

# DroneCAN (aka UAVCANv0) With a PX4 Flight Controller and Vertiq Modules

This document provides some general tips and procedures for integrating a Vertiq module with a PX4 flight controller using DroneCAN, also known as UACANv0. Larger Vertiq modules support DroneCAN, and support using it as a communication protocol with PX4 flight controllers.

Details on the DroneCAN protocol can be found here on the [DroneCAN specification](#). For information on the DroneCAN messages supported by Vertiq modules, refer to [Standard DroneCAN \(UAVCANv0\) Support](#).

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## 1 Bitrate

Currently on Vertiq modules, **the bitrate for DroneCAN is fixed at 500000 bit/s**. Configurable bitrates may be introduced in future versions of the firmware, but currently it cannot be changed from 500000 bit/s.

## 2 Module Configuration and Enumeration

The first step in the process of setting up a Vertiq module is configuring it through the IQ Control Center. The sections below describe these parameters and give suggestions on how to set them.

### 2.1 Mode, Direction, and Limits

Descriptions of some important parameters for the module's direction and mode and how to change them through the IQ Control Center can be found in the [Motor Configuration section of the Vertiq Read-The-Docs tutorial for flight controller integration using hobby protocols](#). That tutorial is focused on using hobby protocols, but the details on configuring the module are still accurate for DroneCAN.

### 2.2 Node ID

The next important setting is the node ID. This is the ID the motor will use to identify itself on the DroneCAN bus. **The node ID must be unique for each module, and none of the module's should use the same node ID as the flight controller.** Typically flight controllers will use node ID 1, so it is best to avoid that ID, and ID 0 is reserved. You should assign the node ID of each module to some unique value from 2 to 127.

**Note that the PX4 documentation mentions dynamic node ID allocation with DroneCAN. Vertiq modules do not currently support dynamic node ID allocation, you must configure a static node ID for each module through the Control Center.**

The entry in the IQ Control Center to configure the node ID is "UAVCAN Node ID", and it can be found in the General tab, as shown below. Note that the module must be rebooted before a change to the node ID will take effect.



### 2.3 ESC Index

The ESC index determines the index of the value in a [RawCommand](#) message the motor will listen to. To be able to control each motor individually, each motor should have a unique ESC index. By default, the ESC index of Vertiq modules is set to 0.

**Vertiq modules do not currently support automatic ESC enumeration, it is necessary to manually assign a node ID to each module on the bus.** Unlike the node IDs, it is not necessary to reboot the module for a change to the ESC index to take effect.

The [PX4 documentation](#) provides some details on how to set up the ESC indices to integrate properly with your flight controller. Most importantly, the ESC indices must correspond with the motor numbers on the [Airframe Reference](#) for your airframe, though generally the ESC index will be one less than the motor number because the ESC indices start from 0. Generally, each module should have a unique ESC index, and the indices should start at 0 and increment to the total number of modules minus one.

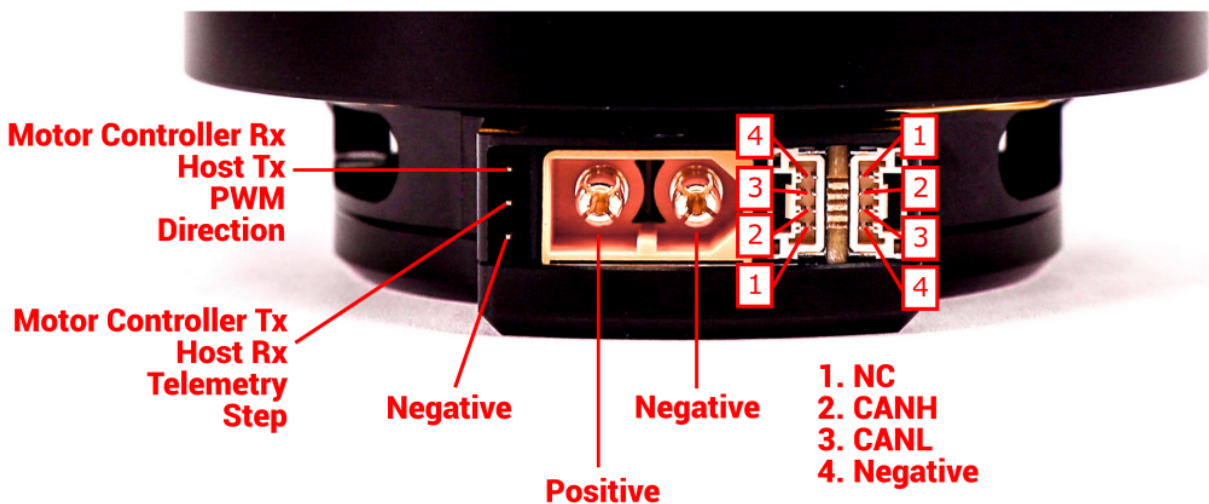
As an example, imagine we were setting up a quadcopter with a [Quadrotor X](#) type airframe . Motor 1 is on the top right of that airframe. When setting the ESC index on that module, it should be set to 0, because the ESC indexing starts at 0, so the index of the module is always 1 less than the motor number on the airframe reference. Similarly, module 2 would have index 1, module 3 would have index 2, and module 4 would have index 3. So, in the Control Center, the ESC index of each module should be set to the appropriate value for its position on the airframe.

