

***bq2060AEVM-001 and  
bq2060AEVM-002  
SBS 1.1 Battery Management Solution  
Evaluation Module***

*User's Guide*

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During normal operation, some circuit components may have case temperatures greater than 60°C. The EVM is designed to operate properly with certain components above 60°C as long as the input and output ranges are maintained. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors. These types of devices can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during operation, please be aware that these devices may be very warm to the touch.

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## Preface

# Read This First

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### ***About This Manual***

This user's guide describes the characteristics and operation of the bq2060AEVM-001 and bq2060AEVM-002 evaluation module. The EVM is used to evaluate the bq2060A battery management system. A complete circuit description, operating procedures, and bill of materials are included. The EVM schematic is appended to the user's guide PDF.

### ***How to Use This Manual***

This document contains the following chapters:

- Chapter 1—Introduction
- Chapter 2—bq2060A-Based Circuit Module
- Chapter 3—Circuit Module Physical Layout
- Chapter 4—EVM Hardware and Software Setup
- Chapter 5—Operation

### ***FCC Warning***

This equipment is intended for use in a laboratory test environment only. It generates, uses, and can radiate radio frequency energy and has not been tested for compliance with the limits of computing devices pursuant to subpart J of part 15 of FCC rules, which are designed to provide reasonable protection against radio frequency interference. Operation of this equipment in other environments may cause interference with radio communications, in which case the user at his own expense will be required to take whatever measures may be required to correct this interference.

[查询"BQ2060AEVM-001"供应商](#)

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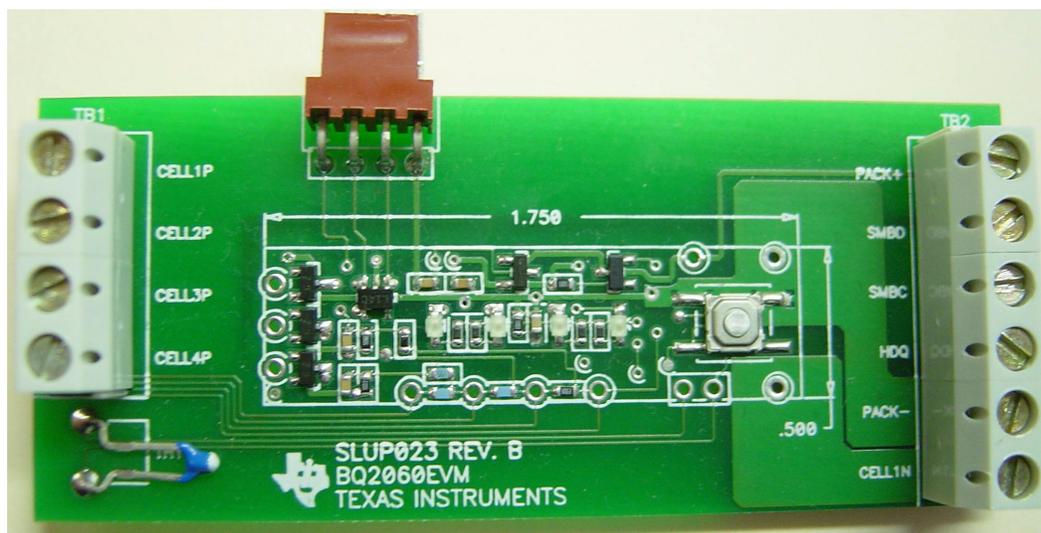
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# Introduction



This EVM is a complete evaluation system for the bq2060A battery management system. The bq2060A is backwards compatible with the bq2060. New features in the bq2060A can be accessed from the EEPROM screen in the EV2200-60 software.

*For this document bq2060A EVM-00X is used for both the bq2060A EVM-001 and the bq2060A EVM-002.*

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## 1.1 Overview

The EVM includes one bq2060A circuit module, a current sense resistor, a thermistor, an EV2200 PC interface board for gas gauge interface, a PC serial cable, and an EEPROM connector. The latest windows based EV2200-60 PC software can be downloaded from the TI web site. The circuit module includes one bq2060A IC and all other onboard components necessary to monitor and predict capacity of Li-Ion or Li-Polymer (bq2060A EVM-001) or NiMH (bq2060A EVM-002) cells. Protection for Li-Ion or Li-Polymer cells is not included on this module. The circuit module connects directly across the cells in a battery. With the EV2200 interface board and software, the user can read the bq2060A data registers, program the chipset for different pack configurations, log cycling data for further evaluation and evaluate the overall functionality of the bq2060A solution under different charge and discharge conditions.

## 1.2 Features

- Complete evaluation system for the bq2060A SBS 1.1 compliant advanced gas gauge
- Populated circuit module for quick setup
- PC software and interface board for easy evaluation
- Software that allows data-logging for system analysis

## 1.3 Kit Contents

- bq2060A circuit module
- EEPROM Interface connector with wires
- Sense resistor
- EV2200 PC interface board
- PC serial cable
- Set of support documentation
- Set of evaluation software disks entitled EV2200-60

To download the latest EVM software:

- 1) Go to [www.ti.com](http://www.ti.com)
- 2) Search for bq2060A, and open the product folder.
- 3) Click on | Development Tools |
- 4) Click the appropriate EVM (LION-001 or NiMH-002) and download the EV2200-60 software under the Contents section.
- 5) You will find software and hardware setup guidelines in Chapter 5 of this document.

## 1.4 Ordering Information

Table 1–1. Ordering Information

EVM Part Number	Chemistry	Configuration	Capacity
bq2060A EVM-001	Li-Ion	3 or 4 cell	800 mAH to 32000 mAH
bq2060A EVM-002	NiMH	10 cell	800 mAH to 32000 mAH

## **bq2060A-Based Circuit Module**

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The bq2060A-based circuit module includes all components required for a complete battery management solution. It includes the bq2060A gas gauge IC, 24LC01 EEPROM and other components to accurately predict and monitor capacity of NiMH, Li-Ion, and Li-Polymer cells.

Contacts on the circuit module provide direct connection to the cells (BAT-, 1P, 2P, 3P, BAT+) and the serial communications port (SMBC, SMBC). The system load and charger connect across PACK+ and PACK-.

The  $\overline{\text{SAFE}}$  output reflects the state of the safety output from the bq2060A and has extra ESD protection just for evaluation purposes.

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## 2.1 Pin Descriptions

BAT-	Negative connection of first (bottom) cell
1P	Positive connection of first (bottom) cell
2P	Positive connection of second cell
3P	Positive connection of third cell
4P	Positive connection of fourth (top) cell
SMBC	Serial communication port clock
SMBD	Serial communication data port
SAFE	bq2060A safety output
PACK-	Pack negative terminal
VSS	Pack negative terminal
PACK+	Pack positive terminal. Used by bq2060A to derive VCC.

## 2.2 bq2060A Circuit Module Bill of Materials

Table 2-1 lists materials required for the bq2060A circuit module.

