



PAC1942-2
Evaluation Board
User's Guide

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Table of Contents

Preface	5
Introduction.....	5
Document Layout	5
Conventions Used in this Guide	6
Recommended Reading.....	7
The Microchip Website	7
Product Change Notification Service.....	7
Customer Support	7
Document Revision History	7
Chapter 1. Product Overview	
1.1 Introduction	9
1.2 PAC1942-2 Device Features	9
1.3 PAC1942-2 Evaluation Board (EV97L33A)	9
1.4 Software and System Control Overview	10
1.5 Contents of the PAC1942-2 Evaluation Board Kit	10
Chapter 2. Installation and Operation	
2.1 Introduction	11
2.2 System Requirements	11
2.3 Installing the Software	11
Chapter 3. Software GUI Description	
3.1 First Launch	15
3.2 Detailed GUI Description	18
Chapter 4. Hardware Description	
4.1 Introduction	35
4.2 Demo Mode and EVB Mode	36
4.3 Default Connections	37
4.4 VBUS and VSENSE Connections – Using External Sources for System Mode	37
4.5 Address Selection	37
4.6 Hardware for I ² C/SMBus Communication over USB or External I ² C Connection	38
4.7 Signal Description in Demo Mode	38
4.8 Additional Hardware Details	39
4.9 Direct External I ² C Connection	39

PAC1942-2 Evaluation Board User’s Guide

Appendix A. Schematic and Layouts

A.1 Introduction	41
A.2 Board – Schematic 1	42
A.3 Board – Schematic 2	43
A.4 Board – Schematic 3	44
A.5 Board – Top Silk	45
A.6 Board – Top Copper and Silk	45
A.7 Board – Top Copper	46
A.8 Board – Bottom Silk	46
A.9 Board – Bottom Copper and Silk	47
Appendix B. Bill of Materials (BOM)	49
Worldwide Sales and Service	53

Preface

NOTICE TO CUSTOMERS

All documentation becomes dated, and this manual is no exception. Microchip tools and documentation are constantly evolving to meet customer needs, so some actual dialogs and/or tool descriptions may differ from those in this document. Please refer to our website (www.microchip.com) to obtain the latest documentation available.

Documents are identified with a “DS” number. This number is located on the bottom of each page, in front of the page number. The numbering convention for the DS number is “DSXXXXXXXXA”, where “XXXXXXXX” is the document number and “A” is the revision level of the document.

For the most up-to-date information on development tools, see the MPLAB® IDE online help. Select the Help menu, and then Topics, to open a list of available online help files.

INTRODUCTION

This chapter contains general information that will be useful to know before using the PAC1942-2 Evaluation Board. Items discussed in this chapter include:

- [Document Layout](#)
- [Conventions Used in this Guide](#)
- [Recommended Reading](#)
- [The Microchip Website](#)
- [Product Change Notification Service](#)
- [Customer Support](#)
- [Document Revision History](#)

DOCUMENT LAYOUT

This document describes how to use the PAC1942-2 Evaluation Board as a development tool to emulate and debug firmware on a target board. The manual layout is as follows:

- **Chapter 1. “Product Overview”** – Important information about the PAC1942-2 Evaluation Board.
- **Chapter 2. “Installation and Operation”** – Includes instructions on installing the application.
- **Chapter 3. “Software GUI Description”** – Includes details about the Graphical User Interface.
- **Chapter 4. “Hardware Description”** – Includes hardware details about the PAC1942-2 Evaluation Board.
- **Appendix A. “Schematic and Layouts”** – Shows the schematic and layout diagrams for the PAC1942-2 Evaluation Board.
- **Appendix B. “Bill of Materials (BOM)”** – Lists the parts used to build the PAC1942-2 Evaluation Board.

PAC1942-2 Evaluation Board User's Guide

CONVENTIONS USED IN THIS GUIDE

This manual uses the following documentation conventions:

DOCUMENTATION CONVENTIONS

Description	Represents	Examples
Arial font:		
Italic characters	Referenced books	<i>MPLAB® IDE User's Guide</i>
	Emphasized text	...is the <i>only</i> compiler...
Initial caps	A window	the Output window
	A dialog	the Settings dialog
	A menu selection	select Enable Programmer
Quotes	A field name in a window or dialog	"Save project before build"
Underlined, italic text with right angle bracket	A menu path	<u><i>File>Save</i></u>
Bold characters	A dialog button	Click OK
	A tab	Click the Power tab
N'Rnnnn	A number in verilog format, where N is the total number of digits, R is the radix and n is a digit.	4'b0010, 2'hF1
Text in angle brackets < >	A key on the keyboard	Press <Enter>, <F1>
Courier New font:		
Plain Courier New	Sample source code	#define START
	Filenames	autoexec.bat
	File paths	c:\mcc18\h
	Keywords	_asm, _endasm, static
	Command-line options	-Opa+, -Opa-
	Bit values	0, 1
	Constants	0xFF, 'A'
Italic Courier New	A variable argument	<i>file.o</i> , where <i>file</i> can be any valid filename
Square brackets []	Optional arguments	mcc18 [options] <i>file</i> [options]
Curly brackets and pipe character: { }	Choice of mutually exclusive arguments; an OR selection	errorlevel {0 1}
Ellipses...	Replaces repeated text	var_name [, var_name...]
	Represents code supplied by user	void main (void) { ... }

RECOMMENDED READING

This user's guide describes how to use the PAC1942-2 Evaluation Board. Another useful document is listed below. The following Microchip document is available and recommended as a supplemental reference resource:

PAC194X Data Sheet – “Single/Multi-Channel Power Monitor with Accumulator, 9V Full-Scale Range” (DS20006543)

THE MICROCHIP WEBSITE

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- **Product Support** – Data sheets and errata, application notes and sample programs, design resources, user's guides and hardware support documents, latest software releases and archived software
- **General Technical Support** – Frequently Asked Questions (FAQs), technical support requests, online discussion groups, Microchip consultant program member listing
- **Business of Microchip** – Product selector and ordering guides, latest Microchip press releases, listing of seminars and events, listings of Microchip sales offices, distributors and factory representatives

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- Distributor or Representative
- Local Sales Office
- Field Application Engineer (FAE)
- Technical Support

Customers should contact their distributor, representative or field application engineer (FAE) for support. Local sales offices are also available to help customers. A listing of sales offices and locations is included in the back of this document.

Technical support is available through the website at:
<http://www.microchip.com/support>.

DOCUMENT REVISION HISTORY

Revision A (March 2022)

- Initial release of this document.

PAC1942-2 Evaluation Board User's Guide

NOTES:

Chapter 1. Product Overview

1.1 INTRODUCTION

The PAC1942-2 Evaluation Board (EV97L33A) provides a flexible platform for evaluating the PAC1942-2 device and demonstrating the feature set.

The PAC1942-2 Evaluation Board is provided with a USB connector for computer-to-device communication. The PAC1942-2 device can be powered directly by V_{BUS} from the USB connector or by an external connection for V_{DD} .

I²C communication can be provided over USB by using the on-board [MCP2221A](#) USB to the I²C bridge. There is also a header that facilitates direct I²C communication by connecting the V_{IO} , Ground, SLOW, ALERT2, SDA and SCL to an external source such as a PC motherboard, a Linux[®] system or a SAM E54 Curiosity Ultra Development Board ([DM320210](#)).

The shorting shunts and the switch on the board facilitate either simple demonstration of the device functions using on-board current sources or detailed evaluation of function and performance with external sources to prototype the user's system.

1.2 PAC1942-2 DEVICE FEATURES

The PAC1942-2 is a two-channel DC power/energy monitor with accumulator. There is a 16-bit ADC for monitoring power rail voltages connected by a multiplexer to the V_{BUS} input pins, producing results named V_{BUS} . There is a second 16-bit ADC for measuring the voltage across a current sense resistor. This ADC is connected by a differential multiplexer to the V_{SENSE+} and V_{SENSE-} pins for each channel, producing V_{SENSE} results. Channel selection for the multiplexers is controlled in sequential fashion to scan both channels up to 1024 SPS.

The device also computes V_{POWER} by multiplying V_{BUS} by V_{SENSE} and accumulates these power results in an accumulator. The device registers hold eight times averaged V_{BUS} and V_{SENSE} results for very accurate low noise voltage and current measurements. All the results are stored in registers. The value in the results registers only changes when a REFRESH or a REFRESH_V command is sent. A software application is available for plotting, displaying and logging data. This application also calculates energy based on the accumulated power and accumulation time, as well as controlling all the registers and alerts.

1.3 PAC1942-2 EVALUATION BOARD (EV97L33A)

1.3.1 Hardware Overview

The EV97L33A evaluation board has a PAC1942-2 device and enables direct control of all device pins and easy measurements of on-board or external voltages and currents. The I²C address is connected as 0x20 (8-bit) by default. Multiple addresses can be done simply by removing resistors in the ADDR Selection area on the PCB (see [Section 4.5 “Address Selection”](#)). The sampling rate is 1024 SPS with adaptive accumulation by default. Pressing the **SLOW** button results in SLOW sampling rate of 8 SPS, while pressing the **PWRDWN** button will do a hardware reset.

PAC1942-2 Evaluation Board User's Guide

An on-board DAC will provide for various current signals for functionality testing and demo purposes. There are also on-board current sense resistors, provisions for external sources and loads and provisions for both USB control and direct I²C connection. See [Chapter 4. “Hardware Description”](#) for more details.

1.4 SOFTWARE AND SYSTEM CONTROL OVERVIEW

The PAC194X/5X demo application, described in detail in [Chapter 2. “Installation and Operation”](#), provides USB control of the PAC1942-2 with the EV97L33A evaluation board.

The application provides an easy way to control the registers and read out the results for the device. To use this software application with the PAC1942-2 Evaluation Board, download the software and launch the application. Then, connect the provided USB cable to the computer and ensure that the USB/I²C switch SW300 is set to bridge (see [Chapter 2. “Installation and Operation”](#)).

1.5 CONTENTS OF THE PAC1942-2 EVALUATION BOARD KIT

The PAC1942-2 Evaluation Board kit includes:

- PAC1942-2 Evaluation Board (EV97L33A)
- USB Cable
- Load Resistor and Wire
- Important Information Sheet

Chapter 2. Installation and Operation

2.1 INTRODUCTION

This section describes how to power-up and interface with the PAC1942-2 Evaluation Board. Items discussed in this chapter include:

- System requirements
- Downloading and installing the software

2.2 SYSTEM REQUIREMENTS

The PAC1942-2 Evaluation Board is designed to be used with a personal computer (desktop or laptop), running Microsoft® Windows® 7 or later. For USB connectivity, the minimum physical requirement for the PC is a standard Type-A USB 2.0 port.

2.3 INSTALLING THE SOFTWARE

To install the software, follow the steps below:

1. Double click the installer and you will be alerted to uninstall any previous versions of the software before the new version is installed.

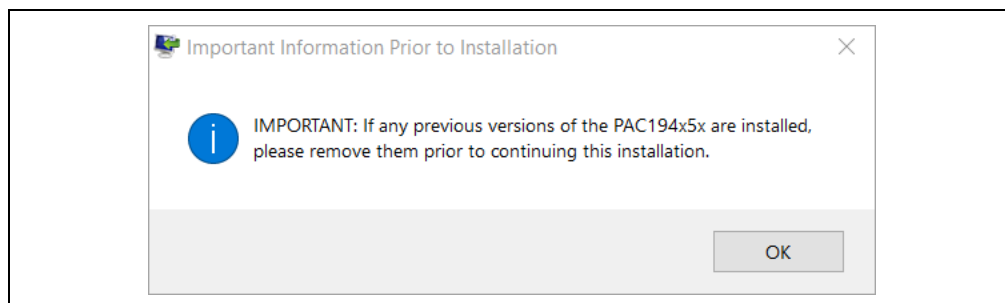


FIGURE 2-1: *Prior Installation Alert.*

Click **OK** to start the installation process.

PAC1942-2 Evaluation Board User's Guide

2. Click the **Next** button and the License Agreement window will appear.

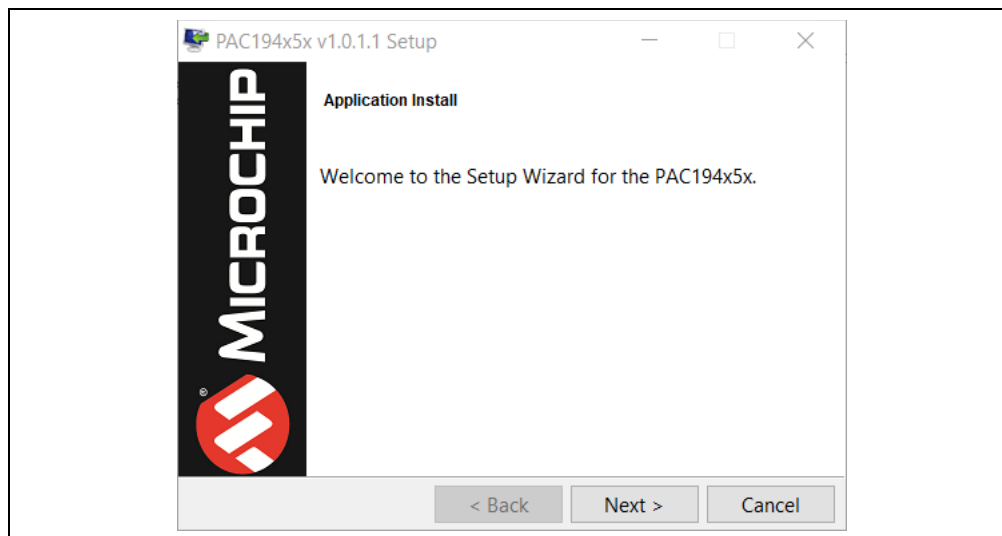


FIGURE 2-2: Installation Window.

3. Read the agreement and select "I accept the agreement" when you are ready to proceed. Selecting "I do not accept the agreement" will stop the installation. Click **Next**.



FIGURE 2-3: License Agreement.

4. Verify the installation directory and click **Next**.

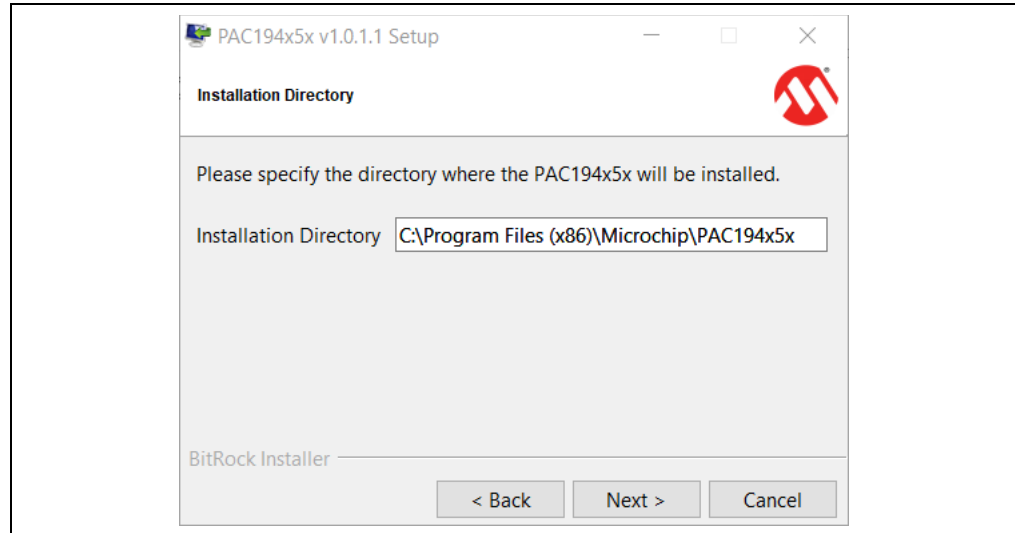


FIGURE 2-4: *Installation Directory.*

5. The setup is now ready. Click **Next** to install the application. A green progress bar indicates when the installation is complete.