You can change the ESC Index of a module through the Control Center under the General tab, as shown below.



### 3 Hardware Setup Notes

Before attempting to communicate with the flight controller, make sure that the hardware for the CAN bus is set up correctly. CANH and CANL should be connected on the flight controller and all of the motors into one bus. There should also be a 120 ohm termination resistor between CANH and CANL on the bus. The image below shows which wires are CANH and CANL for a Vertiq 81-08. For other modules, refer to their datasheets for the appropriate pinouts.

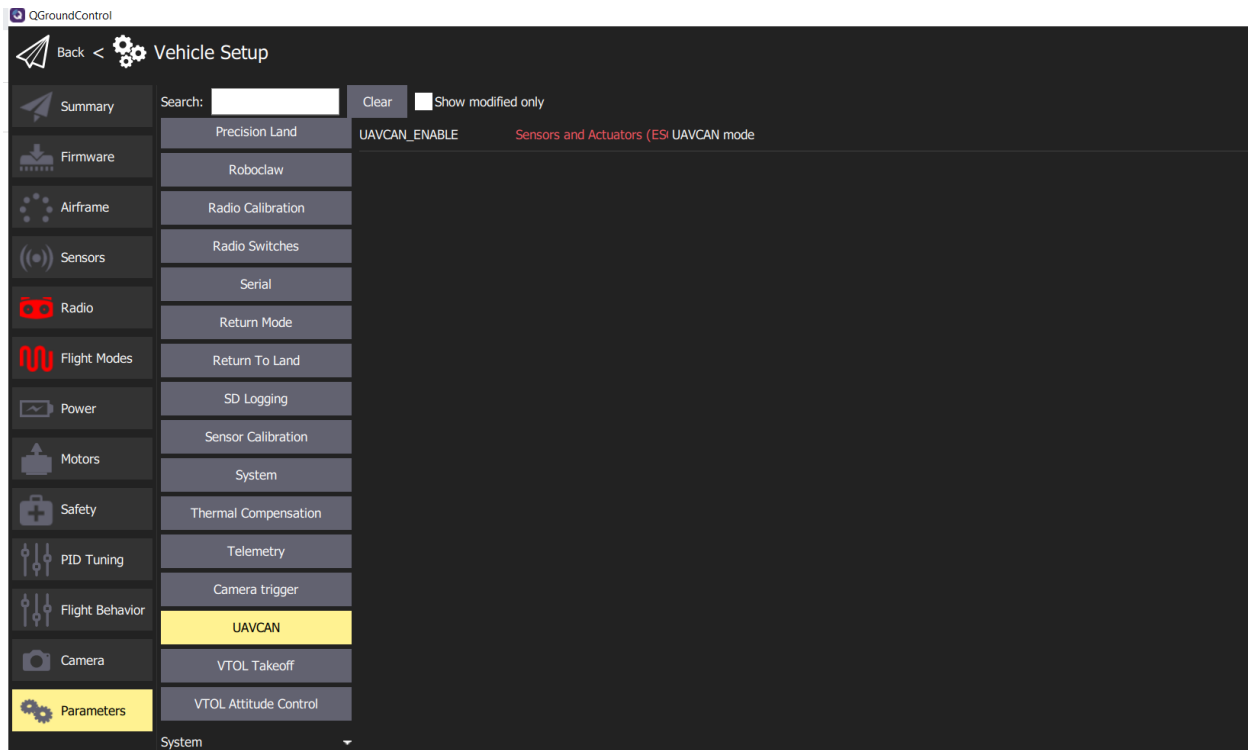


## 4 Flight Controller Configuration

Once the motor is configured and the CAN bus is set up properly, the flight controller needs to be configured. The configurations discussed here were performed on a flight controller using PX4 v1.13.0 with QGroundControl.

### 4.1 Enabling DroneCAN

In QGroundControl under Parameters in the Vehicle Setup menu, there is a parameter section labeled UAVCAN. Initially, this section will only show one parameter, `UAVCAN_ENABLE`. Set `UAVCAN_ENABLE` to “**Sensor and Actuators (ESCs) Automatic Config**”, which has a value of 3. This will enable DroneCAN for controlling motors. The image below shows what the parameters section in QGroundControl should look like.



Next, **reboot the flight controller before continuing.**

### 4.2 Setting Bitrate

After enabling DroneCAN and rebooting the flight controller, re-open the UAVCAN section of Parameters in QGroundControl. More options should now be available for configuring DroneCAN.

The CAN bitrate of the flight controller needs to be changed to match the module's bitrate. Set `UAVCAN_BITRATE` to 500000 bit/s, and reboot the flight controller. 500000 bit/s is the fixed

bitrate currently used by Vertiq modules. The image below shows the proper configuration of this parameter.



