

# Synclavier<sup>3</sup>®

Synclavier<sup>3</sup> Hardware and Software Installation and Test

Version 1.01

April 21, 2015

Installation and Setup for the BTB-1	3
Visual Inspection	3
TB-1 Thunderbolt-to-PCI-Express Chassis	4
PCIe-DIO-48 Digital I/O Card	5
BTB-1 Buss Transceiver	6
Twisted-Pair Cable	7
D0-PCI Interface Card	8
Software Installation	9
After Restarting - The Console Application	10
Starting Synclavier <sup>3</sup>	11
Real Time Settings	12
Bus Cycle Timing	13
Accessing a SCSI Disk Drive (W0: or W1:)	14
SCSI Data Rate	14
Initial Hardware Verification - The BTB-1 Test Program	15
What is the BTB-1 Test Program	16
Synclavier <sup>3</sup> Control Menu	16
The Logger Test Program	23
Starting The Real Time Software	25

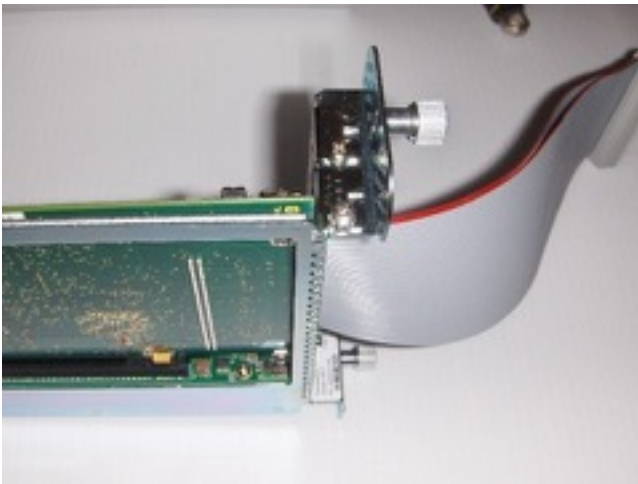
## Installation and Setup for the BTB-1

The BTB-1 hardware and the Synclavier<sup>3</sup> software form a highly integrated system. Different Synclavier® hardware configurations constructed in different eras require slight differences in the BTB-1 setup.

Once the hardware installation is complete there may be some custom timing settings required for your installation.

### Visual Inspection

If you purchased a Thunderbolt Chassis you may wish to inspect that the Digital I/O card in the Chassis is properly seated and that the two flat cables are firmly attached to the Digital I/O Card. The Thunderbolt Chassis is easily opened with the two thumbscrews.



### *Thunderbolt Chassis*

*Detailed assembly instructions for the TB-1 Thunderbolt Chassis are available online at [www.synclavier.com](http://www.synclavier.com).*

*Visual identification of the different hardware pieces can be aided with our [component identification page](#).*

### *Hot Plug-and-Unplug*

*Thunderbolt technology provides for the attachment and removal of Thunderbolt devices without powering down or restarting your computer. Synclavier<sup>3</sup> supports hot plug-and-unplug in certain cases.*

*You should use the Synclavier<sup>3</sup> **Control** menu to **Stop Real Time** before unplugging the Thunderbolt Chassis. Unplugging the chassis while you are using the Sound File Import window to import from a SCSI disk drive is guaranteed to lock up your entire computer.*

## TB-1 Thunderbolt-to-PCI-Express Chassis

The Thunderbolt Chassis connects to your Thunderbolt-equipped computer using a special Thunderbolt cable. The chassis holds the PCI-Express Digital I/O Card. Earlier Macs have PCI-Express card slots; you do not need the Thunderbolt chassis for those installations.



## PCIe-DIO-48 Digital I/O Card

The Digital I/O card plugs into your computer or your Thunderbolt chassis. It connects to the BTB-1 Buss Transceiver using two flat cables.



