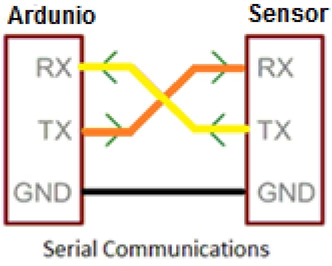
Application Note AN-157:
Arduino UART Interface to TelAire T6613 CO2 Sensor

Introduction



The Arduino UNO, Mega and Mega 2560 are ideal microcontrollers for reading CO2 sensors. Arduino boards are useful for a beginner level project up to integration into a complete sensor product. The Arduino to sensor interface is via 19,200 BAUD serial TXD-RXD connection.

If you are new to Arduino, these low cost development boards are available from many sources. We recommend you start with authentic Arduino products.

The Amphenol TelAire T6613 CO2 Sensor is a non-dispersive infrared (NDIR) carbon dioxide sensor factory calibrated to measure CO2 levels up to 2,000ppm (0.2%). It is one of the most popular C02 sensors ever produced. The dual channel design eliminates the need for calibration in most applications. Its flexible interface is designed to be easily connected to an Arduino or similar microcontroller. The sensor requires 5VDC, 180mA peak current and 33mA average current.

Run the Arduino Blink Example

The best way to become familiar with the Arduino Graphical User's Interface (GIU) is to create an Arduino project and run the example **Blink**. This simple test program confirms that a number of connection details and that the GUI are working properly.

Caution: Do not connect your Arduino board to your computer's USB port until the Arduino software is installed. Otherwise Windows would install a generic driver, not desired here.

Step 1: Install Arduino software on your computer. From this page select the **Windows Installer.** https://www.arduino.cc/en/Main/Software

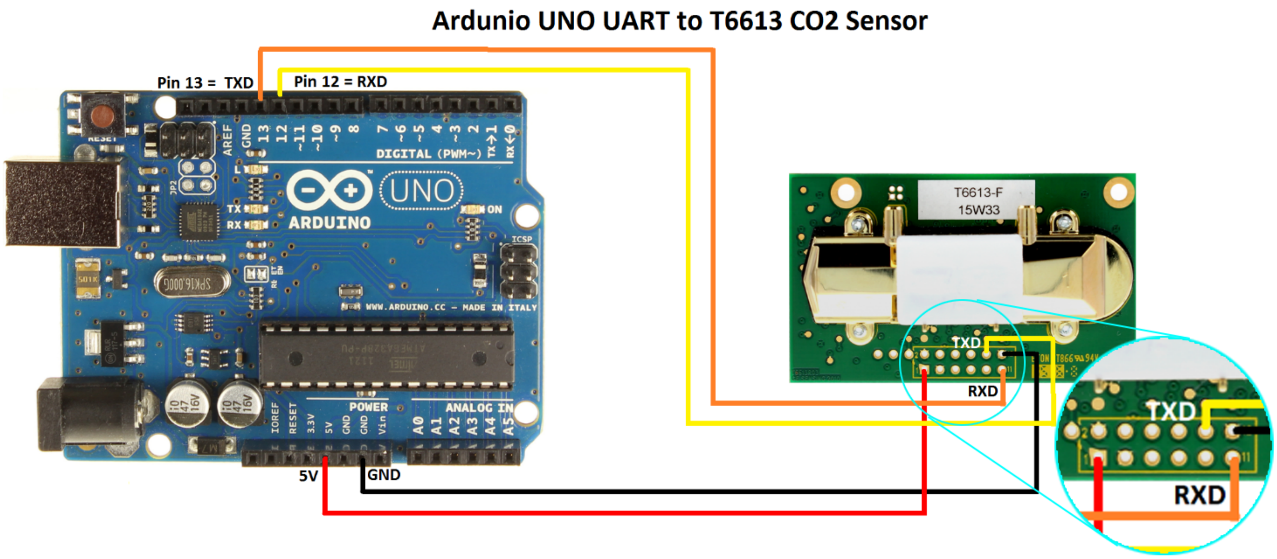
Step 2: To run the Blink example follow these instructions: https://www.arduino.cc/en/Tutorial/Blink

Note that the MEGA Arduinos have a LED on board. The Arduino UNO may require a LED and resistor be added as specified in the tutorial.

