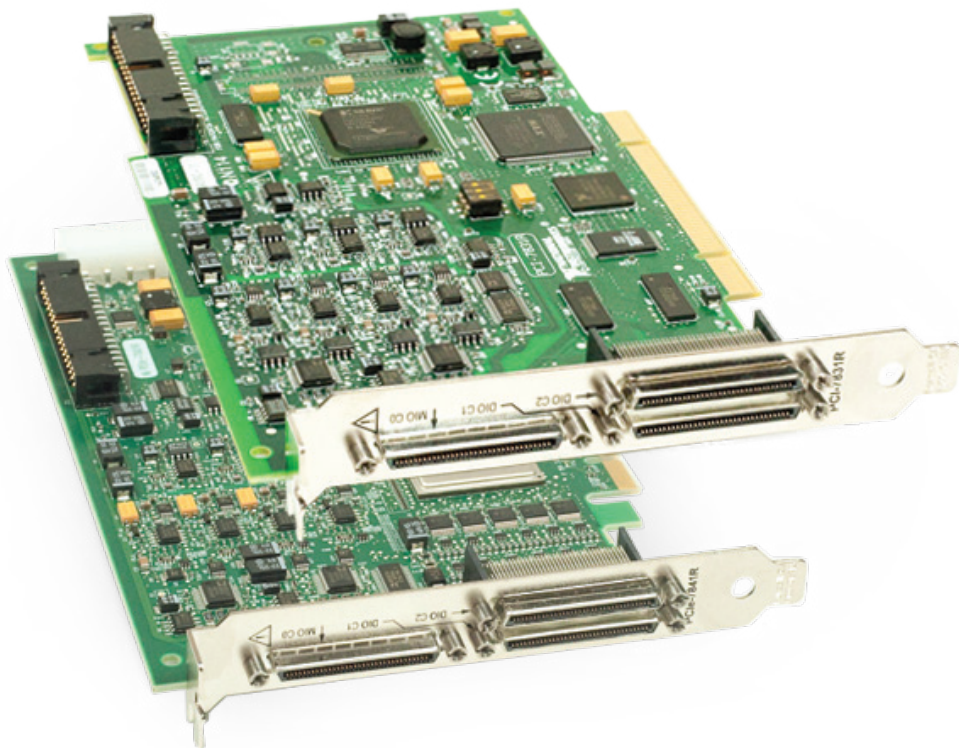




# USER MANUAL

## QPID/QPIdE Data Acquisition Device

Set Up and Configuration



CAPTIVATE. MOTIVATE. GRADUATE.

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For regulatory information about this product, please refer to the National Instruments documentation of NI PCI-7831R or NI-PCle-7841R.

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# 1 PRESENTATION

The Quanser Personality Intelligent Data Acquisition (QPID) device is a versatile and powerful real-time measurement and control board. The **QPID** is a PCI based DAQ board and the **QPIDe** is a PCI Express device. They are both based on the National Instruments Reconfigurable I/O (RIO) technology. With ultra-low I/O conversion times and simultaneous sampling of each I/O type, the QPID and QPIDe are suitable for all complex controls configurations for research and teaching control concepts. They have an extensive range of hardware and software features and include the following:

- 8 Analog input (A/D) channels
- 8 Analog output (D/A) channels
- 8 Pulse-width modulation (PWM) channels
- 8 Encoder inputs
- 56 Digital input/output
- Optimized for real-time control performance with proven real-time targets or custom code
- Programmable counters and watchdog timer for maximum safety and flexibility
- Encoder velocities are provided using on-board filtering
- Multiple OS compatibility: Windows XP, Windows Vista, Windows 7

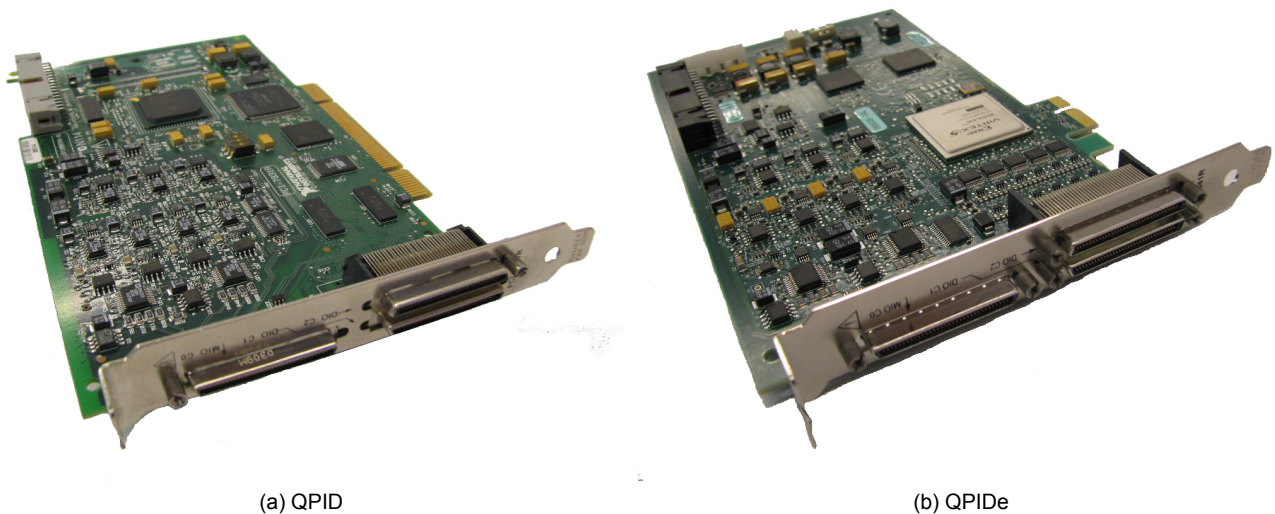


Figure 1.1: Quanser QPID and QPIDe Devices

The QPID and QPIDe are supplied with the terminal board shown in Figure 1.2. The terminal board has a robust, metal case and allows for quick and easy connections to the DAQ input/output signals.



