

# Chemistry Selection for bq78PL114

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PMP - BMS High-Cell and Emerging

## ABSTRACT

Battery Management Systems that use the PowerLAN™ master gateway controller require configuration for the type of cell chemistry and battery-pack construction for optimum performance. This entails the use of a chemistry ID file (.chem) that details the cell as a stand-alone entity and an auxiliary file (.aux) that describes the cells as constructed in a battery pack. This report shows how to perform a data collection run to generate an .aux file, how to identify the .chem file for your particular cell chemistry, and how to load the two configuration files into the PowerLAN master gateway controller with the bqWizard software.

## 1 Introduction

The PowerLAN master gateway controller must be properly configured for the cell chemistry to provide optimum performance in safety, gauging, and advanced SmartSafety features. The chemistry ID file (.chem) provides a description of the open-circuit voltage (OCV) and temperature-dependent behavior of the cells for the gauge. The PowerLAN master gateway controller has an additional capability that allows it to factor in the impedance model for the constructed pack, cells, and connections. This additional impedance information is contained in a configuration file identified by the file extension .aux. The combination of the .chem file and the .aux file gives a complete model of the constructed battery pack in terms of impedance.

An .aux file should be made for each battery pack design by performing a specific data-collection run that is logged by the bqWizard software. The bqWizard software allows loading these files (.chem, .aux) separately and does not check compatibility of the files. A .chem file must be either selected from those available or a new one should be created before an .aux file is created.

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**NOTE:** The bq78PL114, shipped with factory-loaded firmware 4452, is not recommended for new designs. Upgrade of the firmware 4452 is required to take advantage of the .aux file features described in this document. The following .aux file details pertain exclusively to the firmware 5000 associated with part definition bq78PL114S12. The firmware update is available by downloading the current version of the bqWizard (2.5.7 and later) and following the update instructions.

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## 2 Chemistry File Selection

A number of cell chemistry files are provided in the bqWizard installation. These can be viewed using the Load Chemistry Data command in bqWizard and selecting the chemistry type and/or cell part number from the list. Alternatively, the Chem.ini file in the Chemistry subdirectory of the bqWizard installation may be opened as read only with a text editor and the part number searched to identify the chemistry number.

If the desired cell chemistry is not included in the bqWizard installation, a chemistry file may have been created since the bqWizard release, or a new one may be needed. The appropriate chemistry file is needed in order to complete the data collection run for .aux file generation. Chemistry selection for a cell type is described in the *Support of Multiple Li-Ion Chemistries With Impedance Track™ Gas Gauges* application note ([SLUA372](#)).

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**NOTE:** Application note [SLUA372](#) describes loading firmware and learning procedures specific to the bq20zxx gauges which are not applicable to the PowerLAN master gateway controller. Ignore these sections for this device. As new chemistry files are created, these may become available in releases of bqWizard, chemistry updates, or individual files.

Chemistry type may be selected by:

- The cell part number for a known cell type
- Consulting with the cell manufacturer for the chemistry type
- Analysis using data collected from an accurate battery tester
- Creation of a new cell chemistry file by TI from battery tester data or cell testing

### 3 Test Preparation

Generation of the data needed to create an auxiliary (.aux) file first requires certain test equipment, that the PowerLAN master gateway controller device parameters be configured, and that the cell type be matched up with a chem ID to allow for proper execution of the data collection run. See the documents listed in [Section 5](#), *References*, before doing any testing.

#### CAUTION

The device configuration for data collection for the .aux file generation does not represent a properly configured device for production or evaluation. A device in this configuration should not be relied on to provide proper gauging or operation.

#### 3.1 Equipment

The following equipment and materials are required:

- Cell stack assembly matching the target application: production-quality cells and electrical construction
- bq78PL114EVM board or prototype circuit card assembly with the PowerLAN master gateway controller. Cell interconnects and temperature sensor position should match the expected production topology as closely as possible.
- Current- and temperature-measurement equipment for calibration of the PowerLAN master gateway controller
- Battery test equipment (either of the following):
  - Typical battery-cycle tester capable of programmable charge and discharge cycling
  - A power supply with adjustable voltage, current, and overvoltage protection for charging the pack and an electronic load for discharging the pack
- Texas Instruments bqWizard software installed on a suitable personal computer with either of the following: Texas Instruments USB-TO-GPIO host adapter or MCC iPort/USB™ USB to I<sup>2</sup>C™ host adapter.

