

Robocup

Documentation

2022

Parts Summary



Pre Release

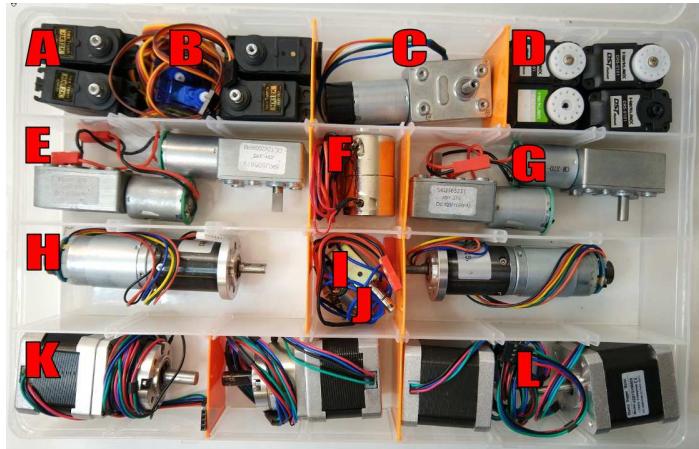
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Parts Summary

Actuators



Sensors



Hardware Box 1



Hardware Box 2



Hardware Box 3



Wires



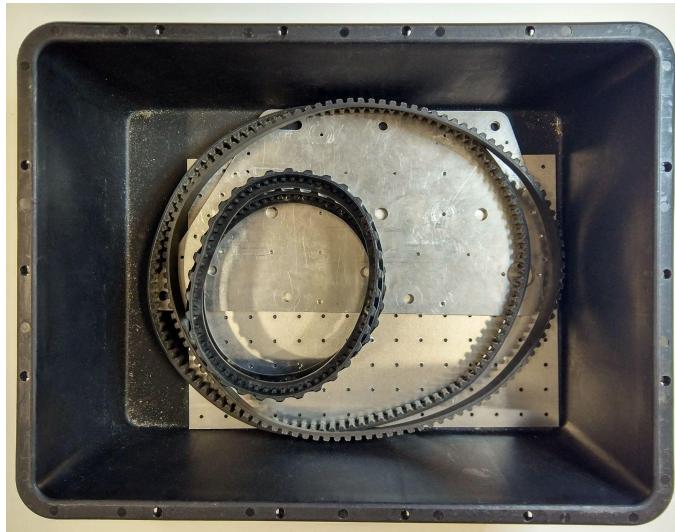
Green Box



Blue Box



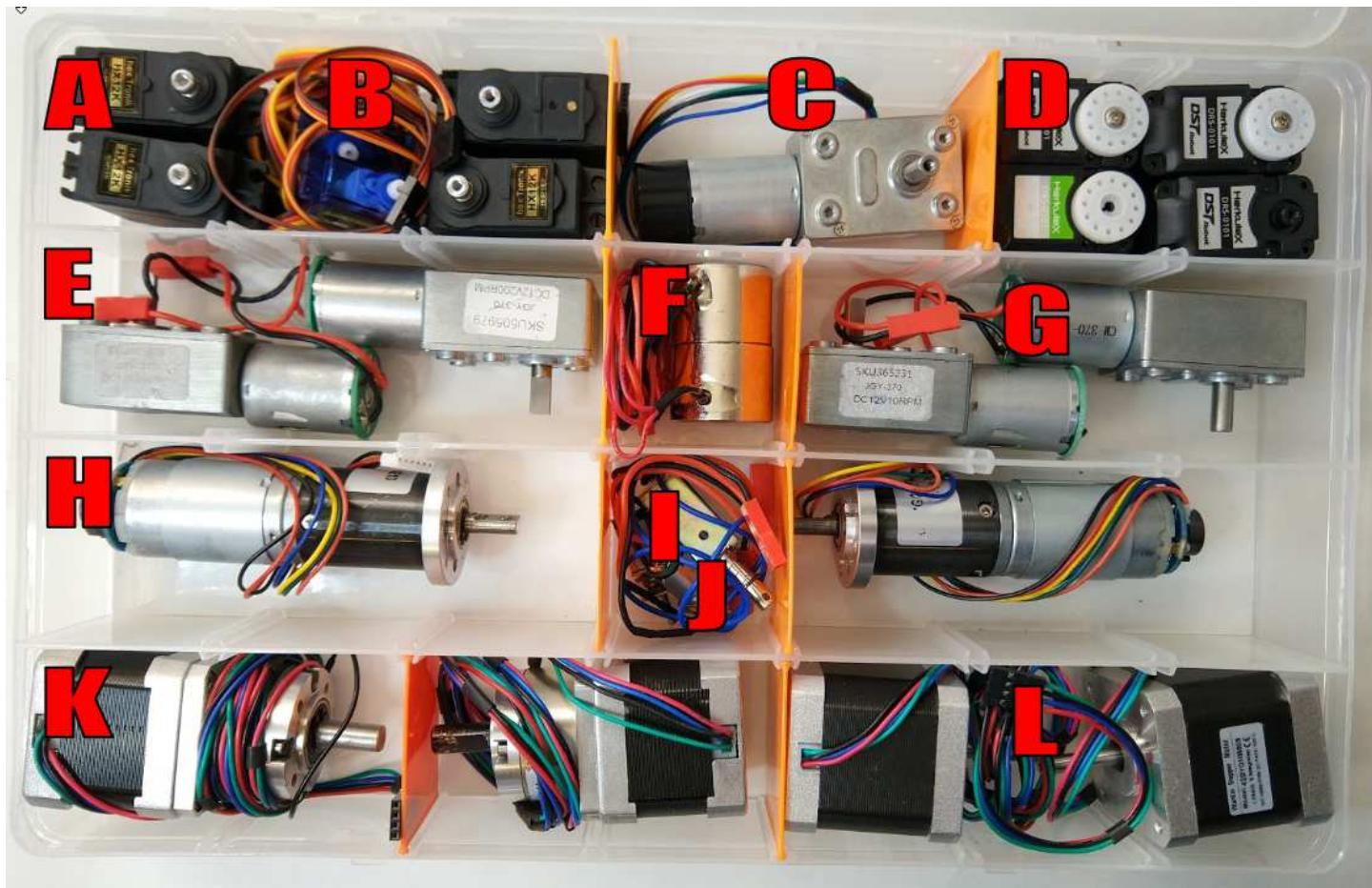
Black Box



Red Box



Actuators



ID	Qty	Cost	Description	Part Number	Major Parameters
A	4	14.0	Standard servo	HX12K	7.4V, 9.4kg.cm
B	2	02.5	Small servo	SG90	5V 1.5kg.cm
C	1	22.0	DC Motor 90RPM , includes gearbox and encoder	JGY-370	12V, 90RPM
D	4	58.0	Smart servo	DRS-0101	7.4V, 12kg.cm, Gear: 1:266
E	2	15.0	DC Motor 200RPM, includes gear box	SKU505979	12V, 200RPM
F	2	06.6	Electromagnet	JK-P30/22	12V, 0.4A, 10kg
G	2	15.0	DC Motor 10RPM, includes gearbox	SKU365231	12V, 10RPM
H	2	70.0	DC Motor 143RPM, includes gearbox and encoder	28PA51G	12V, 143RPM, 3.6A, 5.5kgf.cm
I	1	03.8	Solenoid	TAU-0530T	12V, 1.5A, 0.4N-7N
J	1	04.8	Small DC Motor with gearbox	N20	12V, 0.3A, 148RPM
K	2	50.0	Stepper motor with gearbox NEMA17	36PA5.2G/42BYG40-160-4A	1.6A, 1.8deg/step
L	2	32.0	Stepper motor NEMA17	42BYGHM809	1.7A, 0.9deg/step

From Green box

M	1	60.0	Large Servo	RDS5160	7.4V, 5A, 65kg.cm, 270deg
N	1	01.6	Speaker	MP001193	0.5W, 8ohm
O	1	04.0	Fan	MC32893	12V, 0.15A

~~□○)) Sensors △○○ Sensors



ID	Qty	Cost	Description	Part Number	Major Parameters
A	1	01.0	Ultrasound IO Board	HC-SR04	
B	4	01.8	Low cost ultrasound sensors	VL53L0XV2	
C	2	05.0	TOF I2C	VL53L1XV2	
D	2	10.0	TOF I2C	TFmini	
E	1	50.0	TOF Serial	0A41SK	4-30cm
F	2	08.0	IR Distance Sensor	GP2Y0A21YK0F	10 to 80cm
G	2	08.0	IR Distance Sensor	GP2Y0A02YK0F	20-150cm
H	2	08.0	IR Distance Sensor		
I	2	06.0	IR Distance Sensor, Adjustable, Digital Out		
J	2	03.5	Load Cell		1kg, 10kg
K	1	02.0	Load Sensor	HX711	
L	1	30.0	IR Camera	SEN0158	
M	1	36.0	IMU	SEN0253	BNO055+BMP280
N	2	25.0	IR Distance Sensor	2Y0A710K	100-500cm
O	2	25.0	Inductive Proximity		
P	1	14.0	Color Sensor	TCS34725	
Q	5	00.5	Microswitches	SV-163-1C25	
R	2		Traffic light LED		
S	2	01.0	Variable resistor		10k
T	1	02.2	Rotary Encoder		
U	1	01.5	Analogue Joystick		
V	1		RGB LED		
W	2		Smart LED x16 array		
X	1	01.5	Digital Joystick		
X	2		Smart LED Single		
X	2	60.0	Ultrasonic distance sensor	HRLV-MaxSonar-EZ0	300-5000mm`



Hardware Box 1



ID	Qty	Cost	Description	Part Number	Major Parameters
A1	1	02.2	Anti Backlash Nut		T8 screw Lead 8mm
A2	1	01.8	Anti Backlash Nut		T8 screw Lead 8mm
B	2	03.5	Trapezoidal lead screw block		
C	1	02.0	Linear rail support block		
D1	3	02.0	Shaft Coupler		
D2	2	01.0	Shaft Coupler		
E1	1	03.5	Rod ends		
E2	1	02.5	Rod ends		
F	4	01.8	Rigid Flange Coupling		
G	2	02.5	Trapezoidal lead screw nut		
H	4	01.2	Linear Ball Bearings,	LM8UU, 8mm	
I1	1	02.2	Servo arm Aluminum 25T		
I2	1	05.0	Servo arm Aluminum 25T Long		
J	2	02.5	Pillow block bearing	KP08	
K	2	04.5	Flange pillow block bearing,	KFL08	
L	4	00.8	Plastic pulley wheels, Nylon		
M	4	00.6	Aluminum 90 degree bracket		
N	6	02.5	Pulley GT2		
O	2	06.0	Pulley XL	20-XL-10BF	
P	8	02.5	Aluminum cutouts		
Q	6	02.5	Aluminum cutouts		
R	5	00.6	Plastic hinge		
S	16	01.0	Flanged bearings	F608ZZ	
T	12	03.0	Drive track support hardware		

U 2 18.0 Linear rail

MGN9 C

200mm long

Hardware Box 2



ID	Qty	Cost	Description	Part Number	Major Parameters
A1	2		Trapezoidal lead screw	300mm	300, 150, 100mm available
A2	2		Trapezoidal lead screw	150mm	
A3	2		Trapezoidal lead screw	100mm	
B	2		Robot tracks	880-8M	
C	2		Timing belt.	320 XL	
D	9		Open beam Aluminum profile, Robot main chassis support,		223.5mm
E1	1		Timing belt open ended,	GT2	2m open ended, closed loop
E2	1		Timing belt	GT2	
E3	1		Timing belt	GT2	
F	16		Open beam Aluminum profile		300, 210, 150, 120, 90, 60, 45, 30mm



Hardware Box 3



ID	Qty	Cost	Description
			Aluminium extrusion profiles, 300mm lengths A selection of the following lengths are in the kit...
A	25mm	right angle aluminium	
B	12mm	right angle aluminium	
C	12mm	box section aluminium	
D	12mm	U shaped aluminium	
E	25mm	flat bar aluminium	
F	12mm	flat bar aluminium	
G	8mm	round bar aluminium	
H	6.5mm	round bar aluminium	

Longer lengths of Aluminium extrusion profiles are available on request.

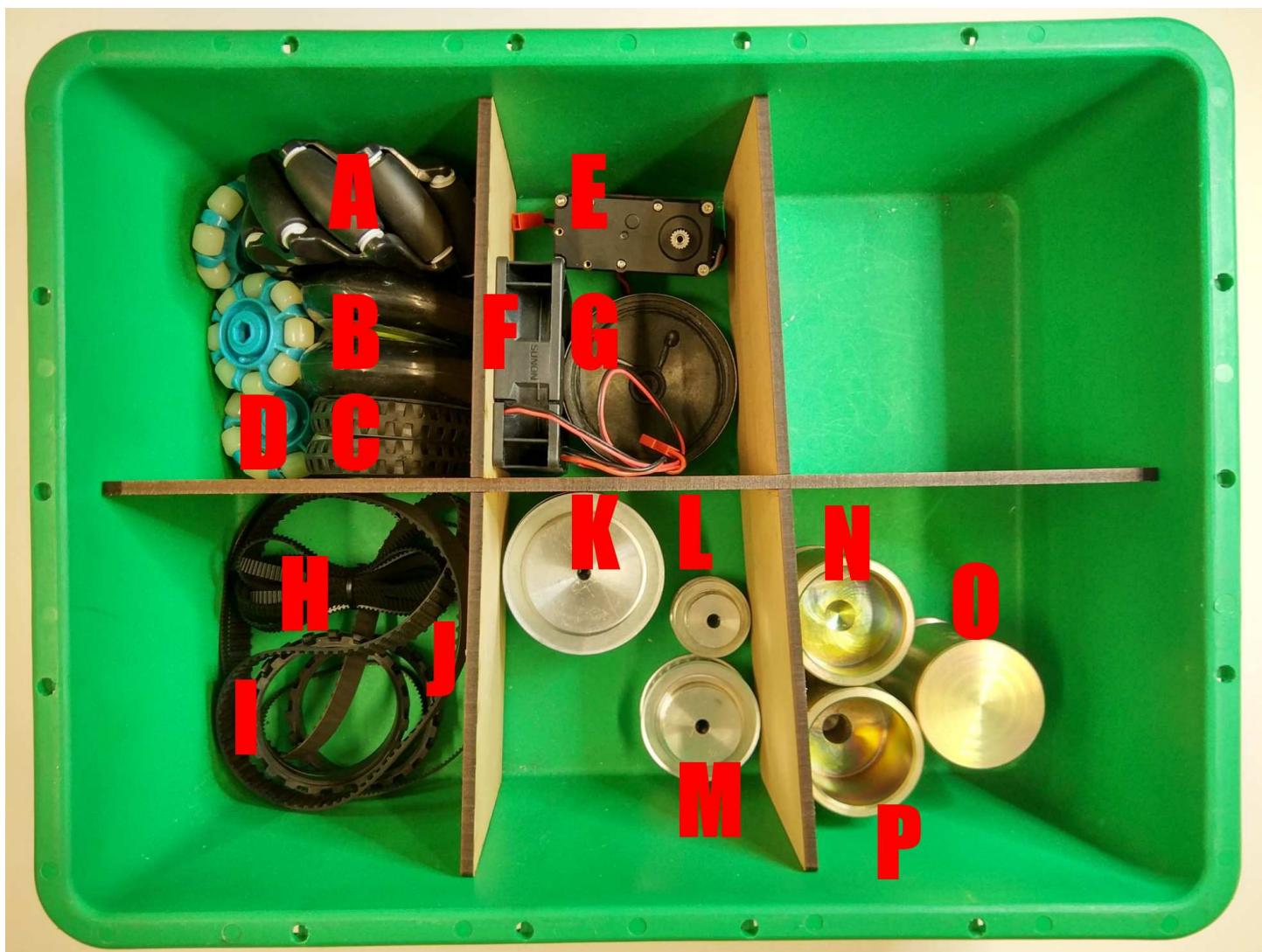


Wires



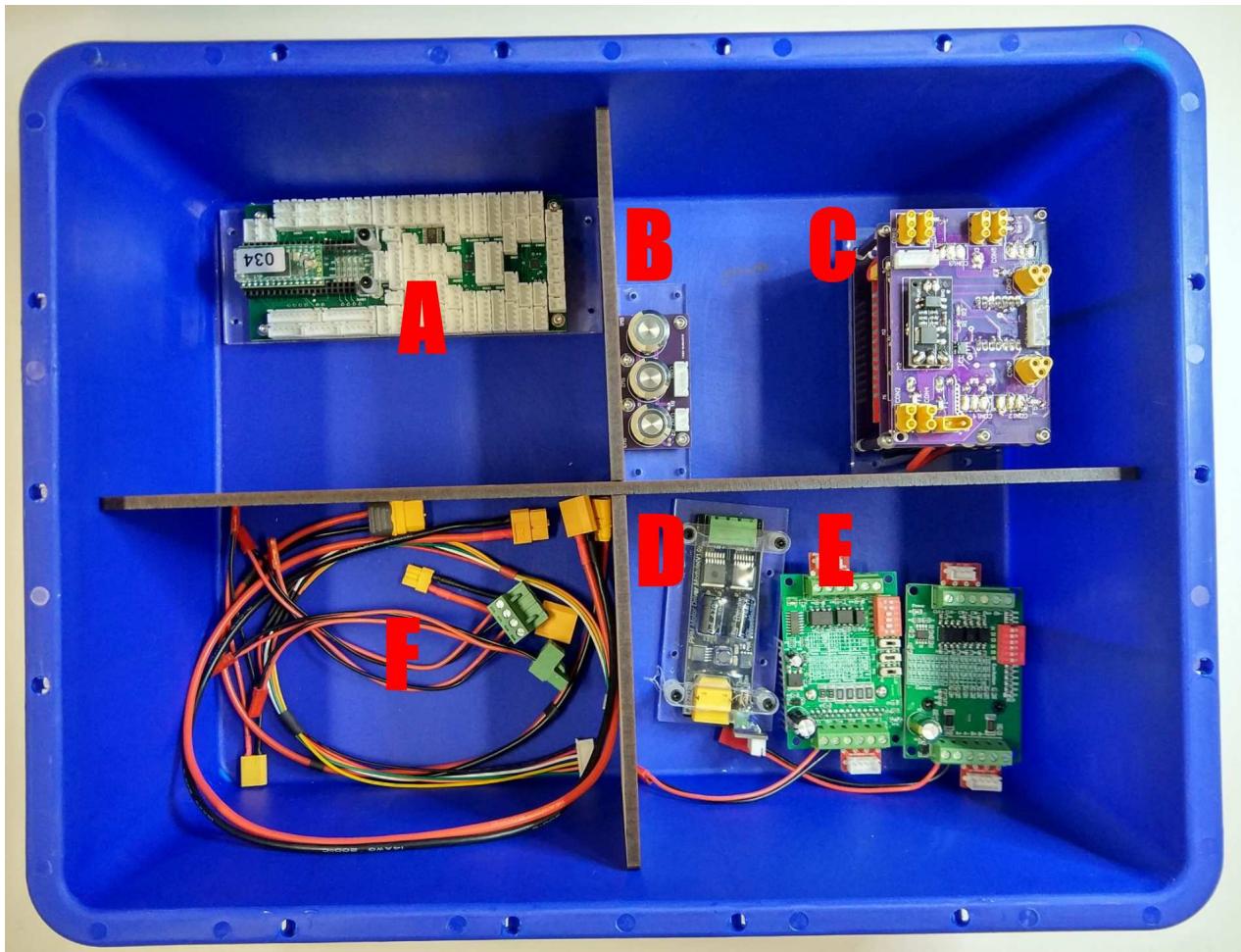
ID	Qty	Cost	Description
A			3 pin cable
B			4 pin cable
C			5 pin cable
D			6 pin cable
E			8 pin cable
G			smart servo IO cable
H			smart servo chain cable
I			RC Servo extender cable
J			11v cable
K			motor extender cable