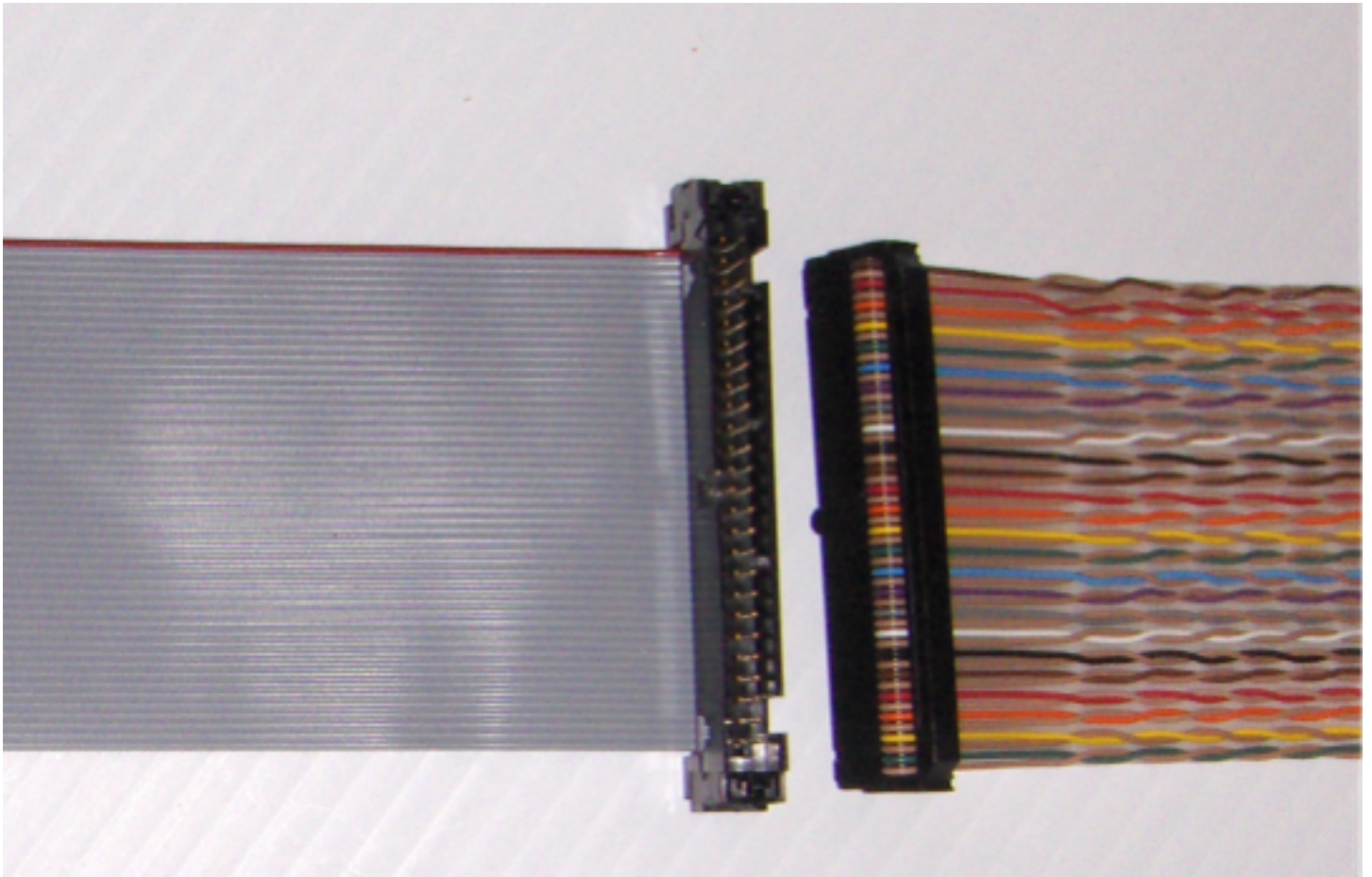
## BTB-1 Buss Transceiver

The BTB-1 Buss Transceiver connects to the Digital I/O card using two flat cables. It connects to your Synclavier® hardware using a special twisted pair cable.



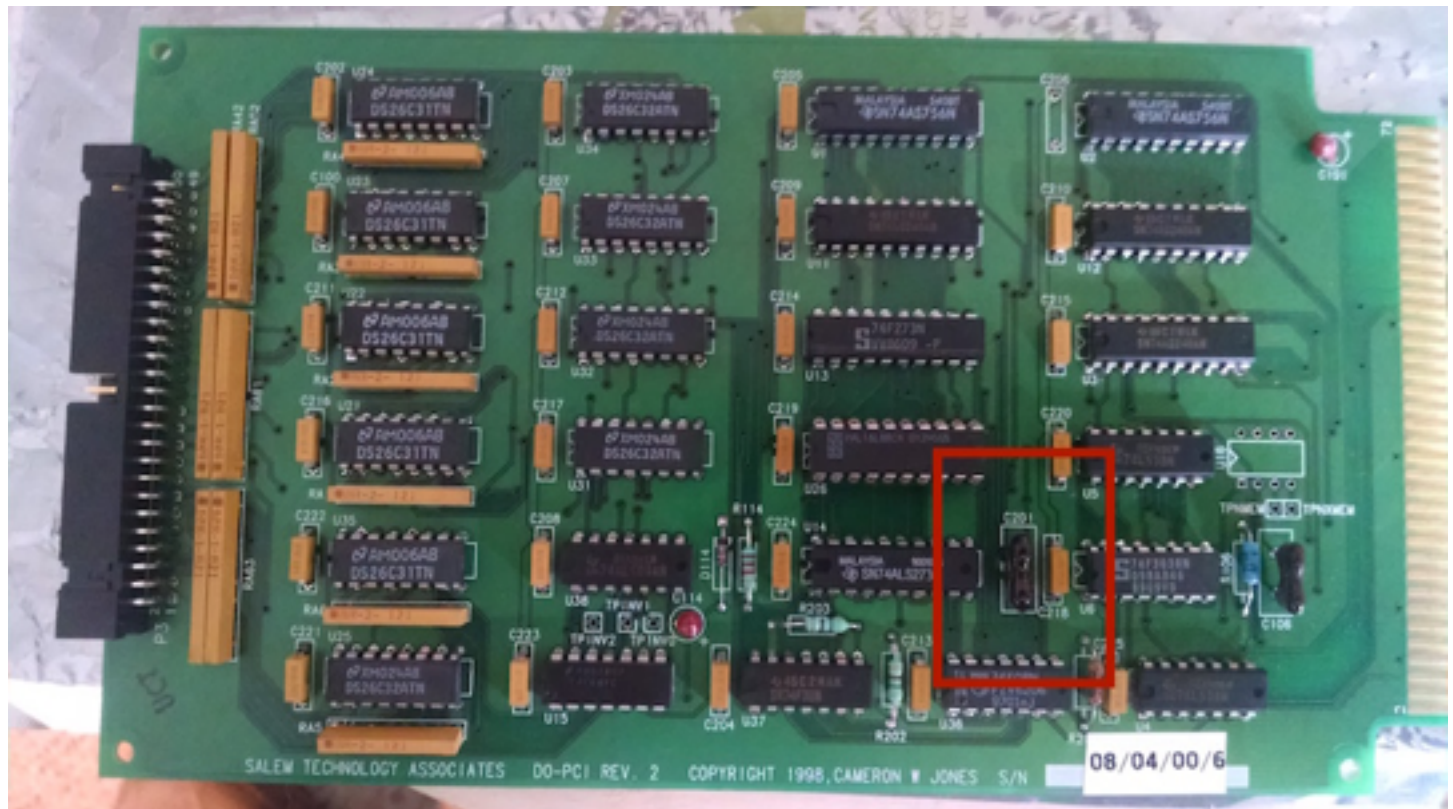
## Twisted-Pair Cable

A special twisted-pair cable connects the BTB-1 Buss Transceiver to your Synclavier® hardware. The twisted pairs provide the proper electrical impedance for high-frequency digital signals. An 8-foot twisted-pair cable is recommended, although the BTB-1 is theoretically capable of longer twisted-pair cable runs. Longer runs will provide a slower transfer rate and may be subject to electrical interference.



## D0-PCI Interface Card

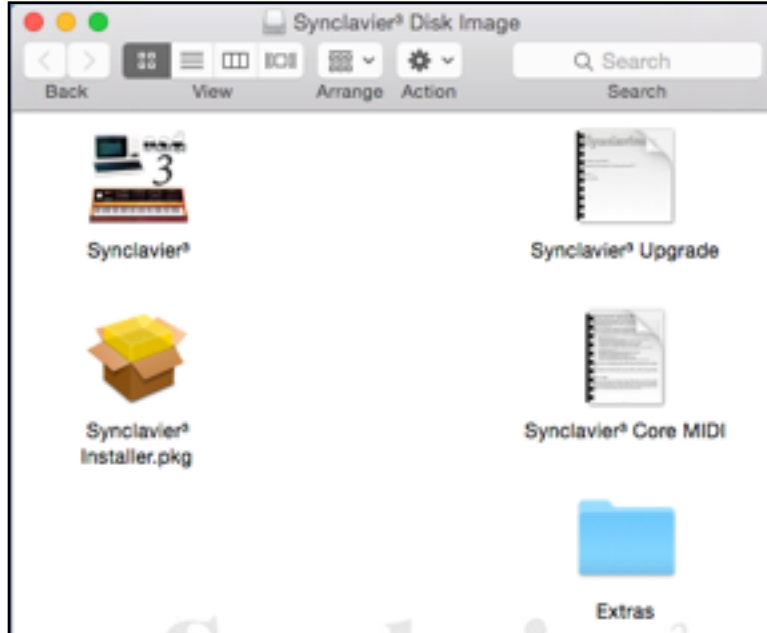
The D0-PCI Interface Card connects the twisted-pair cable to your Synclavier® hardware. Early D0-PCI cards built for the PCI-1 "Classic" PCI card require a small electrical modification to work with the BTB-1. Newly-produced D0-PCI cards do not require any further modification.