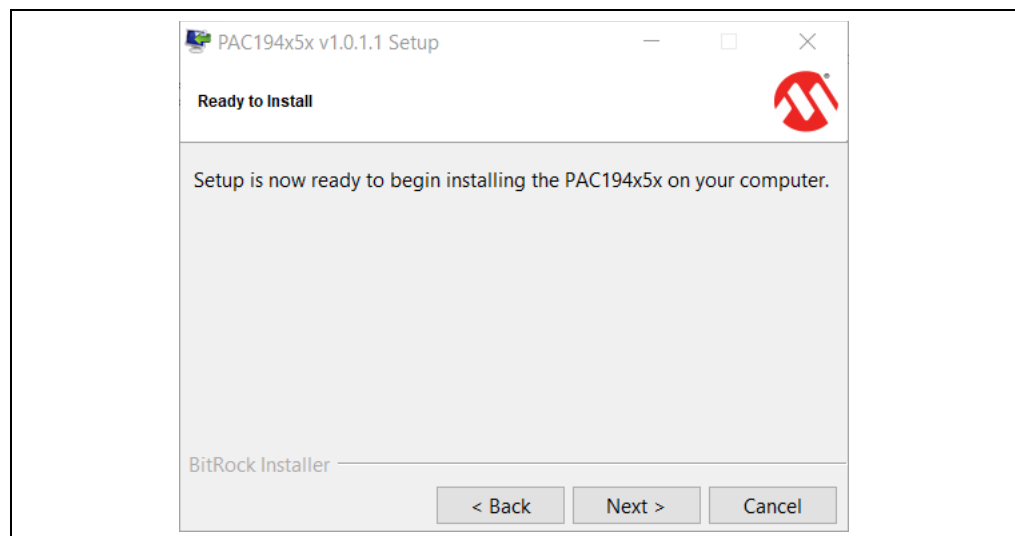


FIGURE 2-5: *Ready to Install.*

PAC1942-2 Evaluation Board User's Guide

6. In the Install Complete window, click **Finish**. The program is now installed and is ready to use. A shortcut on the Windows Start menu is created under the Microchip menu and is called PAC194x5x. Software builds are available from local Sales and ESE contacts.

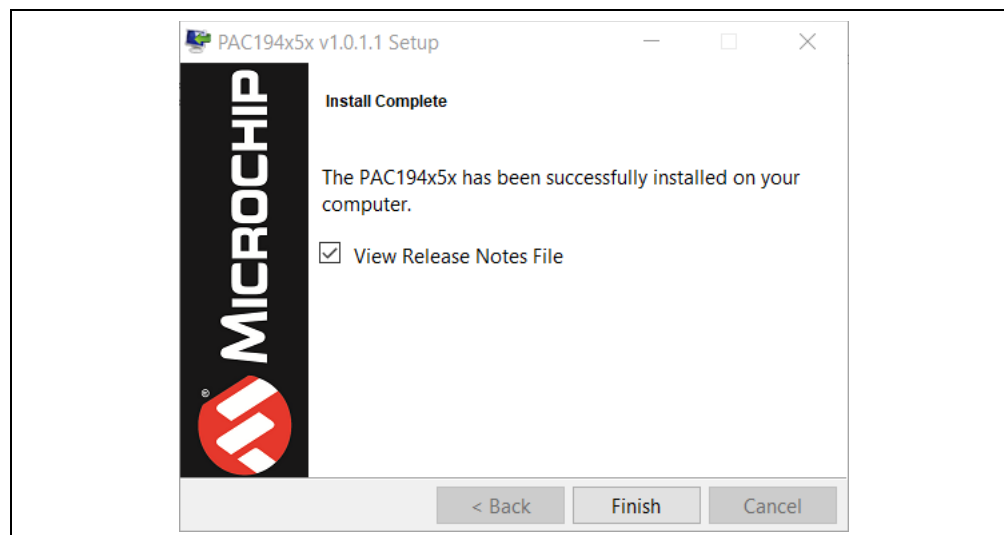


FIGURE 2-6: *Install Complete.*

Chapter 3. Software GUI Description

3.1 FIRST LAUNCH

When the installation is complete, go to Start and double click the PAC194x5x icon in order to launch the PAC194x/PAC195x Demo Application.

1. Connect the board to the PC with the provided USB cable and ensure Jumper 112 is shorted (IVDD jumper) and the SW300 is switched to bridge while SW301 is switched to Extern. The J112 jumper is located near the IC and the two switches are on the right side of the board. Once they are connected, LED activity can be seen on the board – D300: Green LED for +5V USB power from the USB connection. [Figure 3-1](#) shows the GUI for the PAC194x/PAC195x Demo Application.

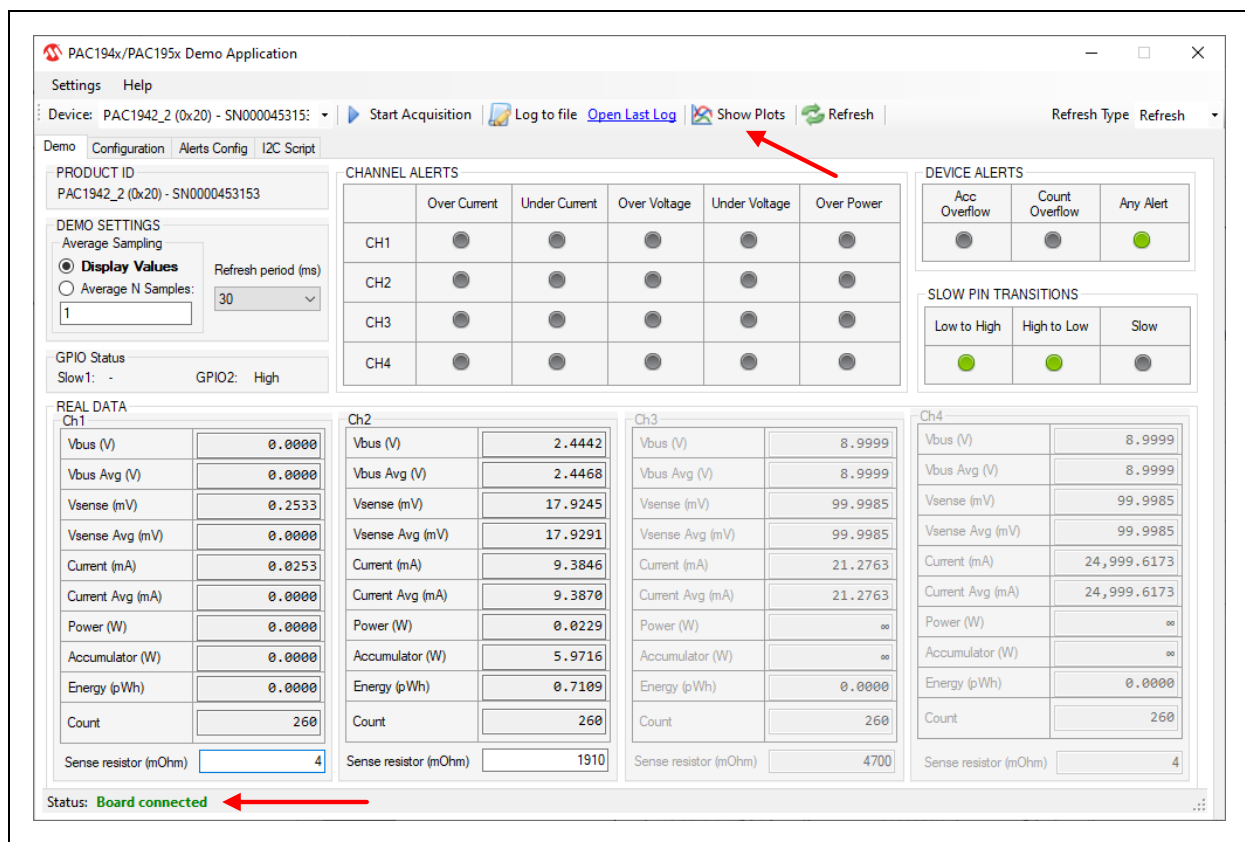
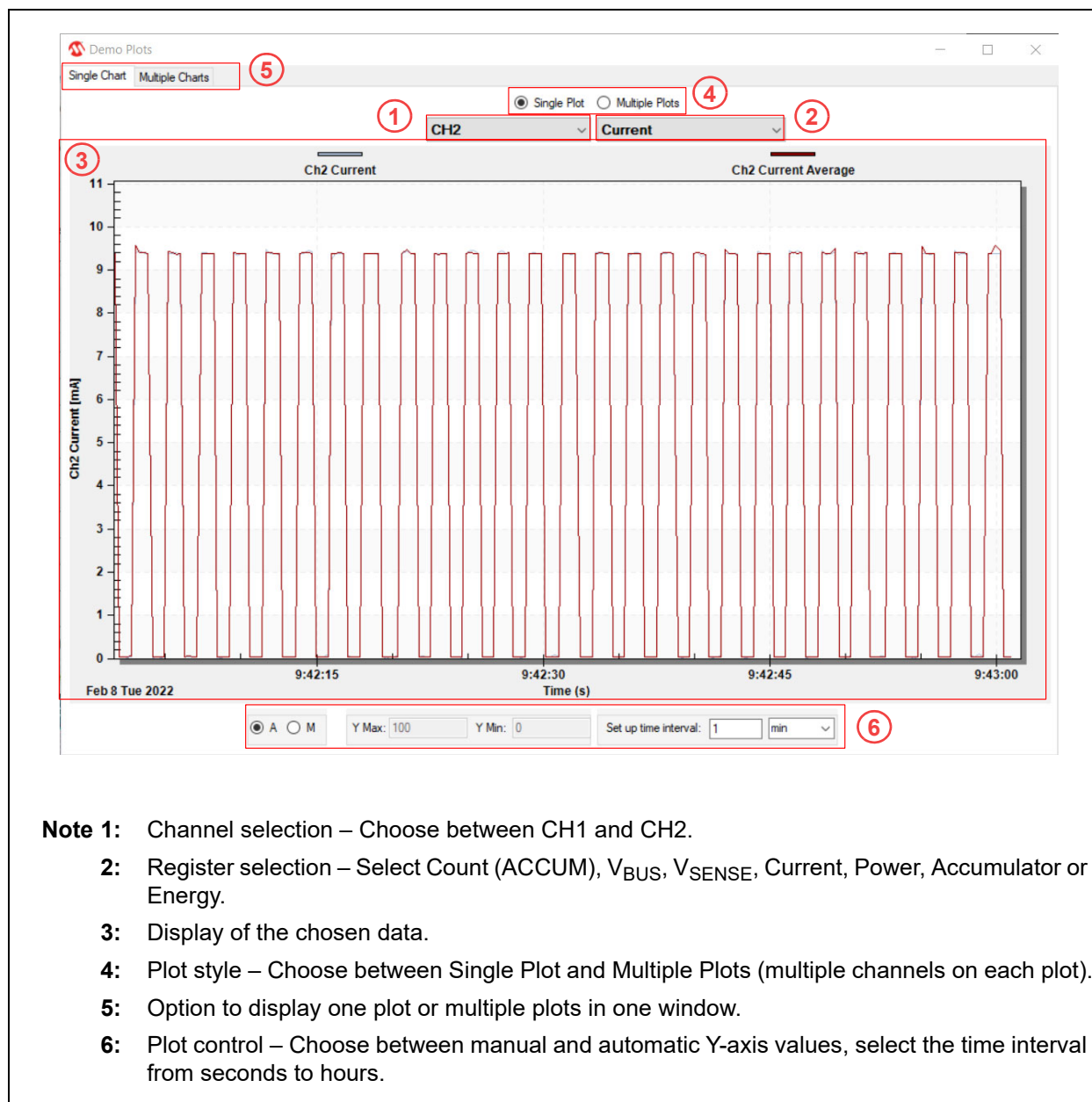


FIGURE 3-1: Software GUI Main Window.

On the bottom left side of the window, there is a field called “Status”. If the board is connected and the device installed, the status will be “Board connected”. The Product ID will contain the part type, the I²C address and the serial number on the left top of the window, under **Device**.

PAC1942-2 Evaluation Board User's Guide

2. Click **Show Plots** to open the Demo Plots window.



Note 1: Channel selection – Choose between CH1 and CH2.

2: Register selection – Select Count (ACCUM), V_{BUS} , V_{SENSE} , Current, Power, Accumulator or Energy.

3: Display of the chosen data.

4: Plot style – Choose between Single Plot and Multiple Plots (multiple channels on each plot).

5: Option to display one plot or multiple plots in one window.

6: Plot control – Choose between manual and automatic Y-axis values, select the time interval from seconds to hours.

FIGURE 3-2: Demo Plots Window.

Four plot instances may run at the same time.



FIGURE 3-3: Multiple Plots.

1. The first time the GUI is run, the resistor values near the bottom on the Demo Application window must be populated. See [Figure 3-5](#) to determine where to enter the resistor values.
2. Click **Start Acquisition** to start generating the default waveforms. After 10 seconds, click the tab again to stop the acquisition and freeze the waveforms. The waveforms above were generated using the Demo software with the DAC enabled and set to various voltages (thus the CH1 current peak changing).

PAC1942-2 Evaluation Board User's Guide

3.2 DETAILED GUI DESCRIPTION

This section provides a detailed description of the GUI and a few scenarios that explain how to change various settings and see the results.

The screenshot shows the PAC194x/PAC195x Demo Application GUI. It features a top menu bar with 'Settings' and 'Help'. Below the menu bar is a toolbar with buttons for 'Start Acquisition', 'Log to file', 'Open Last Log', 'Show Plots', and 'Refresh'. A 'Refresh Type' dropdown menu is also present. The main area is divided into several sections: 'Demo' (with tabs for 'Configuration', 'Alerts Config', and 'I2C Script'), 'PRODUCT ID' (showing 'PAC1942_2 (0x20) - SN0000453153'), 'DEMO SETTINGS' (with 'Display Values' selected and 'Refresh period (ms)' set to 30), 'GPIO Status' (showing 'Slow1: -' and 'GPIO2: High'), 'CHANNEL ALERTS' (a table with columns for Over Current, Under Current, Over Voltage, Under Voltage, and Over Power), 'DEVICE ALERTS' (a table with columns for Acc Overflow, Count Overflow, and Any Alert), 'SLOW PIN TRANSITIONS' (a table with columns for Low to High, High to Low, and Slow), 'REAL DATA' (a table with columns for Vbus (V), Vbus Avg (V), Vsense (mV), Vsense Avg (mV), Current (mA), Current Avg (mA), Power (W), Accumulator (W), Energy (pWh), and Count), and 'Sense resistor (mOhm)' (a table with columns for Sense resistor (mOhm) and Value). The status bar at the bottom shows 'Status: Board connected'.

Note 1: Current device (may have more than one connected).

2: **Start Acquisition** – Starts the data logging function. When started, the tab will display **Stop Acquisition** to stop the function.

3: **Log to file/Open Last Log** – Clicking **Log to file** starts the logging to a CSV file (see Figure 3-5). The user can stop the logging at any time. Data are collected only while the **Start Acquisition** is running. The files are saved to PAC194x5x Files in the user's Documents folder. Click **Open Last Log** to open the last CSV file as configured on the user's system.

4: **Show Plots** – Enables the visualization window; more than one may be open at a time with different registers selected.

5: **Refresh** – Manual refresh which is based on the type of refresh selected in the **Refresh Type** drop-down menu.

6: **Refresh Type** – The user can select one of the three refresh types (Regular, Global and V). Changes can be made while acquisitions are made.

7: Tabs for various setup including current data values, register setup, alert setup or manual I²C commands.

8: **PRODUCT ID** – Displays device information, the I²C address and the MCP2221A serial number.

9: **DEMO SETTINGS** – Displays how fast the SW requests data and for how long the data are shown in the plots. Select Display Values to show the 8x averaged values in the V_{SENSE} Avg and V_{BUS} Avg area (as well as plots). Click the Average N Samples and change the value to use software averaging using the application.

10: **GPIO Status** – Shows the status of the GPIO pins when selected to be an Input or an Output. Notes configuration if it is set for Alerts or Slow functionality.

11: **CHANNEL ALERTS** – Status of all the channel specific alerts (set the alerts in the **Alerts Config** tab).

12: **DEVICE ALERTS** – Accumulator alerts and global Any Alert.

13: **SLOW PIN TRANSITIONS** – Shows if the SLOW pin is asserted/deasserted and if SLOW is currently asserted.

14: **REAL DATA** – All the data associated with each channel.

15: **Sense resistor** – Resistor used to calculate current based on the V_{SENSE} value.

16: **Status: Board connected** – Displays if the SW senses the device correctly or not.

FIGURE 3-4: Main GUI Tab.

	A	B	C	D	E	F	G	H	I	J
1	Count	Vbus_Ch1	VbusAve_Ch1	Vsense_Ch1	VsenseAve_Ch1	Current_Ch1	CurrentAve_Ch1	Power_Ch1	Acc_Ch1	Energy_Ch1
2	[N]	[V]	[V]	[mV]	[mV]	[mA]	[mA]	[W]	[W]	[mWh]
3	35126	5.159317	5.160965	0.03204346	0.04119873	0.006817757	0.008765687	3.52E-05	8.473948456	5.90E-12
4	461	5.159729	5.161789	0.05340576	0.04577637	0.011362928	0.009739653	5.86E-05	0.123873655	8.63E-14
5	407	5.164261	5.163025	0.05645752	0.0579834	0.012012238	0.012336893	6.20E-05	0.105746821	7.37E-14
6	404	5.161789	5.163025	0.06256104	0.06256104	0.013310859	0.013310859	6.87E-05	0.108764314	7.58E-14
7	407	5.162338	5.161514	0.04272461	0.05187988	0.009090342	0.011038273	4.69E-05	0.108678308	7.57E-14
8	401	5.158905	5.16124	0.03509521	0.04882813	0.007467067	0.010388963	3.85E-05	0.10423998	7.26E-14
9	399	5.162476	5.161926	0.06866455	0.05493164	0.014609479	0.011687583	7.54E-05	0.11035761	7.69E-14
10	426	5.161789	5.161789	0.04272461	0.05493164	0.009090342	0.011687583	4.69E-05	0.114062923	7.95E-14
11	411	5.162613	5.161514	0.08392334	0.06408691	0.01785603	0.013635514	9.22E-05	0.112372222	7.83E-14

FIGURE 3-5: Portion of the CSV LOG File.