Green Box



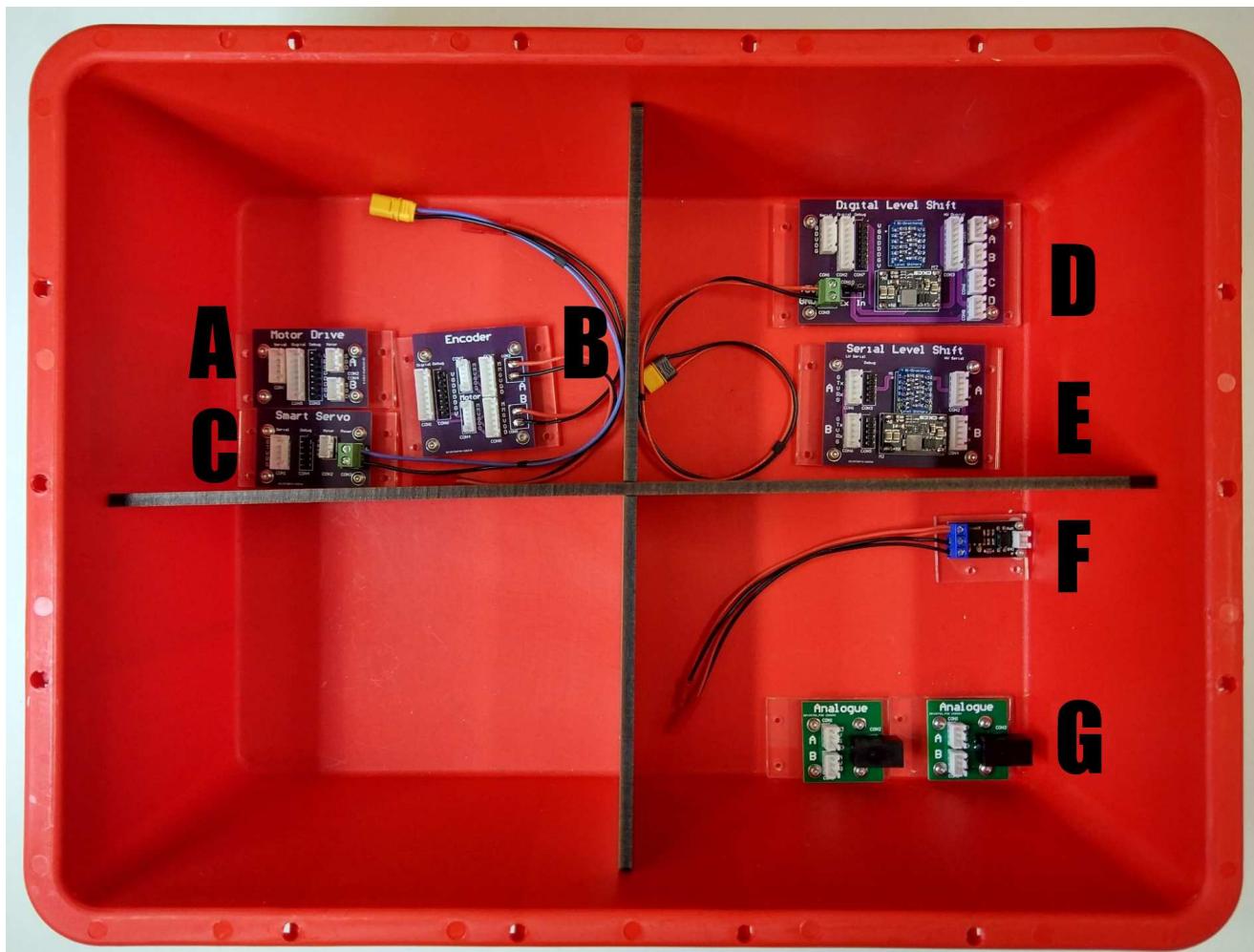
ID	Qty	Cost	Description
A	2	20.0	Mecanum Wheel
B	2	07.5	Skate wheel
C	2		Lego wheel
D	4	04.0	Omni wheel
E	1	60.0	Large servo
F	1	04.0	Fan
G	1	01.6	Speaker
H	1		GT2 Belt
I	2		Small tank tracks
J	1		Belt
K	2		Main drive wheel
L	2		Small drive wheel
M	2		Medium drive wheel
N	1		Weight 750g
O	1		Weight 500g
P	1		Weight 1000g

Blue Box



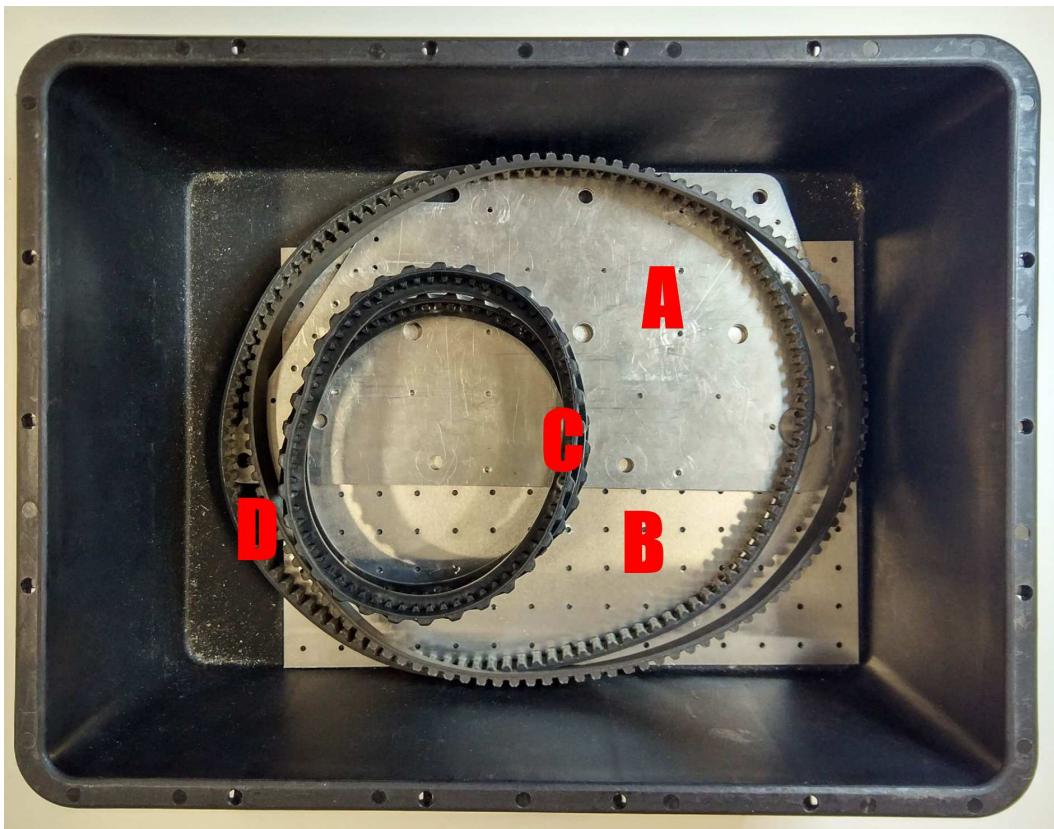
ID	Qty	Cost	Description
A	1		CPU
B	1		Stop Go button
C	1		Power supply board
D	2		Motor drive board
E	2		Stepper motor drive board
F	1		Cables

Red Box



ID	Qty	Cost	Description
A	1		Motor Drive IO Board
B			Encoder IO Board
C			Smart Servo IO Board
D			Digital level shift IO Board
E			Serial level shift IO Board
F			Solid state relay board
G			Analogue IO Board

Black Box



ID	Qty	Cost	Description
A	2		Robot side plate, see file Body02.zip in 08Models for hole layout
B	1		Robot top plate, holes spaced 20mm apart, 3mm hole
C	2		Medium tank track
D	2		Main drive pulley, held on flat of drive motor shaft with two grub screws, 2mm hex tool to tighten

Additional Materials

ID	Qty	Cost	Description
A	2	02.5	Corflute sheet 600*600*3mm
B12	12	06.0	MDF sheet 600*600*6mm
B22	22	04.0	MDF sheet 600*600*4.75mm
C	2	04.0	Aluminium sheet 300*300*2mm
D	2	04.0	Perspex sheet 300*300*2mm
E	2	06.0	Perspex sheet 300*300*4.5mm
F	2	09.0	Perspex sheet 300*300*6mm
G	1	16.0	Perspex sheet 300*300*10mm
H	1	15.0	3D Printing Filament 300g, 5c per gram for PLA
I	1	15.0	Additional 1m of open beam Aluminium extrusion
J	3	01.0	Magnets, Countersunk Ring Magnets 22mm x 5mm, Hole: 5.2mm, N50 Neodymium Magnet

Larger sizes of materials are available on request





Services Available

Email or see Julian Murphy with your job requests.

Specialised 3D Printing, supply file in STL or 3MF file format, Max size 250*210*210mm

Laser cutting, supply file in DXF file format, Max size 1200*900*10mm

Waterjet cutting, supply file in DXF file format, Max size 300*300*20mm

Power guillotine, supply printed diagram or marked out on sheet to cut, straight lines only

Parts repair and or replacement

Parts purchasing, supply links of website to purchase in email



Tools Available

Mechatronics Lab(24 Hour access)

Soldering iron, Oscilloscope, Signal Generator, Power supply

Parts and robot storage, battery storage and charging.

Nuts and bolts

Tools can be found on the peg board, or in the **Yellow** boxes

3D Printing(24 Hour access)

PRUSA I3 MK3s printer with 0.4mm nozzle

Student Workshop (Open 9-5 week days, Non Supervised)

Bender, roller, hand guillotine, notcher

Student Training Workshop (Available 9-4 Friday, and by appointment other days, Supervision)

Lathe, mill, drill, bandsaw

Main Workshop (Available 9-4, Supervision)

Lathe, mill, drill, drop saw



Robot Example Chase Assembly

Tools Required:

13mm Spanner
Hex keys, 6mm, 2.5mm, 2mm

Parts Required:

1x container of M3 x 6mm button head hex bolts
4x M3 Nuts
1x top plate
2x side plate
2x DC geared motor
2x pulley
2x large track
6x open beam 224mm length
8x bolt assemblies

Steps

- 1 **Attach motor**
Attach DC motor using supplied 4 x M3 6mm button head bolts using the smallest 2mm hex key to side plate
- 2 **Attach track supports**
Attach bolt 4 x bolt assemblies using 13mm spanner and 6mm hex key as indicated in diagram
A single flat washer and nylock nut go on the inside of the side plate for each assembly
- 3 **Attach support beams**
Before attaching open beam to side plate slide in two M3 nuts to the top two support beams
Attach open beam support rods to side plate as indicated in diagram
- 4 **Attach pulley**
Place spacer between side plate and pulley.
Push on pulley to hard against spacer
Make sure 2.5mm hex key hole is aligned with flat surface of motor shaft
Do up 2.5mm grub screw
Rotate pulley 90 degrees and do up second grub screw
- 5 **Attach belt**
Slide bottom bolt assembly in slotted hole to the left.
Attach belt, and adjust tension using slotted hole
You should not have to force the belt on, strength is not required
Now slide the bolt assembly to the right to tension the belt.
- 6 **Attach top plate using 4 x M3 bolt**

Important points:

The DC motor bolts must not be any longer than 6mm. Longer bolts will destroy the motor.
Remember the M3 nuts in the top open beam support.
The slotted hole allows adjustment of belt tension.
Pulley grub screw must be done up tight, and aligned with the flat of the motor shaft.
There is a second pulley grub screw.
Use a spacer to set gap between pulley and top of button head hex bolts.





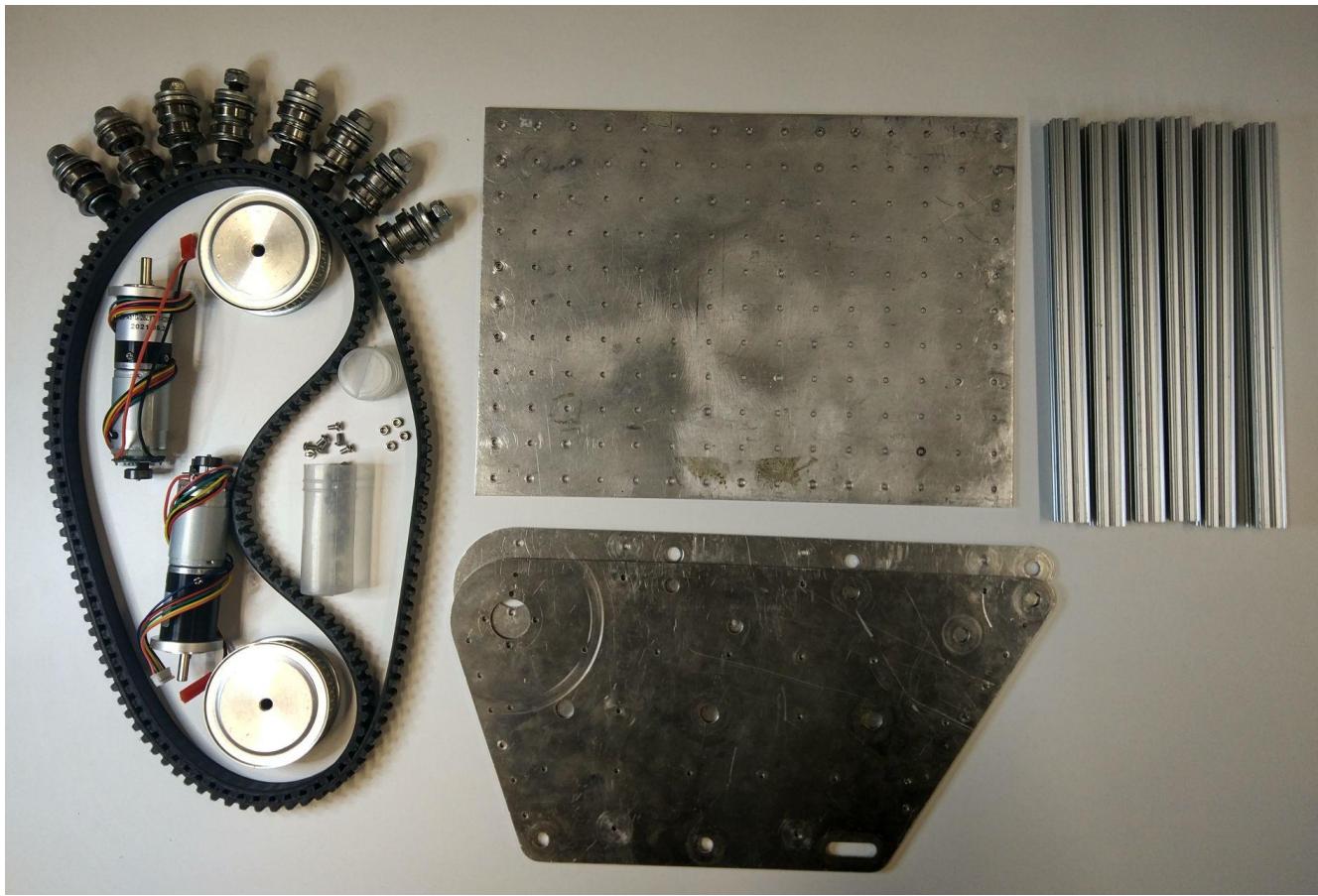
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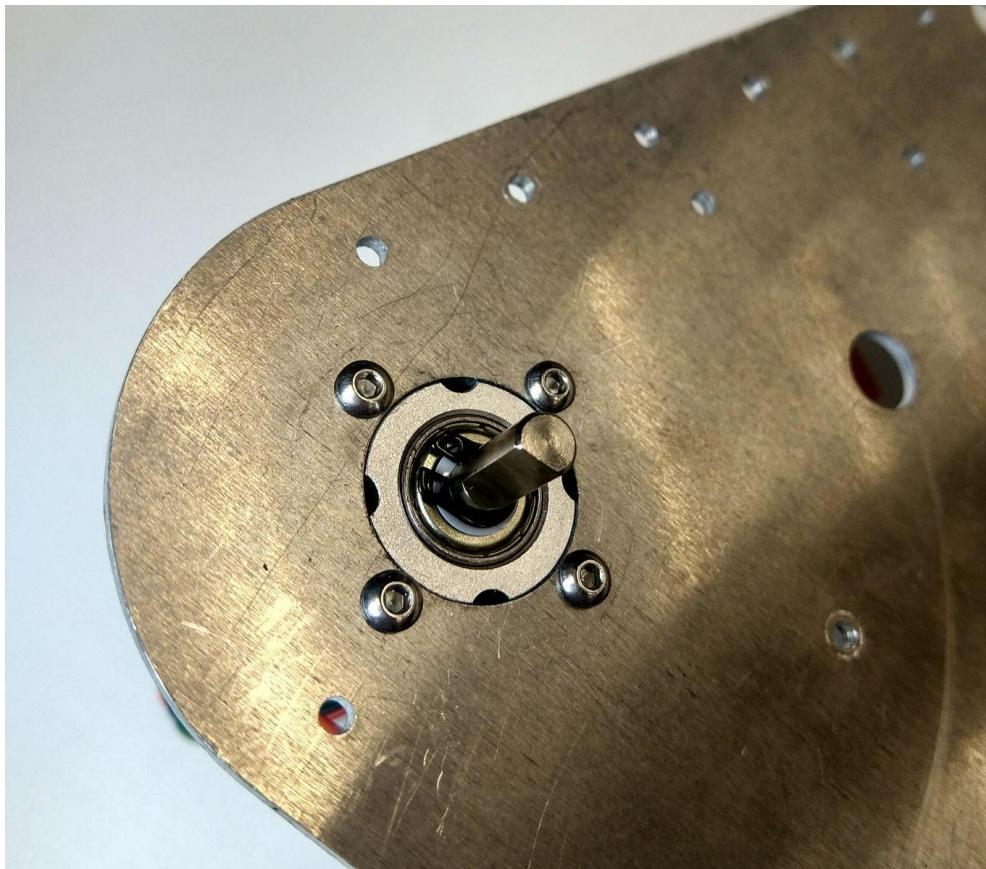
Tools