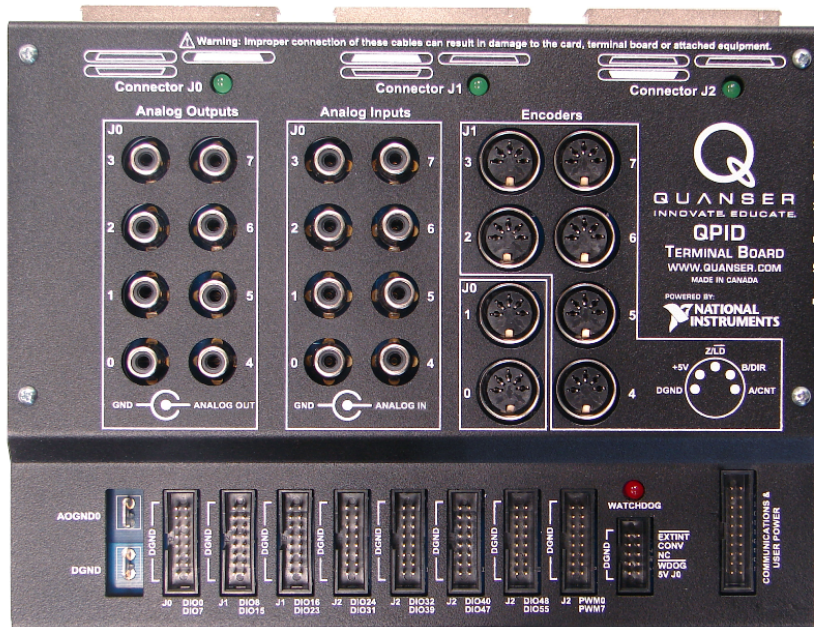


Figure 1.2: Terminal Board



**Caution:** Improper connection of the equipment can result in damage. See Section 4.5 for instructions on how to connect the cables from the QPID or QPIDe device to the terminal board.



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

## 2 SPECIFICATIONS

The specifications of the QPID/QPIDe are listed in Table 2.1 through Table 2.8. The QPID/QPIDe features are summarized below:

- Simultaneous sampling of analog to digital (A/D) converters, encoders, and 32-bit groups of digital inputs.
- Simultaneous update of 32-bit groups of digital outputs, pulse-width modulation (PWM) channels and pairs of digital to analog (D/A) converters.
- Known state of analog outputs, PWM outputs and digital I/O on power-up or reset.
- State of analog, PWM and digital outputs is configurable on expiry of the watchdog.
- Analog outputs are optionally configurable as bipolar PWM.
- Hardware 1X quadrature encoder velocities on the QPID and 4X quadrature encoder velocities on the QPIDe.
- Single-ended encoder inputs
- Individually programmable encoder configurations:
  - 24-bit counter value
  - direction
  - whether to use enabling/disabling filtering
  - polarities of A, B and Z on an index pulse
  - enabling/disabling encoder reset on index pulse
- Common encoder filter frequency configurable
- Counter value at last index pulse
- Individually software programmable digital I/O
- Optional triggering of A/D conversions using 24-bit counter
- One 24-bit counter configurable as watchdog timer
- Watchdog state available on terminal board Control header for applications such as emergency stop
- Counter and watchdog output may be routed to RTSI (real-time system integration) header on QPID/QPIDe board for synchronizing multiple boards
- Leading, centered or trailing edge alignment of PWM outputs
- PWM modes: duty cycle, frequency, period, one-shot and time
- Unipolar, bipolar, paired and complementary PWM configurations with deadband controls
- Configurable polarity and phase of Serial Peripheral Interface (SPI)
- Configurable bit width between 1 and 32 bits on SPI
- SPI integrated into Quanser Stream API (application programming interface)
- Fused terminal board with LED (light-emitting diode) status
- Fuse monitoring with watchdog and interrupt capability
- External A/D conversion triggering support
- Single-ended digital to analog (D/A) converters and support for both single-ended and ground-referenced signals on analog to digital (A/D) converters.

- Target support for Quanser **QUARC®** and **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	QPID	QPIDe
Number of Channels	8	8
Resolution	16-bit	16-bit
Input signal range	$\pm 10$ V	$\pm 10$ V
Conversion time	4 $\mu$ S	4 $\mu$ S
Input impedance	10 G $\Omega$ in parallel with 100 pF	10 G $\Omega$ in parallel with 100 pF
Input bias current	$\pm 2$ nA	$\pm 5$ nA
Input offset current	$\pm 1$ nA	$\pm 5$ nA
Integral non-linearity (INL)	$\pm 6$ LSB max	$\pm 3$ LSB max
Differential non-linearity (DNL)	-1 to +2 LSB max	$\pm 0.9$ LSB max
Absolute accuracy at full scale	$\pm 7.78$ mV	$\pm 3.97$ mV

Table 2.1: QPID/QPIDe Analog Input Specifications

Analog Output Specifications	QPID	QPIDe
Number of Channels	8	8
Resolution	16-bit	16-bit
Output signal range	$\pm 10$ V	$\pm 10$ V
Conversion time	1 $\mu$ S	1 $\mu$ S
Slew rate	10 V/ $\mu$ S	10 V/ $\mu$ S
Output impedance	1.25 $\Omega$	0.5 $\Omega$
Drive current	$\pm 2.5$ mA	$\pm 2.5$ mA
Integral non-linearity (INL)	$\pm 4$ LSB max	$\pm 4$ LSB max
Differential non-linearity (DNL)	$\pm 1$ LSB max	$\pm 1$ LSB max
Absolute accuracy at full scale	$\pm 5.88$ mV	$\pm 5.88$ mV
Noise (DC to 1 MHz)	150 $\mu$ V rms	150 $\mu$ V rms

Table 2.2: QPID/QPIDe Analog Output Specifications

Digital Input Specifications	QPID / QPIDe
Number of digital I/O lines	56
Low-level input voltage	0 V min, 0.8 V max
High-level input voltage	2.0 V min, 5.5 V max
Input leakage current	$\pm 10$ $\mu$ A

Table 2.3: QPID/QPIDe Digital Input Specifications

Digital Output Specifications	QPID / QPIDe
Number of digital I/O lines	56
Low-level output voltage	0 V min, 0.4 V max
High-level output voltage	2.4 V min, 3.3 V max
Drive current	$\pm 4$ mA

