

# VCU128 System Controller GUI Tutorial

May 2019



# Revision History

Date	Version	Description
05/29/19	2.0	Updated for 2019.1. For Production Silicon boards.
12/10/18	1.0	Initial version.

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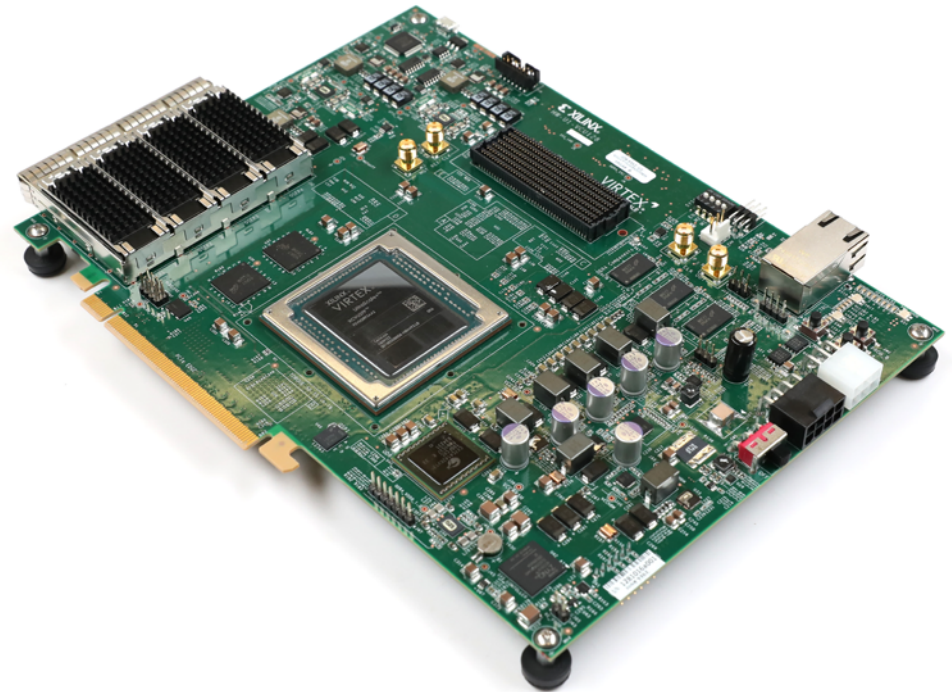
# Overview

- > **Xilinx VCU128 Board**
- > **VCU128 SCUI**
  - >> Clocks
  - >> Voltages
  - >> Power
  - >> FMC
  - >> GPIO Expander
  - >> EEPROM Data
  - >> About
- > **Programming Firmware**
- > **References**

# VCU128 Software Install and Board Setup

## > Complete setup steps in XTP535 – VCU128 Software Install and Board Setup:

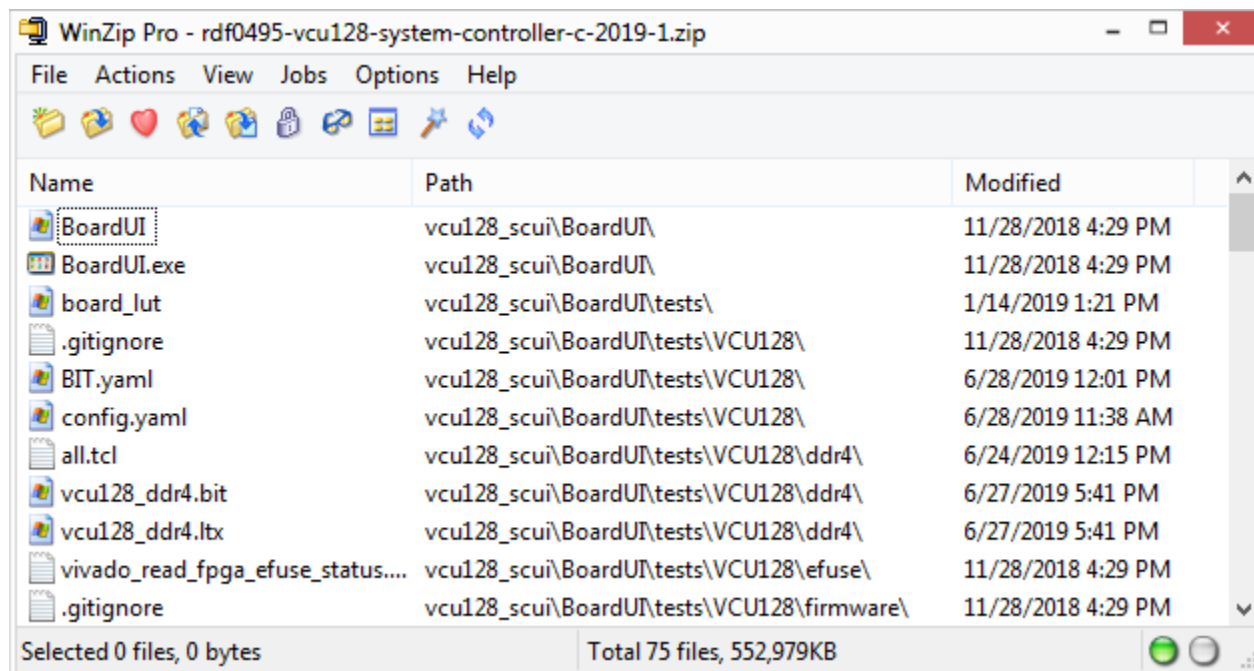
- >> Software Requirements
- >> VCU128 Board Setup
- >> UART Driver Install
- >> Ethernet Setup



# VCU128 System Controller

## > Open the RDF0495 – VCU128 System Controller GUI (2019.1 C) ZIP file

>> Extract these files to your C:\ drive



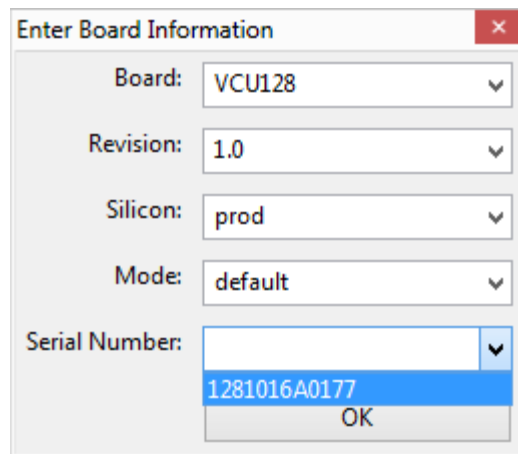
# Running the Board Interface Test

- > From C:\vcu128\_scul/BoardUI, double click on BoardUI.exe



# Basic Board Interface Test

- > Select the Board Serial Number from the pulldown and click OK



Enter Board Information

Board: VCU128

Revision: 1.0

Silicon: prod

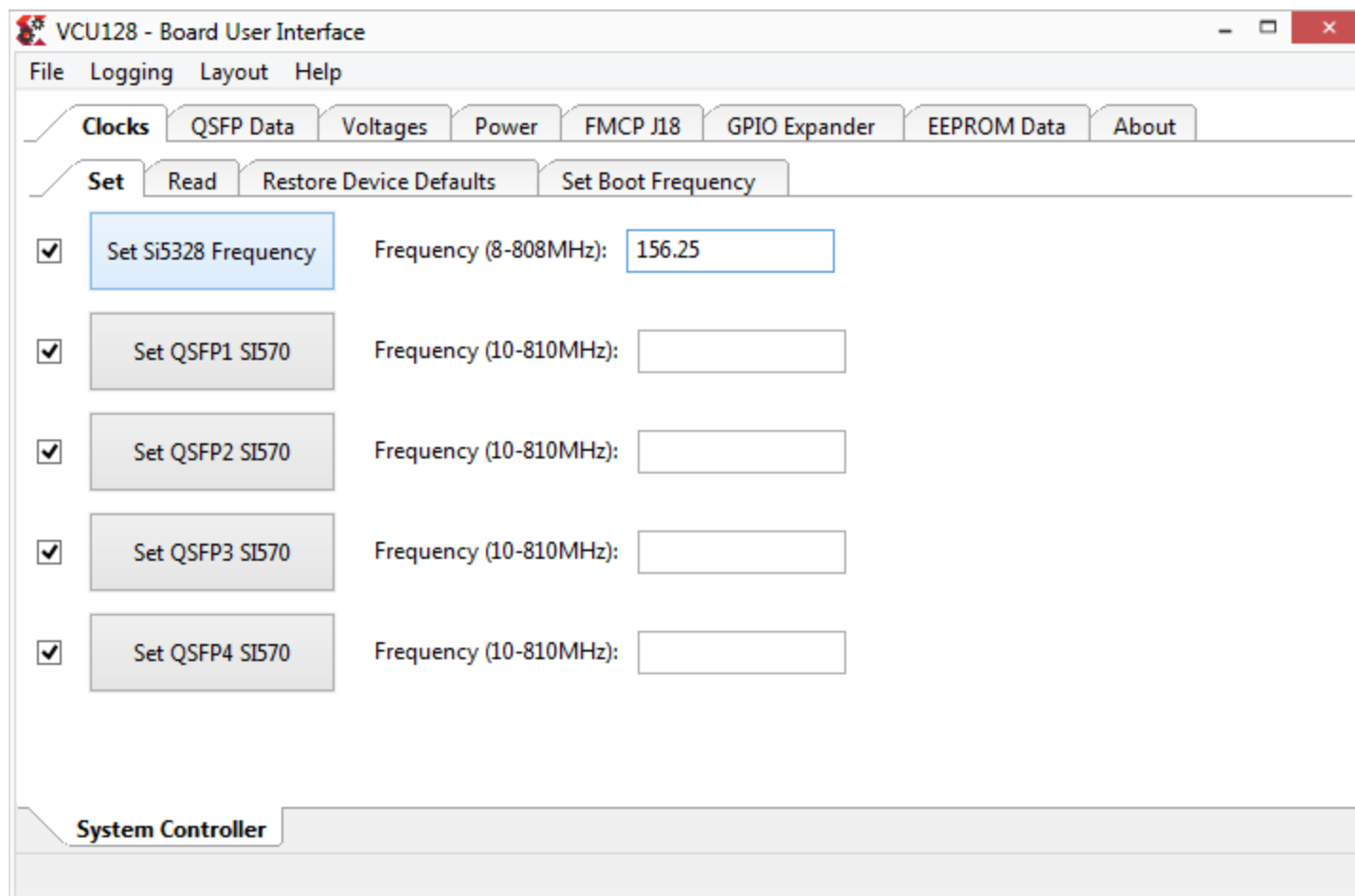
Mode: default

Serial Number: 1281016A0177

OK

# Setting the clocks

- > Select the Set tab underneath the Clocks tab
- > Enter 156.25 for the Si5328 and click the Set Si5328 Frequency button