## Software Installation

The Synclavier<sup>3</sup> software is available for download at [www.synclavier.com](http://www.synclavier.com). After accepting the terms of the License Agreement you will see a folder containing the Synclavier<sup>3</sup> application and related components.



To use the BTB-1 hardware and MIDI you will have to run the installer which will require a restart. The Synclavier<sup>3</sup> can be copied to any convenient location such as your Desktop or your Applications Folder.

The Extras folder includes a copy of InterChangeX that works with the BTB-1. InterChangeX may be useful to you for working with legacy drives and media. InterChangeX is a Carbon application with several screen-drawing problems.

### Mac OS Versions

*Synclavier<sup>3</sup> has been tested with Mac OS 10.10 "Yosemite" as well as Mac OS 10.9 "Mavericks".*

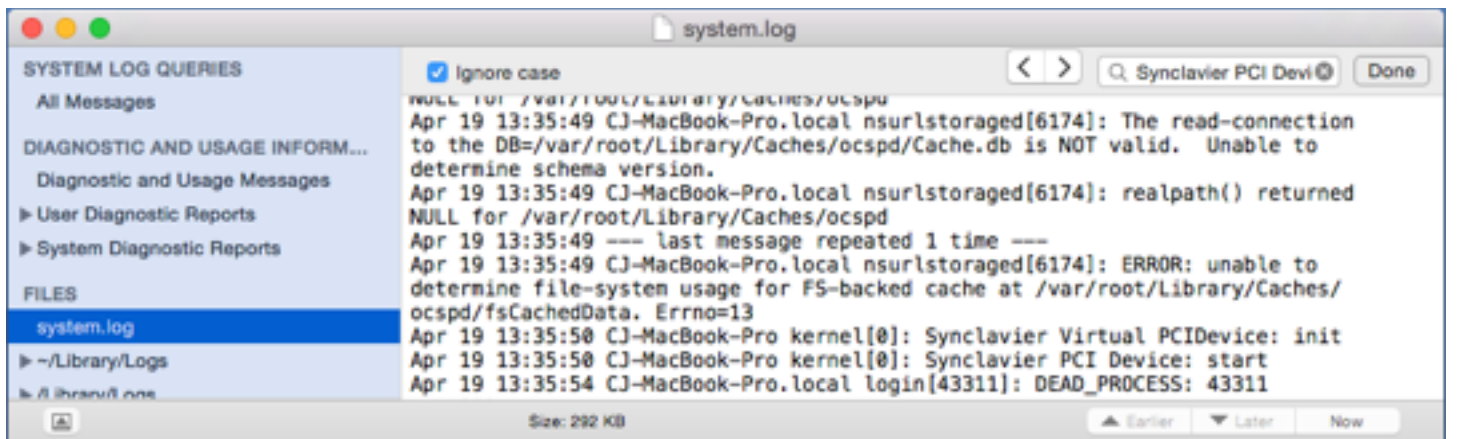
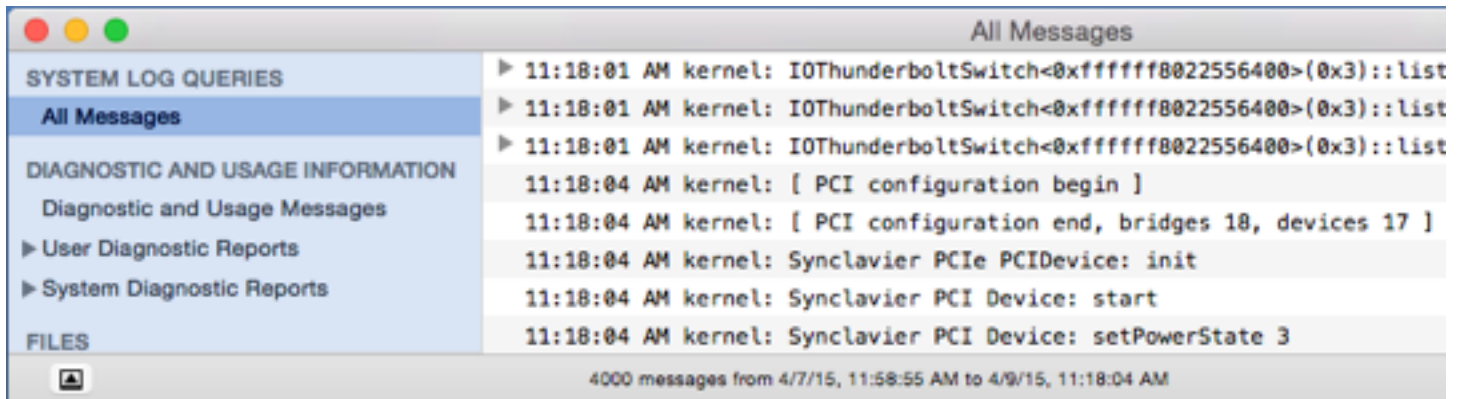
*Both the hardware and software have been designed to allow operation on Mac OS 10.8 "Mountain Lion". however we do not have access to hardware that lets us test that configuration. There may be unexpected problems that show up with the earlier OS.*

## After Restarting - The Console Application

After restarting your computer you should use the Console application (in the Applications/Utilities folder) to verify that the kernel driver was installed and that the Digital I/O card could be found.