#### 3.2 Sample Pack Characteristics

The cell pack to be used for the .aux file characterization run should be indicative of the pack that will be used in production, especially series and parallel count. All cells should be in a condition such that they could meet the manufacturer's data sheet rating, they should be well matched in terms of SOC, and they should not have gone through any detrimental operating conditions.

The PCB and associated electrical connections should ideally be a production exemplar.

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**NOTE:** Use of cells and/or a pack construction that is not representative of the typical production-quality pack can result in an .aux file that does not accurately characterize the impedance of the pack. Do not use cells that are of questionable quality and do not assemble the cells in a manner not representative of the connection process and materials used in production.

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### 3.3 Configuring Files and Parameters

The configuration files, parameter set information, and the bqWizard software used to accomplish system configuration are described in the reference documents in [Section 5](#). It is highly recommended that these documents be reviewed prior to working with the .aux file configuration.

Arrange and connect the PowerLAN battery management PCB (custom or EVM), cell pack, and temperature sensors. Using the USB-TO-GPIO adapter, connect to the PC running the bqWizard. If not already done, perform the following sections in the order that they are listed: firmware download, .tmap file load and parameter set load which includes the chemistry ID.

#### 3.3.1 Firmware

As mentioned in [Section 1](#), this application note assumes that firmware 5000 has been downloaded to the PowerLAN master gateway controller using the bqWizard software. Consult the bqWizard documentation included with the software for firmware upgrade details.

#### 3.3.2 Tmap File

The .tmap file is a configuration file whose purpose, as it relates to .aux file generation, is to configure the PowerLAN master gateway controller for the number of parallel and series cells in the pack, the current sensor resistor value, and the number of temperature sensors.

The bqWizard installation comes with a number of generic .tmap files that can be used to configure the pack for the number of series and parallel cells as well as the number and mapping of the temperature sensors in the battery management PCB used during the .aux file data collection run. The auxiliary file data collection run should be performed at room temperature (approximately 25°C).

File names for nominal .tmap files typically include a description of the series/parallel cell count. For instance, an 8-series, 2-parallel .tmap file would be called bq78PL114S12\_8S2P.tmap. All nominal .tmap files are configured for 1 temperature sensor per series cell and one board temperature. Contact Texas Instruments for assistance if a .tmap file is not available for your configuration. Also visit [www.ti.com](http://www.ti.com) to check on bqWizard updates. A utility will soon be added to the bqWizard to allow users to generate custom .tmap files.

#### 3.3.3 Parameter Set (.ppcsv File)

Once the .tmap file is loaded, the next step is to configure the parameter set. The PowerLAN master gateway controller features a set of parameters that are used to configure the operation of the controller to suit application needs.

Safety and cell-specific parameters can be edited in the bqWizard tabs, but in many cases it is easier to edit these in the designated .ppcsv file format. The .ppcsv file is a comma-separated-value (.csv) format. After modifying the file, re-save in a .csv format, but retain the .ppcsv file extension.

Setting all safety parameters for your cells is highly recommended; other parameter limits for this collection run may be wider than for your production run. The parameters listed in [Table 1](#) are critical to the data collection.

**Table 1. Critical Parameters for the .aux File Data Collection Run**

PARAMETER	DESCRIPTION
Chem ID	This specifies the chemistry file that matches the cell type. The correct .chem file is essential for creation of an accurate .aux file. The .chem file ID is selected from the existing list or a new one is created according to the <i>Support of Multiple Li-Ion Chemistries With Impedance Track™ Gas Gauges</i> application note ( <a href="#">SLUA372</a> ).
Discharge completion pack voltage qualifier	Set this to the pack-voltage equivalent of the higher of the End Of Discharge Voltage (EODV) value from the cell data sheet, or the minimum operating voltage of the PowerLAN master gateway controller (2800 mV per cell recommended) for cells which can operate below the range of the gauge.
Discharge completion time	Set this to a non-zero small value such as the 4-second default.
Discharge completion FET activation time	Set this to a non-zero small value such as the 6 second default. This setting opens the discharge MOSFET (DSG) to stop the discharge.
CUV threshold	Set this value appropriate for the cell, but above the EUV of the PowerLAN master gateway controller.
CUV recovery	If an electronic load is used, set this value above the expected recovery voltage of the cells when the load is removed. The setting must be at a high-enough point to prevent the DSG MOSFET from cycling on/off. If a battery tester is used that removes the load when the CUV limit is reached, this parameter can be set to the normal value expected for the application.
Precharge voltage	Set this value low enough that the gauge does not prevent charge.
Precharge recovery	Set this value low enough that the gauge does not prevent charge.
Charge completion pack voltage qualifier	Set this value appropriate for the pack. This value should be lower than the POV threshold.
Charge completion taper current qualifier	Set this at or below C/20 to allow collection of the full characterization cycle. This value and charge-completion pack-voltage qualifier are the parameters that are used to determine charge completion (CHG OFF).
Algorithm enable	The Inhibit safety-rules bit should be cleared.
System control	Set the pump-disable bit.

