Electronic Components Resource for Arduino-based Rescue Robots

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Summary

Overview

This document should assist you in understanding some of the microprocessor, sensor, and motor options available when selecting parts for Arduino robots. Whilst in the authors' experience all parts are cross compatible, this may vary over time.

Suggested Basic Kits

Below are some basic kit suggestions that you can use to base your robots from. You will likely wish to consider adding other components, such as orientation sensors, as your robots mature. Batteries and Battery Chargers must also be obtained.

	Primary Rescue	Secondary Rescue	Open Rescue
Microprocessor	Qty 1 Arduino Uno Rev3	Qty 1 Arduino Mega 2560 Rev3	Qty 1 Arduino Mega 2560 Rev3
Motor Controllers	Qty 1 Adafruit Motor/Stepper/Servo Shield	Qty 1 Adafruit Motor/Stepper/Servo Shield	Qty 1 Adafruit Motor/Stepper/Servo Shield
Drive Motors	Qty 2 70RPM 12VDC Reversible Gearhead Motor	Qty 2 70RPM 12VDC Reversible Gearhead Motor	Qty 2 70RPM 12VDC Reversible Gearhead Motor
Control/Lift Motors	-	Qty 1 70RPM 12VDC Reversible Gearhead Motor	Qty 1-2 70RPM 12VDC Reversible Gearhead Motor
Colour Sensors	Qty 2 Adafruit TCS34725	Qty 2 Adafruit TCS34725	Qty 2 Adafruit TCS34725
Light Sensor Array		Qty 1 QTRX-MD-13A Reflectance Sensor Array	Qty 1 QTRX-MD-13A Reflectance Sensor Array
Object Sensor	Qty 1 HC-SR04 Ultrasonic Sensor	Qty 1 HC-SR04 Ultrasonic Sensor	Qty 1 HC-SR04 Ultrasonic Sensor
Data Storage	Qty 1 MicroSD card breakout board+	Qty 1 MicroSD card breakout board+	Qty 1 MicroSD card breakout board+

Microprocessors

Selection Guide

When selecting a microprocessor, it is important to have first considered what sensors you wish to include on your robot and in what quantities. This will determine the numbers of analogue and digital pins that your microprocessor will require.

The length of the code you will be running and the number of variables in it will determine the amount of flash memory, SRAM and EPROM you will need. Sensor libraries that are included will also take additional memory.

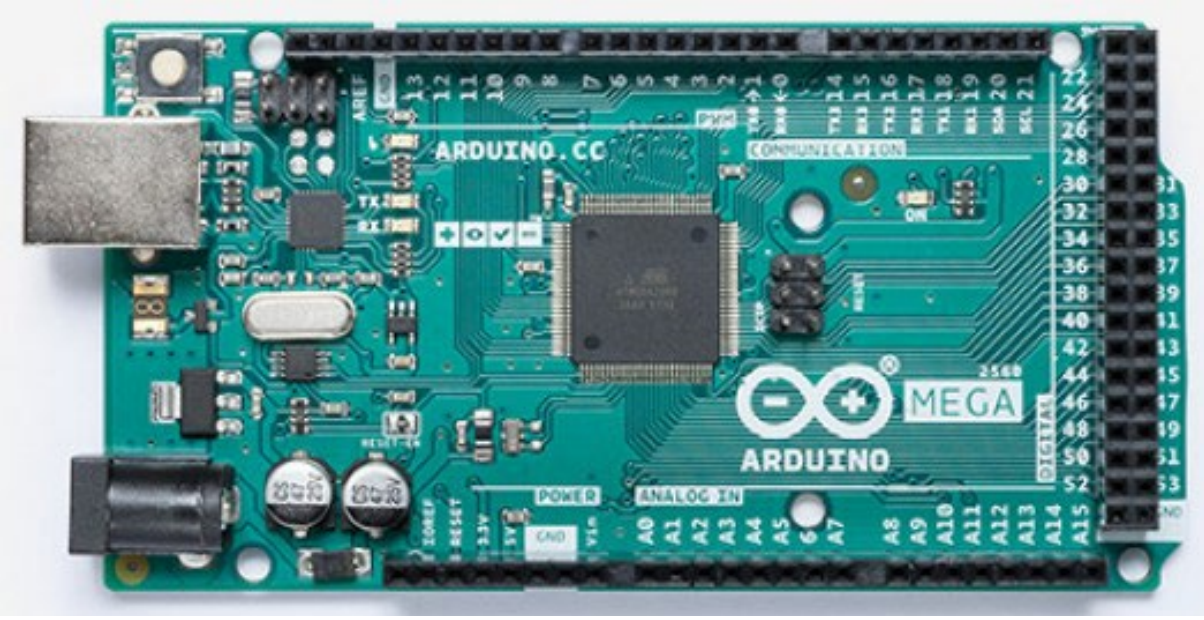
I have found an Arduino Uno Rev3 to be sufficient for Primary and Secondary Rescue Line but not for Open Rescue Line. For Open Rescue Line an Arduino Mega 2560 Rev3 is a good choice.

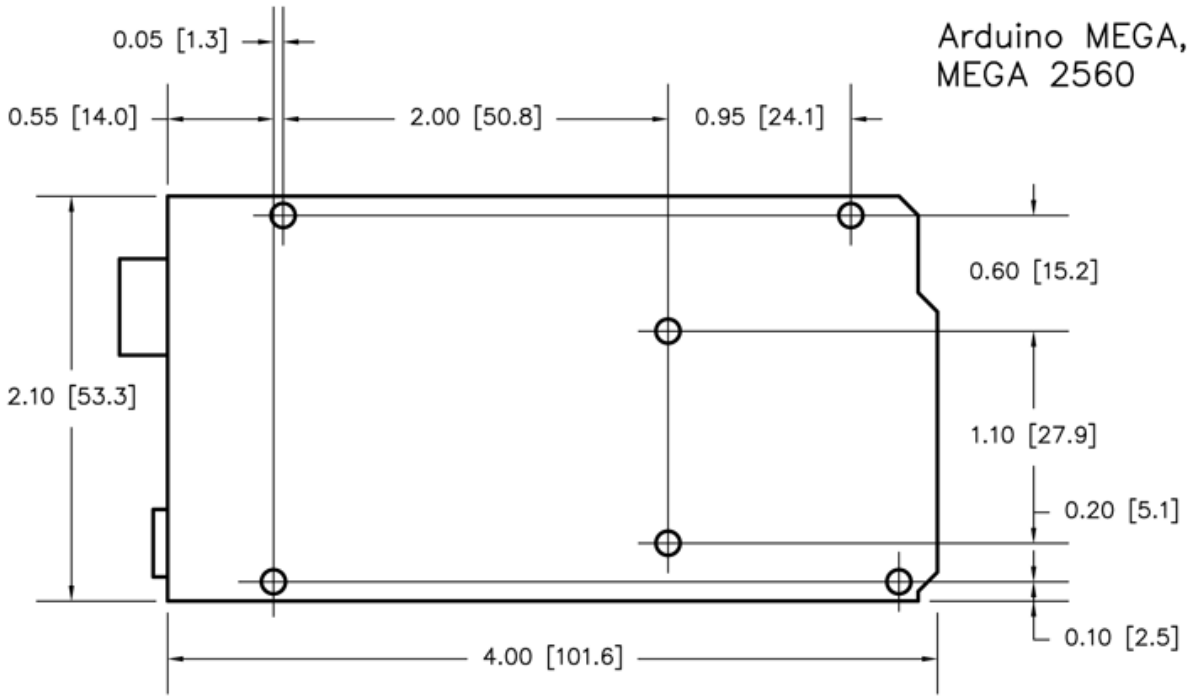
There are many other brands and models of microprocessor boards available. The ones outlined below are ones that I have used and found to work well. Other options that may be worth considering are the Arduino Due, Teensy 4.0, and BeagleBone brand microprocessor boards. The Raspberry Pi is a common choice of microprocessor board; however, I believe that the lack of analogue ports on them is a significant mistake that limits their functionality and usefulness.