PAC194x/PAC195x Demo Application

Settings Help

Device: PAC1942_2 (0x20) - SN000045315: Start Acquisition Log to file Open Last Log Show Plots Refresh Refresh Type Refresh

Demo Configuration Alerts Config I2C Script

PAC SETTINGS CONTROL

Sample Mode: 1024sps, adaptive accu

CH1 CH2 CH3 CH4

Disable ☐ ☐ ☒ ☒

GPIO ALERT1 Set As SLOW ALERT2 Set As GPIO input

☐ High ☒ Low

FULL SCALE RANGE

CH1 CH2 CH3 CH4

Vsense (mV) 0-100mV 0-100mV 0-100mV 0-100mV

Vbus (V) 0-9V 0-9V 0-9V 0-9V

SMBUS

☒ POR ☐ NO SKIP ☐ TIMEOUT ☐ BYTE COUNT ☐ I2C_HISPEED

GPIO

ALERT1 Set As SLOW

☐ High ☒ Low

SLOW Pin

RISING EDGE ☐ Enable Refresh ☐ Enable Refresh_V

FALLING EDGE ☐ Enable Refresh ☐ Enable Refresh_V

FSR ON REFRESH

	LAT	ACT
CH1	Vsense unidir	unidir
	Vbus unidir	unidir
CH2	Vsense unidir	unidir
	Vbus unidir	unidir
CH3	Vsense unidir	unidir
	Vbus unidir	unidir
CH4	Vsense unidir	unidir
	Vbus unidir	unidir

CONTROL REGISTER ON REFRESH

	LAT	ACT
Sample Mode	1024sps-AC	1024sps-AC
GPIO Pin1	Slow	Slow
GPIO Pin2	Input	Input
Inactive Ch	3,4	3,4

ACCUMULATOR CONFIG

	LAT	ACT
CH1	Vpower	Vpower
CH2	Vpower	Vpower
CH3	Vpower	Vpower
CH4	Vpower	Vpower

ACC CONFIGURATION

CH1 Vpower CH2 Vpower CH3 Vpower CH4 Vpower

ACC FULLNESS LIMITS

CH1 15/16 full CH2 15/16 full CH3 15/16 full CH4 15/16 full Count Full 15/16 full

REGISTER LIST

Save Register List Import Register List

Name	Addr	Data	Save
Refresh	0x00	0x00	<input type="checkbox"/>
Control	0x01	0x730	<input type="checkbox"/>
Acc Count	0x02	0xFF	<input type="checkbox"/>
Vacc1 Acc	0x03	0xB14	<input type="checkbox"/>
Vacc2 Acc	0x04	0x31886E0...	<input type="checkbox"/>
Vacc3 Acc	0x05	0xFFFFFFFF...	<input type="checkbox"/>
Vacc4 Acc	0x06	0xFFFFFFFF...	<input type="checkbox"/>
Vbus1	0x07	0x00	<input type="checkbox"/>
Vbus2	0x08	0x4595	<input type="checkbox"/>
Vbus3	0x09	0xFFFF	<input type="checkbox"/>
Vbus4	0x0A	0xFFFF	<input type="checkbox"/>
Vsense1	0x0B	0x00	<input type="checkbox"/>
Vsense2	0x0C	0x2DDE	<input type="checkbox"/>
Vsense3	0x0D	0xFFFF	<input type="checkbox"/>
Vsense4	0x0E	0xFFFF	<input type="checkbox"/>
Vbus1 Avg	0x0F	0x00	<input type="checkbox"/>
Vbus2 Avg	0x10	0x458D	<input type="checkbox"/>
Vbus3 Avg	0x11	0xFFFF	<input type="checkbox"/>
Vbus4 Avg	0x12	0xFFFF	<input type="checkbox"/>
Vsense1 Avg	0x13	0x01	<input type="checkbox"/>
Vsense2 Avg	0x14	0x2DDA	<input type="checkbox"/>
Vsense3 Avg	0x15	0xFFFF	<input type="checkbox"/>

Note 1: See Figure 3-4.

- 2: Various settings for I/O type, disabling channels, unidirectional or bidirectional, etc. See the data sheet for the various operations. Pin functions selectors are used to control the MCP2221A GPIOs that are connected to both the SLOW pin and the PowerDown pin. Activating the box for either one of them will set the MCP2221A to assert the logic high on these pins. Unchecked GPIOs are set as inputs.
- 3: Latch and actual status, as well as accumulator configuration settings.
- 4: REGISTER LIST – Contains the current settings for each register. The registers can be saved to a CSV file and reloaded at a later time. The GUI loads the register values from the device when connected to the USB bridge. This overwrites what was previously in the GUI. A reload of the registers is necessary if the user wants a specific setup for the registers

FIGURE 3-6: Configuration Tab.

PAC1942-2 Evaluation Board User's Guide

PAC194x/PAC195x Demo Application

Settings Help

Device: PAC1942_2 (0x20) - SN000045315 Start Acquisition Log to file Open Last Log Show Plots Refresh Refresh Type: Refresh

Demo Configuration Alerts Config I2C Script

OVER CURRENT					UNDER CURRENT				
	CH1	CH2	CH3	CH4		CH1	CH2	CH3	CH4
Limit (mA)	0.00	0.00	0.00	-0.76	Limit (mA)	0.00	0.00	0.00	-0.76
Nsamples	1	1	1	1	Nsamples	1	1	1	1
Enable Alert	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Enable Alert	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Alert 1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Alert 1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Alert 2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Alert 2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

OVER VOLTAGE					UNDER VOLTAGE				
	CH1	CH2	CH3	CH4		CH1	CH2	CH3	CH4
Limit (V)	0.00	0.00	0.00	0.00	Limit (V)	0.00	0.00	0.00	0.00
Nsamples	1	1	1	1	Nsamples	1	1	1	1
Enable Alert	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Enable Alert	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Alert 1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Alert 1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Alert 2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Alert 2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

OVER POWER					GENERAL ALERTS			
	CH1	CH2	CH3	CH4		Acc Overflow	Acc Count	Alert CC
Limit (W)	0.000	0.000	0.000	0.000	Enable Alert	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Nsamples	1	1	1	1	Alert 1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Enable Alert	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Alert 2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Alert 1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				
Alert 2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				

Note 1: See Figure 3-4.

2: Alert settings including enable and limits:

- Set the limit for the desired alert. For current, use mA (mV for V_{SENSE} for initial builds), V_{BUS} in V and power in W.
- Select the number of consecutive failures before the alert occurs (1, 4, 8 or 16).
- Enable the alert. When enabled, the light on the Demo window turns green (enabled and no alert) and it turns red when limit is exceeded.
- Select which ALERT pin (1 or 2) the alert should appear on. Any combination is allowed, as well as not setting the ALERT pins at all. The alert is still noted in the Alerts Status register (26h).
- The GENERAL ALERTS for Acc Overflow, Acc Count and Alert CC (Conversion Complete) are also enabled here.

FIGURE 3-7: Alerts Config.

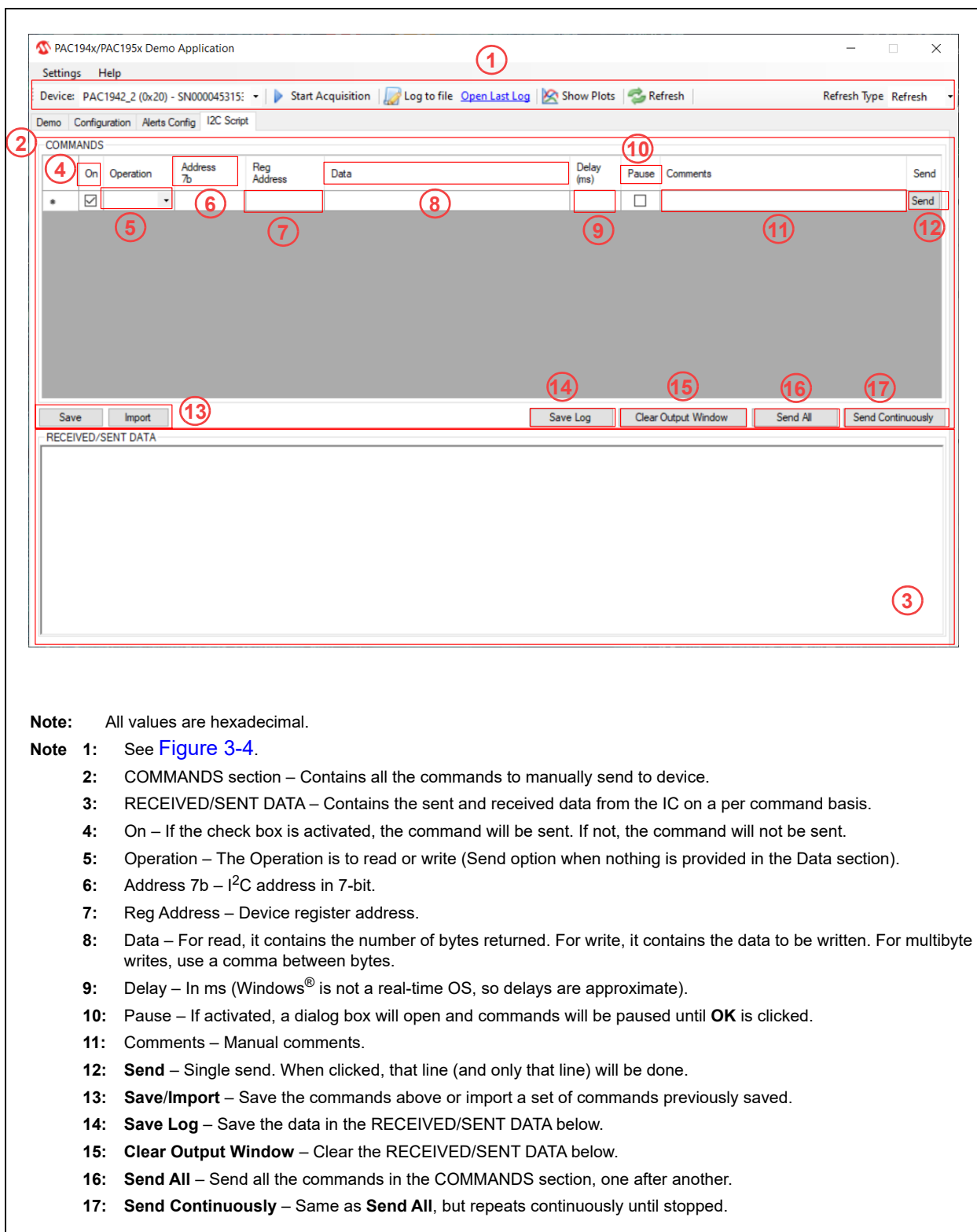


FIGURE 3-8: I²C Script Tab.

PAC1942-2 Evaluation Board User's Guide

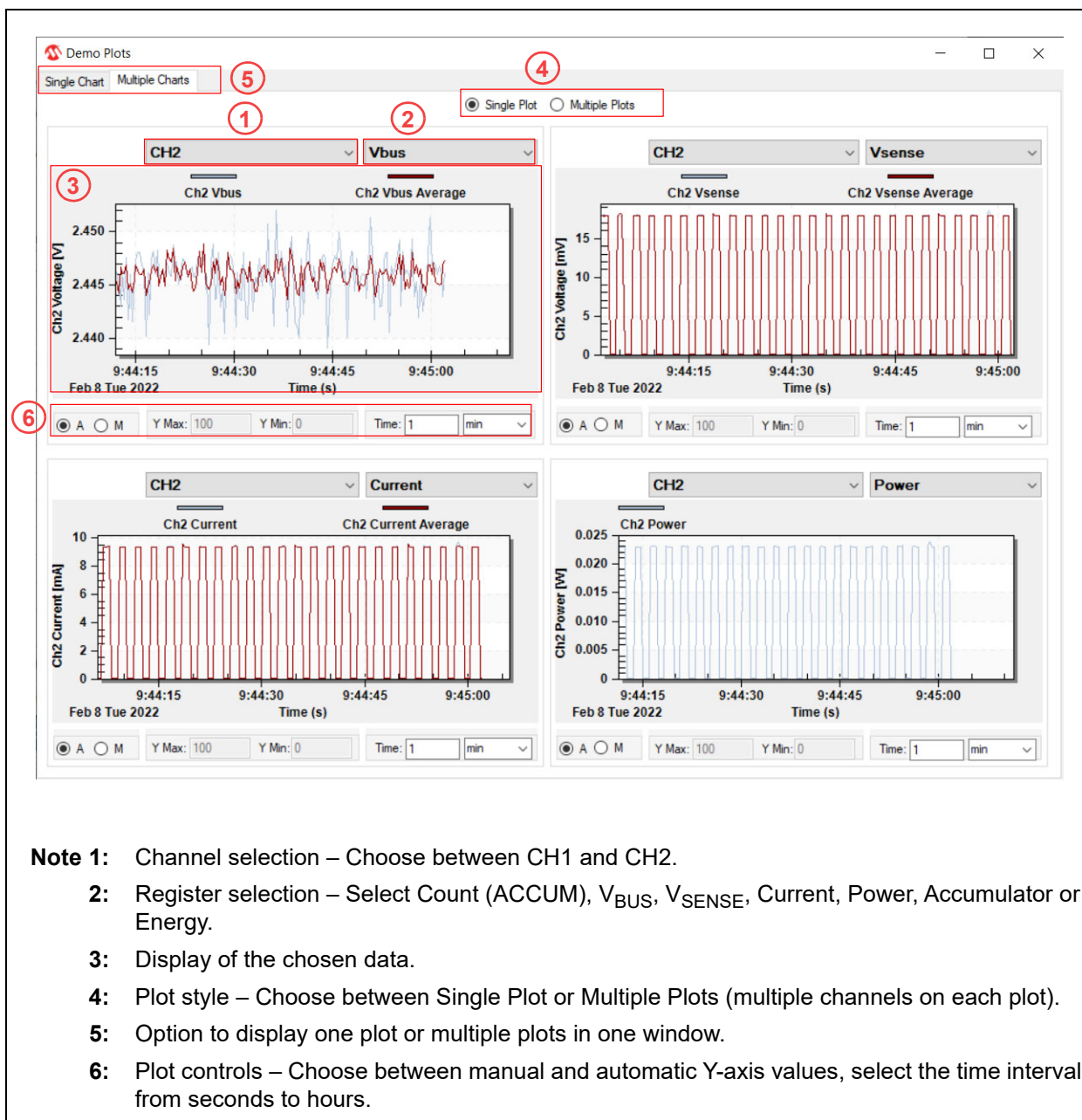


FIGURE 3-9: Demo Plots – Multiple Charts, Single Plot Option.

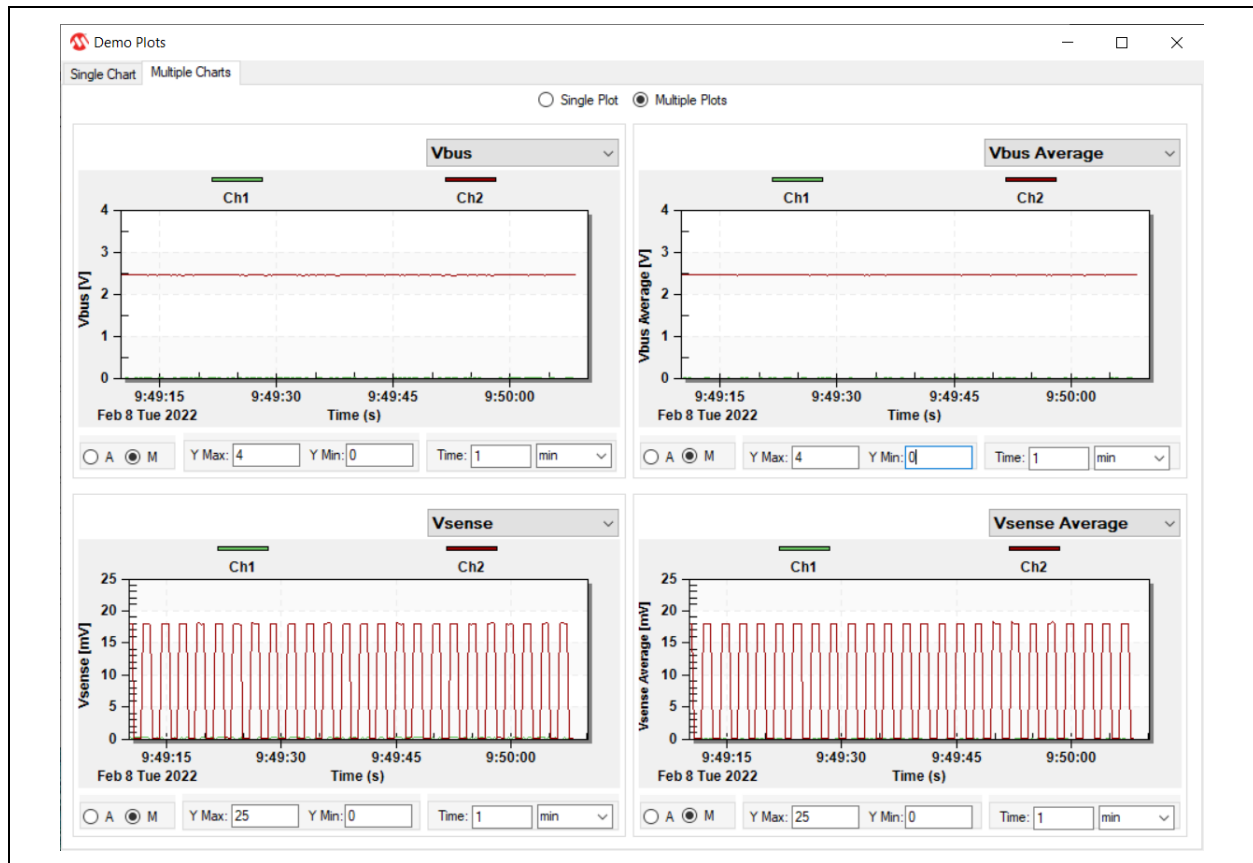


FIGURE 3-10: Demo Plots – Multiple Charts, Multiple Plots Option.