Table 2.4: QPID/QPIDe Digital Output Specifications

<sup>1</sup>This is dependent on the frequency selected for the PWM

Counter Timer Specifications	QPID / QPIDE
General purpose 16-bit counter-timers	2
16-bit counter timers resolution	800 nS
General purpose 24-bit counter timers	2
24-bit counter timers resolution	25 nS

Table 2.5: QPID/QPIDE Counter Timer Specifications

SPI Specifications	QPID / QPIDE
SPI word length	1 to 32 bits
SPI data rate	Up to 10 MHz

Table 2.6: QPID/QPIDE SPI Specifications

Encoder Input Specifications	QPID / QPIDE
Quadrature encoder input channels	8
Encoder counter size	24-bit
Max. A and B frequency in quadrature	10 MHz
Max. A and B frequency in quadrature with filtering	5 MHz
Max. count frequency in 4X quadrature	40 MHz
Max. count frequency in 4X quadrature with filtering	20 MHz
Max. count frequency in non-quadrature	20 MHz
Low-level input voltage	0 V min, 0.8 V max
High-level input voltage	2.0 V min, 5.5 V max
Input leakage current	$\pm 10 \mu\text{A}$

Table 2.7: QPID/QPIDE Encoder Input Specifications

PWM Output Specifications	QPID / QPIDE
User programmable PWM outputs	8
Low-level output voltage	0 V min, 0.4 V max
High-level output voltage	2.4 V min, 3.3 V max
Drive current	$\pm 4 \text{ mA}$
Minimum frequency	9.5367 Hz
Maximum frequency	20 MHz
Resolution	16 bits <sup>1</sup>

Table 2.8: QPID/QPIDE PWM Output Specifications

# 3 COMPONENTS

## 3.1 Layout

The components on the QPID/QPIDe terminal board are depicted in Figure 3.1. Each component on the terminal board has an identification number that corresponds to a short description given in Table 3.1.

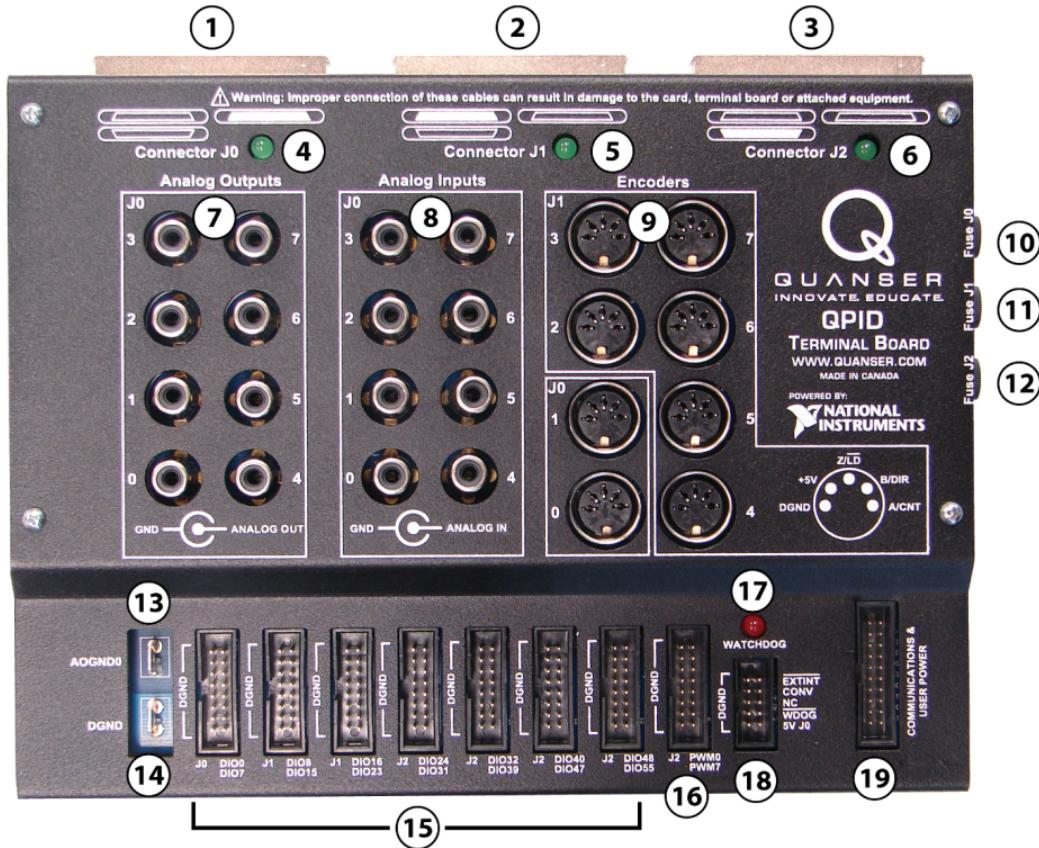


Figure 3.1: QPID/QPIDe Terminal Board

ID	Description	ID	Description
1	Connector J0	11	Fuse for Connector J1
2	Connector J1	12	Fuse for Connector J2
3	Connector J2	13	Analog ground lug
4	Power LED for Connector J0	14	Digital ground lug
5	Power LED for Connector J1	15	Digital I/O connectors
6	Power LED for Connector J2	16	PWM connector
7	Analog output connectors	17	Watchdog LED
8	Analog input connectors	18	Control connector
9	Encoder input connectors	19	Communication connector
10	Fuse for Connector J0		

Table 3.1: QPID/QPIDe Terminal Board Components



## 3.2 Description

As depicted in Figure 3.1, there are three large connectors coming out the side of the terminal board. Connector J0 (ID #1), Connector J1 (ID #2), and Connector J2 (ID #3) are used to connect the terminal board to the QPID/QPIDE device. The terminal board case is labeled to indicate which signals come from Connector J0, J1, and J2. See Table 3.1 for a summary.



**Caution:** Always ensure that the cables between the QPID/QPIDE device and the terminal board are connected correctly. The cables are not keyed. If a cable is connected to the wrong location, power and ground can be shorted, resulting in damage to the QPID/QPIDE device, terminal board, and/or attached equipment. See Section 4.5 for instructions on how to connect the cables.

### 3.2.1 Connectors

Connector J0, J1, and J2 each have a corresponding fuse and green power LED (light-emitting diode).

