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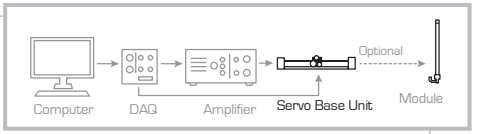
Quick Start Guide: Linear Servo Base Unit and Pendulum

MATLAB SIMULINK

STEP 1 Check Components and Details

Make sure your Linear Servo Base Unit and Pendulum module includes the following components:



1. Linear Servo Base Unit
2. Set of two 5-pin DIN to 5-pin DIN encoder cables
3. Long (0.6m) pendulum
4. Medium (0.34m) pendulum
5. 7/64' Allen key
6. Quanser Workstations Resources DVD* (includes controllers; digital versions of User Manuals, Quick Start Guide and courseware; and other files)

*DVD supplied with the QUARC Real-Time Rapid Control Prototyping Software, see Step 2

STEP 2 Additional Components Required for Set Up

To complete the Linear Servo Base Unit and Pendulum set up, you will also need the following:

1. QUARC Real-Time Rapid Control Prototyping Software Installation DVD
2. Power Amplifier (VoltPAQ-X1 pictured)
3. One of the following data acquisition devices:
   a. Quanser Q2-USB, or
   b. Q8-USB, or
   c. NI PCI/PCIe with Terminal Board
4. RCA to RCA cable
5. 4-pin DIN to 6-pin DIN motor cable

Note: These components must be purchased separately.

STEP 3 Install and Test QUARC

A. Make sure you have all required software, as listed in the QUARC Compatibility Table document located in the QUARC DVD folder.

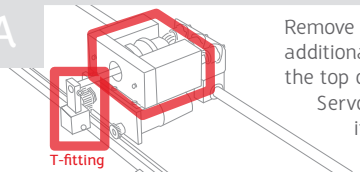
B. See the QUARC Installation Manual for details on how to install the software.

C. Make sure you test the system using the Sine and Scope demo. You can access this by typing **qc_show_demos** in the Matlab prompt.

STEP 4 Set Up the Hardware

To set up your Linear Servo Base Unit and Pendulum, please read the following instructions carefully. For full details, see the Linear Servo Base Unit and Pendulum User Manual (enclosed with shipment).

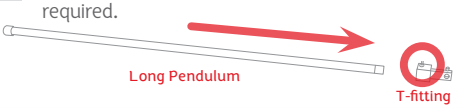
A



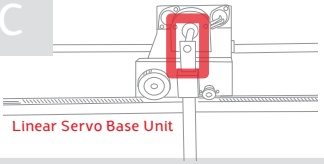
Remove the T-fitting and additional weight from the top of the Linear Servo Base Unit cart, if installed.

B

Insert the long pendulum rod inside its T-fitting. Ensure that it sits properly. Tighten set screw as required.



C



Attach the pendulum, pointing downwards, at the end of the Linear Servo Base Unit cart's pendulum axis. Tighten the T-fitting set screw as required.

D

Ensure that he track is located at the edge of a table so that the pendulum is free to rotate 360-degrees in front of the cart. It is recommended to clamp down the Linear Servo Base Unit to the table (clamp not included).

STEP 5 Wiring

The connections shown below are illustrated using a generic data acquisition (DAQ) device and a VoltPAQ-X1 amplifier (you may have a different DAQ or amplifier). For detailed instructions, see the Linear Servo Base Unit and Pendulum User Manual (enclosed with shipment).

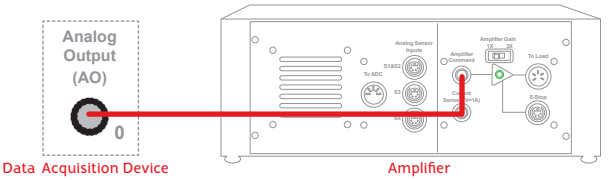
A

Before proceeding, set up and test your Linear Servo Base Unit. For detailed instructions, see the Linear Servo Base Unit Quick Start Guide or User Manual.

B

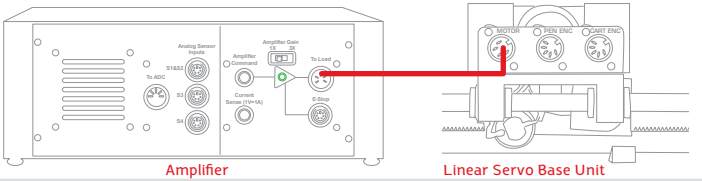
Make sure everything is powered OFF before making any connections. This includes turning off your PC and the amplifier.

C



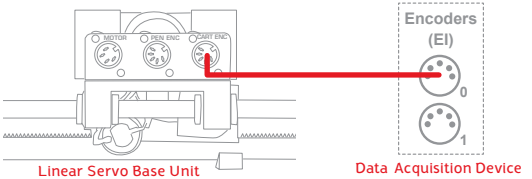
Using the RCA to RCA cable, **connect Analog Output Channel** #0 (AO #0) on the data acquisition (DAQ) device to the **Amplifier Command** socket on the amplifier.

D



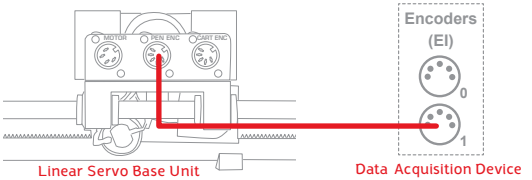
Using the 4-pin DIN to 6-pin DIN motor motor cable, connect the **To Load** socket on the amplifier to the **Motor** socket on the Linear Servo Base Unit.

