



Saturn-X Commutator

Powered Commutator for maximum subject freedom of movement

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Table of Contents

1	Document Overview	4
2	Saturn-X Commutator Overview	4
3	What's Included with the Saturn-X Commutator?	5
3.1	Saturn-X Commutator	5
3.2	Saturn-X Power Supply.....	5
3.3	Additional Items Sold Separately.....	5
3.3.1	TETH-XTN-MM	5
3.3.2	Tether Interconnect	6
3.3.3	FORJ Mount	6
3.3.4	ADPT-HS-36-PSR-36	6
3.3.5	ADPT-HS-18-DUAL-PSR	7
3.3.6	ADPT-HS-27-PSR-36	7
3.3.7	Remote	7
3.4	Electrostatic Sensitive Equipment.....	7
4	Quick Start	8
4.1	Saturn-X Commutator Setup.....	8
4.2	Start Cheetah	9
4.3	Drive Signal into the Saturn-X Commutator.....	9
5	Computer Control	13
5.1	Installing the USB Drivers	13
5.2	Setting Up the Terminal Window	13
5.3	Terminal Window Options.....	15
5.3.1	Set Min Speed	15
5.3.2	Set Max Speed	15
5.3.3	Set Remote Speed	15
5.3.4	Set Acceleration Speed	15
5.3.5	Speed Ramp	15
5.3.6	Set Stop Angle	15
5.3.7	Set Start Angle	15
5.3.8	Calibrate Home Position.....	16
5.3.9	LED Speed indicator.....	16
5.3.10	Reset Factory Defaults.....	16
5.3.11	Reprint Menu	16
6	Mounting.....	17
7	Optical and Fluid Integration	18
8	Glossary	19
9	Appendix.....	20
9.1	Saturn-X Commutator LED Indicator Descriptions.....	20
9.2	Saturn-X Commutator Dimensions.....	21

List of Figures and Tables

Figure 3-1 Saturn-X Commutator	5
Figure 3-2 Saturn-X Power Supply.....	5
Figure 3-3 TETH-XTN-MM.....	5
Figure 3-4 Tether Interconnect	6
Figure 3-5 FORJ Mount.....	6
Figure 3-6 ADPT-HS-36-PSR-36.....	6
Figure 3-7 ADPT-HS-18-DUAL-PSR.....	7
Figure 3-8 ADPT-HS-27-PSR-36.....	7
Figure 3-9 Remote	7
Figure 4-1 Hardware Connections	8
Figure 4-2 Bank 1, 2, 3 and 4 Switches Up. Reference Switch Down.	9
Figure 4-3 Bank 2, 3 and 4 Switches Up. Bank 1 and Reference Switches Down.....	10
Figure 4-4 Bank 3 and 4 Switches Up. Bank 1, 2 and Reference Switches Down.....	10
Figure 4-5 Bank 4 Switches Up. Bank 1, 2, 3 and Reference Switches Down.	11
Figure 4-6 All Switches Down (1000 μ V).....	11
Figure 4-7 All Switches Down (25 μ V).....	12
Figure 4-8 All Switches Up (25 μ V).	12
Figure 5-1 Driver Installation Window.....	13
Figure 5-2 Found New Hardware	13
Figure 5-3 COM Port Number.....	14
Figure 5-4 Terminal Window Setup	14
Figure 5-5 Terminal Window	15
Figure 7-1 FORJ Integration.....	18
Figure 9-1 LED Status Indicators	20
Figure 9-2 Saturn-X Commutator Dimensions – Front View	21
Figure 9-3 Saturn-X Commutator Dimensions – Side View	22

1 Document Overview

This document describes the specifications and features of the Saturn-X Commutator. It also explains how to setup your Saturn-X, test it, and use it during normal operation. There is a glossary at the end of the document.

2 Saturn-X Commutator Overview

This Saturn-X Commutator is a powered slip ring commutator that allows tethers connected to the research subject to rotate independently of the data acquisition system.

Features:

- Power Commutator
- High Sensitivity
- Up to 160 channels
- Adds Minimal Addition Noise
- User Programmable
- Optional Remote Control

3 What's Included with the Saturn-X Commutator?

There are six different channel counts available the; Saturn Mini, Saturn-1, Saturn-2, Saturn-3, Saturn-4, and Saturn-5.

3.1 Saturn-X Commutator

- 1 to 5 Channel Modules
- 32 AD Channels, 4 References, 2 Stimulus Pairs per Channel Module, except for Saturn Mini, which contains 16 AD Channels, 2 References, 2 Stimulus Pairs.
- Compatible with Neuralynx Flex Tether Adapters.
- 9.5 inches to 13.5 inches tall.
- 3.4kg to 6.5kg.

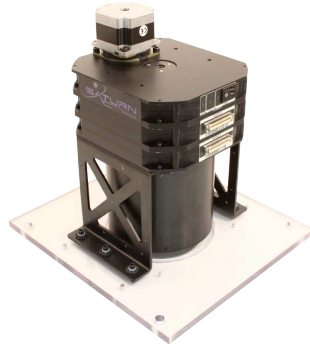


Figure 3-1 Saturn-X Commutator

3.2 Saturn-X Power Supply

- AC/DC Power Supply.
- 24V, 1.67A.



Figure 3-2 Saturn-X Power Supply

3.3 Additional Items Sold Separately

3.3.1 TETH-XTN-MM

- Extension Cable that connects the Saturn-X Commutator to the Data Acquisition System.
- Standard lengths include 1 meter, 2 meters, 5 meters, and 8 meters.



Figure 3-3 TETH-XTN-MM

3.3.2 Tether Interconnect

- Allows multiple TETH-XTN-MMs to connect together.



Figure 3-4 Tether Interconnect

3.3.3 FORJ Mount

- Hardware for mounting rotary joint to the top of the Saturn-X Commutator.
- 17mm and 29mm Diameter Mounts available.



Figure 3-5 FORJ Mount

3.3.4 ADPT-HS-36-PSR-36

- Allows a single HS-36 to connect to the Saturn-X Commutator.

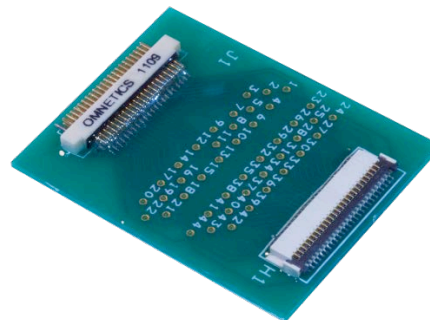


Figure 3-6 ADPT-HS-36-PSR-36

3.3.5 ADPT-HS-18-DUAL-PSR

- Allows two HS-16/18s to connect to the Saturn-X Commutator.