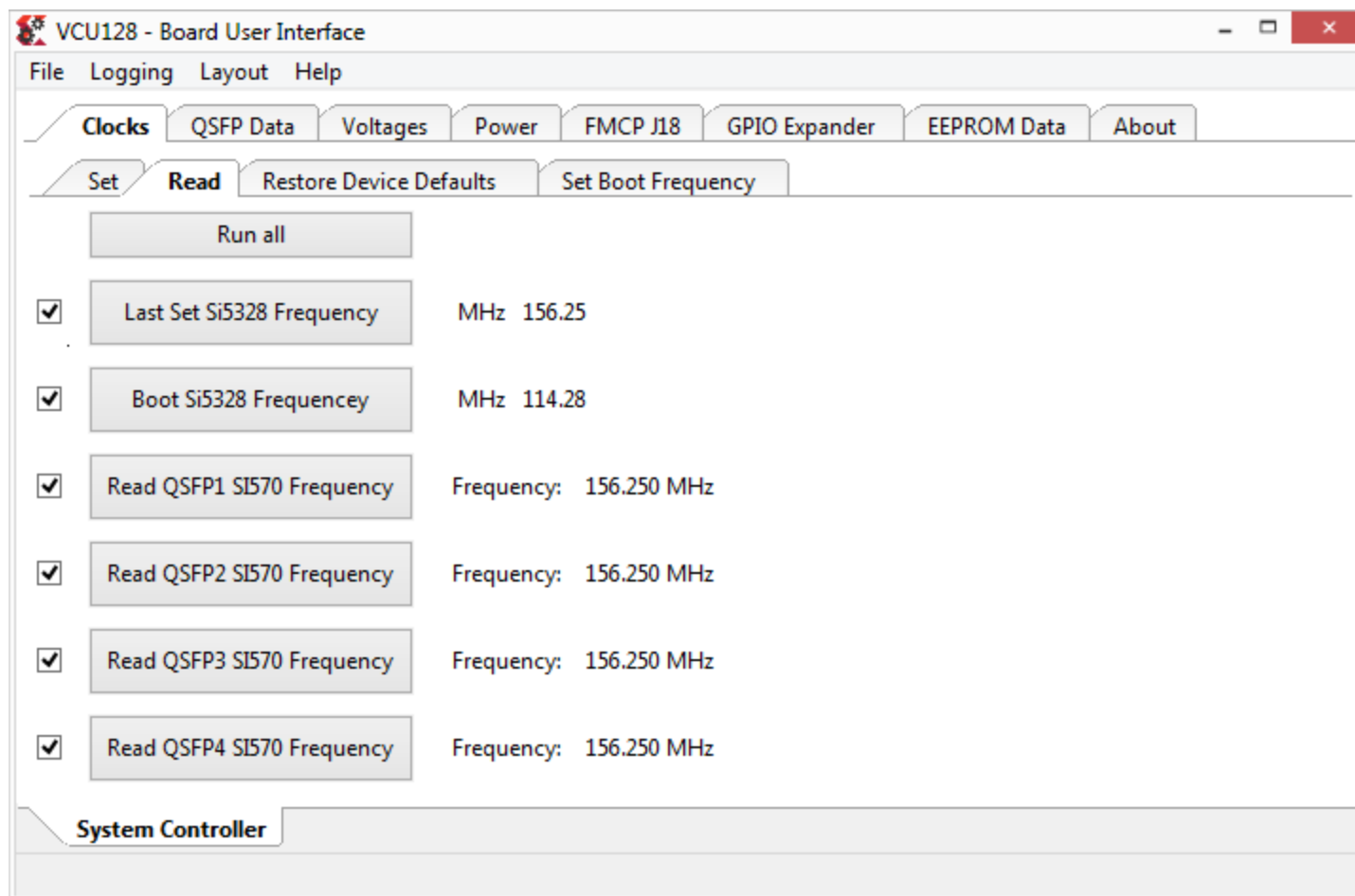


**Note:** Presentation applies to the VCU128



# Reading the clocks

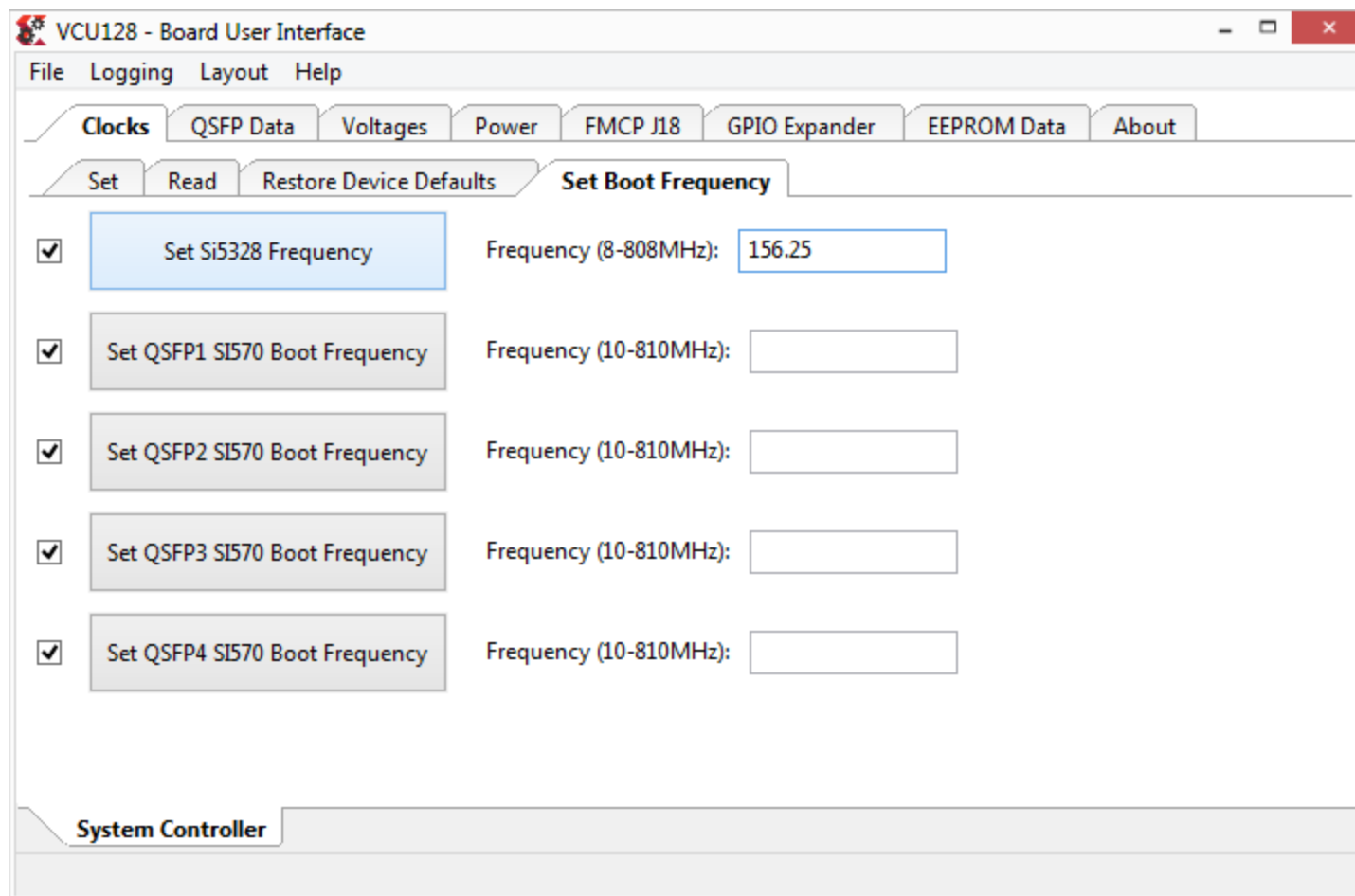
- > Select the Read tab
- > Click each of the Read buttons and verify the frequencies are set as shown



**Note:** Presentation applies to the VCU128

# Setting Clock Boot Frequencies

- > Select the Set Boot Frequency tab
- > Type in your desired boot-up frequency and click the corresponding Set button



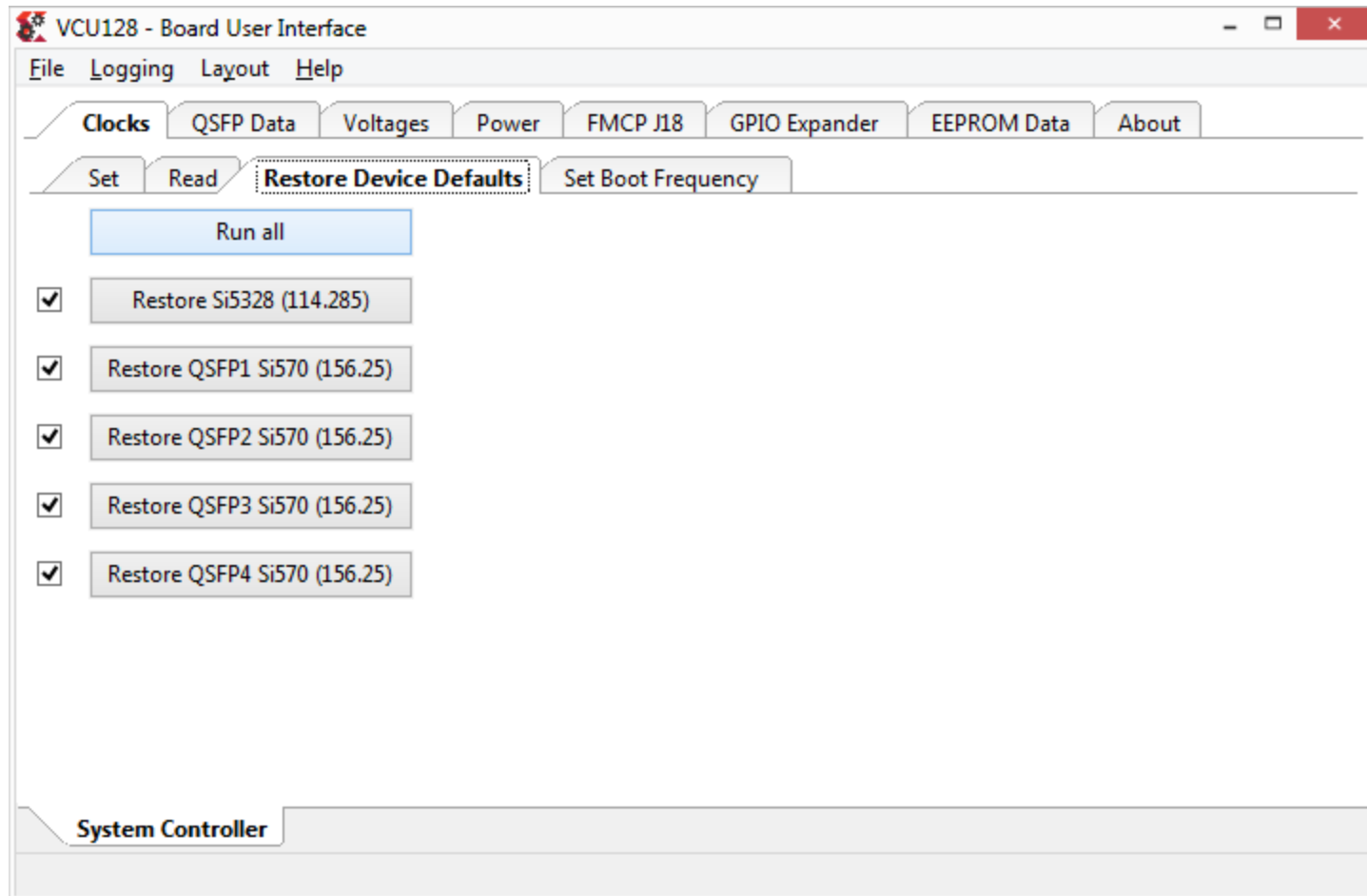
The screenshot displays the 'VCU128 - Board User Interface' window. The 'Clocks' tab is selected, and within it, the 'Set Boot Frequency' sub-tab is active. The interface includes a menu bar (File, Logging, Layout, Help) and a series of tabs (Clocks, QSPF Data, Voltages, Power, FMCP J18, GPIO Expander, EEPROM Data, About). Below the tabs, there are three sub-tabs: 'Set', 'Read', and 'Restore Device Defaults'. The 'Set' sub-tab contains five entries, each with a checked checkbox, a button, and a frequency input field. The first entry, 'Set Si5328 Frequency', has a value of '156.25' entered in its field. The other four entries are for QSPF1, QSPF2, QSPF3, and QSPF4, all with empty input fields. At the bottom of the window, there is a 'System Controller' tab.

