
Digital Mixed Signal Power Manager Using MPM 6.0

Tutorial



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Introduction

The purpose of this document is to provide clear step-by-step instructions to take you through the first usage of the MPM GUI and design examples. The tutorial illustrates the usage of power sequencing and timing slots, trimming options and I2C communication.

Software Installation

Software Requirements

1. MPM 6.0 for SmartFusion GUI and Design Files Installer
http://www.actel.com/download/rsc/?f=SmartFusion_DMPM_DF
2. Installed version of FlashPro Software, either as part of a full Libero[®] SoC install (automatic) or standalone FlashPro installation from www.microsemi.com/soc/download/program_debug/flashpro/default.aspx
3. USB to UART driver for development kit, if not already installed
http://www.actel.com/documents/CDM_2.08.24_WHQL_Certified.zip

Run the installer and follow the installation wizard instructions. By default MPM installs into the *C:\Microsemi\SF2_MPM_RefDesign_v6.0* folder and this is the recommended location for it. In particular avoid installing it in a folder than is very deeply nested or has a very long path name otherwise some tools may encounter problems accessing files with names longer than 259 characters¹.

Once installed MPM adds the following options to the Windows start menu:

- ✓ Start
 - ✓ All Programs
 - Microsemi SmartFusion2 MPM Reference Design v6.0
 - ❖ Browse Design Files
 - Opens in Windows Explorer the folder containing the MPM Libero SoC hardware and SoftConsole firmware projects
 - ❖ MPM GUI
 - Runs the MPM GUI
 - ❖ Uninstall
 - Uninstalls MPM

Hardware Setup

Hardware Requirements

This section explains how to prepare the hardware for programming the MPM reference design and running the default demonstration.

You will need the following:

1. SF2-DEV-KIT: SmartFusion2 Development Kit (Rev B or C Silicon/Board)
http://www.actel.com/products/hardware/devkits_boards/smartfusion2_dev.aspx
 - a. 12V Wall-mounted Power Supply
2. SF2-DMPM-DC-KIT: SmartFusion2 Digital Mixed-Signal Power Management Daughter Card
 - a. 12V Wall-mounted Power Supply
3. Devantech USB-ISS I2C communication module
http://www.robot-electronics.co.uk/acatalog/USB_I2C.html
 - a. (1) USB type A cable
 - b. (3) Jumper wires

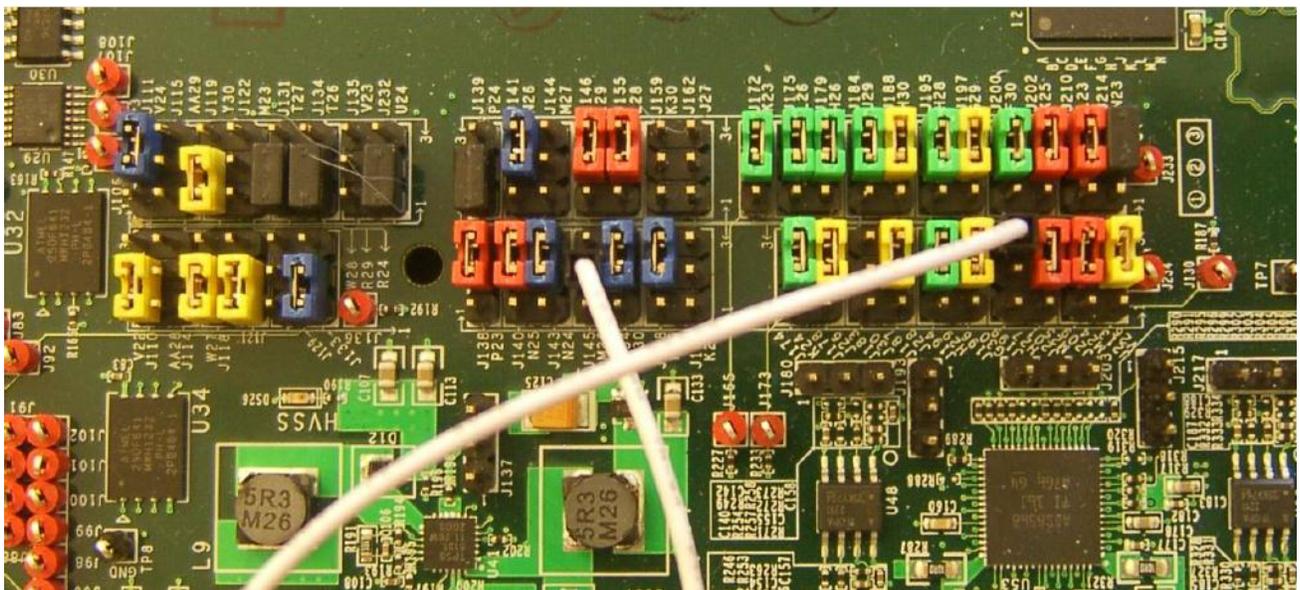
4. FlashPro4
 - a. (1) USB Mini-B cable
5. USB Mini-B Cable

SmartFusion2 Development Kit Board Setup

The following provides basic setup information for the hardware and firmware for the DMPM 6.0 Beta Release. The setup is based on the initial porting of MPM to the SmartFusion2 platform with the Rev B Dev Kit and the Rev A DMPM board. The following jumper settings are required on the SmartFusion2 Dev Kit to route the signals required for the DMPM board to the FMC connector.

Ensure that the following jumpers are installed:

Jumper	Pins	Jumper	Pins
J174	2-3	J172	2-3
J184	2-3	J175	2-3
J179	2-3	J195	2-3
J200	2-3	J194	2-3
J202	2-3	J210	2-3
J201	2-3	J209	2-3
J155	2-3	J146	2-3
J140	2-3	J138	2-3
J158	2-3	J154	2-3
J143	2-3	J141	2-3
J111	2-3	J133	1-2
J214	2-3	J213	2-3
J178	2-3	J188	2-3
J187	2-3	J197	2-3
J196	2-3	J145 pin 2 connected via flying lead to J199 pin 3	



The Dip switch SW10 is used to provide another 4 of the MPM inputs and also to select optional operational modes for MPM.

SW10.1 is connected to MPM input 5.

SW10.2 is connected to MPM input 6.