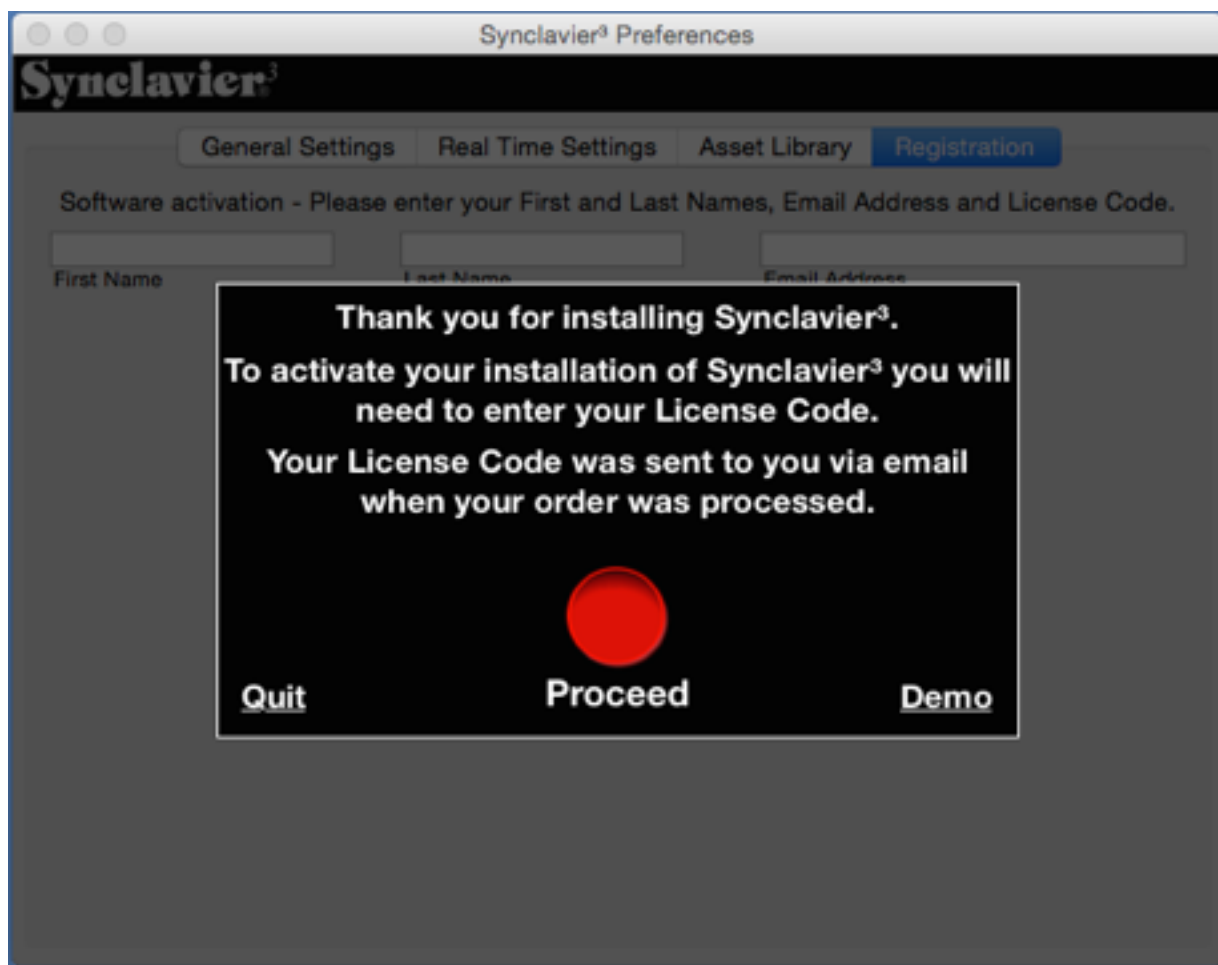
If you have a Thunderbolt Chassis, you will see the “Synclavier PCIe PCI Device: init” message about 5 seconds after you connect your Thunderbolt Chassis.

If you have a PCI-Express Mac Pro, the message may be several pages back in the Console log. To search the console log select the “system log” and cmd-F.



