RENESAS

ISL94202EVKIT1Z GUI

The ISL94202 is a Li-ion battery monitor IC that supports from three to eight series connected cells. It provides complete battery monitoring and pack control. The ISL94202 provides automatic shutdown and recovery from out-of-bounds conditions and automatically controls pack cell balancing.

The internal configuration EEPROM makes the ISL94202 a highly configurable stand-alone device.

This document describes the Microsoft Excel based GUI created to provide a way for you to perform both demonstration and evaluation of the ISL94202. While this document does help to familiarize you with how to interact with the ISL94202 using the GUI, the *ISL94202 Datasheet* should be used for further details about the device.

Note on MS Office Installation

The evaluation kit hardware and software requirements differ depending on which version of MS Office is installed. If the 64-bit version of MS Office is installed, the GUI versions including 64B in the filename must be used in combination with ISO-DONGLE1Z Rev. B. The Rev. B dongle can only be used with the 64B GUIs. This combination also operates on PCs with the 32-bit version of MS Office installed.

Previous versions of the GUIs and Rev. A of the ISO-DONGLE1Z must be used together. These only operate on 32-bit versions of MS Office.

Key Features

- Communicates with the ISL94202 I²C port using a USB to I²C conversion dongle
- Provides the ability to evaluate all important features of the ISL94202
- Complete EEPROM programming capability included
- Customizable Excel Visual Basic for applications source code is included

Specifications

The evaluation GUI is compatible with released versions of the ISL94202 and ISL94203 devices, evaluation kits, and dongles. The EEPROM programming portion of the GUI is compatible with files created by the legacy GUI and ISL94202 EEPROM Programming GUI.

- V_{BAT}/V_{DD} = 4V to 36V
- I²C clock frequency (SCL) = 400kHz

Ordering Information

Part Number	Description
ISL94202IRTZ	ISL94202 48 Ld TQFN
ISL94202EVKIT1Z	ISL94202 evaluation kit, includes dongle
ISO-DONGLE1Z	Rev. A - Isolated USB to I ² C conversion dongle (32-bit MS Office only) Rev. B - Isolated USB to I ² C conversion dongle

Related Information

For a full list of related documents, visit our website:

• ISL94202EVKIT1Z, ISL94202, ISL94203 device pages



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1. Functional Description

The ISL94202 evaluation GUI allows you to communicate with an ISL94202 device to evaluate the features of the device. The evaluation GUI also contains a simplified demonstration GUI, which provides a straight-forward way of understanding some key features of the ISL94202.

The GUI was implemented using Microsoft Excel and Visual Basic for Applications to be both portable and customizable given the included source code. GUI operation does not require Excel or VBA expertise, but customization of the GUI does.

Note: Many of the instructions in this document refer to changing the device thresholds to trigger a fault or another action. In most of these cases (such as cell voltage thresholds), the power supply voltage can also be changed to trigger the action. In all cases, the thresholds can be set as desired and then the voltage they are monitoring can be adjusted to test the function. This document was written with the intention of helping you become familiar with the GUI prior to evaluating the device operation, so the examples are simplified for this purpose.

2. Hardware Setup

An ISL94202 BMS assembly consists of the following components:

- ISL94202EVAL1Z ISL94202 evaluation board
- ISL-DONGLE1Z ISL94202 communications dongle with USB cable
- A resistor ladder board (or target battery pack)
- Power supply

2.1 Evaluation Board

The ISL94202 board as shipped from stock is set up for 8 cells.

Supply current can be monitored by connecting a voltmeter across CS1 and CS2.



Figure 1. ISL94202EVAL1Z Board



2.2 Communications Dongle

The communications dongle is a board designed to isolate the ISL94202 evaluation board assembly ground from the PC and workbench grounds. Most Battery Management Systems (BMS) operate isolated from earth ground. When an oscilloscope probe is connected to the assembly it can provide a path to earth ground, which could potentially reset the ISL94202 in severe cases.

The dongle uses I²C communication in combination with the evaluation GUI to communicate with the ISL94202 device. Connect the Dongle to the PC using the provided USB cable.

Note: The communications dongle should not be connected to the ISL94202 evaluation board when powering up the evaluation board, or the dongle can prevent the ISL94202 from properly powering on.



Figure 2. ISO-DONGLE1Z Board

2.3 Resistor Ladder

A resistor ladder board is used to mimic a cell stack (limited) if a battery pack is not available. AC or heavy load currents and cell balancing cause voltage fluctuations when using a resistor ladder that would not occur with batteries.

Connector J3 can be used to short out center cells for evaluation of systems with fewer than eight cells.

Each cell of the resistor ladder consists of three 300Ω resistors in parallel resulting in 100Ω per cell.



Figure 3. Resistor Ladder



2.4 Power Supply

In many cases a battery pack is not available so the combination of a power supply and a resistor ladder is used. The power supply must be selected so it can supply the ladder, ISL94202, and load at the desired voltage without current limiting.

With the power supply disabled, connect the negative terminal to the GND clip and the positive terminal to the 8-Cell clip on the resistor ladder board.

Set the power supply output voltage to 28V but keep the output disabled. If using a reduced number of cells, set to the appropriate voltage.

Enable the power supply output prior to connecting the dongle and executing the Connect step in the Connect section.

2.5 BMS Assembly

The three boards previously described are connected together as shown in Figure 4.

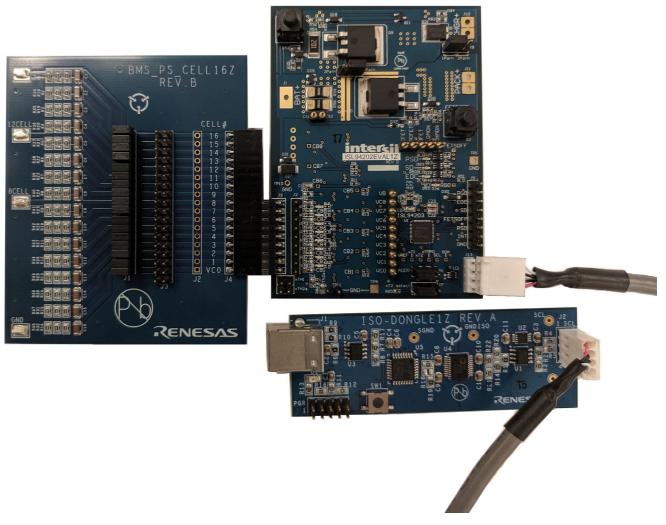


Figure 4. Board Connection



3. Evaluation GUI

The following section contains information on how to use the evaluation portion of the GUI. To ensure proper operation, the steps should be completed in the order they are presented. Completing this section provides you with the level of experience required to feel comfortable using the kit for your application.

3.1 Launch

Open the workbook to get started, there is no installation required. **Note:** Macros are automatically disabled on some PCs. If the message *SECURITY WARNING Macros have been disabled* is visible beneath the menu bar, select **Enable Content**. See Figure 5.

Press the **<Ctrl>** and **<J>** keys simultaneously to start the GUI.

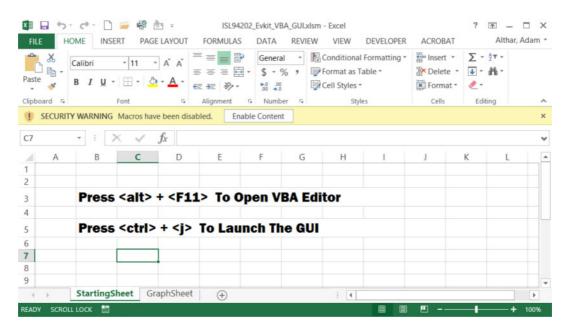


Figure 5. Workbook View

3.2 Connect

The GUI must detect that the dongle is present to operate, this is referred to as the Connect step. Connect the USB cable to the dongle then press the green **Connect** button to start the detection process as shown in Figure 6.

Note: The ISL94202 must be powered up before connecting the dongle to the ISL94202 I²C pins. If the ISL94202 is not powered, the dongle I²C pull-ups can inadvertently provide power to the ISL94202 through the RGO pin and force it into an indeterminate state. This situation must be avoided for proper EEPROM programming and also applies if the ISL94202 is in its Power-Down state. See the *ISL94202 Datasheet* for more details.



Figure 6. Connect Sequence



3.3 Read All

After connecting press the **Read All** button, highlighted in Figure 7. This button reads all relevant information from the device and updates the GUI to reflect this information. Renesas recommends performing a **Read All** whenever the GUI is launched to prevent errors caused by a discrepancy between the GUI information and actual device settings.

