

Wiring Diagrams Index - SCUTTLE Robot

Making notes for (clear new) wiring diagrams by files and names

Author David Malawey

Date created 12/12/2025

NEEDS

tech next steps: complete the raspberry pi pinout diagram, convert pptx diagrams to drawio

overall: publish this collection of drawio drawings in an archive at scuttletechguide

file	describe	includes
SCTL_2025_wiring	WORKING FILE - NOT CENTRAL	
wiring_battery	battery, BMS, and adapter graphics,	
wiring_bot	robot overall wiring config	
wiring_cpu	cpu device diagrams (callout + pinout)	PI, TI
wiring_device	device examples, stepper motor, etc	stepper
wiring_motor	motor power diagram, motor driver pin diagram	
wiring_sensor	device diagram for accelerometer, addon sensor	
wiring_signals	signals for i2c and pwm - routing, pinout, cables diagrams	
wiring_standards	copies of important graphics	

Terminology

Terms are still being adjusted to some degree as of 2025.12

term	I want to
wiring diagram	see routing, function, pinout, or cables
routing diagram	see cable routing, see devices in relation to wiring
functional diagram	which devices are hooked up? a wiring diagram without wires
cable diagram	how is cable made or configured?
pinout diagram	which pins will connect?
device diagram	have graphics of the device & locations of terminals onboard

Extras

Notes extracted from inside diagram files

Get icons etc. icon-icons.com

Scheme-it digikey.com/schemedit/

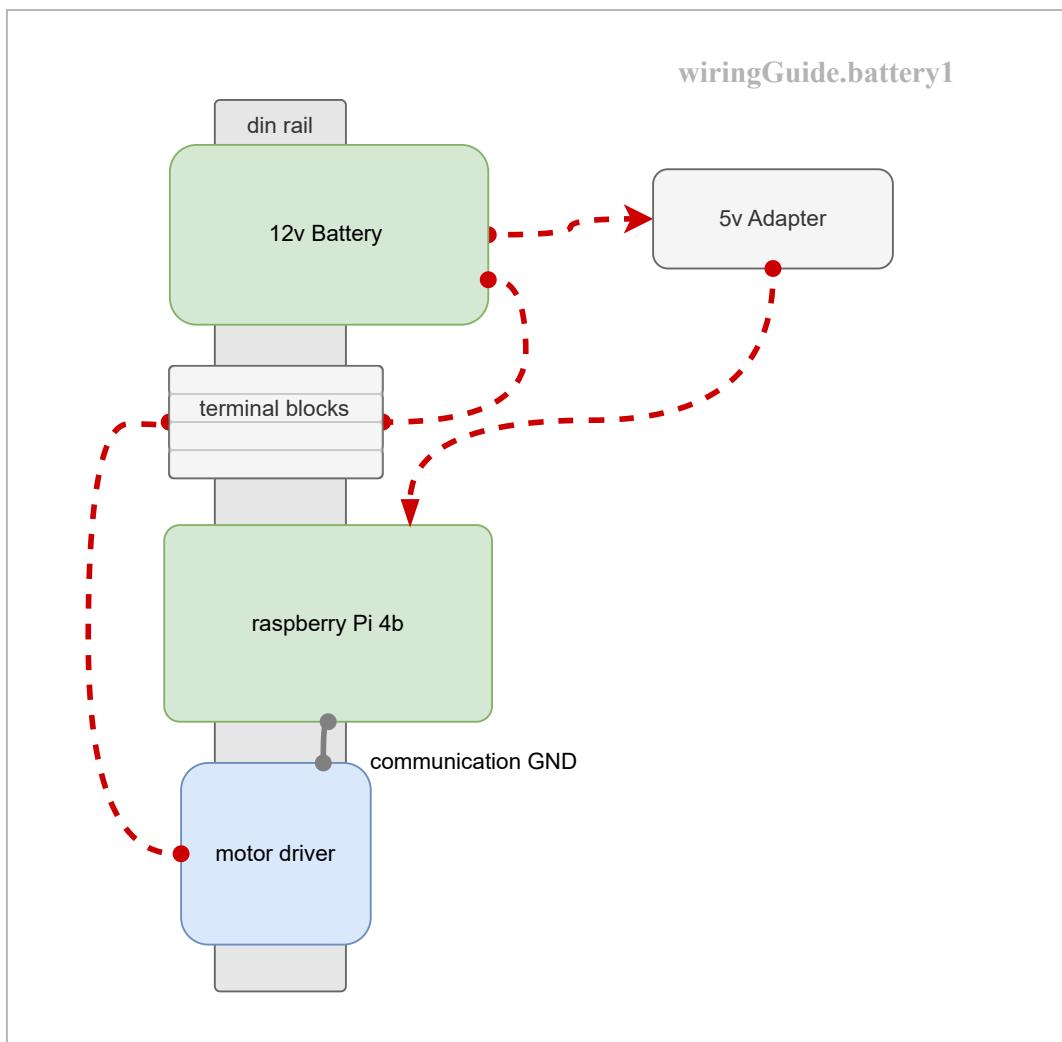
Requirements

For engineers reviewing diagram documents

square A/R	Each diagram has box w/square aspect ratio
label	label in gray text with file.category.itemno - this gives differentiation between exported images, allows overwriting for updates of image
photo box	each diagram goes in a box with square aspect ratio. ultimately it becomes exported to image, 2048x2048 for documentation
grouping box	the diagrams with two "areas" go inside a subtle graphic. That makes for easy selection & move of graphics
scale	do not deviate far from 11pt fonts shown - start graphics with the photo box to match scaling of items

Routing Diagram

Power routing from battery to onboard devices. (for paired 18awg wires)

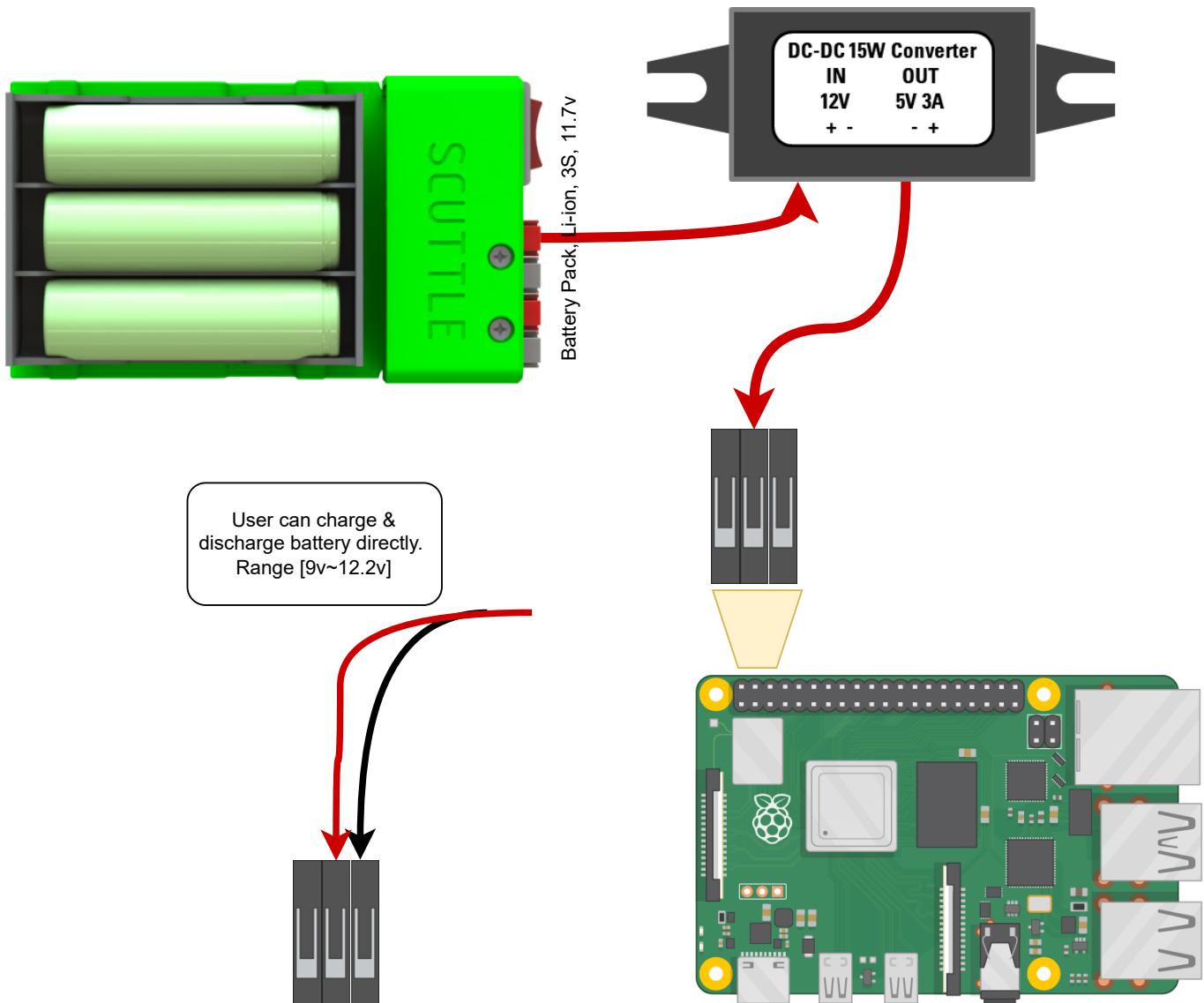


Routing Diagram

Battery connection to the 5v adapter and raspberry pi

wiringGuide.battery2

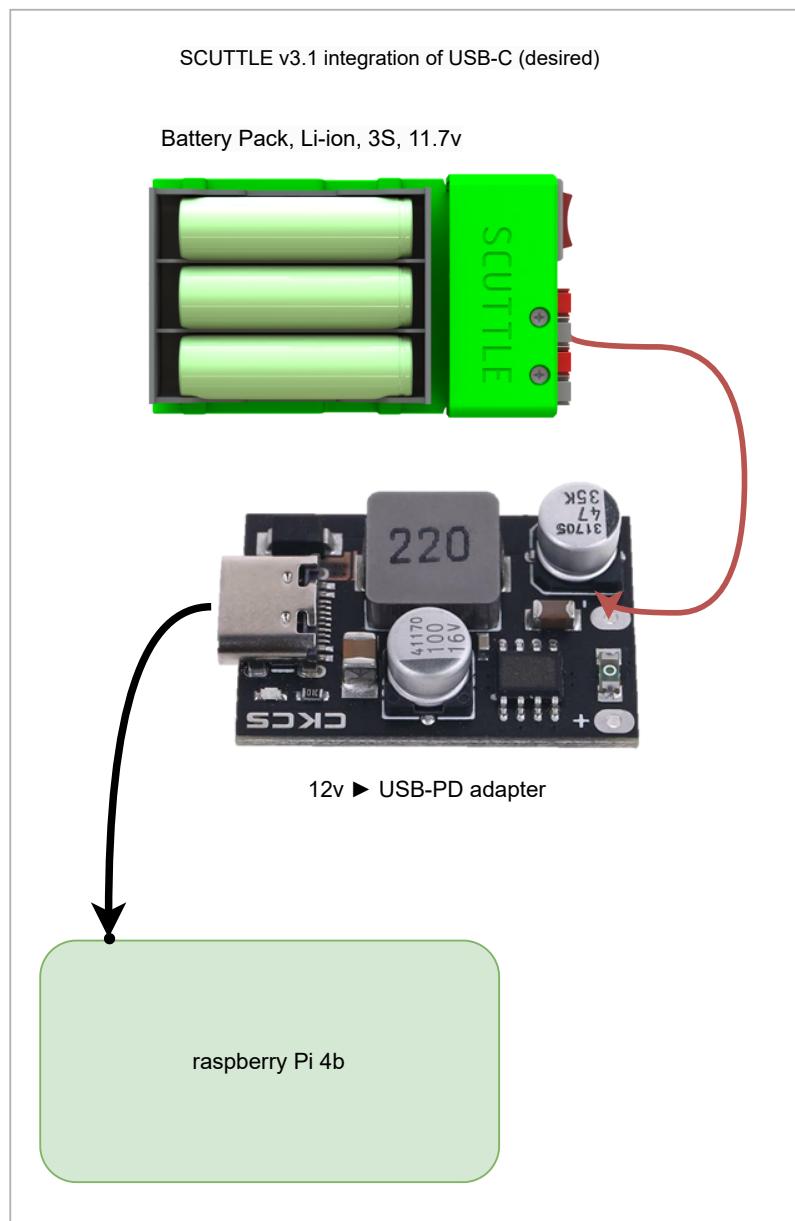
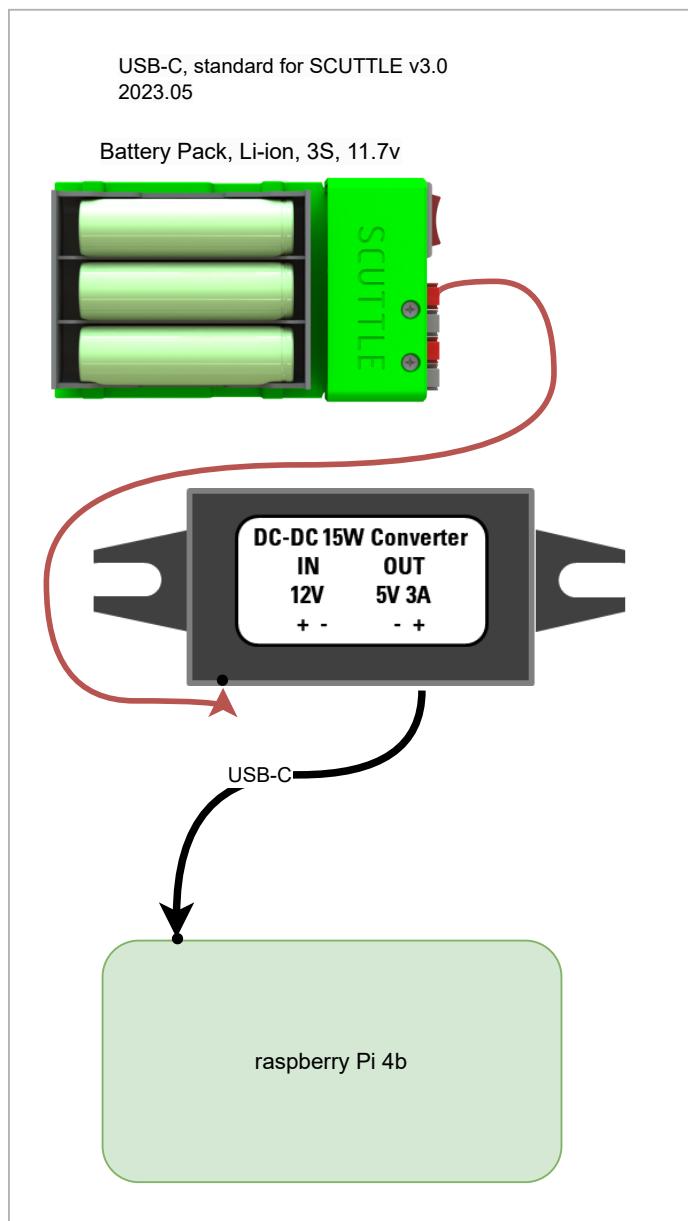
doc v2023.05.17