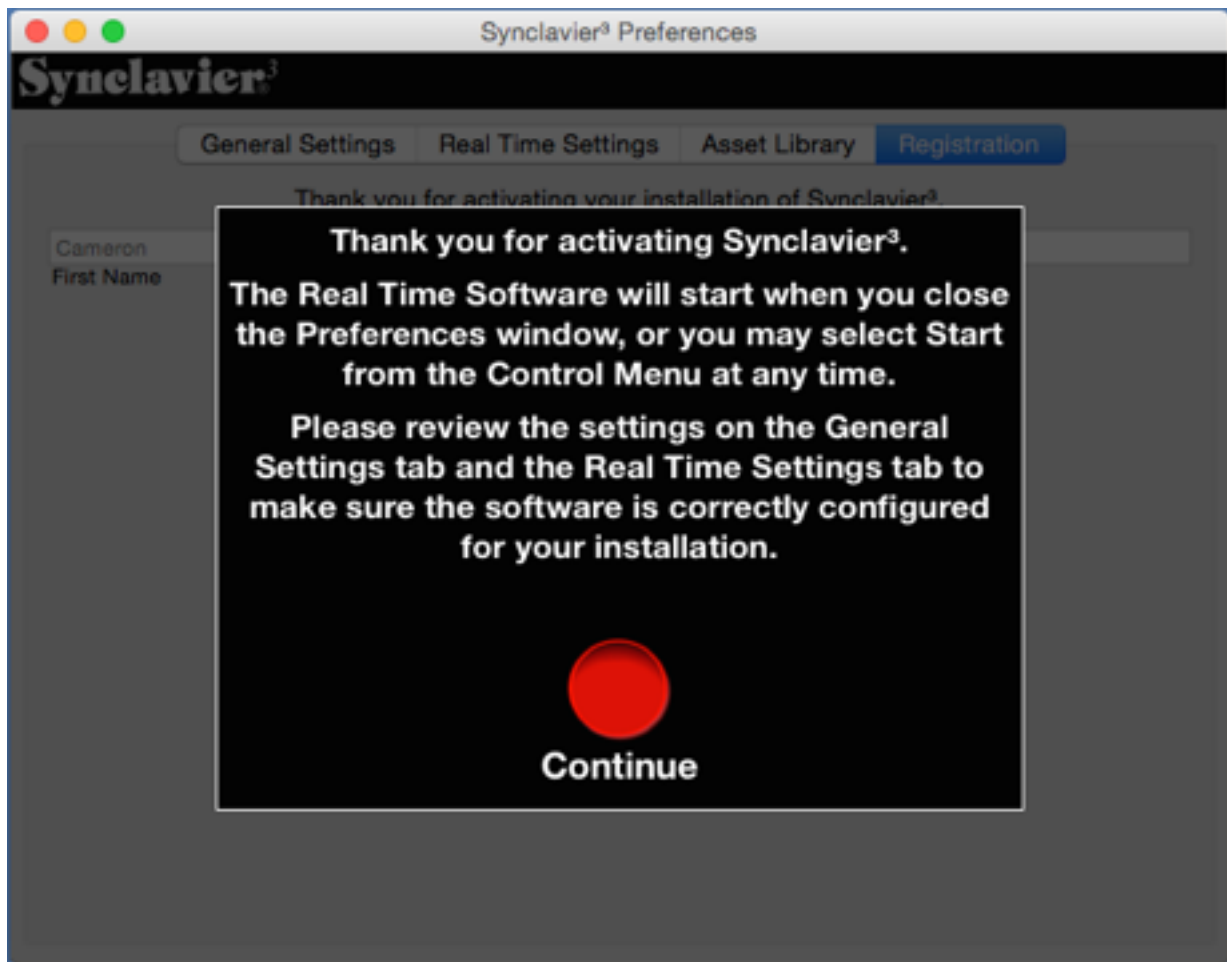
## Starting Synclavier<sup>3</sup>

When you first start Synclavier<sup>3</sup> you will be asked for your license code. Many of the features of Synclavier<sup>3</sup> are available if you select the "Demo" option.

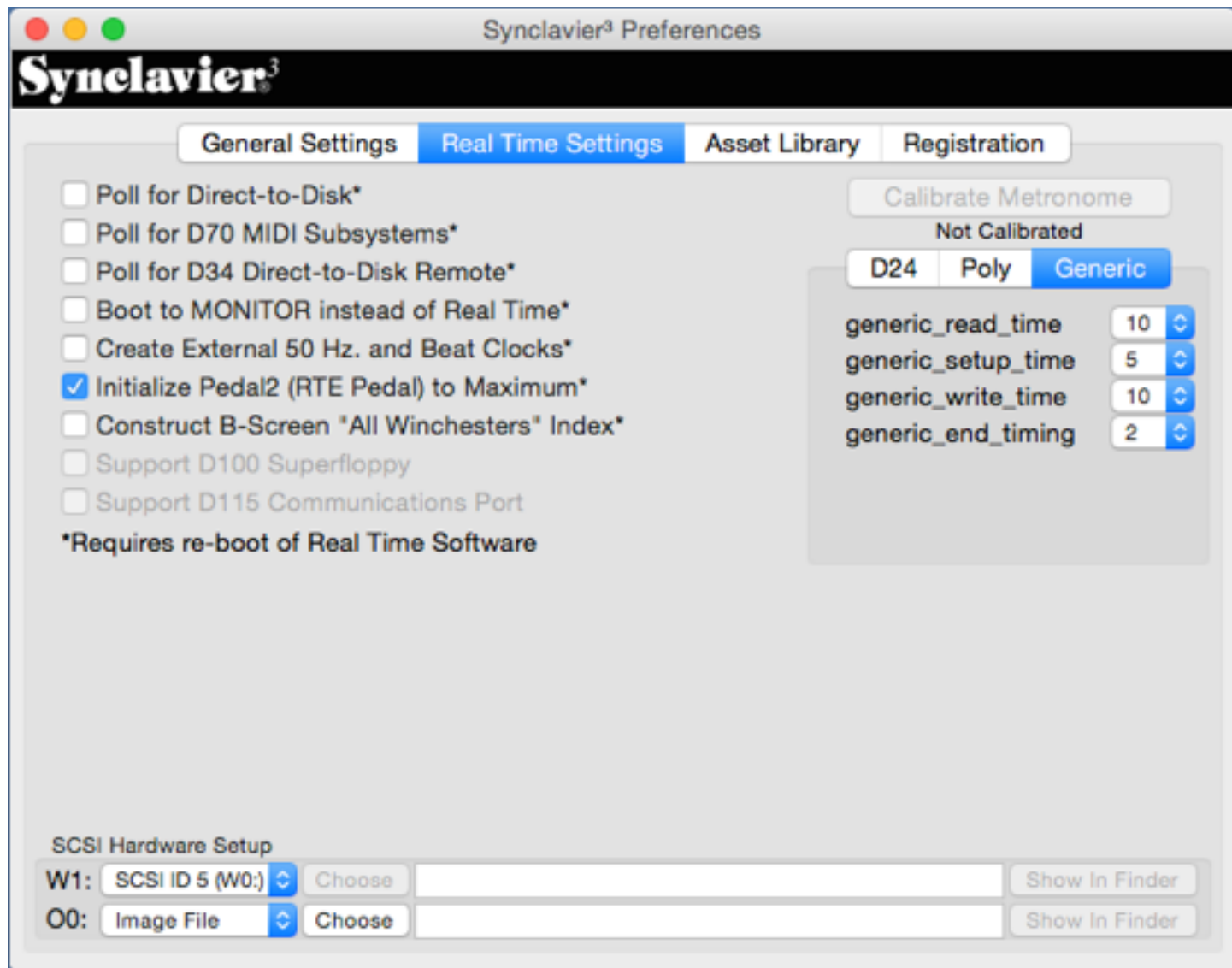


## Real Time Settings

After you enter your license code you will be presented with the Real Time Settings tab of the Synclavier<sup>3</sup> Preferences Window.



## Bus Cycle Timing



## Accessing a SCSI Disk Drive (W0: or W1:)

The Real Time Settings tab includes a control for accessing a SCSI disk drive installed in your Synclavier® hardware. The SCSI disk drive is connected using a D24 SCSI Card.

Synclavier<sup>3</sup> can access your real W0: or W1: disk drive using some special software and the BTB-1 Buss Transceiver