It is recommended that a discharge/charge cycle is conducted to make sure that all of the parameters are set properly. It is important to verify the following prior to the data collection run:

- The desired full charge and discharge ranges can be captured under control of the PowerLAN master gateway controller.
- The end of each discharge period should happen definitely with the cells going to a continuous open-circuit condition for the prescribed duration. ON/OFF cycling (chattering) of the discharge MOSFET switch at the end of a cycle must be avoided.
- The taper current at the end of a constant-voltage, constant-current (CVCC) charge cycle can be captured in a continuous exponential-shaped curve until the Charge Completion taper current qualifier shuts down charge.

#### CAUTION

The device configuration for data collection does not necessarily represent a properly configured device for production or evaluation. A device in this configuration should not be relied on to provide proper gauging or operation.

### 3.4 Calibration

The PowerLAN master gateway controller temperature- and current-measurement hardware must be calibrated in-system because these measurements depend on external circuitry and PCB construction.

Follow the instructions in the bqWizard to calibrate temperature and current. Cell voltage calibration is not required, because the PowerLAN master gateway controller devices come pre-calibrated from the factory.

If the cell pack contains more than four series cells, the cell voltage calibration data from the bq76PL102 PowerLAN dual-cell monitor devices must be downloaded to the PowerLAN master gateway controller. This is accomplished by performing a Relearn/Initialize command in the bqWizard.

**NOTE:** Proceed with temperature and current calibration ONLY after the number of cells is set correctly with the .tmap file and all cell voltages appear to be reading correctly after the Relearn/Initialize command is completed.

### 3.5 Data Log File Setup

The bqWizard software is used to collect the data during the auxiliary-file data-collection run. There are three files relating to data logging in the bqWizard: static log definition file (.slog), dynamic log definition file (.dlog), and data log file (.csv).

Use the static log definition file that is called "characterize\_12cell.slog." This is available with versions of bqWizard greater than 2.5.7. The data log file is simply the location where the logged data is stored and can be named appropriately. The dynamic log definition file (.dlog) requires a specific format. A default file is included with the bqWizard installation (2.5.7+) and is called characterize\_12cell.dlog. This file should be used for all .aux file data collection runs. The parameters logged when this .dlog file is used are shown in [Table 2](#)

**Table 2. Required Logged Parameters for .aux File Generation**

PARAMETER	COMMENT
Tick	Automatically generated
Current	SBDData dynamic parameter
Pack voltage	SBDData dynamic parameter
Relative state of charge	SBDData dynamic parameter
Cell voltage(1)	Cell dynamic value
Cell voltage(2)	Cell dynamic value
Cell voltage(3)	Cell dynamic value
Cell voltage(4)	Cell dynamic value
Cell voltage(5)	Cell dynamic value
Cell voltage(6)	Cell dynamic value
Cell voltage(7)	Cell dynamic value
Cell voltage(8)	Cell dynamic value
Cell voltage(9)	Cell dynamic value
Cell voltage(10)	Cell dynamic value
Cell voltage(11)	Cell dynamic value
Cell voltage(12)	Cell dynamic value
Cell temperature(1)	Cell dynamic value
Cell temperature(2)	Cell dynamic value
Cell temperature(3)	Cell dynamic value
Cell temperature(4)	Cell dynamic value
Cell temperature(5)	Cell dynamic value
Cell temperature(6)	Cell dynamic value
Cell temperature(7)	Cell dynamic value
Cell temperature(8)	Cell dynamic value
Cell temperature(9)	Cell dynamic value
Cell temperature(10)	Cell dynamic value
Cell temperature(11)	Cell dynamic value
Cell temperature(12)	Cell dynamic value
Pack passed current	Pack dynamic value