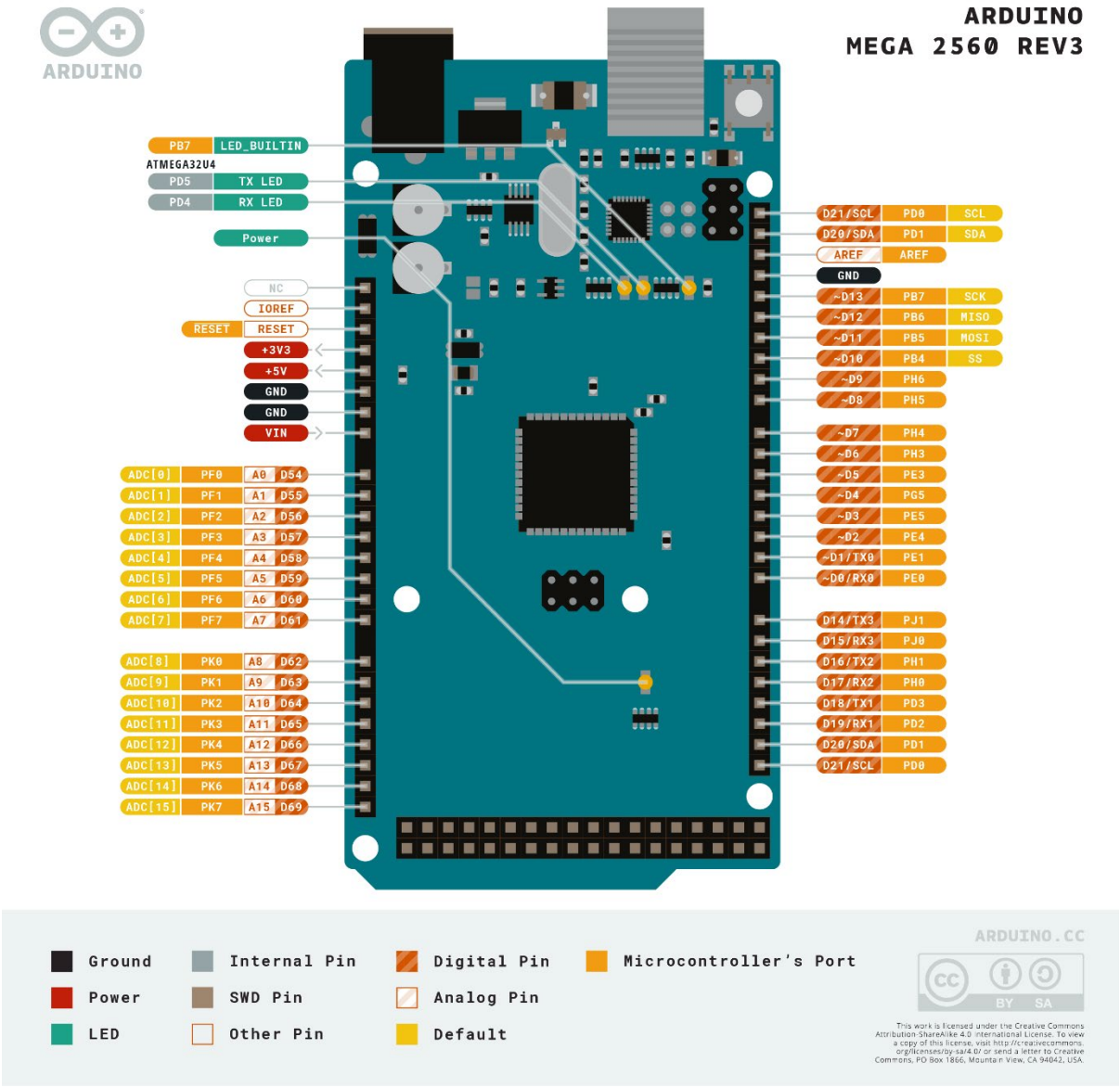
Comparison Table

	Arduino Mega 2560 Rev3	**Arduino Uno Rev3**
Microcontroller	ATmega2560	ATmega328P
Operating Voltage	5V	5V
Input Voltage (recommended)	7-12V	7-12V
Input Voltage (limit)	6-20V	6-20V
Digital I/O Pins	54 (of which 15 provide PWM output)	14 (of which 6 provide PWM output)
PWM Digital I/O Pins	15	6
Analog Input Pins	16	6
DC Current per I/O Pin	20 mA	20 mA
DC Current for 3.3V Pin	50 mA	50 mA
Flash Memory	256 KB of which 8 KB used by bootloader	32 KB (ATmega328P) of which 0.5 KB used by bootloader
SRAM	8 KB	2 KB (ATmega328P)
EEPROM	4 KB	1 KB (ATmega328P)
Clock Speed	16 MHz	16 MHz

