Connecting the Pixhawk Flight Controller to the Intel® Aero Compute Board

The Aero Compute Board can connect to a variety of sensors and controllers through a variety of electrical interfaces. A popular usage is to connect the Compute Board to a Pixhawk flight controller. This can be done using the Compute Board's high-speed UART (HSUART). This application note provides the necessary instructions for connecting the hardware and configuring the software.

Though these instructions are specifically for the Pixhawk flight controller, any flight controller with a UART interface can be attached.

Instructions

1) Run the Latest Aero Software:

   Ensure the Aero Compute Board software is up to date by following these instructions:
   https://github.com/intel-aero/meta-intel-aero/wiki/Upgrade-To-Latest-Software-Release

2) Configure the On-board Altera Max 10 FPGA:

   The on-board Altera Max 10 FPGA must be configured to disconnect from the HSUART. Specifically, pins **B11** and **B12** must be tri-stated.

   An FPGA configuration file (JAM) with the necessary changes is distributed as part of the software release starting with the 01.00.03 release.

   ```
   /etc/aero_compute_board_only_fpga.jam
   ```

   Follow the instructions for using this configuration file to update the FPGA:
   https://github.com/intel-aero/meta-intel-aero/wiki/Quickstart-Guide#updating-the-fpga-firmware

   If the FPGA is configured for other purposes, ensure pins **B11** and **B12** are tri-stated in order to communicate to the external flight controller using this HSUART.

   General instructions for programming the on-board FPGA can be found here:
   https://github.com/intel-aero/meta-intel-aero/wiki/FPGA-Programming

3) Connect Pixhawk Flight Controller over USB and configure TELEM2 as the Companion Link.

    With QGroundControl, modify the parameter SYS_COMPANION to "Companion Link (57600 baud, 8N1)".
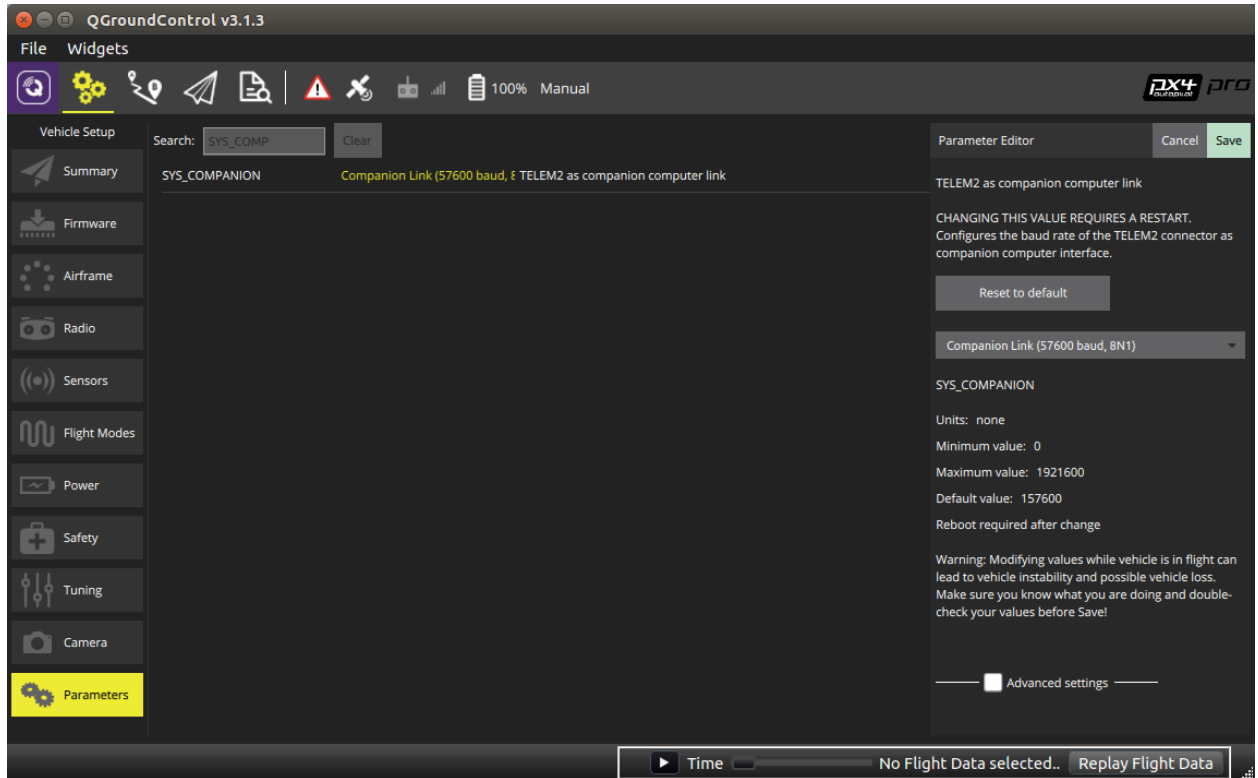
4) Configure mavlink router on the Intel Aero Compute Board to match Pixhawk baudrate setting.

    From Aero's Linux shell, modify the /etc/init.d/mavlink_router.sh script. Change the "-b" parameter under start function to the desired baudrate.