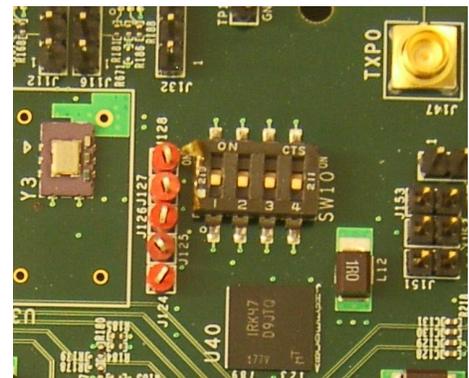
SW10.3 is connected to MPM input 7.

SW10.4 is connected to MPM input 8.

SW10.1 also selects whether MPM shuts down if a POL goes to OV2 or UV2 or not. When OFF MPM does not shut down and when ON MPM does shut down.

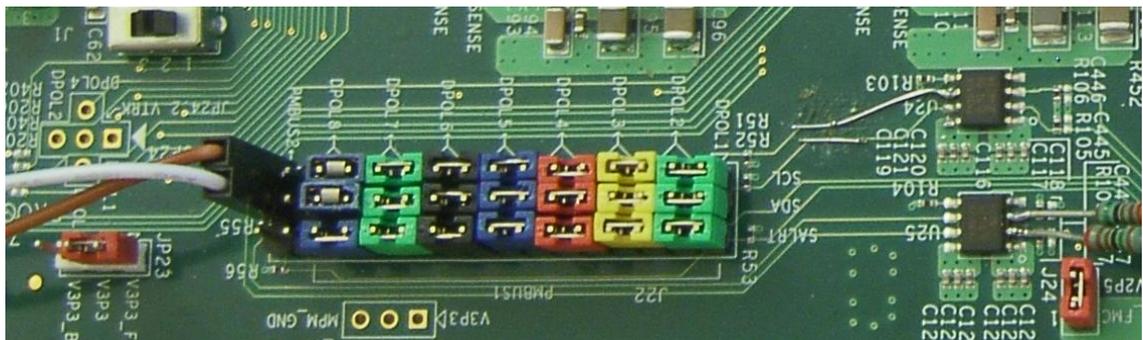
SW10.2 selects whether MPM reloads the configuration in eNMV with known good values on power up or not.

*******SET SW10.2 to the OFF position*******



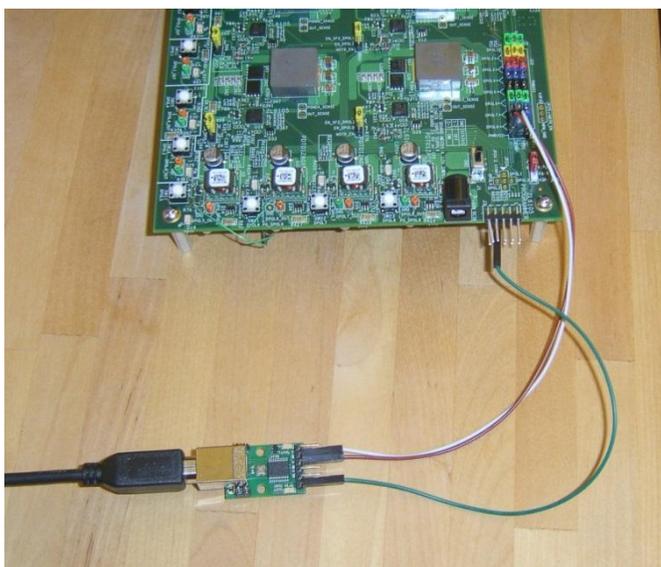
J20, J21, J22 and J25 should have their jumpers removed as they currently replicate the signals going to LEDs 5 to 8 to provide convenient access for logic analysers or oscilloscopes to measure task timing in MPM.

SF2 DMPM Daughter Board Setup



J23 should have pins 1 and 2 jumpered and J24 should be jumpered to provide 3.3V and 2.5V supplies to the DMPM board from the FMC connector.

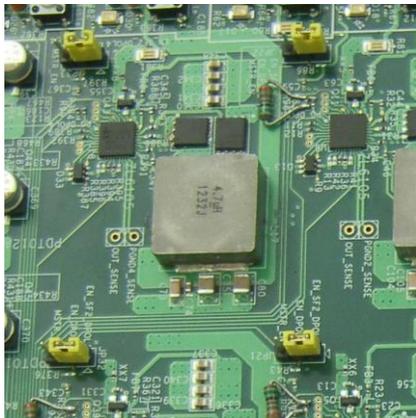
J22 should have 7 x 3 jumpers installed as shown above, to link the 8 DPOLs to PMBus 1. The last pair of pins labeled PMBUS2 are unjumpered but are used to connect the Devantech USB Adaptor as shown below. A suitable ground connection for this can be found on J3 - second pin from the left on the bottom row.



For the APOLs on the DMPM board JP3, JP26, JP27, JP28, JP2, JP29, JP30 and JP31 must be jumpered to enable trimming.



For the DPOLs on the DMPM board JP21, JP22, JP32 and JP33 must be jumpered on pins 1 and 2 to route the regulator enables of the first 4 DPOLs to the FMC connector.



Programming MPM

The first time you use MPM you need to use the MPM GUI to program the MPM design to the target hardware.

- For the SmartFusion2 Development Kit Board
 - ✓ Connect the 12V 6A power supply to the J18 12V INPUT SUPPLY connector
 - ✓ Connect a FlashPro4 programmer to the J59 – FP4 Header
 - ✓ Connect a mini USB cable between your PC and the FlashPro4
 - ✓ Power the board on using SW7

- Run the MPM GUI.
 - ✓ Select **Data > FlashPro > Choose STAPL** template and select the appropriate STAPL file for your target hardware from the C:\Microsemi\SF2_MPM_RefDesign_v6.0\template folder.¹
 - Use MPM_M2S050T_ES_template.stp for Rev B silicon on the LCP kit.
 - Use MPM_M2S050T_template.stp for Rev C silicon on the PP kit.
 - ✓ Select **Data > FlashPro > FlashPro Setup** and browse to and select the FlashPro software executable in your Libero SoC v10.1 or later installation.
 - ✓ Select **Data > FlashPro > Write NVM & Fabric** and the MPM GUI will launch FlashPro and program the full design (MSS configuration, MPM firmware, MPM configuration data in ENVM along with the FPGA fabric logic) to the target hardware. You will see a Command Shell “DOS Box” appear reporting progress. When prompted you can close this. At this stage the MPM target should be programmed with the MPM reference design.
- Power off the SmartFusion2 board by disconnecting the USB cable and power supply cables.
- Connect the SF2 DMPM Daughter Board to the SmartFusion2 Development Kit Board by connecting their respective FMC connectors.
- Connect the 12V power supply to the SF2 DMPM Daughter Board’s J1 12V DC IN connector
- Reconnect power and USB to the SmartFusion2 Dev Kit as described above.
- Power the MPM Daughter Board on using SW2
- Reset the SmartFusion2 board by pressing SW9 RESET.
- Once the initial programming of the MPM design to the target has been performed then MPM configuration setting changes alone can be programmed to the target’s MSS ENVM over an I²C connection between the MPM GUI and the MPM target hardware using **Data > I²C > Read Config Via I²C** and **Write Config Via I²C**.