- The power LED (ID #4) for Connector J0 turns on when power is present at Connector J0, and the fuse (ID #10) for Connector J0 is good.
- The power LED (ID #5) for Connector J1 turns on when power is present at Connector J1, and the fuse (ID #11) for Connector J1 is good.
- The power LED (ID #6) for Connector J2 turns on when power is present at Connector J2, and the fuse (ID #12) for Connector J2 is good.

### 3.2.2 Analog Channels

The RCA connectors are for the analog inputs (ID #8) and analog outputs (ID #7). The analog inputs support either single-ended or ground-referenced differential inputs. **If you require floating differential analog inputs, please contact Quanser sales support.** The inner connection is for the signal (positive signal for differential) and the outer shell is for ground (negative signal for differential). For the analog outputs the inner connection is for the signal and the outer shell is for the ground. Only single-ended signals are produced by the analog outputs.

Each analog input and analog output has its own separate ground. These grounds may be connected together if desired, but they are not connected on the QPID/QPIDE terminal board. The analog ground lug (ID #13) is connected to the ground for analog output 0.

### 3.2.3 Ground Lugs

The digital ground lug (ID #14) is connected to digital ground. All the digital I/O, PWM and the encoders share the same digital ground.

### 3.2.4 Encoder Channels

The pinout for the encoder DIN connectors (ID #9) is indicated on the terminal board case. Encoders 0 and 1 are connected through Connector J0, and encoders 2 to 7 are connected through Connector J1.



**Caution:** For the QPIDE board, if the ATX power connection is not attached, only limited power will be available and the encoders may not be properly powered. This may also result in damage to the board.

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

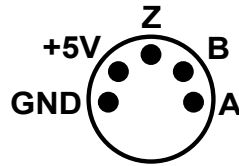


Figure 3.2: Encoder pin-out

### 3.2.5 Digital Channels

The digital I/O (DIO) headers (ID #15) all have the pins on one side connected to digital ground, as indicated on the terminal board case. DIO0-DIO7 are connected through Connector J0, DIO8-DIO23 are connected through Connector J1, and DIO24-DIO55 are connected through Connector J2.

### 3.2.6 PWM Outputs

The PWM header (ID #16) has all the pins on one side connected to digital ground, as indicated on the terminal board case. The PWM outputs are connected through Connector J2.

### 3.2.7 Watchdog LED

The Watchdog LED (ID #17) turns on if the watchdog is triggered, or if Connector J0 is unplugged. (The watchdog signal comes from Connector J0, so if Connector J0 is unplugged, the watchdog LED turns on as a reminder that there is no watchdog indicator.) If any of the fuses blow, the watchdog may optionally be triggered.

### 3.2.8 Control Header

The Control header (ID #18) has all the pins on one side connected to digital ground, as indicated on the terminal board case. The external interrupt input and convert input are connected through Connector J1. The watchdog output and +5V are connected through Connector J0. If Connector J0 is unplugged, +5V will not be available at the Control header.

### 3.2.9 Communication Header

The Communication header (ID #19) is used for SPI communications. SPI is connected through Connector J1. The Communication header also has four digital I/O pins from Connector J2. There are separate +5V supplies from Connectors J0, J1, and J2, so that at least one +5V supply is available for applications that don't require Connectors J0, J1, and J2 to all be connected. The pin-out for the Communication header is shown in .



**Caution: Do not connect the +5V supplies together.** Separate +5V supplies from Connectors J0, J1, and J2 are provided. These supplies should never be connected to each other.

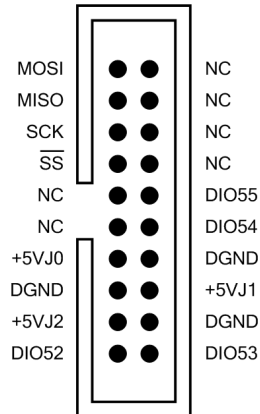


Figure 3.3: Communication Header Pin-out

### 3.3 Cable Nomenclature

Table 3.2 provides a description of the standard cables that are used to connect the QPID/QPIDE device to the terminal board. Table 3.3 summarizes the functions of each cable.



Cable	Type	Description
 (a) NI SHC68-68-RMIO cable	High-performance shielded 68-conductor cable terminated with a VHDCI 68-pin male connector at one end and a 68-pin female 0.050 D-type connector at the other.	The NI SHC68-68-RMIO cable has been designed and shielded specifically for the multifunction I/O (MIO) connectors. (Connector 0 on the QPID/QPIDE device, and Connector J0 on the terminal board). Beyond the basic external shielding, each of the analog input, analog output, and digital I/O sections has individual shielding and specific twisted pairs for high signal integrity and noise immunity.
 (b) NI SHC68-68-RDIO cable	High-performance shielded 68-conductor cable terminated with a VHDCI 68-pin male connector at one end and a 68-pin female 0.050 D-type connector at the other.	The NI SHC68-68-RDIO cable has been designed and shielded specifically for the digital I/O (DIO) connectors. (Connectors 1 and 2 on the QPID/QPIDE device, and Connectors J1 and J2 on the terminal board). Beyond the basic external shielding, each of the digital I/O lines is individually twisted with digital ground for high signal integrity and noise immunity.

Table 3.2: QPID/QPIDE Cables



## 3.4 Cable/Connector Functions

QPID/QPIDe Device	Terminal Board	Cable	Sticker Color	Function
Connector 0	Connector J0	NI SHC68-68-RMIO	Brown 	<ul style="list-style-type: none"> <li>• Analog inputs 0 to 7</li> <li>• Analog outputs 0 to 7</li> <li>• Encoder inputs 0 and 1</li> <li>• Digital I/O 0 to 7</li> <li>• Watchdog indicator</li> </ul>
Connector 1	Connector J1	NI SHC68-68-RDIO	Green 	<ul style="list-style-type: none"> <li>• Encoder inputs 2 to 7</li> <li>• Digital I/O 8 to 23</li> <li>• External interrupt input</li> <li>• Convert input</li> <li>• SPI interface</li> </ul>
Connector 2	Connector J2	NI SHC68-68-RDIO	Orange 	<ul style="list-style-type: none"> <li>• Digital I/O 24 to 55</li> <li>• PWM outputs 0 to 7</li> </ul>

Table 3.3: QPID/QPIDe Cable/Connector Functions

# 4 QPID/QPIDE INSTALLATION

## 4.1 Hardware Installation

The **QPID** data acquisition board is a **PCI** board. The **QPIDE** data acquisition board is a **PCIe** board.