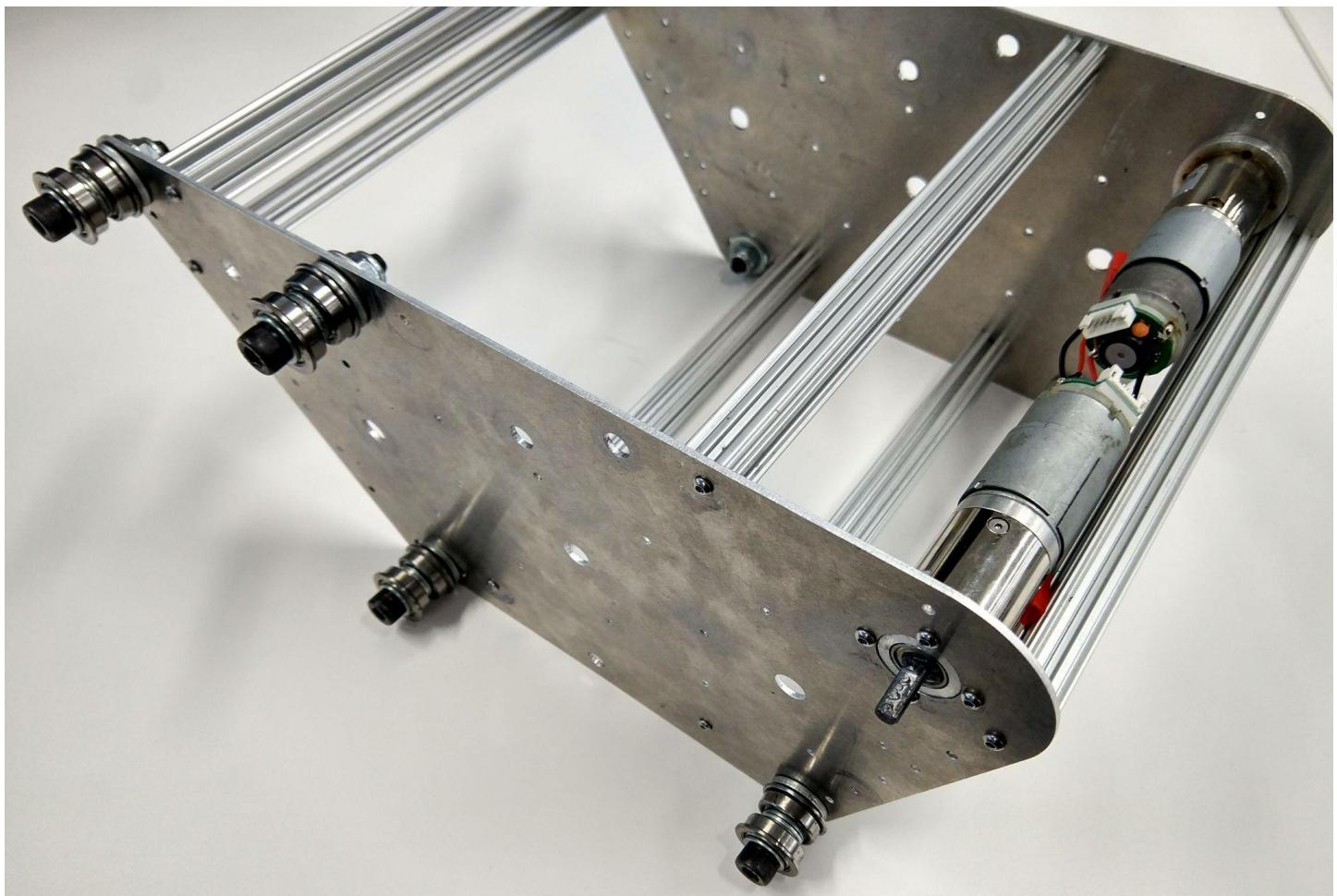
Parts



Attach DC Motor to side panel



Attach support beams and track support





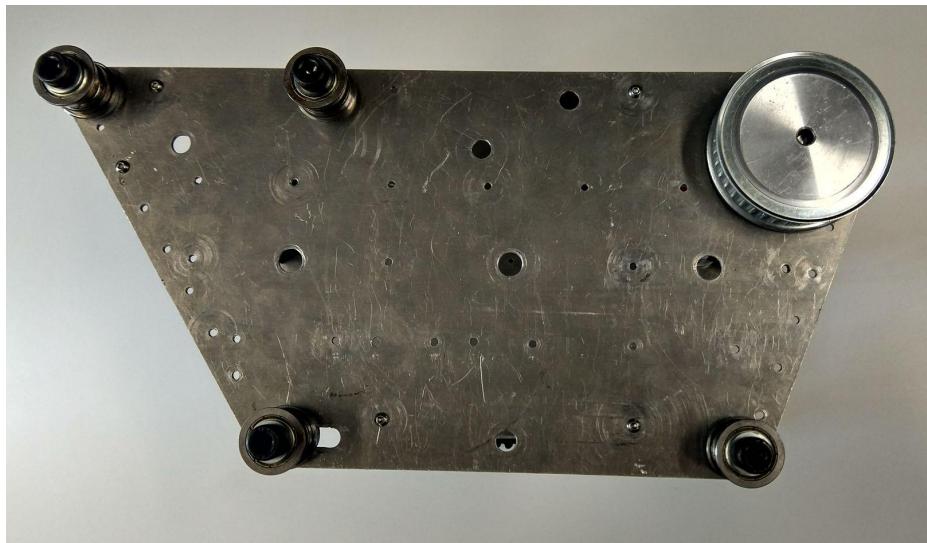
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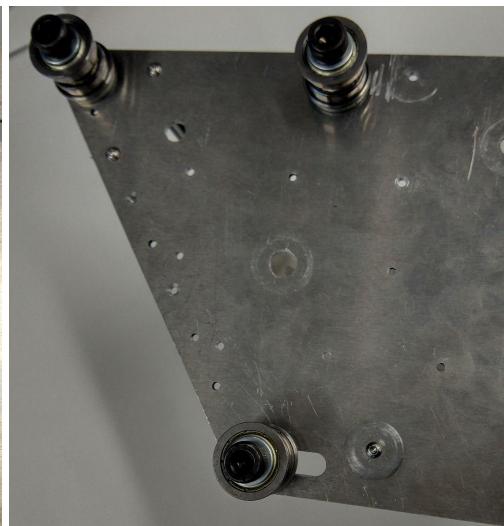
Attach pulley to DC motor, use spacer to set gap between button head bolts and pulley



Attach track

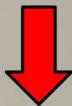


Attach track with track support to the right, once track on frame slide to left to tension track.



Spacer Layout

Use 6mm Hex Key



M8 x 40mm Hex Bolt

Thin washer

Flanged Bearing

3 x M8 Thin washer

Flanged Bearing

Thin washer

Fat washer

Robot laser cut side panel

Fat washer

M8 Nyloc nut

Use 13mm Spanner

Parts Supply

Supplied parts are to be kept in their current form, i.e. can-not be cut or drilled into.
Some additional parts are available on request.

- 3x Mecrum wheels
- 2x Large scooter wheels
- More open beam lengths
- Smaller main motor drive pulley
- 2nd electromagnet
- 2nd 90 rpm encoder worm motor
- 2 x 100 rpm worm motor
- 2nd geared stepper motor
- 3rd and 4th standard sized servo
- 4 x rare earth magnets
- 2nd linear rail, or shorter linear rail 100mm

Parts purchase requests must be sent to technician by email.
If you believe your part to be broken or faulty, they can be exchanged for a replacement part.

Notes about parts

A design requirement is that you use items given to you in the kit in their current form.

Do not disassemble the modules.

If you require a smaller IR distance sensor, smaller versions are available to swap.

Do not disassemble the motors, or servos.

If you want continuous rotation from servos, some are available by request.

Do not add any holes or cut the side plates.

You can bolt on extra metal bits or have a whole new side panel cut for you using the waterjet.

Do not cut the Open beam Al extrusion, additional items are available on request.

Do not cut up provided cables.

If you want shorter or longer cables, you can make your own with provided cables in cabinets below the batteries storage area.

What can be cut up?

Al extrusion is available for you to cut up

MDF board is available to be laser cut.

Perspex is available to be laser cut.

Al sheet is available to be waterjet cut.





Additional steel or AI is available via request, or from the main workshop.

Actuators

Stepper motors require a stepper motor driver board. Control signal: 1 digital line, servo signal.

DC Motors require a DC motor driver board, Control signal: 2 digital lines, step & direction.

Electromagnet and solenoid require an electronic switch driver board. Control signal: 1 digital line.

Servos can connect to CPU through an adapter board to supply higher current. Control signal: 1 digital line, servo signal

Smart servos can connect to CPU through an adapter board to supply higher current. Control signal: 2 serial lines.

Main drive motors can supply position feedback to CPU via 2 digital lines, needs special cable 2mm 6 pin

Smart servos can supply position feedback TO CPU via Rx serial line, needs special cable 2mm 4 pin

90rpm worm motors can supply position feedback via 2 digital lines.



CPU

The CPU of the board is a Teensy 4.0 with an ARM Cortex-M7 running at 600 MHz.

For more technical information about the board and microprocessor take a look at
www.pjrc.com/store/teensy40.html

Teensy 4.0 pins accept 0 to 3.3V signals. The pins are **NOT** 5V tolerant. Do not drive any digital pin higher than 3.3V
 To drive any actuator you will need a dedicated driver board.

CPU Ports

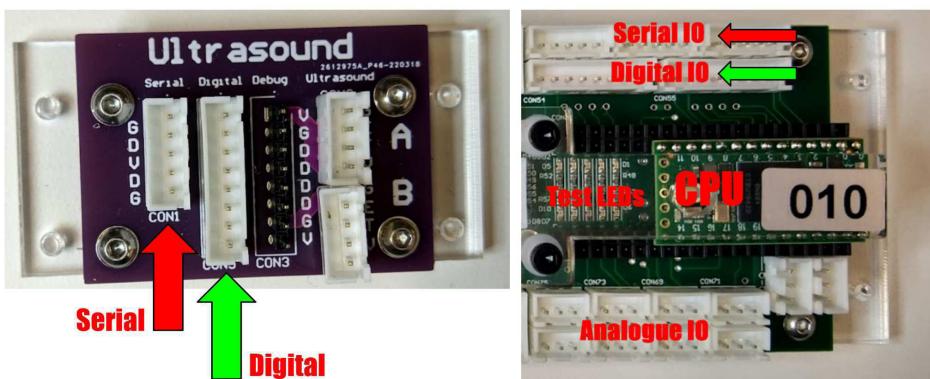
The microcontroller has a number of ports that can change their function based on your needs.

Arbitrary decisions have been made and various ports have been assigned a purpose.

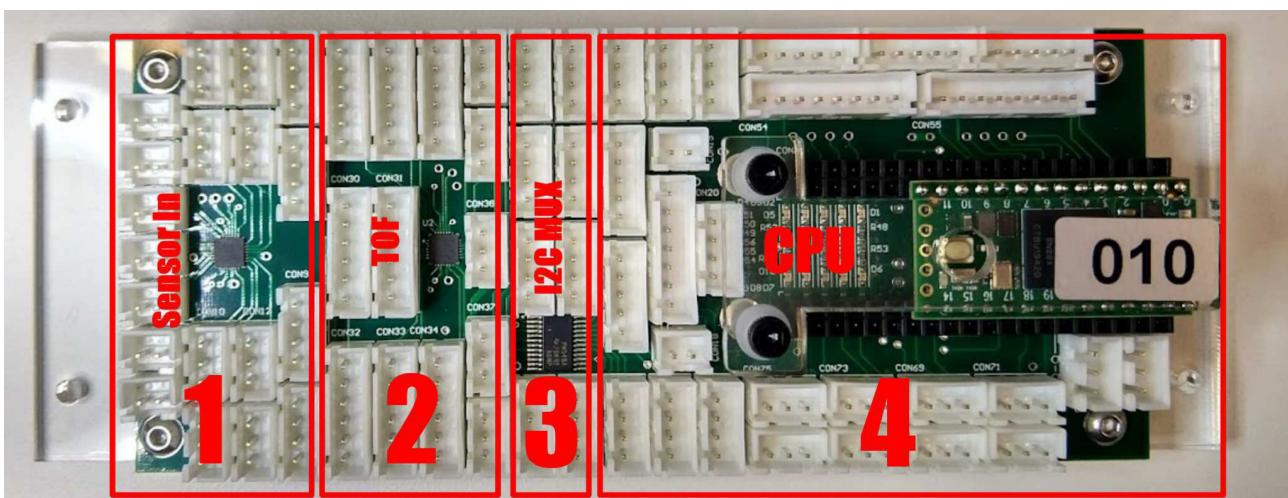
SERIAL	There are 3 labelled serial ports. These contain 2 digital lines.	5 pin cable
DIGITAL	There are 2 labelled digital ports. These contain 4 digital lines.	8 pin cable
ANALOGUE	There are 10 labelled analogue ports. These contain 1 digital line.	3 pin cable

A number of the IO boards contain both the SERIAL and DIGITAL port connectors.

You should only hook ONE of these up at a time.



The CPU board actually consists of 4 separate sub assemblies. To use these, each assembly must be connected to the CPU using a 4 pin I2C cable. Each assembly also has its own unique I2C address.





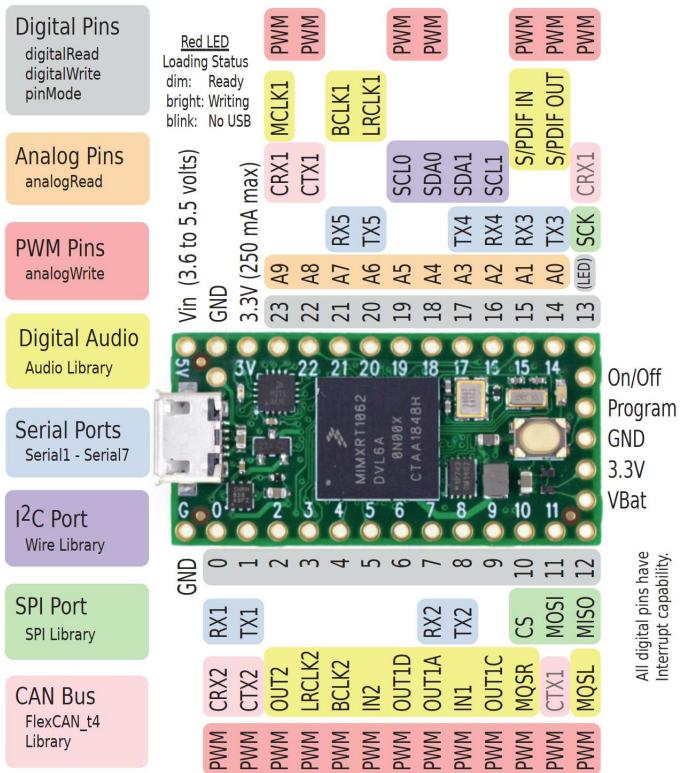
Raw Teensy Pins

Welcome to Teensy® 4.0

32 Bit Arduino-Compatible Microcontroller

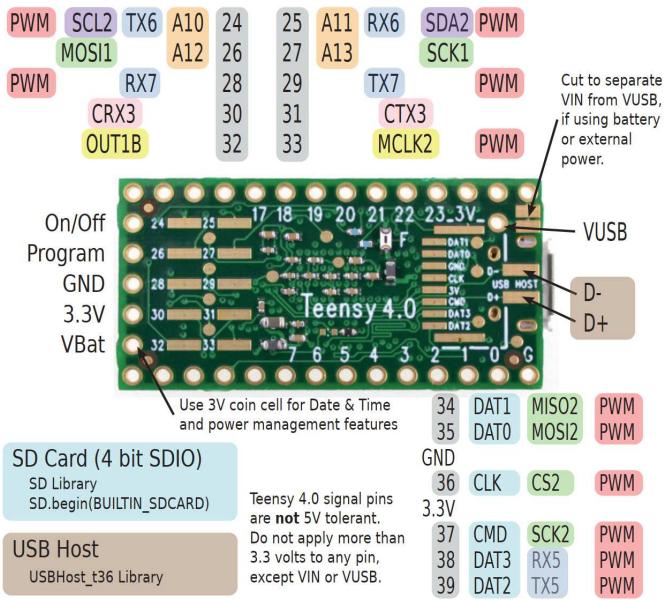
To begin using Teensy, please visit the website & click [Getting Started](#).

www.pjrc.com/teensy



Teensy® 4.0 Back Side

Additional pins and features available on the back side



For solutions to the most common issues and technical support, please visit:

www.pjrc.com/help

Teensy 4.0 System Requirements:
PC computer with Windows 7, 8, 10 or later
or Ubuntu Linux 14.04 or later
or Macintosh OS-X 10.8 or later
USB Micro-B Cable



Port Expanders

The CPU board contains a number of additional features.

One of the features is the use of port expanders.

The board contains 2 port expanders, each at a different I2C address.

The left hand side contains seven 2 pin ports that can be used for limit switches.

They are labelled AI00 to AI06

These ports contain pullup resistors.

There are also eight 3 pin ports to be used for digital sensors.

They are labelled AI08 to AI15

To use the port expander the IC needs to be connected to the I2C bus, this is done with a 4 pin cable.

I2C Summary

I2C Address	Part #
0x28 IMU	BN0055
0x29 TOF Sensor	VL53L1X
0x29 Color Sensor	TSC34725
0x30 0x30-0x38 TOF Sensor Reassign	
0x3C OLED	SSD1306
0x3E Limit switches AI00-AI015	SX1509
0x3F TOF Control XSHUTO-XSHUT7 and BI08-BI012	SX1509
0x40 0x40-0x4f TOF Sensor Reassign 2nd space	
0x52 TOF Imager Sensor, 8x8 zones	VL53L5CX
0x70 Multiplexor Control	TCA9548

In order to use the TOF and Color sensor in the same design there are 2 strategies that can be taken...

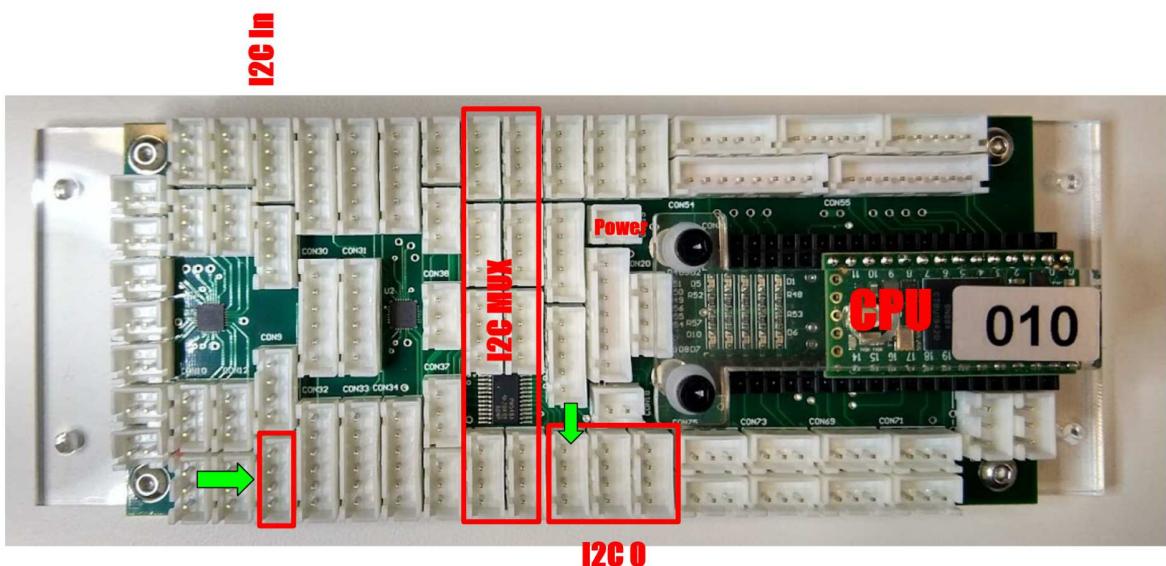
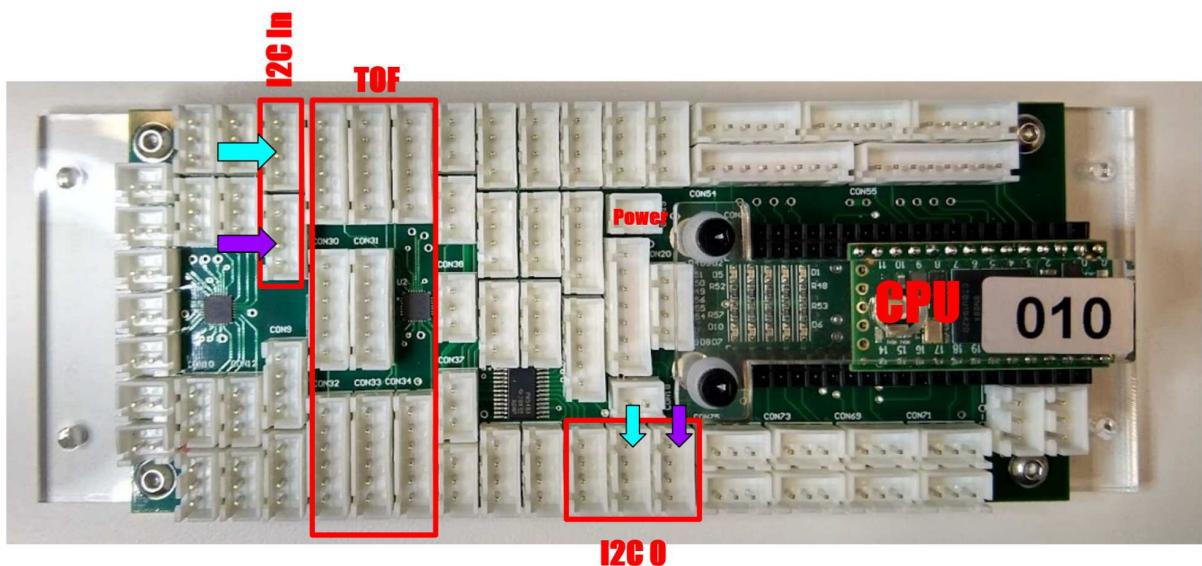
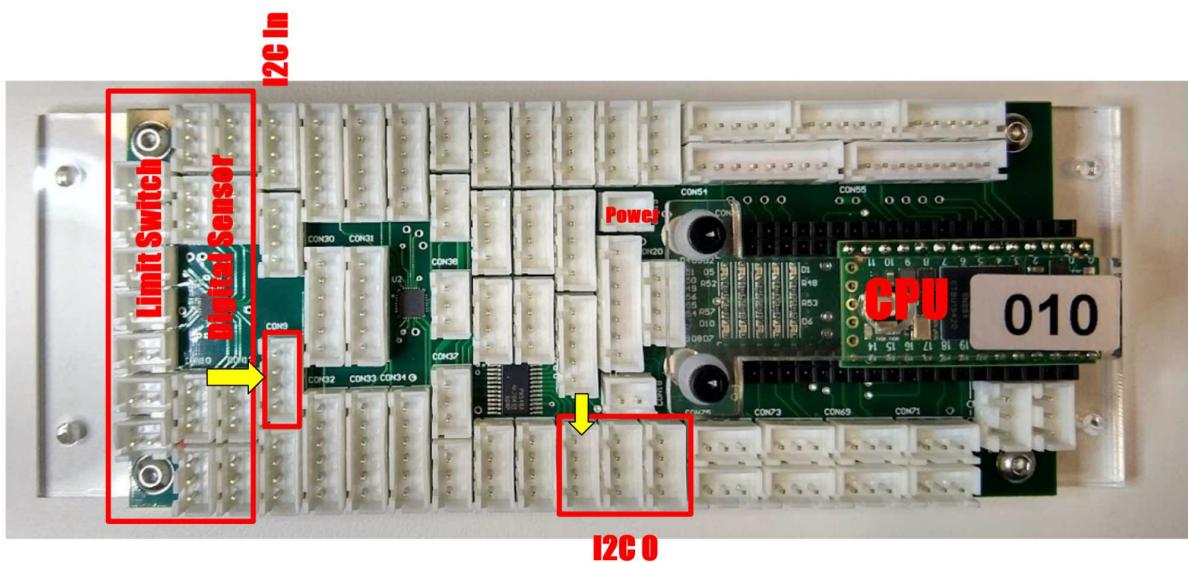
- 1 Use I2C Multiplexor
- 2 Use separate I2C busses, the CPU has two I2C buses labelled I2C0 and I2C1





