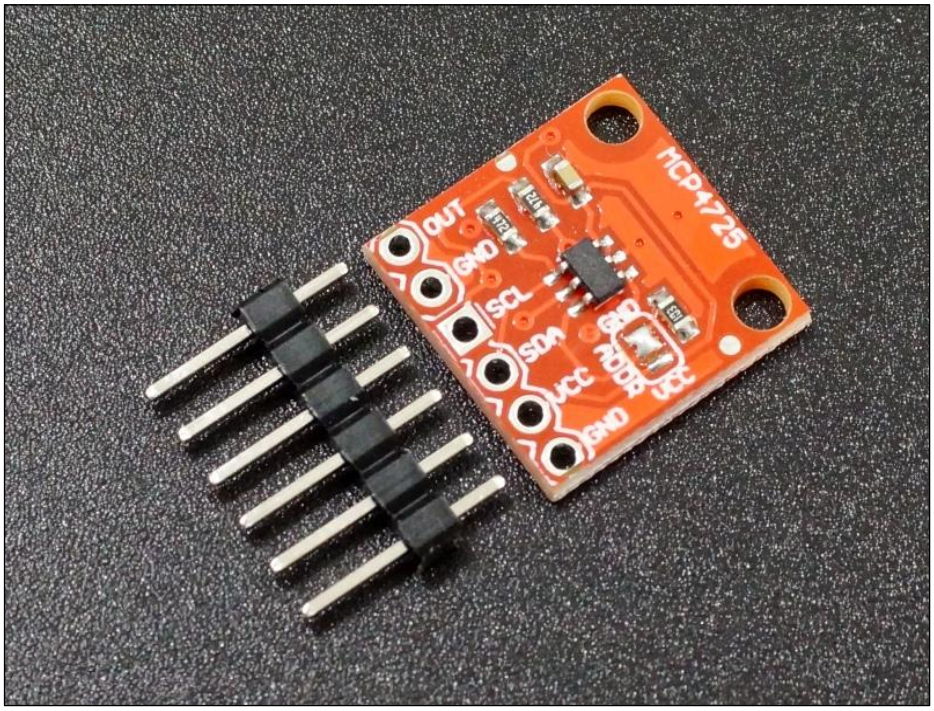
Electronic DC Load – Sensors & Modules

1. MCP 4725 – Digital to analog converter(DAC)

In our microcontroller, ATmega 328(Arduino Uno) does not have DAC. The MCP4725 module is a precision 12-bit Digital-to-Analog converter with I2C interface and build-in EEPROM.



Output – The 12-bit single provides 4096 steps of resolution. For VCC 5V,the step size will be 5V/4096 = 1.22mV. The maximum amount of current that the output can sink or source is 25mA.

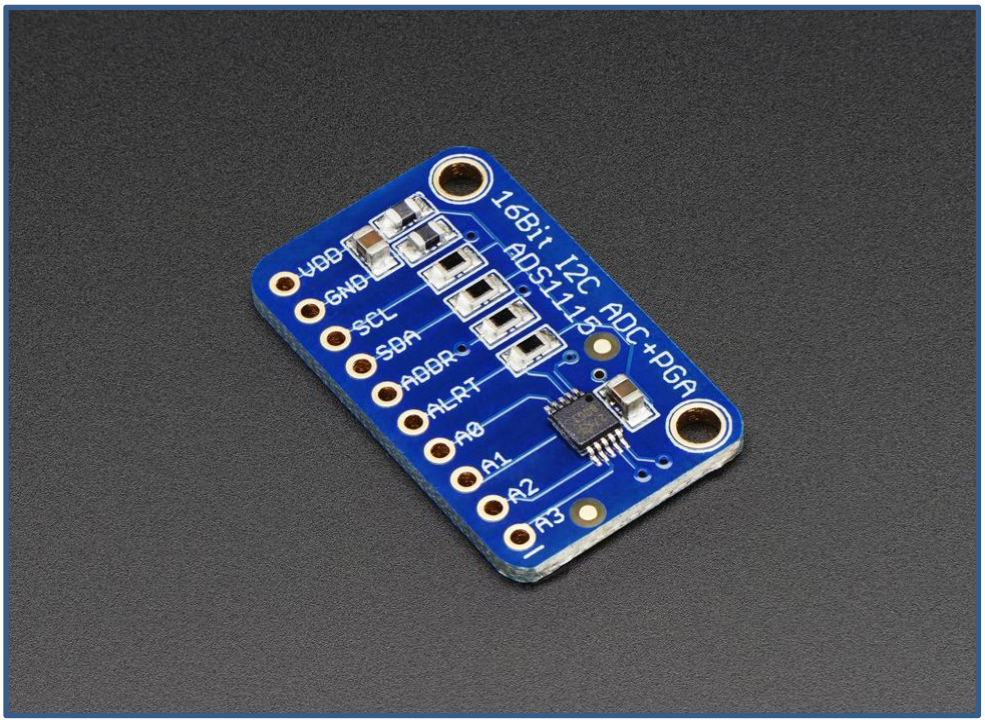
I2c interface - Connect SCL and SDA, I2C lines to same on the MCU. The address is set by bridging 2 of the 3 small solder pads on top of the module marked 'ADDR'. Default I2C address is 0x60. If you want to change it , the solder blob removed and the center pin and the VCC pin can bridged.