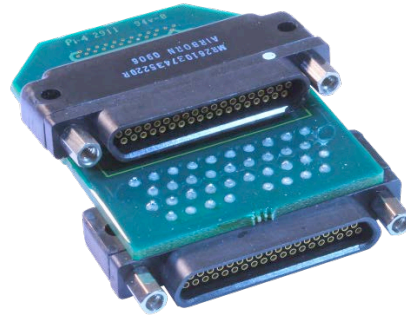


Figure 3-7 ADPT-HS-18-DUAL-PSR

3.3.6 ADPT-HS-27-PSR-36

- Allows a single HS-27 or HS-16/18 to connect to the Saturn-X Commutator.

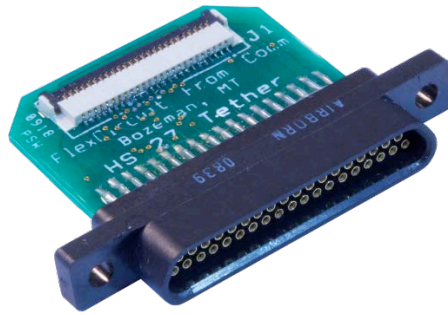


Figure 3-8 ADPT-HS-27-PSR-36

3.3.7 Remote

- Allows manual control of the Saturn-X Commutator.



Figure 3-9 Remote

3.4 *Electrostatic Sensitive Equipment*

All Neuralynx Equipment is Electrostatic Sensitive and should be handled with appropriate measures. Always wear a static strap and use all appropriate ESD measures when handling any electronics. Please contact Neuralynx for detailed information if you have questions.

4 Quick Start

The following instructions are provided to quickly setup and test your Saturn-X Commutator setup. Note, the Saturn-X Commutator should be allowed to warm up to room temperature before performing the steps in the following section.

4.1 Saturn-X Commutator Setup

The Saturn-X Commutator connections are illustrated and described below.

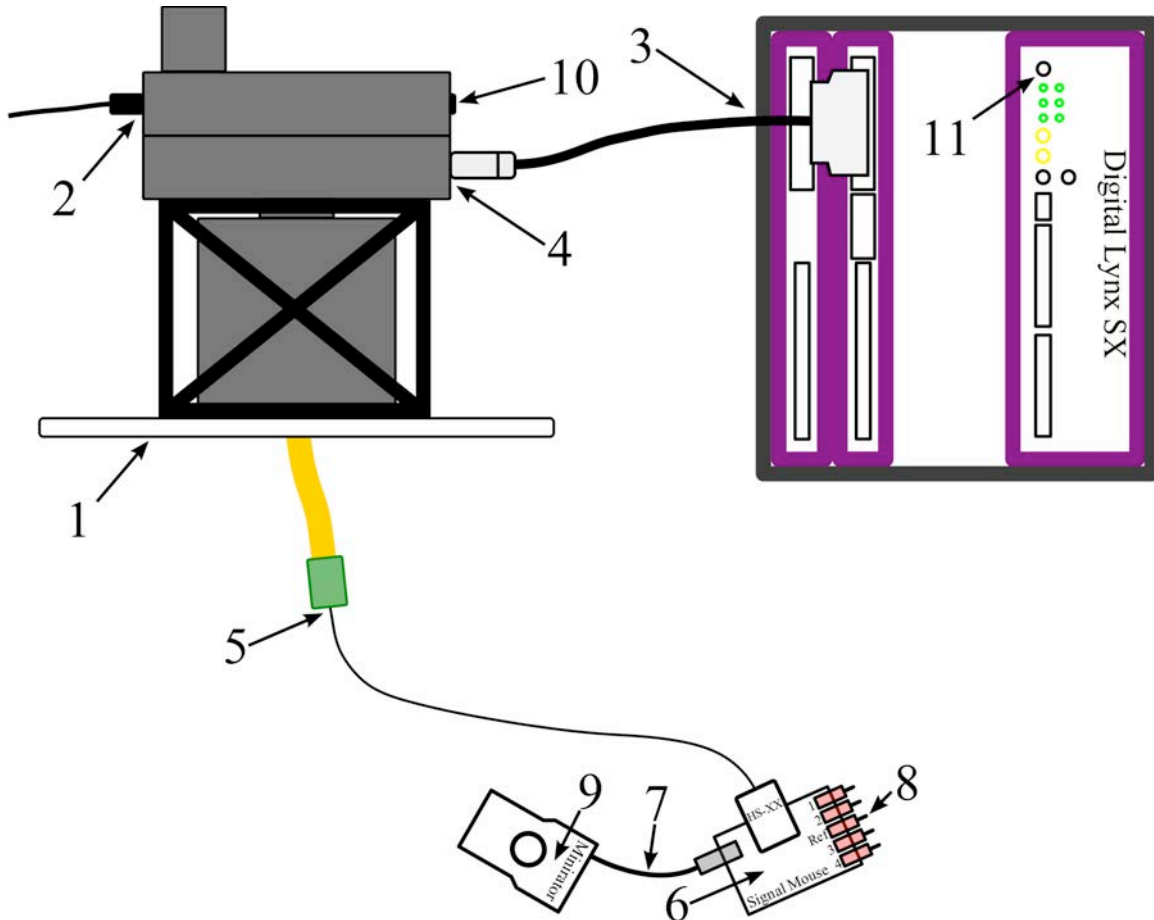


Figure 4-1 Hardware Connections

Connections:

1. Mount the Saturn-X Commutator.
2. Connect the 24V Saturn-X Power Supply to the connector labeled *Power* on the Saturn-X Commutator.
3. Connect one end of the TETH-XNT-MM Extension Cable to Data Acquisition System.
4. Connect the other end of the TETH-XNT-MM Extension Cable to the connector labeled *Module 1* on the Saturn-X Commutator.
5. Connect the Headstage to the Flex Tether on the Saturn-X Commutator.
6. Connect the Headstage to the Signal Mouse.
7. Connect the Minirator, or other signal source, to the Signal Mouse using a BNC Cable.

8. Turn the Bank 1, 2, 3, and 4 switches on the Signal Mouse to the Signal Position (Up). Turn the Reference switch on the Signal Mouse to the Ground Position (Down).
9. Set the Minirator, or other signal source, to output a $1V_{PP}$ Sine Wave at 100 Hz. The Signal Mouse will reduce this signal to approximately $1mV_{PP}$.
10. Power the Saturn-X Commutator ON.
11. Power the Digital Lynx SX ON.

4.2 Start Cheetah

Power On the Digital Lynx SX and wait for boot cycle to complete. On the Desktop select the *Run Cheetah* shortcut to open the Cheetah Welcome Screen. Boot Cheetah with a your preferred configuration file for your new setup. In this example 32 CSCs are used.

4.3 Drive Signal into the Saturn-X Commutator

In Cheetah, select the *ACQ* Button to Start Acquisition. Set the Input Range for all 32 CSCs to $1000\mu V$ and set the Reference for all 32 CSCs to Reference 1. Observe the 32 CSCs. Each should show a reduced (approximately $1mV_{PP}$) version of the Minirator output. Refer to the figure below.

