

Getting Started with BrainStem/MTM (2 of 2)

Software Setup Guide

Thank you for choosing MTM from Acroname! In this guide, we will walk an initial bring-up and basic evaluation of the BrainStem/MTM platform. By the end of this guide, you will be able to:

1. Use USB to access MTM modules over the BrainStem network
2. Use the Updater tool to update your MTM modules to the latest firmware and
3. Use StemTool to exercise simple functions using resources of the MTM modules:
 - a. Configuring, setting and reading digital signals
 - b. Analog measurement of a digital signal
 - c. Analog measurement of an analog signal
 - d. Enable BrainStem network routing to access multiple MTM modules
 - e. Using multiple MTM modules - analog measurement of a power rail

Before you start, you will need an MTM Development Board and the relevant MTM modules that you will be exercising in your project.

See the ["Getting Started with BrainStem/MTM: Hardware Setup Guide"](#) document.

Setup MTM Hardware

You will need an internet-connected host computer with at least one USB port and running either Windows (7 or higher), Linux or Mac OS X. In this example, we will be running Windows 10.

From the Hardware Setup Guide, we assume that MTM Evaluation Kit hardware is available and running:

- (1) MTM Development Board
- (1) MTM USBStem Module
- (1) MTM PM-1 Single-Channel Programmable Power Module
- (1) MTM IO-Serial Module
- (1) 12V/5A power supply
- (1) USB Type A to mini-USB cable



Figure 1: MTM Evaluation Kit

Once your MTM hardware is set up and powered on, you will need to connect one module to your host machine. The connection can be to any of the modules in the MTM Evaluation Kit, but for the first example, we will connect our host to the MTM-USBStem module using mini-B USB edge connector:

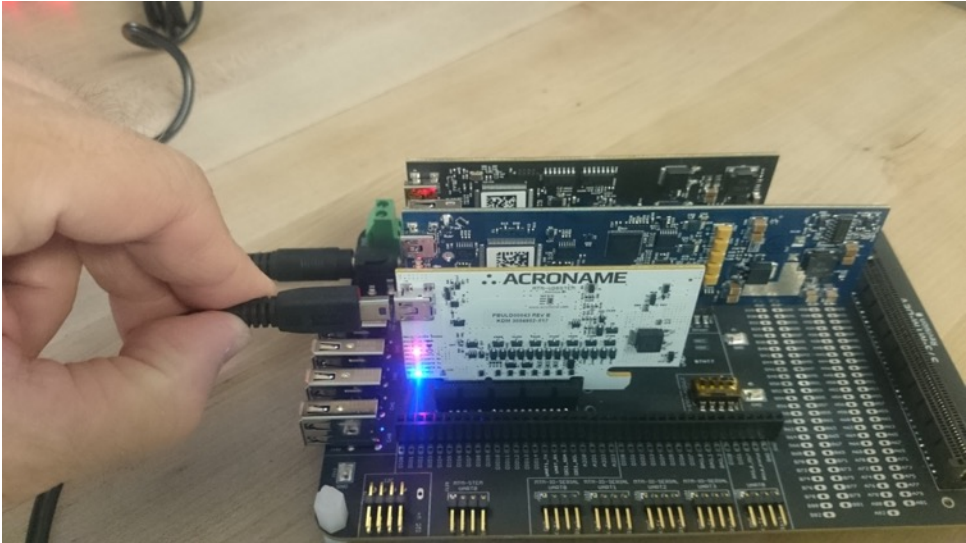


Figure 2: Plug in USB from host machine

With the host plugged in to the MTM module edge connector, you should now see the yellow “USB Status” LED lit to indicate an active host connection:

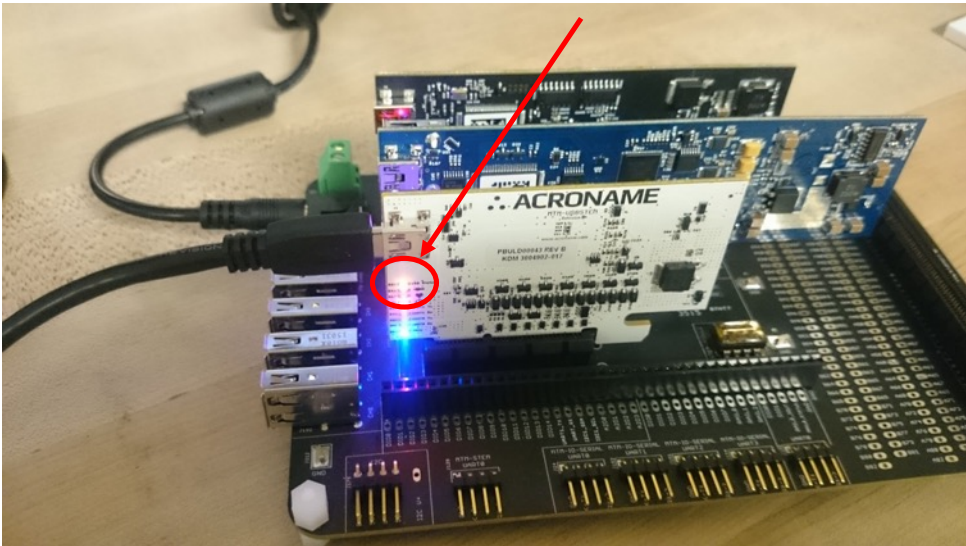
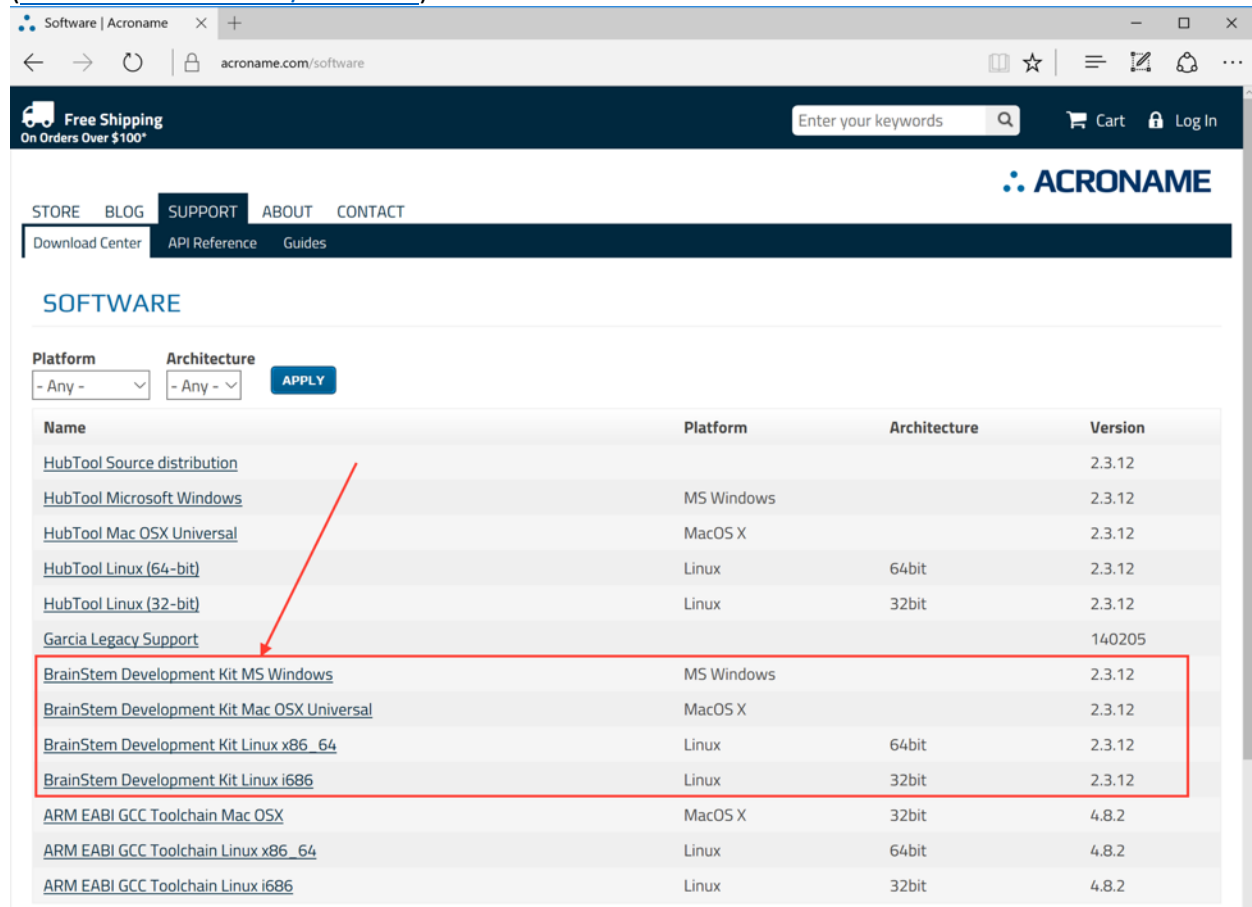


Figure 3: Host LED enabled when USB host detected

Download BrainStem Developer's Kit

In order to communicate with any of the MTM modules, the BrainStem libraries will need to be installed on the host machine.