Checkbox	Button	Frequency (MHz)
<input checked="" type="checkbox"/>	Set Si5328 Frequency	156.25
<input checked="" type="checkbox"/>	Set QSPF1 SI570 Boot Frequency	
<input checked="" type="checkbox"/>	Set QSPF2 SI570 Boot Frequency	
<input checked="" type="checkbox"/>	Set QSPF3 SI570 Boot Frequency	
<input checked="" type="checkbox"/>	Set QSPF4 SI570 Boot Frequency	

**Note:** Presentation applies to the VCU128

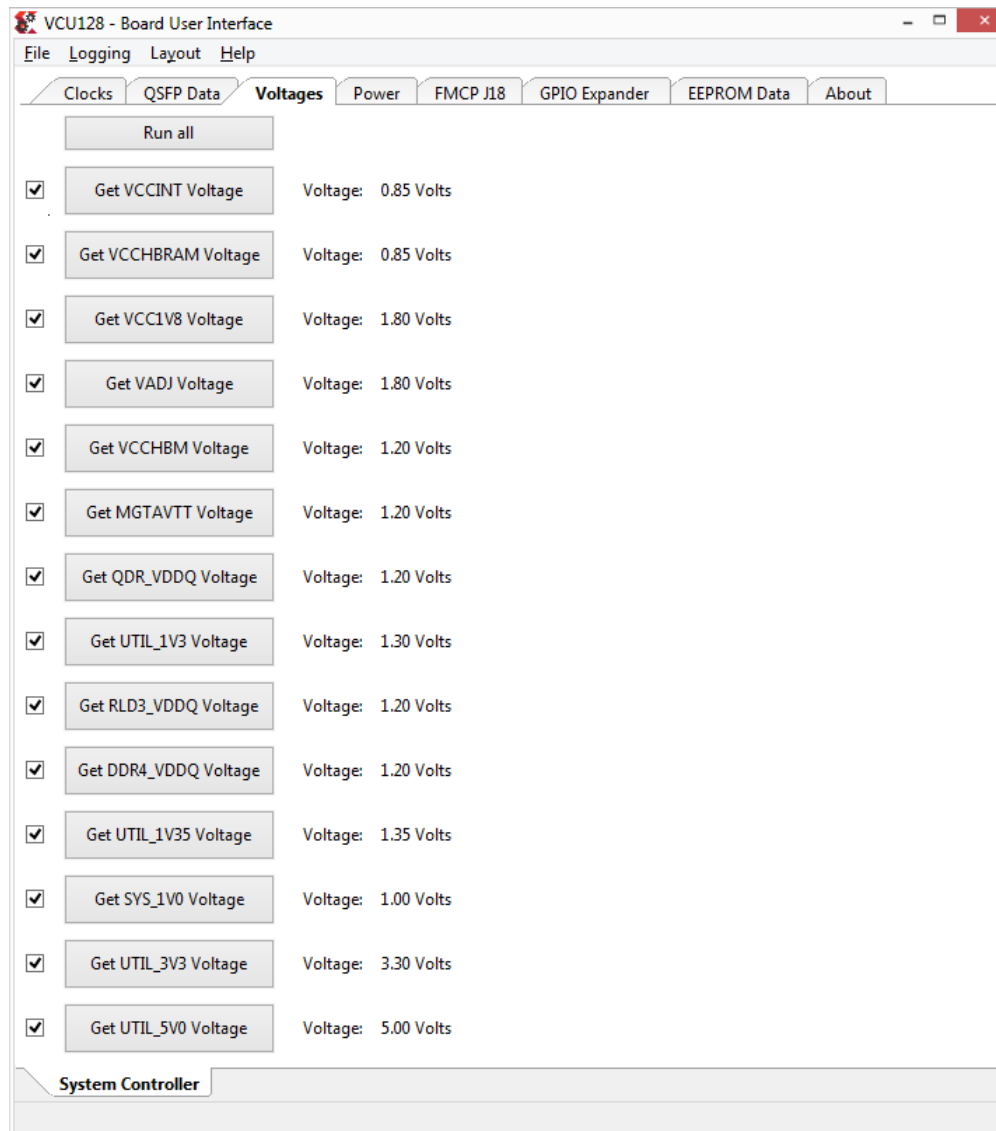
# Setting the clocks

- > Select the Restore Device Defaults tab
- > Click Run All to restore all to the factory settings
- > Set the Si5328 back to 156.25 after this step



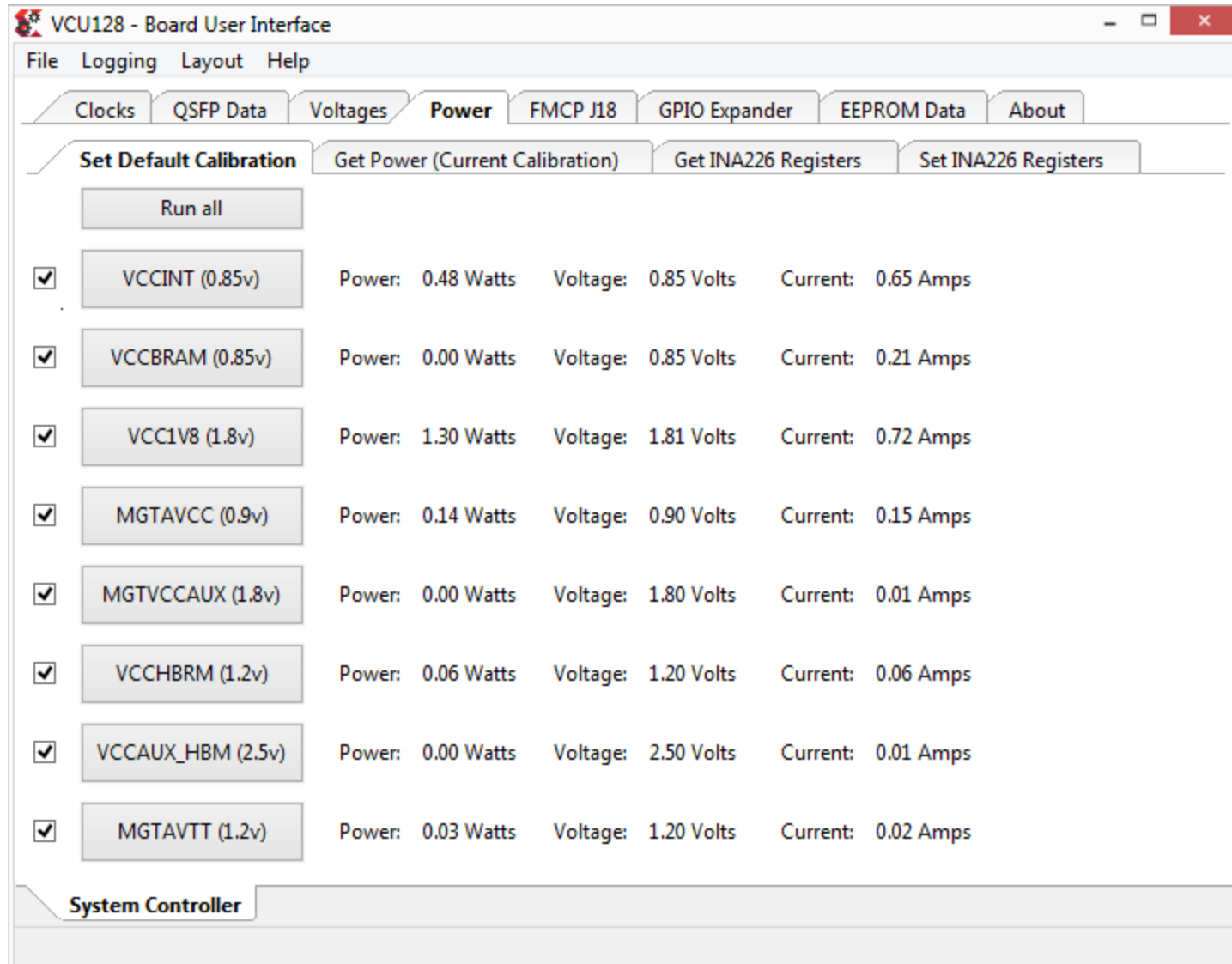
# Reading onboard VCU128 voltages

- > Select the Voltages tab
- > Click the Run all



# Reading power values using default calibration

- > Select the Set Default Calibration tab underneath Power and click Run all
- > This sets the default calibration and returns the calibrated power values



The screenshot shows the VCU128 - Board User Interface. The 'Power' tab is selected, and the 'Set Default Calibration' sub-tab is active. A 'Run all' button is visible. Below it, a table lists calibrated power values for various voltage rails, each with a checked checkbox.

Voltage Rail	Power (Watts)	Voltage (Volts)	Current (Amps)
VCCINT (0.85v)	0.48	0.85	0.65
VCCBRAM (0.85v)	0.00	0.85	0.21
VCC1V8 (1.8v)	1.30	1.81	0.72
MGTA VCC (0.9v)	0.14	0.90	0.15
MGTVCCAUX (1.8v)	0.00	1.80	0.01
VCCHBRM (1.2v)	0.06	1.20	0.06
VCCAUX_HBM (2.5v)	0.00	2.50	0.01
MGTAVTT (1.2v)	0.03	1.20	0.02

System Controller

# Read INA226 Registers

- > Select the Get INA226 Registers tab and click Run all
- > Observe the INA226 Registers settings

The screenshot displays the VCU128 Board User Interface. The 'Power' tab is selected, and within it, the 'Get INA226 Registers' sub-tab is active. A 'Run all' button is visible at the top left of the main content area. Below this, four power rails are listed, each with a checked checkbox, a name, and a table of INA226 register values. The registers shown are Configuration, Power, Mask/Enable, Shunt Voltage, Current, and Alert Limit. The rightmost column of the table is partially obscured by a scrollbar.