I²C Setup

Use the MPM GUI to connect to the MPM target via I²C the included Devantech/Robot Electronics USB-ISS communications module. Ensure that the USB-ISS Power Link has a jumper removed for 3.3V operations for compatibility with the MPM target.

Use the included standard USB A/B cable to connect the USB-ISS to your PC. Install the drivers that are bundled with MPM GUI install in the C:\Microsemi\SF2_MPM_RefDesign_v6.0\Devantech_USB-ISS_drivers folder.

After installing the drivers, and plugging the USB-ISS module into a spare USB port, you need to know to which COM port it has been assigned to. This will vary from system to system depending on how many COM ports you currently have installed. To find out where it is, right-click on your **My Computer** desktop icon and select **Properties > Hardware > Device Manager**. Now scroll down and open the **Ports (COM & LPT)** tab. You should see the USB serial port listed - COM5 in the example below. If you want to change the COM port number - just right-click on it, select **properties > advanced > COM port number** from the available list. The COM port default settings are sufficient.

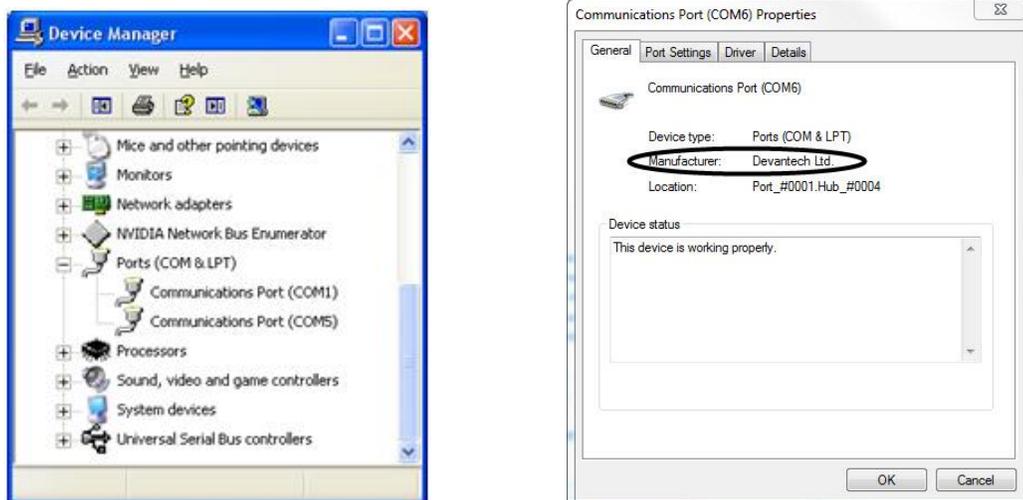


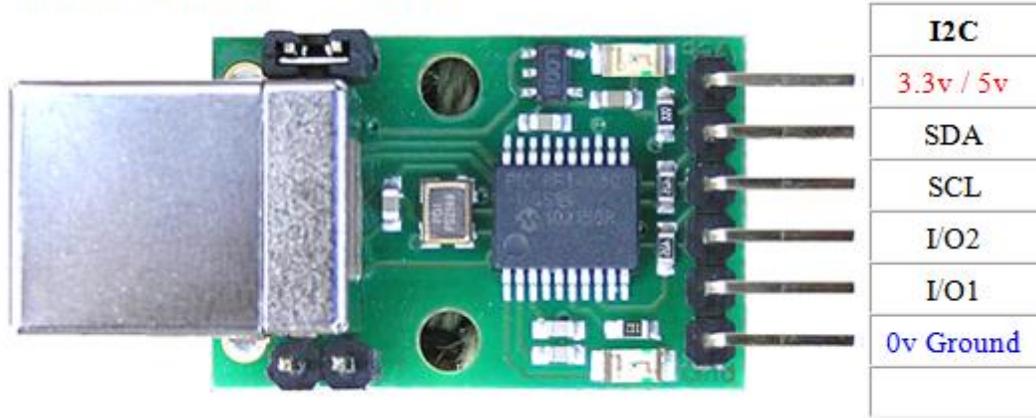
Figure 1 Device Manager

To allow the MPM GUI to communicate with MPM, connect the Devantech USB-ISS to the SmartFusion2 board's MSS I2C_1 by installing female to female jumper cables between the following pins:

I ² C Signal Board	SCL	SDA	GND
Devantech/Robot Electronics USB-ISS http://www.robot-electronics.co.uk/hm/usb_iss_tech.htm	SCL (I/O 3)	SDA (I/O 4)	0V/Ground
SF2 DMPM Board Rev A	J22P pin 16	J22P pin 32	3 pin 8

Devantech/Robot Electronics USB-ISS Connections

Power Link - Remove for 3.3v operation.



