

## Overview

This document explains PicoZed SDR 2x2 System-on-Module (SOM) power up issues that have been occasionally reported. This pertains only to part number AES-Z7PZ-SDR2-G. This document also provides the steps necessary to update the firmware of the power sequencer located on the SOM, which resolves the power up issues. This critical update should be applied to all PicoZed 2x2 SOMs to ensure reliable operation.

## Background

PicoZed SDR 2x2 SOM uses the ADM1166 Super Sequencer (U7) to implement a complete supervisory and sequencing system to ensure all power rails are regulated properly. If the sequencer detects a problem, it will disable all regulators to protect the module from damage.

Early versions of the SOM's ADM1166 firmware set pass/fail conditions that, in some systems, are too prohibitive. The latest firmware alleviates these restrictions. The changes are summarized below, followed by instructions to update the ADM1166 firmware.

Please ask questions or provide feedback on the [PicoZed SDR Forum](#).

## Summary of Issues Resolved

This section provides details of the issues that have been resolved.

### 5.0V System Input Range

Early ADM1166 firmware required that the 5.0V input on JX\_VIN maintain a narrow voltage tolerance. Some carriers were not meeting these requirements, causing the SOM to fail power up checks.

**Resolution:** The latest ADM1166 firmware opens the voltage input range to 5.0V  $\pm$  10% (4.50V – 5.50V).

### 5.0V System Input Ramp Time

Early ADM1166 firmware required that the 5.0V input on JX\_VIN satisfy a fast rise time. Some carriers were not meeting these requirements, causing the SOM to fail power up checks.

**Resolution:** The latest ADM1166 firmware extends the rise time window to 400ms.

### MGT and User I/O Voltage Rail Requirements

Early ADM1166 firmware required all user I/O banks to be powered. This was not ideal for carriers that did not use some or all of the user I/O banks. In addition, the firmware imposed narrow ranges for the user voltage rails.

**Resolution:** The latest ADM1166 firmware is programmed such that only a single 5.0V supply (VIN) is required to successfully power up the SOM. In addition, the sequencer monitors all Zynq SoC user bank voltage rails and will power down the SOM if an overvoltage condition is detected.

This scheme allows a carrier to provide voltage only to the banks that are being used, but ground the other unused banks rails. The programmable sequencer also makes it possible to create custom sequencing and monitoring schemes. See Firmware Modification for details.

For example, if you plan to use a Zynq High Range (HR) bank powered at 3.3V, you can modify the firmware to power down the SOM if the bank voltage deviates from a certain margin around the nominal 3.3V potential. This can help you protect your system from driving signals into an I/O bank when the voltage supply on your carrier has failed.

See Table 1 for a summary of acceptable ranges for banks that will be powered.

**Table 1 - Supply Voltage Summary**

Voltage Input	Nominal (V)	Range (V)	SOM Pins	Notes
VIN <sup>1</sup>	5.0	4.500 – 5.500	JX1 [57:60] JX2 [12, 57:60]	Main SOM supply.
JX_VCCO_12	1.8 – 3.3	1.140 – 3.465	JX1 [78:80]	Zynq PL HR Bank 12 Optional (GND if unused)
JX_VCCO_13	1.8 – 3.3	1.140 – 3.465	JX2 [98] JX3 [45:46]	Zynq PL HR Bank 13 Optional (GND if unused)
JX_VCCO_33_34 <sup>4</sup>	1.2 – 1.8	1.140 – 1.890	JX2 [78:80]	Zynq PL HP Banks 33/34 Optional (GND if unused)
JX_MGTAVTT <sup>2,3,4</sup>	1.2	1.171 – 1.230	JX3 [30, 32]	Zynq MGT Bank 111/112 Optional (GND if unused)
JX_MGTAVCC <sup>2,3,4</sup>	1.0	0.972 – 1.079	JX3 [5,7,9,11]	Zynq MGT Bank 111/112 Optional (GND if unused)
	1.05	0.972 – 1.079		For QPLL > 10.3123 GHz

- (1) VIN is the only required voltage, unused banks may be grounded on your carrier.
- (2) Xilinx recommends less 10mV peak-to-peak voltage from 10 kHz – 80 MHz on MGAVTT and MGAVCC supplies (Xilinx UG476). MGAVCC power consumption can be reduced when the Zynq internal PLL is operated below 10.3123GHz.
- (3) Rev A-C SOMs implement Zynq MGTs in Bank 111. Rev D and later SOMs use Bank 112.
- (4) Deviation from the Zynq datasheet recommended range is a result of the ADM1166 ADC precision.