## SCSI Data Rate

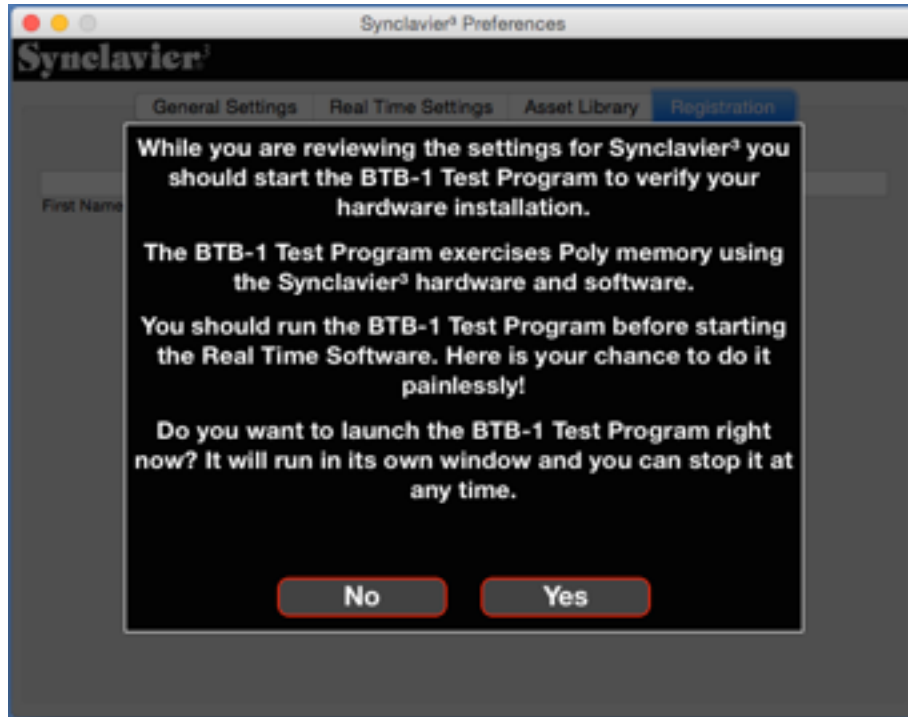
The D24 SCSI card required very specific bus cycle times that are difficult for the BTB-1 to achieve accurately. The result is that access to a real SCSI disk drive is very slow - about 11 seconds per megabyte, or almost 3 hours per gigabyte.

The Sound File Import Window (described elsewhere) can be used to import the entire contents of a W0: or W1: hard drive into a hierarchy of folders and files stored on your computer. Once the import process is completed Synclavier<sup>3</sup> can access all your files very quickly.

## Initial Hardware Verification - The BTB-1 Test Program

The Synclavier<sup>3</sup> application and the associated BTB-1 Buss Transceiver form a complex system. The modern computers are so fast that their I/O instructions have to be slowed down to match the speed of the legacy SynclavierR® hardware. This modulation of the computer I/O bus is accomplished using a combination of timing measurements of the computer hardware conducted during startup, and user settings that can be changed in the Preferences Window.

After you enter your license code (or choose to run in Demo mode) you will be prompted to launch the BTB-1 Test



### *BTB-1 Test Program*

*The BTB-1 Test Program itself is stored within the Resources subfolder within the Synclavier<sup>3</sup> application bundle. The test program is a simple Unix command-line tool that can be stored anywhere on your computer.*

*If you are struggling with installation and setup issues you may wish to move a copy of the BTB-1 Test Program to your desktop where it can easily be launched from the Finder.*

Program. For most installations it is highly desirable to run the BTB-1 Test Program at this point.

## What is the BTB-1 Test Program

The BTB-1 Test Program is a miniature version of the Real Time Software that performs an internal test of the BTB-1 hardware and then uses the BTB-1 to test memory in the polyphonic synthesizer (RAM).

The BTB-1 Test Program is a unix command-line tool and opens in its own window under the Terminal application. Several common error scenarios are shown on the following pages.

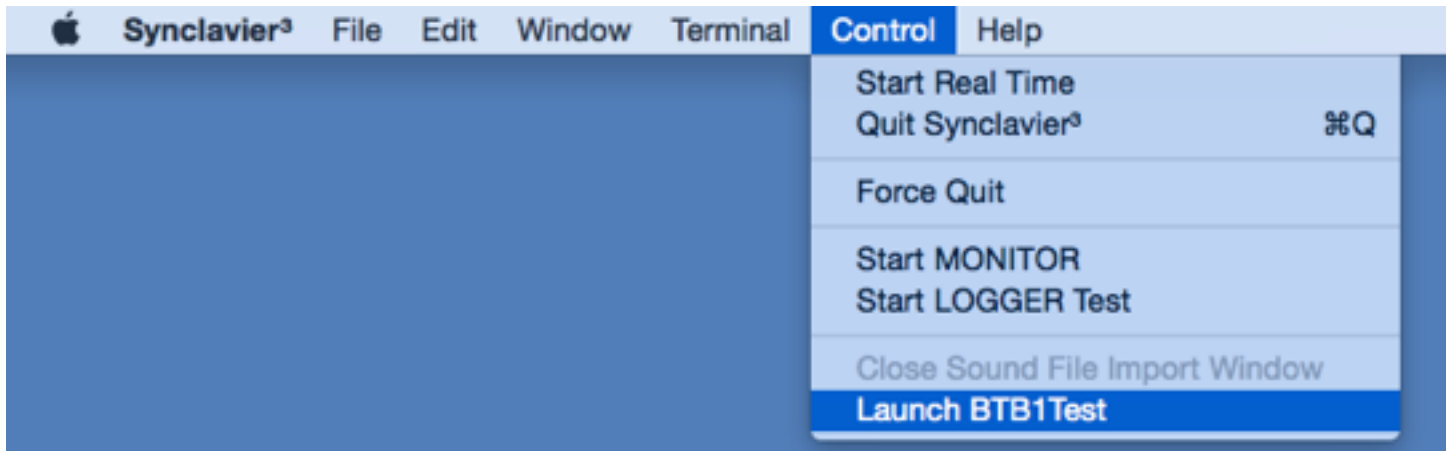
### *Synclavier<sup>3</sup> Control Menu*

*Synclavier<sup>3</sup> includes a new Control Menu that lets you start and stop the Real Time Software.*

*It also has options for easily starting the BTB-1 Test Program and the Logger test program.*

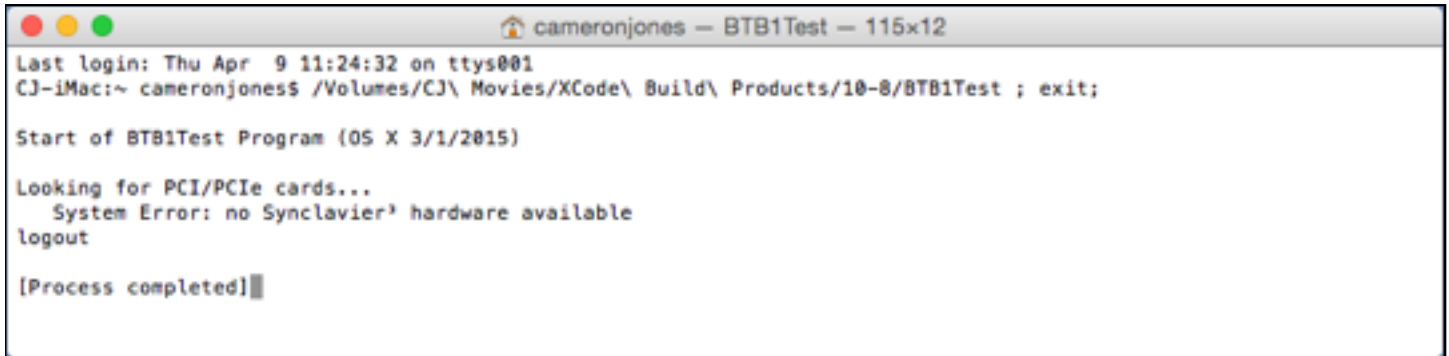
## Synclavier<sup>3</sup> Control Menu

The Control Menu has options for starting and stopping the Real Time Software as well as for launching the test programs. You have to stop the Real Time Software before you can run the tests. Synclavier<sup>3</sup> normally starts the Real Time Software automatically; **holding the shift key will prevent starting Real Time.**