Arduino Mega 2560 Rev3



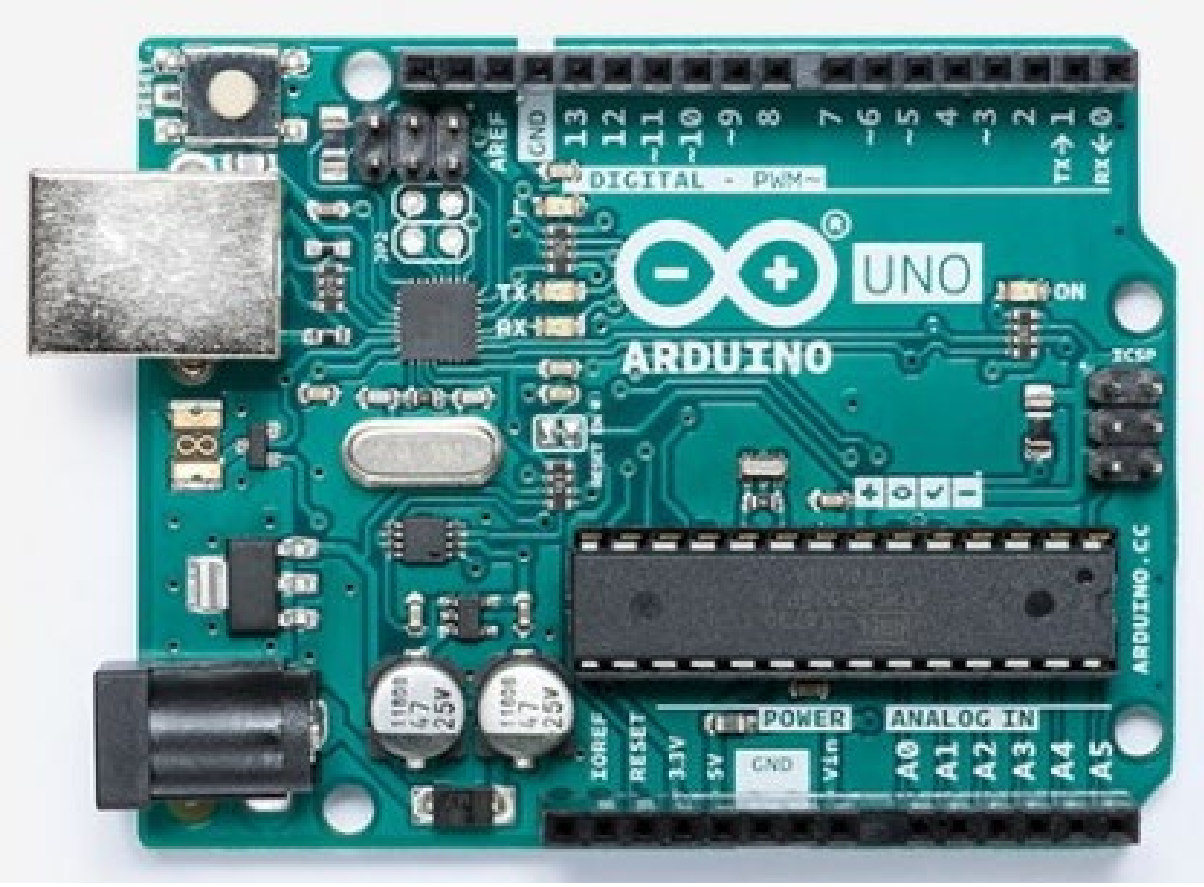


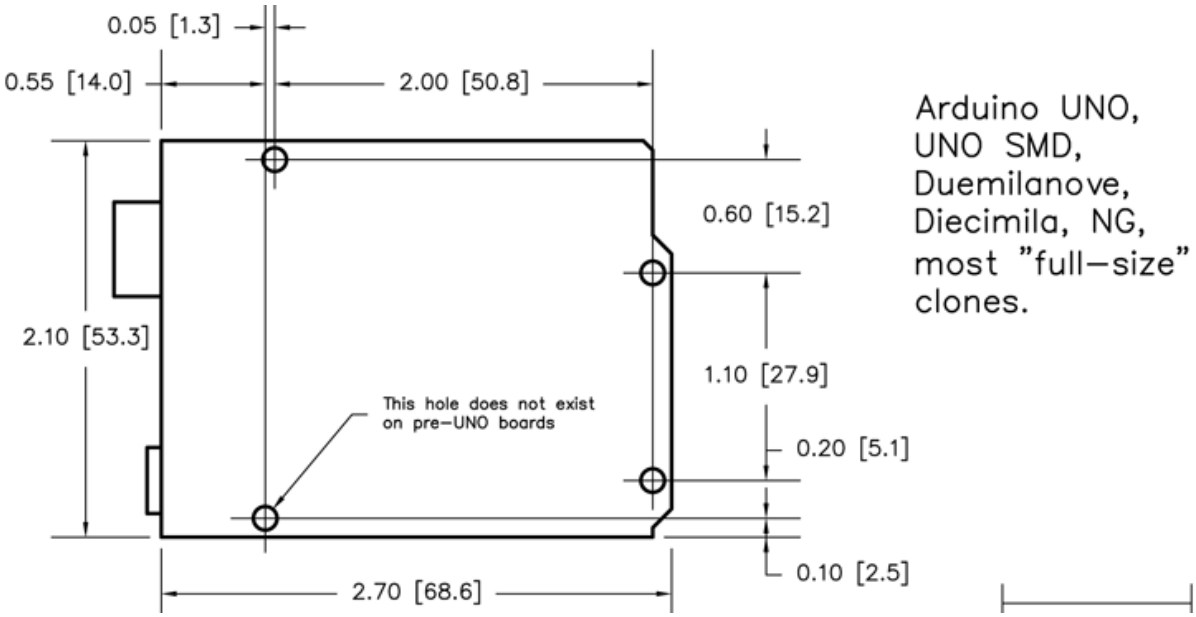


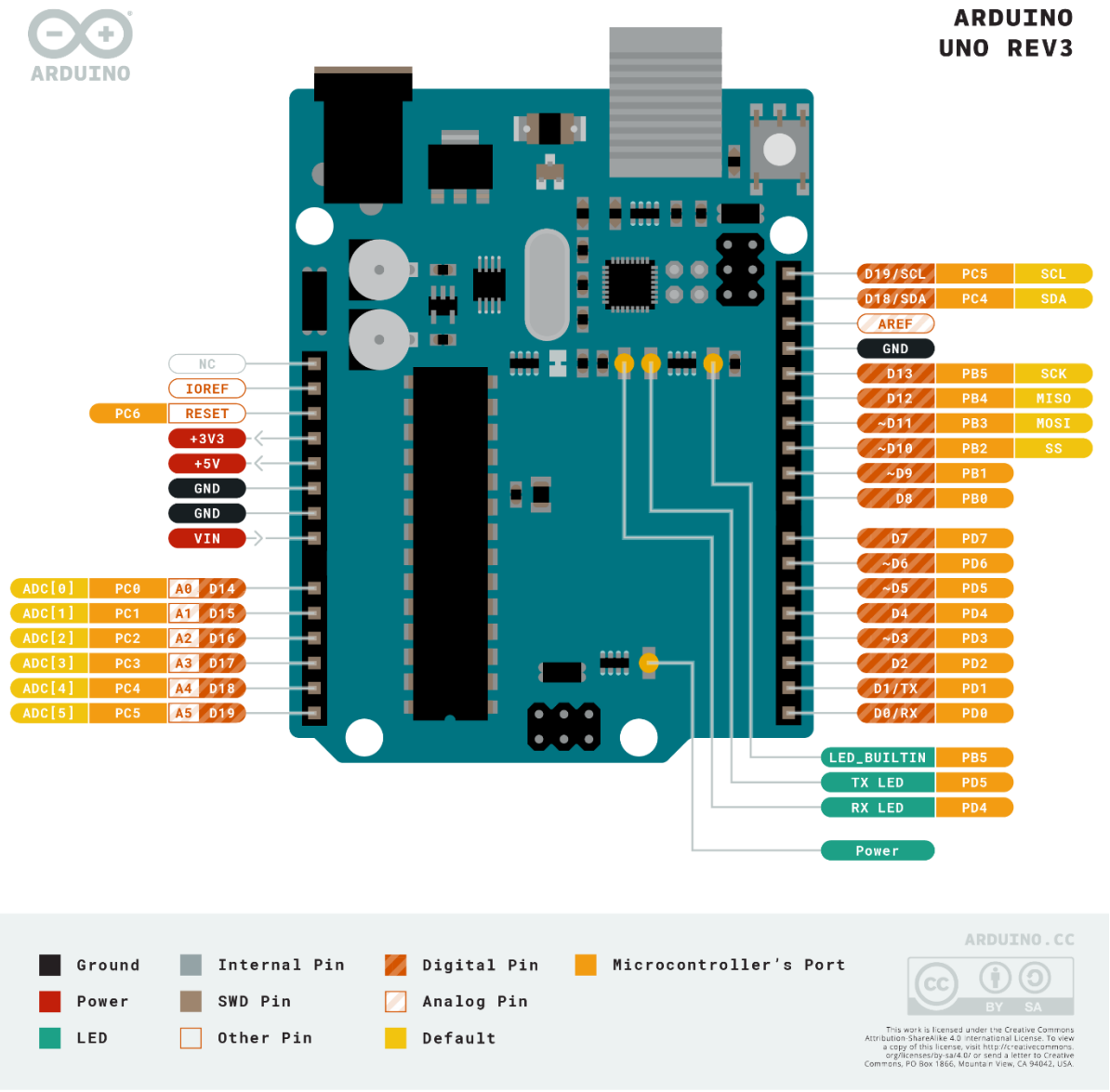
Specifications:

Microcontroller	ATmega2560
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limit)	6-20V
Digital I/O Pins	54 (of which 15 provide PWM output)
PWM Digital I/O Pins	15
Analog Input Pins	16
DC Current per I/O Pin	20 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	256 KB of which 8 KB used by bootloader
SRAM	8 KB
EEPROM	4 KB
Clock Speed	16 MHz

Arduino Uno Rev3





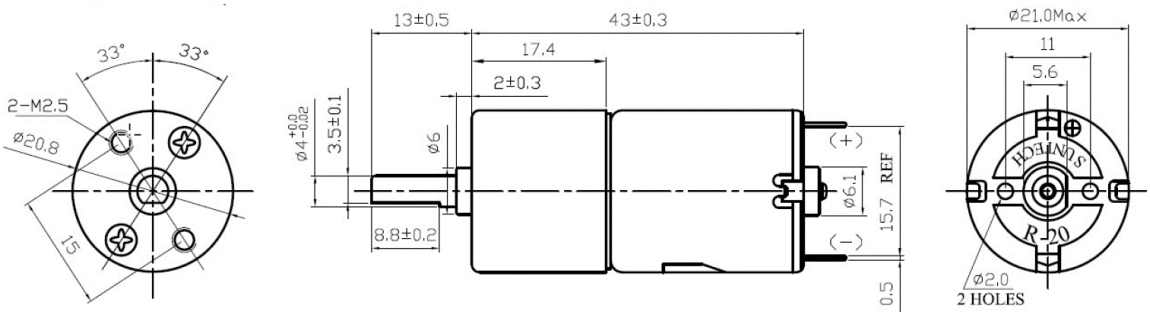


Specifications:

Microcontroller	ATmega328P
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limit)	6-20V
Digital I/O Pins	14 (of which 6 provide PWM output)
PWM Digital I/O Pins	6
Analog Input Pins	6
DC Current per I/O Pin	20 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	32 KB (ATmega328P) of which 0.5 KB used by bootloader
SRAM	2 KB (ATmega328P)
EEPROM	1 KB (ATmega328P)
Clock Speed	16 MHz

Motors

70RPM 12VDC Reversible Gearhead Motor



Pin:	Connects to:
+	Motor Controller: +/- 4.5 to 18V DC (12V DC recommended)
-	Motor Controller: Ground

Full load torque: 2.1 kg · cm
Maximum RPM: 70 RPM
Gear Ratio: 82:1

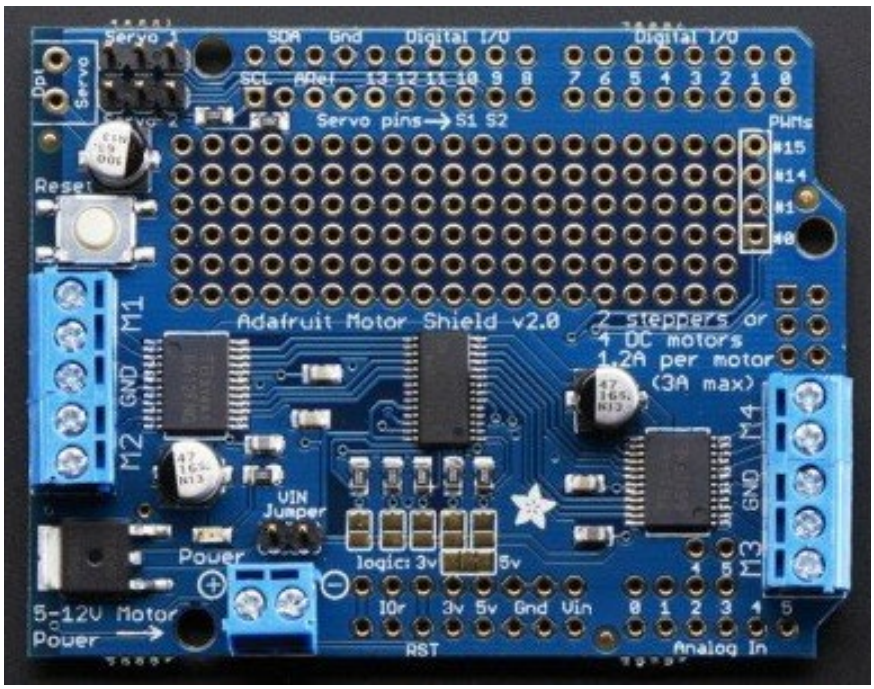
This motor requires a controller (see *Motor Controllers*) to be operate using an Arduino.

