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Guides and Resources: Hardware - QBot 2

Embedded Compute Module

This document provides information on the QBot 2's Embedded Compute module and expansion DAQ.

Embedded Computer - Duovero-Y Zephyr

The Gumstix DuoVero is a small-scale embedded computer that runs the QUARC® runtime. With QUARC® installed, code generated from Matlab® Simulink® is cross-compiled, downloaded, and executed directly on the DuoVero. The DuoVero is connected directly to the QBot 2 DAQ on the bottom side of the PCB.

Table 1: Gumstix Duovero-Y Zephyr specifications	
Item	**Description**
Processor	ARM Cortex-A9 dual-core 1.00 GHz
Memory	1-GB LPDDR3-1600 RAM
FPGA	Altera Max 10 (Preconfigured for expandable IO)
Wifi	IEEE 802.11 b,g,n,

Quanser Expansion Data Acquisition (DAQ) Card

The QBot 2 DAQ contains the wiring and circuitry integrating the DuoVero embedded computer, Kobuki robot, Kinect sensor, and additional input/output (I/O) components connected to the DAQ. Figure 1 shows the QBot 2 DAQ with accessible I/O headers for the user including SPI, I2C, UART, digital I/O, analog input, encoder input, and PWM output. The QBot 2 DAQ connects to the Kinect sensor via a USB port (see Figure 2). The QBot 2 DAQ connects to the Kobuki via a ribbon cable (see Figure 2). The QBot 2 DAQ is powered via a cable connected to the Kobuki 12V and 5A power source (see Figure 2).