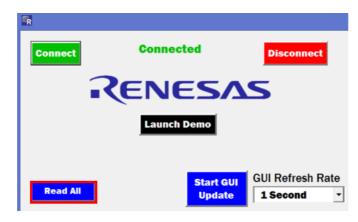


Figure 7. Read All Button

3.4 Default Settings

Upon receiving the ISL94202 evaluation kit the device EEPROM should contain the factory default values. However, if the evaluation kit has been used previously it is possible the EEPROM values have been modified, which could cause problems while using this manual. To reset the device to its default, first navigate to the **Memory Map** tab of the GUI. Then press the **Display Factory Defaults** button on the right side of the GUI, (highlighted in yellow in Figure 8). This updates the display with the factory default values for the configuration memory, but does not write the values to the device. To write the values to the device, press **Write EEPROM** (highlighted in green in Figure 8) to write the default values to the EEPROM. This takes a brief period of time due to the timing required to write to the device EEPROM. A confirmation message should be displayed that the EEPROM was written successfully, as shown in Figure 9. Next, click **Write Registers** (highlighted in red in Figure 8) to write the default configuration settings to the device registers. A confirmation message appears as shown in Figure 9 if the registers were successfully written.

Memory	Мар					
0x00: 0x2A	0x15: 0x02	0x2A: 0x93	0x3F: 0x0A	User EEPR	<u>NOM</u>	
0x01: 0x1E	0x16: 0xA0	0x2B: 0x0A	0x40: 0x64	0x50: 0x	00	
0x02: 0xD4	0x17: 0x44	0x2C: 0xB6	0x41: 0x06	0x51: 0x	00	
0x03: 0x0D	0x18: 0xA0	0x2D: 0x04	0x42: 0x10	0x52: 0x	00	
0x04: 0xFF	0x19: 0x44	0x2E: 0x3E	0x43: 0x06	0x53: 0x	00	
0x05: 0x18	0x1A: 0xC8	0x2F: 0x05	0x44: 0xAA	0x54: 0x	00	
0x06: 0xFF	0x1B: 0x60	0x30: 0xB6	0x45: 0x06	0x55: 0x	00	
0x07: 0x09	0x1C: 0x55	0x31: 0x04	0x46: 0x0F	0x56: 0x	00	
0x08: 0x7F	0x1D: 0x0A	0x32: 0x3E	0x47: 0xFC	0x57: 0x	00	Display
0x09: 0x0E	0x1E: 0x70	0x33: 0x05	0x48: 0xFF			Factory
0x0A: 0x00	0x1F: 0x0D	0x34: 0xF2	0x49: 0x83			Defaults
0x0B: 0x06	0x20: 0x10	0x35: 0x0B	0x4A: 0x00			Write File
0x0C: 0xFF	0x21: 0x00	0x36: 0x93	0x4B: 0x40			
0x0D: 0x0D	0x22: 0xAB	0x37: 0x0A				Write EEPROM
0x0E: 0xAA	0x23: 0x01	0x38: 0xB6				Write Registers
0x0F: 0x07	0x24: 0x02	0x39: 0x04				while Registers
0x10: 0x01	0x25: 0x08	0x3A: 0x3E				Read File
0x11: 0x08	0x26: 0x02	0x3B: 0x05				
0x12: 0x01	0x27: 0x08	0x3C: 0xF2				Read EEPROM
0x13: 0x08	0x28: 0xF2	0x3D: 0x0B				Read Registers
0x14: 0x14	0x29: 0x0B	0x3E: 0x93				Reau Registers

Figure 8. Memory Map Tab



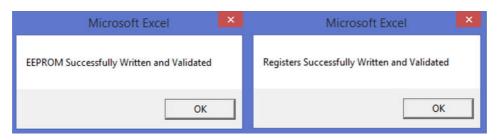


Figure 9. EEPROM and Register Write Confirmation Messages

After this, the device is in its factory configuration.

3.5 Operating Mode

After powering on, the device enters Normal mode. The mode can be confirmed in the **Mode** box on the **Meas** tab (highlighted in Figure 10). In Normal mode the device monitors for overcurrent and scans the voltages every 32ms.

Charging	No
Discharging	No
LD PRSNT	No
CH PRSNT	No
Mode	Normal

Figure 10. Mode Display

Depending on the amount of time that has elapsed between powering on the device and checking the mode, the device may no longer be in Normal mode. If the mode is displayed as **Sleep**, press the **WakeUp** button located on the ISL94202 evaluation board. If the mode is displayed as **Idle** or **Doze**, no action is required. Switch to the **System** tab. In the bottom right corner, select **Idle** from the **Mode Set** drop-down menu and press the **Write Mode** button. This puts the device into Idle mode. Press the **Read Mode** button and confirm the IN_IDLE bit is set. This sequence is shown in Figure 11.

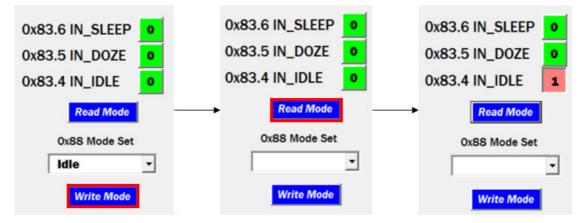


Figure 11. Idle Mode Write/Read Sequence

While in Idle mode the device scans at a rate of 256ms and can perform communication. A charge or discharge current detection causes the device to transition back to Normal mode. On the bottom left of the **System** tab select **0 Minutes** from the Idle and Doze mode timer as shown in Figure 12. Press **Write Timers** to write the setting to the device, then press **Read Timers** to confirm the setting was written properly. This timer controls the

amount of time required without a current flow detection for the ISL94202 to transition from Normal mode to Idle mode and Idle mode to Doze mode.

0x48.7.4 Sleep Mode Timer
240 Minutes 🔹
0x48.3:0 Idle and Doze Mode Timer
o minutes
Write Timers Read Timers

Figure 12. Mode Timers

Press **Read Mode** and note that **IN_IDLE** is still set. This is because when Register 0x88 is used to set the device mode, the mode does not transition due to the timers. To allow the timers to cause mode transition Register 0x88 must be cleared. To do this, select **Clear** from the **Mode Set** menu then press the **Write Mode** button. Next, press the **Read Mode** button. The **IN_DOZE** indicator should be set as seen in Figure 13. In Doze mode, the device scan rate is once every 512ms.

0x83.6 IN_SLEEP	0
0x83.5 IN_DOZE	1
0x83.4 IN_IDLE	0
Read Mode	

Figure 13. IN_DOZE Status Indicator

Select **15 Minutes** from the **Idle and Doze Mode Timer** drop-down list, then write and read the timers to set and confirm the mode. Next, select **0 Minutes** from the **Sleep Mode Timer** drop-down menu and perform a **Write Timers** followed by a **Read Timers**. Next, perform a **Read mode**. The **IN_SLEEP** indicator should now be set as seen in Figure 14.

0x83.6 IN_SLEEP	1
0x83.5 IN_DOZE	0
0x83.4 IN_IDLE	0
Read Mode	

Figure 14. IN_SLEEP Status Indicator

Attempt to set the device into idle by using the **Mode Set** drop-down menu as previously discussed and perform a **Read Mode**. The **IN_SLEEP** indicator is still set. This is because in Sleep mode the device cannot be written to. In Sleep mode, the only operational components of the ISL94202 are the 2.5V regulator and wake-up circuits. Press the **WakeUp** button on the ISL94202 evaluation board. This connects the CHMON pin to VBAT causing the device to think a charger is connected and takes the device out of Sleep mode.

3.6 Cell Configuration

The default cell count for the ISL94202 is three cells. To check the cell configuration of the device, navigate to the **System** tab and locate the region labeled **0x49 Cell Configuration**. Select **8 Cells** from the drop-down menu. This writes the value to Register 0x49 to configure the ISL94202 for eight cells. To confirm the value was set properly, press the **Read Cell Config** button (highlighted in Figure 15) and verify the label reads 8 Cells.





3.7 Overvoltage (OV)

Navigate to the Meas tab and press the **Read Measurements** button to update the GUI with the latest measurements from the ISL94202. For now, look at the cell voltages as shown in Figure 16.