This motor creates a lot of electromagnetic interference (EMI) which can cause inaccurate or corrupted sensor data, and the Arduino to crash. To reduce EMI connect the + terminal to the – terminal, the + terminal to the nearest part of the metal motor housing, and the – terminal to the nearest part of the metal motor housing by soldering a 0.1 µF (100 nF) ceramic capacitor between each pair. When soldering to the metal motor housing the area to be soldered needs to be prepared by lightly filing until shiny, fresh metal is exposed, and powerful soldering iron at a high heat (450° C or higher) must be used.

Links:
https://www.jaycar.com.au/70rpm-12vdc-reversible-gearhead-motor/p/YG2732

Motor Controllers

Adafruit Motor/Stepper/Servo Shield for Arduino v2 Kit - v2.3



Arduino Pins Used:

Pin:	Pin Mode (on Arduino):	Purpose:
SCL		DC & Stepper Motor Control
SDA		DC & Stepper Motor Control
Digital Pin 9 (Only if Servo 1 is being used)	OUTPUT (PWM)	Servo Motor 1 Control
Digital Pin 10 (Only if Servo 2 is being used)	OUTPUT (PWM)	Servo Motor 2 Control

I2C Address: Set to 0x60 by default. Modifiable by up to 32 addresses using jumpers next to the header labelled "VIN Jumper" (see Adafruit tutorial linked below for more information). The shield also uses 0x70 (which conflicts with *Adafruit TCA9548A 1-to-8 I2C Multiplexer Breakout*) as a (fixed) all call address for the motor shields (used to control all shields simultaneously when more than one is being used).

Libraries:

Name:	File Name:	Required:	Link:
Adafruit_Motor_Shield_V2_Library	Adafruit_MotorShield.h	Required	https://github.com/ladyada/Adafruit_Motor_Shield_V2_Library

Links:
https://learn.adafruit.com/adafruit-motor-shield-v2-for-arduino
https://core-electronics.com.au/adafruit-motor-stepper-servo-shield-for-arduino-v2-kit-v2-0.html

Proximity Sensors

HC-SR04 Ultrasonic Sensor

Module size and layout varies between brands. Take measurements off sensor being used.

Pin:	Connects to:	Pin Mode (on Arduino):
Vcc	+ 5V DC	
Trig	Digital Pin	OUTPUT
Echo	Digital Pin	INPUT
Gnd	Ground	

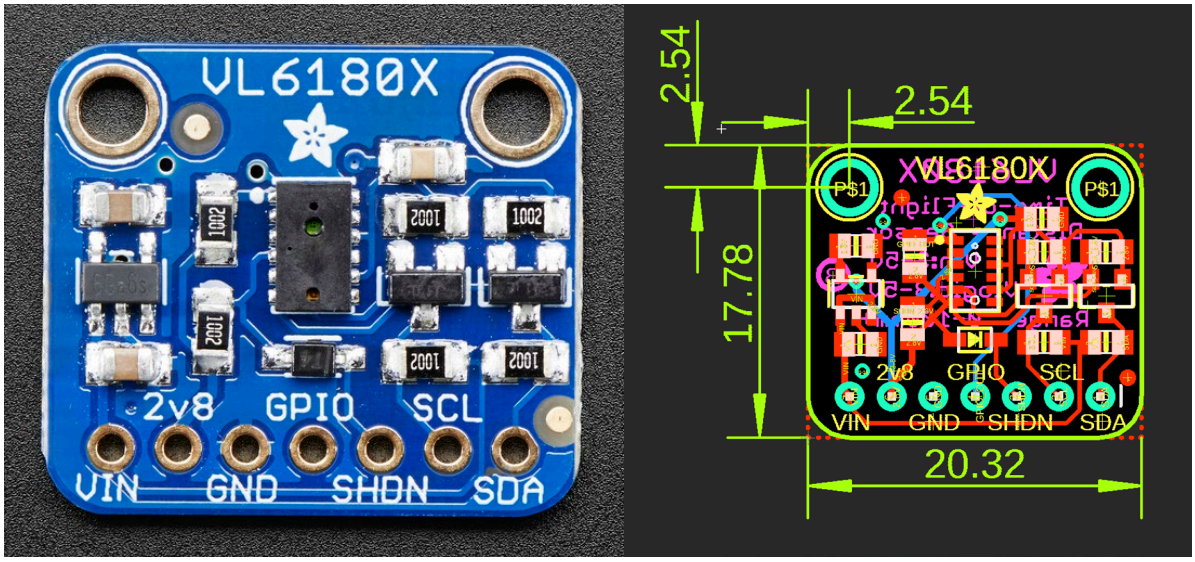
Libraries:

Name:	File Name:	Required:	Link:
NewPing	Adafruit_TCS34725.h	Recommended	https://playground.arduino.cc/Code/NewPing/#Download https://bitbucket.org/teckel12/arduino-new-ping/wiki/Home

NewPing adds functionality to the ultrasonic sensor and reduces delay in program while the sensor waiting for an echo.

Links:
https://learn.adafruit.com/ultrasonic-sonar-distance-sensors
https://core-electronics.com.au/hc-sr04-ultrasonic-module-distance-measuring-sensor.html

Adafruit VL6180X Time of Flight Micro-LIDAR Distance Sensor Breakout



Pin:	Connects to:	Pin Mode (on Arduino):
VIN	+ 3 - 5V DC	
2v8 (not required)	+ 2.8V Output	
GND	Ground	
GPIO (not required)	Digital Pin (indicates readiness of data output)	INPUT
SHDN (not required)	Digital Pin (pull to low to shut sensor down)	OUTPUT
SCL	SCL	
SDA	SDA	

GPIO - this is a pin that is used by the sensor to indicate that data is ready. It is useful for when doing continuous sensing. Note there is no level shifting on this pin, you may not be able to read the 2.8V-logic-level voltage on a 5V microcontroller (usually works with Arduino UNO and MEGA but not always).

XSHUT/SHDN - the shutdown pin for the sensor. By default, it is pulled high. There is a level-shifting diode so you can use 3-5V logic on this pin. When the pin is pulled low, the sensor goes into shutdown mode.

I2C Address: 0x29 (Conflicts with *Adafruit TCS34725 RGB Colour Sensor with IR filter and White LED*)

Sensitive to electromagnetic interference from motors (see *Other Resources* and *Motors* for information regarding the resolution of this issue)

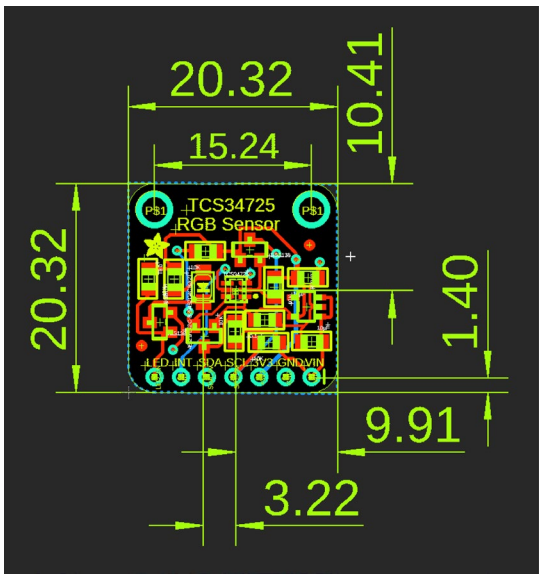
Libraries:

Name:	File Name:	Required:	Link:
Adafruit_VL6180X	Adafruit_VL6180X.h	Required	https://github.com/adafruit/Adafruit_VL6180X

Links:
https://learn.adafruit.com/adafruit-vl6180x-time-of-flight-micro-lidar-distance-sensor-breakout/
https://core-electronics.com.au/adafruit-vl6180x-time-of-flight-distance-ranging-sensor-vl6180.html

Colour Sensors

Adafruit TCS34725 RGB Colour Sensor with IR filter and White LED



Pin:	Connects to:	Pin Mode (on Arduino):
VIN (only one positive voltage terminal is required)	+ 3.3 - 5V DC	
GND	Ground	
3V3 (only one positive voltage terminal is required)	+ 3.3V DC	
SCL	SCL	
SDA	SDA	
INT (not required)	See Below	See Below
LED (not required)	See Below	See Below

Controlling the LED:

The LED pin can be pulled low to turn off the LED. This can be done in three ways:

1. Wire directly to ground to turn it off completely.
2. Wire to a spare digital pin and control it with digitalWrite().
3. Wire the LED pin to the INT pin and control with setInterrupt() (See Library Reference linked below for details).

