

Calibration of the bq6400 Battery Management Controller

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SCOPE

Proper operation of the bq6400 battery management controller requires that it be calibrated for voltage, temperature and current. This document details the calibration setup and manual calibration procedure used for calibrating small numbers of boards or packs. The example given is for a 3-series cell design, a similar procedure can be applied to 4-series cell designs or greater.

CALIBRATION SETUP

The following equipment is required for calibration. Suggested sources are in parentheses.

- DMM with better than ± 0.5 -mV accuracy
- Thermocouple type K, min. $\pm 1^\circ\text{C}$ accuracy at 25°C (Fluke 80BK-A).
- Power supply, 16.8 V at 3A (BK-Precision 1696).
- DC Electronic load 0-5A CC (BK-8500).
- Battery Simulator (see [Figure 1](#)) This is easily constructed from three 10- Ω , 10-W power resistors (4 required for 4 series cell design).
- MCC iPort/USB™ USB to I²C™ Host Adapter #MIIC-204 and driver software on PC.
- Texas Instruments bqWizard™ application installed on Windows™ PC.
- Battery pack connector with power and SMBus cabling (see [Figure 1](#)).

VOLTAGE CALIBRATION PROCEDURE

Voltage calibration must be done prior to the PCB being connected to cells. It is recommended that the 3-terminal FUSE be disconnected (if present in your design) prior to connecting to the board. The power supply should be initially set to 12.6 V, current limit at 500 mA.

The voltage is calibrated at two points, 2700 mV and 4200 mV/cell ± 50 mV (8.1-V and 12.6-V pack voltage, respectively).

1. Turn off the power supply and connect the its positive and negative outputs to the V3 and B- connection points respectively of the resistive divider.
2. Connect the B-, V1, V2, V3 points of the resistive divider to the equivalent cell voltage connections on the printed circuit board being calibrated.
3. Set the power supply to 12.6 V and enable the output.
4. Run the bqWizard application. Click on the *Pack Static* tab, then select *Hardware Configuration*. Ensure that cell balancing is disabled.
5. From the bqWizard main menu bring up the calibration dialog box: *Utilities | Calibration*.
6. In the bqWizard voltage calibration dialog box select Cell 1.
7. Set the power supply output to 8.1 V.
8. Measure Cell-1 mV with the DMM to 3 decimal places of accuracy.
9. Enter the DMM reading into the [2700–3000] box.
10. Click on the *Calibrate* button located to the right of the box.
11. Wait for the Information Window to respond with Calibration Successful.
12. Set the power supply output to 12.6 V.
13. Measure Cell1 mV with the DMM.

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14. Enter the DMM reading into the [4000–4500] box.
15. Click on the *Calibrate* button located to the right of the box.
16. Wait for the Information Window to respond with Calibration Successful.
17. In the bqWizard voltage calibration dialog box, select Cell 2.
18. Repeat steps 7 through 16 for Cell-2.
19. In the bqWizard voltage calibration dialog box, select Cell 3.
20. Repeat steps 7 through 16 for Cell-3.
21. Click on the Close button to exit the calibration dialog box and commit the values to flash.
22. Use the bqWizard to read back the cell voltages and verify the values against that reported by the DMM. Do this at the two calibration points. There should be less than a ± 3 -mV difference between the values reported by the bqWizard and the DMM reading.

TEMPERATURE CALIBRATION PROCEDURE

The temperature calibration is a single point calibration and must be done at $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$. It can be performed using the cell simulator, or actual cells, but must be done after successful voltage calibration. No current should be flowing during this procedure.

1. Run the bqWizard application. From the main menu bring up the calibration dialog box: *Utilities | Calibration*.
2. Measure the ambient temperature using a calibrated thermocouple.
3. Enter this value in the Temperature box.
4. Click on the *Calibrate* button located to the right of the box.
5. Click on the Close button to exit the calibration dialog box and Write/Commit the values to flash.
6. With the bqWizard verify that the cell and board temperature readings are within $\pm 1^{\circ}\text{C}$ of the current temperature measured with the thermocouple.

CURRENT CALIBRATION PROCEDURE

The current calibration is done using the cell simulator, or after the PCB has been connected to cells. Calibration is done at two points; 0 mA and 2000 mA of discharge. Discharge is represented here as a negative (–) value.