PAC1942-2 Evaluation Board User's Guide

3.2.1 Settings

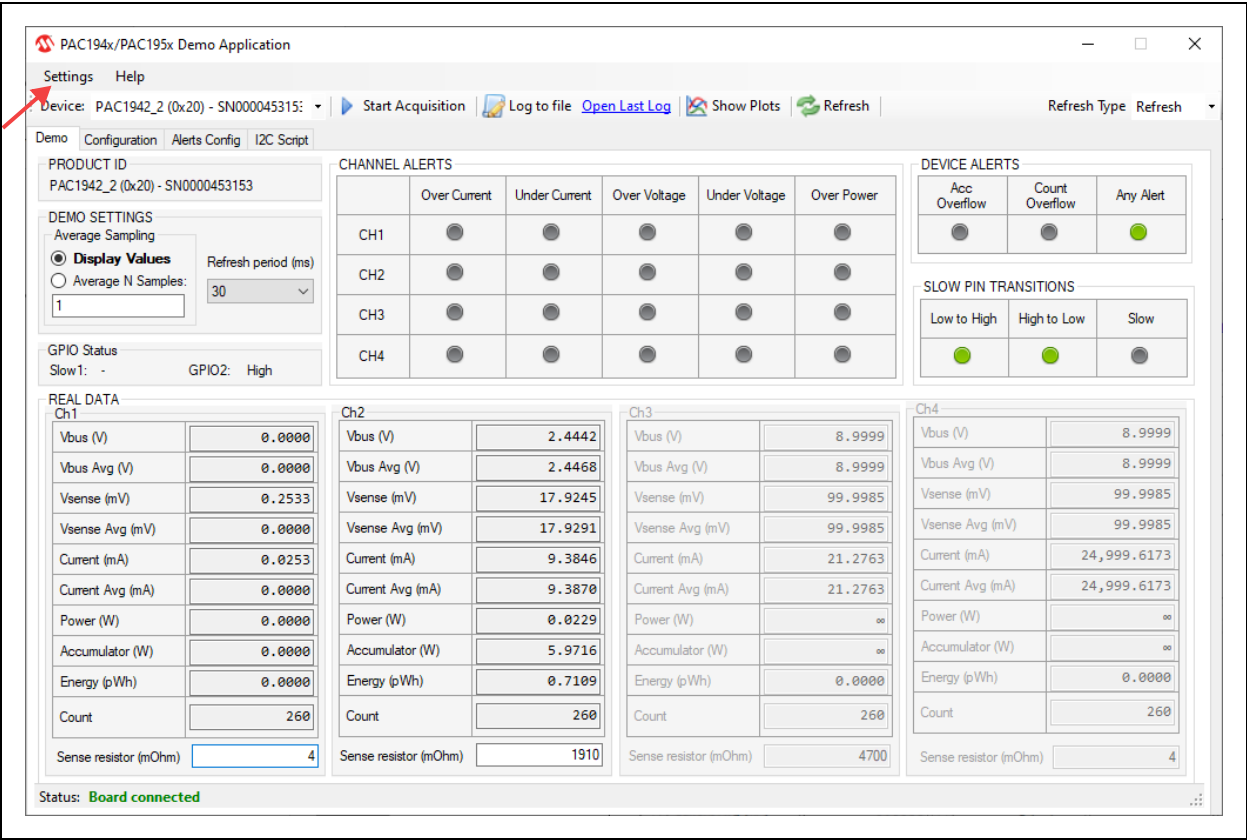


FIGURE 3-11: Settings.

The Settings drop-down menu contains three items:

- Demo Board Settings
- Rename Channels
- Voltage Ratios

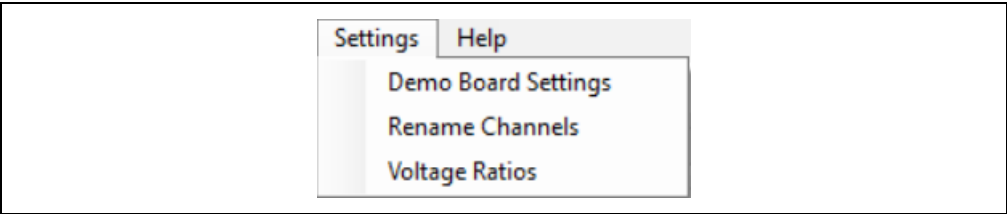


FIGURE 3-12: Settings Options.

Software GUI Description

1. Demo Board Settings – This is used in Demo configuration to control an on-board FET. It currently produces a pulsed current waveform, as seen in [Figure 3-10](#). The DAC Settings enable the DAC output on the MCP2221A and the amplitude is determined by the value entered in “Max”.

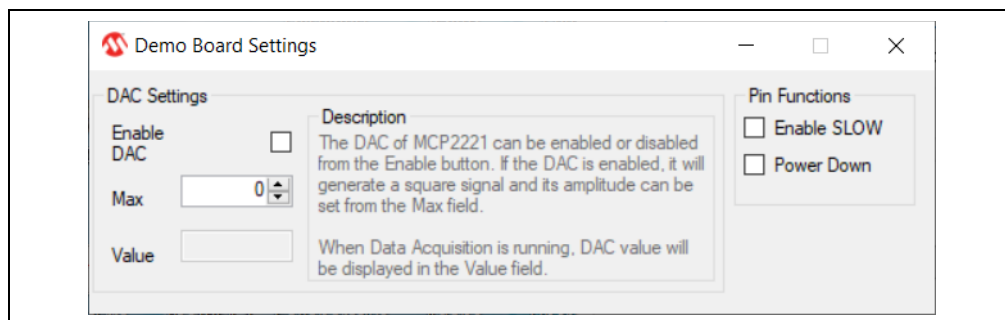


FIGURE 3-13: Demo Board Settings.

2. Rename Channels – This setting allows the user to change the name of a channel from CH1 to “Ch1 - Text”. The new name will be visible in the Demo Application window, as well as the Demo Plots (see [Figure 3-16](#) and [Figure 3-17](#)).

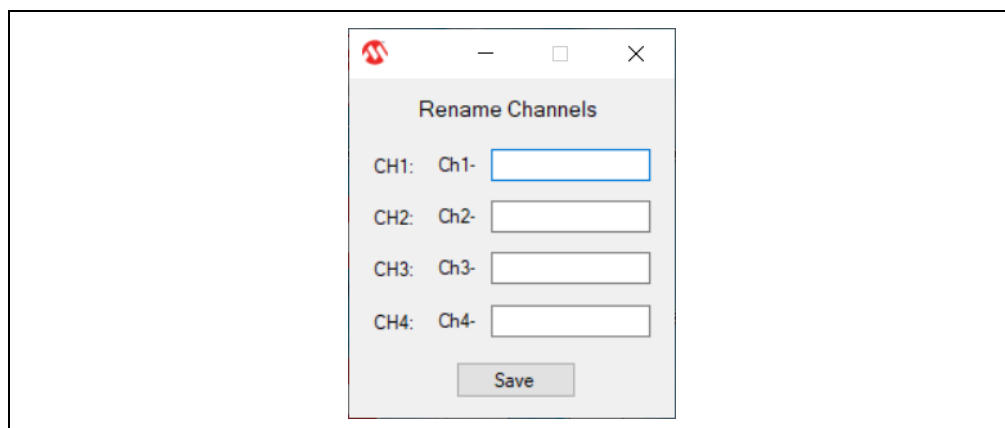


FIGURE 3-14: Rename Channels.

3. Voltage Ratios – This setting allows the user to set the resistor divider ratio (when selected with J106 or J104). The GUI will translate the measured voltage to the value before the divider.

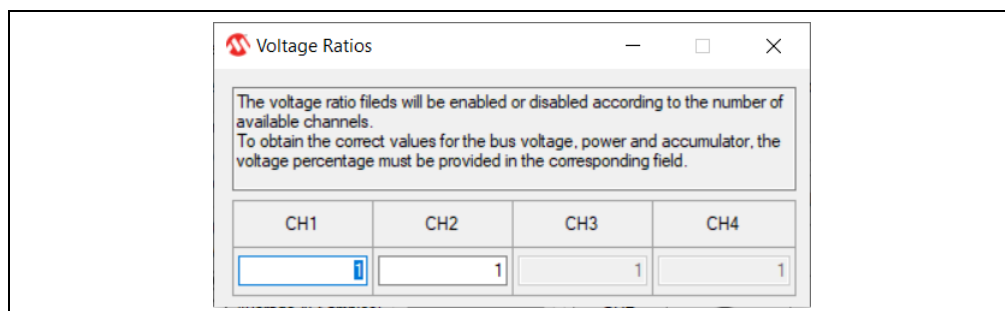


FIGURE 3-15: Voltage Ratios.

PAC1942-2 Evaluation Board User's Guide

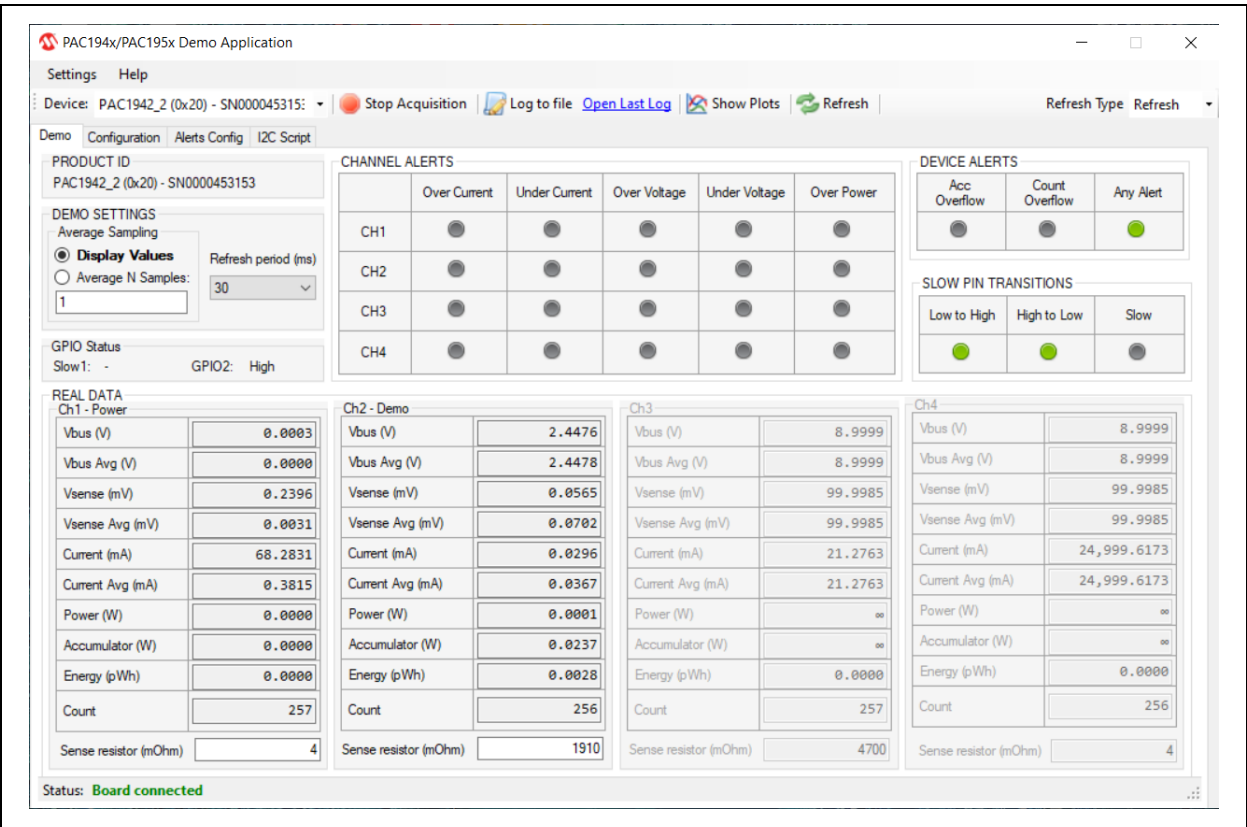


FIGURE 3-16: Channel Renaming Example.



FIGURE 3-17: Plots with Renamed Channels.

3.2.2 Help

The Help drop-down menu contains one item:

- About – Contains the software revision number and the Microchip base warranty information.

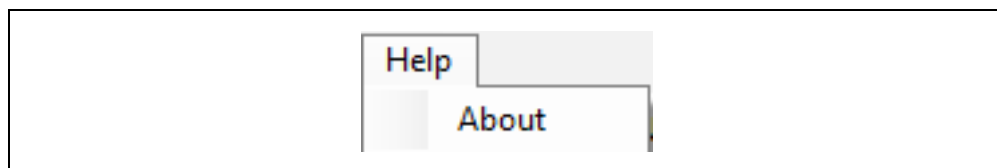


FIGURE 3-18: Help.

3.2.3 Other GUI Descriptions

Here are some general hints and tricks to improve the usability of the GUI:

1. If the user has multiple PAC1942-2 devices connected to the I²C bus, the GUI will see them and the user can control them via [PAC194x/PAC195x Demo Application>Device](#).
2. Disabling channels under the **Configuration** tab and then choosing Fast or Burst will speed up the device operation on the enabled channels. The MCP2221A cannot support the data rate, so while the chip is operating at a higher speed, the user will not be able to get each sample out with the on-board bridge.
3. On the **Configuration** tab, a REFRESH is done after any selection. The user will see the GUI change the LAT/ACT values after selecting the setting for this reason.
4. Right click **Save** in the REGISTER LIST to select or deselect all registers.

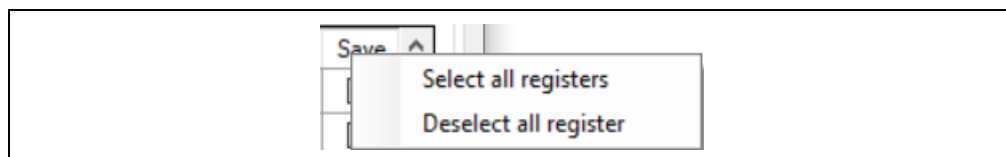


FIGURE 3-19: Registers Selection.

5. Each writable register can be changed by clicking Data for that register and changing the value. This only works for writable registers.
6. Change the color of the trace:
 - Right click on the plot (anywhere) to get the menu below:

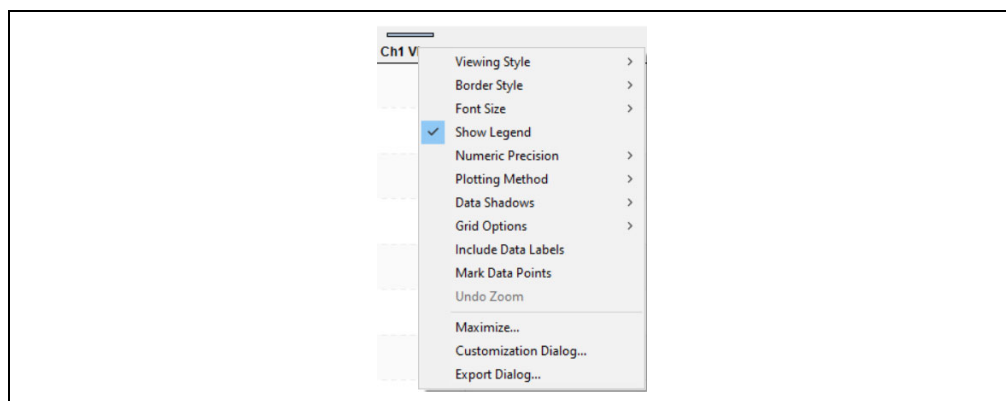


FIGURE 3-20: Changing Colors.