## 4 Auxiliary File (.aux) Generation

Section 3 recommended that the following items be completed prior to the data collection test:

- Cells have been mated to PowerLAN master gateway controller electronics and successfully powered with communication to bqWizard.
- The firmware in the PowerLAN master gateway controller has been updated to version 5000.
- PowerLAN master gateway controller has been configured for the application using the .tmap file.
- Current and temperature have been calibrated using the bqWizard.
- A chemistry file (ID) has been identified and loaded that matches the cell chemistry being used.
- The parameter set, including SmartSafety rules and charge-control settings, has been properly configured to achieve desired discharge and charge ranges during the data-collection run.
- A sample charge-discharge-charge cycle has been performed to confirm that parameter set and data logging are functioning properly.

### 4.1 Details of Data Collection

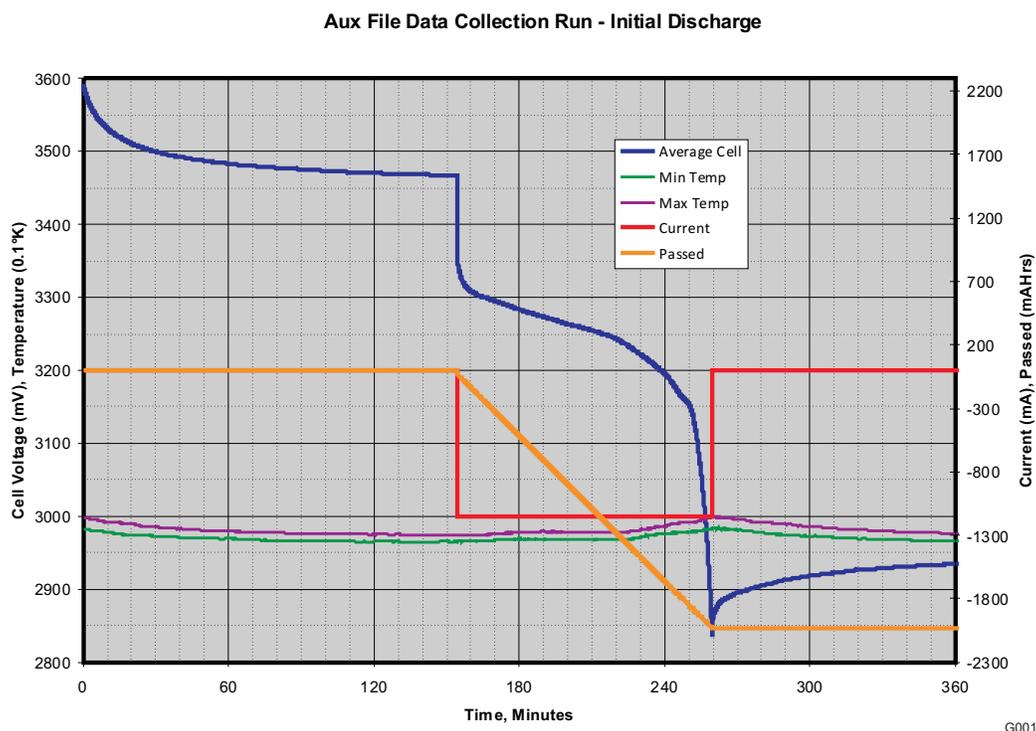
The .aux file data collection test can be divided into three sections:

- Initial discharge
- Charge
- Final discharge

Each section has a specific purpose in the calculation of the .aux file parameters. In the following explanations, the cell voltages were combined into an average voltage to make the figures less busy.

#### 4.1.1 Initial Discharge

The initial discharge is shown in Figure 1. The cells start the test at an unknown relative state-of-charge (RSOC). This portion of the test is used to bring the cells to the fully discharged state as controlled by the safety rules of the PowerLAN master gateway controller. The cells are then allowed to sit at zero current to obtain an accurate open-circuit voltage (OCV) at 0% RSOC. This OCV reading can be referred to as  $OCV_{0\%}$ .