EEPROM – This module includes a built-in EEPROM that can be used to save the setting when the device is powered down. This includes the data values for the DAC output which can be handy in some applications because it allows the device to power up and output a particular voltage without needing to be reprogrammed by an microcontroller.

2. ADS 1115 – Analog to Digital converter(ADC)

The ADS1115 is a precision 4-channel 16-bit ADC with I2C interface that greatly improves the measurements accuracy over the built-in ADC of arduino.

Microcontrollers usually have built-in ADC capability, but it is generally limited to no more than 10-bit resolution. That resolution is fine for monitoring basic analog voltages such as reading a potentiometer setting, but they fall far short for more demanding applications such as calculating current flow by measuring the small voltage drop across a shunt resistor.



Inputs - With its 16-bit resolution and programmable measurement ranges, it can measure voltage in resolution steps from 0.1875mV when measuring a 5V range to as small as 7.8125uV when measuring a 0.256V range.

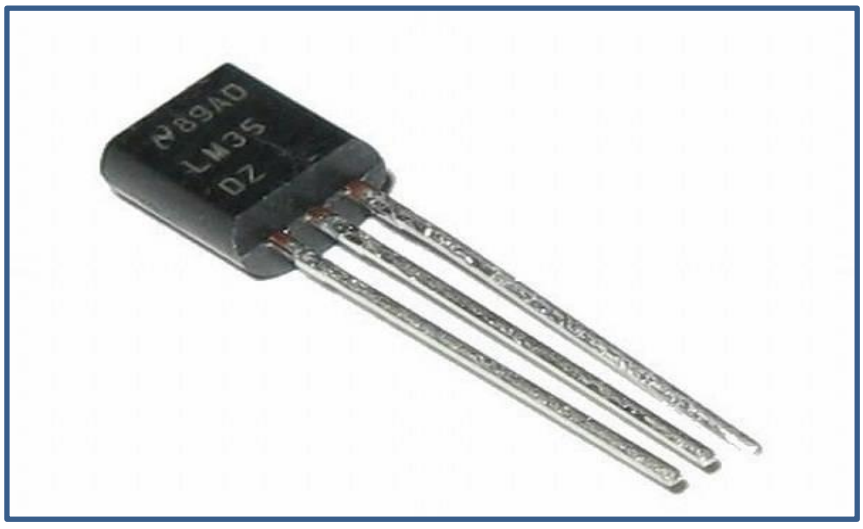
This module has 4 inputs and they can be configured to operate in 3 different modes.

- Single-Ended mode - The 4 inputs (A0-A3) can each be used as separate inputs with each referenced to ground.
- Differential mode - The inputs act in pairs to measure the difference in voltage between the two inputs. The channel pairing is A0 – A1 and A2 – A3.
- Comparator mode - The input is constantly measured and compared against a value that has be set in the device.

3. LM 35 – Temperature sensor

LM35 is a temperature measuring device having an analog output voltage proportional to the temperature. It provides output voltage in Centigrade (Celsius). It does not require any external calibration circuitry.

The sensitivity of LM35 is 10 mV/degree Celsius. As temperature increases, output voltage also increases. It is a 3-terminal sensor used to measure surrounding temperature ranging from -55 °C to 150 °C.



Pin description

VCC – Supply voltage(4V-30V)

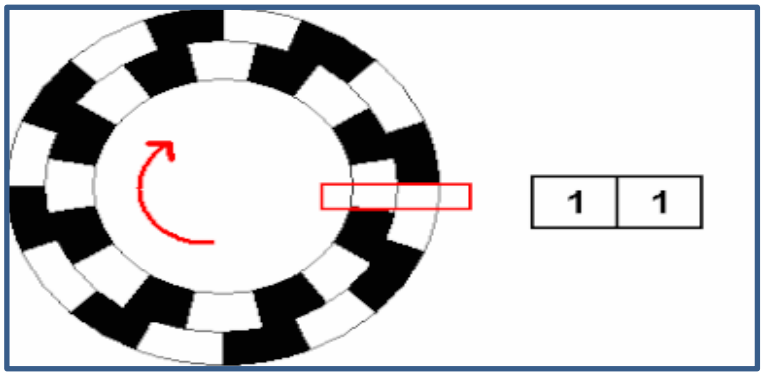
Out – analog output voltage which is proportional to the temperature (in degree Celsius).