I2C Address: 0x29 (Conflicts with *Adafruit TCS34725 RGB Colour Sensor with IR filter and White LED*)

Libraries:

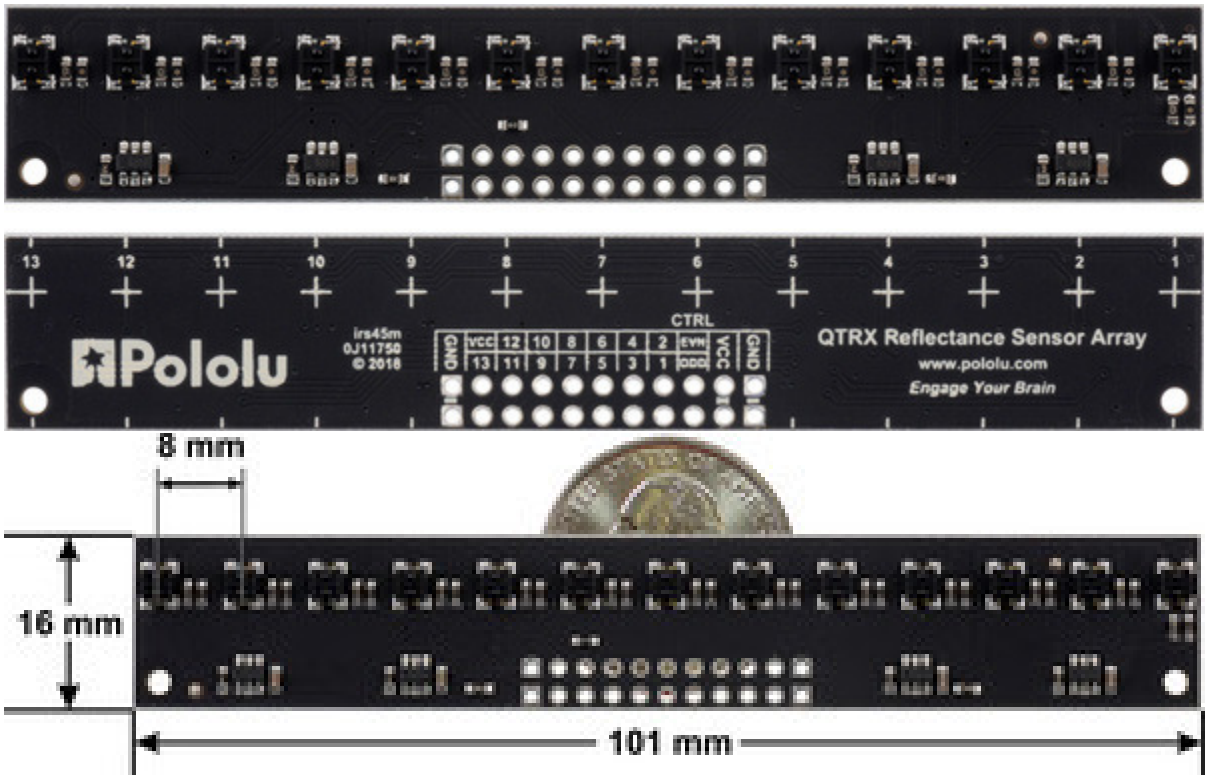
Name:	File Name:	Required:	Link:
Adafruit TCS34725	Adafruit_TCS34725.h	Required	https://github.com/adafruit/Adafruit_TCS34725

Links:

https://learn.adafruit.com/adafruit-color-sensors
https://core-electronics.com.au/rgb-color-sensor-with-ir-filter-tcs34725.html

Line Following Sensor Arrays

QTRX-MD-13A Reflectance Sensor Array: 13-Channel, 8mm Pitch, Analog Output, Low Current



Dimensions: https://www.pololu.com/file/0J1552/qtr-qtrx-dimensions.pdf

Optimal Sensing Distance: 10mm
Maximum Recommended Sensing Distance: 40mm

Pin:	Connects to:	Pin Mode (on Arduino):
VCC	+2.9 - 5.5V DC	
GND	Ground	
EVN (not required)	Digital Pin	OUTPUT
ODD (not required)	Digital Pin	OUTPUT
1	Analog Pin	INPUT
2	Analog Pin	INPUT
3	Analog Pin	INPUT
4	Analog Pin	INPUT
5	Analog Pin	INPUT
6	Analog Pin	INPUT
7	Analog Pin	INPUT
8	Analog Pin	INPUT
9	Analog Pin	INPUT
10	Analog Pin	INPUT
11	Analog Pin	INPUT
12	Analog Pin	INPUT
13	Analog Pin	INPUT

Pins 1 to 13 output as analog voltages between 0 volts and the voltage supplied to VCC.

Libraries:

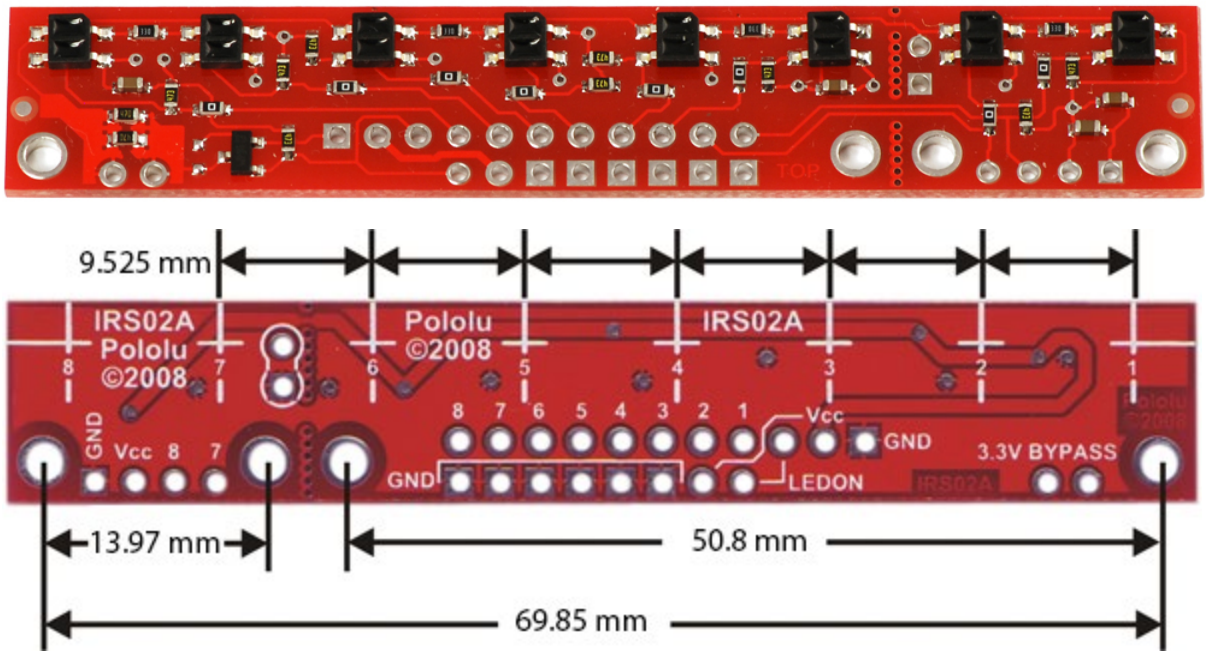
Name:	File Name:	Required:	Link:
QTRSensors	QTRSensors.h	Required	https://www.pololu.com/docs/0J19/all

Links:
https://www.littlebird.com.au/products/qtrx-md-13a-reflectance-sensor-array-13-channel-8mm-pitch-analog-output-low-current
https://www.pololu.com/product/4453

Note

A little wider than needed for rescue line. If I was to replace it I would probable use narrower equivalent.