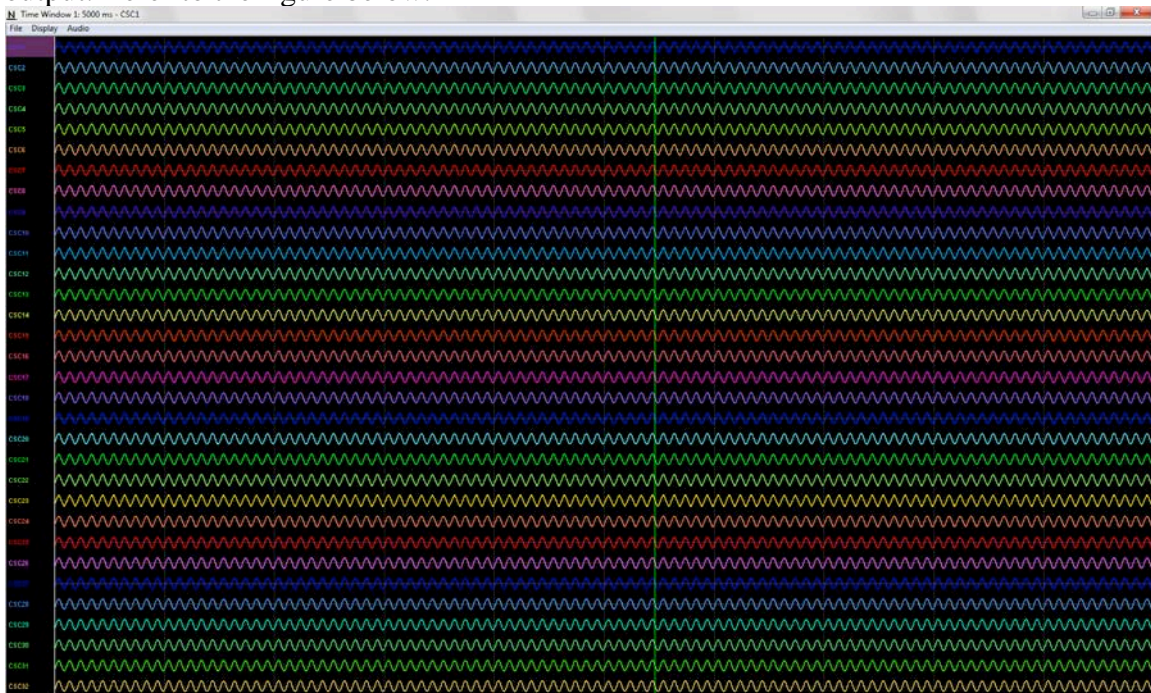


Figure 4-2 Bank 1, 2, 3 and 4 Switches Up. Reference Switch Down.

Switch the Bank 1 Switch to the Ground Position (Down). Observe the 32 CSCs. CSCs 1-8 should now be flatlined while CSCs 9-32 still show a reduced (roughly $1mV_{PP}$) version of the Minirator output. Refer to the figure below.



Figure 4-3 Bank 2, 3 and 4 Switches Up. Bank 1 and Reference Switches Down.
 Switch the Bank 2 Switch to the Ground Position (Down). Observe the 32 CSCs. CSCs 1-16 should now be flatlined while CSCs 17-32 still show a reduced (roughly 1mV_{PP}) version of the Minirator output. Refer to the figure below.

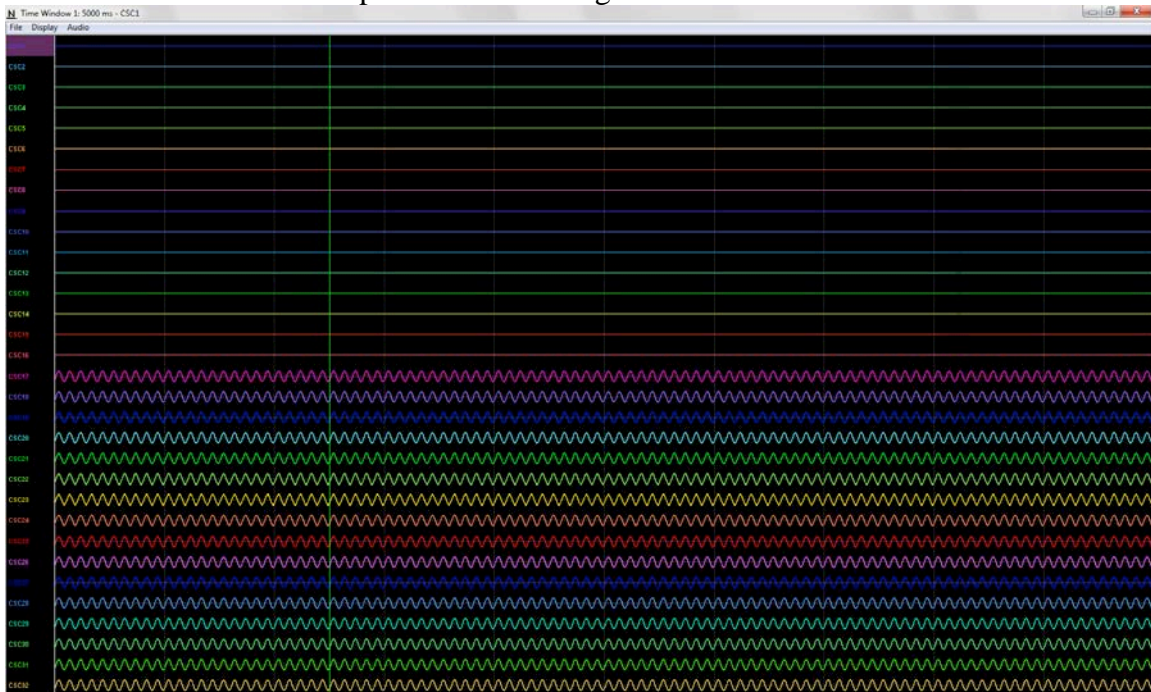


Figure 4-4 Bank 3 and 4 Switches Up. Bank 1, 2 and Reference Switches Down.
 Switch the Bank 3 Switch to the Ground Position (Down). Observe the 32 CSCs. CSCs 1-24 should now be flatlined while CSCs 25-32 still show a reduced (roughly 1mV_{PP}) version of the Minirator output. Refer to the figure below.

