

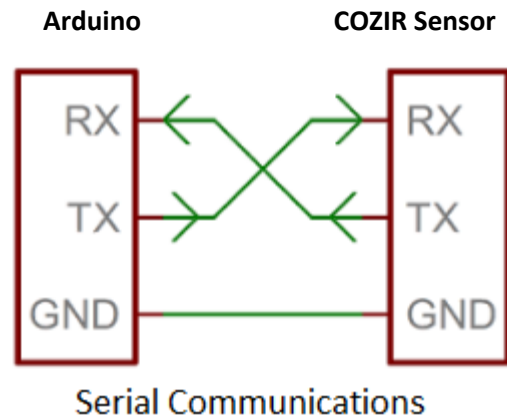
# Application Note AN-128: Arduino UART to Interface to COZIR Sensor

## Introduction

The Arduino Uno, Mega 1280 or Mega 2560 are ideal microcontrollers for operating a COZIR sensor using an industry-standard UART TXD-RXD connection.

The example code contained in this app note utilizes Software.Serial, a library built into the Arduino software.

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



## Run the Blink Example

The best way to become familiar with the Arduino Graphical User's Interface (GUI) is to verify your Arduino board is operating properly. 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 the Arduino board to the USB port until the Arduino software is installed. Otherwise Windows will install a generic driver and the Arduino will not operate.

**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>

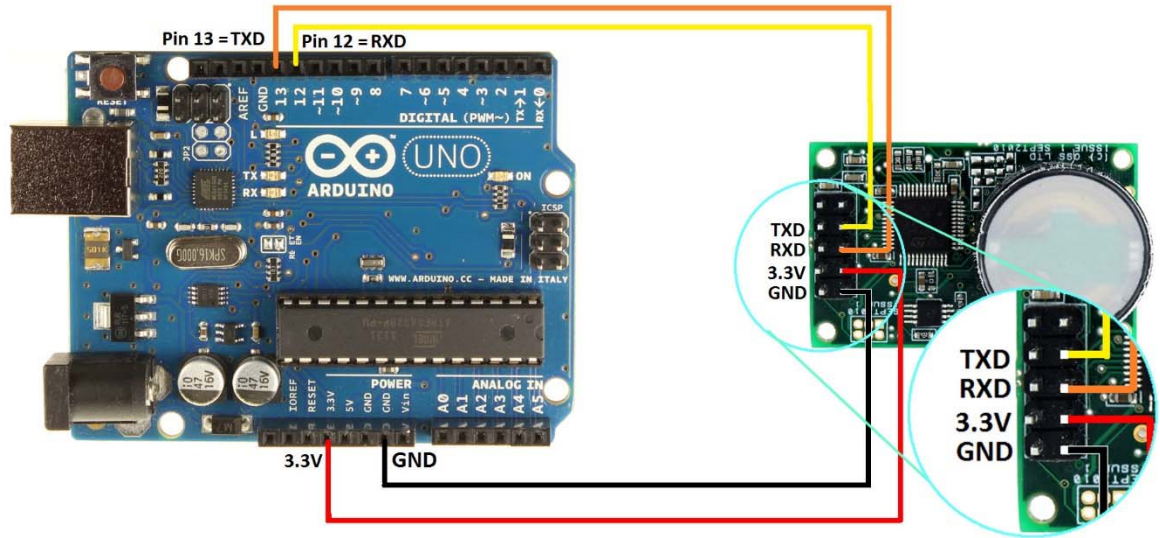
Note that the MEGA Arduinos have a LED on board. The Arduino UNO may require a LED and resistor be added as specified in the tutorial.

Once Blink runs properly, you can connect the COZIR sensor.