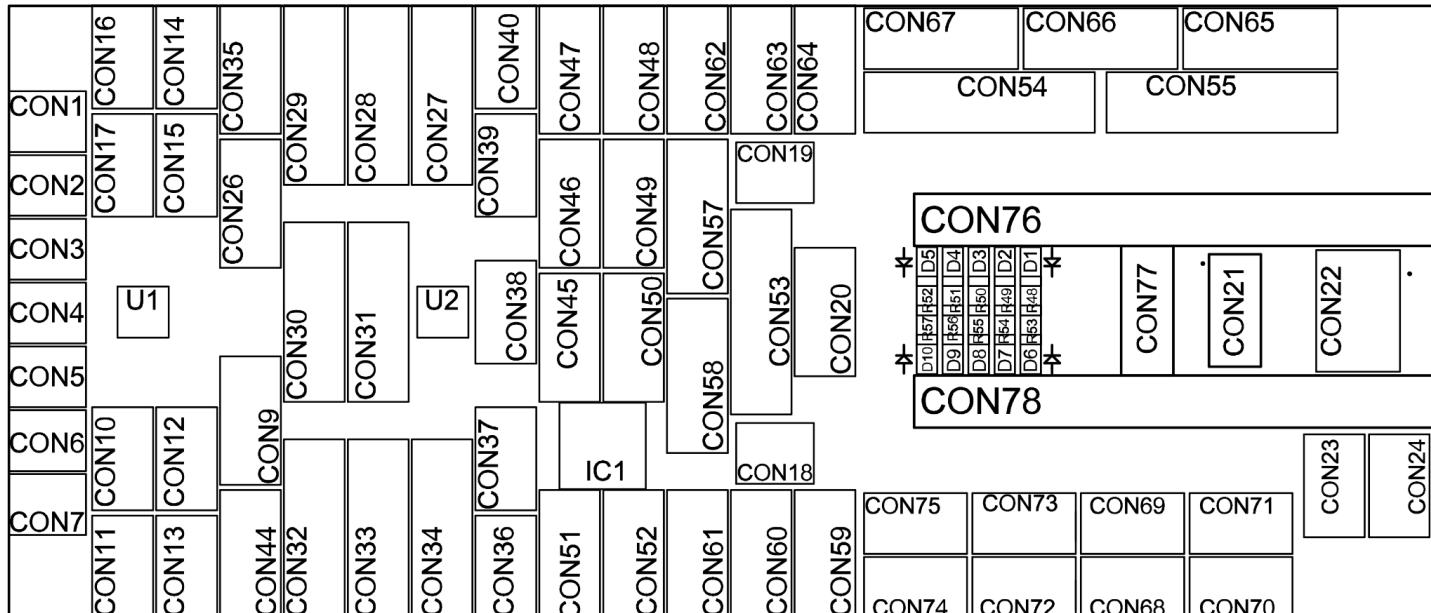
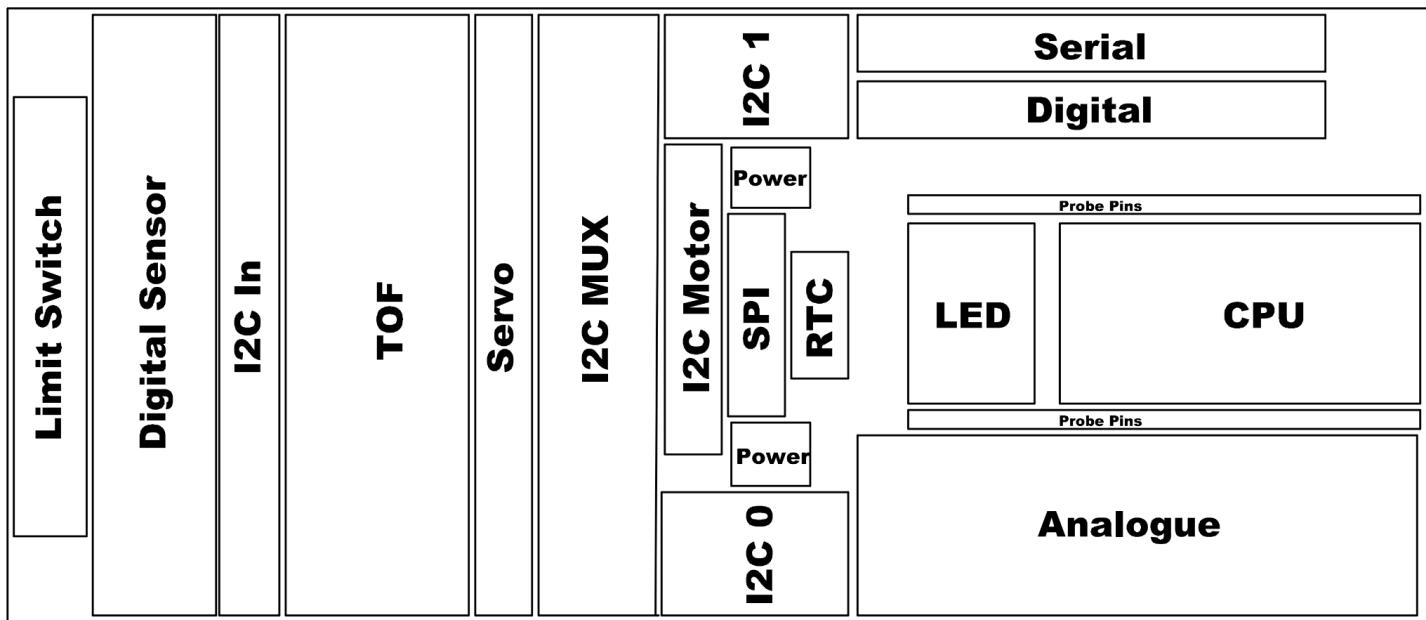
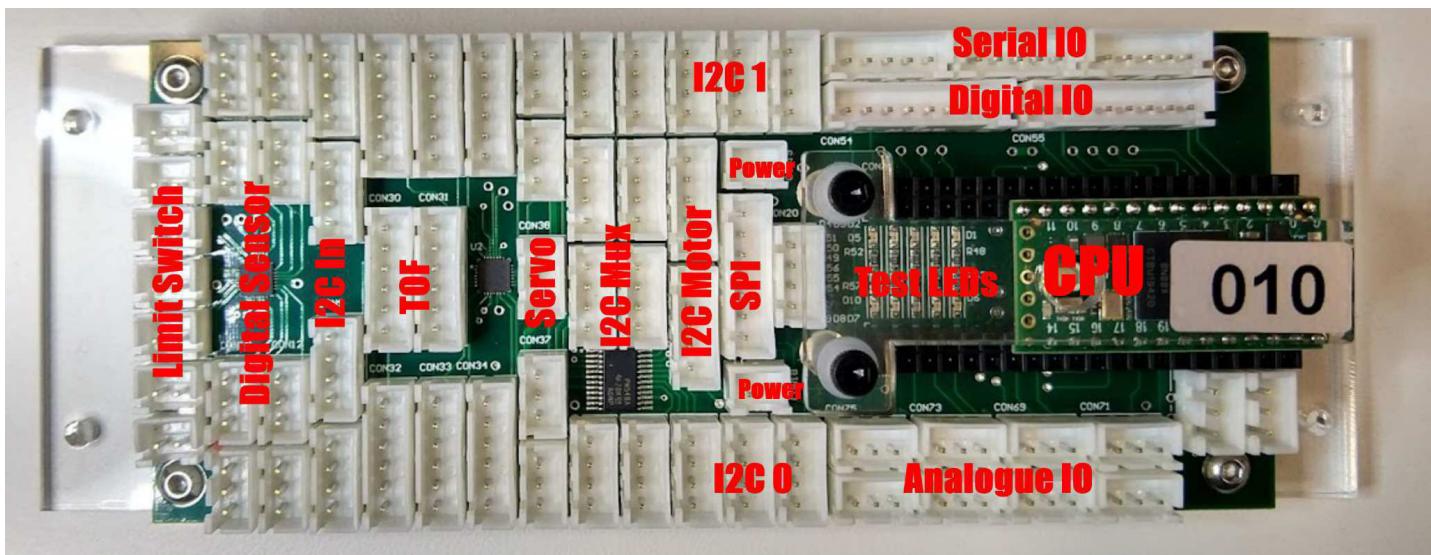
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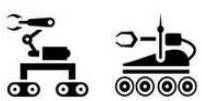
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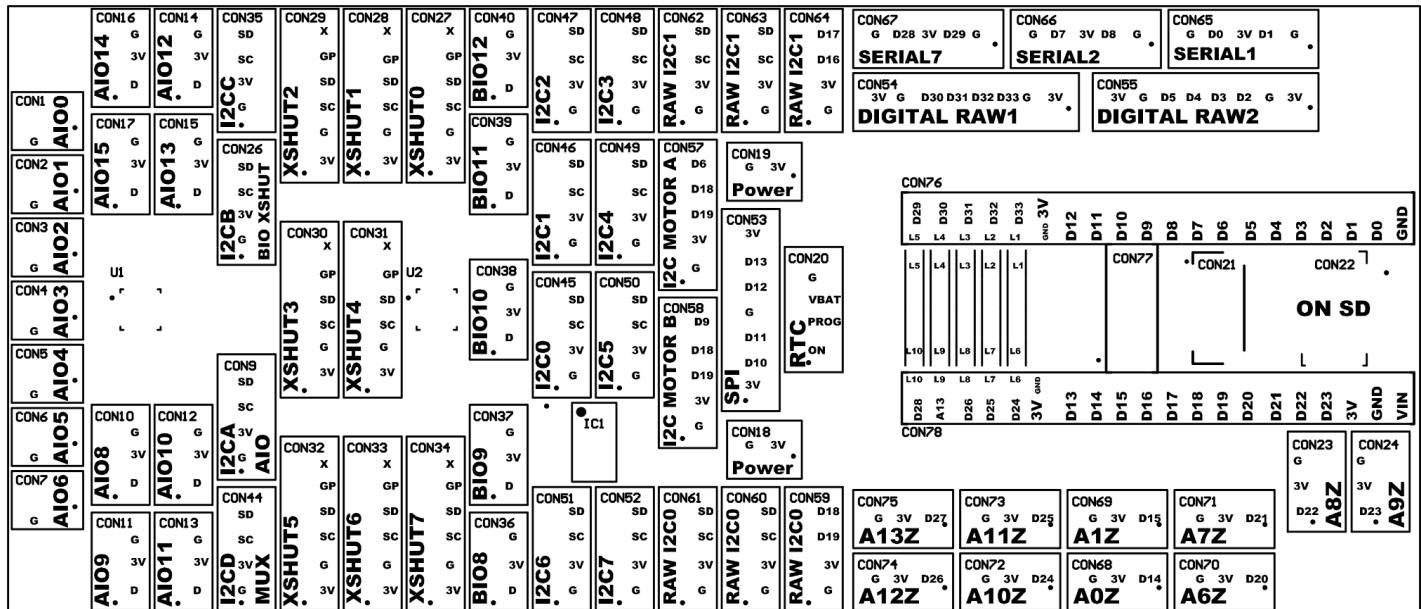
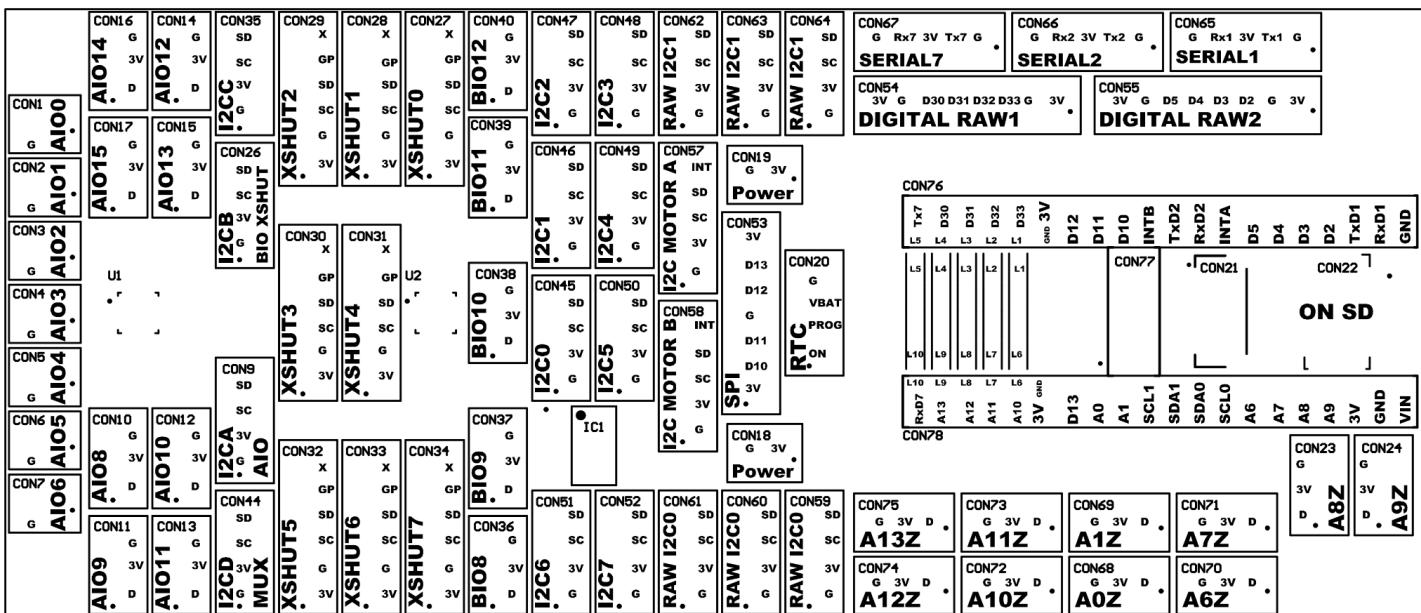
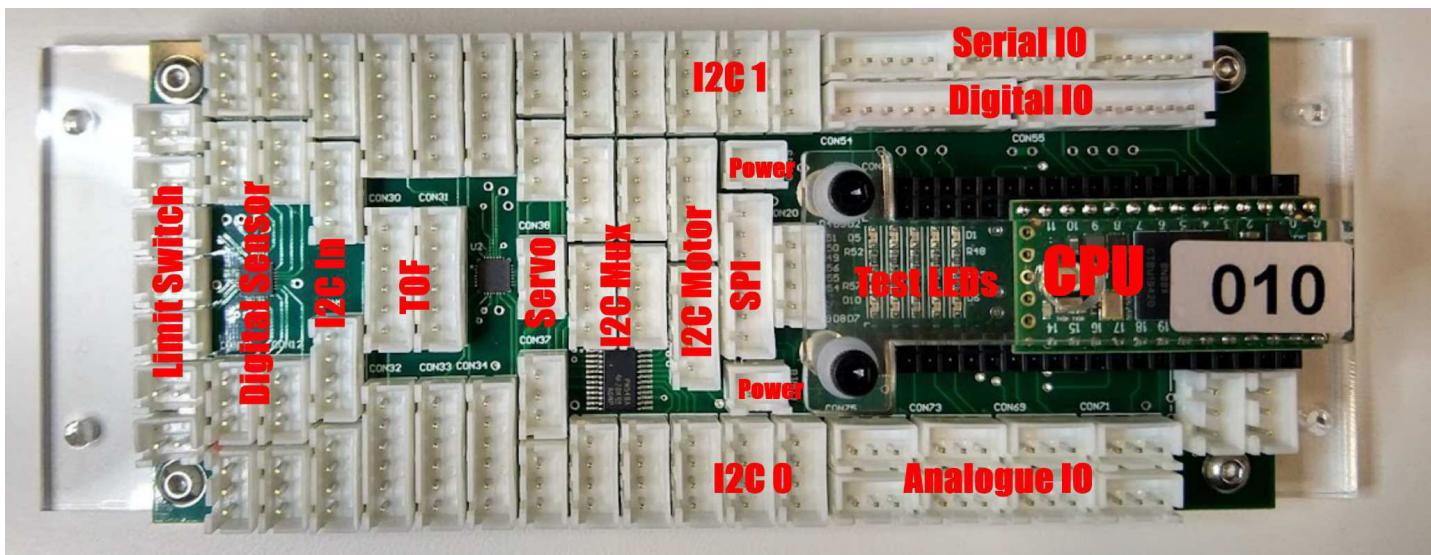
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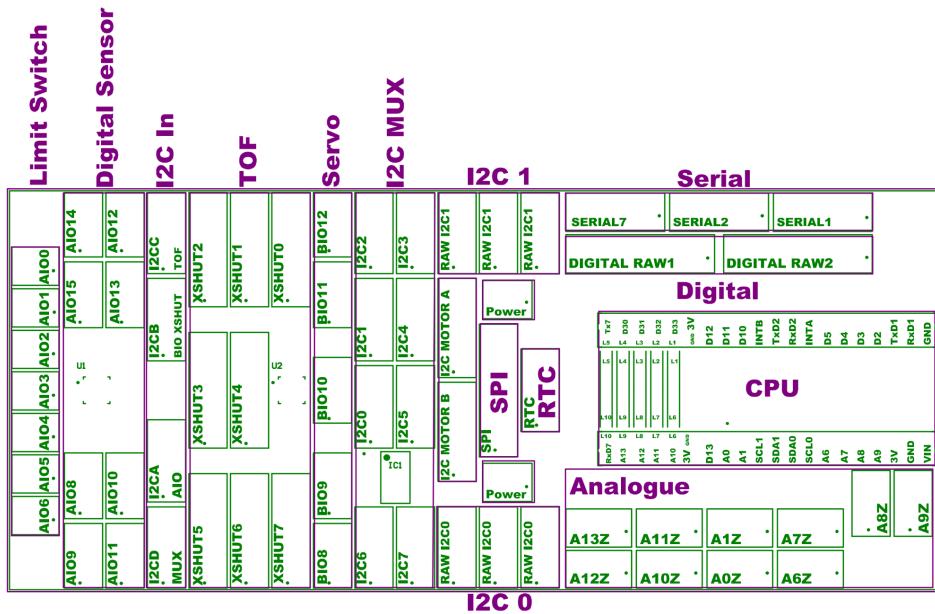
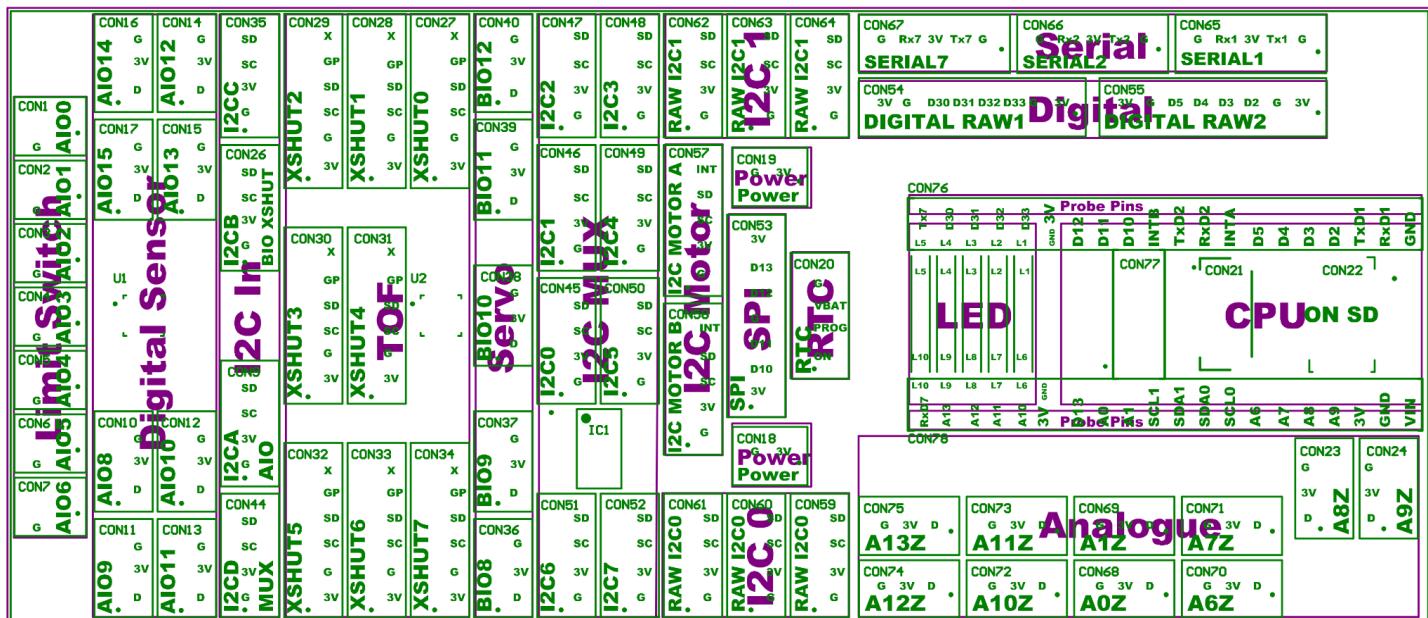
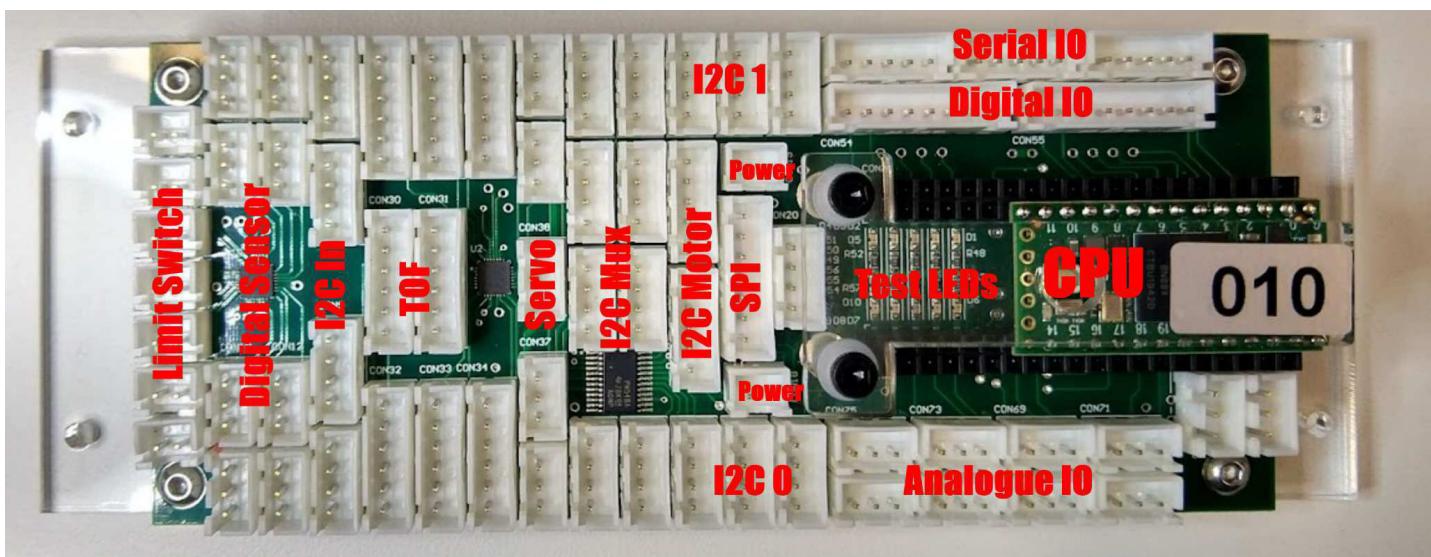
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Documentation 2022 V0.8