**Figure 1. Initial Discharge**

This portion of the test is also used to determine the accuracy of the current measurement. In the (future) utility in the bqWizard that processes the test data, the user will be asked to enter the value of the current during this initial discharge. The average current during the initial discharge will be computed and compared to the user's value. If there is a significant enough difference that could effect file generation, it will be brought to the user's attention during data processing.

#### 4.1.2 Charge

The charge section is shown in Figure 2. This section of the test starts at  $OCV_{0\%}$  and ends with the cells at a fully charged state as controlled by the safety rules of the PowerLAN master gateway controller. The interrupted charge portion allows the capture of the OCV values and the normalized dynamic impedance (NDI) at low RSOC levels, where the rate of change is normally quite high under discharge conditions.

The capture of the exponential-shaped taper curve of the current at the end of charge is used to calculate the gauging parameter called Tau10. It is important that this taper section be continuous and not interrupted. An example of such an interruption would be the cell overvoltage rule (COV) activating due to cell-voltage divergence.

The cells are then allowed to sit at zero current to obtain an accurate OCV at 100% RSOC. This OCV reading can be referred to as  $OCV_{100\%}$ .

Aux File Data Collection Run - Charge

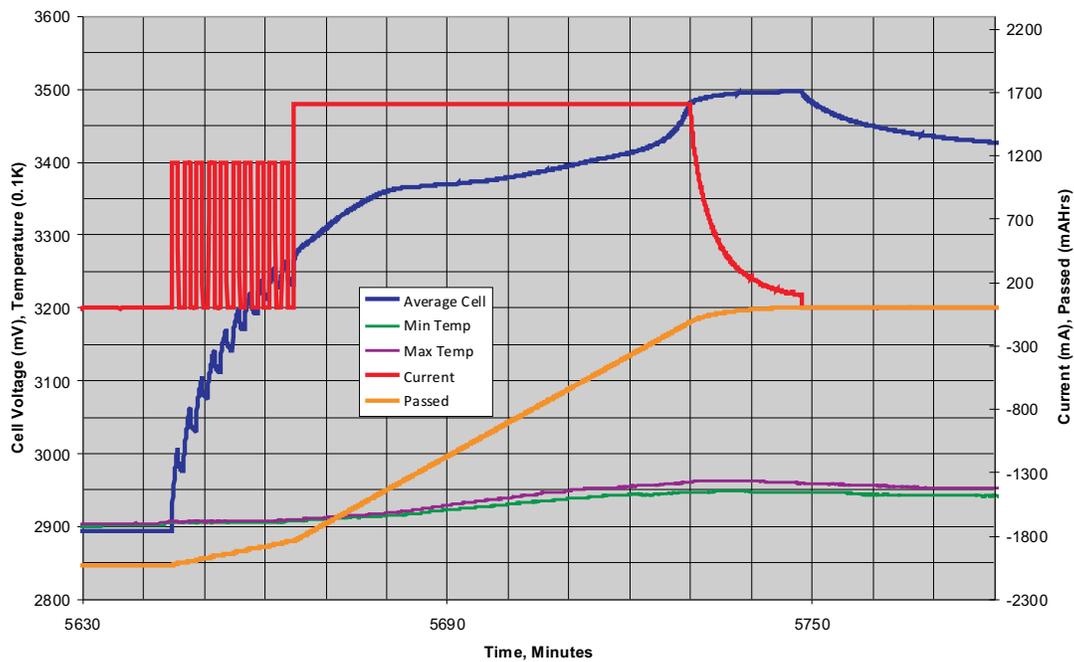
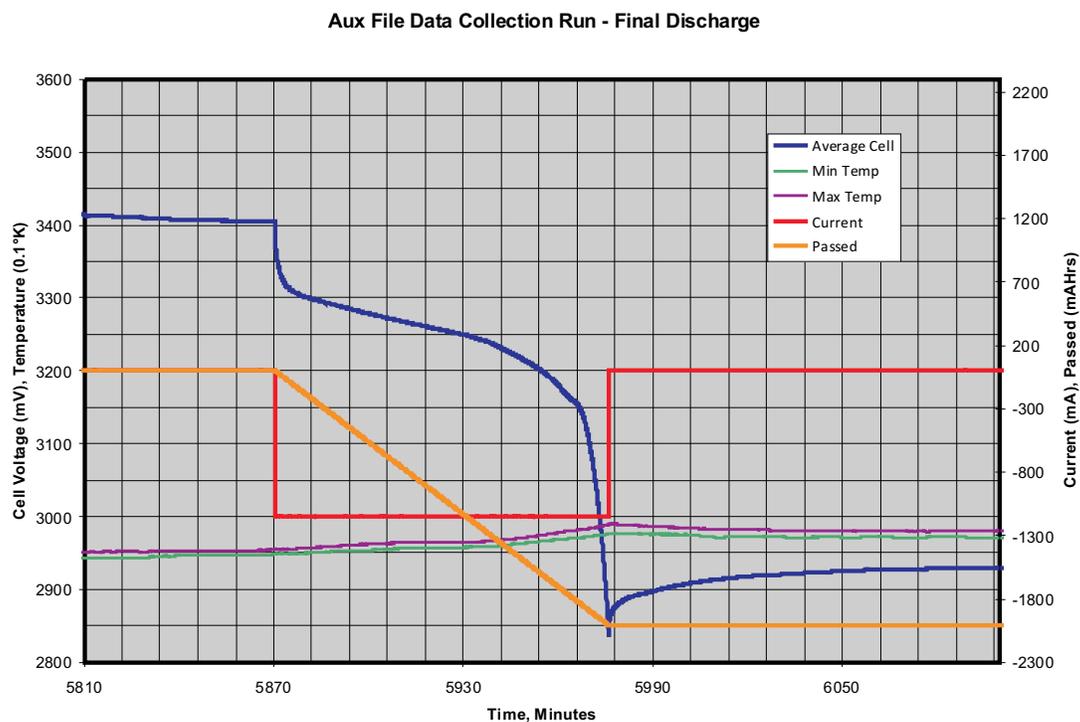