Raspberry Pi 4B

Routing Diagram

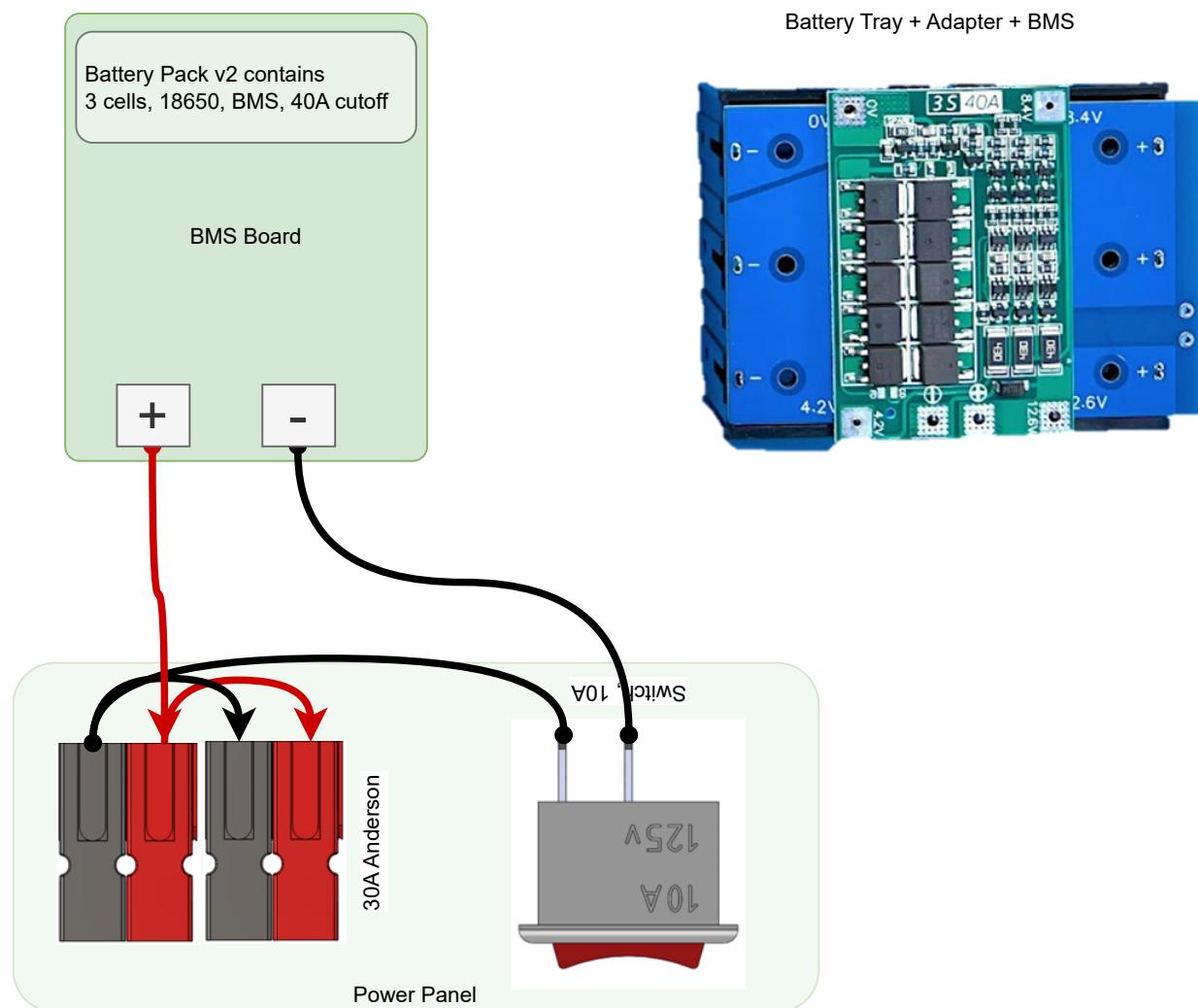
Battery connection to the 5v adapter with alternatives. USB-C adapter with female outlet, or with male cable and outlet.



Hookup Diagram

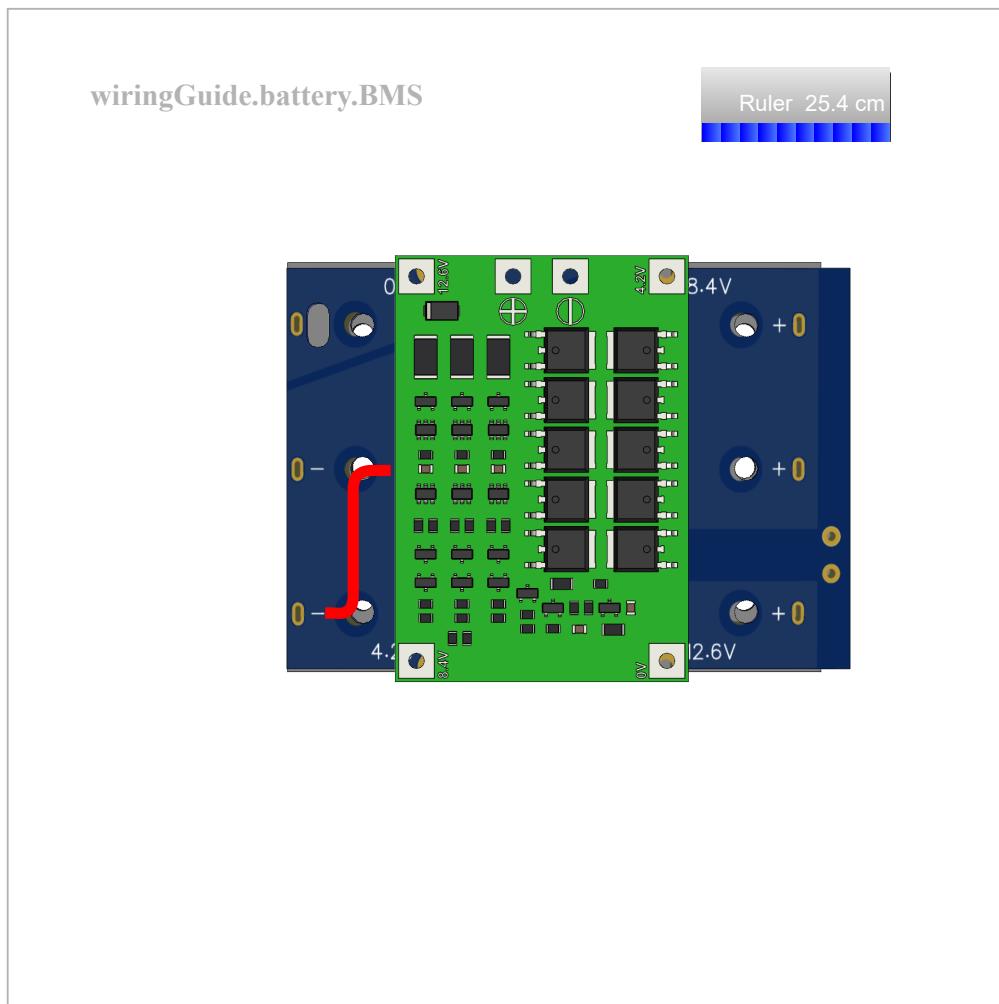
This diagram is only a collection of icons for working. Information displayed diagrammatically for elements in the battery pack which are impacted by changed power configuration.

wiringGuide.battery3



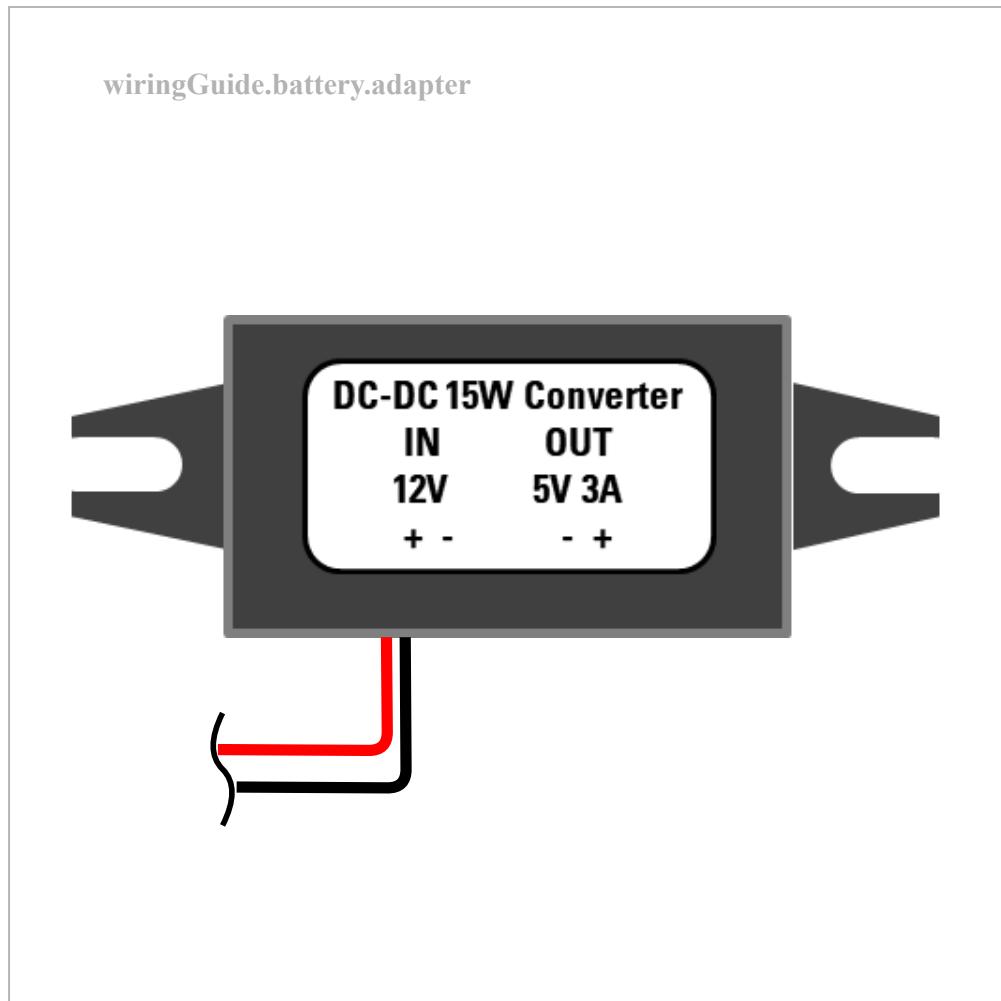
Graphics Diagram

This diagram places the necessary graphics together for further work - the BMS features a special "adapter" board in place of individual wires, between BMS and adapter.

