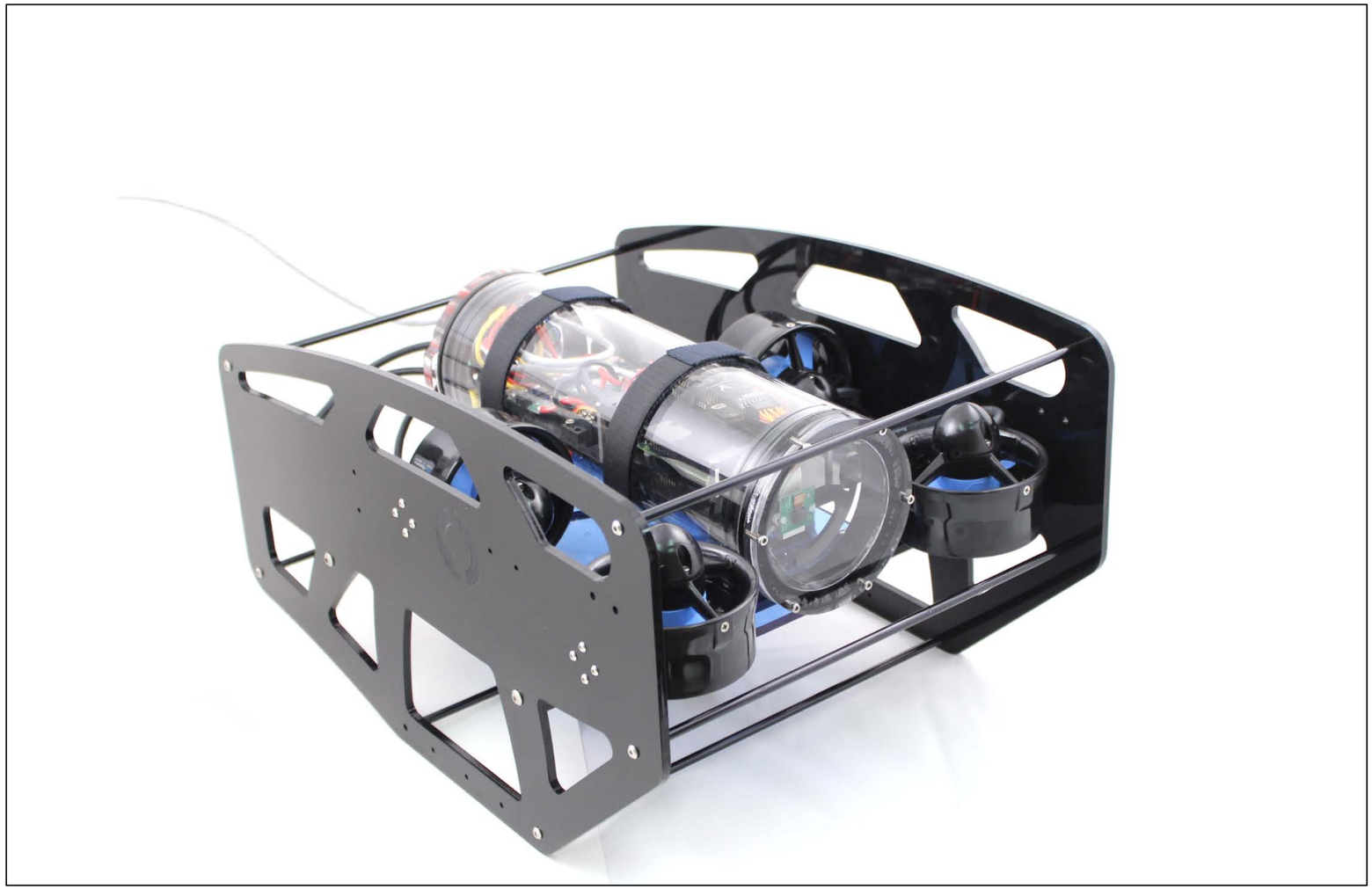
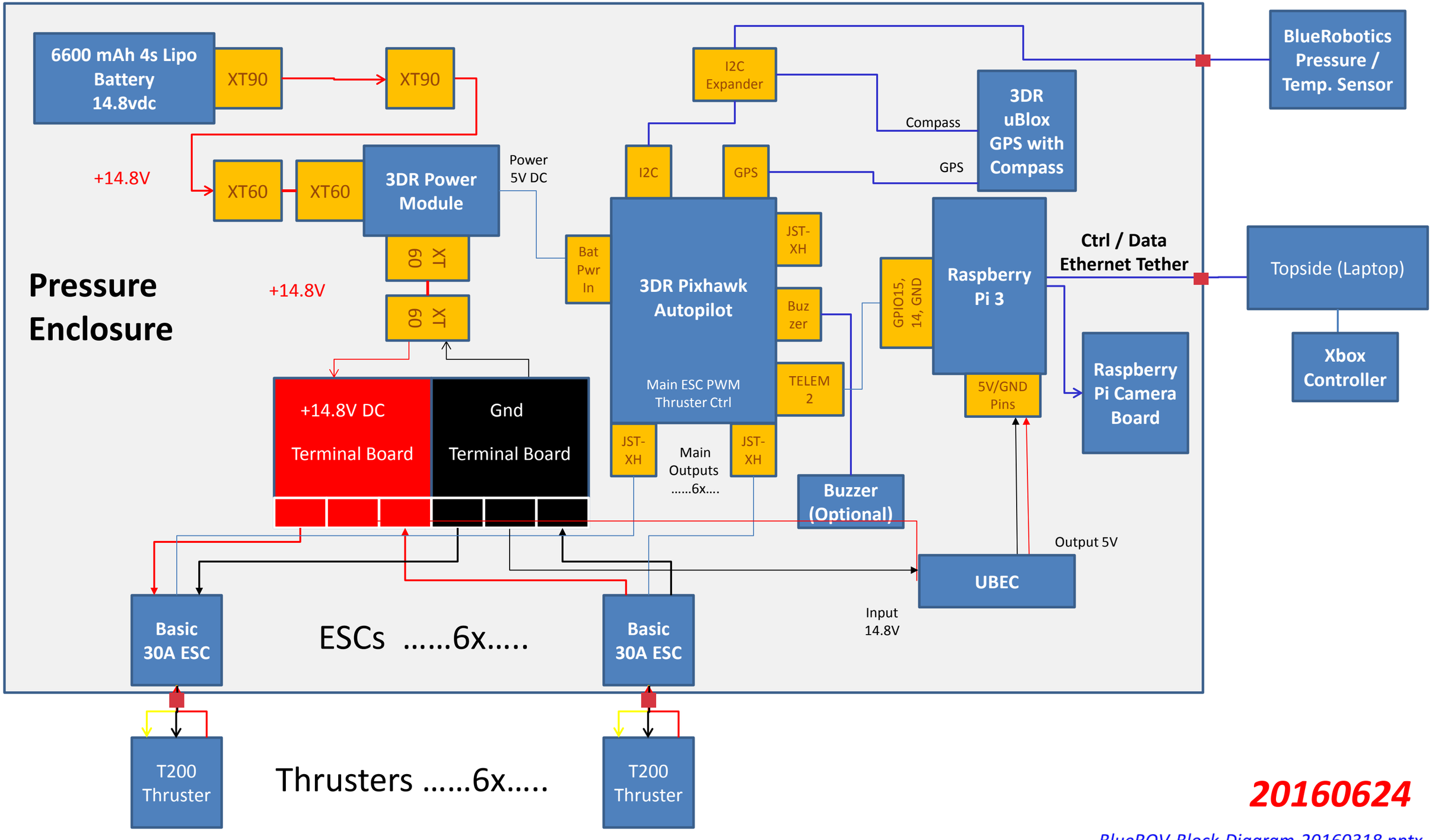


