GND. The input voltage range should be between **1.8-3.6V**.



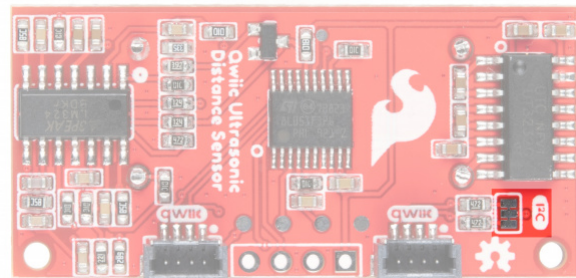
## Trigger and Echo Pins

If you (for some crazy reason) don't want to utilize the Qwiic connectors, we've broken out the Trigger and Echo pins as PTH. We've included headers that can be soldered in place.



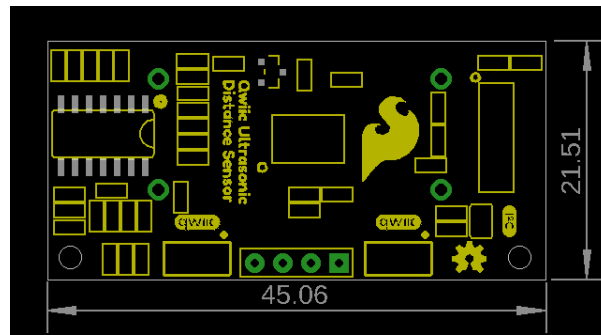
## I<sup>2</sup>C Jumpers

The Qwiic Ultrasonic Distance Sensor has built-in 2.2k pull-up resistors on the SDA and SCL lines. These are needed for normal I<sup>2</sup>C communication. The I<sup>2</sup>C jumper has two small traces connecting the pull-ups to 3.3V. **For general use you can leave this jumper unmodified.** If you have many (over 7) devices on the I<sup>2</sup>C bus, each with their own pull up resistors, then you may want to cut the I<sup>2</sup>C jumpers to disconnect the 2.2k resistors on each Qwiic board.



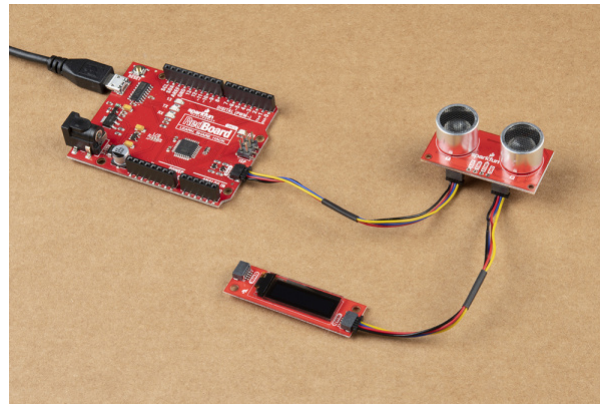
## Board Dimensions

Units below are in mm.



## Hardware Hookup

Using the Qwiic system, assembling the hardware is simple. Connect the RedBoard to one of the Ultrasonic Distance Sensor Qwiic ports and the Qwiic OLED Display on the other Qwiic port using your Qwiic cables. Then connect the RedBoard to your computer via the MicroUSB cable and voila! You're ready to rock!



## Software Setup and Programming

**Note:** Make sure you are using the latest stable version of the Arduino IDE on your desktop. If this is your first time using Arduino IDE, library, or board add-on, please review the following tutorials.

- Installing the Arduino IDE
- Installing an Arduino Library
- Installing Board Definitions in the Arduino IDE

Our friends over at Zio have provided an example to get you started with this Ultrasonic Distance Sensor. In order to do so, you'll need to install a few libraries first.

To display the sensor readings on the connected Qwiic OLED, we will use three Adafruit libraries:

- Adafruit BusIO GitHub
- Adafruit GFX GitHub
- Adafruit SSD1306 GitHub

### Adafruit BusIO Library

You can install this library to automatically in the Arduino IDE's Library Manager by searching for "**Adafruit BusIO**". Or you can manually download it from the GitHub repository.

[DOWNLOAD THE ADAFRUIT BUSIO LIBRARY \(ZIP\)](#)

## Adafruit GFX Library

You can install this library to automatically in the Arduino IDE's Library Manager by searching for "**Adafruit GFX**". Or you can manually download it from the GitHub repository.