Table 2-1. SLUP023-00X Bill of Materials

Count		RefDes	Description	Size	Part Number	MFG
-001	-002					
10	10	C1, C11, C3, C4, C5, C6, C7, C8, C9, C10	Capacitor, ceramic, 0.1 $\mu$ F, X7R, 25 V	603	VJ0603Y104KXXX	Vishay
1	1	C2	Capacitor, ceramic, 0.001 $\mu$ F, X7R, 25 V	603	VJ0603Y102KXXX	Vishay
4	4	D1, D2, D3, D4	Diode, LED, green, Gullwing	SMT Gullwing	LN1371G	Panasonic
1	1	D5	Diode, dual	SOT23	BAV99	Zetex
3	3	D6, D7, D8	Diode, Zener, 5.6 V	SOT23	BZX84C5V6	On Semi
1	1	Q1	Transistor, JFET, N-channel	SOT23	SST113	Vishay Siliconix
1	1	Q2	Transistor, NPN	SOT23	MMBT3904	On Semi
1	1	Q3	Transistor, N-Channel, 2N7002, SOT23	SOT23	2N7002	Zetex
9	9	R1, R15, R18, R19, R20, R21, R22, R23, R34	Resistor, chip, 100 k $\Omega$ , 5%	603	CRCW0603104J	Vishay
1	1	R13	Resistor, chip, 10 M $\Omega$ , 5%	603	CRCW0603106J	Vishay
3	3	R14, R24, R25	Resistor, Chip, 1.5 M $\Omega$ , 5%	603	CRCW0603155J	Vishay
3	3	R17, R2, R3	Resistor, chip, 10 k $\Omega$ , 5%	603	CRCW0603103J	Vishay
2	2	R26, R27	Resistor, chip, 698 k $\Omega$ , 1%	603	CRCW06036983F	Vishay
1	1	R29	Resistor, chip, 0.03 $\Omega$ , 2%, 1W	2512	WSL-2512.03 1%	Vishay
1	0	R30	Resistor, chip, 178 k $\Omega$ 1%	603	CRCW06031783F	Vishay

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Table 3-1. SLUP023-00X Bill of Materials (Continued)

Count		RefDes	Description	Size	Part Number	MFG
-001	-002					
1	1	R31	Resistor, chip, 267 k $\Omega$ 1%	805	CRCW08052673F	Vishay
1	1	R32	Resistor, chip, 806 k $\Omega$ 1%	603	CRCW06038063F	Vishay
1	1	R36	Resistor, chip, 1 k $\Omega$ , 5%	603	CRCW0603102J	Vishay
6	6	R6, R7, R33, R35, R4, R5	Resistor, chip, 100 $\Omega$ , 5%	603	CRCW0603101J	Vishay
4	4	R8, R9, R10, R12	Resistor, chip, 330 $\Omega$ , 5%	603	CRCW0603331J	Vishay
1	1	S1	Switch, momentary, push button, EVQPLHA	SMT	EVQ-PLHA15	Panasonic
1	1	TH1	Thermistor	Radial	103AT-2	Semitec
1	1	U1	IC, gas gauge	28P-SSOP	bq2060A-E619DBQ	Texas Instruments
1	1	U2	IC, EEPROM, 128 byte	SOT23-5	24LC01BI/OT	Micro Chip, Atmel
1	1	J1	Connector, header, right angle, male, 4 pin, 0.100 inch centers		22-12-2044	Molex
1	1	J1 mate	Connector, female, 0.100 inch centers		22-01-3047	Molex
4	4	N/A	Terminals, crimp, tin		08-50-0114	Molex
1	1	N/A	Wire, insulated 22 Awg, red, 8 inches (VCC)		Any	Any
1	1	N/A	Wire, insulated 22 Awg, white, 8 inches (SMBC)		Any	Any
1	1	N/A	Wire, insulated 22 Awg, black, 8 Inches (GND)		Any	Any
1	1	N/A	Wire, insulated 22 Awg, brown, 8 inches (SMBD)		Any	Any
1	1	TB1	Terminal block, 0.200-mil centers, 4 position, 90 degree		ED120/4DS	On Shore Technology
1	1	TB2	Terminal block, 0.200-mil centers, 6 position, 90 degree		ED120/6DS	On Shore Technology

## 2.3 bq2060A Circuit Module Performance Specification Summary

Table 2-2 gives the performance specifications of the circuit.

Table 2-2. Performance Specification Summary

Specification	Min	Typ	Max	Units
Input voltage Pack+ to Pack-	3.0		25	V
Charge and Discharge Current			See Note	A

**Note:** Maximum currents are determined by the value of the sense resistor used. Do not exceed  $\pm 250$  mV across sense resistor. For the supplied sense resistor do not exceed 1 Watt.

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# Circuit Module Physical Layouts

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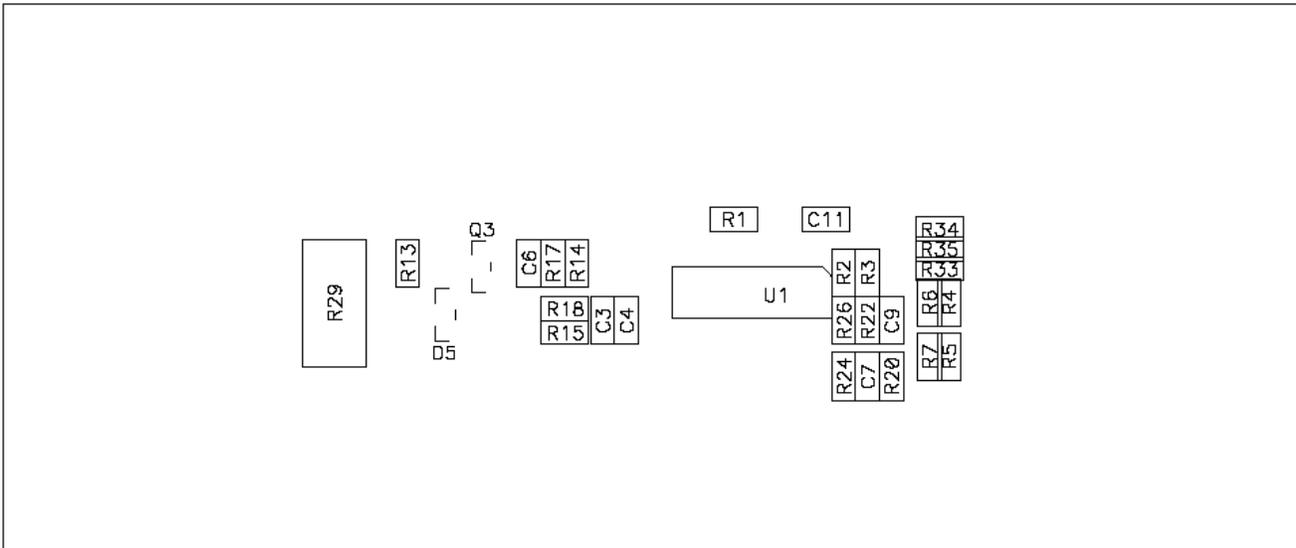
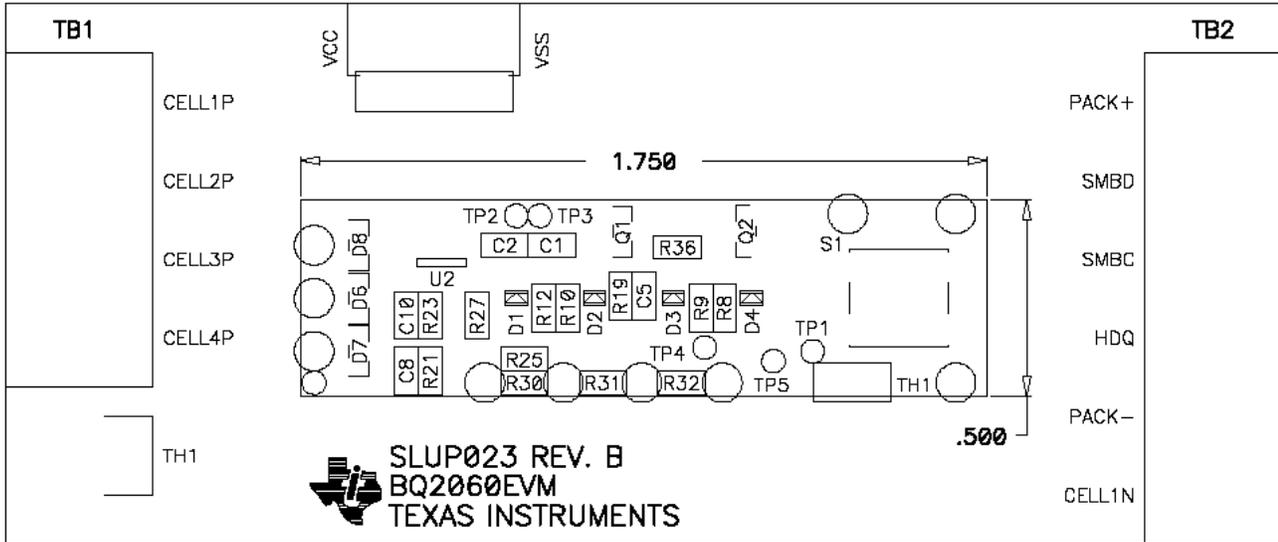
This chapter contains the board layout and assembly drawings for the bq2060A circuit module.