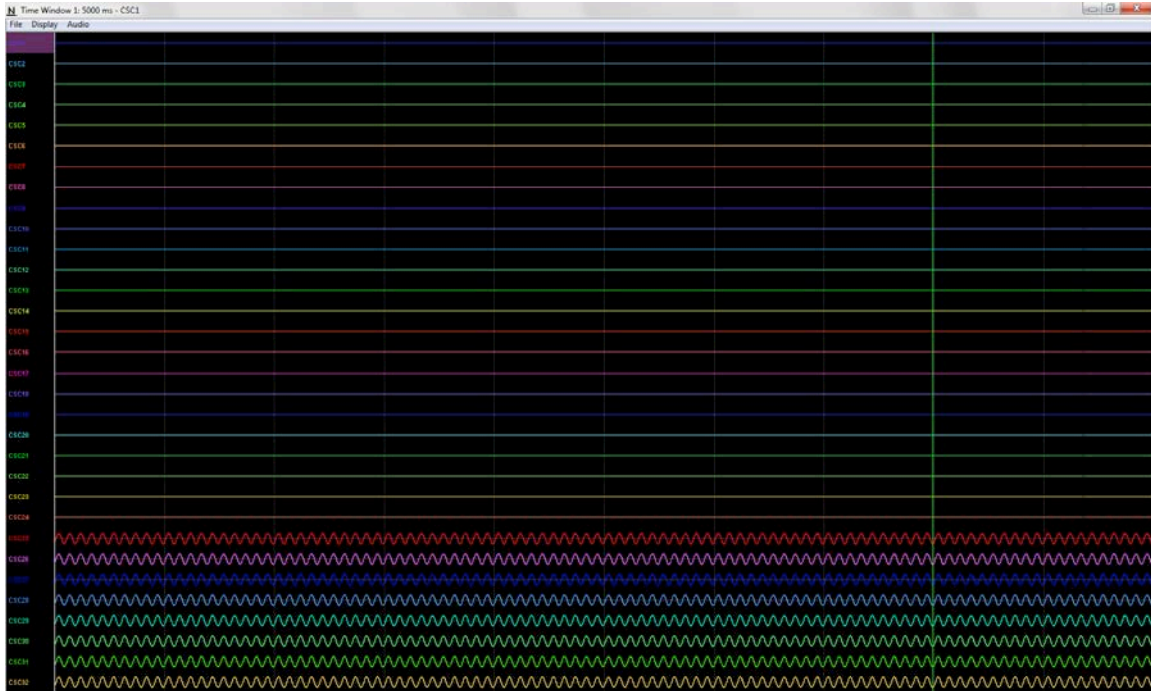


Figure 4-5 Bank 4 Switches Up. Bank 1, 2, 3 and Reference Switches Down.
 Switch the Bank 4 Switch to the Ground Position (Down). Observe the 32 CSCs. CSCs 1-32 should now be flatlined. Refer to the figure below.

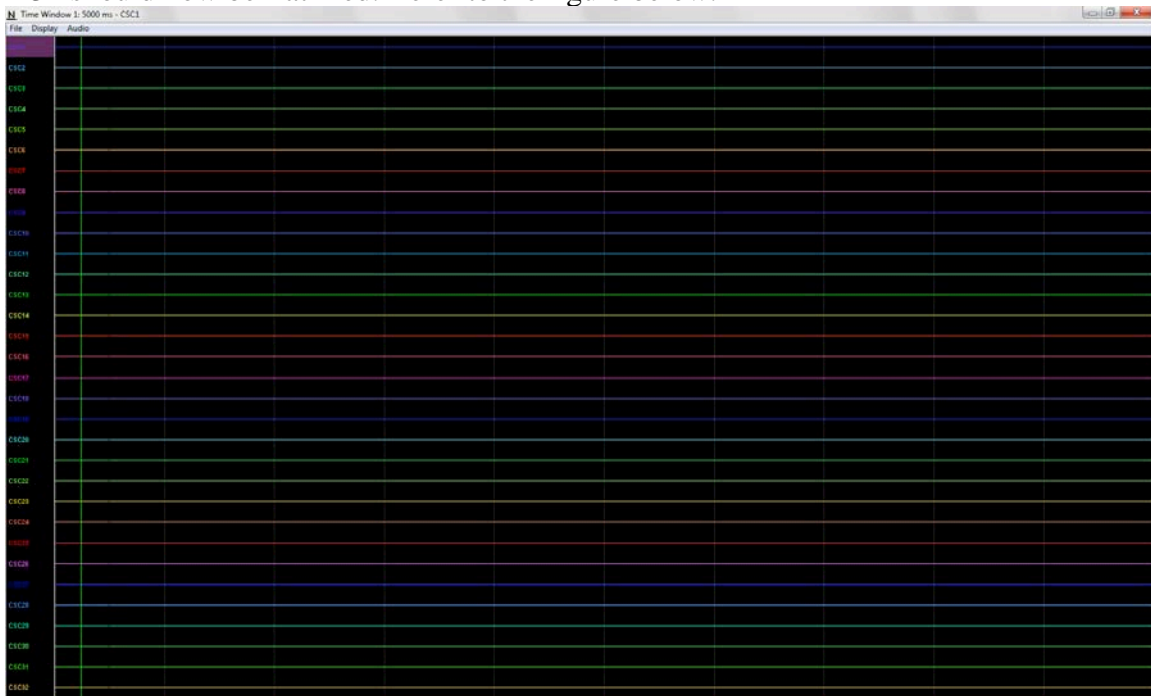


Figure 4-6 All Switches Down (1000 μ V).
 Set the Input Range for all 32 CSCs to 25 μ V. Observe the 32 CSCs. CSCs 1-32 now show the baseline noise. Each should be less than 25 μ V_{pp} and void of any repetitive signals. Refer to the figure below.

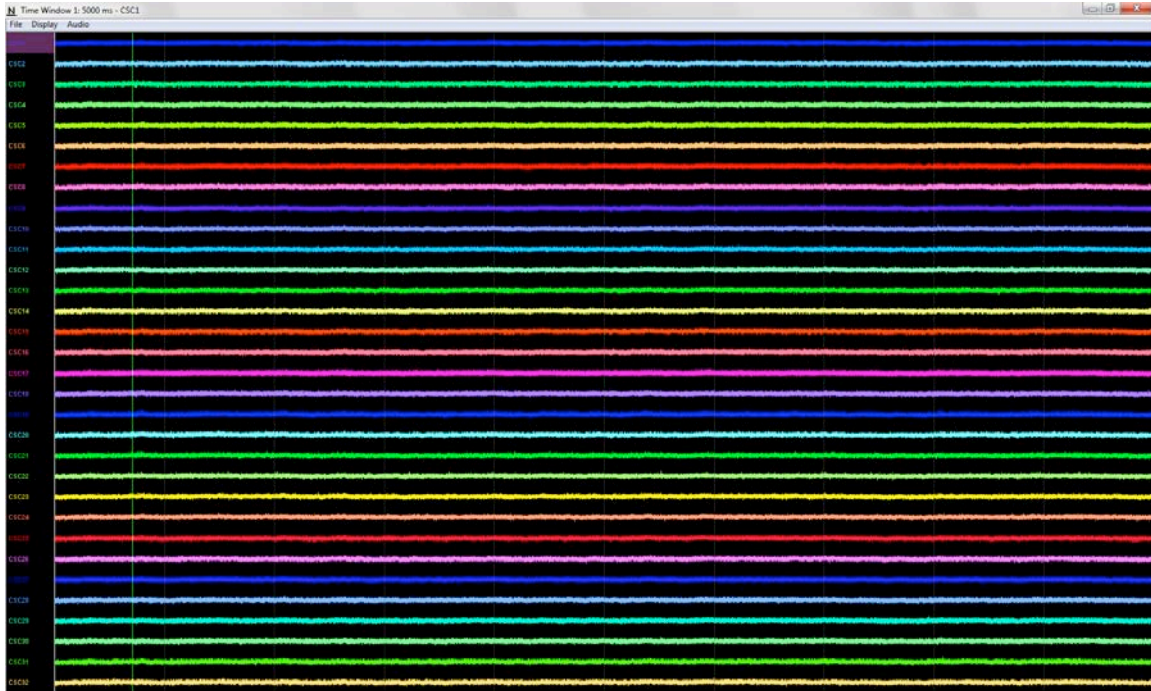


Figure 4-7 All Switches Down ($25\mu\text{V}$).