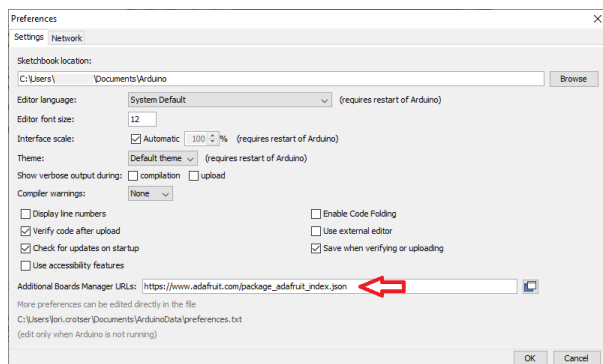
**DOWNLOAD THE ADAFRUIT GFX LIBRARY (ZIP)**

## Adafruit SSD1306 Library

You can install this library to automatically in the Arduino IDE's Library Manager by searching for "**Adafruit SSD1306 Library**". Or you can manually download it from the GitHub repository.

**DOWNLOAD THE ADAFRUIT SSD1306 LIBRARY (ZIP)**

**i Pro tip:** Trying to do a search for the Adafruit libraries and not finding them? Make sure you have the Adafruit json link in your Preferences. After your SparkFun json link, of course.



## Example 1

This example lives in the GitHub Repo in the *Arduino* folder. Feel free to download the code, alternatively you can copy the code below into a blank Arduino sketch. Select your board (for this example we'd select "SparkFun RedBoard") and the port your board has enumerated on. Go ahead and upload your code.

```

#include <Wire.h>
#include <Adafruit_GFX.h>
#include <Adafruit_SSD1306.h>
#define SLAVE_BROADCAST_ADDR 0x00 //default address
#define SLAVE_ADDR 0x00 //SLAVE_ADDR 0xA0-0xAF
uint8_t distance_H = 0;
uint8_t distance_L = 0;
uint16_t distance = 0;

#define SCREEN_WIDTH 128 // OLED display width, in pixels
#define SCREEN_HEIGHT 32 // OLED display height, in pixels

// Declaration for an SSD1306 display connected to I2C (SDA, SCL pins)
#define OLED_RESET 4 // Reset pin # (or -1 if sharing Arduino reset pin)
Adafruit_SSD1306 display(SCREEN_WIDTH, SCREEN_HEIGHT, &Wire, OLED_RESET);

void setup() {
  Wire.begin(); // join i2c bus (address optional for master)
  Serial.begin(9600); // start serial for output
  display.begin(SSD1306_SWITCHCAPVCC, 0x3C); // initialize with the I2C addr 0x3C (for the 128x
32)
  Serial.println("IIC testing.....");
  display.clearDisplay();
  // Wire.beginTransmission(SLAVE_BROADCAST_ADDR); // transmit to device SLAVE_BROADCAST_ADDR
  // Wire.write(SLAVE_ADDR); // Change the SLAVE_ADDR
  // Wire.endTransmission(); // stop transmitting
}

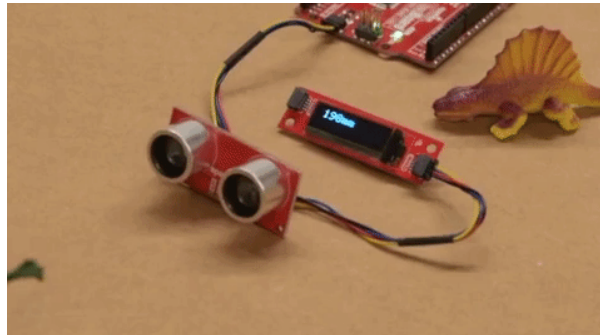
void loop() {
  Wire.beginTransmission(SLAVE_ADDR); // transmit to device #8
  Wire.write(1); // measure command: 0x01
  Wire.endTransmission(); // stop transmitting

  Wire.requestFrom(SLAVE_ADDR, 2); // request 6 bytes from slave device #8
  while (Wire.available()) { // slave may send less than requested
    distance_H = Wire.read(); // receive a byte as character
    distance_L = Wire.read();
    distance = (uint16_t)distance_H << 8;
    distance = distance | distance_L;
    Serial.print(distance); // print the character
    Serial.println("mm");
    display.setTextSize(2);
    display.setTextColor(WHITE);
    display.setCursor(10, 0);
    display.clearDisplay();
    display.print(distance);
    display.print("mm");
    display.display();
    delay(1);
  }
}

```

```
    delay(100);  
  }  
}
```

Try moving an object (like your hand or a dinosaur) closer to the sensor - notice the output of the OLED shows you how close the object is! Grr. Rawr!