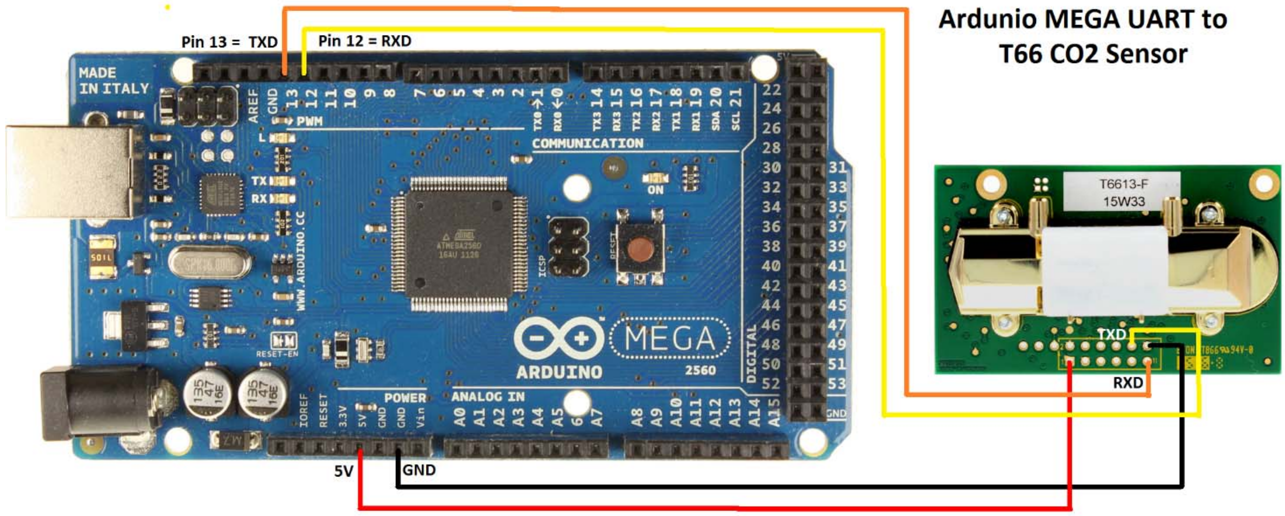
Once Blink runs properly, you can connect the sensor.

Connecting the T6613 Sensor

Refer to the wiring diagram below for the Arduino Uno or Arduino Mega.



The connections for the Arduino MEGA are identical to the Mega2560.



Creating an Arduino Project

This Arduino project uses the Software.Serial driver which is built into the Arduino software. This statement

```
SoftwareSerial T66_Serial(12,13)
```

Sets up a virtual serial port using pin 12 for Rx and pin 13 for Tx on both UNO and MEGA boards.

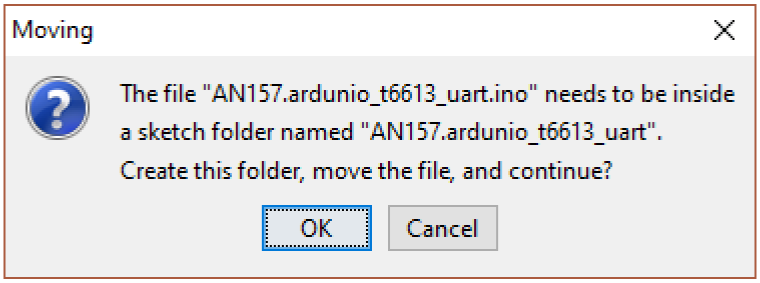
Demo file download instructions

1. Click on the following link or copy this URL to download the example code:

   http://co2meters.com/Documentation/AppNotes/AN157-T6613-Arduino-uart.zip

2. Save the example code to your hard drive. Inside the .zip file, navigate to the AN157-Arduno-T6613-uart.ino file in the example folder. Extract it from the .zip file.

3. Double-click the K30_basic.ino file to open it in the Arduino GUI. It will start and ask the following:



Moving

The file "AN157.ardunio_t6613_uart.ino" needs to be inside a sketch folder named "AN157.ardunio_t6613_uart".
Create this folder, move the file, and continue?