Force the Saturn-X Commutator to spin. Observe the 32 CSCs. CSCs 1-32 should still show the baseline noise. Each should be less than $25\mu\text{Vpp}$ and void of any repetitive signals.

Switch all the Switches to the Signal Position (Up). Observe the 32 CSCs. Each should be less than $25\mu\text{Vpp}$ and void of any repetitive signals. Refer to the figure below.

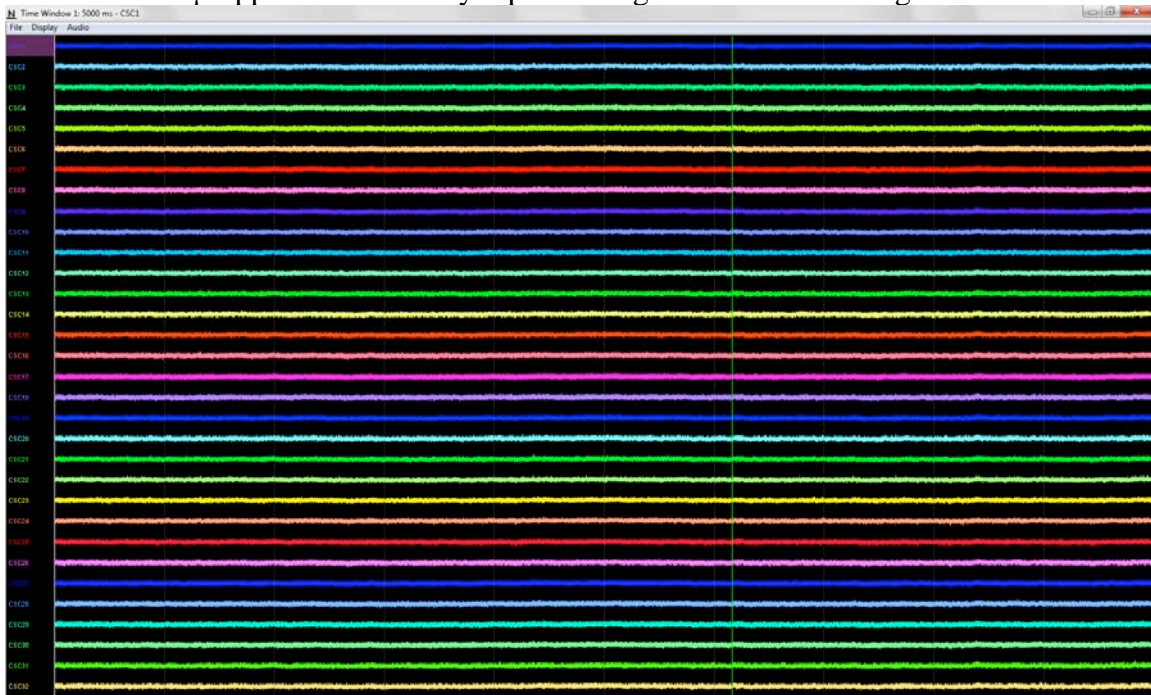


Figure 4-8 All Switches Up ($25\mu\text{V}$).

5 Computer Control

5.1 Installing the USB Drivers

Computer control over the Saturn-X Commutator is accomplished via a Virtual COM Port and a USB to Serial UART IC in the device. The drivers for the Virtual COM Port can be found at the Neuralynx website under the Software Section. By enabling this connection, the user can access control settings for the Saturn-X Commutator. These include Speed, Acceleration, Start Angle, Stop Angle, and Home Position.

Once the driver package has been downloaded the drivers for the Virtual COM Port can be found in the Folder labeled USB Drivers. Install the drivers by running the *CDMXXXXX_Setup.exe* file. The window in the figure below will appear.

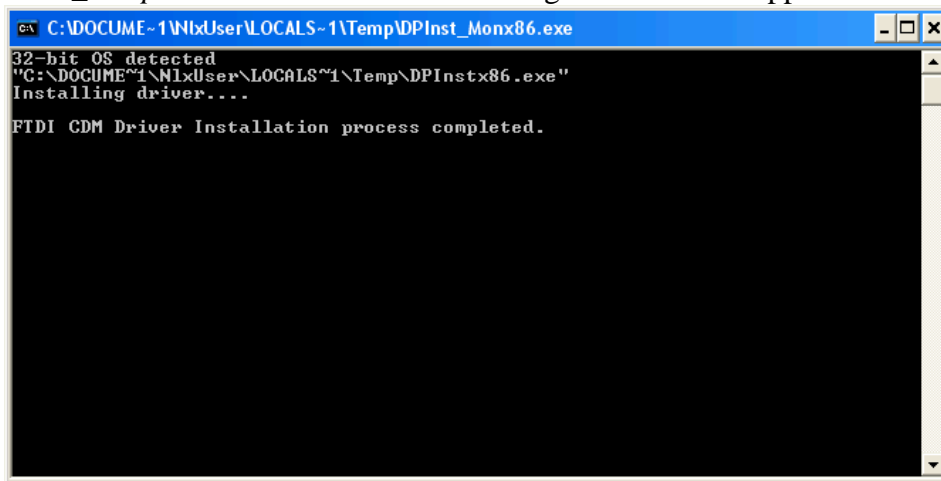


Figure 5-1 Driver Installation Window

It may take a few minutes to install the drivers. When it is finished, make sure the window states: "FTDI CDM Driver Installation process completed." Once the drivers have been installed the window will close itself.

You can now attach the Saturn-X Commutator to your computer with the USB Cable. After cycling through some Found New Hardware popups the popup shown in the following figure will appear confirming the driver was installed properly.

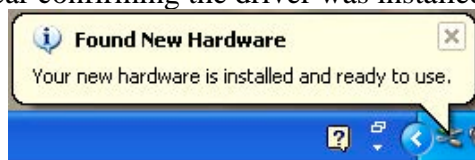


Figure 5-2 Found New Hardware

5.2 Setting Up the Terminal Window

PuTTY, a free Terminal Window is also included in the driver package.