BlueROV Electronics and Controls Documentation

Edited and updated by Alicia Cabrera-Mino ’17 and Kyubin Lee ‘19, summer UROP
The AUV Laboratory at MIT Sea Grant
June 24, 2016

Original presentation:
Original forum post: https://www.bluerobotics.com/forums/topic/bluerov-interconnect-diagram/

BlueROV Electrical Interconnect Block Diagram



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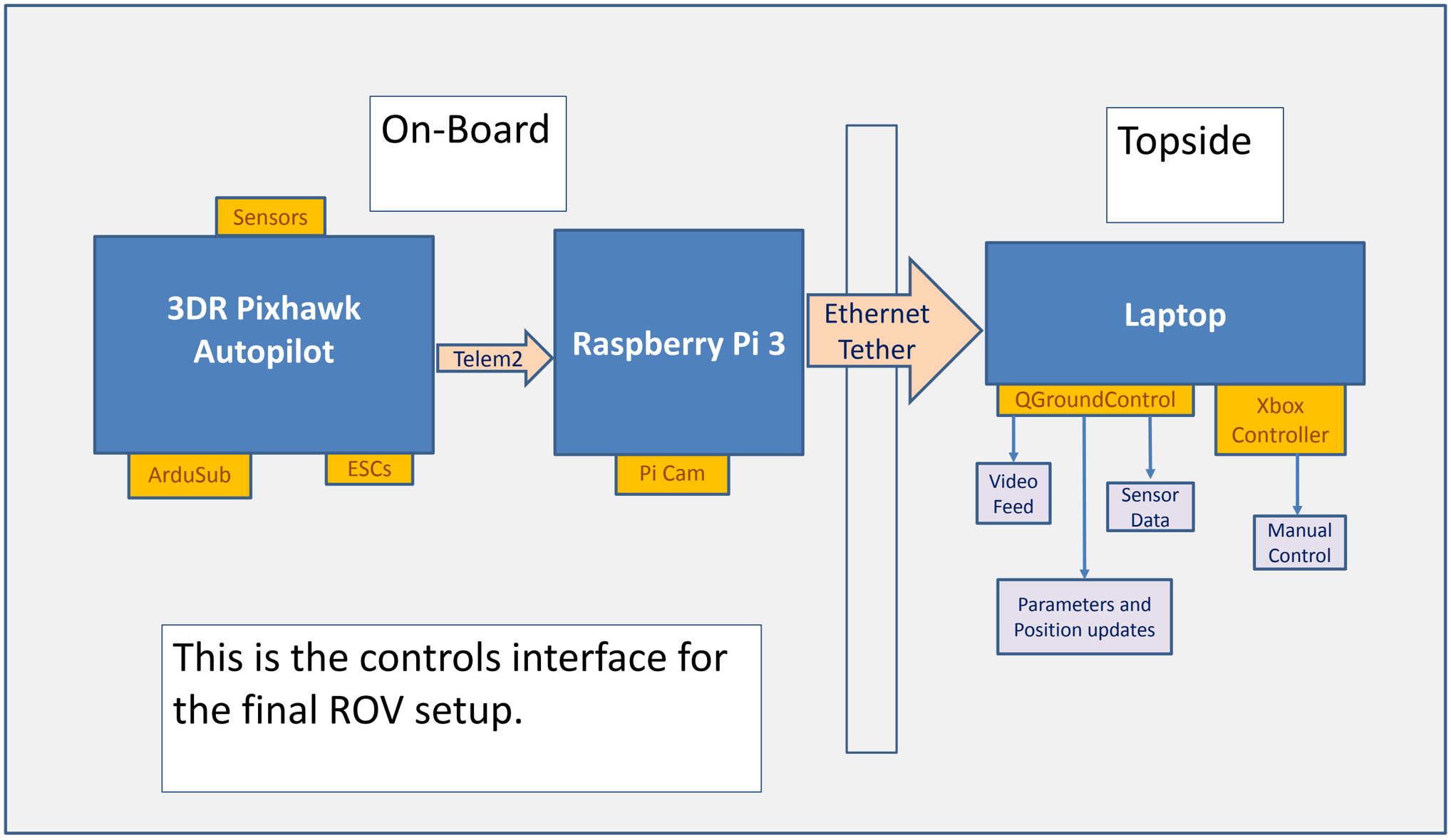