## No Thunderbolt, No Digital I/O Card, No BTB-1 Attached

A screenshot of a macOS terminal window. The title bar shows the user 'cameronjones' and the window title 'BTB1Test - 115x12'. The terminal content shows the following text:

```
Last login: Thu Apr 9 11:24:32 on ttys001
CJ-iMac:~ cameronjones$ /Volumes/CJ\ Movies/XCode\ Build\ Products/10-8/BTB1Test ; exit;

Start of BTB1Test Program (OS X 3/1/2015)

Looking for PCI/PCIe cards...
  System Error: no Synclavier3 hardware available
logout

[Process completed]
```

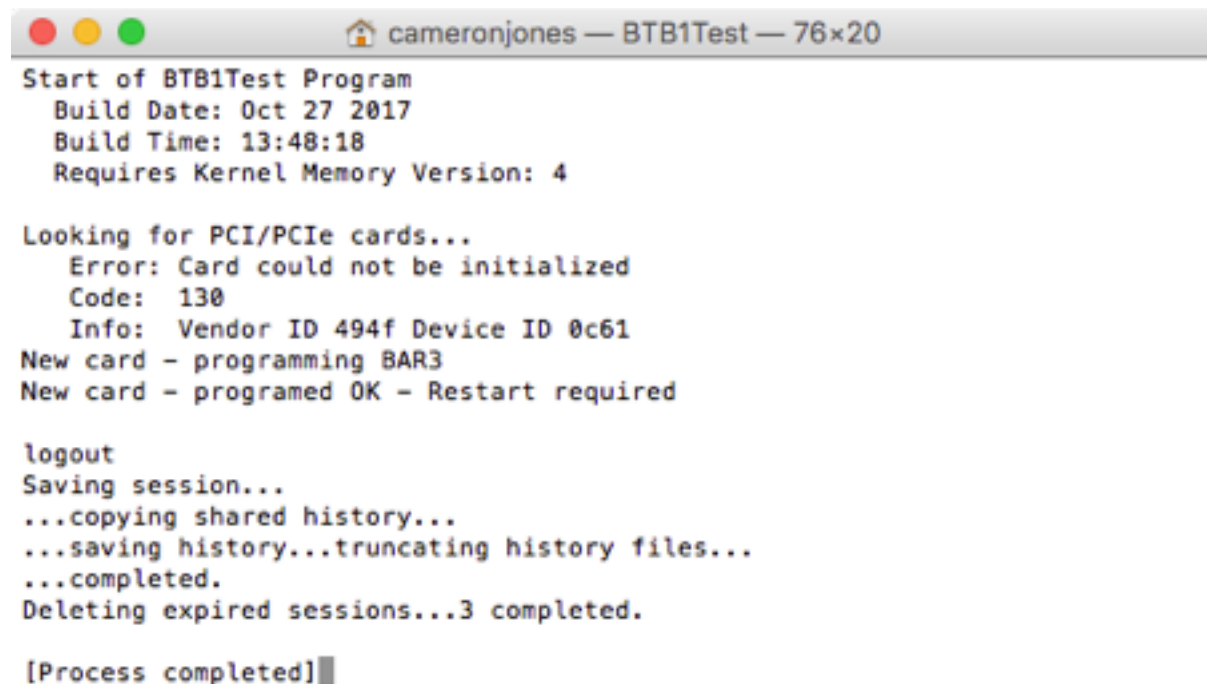
Possible indications include the Thunderbolt chassis turned off, The Digital I/O card unplugged from the PCI-Express slot or problems with the Mac -> Thunderbolt Chassis cable.

## Digital I/O Card Installed; Needs Initialization

The Digital I/O Card must be programmed the very first time it is used. This step needs to only be performed once. The card programming is typically performed at Synclavier Digital during system testing. However, if you purchase a replacement Digital I/O Card the programming step will need to be completed.

The programming is done automatically the first time the card is used. However a system restart or Thunderbolt power cycle will be required after the programming is completed.

A message indicating the programming status is presented by the BTB- Test Program.

A screenshot of a macOS terminal window. The title bar shows a home icon, the name 'cameronjones', the window title 'BTB1Test', and the size '76x20'. The terminal text is as follows:

```
Start of BTB1Test Program
  Build Date: Oct 27 2017
  Build Time: 13:48:18
  Requires Kernel Memory Version: 4

Looking for PCI/PCIe cards...
  Error: Card could not be initialized
  Code: 130
  Info: Vendor ID 494f Device ID 0c61
New card - programming BAR3
New card - programed OK - Restart required

logout
Saving session...
...copying shared history...
...saving history...truncating history files...
...completed.
Deleting expired sessions...3 completed.

[Process completed]
```