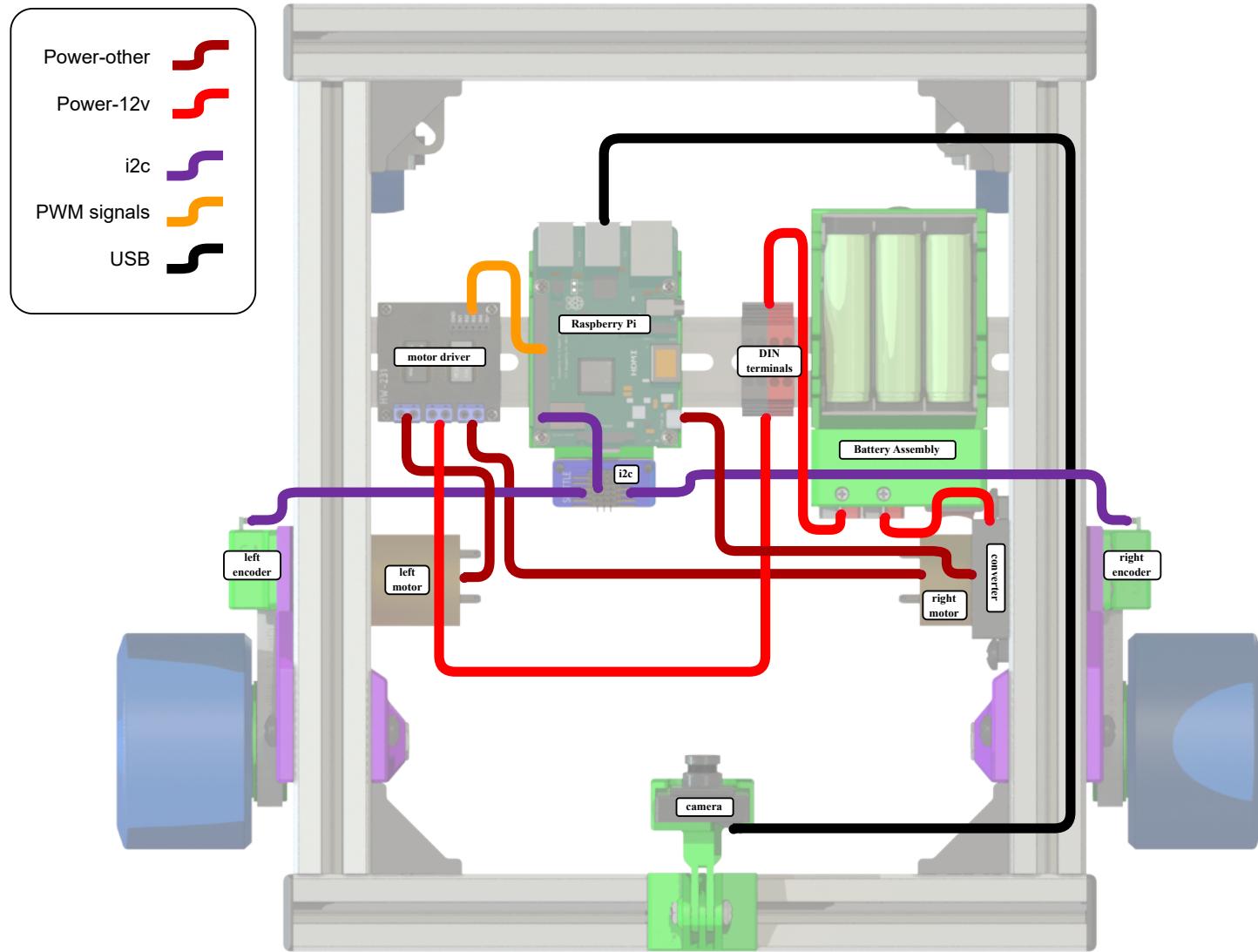


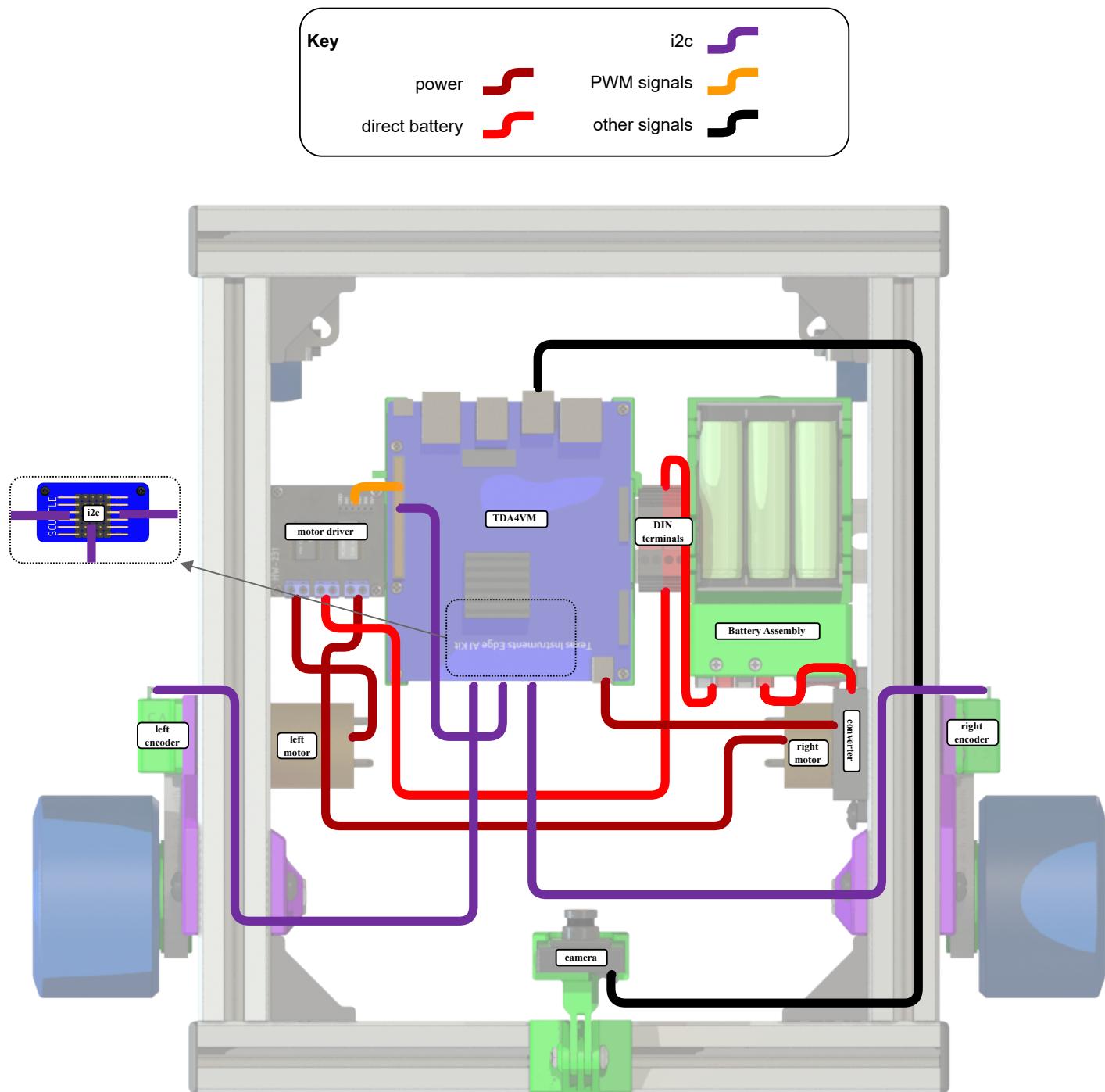
Graphics Diagram

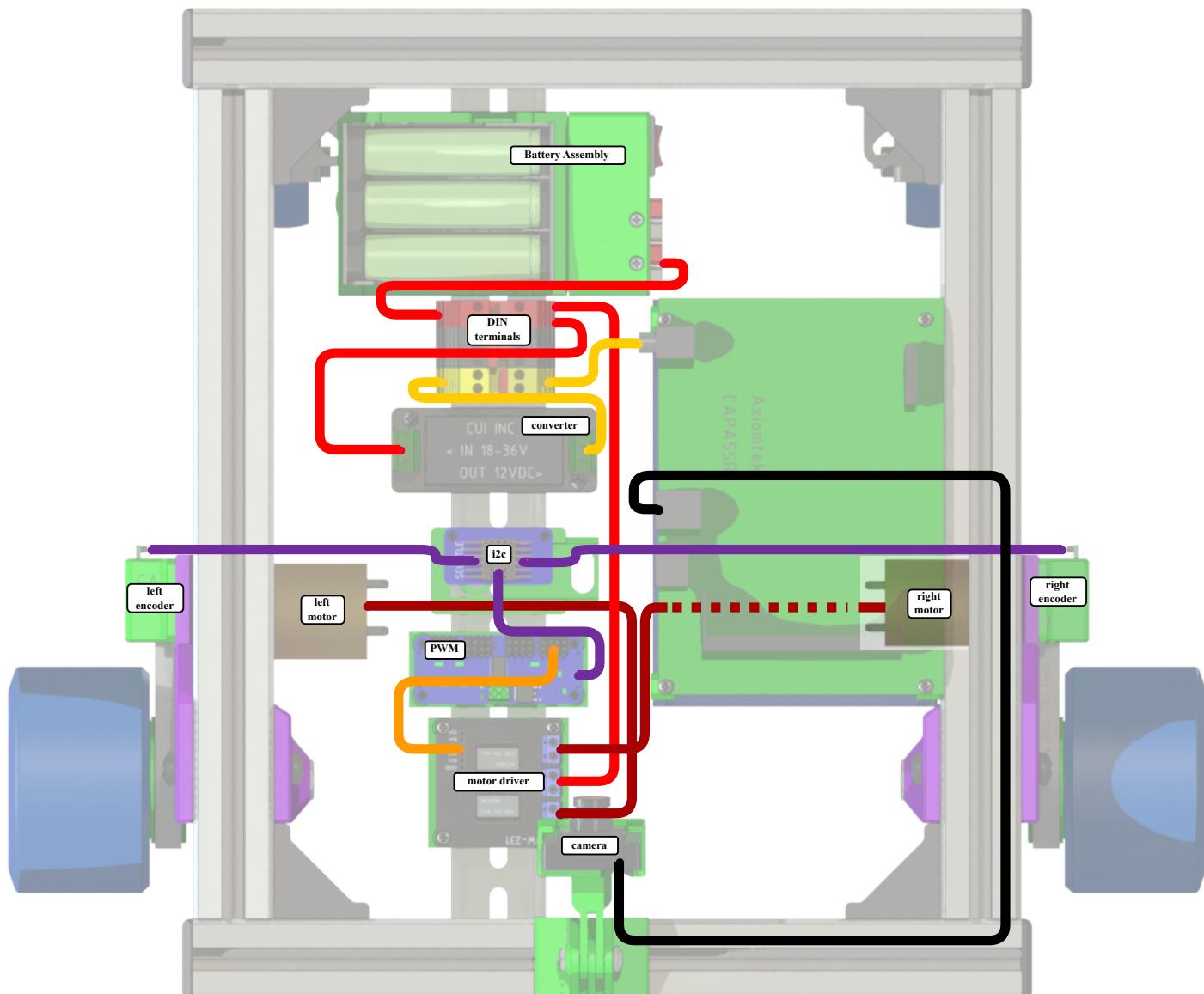
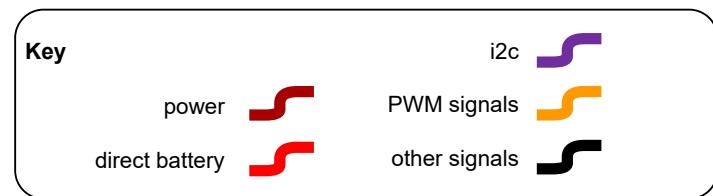
This diagram offers graphics detail for the 15w 5v adapter. Adjust this drawing as needed to display a different power adapter option.



Robot Wiring diagrams for whole robot assembly.