Cell08:	3.500 V
Cell07:	3.505 V
Cell06:	3.502 V
Cell05:	3.492 V
Cell04:	3.488 V
Cell03:	3.485 V
Cell02:	3.495 V
Cell01:	3.490 V

Figure 16. Cell Voltage Measurements

The highest cell voltage of the enabled cells is highlighted in pink, and the lowest cell voltage is highlighted in blue. This information can also be found on the **Meas** tab, as shown in Figure 17.

dVCell:	17.5824	mV	Cell #
VcMax:	3.5036	V	@ 7
VcMin:	3.4860	V	@ 3

Figure 17. VcMax/VcMin Display

Make mental note of the VcMax voltage and switch to the **Voltage** tab. Locate the boxes labeled **0x01 - 0x00 OV Threshold** and **0x03 - 0x02 OV Recovery**. Change the value in the threshold box to a value ~200mV beneath the VcMax value previously read and change the value in the recovery box to a value ~300mV beneath the VcMax value previously read. Next, press **Write Thresh** button to write the new threshold to the device and then the **Read** button to confirm the threshold was set properly. This entire sequence is shown in Figure 18.

Note: When the **Write Thresh** button is pressed, the values entered in the boxes change to the closest possible setting. This reflects the actual value written to the device, which is the closest threshold value compatible with the device based on what was entered in the threshold box. For more information, see the *ISL94202 Datasheet*.

VCell Threshold Lim	its			VCell Threshold Lim	nits			VCell Threshold Lin	nits	
0x01 - 00 OV Threshold 3.3 V =0x1E2A	0x03 - 02 OV Recovery 3.1 V =0x0DD4	0x09 - 08 OV Lockout 4.34989 V =0x0E7F		0x01 - 00 OV Threshold 3.299634 V =0x1E2A	0x03 - 02 OV Recovery 3.100366 V =0x0DD4	0x09 - 08 OV Lockout 4.34989 V =0x0E7F		0x01 - 00 OV Threshold 3.299634 V =0x1AFF	0x03 - 02 OV Recovery 3.100366 V =0x0A55	0x09 - 08 0V Lockout 4.34989 V =0x0E7F
2.699487 V =0x18FF	0x07 - 06 UV Recovery 2.99956 V =0x09FF	0x0B - 0A UV Lockout 1.80044 V =0x0600		0x05 - 04 UV Threshold 2.699487 V =0x18FF	0x07 - 06 UV Recovery 2.99956 V =0x09FF	0x0B - 0A UV Lockout		0x05 - 04 UV Threshold 2.699487 V =0x18FF	0x07 - 06 UV Recovery 2.99956 V =0x09FF	0x0B - 0A UV Lockout 1.80044 V =0x0600
0x0D - OC EOC Threshold 4.199853 V =0x0DFF	0x0F - OE Low Voltage Charge 2.29978 V =0x07AA	0x45 - 44 Sleep Level Voltage 1.999707 V =0x06AA		0x0D - OC EOC Threshold 4.199853 V =0x0DFF	0x0F - 0E Low Voltage Charge	0x45 - 44 Sleep Level Voltage 1.999707 V =0x06AA		0x0D - OC EOC Threshold 4.199853 V =0x0DFF	0x0F - 0E Low Voltage Charge	0x45 - 44 Sleep Level Voltage
0x11 - 10 OV Delay Time Out 1 s =0x0801	0x13 - 12 UV Delay Time Out 1 s =0x0801	0x15 - 14 Open-Wire Timing (OWT) 20 ms =0x0214		0x11 - 10 OV Delay Time Out	0x13 - 12 UV Delay Time Out 1 s =0x0801	0x15 - 14 Open-Wire Timing (OWT) 20 ms =0x0214		0x11 - 10 OV Delay Time Out 1 s =0x0801	0x13 - 12 UV Delay Time Out	0x15 - 14 Open-Wire Timing (OWT) 20 ms =0x0214
≪is ⊂ min	≪is ⊂ min	⊂µs ≇ms		≪is ⊂ min	≪is ⊂ min	⊂µs ≪ims		• ≪is ⊂ min	‴s ⊂ min	⊂µs ≇ms
⊂µs ⊂ms	⊂µs ⊂ms	0x80.3 UVLO	0	⊂µs ⊂ms	⊂µs ⊂ms	0x80.3 UVL0		⊂µs ⊂ms	⊂µs ⊂ms	0x80.3 UVL0
		0x80.2 UV	0			0x80.2 UV	0			0x80.2 UV 0
		0x80.1 OVL0	0			0x80.1 OVLO	0			0x80.1 OVL0
Ox48.5 DFET on during UV :N	ormal Operation	0x80.0 OV		Ox48.5 DFET on during UV	Normal Operation	0x80.0 OV		Ox48.5 DFET on during UV	Normal Operation	0x80.0 OV
Ox48.4 CFET on during OV :N		0,0010 01		Ox48.4 CFET on during OV		0.0010 01	-	Ox48.4 CFET on during OV		
Ox48.3 Enable UVLO PD :Disa	bled	0x01.7:4 Charge 0x05.7:4 Load Detect Pulse Width Detect Pulse Width		Ox48.3 Enable UVLO PD :Dis	abled	Ox01.7:4 Charge Ox05.7:4 Detect Pulse Width Detect Pul 1 ms - 1 ms		Ox48.3 Enable UVLO PD :Dis Write Thresh	abled Read	Ox01.7:4 Charge Ox05.7:4 Load Detect Pulse Width Detect Pulse Width 1 ms • 1 ms •

Figure 18. OV Thresh Configuration Sequence

If done correctly, the **OV Fault** indicator bit is also set. To confirm this, perform a **Read All**. In the **Faults And Indicators** box on the left-hand side of the GUI should now show OV. Additionally, the CFET should now be off as indicated by its gray color. Figure 19 shows how these status indicators should look.

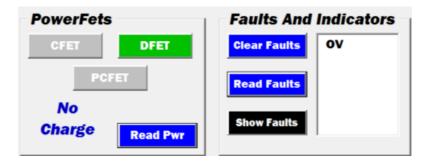


Figure 19. OV Fault

On the **Voltage** tab, set the **OV Threshold** and **Recovery** to their default values, which are approximately 4.25V and 4.15V, respectively. Then, press the **Clear Faults** button followed by the **Read Faults** button in the **Faults And Indicators** box. Next, perform another **Read Pwr**. The **Faults And Indicators** should display no faults, and both CFET and DFET should be enabled indicated by their green color as seen in Figure 20.

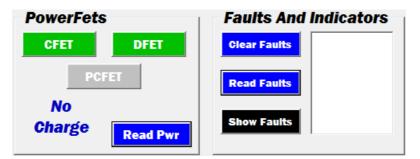


Figure 20. No Faults Present

3.8 Overvoltage Lockout (OVLO)

On the **Voltage** tab, locate the box labeled **0x09 - 08 OV Lockout**. Adjust the value in the box to ~100mV beneath the read VcMax value. Adjust the value in the **OV Threshold** box to a value ~200mV beneath the VcMax value and **OV Recovery** ~300mV beneath the VcMax value as previously done. Perform a **Write Thresh** to write the settings to the device followed by a **Read** to confirm the settings were written properly. The **OVLO** indicator on the **Voltage** tab should now be set. Perform a **Read All** and examine the **PowerFets** and **Faults And Indicators** boxes. The **PowerFets** box should indicate the CFET has been disabled as shown in Figure 21.



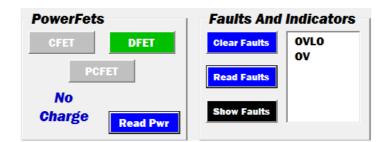


Figure 21. OVLO Fault

Look at the ISL94202 evaluation board. A number of red LEDs should be lit, including one labeled **PSD** as shown in Figure 22.

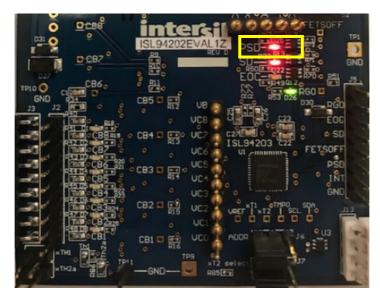


Figure 22. Lit PSD Indicator

This LED indicates that the PSD pin is being driven high. This pin can be used with additional external components to blow a fuse when specified out of bounds conditions occur, such as OVLO. Write the OV Threshold, OV Recovery, and OV Lockout values to their default. Perform a **Clear Faults** followed by a **Read All** to confirm that the OVLO condition is no longer present.

3.9 Undervoltage (UV)

Navigate back to the **Meas** tab and perform a **Read Measurements**. This time make a mental note of the VcMin voltage value and return to the **Voltage** tab. Locate the boxes labeled **0x05 - 04 UV Threshold** and **0x07 - 06 UV recovery**. Change the value in the threshold box to a value ~200mV above the previously read VcMin value, and change the value in the recovery box to a value ~300mV above the previously read VcMin. Perform a **Write Thresh** to write the values followed by a **Read** to confirm the values were set properly. The **UV indicator** on the **Voltage** tab should now be set. Perform a **Read All**. The GUI should display the UV fault that is present and the DFET should be off, as indicated by its gray color as shown in Figure 23.