PAC1942-2 Evaluation Board User's Guide

- Select Customization Dialog and then select **Style**.

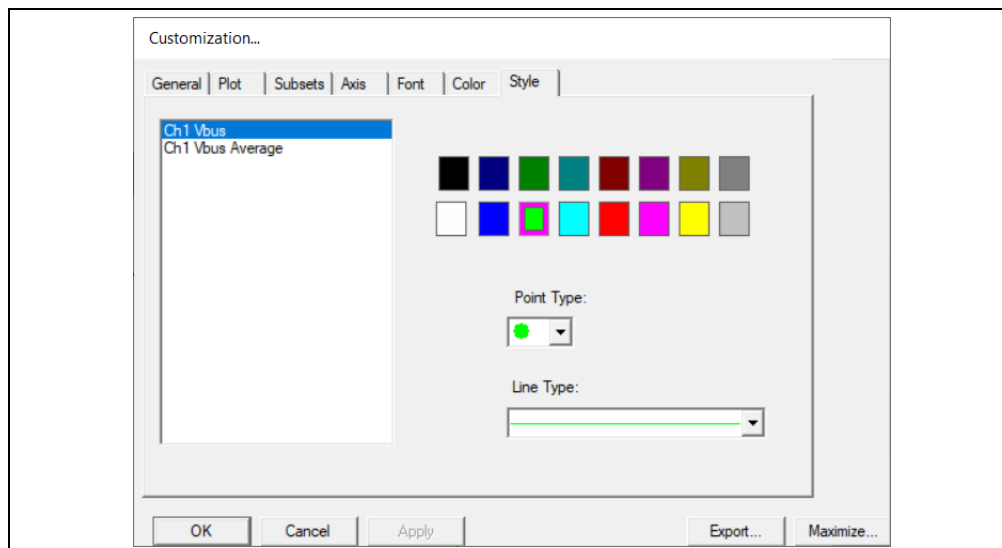


FIGURE 3-21: Customization.

- Change the color to one of the 16 options and set the “Point Type” and “Line Type”.
7. Choose between hardware averaging, 8x (Display Values) and software averaging (Average N Samples). See [Figure 3-4](#). If the user selects Average N Samples, the values in the REAL DATA section for average V_{BUS} Avg and V_{SENSE} Avg, as well as the Plot data will be the software averaged value.

3.2.4 Scenario 1: Changing the Sampling Rate/Mode

The PAC1942-2 supports several sampling rates (8, 64, 256 and 1024 SPS) along with variations on accumulation. This scenario describes how to change the settings for a couple of different options.

The first selection moves from the default sampling speed of 1024 SPS to 8 SPS, as well as from the sampling mode Adaptive Accumulation to the regular Accumulation Method (see the data sheet for differences).

Under the **Configuration** tab, go to **CONTROL>Sample Mode** and select the eighth element, labeled “8sps”. This triggers a Refresh and the ACT register for the CONTROL REGISTER ON REFRESH will show 8 SPS while the LAT will show the previous setting of 1 ksps.

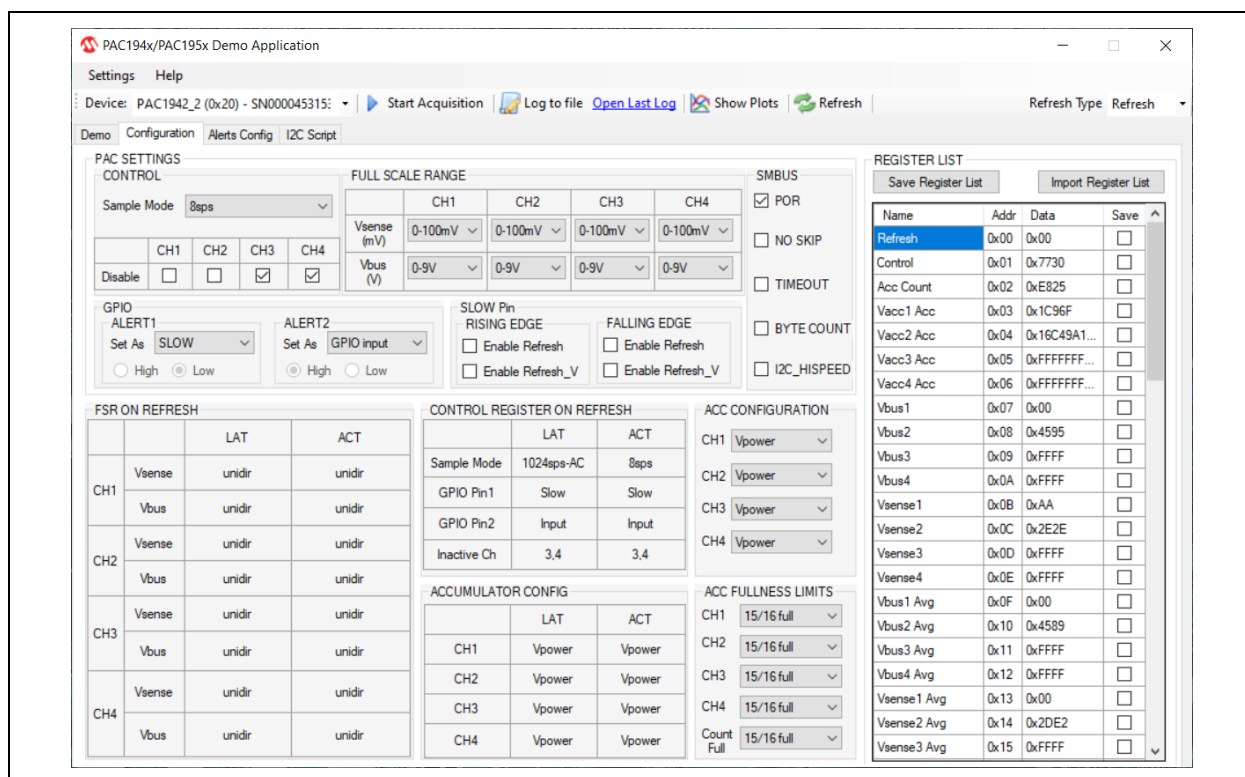


FIGURE 3-22: Changing Sample Mode to 8 SPS.

In the PAC194x/PAC195x Demo Application window, click **Start Acquisition** and the data will be collected at the new rate. This can be seen in the Acc Count register, as a much lower rate. The MCP2221A and the GUI collect data a little over two times per second. Thus the user will see a count of 3 as the device does 3 samples during the time the GUI sends the next Refresh command.

PAC1942-2 Evaluation Board User's Guide

3.2.5 Scenario 2: Changing the Refresh Type to Refresh_V

The PAC1942-2 supports three Refresh options:

- Refresh (regular) – This Refresh causes the device to load all changes and become the active setup.
- Refresh_G – This is the same as a regular Refresh but it is a Global Refresh for the bus.
- Refresh_V – This does not reset the Acc Count or Load registers, it simply moves the data to the I²C domain for reading.

Changing the Refresh Type to Refresh_V allows the Count to continue to go up while still allowing the user to read the latest data.

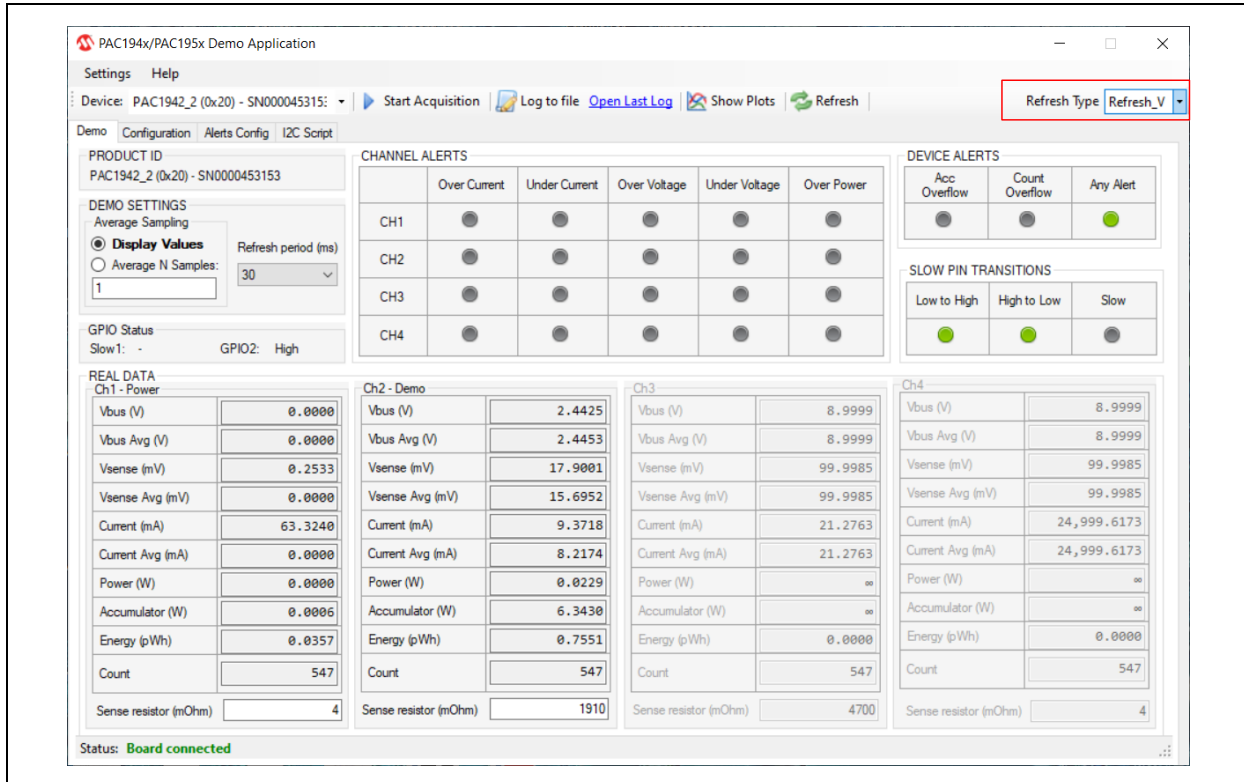


FIGURE 3-23: Refresh Type.

Click the drop-down menu and select Refresh_V.

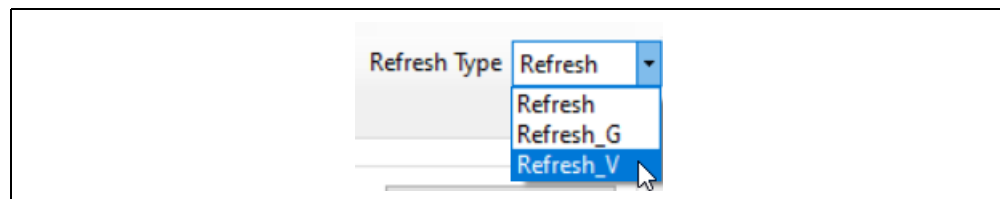


FIGURE 3-24: Refresh_V.

Click **Start Acquisition** and the data will be collected using the Refresh_V method. This option is available while the GUI collects data. With the GUI still running, use the drop-down to select the Refresh and see the Count being reset regularly.

3.2.6 Scenario 3: Setting Limits and Alerts

A new feature of the PAC1942-2 is the additional alert functionality, including limits for overcurrent, undercurrent, overvoltage, undervoltage and overpower. These limits are selectable per channel and able to drive one of the two ALERT pins.

CHANNEL ALERTS						DEVICE ALERTS		
	Over Current	Under Current	Over Voltage	Under Voltage	Over Power	Acc Overflow	Count Overflow	Any Alert
CH1	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
CH2	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
CH3	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
CH4	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

SLOW PIN TRANSITIONS		
Low to High	High to Low	Slow
<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>

FIGURE 3-25: Channel Alerts.

The alert is green when the limit is enabled. If the data value is within the limits (or condition), the alert is green. If the data value is outside the limit, the alert turns red.

EXAMPLE 3-1: SETTING LIMITS

Select the **Alerts Config** tab and note the options for the various limits. Limits are set on CH4 and Limit, Nsamples and Enable Alert are modified. The user may also select the Alert to be visible on one of the two ALERT pins.

Below, Over Current (V_{SENSE}), Over Voltage (V_{BUS}) and Under Voltage (V_{BUS}) are set, limits are set and the Alert is enabled for those limits (see Figure 3-27). 2.0V are applied on the SENSE4+ pin.

PAC194x/PAC195x Demo Application

Settings Help

Device: PAC1942_2 (0x20) - SN000045315: Start Acquisition Log to file Open Last Log Show Plots Refresh Refresh Type Refresh

Demo Configuration Alerts Config I2C Script

OVER CURRENT				
	CH1	CH2	CH3	CH4
Limit (mA)	10.00	0.00	0.00	-0.76
Nsamples	1	1	1	1
Enable Alert	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Alert 1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Alert 2	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

UNDER CURRENT				
	CH1	CH2	CH3	CH4
Limit (mA)	0.00	0.00	0.00	-0.76
Nsamples	1	1	1	1
Enable Alert	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Alert 1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Alert 2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

OVER VOLTAGE				
	CH1	CH2	CH3	CH4
Limit (V)	5.50	0.00	0.00	0.00
Nsamples	1	1	1	1
Enable Alert	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Alert 1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Alert 2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

UNDER VOLTAGE				
	CH1	CH2	CH3	CH4
Limit (V)	4.5	0.00	0.00	0.00
Nsamples	1	1	1	1
Enable Alert	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Alert 1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Alert 2	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

OVER POWER				
	CH1	CH2	CH3	CH4
Limit (W)	0.000	0.000	0.000	0.000
Nsamples	1	1	1	1
Enable Alert	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Alert 1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Alert 2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

GENERAL ALERTS			
	Acc Overflow	Acc Count	Alert CC
Enable Alert	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Alert 1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Alert 2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

FIGURE 3-26: Alerts Config Tab.

PAC1942-2 Evaluation Board User's Guide

In the PAC194x/PAC195x Demo Application window, click **Start Acquisition**. The CHANNEL ALERTS are set based on the setup in the **Alerts Config** tab and will be green when the calculated values are within the limits, and red when the values exceed the limits.

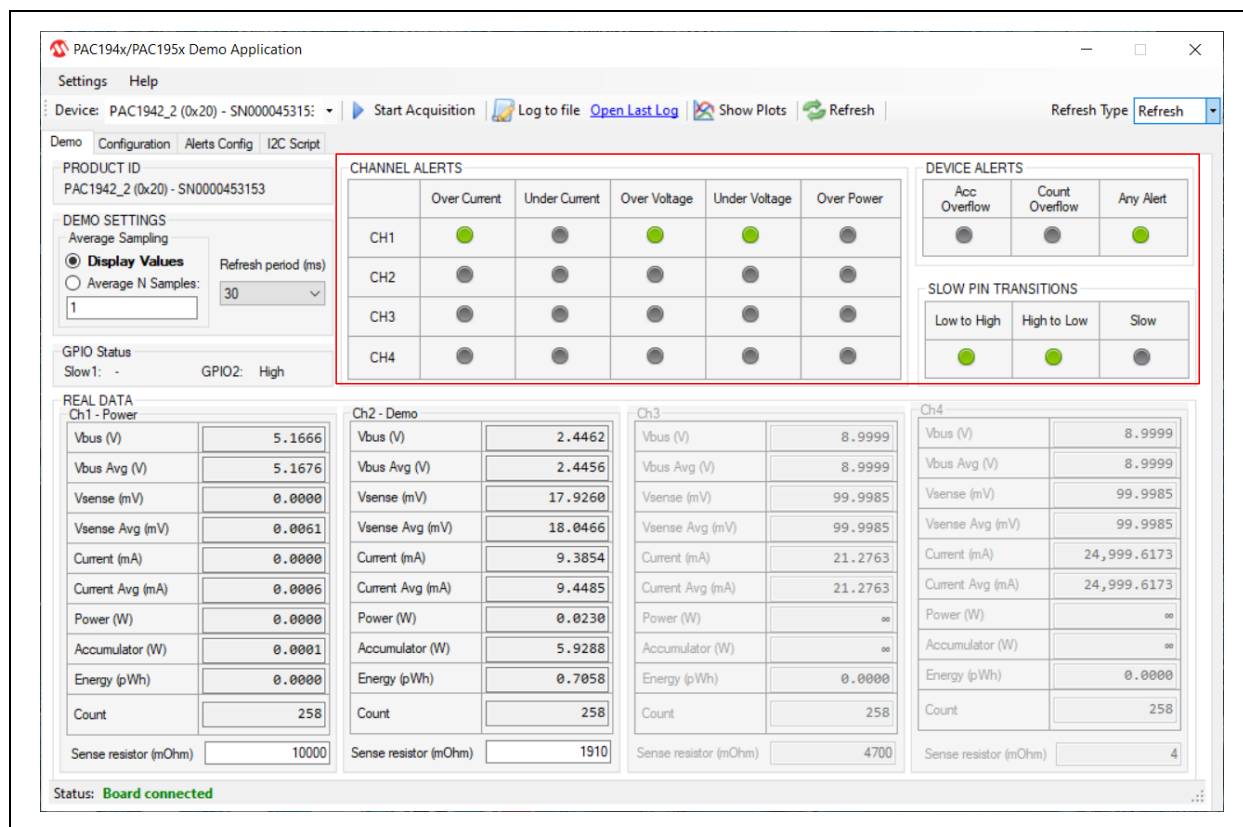


FIGURE 3-27: Limits Set.