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### 3.1 Board Layout

Figure 3–1 shows the dimensions, PCB layers, and assembly drawing for the bq2060A module.

Figure 3–1. bq2060AEM-00X Layout



# **EVM Hardware and Software Setup**

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This section describes how to install the bq2060AEVM-00X PC software and how to connect the different components of the EVM.

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## 4.1 Software Installation

Follow these steps to install the EV2200-60 software from the included disks:

- 1) Insert disk 1 into a 3 1/2 inch floppy drive.
- 2) Select the 3 1/2 inch drive using My Computer or File Manager.
- 3) Double-click on the Setup.exe icon.
- 4) The setup program prompts for the remaining disks and installs a Windows application group.

Follow these steps to install the latest EV2200-60 software downloaded from the TI website: [www.ti.com](http://www.ti.com)

- 1) Unzip the self-extracting EXE file to a temporary directory.
- 2) Double-click on the Setup.exe icon.
- 3) Follow the onscreen instructions and the setup program will install a Windows application group.

## 4.2 Hardware Connection

The four hardware components of the bq2060AEM-00X are: the bq2060A circuit module, the EEPROM interface connector, the EV2200 PC interface board, and the PC.

### 4.2.1 Connecting the bq2060A Circuit Module to a Battery Pack

Figure 4–1 and Figure 4–2 show how to connect the bq2060A circuit module to the cells and system load/charger. Connect the cells in the following order.

**NOTE:** The cell terminal connections not listed below should remain open.

- 4-Cell LION Pack:
  - Connect the PACK+ terminal to the Cell4P terminal on the bq2060AEM-00X module.
  - Connect the BAT– terminal to the negative side of the bottom (first) cell.
  - Connect the Cell4P terminal to the positive side of the top (fourth) cell.
  - Connect the Cell1 terminal to the positive side of the first cell.
  - Connect the Cell2 terminal to the positive side of the second cell.
  - Connect the Cell3 terminal to the positive side of the third cell.
- 3-Cell LION Pack:
  - Connect the PACK+ terminal to the Cell3P terminal on the bq2060AEM-00X module.
  - Connect the BAT– terminal to the negative side of the bottom (first) cell.
  - Connect the Cell3P terminal to the positive side of the top (third) cell.
  - Connect the Cell1 terminal to the positive side of the first cell.
  - Connect the Cell2 terminal to the positive side of the second cell.

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- 2-Cell LION Pack:
  - Connect the PACK+ terminal to the Cell2P terminal on the bq2060A EVM-00X module.
  - Connect the BAT- terminal to the negative side of the bottom (first) cell.
  - Connect the Cell2P terminal to the positive side of the top (second) cell.
  - Connect the Cell1 terminal to the positive side of the first cell.
- No Individual Cell Voltage Monitoring/NiMH:
  - Connect the PACK+ terminal to the Cell4P terminal on the bq2060A EVM-00X module.
  - Connect the BAT- terminal to the negative side of the bottom (first) cell.
  - Connect the Cell4P terminal to the positive side of the top cell.

Figure 4–1. bq2060A Circuit Module Connection to LION Cells and System Load/Charger

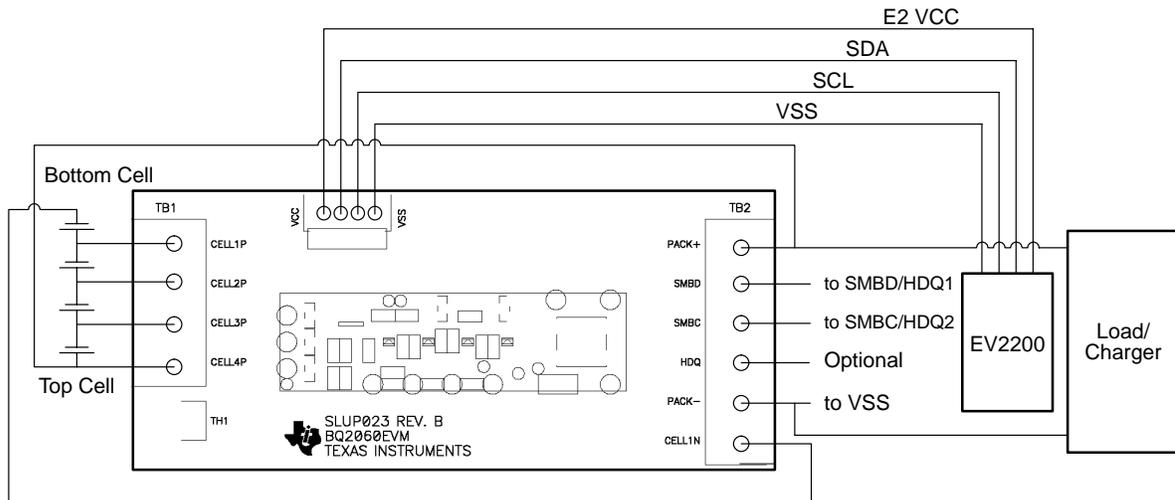
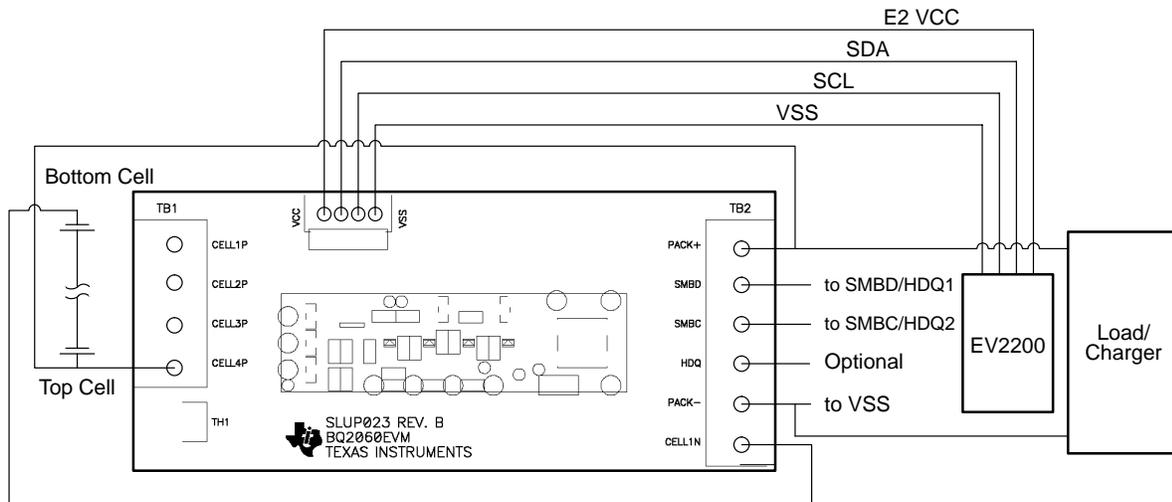


Figure 4-2. bq2060A Circuit Module Connection to NiMH Cells and System Load/Charger



#### 4.2.2 PC Interface Connection

The following steps configure the hardware for interface to the PC:

- 1) Connect the bq2060A-based smart battery (bq2060A EVM-00X) to the EV2200 using wire leads as listed in Table 4-1.