Download the latest BDK (BrainStem Developer's Kit) package from Acroname (www.acroname.com/software)



The screenshot shows the Acroname website's software download page. The page has a navigation bar with links for STORE, BLOG, SUPPORT, ABOUT, and CONTACT. Below the navigation bar, there is a search bar and a 'Log In' button. The main content area is titled 'SOFTWARE' and features a filter section with 'Platform' and 'Architecture' dropdown menus and an 'APPLY' button. A table of software packages is displayed below the filter section. The table has four columns: Name, Platform, Architecture, and Version. The packages listed are:

Name	Platform	Architecture	Version
HubTool Source distribution			2.3.12
HubTool Microsoft Windows	MS Windows		2.3.12
HubTool Mac OSX Universal	MacOS X		2.3.12
HubTool Linux (64-bit)	Linux	64bit	2.3.12
HubTool Linux (32-bit)	Linux	32bit	2.3.12
Garcia Legacy Support			140205
BrainStem Development Kit MS Windows	MS Windows		2.3.12
BrainStem Development Kit Mac OSX Universal	MacOS X		2.3.12
BrainStem Development Kit Linux x86_64	Linux	64bit	2.3.12
BrainStem Development Kit Linux i686	Linux	32bit	2.3.12
ARM EABI GCC Toolchain Mac OSX	MacOS X	32bit	4.8.2
ARM EABI GCC Toolchain Linux x86_64	Linux	64bit	4.8.2
ARM EABI GCC Toolchain Linux i686	Linux	32bit	4.8.2

Figure 4: Location of BrainStem Development Kit Download

Expand the BDK package to a directory of your choosing. In this example, we have installed the BrainStem Development Kit for MS Windows to the local Desktop folder:

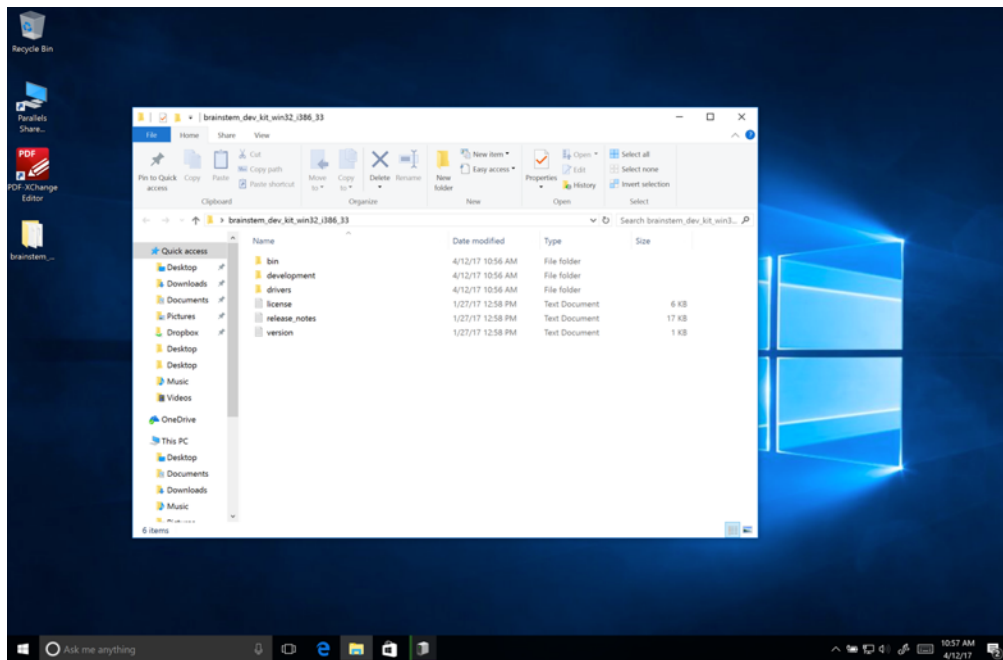


Figure 5: BrainStem Development Kit (BDK) folder contents

****Windows 7 CAVEAT**** Under Windows 7, you will need to manually load the USB BrainStem driver. This applies only to Windows 7 and does not apply to Windows 8.1 or higher.

Instructions to update the BrainStem driver in Windows 7 are also included within the BDK directory under the \drivers folder:

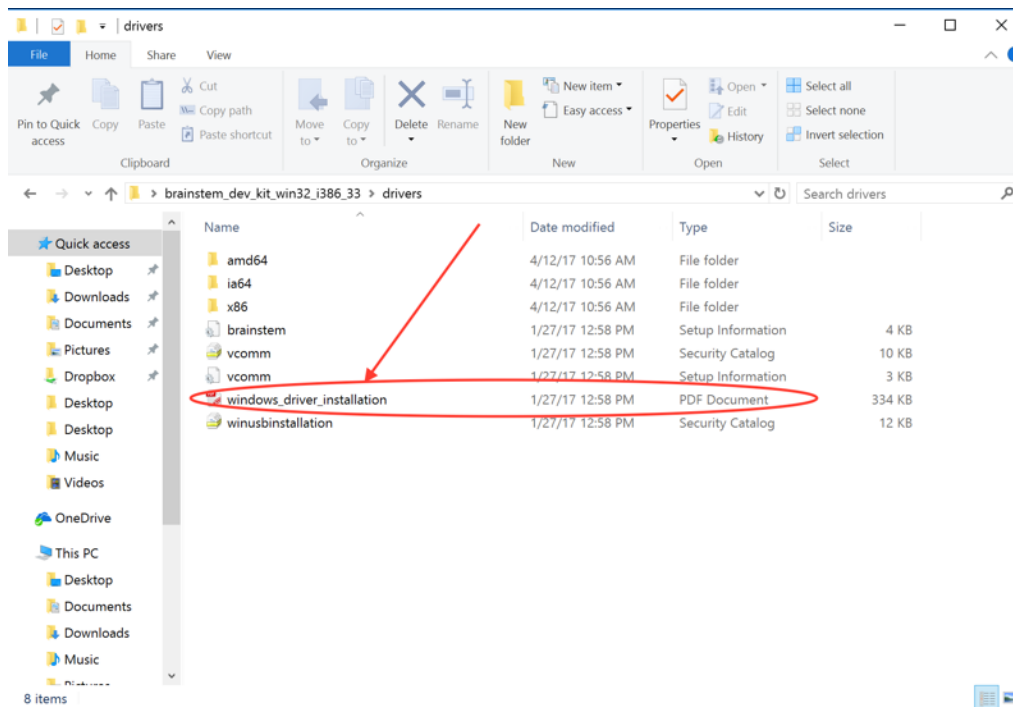


Figure 6: Windows 7 Driver Installation Instructions

In the next steps of this guide, we will be using two applications, located in the /bin folder:

- Updater
CLI/command line interface tool for updating and managing BrainStem firmware
- StemTool
GUI tool used for exercising simple MTM module functions and troubleshooting

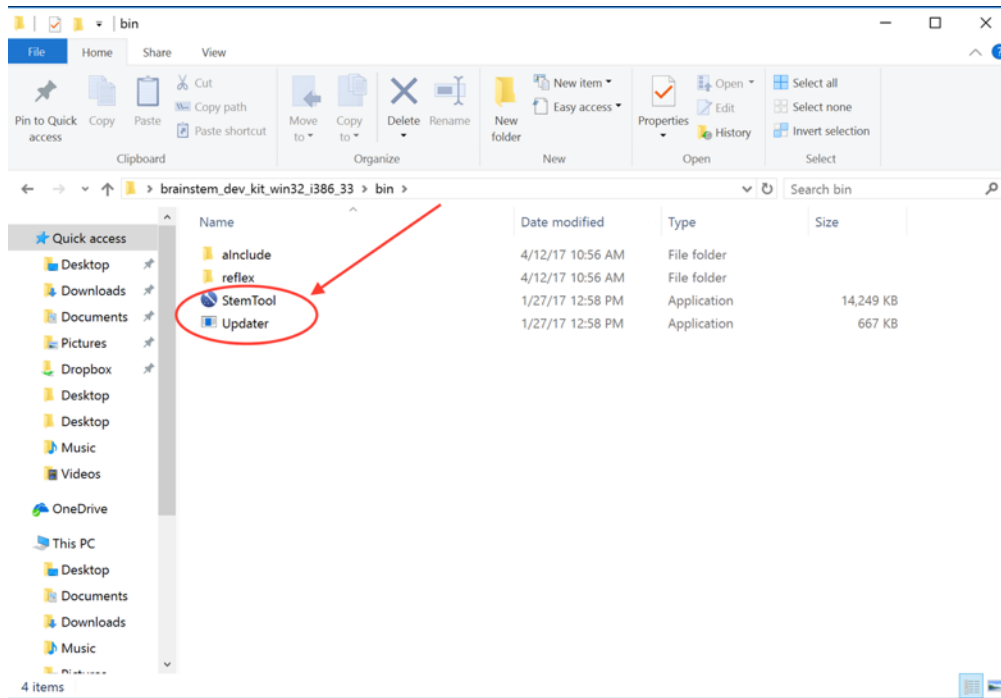
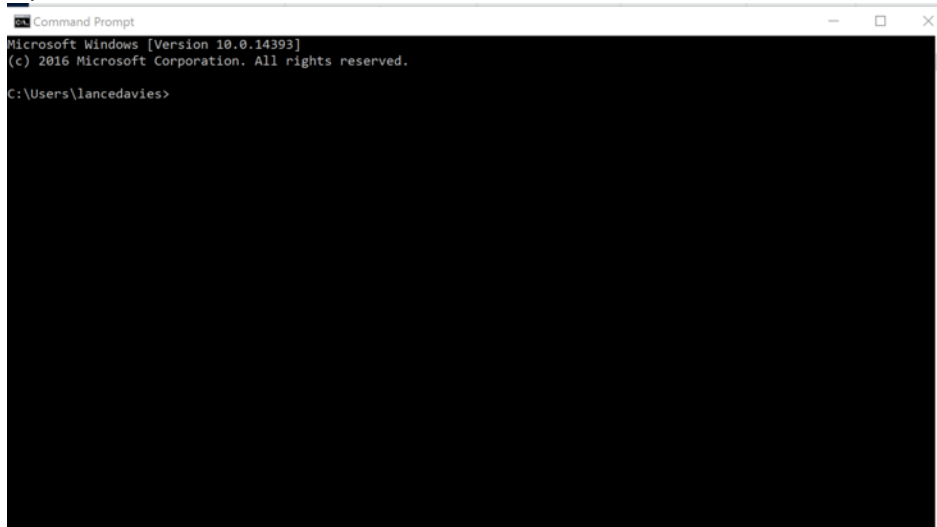


Figure 7: StemTool and Updater Utilities

Firmware Update

Now that the BrainStem driver is loaded, update firmware on the BrainStem/MTM modules to the latest version.

