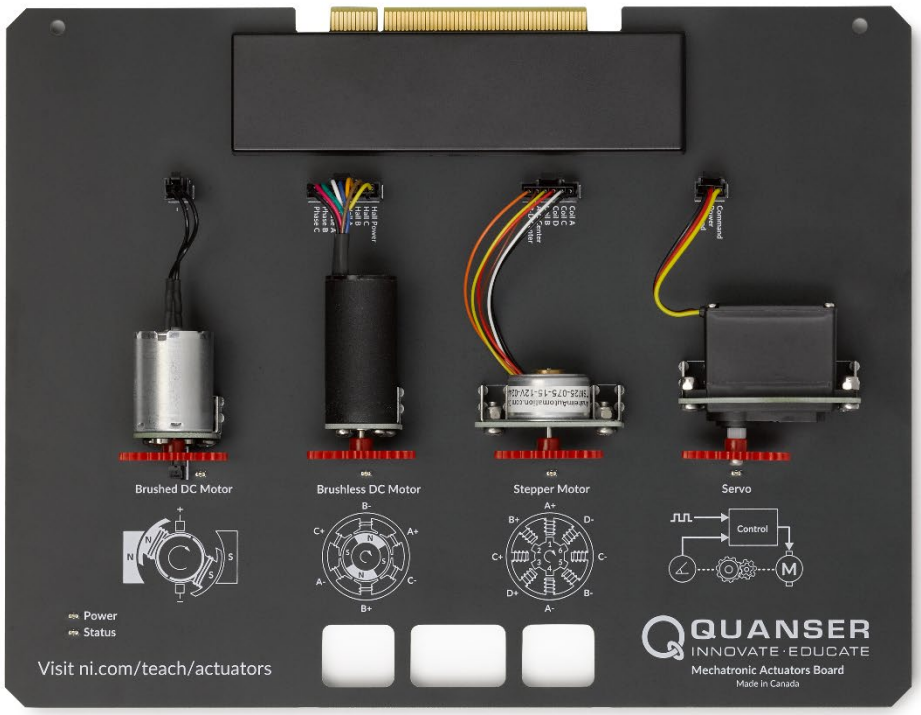
User Manual

Quanser Mechatronic Actuators Board for NI ELVIS III



Setup and Configuration

Printed in Markham, Ontario.

Safety Information

The following symbols and definitions are interchangeably used throughout the User Manual:

Symbol	Description
	Caution: consult documentation for additional information
	Attention: Observe precautions for handling electrostatic sensitive devices

The Quanser Mechatronic Actuators Board

The Quanser Mechatronic Actuators board, pictured in Figure 1, is an ideal tool to introduce a variety of common actuators and demonstrate their advantages, interfacing and operation, as well as design considerations and limitations. Topics include DC motors, power amplifiers, and position-controlled actuators. The board consists of a brushed DC motor with selectable linear and PWM amplified power amplifiers, a brushless DC motor, stepper motor, integrated servo, and modifiable LabVIEW controllers. The board gives students the experience with working actuators, while removing the complications involved with wiring and configuring power and control circuitry. Actuator technologies are compared and contrasted, allowing users to become comfortable with making design decisions about actuators and amplifiers in real-world applications.

