



Application Note 2023

Ultrasonic Sensor Modules

Simple Setup with Arduino

The compact TDK Ultrasonic Sensor Module is a sensor that measures distances completely invisible and contact-free. It detects objects using inaudible ultrasonic waves, which are transmitted and received by a piezoelectric disc. All necessary electronics for analog/digital conversion and signal processing are built into the sensor itself which results in best reliability and best noise immunity. Detection thresholds and characteristics can be customized and optimized as needed.

The very compact aluminum housing makes it a highly robust, dust and splash-proof ultrasonic sensor. As such, it is ideally suitable for numerous harsh industrial applications and wherever size is a limiting factor and best object detection is desired.

- Easy to mount due to integrated decoupling element
- Water/dust protected chassis integration up to IP65/67
- Single sensor or pitch-and-catch mode possible
- For harsh industrial applications
- TDK evaluation board available



More information

www.tdk-electronics.tdk.com/en/ultrasonic_sensor_module
or contact your local sales office

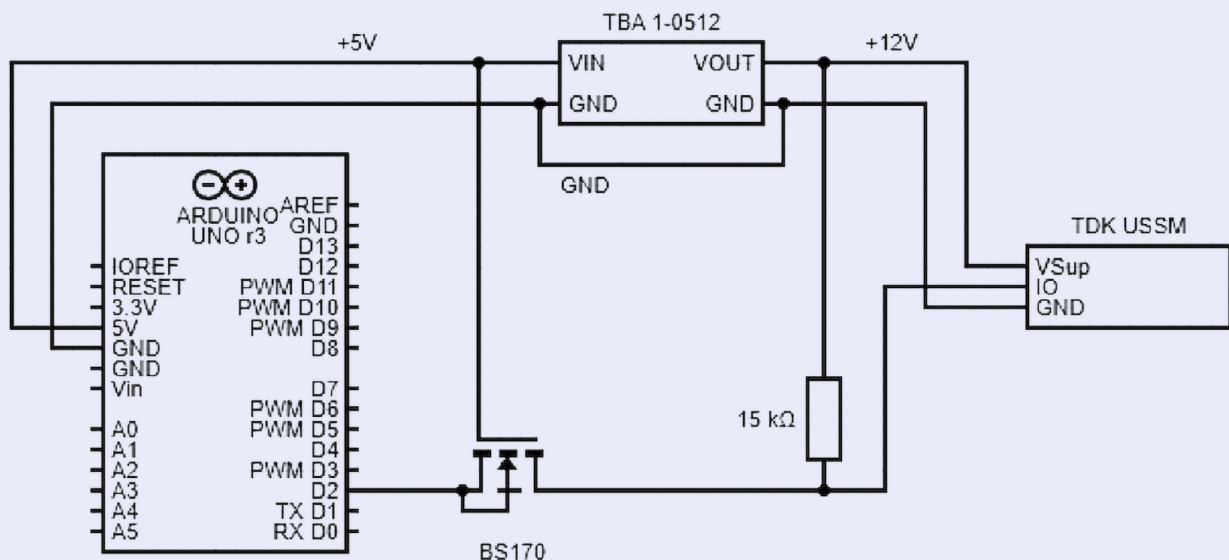
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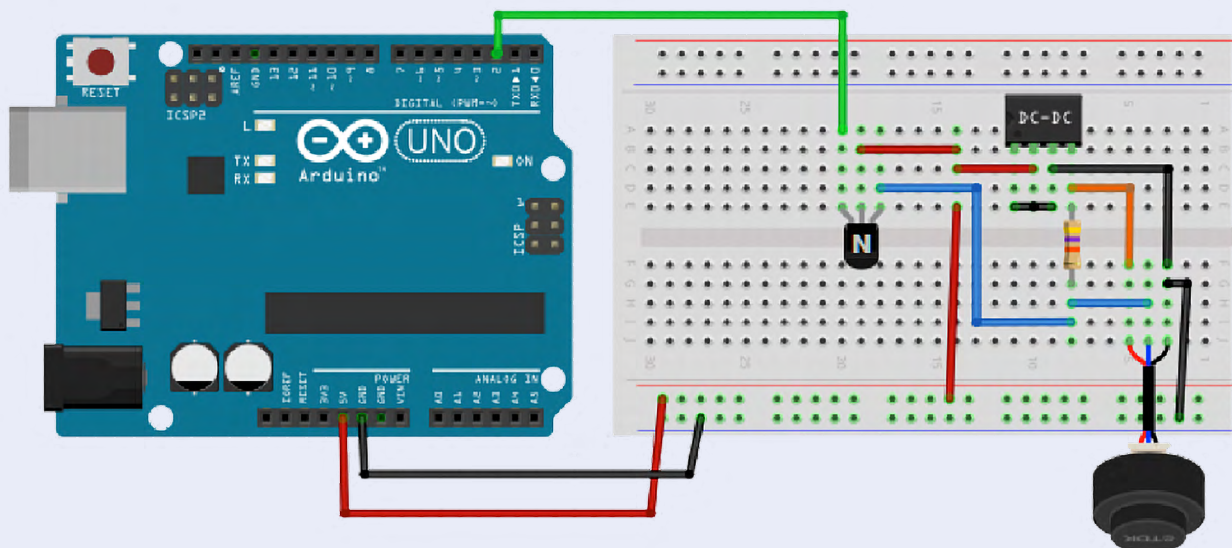
Hardware setup