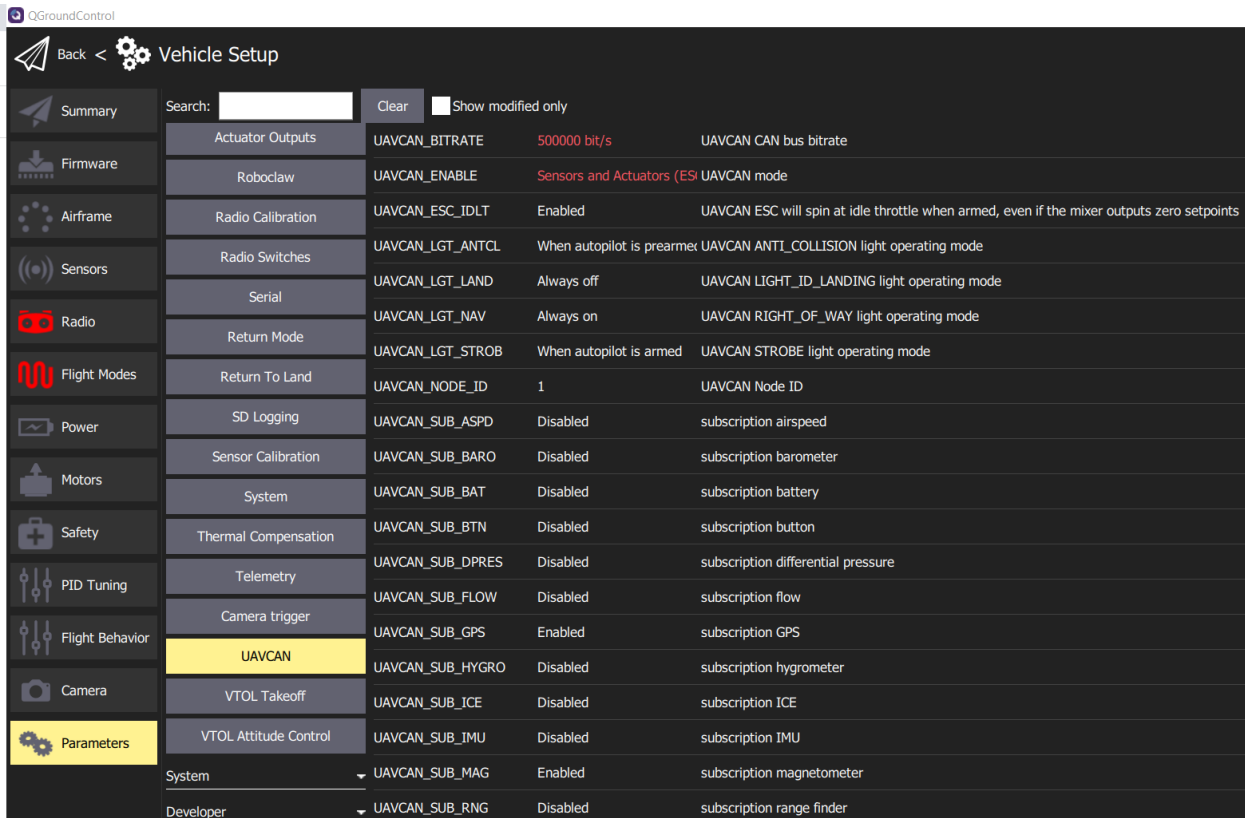
### 4.3 Other Configurations

There are various other configurations available under the UAVCAN section of the Parameters, but none of them are essential for using DroneCAN with a Vertiq module. Refer to the PX4 documentation for more information on each of these parameters, they may be useful in some applications.

One other parameter of note is *UAVCAN\_NODE\_ID*. This sets the flight controllers' node ID. Generally, this can be left at its default of 1 as long as none of your motodule have a node ID of 1.