Power Rail	Configuration	Power	Mask/Enable	Shunt Voltage	Current	Alert Limit
<input checked="" type="checkbox"/> VCCINT (0.85v)	4127	0005	0008	00FD	00A4	0000
<input checked="" type="checkbox"/> VCCBRAM (0.85v)	4127	0000	0008	0056	0017	0000
<input checked="" type="checkbox"/> VCC1V8 (1.8v)	4127	00AA	0008	0598	092C	0000
<input checked="" type="checkbox"/> MGTAVCC (0.9v)	4127	0010		0124	01DE	

# Set INA226 Registers

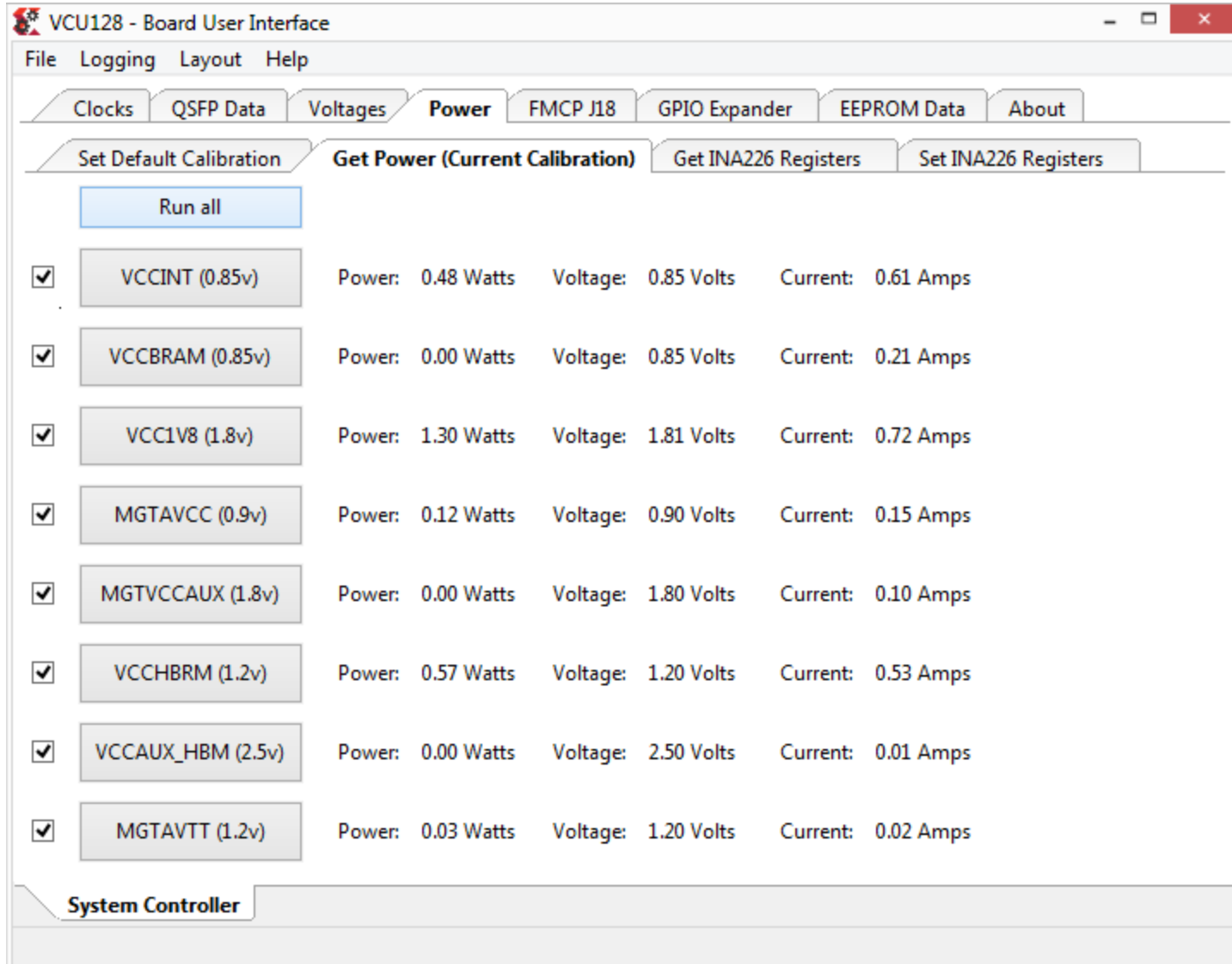
- > Select the Set INA226 Registers tab
- > Review [TI INA226](#) documentation before making changes

The screenshot displays the 'VCU128 - Board User Interface' window. The 'Power' tab is selected, and within it, the 'Set INA226 Registers' sub-tab is active. The interface lists five power domains, each with a checked checkbox, a configuration field, a mask/enable field, a calibration field, and an alert limit field. The domains are VCCINT (0.85v), VCCBRAM (0.85v), VCC1V8 (1.8v), MGTAVCC (0.9v), and MGTVCCAUX (1.8v). The 'System Controller' tab is visible at the bottom.

Power Domain	Configuration	Mask/Enable	Calibration	Alert Limit
<input checked="" type="checkbox"/> VCCINT (0.85v)				
<input checked="" type="checkbox"/> VCCBRAM (0.85v)				
<input checked="" type="checkbox"/> VCC1V8 (1.8v)				
<input checked="" type="checkbox"/> MGTAVCC (0.9v)				
<input checked="" type="checkbox"/> MGTVCCAUX (1.8v)				

# Reading power values using current calibration

- > Select the Get Power (Current Calibration) tab and click Run all
- > Observe readings (no calibrations were entered in this example)



The screenshot displays the VCU128 - Board User Interface. The 'Power' tab is selected, showing the 'Get Power (Current Calibration)' sub-tab. A 'Run all' button is visible. Below it, a table lists power supply rails with their respective power, voltage, and current readings. All checkboxes are checked.

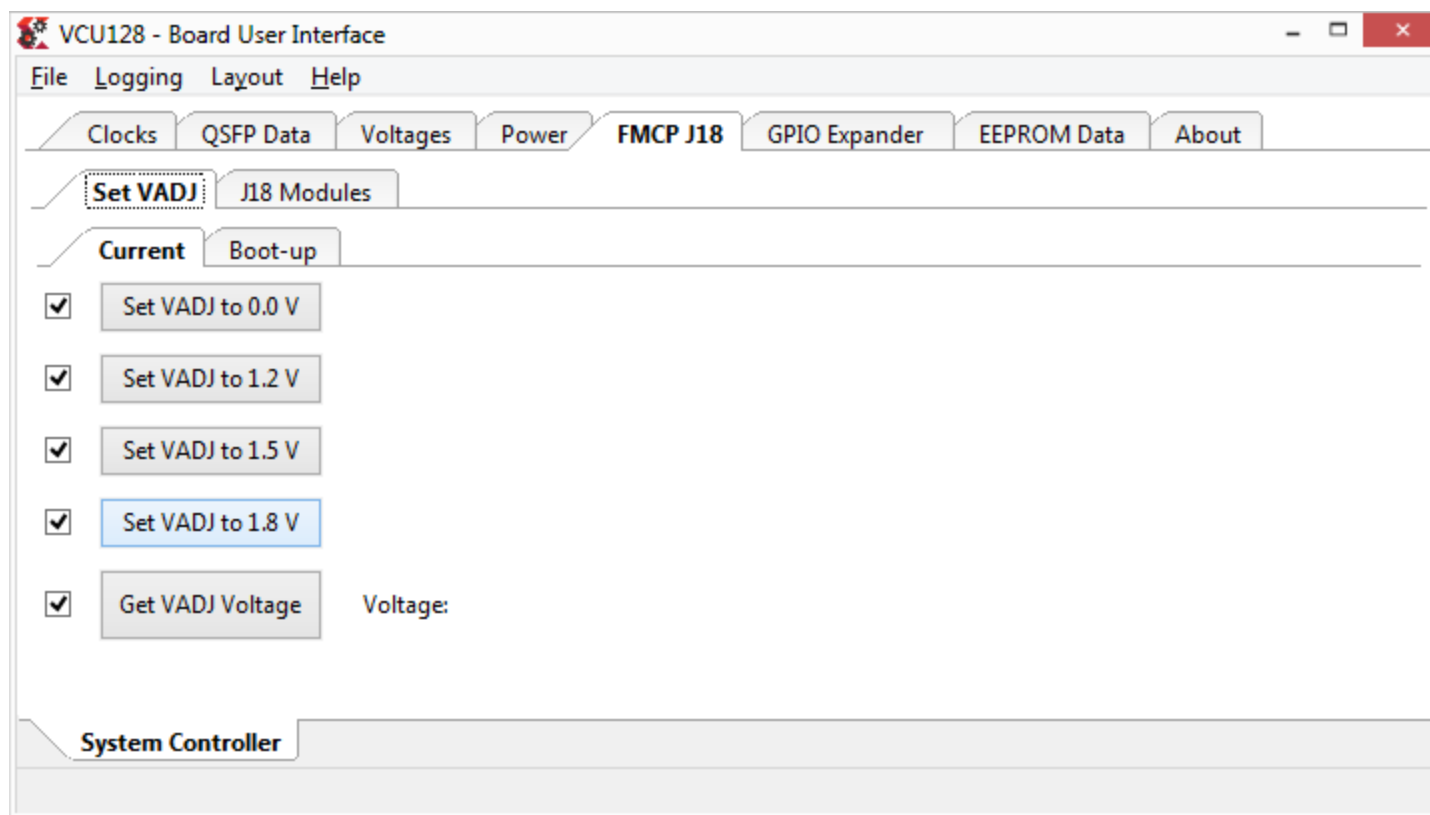
Power Supply Rail	Power (Watts)	Voltage (Volts)	Current (Amps)
VCCINT (0.85v)	0.48	0.85	0.61
VCCBRAM (0.85v)	0.00	0.85	0.21
VCC1V8 (1.8v)	1.30	1.81	0.72
MGTAVCC (0.9v)	0.12	0.90	0.15
MGTVCCAUX (1.8v)	0.00	1.80	0.10
VCCHBRM (1.2v)	0.57	1.20	0.53
VCCAUX_HBM (2.5v)	0.00	2.50	0.01
MGTAVTT (1.2v)	0.03	1.20	0.02