Open a command line in Windows:

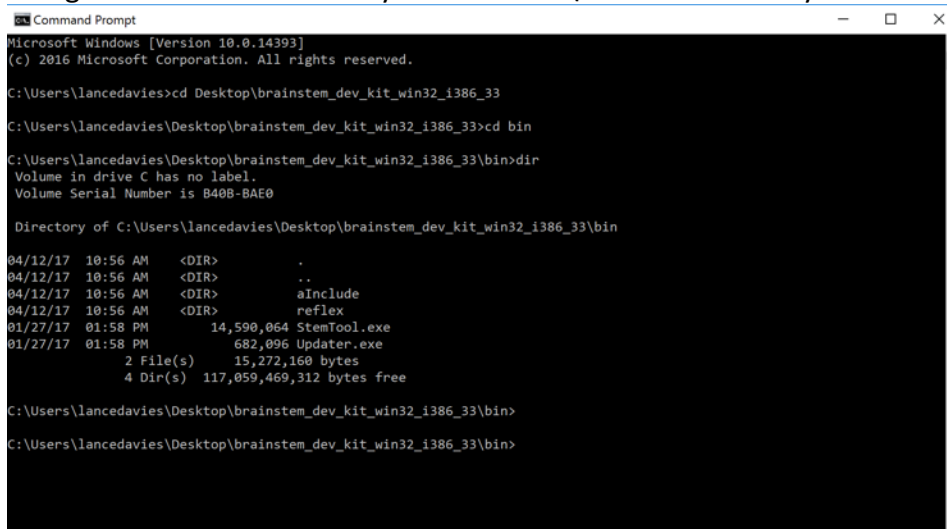


```
Command Prompt
Microsoft Windows [Version 10.0.14393]
(c) 2016 Microsoft Corporation. All rights reserved.

C:\Users\lancedavies>
```

Figure 8: Windows Command Line

Navigate to the BDK directory and find the \bin folder where you will find the updater utility:



```
Command Prompt
Microsoft Windows [Version 10.0.14393]
(c) 2016 Microsoft Corporation. All rights reserved.

C:\Users\lancedavies>cd Desktop\brainstem_dev_kit_win32_i386_33
C:\Users\lancedavies\Desktop\brainstem_dev_kit_win32_i386_33>cd bin
C:\Users\lancedavies\Desktop\brainstem_dev_kit_win32_i386_33\bin>dir
Volume in drive C has no label.
Volume Serial Number is B40B-BAE0

Directory of C:\Users\lancedavies\Desktop\brainstem_dev_kit_win32_i386_33\bin

04/12/17  10:56 AM  <DIR>          .
04/12/17  10:56 AM  <DIR>          ..
04/12/17  10:56 AM  <DIR>          aInclude
04/12/17  10:56 AM  <DIR>          reflex
01/27/17  01:58 PM             14,590,064 StemTool.exe
01/27/17  01:58 PM             682,096 Updater.exe
                2 File(s)      15,272,160 bytes
                4 Dir(s)    117,059,469,312 bytes free

C:\Users\lancedavies\Desktop\brainstem_dev_kit_win32_i386_33\bin>
C:\Users\lancedavies\Desktop\brainstem_dev_kit_win32_i386_33\bin>
```

Figure 9: Location of Updater in Windows command terminal

From the command line, run two separate commands to update firmware:

`updater -D` <<this will Discover any locally attached BrainStem devices and return serial numbers in XXXXXXXX format>>

```

Microsoft Windows [Version 10.0.14393]
(c) 2016 Microsoft Corporation. All rights reserved.

C:\Users\lancedavies>cd Desktop\brainstem_dev_kit_win32_i386_33
C:\Users\lancedavies\Desktop\brainstem_dev_kit_win32_i386_33>cd bin
C:\Users\lancedavies\Desktop\brainstem_dev_kit_win32_i386_33\bin>updater -D
updater [Version: 1.1 Jan 27 2017 13:49:57] [BrainStem Release:2.3.12] [Copyright (C) 1994-2016, Acroname Inc.]

Discovering Devices [USB]:
  Device  Module  Router  Model          Firmware Version
  76D2A3BD  22      22      10 [MTMUSBStem ]  2.3.12 (59053320)

Discovering Devices [TCP/IP]:
  Device  Module  Router  Model          Firmware Version  [IP address]

Completed processing: Updater [Version: 1.1 Jan 27 2017 13:49:57] [BrainStem Release:2.3.12] [Copyright (C) 1994-2016, Acroname Inc.]

C:\Users\lancedavies\Desktop\brainstem_dev_kit_win32_i386_33\bin>

```

Figure 10: Updater utility - Discover

`updater -G -U -d XXXXXXXX` <<this command will Get latest firmware from Acroname servers and Update the device with serial number XXXXXXXX>>

```

Microsoft Windows [Version 10.0.14393]
(c) 2016 Microsoft Corporation. All rights reserved.

C:\Users\lancedavies>cd Desktop\brainstem_dev_kit_win32_i386_33
C:\Users\lancedavies\Desktop\brainstem_dev_kit_win32_i386_33>cd bin
C:\Users\lancedavies\Desktop\brainstem_dev_kit_win32_i386_33\bin>updater -D
updater [Version: 1.1 Jan 27 2017 13:49:57] [BrainStem Release:2.3.12] [Copyright (C) 1994-2016, Acroname Inc.]

Discovering Devices [USB]:
  Device  Module  Router  Model          Firmware Version
  76D2A3BD  04      04      10 [MTMUSBStem ]  2.3.12 (59053320)

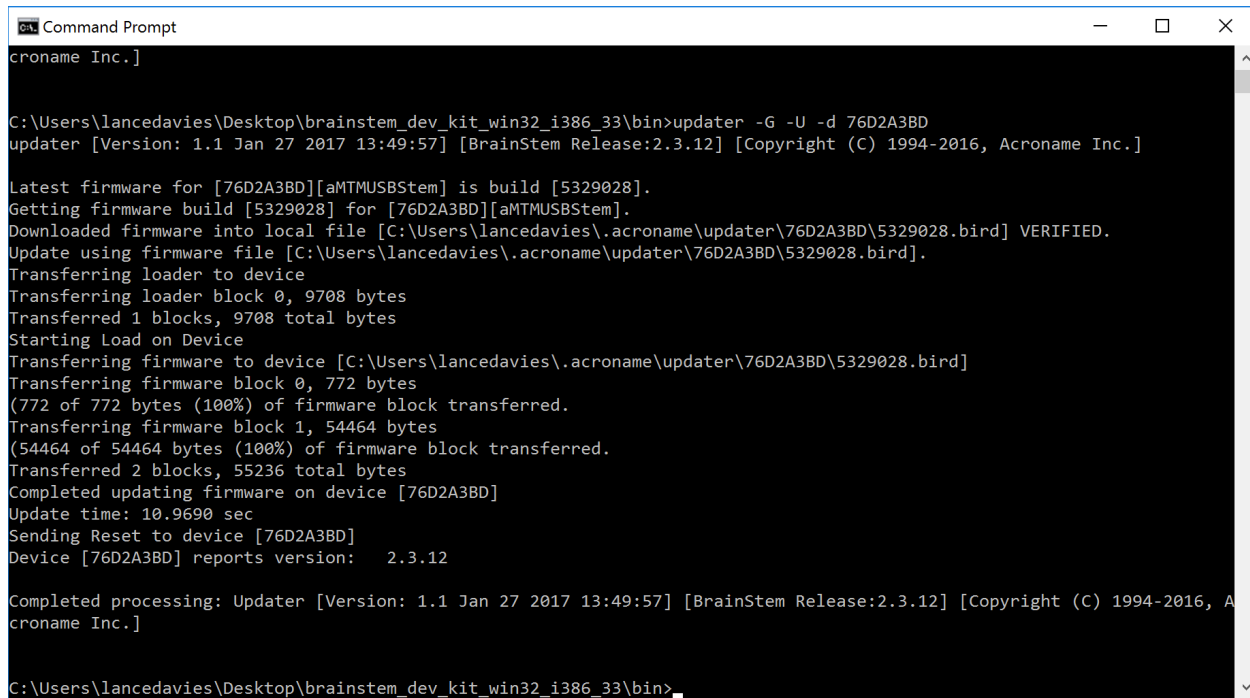
Discovering Devices [TCP/IP]:
  Device  Module  Router  Model          Firmware Version  [IP address]

Completed processing: Updater [Version: 1.1 Jan 27 2017 13:49:57] [BrainStem Release:2.3.12] [Copyright (C) 1994-2016, Acroname Inc.]

C:\Users\lancedavies\Desktop\brainstem_dev_kit_win32_i386_33\bin>updater -G -U -d 76D2A3BD