*Curse your sudden but inevitable betrayal!*

## Troubleshooting

### 🔗 Not working as expected and need help?

If you need technical assistance and more information on a product that is not working as you expected, we recommend heading on over to the SparkFun Technical Assistance page for some initial troubleshooting.

[SPARKFUN TECHNICAL ASSISTANCE PAGE](#)

If you don't find what you need there, the SparkFun Forums are a great place to find and ask for help. If this is your first visit, you'll need to create a Forum Account to search product forums and post questions.

[CREATE NEW FORUM ACCOUNT](#)

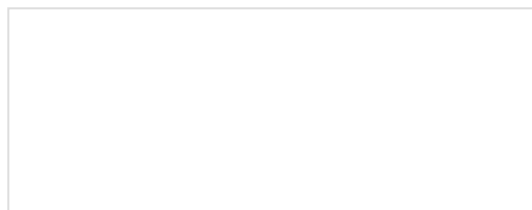
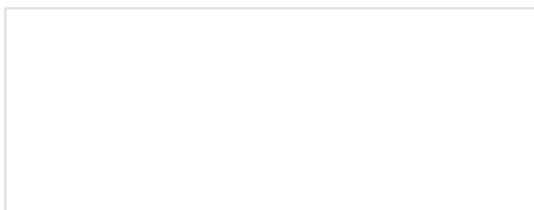
[LOG INTO SPARKFUN FORUMS](#)

## Resources and Going Further

For more information on the Qwiic Ultrasonic Distance Sensor, check out the following links:

- Schematic (PDF)
- Eagle Files (ZIP)
- Datasheet (PDF)
- Github (Eagle files and Example Code)

Need some inspiration for your next project? Check out some of these other Qwiic product tutorials:








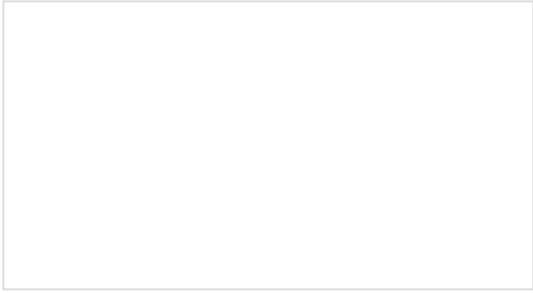
### Qwiic VR IMU (BNO080) Hookup Guide

Figure out how things are oriented with the robust 9 degrees of freedom (DOF) BNO080 IMU. Maybe even make your own virtual reality (VR) applications if you're feeling savvy.



### Assembly Guide for SparkFun JetBot AI Kit V2.0 Assembly Guide for the SparkFun JetBot AI Kit v2.0.

This tutorial includes photos & comments to assemble the two-layer chassis & additional components unique to the JetBot kit.



### SparkFun GPS-RTK Dead Reckoning ZED-F9R Hookup Guide

The u-blox ZED-F9R is a powerful GPS-RTK unit that uses a fusion of IMU, wheel ticks, a vehicle dynamics model, correction data, and GNSS measurements to provide highly accurate and continuous position for navigation in the difficult conditions. We will quickly get you set up using the Qwiic ecosystem through Arduino and Python so that you can start reading the output!



### SparkFun Qwiic 3-Axis Accelerometer (ADXL313) Hookup Guide

Let's get moving with the SparkFun Triple Axis Digital Accelerometer Breakout - ADXL313 (Qwiic), a low cost, low power, up to 13-bit resolution, 3-axis accelerometer with a 32-level FIFO stack capable of measuring up to  $\pm 4g$ . This hookup guide will get users started reading measurements from the ADXL313, by Analog Devices, with an Arduino microcontroller, Jetson Nano, or Raspberry Pi.