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. Make sure you are properly grounded.



**Caution:** Quanser highly recommends that you wear proper ESD (electrostatic discharge) protection, such as a grounded wrist strap, when handling the QPID/QPIDE device. Quanser can not take responsibility for mishandling of the board.

4. Unplug your computer and remove the cover. (Turning off your computer may not remove power from the motherboard. Please unplug your computer to ensure power has been removed.)
5. Insert the QPID/QPIDE DAQ board into the PCI/PCIe slot. Excessive force is not required to insert the board. Once it is properly inserted, secure the board's mounting bracket to the computer chassis using the mounting screw.
6. If you are installing a **QPIDE** board (PCIe), attach a standard ATX (Advanced Technology Extended) peripheral power connector to the board.



**Caution:** If the ATX power connection is not attached on the QPIDE board, only limited power will be available and the encoders may not be properly powered. This may also result in damage to the board.

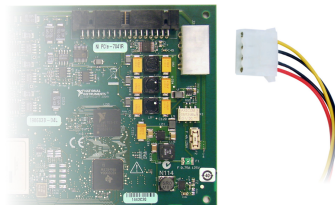
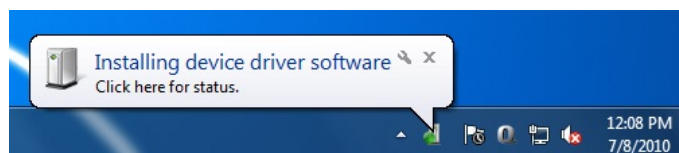


Figure 4.1: The ATX power connector for the QPIDE board

7. Plug in your computer and turn on the power.
8. After your computer has booted, it should automatically detect the installation of the new board. Follow the appropriate directions for your operating system to install the driver.

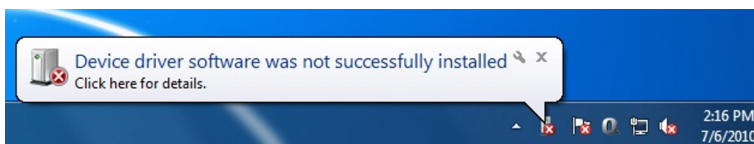
## 4.2 Driver Installation for Windows 7

After booting up your computer, it should automatically detect the presence of the QPID/QPIDE board and attempt to install a driver.



If you have a recent version of **LabVIEW™** installed, it will likely automatically install the driver for the NI PCI-7831R or 7841R. In that case, after installation is complete, please update the driver as instructed in Section 4.4.

If you do not have a recent version of **LabVIEW™** installed, the driver installation will fail. Manually update the driver as instructed in Section 4.4.



## 4.3 Manual Driver Updates

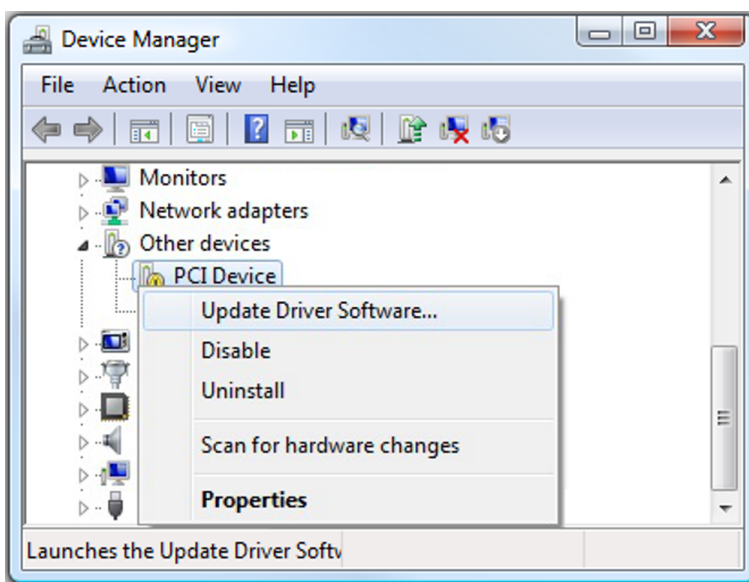
If you install LabVIEW after initially installing the QPID/QPIDE board, or if you already have a recent version of LabVIEW installed when you install the QPID/QPIDE board, the board may be identified as an NI PCI-7831R or 7841R. LabVIEW may automatically install the driver for the NI RIO board. In that case, the driver must be updated as outlined below.

The driver may also need to be updated if you receive an updated version of QUARC after initially installing the QPID/QPIDE board. If this is necessary, it will be indicated in the release notes.

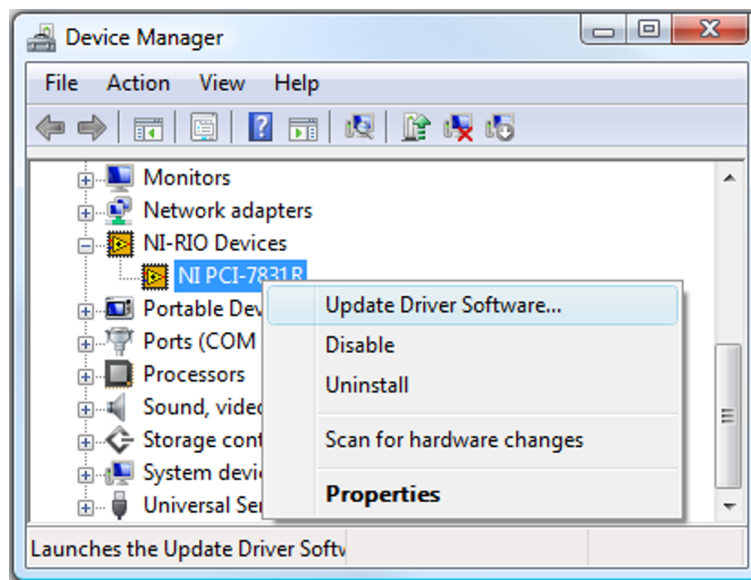
## 4.4 Windows 7 Manual Driver Update

Go to Control Panel, then Device Manager. If the Windows Security requests permission to continue, click Continue. The QPID/QPIDE board will show up in one of three locations:

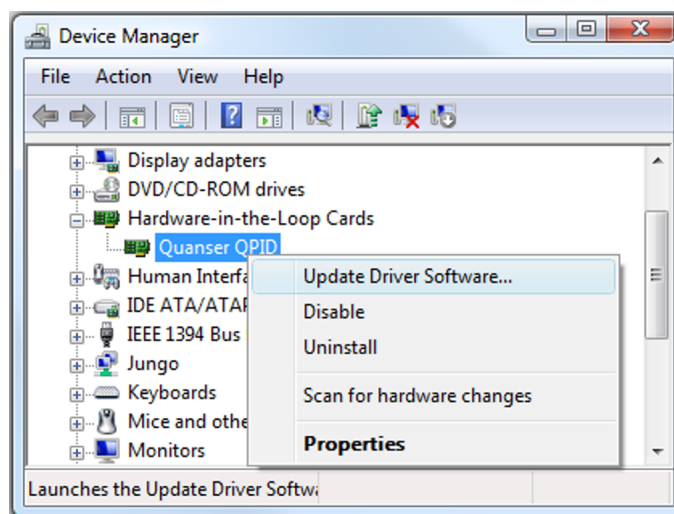
1. If a driver has never been installed for the QPID/QPIDE board, you may find the board under Other devices. Right click on the PCI Device and select Update Driver Software.



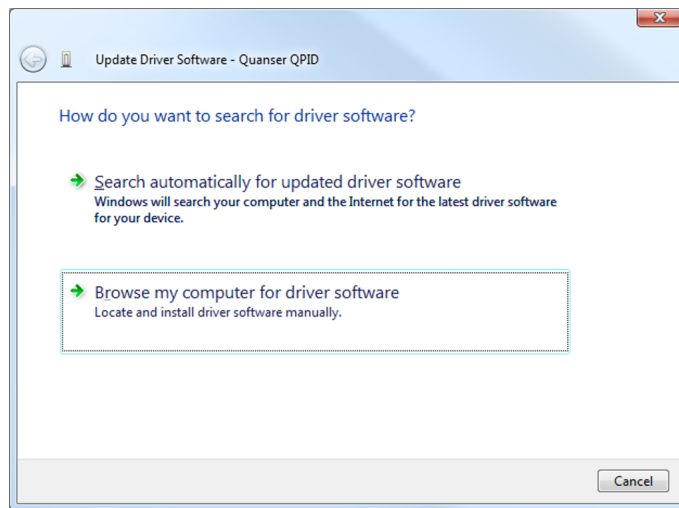
2. If you have a recent version of LabVIEW installed, you may find the board under NI-RIO Devices. Right click on the NI PCI-7831R or NI PCIe-7841R and select Update Driver Software.



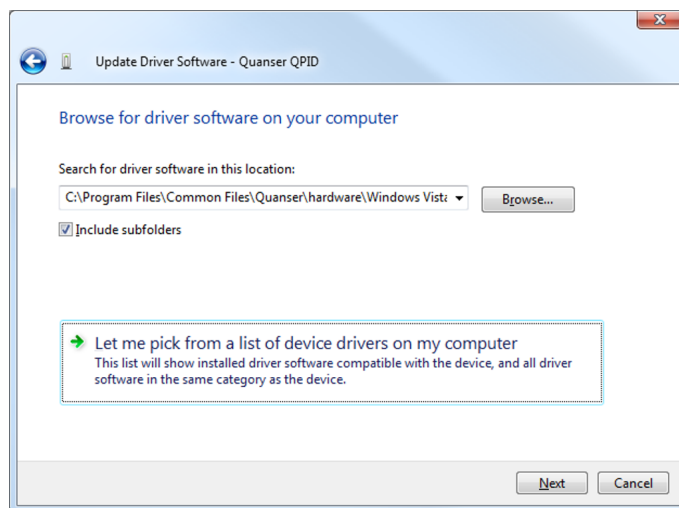
3. Otherwise, the board will be under Hardware-in-the-Loop Cards. Right click on the Quanser QPID or Quanser QPIDe and select Update Driver Software.



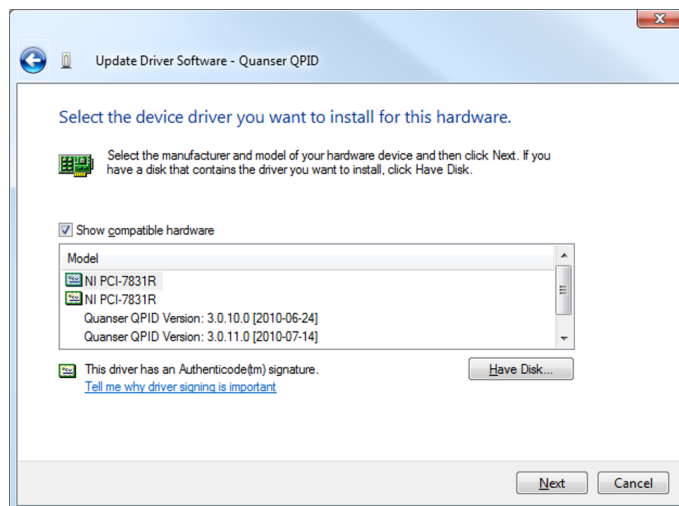
On the next screen click *Browse my computer for driver software*.



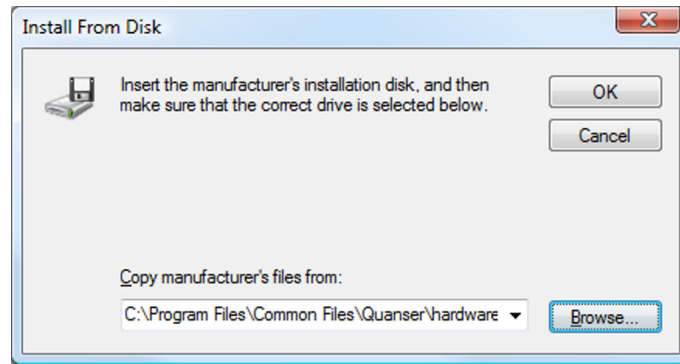
Click *Let me pick from a list of device drivers on my computer*.