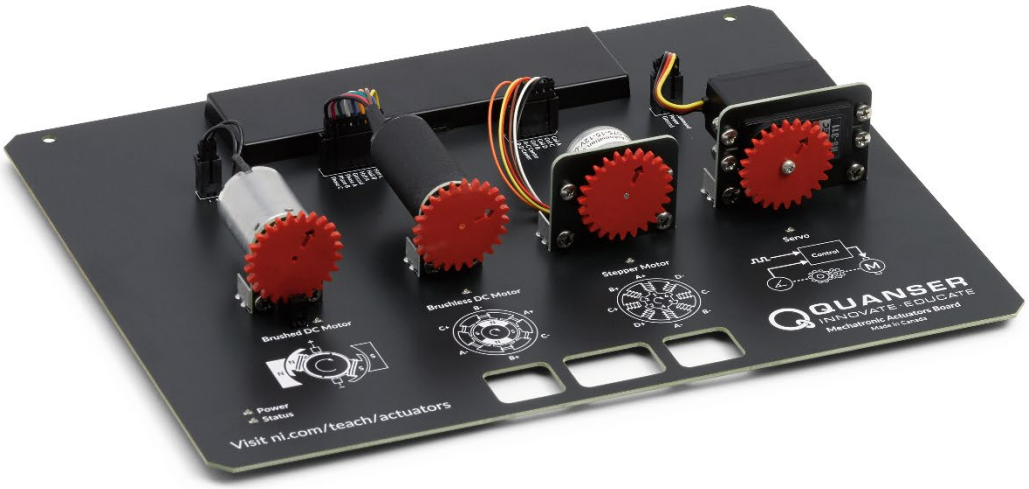


Figure 1: The Quanser Mechatronic Actuators board

Main Features

- Brushed DC motor with 24 pulse/revolution photomicrosensor
- Current sense for brushed DC motor
- Linear power amplifier
- PWM power amplifier
- Brushless DC motor with integrated Hall effect sensors
- 48 step unipolar stepper motor
- Servo motor

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.

System Schematic

Control of the Actuators board hardware is achieved via direct digital and analog control signals from the NI ELVIS III. The PC communicates with the NI ELVIS III via network or USB. The Brushed DC motor is driven via either an analog signal to the linear amplifier or a digital PWM signal to the PWM amplifier. The speed of the brushed DC motor is sensed using an onboard photomicrosensor. The brushless DC motor is controlled via the integrated FPGA. Users can configure what motor coils are energized based on the Hall sensor state. The stepper motor and servo motor are controlled directly using the NI ELVIS III reconfigurable I/O.

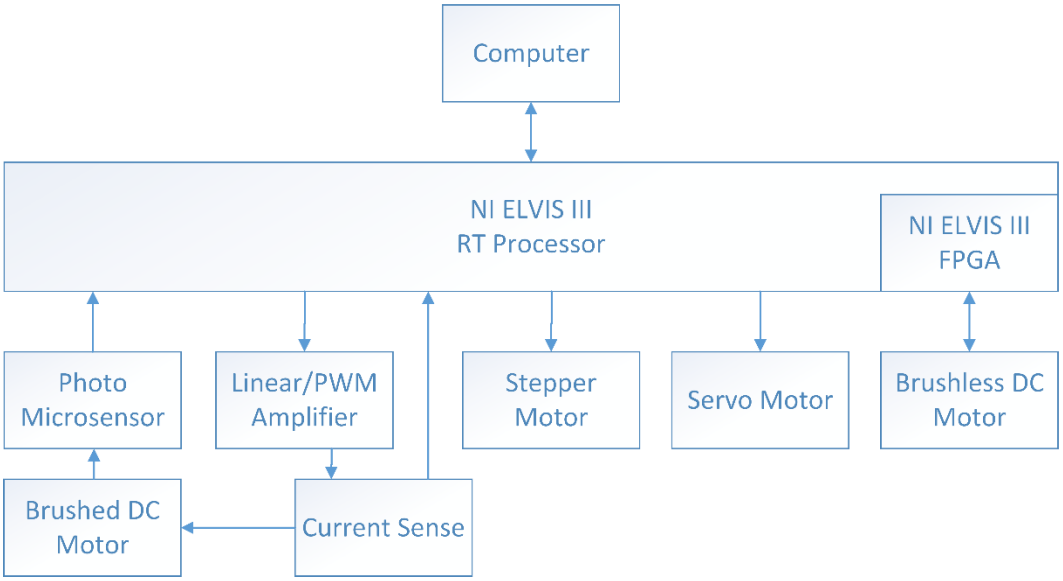


Figure 2: Interaction between components of the board and the NI ELVIS III

Hardware Components

The major components of the application board are identified in Figure 3.