Table 4-1. Circuit Module to EV2200 Connections

bq2060A EVM-00X	EV2200
SMBD	SMBD/HDQ1
SMBC	SMBC/HDQ2
PACK-	VSS

- 2) Connect the EEPROM connector to the bq2060A EVM-00X and the wire leads of the EEPROM connector to the EV2200 as listed in Table 4-2.

Table 4-2. Circuit Module EEPROM Connector to EV2200 Connections

bq2060A EVM-00X	EV2200
VCC	E2 VCC
EEPROM data	SDA
EEPROM clock	SCL
VSS	VSS

- 3) Connect the PC serial cable to the EV2200 and the PC COM port.

The bq2060A EVM-00X is now set up for operation.

# Operation

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This chapter details the operation of the EV2200-60 software.

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## 5.1 Starting the Program

Run EV2200–60 from the *Start | Programs | Texas Instruments | EV2200–60* menu sequence. The SBS Data screen appears. Data begins to populate the fields on the screen as the indicator scans (e.g., *Remaining Capacity* is highlighted in Figure 5–1). To disable the scan feature, select *| Options | Poll BQ Registers | Stop |*.

Figure 5–1. SBS Data Screen

The screenshot shows the 'EV2200-60 Information Lithium Ion' software window. The title bar includes 'File', 'Communications', 'Options', and 'Help'. Below the title bar is a red banner with the Texas Instruments logo and the text 'THE WORLD LEADER IN DSP AND ANALOG'. A 'Polling' button is located in the top right corner. The main interface is divided into several sections:

- Log Section:** A list of battery parameters with checkboxes and numerical values. The 'Remaining Capacity' field is highlighted in yellow.
- Charging Section:** Parameters for charging current, voltage, and battery status.
- DISPLAY MODE:** Radio buttons for 'Dec (black)', 'Hex (blue)', and 'Preferred (both)'.
- Read Section:** A 'Read' button and a list of fields for design capacity, voltage, and other device information.

Parameter	Value	Unit
Manufacturer Access	0000	
Remaining Capacity Alarm	450	mAh
Remaining Time Alarm	10	min
Battery Mode	0080	
At Rate	0	mA
At Rate Time To Full	65535	min
At Rate Time To Empty	65535	min
At Rate OK	1	
Temperature	296.8	K
Voltage	10800	mV
Current	0	mA
Average Current	0	mA
Max Error	100	%
Relative State Of Charge	50	%
Absolute State Of Charge	50	%
Remaining Capacity	2250	mAh
Full Charge Capacity	4500	mAh
Run Time To Empty	65535	min
Average Time To Empty	65535	min
Average Time To Full	65535	min

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This screen shows the SBS data set along with additional Static data which is shown in a box in the bottom right quadrant. By clicking on the *Read* button, the box changes to show the static data from the bq2060A (see Figure 5–2).

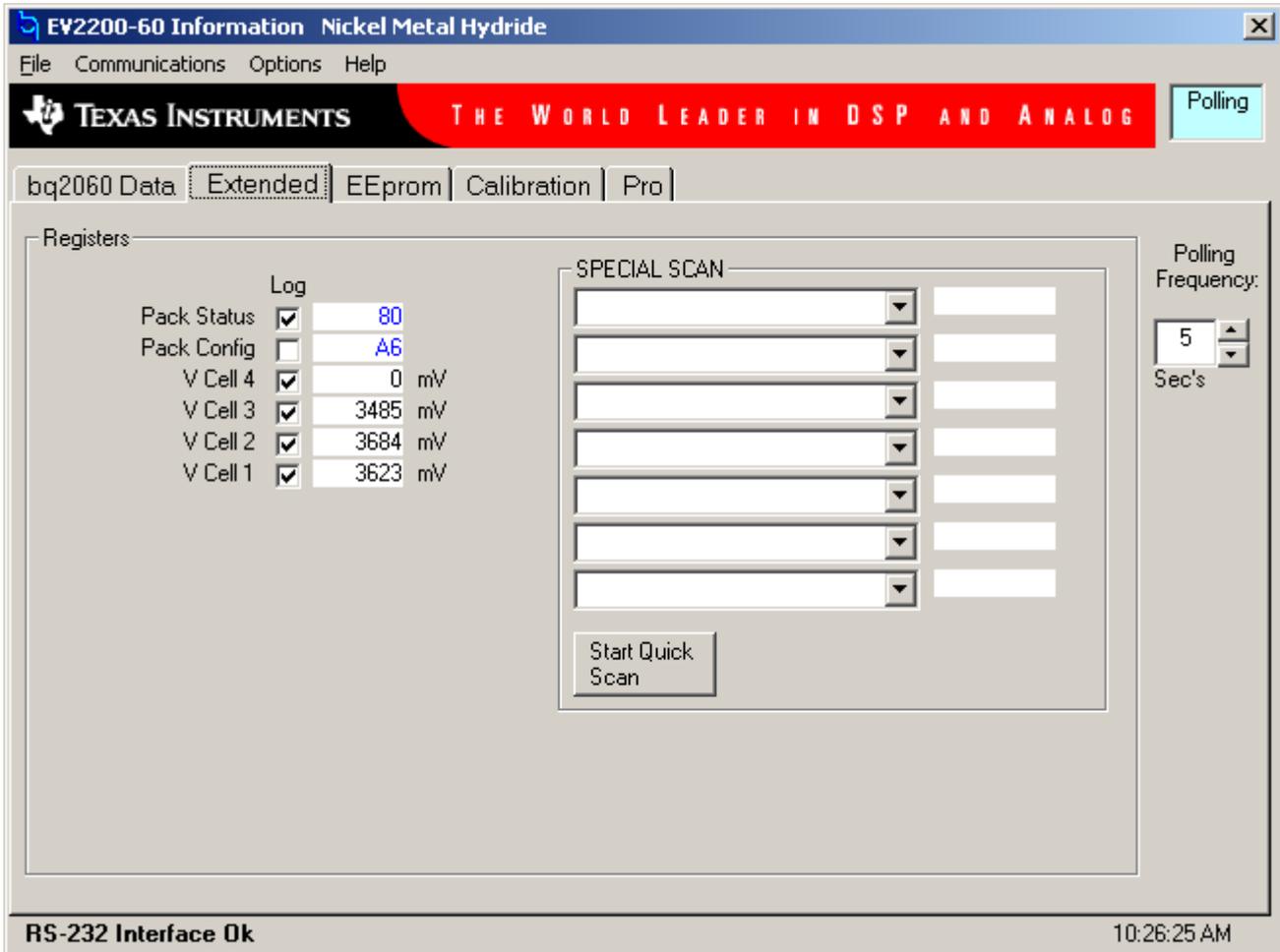
Figure 5–2. SBS Data Screen—Static Data Window

Design Capacity	4500 mAh
Design Voltage	10900 mV
Specification Info	0 0 2 1
Manufacture Date	3/4/2003
Serial Number	1
Manufacturer Name	Bq
Device Name	bq2060A
Device Chemistry	LION

## 5.2 Extended Data Screen

The SBS Extended Data Screen has two frames. The first frame contains the SBS Extended data that continues scanning from the bq2060A Data Screen. The second frame is for high speed scanning up to 7 SBS data values. When the | Start Quick Scan | button is clicked, these scans take precedence over all other scanning to get the highest update rate possible.

Figure 5–3. SBS Extended Data Screen



### 5.3 Data Logging

SBS Data can be logged for further evaluation by using the File | Start Data Log menu options. Then enter the desired file name and click on | SAVE |. A window appears asking for the desired log interval. Select a desired interval and click | CLOSE |. An example of a data log file is shown in Table 5–1. To stop the data log, follow the same sequence. The log file can be customized by clicking on the check box (in the Log column) next to the data fields on the bq2060A Data and Extended screens. All the data fields that are checked are recorded in the log file. It is important to select the desired data fields prior to starting a log because check-box updates made after logging starts are ignored.