System Controller



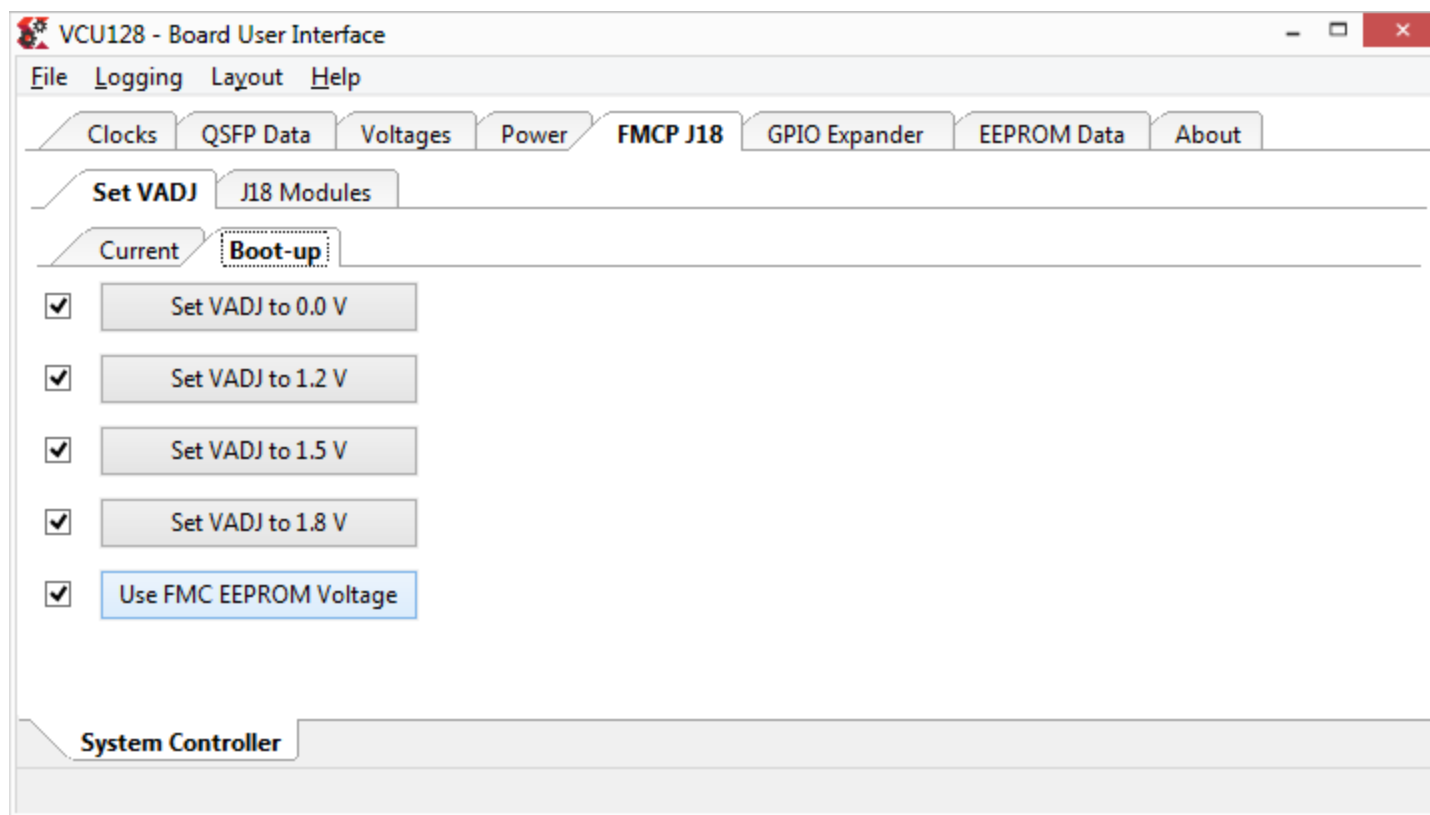
# Set VADJ

- > Select the Set VADJ tab underneath the FMC J18 tab
- > Under the Current tab, select the desired VADJ voltage
- > Some BIT tests expect 1.8 V



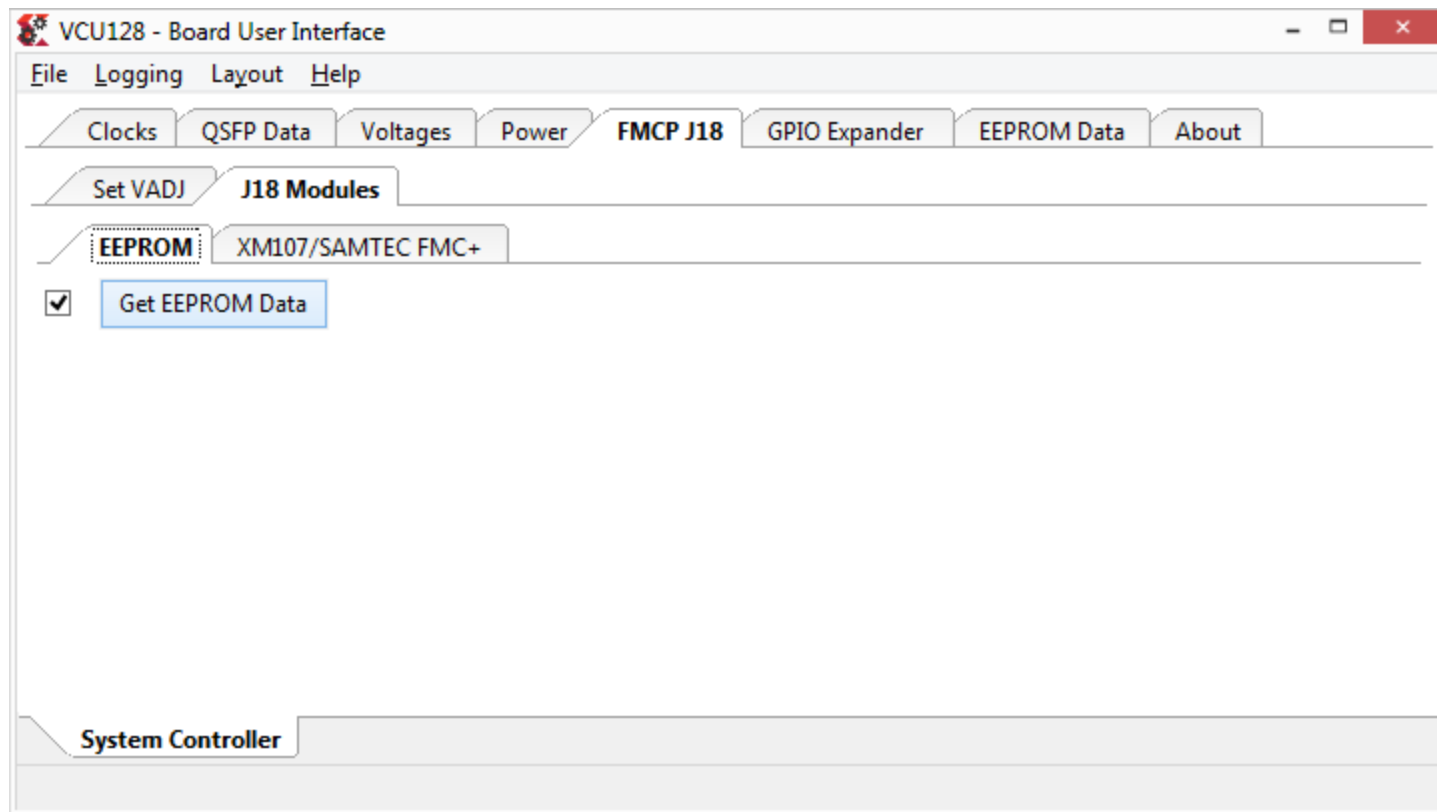
# Set Boot-Up VADJ

- > Select the Boot-up tab and choose the desired power-on voltage
- > The default, Use FMC EEPROM Voltage, will set 1.8 V unless you attach an FMC card with a different setting