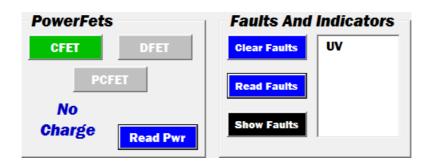


Figure 23. UV Fault

Return to the **Voltage** tab. Return the **UV Threshold** and **UV Recovery** boxes to their default values, then perform a **Write Thresh** followed by a **Read** to set and confirm the original values were set properly.

3.10 Undervoltage Lockout (UVLO)

On the **Voltage** tab locate the box labeled **0x0B** - **0A UV Lockout**. Adjust the value in the box to ~100mV above the read VcMin value. Adjust the value in the **UV threshold** box to a value ~200mV above the VcMin value and **UV Recovery** to a value ~300mV above the VcMin value as done previously. Perform a **Write Thresh** to write the thresholds to the device followed by a **Read** to confirm the settings were written properly. The **UVLO indicator** should now be set. Perform a **Read All** and examine the **PowerFets** and **Faults And Indicators** boxes. The DFET should be disabled and the **Faults And Indicators** box should list UVLO as shown in Figure 24.

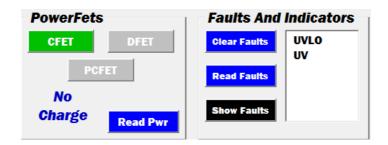
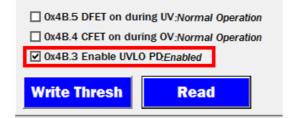
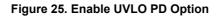


Figure 24. UVLO Fault

Note: The ISL94202 can be configured to power down when a UVLO condition occurs. To enable this, check the box labeled **0x4B.3 Enable UVLO PD** on the bottom of the **Voltage** tab as shown in Figure 25. When the device is in power-down, it can only wake up with a charger detection (**Wake up** button on EvKit). If the cell voltage(s) are below the UVLO threshold the device immediately returns to power-down.





Change the values in the **UV Threshold**, **UV Recovery**, and **UV Lockout** boxes to their original values. Then perform a **Write Thresh** followed by a **Clear Faults**. Next, perform a **Read All** to confirm the settings were written properly and the UV and UVLO faults are no longer present.

3.11 Current Readings

Navigate to the **Meas** tab and perform a **Read Measurements**. The following sections are primarily concerned with the current related measurements shown in Figure 26. The areas to note are the **IPack** measurements, shown both as a voltage and calculated current.

		Charging No	
IPack:	5.6791 mV	Discharging Yes	
IPack:	28.3956 mA	LD PRSNT No	
Timer:	000.000 ms	CH PRSNT No	
		Mode Norma	ı

Figure 26. Current Measurements and Indicators

Note: The values displayed in the **IPack** boxes are only accurate if there is enough current for either the Charging or Discharging bits to be set. If they are not set, the data from the IPack measurement cannot be considered reliable. In the GUI this is noted by the **IPack** boxes having a red background, as shown in Figure 27. To simulate a charge or discharge current, apply a voltage across the sense resistors by connecting a floating power supply to the CS1 and CS2 pins.

IPack:	277.186	mV
IPack:	27.7187	Α
Timer:	000.000	ms

Figure 27. Invalid Current Measurements

3.12 Discharge Overcurrent (DOC)

Configure the board to simulate a discharge current, then navigate to the **Meas** tab and execute **Read Measurements**. Make note of the IPack measurement in mV. Then switch to the **IPack** tab and locate the drop-down menu labeled **0x16 6:4 Discharge Overcurrent Threshold** and select a value from the drop-down menu that is less than the measured IPack voltage. The value is immediately written to the device when it is selected from the drop-down menu. Perform a **Read AII** and examine the **PowerFets** and **Faults And Indicators** boxes. Both FETs should be disabled and the DOC should be listed as a fault as seen in Figure 28.

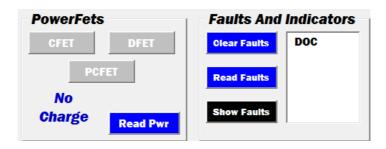


Figure 28. DOC Fault

Return the DOC Threshold to its original value and perform a **Clear Faults** followed by a **Read All** to verify the fault is no longer present.

3.13 Discharge Short-Circuit (DSC)

On the **IPack** tab locate the drop-down menu labeled **0x1B - 1A Discharge Short-Circuit Threshold**. Select a value less than the measured IPack voltage value. The value is immediately written to the device when it is selected from the drop-down menu. Perform a **Read All** and examine the **PowerFets** and **Faults And Indicators** boxes. Both FETs should be disabled and DSC should be listed as a fault as seen in Figure 29.

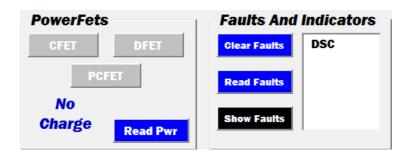


Figure 29. DSC Fault

3.14 Charge Overcurrent (COC)

Configure the board to simulate a charge current, then navigate to the **Meas** tab and execute **Read Measurements**. Confirm the charging indicator is set and make note of the IPack mV value. Return to the **IPack** tab and locate the drop-down menu labeled **0x18.6:4 Charge Overcurrent Threshold**. Select a value from the drop-down list lower than the previously read IPack mV value. The value is immediately written to the device when it is selected from the drop-down menu. Perform a **Read AII** and examine the **PowerFets** and **Faults And Indicators** boxes. Both FETs should be disabled and the COC should be listed as a fault as seen in Figure 30.

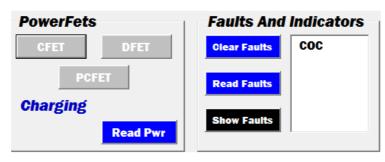


Figure 30. COC Fault



3.15 Internal Over-Temperature (IOT)

Navigate to the **Meas** tab and perform a **Read Measurements**. Locate the various temperature related measurements shown in Figure 31.

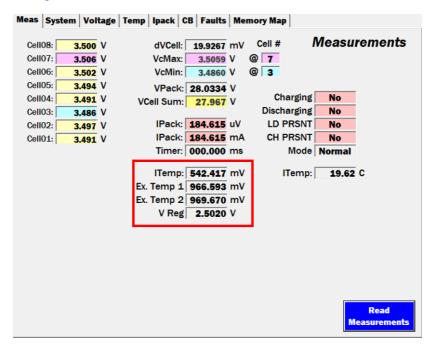


Figure 31. Temperature Related Measurements

Make note of the displayed ITemp value. Navigate to the **Temp** tab and locate the boxes labeled **0x41 - 40 Internal OT Voltage** and **0x43 - 42 Internal OT Recovery Voltage** as shown in Figure 32.





Change the value in the **Internal OT Voltage** box to a value ~150mV less than the measured ITemp voltage. Change the value in the **Internal OT Recovery Voltage** box to a value ~100mV less than the measured ITemp voltage. Perform a **Write Thresh** to write the settings to the device then a **Read** to confirm the setting was written properly. The **IOT fault indicator** on the **Temp** tab should now be set. Perform a **Read Faults** in the **Faults And Indicators** box and a **Read Pwr** in the **PowerFets** box. The **Faults and Indicator** section should display that an IOT fault is present, and CFET and DFET should both be disabled as shown by their gray color, as seen below in Figure 33.

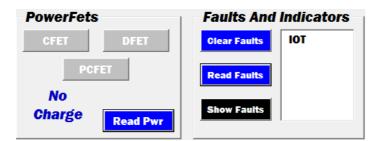


Figure 33. IOT Fault



Return the IOT Voltage and IOT Recovery Voltage values to their original values and perform a **Write Thresh**. Then perform a **Clear Faults** followed by a **Read All** to confirm that the IOT Voltage values were properly set and the IOT fault is no longer present.

3.16 Charge Over-Temperature (COT)

Go to the **Meas** tab and perform a **Read Measurements**. Make note of the Ex. Temp 1 and Ex. Temp 2 values. Switch to the **Temp** tab and locate the boxes labeled **0x31 - 30 Charge OT Voltage** and **0x33 - 32 Charge OT Recovery Voltage** as shown in Figure 34.

Note: For the COT/CUT and DOT/DUT faults to set, the corresponding charge/discharge current direction bit must also be set.