4. Click on OK. Observe the Arduino project code is displayed.

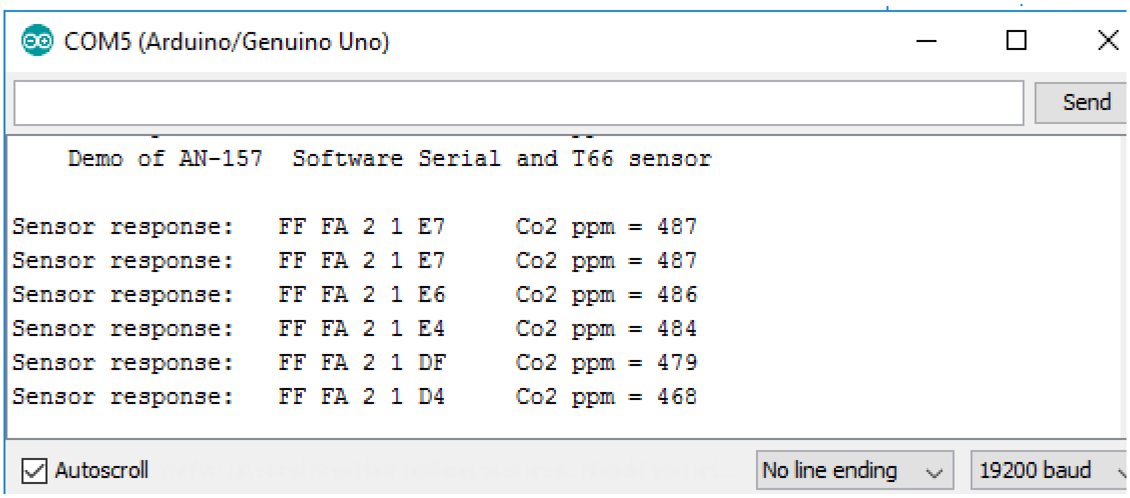
5. Click on Sketch >> Verify/Compile. The project should compile without errors.

6. Verify that your Arduino board is recognized correctly:
   a. Click on Tools. Set Board to Arduino Uno or MEGA.
   b. Confirm that Processor matches your Arduino: UNO, MEGA or MEGA 2560.

7. Click on Upload. When done uploading, your project is now running in the Arduino board.

8. To view program operation, click on Tools >> Serial Monitor.

9. Observe the following:



```
    Demo of AN-157  Software Serial and T66 sensor

Sensor response:   FF FA 2 1 E7     Co2 ppm = 487
Sensor response:   FF FA 2 1 E7     Co2 ppm = 487
Sensor response:   FF FA 2 1 E6     Co2 ppm = 486
Sensor response:   FF FA 2 1 E4     Co2 ppm = 484
Sensor response:   FF FA 2 1 DF     Co2 ppm = 479
Sensor response:   FF FA 2 1 D4     Co2 ppm = 468
```

☑ Autoscroll

No line ending

19200 baud

Note Appendix A contains the .txt version of Arduino code. It is also available in the .zip file.

Appendix A:

Ardunio code runs on UNO, MEGA OR MEGA2560

```
/* AN-157 Demo of T-66 using Software Serial

 Arduino example for t6613 CO2 sensor 0-2000 PPM   19200 BPS
 2/2017 by Marv Kausch @ Co2meter.com
*/
#include "SoftwareSerial.h"
SoftwareSerial T66_Serial(12,13); //Sets up a virtual serial port
 //Using pin 12 for Rx and pin 13 for Tx
byte readCO2[] = {0xFF, 0XFE,2,2,3}; //T66 read CO2 command: 5 bytes

byte response[] = {0,0,0,0,0}; //create an array to store the response


void setup()
{
 // put your setup code here, to run once:
 Serial.begin(19200); //Opens the main serial port to communicate with the computer
 T66_Serial.begin(19200); //Opens the virtual serial port with a baud of 9600
 Serial.println("    Demo of AN-157  Software Serial and T66 sensor");
 Serial.print("\n");
}

void loop()
{
 sendRequest(readCO2);   //Locate the problem of program reset whduring this
function call

 unsigned long valCO2 = getValue(response);// Request from sensor 5 bytes of data
 Serial.print("Sensor response:   ");
 for(int i=0;i<5;i++)
 {
  Serial.print(response[i],HEX);
  Serial.print(" ");
 }
 Serial.print("    Co2 ppm = ");
 Serial.println(valCO2);
delay(2000);  //T6613 spec indicates signal update every 4 seconds
}

void sendRequest(byte packet[])
{
 while(!T66_Serial.available()) //keep sending request until we start to get a
response
 {
 T66_Serial.write(readCO2,5);// Write to sensor 5 byte command
 delay(50);
 delay(1000);
 }
 int timeout=0; //set a timeoute counter
 while(T66_Serial.available() < 5 ) //Wait to get a 7 byte response
 {
 timeout++;
 if(timeout > 10) //if it takes to long there was probably an error
 Serial.print("Timeout");
 {
 while(T66_Serial.available()) //flush whatever we have
 T66_Serial.read();

 break; //exit and try again
 }
 delay(50);
 }
  for (int i=0; i < 5; i++) response[i] = T66_Serial.read();
}

unsigned long getValue(byte packet[])
{
 int high = packet[3]; //high byte for value is 4th byte in packet in the packet
 int low = packet[4]; //low byte for value is 5th byte in the packet
 unsigned long val = high*256 + low; //Combine high byte and low byte with this
formula to get value
 return val;
}
```