```

Figure 11: Updater utility – Get latest firmware, Update to latest firmware



```
Command Prompt
C:\Users\lancedavies\Desktop\brainstem_dev_kit_win32_i386_33\bin>updater -G -U -d 76D2A3BD
updater [Version: 1.1 Jan 27 2017 13:49:57] [BrainStem Release:2.3.12] [Copyright (C) 1994-2016, Acroname Inc.]

Latest firmware for [76D2A3BD][aMTMUSBStem] is build [5329028].
Getting firmware build [5329028] for [76D2A3BD][aMTMUSBStem].
Downloaded firmware into local file [C:\Users\lancedavies\acroname\updater\76D2A3BD\5329028.bird] VERIFIED.
Update using firmware file [C:\Users\lancedavies\acroname\updater\76D2A3BD\5329028.bird].
Transferring loader to device
Transferring loader block 0, 9708 bytes
Transferred 1 blocks, 9708 total bytes
Starting Load on Device
Transferring firmware to device [C:\Users\lancedavies\acroname\updater\76D2A3BD\5329028.bird]
Transferring firmware block 0, 772 bytes
(772 of 772 bytes (100%) of firmware block transferred.
Transferring firmware block 1, 54464 bytes
(54464 of 54464 bytes (100%) of firmware block transferred.
Transferred 2 blocks, 55236 total bytes
Completed updating firmware on device [76D2A3BD]
Update time: 10.9690 sec
Sending Reset to device [76D2A3BD]
Device [76D2A3BD] reports version: 2.3.12

Completed processing: Updater [Version: 1.1 Jan 27 2017 13:49:57] [BrainStem Release:2.3.12] [Copyright (C) 1994-2016, Acroname Inc.]

C:\Users\lancedavies\Desktop\brainstem_dev_kit_win32_i386_33\bin>
```

Figure 12: Successful firmware update

Once the updater utility successfully updates the module you are connected to, move the USB connection to the next module you would like to update and repeat the updater command sequence for each module.

In the future, with BrainStem networking enabled, you can update all modules without having to move the USB connection.

Exercising MTM Modules

StemTool is a useful utility for exercising simple functions and generally troubleshooting MTM modules in the lab or in the field.

Start the StemTool GUI:

Open the BDK folder and navigate to the \bin directory. Double-click StemTool:

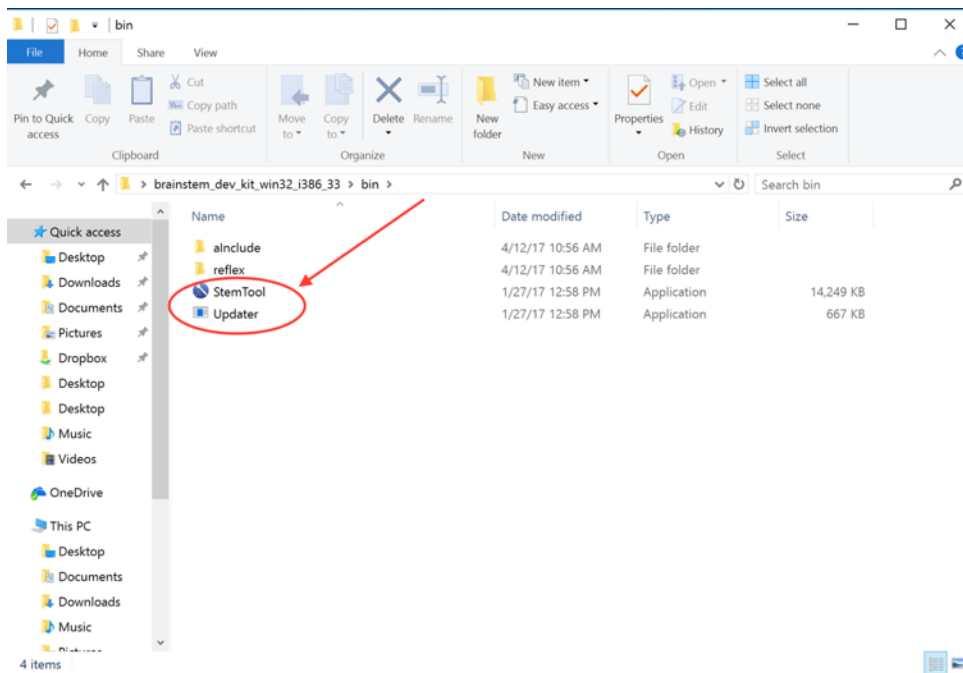


Figure 13: Location of StemTool Utility

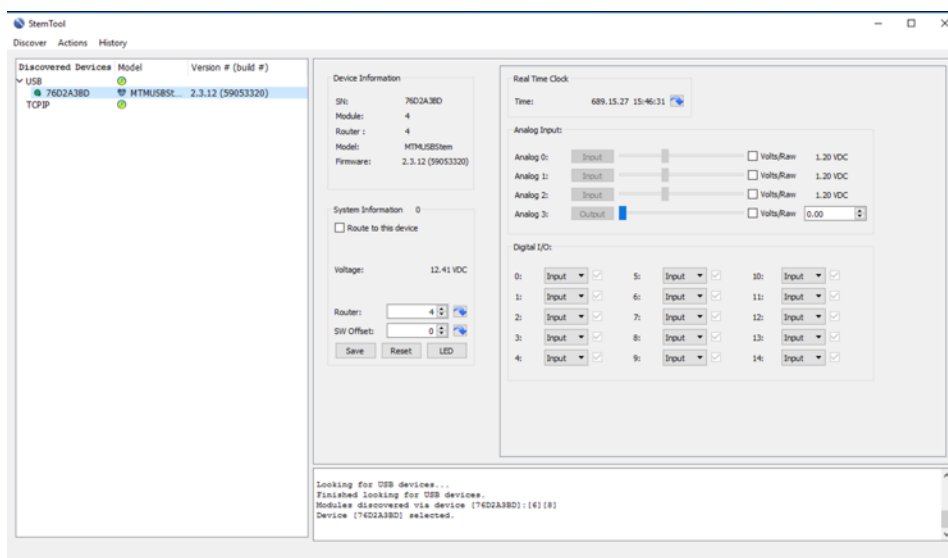


Figure 14: StemTool Utility with MTM-USBStem

Exercise 1: Toggling a Digital IO

On the MTM Development board, connect a wire from one Digital pin to another digital pin. In this example, see the white jumper wire connecting D0 to D7 on the MTM-USBStem:

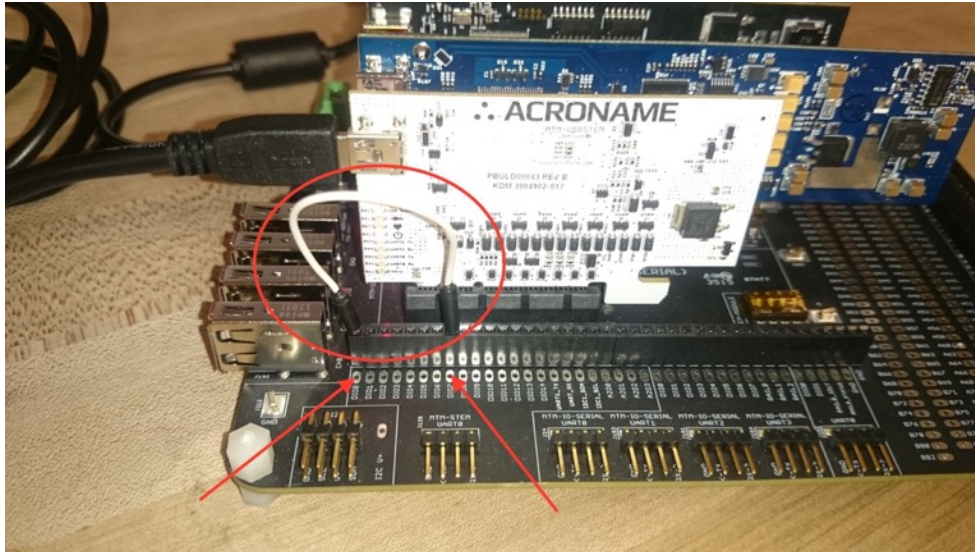


Figure 15: Example connection to toggle a Digital IO

In StemTool, find the Digital I/O resource section. Change the configuration of the D0 resource from it's default (input) to an output:

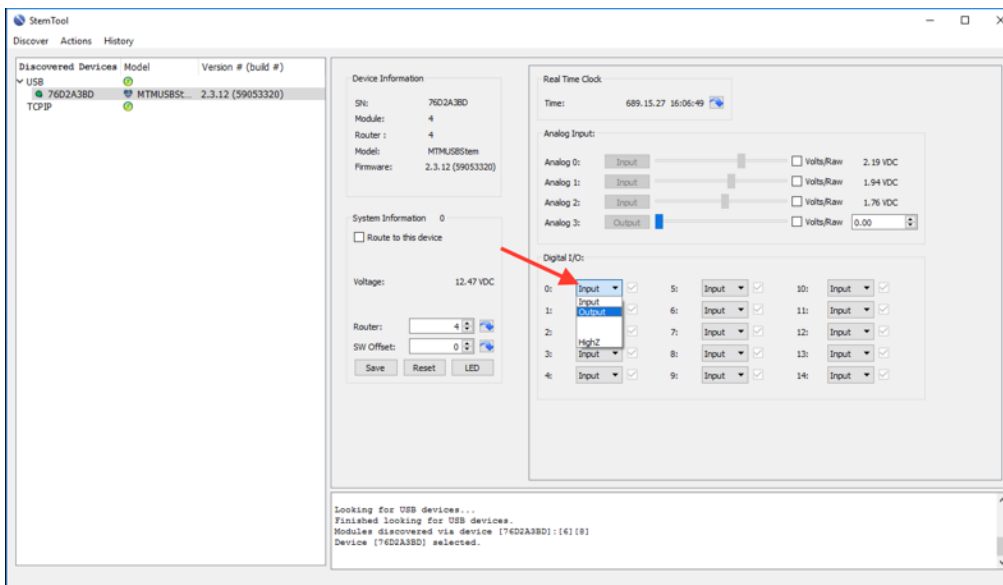


Figure 16: Using StemTool to change MTM Digital resource configuration

toggling the checkbox next to the D0 output will change the logic level on D0. Since D0 is connected to D7, the D7 input logic level will change as indicated by the D7 checkbox:

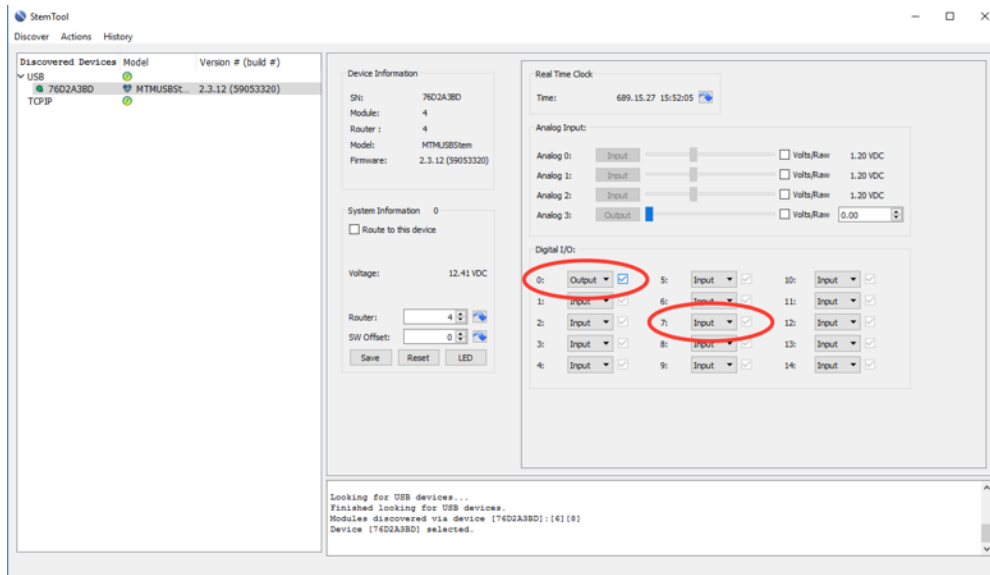
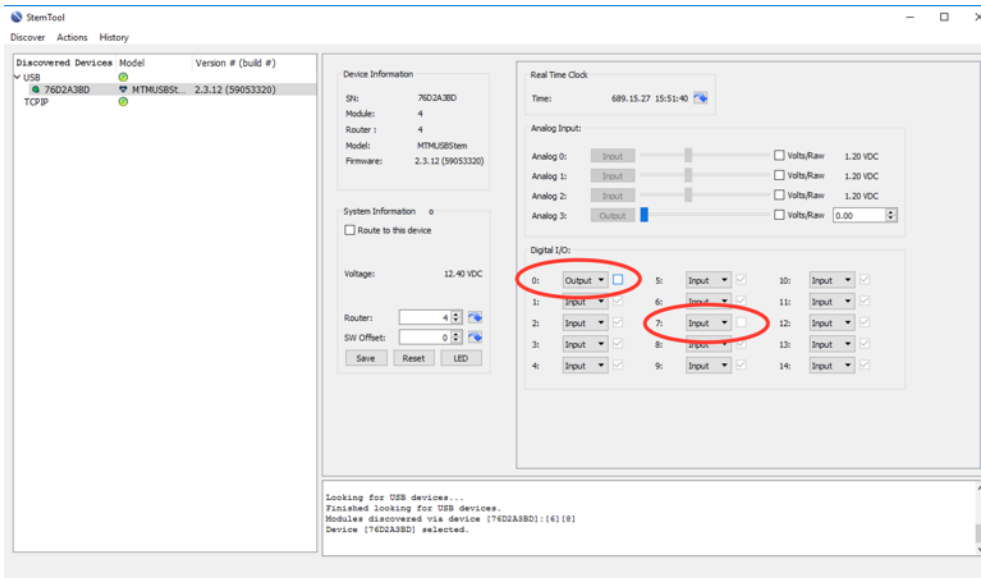


Figure 17: Using MTM to change and read an MTM Digital resource value

Exercise 2: Measuring a voltage

On the MTM Development board, connect a wire from one Digital pin to an Analog input pin. In this example, see the yellow jumper connecting D1 to AD0 on the MTM-USBStem:

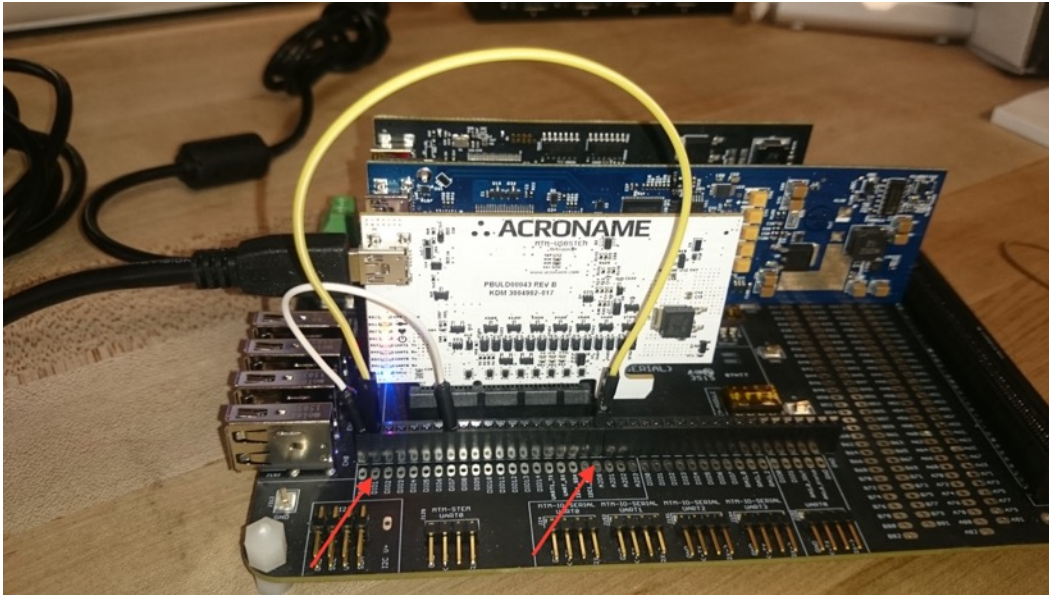


Figure 18: Example connection to measure voltage of a digital output

In StemTool, find the Analog resource section and Digital I/O resource section. Change the configuration of the D1 resource from it's default (input) to an output:

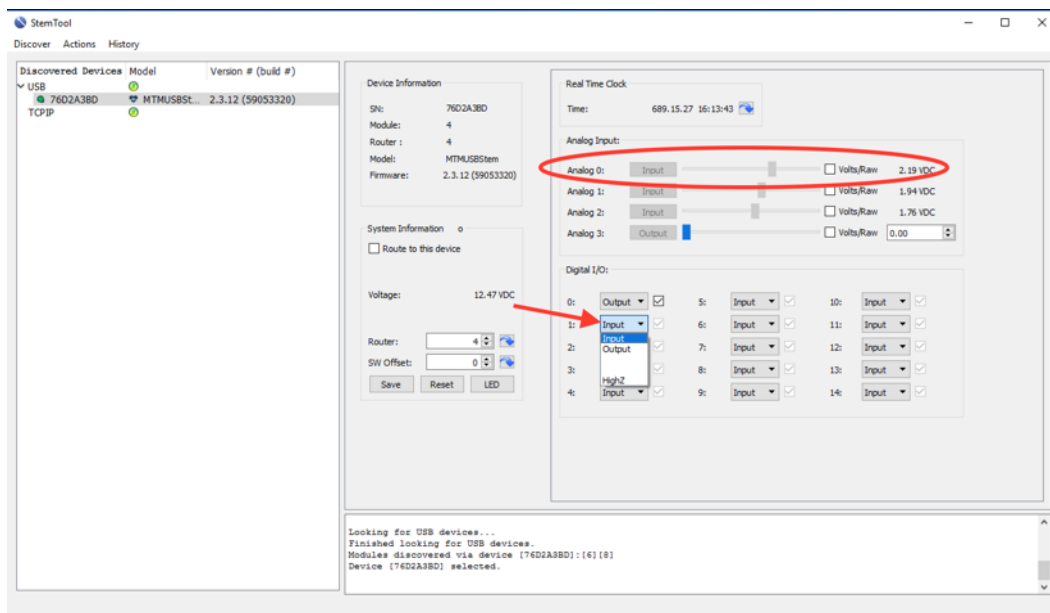


Figure 19: Use StemTool to change D1 configuration to digital output

The A2D0 is now measuring the high logic level voltage on the D1 digital pin. Toggle the D1 output value box and you can see the A2D0 voltage measurement change:

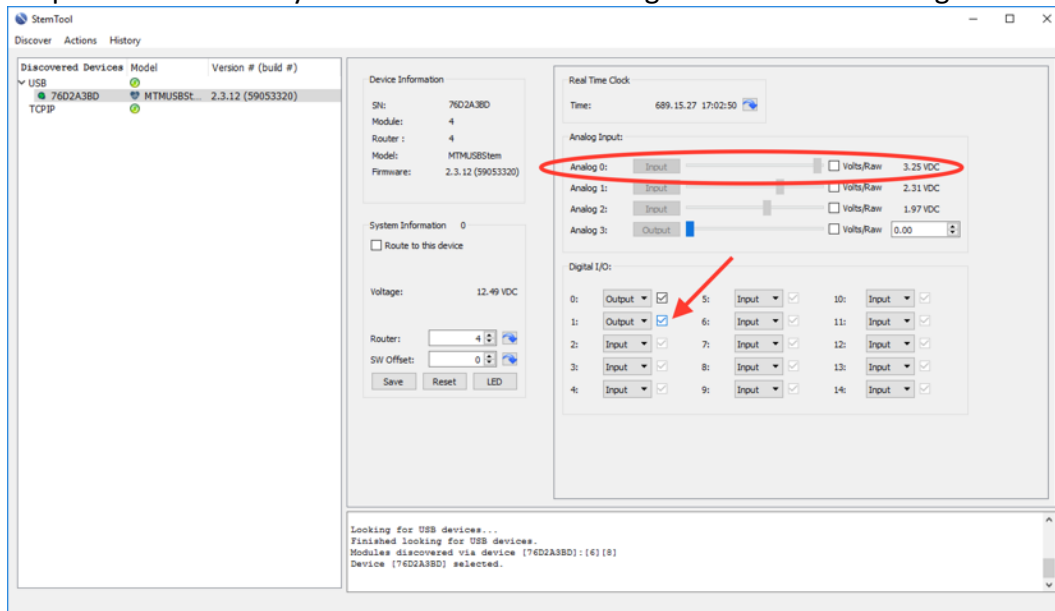


Figure 20: Using StemTool to show analog voltage measurement of a digital output

Since the A2D1 and A2D2 inputs are not connected to any signal, they are floating and their measurements indicate that case.

Exercise 3: Setting an analog output, measuring an analog voltage

On the MTM Development board, connect a wire from an analog output to an analog input. In this example, see the red jumper wire connecting A2D3 (fixed configuration as an output) to the A2D1 input on the MTM-USBStem:

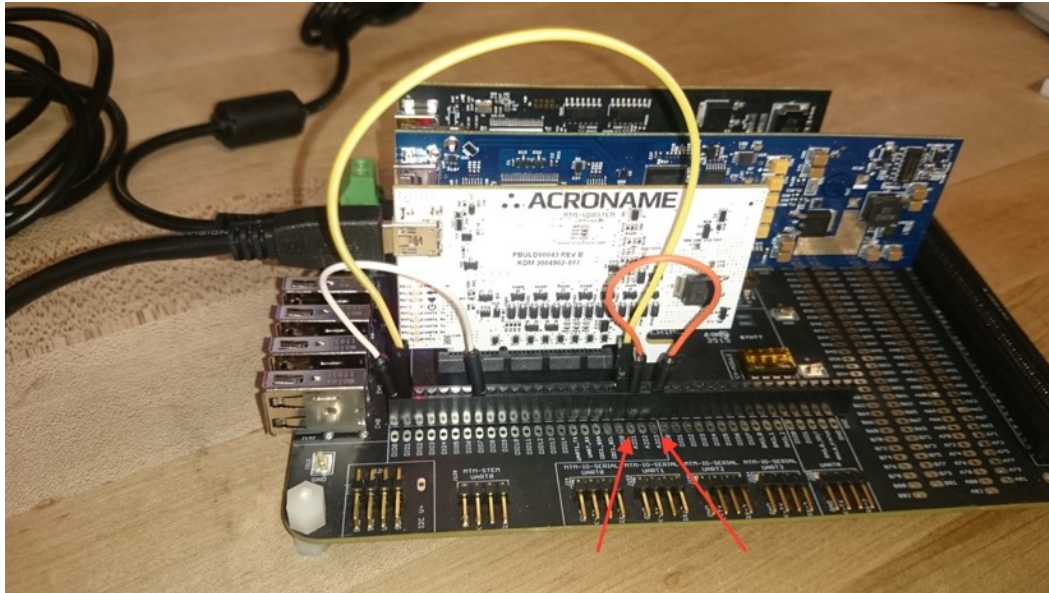


Figure 21: Example connection to measure analog voltage of an analog signal

In StemTool, find the Analog resource section. Change the value of the A2D3 analog output by using the slider or the entry box. Note that the A2D1 value is affected and we can measure the analog voltage of the A2D3 output using the A2D1 input:

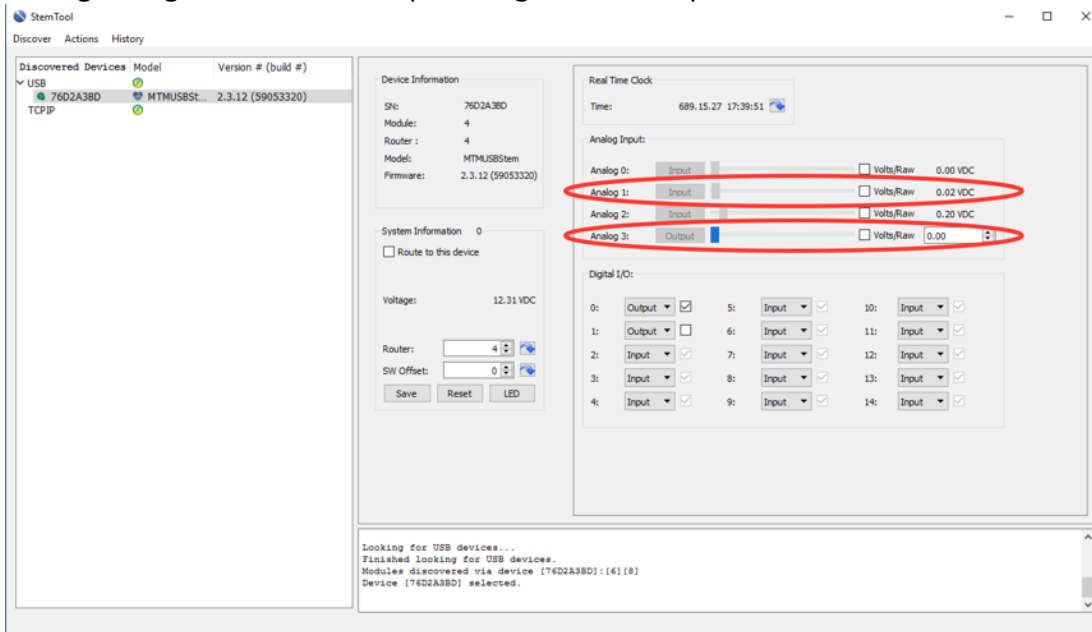


Figure 22: Using StemTool for analog measurements. A2D3 output value being measured by A2D1

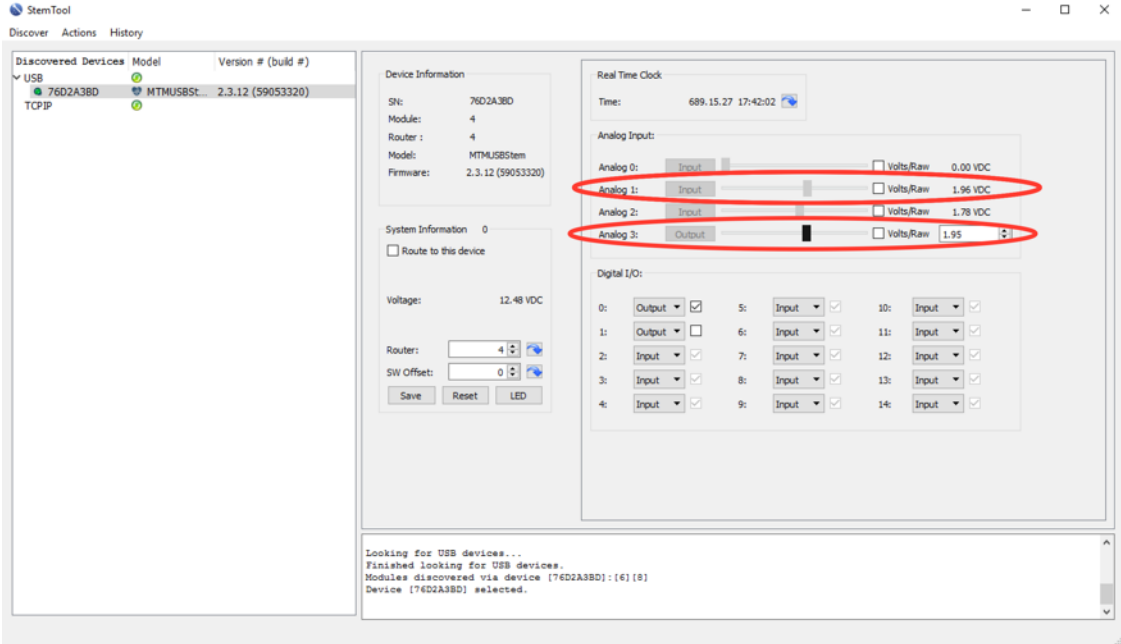


Figure 23: Increasing A2D3 output value and measuring at A2D1

Exercise 4: Enabling Routing of a BrainStem Network

In a test environment, multiple MTM modules are usually present. The BrainStem network allows for a single host connection to one module to pass BrainStem commands and data to any other BrainStem-connected module. In this exercise, we will enable routing of a BrainStem network through the host-connected module. After doing so, we will then be able to access resources or update firmware on any networked modules – all using the same USB host connection. The BrainStem network will route commands appropriately between modules.