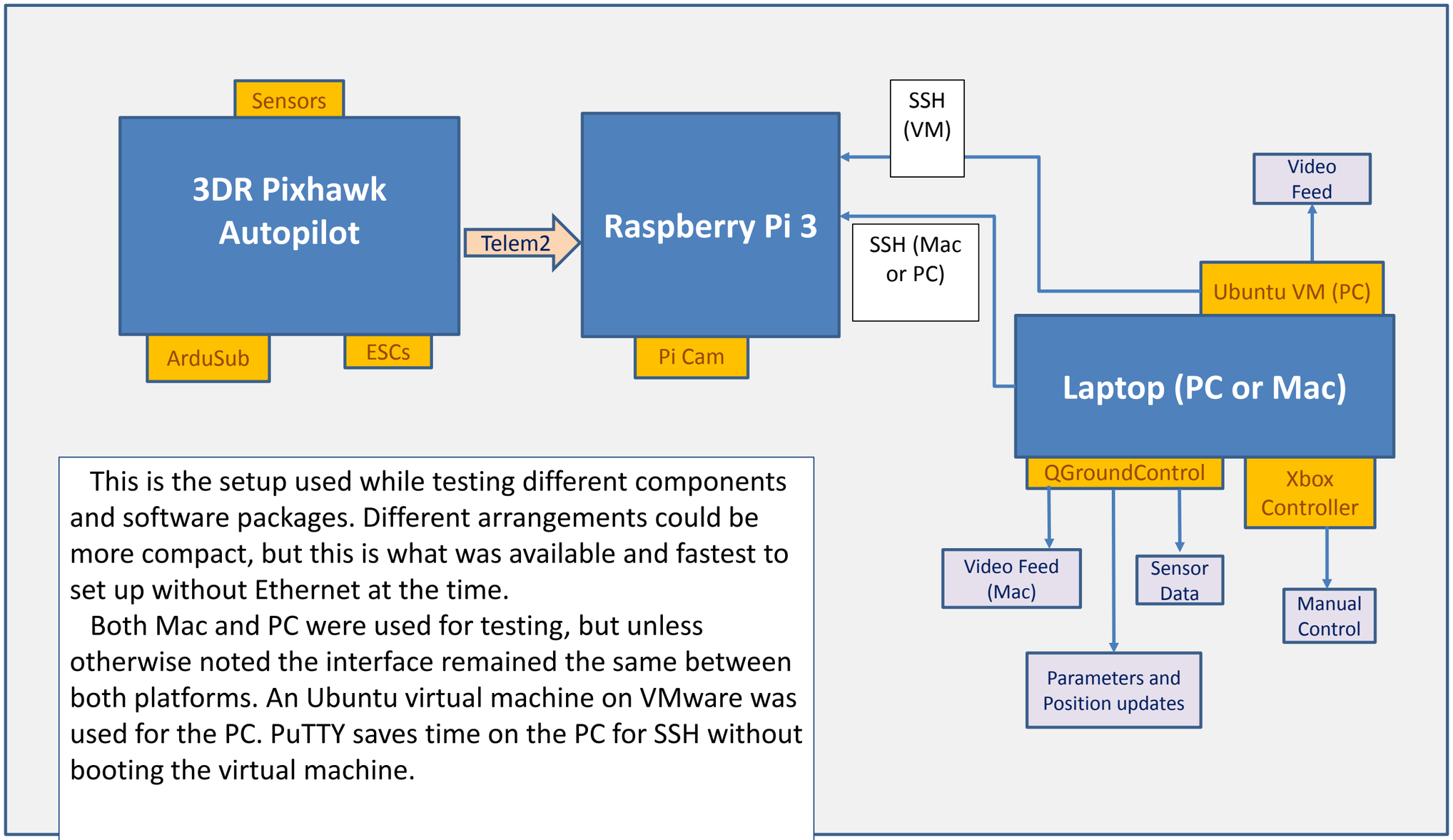
BlueROV-Block-Diagram-20160318.pptx

Controls Interface



This is the controls interface for the final ROV setup.

Controls Interface- Testing



This is the setup used while testing different components and software packages. Different arrangements could be more compact, but this is what was available and fastest to set up without Ethernet at the time.