Meas System Voltage Temp	Ipack CB Faults Memory Map	
0x31 - 30 Charge OT Voltage 0.53011 V =0x04B6	0x33 - 32 Charge OT Recovery Voltage 0.58989 V =0x053E	0x80.6 COT 0
0x35 - 34 Charge UT Voltage 1.344176 V =0x0BF2	0x37 - 36 Charge UT Recovery Voltage 1.18989 V =0x0A93	0x80.7 CUT 0
0x39 - 38 Discharge OT Voltage 0.53011 V =0x04B6	0x3B - 3A Discharge OT Recovery Voltage 0.58989 V =0x053E	0x80.4 DOT 0
0x3D - 3C Discharge UT Voltage 1.344176 V =0x0BF2	0x3F - 3E Discharge UT Recovery Voltage	0x80.5 DUT 0
0x41 - 40 Internal OT Voltage 0.719121 V =0x0664	0x43 - 42 Internal OT Recovery Voltage 0.682198 V =0x0610	0x81.0 IOT 0
Write Thresh Read	4	

Figure 34. Charge Over-Temperature Thresholds

Replace the value in the **Charge OT Voltage** box with a value 50mV above the Ex. Temp 1 and Ex. Temp 2 values. Replace the value in the **Charge OT Recovery Voltage** box with a value 100mV above the Ex. Temp 1 and Ex. Temp 2 values. Perform a **Write Thresh** followed by a **Read** to set the new voltage thresholds and confirm they were properly set. The **COT indicator** on the **Temp** tab should now be set. Perform a **Read All** and examine the **PowerFets** and **Faults And Indicators** boxes. The CFET should now be disabled and COT should be listed in the **Faults And Indicators** box as seen in Figure 35.

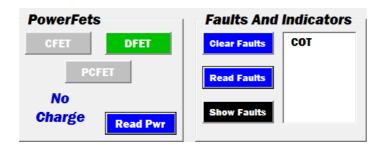


Figure 35. COT Fault



Change the Charge OT Voltage and Charge OT Recovery voltages to their default values and perform a **Write Thresh** followed by a Clear Faults. Perform a **Read All** to confirm the voltage thresholds were written properly and the fault is no longer present.

3.17 Charge Under-Temperature (CUT)

On the **Temp** Tab locate the boxes labeled **0x35 - 34 Charge UT Voltage** and **0x37 - 36 Charge UT Recovery Voltage** shown in Figure 36.

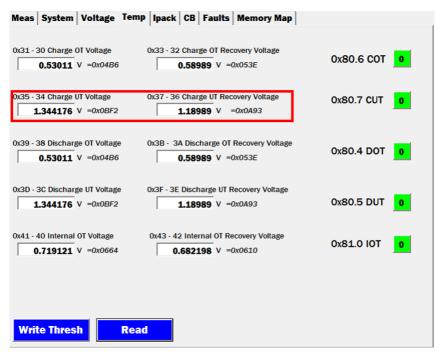


Figure 36. Charge Under-Temperature Thresholds

Replace the value in the **Charge UT Voltage** box with a value ~50mV below the measured Ex. Temp 1 and Ex. Temp 2 values and replace the value in the **Charge UT Recovery Voltage** box with a value ~100mV below the measured Ex. Temp 1 and Ex. Temp 2 values. Perform a **Write Thresh** followed by a **Read** to write the thresholds to the device and confirm they were written properly. The **CUT indicator** on the **Temp** tab should now be set. Perform a **Read All** and examine the **PowerFets** and **Faults And Indicators** blocks. The DFET should be disabled and CUT should be listed in the **Faults And Indicators** box as shown in Figure 37.

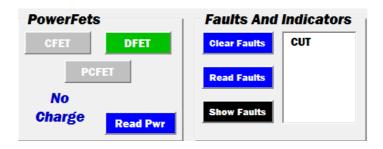


Figure 37. CUT Fault

Write the Charge UT Voltage and Charge UT Recovery Voltage values to their original value and perform a **Write Thresh**. Next, perform a **Read All** to confirm the voltage thresholds were set properly and the CUT fault is no longer present.

3.18 Discharge Over-Temperature (DOT)

On the **Temp** tab locate the boxes labeled **0x39 - 38 Discharge OT Voltage** and **0x3B - 3A Discharge OT Recovery Voltage**, highlighted in Figure 38.

Note: For the DOT/DUT faults to set, the discharge current direction bit must also be set.

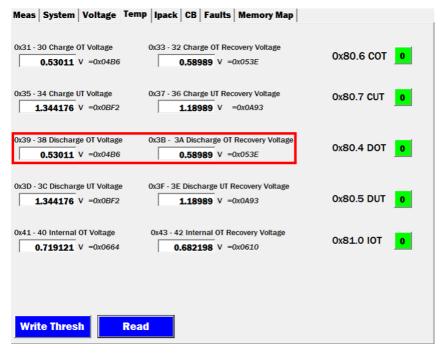


Figure 38. Discharge Over-Temperature Thresholds

Replace the value in the **Discharge OT Voltage** box with a value 50mV above the Ex. Temp 1 and Ex. Temp 2 values. Replace the value in the **Discharge OT Recovery Voltage** box with a value 100mV above the Ex. Temp 1 and Ex. Temp 2 values. Perform a **Write Thresh** followed by a **Read** to set the new voltage thresholds and confirm they were properly set. The **DOT indicator** on the **Temp** tab should now also be set. Perform a **Read All** and examine the **PowerFets** and **Faults And Indicators** boxes. The DFET should be disabled, and DOT should be listed in the **Faults and Indicator** box as seen in Figure 39.

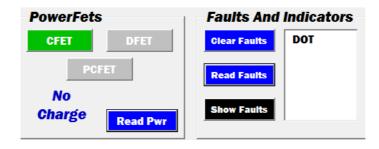


Figure 39. DOT Fault

Write the Discharge OT Voltage and Discharge OT Recovery Voltage values to their original values and perform a **Write Thresh**. Next, perform a **Read All** to confirm the voltage thresholds were set properly and the DOT fault is no longer present.

3.19 Discharge Under-Temperature (DUT)

On the Voltage tab locate the boxes labeled 0x3D - 3C Discharge UT Voltage and 0x3F - 3E Discharge UT Recovery Voltage shown in Figure 40.

Meas System Voltage Temp Ipack CB Faults Memory Map	
0x31 - 30 Charge OT Voltage 0x33 - 32 Charge OT Recovery Voltage 0.53011 V =0x04B6 0.58989 V =0x053E	0x80.6 COT
0x35 - 34 Charge UT Voltage 0x37 - 36 Charge UT Recovery Voltage 1.344176 V =0x0BF2 1.18989 V =0x0A93	0x80.7 CUT 0
0x39 - 38 Discharge OT Voltage 0x3B - 3A Discharge OT Recovery Voltage 0.53011 V =0x04B6 0.58989 V =0x053E	0x80.4 DOT 0
0x3D - 3C Discharge UT Voltage 0x3F - 3E Discharge UT Recovery Voltage 1.344176 V =0x0BF2 1.18989 V =0x0A93	0x80.5 DUT 0
0x41 - 40 Internal OT Voltage 0x43 - 42 Internal OT Recovery Voltage 0.719121 V =0x0664 0.682198 V =0x0610	0x81.0 IOT 0
Write Thresh Read	

Figure 40. Discharge Under-Temperature Thresholds

Replace the value in the **Discharge UT Voltage** box with a value ~50mV below the measured Ex. Temp 1 and Ex. Temp 2 values and replace the value in the **Discharge UT Recovery Voltage** box with a value ~100mV below the measured Ex. Temp 1 and Ex. Temp 2 values. Perform a **Write Thresh** followed by a **Read** to write the thresholds to the device and confirm they were written properly. The **DUT indicator** on the **Temp** tab should now be set. Perform a **Read All** and examine the **PowerFets** and **Faults And Indicators** blocks. The DFET should be disabled and DUT should be listed in the **Faults And Indicators** box as shown in Figure 41.

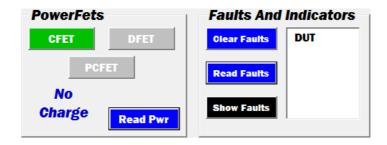


Figure 41. DUT Fault

Restore the Discharge UT Voltage and Discharge UT Recovery Voltage values back to their original values and perform a **Write Thresh** followed by a **Clear Faults**. Next, perform a **Read All** to confirm the voltage thresholds were written properly and the fault is no longer present.



3.20 Cell Fail

Go to the Meas tab and perform a Read Measurements. Locate the dVCell value (highlighted in Figure 42).