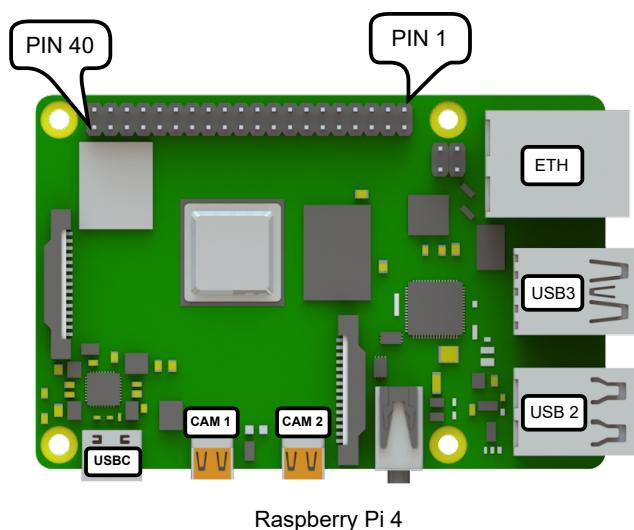




Callout Diagram

Indicating the relevant connection ports on the CPU or other device.

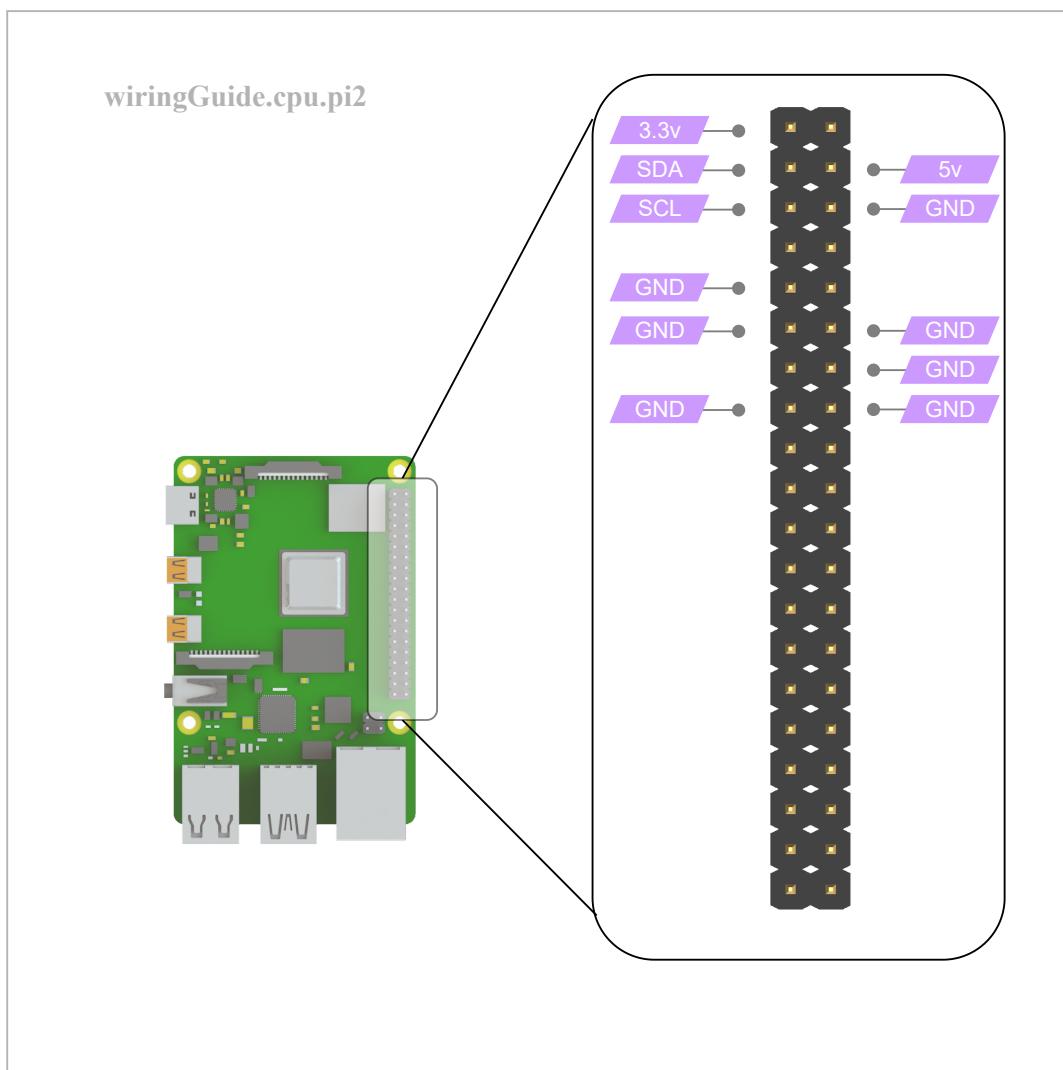
wiringGuide.cpu.pi1



Raspberry Pi 4

Pin Diagram

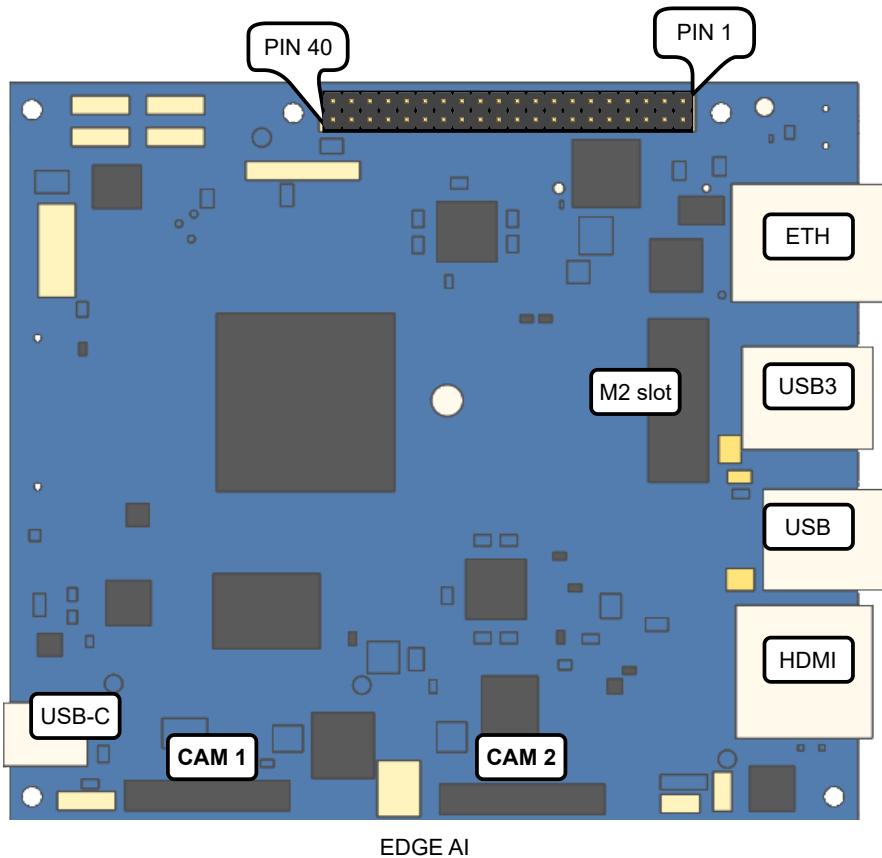
Indicating the relevant connection pins and locations for raspberry pi. Remember the board orientation is necessary for relating this diagram. Pins 1 and 40 may also be noted on the diagram.



Callout Diagram

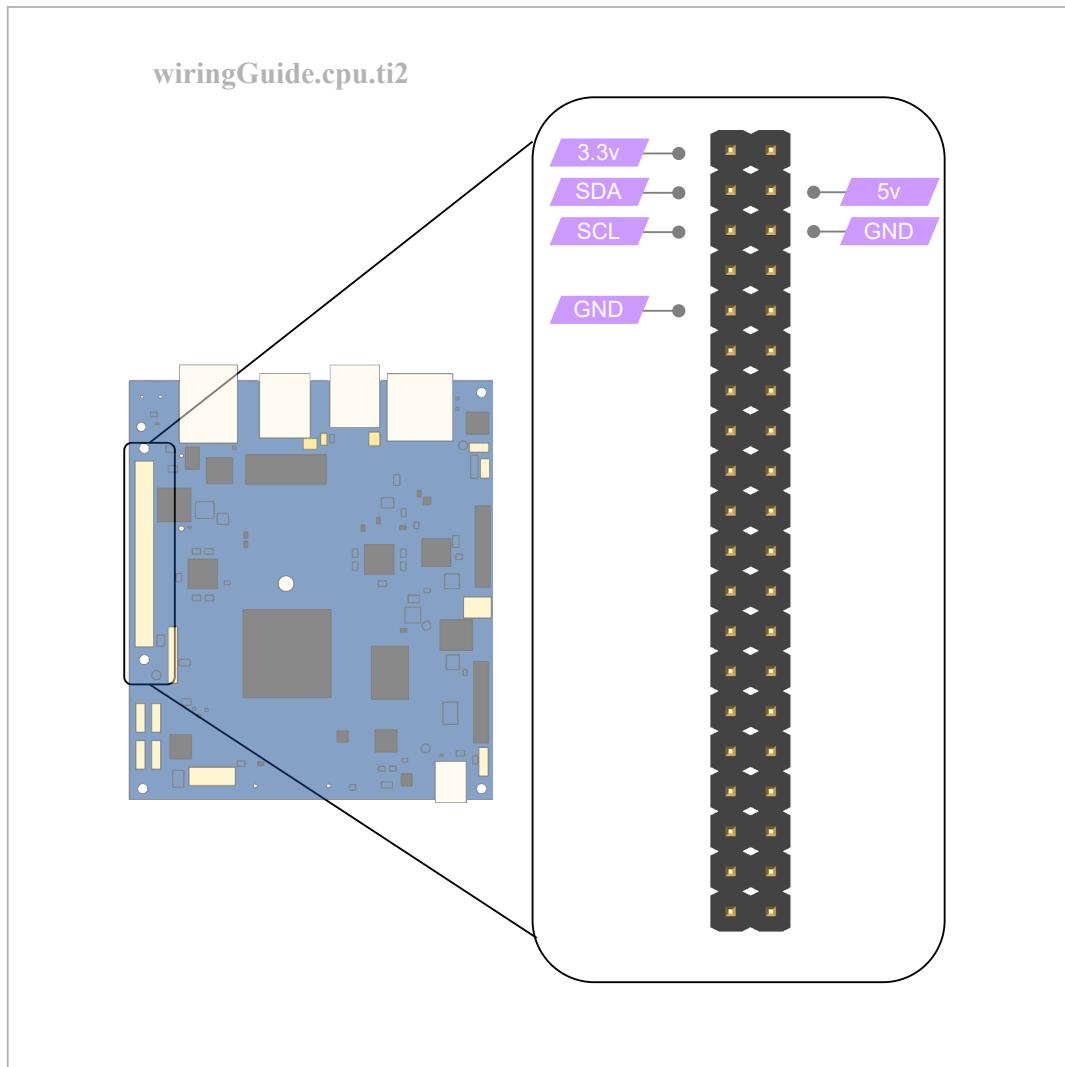
Indicating the relevant connection ports on the CPU or other device.