More details about the Digital I/O card programming are available by using the Mac O/S Console application to look at the system log:

```
system.log
SYSTEM LOG QUERIES
All Messages
DIAGNOSTIC AND USAGE INFORMATION
Diagnostic and Usage Messages
User Diagnostic Reports
System Diagnostic Reports
FILES
system.log
~/Library/Logs
/Library/Logs
/var/log
accountpolicy.log
accountpolicy.log.gz
Nov 2 10:33:53 CJ-Mini kernel[0]: Synclavier PCI Device: newUserClient
Nov 2 10:33:53 CJ-Mini kernel[0]: Synclavier PCI User Client: start
Nov 2 10:33:53 CJ-Mini kernel[0]: Synclavier PCI Device: SetParameter - InitializeHardware (2, 2)
Nov 2 10:33:53 CJ-Mini kernel[0]: InitializePCIHardware - New AccessIO card detected - programming required
Nov 2 10:33:53 CJ-Mini kernel[0]: InitializePCIHardware - Got BAR0 <ptr>
Nov 2 10:33:53 CJ-Mini kernel[0]: InitializePCIHardware - LCS_LAS0RR 0xffffffff1
Nov 2 10:33:53 CJ-Mini kernel[0]: InitializePCIHardware - LCS_LAS0BA 0x00000001
Nov 2 10:33:53 CJ-Mini kernel[0]: InitializePCIHardware - LCS_LBRD0 0x42400040
Nov 2 10:33:53 CJ-Mini kernel[0]: InitializePCIHardware - LCS_LAS1RR 0x00000000
Nov 2 10:33:53 CJ-Mini kernel[0]: InitializePCIHardware - LCS_LAS1BA 0x00000000
Nov 2 10:33:53 CJ-Mini kernel[0]: InitializePCIHardware - LCS_LBRD1 0x00000040
Nov 2 10:33:53 CJ-Mini kernel[0]: InitializePCIHardware - LCS_PROT (1) 0x30
Nov 2 10:33:53 CJ-Mini kernel[0]: InitializePCIHardware - LCS_PROT (2) 0x12
Nov 2 10:33:53 CJ-Mini kernel[0]: InitializePCIHardware - EE_LAS1RR 0x00000000
Nov 2 10:33:53 CJ-Mini kernel[0]: InitializePCIHardware - EE_LAS1BA 0x00000000
Nov 2 10:33:53 CJ-Mini kernel[0]: InitializePCIHardware - EE_LBRD1 0x00000040
Nov 2 10:33:53 CJ-Mini kernel[0]: InitializePCIHardware - EE_LAS1RR 0xffffffff00
Nov 2 10:33:53 CJ-Mini kernel[0]: InitializePCIHardware - EE_LAS1BA 0x00000001
Nov 2 10:33:53 CJ-Mini kernel[0]: InitializePCIHardware - EE_LBRD1 0x00000240
Nov 2 10:33:53 CJ-Mini kernel[0]: InitializePCIHardware - New AccessIO card detected - programming OK
```

## BTB-1 Connected; Synclavier® Hardware Turned Off

```

Last login: Thu Apr  9 11:29:01 on ttys001
CJ-iMac:~ cameronjones$ /Volumes/CJ\ Movies/XCode\ Build\ Products/10-8/BTB1Test ; exit;

Start of BTB1Test Program (OS X 3/1/2015)

Looking for PCI/PCIe cards...
Vendor ID 494f Device ID 0c61
BTB-1 revision 1 identified

OK: Board pci494f,c61 found; beginning tests...
  Testing the Registers on board pci494f,c61...
  Registers OK
  Error: No poly memory available for test
logout

[Process completed]
```

## BTB-1 Test Program Normal Operation

```
cameronjones — BTB1Test — BTB1Test — 89x18
Last login: Thu Apr  9 11:31:10 on ttys001
CJ-iMac:~ cameronjones$ /Volumes/CJ\ Movies/XCode\ Build\ Products/10-8/BTB1Test ; exit;

Start of BTB1Test Program (OS X 3/1/2015)

Looking for PCI/PCIe cards...
Vendor ID 494f Device ID 0c61
BTB-1 revision 1 identified

OK: Board pci494f,c61 found; beginning tests...
  Testing the Registers on board pci494f,c61...
  Registers OK
  OK: Looks like a poly system is available for testing
  Note: Test will run forever. Halt test with ctrl-c
  Time:  0:01:45  Megs:    29  Write MB/Min:  56  Read MB/Min:  16
```

## BTB-1 Test Program One Flat Cable Disconnected

```

● ● ● cameronjones — BTB1Test — 93x21
Last login: Thu Apr 9 11:28:35 on ttys001
CJ-iMac:~ cameronjones$ /Volumes/CJ\ Movies/XCode\ Build\ Products/10-8/BTB1Test ; exit;

Start of BTB1Test Program (OS X 3/1/2015)

Looking for PCI/PCIe cards...
Vendor ID 494f Device ID 0c61
BTB-1 revision 1 identified

OK: Board pci494f,c61 found; beginning tests...
  Testing the Registers on board pci494f,c61...
  Error: PCI - Registers failed
  Code: 0
  Info: Exercise_PCI1_registers failed cable data
  wrote: 0x2710
  read: 0xffffffff
  re-read: 0xffff

logout

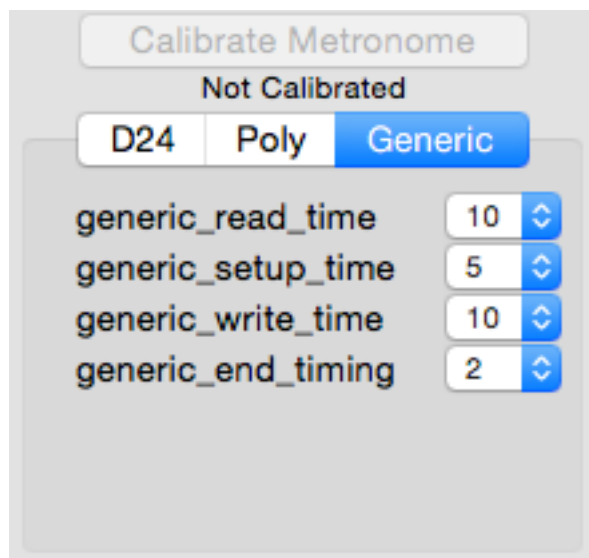
[Process completed]
```

## The Logger Test Program

The Logger Test Program is a comprehensive diagnostic program for the Polyphonic Synthesizer. It exercises all the hardware registers using the BTB-1 Buss Transceiver.

Once your installation passes the Logger test it will likely run the Real Time Software without issue.

For large systems with multiply poly bins the buss cycle times might need to be adjusted. Typically increasing the `generic_read_time` and `generic_write_time` to 12 or 14 will slow down the BTB-1 sufficiently to communicate with your Synclavier® hardware.



Error log diagnostic - 2015/01/01

Iteration # 5

Test	Bin #1 Errors	Test	Errors
Serial chain	0	D16 timer load	0
Poly memory addressing	0	D16 vs. D3 timer	0
Poly Memory	0	D4567 Mpy./Divide	0
Phase accumulator #1	0	External memory	0
Phase accumulator #2	0	M64K clocks	0
Sample rate generator	0		
A/D controller	-----		
Amplitude computer #1	0		
Amplitude computer #2	-----		
Wave bus	0		
Envelope bus	0		
Oscillator swap	0		

Testing 16 Mbytes of Poly memory in bin 1 ...

- Addressing Test with random interference:

Performing refresh test .....

&lt;S&gt; - Select tests

&lt;BREAK&gt; - Exit



## Starting The Real Time Software

The Synclavier® Real Time Software will start automatically when you first close the Synclavier<sup>3</sup> Preferences window. You will be prompted to run Logger the first time you start the Real Time Software.