Note that Any Alert (top right corner) is also green. This signifies that alerts are not sensed. If you lower the voltage that is applied to the SENSE1+ to 0.0V (under the previous limit of 4.5V), the limit fails and the Under Voltage alert is red, as well as Any Alert. The V_{SENSE} value in the REAL DATA section will show 0.0V. See [Figure 3-28](#).

Software GUI Description

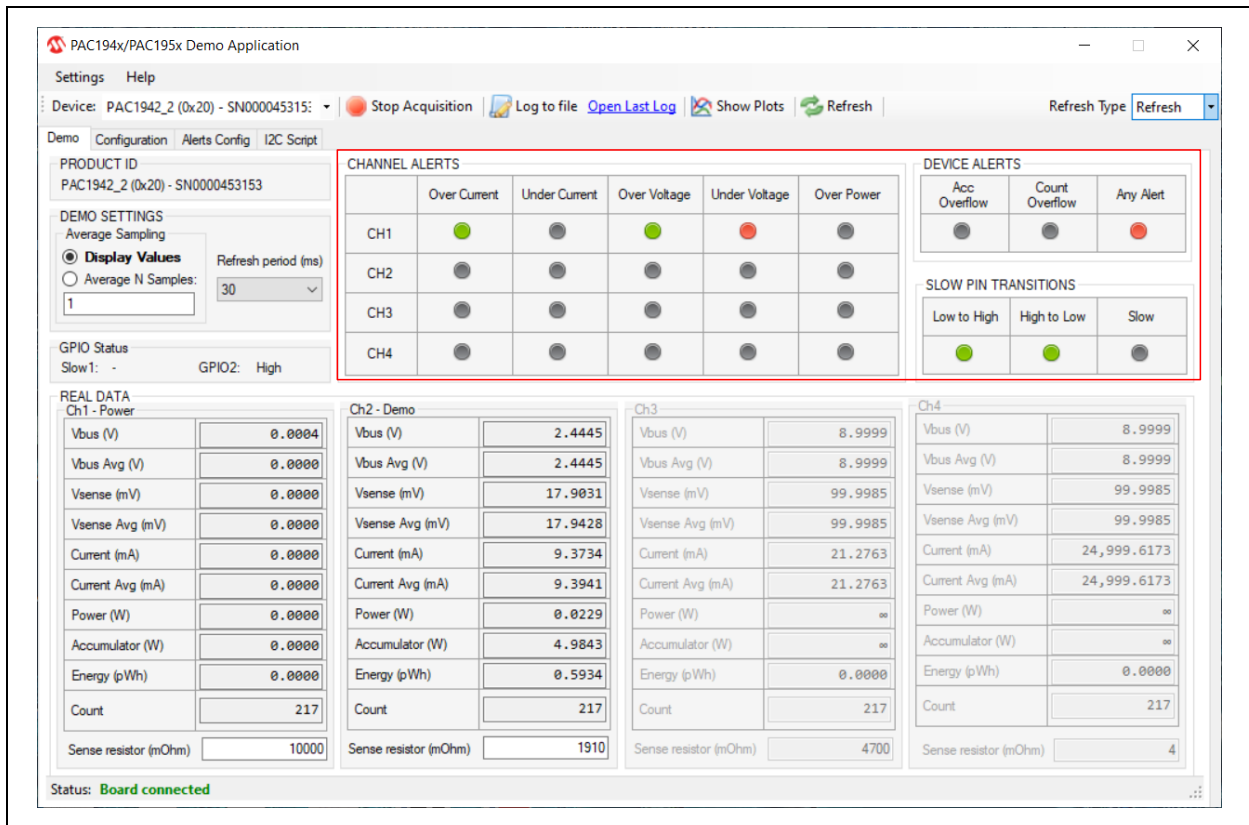


FIGURE 3-28: Limits Failing.

PAC1942-2 Evaluation Board User's Guide

3.2.7 Scenario 4: Go Fast

The PAC1942-2 default sampling rate is 1024 SPS and it can sample all channels (and offset correction) at that rate. In order to sample faster than that rate, the Fast and Burst options are available. Reducing the number of channels sampled leads to an increase in the sampling speed for the remaining channels, up to 5120 SPS (see the data sheet for a detailed explanation). The MCP2221A cannot support the communication speeds necessary to capture all the data, so an alternative Host is required to capture the data.

Select the **Configuration** tab, set the Sample Mode to Fast and disable CH2. You can see the results in the CONTROL REGISTER ON REFRESH section. Sample at a Fast rate of 2560 SPS (because you are still doing offset correction). To go to the full 5120 SPS, select Burst from the Sample Mode drop-down menu.

The chip is now in that mode, the GUI is not capturing/refreshing the data until you **Start Acquisition**. When you **Start Acquisition**, you can see the count going up faster than the previous settings.

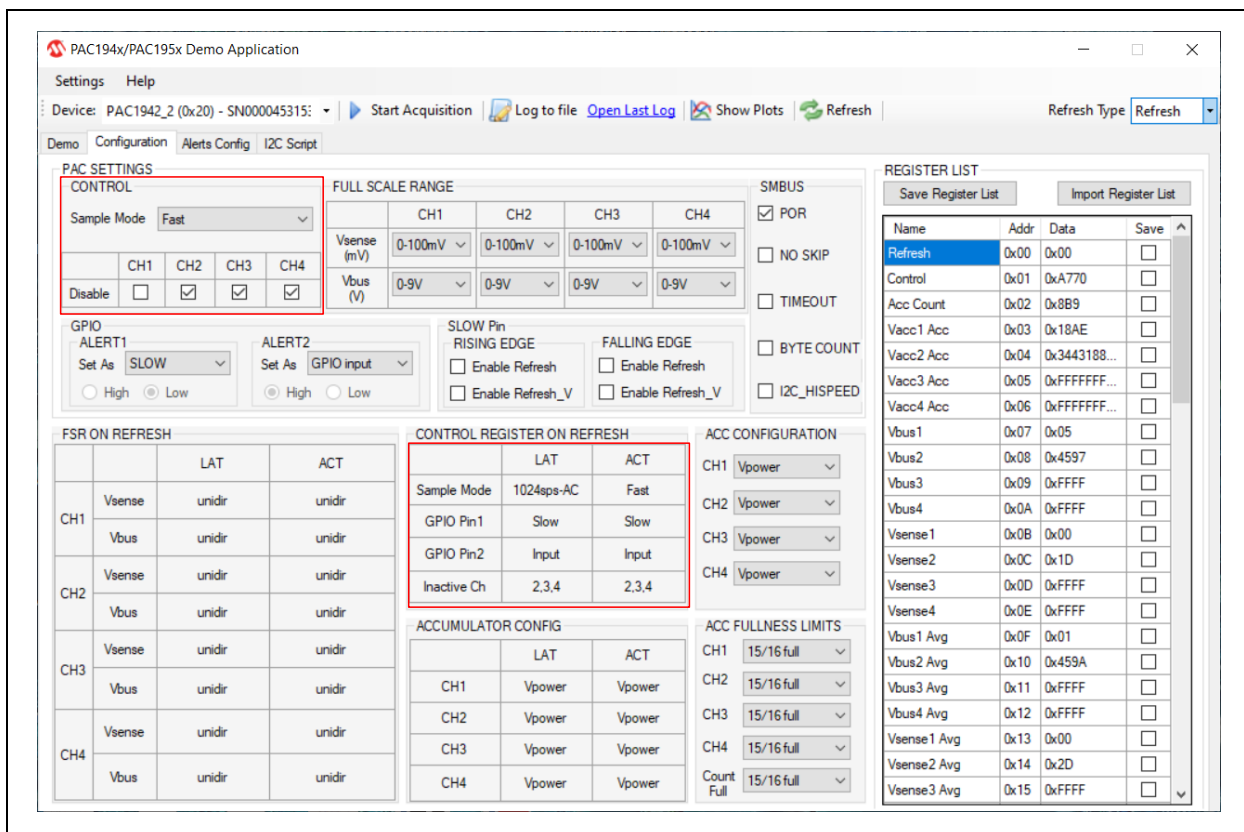


FIGURE 3-29: Sample Mode: Fast.

Chapter 4. Hardware Description

4.1 INTRODUCTION

The PAC1942-2 is placed at the center of the board, in a quad flat no-lead package (QFN) with wettable flanks; U1. It is surrounded by probe points with the pin names labeled. There is a provision for an input filter for each pair on the input pins, but these are not populated. The other hardware on the board is described below.

Initial samples will be provided with a Plug-In Module (PIM) that allows easy changing of parts and the update of parts as needed.

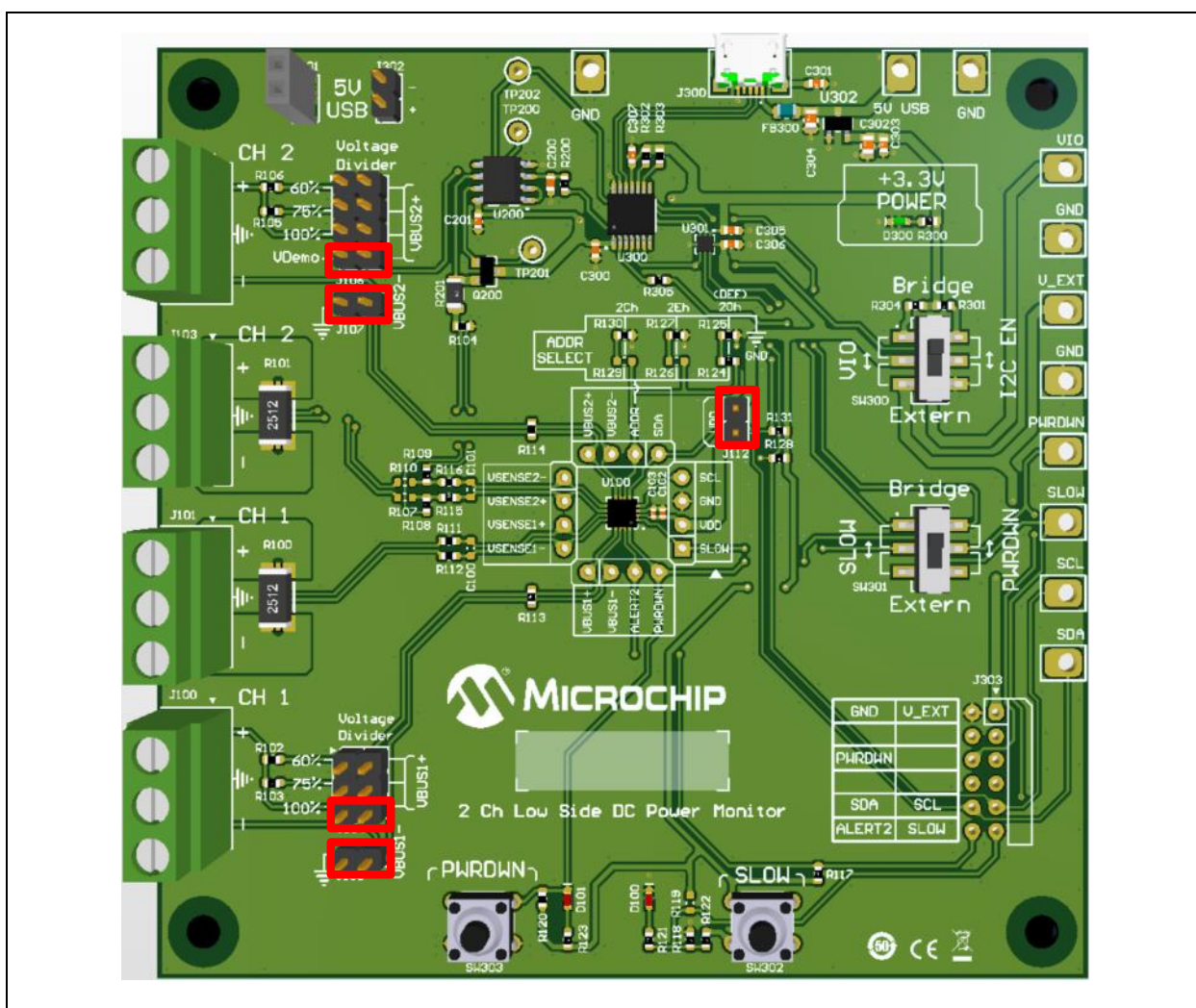


FIGURE 4-1: PAC1942-2 Evaluation Board.

PAC1942-2 Evaluation Board User's Guide

4.2 DEMO MODE AND EVB MODE

The EVB mode is designed to allow an easy demonstration of the board or to be used in a normal evaluation of the four channel inputs. In Demo mode, the inputs are connections to different sense resistors, compared to the EVB mode. They are configured as in [Table 4-1](#).

TABLE 4-1: DEMO VS. EVB SENSE RESISTOR VALUES

Channel	Demo	EVB (Headers)
1	R100 = 4 mΩ	R100 = 4 mΩ
2	R104 = 1.9Ω (Demo signal)	R101 = 4 mΩ

The EVB sense resistors are connected to the headers on the edge of the board labeled CH1 (J100), CH2 (J102), CH3 (J103) and CH4 (J107). CH4 is connected to the header in the Demo and EVB configuration. The center pin for each header is Ground to allow easy testing but it is not required to use it.

To change from Demo mode to EVB mode (and back), the following 0Ω resistors must be populated as per [Table 4-2](#).

TABLE 4-2: DEMO VS. EVB SETUP PER CHANNEL

Channel	Demo	EVB
1	No Change	No Change
2	R108 and R109 populated R107 and R110 not populated	R108 and R109 not populated R107 and R110 populated

[Figure 4-2](#) shows the configurations for the Demo and EVB setups.

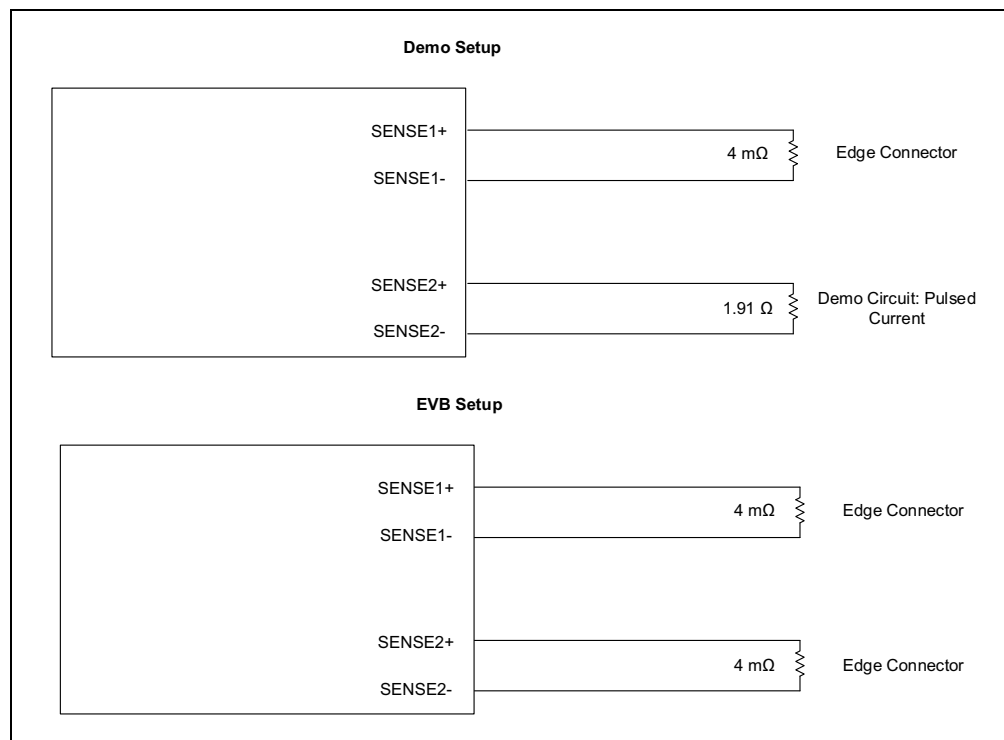


FIGURE 4-2: Demo and EVB Configuration.

4.3 DEFAULT CONNECTIONS

In [Section A.2 “Board – Schematic 1”](#), the USB connector is at the top. This is the default (as shipped) position of the shorting shunts that connect the different pin pairs. SW300 must be set to the bridge position for the USB communication to work properly. SW301 must be switched to Extern for the initial evaluation. A jumper must be on J112 to operate.