1. Connect the DMM in series between the pack being calibrated and the electronic load. Connect in Ammeter configuration.
2. Enable the DMM to measure amperes.
3. Ensure the electronic load output is off and that no current drain is reported by the DMM.
4. Run the bqWizard application. From the main menu bring up the calibration dialog box: *Utilities | Calibration*.
5. In the Calibration dialog box, click on the *Calibrate* button located to the right of *Zero Offset* in the Current and Coulomb Count section.
6. Wait for the Information Window to respond with Calibration Successful.
7. Configure the electronic load for 2.000 A and turn its output on.
8. Enter the DMM current reading into the *Gain* box as a negative number in mA.
9. Wait for the Information Window to respond with Calibration Successful.
10. Click on the Close button to exit the calibration dialog box and commit the values to flash.
11. Validate the procedure by using the bqWizard to display the current and verify the values against that reported by the DMM. Do this at the two calibration points. There should be less than a ± 5 mA difference between the values reported by the bqWizard and the DMM reading.

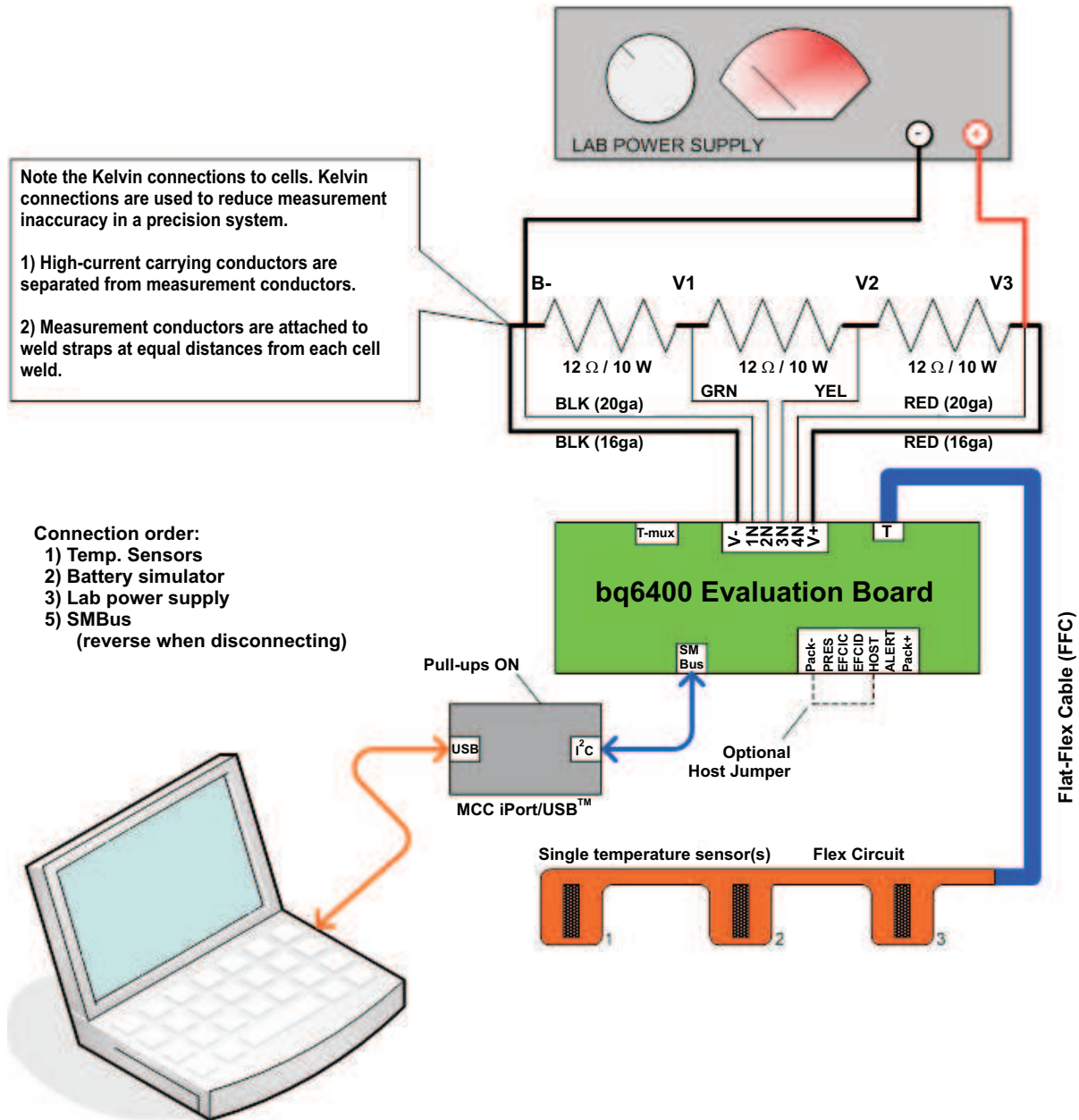


Figure 1. Voltage Calibration Connection Diagram

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