QTR-8A Reflectance Sensor Array



Dimensions: 74.93 mm x 12.7 mm x 3.175 mm (without header pins installed)

Optimal Sensing Distance: 3mm
Maximum Recommended Sensing Distance: 6mm

Pin:	Connects to:	Pin Mode (on Arduino):
VCC	+3.3 - 5.5V DC	
GND	Ground	
LEDON (not required)	Digital Pin	OUTPUT
1	Analog Pin	INPUT
2	Analog Pin	INPUT
3	Analog Pin	INPUT
4	Analog Pin	INPUT
5	Analog Pin	INPUT
6	Analog Pin	INPUT
7	Analog Pin	INPUT
8	Analog Pin	INPUT

Pins 1 to 8 output as analog voltages between 0 volts and the voltage going into VCC.

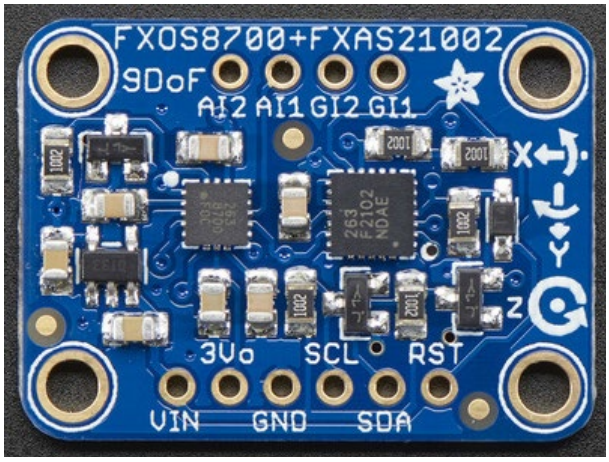
Libraries:

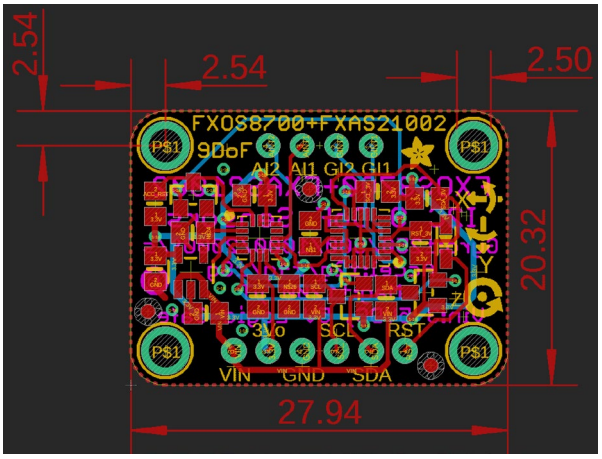
Name:	File Name:	Required:	Link:
QTRSensors	QTRSensors.h	Required	https://www.pololu.com/docs/0J19/all

Links:
https://core-electronics.com.au/qtr-8a-reflectance-sensor-array.html
https://www.pololu.com/product/960

Orientation Sensors

Adafruit Precision NXP 9-DOF Breakout Board - FXOS8700 + FXAS21002





Pin:	Connects to:	Pin Mode (on Arduino):
VIN	+3 - 5V DC	
3Vo	+3.3V DC	
GND	Ground	
SCL	Arduino SCL Pin	
RST (not required)	Arduino Digital Pin	OUTPUT
AI1 (not required)	Arduino Digital Pin	INPUT
AI2 (not required)	Arduino Digital Pin	INPUT
GI1 (not required)	Arduino Digital Pin	INPUT
GI2 (not required)	Arduino Digital Pin	INPUT

RST Pin is the reset pin, for resetting the chips. It is not required.

I2C Addresses:
FXOS8700 (Accelerometer and Magnetometer) uses 0x
FXAS21002 (Gyroscope) uses 0x

AI1 & AI2 are outputs from the FXOS8700 (Accelerometer and Magnetometer). They are not required for standard use. More information can be found in the chips' datasheet.

GI1 & GI2 are outputs from the FXAS21002 (Gyroscope). They are not required for standard use. More information can be found in the chips' datasheet.

Sensitive to electromagnetic interference from motors (see *Other Resources* and *Motors* for information regarding the resolution of this issue)

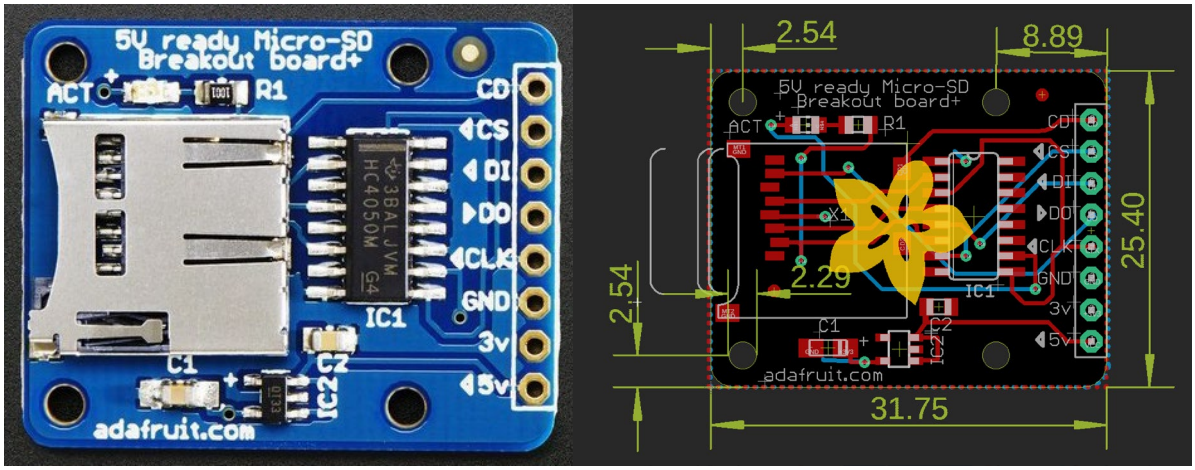
Libraries:

Name:	File Name:	Required:	Link:
Adafruit Unified Sensor	Adafruit_Sensor.h	Required	https://github.com/adafruit/Adafruit_Sensor
Adafruit FXOS8700	Adafruit_FXOS8700.h	Required	https://github.com/adafruit/Adafruit_FXOS8700
Adafruit FXAS21002C	Adafruit_FXAS21002C.h	Required	https://github.com/adafruit/Adafruit_FXAS21002C
Adafruit AHRS	Adafruit_AHRS.h	Recommended	https://github.com/adafruit/Adafruit_AHRS

Links:
https://core-electronics.com.au/adafruit-precision-nxp-9-dof-breakout-board-fxos8700-fxas21002.html
https://learn.adafruit.com/nxp-precision-9dof-breakout

Data Storage Interface Modules

MicroSD card breakout board+



Dimensions: 31.85 mm x 25.4 mm x 3.75 mm (without header pins installed)

Card Compatibility: microSD & microSDHC

Pin:	**Connects to:**		**Pin Mode (on Arduino):**
5v (only one positive voltage terminal is required)	+5V DC		
3v (only one positive voltage terminal is required)	+3.3V DC		
GND	Ground		
	Arduino UNO	**Arduino Mega**	
CLK	Digital Pin 13	Digital Pin 52	
DO	Digital Pin 12	Digital Pin 50	
DI	Digital Pin 11	Digital Pin 51	
CS	Digital Pin 10	Digital Pin 53	
CD (not required)	Digital Pin		INPUT

Pins CLK, DO & DI are fixed and cannot be changed from the above pins. The pin CS can be connected to any pin however it is traditionally connected to the one stated above.

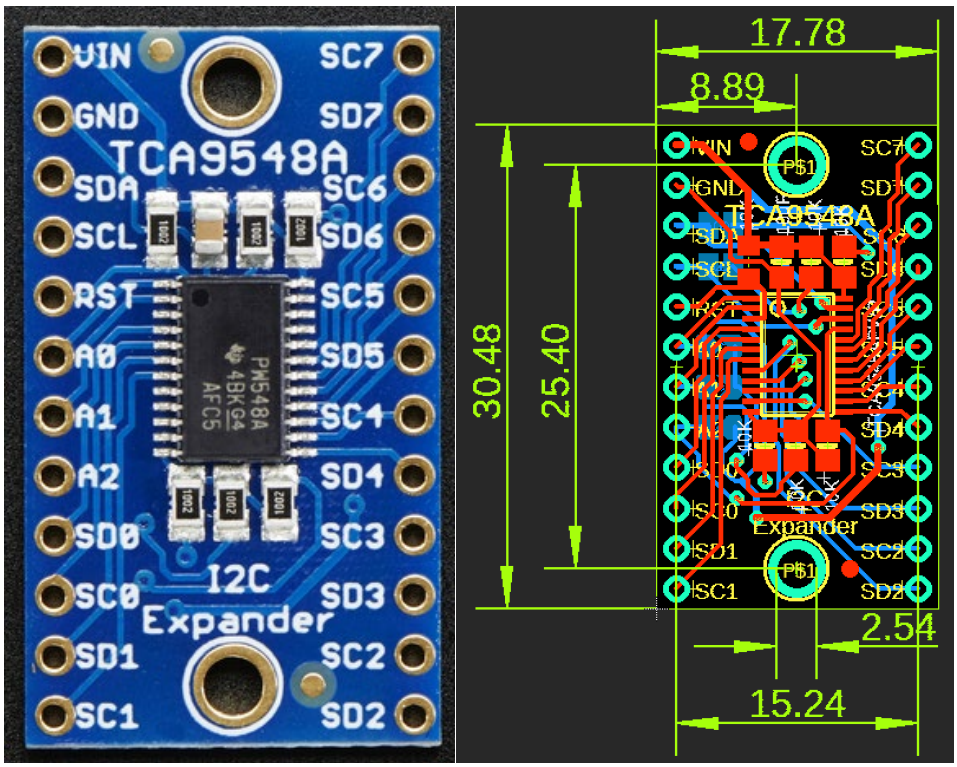
Libraries:

Name:	**File Name:**	**Required:**
SD	SD.h	Required (automatically installed with Arduino IDE)
SPI	SPI.h	Required (automatically installed with Arduino IDE)

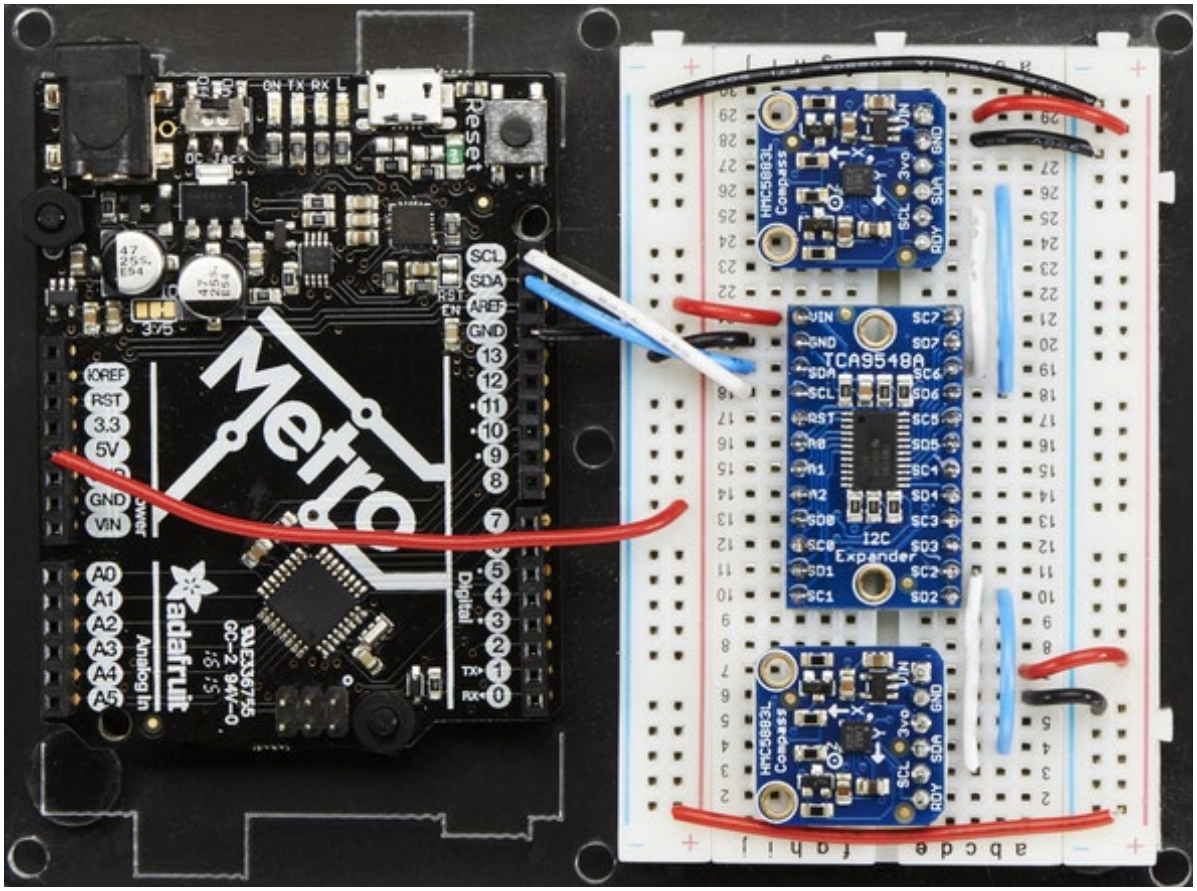
Links:
https://core-electronics.com.au/microsd-card-breakout-board.html
https://learn.adafruit.com/adafruit-micro-sd-breakout-board-card-tutorial/introduction

I/O Expansion and Multiplexer Modules

Adafruit TCA9548A 1-to-8 I2C Multiplexer Breakout



Example Circuit (Note: Adafruit Metro is equivalent to Arduino UNO for wiring purposes):



Pin:	Connects to:	Pin Mode (on Arduino):
VIN	+3.3 - 5V DC	
GND	Ground	
SDA	Arduino SDA Pin	
SCL	Arduino SCL Pin	
RST (not required)	Arduino Digital Pin	OUTPUT
A0 (not required)	Arduino Digital Pin or VIN	OUTPUT
A1 (not required)	Arduino Digital Pin or VIN	OUTPUT
A2 (not required)	Arduino Digital Pin or VIN	OUTPUT
SDx (SD0 through to SD7)	I2C Device Serial Data Pin	
SCx (SC0 through to SC7)	I2C Device Serial Clock Pin	

RST Pin is the reset pin, for resetting the multiplexer chip. Pulled high by default, connect to ground to reset

A0, A1 & A2 Pins are the I2C address selection pins for the multiplexer. Pull A0 to high to increase address by one. Pull A1 to high to increase address by two. Pull A2 to high to increase address by four.

I2C Address: Set to 0x70 by default (conflicts with the all-call address of the *Adafruit Motor/Stepper/Servo Shield for Arduino v2 Kit - v2.3*). Modifiable by up to 7 using pins A0, A1 & A2.

SDx & **SCx**: There are 8 sets of SDx and SCx pins, from SD0/SC0 to SD7/SC7. These are the multiplexed pins. Each one is a completely seperate I2C bus set. This allows you to have 8 I2C devices with identical addresses, so long as they are on one I2C bus each.

Libraries:

Name:	File Name:	Required:	Link:
Wire	Wire.h	Required (automatically installed with Arduino IDE)	
Adafruit TCS34725	Adafruit_TCS34725.h	Required	https://github.com/adafruit/Adafruit_TCS34725

Links:
https://core-electronics.com.au/tca9548a-i2c-multiplexer.html
https://learn.adafruit.com/adafruit-tca9548a-1-to-8-i2c-multiplexer-breakout

Batteries

Recommended Specifications:

Chemistry: Lithium-Ion Polymer (LiPo)
Cells: 3 Cells (11.1 Volts)
Capacity: 1000mAh to 2000mAh (1Ah to 2Ah). 2000mAh will easily get my Open Rescue Line robot through an entire day of a competition but it is relatively large and heavy. For smaller robots 1000mAh would be sufficient.
Discharge Rate: Minimum of 10C

Charger

Ensure charger is compatible with chemistry and cell count. If using a Lithium-Ion variant battery chemistry, ensure the use of a balance charger.