Software

All machines in the Mechatronics lab have the software already installed. Shortcut to start the IDE can be found at **C:_shortcuts\programming**

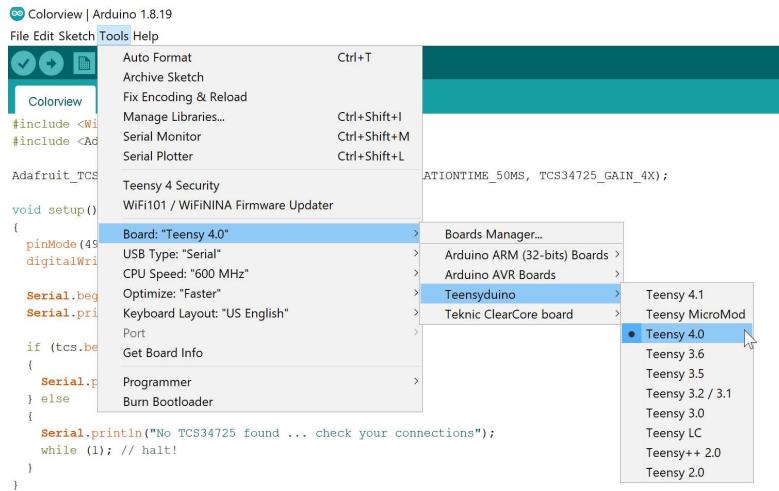
Do not use the default IDE from the start menu, as it does not contain the ARM extensions.

If you want to install on your own laptop there are two pieces of software to download and install.

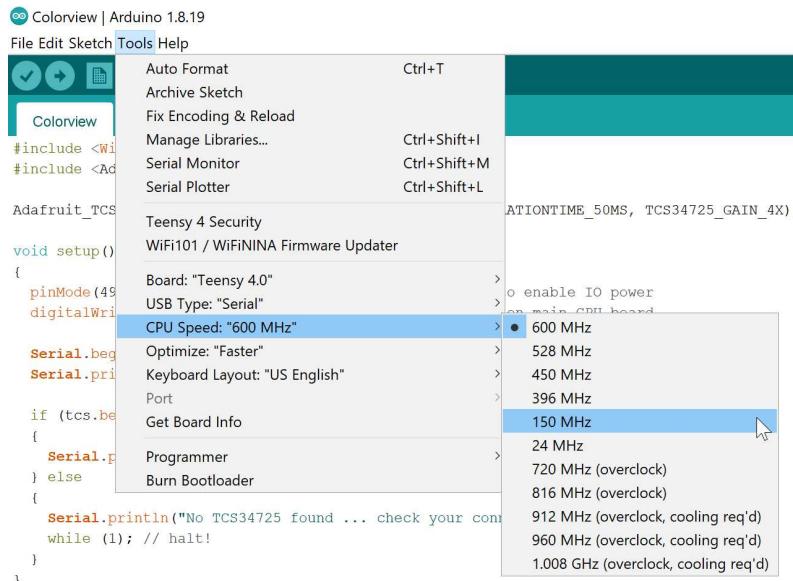
www.arduino.cc/en/software

www.pjrc.com/teensy/td_download.html

Once installed start the IDE and chose the correct processor from the menu



Select a speed, not everything works at 600MHz, I would suggest 150MHz and increase it later if needed.



To send a program to the micro press the upload button





Software Library

Some of the provided examples need additional libraries installed to work correctly.

SX1509 IO Expander by Sparkfun, Version 2.0.1 for CPU IO Expansion

VL53L0X by Pololu Version 1.3.1 for TOF Sensor

VL53L1X by Pololu Version 1.3.1 for TOF Sensor

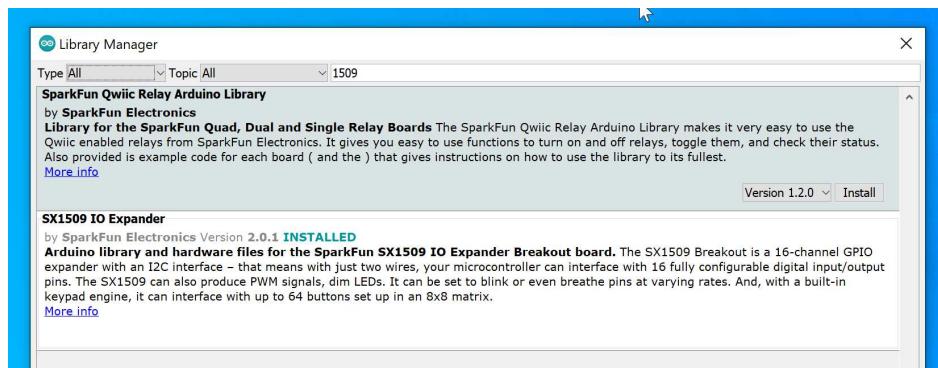
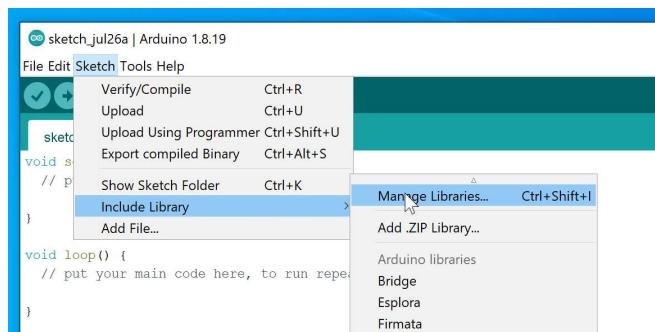
FastLED by Daniel Garcia for Smart LED's

Adafruit BNO055 for IMU

Adafruit TCS34725 for Color Sensor

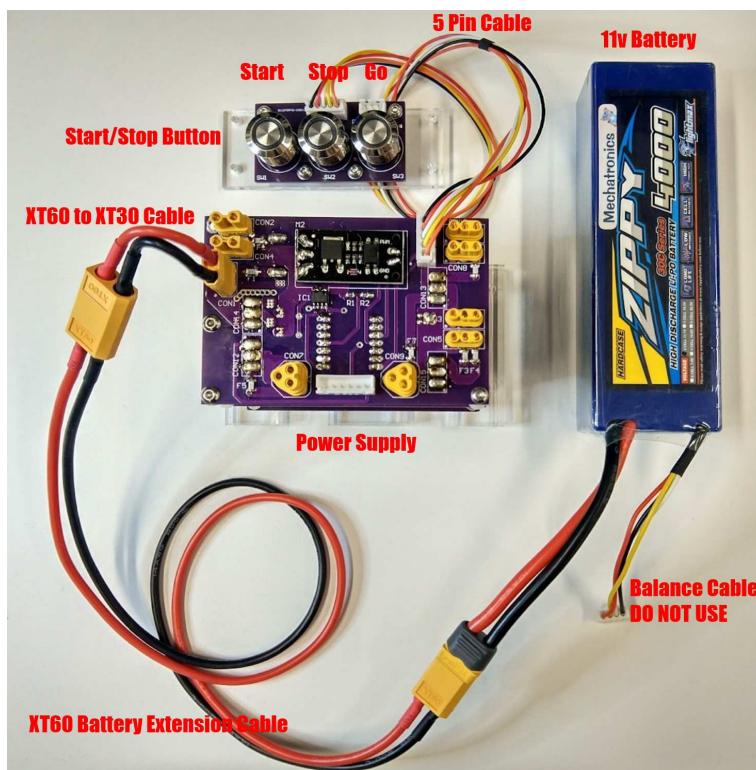
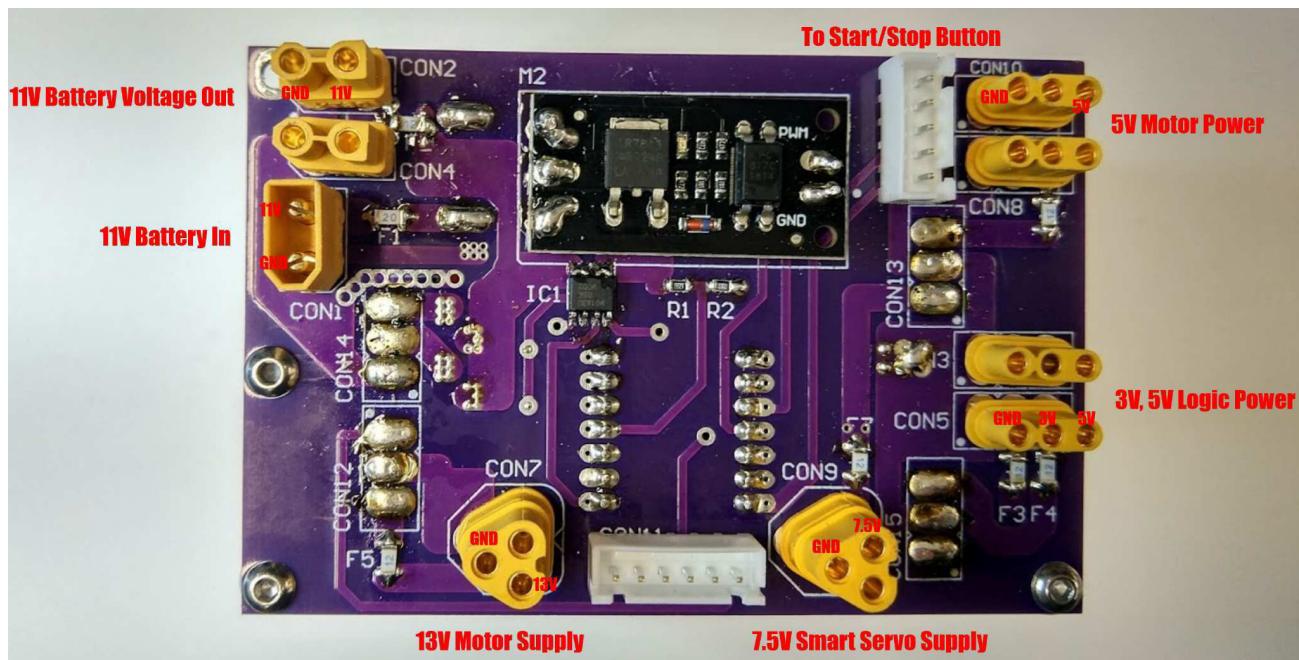
DFRobot HX711 for Weight Sensor

How to install libraries, once opened Library manager in Arduino IDE, use keyword to narrow down choices.



Power Supply

The battery **MUST** be connected to this board. All power sourced for other components comes from this board. Press and hold the start button for 2 seconds to enable power. Press the stop button for 1 second to cut power. The Go button can be wired separately to the CPU board and used as a digital input to start your program running. Points to take note of. The 5V Motor Power connector does not provide 3V on the connector. Although the 13V and 7.5V supplies have the same connector, the third pin is not connected to the other power supply.



Power Expander

This board provides a mechanism to get additional power connection points.



Hookup Diagrams

Example code is available with hookup diagrams. Download the examples from the Learn website, and refer to the supplied hookup diagrams.

These are reference examples used to learn how things work. You should try to understand the electrical connections, and follow the example code.

Each of the examples works in isolation to the other examples. To use these examples together the user will need to study the documentation , plug the sensors or actuators into another port and make the correct port reassignment in the code.

Sensors

101_IMU
102_Color
103_IR_XYPosition
104_TOF_Short
105_TOF_Long
X106_TOF
107_TOF_SerialMini
X108_TOF_SerialMicro
109_IR_Distance
X110_UltrasonicSmart
111_UltrasonicDigital
112_LoadCell
113_Encoder
114_IR_DistanceDigital
115_LimitSwitch
X116_MagSensor
X117_JoystickDigital
X118_JoystickAnalogue
X119_RFID

Actuators

201_SmartServo
202_StepperMotor
203_DCMotor
204_Servo
205_Electromagnet
X206_Speaker





Indicators

X301_Onboard LED
X302_SmartLEDSingle
X303_SmartLEDStrip
X304_TrafficLightLED
X305_OLEDDisplay

Debugging

X401_Bluetooth
X402_Wifi
X403_SDCard



201_SmartServo

This actuator needs to be connected to a serial port.

Smart servos are tunable and can give position feedback.

Run off 7.5V power supply output.