Before opening the Terminal Window the COM Port Number must first be found. Do this by opening the Device Manager and expanding the Ports (COM and LPT) tab. Open the

Device Manager by right-clicking on the My Computer Icon followed by selecting Properties then selecting the Hardware Tab and finally clicking Device Manager. The COM Port Number will be listed after the USB Serial Port. The COM Port Number of the figure below is **COM7**.



Figure 5-3 COM Port Number

Now that the COM Port Number has been obtained, the Terminal Window can be configured. Do this by opening the File *PuTTY.exe* found in the PuTTY Folder. The window in the following figure will appear.

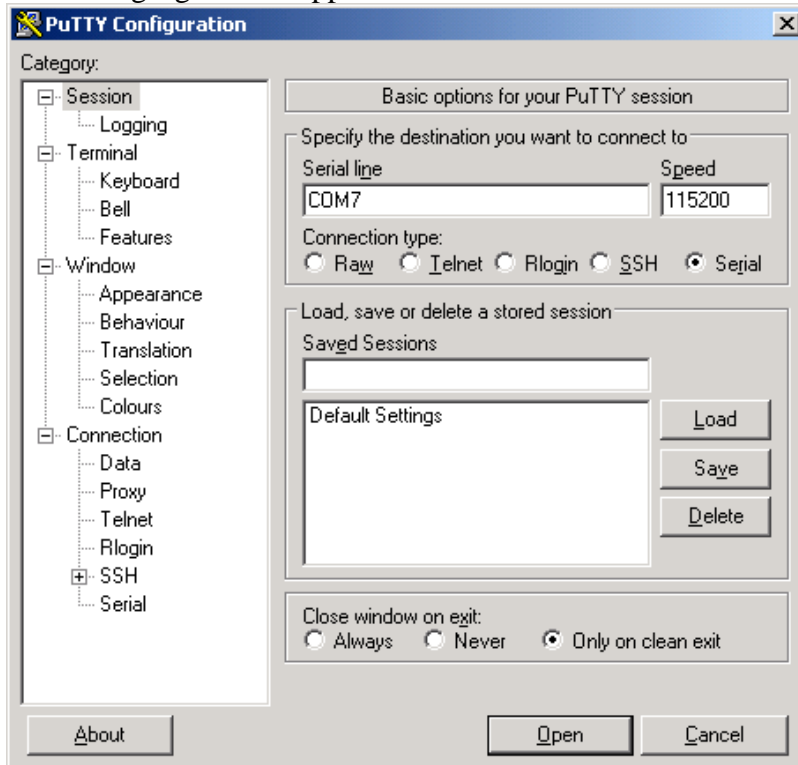


Figure 5-4 Terminal Window Setup

Enter the COM Port Number found earlier into the text box below Serial Line. Select Default Settings under Saved Sessions and click Save. Click Cancel when finished. The Terminal Window has now been configured.

Now open *PuTTY.exe* in the root folder. Press “99” then Enter on the Keyboard, the Terminal Window should display the Auto Mode choices as shown in the figure below. If the Terminal Window does match the figure below the Terminal Window has been configured properly.

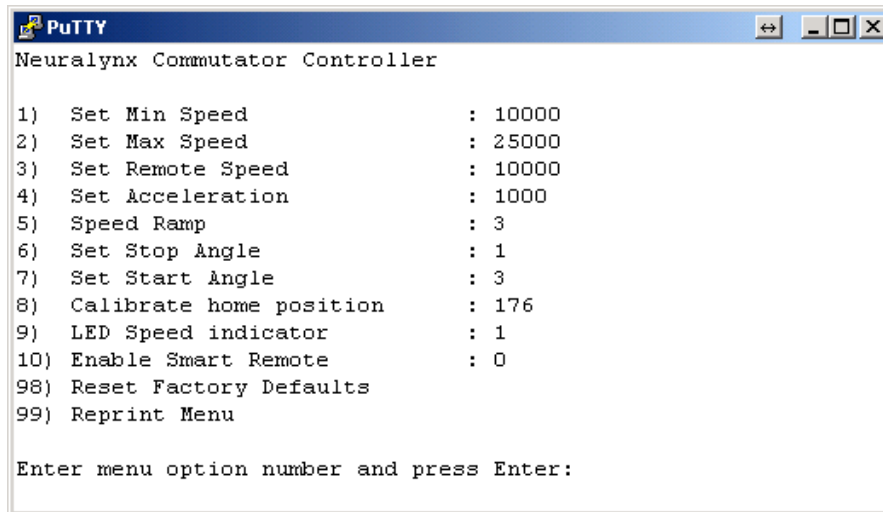
A screenshot of a PuTTY terminal window. The title bar reads "PuTTY" and the window content displays the "Neuralynx Commutator Controller" menu. The menu items are listed as follows:
1) Set Min Speed : 10000
2) Set Max Speed : 25000
3) Set Remote Speed : 10000
4) Set Acceleration : 1000
5) Speed Ramp : 3
6) Set Stop Angle : 1
7) Set Start Angle : 3
8) Calibrate home position : 176
9) LED Speed indicator : 1
10) Enable Smart Remote : 0
98) Reset Factory Defaults
99) Reprint Menu
Below the menu, it says "Enter menu option number and press Enter:".

Figure 5-5 Terminal Window

5.3 Terminal Window Options

5.3.1 Set Min Speed

Sets the minimum pulse rate for the Saturn-X Commutator motor.

5.3.2 Set Max Speed

Sets the maximum pulse rate for the Saturn-X Commutator motor.

5.3.3 Set Remote Speed

Sets the pulse rate for the Saturn-X Commutator motor in Manual Mode.

5.3.4 Set Acceleration Speed

When combined with Ramp Setting, sets the speed at which the Saturn-X Commutator motor accelerates from its minimum pulse rate to its maximum pulse rate, based on the amount of tether displacement.

5.3.5 Speed Ramp

When combined with Acceleration Setting, sets the speed at which the Saturn-X Commutator motor accelerates from its minimum pulse rate to its maximum pulse rate, based on the amount of tether displacement.

5.3.6 Set Stop Angle

Sets the number of displacement degrees from the home position at which the motor will stop spinning.

5.3.7 Set Start Angle

Sets the number of displacement degrees from the home position at which the motor will start spinning.

5.3.8 Calibrate Home Position

Calibrates the home position of the Saturn-X Commutator.

5.3.9 LED Speed indicator

Enables and Disables the Status LED on the Saturn-X Commutator.

5.3.10 Reset Factory Defaults

Resets the Saturn-X Commutator to factory defaults. The Saturn-X Commutator will most likely immediately begin spinning after selecting this option.

5.3.11 Reprint Menu

Simply reprints the Neuralynx Commutator Controller Menu.