Other Basic Electronics Components

- 100nF (0.1 µF) Ceramic Capacitors
  - Reduce electromagnetic interference from motors (see *Other Resources* and *Motors* for more information).
  - https://www.jaycar.com.au/0-1uf-50v-blue-chip-monolythic-capacitor-pk-100/p/RC5496
- 470 µF Electrolytic Capacitors
  - Isolates sensors that are sensitive to electromagnetic interference from that created by motors (see *Other Resources* for more information).
  - https://www.jaycar.com.au/470uf-25vdc-electrolytic-rb-capacitor/p/RE6195
- Toggle Switches
  - Switching between states (eg. powered on and off).
  - Creating a Boolean (two states, true and false) type, mechanically controlled variable (eg. switch position is read by microprocessor when programmed to do so. This can be used in if statements such as: if switch is in true position, then disable motors. This could be used for testing to switch instantly between collecting of sensor data while robot is immobile and mobile testing without having to upload different codes).
  - https://www.jaycar.com.au/spdt-sub-miniature-toggle-switch-solder-tag/p/ST0300
- Tactile Switches
  - Initiating functions in code (eg. triggering sensor calibration function).
  - https://core-electronics.com.au/mini-push-button-switch.html
- Micro Switches
  - Not needed but I have found them useful for several purposes (eg. I have one mounted on a forklift mechanism on my robot which becomes depressed by the forklift carriage when it is fully raised to stop the motor from trying to overextend the forklift).
  - https://core-electronics.com.au/mini-snap-action-switch-with-13-5mm-lever-3-pin-spdt-1a.html
- DC to DC Buck Voltage Converters
  - Converts battery output voltage (in an efficient manner) to the 5V that Arduinos and many sensors run on.
  - The one linked below has a variable output voltage and needs to be adjusted BEFORE use. If you fail to do so you are likely to damage or destroy many of your components.
  - https://core-electronics.com.au/adjustable-switching-power-supply-module-in-4v-35v-out-1-5v-30v-lm2596s.html
- 12V Stepdown Voltage Regulators
  - Regulates voltage to prevent voltage spikes from reaching and damaging componentry. Should NOT be used as a voltage converter as it will overheat and fail.
  - https://core-electronics.com.au/voltage-regulator-12v.html
- 5V Stepdown Voltage Regulators
  - Regulates voltage to prevent voltage spikes from reaching and damaging componentry. Should NOT be used as a voltage converter as it will overheat and fail.
  - https://core-electronics.com.au/5v-1-5a-linear-voltage-regulator-7805-to-220.html

- Assorted Wire
  - For general wiring.
  - https://www.jaycar.com.au/light-duty-hook-up-wire-pack-8-colours/p/WH3009
- Assorted Jumper Wires
  - For general wiring, prototyping, and testing.
  - https://core-electronics.com.au/premium-male-male-jumper-wires-40-x-6-150mm.html
  - https://core-electronics.com.au/premium-female-male-extension-jumper-wires-40-x-6-150mm.html
  - https://core-electronics.com.au/premium-female-female-jumper-wires-20-x-6-150mm.html
  - https://core-electronics.com.au/premium-male-male-jumper-wires-20-x-3-75mm.html
  - https://core-electronics.com.au/premium-female-male-extension-jumper-wires-20-x-3.html
  - https://core-electronics.com.au/premium-female-female-jumper-wires-20-x-3-75mm.html
- Assorted Alligator Clip Wires
  - Good for testing and prototyping with electronics that cannot be plugged directly into a breadboard (eg. motors).
  - https://www.jaycar.com.au/heavy-duty-jumper-test-cable-kit/p/WC6020
- Small Breadboards
  - Used to create circuits without the need for soldering. I prefer multiple small breadboards over a single large one.
  - The below option comes in a variety of colours.
  - https://core-electronics.com.au/170-tie-point-mini-white-solderless-breadboard.html
- Assorted Breadboard Jumper Wires
  - Used to create connection on a breadboard in a tidy way that is easy to follow and doesn't lead to a massive mess of tangled standard jumper wires.
  - https://www.jaycar.com.au/economy-breadboard-jumper-kit-5-colours/p/WH3032
- Female Pin Head Strips
  - Soldered into header terminal holes on electrical components.
  - https://core-electronics.com.au/20-pin-0-1-female-header-pack-of-5.html
- Male Pin Head Strips
  - Soldered into header terminal holes on electrical components.
  - https://core-electronics.com.au/10-pcs-40-pin-headers-straight.html
- Right Angle Male Pin Head Strips
  - Soldered into header terminal holes on electrical components.
  - https://core-electronics.com.au/40-pin-break-away-male-header-right-angle-10-pcs.html
- Male Crimp Pins
  - Used in combination with wire to create custom length jumper wires.
  - https://core-electronics.com.au/male-crimp-pins-for-0-1-housings-100-pack.html
- Female Crimp Pins
  - Used in combination with wire to create custom length jumper wires.
  - https://core-electronics.com.au/female-crimp-pins-for-0-1-housings-100-pack.html

- Crimp Pin Housings
    - Slides over crimps to insulate and protect them.
    - https://core-electronics.com.au/0-1-2-54mm-crimp-connector-housing-1x1-pin-25-pack.html

Tools and Hardware

Links for specific products provided below are products that I use and would recommend but there are many other good options available. All items in this section are available from the from either one of the suppliers listed in the *Suppliers* section below or a hardware store.

Tools

- Soldering Iron
  - https://www.jaycar.com.au/60w-esd-safe-soldering-station-with-led-temperature-display/p/TS1640
- Soldering Iron Stand (usually included with iron)
- Soldering Iron Cleaner
  - https://www.jaycar.com.au/goot-soldering-iron-tip-cleaner/p/TS1510
- Solder Sucker
  - https://www.jaycar.com.au/metal-desolder-tool/p/TH1862
- Soldering Clamps or Holders
  - https://www.jaycar.com.au/third-hand-pcb-holder-tool-with-2-clips-and-heavy-base/p/TH1982
- Silicone Soldering Mat
  - https://core-electronics.com.au/insulated-silicone-soldering-mat.html
- Crimping Tool
  - https://core-electronics.com.au/crimping-tool-0-1-1-0-mm-capacity-16-28-awg.html
- Wire Strippers
  - https://www.jaycar.com.au/heavy-duty-wire-stripper-cutter-crimper-with-wire-guide/p/TH1827
- Small Wire Cutters
- Flush Cut Wire Cutters
  - The cheap Duratech ones I've purchased at Jaycar have always been of poor quality and the cutters come out of alignment after minimal use.
- Small Pointy Nosed Pliers
- Small Fine Files
  - https://www.jaycar.com.au/10-piece-needle-file-kit/p/TD2128
- Forceps
- Electronics Screwdrivers Set
  - I have never found a great set, but I have heard that iFixit make excellent ones. The Duratech sets I have used have been pretty good.
- Small Spanners Set
  - https://www.jaycar.com.au/10-piece-spanner-set-for-electronics/p/TH1910
- Cordless Drill
- Heat Gun
- Accurate Electronic Callipers
  - https://www.jaycar.com.au/lcd-type-engineers-calipers/p/TD2082
- Hot Glue Gun

Accessories & Consumables

- Flux Cored Solder Wire (lead free)
  - https://www.jaycar.com.au/lead-free-solder-0-71mm-500g-roll/p/NS3090

- Tip Tinner
  - https://www.jaycar.com.au/soldering-iron-tip-cleaning-paste/p/TS1512
- Sandpaper of Assorted Grit Sizes
- Heat-shrink of Assorted Sizes (up to 8mm diameter)
  - https://www.jaycar.com.au/2-1-1-5mm-heatshrink-tubing-5m-black/p/WH5680
  - https://www.jaycar.com.au/2-1-3mm-heatshrink-tubing-5m-black/p/WH5682
  - https://www.jaycar.com.au/2-1-5mm-heatshrink-tubing-5m-black/p/WH5683
- Standard Metric Drill Bit Set
  - Make sure they are designed to work with metals and plastics.
- Micro Metric Drill Bit Set
  - https://www.jaycar.com.au/20-piece-micro-drill-set-0-3-1-6mm/p/TD2406
- Hot Glue Sticks

Fasteners

- M2, M2.5 & M3 Machine Screws of Assorted Lengths
- M2, M2.5 & M3 Nylon Washers
- M2, M2.5 & M3 Stand-offs or Spacers of Assorted Lengths
- M2, M2.5 & M3 Nuts
- Small Cable Ties
- Velcro Cable Organisers

Adhesives & Tapes

- Electrical Tape
- Masking Tape
- Double Sided Tape
- Double Sided Tape with Foam Core
- Adhesive backed Velcro
- Super Glue
- Acrylic Cement

Other Resources

- Dealing with Electromagnetic Interference (EMI) from Motors: https://www.pololu.com/docs/0J15/9
- Information on I2C Communication Protocols and a list the I2C addresses of common components https://learn.adafruit.com/i2c-addresses
- Arduino Tutorials https://www.arduino.cc/en/Tutorial/HomePage

Suppliers

This is a list of suppliers from whom I have obtained parts. There are other suppliers that also have components listed. They may be more suitable for your locality or if the part is not available at the store listed.

- https://core-electronics.com.au/
  - Good for electronics
- https://www.littlebird.com.au/
  - Good and wide range of electronics
  - Shipping can be slow
- https://www.jaycar.com.au/
  - Good for hardware, tools, and basic circuitry components.
  - Electronics sensors and controllers are largely outdated, unreliable and low quality.
- https://hobbyking.com/
  - Good for batteries and chargers.
  - Slow international shipping when purchasing products not in stock at their Australian warehouse.
- https://au.element14.com/
  - Good for hardware, tools, and specialised electronics.
  - Massive range (combined with average user interface) can be very daunting.
- https://www.makerstore.com.au/
  - Good for bearings, slides, rails, axles, and rods