Table 5–1. Example Log File

Elapsed Time(s)	Temperature	Voltage	Current	Max Error	Remaining Capacity	Full Charge Capacity
2	296.3	10797	0	100	2025	4050
5	296.3	10791	0	100	2025	4050
8	296.3	10800	0	100	2025	4050
10	296.3	10799	0	100	2025	4050
13	296.3	10800	0	100	2025	4050
15	296.3	10802	0	100	2025	4050
18	296.3	10793	0	100	2025	4050
21	296.3	10792	0	100	2025	4050
23	296.3	10794	0	100	2025	4050
26	296.4	10798	0	100	2025	4050
29	296.4	10797	0	100	2025	4050
32	296.4	10791	0	100	2025	4050
34	296.3	10797	0	100	2025	4050
37	296.3	10794	0	100	2025	4050
39	296.3	10797	0	100	2025	4050
42	296.3	10793	0	100	2025	4050
44	296.3	10795	0	100	2025	4050
47	296.3	10791	0	100	2025	4050

### 5.4 Setting Programmable bq2060A Options

The EEPROM on the EVM is configured as an example LION battery for the bq2060AEVM-001 and for an example Nickel battery for the bq2060AEVM-002 on delivery. The bq2060A includes 3 new EEPROM locations that are not in the bq2060. They are: EDV TC factor, Misc Options, and Safety Over Temperature. The bq2060A is backwards compatible with the bq2060. Special attention should be paid to make sure the settings are correctly changed for the pack, and application with which the bq2060A solution is being evaluated. Do this prior to calibrating the module, described in the following section. The bq2060A must be reset after changing EEPROM

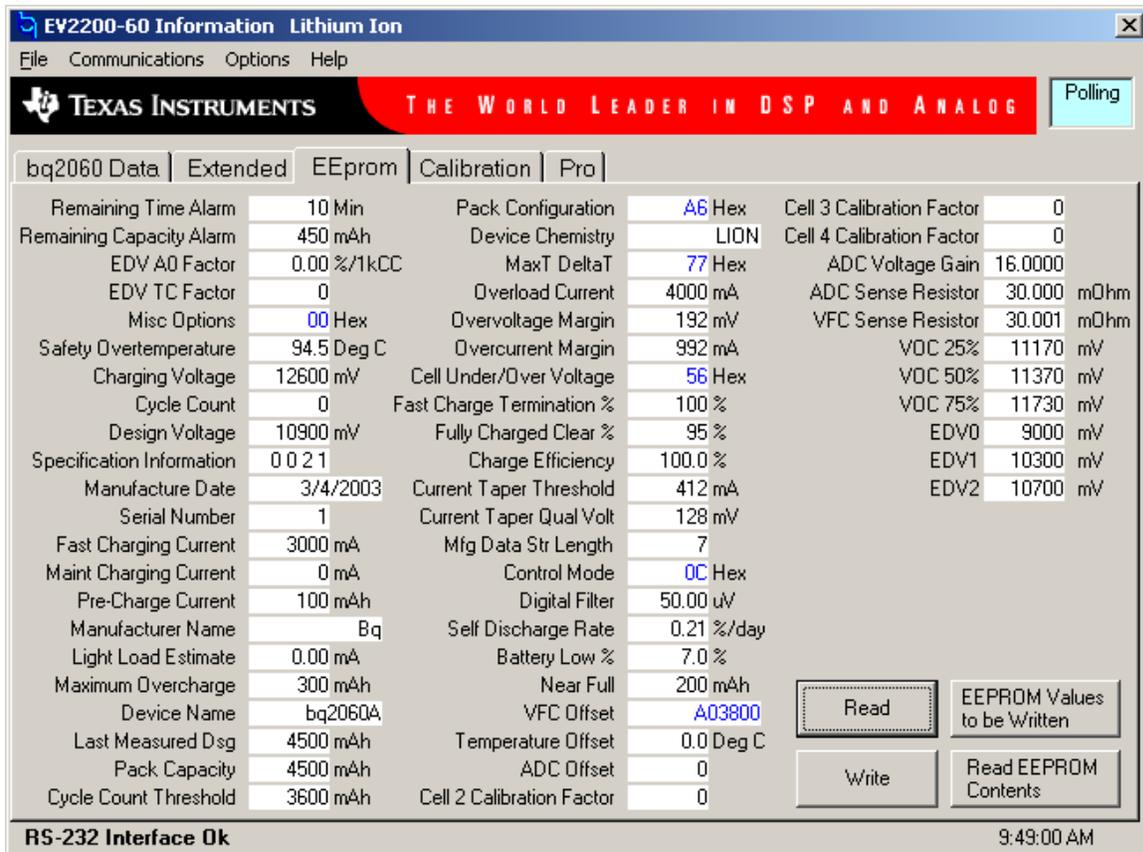
data or calibration for the changes to take effect. To reset the bq2060A click | Options | Initialize Device |.

EEPROM data cannot be accessed on a sealed bq2060A (*Pack Configuration* bit 6 is set). To unseal the pack, connect the EEPROM connector, and click | Options | Unlock Device |. Be sure to remove power from the device and re-apply to finish the unsealing procedure. To reseal the part, click | Options | Seal | bq2060A |. Then reset the bq2060A by clicking | Options | Initialize Device |.

**IMPORTANT:**

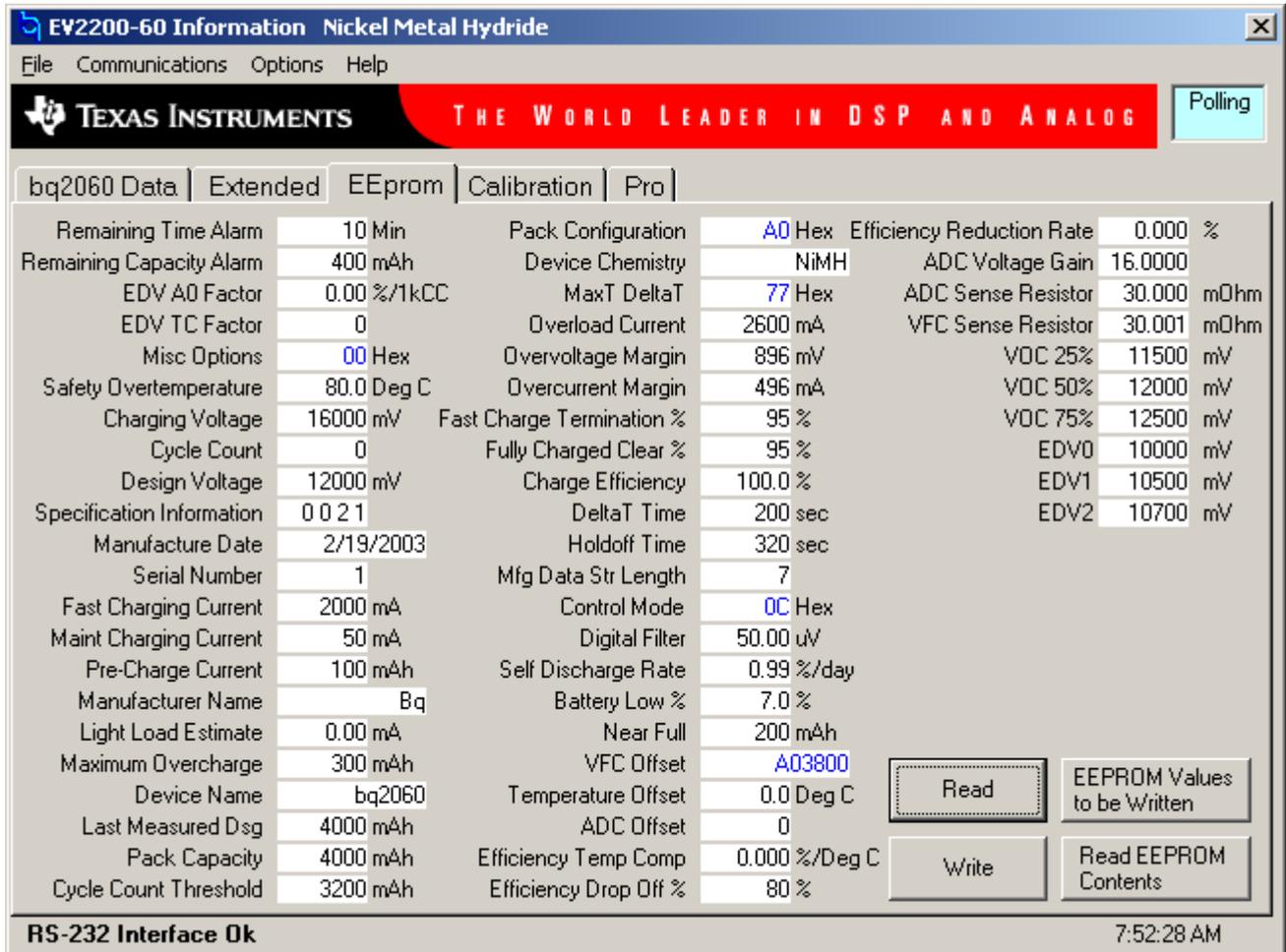
The correct setting of these options is essential to get the best performance. The settings can be configured using the EEPROM Data Screen.