To enable the BrainStem network, use StemTool to enable the RouteToMe command. This will instruct the selected module to now be the parent or routing hub for all BrainStem network traffic. All attached modules are considered child modules in the BrainStem network:

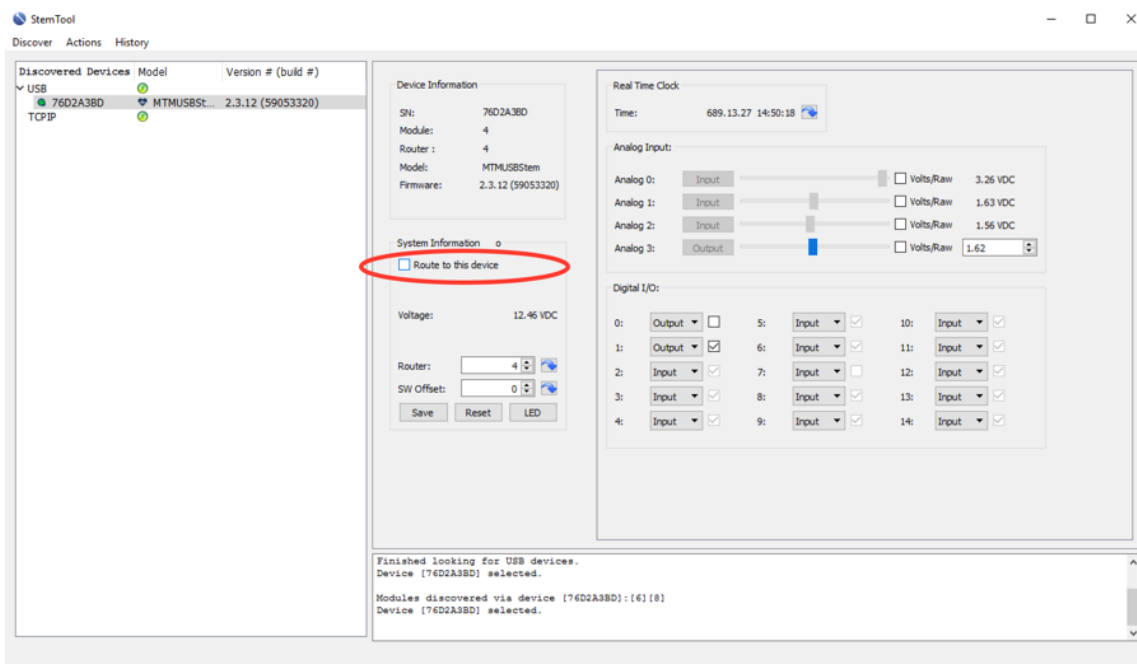


Figure 24: Enable routing of the BrainStem network on the selected module

****NOTE**** BrainStem routing settings of the parent and all child modules will remain until: (1) the RouteToMe function is disabled via StemTool, (2) the MTM Development Board is reset via button push or (3) a power cycle condition occurs.

With the BrainStem now enabled and routed through the parent MTM-USBStem, note the other which are now MTM modules accessible:

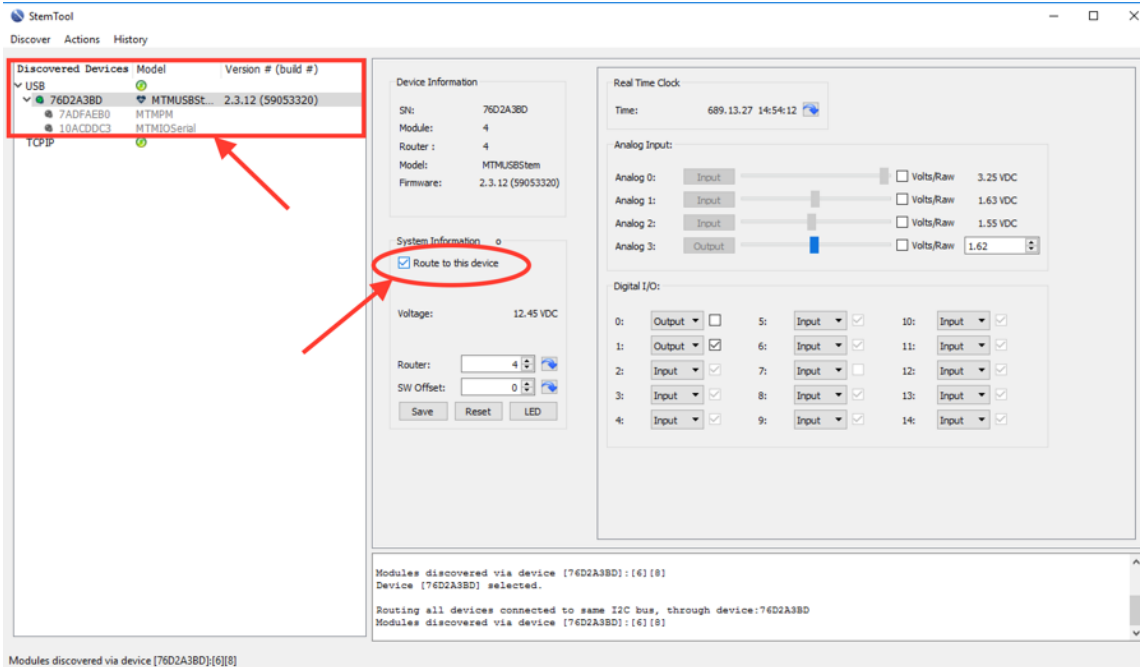


Figure 25: MTM modules discovered under the parent module on the BrainStem network

Select the MTM-PM-1 module. The BrainStem heartbeat icon should be enabled, indicating communication connection with that module. The function screen should also change to indicate the new functions of the selected module:

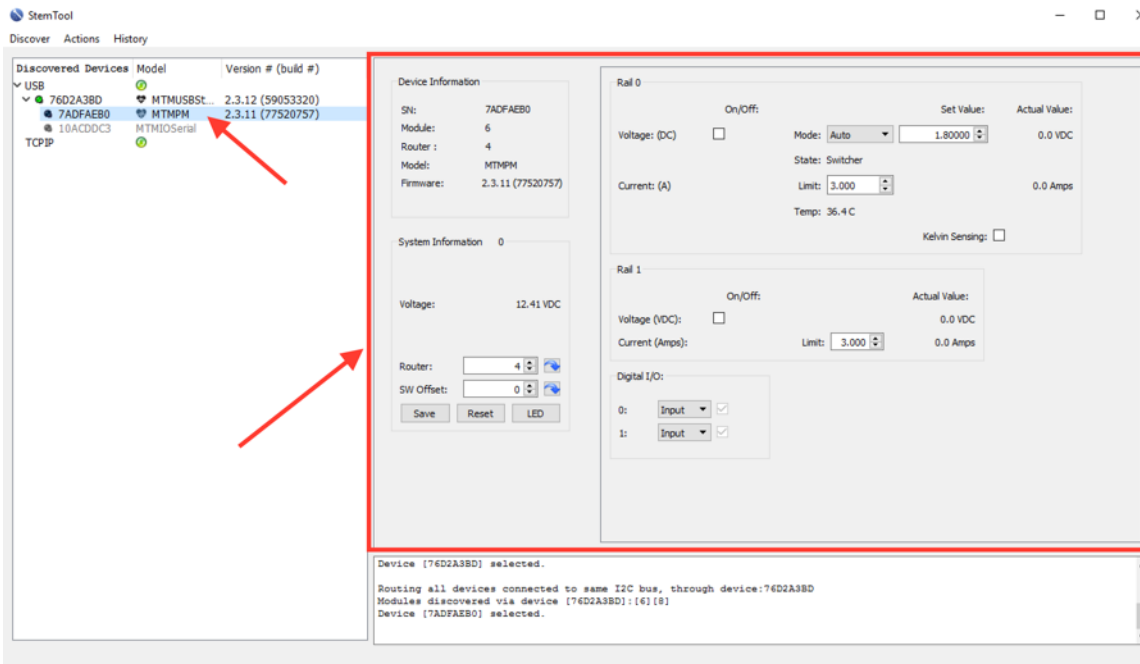


Figure 26: Select a routed MTM module, noting the available resources of the new module

Exercise 5: Using multiple MTM Modules - Analog Measurement of a Power Rail

On the MTM Development board, connect a wire from a power rail to an available analog input. In this example, see the brown jumper wire connecting A2D2 (analog input) of the MTM-USBStem to the Rail0 output on the MTM-PM-1 programmable power supply:

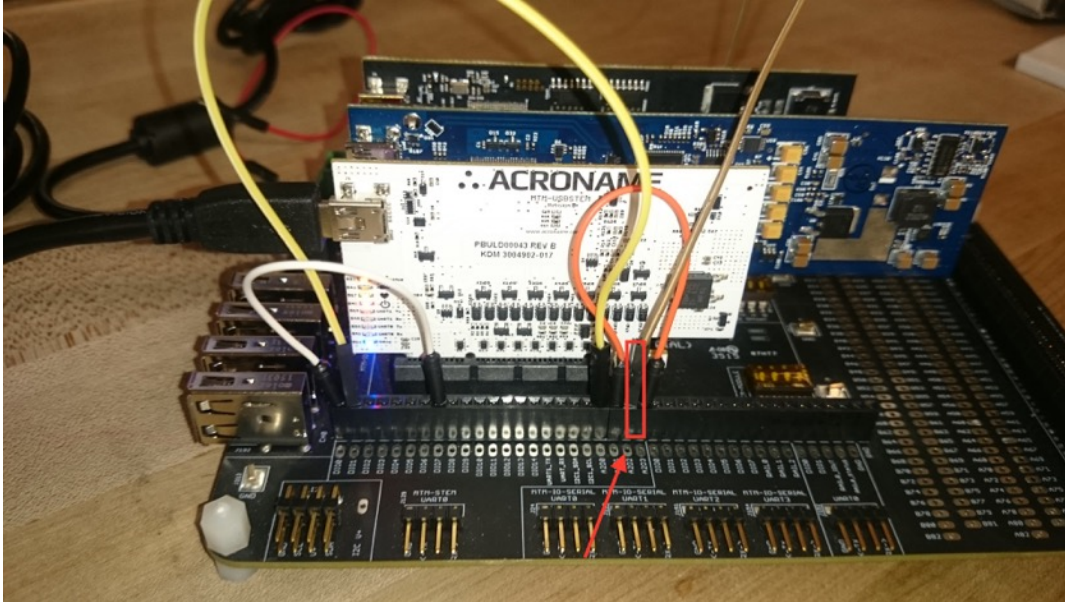


Figure 27: A2D2 analog input used to measure to Rail0 output

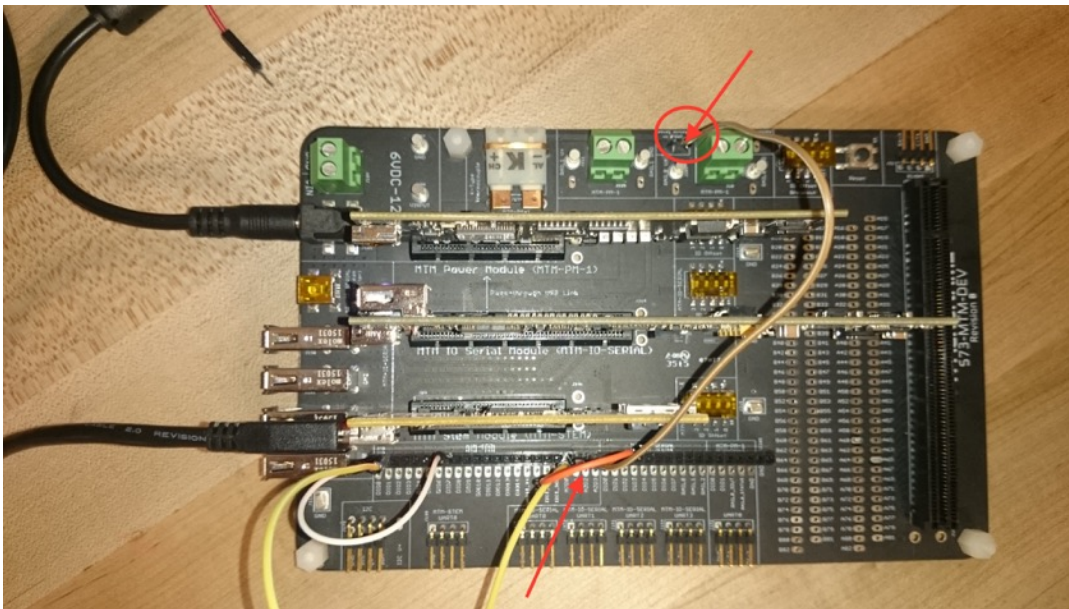


Figure 28: Connecting to Rail0 Sense pin on MTM-PM-1

Enable the adjustable Rail0 output and Kelvin Sense output and set the Rail0 voltage to a level you wish to measure. We have chosen 2.5V for this example:

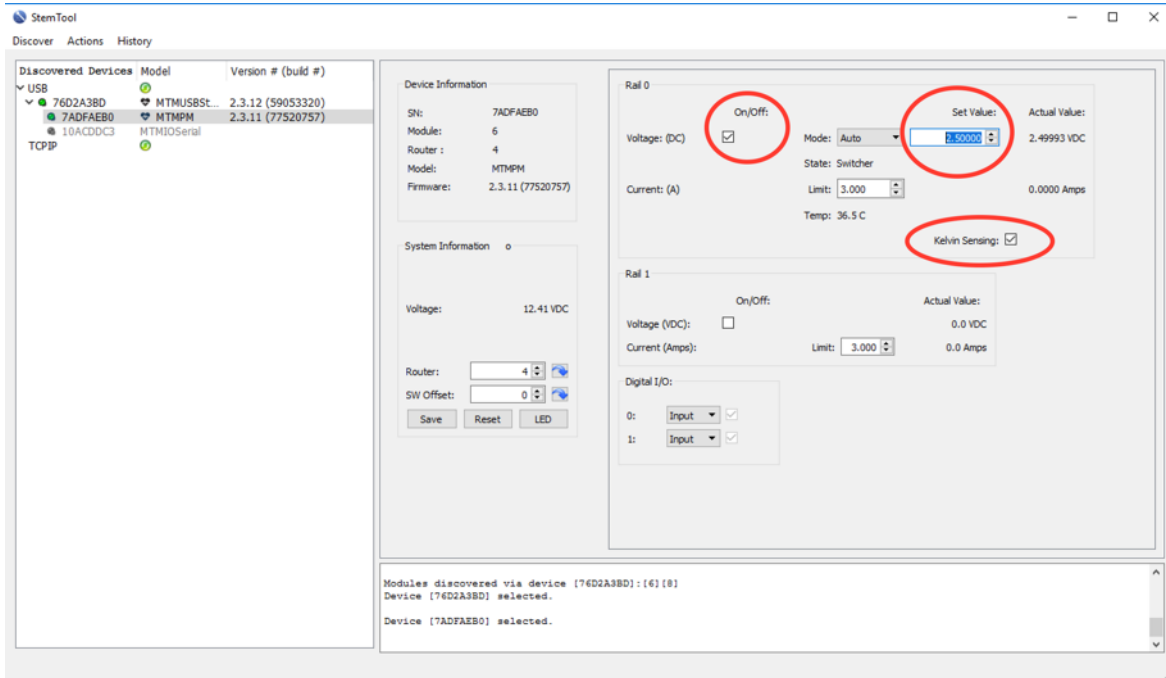


Figure 29: Enable the Rail0 adjustable output and its Kelvin Sense output

Return to the MTM-USBStem module and note that A2D2 is now measuring the previously set voltage enabled on MTM-PM-1 Rail0:

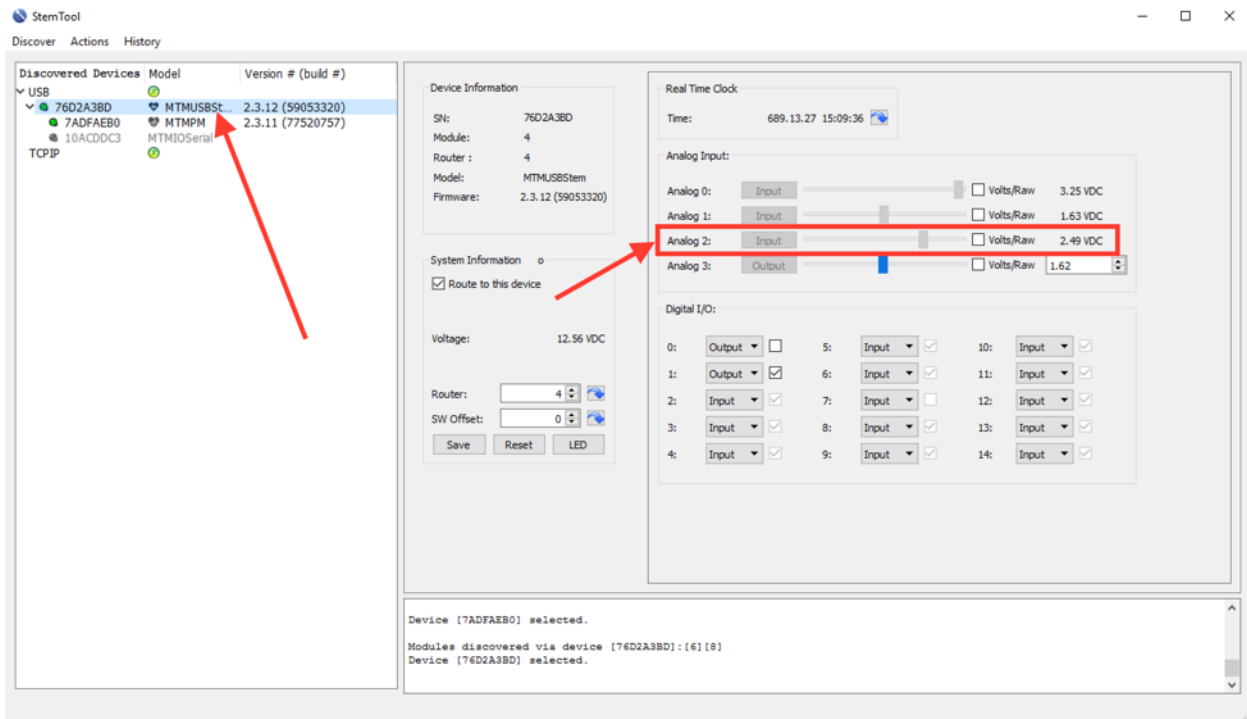


Figure 30: Measuring MTM-PM-1 Rail0 voltage on MTM-USBStem A2D2

Congratulations! You are now fully up and running with MTM instrumentation!

As a next step, you can implement your test plan using the BrainStem APIs and design a low-cost fixture that integrates MTM instrumentation.

Please see our blog (www.acroname.com/blog) for latest updates and video tours of our instrumentation and other manufacturing test tools.

If you have any questions, concerns or comments, please contact us at:

Acroname Sales (sales@acroname.com) or

Acroname Support (support@acroname.com)