Requirements:

1. TDK's Ultrasonic Sensor Module (USSM) with a cable to connect it to the board
2. Power supply of 8 to 18 V, typically 12 V. For this you can use:
 - a. DC-DC to provide 12 V from 5 V (as in the example below)
 - b. or a simple 9 V or 12 V battery.
3. IO line level-shifter using:
 - a. a simple N-MOS level shifter with 2 pullup resistors $>12\text{ k}\Omega$ (as shown in the figure)
 - b. or a pre-assembled level shifter like Adafruit 4-channel I2C-safe Bi-directional logic level converter
4. Any Arduino compatible board with 3 V 3 or 5 V IOs logic levels



The equivalent wiring diagram on breadboard is shown in the following figure, generated using Fritzing tool.

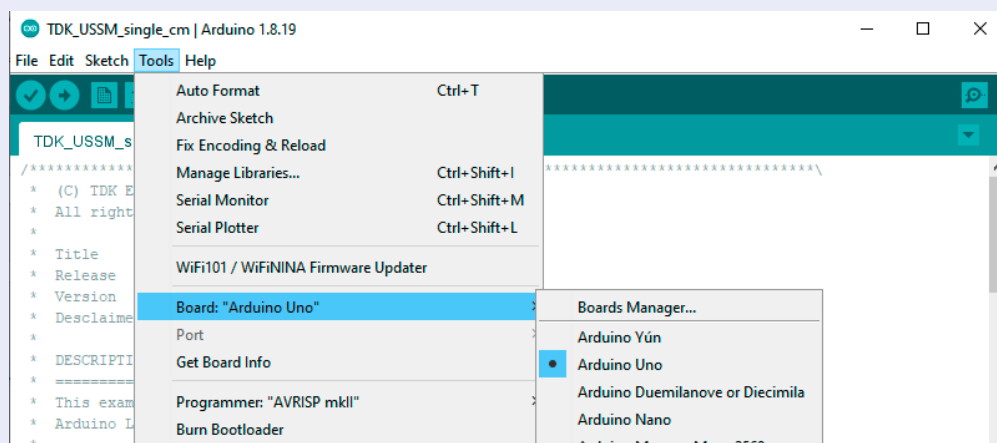


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Arduino software setup

1. Install Arduino IDE, if not already installed, from [here](#)
2. Select the Arduino board you use (e.g. Arduino Uno). Any Arduino compatible board is fine.



Note:

The included sketch works with a wide range of Arduino and Arduino compatible boards, including the high-end ARM Cortex-M MCUs such as STM32, SAMD, nRF, ... etc.

Make sure you have installed the appropriate board via the "Board Manager" if needed.

TDK's USSM Arduino Library offers much more ...

If you want to learn more about TDK's USSM sensors, please refer to our TDK USSM Arduino Library and the corresponding Application Note on our product website.

TDK's USSM Arduino Library

1. simplifies the handling of sensors from one up to 50+ sensors.
2. provides a comprehensive API for using all sensor functions and accessing all registers.
3. is transferrable to different Arduino and non-Arduino platforms.
4. includes advanced functions for parallel measurements, pitch-catch, in-application calibration, analog envelope, ... etc.
5. is provided with a set of ready-to-use examples like:
 - a. Reading and writing sensor registers
 - b. Multiple sensors running in parallel or sequential mode
 - c. Pitch-catch measurement mode
 - d. Analog envelope readout
 - e. Detailed measurement report

and many more ...

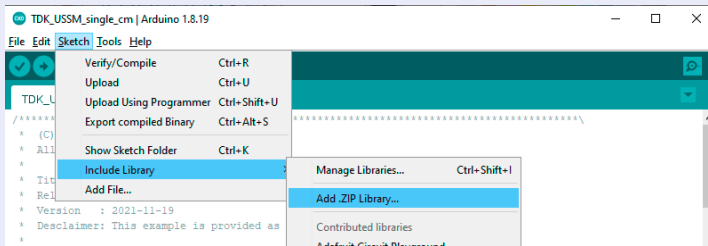
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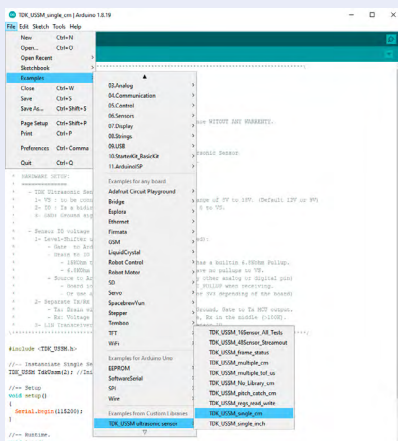
TDK's USSM Arduino Library offers much more ...