Both Mac and PC were used for testing, but unless otherwise noted the interface remained the same between both platforms. An Ubuntu virtual machine on VMware was used for the PC. PuTTY saves time on the PC for SSH without booting the virtual machine.

Software Setup – QGroundControl

- QGC is a GUI that allows near total control of the ROV
- Download and install here: http://qgroundcontrol.org/downloads
- Download and install firmware that will run QGC when pixhawk is connected:
  http://firmware.ardusub.com/Sub/latest/

→Note that firmware has different frame setups (we used bluerov)

- Connect QGC to pixhawk and calibrate according

Software Setup - Calibration

- For Mac users:
  - Mac will not recognize the xbox 360 controller that is crucial for calibrating radio and joystick
  - Download:

https://github.com/360Controller/360Controller/releases

→ the first version should work fine, reboot needed

Software Setup - Video Streaming

- Hook up Raspi to your laptop using an ethernet cable
- Create a static IP address on your laptop
  - Use command ‘ipconfig’ for PC
  - Go to network under System Preferences for Mac
  - e.g. we used 10.0.0.10
- Find static IP address of your Raspi

Video Streaming – laptop

- Install gstreamer on PC/Mac:
  - oMac: brew install gstreamer gst-libav gst-plugins-ugly gst-plugins-base gst-plugins-bad gst-plugins-good
- Install gstreamer on Raspi:
  - osudo apt-get install gstreamer1.0
- After installation:
  - oPC/Mac: gst-launch-1.0 -v tcpclientsrc host=YOUR-PI-IP-ADDRESS port=5000 ! gdpdepay ! rtph264depay ! avdec_h264 ! videoconvert ! autovideosink sync=false
  - oRaspi: raspivid -t 999999 -h 720 -w 1080 -fps 25 -hf -b 2000000 -o - | gst-launch-1.0 -v fdsrc ! h264parse ! rtph264pay config-interval=1 pt=96 ! gdppay ! tcpserversink host=YOUR-PI-IP-ADDRESS port=5000

Video Streaming - laptop

- If first instruction does not work, try:
- http://robogoby.blogspot.com.au/2014/01/raspi-camera-gstreamer-10-w-windows-7.html

-> For pc command, remember to match pathway to your file directory

Video Streaming - QGroundControl

- Raspi:

  oraspivid -n -md 2 -b 25000000 -fps 30 -t 0 -awb off -o - | gst-launch-1.0 -v fdsrc ! h264parse ! rtph264pay config-interval=10 pt=96 ! udpsink host=YOUR-PI-IP-ADDRESS port=5600

  ❖It is assumed that you already installed gstreamer!

  ❖Mac users: Rebooting you laptop might cause changes to your ethernet address. Use command ‘ifconfig’ and check if the inet address is the constant IP address that you setup earlier. If it is not, try using:

sudo ifconfig [UR ETH PORT(e.g. en5)] inet [UR laptop’s

Software Setup – Getting Code

- Instructions:

http://ardusub.com/developers/#compiling

→Make sure the ArduSub link that you are cloning is up-to-date

→Remember how firmware had different frame setups? Make sure to use the right frame when compiling ArduSub

→Developers still seem to be updating software so keep an eye out!

Software Summary

List of all sites consulted for software downloads, some of the links may be redundant.

- https://www.bluerobotics.com/forums/topic/radio-calibration/
- http://ardusub.com/initial-setup/#install-qgroundcontrol
- https://github.com/mavlink/qgroundcontrol/releases/tag/v2.9.7b
- http://firmware.ardusub.com/Sub/latest/
- https://www.bluerobotics.com/forums/topic/bluerov-ros-package-updates/
- https://www.bluerobotics.com/forums/topic/problem-with-running-bluerov/
- http://www.ros.org/install/

Common error fixes

- RC3_MAX and RC3_MIN change to 2200 and 800 – fixes joystick/radio calibrating
- Change baud rate and a few other parameters listed here http://ardusub.com/initial-setup/#configuring-parameters
- ssh into bluerov raspi when simplerov frame is installed on Pixhawk, and UDP com port on qgroundcontrol is 14550: sudo -s mavproxy.py --master=/dev/ttyAMA0 --baudrate 57600 --out LAPTOP_IP_ADDRESS:14550 --aircraft simplerov
- If connection times out and mavproxy.py still running: sudo –s pkill mavproxy.py

General Assembly

- Overall Instructions:
  - http://docs.bluerobotics.com/bluerov/#assembly
  - When assembling thrusters, make sure to refer to BlueRov pictures for exact placement of motors (diagram can be confusing!)
- Additional Orders:
  - Temperature sensor:https://www.bluerobotics.com/store/electronics/celsius-sensor-r1/
  - Pressure sensor:https://www.bluerobotics.com/store/electronics/b