Bootloader Link - Fit link for Bootloader mode

Figure 1 Devantech/Robot Electronics USB-ISS

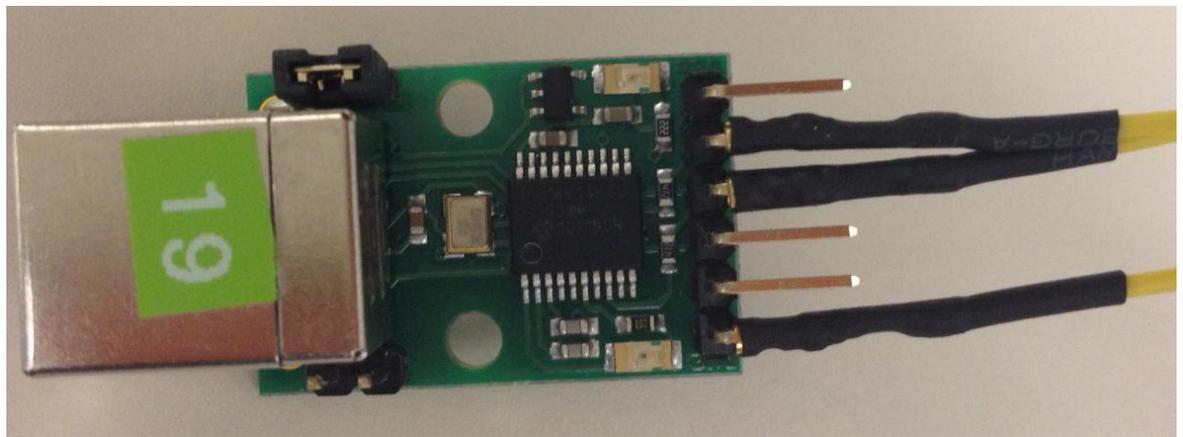


Figure 2 · USB-ISS Module with Wires Connected

As explained earlier note the COM port assigned to the USB-ISS communications module. Run the MPM GUI, select **Data > I²C > Test I²C Dongle**. Select the USB-ISS COM port from the **Communications > Port:** drop-down list. Select **Test Dongle** from the **Activity > Action** drop-down list and click the **Go** button. If the test is successful then you should see the following in the **Status** text box.

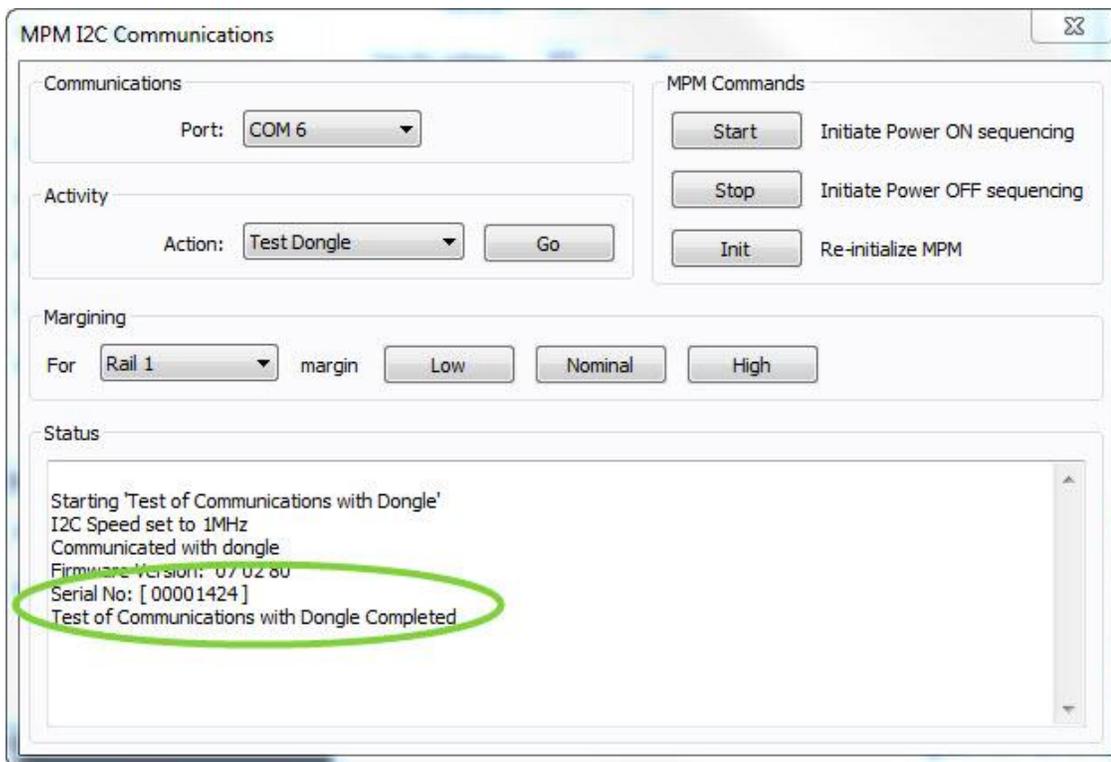


Figure 3 · MPM I2C Communications **Success**

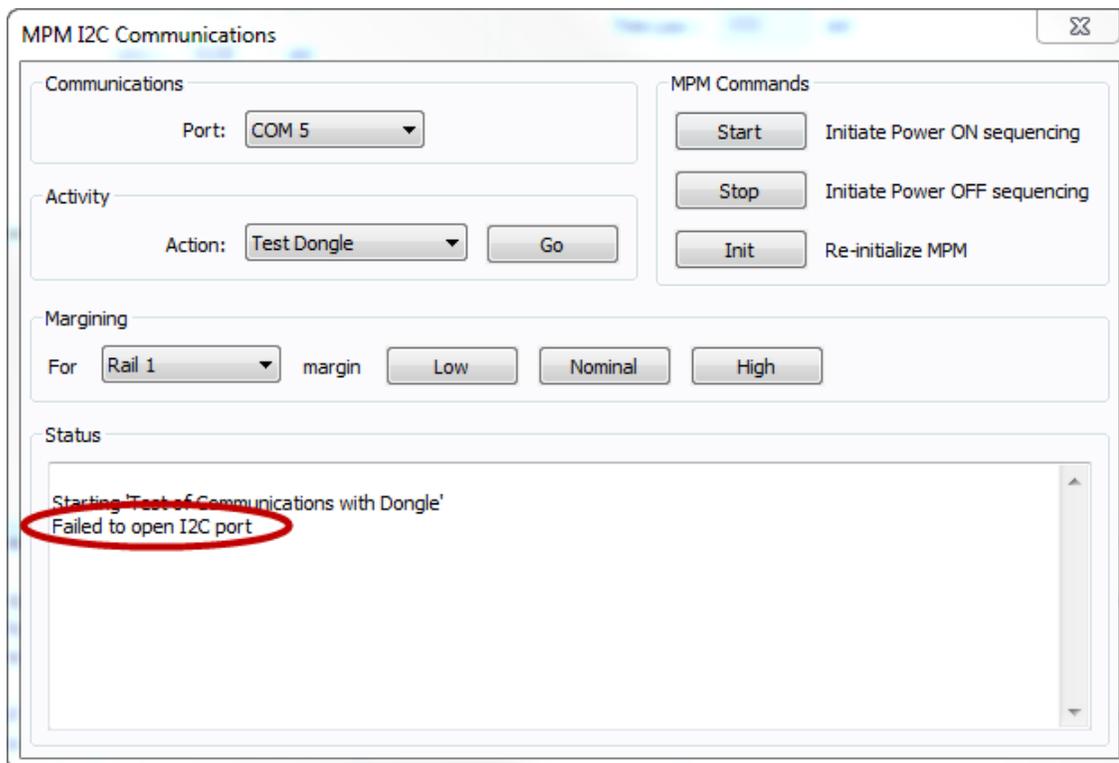
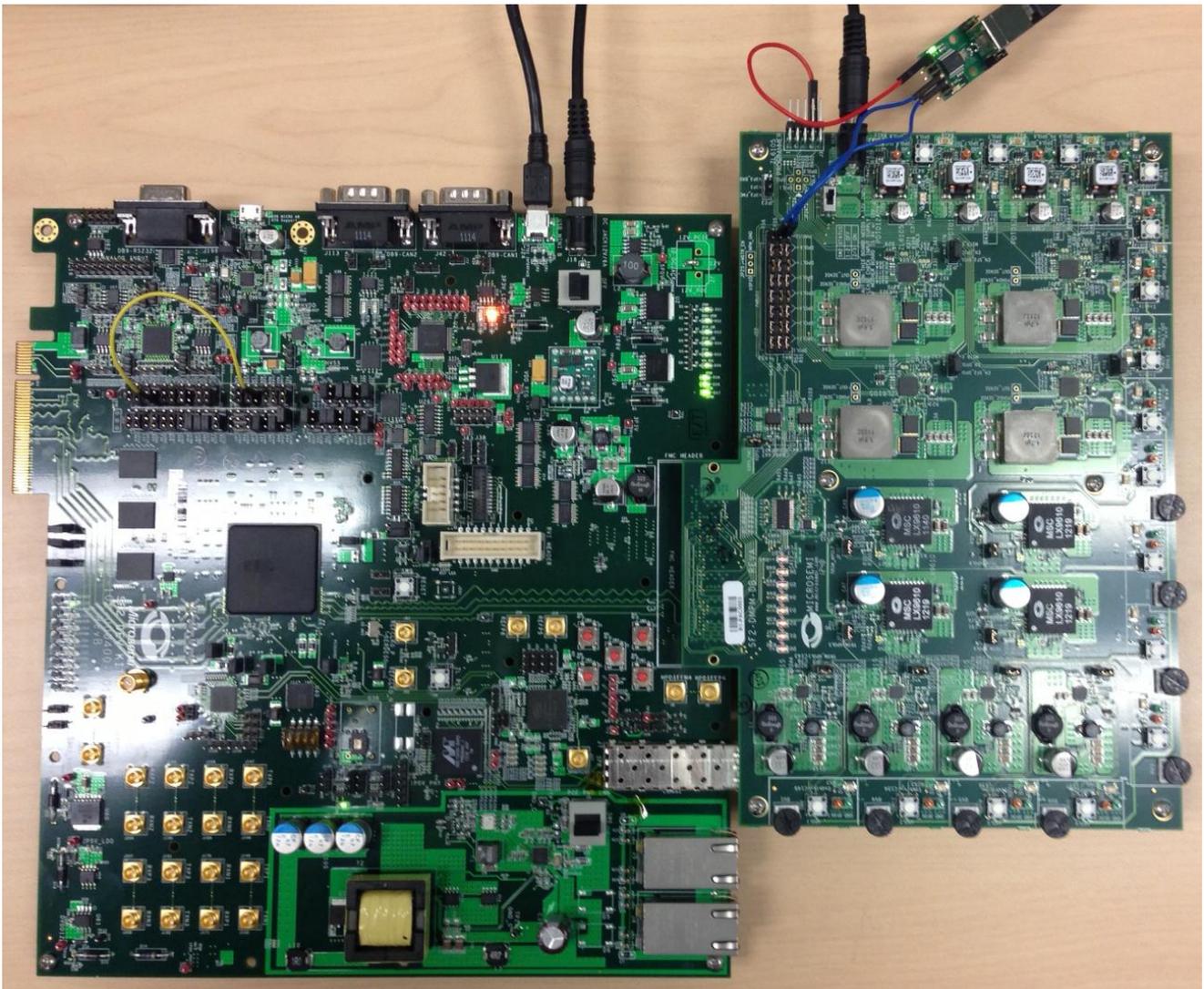


Figure 4 · MPM I2C Communications **Failure**



Fully Connected Hardware Setup

Power-Up and Power-Down System

The first 4 of the 8 LEDs on the Dev Kit are used to display the current state of the MPM system as follows:

LED 1 – This is on when the MPM system is in the off state. **(Always ensure this LED is lit before trying to power up the system)**

LED 2 – This is on when the MPM system is sequencing power up.

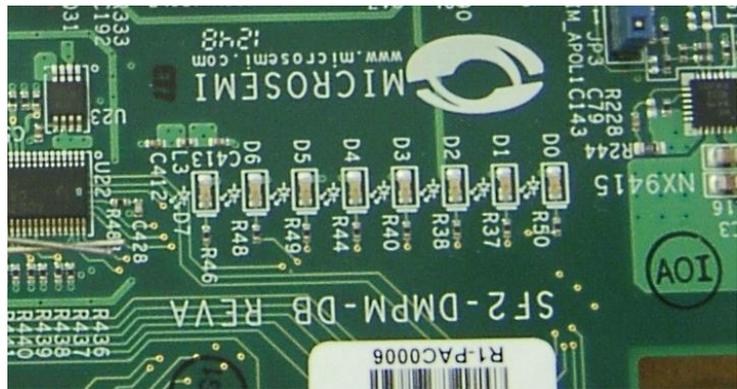
LED 3 – This is on when all POLs have been sequenced on.

LED 4 - This is on when the MPM system is sequencing power down.



1. Press **SW3** on the DEV KIT to initiate a startup sequence.
2. Observe the LEDs around the outer edge of the DMPM board turn on one at a time starting with APOL1 – APOL8 and then DPOL1 – DPOL8.
3. Notice which LED is lit on DEV KIT. LED3 indicates that the system has powered on and all POLs are in a nominal state.
4. Press **SW3** again to initiate a shutdown.
5. Observe all of the LEDs turn off in reverse sequence.
6. Also notice which LED on the DEV KIT is lit during shutdown. Ensure the state of the system corresponds with the LED indicated above.
7. Press **SW3** to start the system up.
8. Once the system has completed startup, press any of the white push-button switches associated with any of the POLs. This drops the voltage of that POL to 0V and simulates a fault. The reference design is programmed to initiate an auto-shutdown if this occurs.

The 8 LEDs on the DMPM board display the state of the first 8 MPM outputs. With the default configuration for the Beta release, these LEDs represent the state of the first 8 APOLs. When an LED is on, the corresponding APOL is in a non nominal state. When an LED is off, the corresponding channel is in the nominal state. This is useful when sequencing the APOLs as you can adjust the pot for a channel until it enters the nominal state by watching for the LED to turn off.



If you press SW 3 to initiate power-up sequencing, the MPM state changes to Starting and you can see the various regulator enabled LEDs on the SF2 DMPM Daughter Board turning on in sequence. If the status does not change to Started and the power-on sequence restarts, you can adjust the voltage of the individual APOL channels via the associated potentiometers to complete the sequencing. If open-loop trimming is enabled, the open-loop trim pin voltage will only achieve nominal value if the potentiometer is suitably adjusted.

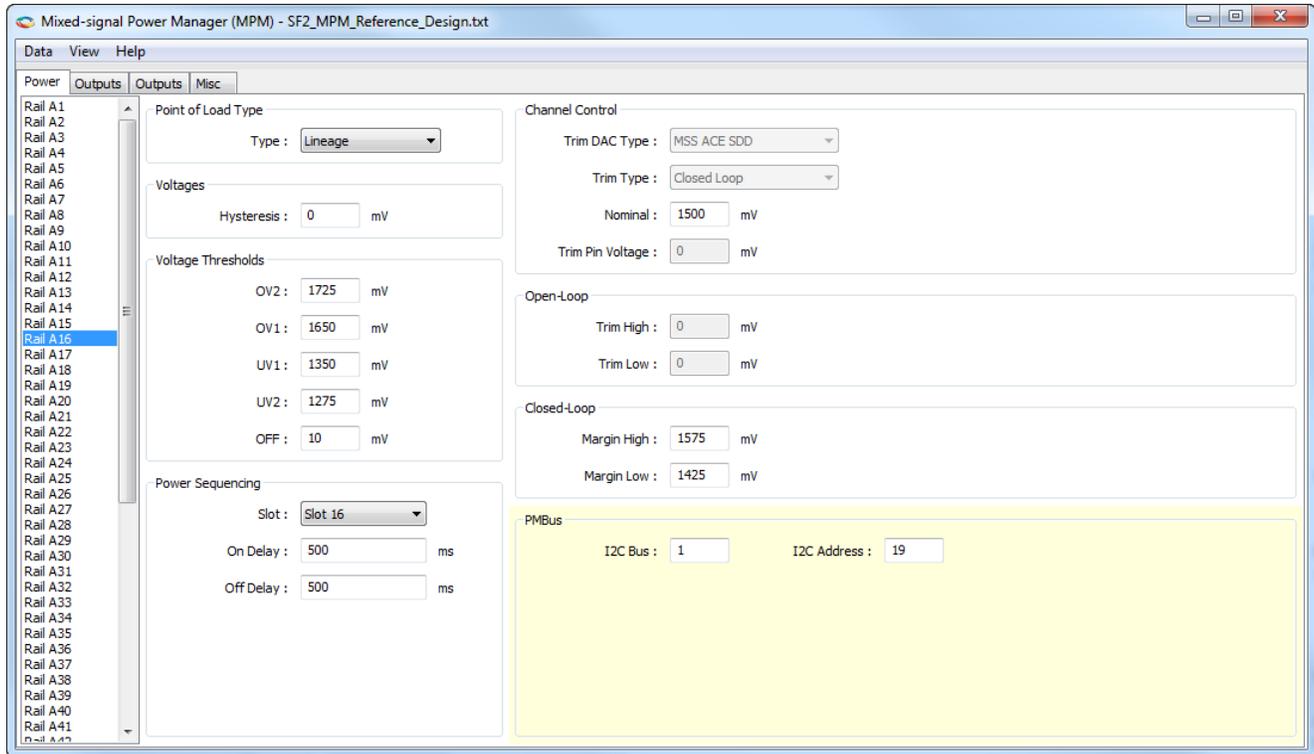
Trimming

When power sequencing has completed and all regulators have reached nominal voltage, the status changes to Started and APOL closed-loop trimming is also enabled if applicable. Closed-loop trimming keeps the APOL channel output voltage at the nominal value specified in the GUI, even when the potentiometer is adjusted. You can disable trimming by removing the Trim jumper for a given regulator. The following list shows which jumper configures which APOL:

Jumper	APOL
JP3	1
JP26	2
JP27	3
JP28	4
JP2	5
JP29	6
JP30	7
JP31	8

Removing one of these jumpers disables closed-loop trimming for the associated APOL and you see that the output voltage can be varied using the potentiometer for that channel. Reinstalling the jumper reactivates closed-loop trimming and brings it back to nominal.

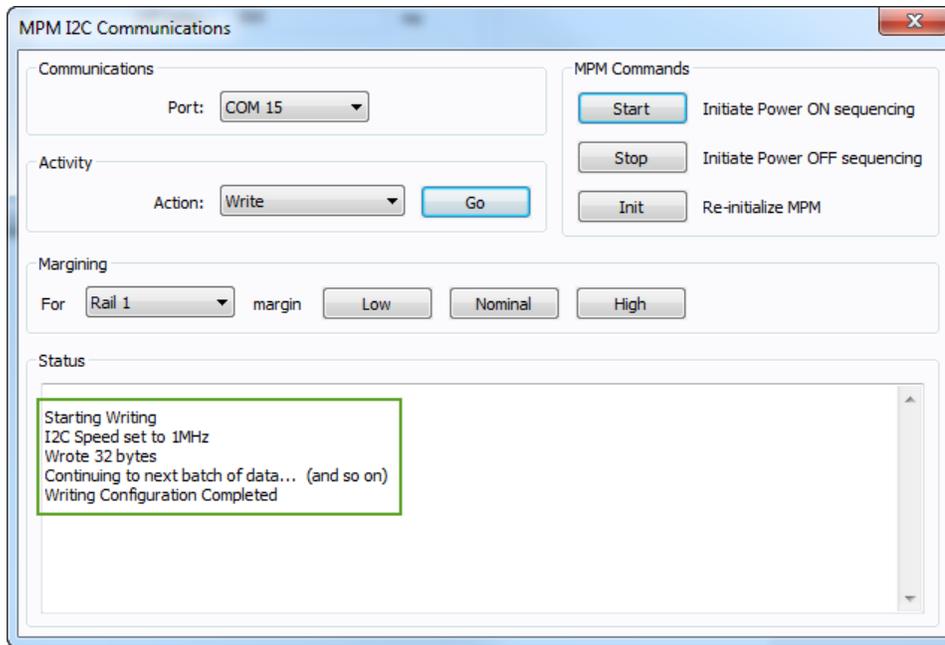
9. Power on the system by pressing **SW3** on the DEV KIT. Once it has completed startup. Try rotating any of the APOL potentiometers to adjust the voltage. Notice that it doesn't go into the critical non-nominal ranges even at the extremes of the potentiometer.
10. While the system is still powered up, remove the jumper **JP3** for the **APOL1** listed above in the table.
11. Try adjusting the potentiometer for the APOL1 and notice the corresponding LED on the DMPM board turn on once it goes into a critical voltage range. This will initiate a shutdown of the system.
12. Replace the jumper and do a power up cycle to ensure the system can properly start up.



MPM GUI

1. Open the I2C Communication window by selecting **Data > I²C > Test I²C Dongle**. Select the USB-ISS COM port from the **Communications > Port:** drop-down list. Select **Test Dongle** from the **Activity > Action** drop-down list and click the **Go** button. This is a repeat of a previous step to ensure the I2C communication is still active.
2. In the main MPM GUI window, select **Data > File > Load Values** and browse to `C:\Microsemi\SF2_MPM_RefDesign_v6.0\bin\SF2_MPM_Reference_Design.txt` to load the default values.
3. Back in the I2C COMM window, in the activity drop down menu, select Write and click Go. This will write the configuration from the MPM GUI into the eNVM.

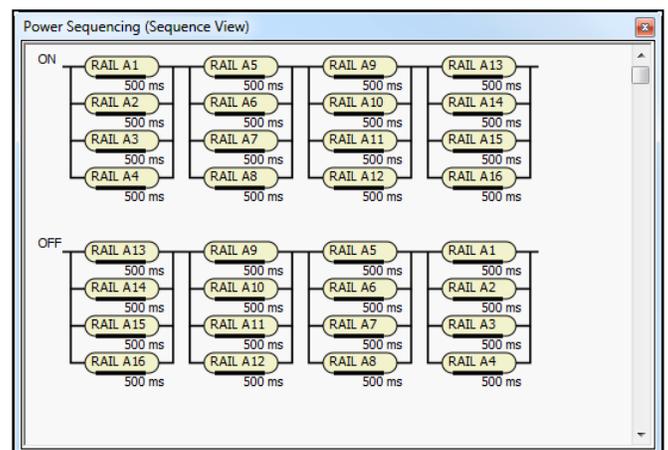
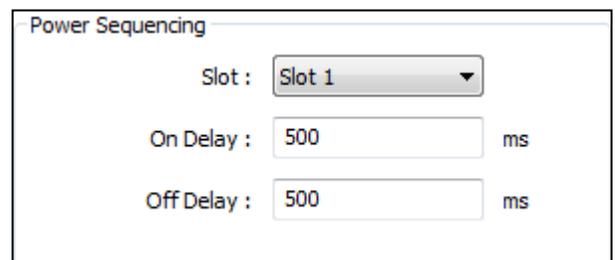
- Successful write of the configuration will produce the below window.



- Once you have successfully written the configuration data, click **Start** under the MPM Commands to initiate a startup sequence. All LEDs corresponding to the POLs should light up and sequence.
- Click **Stop** under MPM Commands to initiate a shutdown.

Power Sequencing

- In the MPM GUI window under the Power tab, in the Power Sequencing section, each of the power rails can be assigned a Slot.
- Assign the first four rails (A1-A4) to Slot 1.
- Assign the next four rails (A5-A8) to Slot 2.
- Assign the next four rails (A9-A12) to Slot 3.
- Assign the final four rails (A13-A16) to Slot 4.
- Check your assignments by looking at the **Sequencing** view. Click **View > Sequencing**. It should look as shown.
- After finishing configuration, ensure the system is powered down by either clicking **Stop** in the MPM I2C window or pressing **SW3** on the DEV KIT.
- With the system powered down, write the configuration to the eNVM by using the **Write** command in the I2C window.
- After successfully writing the configuration, click **Init** under the MPM commands.
- Click **Start** under the MPM commands to initiate a power up.
- Observe the POL LEDs turning on in groups of 4 according to the slots they were assigned to.
- Note: time delays can be inserted for power on and off for each of the rails.
- Click **Stop** in the MPM Commands window to initiate a shutdown.



- The POLs will shutdown in the same slot groups as they powered up in as expected.

Live Metering

- Revert back to the default MPM configuration by clicking **Data > File > Load Values** and selecting **SF2_MPM_Reference_Design.txt**
- For **Rails A9-A16**, set the **Point of Load Type** to **ACE Analog** and set the **Slot** to **No Sequencing**.
- Once this configuration has been set, write the config to eNVM in the I2C window.
- After writing the configuration, click **Init** under MPM Commands.
- In the MPM GUI, click **View > Meters**.
- For the purposes of this exercise, it is advisable to resize the Meters window to show only the first 8 meters.
- In the MPM I2C window, select **Monitor** in the Activity drop down menu and click **Go**.
- This will initiate the I2C communication to monitor the voltages on all of the active rails.
- On the DEV KIT, press **SW3** to start the power up sequence.
- On the DMPM board, only the first 8 APOL's should turn on.
- Observe the voltages on each of the rails show live readings.