To use TDK's USSM Sensor Arduino Library

1. download the latest library ZIP file from our [product web page](#)
2. install the downloaded sensor library: from the "Sketch" menu, select "IncludeLibrary" and then click "Add .ZIP Library..."



3. Run the TDK USSM Library example: From the "File" menu select "Examples", then look for "TDK_USSM ultrasonic sensor" and select (for example) "TDK_USSM_single_cm".



4. Make sure the IO pin assignment is correct when creating the TDK_USSM object, adjust if needed.

```
#include <TDK_USSM.h>

//-- Instanciate Single Sensor
TDK_USSM TdkUssm(2,2); //Initialize Sensor Pins (TxPin , RxPin)

//-- Setup
void setup()
{
  Serial.begin(115200);
}

//-- Runtime.
void loop()
{
  while(1){
    Serial.println( TdkUssm.GetDistanceCm() ); // Prints Distance in cm.
    delay(200);
  }
}
```

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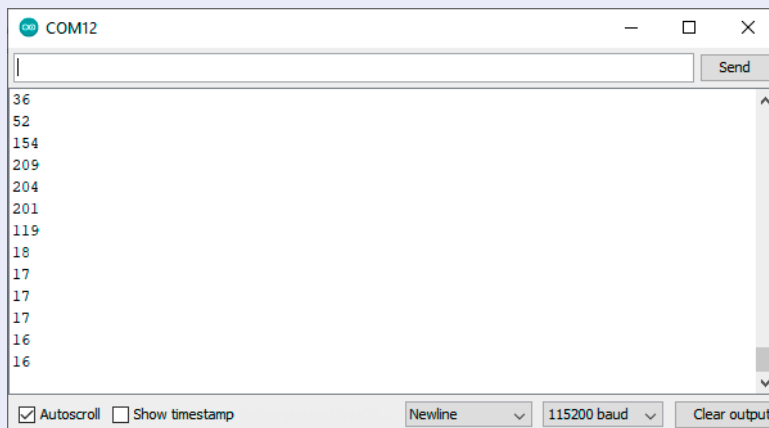
Run

1. Make sure Arduino is connected to the host PC via USB.
2. Select the appropriate port used by the Arduino Board.
In the “Tools” menu select “Port” then select the port to which the board is connected.
Click the “Upload” button (second from the left) to compile the code and start the binary download to the card.

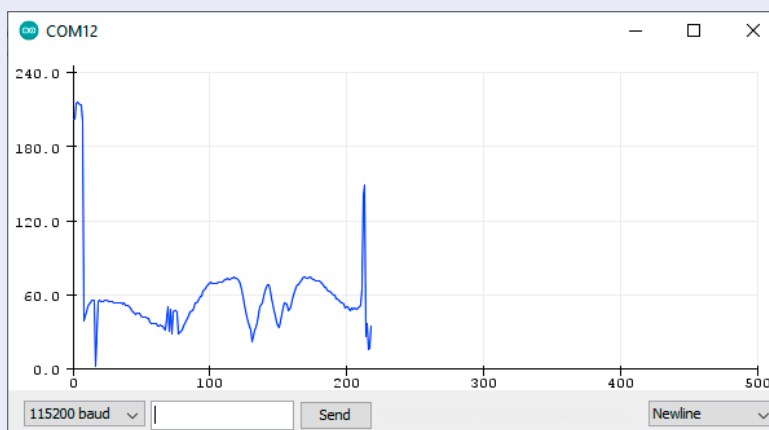


Visualize sensor output

You can visualize the sensor output as text or as a chart/plot. Both visualization methods require the serial port to be set up. The default baud rate used in the example is 115,200. Make sure it matches the monitor or plotter setting.



To visualize in chart or plot mode: From “Tools” menu select “Serial Plotter”



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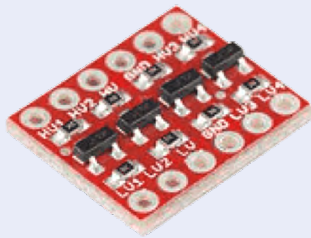
Multiple sensors

You can handle multiple sensors by following these steps:

1. For each sensor add its level shifter or use off-the-shelf N-MOS level shifters like:
 - a. Adafruit 4-channels bidirectional level-shifter,



- b. Sparkfun logic level shifter (making sure that Sensor IO Pull-up is 15 k Ω)



2. Open an example which supports multiple sensors, e.g. "TDK_USSM_multiple_cm"
3. Save, run and enjoy ...

Important information: Some parts of this publication contain statements about the suitability of our products for certain areas of application. These statements are based on our knowledge of typical requirements that are often placed on our products. We expressly point out that these statements cannot be regarded as binding statements about the suitability of our products for a particular customer application. It is incumbent on the customer to check and decide whether a product is suitable for use in a particular application. This publication is only a brief product survey which may be changed from time to time. Our products are described in detail in our data sheets. The Important notes (www.tdk-electronics.tdk.com/ImportantNotes) and the product-specific Cautions and warnings must be observed. All relevant information is available through our sales offices.