Figure 2. Charge

#### 4.1.3 Final Discharge

The final discharge section is shown in Figure 3. This section starts at the  $OCV_{100\%}$  condition and ends with the cells in a fully discharged state,  $OCV_{0\%}$ , as controlled by the safety rules of the PowerLAN master gateway controller. This final discharge permits the calculation of the  $Q_{MAX}$  of the cells and the  $R_A$  values of the cells as constructed in the battery pack.



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**Figure 3. Final Discharge**

The data collection procedure is described in [Section 4.2](#). Total test time for the data collection run is about 11 to 12 hours. Automated test equipment should permit continuous operation of the cell pack. If manually controlled equipment is used, the test will likely go beyond the typical work day. A convenient way to break up the test is to elongate one of the 2-hour rest periods to a full-overnight time.

## 4.2 Data Collection Procedure

The discharge-charge-discharge profile described below can be programmed into a battery tester or can be run manually using a power supply and electronic load. Be sure settings and safety limits set on the load and power supply meet the cell data sheet. The PowerLAN master gateway controller should be used to terminate charge and discharge during the test. The following sequence shows parameter names and some typical values for a specific configuration. Be sure that any load or charge is eliminated during the rest periods.

1. The auxiliary-file data-collection run should be performed at room temperature of 25°C. Cell temperature range during test should not exceed 15°C to 30°C.
2. Be certain PowerPump™ cell balancing is disabled.
3. Start logging with prescribed log definition files and desired output file.
  - (a) Set up .slog, .dlog and .csv files. Use the *characterize\_12cell.slog* and *characterize\_12cell.dlog* files.
  - (b) Enable logging.
  - (c) Poll data at a rate of 2 seconds.
4. Discharge the pack at C/2 constant-current rate to discharge completion pack voltage (cell EODV; 3 V/cell typical).
5. Rest at open circuit for 2 hours, minimum.
6. Apply approximately 1% of capacity at the C/2 constant-current charge rate. Alternatively, charge at C/2 constant-current rate for 1 minute.
7. Rest at open circuit for 1 minute.
8. Loop to step #6 above and repeat the incremental charge and rest step 10 times.
9. Continue charging at 0.7 C to a clamp voltage recommended by the cell manufacturer (maximum

- charge voltage, example 4.2 V/cell typical).
10. Terminate charge when current tapers to approximately C/20. Charge termination can be done by safety rules.
  11. Rest at open circuit for 2 hours, minimum.
  12. Discharge at C/2 constant-current rate to discharge completion pack voltage (cell EODV; 3 V/cell typical).
  13. Rest at open circuit for 2 hours, minimum.
  14. Terminate logging.
    - (a) Stop polling.
    - (b) Disable logging.
  15. Stop test.