Meas	Sys	tem	Vol	tage	Temp	lpack	СВ	Faults	Me	mory Maj	p		
							_					Maaau	rements
Cell			.500			dVCel	-	21.0989	mV	Cell #	'	viedsu	rements
Cell	07:	3	.506	V		VcMax	:	3.5059	v	@ 7			
Cell	06:	3	.505	v		VcMin	:	3.4848	V	@ 3			
Cell	05: 🛛	3	.494	V		VPack	c 2	8.0334	v				
Cell	04: 🛛	3	.491	V	VC	ell Sum	n: 🗖	27.970	v	Ch	narging	No	
Cell	03: 🛛	3	.485	V			,			Disch	narging	No	
Cell	02:	3	.497	V		IPack	: 1	67.033	uV	LD I	PRSNT	No	
Cell	01:	3	.493	v		IPack	: 1	67.033	mA	CHI	PRSNT	No	
						Time	: 0	00.000	ms		Mode	Normal	
							_				_		-
							_	39.780			ITemp:	18.20	С
							_	85.934					
					Ex.	Temp :	2 9	85.934	mV				
						V Re	g	2.5011	v				
												M	Read easurements

Figure 42. dVCell Value

Switch to the CB tab and locate the boxes labeled 0x21 - 20 CB Min Delta Threshold and 0x23 - 22 CB Max Delta Threshold (highlighted in Figure 43).

Setup Thresholds			
Cell Balancing Threshol	d		
0x1D - 1C CB Min Threshold 3.100366 V =0x0A55	0x1F - 1E CB Max Threshold 4.032234 V =0x0D70	0x83.3 CBUV 0x83.2 CBOV	0
0x21 - 20 CB Min Delta Threshold 0.018755 V =0x0010	0x23 - 22 CB Max Delta Threshold 0.500513 V =0x01AB		
0x29 - 28 CB Min Temp Limit 1.344176 V =0x0BF2	0x2B - 2A CB Min Temp Recovery Level 1.18989 V =0x0A93	0x83.1 CBUT	0
0x2D - 2C CB Max Temp Limit 0.53011 V =0x04B6	0x2F - 2E CB Max Temp Recovery Level 0.58989 V =0x053E	0x83.0 CBOT	0
Write Thresh Read			

Figure 43. Cell Balance Delta Thresholds

Replace the value in the **CB Min Delta Threshold** box with a 0. Replace the value in the **CB Max Delta Threshold** with a value beneath the previously read dVCell. Perform a **Write Thresh** followed by a **Read** and confirm the thresholds were set properly. Next, perform a Read All and examine the Powerfets box and Faults And Indicators box. The CFET and DFET should be disabled and the **Faults And Indicators** box should list CELL FAIL as shown in Figure 44.

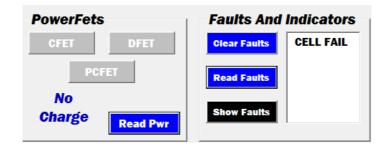


Figure 44. Cell Fail Fault

Return the CB Min Delta Threshold and CB Max Delta Threshold to their original values and perform a **Write Thresh**. Next, perform a **Read All** to confirm the thresholds were written properly.

Switch to the **System** tab and look at the group of check boxes labeled **0x4A System Settings** (highlighted in Figure 45). Check Bit 7 **CELL PSD** and press the **Write** button, followed by a **Read**. The box should remain checked indicating the bit was successfully written to the device. Perform the same steps to create a cell fail condition and examine the ISL94202 evaluation board. The PSD LED should now be illuminated. This is because the CELLF PSD causes the device to drive the PSD pin high when a CELLF condition occurs.

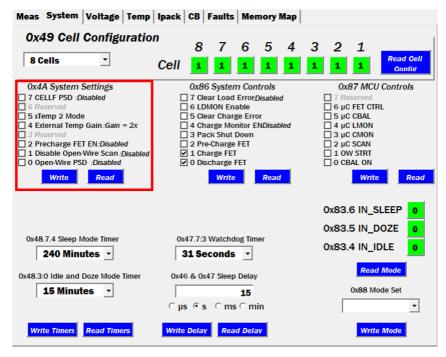


Figure 45. System Settings Register Control Area



4. Demonstration GUI

The evaluation GUI includes a demonstration GUI designed to highlight some of the key features and behaviors of the ISL94202.

4.1 Launching the GUI

To launch the demonstration, first press the green **Connect** button. If the device is not connected, the demonstration GUI does not launch and you are prompted with an error message. After connecting, press the **Launch Demo** button to bring up the demo GUI.



Figure 46. Launching the Demo GUI

4.2 Initializing the Demonstration GUI

After launching the demo GUI press the **Demo Init** button on the left side of the GUI. This configures the ISL94202 with settings appropriate for demonstration then reads these settings into the GUI.

ISL94202 Demo	
Exit Demo	Measurements
CB Min Delta 0.018755 V VCell OV 4.250256 V Over Temp 0.72967 V Charge OC 8mV -	dVCell: 17.5824 mV
Demo Init CB Max Delta 0.500513 V VCell UV 2.699487 V Discharge OC 32mV Image: Color and C	Cell08: 3.500 V Cell07: 3.505 V
Pagin Pagding	Cell07: 3.505 V Cell06: 3.504 V
Graph rype	Cell05: 3.494 V
Write Thresholds CB Min 3.100366 V	Cell04: 3.491 V
PC-FET C-FET D-FET	Cell03: 3.487 V
	Cell02: 3.497 V
IPack: 175.8242 uV IPack: 175.824 mA	Cell01: 3.491 V
No Charge	V Reg 2.5011 V
C-FET Pa	ITemp 541.5385 mV Ex.Temp 1 980.2198 mV
	Ex.Temp 2 981.0989 mV
VPack: 28.0334 V ⊻+	
Faults VCell OV VCell UV	I
Charge OC	
Discharge OC	
IOTF V-	Mode
	Normal

Figure 47. Demo Init Button



4.3 Demonstration System Read

The **Begin Reading** button (highlighted below) causes the GUI to begin continuously reading all relevant information from the device into the demonstration GUI. This begins a continuous read in which the GUI updates with the latest information from the device every two seconds.

	ISL94202 Demo	
Exit Demo	Thresholds	Measurements
CB Min Delta 0.018755 V	VCell OV 4.250256 V Over Temp 0.72967 V Charge OC 8mV -	dVCell: 17.5824 mV
Demo Init	VCell UV 2.699487 V Discharge OC 32mV -	Cell08: 3.500 V
CB Max Delta 0.500513 V		Cell07: 3.505 V
Begin Reading CB Max 4.032234 V	Graph Type	Cell06: 3.504 V
Write Thresholds CB Min 3.100366 V	© VCell C Temperature C Vpack/Ipack Start Graphing	Cell05: 3.494 V
		Cell04: 3.491 V
PC-FET C-FET D-F		Cell03: 3.487 V
		Cell02: 3.497 V
IPack: 175.8242 uV IPack: 175	824 mA	Cell01: 3.491 V
No Charge		V Reg 2.5011 V
C-FET	D FFT -	ITemp 541.5385 mV
	D-FET Pa	Ex.Temp 1 980.2198 mV
VPack: 28.0334 V ⊻+		Ex.Temp 2 981.0989 mV
VFack: 28.0334 V		
- Faults		
VCell OV ISL94202		
VCell UV		
Charge OC		
Discharge OC		
IOTF V-		Mode
Clear Faults		Normal

Figure 48. Begin Reading Button

4.4 Demonstration Graphing

The demonstration GUI enables graphing of measurements of interest versus time.

Note: The graphing function must generate an image in the directory in which the workbook is stored to function properly.

To use the graphing function a continuous read must be in progress, otherwise the **Start Graphing** button is grayed out and locked.

Graph Type			
VCell	C Temperature	O Vpack/Ipack	Start Graphing

Figure 49. Graph Type Options

When a continuous read has been started, the **Start Graphing** button can be pressed. The graph displays information based on which option is selected in the **Graph Type** section. The VCell option displays the voltage of each cell, the temperature option shows both internal and auxiliary temperatures, and the VPack/IPack option shows the VPack and IPack values. When graphing has started you can freely switch between the three graph types without erasing the data for any of them.



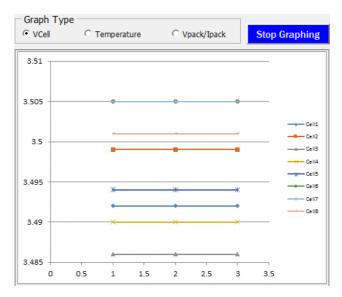


Figure 50. Demo Graph Example

If you want to more closely examine the data that is used to make the graphs, it can be seen on the **Graph Sheet** tab of the GUI workbook. This data gets erased every time **Start Graphing** is pressed.