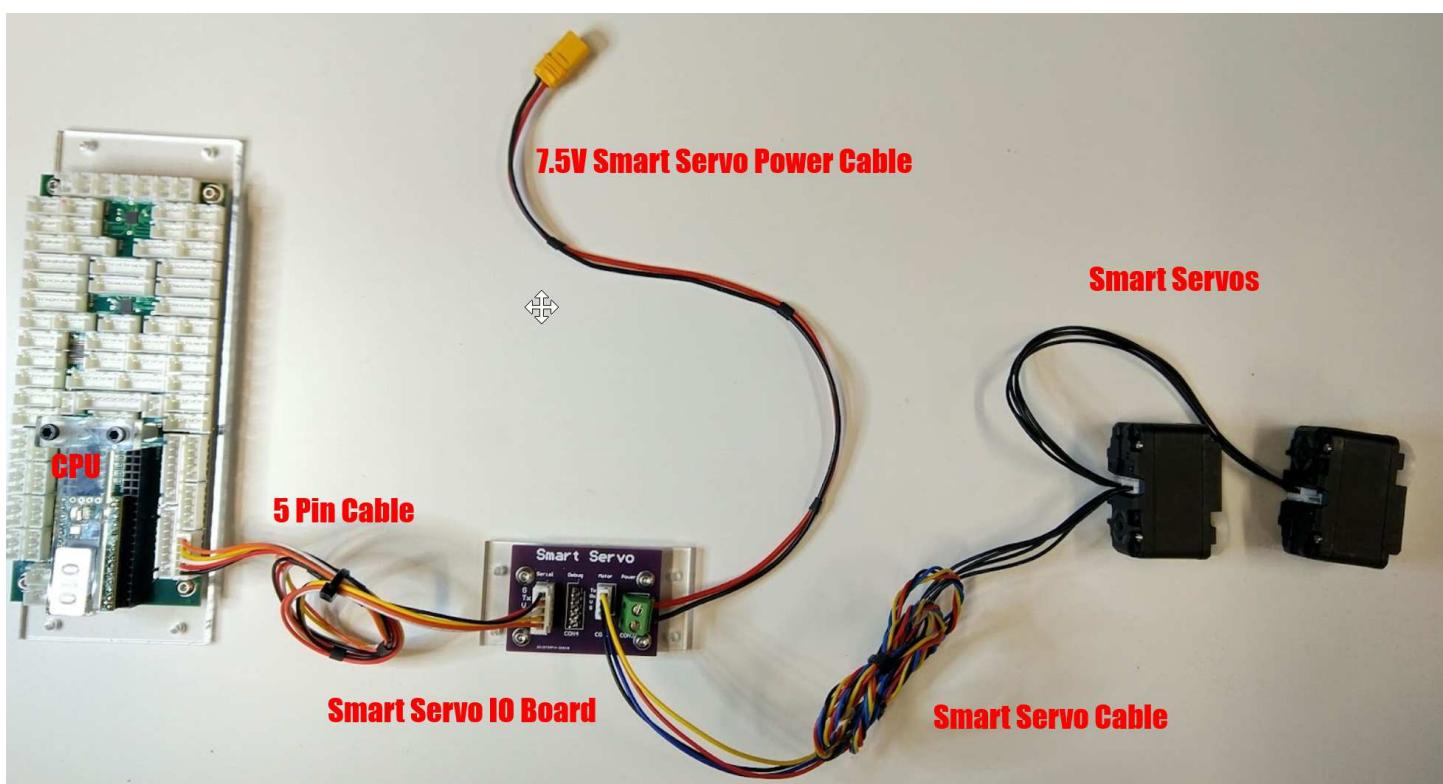
Each smart servo can be programmed with a unique ID that is used to identify it.

The ID is written on the side of the servo.

The cable connecting the servo to the IO board is a special cable provided in the kit.

There is a program on the PC called HerkuleX Manager that can be used to configure the servos parameters.

Also needed to connect to PC is a USB cable that is available at the front for the room.

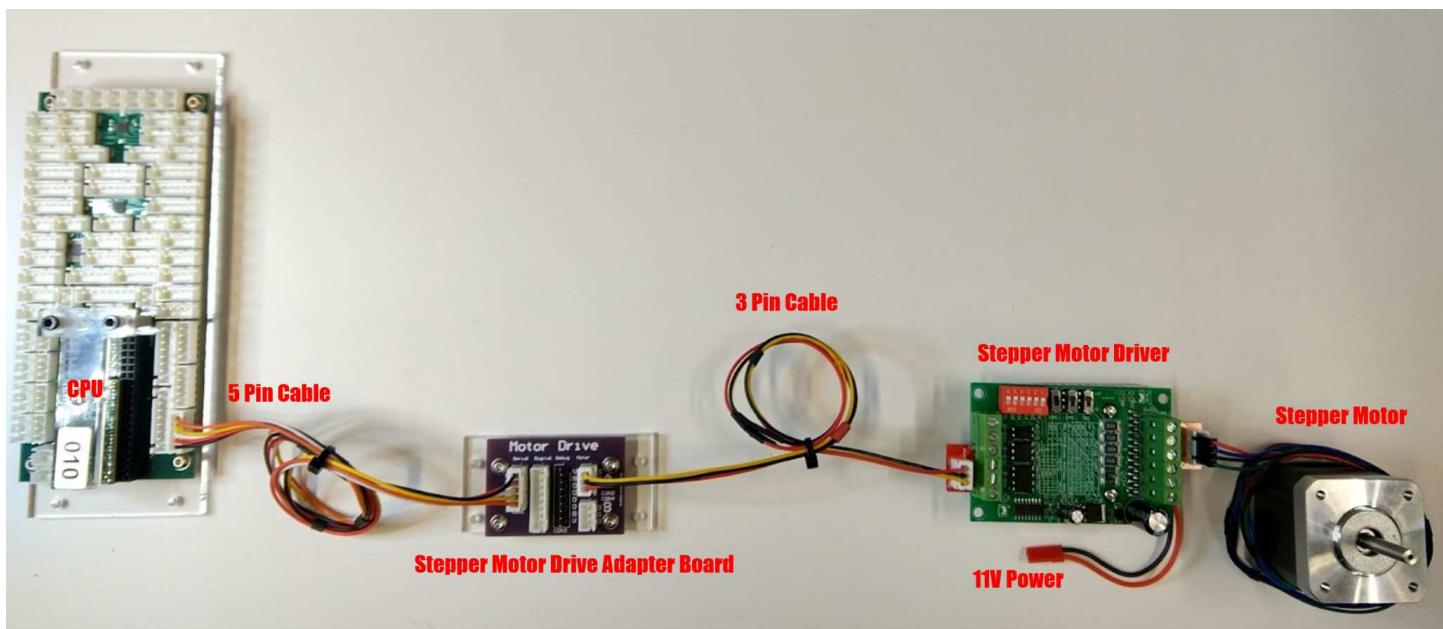
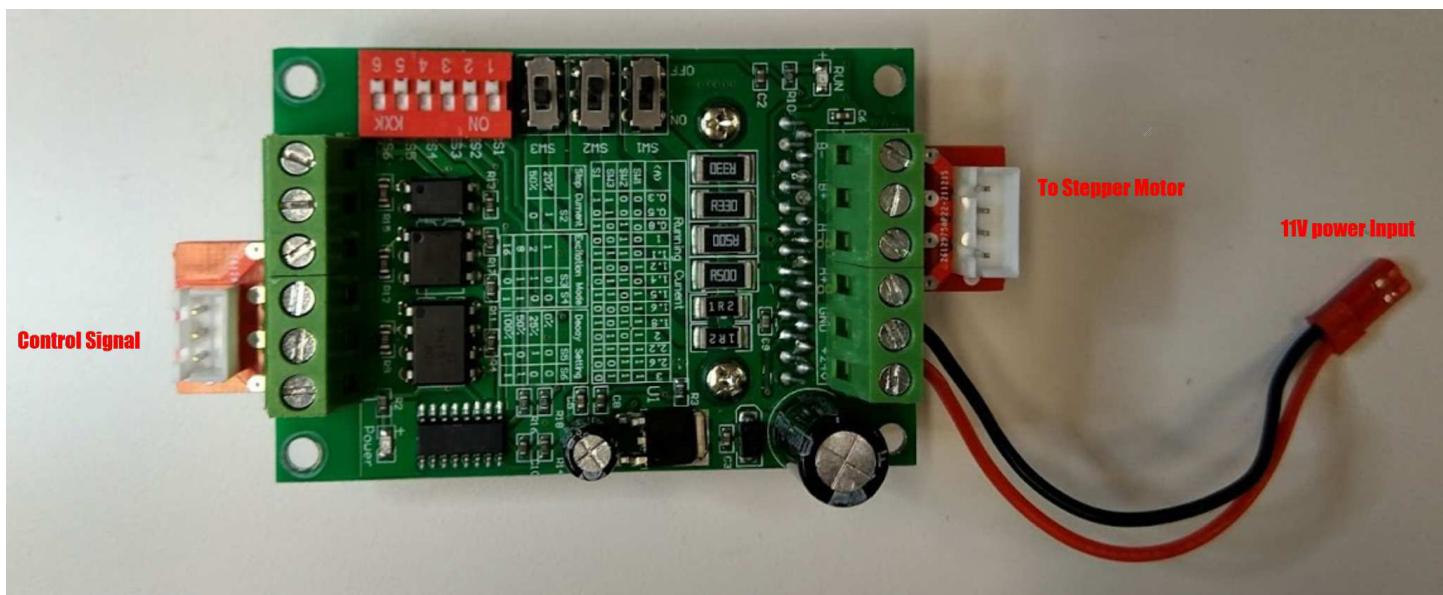




202 StepperMotor

This actuator can be connected to any digital pin.

Two control signals , step and direction



203_DCMotor

This actuator can be connected to any digital pin.

Used to drive any DC motor including the worm gear motor. Two channels.

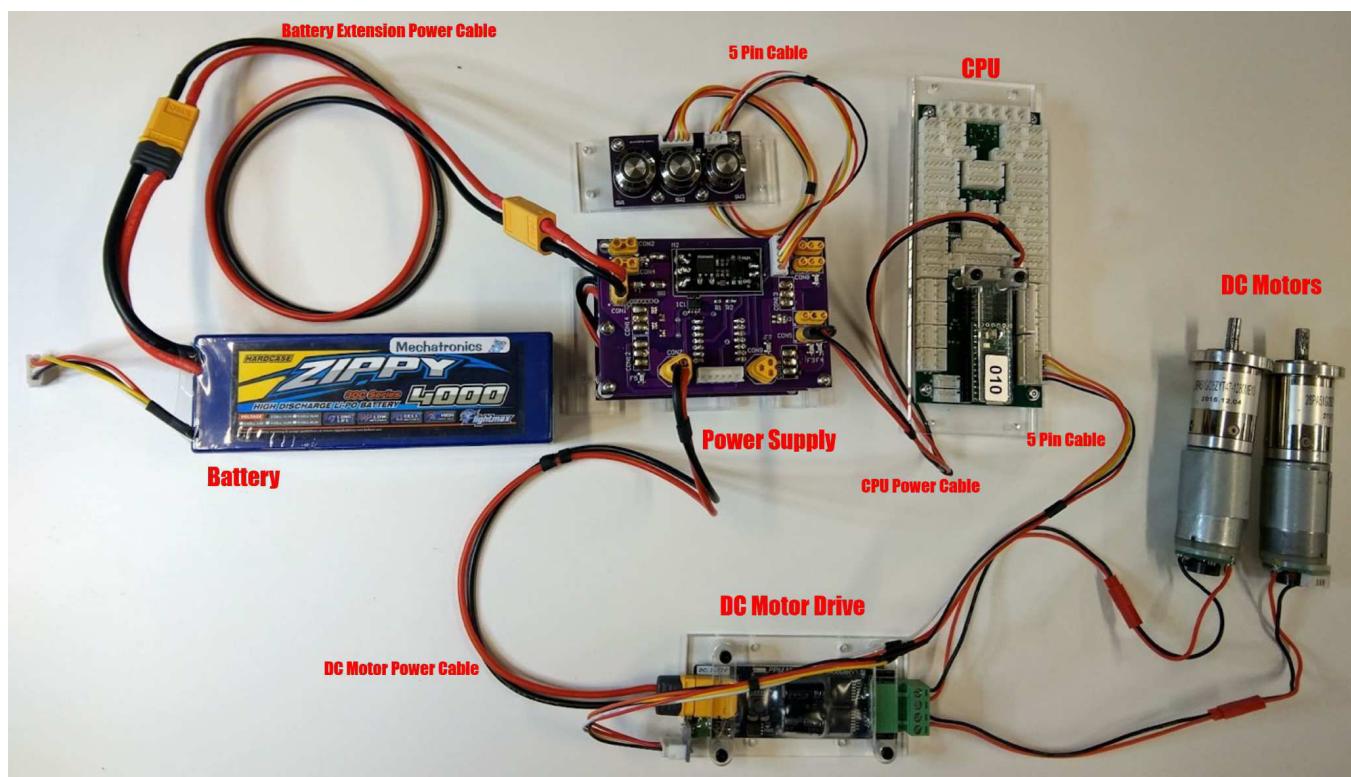
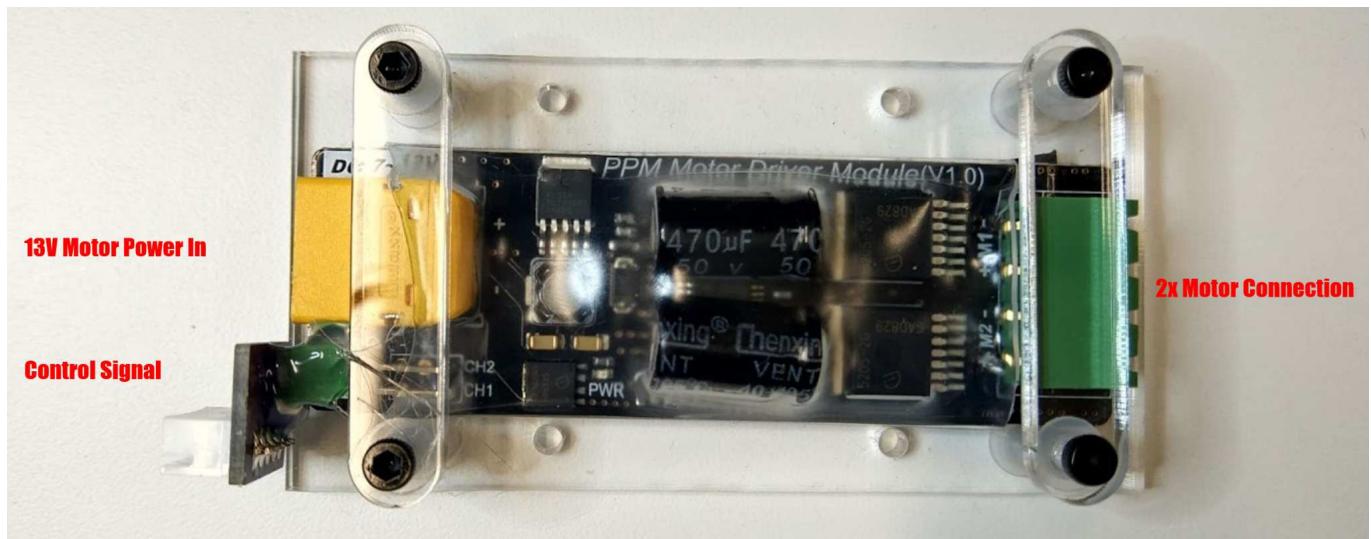
Uses servo signal as control input, ie a pulse that varies in width from 1ms to 2ms.

1.05ms full speed reverse

1.5ms stop

1.950ms full speed forward

The motor controller will ignore any signal outside what it sees as a valid range

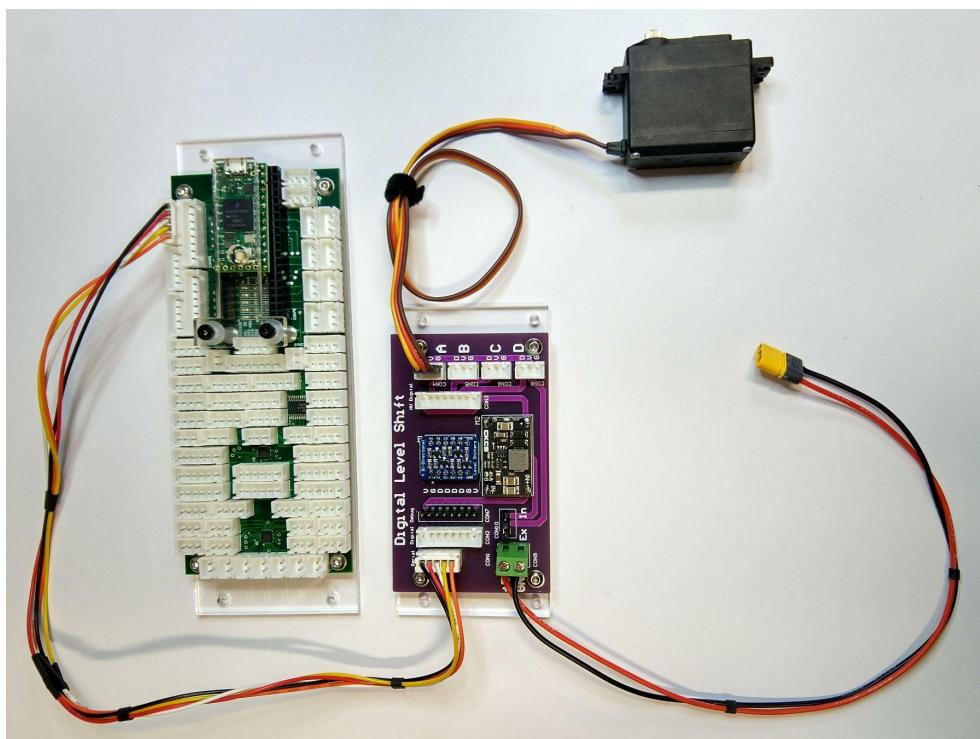


204_Servo

This actuator can be connected to any digital pin.

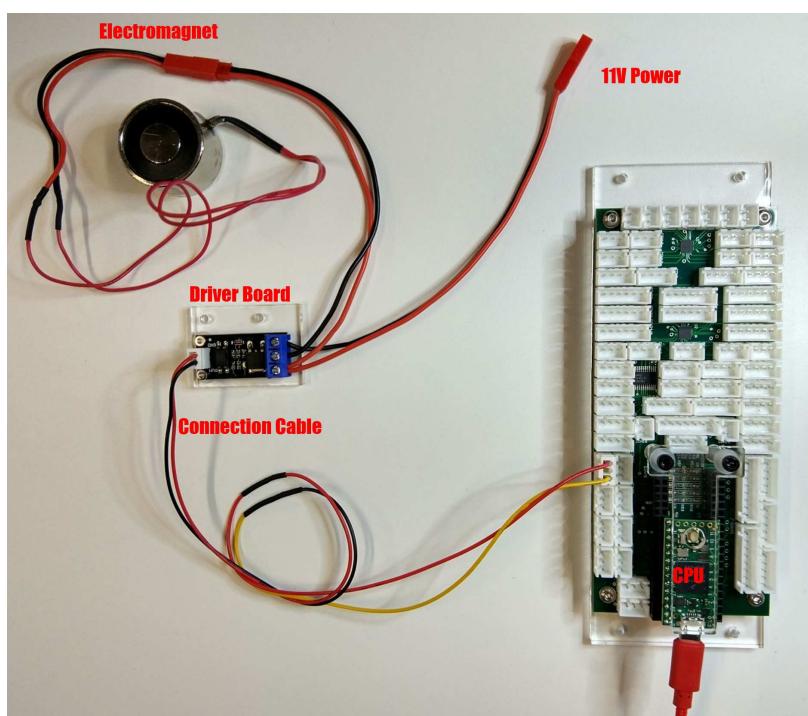
Servos can draw a lot of power, several amps.

So it's best to use the Digital Level shift board to supply the servo with power from an external source.



205_Electromagnet

This actuator can be connected to any digital pin.





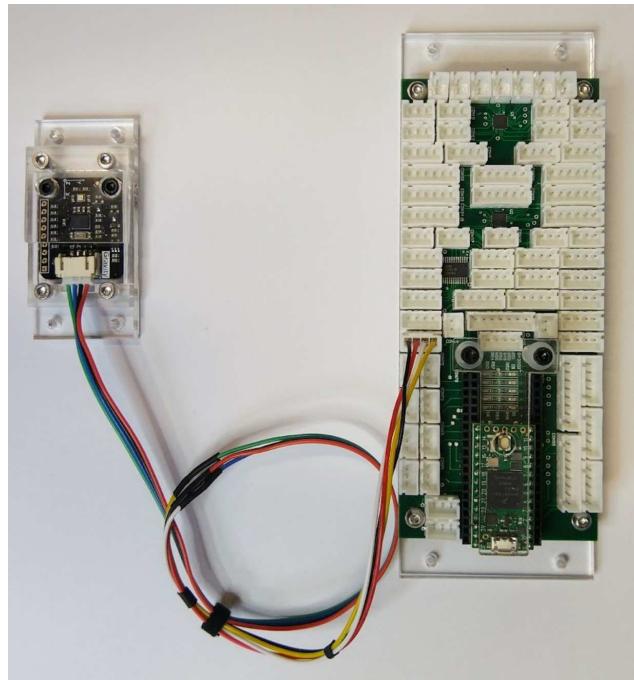
206_Speaker



101_IMU

This sensor needs to be connected to the I2C bus.