### 4.3 Auxiliary Data File and Results

A software utility is soon to be available in the bqWizard that will permit automatic generation of the .aux file from the data in the data log file (.csv). Until that is created, send your data log file to Texas Instruments for .aux file generation. The following is a list of information required to process the data into an auxiliary file.

#### 4.3.1 Information Needed for Analysis

In addition to the .aux data log file, the following information is needed before analysis can be completed.

##### 4.3.1.1 Chemistry ID Number

This is the number assigned to the chemistry file used during the test. Use of an accurate chemistry file is essential to creation of an .aux file. See [Appendix A](#) for a listing of Chem IDs available with version 2.5.7 of the bqWizard. Others may have become available since publication of this document.

##### 4.3.1.2 Series Cell Count

Record the series cell count.

##### 4.3.1.3 Parallel Cell Count

Record the parallel cell count.

##### 4.3.1.4 Initial Discharge Current

Record the initial discharge current. This should be C/2.

#### 4.3.2 Analysis Method

Two methods of analysis are available to the user. The auxiliary log file data (.csv) can be converted to an .aux file using the generic method or the actual method.

Both methods perform an individual characterization and analysis of the cells. The actual method produces the file using the characterization of the individual cells. The generic method removes the worst and best performing cell characterizations and then averages the remaining characterizations to get a generic cell model. Then, this generic cell model is applied to all cells.

Having two methods of analysis gives the user a degree of freedom. There may be cases where the condition of all cells used for the test is not indicative of those used in production. In this instance, a low-performing cell could be ignored with the generic analysis method. For the preferred case where all cells are indicative of the production cells, the actual method can be used.

## 5 References

1. *bq78PL114 PowerLAN™ Master Gateway Battery Management Controller With PowerPump™ Cell Balancing Technology* data sheet ([SLUS850](#))
2. *bq78PL114 and bq78PL114S12* technical reference manual ([SLUU330](#))
3. *What is a .tmap File?* application note ([SLUA542](#))
4. *bqWizard* user's guide ([SLUU336](#))
5. *bq78PL114 System Design Guidelines* application report ([SLUA537](#))
6. *Support of Multiple Li-Ion Chemistries With Impedance Track™ Gas Gauges* application note ([SLUA372](#))

## Appendix A Chemistry Files

### A.1 Chemistry File Listing

Following is the listing of cell chemistries and matching Chem ID numbers. Consult [www.ti.com](http://www.ti.com) for details on Chem ID updates.

[File]

Name=Chem.ini

NumChemFiles=27

[1\_Chem]

ChemID=0100

Description=LiCoO<sub>2</sub>/graphitized carbon (default)

NumKnownCells=23

1=ATL:604396

2=A&TB:LGR18650OU

3=LG:ICR18650A2

4=LG:ICR18650S2

5=Moli:ICR-18650G

6=Panasonic:CGR-18650A

7=Panasonic:CGR-18650C

8=Panasonic:CGR-18650D

9=Panasonic:CGR-18650E

10=Samsung:ICR18650-20

11=Samsung:ICR18650-20B

12=Samsung:ICR18650-20C

13=Samsung:ICR18650-20E

14=Sanyo:18650 JCBFK16

15=Sanyo:UR18650F (JH)

16=Sanyo:UR18650F (JT)

17=Sanyo:UR18650F (FK)

18=Sanyo:UR18650F (FM)

19=Sony:US18650S

20=Sony:US18650G4

21=Sony:US18650G5

22=Sony:US18650G6C

23=Sony:18650GR

[2\_Chem]

ChemID=0101

Description=Mixed Co/Ni/Mn cathode

NumKnownCells=3

1=Sony:SF US18650GR

2=Sony:SF US18650G7

3=Sony:SF US18650G8

[3\_Chem]

ChemID=0102

Description=Mixed Co/Mn cathode

NumKnownCells=1

1=Sanyo:laminare

[4\_Chem]  
 ChemID=0103  
 Description=LiCoO2/Carbon 2  
 NumKnownCells=2  
 1=ATL:laminare 554490  
 2=Moli:ICP103450CA-02

[5\_Chem]  
 ChemID=0104  
 Description=Mixed Co/Mn cathode  
 NumKnownCells=1  
 1=Sony:laminare US604496 K3