Table 1: Application board hardware components

ID	Component	ID	Component
1	PCI Connector for interfacing with NI ELVIS III	5	Stepper Motor
2	Linear and PWM amplifiers, brushed DC motor current sense (under cover)	6	Servo Motor
3	Brushed DC Motor	7	Photomicrosensor
4	Brushless DC Motor		

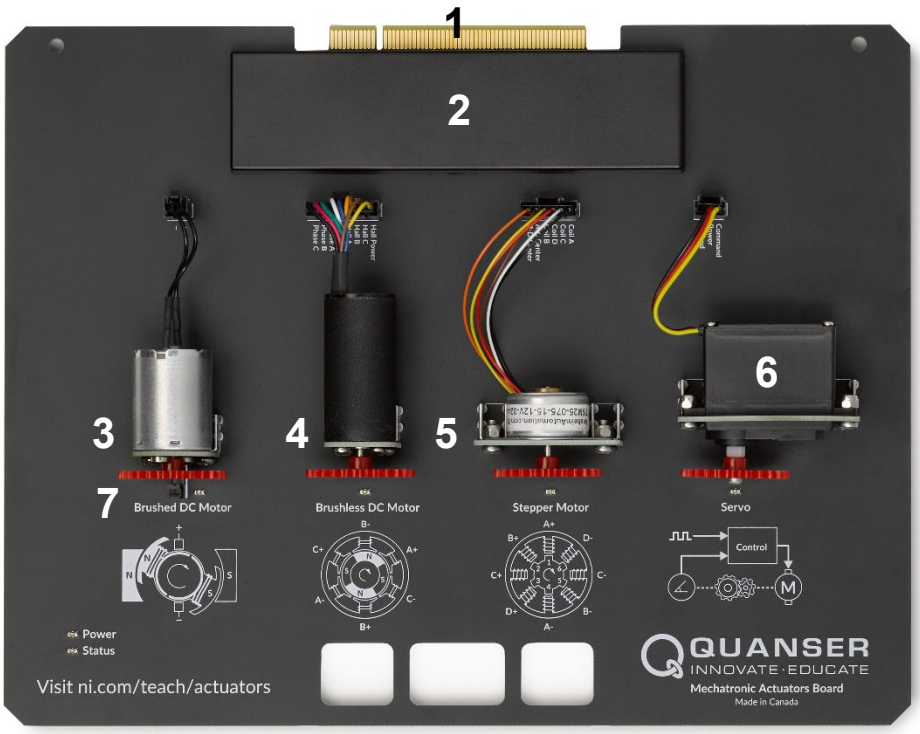


Figure 3: Quanser mechatronic actuators board components

Caution Exposed moving parts.

Brushed DC Motor

The Mechatronic Actuators board features a direct drive 24 V DC motor. This motor can be driven either by a linear or PWM amplifier. The included motor is a Kinmore Motor RF-370CHV-13455. More information on this motor is available from Kinmore Motor.

Brushless DC Motor

The Mechatronic Actuators board features a 3 phase, 8 pole 24V brushless DC motor which is driven by a PWM power amplifier. The included motor is an Anaheim Automation BLWR092S-24V-4600. The complete specification sheet of the motor is available from Anaheim Automation.

Stepper Motor

The Mechatronic Actuators board features a 48 step/revolution, 12V unipolar stepper motor which is driven directly by the NI ELVIS III. Protection circuits are included to prevent stepper phases from being powered in a manner which would damage hardware. The included motor is an Anaheim Automation TSM25-075-15-12V-024A-LW6. The complete specification sheet of the motor is available from Anaheim Automation.

Servo Motor

The Mechatronic Actuators board features a 4.8-6 V PWM controlled servo motor. The included motor is a Hitec Servo motor model HS-311. Full motor specifications are available from HITEC RCD USA.

Photomicrosensor

The speed of the brushed DC motor is measured using an onboard photomicrosensor which detects the teeth on the motor-mounted gear. The included sensor is a Omron EE-SX1081. Further information and sensor specifications are available from omron.com.

Environmental

The application board is designed to function under the following environmental conditions:

- Standard rating
- Indoor use only
- Temperature 5◦C to 40◦C
- Altitude up to 2000 m
- Maximum relative humidity of 80% up to 31◦C decreasing linearly to 50% relative humidity at 40◦C
- Pollution Degree 2
- Maximum transient overvoltage 2500 V
- Marked degree of protection to IEC 60529: Ordinary Equipment (IPX0)

System Setup

The procedure to set up the application board on the NI ELVIS III module is detailed in this section.

Caution

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

ESD Warning

The electrical components on the Quanser Mechatronic Actuators application board are sensitive to electrostatic discharge (ESD). Before handling the board ensure that you have been properly grounded.

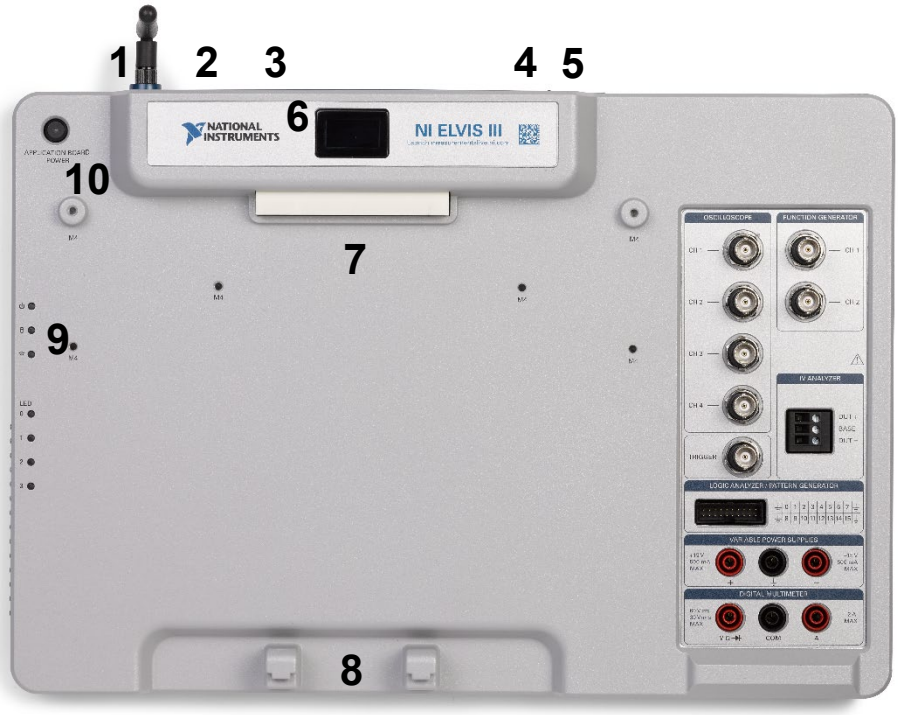


Figure 3: Components of the NI ELVIS III

Table 2: NI ELVIS III Hardware Components

ID	Component	ID	Component
1	Antenna connector	6	Connection data screen
2	Ethernet connector	7	PCI connector
3	USB C connector	8	Handle latching hooks
4	Power cable	9	Status LEDs
5	Power switch	10	Application board power button

Caution Do NOT make the following connections while power is supplied to the application board!

Follow these instructions to setup the application board on the NI ELVIS III:

1. Power on the ELVIS III
2. Connect the ELVIS III to the network or to your computer via USB C
3. Ensure the LED on the application board power button is NOT lit

4. Position the handle of the application board over the handle latching hooks
5. Position the PCI connector on the application board so that it aligns with the PCI connector on the ELVIS III
6. Push the application board upward until the PCI connector is firmly seated
7. Press the application board power button and ensure the LED on the button is lit
8. Ensure the Power LED on the application board is lit.

Troubleshooting

Please review the following before contacting technical support.

1. Verify the board is properly seated on the ELVIS III and that it has power.
2. Verify that the ELVIS III is correctly set up as outlined in the NI product documentation.

You are getting 'VI Missing' messages

Make sure the required LabVIEW add-ons listed in the Quick-Start Guide are installed. Verify that the correct LabVIEW version is installed (The ELVIS III is only compatible with LabVIEW 2018 or later).

Brushless DC motor is not responding

Ensure that the custom FPGA for the Mechatronics Actuators board has been properly deployed to the NI ELVIS III. You may have to download a new copy of the LabVIEW controllers if the included bitfiles have become corrupt.