Pixhawk Overview

Pi Data connects to Pixhawk via Telem 2

Connect 3DR Power Module Pigtail Here

Connect ESCs Control 1-6 Here

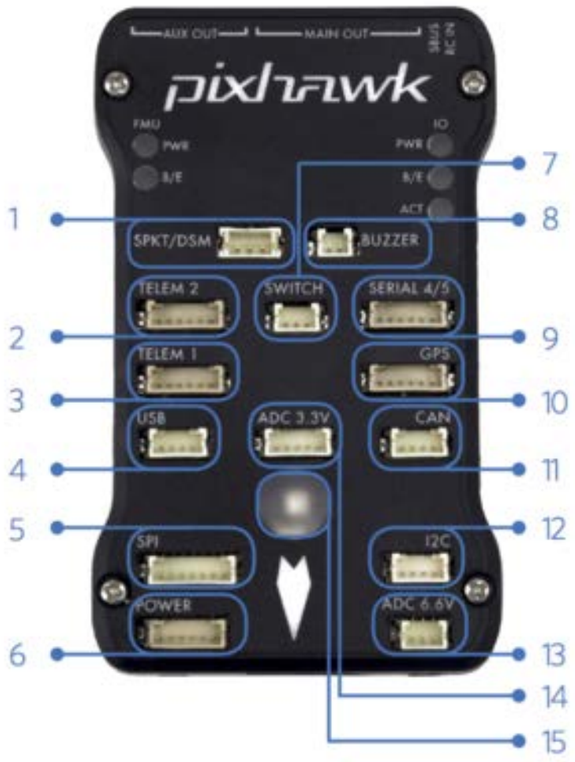
Buzzer (Optional)

3DR uBlox GPS

Connect I2C Expander Then connect Pressure Sensor and BlueRobotics Depth Sensor to Expander

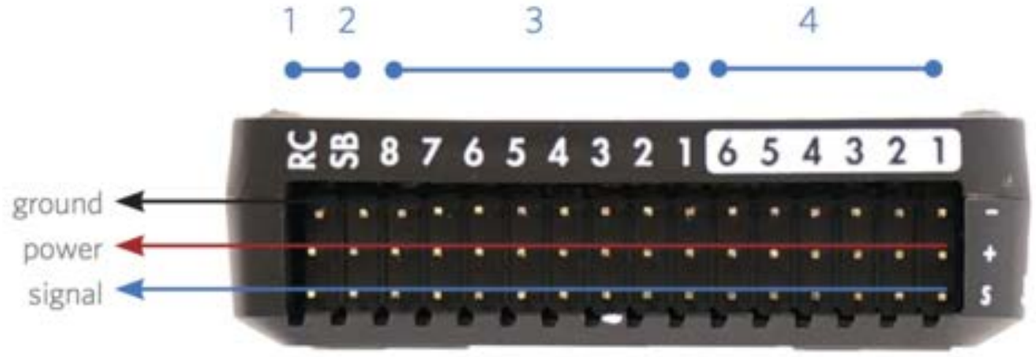
http://copter.ardupilot.com/wiki/common-pixhawk-overview/

Pixhawk connector assignments



1 Spektrum DSM receiver
2 Telemetry (on-screen display) Comms (to Rasp. Pi3)
3 Telemetry (radio telemetry)
4 USB
5 SPI (serial peripheral interface) bus
6 Power module Pwr Input (from module)
7 Safety switch button
8 Buzzer Warning Buzzer (optional)
9 Serial
10 GPS module Signal from GPS/Compass
11 CAN (controller area network) bus
12 I²C splitter or compass module Connect I2c Expander which is connected to Pressure sensor and Bluerobotics depth/temp. sensor
13 Analog to digital converter 6.6 V
14 Analog to digital converter 3.3 V
15 LED indicator