E



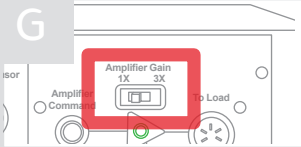
Using the 5-pin DIN to 5-pin DIN encoder cable, connect the **Encoder Channel #0** (EI #0) on the data acquisition (DAQ) device to the **Cart Encoder** connector (CART ENC) on the Linear Base Unit Cart.

F



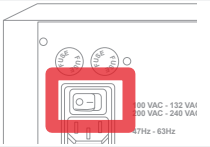
Using the 5-pin DIN to 5-pin DIN encoder cable, connect the **Pendulum Encoder** socket on the **Linear Servo Base Unit** panel to the **Encoder Channel #1** (EI #1) socket on the data acquisition (DAQ) device.

G



Attention VoltPAQ-X1 Users: Make sure you set the GAIN on the VoltPAQ-X1 to 1 when using any Linear Servo Base Unit experiment.

H



Turn ON the power switch on the VoltPAQ-X1. It is located on the rear of the device.

STEP 6 Testing the Linear Servo Base Unit and Pendulum

Follow the procedure below to test your Linear Servo Base Unit and Pendulum module.

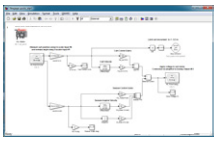
A

Make sure your PC and amplifier are powered ON.

B

On the Resources DVD (supplied with the QUARC and Servo Base Unit package), locate the **Quick Start Folder**: Linear\Linear Servo Base Unit\Quick Start. Copy the Quick Start folder to your local hard drive.

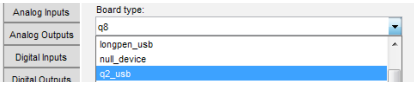
C



Open the Simulink model file (.mdl) found under the Quick Start folder on your hard drive.

D

Double-click on the HIL Initialize block and choose the board that is installed on your system (e.g. Q2-USB).

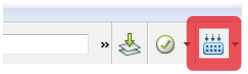


E

Check that the pendulum is resting perfectly vertically with the tip towards the ground.

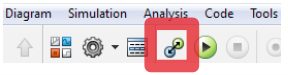
F

Click on the **Build Model** button on the Simulink model toolbar.



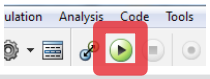
G

Once the model code has been compiled, click on the **Connect To Target** button.

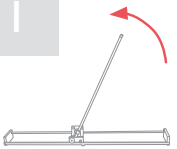


H

Click on the **Run** button to start the QUARC real-time model.

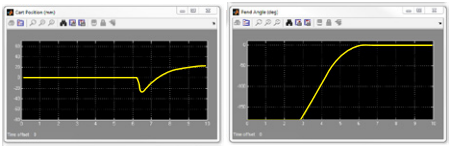


I



Slowly raise the pendulum to the upright position. When the pendulum is close to vertical, the controller will activate and attempt to balance the pendulum. Immediately release the pendulum when you feel the balance controller engage. If there is a problem, immediately stop the controller by clicking on the STOP button (see Step K). **Do not attempt to lower the pendulum manually once the controller has engaged!**

J

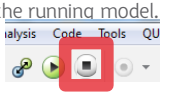


Scope view of the VI Front Panel

The pendulum should balance, and the scopes should look similar to those shown here. Once the pendulum is balanced, try to disturb it as little as possible. If the pendulum is unable to balance, consult the Troubleshooting section at the end of this guide.

K

Click on the Simulink **Stop** button to stop the running model.



TROUBLESHOOTING

Review the following recommendations before contacting Quanser's technical support engineers.

1. Make sure the cables are firmly connected.
2. Check the connection outlined in Step 5 in this guide.

Getting an error when trying to build or run the Quick Start Simulink model (.mdl)

A. Type ver in the *Matlab Command Window* and verify that QUARC is on the list. If not, then go through the QUARC Quick Installation Guide to install QUARC. If it is listed, run *mex -setup* as described in the the QUARC Installation Guide.

B. If the "... specific kernel level driver for the specified card could not be found" error is prompted when you attempt to run, then you may not have selected the correct data acquisition (DAQ) device in the HIL Initialize block or the DAQ device has not been installed properly (refer to the DAQ device User Manual).

The Motor is not responding.

A. Review connection Steps 5C tand 5D.

B. Ensure the power amplifier is powered on and operational, i.e., when using VoltPAQ-X1, verify that the green LED is lit.

C. Verify that the data acquisition (DAQ) device is functional. Go through the DAQ User Manual for troubleshooting guidelines.

D. Ensure the voltage is actually reaching the motor terminals. See the Linear Servo Base Unit and Pendulum User Manual for details.

The Encoder(s) is (are) not reading.

A. Review connection in Steps 5E and 5F.

B. Verify that the data acquisition (DAQ) device is functional. Go through the DAQ User Manual for troubleshooting guidelines.

STILL NEED HELP?

For further assistance from a Quanser engineer, contact us at tech@quanser.com or call +1-905-940-3575.

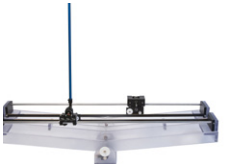
Expand the Linear Servo Base Unit to the following popular experiments using Quanser Linear control add-on modules.

Linear Pendulum

Linear Flexible Joint

Flexible Inverted Pendulum

Seesaw Pendulum



LEARN MORE

To find out about the full range of Quanser control experiments, visit www.quanser.com