    ```
    start() {
            /usr/bin/mavlink-routerd -b 57600 -e 192.168.7.255 -e 192.168.1.255 /dev/ttyS1 &
    }
    ```
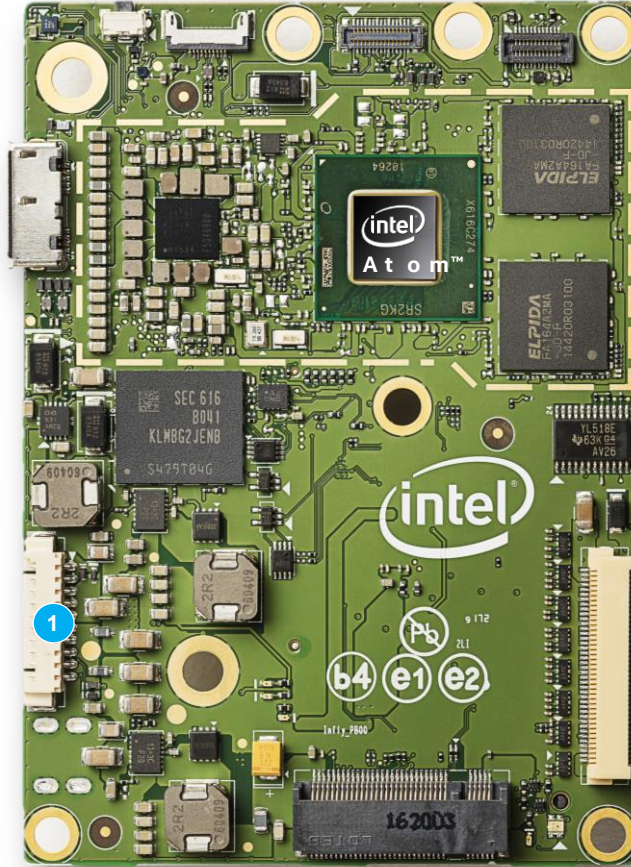
    Restart mavlink router with the following commands.

    ```
    $ /etc/init.d/mavlink_router.sh stop
    $ /etc/init.d/mavlink_router.sh start
    ```

5) Connect to the Intel Aero Compute Board:

The Compute Board's HSUART is accessible using the connector labeled **1** in Figure 1.

Figure 1. Power + UART Connector on the Intel Aero Compute Board

Connect to the UART port using the power cable that was shipped with the Intel Aero Compute Board. This cable has a 3-pin header split off to access the UART pins.

NOTE: In this document, when referring to the Aero UART port, it is the same as the HSUART.

Figure 2. Power + UART Cable

The pinout for the Power + UART connector is shown in Table 1. Connector Pin 1 is identified on the printed circuit board with the white triangle.

Table 1: Pin Assignment for the Power + UART Connector

| Pin#	Net Name	
1	+VIN	
2	+VIN	
3	GND	
4	GND	
5	GND	
6	+VIN	
7	+VIN	
8	GND	
9	UART_TX (3.3V)	*Yellow wire (Output from Aero)*
10	UART_RX (3.3V)	*Blue wire (Input to Aero)*

The UART interface is 3.3V tolerant. Do not exceed 3.6V.

Input voltage (+VIN): +5V DC

Access this UART as **/dev/ttyS1** through the Aero Linux software stack.

6) Connect to the Pixhawk Flight Controller:

Connect the Aero UART port to the Pixhawk flight controller through its Telemetry (UART) interface "**Telem 2**". Keep in mind that the TX from Aero should go to RX of Pixhawk and RX from Aero goes to TX of Pixhawk.

Figure 3. Pixhawk Flight Controller Connector Description
source: https://pixhawk.org/modules/pixhawk
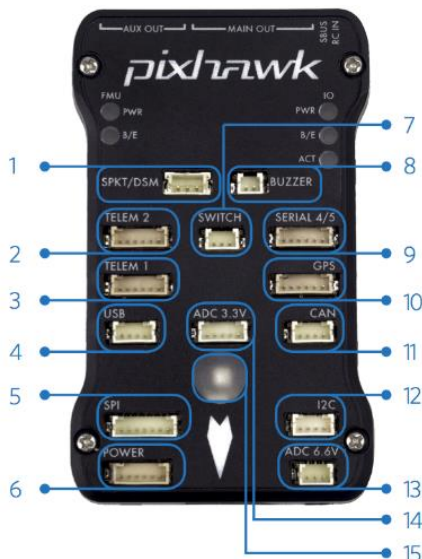
1 Spektrum DSM receiver
2 Telemetry (radio telemetry)
3 Telemetry (on-screen display)
4 USB
5 SPI (serial peripheral interface) bus
6 Power module
7 Safety switch button
8 Buzzer
9 Serial
10 GPS module
11 CAN (controller area network) bus
12 I²C splitter or compass module
13 Analog to digital converter 6.6 V
14 Analog to digital converter 3.3 V
15 LED indicator

Pinouts

TELEM1, TELEM2 ports

Pin	Signal	Volt
1 (red)	VCC	+5V
2 (blk)	TX (OUT)	+3.3V
3 (blk)	RX (IN)	+3.3V
4 (blk)	CTS (IN)	+3.3V
5 (blk)	RTS (OUT)	+3.3V
6 (blk)	GND	GND

7) Power the Aero Compute Board for Flight:

The Aero Compute Board should be powered directly from the drone's power distribution board. Feed power through the power + UART connector ❶ in Figure 1.

a) Input voltage: **+5V DC**

b) Option #1 – Modify the supplied power + UART cable (Figure 2) by removing the barrel connector and connecting +VIN and GND per the pinout described in Table 1.

c) Option #2 – Make a custom power + UART cable
- ‹ The connector on the Aero Compute Board = Molex # 53261-1071
- ‹ Recommended mating connector for power cable = Molex # 0510211000