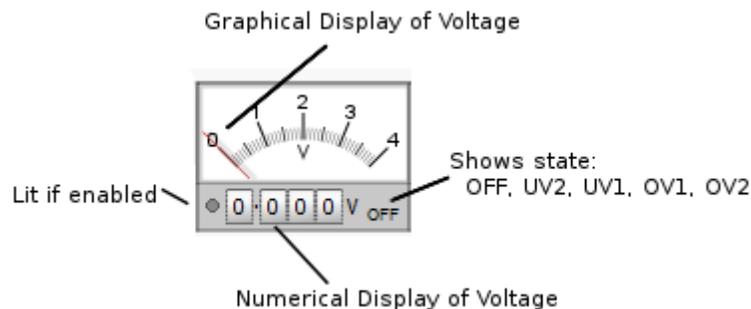
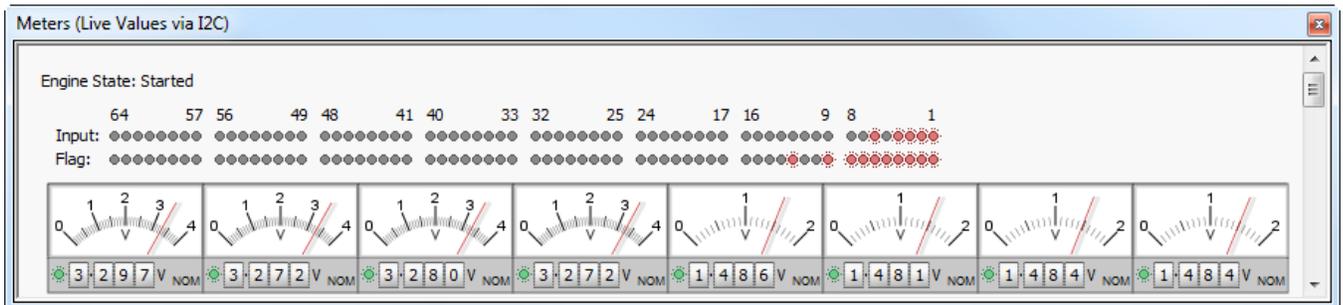
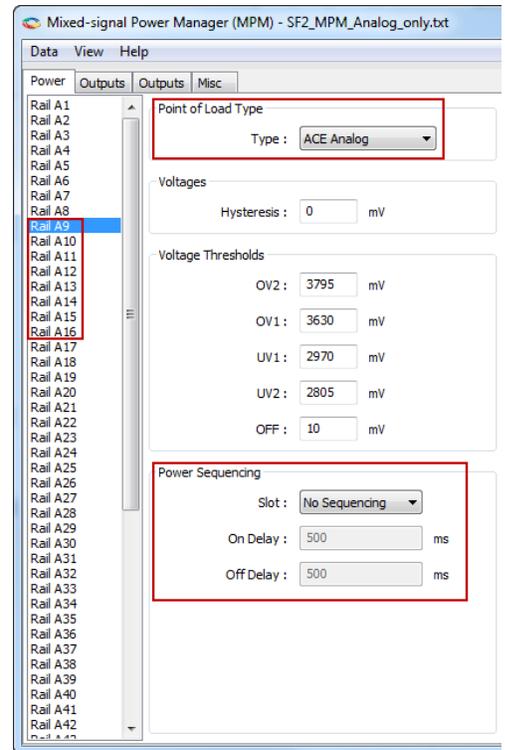
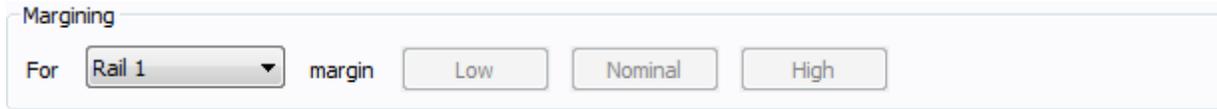
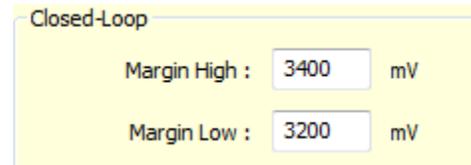


Figure 2 Details of Meter Information

Margining



12. In the I2C window, click **Stop** to halt the monitoring.
 13. For Rail 1-8, click **margin low**.
 14. Restart live voltage monitoring by clicking **Go** while the Monitor Action is selected.
 15. Observe the voltages across all 8 rails are now lower according to the **Closed-Loop Margin Low** value in the MPM GUI for each of the rails.
- Try to margin high all 8 rails to confirm.



Product Support

Microsemi SoC Products Group backs its products with various support services, including Customer Service, Customer Technical Support Center, a website, electronic mail, and worldwide sales offices. This appendix contains information about contacting Microsemi SoC Products Group and using these support services.

Customer Service

Contact Customer Service for non-technical product support, such as product pricing, product upgrades, update information, order status, and authorization.

From North America, call **800.262.1060**
 From the rest of the world, call **650.318.4460**
 Fax, from anywhere in the world **408. 643.6913**

Customer Technical Support Center

Microsemi SoC Products Group staffs its Customer Technical Support Center with highly skilled engineers who can help answer your hardware, software, and design questions about Microsemi SoC Products. The Customer Technical Support Center spends a great deal of time creating application notes, answers to common design cycle questions, documentation of known issues and various FAQs. So, before you contact us, please visit our online resources. It is very likely we have already answered your questions.

Technical Support

Visit the Microsemi SoC Products Group Customer Support website for more information and support (<http://www.microsemi.com/soc/support/search/default.aspx>). Many answers available on the searchable web resource include diagrams, illustrations, and links to other resources on website.

Website

You can browse a variety of technical and non-technical information on the Microsemi SoC Products Group home page, at <http://www.microsemi.com/soc/>.

Contacting the Customer Technical Support Center

Highly skilled engineers staff the Technical Support Center. The Technical Support Center can be contacted by email or through the Microsemi SoC Products Group website.

Email

You can communicate your technical questions to our email address and receive answers back by email, fax, or phone. Also, if you have design problems, you can email your design files to receive assistance. We constantly monitor the email account throughout the day. When sending your request to us, please be sure to include your full name, company name, and your contact information for efficient processing of your request.

The technical support email address is soc_tech@microsemi.com.

My Cases

Microsemi SoC Products Group customers may submit and track technical cases online by going to [My Cases](#).

Outside the U.S.

Customers needing assistance outside the US time zones can either contact technical support via email (soc_tech@microsemi.com) or contact a local sales office. [Sales office listings](#) can be found at www.microsemi.com/soc/company/contact/default.aspx.

ITAR Technical Support

For technical support on RH and RT FPGAs that are regulated by International Traffic in Arms Regulations (ITAR), contact us via soc_tech_itar@microsemi.com. Alternatively, within [My Cases](#), select **Yes** in the ITAR drop-down.