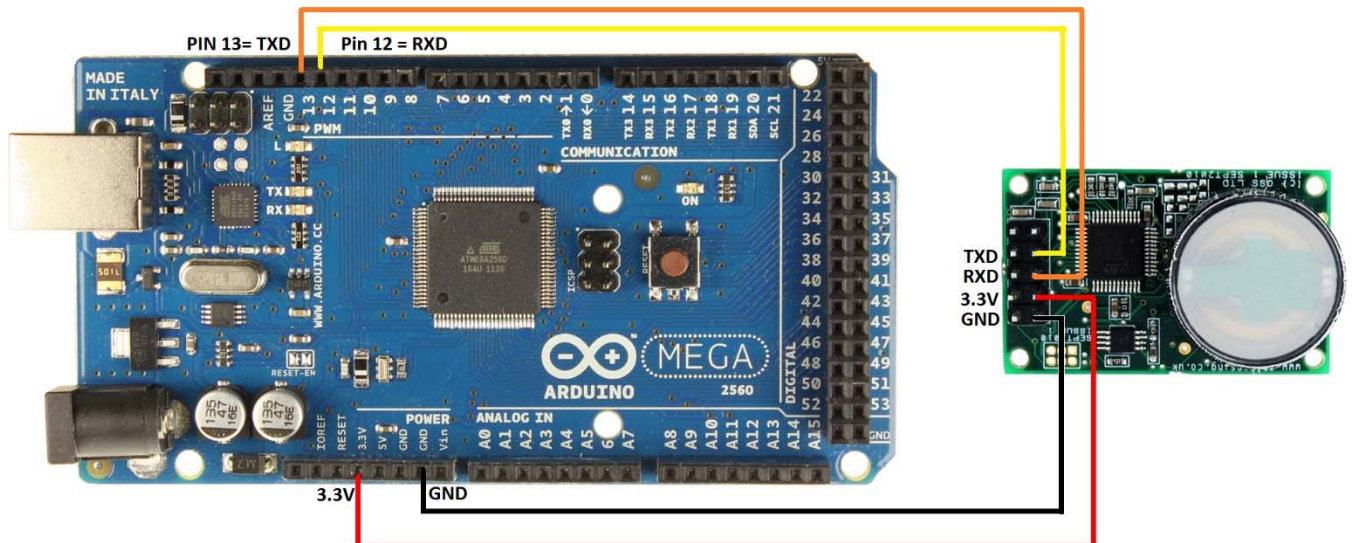
## Connecting your Arduino

Refer to the wiring diagram below for the Arduino Uno or Arduino Mega 2560. The connections for Arduino MEGA are identical to the Mega 2560.

### Arduino Uno to COZIR via Software.Serial UART



### Arduino Mega or MEGA 2560 to COZIR via Software.Serial UART



## Creating an Arduino Project

### Example

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

```
SoftwareSerial mySerial(12, 13); // RX, TX pins on Arduino
```


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

### Demo file download instructions

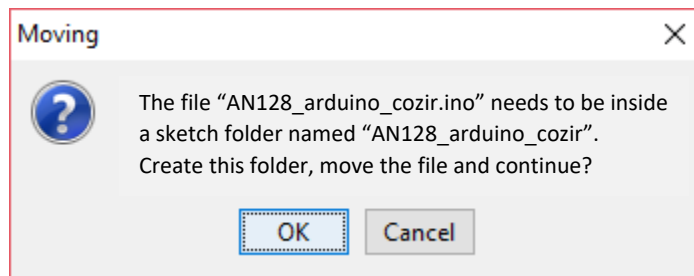
1. Click on the following link or copy this URL to download the example code:

<http://co2meters.com/Documentation/AppNotes/AN128-COZIRWR-arduino-uart.zip>

2. Save the example code to your hard drive. Inside the .zip file, navigate to the AN128\_arduino\_cozir.ino file in the example folder. Extract it from the .zip file.

Name	Type	Compressed size	Password ...
 AN128_arduino_cozir.ino	INO File	2 KB	No

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



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:

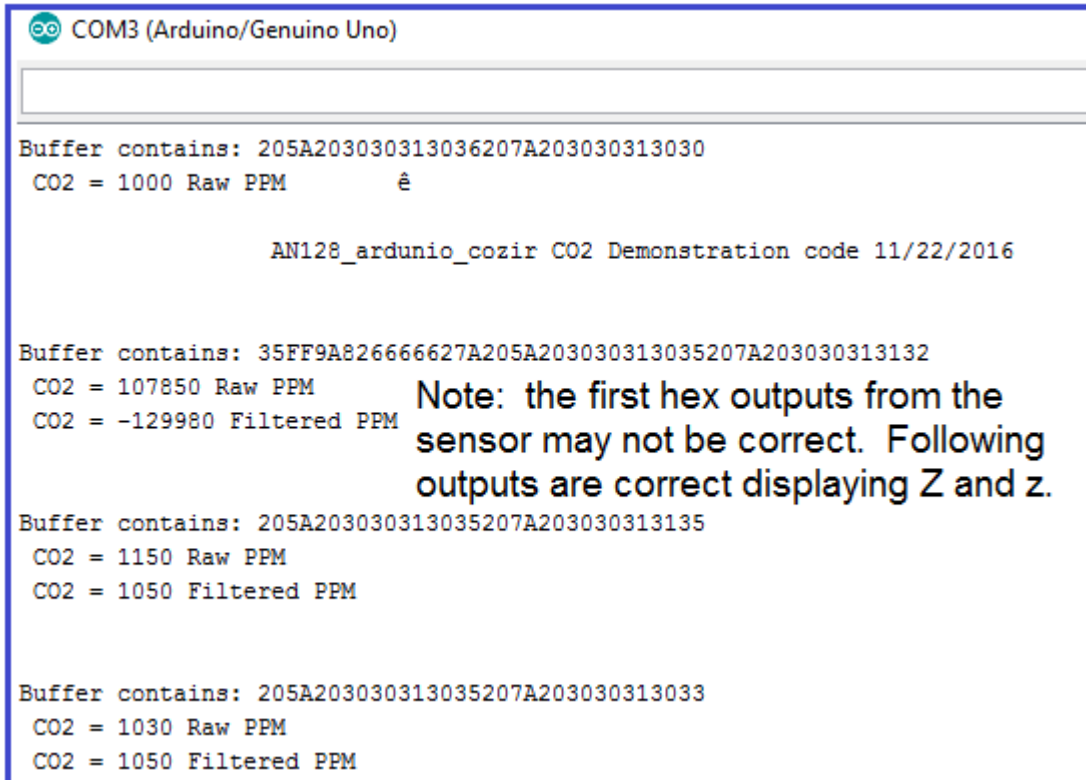
- Click on Tools. Set Board to Arduino Uno or MEGA.
- Confirm that Processor matches your Arduino: Uno, MEGA or MEGA 2560.

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. Note that your COM number may differ from the COM port number shown here.

9. You should see the following:

### Serial Monitor output



The screenshot shows a serial monitor window titled "COM3 (Arduino/Genuino Uno)". The output text is as follows:

```
Buffer contains: 205A203030313036207A203030313030
CO2 = 1000 Raw PPM      ê

                AN128_ardunio_cozir CO2 Demonstration code 11/22/2016

Buffer contains: 35FF9A826666627A205A203030313035207A203030313132
CO2 = 107850 Raw PPM
CO2 = -129980 Filtered PPM
Note: the first hex outputs from the
sensor may not be correct. Following
outputs are correct displaying Z and z.

Buffer contains: 205A203030313035207A203030313135
CO2 = 1150 Raw PPM
CO2 = 1050 Filtered PPM

Buffer contains: 205A203030313035207A203030313033
CO2 = 1030 Raw PPM
CO2 = 1050 Filtered PPM
```

The easiest way to test the sensor is to blow on it and watch the CO2 level rise.

## Appendix A: Sample code

```

/*
AN128_ardunio_cozir CO2 Demonstration code.
  Runs on Ardunio UNO, MEGA or MEGA2560
  Written by: Marv Kausch 11/22/2016 for Co2meter.com
  Revised 11/29/17, 2/14/18 by John Houck

  This sketch connects a COZIR sensor and reports readings back to the host
  computer over USB.
  The value is stored in a global variable 'co2' and can be used for any
  number of applications.

  pin connections:

  Arduino_____COZIR Sensor
  GND ----- 1 (gnd)
  3.3v----- 3 (Vcc)
  13 ----- 5 (Rx)
  12 ----- 7 (Tx)
*/
#include <SoftwareSerial.h>

SoftwareSerial mySerial(12, 13); // RX, TX pins on Ardunio

int co2 =0;
double multiplier = 1;// 1 for 2% =20000 PPM, 10 for 20% = 200,000 PPM
uint8_t buffer[25];
uint8_t ind =0;
uint8_t index =0;

int fill_buffer(); // function prototypes here
int format_output();

void setup() {
  Serial.begin(9600);
  Serial.print("\n\n");
  Serial.println("          Ardunio to COZIR CO2 Sensor - Demonstration
code 2/14/18\n\n");
  mySerial.begin(9600); // Start serial communications with sensor
  //mySerial.println("K 0"); // Set Command mode
  mySerial.println("M 6"); // send Mode for Z and z outputs
  // "Z xxxxx z xxxxx" (CO2 filtered and unfiltered)

  mySerial.println("K 1"); // set streaming mode
}