6 Mounting

The Saturn-X Commutator is designed to be mounted above an experiment location, usually at the ceiling of the experiment room. The Saturn-X Commutator platform should be mounted as parallel to the floor as possible. Vibration in the mounting structure can cause the torque sensor to shift enough to cause motor rotation. If this happens with nothing attached to provide counter torque, the motor will spin continuously until counter torque is applied or power is removed. The chance of this unintended rotation occurring can be reduced by using the sensitivity threshold jumpers.

Due to the difficulty of locating the Cheetah system near the ceiling, the Saturn-X Commutator is always used with the Neuralynx tether extension, which also protects the delicate wiring from damage in a potentially hostile ceiling environment. The Neuralynx headstage buffers are able to drive up to 25 feet of tether extension cable with no increase in system noise. In most cases, the use of the Saturn-X Commutator and extension cabling should be transparent to the performance of the system. It is suggested, however, that the power cabling for the Saturn-X Commutator be run at least half of one meter away from the tether extension (along its entire length), in order to avoid conducting power supply noise into the electrode signals. This is not a hard requirement but is strongly recommended.

The flex circuit tether exiting the bottom of the Saturn-X Commutator is connected to the headstage tether using the appropriate adapter board. The tether and headstage assembly are usually left plugged in after mounting. The animal is disconnected and reconnected to the hanging tether and headstage each day.

7 Optical and Fluid Integration

The Saturn-X Commutator comes pre-designed for optical and fluid integration. This mount can be purchased separate and can be added at anytime after initial installation. The Saturn-X Commutator unit works independently of the FORJ or Fluid Rotary Joint. The mount does not include either fluid or optical joint. These must be purchased separately.

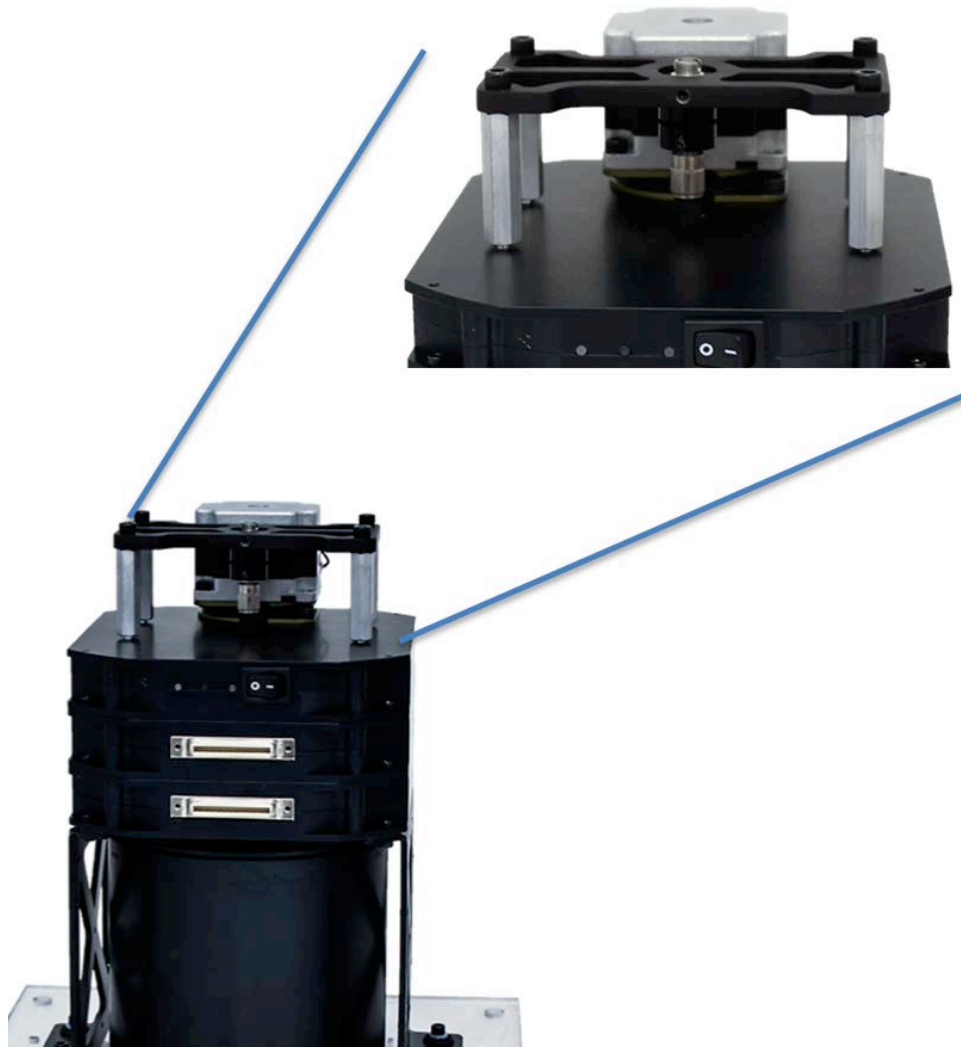


Figure 7-1 FORJ Integration

8 Glossary

CSC – Neuralynx acronym for Continuously Sampled Channel.

EIB – Neuralynx acronym for Electrode Interface Board.

HS – Neuralynx acronym for Headstage.

Saturn-X Commutator – Powered slip ring commutator. X denotes the number of Channel Modules (ie. Saturn-1 contains one Channel Module).

9 Appendix

9.1 Saturn-X Commutator LED Indicator Descriptions



- Saturn-X Commutator powered Off.
- Saturn-X Commutator powered On.
- Power Good.
- Saturn-X Commutator powered On.
- Power Good.
- Motor Spinning.
- Saturn-X Commutator powered On.
- Power Good.
- Device in Manual Mode
- USB Cable connected to Saturn-X Commutator.
- Serious power problem.
- Contact Neuralynx for support.
- Saturn-X Commutator powered On.
- Power Good.
- Serious Saturn-X Commutator problem.
- Contact Neuralynx for support.