GND – ground

4. Rotary encoder

A rotary encoder is a type of position sensor which is used for determining the angular position of a rotating shaft. It generates an electrical signal, either analog or digital, according to the rotational movement.

The encoder has a disk with evenly spaced contact zones that are connected to the common pin C and two other separate contact pins A and B, as illustrated below.



When the disk will start rotating step by step, pins A and B will start making contact with the common pin and the two square wave output signals will be generated accordingly.

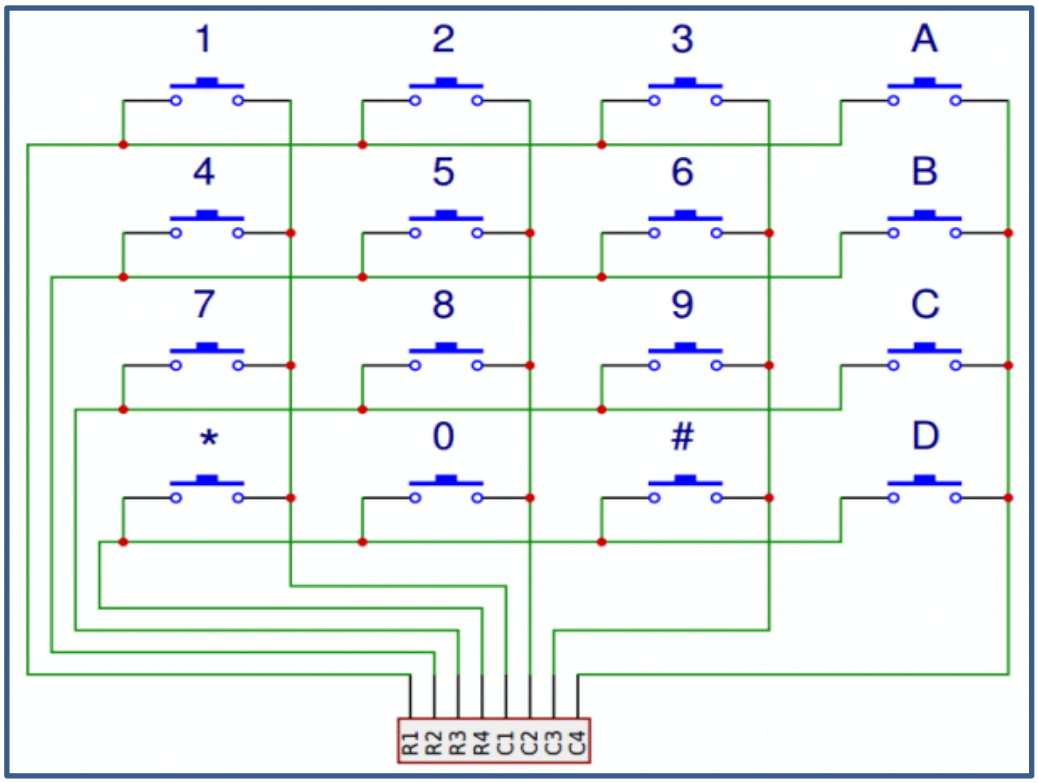
Any of the two outputs can be used for determining the rotated position if we just count the pulses of the signal. However, if we want to determine the rotation direction as well, we need to consider both signals at the same time.

So if we count the steps each time the signal changes, from High to Low or from Low to High, we can notice at that time the two output signals have opposite values. Vice versa, if the encoder is rotating counter-clockwise, the output signals have equal values.

5. Keypad

I'll be using a 4X4 matrix membrane keypad in this project, 4X4 keypad has 4 rows and 4 columns.

The schematic for a 4X4 keypad shows how the rows and columns are connected:



The working principle is very simple. Pressing a button shorts one of the row lines to one of the column lines, allowing current to flow between them. For example, when key ‘4’ is pressed, column 1 and row 2 are shorted.

6. I2C LCD adapter

There are 16 output pins for LCD display which can be soldered directly to back of the 16 X 2 LCD module. The input pins are +5V, GND, SDA and SCL. The SDA and SCL pins on Arduino Uno are pins A4 and A5 respectively. The Adapter is soldered on the back of the LCD display and as we can see that we saved loads of GPIO pins for other tasks

The module has 16 output pins and 4 input pins. We can just solder the adapter to the back of the 16 x 2 LCD display. Out of the 4 input pins, the two are +5V and GND, rest of the two are SDA and SCL. We can see that we saved a lot of pins at Arduino for other input / output tasks. We can adjust the contrast of the display by adjusting the potentiometer with small screw driver

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