The *SOM User Guide* has also been updated with this information

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## Identification

Turn the SOM over and look for a white label near the JX4 and P1 connectors.

Your module already has the firmware update if you see one of the following:

- Your label has a red dot, or
- Your label is printed with S16-1406



**Figure 1 – Manufacturer's Label**

If your module does not match either description, then this critical update should be applied to ensure reliable operation.

## Update Instructions

This section describes how to update the ADM1166 firmware on a PicoZed SDR 2x2 SOM connected to an Avnet carrier card. A Linux application running on the Zynq SoC reprograms the ADM1166 over I2C. This assumes your SOM powers up successfully (See Figure 1). If your SOM does not power up, refer to the section [Power Up Fails](#).



Figure 2 - Successful SOM Power Up with FMC Carrier

### Software Required

The following software is required:

- Analog Devices Zynq Linux boot image
- Silicon Labs CP210x USB-to-UART host PC driver
- Terminal program (e.g., TeraTerm, PuTTY, or similar)

1. Prepare the Zynq Linux boot image.

PicoZed SDR carriers come with an 8GB SD card programmed with the required Zynq Linux boot image. If you need to prepare a new 8GB SD card, follow the instructions on the Analog Devices Zynq Quick Start Guide wiki page at:

[https://wiki.analog.com/resources/tools-software/linux-software/zynq\\_images](https://wiki.analog.com/resources/tools-software/linux-software/zynq_images)

2. Install the Silicon Labs CP210x USB-to-UART Driver on your host PC.

[http://picozed.org/sites/default/files/documentations/CP210x\\_Setup\\_Guide\\_1\\_2\\_0.pdf](http://picozed.org/sites/default/files/documentations/CP210x_Setup_Guide_1_2_0.pdf)

3. Install a terminal program like TeraTerm or PuTTY on your host PC. Configure the terminal as described in the *CP210x Setup Guide* link above.

### Hardware Required

The hardware used in this procedure includes the following:

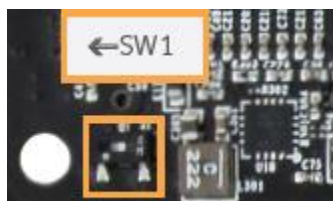
[www.picozed.org/sdr](http://www.picozed.org/sdr)

- Avnet PicoZed SDR 2x2 SOM (AES-Z7PZ-SDR2-G)
- Avnet PicoZed SDR FMC or Breakout Carrier ([AES-PZSDRCC-FMC-G](#), or [AES-PZSDRCC-BRK-G](#))
- 8GB SD card (class 10 or better)
- Host PC with SD card slot

## Configuration

Configure the hardware, as follows:

1. Assemble the SOM and carrier.
2. Provide an Ethernet connection to a networked DHCP router/switch.
3. Connect USB to the host PC and the carrier USB-UART port.
4. Configure the SOM switches to boot from the SD slot.



SD Card Select



Boot Mode Select

5. Insert SD card into the SOM.
6. Connect the power supply to the carrier.
7. Turn the carrier power switch ON.

If you need help making these configurations, refer to the Quick Start Cards and User Guides located at [www.picozed.org](http://www.picozed.org).

## Automated Update Procedure

Analog Devices provides a simple Linux script executed on Zynq to download the latest ADM1166 firmware and program the SOM. You will need a networked router with DHCP capability. Follow the instructions at the wiki site listed below. Look for the section “*Programming the ADM1166 Power Sequencer – Using Linux or HyperTerminal Program*”.

<https://wiki.analog.com/resources/eval/user-guides/pzsd/power-and-sequencing>

**Done!**


Alternatively, you may use the Manual Update Procedure.

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## Manual Update Procedure

This is an optional “manual” method to update the ADM1166 firmware, provided if you are unable to connect your development kit to a DHCP networked router. This method can also be used to program your custom ADM1166 firmware, however consider whether your custom thresholds will be compatible with the carrier you are using during this process. Upon completion the board may shutdown. The only way to recover from this situation is to use the USB adapter to program the SOM standalone. If this occurs, see section [Power Up Fails](#).