# Reading FMC EEPROM

- > Select the J18 Modules tab
- > Click the Get EEPROM Data button



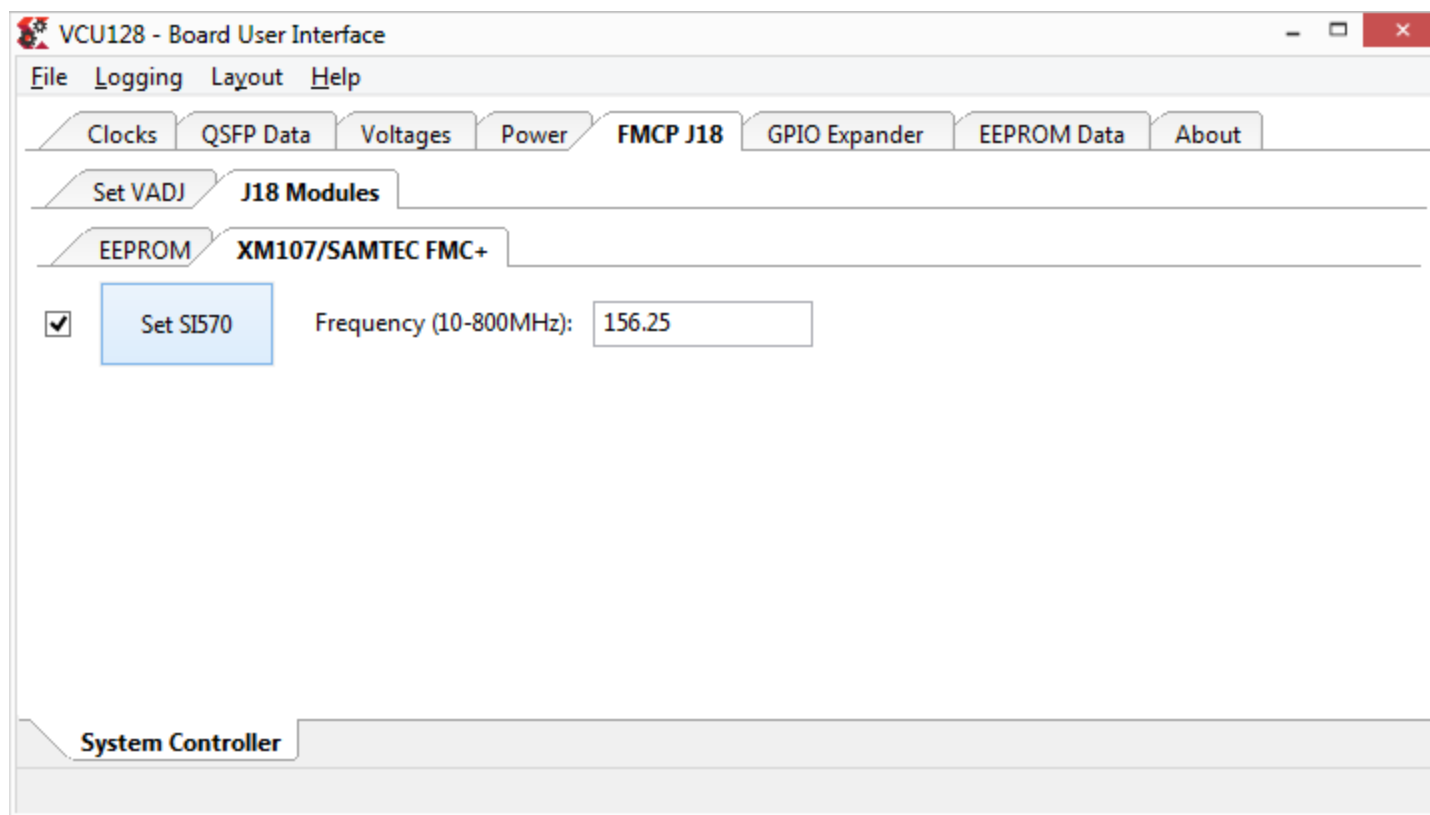
# Reading FMC EEPROM

- > The EEPROM data will be displayed in a separate window (SAMTEC FMC+ loopback data shown)

```
data.dump - Simple Hexadecimal Viewer
01 00 00 01 00 0a 00 f4 01 09 00 40 ec 87 c6 53  [] [] [] [] [] [] [] [] [] [] @ [] [] [] S
61 6d 74 65 63 cd 46 4d 43 2b 20 4c 6f 6f 70 62 amtec [] FMC+ Loopb
61 63 6b c0 ce 50 43 42 41 2d 31 39 34 31 39 35 ack [] [] PCBA-194195
2d 30 31 da 32 30 31 36 2d 31 31 2d 30 39 20 31 -01 [] 2016-11-09 1
39 3a 33 36 3a 32 31 2e 36 39 35 33 36 36 c1 a7 9:36:21.695366 [] []
02 02 0d b0 3f 02 b0 04 74 04 ec 04 32 00 00 00 [] [] [] ? [] [] [] t [] [] [] 2 [] [] []
00 00 02 02 0d 10 df 01 4a 01 3b 01 5e 01 32 00 [] [] [] [] [] [] [] J [] ; [] ^ [] 2 []
00 00 d0 07 02 02 0d 30 bf 00 fa 00 6e 00 5e 01 [] [] [] [] [] [] [] 0 [] [] [] [] n [] ^ []
32 00 00 00 d0 07 01 02 0d fb f5 05 00 00 00 00 2 [] [] [] [] [] [] [] [] [] [] [] [] [] []
00 00 00 00 00 00 00 00 01 02 0d fc f4 04 00 00 [] [] [] [] [] [] [] [] [] [] [] [] [] []
00 00 00 00 00 00 00 00 00 00 01 02 0d 82 6e 03 [] [] [] [] [] [] [] [] [] [] [] [] [] n []
fa 00 6e 00 5e 01 32 00 00 00 7e 04 fa 82 0b b4 [] [] n [] ^ [] 2 [] [] [] ~ [] [] [] [] []
c5 a2 12 00 00 1c 70 2c 00 00 60 80 00 00 00 00 [] [] [] [] [] [] p, [] [] ` [] [] [] []
ff ff ff ff ff ff ff ff ff ff ff ff ff ff [] [] [] [] [] [] [] [] [] [] [] [] [] []
ff ff ff ff ff ff ff ff ff ff ff ff ff ff [] [] [] [] [] [] [] [] [] [] [] [] [] []
```

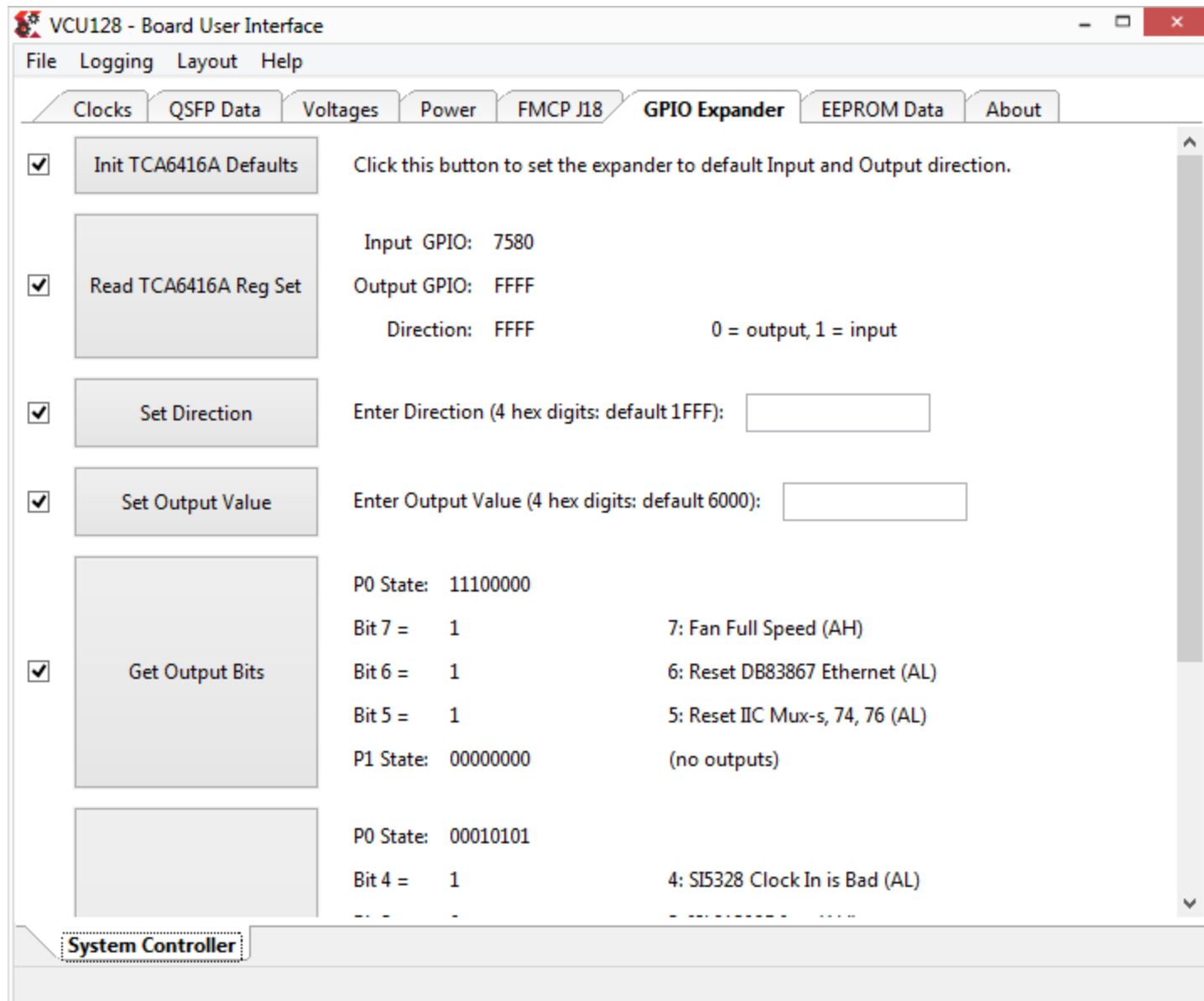
# Setting FMC HPC clocks

- > With an XM107 or SAMTEC FMC+ card attached, select the XM107/SAMTEC tab
- > For the IBERT FMC+ testing, set 156.25, and click the Set SI570 button



# GPIO Expander

## > Various setting for the TCA6416 IIC expander



The screenshot displays the 'VCU128 - Board User Interface' window, specifically the 'GPIO Expander' tab. The interface includes a menu bar (File, Logging, Layout, Help) and a series of tabs (Clocks, QSFQ Data, Voltages, Power, FMCP J18, GPIO Expander, EEPROM Data, About). The 'GPIO Expander' tab is active, showing a list of actions on the left and their corresponding descriptions and values on the right.

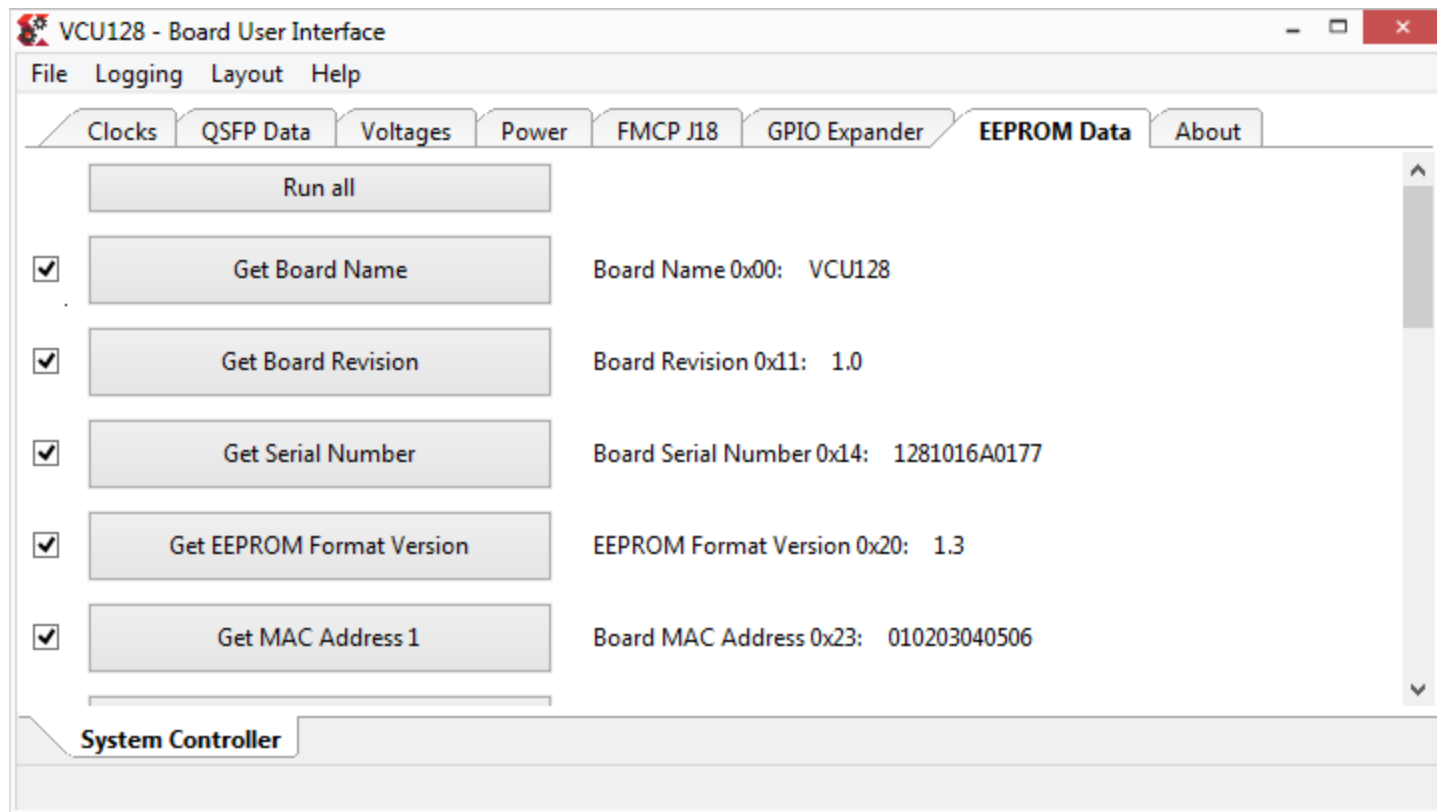
**GPIO Expander Settings:**

- ☒ **Init TCA6416A Defaults**: Click this button to set the expander to default Input and Output direction.
- ☒ **Read TCA6416A Reg Set**:
  - Input GPIO: 7580
  - Output GPIO: FFFF
  - Direction: FFFF
  - 0 = output, 1 = input
- ☒ **Set Direction**: Enter Direction (4 hex digits: default 1FFF):
- ☒ **Set Output Value**: Enter Output Value (4 hex digits: default 6000):
- ☒ **Get Output Bits**:
  - P0 State: 11100000
    - Bit 7 = 1: 7: Fan Full Speed (AH)
    - Bit 6 = 1: 6: Reset DB83867 Ethernet (AL)
    - Bit 5 = 1: 5: Reset IIC Mux-s, 74, 76 (AL)
  - P1 State: 00000000 (no outputs)
  - P0 State: 00010101
    - Bit 4 = 1: 4: SI5328 Clock In is Bad (AL)