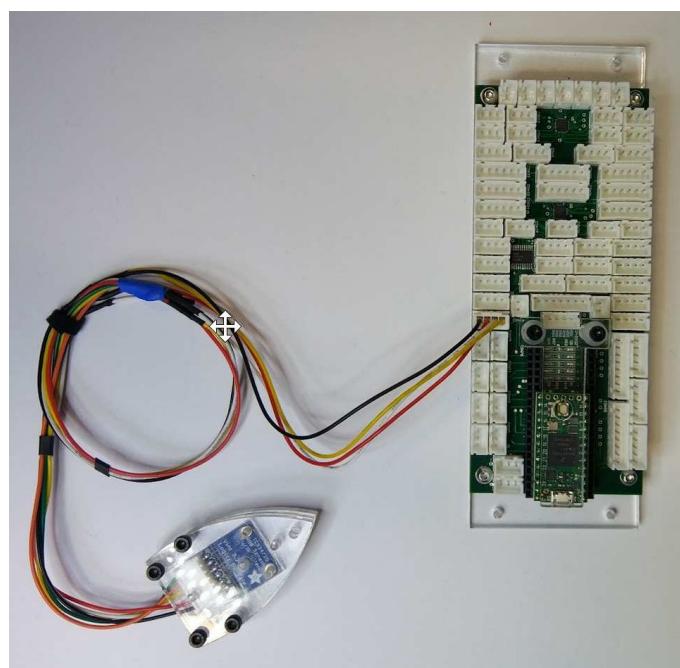
Sensor used BN0055



102_Color

This sensor needs to be connected to the I2C bus.

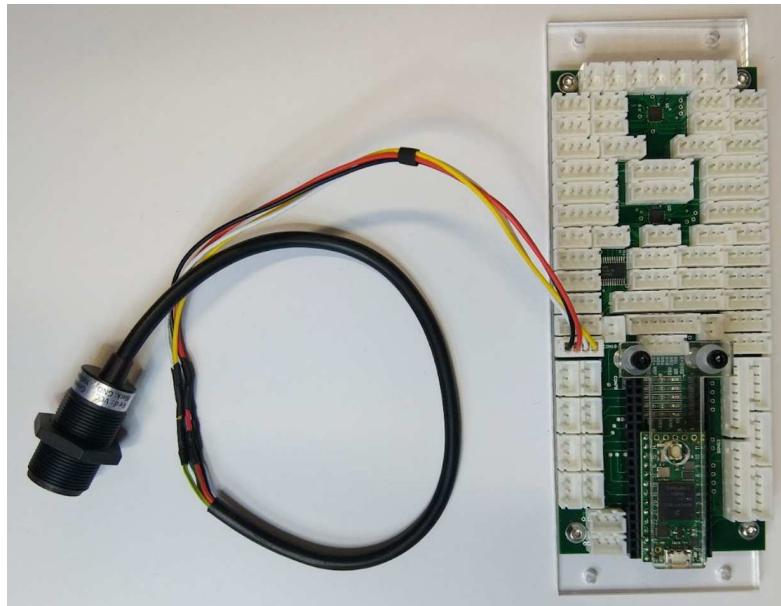
Sensor used TCS34725



103_IR_XYPosition

This sensor needs to be connected to the I2C bus.

Part number SEN0158



TOF

This sensor needs to be connected to the I2C bus.

There are 2 different modules available.

104_TOF_Short

VL53L0X

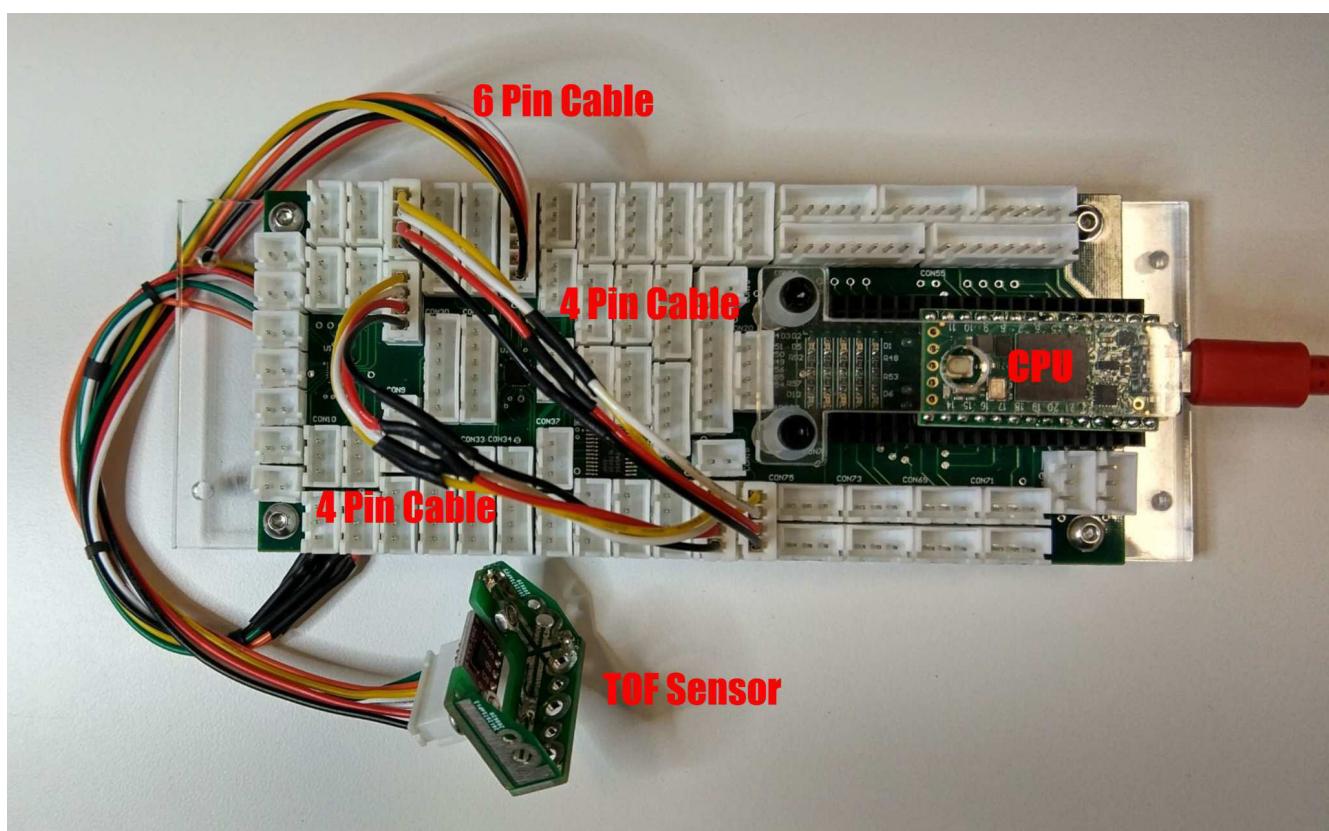
30-2000mm Blue



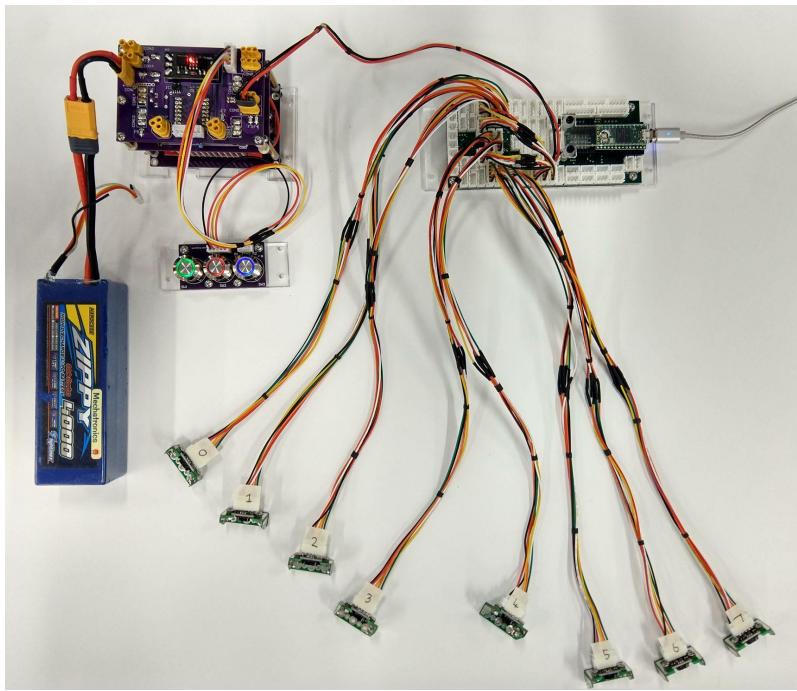
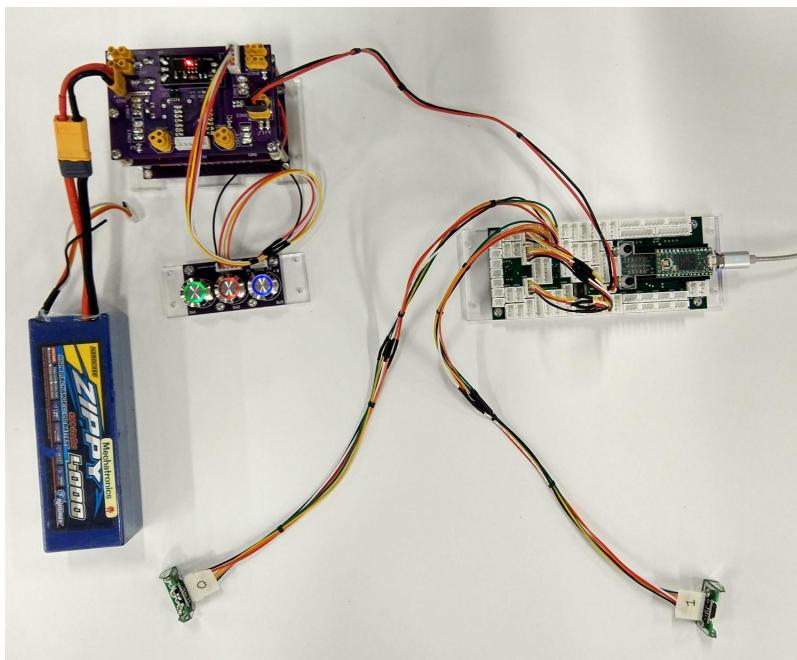
105_TOF_Long

VL53L1X

40-4000mm Purple



Multi Sensor Examples



107_TOF_Serial

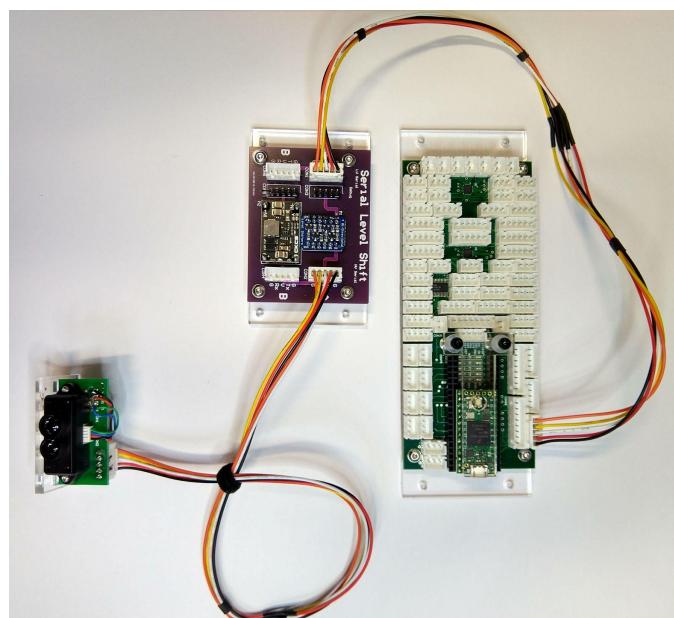
This sensor needs to be connected to a serial bus.

This sensor needs 5V to operate hence the need for the serial level shift board

TFmini

100-12000mm

White



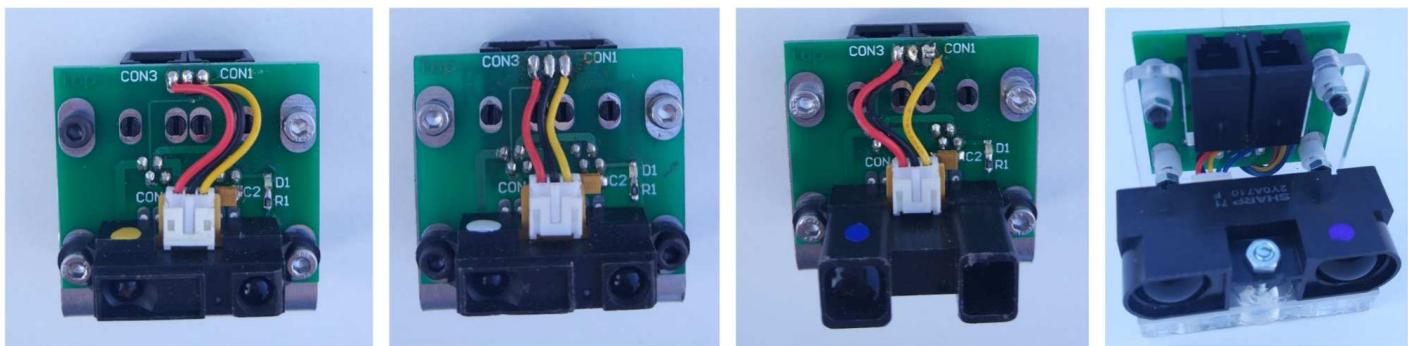
108_TOF_SerialMicro



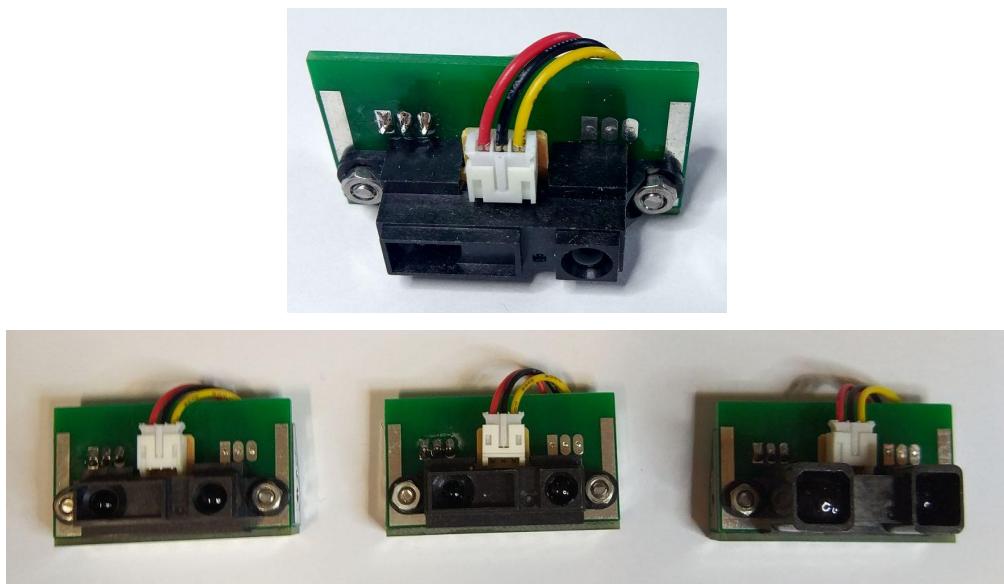
109_IR_Distance

This sensor needs to be connected to an analogue input line.

Yellow 0A41SK	40–300mm
White 2Y0A21	100–800mm
Blue 2Y0A02	200–1500mm
Purple 2Y0A710	1000–5500mm



It is possible to swap the larger sensor mount for this smaller sensor mount of the same type

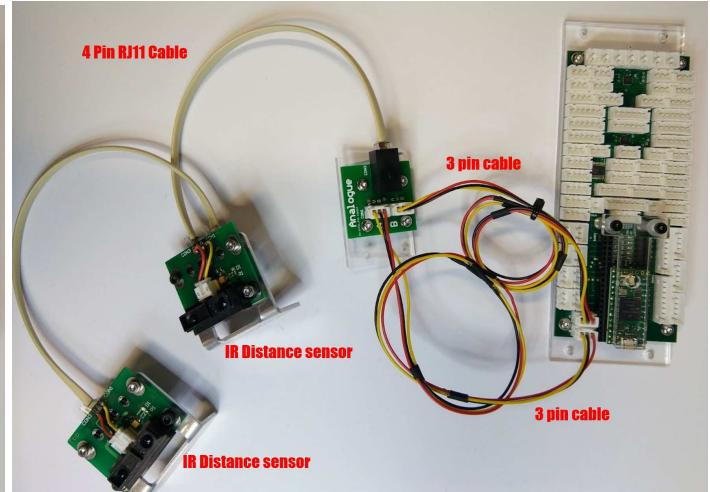
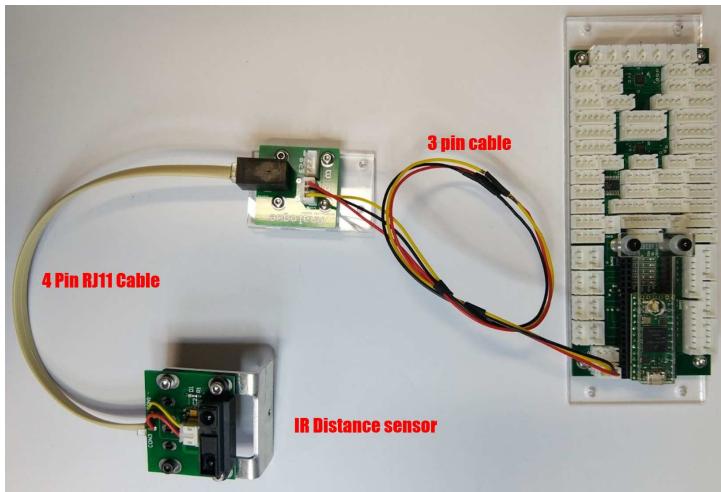


RJ11 Mount

The RJ11 cable fits into the connector labelled CON3.

With the sensor facing you this is the left hand connector.

Maximum of 2 sensors can be connected using the RJ11 cable.