### 4.4 Example Configuration

An example configuration of the parameters in the UAVCAN section is shown below, note that only the bitrate and the enable are modified from the defaults.



# 5 Testing

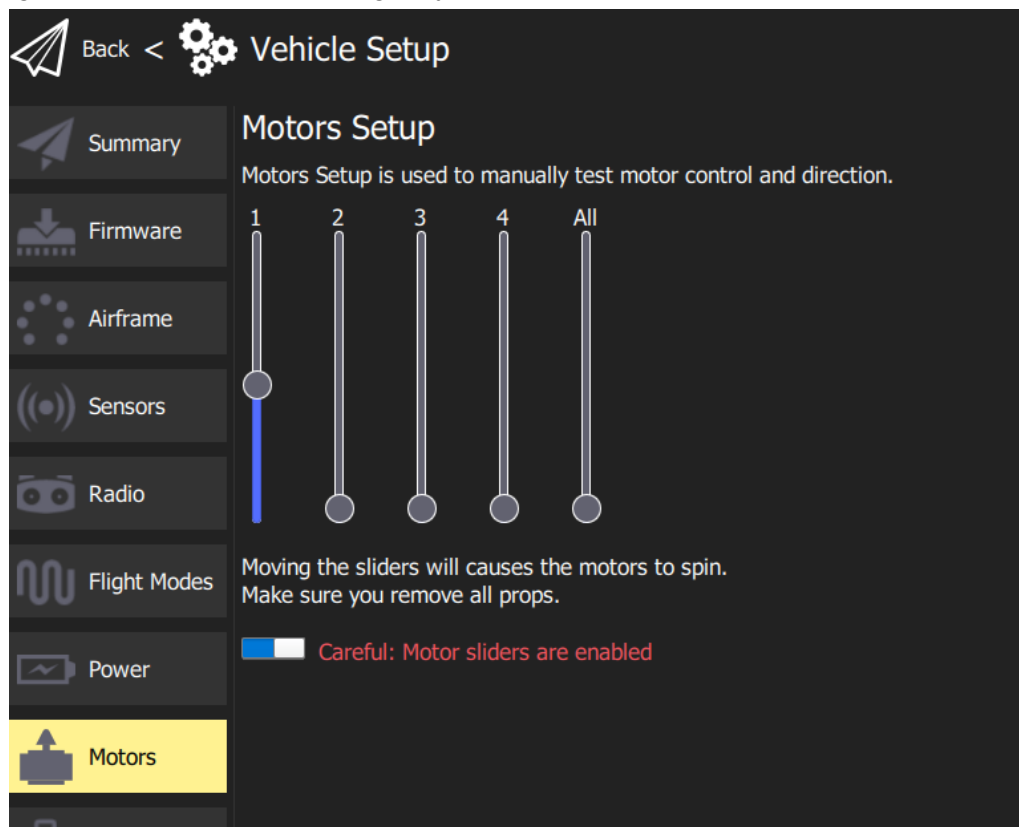
QGroundControl provides multiple helpful tools for testing if your motor is properly integrated with the flight controller over UAVCAN. The sections below describe some of these testing methods.