**System Controller**

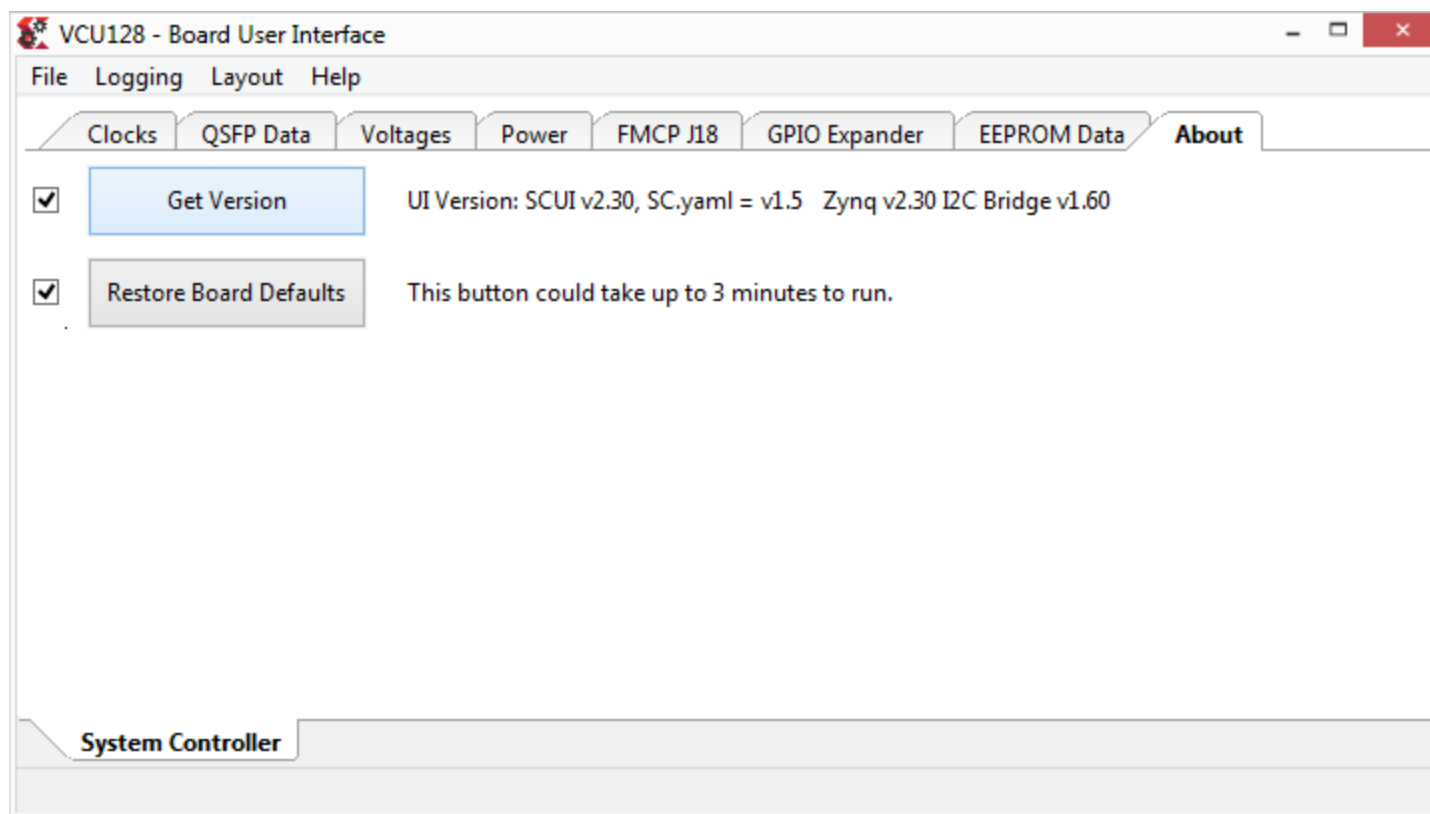
# Reading the Board EEPROM Data

- > Select the EEPROM Data tab
- > Click the Run all button



# Reading version information

- > Select the About tab
- > Click the Get Version button to get MSP430 and SCUI GUI version information

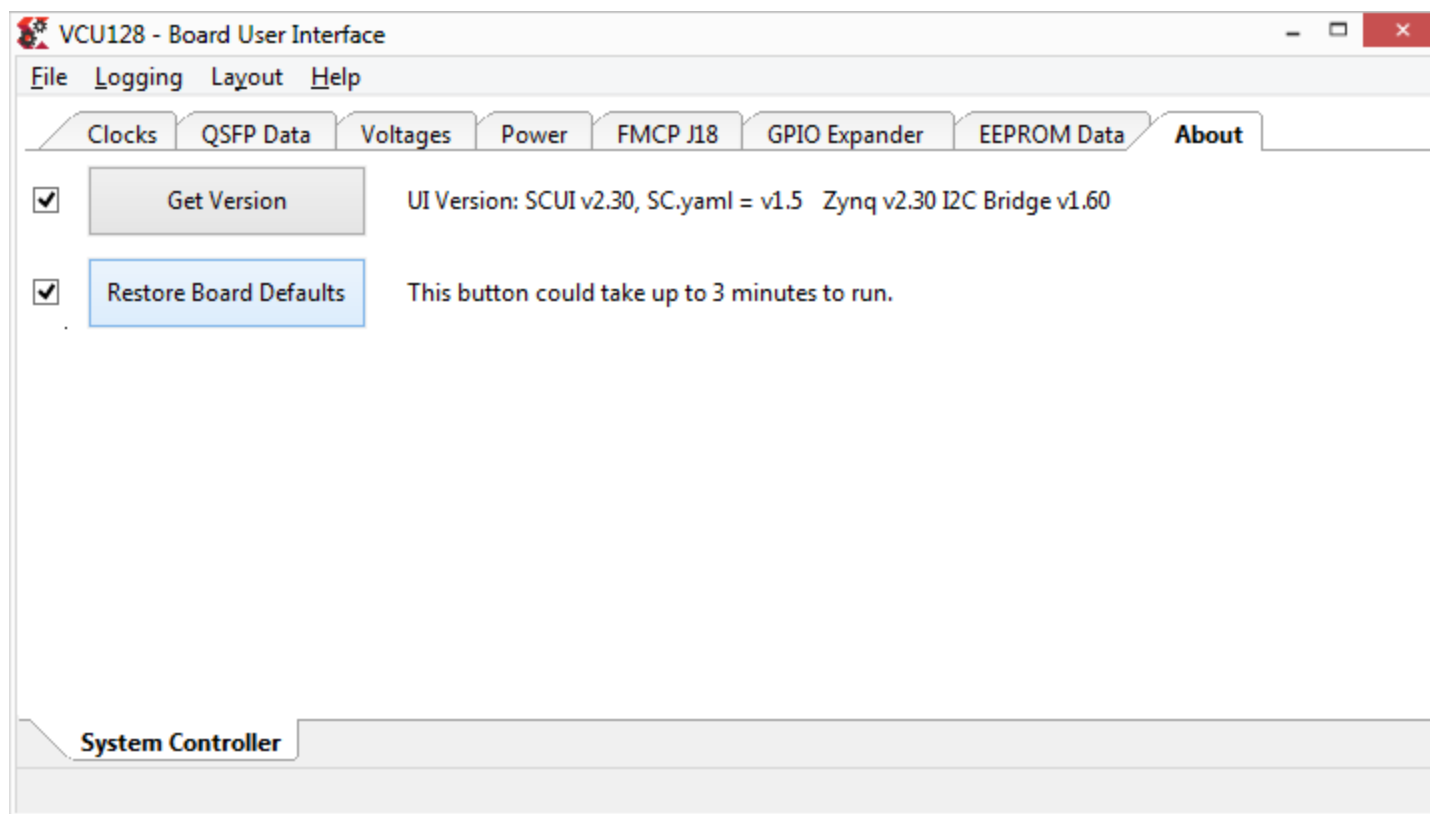




# Reading version information

## > Click the Restore Board Defaults button to reset initializations

- >> This restores the QSFP Si570s clocks to their default of 156.25 MHz
- >> Si5328 is reset to Default of 114.285 MHz
- >> The FMC VADJ is reset to Use FMC EEPROM Voltage



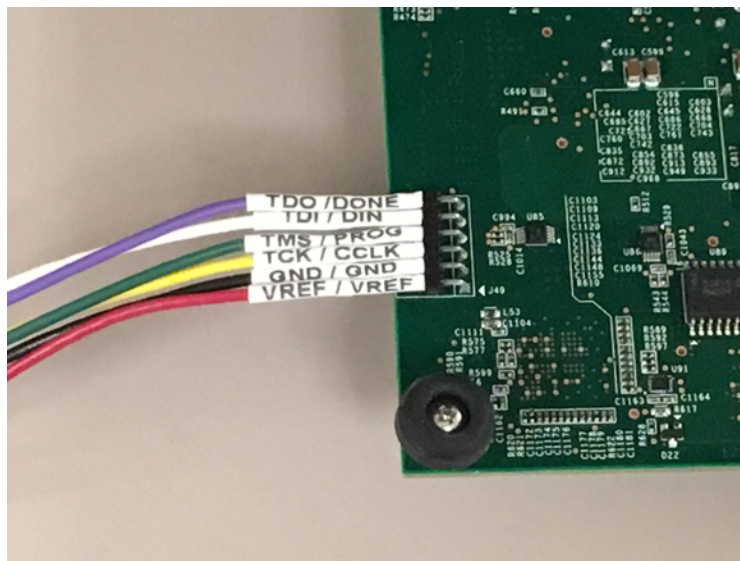
**Note:** This step stores values in the Zynq QSPI; it will no longer verify after this has been run

# Programming Firmware



# Programming Firmware

- > Connect a USB Platform Cable to J49 with the Flying Leads
- > Shown here with board flipped over