```

```

void loop() {
  fill_buffer(); // function call that reads CO2 sensor and fills buffer

  Serial.print("Buffer contains: ");
  for(int j=0; j<ind; j++)Serial.print(buffer[j],HEX);
  index = 0;
  format_output();
  Serial.print(" Raw PPM          ");

  index = 8; // In ASCII buffer, filtered value is offset from raw by 8
bytes
  format_output();
  Serial.println(" Filtered PPM\n\n");
}

int fill_buffer(void){

// Fill buffer with sensor ascii data
ind = 0;
while(buffer[ind-1] != 0x0A){ // Read sensor and fill buffer up to 0xA = CR
  if(mySerial.available()){
    buffer[ind] = mySerial.read();
    ind++;
  }
}
// buffer() now filled with sensor ascii data
// ind contains the number of characters loaded into buffer up to 0xA =
CR
  ind = ind -2; // decrement buffer to exactly match last numerical
character
}

int format_output(void){ // read buffer, extract 6 ASCII chars, convert to
PPM and print
  co2 = buffer[15-index]-0x30;
  co2 = co2+((buffer[14-index]-0x30)*10);
  co2 +=(buffer[13-index]-0x30)*100;
  co2 +=(buffer[12-index]-0x30)*1000;
  co2 +=(buffer[11-index]-0x30)*10000;
  Serial.print("\n CO2 = ");
  Serial.print(co2*multiplier,0);
// Serial.print(" PPM,");
// Serial.print("\n");
  delay(200);
}

```

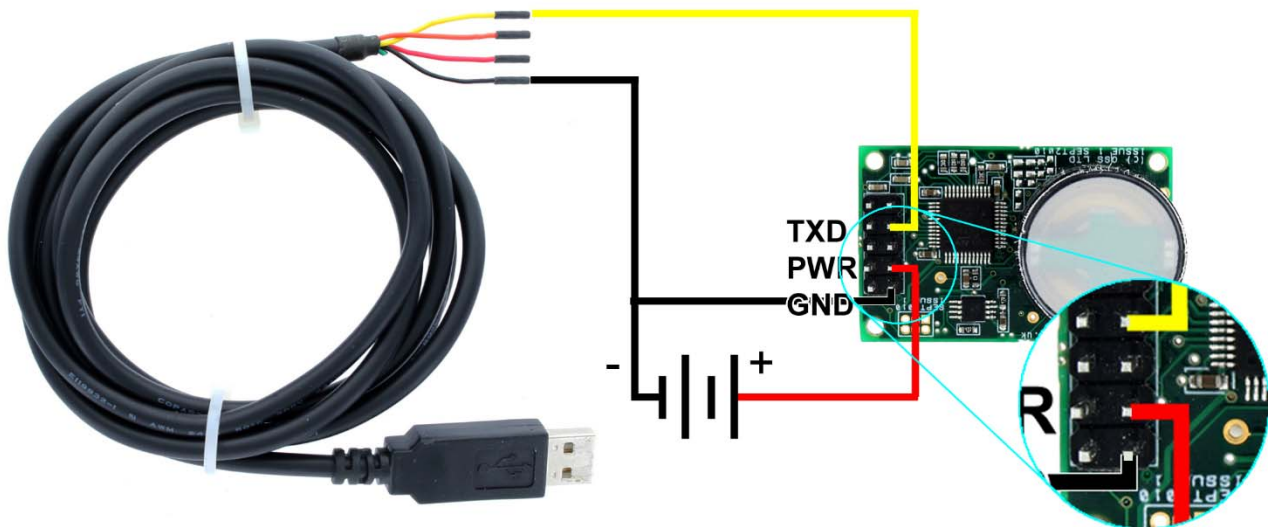


## Appendix B: Termite Output Monitor

**Termite**, a Simple RS-232 Terminal emulator, is very useful for observing, sending and receiving RS-232 serial ASCII data. The image below shows the connections which will display actual ASCII data coming from the COZIR. This ASCII data is also parsed by the Arduino code described in this app note.

**Important:** The USB cable contains a FTDI interface converting RS-232 to USB. Be sure to use a FTDI compatible cable **Termite** is available from <http://termie.sourceforge.net>

USB FTDI Cable to COZIR Sensor



Sample Data  
Output:

