USER MANUAL

Q2-USB Data Acquisition Board

Set Up and Configuration

FCC NOTICE
This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Waste Electrical and Electronic Equipment (WEEE)

This symbol indicates that waste products must be disposed of separately from municipal household waste, according to Directive 2002/96/EC of the European Parliament and the Council on waste electrical and electronic equipment (WEEE). All products at the end of their life cycle must be sent to a WEEE collection and recycling center. Proper WEEE disposal reduces the environmental impact and the risk to human health due to potentially hazardous substances used in such equipment. Your cooperation in proper WEEE disposal will contribute to the effective usage of natural resources. For information about the available collection and recycling scheme in a particular country, go to ni.com/citizenship/weee.

电子信息产品污染控制管理办法 （中国 RoHS）

中国客户 National Instruments 符合中国电子信息产品中限制使用某些有害物质命令 （RoHS）。
关于National Instruments 中国 RoHS合规性信息，请登录 ni.com/environment/rohs_china
(For information about China RoHS compliance, go to ni.com/environment/rohs_china)

CE Compliance C E

This product meets the essential requirements of applicable European Directives as follows:

- 2006/95/EC; Low-Voltage Directive (safety)
- 2004/108/EC; Electromagnetic Compatibility Directive (EMC)

CONTENTS

1 INTRODUCTION

The Quanser Q2-USB provides a cost-effective, portable data acquisition solution for control applications. This two-channel, USB-based device has the following features:

- Functions with QUARC®, LabVIEW™ or custom code

- No expensive or inflexible DSP used, all processing via CPU.

- Quick-connect terminal board and cabling provided

- Robust metal case

- Watchdog timer for maximum safety and flexibility

- Multiple OS compatibility: Windows XP, Windows Vista, Windows 7

- 500 mA self resettable fuse

⚠ **Caution:** **If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.**

⚠ **Caution:** **This equipment is designed to be used for educational and research purposes and is not intended for use by the general public. The user is responsible to ensure that the equipment will be used by technically qualified personnel only.**

⚠ **Caution:** Before handling the Q2-USB, make sure you touch something metal to ground yourself.

2 SPECIFICATIONS

The feature summary of the Q2-USB data acquisition board (DAQ) are listed below followed by the detailed specifications:

- USB 2.0 Hi-Speed Interface

- 8 Individually configurable digital inputs/outputs (I/O)

- 2 Pulse-width modulated (PWM) outputs available on DIO pins with independent clocks

- 2 Analog to digital (A/D) converters, i.e analog input channels.

- 2 Digital to analog (D/A) converters, i.e analog output channels.

- 2 Single-ended encoder inputs with 4X quadrature decoding

- Configurable state of analog, PWM and digital outputs on watchdog expiry

- Duty cycle and active pulse time PWM modes

- LED status

- 500 mA self resettable fuse

- Real-time target support for Quanser QUARC Windows target and NI LabVIEW

- OS Drivers: Microsoft Windows XP, Windows Vista, Windows 7

- API: C, C++, ActiveX, .NET (Visual Basic, C#, C++ and others), LabVIEW, MATLAB, and Simulink

Analog Input Specifications	Value
Analog Input Specifications Number of Channels	2
Resolution	12-bit
Input Range	$\pm$ 10 V
Conversion Time	250 ns[1]
Input impedance	10 MΩ
Max full scale range (FSR) error	$\pm$ 10 LSB

Table 2.1: Q2-USB Analog Input Specifications

Analog Output Specifications	Value
Number of Channels	2
Resolution	12-bit
Output Voltage Range	$\pm$ 10 V
Slew Rate	3.5 V/μS
Non-linearity	$\pm$ 1 LSB
Max full scale range (FSR) error	$\pm$ 12 LSB
Conversion Time (to within FSR error)	10 μ_S[1]
Short-circuit current clamp	20 mA
Max load for specified performance	2 KΩ
Max capacitive load stability	4000 pF
DC output impedance	0.5 Ω

Table 2.2: Q2-USB Analog Output Specifications

[1]the effective conversion time will be limited by the USB communications at a 125μs clock rate
[2]Pins 0 and 1 of the digital I/O
[3]This is dependent on the frequency selected for the PWM

Digital Input Specifications	Value
Number of digital I/O Lines	8
Input Low	0.66 v
Input High	2.31 V
Input leakage current	$\pm$ 2 μA

Table 2.3: Q2-USB Digital Input Specifications

Digital Output Specifications	Value
Number of digital I/O Lines	8
Output Low (Max)	0.4 v
Output High (Min)	2.40 V
Output High (Typical)	3.3 V
Maximum drive current	$\pm$ 4 mA

Table 2.4: Q2-USB Digital Output Specifications

Encoder Input Specifications	Value
Number of encoder inputs	2
Input Low	0.66 V
Input High	2.31 V
Input leakage current	$\pm$ 2 μA
Max. A and B Frequency in Quadrature	6 MHz
Max. Count Frequency in 4X Quadrature	10 MHz

Table 2.5: Q2-USB Encoder Input Specifications

PWM Output Specifications	Value
Number of PWM outputs	2^2
Output Low (Max)	0.40 V
Output High (Min)	2.40 V
Output High (Typical)	3.3 V
Maximum Drive Current	$\pm$ 4 mA
Minimum frequency	2.385 Hz
Maximum frequency	40 MHz
Bits resolution	16 bits[3]

Table 2.6: Q2-USB PWM Output Specifications

3 COMPONENTS

3.1 Component Nomenclature

The components on the Q2-USB are depicted in below. Each component on the board has an identification number that corresponds to a short description given in Table 3.1.
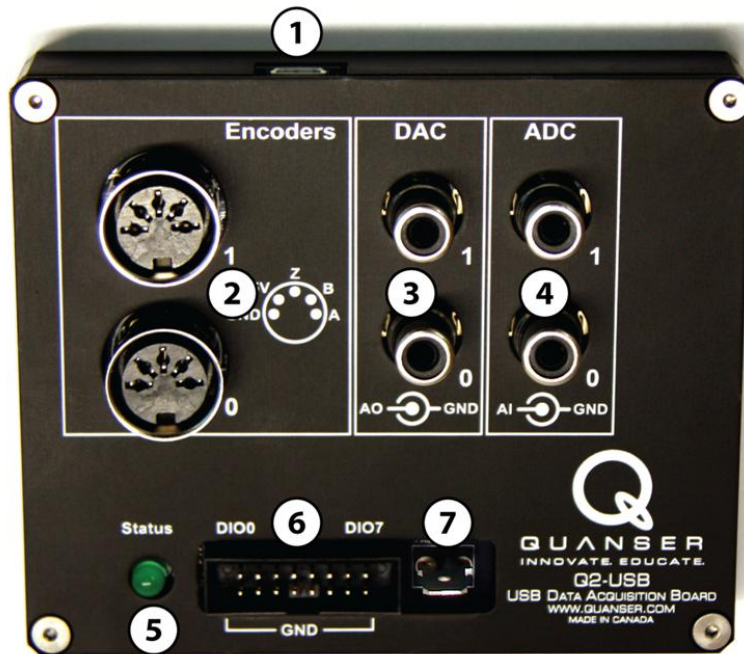

Figure 3.1: Q2-USB

ID	Description	ID	Description
1	Mini USB connector	5	Power/Watchdog LED
2	Encoder input connectors	6	Digital I/O connectors
3	Analog output connectors	7	Ground lug
4	Analog input connectors		

Table 3.1: Q2-USB Components

3.2 Component Description

3.2.1 Analog Output

The *Analog Output* RCA connectors are shown in Figure 3.1 with ID #3. The 12-bit single-ended analog outputs have a range of ± 10 V. See Section 2 for more specifications.

The center pin of the RCA connection is the signal and the outer shell is ground.

3.2.2 Analog Input

The Q2-USB has two RCA *Analog Input* connectors, shown in Figure 3.1 with ID #4. The 12-bit single-ended analog inputs have a range of ± 10 V. See Section 2 for more specifications.

3.2.3 Digital I/O

The digital I/O (DIO) headers (ID #6) all have the pins on one side connected to digital ground, as indicated on the terminal board case. DIO0-DIO7 have a maximum output voltage of 3.3V when configured as digital outputs, but they can tolerate a maximum input of 5V when configured as digital inputs. Each digital output can source or sink a maximum of 4 mA. Digital output 0 and 1 can be configured as PWM outputs and are subject to the same electrical constraints.

3.2.4 Encoder Input

The Q2-USB has two 5-pin DIN *Encoder Input* connectors, shown in Figure 3.1 with ID #2. Each encoder can provide a 16-bit count values and only supports 4x quadrature. The initial encoder count can be specified. The encoder can also be configured to reload the intial encoder count on an index pulse, define on what edges of A, B, and Z (index) are used for the index pulse.

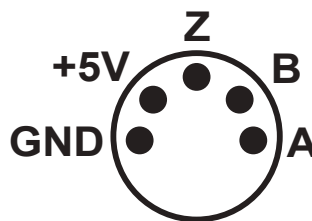The encoder pin-out is shown in Figure 3.2 when facing the front of the module.

Figure 3.2: Encoder pin-out

3.2.5 Ground Lug

The ground lug (ID #7) is connected to both analog and digital grounds. It is provided as a ground reference for testing and rapid prototyping purposes.

4 Q2-USB INSTALLATION

4.1 Hardware Installation

The Q2-USB consists of the DAQ board and a single USB 2.0 cable.

1. Read all instructions before proceeding.

2. Install either LabVIEW™ with NI-DAQmx and Quanser Rapid Control Prototyping Toolkit® or QUARC®. Be sure to accept the installation of any drivers if the installer warns you that they are not signed.

3. When the necessary software is installed, make sure your computer is powered ON and you are logged on.

4. Touch any metal part of the computer to discharge any static electricity.

5. Using the USB cable, connect the **USB connector** on the Q2-USB DAQ device to a **USB 2.0 port** on the computer.
   Note: For the most consistent sample times, it is preferable to use a USB hub that is not occupied by any other USB devices.

6. Follow the driver installation instructions for your operating system in 4.2

4.2 Driver Installation for Windows 7

The driver for the Q2-USB is preinstalled during the QUARC Installation or during the Quanser Rapid Control Prototyping Toolkit software installation. After you plug in the device for the first time, a pop-up balloon will indicate that it is searching for the driver.
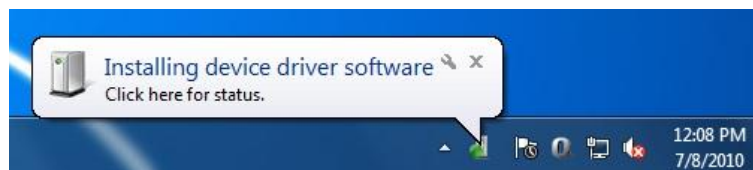
Upon completion, Windows will notify you that the device is ready for use.
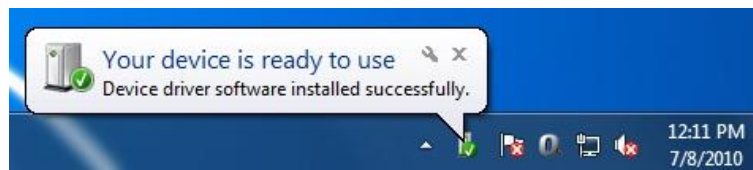
4.3 Q2-USB Software Examples

4.3.1 LabVIEW Users

- Make sure NI-DAQmx and Quanser Rapid Control Prototyping Toolkit® have been installed.

- For the Quanser RCP-related example VIs, go to *Find Examples* in LabVIEW and look under the *Toolkits and Modules | Quanser Rapid Control Prototyping* category.

4.3.2 Matlab/Simulink Users

- Make sure QUARC®has been installed.

- Refer to the MATLAB Help page under QUARC Targets/User's Guide/Accessing Hardware. In the HIL Initialize Block, the Board Type will be listed as **q2_usb**.

- Refer to the MATLAB Help pages under QUARC Targets/User's Guide/QUARC Data Acquisition Card Support/Quanser Cards/Q2-USB. [1]

5 TROUBLESHOOTING

Please review the following before contacting Quanser technical support.

Make sure you have setup and tested the Q2-USB as outlined in its **Quick Start Guide** (found on the Q2-USB Resources CD).

If the *Status* LED on the Q2-USB is not lit:

- Make sure the USB 2.0 cable is connected from the Q2-USB board to an enabled USB 2.0 port on the computer.

- Verify that the corresponding cable is firmly connected in both the Q2-USB USB connector and the computer USB 2.0 port.

- Unplug the USB 2.0 cable from the Q2-USB port and plug it back in.

- Try using different USB 2.0 port on your computer.

- Try using a diffent USB 2.0 cable.

If the analog output fails to respond to your command:

- Unplug the USB 2.0 cable from the Q2-USB port and plug it back in.

6 TECHNICAL SUPPORT

To obtain support from Quanser, go to http://www.quanser.com/ and click on the Tech Support link. Fill in the form with all the requested software and hardware information as well as a description of the problem encountered. Also, make sure your e-mail address and telephone number are included. Submit the form and a technical support person will contact you.

REFERENCES

[1] Quanser Inc. *QUARC User Manual*.

Data acquisition and control interface solutions for education and research

▶ **Q2-USB**

▶ **QPID**

▶ **QPIDe**

▶ **Q1-cRIO**

▶ **Q8-USB**

▶ **NI Terminal Board**

Quanser's range of data acquisition and control solutions includes PCI and USB-based boards and the NI CompactRIO-based data acquisition module. These devices offer unmatched convenience and performance for controls system design and implementation. To learn more about which devices can best support your teaching or research needs, please contact info@quanser.com.

QUANSER
INNOVATE. EDUCATE.

INFO@QUANSER.COM   +1-905-940-3575   QUANSER.COM

Solutions for teaching and research. Made in Canada.