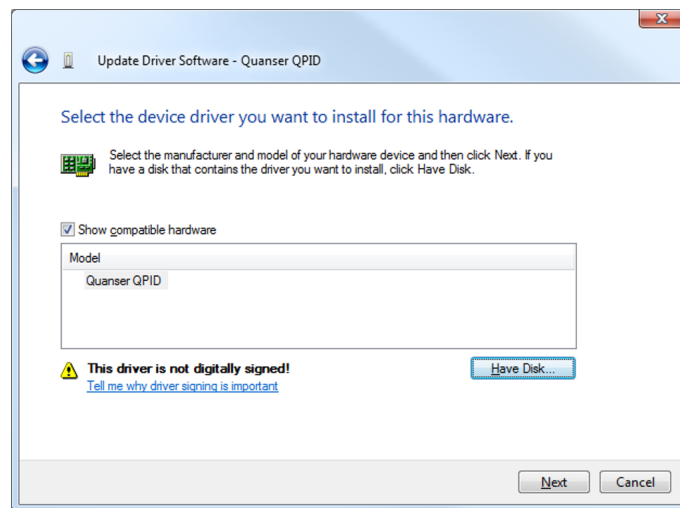
Click the *Have Disk* button.



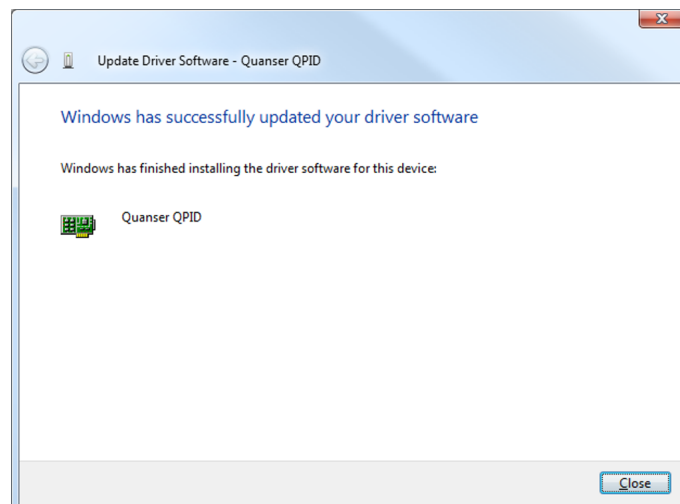
Browse to *C: > Program Files > Common Files > Quanser > hardware*. Click Open and then OK.



Check the box next to *Show compatible hardware* and the QPID/QPIDE board should show up in the list below it. Click Next and the driver installation should begin. (If you are prompted by the Windows security, click *Install this driver software anyway*.)



When the installation is complete, you should receive this notification. Click Close. Your board is now ready to be used.



## 4.5 Connecting the Terminal Board

The QPID/QPIDe cable connections are depicted in Figure 4.2, Figure 4.3, and Figure 4.4. The function of each cable is listed in Table 3.3.

Follow this procedure to connect the terminal board to the QPID/QPIDe DAQ device:

1. Ensure that power is off prior to connecting the cables.
2. The connectors on the QPID/QPIDe and terminal board are colour coded, as shown in Figure 4.2 and Figure 4.3. Align the sticker colors when connecting the cables.
3. There is also a diagram on the terminal board case to indicate which connector on the terminal board connects to the corresponding connector on the QPID/QPIDe device.

It is not necessary to connect all three cables if some of the functions are not required. For example, Connector J0 on the terminal board is used for the analog I/O, two encoders, and eight digital I/O. If this is sufficient, then Connectors J1 and J2 on the terminal board may be left unconnected.

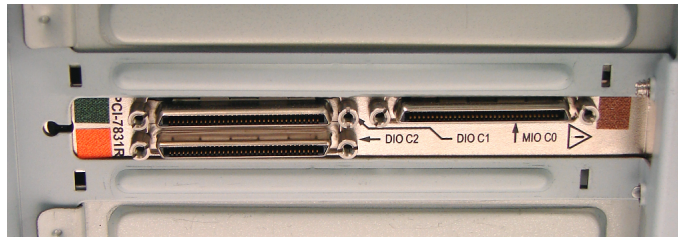


Figure 4.2: Connections on the installed QPID/QPIDe device with the color indications

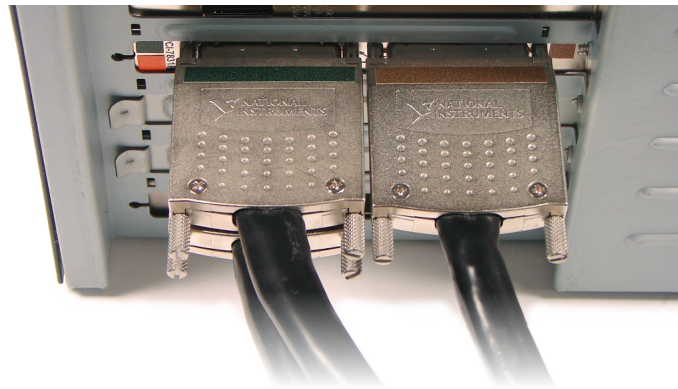


Figure 4.3: Attaching the cables to the QPID/QPIDe device to match the corresponding colors



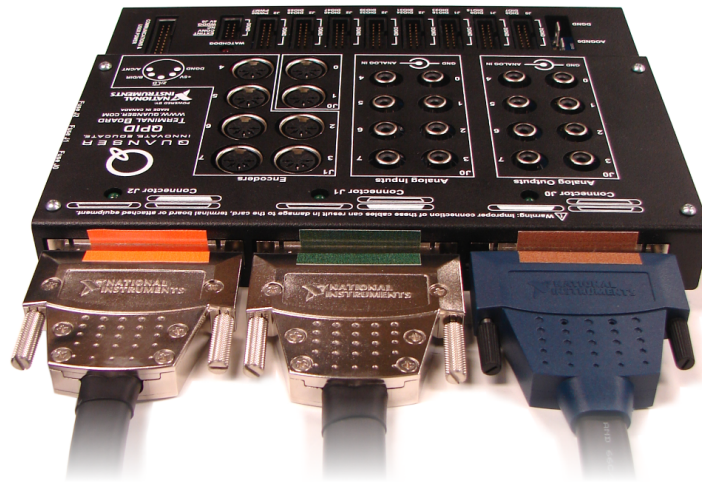


Figure 4.4: Attaching the cables to the terminal board to match the corresponding colors



**Caution:** Always ensure that the cables between the QPID/QPIDE device and the terminal board are connected correctly. The cables are not keyed. If a cable is connected to the wrong location, power and ground can be shorted, resulting in damage to the QPID/QPIDE device, terminal board, and/or attached equipment.



**Caution:** Always ensure that the correct cables are used. The NI SHC68-68-RMIO and NI SHC68-68-RDIO cables are designed and shielded for specific signals. The cables are not keyed. They have the same pin-out, but they are not interchangeable. If an incorrect cable is used, signal integrity and noise immunity may be compromised.

## 4.6 Using the QPID/QPIDE

### 4.6.1 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. Make sure you choose **qpId** or **qpId\_e** Board type in the HIL Initialize VI when running the examples.

### 4.6.2 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 **qpId** and **qpId\_e**.
- Refer to the MATLAB Help pages under QUARC Targets/User's Guide/QUARC Data Acquisition Card Support/Quanser Cards/QPID or QPIDE. [1]
- When using the PWM outputs, refer to the *PWM Output Configuration* Help page in MATLAB. (There is not a direct link from the Help Contents. Search for *QPID PWM*.)



# 5 TROUBLESHOOTING

Please review the following before contacting Quanser technical support.

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

If a green power LED on the QPID/QPIDe terminal board is off, check the following:

- The corresponding cable is firmly seated in both the terminal board connector and the QPID/QPIDe device connector.
- The computer in which the QPID/QPIDe device is installed is powered up.
- The QPID/QPIDe cables are connected correctly. (See Section 4.5 for instructions on how to connect the cables.)

# 6 FUSE REPLACEMENT

## 6.1 Terminal Board

If the above conditions given in Section 5 are met, and the power LED remains off, replace the corresponding fuse on the terminal board with the following fuse or equivalent.

**Littelfuse Inc. 0235.500HXP (500mA, 250V, fast acting, 5mm x 20mm)**

Note that the fuse indicator signal on the terminal board goes to Connector J0, so if Connector J0 is unplugged, the QPID/QPIDe device cannot detect the state of the fuses.

## 6.2 QPIDe

If the above conditions given in Section 5 are met, the terminal board fuses are intact, and the power LED remains off the surface mount fuse on the data acquisition board may be burnt.

To replace the surface mount fuse on the QPIDe board with the following fuse or equivalent

**Littelfuse Inc. 0451004.MRL (125V FAST NANO2 SMD)**

These instructions detail the replacement procedure:

- Turn off the PC
- Ground yourself using an anti-static wrist strap.
- Remove the QPIDe board from the PC.
- Place the board on anti-static surface.
- Using a pair of fine pliers, pull the blown fuse out from the QPIDe fuse holder.

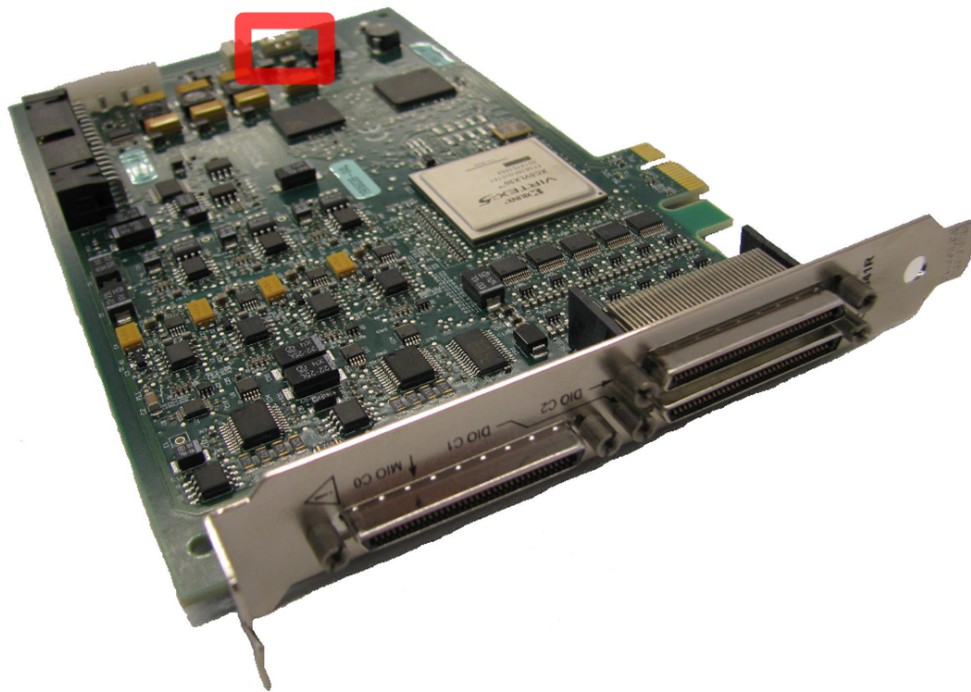


Figure 6.1: pull the blown fuse out from the QPIDe fuse holder

- Install the new fuse.
- Reinstall the board into the PC.

## 6.3 QPID

If the surface mount fuse on the QPID board is burnt, please have a qualified technician with disordering/soldering experience replace the fuse with the following fuse or equivalent

**Littelfuse Inc. 0451002.MRL (FUSE 2A 125V FAST NANO2 SMD)**

For additional instructions or assistance replacing the QPID surface mount fuse, go to <http://www.quanser.com/> and click on the Tech Support link.

## 7 TECHNICAL SUPPORT

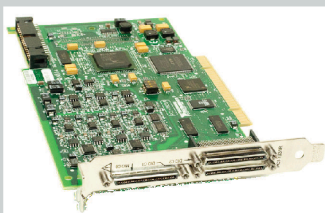
To obtain support from Quanser, go to <http://www.quanser.com/> and click on the Tech Support link. Fill in the form with all the requested software and hardware information as well as a description of the problem encountered. Also, make sure your e-mail address and telephone number are included. Submit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

► QPID



► QPIDe



► Q1-cRIO



► Q2-USB



► 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](mailto:info@quanser.com).

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