1 Input/output reset button
2 SD card
3 Flight management reset button
4 Micro-USB port

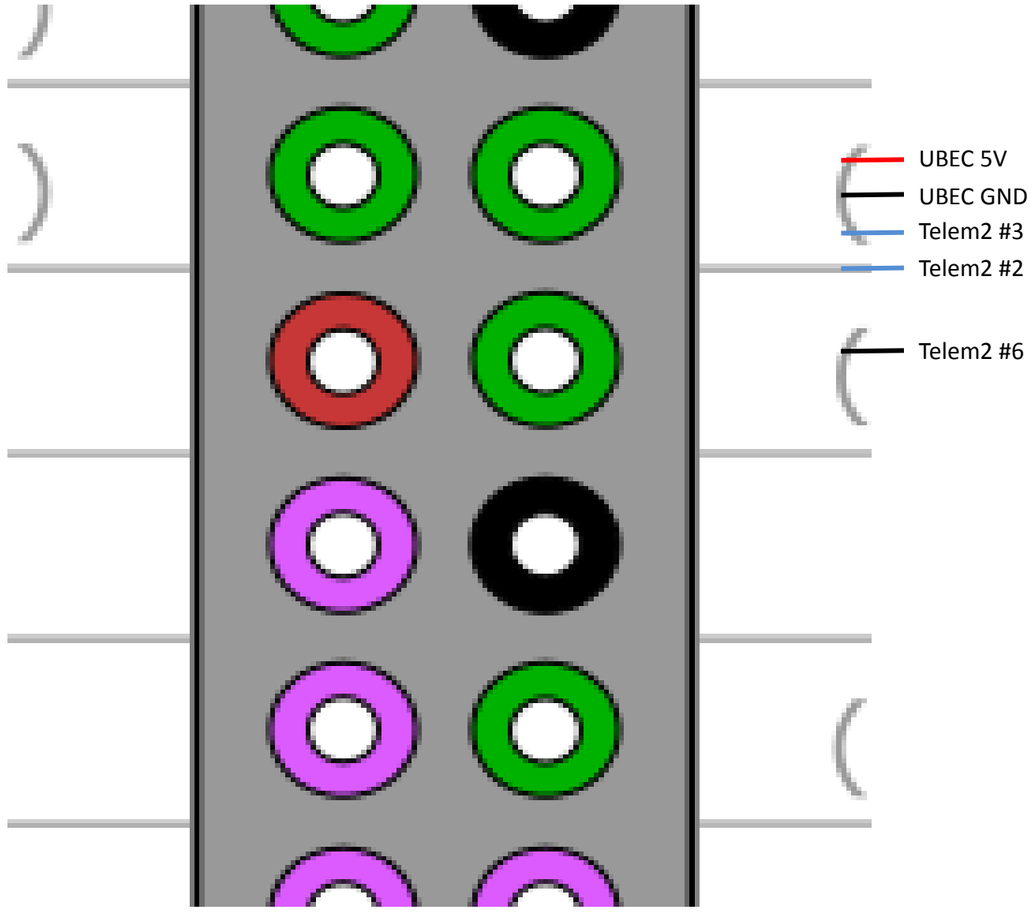


1 Radio control receiver input
2 S.Bus output
3 Main outputs Thruster ESCs - PWM
4 Auxiliary outputs

http://copter.ardupilot.com/wiki/common-pixhawk-overview/

Raspberry Pi Connectors

The pins are labeled in a confusing manner, so this page is to clarify the connections necessary to run the Pixhawk and Raspberry Pi together.



, http://ardupilot.org/dev/_images/RaspberryPi_Pixhawk_wiring1.jpg

3DR Power Module

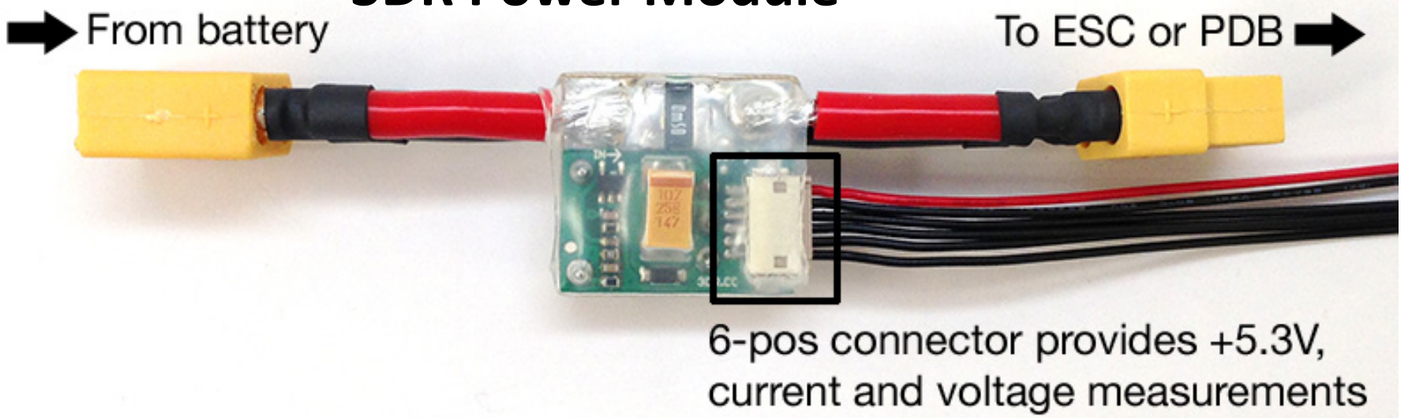
This page explains how to set up the 3DR Power Module (PM) to measure battery voltage and current consumption. The

information will also be useful for setting up other types of Power Module.

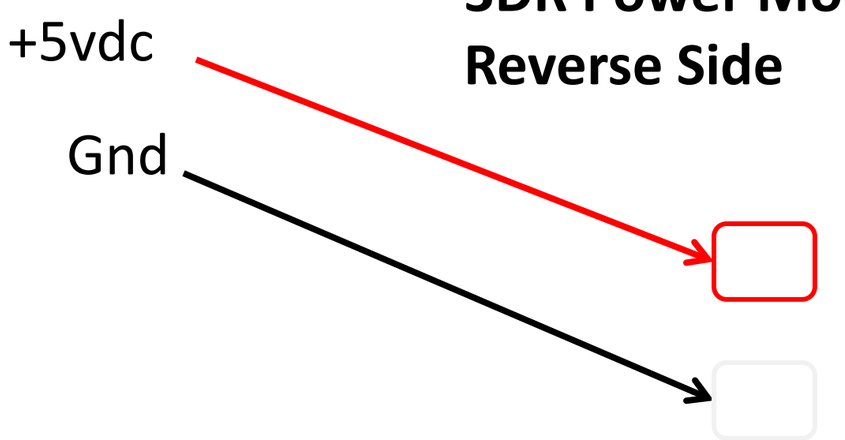
XT60 Connector

To BlueROV
Terminal Board +/Gnd

3DR Power Module



**3DR Power Module-
Reverse Side**



To Pixhawk Power Input Conn.

http://copter.ardupilot.com/wiki/common-3dr-power-module/

UBEC

This page explains how to set up the 3A-6s UBEC Voltage regulator to power Raspberry Pi from LiPo safely.