4.4 V_{BUS} AND V_{SENSE} CONNECTIONS – USING EXTERNAL SOURCES FOR SYSTEM MODE

To use external sources for V_{BUS} with an external load, the board must be used in the EVB configuration discussed above. The center terminal of each connector is connected to ground for a convenient return connection for the load. Each PAC1942-2 channel has an on-board current sense resistor of 4 m Ω connected between the positive (+) input and the negative (-) input pins, which gives 25A for the full-scale current.

The 4 m Ω resistors can be unsoldered and replaced with a different value at the discretion of the user. The 4 m Ω resistors have very wide metal connecting each end to terminals 1 and 3 of the connector block and it is challenging to remove them cleanly. If they are removed, they will reveal a layout that facilitates soldering this wide metal connection to each end of the new sense resistor and a Kelvin connection for each end that goes to the inputs of the PAC1942-2. Both the wide metal to the connector block and the Kelvin connection need to be soldered to the new sense resistor.

4.5 ADDRESS SELECTION

The PAC194X/5X devices can have up to 16 different I²C addresses based on the resistor connected to the ADDR_SEL pin (see the data sheet). The EVB has resistors on-board that allow the user to select up to four different addresses based on the resistors on-board. The default resistor setup is grounded which results in an address of 20h (10h for a 7-bit address). [Table 4-3](#) shows the hardware setting for each address.

TABLE 4-3: ADDR_SEL PIN OPTIONS

Setup	R125	R127	R129	8-bit Address
1	POP	DNP	DNP	20h (default)
2	DNP	POP	DNP	2Eh
3	DNP	DNP	POP	2Ch
4	DNP	POP	POP	2Ah
Generic	DNP	DNP	DNP	Various: connect the desired resistor to the ADDR PIM connection and connect to ground.

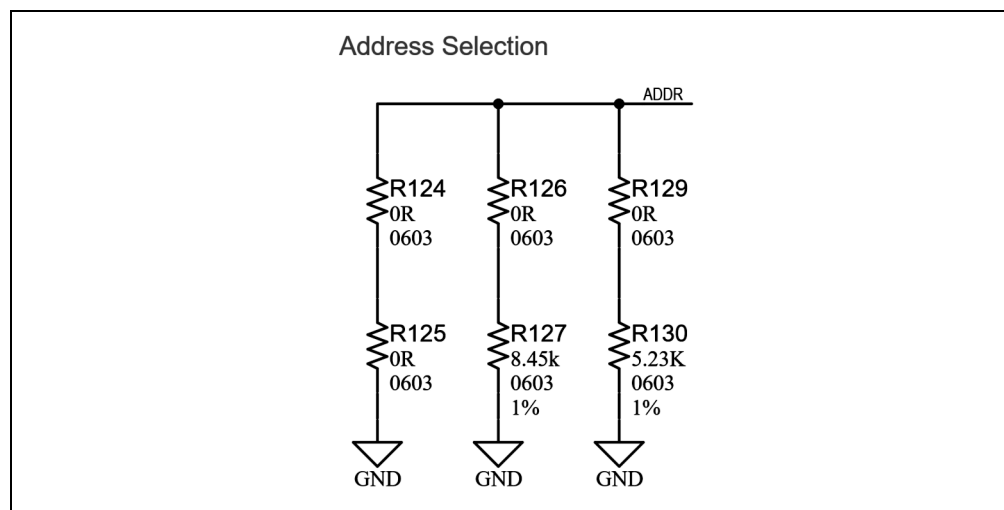


FIGURE 4-3: ADDR_SEL Circuit.

4.6 HARDWARE FOR I²C/SMBUS COMMUNICATION OVER USB OR EXTERNAL I²C CONNECTION

U300 is an MCP2221 USB-2 to I²C bridge chip that translates the USB communications into I²C read/write commands to configure the PAC1942-2 and to capture status and results data. To the left of U300 there is U301, a level shifter that matches the I²C signals from the MCP2221 to the V_{IO} voltage used for the PAC1942-2 V_{DD}. On the far right side of the board, there is an SW300 switch and a J303 connector. These are both used when connecting an external I²C connection directly to the board instead of using the USB connection. J303 allows the user to connect the external V_{IO}, SCA and SCL signals directly to the PAC1942-2. SW300 disables the USB bridge and level shifter and connects the pull-up resistors on the SCA and SCL pins to the external V_{IO} voltage.

SW301 is used to select the SLOW and POWER-DOWN pins to either the MCP2221A (bridge selection) or the J303 (external selection).

4.7 SIGNAL DESCRIPTION IN DEMO MODE

In Demo mode, the signals measured are:

- Channel 1: Edge Connector
- Channel 2: PAC1942-2 Demo signal – 1.91Ω
 - a) A pulsed waveform using the DAC to control the current level.
 - b) Enable the DAC and change the value to 1.0, 2.0, 3.0 to see different current levels.

All the plots in the GUI description above are made in the default Demo mode configuration using varied DAC settings.

4.8 ADDITIONAL HARDWARE DETAILS

The J112 jumper is available for the use of an external meter to measure the I_{DD} . This provides a place to remove the short and insert a current meter to measure the current in the PAC1942-2 I_{DD} .

4.9 DIRECT EXTERNAL I²C CONNECTION

The EV97L33A can be used with direct I²C control from a PC running Windows®, Linux® or other digital controller. For external I²C use, V_{DD} may need a voltage that is different from the default settings for USB control. This is easily implemented by moving SW300 from the bridge position used for USB control to the external position used for external I²C control. Connecting the external SCA and SCL signals is then required, along with the power (V_{IO}) and ground used for these I²C signals. The PAC194x5x Demo Application cannot be used with direct I²C connection.

PAC1942-2 Evaluation Board User's Guide

NOTES:

Appendix A. Schematic and Layouts

A.1 INTRODUCTION

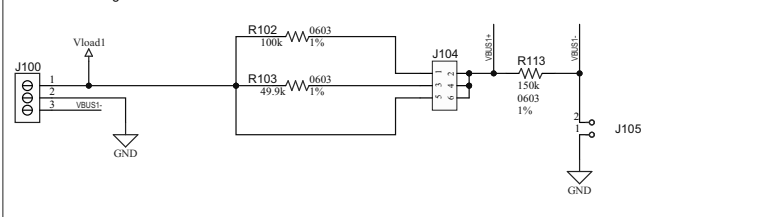
This appendix contains the following schematics and layouts for the PAC1942-2 Evaluation Board:

- [Board – Schematic 1](#)
- [Board – Schematic 2](#)
- [Board – Schematic 3](#)
- [Board – Top Silk](#)
- [Board – Top Copper and Silk](#)
- [Board – Top Copper](#)
- [Board – Bottom Silk](#)
- [Board – Bottom Copper and Silk](#)

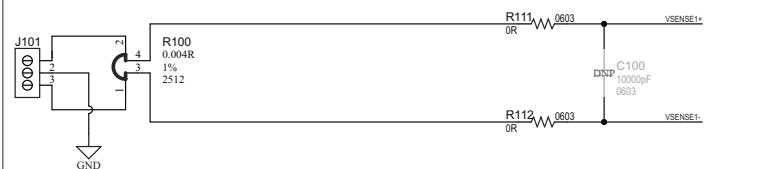
A.2 BOARD – SCHEMATIC 1

PAC Channel Connections

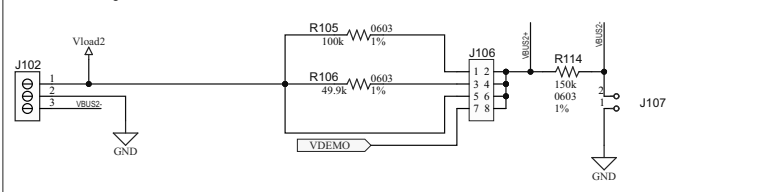
Channel 1 - Voltage measurement



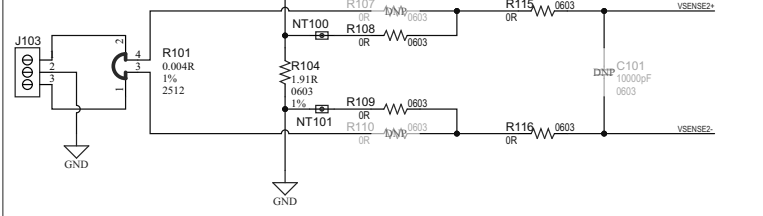
Channel 1 - Current measurement



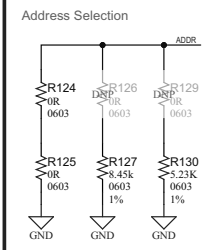
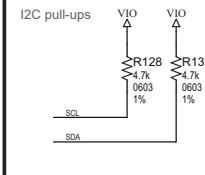
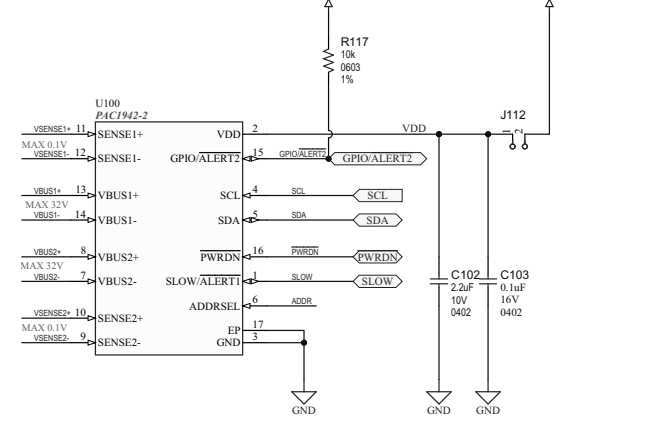
Channel 2 - Voltage measurement



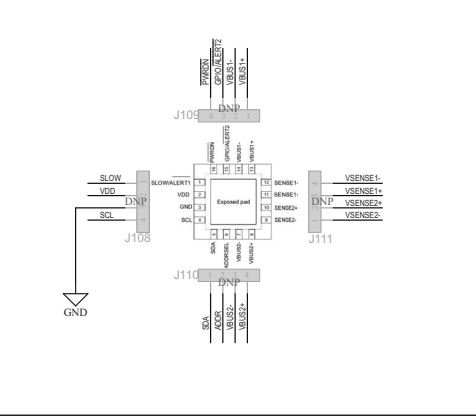
Channel 2 - Current measurement



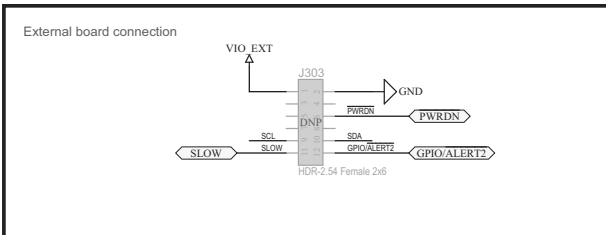
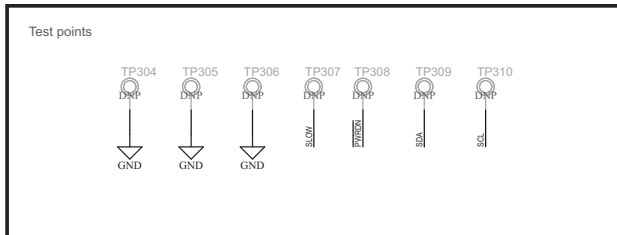
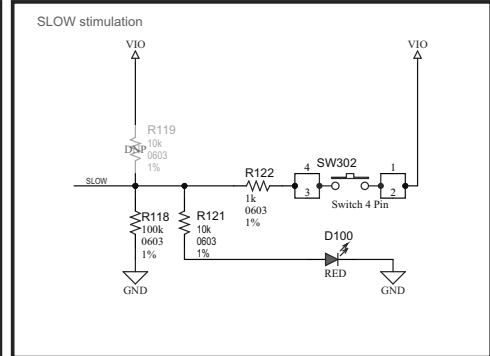
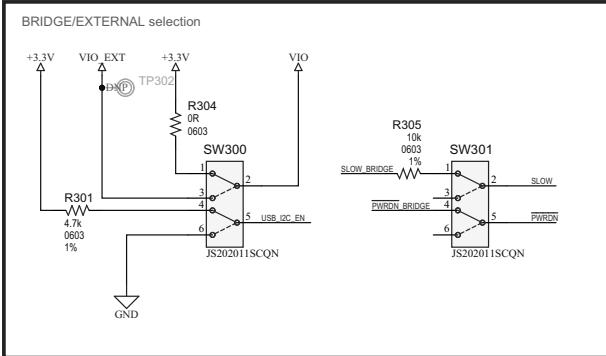
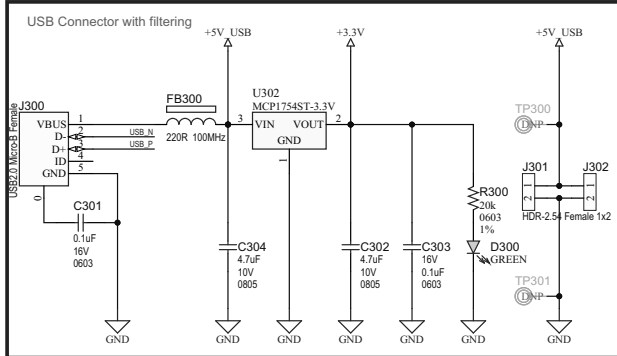
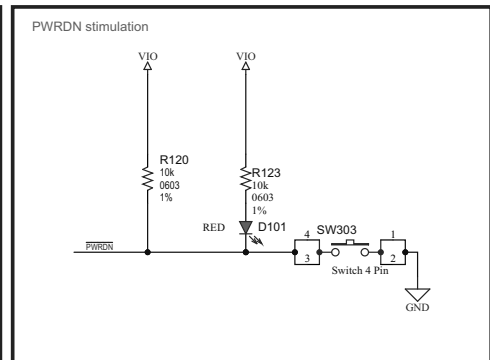
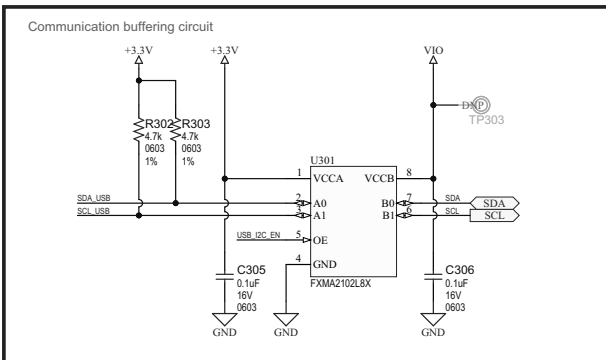
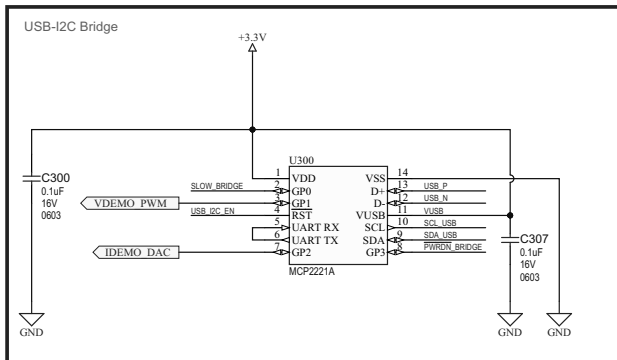
PAC IC and Power