Figure 5–4. LION EEPROM Data Screen



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Figure 5-5. NiMH EEPROM Data Screen

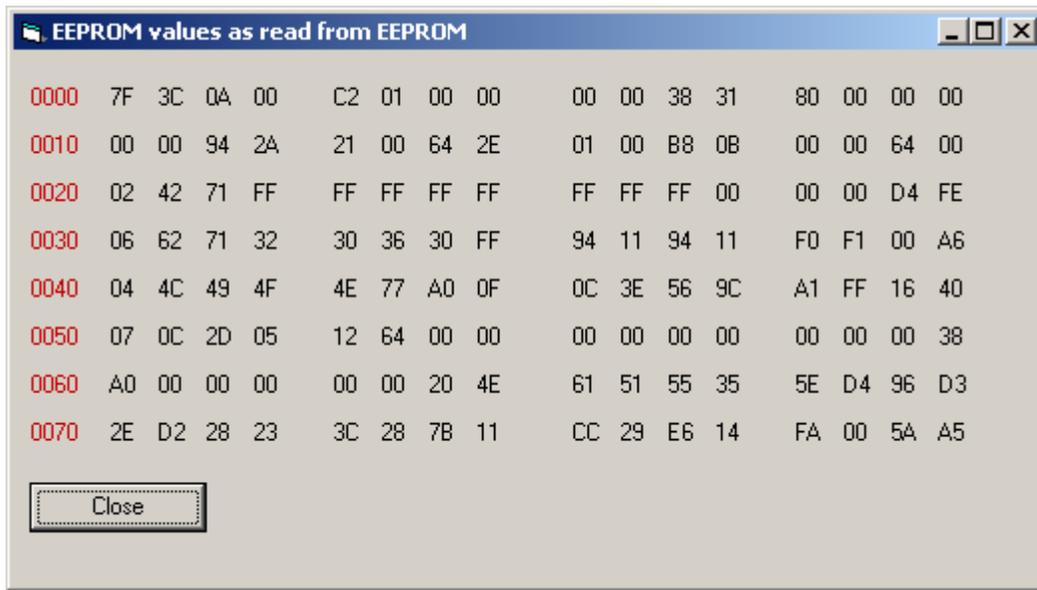


To read all the data from the bq2060A EEPROM click on | Read |. To write to a selected location, click on the desired location, type in the desired data, and press the ENTER key. After a moment, the next location is highlighted. The entire EEPROM can be written this way.

The EEPROM configuration data can be saved to a file by selecting | File | Store EEPROM | and entering a file name. An EEPROM file can also be retrieved in this way and written to the bq2060A using the | Write | button.

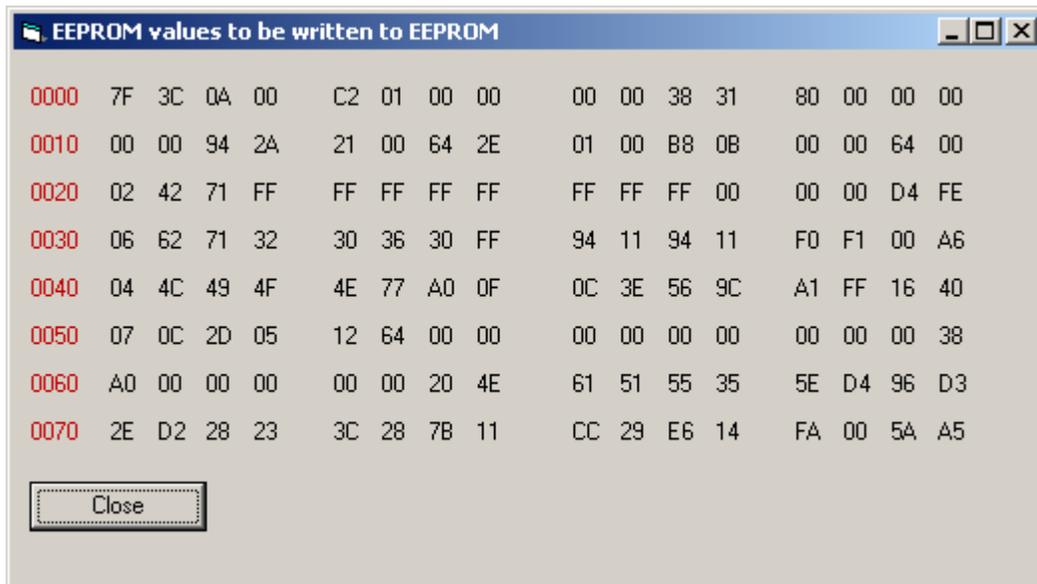
To read the raw Hex data in the EEPROM, click on | Read EEPROM Contents |. This reads the entire EEPROM contents and displays it in a new window.

Figure 5-6. Read EEPROM Values Screen



To view the raw Hex data prior to writing it to the EEPROM, click on | EEPROM Values to be Written |. This reading is not from the EEPROM, but rather from the locations as they are displayed. It translates all locations to a raw Hex EEPROM map that is displayed in a new window exactly as it would go into the EEPROM once written.

Figure 5-7. EEPROM Values to be Written Screen



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All data required for calibration is also held in the EEPROM for the bq2060A as highlighted in Figure 5–8.

Figure 5–8. EEPROM Data Screen—bq2060A Module Calibration Locations

**EV2200-60 Information Lithium Ion**

File Communications Options Help

TEXAS INSTRUMENTS THE WORLD LEADER IN DSP AND ANALOG Polling

bq2060 Data | Extended | **EEProm** | Calibration | Pro

Remaining Time Alarm	10 Min	Pack Configuration	A6 Hex	Cell 3 Calibration Factor	0
Remaining Capacity Alarm	450 mAh	Device Chemistry	LION	Cell 4 Calibration Factor	0
EDV A0 Factor	0.00 %/1kCC	MaxT DeltaT	77 Hex	ADC Voltage Gain	16.0000
EDV TC Factor	0	Overload Current	4000 mA	ADC Sense Resistor	30.000 mOhm
Misc Options	00 Hex	Overvoltage Margin	192 mV	VFC Sense Resistor	30.001 mOhm
Safety Overtemperature	80.0 Deg C	Overcurrent Margin	992 mA	VOC 25%	11170 mV
Charging Voltage	12600 mV	Cell Under/Over Voltage	56 Hex	VOC 50%	11370 mV
Cycle Count	0	Fast Charge Termination %	100 %	VOC 75%	11730 mV
Design Voltage	10800 mV	Fully Charged Clear %	95 %	EDV0	9000 mV
Specification Information	0 0 2 1	Charge Efficiency	100.0 %	EDV1	10300 mV
Manufacture Date	3/4/2003	Current Taper Threshold	206 mA	EDV2	10700 mV
Serial Number	1	Current Taper Qual Volt	200 mV		
Fast Charging Current	3000 mA	Mfg Data Str Length	7		
Maint Charging Current	0 mA	Control Mode	0C Hex		
Pre-Charge Current	100 mAh	Digital Filter	50.00 uV		
Manufacturer Name	Bq	Self Discharge Rate	0.21 %/day		
Light Load Estimate	0.00 mA	Battery Low %	7.0 %		
Maximum Overcharge	300 mAh	Near Full	200 mAh		
Device Name	bq2060	VFC Offset	A03800		
Last Measured Dsg	4500 mAh	Temperature Offset	0.0 Deg C		
Pack Capacity	4500 mAh	ADC Offset	0		
Cycle Count Threshold	3600 mAh	Cell 2 Calibration Factor	0		

**Calibration Data**

Read EEPROM Values to be Written

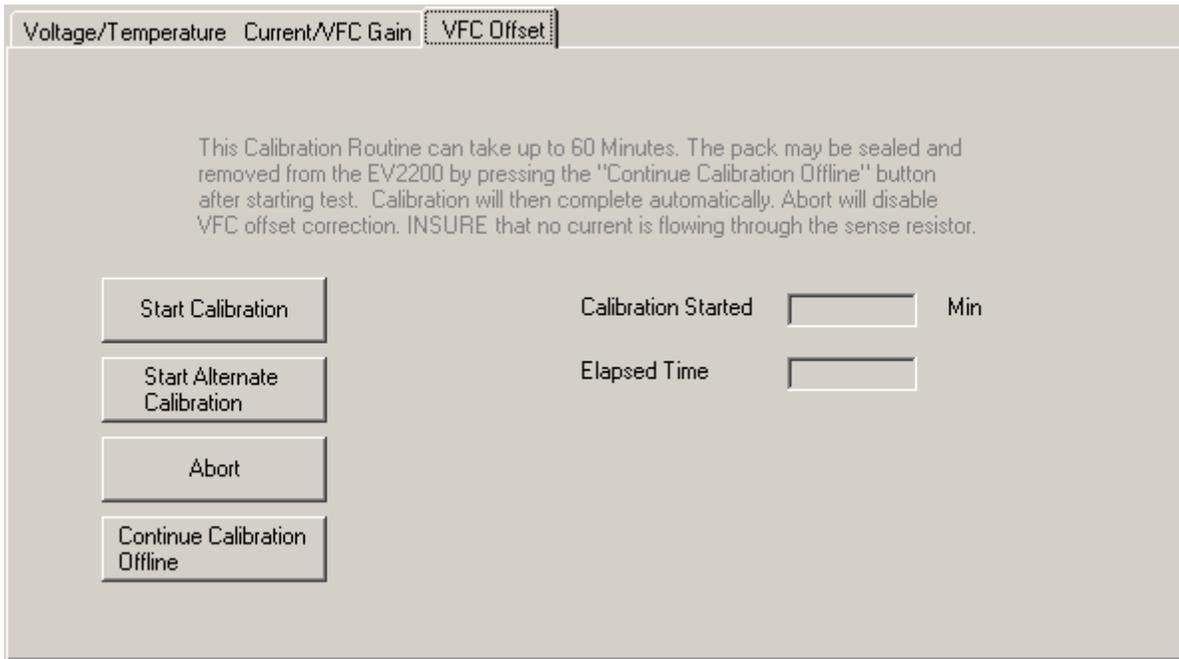
Write Read EEPROM Contents

RS-232 Interface Ok 8:01:43 AM

## 5.5 Calibration of a bq2060A Based Module Using the EV2200-60 Software

The VFC Offset tab is used in the calibration routine. The VFC Offset screen offers a simple-to-use interface for calibrating the Offset of the VFC. Two different types of offset can be selected.

Figure 5–9. VFC Offset Screen



**Default VFC Offset:** To select this offset method, click on | Start Calibration |. This method applies an internal short (inside the bq2060A) across the sense resistor. With the sense resistor shorted inside the bq2060A, there is less chance that an external current can cause a poor offset calculation. If the circuit board induces a slight offset, then it is not compensated for with this method.

**Alternate VFC Offset:** To select this offset method, click on | Start Alternate Calibration |. This method does not apply an internal short across the sense resistor. Care must be taken that no current is flowing through the sense resistor. If there is current, the bq2060A applies this current to its calculations, resulting in an inaccurate VFC offset. With no short across the sense resistor, this method compensates for board offset as long as no current is flowing.

Once calibration is started, the Calibration Started Field displays the time when the calibration was initiated. The Elapsed Time continually updates the amount of time in minutes since the calibration began.

To abort the offset attempt, click on | Abort |. This halts the offset calculation process and stores a value of 0x003800 in to the EEPROM.

If this module is installed on a pack where VCC will be present to the bq2060A after disconnecting from the EV2200, then you can click | Continue Calibration Offline | and the bq2060A automatically finishes the calibration and stores the

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final result in the EEPROM when it is complete. When this option is selected, a popup window appears asking if you wish to seal the pack after the calibration is complete. Click | Yes | to seal the pack after calibration or | No | to finish calibration without sealing the pack. This also is done automatically by the bq2060A after it completes calibration.

Figure 5–10. 3 Cell LiON Calibration Screen

The screenshot shows the '3 Cell LiON Calibration Screen' with the following fields and values:

Field	Value	Unit
Temperature	296.2	K
Cell 1	3574	mV
Cell 1 + 2	7208	mV
Battery Voltage	10653	mV
Current Reading	0	mA

Additional settings: Chemistry: Lion, Cell Structure: 3 Cells.

Warning: Do this calibration first, as ADC Offset will affect current calibration accuracy. INSURE that no current is flowing through the sense resistor.

The LiON Calibration screen differs from the NiMH calibration screen by the individual cell voltages and cell structure. If the Chemistry or Cell Structure fields do not show the proper configuration in their respective fields, then select the bq2060A Data Screen Tab, select | Options | Initialize Device |, wait 5 seconds and then return to the Calibration Tab.

The Voltage/Temperature and Current/VFC Gain screen has two frames. The top frame is for calibrating voltage and temperature. Perform this calibration procedure prior to the Current/VFC Gain calibration.