Turnigy UBEC-5A

Input

To BlueROV
Terminal Board +/-

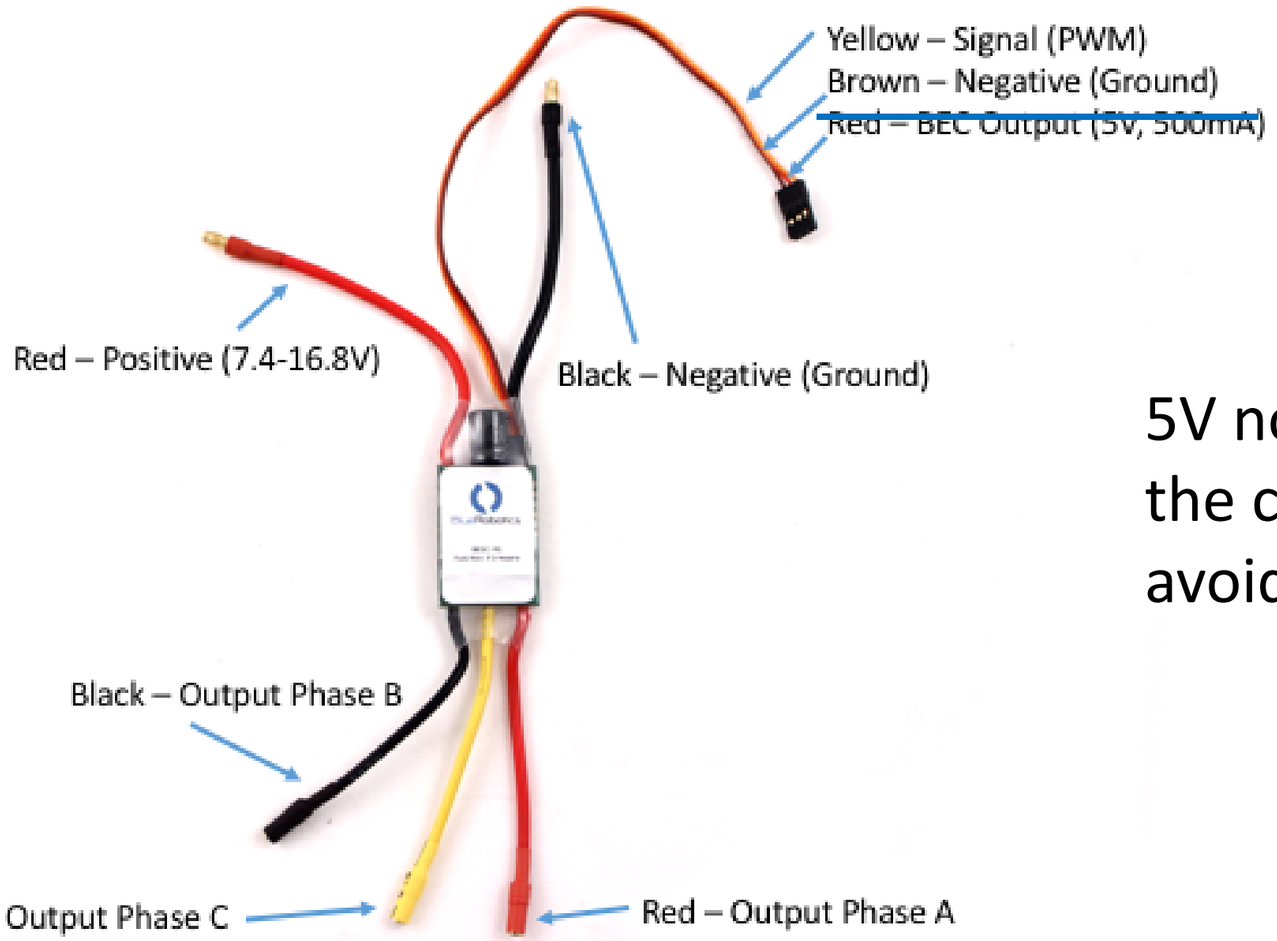
To Raspberry Pi
5V and Gnd pins

Output

http://www.brontoseno.com/kategori-produk/sbecubec/

ESC Connections

Motor directions determined by output phase, exact wiring not known until tested



5V not needed, cut the connections to avoid overheating

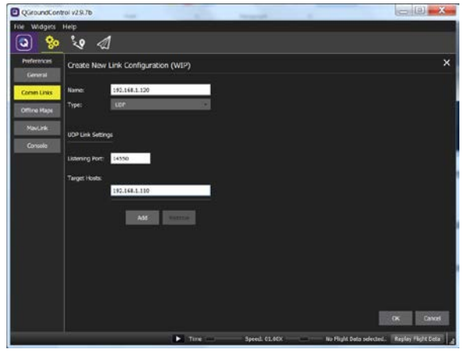
http://docs.bluerobotics.com/assets/images/documentation/besc-labels.png

Comments:

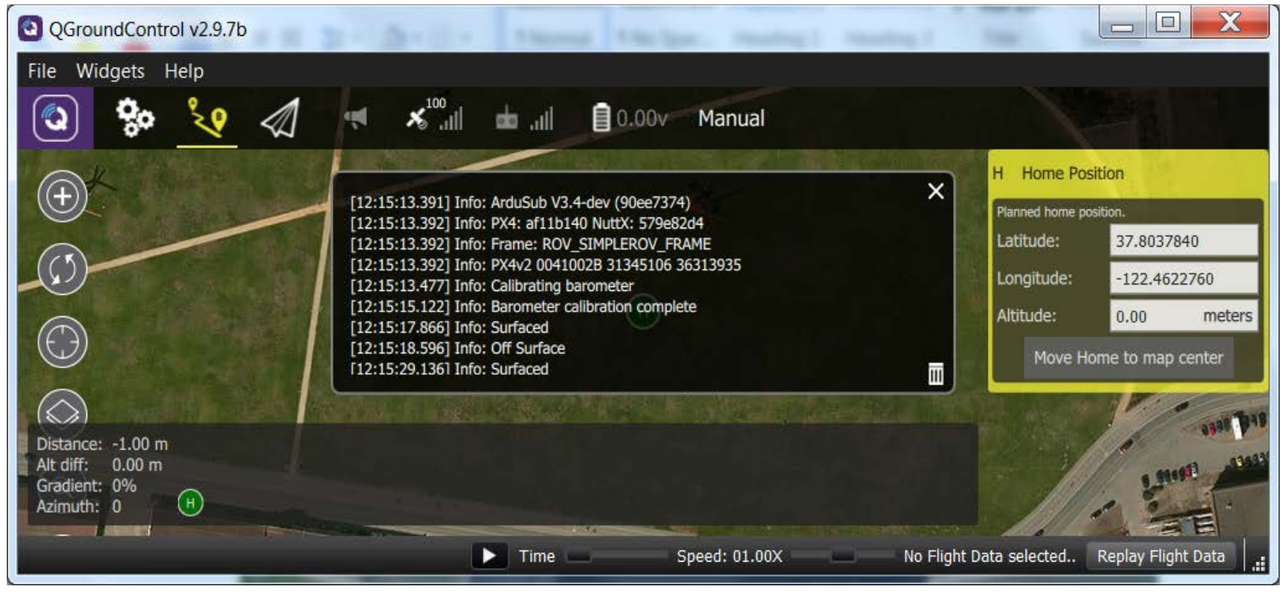
- The “safety sw” is currently disabled in our recommended
- Changes have been made to diagram to power Raspberry Pi separately from Pixhawk
- ESC 5V connections removed by rec.
- GPS won't be locked unless it is outside for around 3-5 minutes
- Slides 1, 3, 4, 5, 6, 7, 8, 9, 14, 15 added for clarity

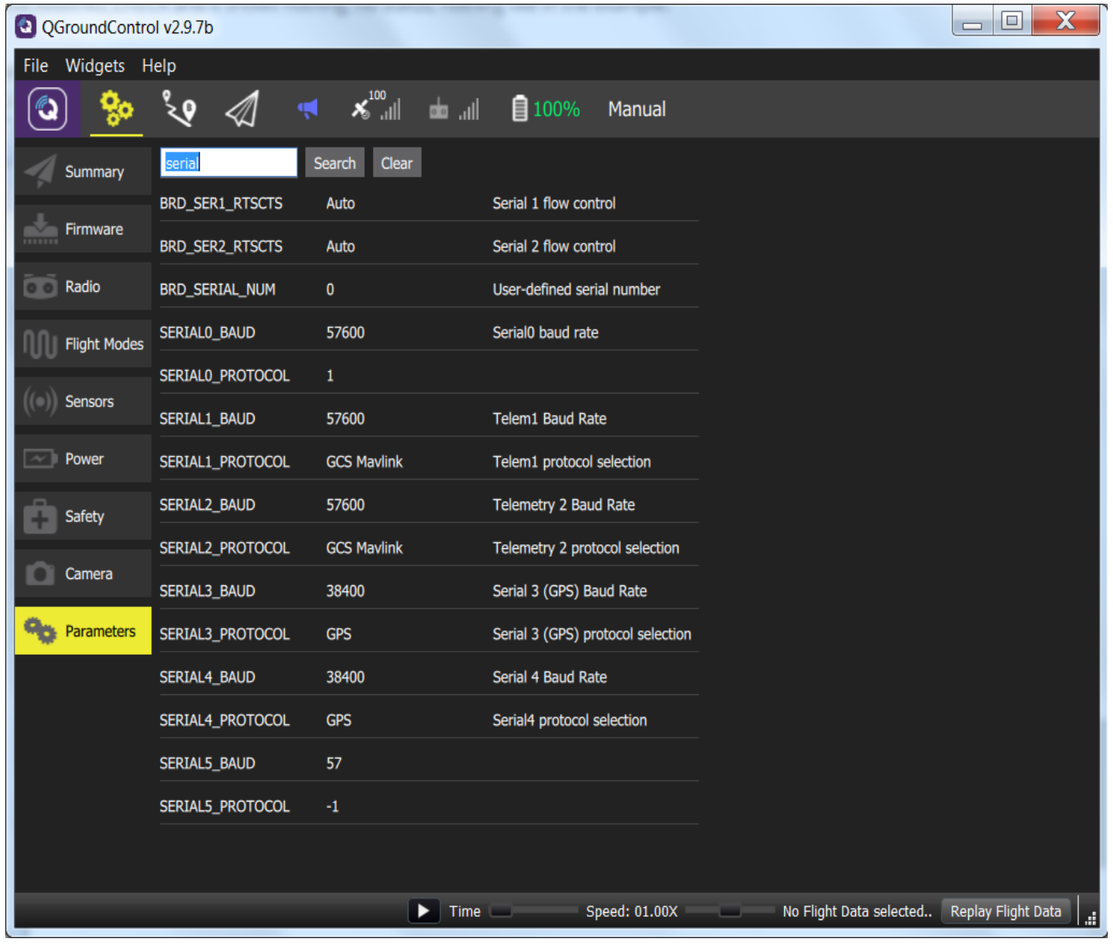
Additional Sources

- https://www.bluerobotics.com/wp-content/uploads/2016/06/Diagram-Mockup-Ethernet.jpg
- https://www.bluerobotics.com/forums/
- http://ardupilot.org/dev/docs/raspberry-pi-via-mavlink.html
- http://ardusub.com/initial-setup/#configuring-parameters
- https://www.bluerobotics.com/forums/topic/radio-calibration/



Additional Images





Additional Images