## 5.1 Motor Setup Test

Under the Motors tab in QGroundControl, there are sliders that can test if the modules will spin, and if the flight controller is configured to use DroneCAN properly. If DroneCAN is enabled, this test should send DroneCAN commands to control the modules.

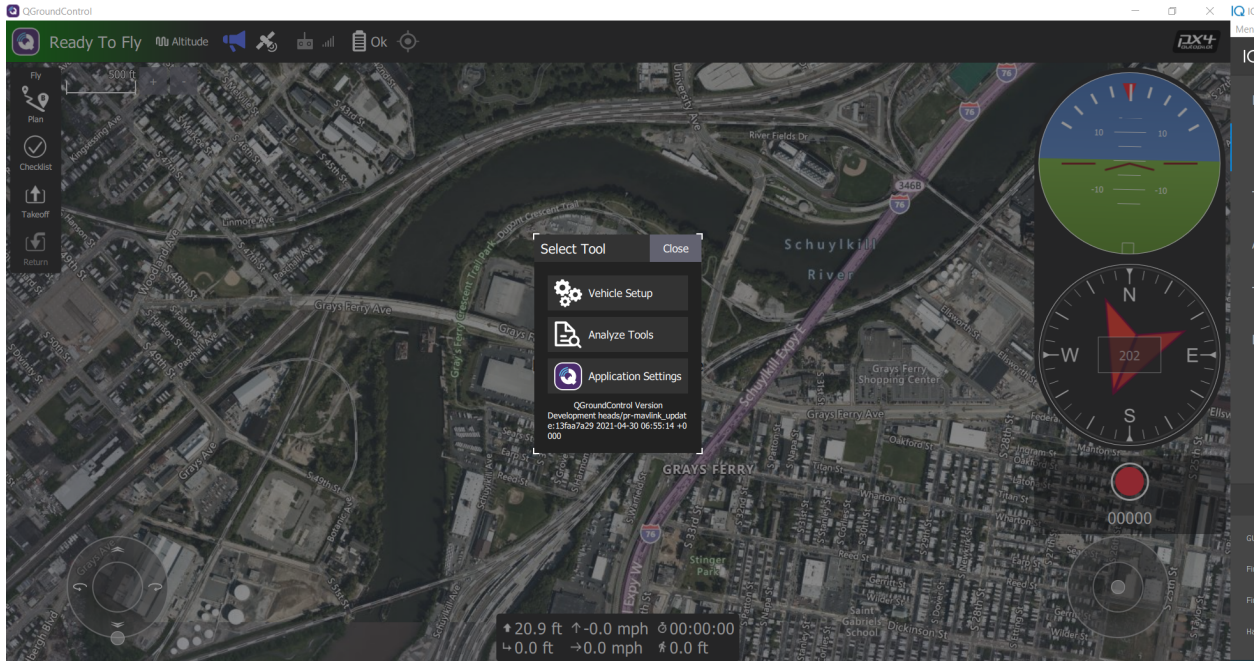
To run the test, arm your safety switch if you have one, and click the horizontal slider at the bottom of the window to enable the motors. Make sure the Vertiq module is powered up and connected to the same CAN bus as the flight controller.

Then move the slider corresponding to the motor number of the module you wish to test. E.g. to test a module with an ESC index of 0, move slide 1. If configured correctly, the motor with the corresponding index should start spinning as you move the slider.