1. Go to the Analog Devices GitHub repository at:  
<https://github.com/analogdevicesinc/PicoZed-SDR>
2. Download the latest revision of the repository to your host PC. It’s important to either clone or download the zip archive.



3. Plug the SD card (included with the kit) into the host PC and copy the following files to the root directory.
  - Hex file: **ADM1166.hex**
  - Executable: **adm1166\_eeprom**
4. Safely remove the SD card from the PC.
5. Plug the SD card into the PicoZed SDR Carrier.
6. Turn on the system and wait for Linux to boot.
7. Open a terminal and enter the following commands:

```
➤ mkdir -p /media/boot/  
➤ sudo mount /dev/mmcblk0p1 /media/boot/  
➤ cp /media/boot/adm1166_eeprom .  
➤ cp /media/boot/ADM1166.hex .  
➤ sudo umount /media/boot  
➤ sudo chmod +x ./adm1166_eeprom  
➤ sudo ./adm1166_eeprom ADM1166.hex
```

8. Following the last command, the terminal displays a log of operations as the ADM1166 EEPROM is overwritten with new firmware. The final text should say:

```
Successfully reprogrammed the ADM1166 EEPROM.  
... reboot the board to load the new configuration.
```

9. Safely reboot the system using the Logout icon on the Linux desktop.
10. Verify the PG\_MODULE LED (D3) of the SOM illuminates and Linux boots.

**Done!**

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## Power Up Fails

If you have a factory-programmed SOM that does not successfully power up on your Avnet carrier, please accept our apologies for this inconvenience. Contact your local Avnet representative who will gladly perform the firmware upgrade for you.

Alternatively, follow the instructions in the next section to reprogram the module yourself using an inexpensive USB adapter.

### Standalone Programming with USB Adapter

PicoZed SDR 2x2 SOM includes a programming port for the ADM1166 (P1). This is a 5-pin header located on the back side of the module, near JX4. The Analog Devices [USB-SDP-CABLEZ Serial I/O Interface](#) cable can be used to program the ADM1166 at this port. The SOM can be programmed standalone, or plugged into a carrier card. In the standalone case, the USB interface cable provides power to the ADM1166 during programming.



Instructions for programming are on the Analog Devices wiki:

<https://wiki.analog.com/resources/eval/user-guides/pzsd/power-and-sequencing>

Look for the section titled *“Using the USB-SDP-CABLEZ Serial I/O Interface”*.

Download the latest ADM1166 firmware repository from the GitHub link below. It’s important to either clone or download the zip archive.

Clone or download ▾

<https://github.com/analogdevicesinc/PicoZed-SDR>.

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## Firmware Modification

The ADM1166 firmware can easily be modified to implement custom monitoring and sequencing schemes. Be advised that a number of factors must be considered, including:

- Resistor dividers (and their tolerances) at ADM1166 inputs
- ADM1166 programmable input ranges
- ADM1166 input impedance (voltage dependent)

Analog Devices provide an in depth analysis for calculating ADM1166 thresholds for PicoZed SDR on their wiki page – <https://wiki.analog.com/resources/eval/user-guides/pzsdr/power-and-sequencing>

Designers are strongly encouraged to start with the latest ADM166.txt file ([on GitHub](#)) and make changes using the Analog Devices [Super Sequencer Configuration Tool](#). Consult the [Xilinx Zynq datasheet](#) before making any changes.

**IMPORTANT! Consult the Zynq AP SoC and AD9361 datasheets before updating threshold windows for SOM voltage rails. Sequencing changes are strongly discouraged.**

Once you have made updates to the ADM1166 firmware file using the configuration tool, there are two methods for programming the device.

- Program the ADM1166 using the Zynq SoC to execute a Linux command line script (See Update Instructions)
- Purchase a [USB-SDP-CABLEZ Serial I/O Interface](#) cable to program the SOM directly (See [Standalone Programming with USB Adapter](#))

Also note that Avnet can provide SOM programming services for your custom ADM1166 firmware. Send an email to Avnet Engineering Services at [customize@avnet.com](mailto:customize@avnet.com) for a quote.



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## Revision History

Date	Version	Revision
01 Mar 2016	1.0	Initial release
06 Mar 2016	1.1	Updated ADI wiki URL
29 Mar 2016	1.2	Added section “Determine Board Revision”; renamed Automated and Manual sections under Software Update.
07 Sep 2016	1.3	Limited release for test.
21 Sep 2016	1.4	Major update, all sections.