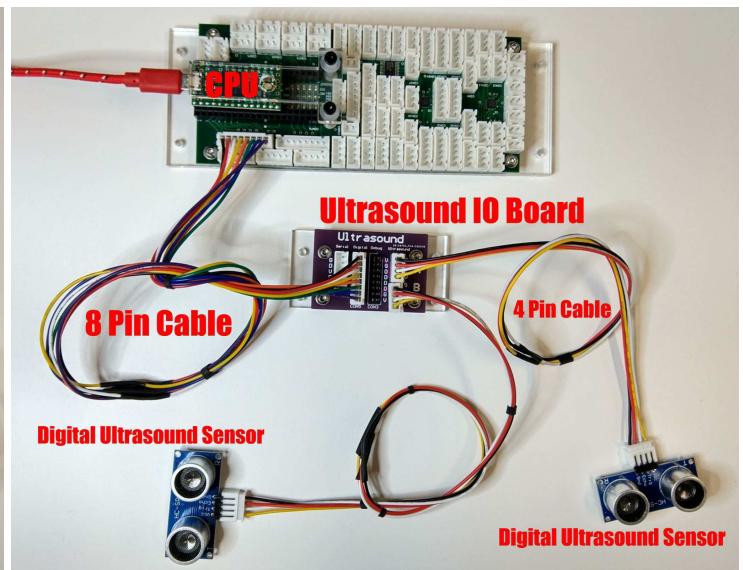
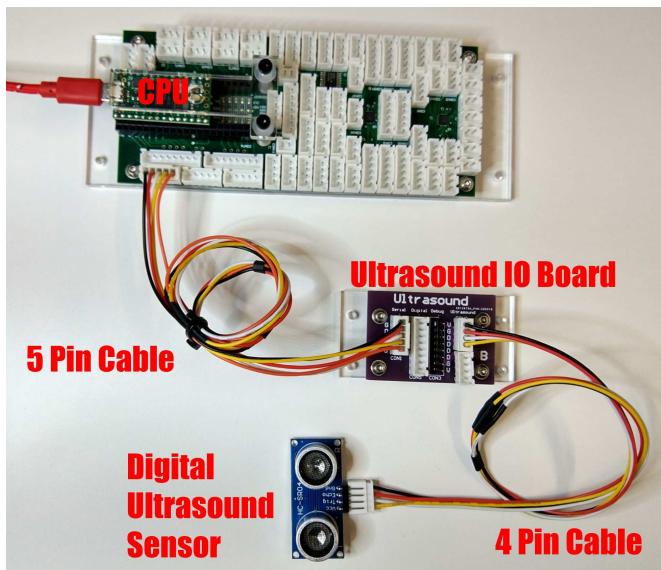


Small Mount

110_UltrasoundSmart

111_UltrasoundDigital

This sensor needs to be connected to any digital line.
 Allows easy connection of low cost Ultrasound sensors to CPU.
 Also used for connecting to load cell board.
HC-SR04

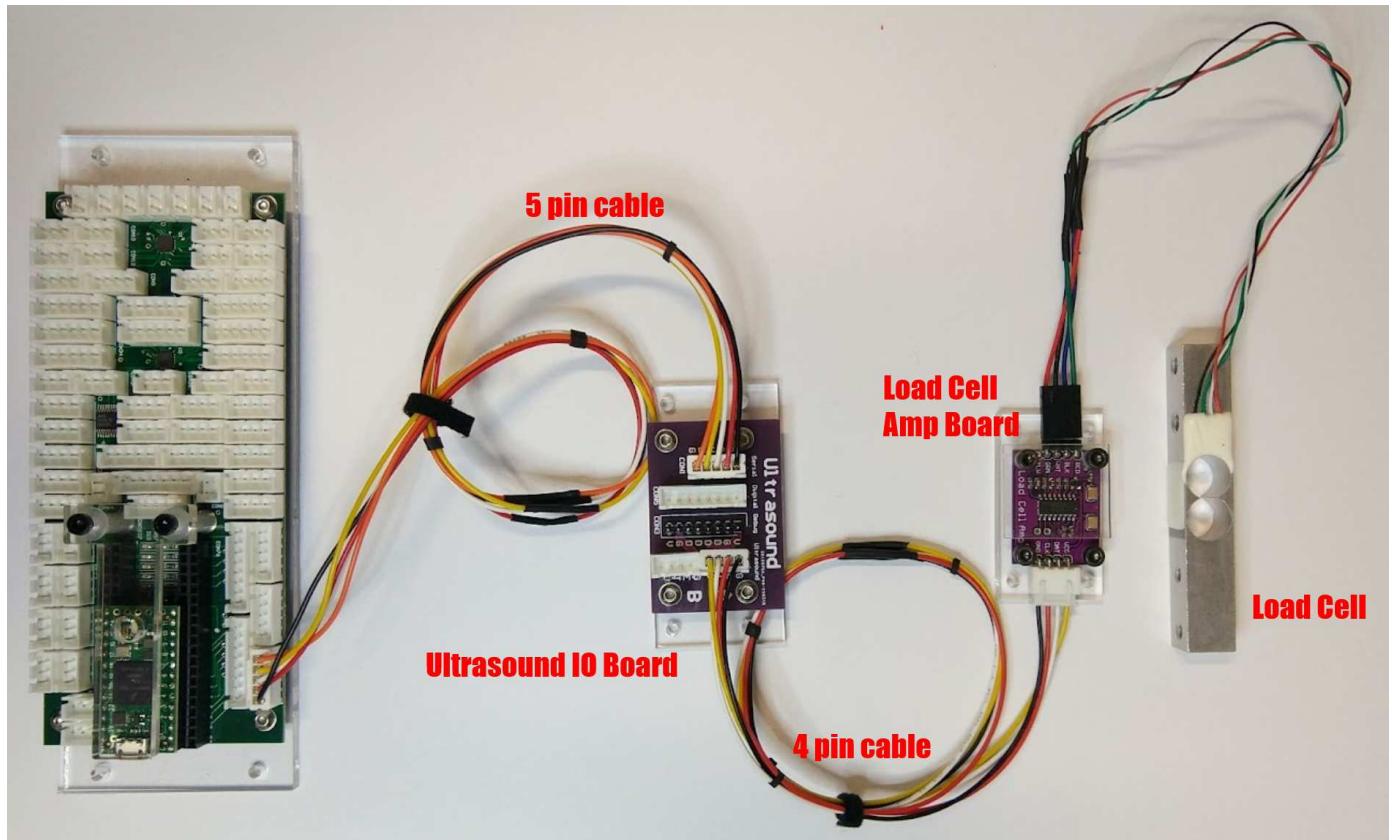


112_LoadCell

This sensor needs to be connected to any digital line.

Amplifier board used HX711

Load cells available 1 or 10kg



113_Encoder

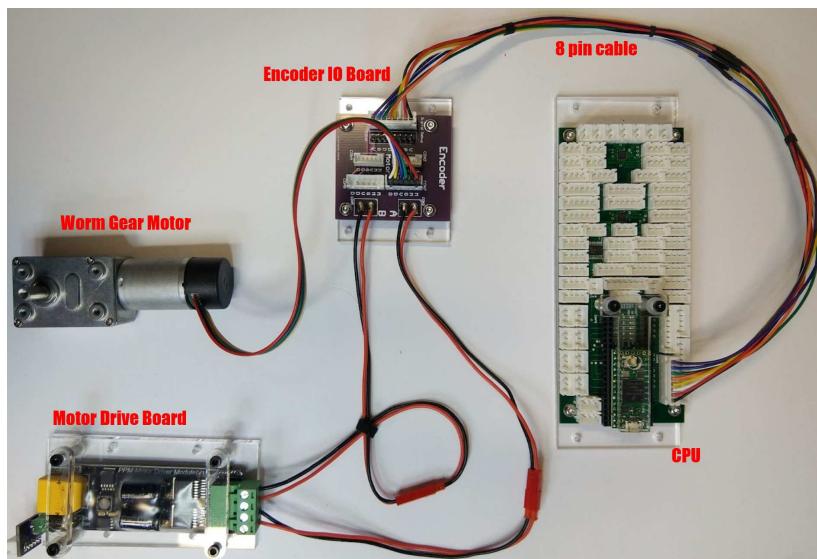
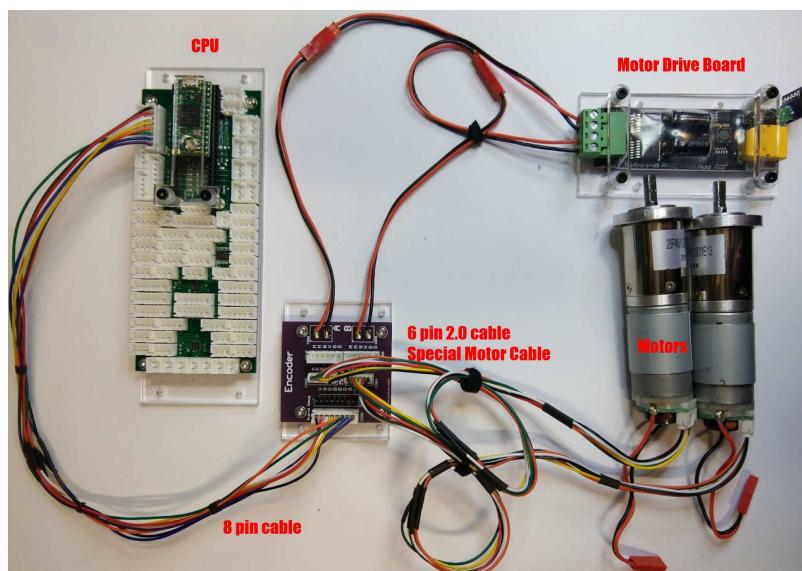
This sensor needs to be connected to any digital line.

The main drive DC motors contain a magnetic encoder.

It is possible to determine direction and distance the motor has travelled.

This IO board can be also used with the encoder on the worm gear motor.

Some of the motors have the encoder cable permanently attached, some use a separate cable.



114_IR_DistanceDigital

This sensor needs to be connected to any digital line.

The sensor is generally wired into the IO expander.

This sensor needs 5V to operate hence the need for the digital level shift board



115_LimitSwitch

This sensor needs to be connected to any digital line.

The sensor is generally wired into the IO expander.

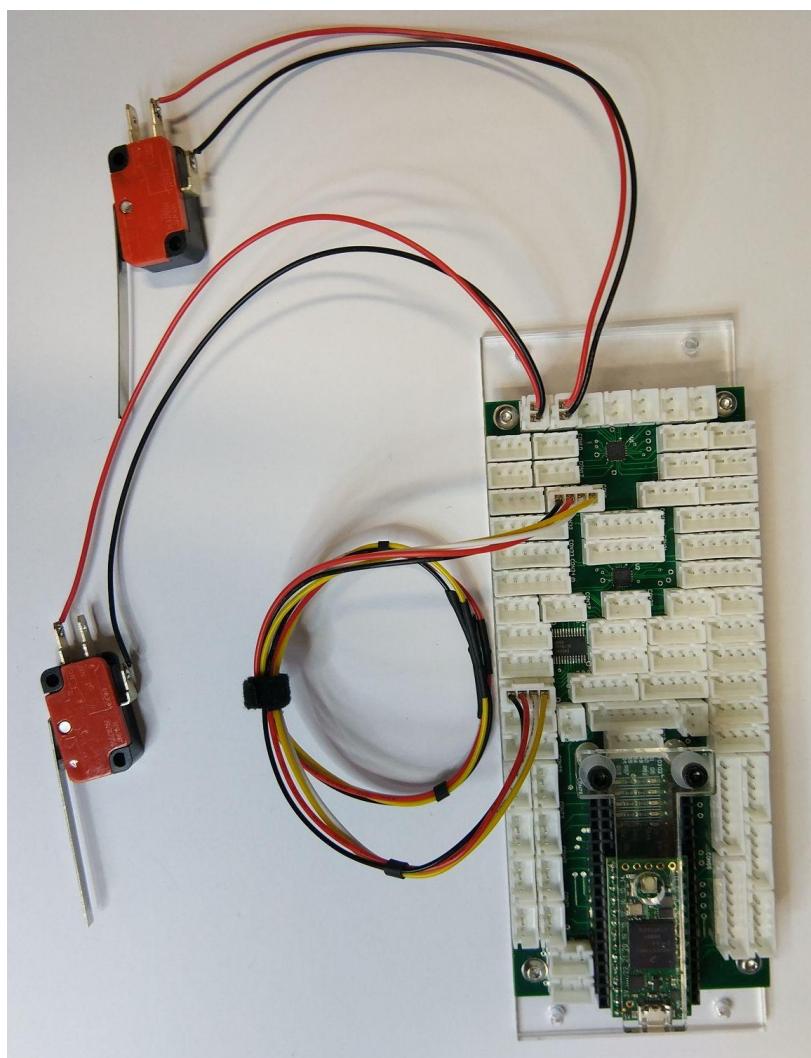
Internally there are pullup resistors on the digital lines.

Hence closing the switch will pull the digital line to GND.

To use this IO expander the chip needs to be wired to the CPU.

This is done with the 4pin cable connecting the IO expander to the CPU's I2C bus.

The address of this IO expander is



116_MagSensor

117_JoystickDigital

No cable is provided, you will have to make your own.

118_JoystickAnalogue

No cable is provided, you will have to make your own.

119_RFID

The robot playing area has NFC sensors embedded into the floor.



Indicators

301_Onboard LED

The CPU board has a set of LED's built into the board.

Jumper leads are required to connect these to a pin.

302_SmartLEDSingle

Special supplied cable is required.

This module requires 5V power.

303_SmartLEDStrip

Special supplied cable is required.

This module requires 5V power.

304_TrafficLightLED

Jumper leads or 3 pin socket are required to connect this module to a pin.

305_OLEDDisplay





Debugging

401_Bluetooth

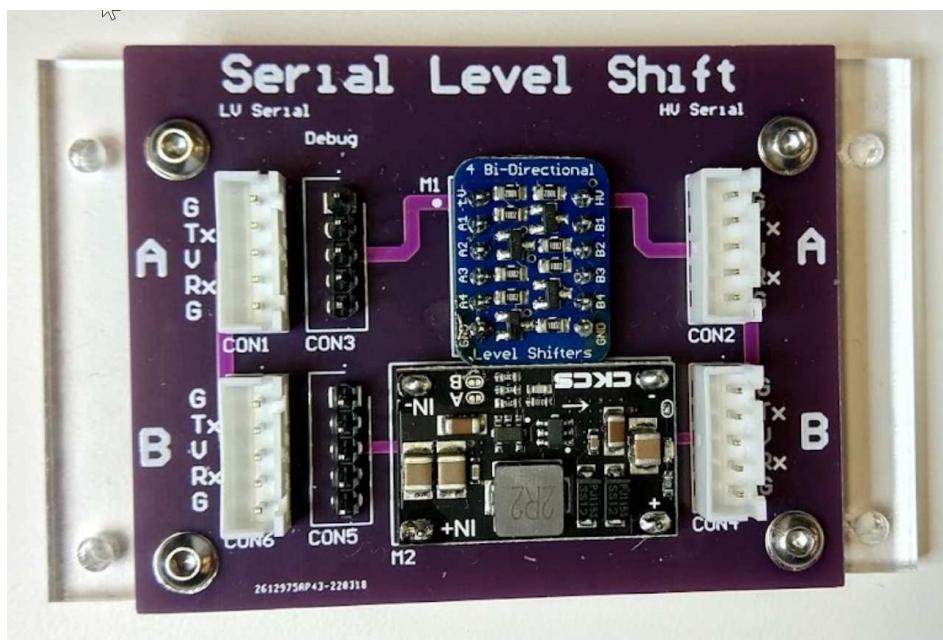
402_Wifi

403_SDCard



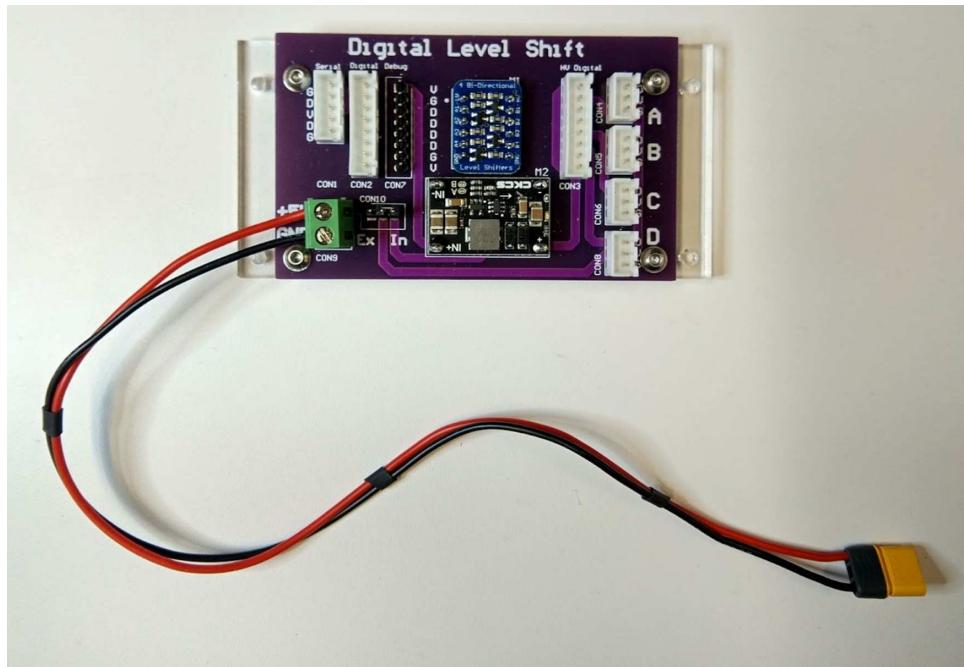
Serial Level Shift

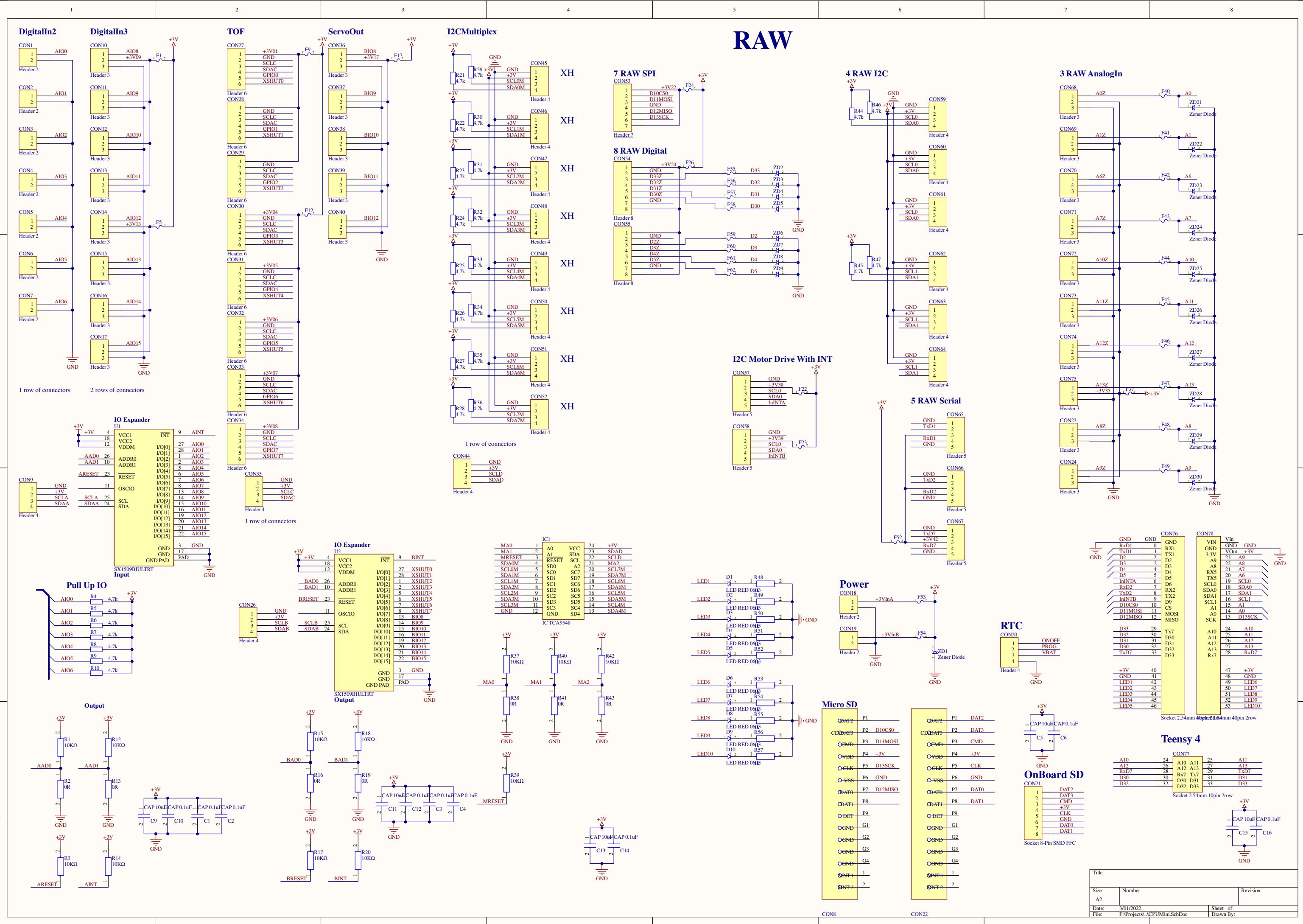
3v to 5v level shift.



Digital Level Shift

3v to 5v level shift, along with external power supply.





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