External IC connector

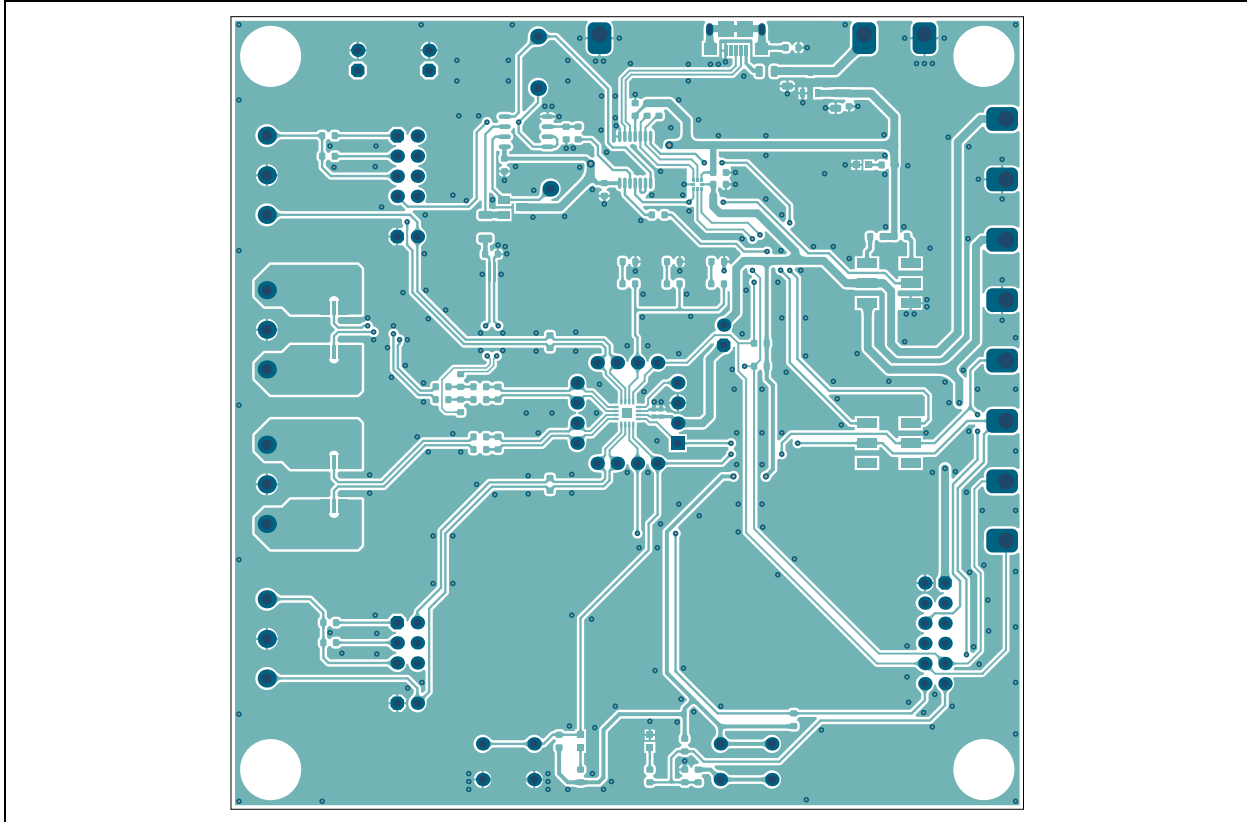


A.4 BOARD – SCHEMATIC 3

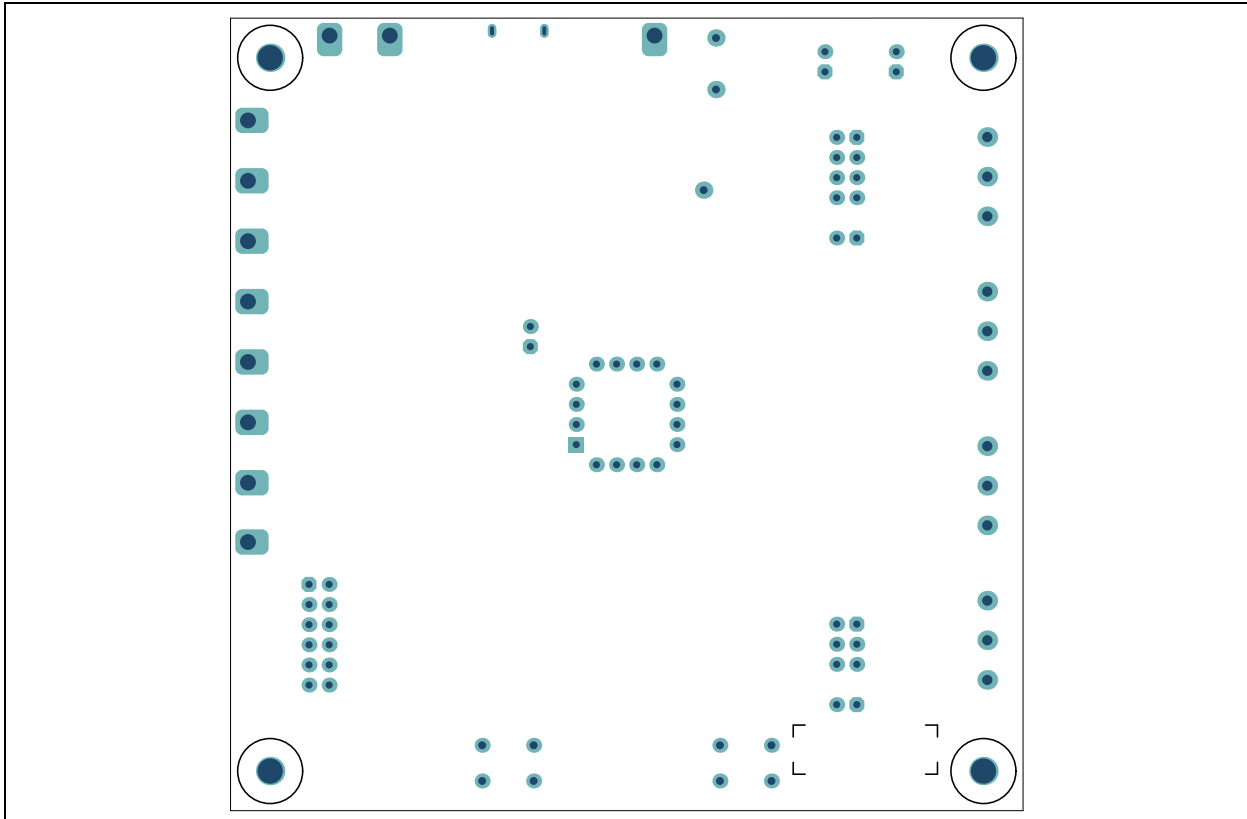


PAC1942-2 Evaluation Board User's Guide

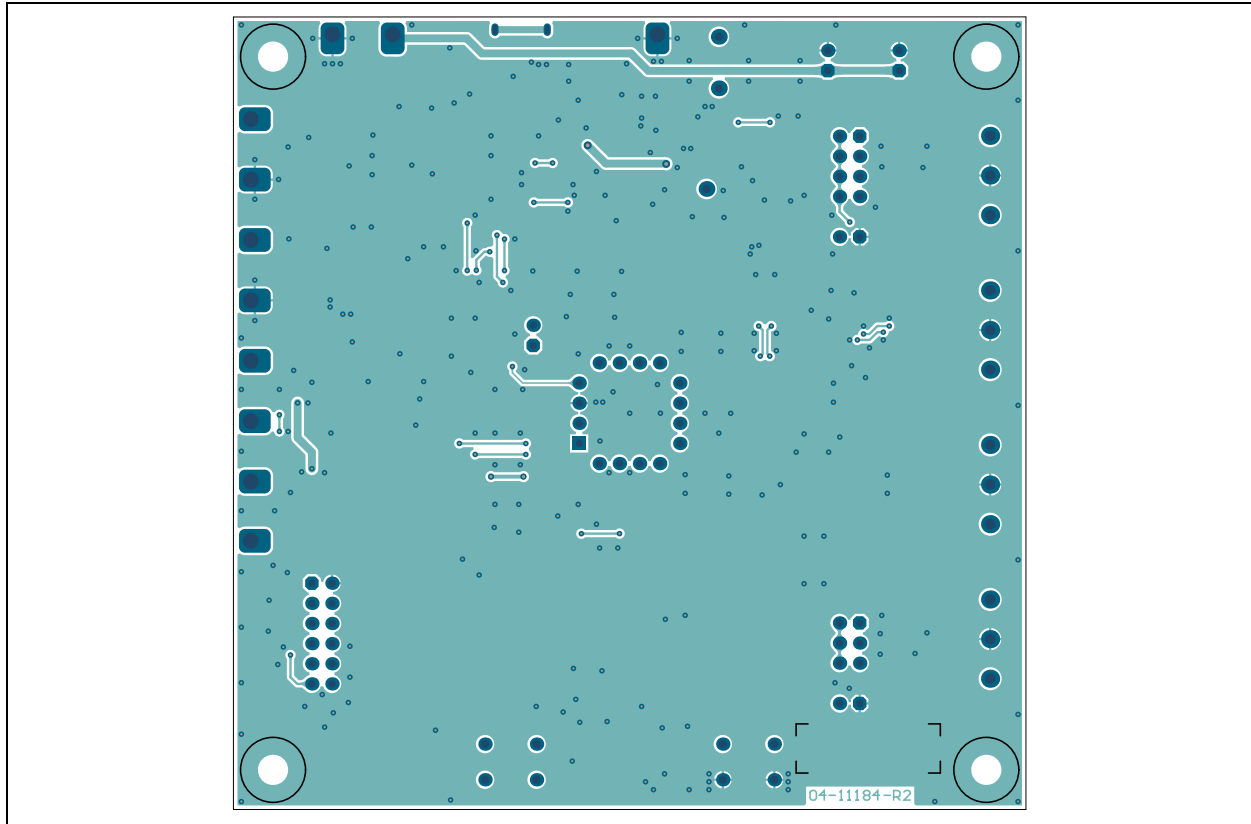
A.7 BOARD – TOP COPPER



A.8 BOARD – BOTTOM SILK



A.9 BOARD – BOTTOM COPPER AND SILK



PAC1942-2 Evaluation Board User's Guide

NOTES:

Appendix B. Bill of Materials (BOM)

TABLE B-1: BILL OF MATERIALS (BOM)

Qty.	Reference	Description	Manufacturer	Part Number
0	C100, C101	DO NOT POPULATE , Ceramic capacitor, 10000 pF, 50V, 20%, X7R, SMD, 0603	Kyocera AVX	06035C103KAT2A
1	C102	Ceramic capacitor, 2.2 μ F, 10V, 10%, X7S, SMD, 0402	TDK Corporation	C1005X7S1A225K050BC
1	C103	Ceramic capacitor, 0.1 μ F, 16V, 10%, X7R, SMD, 0402	Wurth Elektronik	885012205037
1	C200	Ceramic capacitor, 10000 pF, 25V, 10%, X7R, SMD, 0603	Samsung Electro-Mechanics America, Inc.	CL10B103KA8NNNC
7	C201, C300, C301, C303, C305, C306, C307	Ceramic capacitor, 0.1 μ F, 16V, 10%, X7R, SMD, 0603	Taiyo Yuden Co., Ltd.	EMK107B7104KA-T
2	C302, C304	Ceramic capacitor, 4.7 μ F, 10V, 10%, X5R, SMD, 0805	Samsung Electro-Mechanics America, Inc.	CL21A475KPFNNNE
1	CBL1	Mechanical, hardware cable, USB, Male-A to Male Micro-B, clear 4	Dongguan ZhanXin Electronic Technology Co., Ltd.	A006ZX027
2	D100, D101	Diode, red LED, 2V, 20 mA, 25 mcd, clear, SMD, 0603	Wurth Elektronik	150060RS75000
1	D300	Diode, green LED, 3.2V, 20 mA, 430 mcd, Clear, SMD, 0603	Wurth Elektronik	150060GS75000
1	FB300	Ferrite, 2A, 220R, SMD, 0805	Murata Manufacturing Co., Ltd.	BLM21PG221SN1D
4	J100, J101, J102, J103	Connector, terminal, 5 mm, 1x3, female, 12-30AWG, 16A, Through-Hole, R/A	Wurth Elektronik	691137710003
1	J104	Connector, header-2.54, male, 2x3, gold, 5.84 MH, Through-Hole, vertical	Samtec, Inc.	TSW-103-07-G-D
4	J105, J107, J112, J302	Connector, header-2.54, male, 1x2, gold, 5.84 MH, Through-Hole, vertical	Multicomp Inc.	SPC20481
1	J106	Connector, header-2.54, male, 2x4, gold, 5.84 MH, Through-Hole, vertical	Wurth Elektronik	61300821121
0	J108, J109, J110, J111	DO NOT POPULATE , connector, header-2.54, female, 1x4, gold, Through-Hole, vertical	Samtec, Inc.	SSW-104-01-G-S
1	J300	Connector, USB 2.0, Micro-B, female, SMD, R/A	Amphenol ICC (FCI)	10118193-0001LF
1	J301	Connector, header-2.54, female, 1x2, gold, Through-Hole, vertical	Samtec, Inc.	SSW-102-01-T-S

Note 1: The components listed in this Bill of Materials are representative of the PCB assembly. The released BOM used in manufacturing uses all RoHS-compliant components.

PAC1942-2 Evaluation Board User's Guide

TABLE B-1: BILL OF MATERIALS (BOM) (CONTINUED)

Qty.	Reference	Description	Manufacturer	Part Number
0	J303	DO NOT POPULATE , connector, header-2.54, female, 2x6, gold, Through-Hole, R/A	Sullins Connector Solutions	PPPC062LJBN-RC
5	JP1, JP2, JP3, JP4, JP5	Mechanical, hardware, jumper, 2.54 mm, 1x2 handle, gold	TE Connectivity, Ltd.	881545-2
1	LABEL1	Label PCBA, 18x6 mm, Datamatrix Assy#/Rev/Serial/Date	ACT Logimark AS	505462
1	LABEL2	Label, ASSY W/REV Level (Small Modules) per MTS-0002		
4	PAD1, PAD2, PAD3, PAD4	Mechanical, hardware, rubber pad, cylindrical, D7.9, H5.3, black	3M	70006431483
1	PCB1	PAC1942-2 Evaluation Board – Printed Circuit Board	Microchip Technology Inc.	04-11184-R2
1	Q200	Transistor FET N-Channel, 20V, 1.9A, 625 mW, SOT-23-3	Diodes Incorporated®	ZXMN2A01FTA
2	R100, R101	Resistor, Shunt MF, 0.004R, 1%, 2W, 2512	Stackpole Electronics, Inc.	CSNL2512FT4L00
3	R102, R105, R118	Resistor, Thick Film, 100 kΩ, 1%, 1/10W, SMD, 0603	TE Connectivity, Ltd.	1622827-1
2	R103, R106	Resistor, Thick Film, 49.9 kΩ, 1%, 1/10W, SMD, 0603	Panasonic® - ECG	ERJ-3EKF4992V
1	R104	Resistor, Thick Film, 1.91R, 1%, 1/10W, SMD, 0603, AEC-Q200	Stackpole Electronics, Inc.	RMCF0603FT1R91
0	R107, R110, R126, R129	DO NOT POPULATE , resistor, Thick Film, 0R, 1/10W, SMD, 0603	Stackpole Electronics, Inc.	RMCF0603ZT0R00
9	R108, R109, R111, R112, R115, R116, R124, R125, R304	Resistor, Thick Film, 0R, 1/10W, SMD, 0603	Stackpole Electronics, Inc.	RMCF0603ZT0R00
2	R113, R114	Resistor, Thick Film, 150 kΩ, 1%, 1/8W, SMD, 0603	KOA Speer Electronics, Inc.	SG73S1JTDD1503F
5	R117, R120, R121, R123, R305	Resistor, Thick Film, 10 kΩ, 1%, 1/10W, SMD, 0603	Yageo Corporation	RC0603FR-0710KL
0	R119	DO NOT POPULATE , resistor, Thick Film, 10 kΩ, 1%, 1/10W, SMD, 0603	Yageo Corporation	RC0603FR-0710KL
1	R122	Resistor, Thick Film, 1 kΩ, 1%, 1/10W, SMD, 0603	Stackpole Electronics, Inc.	RMCF0603FT1K00
1	R127	Resistor, Thick Film, 8.45 kΩ, 1%, 1/10W, SMD, 0603	Yageo Corporation	RC0603FR-078K45L
6	R128, R131, R200, R301, R302, R303	Resistor, Thick Film, 4.7 kΩ, 1%, 1/10W, SMD, 0603	Vishay/Dale	CRCW06034K70FKEA
1	R130	Resistor, Thick Film, 5.23 kΩ, 1%, 1/10W, SMD, 0603	Panasonic - ECG	ERJ-3EKF5231V

Note 1: The components listed in this Bill of Materials are representative of the PCB assembly. The released BOM used in manufacturing uses all RoHS-compliant components.

Bill of Materials (BOM)

TABLE B-1: BILL OF MATERIALS (BOM) (CONTINUED)

Qty.	Reference	Description	Manufacturer	Part Number
1	R201	Resistor, Thick Film, 100R, 1%, 1/4W, SMD, 1206	Yageo Corporation	RC1206FR-07100RL
1	R300	Resistor, Thick Film, 20 kΩ, 1%, 1/10W, SMD, 0603	Yageo Corporation	RC0603FR-0720KL
2	SW300, SW301	Switch, Slide DPDT, 6V, 300 mA, SMD	C&K Components	JS202011SCQN
2	SW302, SW303	Switch, tactile, SPST, 15V, 20 mA	Panasonic - ECG	EVQ-PAC05R
1	U100	Microchip Analog Power Current Sense Monitor, PAC1942-2, QFN-16	Microchip Technology Inc.	PAC1942T-2E/4MX
1	U200	Microchip Analog Op Amp, 2-Channel, 1.2 MHz, SOIC-8	Microchip Technology Inc.	MCP6072-E/SN
1	U300	Microchip Interface USB I ² C, UART, TSSOP-14	Microchip Technology Inc.	MCP2221A-I/ST
1	U301	IC Interface, 2-bit voltage translator/buffer Micropak-8	ON Semiconductor®/Fairchild Semiconductor®	FXMA2102L8X
1	U302	Microchip Analog LDO, 3.3V, SOT-23A-3	Microchip Technology Inc.	MCP1754ST-3302E/CB

Note 1: The components listed in this Bill of Materials are representative of the PCB assembly. The released BOM used in manufacturing uses all RoHS-compliant components.

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Fax: 31-416-690340

Norway - Trondheim
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Spain - Madrid
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Sweden - Stockholm
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