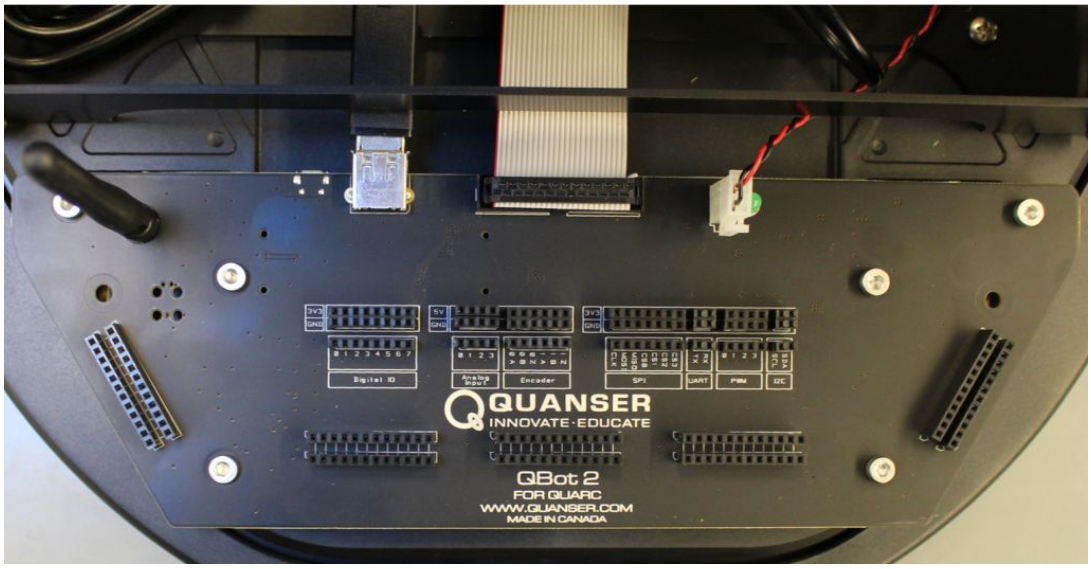

Figure 1 - The QBot 2 DAQ

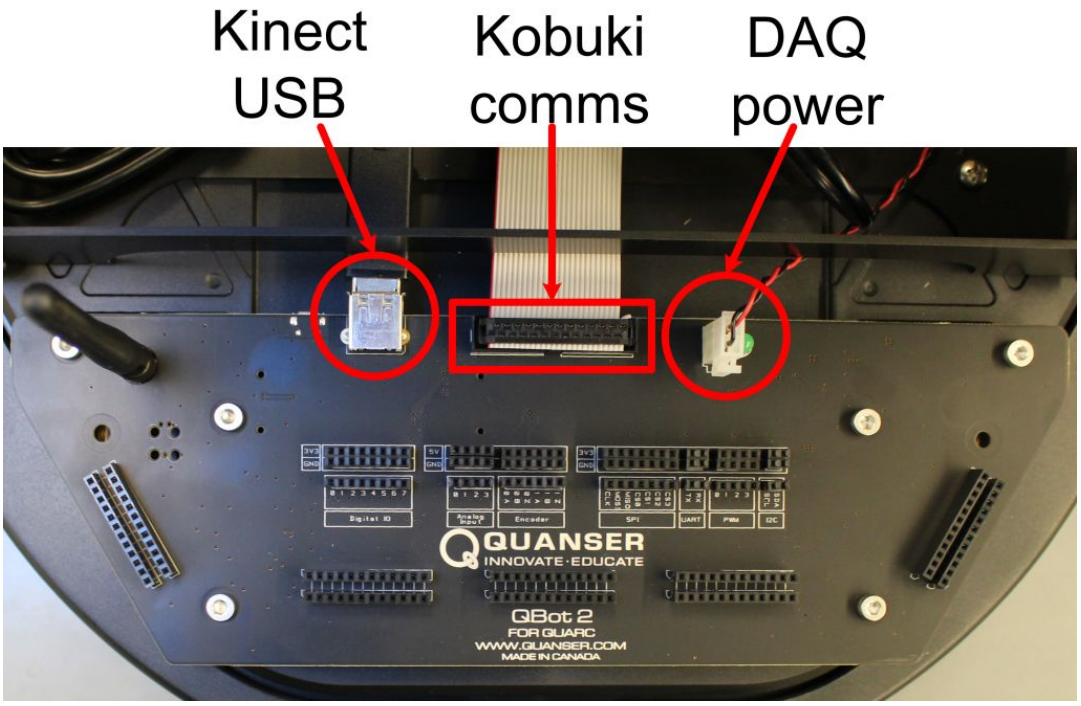

Figure 2 - The QBot 2 DAQ connectors

The QBot 2 DAQ also provides five headers for users to use when integrating additional I/O components. Each header is a double row where each pin in the first row is electrically connected to the pin in the second row directly opposite. This allows users to connect a sensor to one row and map the connection from the DAQ I/O to the pins in the mating row similar to a breadboard. Figure 3 shows the location of the headers.

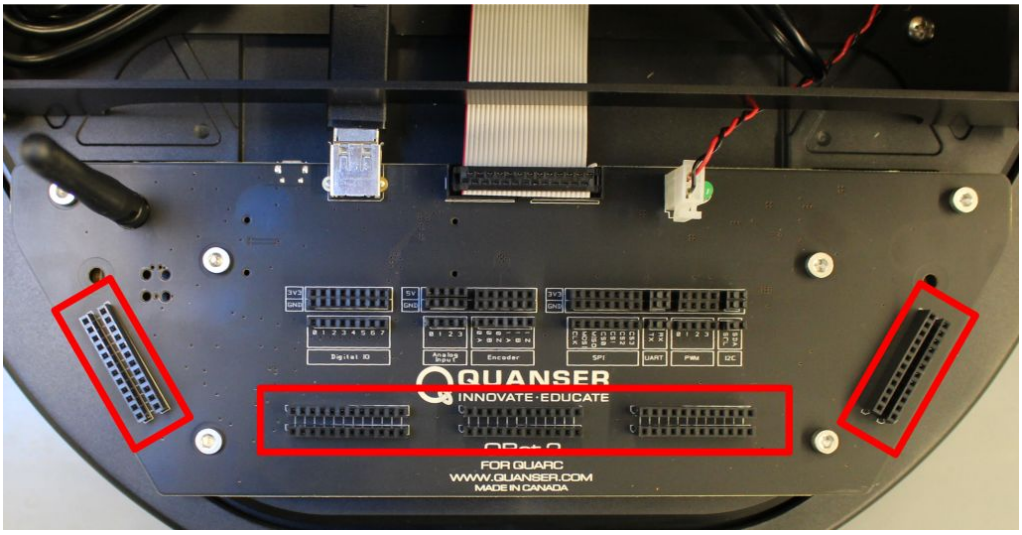

Figure 3 - The QBot 2 DAQ sensor mounting rows

Digital Input/Output Pins (DIO)

The user DIO channels (Figure 4) are set as inputs by default. Each of the DIO channels need to be configured as either inputs (or outputs, but not both) using the HIL Initialize block. Also, if an output needs to be in a known state on power up, it is recommended that a 10k resistor is put from the I/O to 5 V or GND as needed. The DIO channels are accessed through the HIL API.

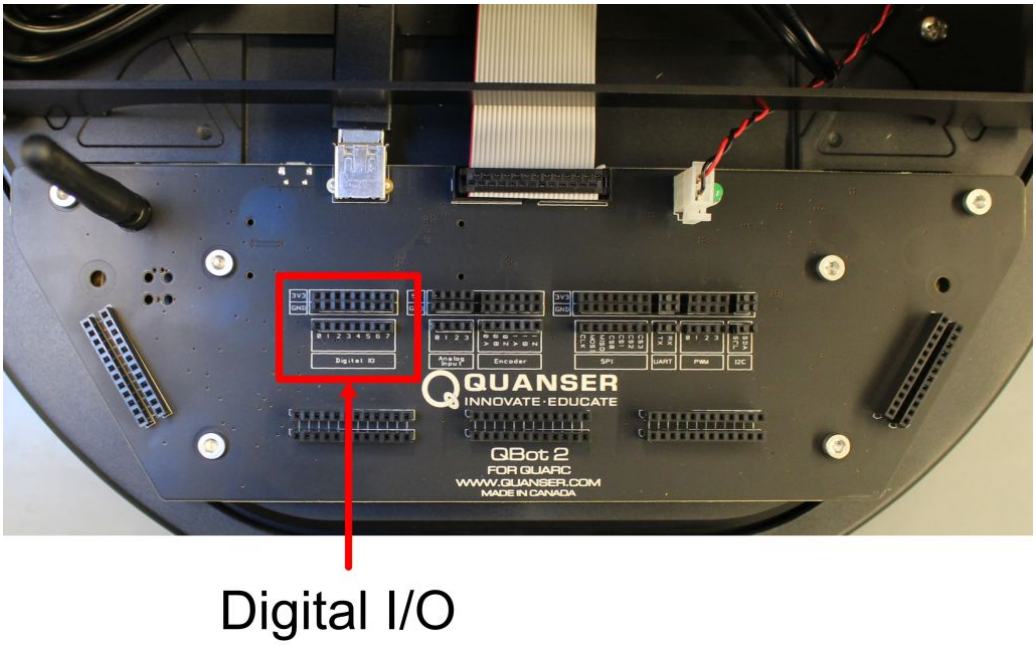

Figure 4 - The QBot 2 DAQ user digital I/O (3.3V)

Analog inputs

The QBot 2 provides four user analog input channels (Figure 5) that are rated for signals between 0- 5 V and uses 12-bit analog to digital converters (ADCs). The analog inputs are accessed through the HIL API.

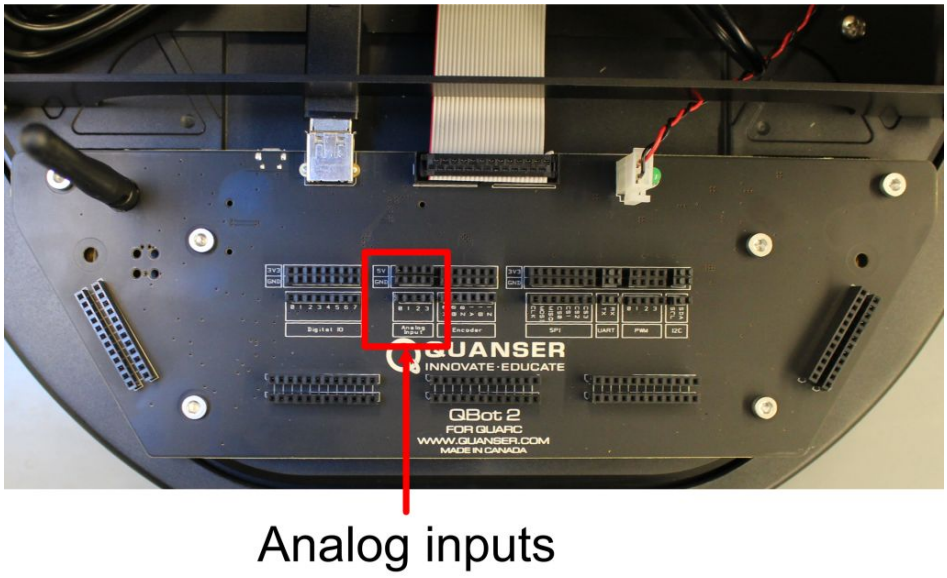

Figure 5 - The QBot 2 DAQ user analog inputs (5V)

Encoder inputs

The QBot 2 provides two user encoder input channels (Figure 6). Each encoder input channel has an A and B pulse as well as a Z index signal. The encoders are sampled at 100 kHz. The encoder inputs are accessed through the HIL API.

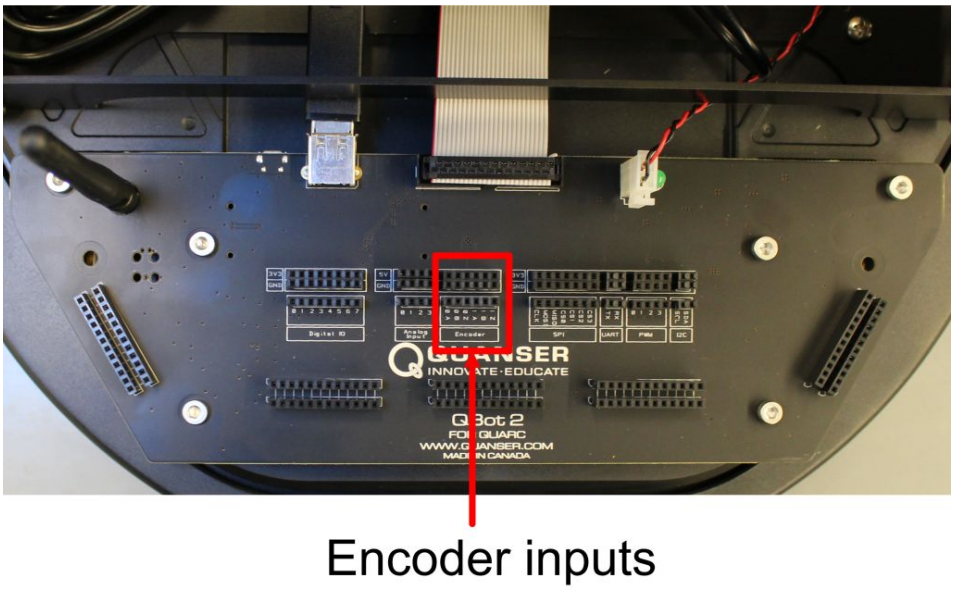

Figure 6 - The QBot 2 DAQ user encoder inputs (5V)

PWM

The QBot 2 provides four user PWM outputs (Figure 7) that users can configure to output pulse-width modulated digital signals.

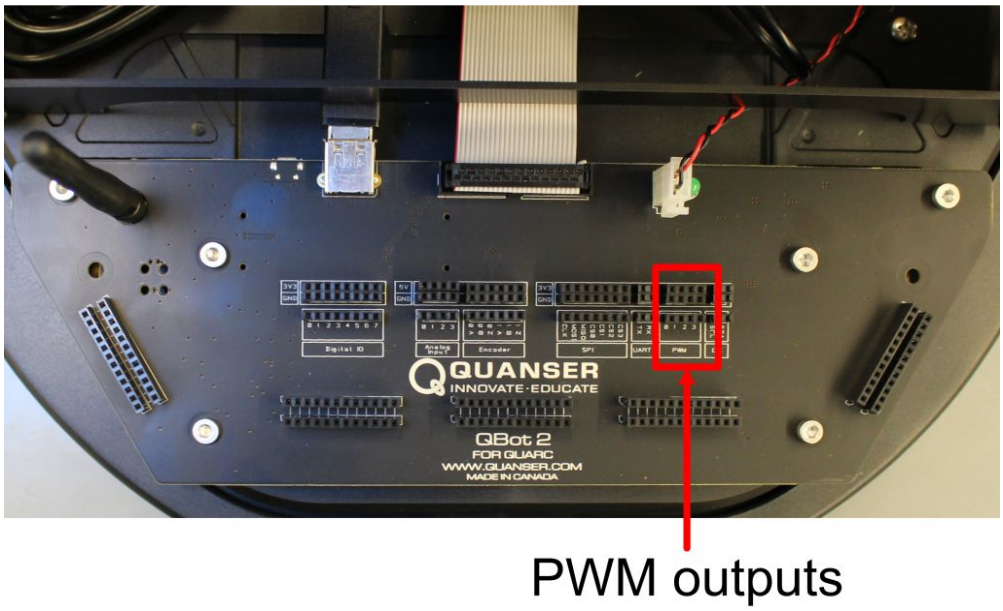

Figure 7 - The QBot 2 DAQ user PWM outputs (3.3V)

SPI

The QBot 2 provides one Serial Peripheral Interface (SPI) bus (Figure 8), which is a synchronous serial data bus for interfacing other sensors or devices with the embedded computer. The SPI channel is accessed through the Steam API (see the SPI protocol in the QUARC® help).

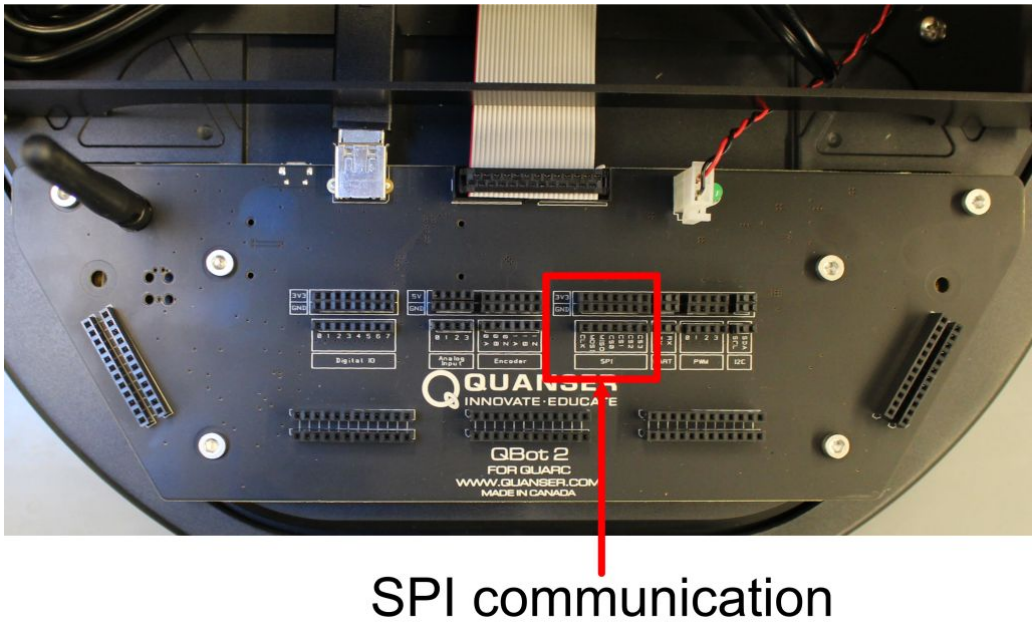

Figure 8 - The QBot 2 DAQ user SPI channel (3.3V)

UART

The QBot 2 provides one UART serial port (Figure 9) that can be used to interface with 3.3 V (TTL) serial devices. The UART is accessed through the Steam API (see the serial protocol in the QUARC® help).

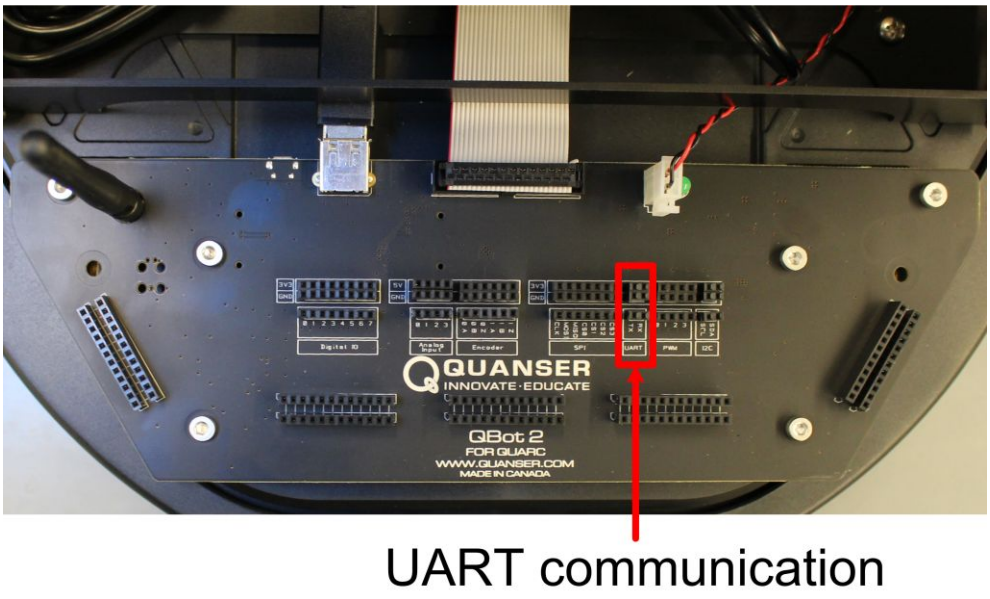

Figure 9 - The QBot 2 DAQ UART communication port (3.3V)

I²C

The QBot 2 provides one inter-integrated circuit (I2C) serial bus (Figure 10) for interfacing with external sensors and devices. The I2C channel is accessed through the Steam API (see the I²C protocol in the QUARC® help).

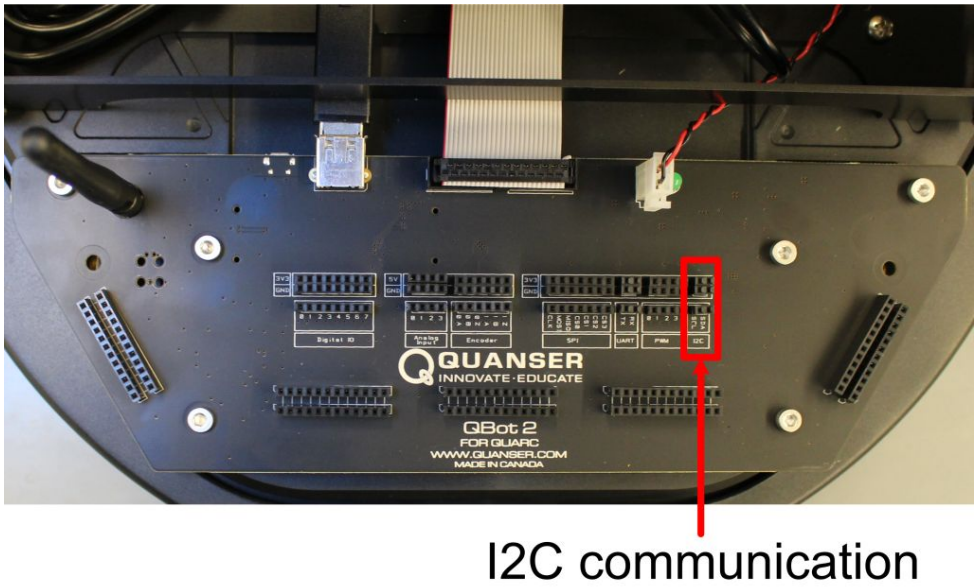

Figure 10 - The QBot 2 DAQ I²C communication port (3.3V)