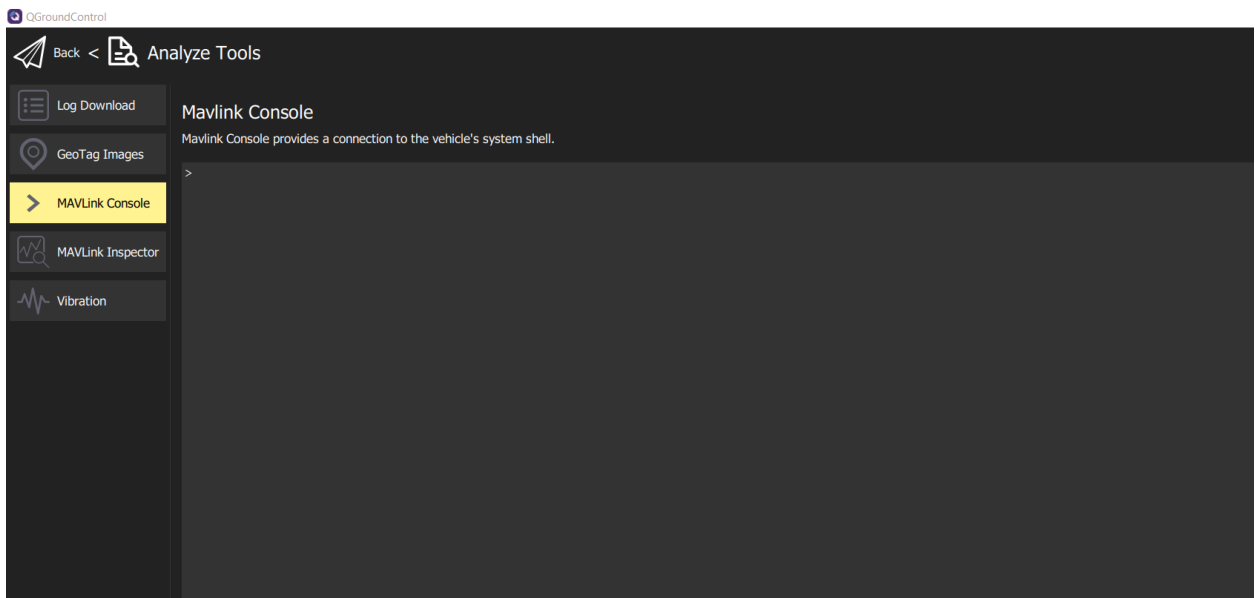


## 5.2 MAVLink Console

The MAVLink console can also be used to check if your motor is sending out the expected status messages. To open the MAVLink console, on the home screen from QGroundControl click on the QGroundControl logo and select Analyze Tools from the Select Tool menu, as shown below.



In Analyze Tools, select the MAVLink Console. This makes it possible to execute various DroneCAN related commands through the flight controller. Confirm that the Vertiq module is powered on and is connected to the flight controller's CAN bus. The image below shows what the console should look like when it is first opened.



## 5.2.1 Check Node Status

The status of the online nodes can be checked using the MAVLink console. This will indicate if the modules are successfully connected to the DroneCAN bus. Enter “uavcan status” into the console to check on the status of the connected DroneCAN nodes. This will print out data about the flight controller’s DroneCAN status. The most interesting section is the listing of “Online nodes”. This should include information on all of the nodes connected to the flight controller, with their assigned node IDs and status. All of the nodes should report they are “OK” and “OPERATIONAL”. The image below shows an example where one module is connected to the flight controller, with node ID 99.

## 5.2.2 Test Throttle

It is also possible to test spinning the module in this console using the `motor_test` command. Typing “`motor_test -h`” in the console will provide help on how to use the command. As a basic example, to spin the motor with an ESC index of 1 at 20% of its maximum, you could use the command “`motor_test test -m 1 -p 20`”. The image below shows some examples of using the `motor_test` command.

```
nsh> motor_test test -m 0 -p 20
INFO [motor_test] motor 0 set to 0.20
nsh>
nsh>
nsh>
nsh>
nsh>
nsh>
nsh>
nsh>
nsh> motor_test test -m 1 -p 50
INFO [motor_test] motor 1 set to 0.50
nsh>
nsh> motor_test stop
INFO [motor_test] motors stop command sent
nsh>
```

## 5.3 Virtual Joysticks

For a test that is closer to actual flight, the [Virtual Joysticks](#) in PX4 can be used to control connected modules while the flight controller is connected to a computer. Enable the virtual joysticks as detailed in the PX4 documentation, and ensure that all Vertiq modules are powered on and connected to the CAN bus.

Return to the home screen of PX4. If the flight controller is fully setup, it should say “Ready To Fly”. Lower the virtual throttle joystick to 0, click on where it says “Ready To Fly”, and arm the flight controller using the Arm button. Moving the virtual joysticks should cause the modules to



respond as the flight controller begins sending commands. Switching to Manual mode may simplify this testing.