wiringGuide.cpu.til



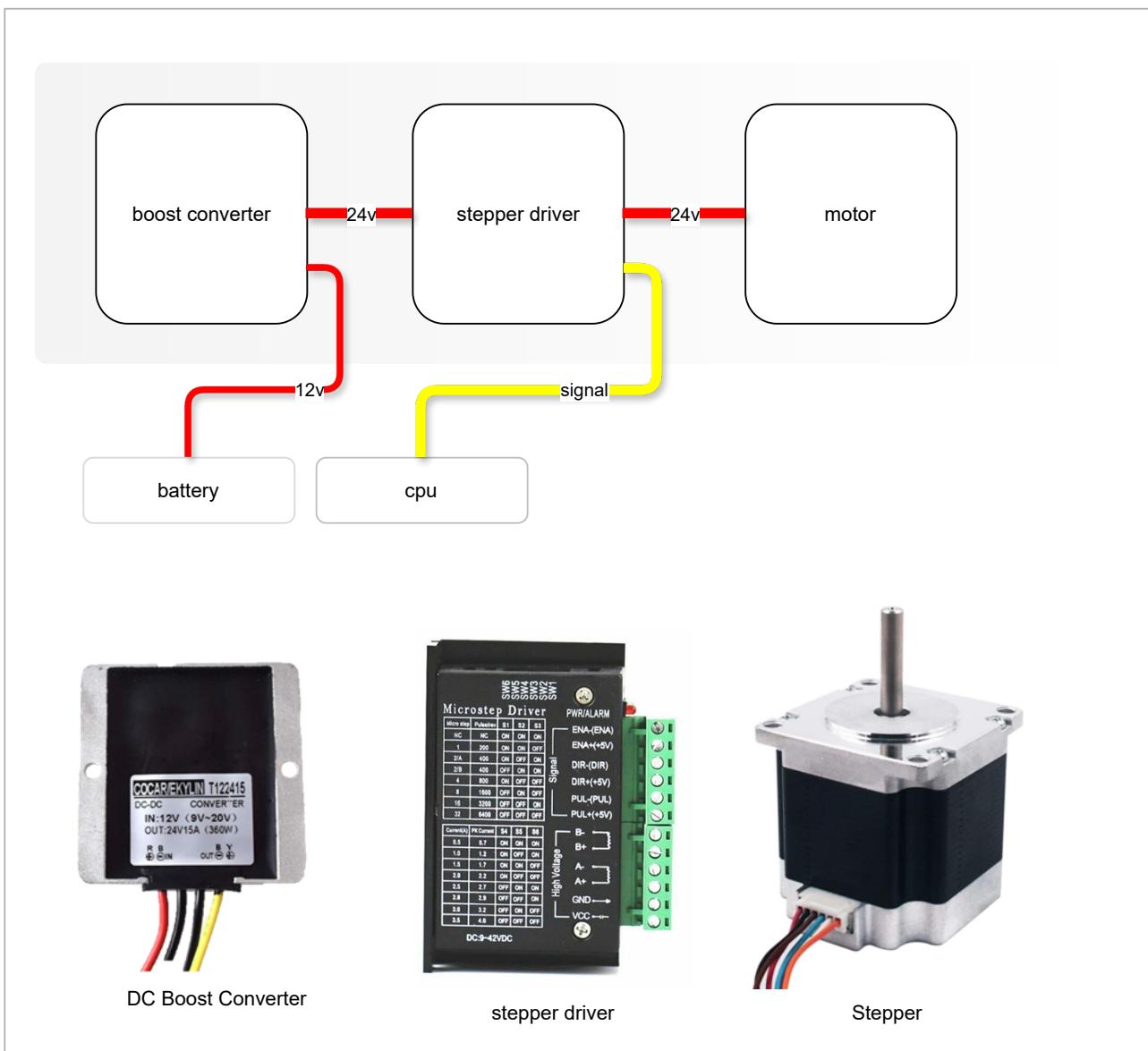
Pin Diagram

Indicating the relevant pins for connections of the 40-pin header ai to the SCUTTLE devices. This diagram should include preferred PWM pins, preferred i2c pins, etc.



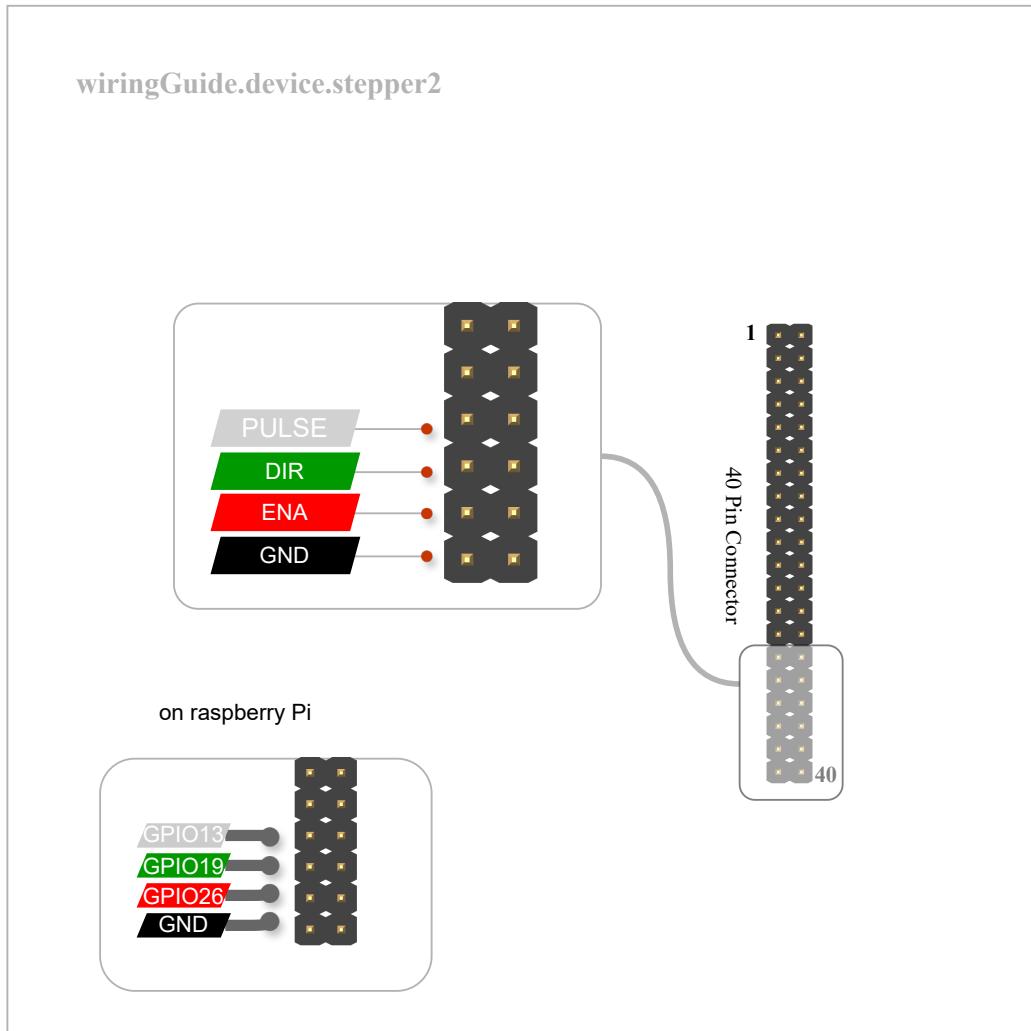
Device Diagram

The required devices to add a stepper motor to the SCUTTLE robot basic configuration. Includes a voltage adapter, a stepper driver, and a stepper motor. The stepper motor, a common actuator for addon, requires the following devices added to the robot.



Pinout Diagram

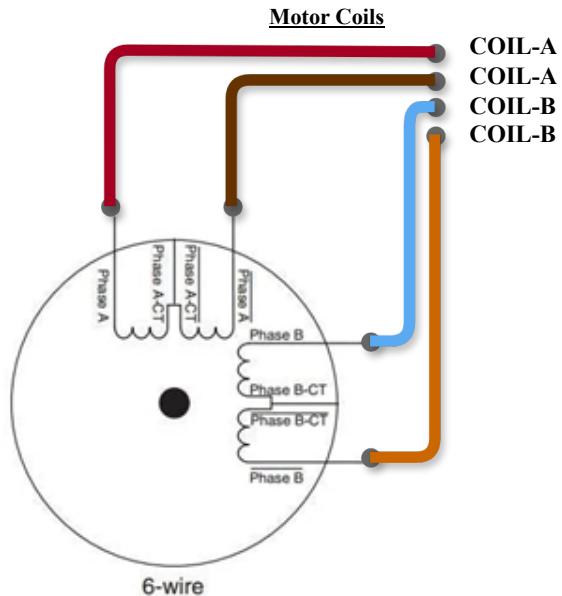
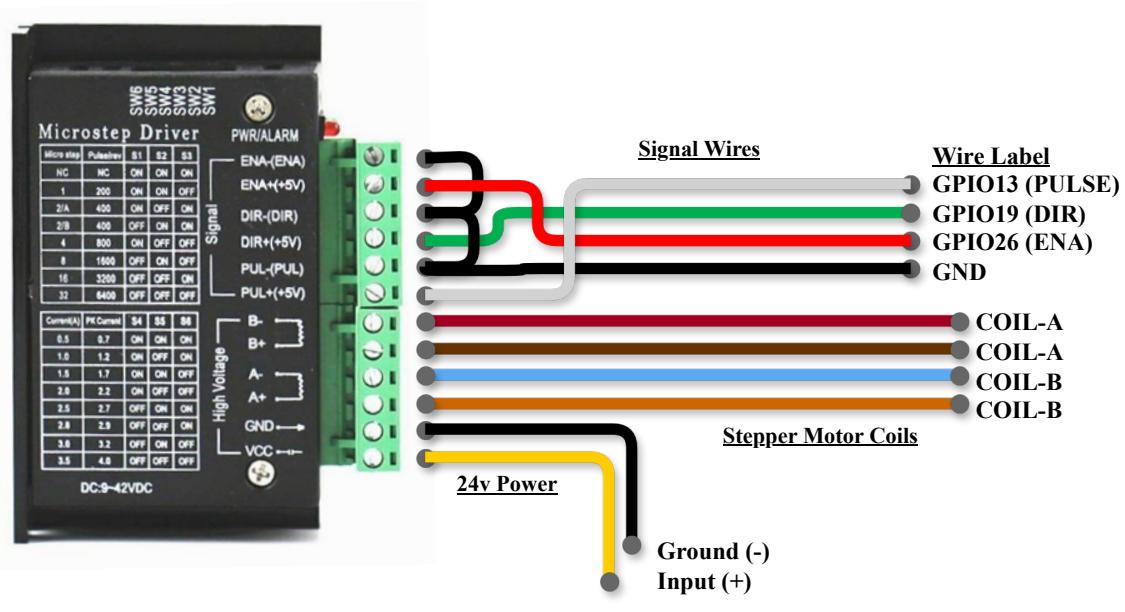
Where does the stepper motor connect to raspberry pi for healthy pin designation? The pinout below indicates the data collected for a working connection to the pi.



Pinout Diagram

See the designated pins found on a common stepper motor driver, verified by SCUTTLE team. Adjust this diagram to plan your project wiring for a stepper motor.

wiringGuide.device.stepper3



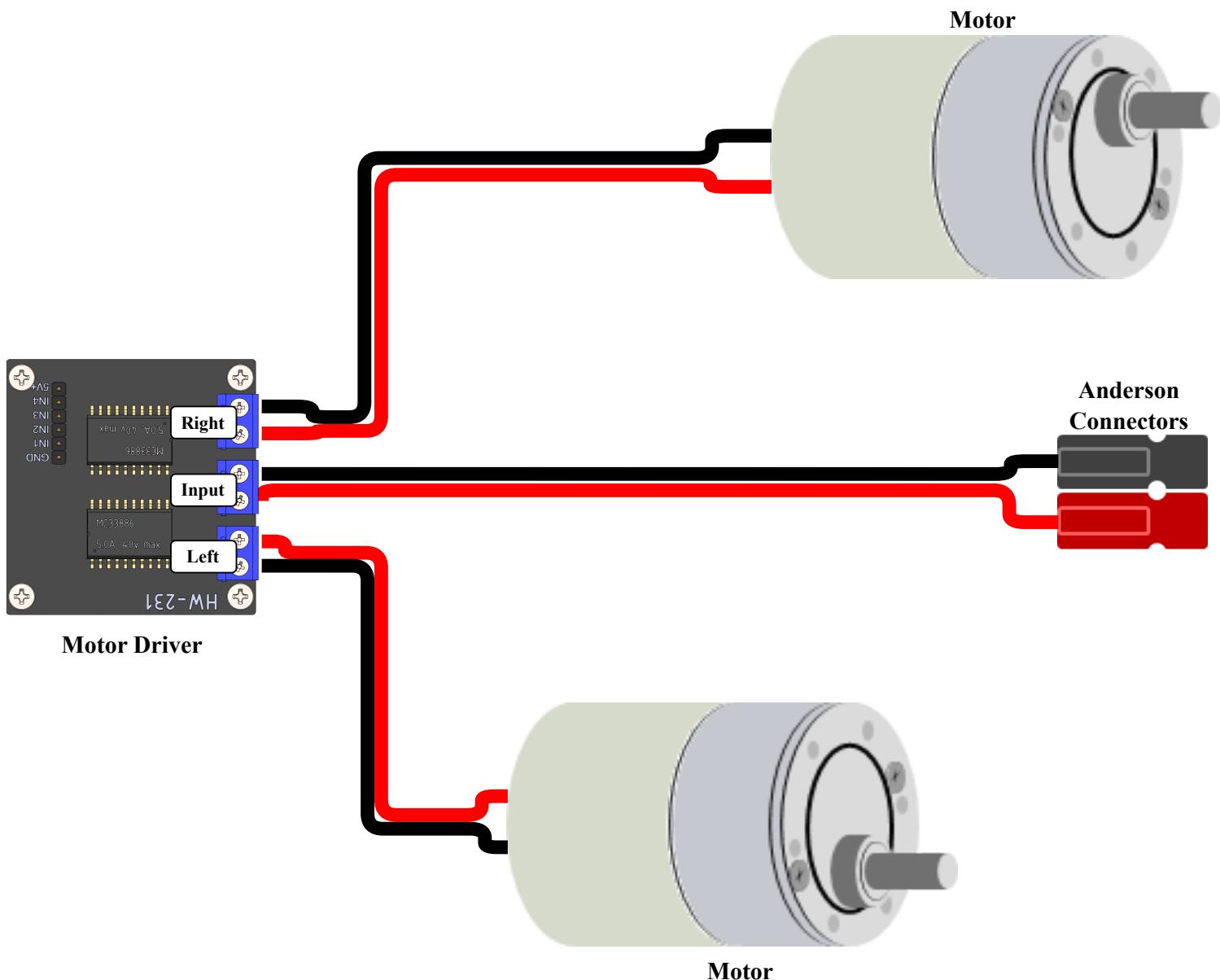
NEMA 23 Stepper Motor

Power Diagram

Some template key points to copy:

- power wires colored red & black to inform real colors
- font size large enough to read while zoomed out to full diagram
- boards feature connection-nodes (invisible) for accurate attachment of wires.
- scale: aiming for relative scale of motor, board, and wires.
- diagram is designed to express wiring hookup method, no details for connector types at each node.
- text input here in diagram becomes searchable keywords in PDF format.

wiringGuide.motor.power

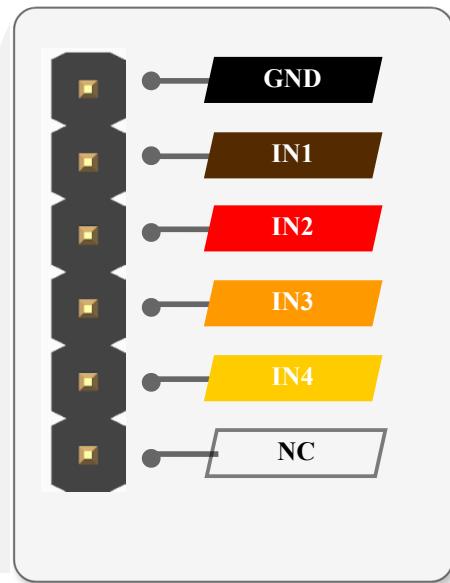
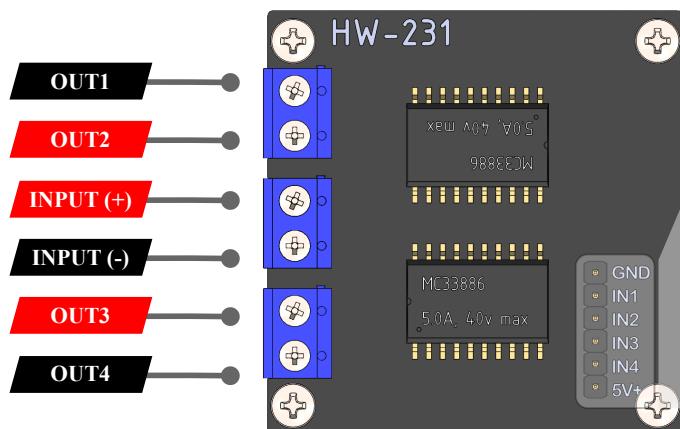


PIN Diagram

Some template key points to copy:

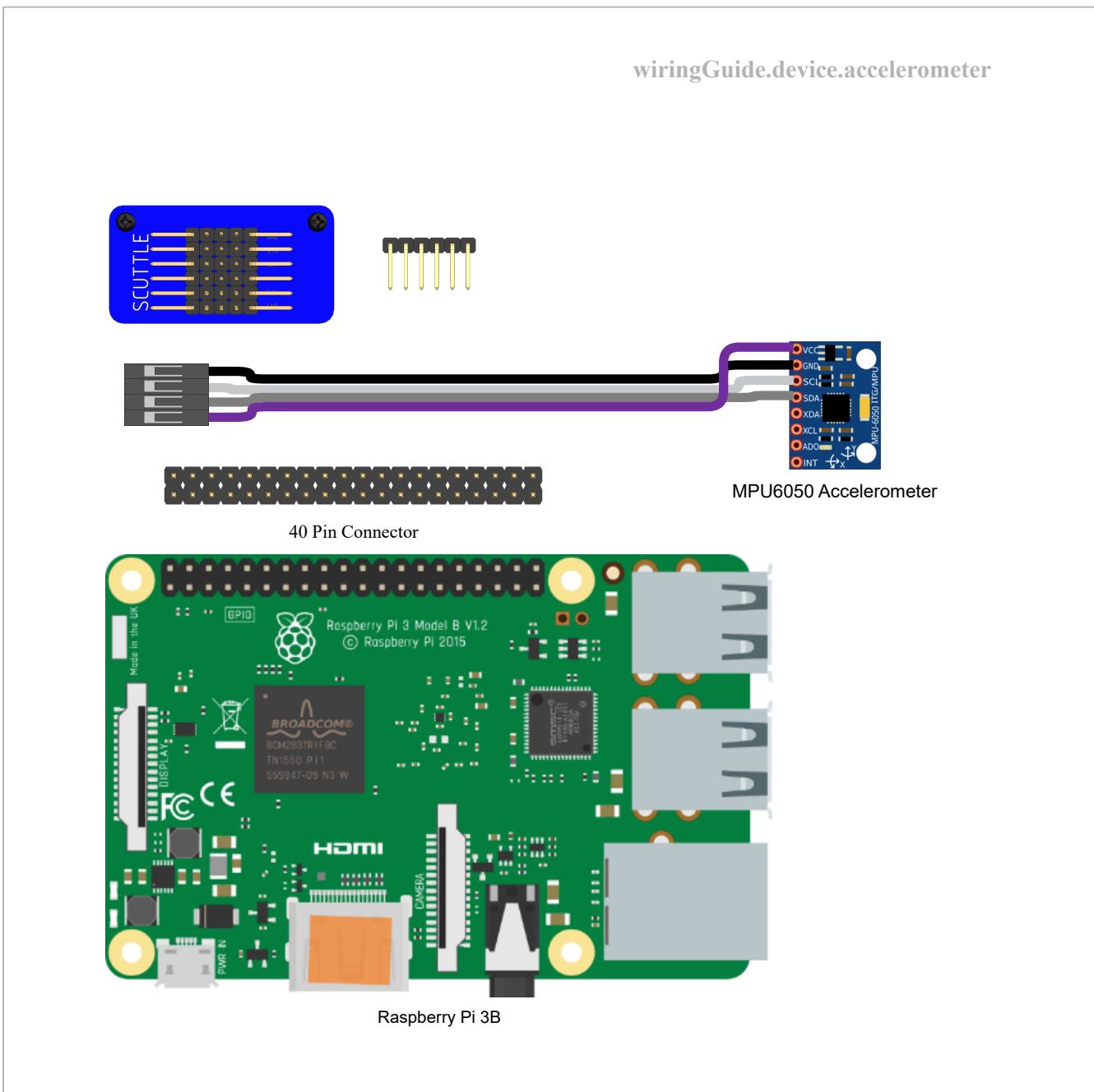
- graphic is designed to show inputs and outputs of a board.
- good method to blow-up features
- image of board has enough detail to identify board and orientation - no more
- power inputs have red & black color scheme, data inputs have wire color scheme
- row of dupont pins can copy-paste for the next diagram; can adjust quantity of pins
- board is oriented for pins to stack vertically on diagram - easier text adjustment

wiringGuide.motor.signals



Device Diagram

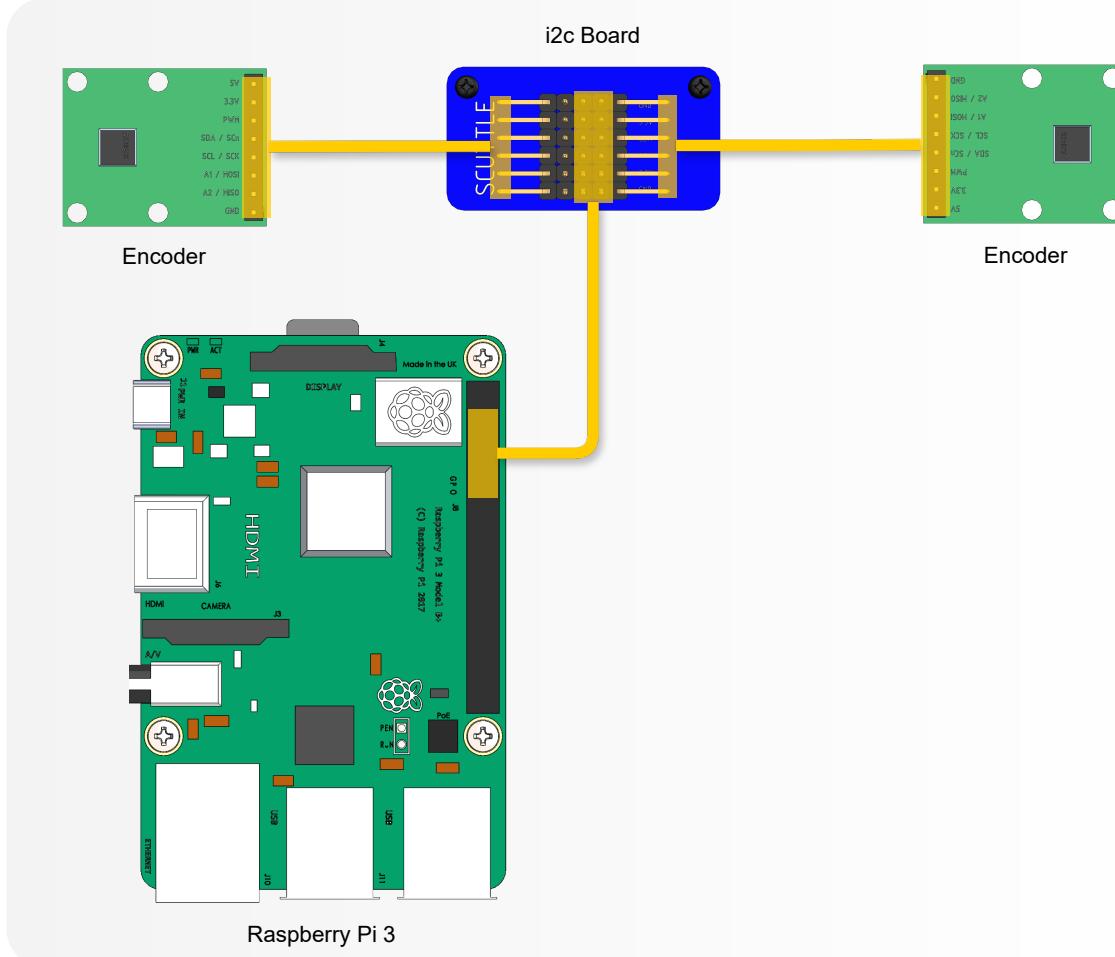
A diagram intended to generate graphics for an addon device. Sensors to be added will need information including pinout, cable diagram, routing diagram. With this template we can copy and generate new wiring diagrams for projects.