[6\_Chem]  
 ChemID=0105  
 Description=LiCoO2/carbon 3  
 NumKnownCells=4  
 1=ATL:laminare 606168 (M42-V2)  
 2=ATL:laminare 604396 (M1-V4)  
 3=Samsung:ICR18650-26A  
 4=Sanyo:UF103450P

[7\_Chem]  
 ChemID=0106 Description=LiCoO2/carbon 4  
 NumKnownCells=1  
 1=LG:18650 B2

[8\_Chem]  
 ChemID=0107  
 Description=LiCoO2/carbon 5  
 NumKnownCells=1  
 1=Sanyo:18500 UR18500F (1700mAh)

[9\_Chem]  
 ChemID=0108  
 Description=Mixed Co/Mn cathode 2  
 NumKnownCells=1  
 1=Sony:laminare US604496 K3

[10\_Chem]  
 ChemID=0109  
 Description=LiCoO2/carbon 6 (2.75V cutoff)  
 NumKnownCells=1  
 1=Samsung:ISR18650-26C (2650 mAh)

[11\_Chem]  
 ChemID=0110  
 Description=LiCoO2/carbon 2  
 NumKnownCells=2  
 1=ATL:laminare 554490  
 2=Moli: ICP103450CA-02

[12\_Chem]  
 ChemID=0200  
 Description=PSS, LiNiO2 with Co, Mn doping NumKnown  
 Cells=2  
 1=Panasonic:CGR18650AF  
 2=Panasonic:CGR18650DA

[13\_Chem]  
ChemID=0201  
Description=ATL LiNiO<sub>2</sub> (Co, Nn doped)/carbon  
NumKnownCells=1  
1=ATL:laminare 6052103

[14\_Chem]  
ChemID=0202  
Description=GP, LiNiO<sub>8</sub>Co<sub>2</sub>O<sub>2</sub>  
NumKnownCells=1  
1=GP:18650 L260Y

[15\_Chem]  
ChemID=0203  
Description=PSS, LiNiO<sub>2</sub> with Co, Mn doping  
NumKnownCells=1  
1=Panasonic:CGR18650CF

[16\_Chem]  
ChemID=0204  
Description=NiCoMn/carbon  
NumKnownCells=1  
1=Sanyo:18650 Y

[17\_Chem]  
ChemID=0205  
Description=NiCoMn/carbon high rate  
NumKnownCells=1  
1=Kokam:PF 533438XP

[18\_Chem]  
ChemID=0206 Description=NiCoAl(NCA)/carbon  
NumKnownCells=1  
1=LG:18650 S3 (2200 mAh)

[19\_Chem]  
ChemID=0207  
Description=NiCoMn/carbon 2  
NumKnownCells=1  
1=A01:ALPBA002 (3430 mAh)

[20\_Chem]  
ChemID=0300  
Description=LiMn<sub>2</sub>O<sub>4</sub>/carbon  
NumKnownCells=1  
1=Moli:IMR26700

[21\_Chem]  
ChemID=0301  
Description=LiMn<sub>2</sub>O<sub>4</sub>(Co,Ni)/carbon,4.35V  
NumKnownCells=1  
1=LG:ICR18650 B1

[22\_Chem]  
ChemID=0302 Description=LiMn<sub>2</sub>O<sub>4</sub>(Co,Ni)/carbon,4.35V  
NumKnownCells=1  
1=LG:ICR18650 B1

[23\_Chem]  
ChemID=0400  
Description=LiFePO4/carbon  
NumKnownCells=1  
1=A123:Systems 26650A

[24\_Chem]  
ChemID=0401  
Description=LiFePO4/carbon  
NumKnownCells=1  
1=K2Energy: LFP26650P

[25\_Chem]  
ChemID=0402  
Description=LiFePO4/carbon  
NumKnownCells=1  
1=K2Energy: LFP26650EV

[26\_Chem]  
ChemID=0403  
Description=LiFePO4/carbon  
NumKnownCells=1  
1=BYD: FC 18650 (1700 mAh)

[27\_Chem]  
ChemID=0404  
Description=LiFePO4/carbon  
NumKnownCells=1  
1=A123 Systems: APR18650M1 (1100 mAh)

## IMPORTANT NOTICE

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