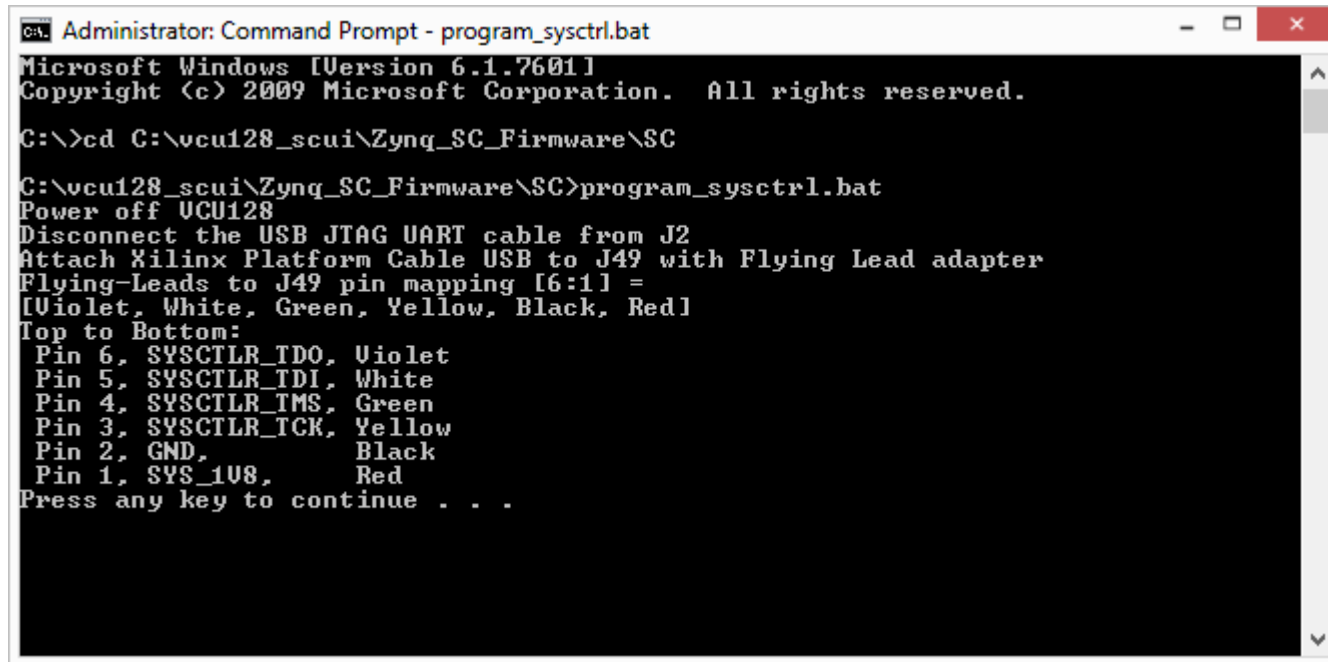
# Programming Firmware

> Script files are included to program the firmware

└─ Zynq_SC_Firmware	9.64 ...	1/14/2019 1:20:17 pm
└─ SC	9.64 ...	1/14/2019 1:20:17 pm
■ BOOT.bin	7.08 ...	8/28/2018 5:47:34 pm
■ Jtag_connection_setup.jpg	2.21 ...	8/28/2018 5:47:34 pm
■ programming_README.txt	1,054	8/28/2018 5:47:34 pm
■ program_sysctrl.bat	764	10/30/2018 3:09:33 pm
■ program_sysctrl.tcl	2,316	10/30/2018 2:30:38 pm
■ program_sysctrl.tcl	2,148	10/30/2018 2:29:33 pm
■ verify_sysctrl.bat	763	10/30/2018 3:09:33 pm
■ verify_sysctrl.tcl	2,321	10/30/2018 3:04:45 pm
■ vivado_lab.jou	725	10/30/2018 3:08:51 pm
■ vivado_lab.log	4,041	10/30/2018 3:08:51 pm
■ vivado_lab_10248.backup.jou	728	10/30/2018 2:47:39 pm
■ vivado_lab_10248.backup.log	4,338	10/30/2018 2:47:39 pm
■ zynq_1b_debug_fsbl.elf	339 KB	8/28/2018 5:47:34 pm

# Programming Firmware

- > The Programming BAT files will prompt you to connect the Flying Leads
- > Press any key to continue...



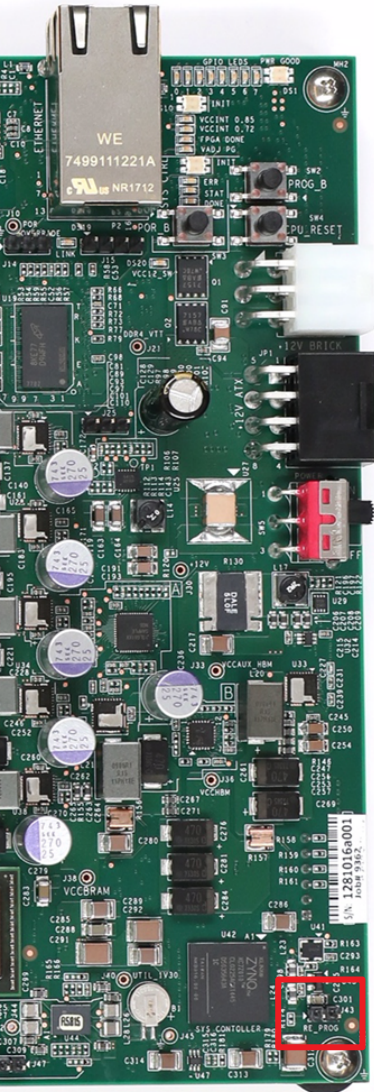
```
Administrator: Command Prompt - program_sysctrl.bat
Microsoft Windows [Version 6.1.7601]
Copyright (c) 2009 Microsoft Corporation. All rights reserved.

C:\>cd C:\vcu128_scui\Zynq_SC_Firmware\SC

C:\vcu128_scui\Zynq_SC_Firmware\SC>program_sysctrl.bat
Power off UCU128
Disconnect the USB JTAG UART cable from J2
Attach Xilinx Platform Cable USB to J49 with Flying Lead adapter
Flying-Leads to J49 pin mapping [6:1] =
[Violet, White, Green, Yellow, Black, Red]
Top to Bottom:
Pin 6, SYSCTLR_TDO, Violet
Pin 5, SYSCTLR_TDI, White
Pin 4, SYSCTLR_TMS, Green
Pin 3, SYSCTLR_TCK, Yellow
Pin 2, GND, Black
Pin 1, SYS_1V8, Red
Press any key to continue . . .
```

# Programming Firmware

- > Important: The current System Controller must be disabled prior to programming
- > Put a jumper on J43, cycle VCU128 power and remove the jumper and press any key to continue...



```
Administrator: Command Prompt - program_sysctrl.bat
Microsoft Windows [Version 6.1.7601]
Copyright (c) 2009 Microsoft Corporation. All rights reserved.

C:\>cd C:\vcu128_scui\Zynq_SC_Firmware\SC
C:\vcu128_scui\Zynq_SC_Firmware\SC>program_sysctrl.bat
Power off UCU128
Disconnect the USB JTAG UART cable from J2
Attach Xilinx Platform Cable USB to J49 with Flying Lead adapter
Flying-Leads to J49 pin mapping [6:1] =
[Violet, White, Green, Yellow, Black, Red]
Top to Bottom:
Pin 6, SYSTLR_IDO, Violet
Pin 5, SYSTLR_TDI, White
Pin 4, SYSTLR_IMS, Green
Pin 3, SYSTLR_TCK, Yellow
Pin 2, GND, Black
Pin 1, SYS_1V8, Red
Press any key to continue . . .
Put jumper on J43
Power on UCU128.
Remove jumper on J43.
Press any key to continue . . .
```

# Programming Firmware

- > Programming finished successfully
- > Cycle VCU128 power to enable the System Controller

```
Administrator: Command Prompt - program_sysctrl.bat
SF: 65536 bytes @ 0x6f0000 Read: OK
Zynq> cmp.b FFFC0000 FFFD0000 10000
Total of 65536 byte(s) were the same
Zynq> sf read FFFC0000 700000 10000
device 0 offset 0x700000, size 0x10000
SF: 65536 bytes @ 0x700000 Read: OK
Zynq> cmp.b FFFC0000 FFFD0000 10000
Total of 65536 byte(s) were the same
Zynq> sf read FFFC0000 710000 5764
device 0 offset 0x710000, size 0x5764
SF: 22372 bytes @ 0x710000 Read: OK
Zynq> cmp.b FFFC0000 FFFD0000 5764
Total of 22372 byte(s) were the same
Zynq> INFO: [Xicom 50-44] Elapsed time = 157 sec.
Verify Operation successful.
INFO: [Labtoolstcl 44-377] Flash programming completed successfully
program_hw_cfgmem: Time (s): cpu = 00:00:00 ; elapsed = 00:04:50 . Memory (MB):
peak = 1090.781 ; gain = 7.383
# close_hw_target [current_hw_target [get_hw_targets */xilinx_tcf/Xilinx/*]]
INFO: [Labtoolstcl 44-464] Closing hw_target localhost:3121/xilinx_tcf/Xilinx/00
000ach466501
# disconnect_hw_server localhost:3121
# close_hw
INFO: [Common 17-206] Exiting vivado_lab at Tue Jan 15 14:25:59 2019...
Press any key to continue . . .
```

**Note:** Programming takes about 9 minutes

# Programming Firmware

- > Use the Verify BAT files to check the BOOT.bin programmed into the Zynq QSPI

└─ Zynq_SC_Firmware	9.64 ...	1/14/2019 1:20:17 pm
└─ SC	9.64 ...	1/14/2019 1:20:17 pm
■ BOOT.bin	7.08 ...	8/28/2018 5:47:34 pm
■ Jtag_connection_setup.jpg	2.21 ...	8/28/2018 5:47:34 pm
■ programming_README.txt	1,054	8/28/2018 5:47:34 pm
■ program_sysctrl.bat	764	10/30/2018 3:09:33 pm
■ program_sysctrl.tcl	2,316	10/30/2018 2:30:38 pm
■ program_sysctrl.tcl	2,148	10/30/2018 2:29:33 pm
■ verify_sysctrl.bat	763	10/30/2018 3:09:33 pm
■ verify_sysctrl.tcl	2,321	10/30/2018 3:04:45 pm
■ vivado_lab.jou	725	10/30/2018 3:08:51 pm
■ vivado_lab.log	4,041	10/30/2018 3:08:51 pm
■ vivado_lab_10248.backup.jou	728	10/30/2018 2:47:39 pm
■ vivado_lab_10248.backup.log	4,338	10/30/2018 2:47:39 pm
■ zynq_1b_debug_fsbl.elf	339 KB	8/28/2018 5:47:34 pm

**Note:** Verify will not pass after Restore Board Defaults has been run. This is the as-shipped condition. Safe to reprogram, verify, then perform Restore step.



# References



# References

## > Vivado Release Notes

- >> Vivado Design Suite User Guide - Release Notes – UG973
  - [https://www.xilinx.com/support/documentation/sw\\_manuals/xilinx2019\\_1/ug973-vivado-release-notes-install-license.pdf](https://www.xilinx.com/support/documentation/sw_manuals/xilinx2019_1/ug973-vivado-release-notes-install-license.pdf)
- >> Vivado Design Suite 2019 - Vivado Known Issues
  - <https://www.xilinx.com/support/answers/72162.html>

## > Vivado Programming and Debugging

- >> Vivado Design Suite Programming and Debugging User Guide – UG908
  - [https://www.xilinx.com/support/documentation/sw\\_manuals/xilinx2019\\_1/ug908-vivado-programming-debugging.pdf](https://www.xilinx.com/support/documentation/sw_manuals/xilinx2019_1/ug908-vivado-programming-debugging.pdf)

# Documentation



# Documentation

## > Virtex UltraScale+ HBM

- >> Virtex UltraScale+ FPGA Family
  - <https://www.xilinx.com/products/silicon-devices/fpga/virtex-ultrascale-plus.html>

## > VCU128 Documentation

- >> Virtex UltraScale+ FPGA VCU128 Evaluation Kit
  - <https://www.xilinx.com/products/boards-and-kits/vcu128.html>
- >> VCU128 Board User Guide – UG1302
  - [https://www.xilinx.com/support/documentation/boards\\_and\\_kits/vcu128/ug1302-vcu128-eval-bd.pdf](https://www.xilinx.com/support/documentation/boards_and_kits/vcu128/ug1302-vcu128-eval-bd.pdf)
- >> VCU128 - Known Issues and Release Notes Master Answer Record
  - <https://www.xilinx.com/support/answers/71849.html>