Routing Diagram - i2c

A diagram for the routing between devices. The i2c distribution board routes to the encoder via the designated cable. This diagram shows only the connection overall, not each pin.

wiringGuide.signals.routing1

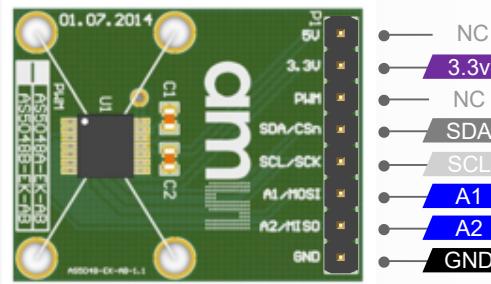


Pinout Diagram

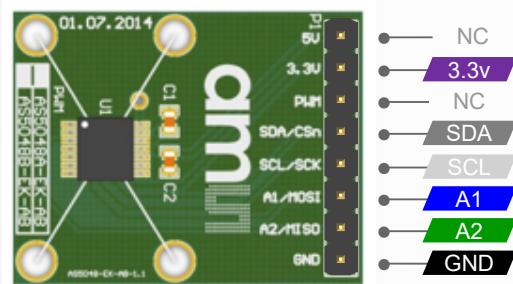
These are the wiring drawings for plain cables, selected from a common ribbon cable and designed to support SCUTTLE I2C signals for each encoder. The

wiringGuide.pinout.encoder

LEFT
HAND

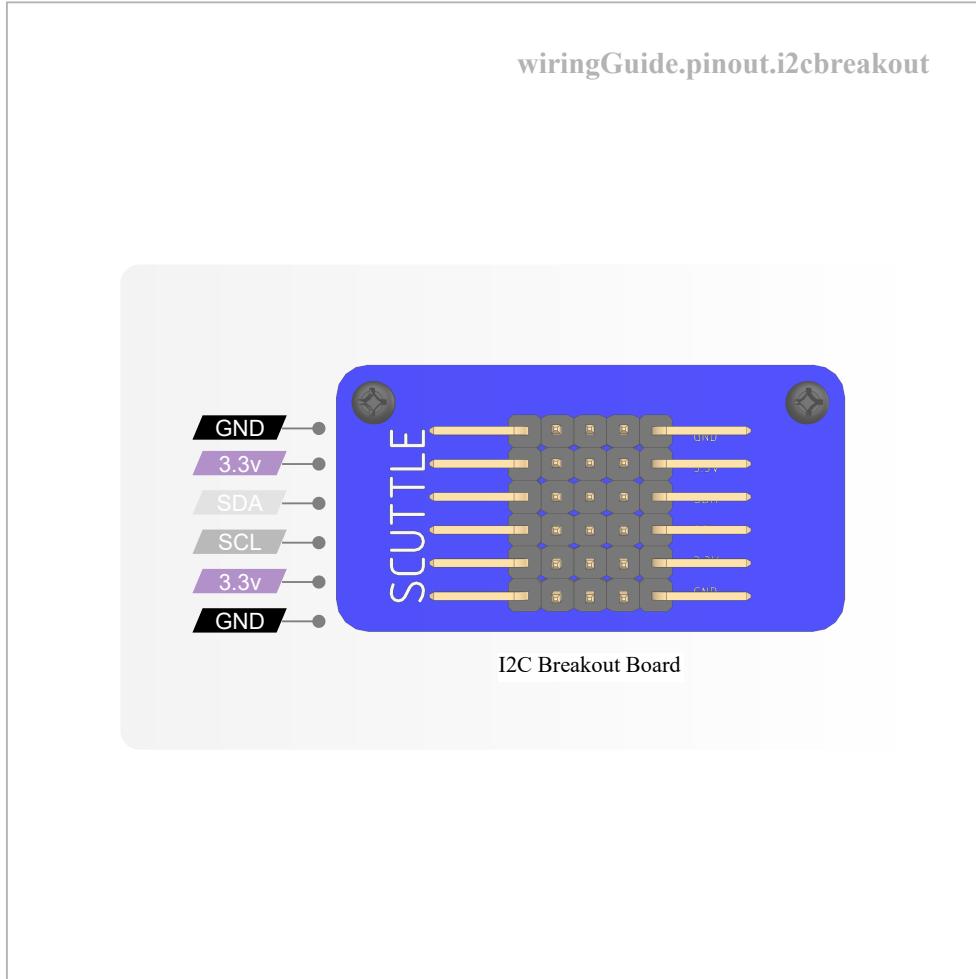


RIGHT
HAND



Pinout diagram

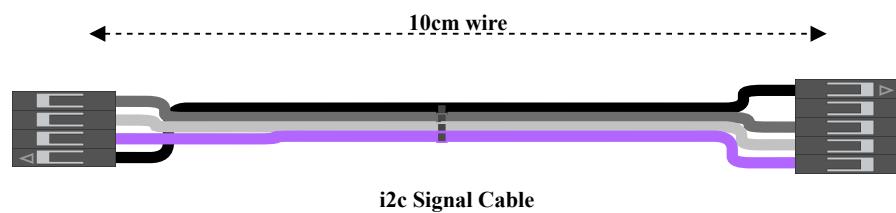
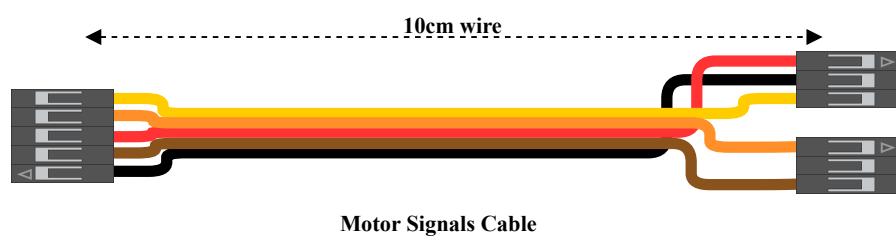
Indicating the pin designations for the pins of the i2c bus board. This board is made of simple traces to give access to the i2c signals, made of 4 total wires. Ground and 3.3v are duplicated to facilitate reversed wire connections in physical orientation.



Signals Diagram

These are the wiring drawings for plain cables, selected from a common ribbon cable and designed to support SCUTTLE PWM signals for the motor and i2c signals for the encoders.

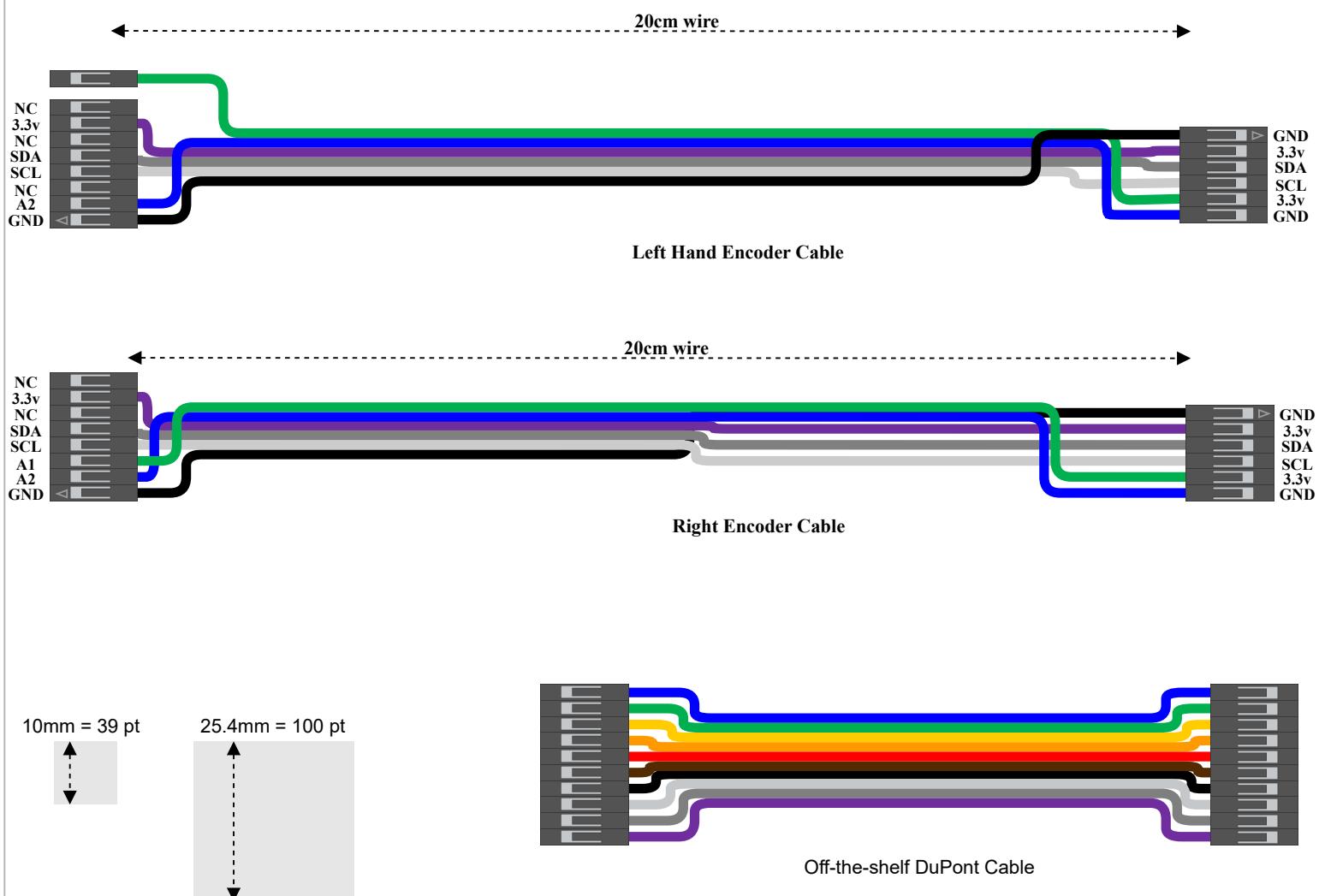
wiringGuide.signals.cables1



Signals Diagram

These are the wiring drawings for plain cables, selected from a common ribbon cable and designed to support SCUTTLE I2C signals for each encoder. The

wiringGuide.cables2



Cable Diagram

Copy these signal wires to build your own diagram as needed. These are the wiring drawings for plain cables, selected from a common ribbon cable and designed to support SCUTTLE I2C signals for each encoder.

wiringGuide.signals.cables3



i2c cable

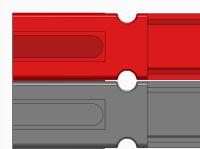
Standards for Diagrams - SCUTTLE Robotics

Wiring Standards

This file is intended to inform about good practices on wiring diagrams,
Provide graphics to copy/paste into new diagrams,
Become iterated as the best practices become clearer.

It was extracted from the wiring guide .drawio file called "SCTL_2025_wiring.drawio" to simplify the wiring document & reduce pages there. - 2025.10.10 David M

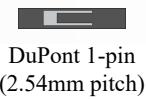
Connectors



Dupont 4-pin L



Dupont 4-pin R



DuPont 1-pin
(2.54mm pitch)



Ferrule



JST-ZH 4-PIN
(1.5mm pitch)

Labels Standards

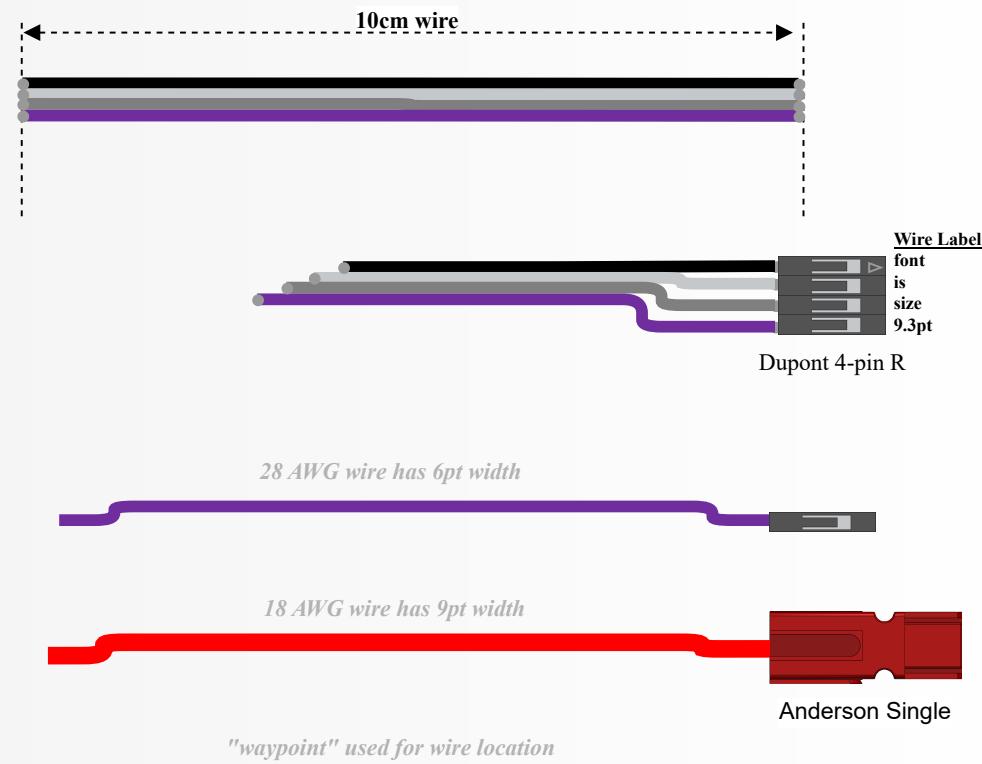
Labels have a rounded box

Font: Roboto Serif

▶ See on Google Fonts

Descriptive Text has gray color
and italics.

Wires for Standard Style



Wires Colors

Color ► HEX code
blue ► 0000FF
green ► 00B050
yellow ► FFCC00
orange ► FF9900
red ► FF0000
brown ► 663300
black ► 000000
white ► D1D1D1
gray ► 7F7F7F
purple ► 702D9E

i2c cable: A bundle of four wires: black, gray, white, and purple.

Pin Labels

Pin Labels here can copy/paste to new sets of terminals.