Figure 9-1 LED Status Indicators

9.2 Saturn-X Commutator Dimensions

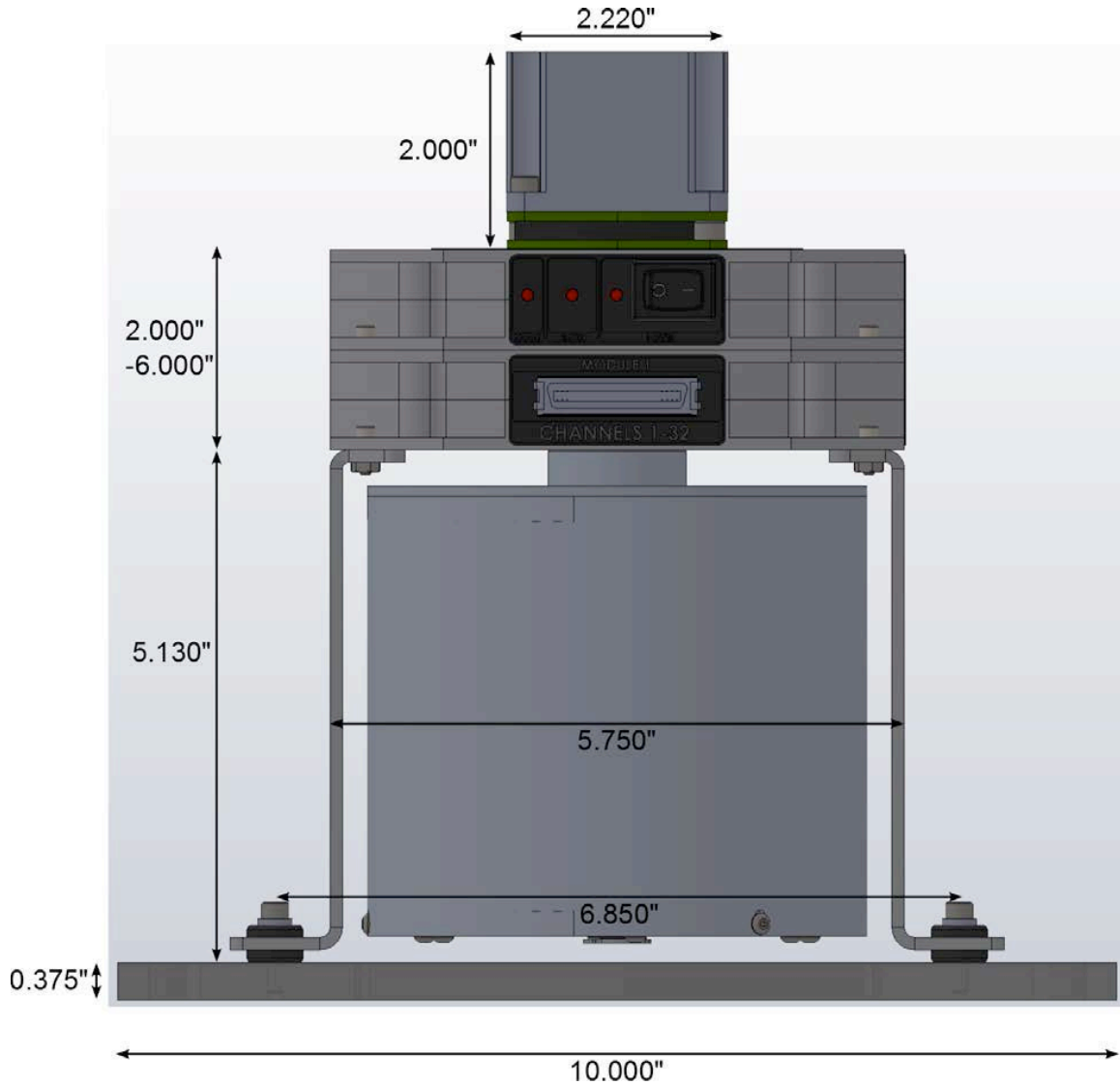


Figure 9-2 Saturn-X Commutator Dimensions – Front View

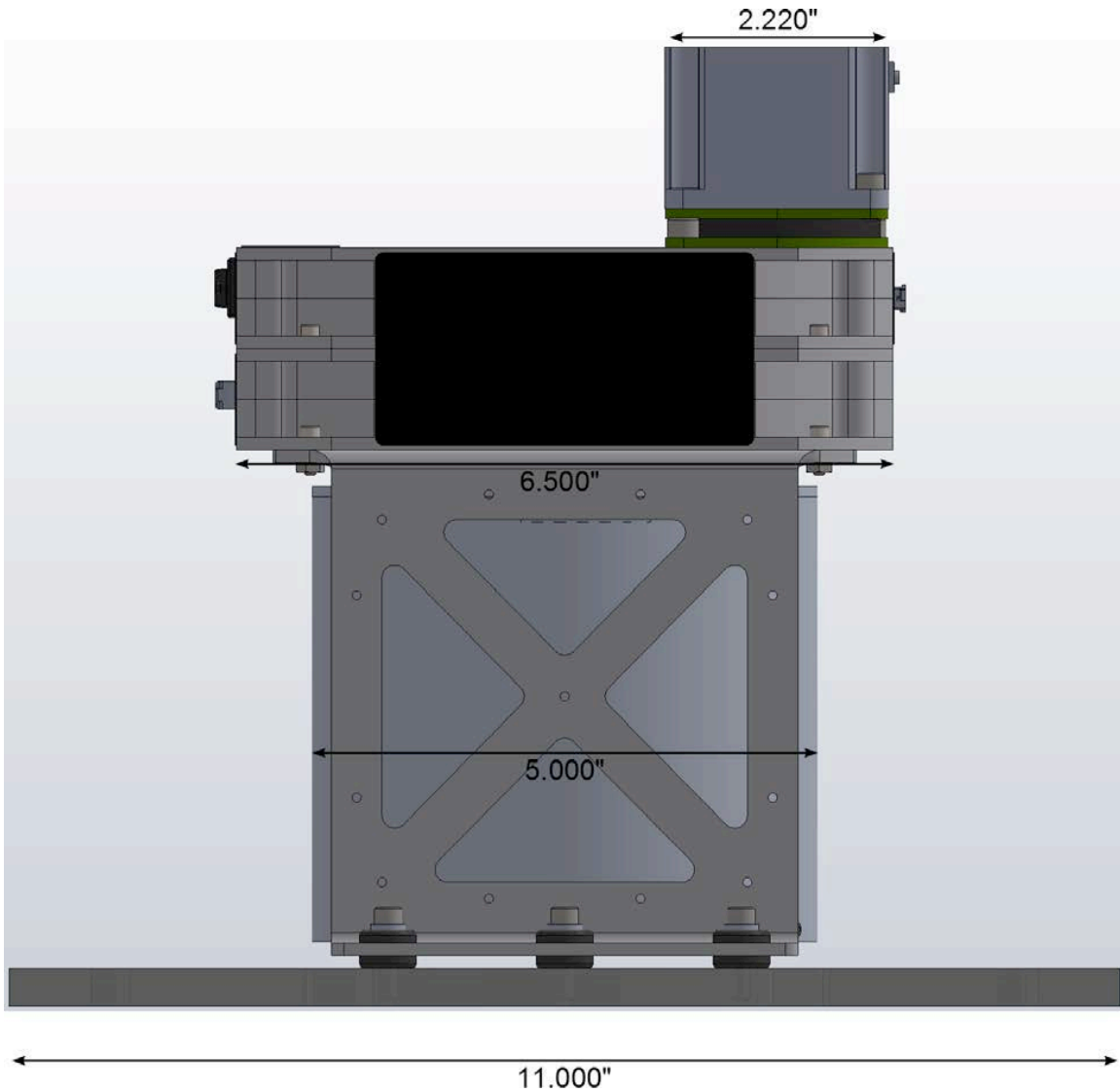


Figure 9-3 Saturn-X Commutator Dimensions – Side View