

AMS 5915 AN02

How to use an AMS 5915 pressure sensor with an Arduino Nano

This application note describes how to interface an AMS 5915 board mount pressure sensor with the Arduino Nano development board to read data from the sensor's I2C interface.

AMS 5915 [1] is a series of 14 bit digital board-mount pressure sensors available for all pressure types in various pressure ranges from 5 mbar up to 16 bar. With a supply voltage of 3.3 V and an I2C output providing calibrated pressure and temperature data, it is ideal for microcontroller applications. A popular, very small microcontroller development board in the Arduino family is the Arduino Nano [2] based on the ATmega328. It features a Mini-B USB port and several GPIO-pins (general purpose in- and outputs) including an I2C-interface on a compact PCB. The Arduino Nano is ideal for beginners and experts to read data from sensors without a long development time.

The communication between AMS 5915 and Arduino Nano is established via the I2C-Bus. *Figure 1* illustrates the principal electrical circuit, which can be used to read data from AMS 5915 using an Arduino Nano.

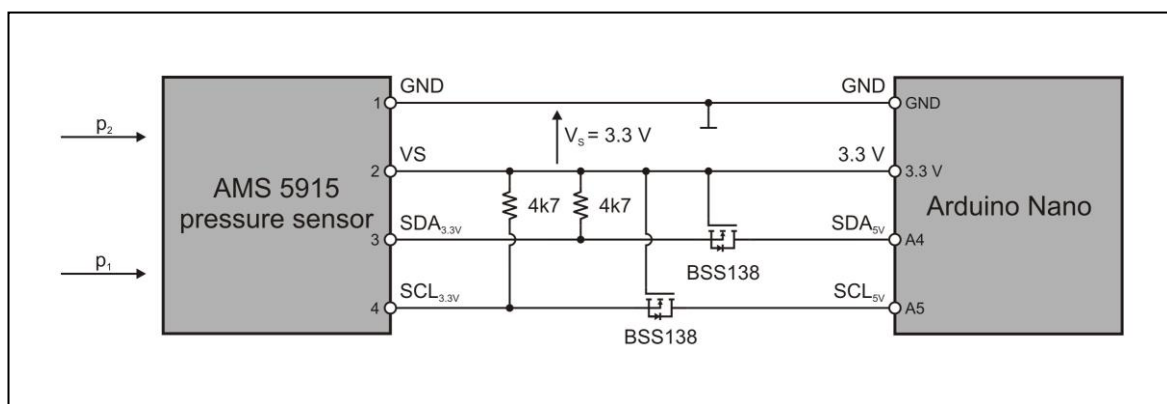


Figure 1: Electrical circuit for data read out of AMS 5915 with an Arduino Nano

In general only four lines are necessary to interface an AMS 5915 pressure sensor with an Arduino Nano: two lines are required to power AMS 5915 using Arduino's 3.3 V voltage source and additional two lines are needed for I2C communication. To power the sensor Arduino's 3.3 V and GND pins are connected to AMS 5915's corresponding pins 2 (Vs) and 1 (GND) directly. Due to the different logic voltage high levels of AMS 5915's (3.3 V) and Arduino's I2C bus (5 V) the I2C connection cannot be established by simply connecting Arduino Nano's and AMS 5915's corresponding SCL and SDA pins. Instead two bidirectional level shifters, one for the SDA and one for the SCL line, are needed to translate the different voltage levels into each other.

These bidirectional level shifters can be realized using N-channel enhancement MOSFETs (e.g. BSS138 [3]) with a threshold voltage of $V_{GS(th)} < 3.3$ V. For each I2C-Bus line one MOSFET is used; the gate of each MOSFET is connected to Arduino's 3.3 V pin, the respective source is connected either to AMS 5915's pin 3 (SCL) or pin 4 (SDA) and the respective drain to Arduino Nano's pin A5 (SCL) or pin A4 (SDA) (for more information see [4]).

Furthermore two 4.7 kΩ pull-up resistors have to be added to the I2C communication lines (SCL and SDA) on the sensor's 3.3 V side to generate the logic high levels. At Arduino's 5 V side no pull-up resistors are required due to Arduino's internal pull-up resistors. As soon as AMS 5915 is connected to Arduino Nano as described above, I2C communication between AMS 5915 and Arduino is possible and after uploading a suitable program to Arduino data can be read from the sensor.

Since assembling the circuit takes soldering skills or at least a suitable solderless breadboard Analog Microelectronics offers the AMS 5915 Arduino Nano kit [5], which is ready-to-use without any soldering. It contains a set of PCBs connecting AMS 5915 to an Arduino Nano and a free software package [6], [7].

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References:

- 1.) AMS 5915's data sheet
(see <https://www.analog-micro.com/products/pressure-sensors/board-mount-pressure-sensors/ams5915/ams5915-datasheet.pdf>)
- 2.) Arduino Nano (<https://www.arduino.cc/en/Main/ArduinoBoardNano>)
- 3.) BSS138's data sheet (see <http://www.onsemi.com/PowerSolutions/product.do?id=BSS138>)
- 4.) AN10441 (<https://www.nxp.com/docs/en/application-note/AN10441.pdf>)
- 5.) AMS 5915 Arduino Nano kit (available at <https://www.analog-micro.com>)
- 6.) AMS Arduino library "AMS.zip" (see <https://www.analog-micro.com/products/pressure-sensors/board-mount-pressure-sensors/ams5812/AMS.zip>)
- 7.) AMS Arduino library reference
(available at https://www.analog-micro.com/products/pressure-sensors/board-mount-pressure-sensors/ams5812/AMS_arduino_lib.pdf)