Example Connector

This ferrule was drawn manually to produce a vector graphic. Export to PNG, then place in diagram, add to Library_MXET or other Draw.io library. Small graphic omits text, and text is added in draw.io



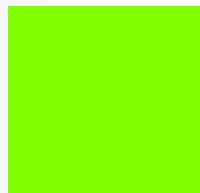
Helpful Rulers



10mm = 39 pt



25.4mm = 100 pt



Line length defined by start & end, in pts

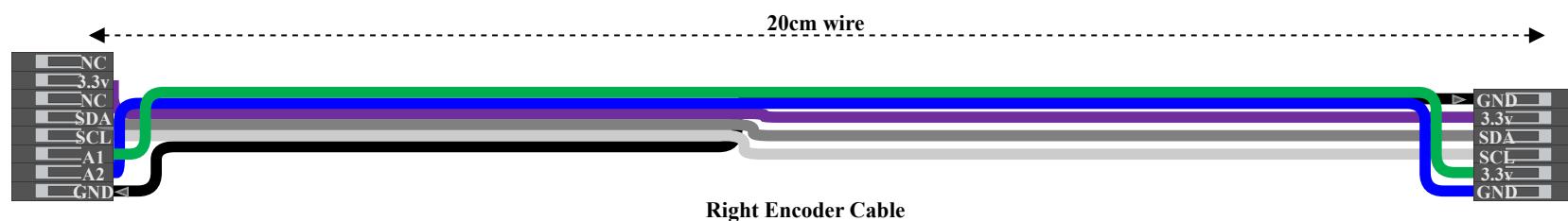
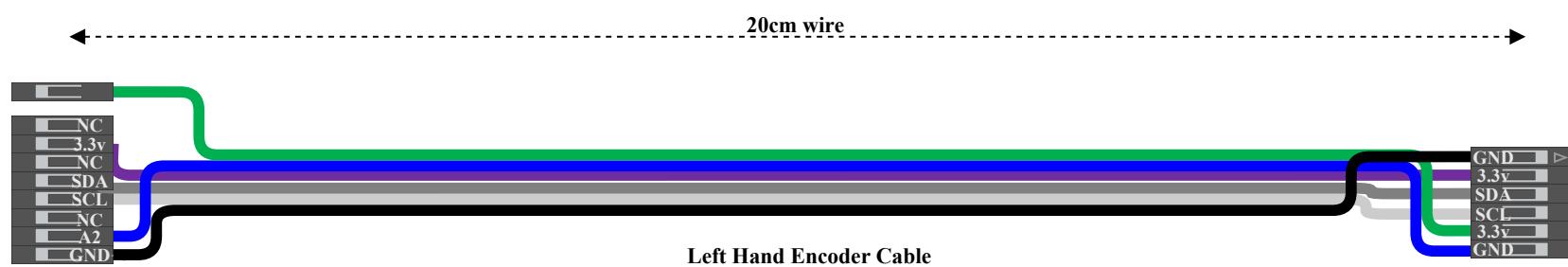
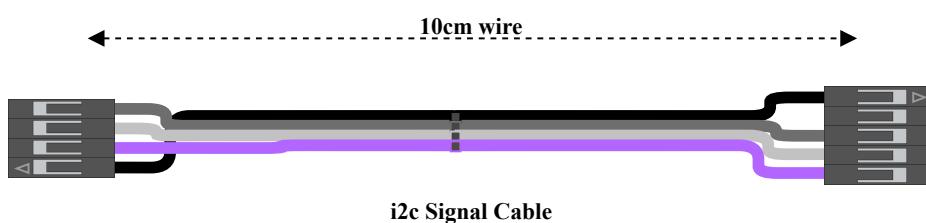
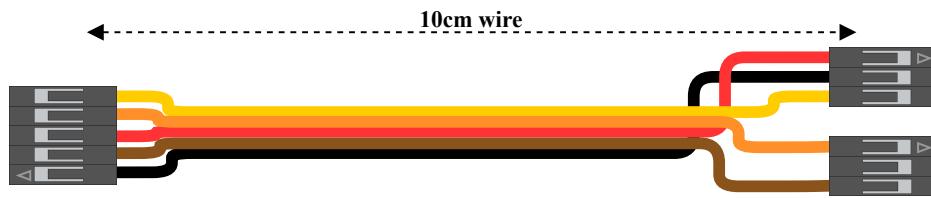
Line start	500 ▲ Left	700 ▲ Top
Line end	600 ▲ Left	700 ▲ Top

waypoints are
defined by coordinates



Waypoint Color = 666666

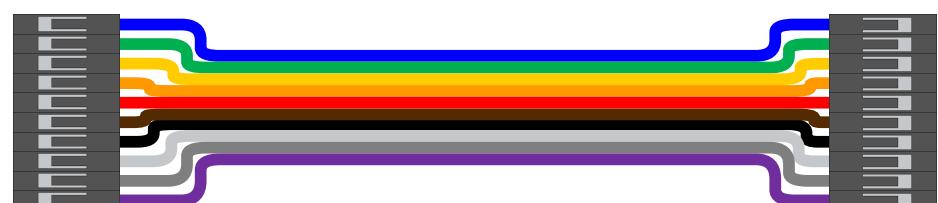
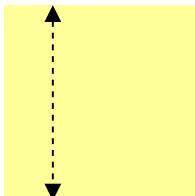
Wires in 1 Page



10mm = 39 pt



25.4mm = 100 pt



Diagrams Standards

Decide which features to include in each diagram type (unresolved)

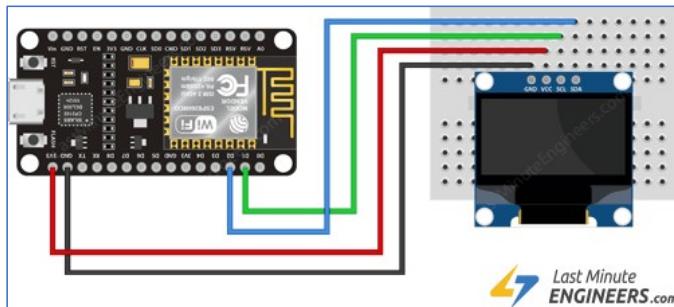
Author David Malawey

Date created 6/29/2023

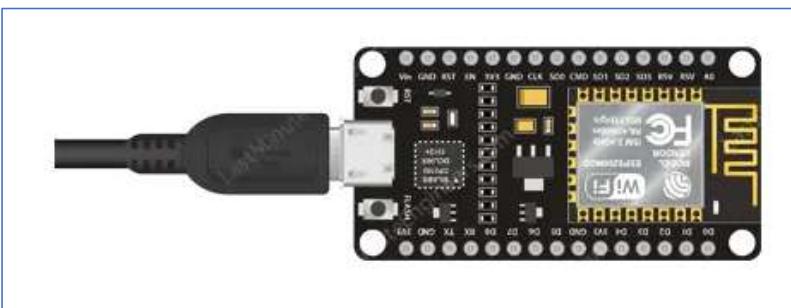
Benchmark

Review of standards from LastMinuteEngineers publications

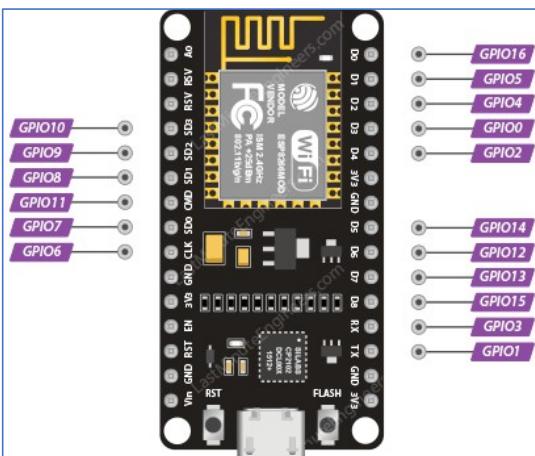
Circuit Diagram



Connection Diagram



Pinout Diagram



Cable Diagram

[link here](#) [lastminuteengineers](#)

Servo Motor		Arduino
5V	—	5V
GND	—	GND
Control	—	9

Circuit Diagram

Graphics for wires show the male or female terminals. Helps users who will choose wires from a bin or build wire terminals. Informs of wire colors that appear in next images.

Connection Diagram

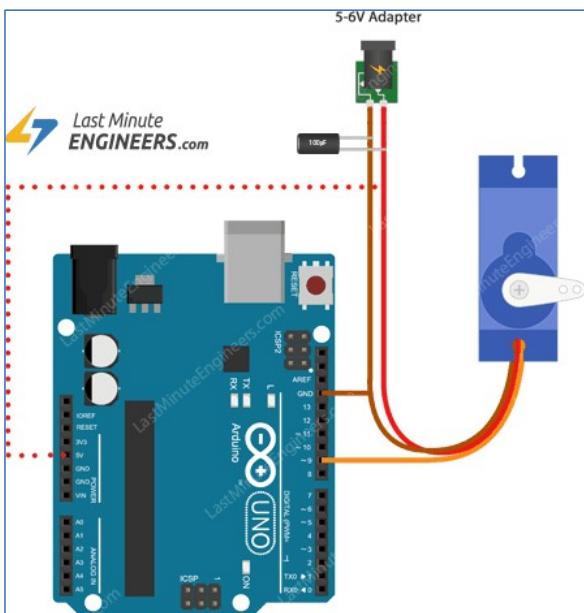
Image for the microcontroller: highly detailed, near-perfect match for true parts. High effort graphic, used repeatedly for more than one diagram and more than one project, to pay off investment of time.

Pinout Diagram

Indicating pins for connection. Colors are made uniform for label shapes. instead of labeling all terminals, only the terminals which are discussed in the particular tutorial are indicated in each image. The detailed MCU graphic is re-used, but the total JPG in the article is unique. Which pins are labeled? Only the ones which are relevant for the task that is being instructed. For this diagram the range of GPIO options are discussed to show what quantity and choices of terminals are available for a certain type of project.

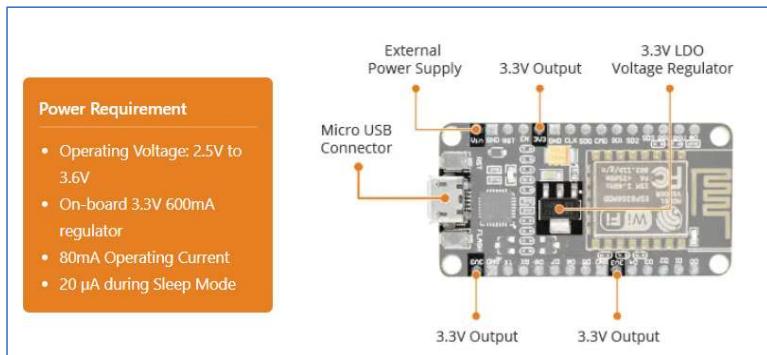
Function diagram

lastminuteengineers



Describing pin functions

<https://lastminuteengineers.com/getting-started-with-esp8266/>



Findings & Decisions from this activity

There are no parallels found online which include diagrams of microcontrollers in this level of quality and clarity - major companies like national instruments have engineering diagrams which cannot communicate without specific engineering knowledge of a particular field. Or the diagrams are one-off, not appearing to have a consistent style guide. Or the diagrams are beautiful diagrams without providing the value of learning to connect electronics. no standard appears to exist - while some groups like fritzing can produce elegant images, they require a whole circuit to be made inside of the simulation software which does not support all possible devices we may wish to include.

Decisions to act on: let us separate the diagrams by their purpose, and some devices and labels will appear in multiple diagrams serving unique purposes.

Function Diagram

Components in a diagram show how they are connected. The image contains minimal labels while the identifying remarks are located in text. Optional connection is shown with dotted line.

Pins Descriptions Diagram

Indicating pins for connection. Colors are made uniform for label shapes. instead of labeling all terminals, only the terminals which are discussed in the particular tutorial are indicated in each image. The detailed MCU graphic is re-used, but the total JPG in the article is unique. Which pins are labeled? Only the ones which are relevant for the task that is being instructed. For this diagram the range of GPIO options are discussed to show what quantity and choices of terminals are available for a certain type of project.

Diagrams Standards - SCUTTLE Robotics

Decide which features to include in each diagram type (unresolved)

Author David Malawey

Date created 6/29/2023

Feature	Connection Diagram	Cable Diagram	Functional Diagram	Pin Diagram
Wires to Scale ✗	0	✓	1	✗ 0
Pin functions ✗	0	✓	1	✓ 1
connectors to scale ✗	0	✓	1	✗ 0
devices at both terminals ✓	1	✗	0	✓ 1
cable connector type ✓	1	✓	1	✗ 0
cable merged ✓	1		✓	1
wire lengths to scale ✗	0	✓	1	
pin pitch to scale				✓ 1
indicate ground position ✓	1	✓	1	✗ 0
orientation of PCB on bot				✓ 1