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	. X ⊡ .	Calibri	- 11	· A A	==	≡ ॐ-	F (General	*	🖶 Conditi	onal Format as Table -		° Insert →	∑ · A ▼ Z
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		- :)	X 🗸	fx										
	А	В	С	D	E	F	G	Н	I.	J	К	L	м	N
1	5	5 Cell 1	Cell 2	Cell 3	Cell 4	Cell 5	Cell 6	Cell 7	Cell 8	Vpack	Ipack	Itemp	Extemp1	Extemp2
2		3.492	3.499	3.486	3.49	3.494	3.505	3.505	3.501	28.0334	175.8242	541.978	971.4286	973.6264
3		3.492	3.499	3.486	3.49	3.494	3.505	3.505	3.501	28.0334	175.8242	541.978	971.4286	973.6264
4		3.492	3.499	3.486	3.49	3.494	3.505	3.505	3.501	28.0334	175.8242	541.978	971.4286	973.6264
5		3.492	3.499	3.486	3.49	3.494	3.505	3.505	3.501	28.0334	175.8242	541.978	971.4286	973.6264
6		3.492	3.499	3.486	3.49	3.494	3.505	3.505	3.501	28.0334	175.8242	541.978	971.4286	973.6264
7														
	Þ	Startin	gSheet	GraphShee	et (†	•								
READ	Y 🛅											Ⅲ 🗉	.	

Figure 51. Graph Data in Workbook

4.5 Demonstration Threshold Modification

Demo Init sets some of the key thresholds in the ISL94202 to values more useful than that of the default values, but these values may need to be modified further. To modify any of the available settings, simply change the value in the boxes, then press the **Write Thresholds** button. A system read should be performed to confirm the settings were written correctly.



		ISL94202 Demo
Exit Demo Demo Init	- Cell Balance Settings CB Min Delta 0.018755 V CB Max Delta 0.500513 V	
Begin Reading Write Thresholds	CB Max 4.032234 V CB Min 3.100366 V	Graph Type C Temperature C Vpack/Ipack Start Graphing

Figure 52. Demonstration Fault and Cell Balance Thresholds

4.6 Demonstration Fault Indicators/Clearing

The bottom left side of the screen provides fault indicators. If any of the faults listed are detected during a scan, the corresponding **Fault** box turns red. This can be seen for VCell OV in Figure 53. Pressing **Clear Faults** writes these bits to 0, but keep in mind some faults cannot be written low while the fault condition persists.

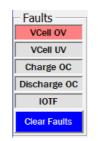


Figure 53. Demonstration Fault Display

4.7 Exiting the Demonstration GUI

To return to the evaluation GUI from the demonstration GUI simply press the **Exit Demo** button in the top left corner of the display.

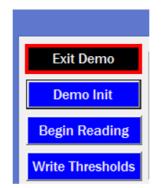


Figure 54. Demonstration Exit Button



A. Appendix

A.1 Appendix A - GUI Overview

The values displayed in Figure 55 are the factory default values. This tab functions identically to the ISL94202 Standalone EEPROM Programmer GUI. For detailed instructions on proper programming, see the ISL94202 EEPROM Programmer User's Guide.

The **Memory Map** tab displays the values of all registers that have EEPROM associated with them or the User EEPROM space. The **Display Factory Defaults** button updates the GUI to show the default values for the EEPROM. The **Read Registers** button updates the **Memory Map** tab for values 0x00 through 0x4B with the values that are currently stored in the connected device shadow registers. **Read EEPROM** updates the **Memory Map** tab with the values stored in the device EEPROM, including the User EEPROM space. The **Read File** button updates the **Memory Map** tab from your selected text file. Text files are generated by the evaluation GUI, stand-alone EEPROM programmer, and legacy ISL94202 evaluation GUI.

Note: Display Factory Defaults, **Read File**, **Read EEPROM**, and **Read Registers** only update the values displayed in the **Memory Map** tab, it does not update the values in the device. The **Write Registers** button updates the shadow registers associated with addresses 0x00 through 0x04B with the values displayed in the Memory Map. The **Write EEPROM** button updates the EEPROM for addresses 0x00 through 0x04B and the User EEPROM. The **Write File** button allows you to create a text file copy of the Memory Map.

Meas Syst	em Voltage	Temp Ipaci	CB Faults	Memory	Map	
Memory	Иар					
0x00: 0x2A	-	0x2A: 0x93	0x3F: 0x0A	User EEPR	OM	
0x01: 0x1E	0x16: 0xA0	0x2B: 0x0A	0x40: 0x64	0x50: 0x	00	
0x02: 0xD4	0x17: 0x44	0x2C: 0xB6	0x41: 0x06	0x51: 0x	00	
0x03: 0x0D	0x18: 0xA0	0x2D: 0x04	0x42: 0x10	0x52: 0x	00	
0x04: 0xFF	0x19: 0x44	0x2E: 0x3E	0x43: 0x06	0x53: 0x	00	
0x05: 0x18	0x1A: 0xC8	0x2F: 0x05	0x44: 0xAA	0x54: 0x	00	
0x06: 0xFF	0x1B: 0x60	0x30: 0xB6	0x45: 0x06	0x55: 0x	00	
0x07: 0x09	0x1C: 0x55	0x31: 0x04	0x46: 0x0F	0x56: 0x	00	
0x08: 0x7F	0x1D: 0x0A	0x32: 0x3E	0x47: 0xFC	0x57: 0x	00	Display
0x09: 0x0E	0x1E: 0x70	0x33: 0x05	0x48: 0xFF			Factory Defaults
0x0A: 0x00	0x1F: 0x0D	0x34: 0xF2	0x49: 0x83			Deraults
0x0B: 0x06	0x20: 0x10	0x35: 0x0B	0x4A: 0x00			Write File
0x0C: 0xFF	0x21: 0x00	0x36: 0x93	0x4B: 0x40			
OxOD: OxOD	0x22: 0xAB	0x37: 0x0A				Write EEPROM
OxOE: OxAA	0x23: 0x01	0x38: 0xB6				Write Registers
0x0F: 0x07	0x24: 0x02	0x39: 0x04				write Registers
0x10: 0x01	0x25: 0x08	0x3A: 0x3E				Read File
0x11: 0x08	0x26: 0x02	0x3B: 0x05				
0x12: 0x01	0x27: 0x08	0x3C: 0xF2				Read EEPROM
0x13: 0x08	0x28: 0xF2	0x3D: 0x0B				Road Registers
0x14: 0x14	0x29: 0x0B	0x3E: 0x93				Read Registers

Figure 55. Factory Default Values

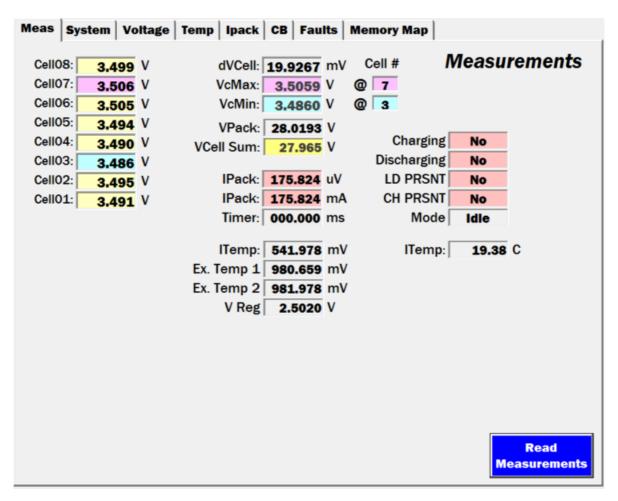


Figure 56. Measurement Tab

The **Meas** tab allows you to see the ISL94202 measurement results from a scan. The equations used to convert from the digital value to the displayed measurement value can be found in the *ISL94202 Datasheet* and the included GUI source code.

The IPack current measurement is calculated by dividing the IPack voltage by the RSense resistor value stored on the **IPack** tab.



Meas System Voltage Temp	Ipack CB Faults Memory I	Мар
0x49 Cell Configuration 8 Cells	87654 Cell 1111	321 Read Cell Config
0x4A System Settings 7 CELLF PSD :Disabled 6 Reserved 5 xTemp 2 Mode 4 External Temp Gain :Gain = 2x 3 Reserved 2 Precharge FET EN :Disabled 1 Disable Open-Wire Scan :Disabled 0 Open-Wire PSD :Disabled Write	Ox86 System Controls 7 Clear Load Error :Disabled 6 LDMON Enable 5 Clear Charge Error 4 Charge Monitor EN :Disabled 3 Pack Shut Down 2 Pre-Charge FET ✓ 1 Charge FET ✓ 0 Discharge FET Write	Ox87 MCU Controls 7 Reserved 6 µC FET CTRL 5 µC CBAL 4 µC LMON 3 µC CMON 2 µC SCAN 1 OW STRT 0 CBAL ON
0x48.7.4 Sleep Mode Timer 240 Minutes • 0x48.3:0 Idle and Doze Mode Timer 15 Minutes • Write Timers Read Timers	Ox47.7:3 Watchdog Timer 31 Seconds ▼ Ox46 & Ox47 Sleep Delay 15 ∩ µs ● s ∩ ms ∩ min Write Delay Read Delay	0x83.6 IN_SLEEP 0 0x83.5 IN_DOZE 0 0x83.4 IN_IDLE 0 Read Mode 0x88 Mode Set

Figure 57. System Tab

The **System** tab contains various settings related to overall system behavior including which cells are present, mode transition timers and delays, mode status bits, and other miscellaneous options.