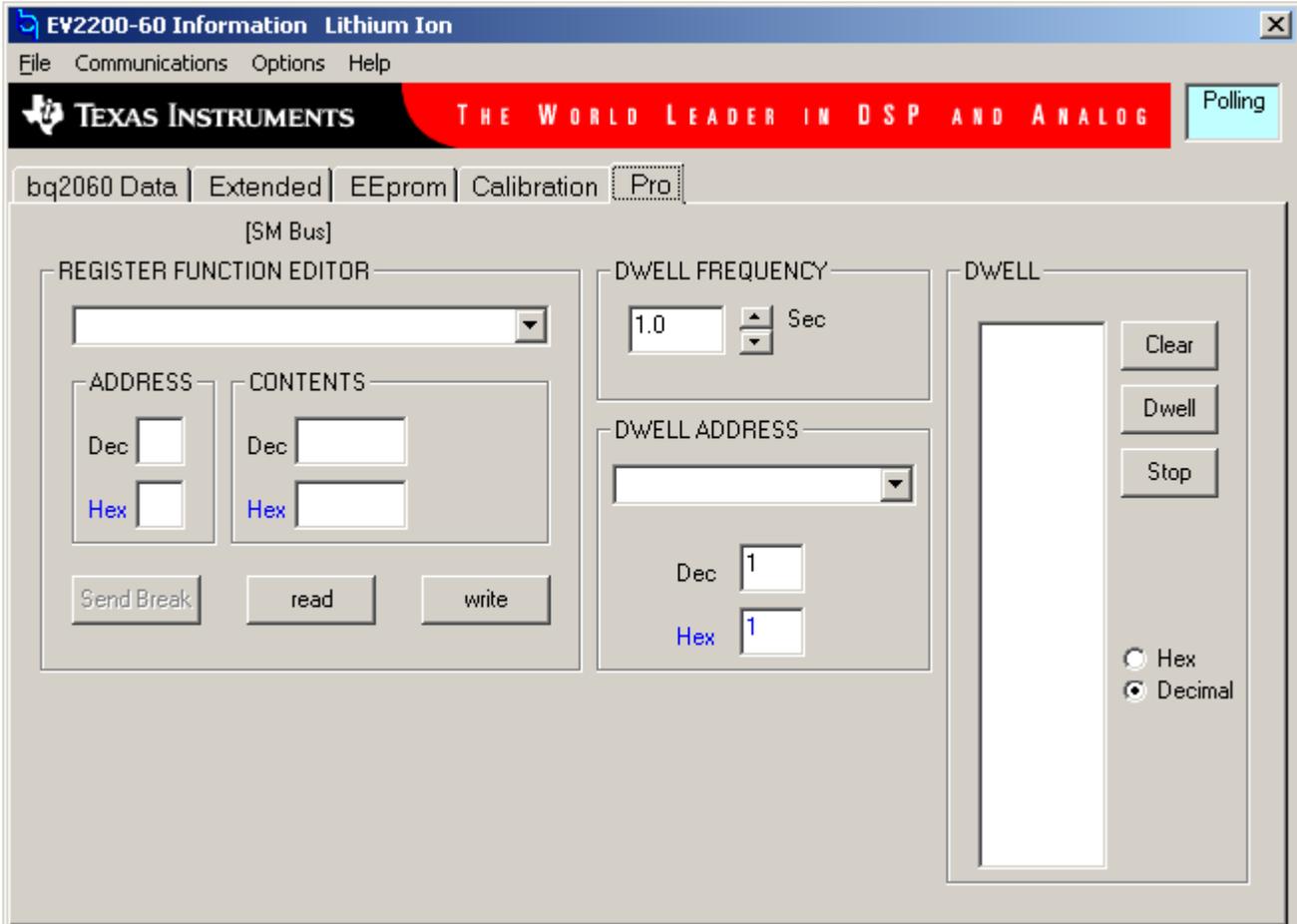
To perform the Voltage/Temperature calibration, enter values in the Reference Standard column that were recorded using a traceable calibrated standard. Be sure to measure the voltage at the connections to the bq2060AEVM-00X module to get the most accurate results. Also be sure to add the cells together at each individual cell field for all the cells below it. The Battery Voltage Field should be derived from all the cells added together. If this application does not have individual cell voltage monitoring, then only the Battery Voltage field is displayed. Enter the temperature in the appropriate field in the Reference Standard column. Click on the | Start | button to finish the Voltage/Temperature calibration.

To perform the Current/VFC Gain calibration, connect a traceable calibrated load to the bq2060AEVM-00X module as shown in Figure 5–1 or 5–2. Then enter the Load current in the Reference Standard column, and click | Start | to finish the Current/VFC Gain calibration.

## 5.6 Direct Access Communication

The Pro Screen allows direct access to all the memory in the bq2060A including the memory above the SMBus locations providing that the bq2060A is unsealed. The scan tool called Dwell is useful for scanning a specific location.

Figure 5–11. Pro Screen

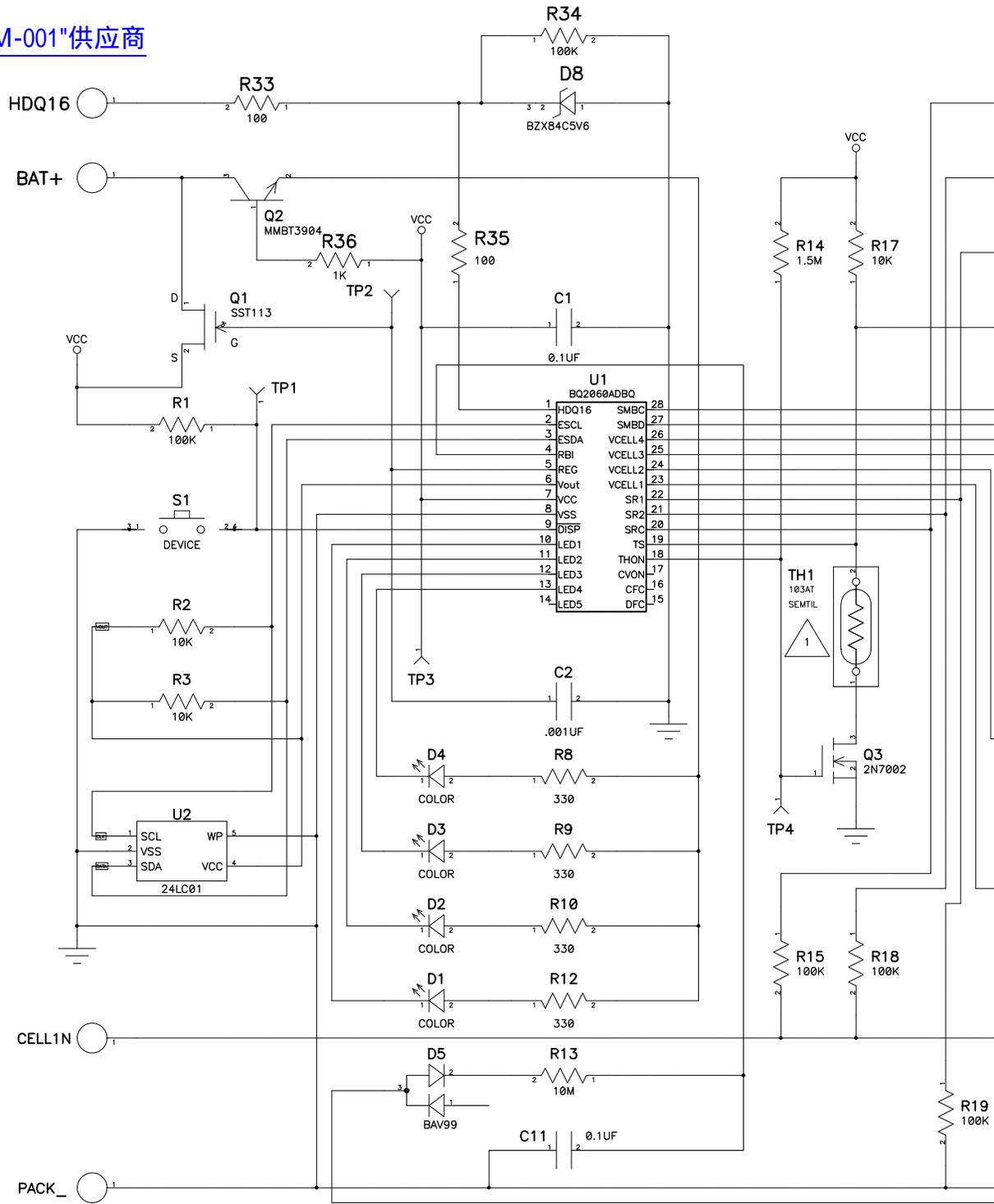


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## 5.7 Schematic

(The schematic diagram is appended to the PDF document).

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TH1 IS LOCATED OFF BOARD AND ATTACHED THROUGH TERMINALS P1 AND P2.