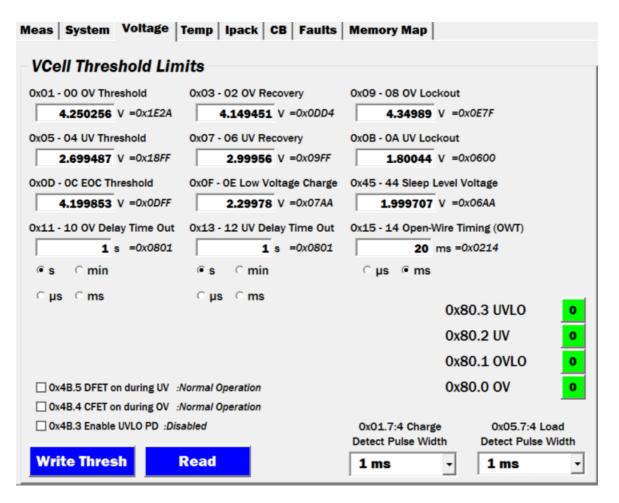


Figure 58. Voltage Tab

The **Voltage** tab allows you to view and change various thresholds and settings related to cell voltage. Options include the overvoltage and undervoltage fault thresholds, recovery thresholds, and delay time outs. Additional voltage options include the sleep level voltage, low voltage charge level, and end-of-charge voltage. There are a number of miscellaneous settings including if DFET can be on during an undervoltage condition, CFET can be on during an overvoltage condition, UVLO causing PD, charge detect pulse width, and load detect pulse width. The UVLO, UV, OVLO, and OV fault status indicators are also found on this tab.



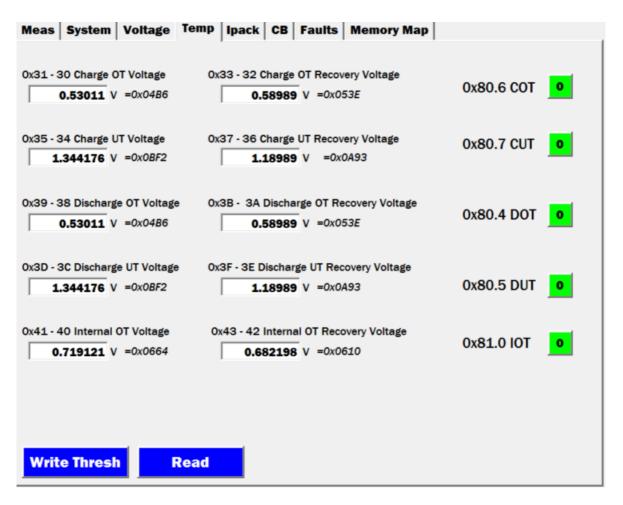


Figure 59. Temperature Tab

The **Temp** tab allows you to view and change various settings related to temperature fault and recovery thresholds. See the *ISL94202 Datasheet* for additional information on temperature conversions and calculations. The various temperature fault indicators are also duplicated on this tab.



Meas System Voltage	Temp Ipack CB Faults	Memory Map
0x17 - 16 Discharge Overcurrent Time Out 160	0x16.6:4 Discharge Overcurrent Threshold	
⊂s ⊂ min ⊂µs ⊂ims		0x85.5:4 CurrentGainSetting
ν με ν πιε		x50 🔽
0x19 - 18 Charge Overcurrent Time Out	Ox18.6:4 Charge Overcurrent Threshold	
160	8mV -	R Sense
⊂s ⊂min ⊂µs ≋ms		0.001 Ω
0x1B - 1A Discharge Short-Circuit Time Out 200	0x1B.6:4 Discharge Short-Circuit Threshold	
⊂s ⊂ min		0x82.3 DCHING
i⊂ µs ⊂ ms		0x82.2 CHING
		0x82.1 CH_PRSNT
		0x82.0 LD_PRSNT
Write Thresh	Read	

Figure 60. IPack Tab

The **IPack** tab allows you to view and modify settings related to pack current. The discharge overcurrent, charge overcurrent and discharge short-circuit thresholds, and timeouts can be adjusted on this tab along with the current gain setting. Importantly, this is where you can set the RSense value the GUI uses to calculate the current displayed on the **Meas** tab. Press **Write Thresh** to store the value after changing it.



Meas System Voltage Temp Ipack CB	Faults Memory Map
Setup Thresholds	
Cell Balancing Setup	8 7 6 5 4 3 2 1
 Ox4B.7 CB During Discharge :Disabled Ox4B.6 CB During Charge :Enabled Ox4B.0 Enable CB during EOC :Disabled Read CB Settings 	Cell 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0x25 - 24 Cell Balance On Time0x27 - 26 Cell Balance Off Time2s2* scs* scmin· μscmsWrite TimesRead Times	

Figure 61. Cell Balance Tab

The **CB** or **Cell Balance** tab is comprised of two sub-tabs. The first sub-tab is the **Setup** tab. This tab contains configuration options for cell balancing behavior, including the cell balance on-time and off -time and if cell balancing can occur during discharge, charge, or end-of-charge. The Cell Balance FET Control Bits can also be read and written to on this tab. See the *ISL94202 Datasheet* before attempting to use these bits, as they require certain settings related to MCU control options (register 0x87, see **Systems tab**) being enabled or disabled.



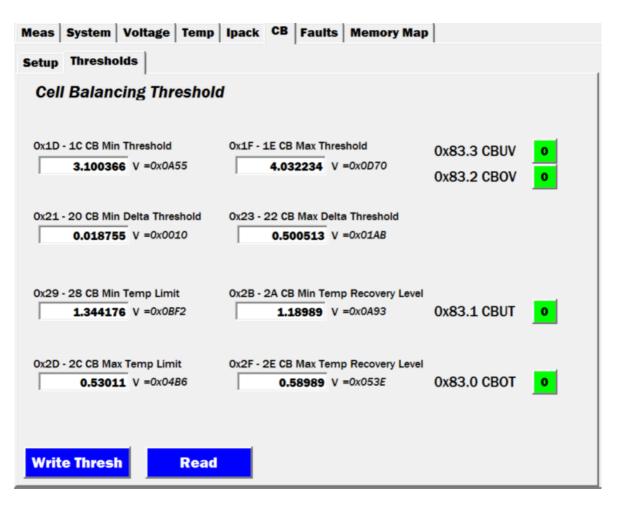
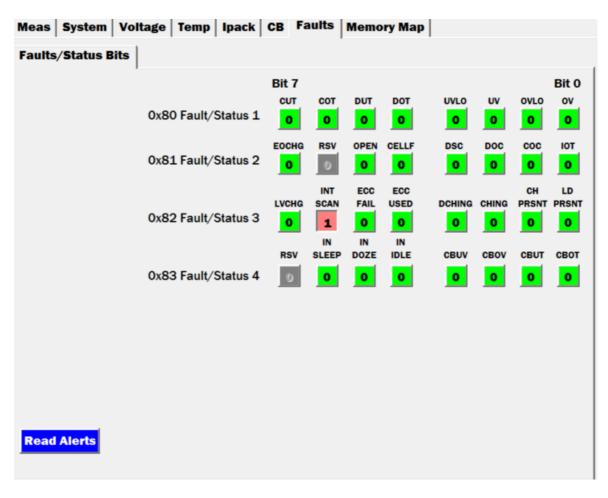


Figure 62. Threshold Tab

The second sub-tab in the **CB** tab is the **Threshold** tab. This tab allows you to view and modify thresholds related to cell balancing. These include the various voltage and temperature limits in which cell balancing is allowed to occur. The fault indicators related to cell balancing are also duplicated on this tab.







The Faults tab shows the status of the various fault and status bits contained in the ISL94202.



5. Revision History

Rev.	Date	Description
1.01	Dec 12, 2023	Applied latest template. Updated page 1 information.
1.00	Sep 12, 2019	Initial release



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