# Simple Guide to CEDV Data Collection for Gauging Parameter Calculator (GPC)

## 1 Tool Summary

Gauging Parameter Calculator (GPC) is a math calculation and simulation tool that helps the battery designer to obtain matching Compensated End of Discharge Voltage (CEDV) coefficients for the specific battery profile. The tool allows the user to increase the accuracy of the fuel gauge IC over temperature.

The battery pack must use one of TI's CEDV algorithm-based fuel gauges. It accepts 3 pairs of log files that can be created with various user equipment or by using TI's Battery Management Studio (bqStudio) software with a CEDV evaluation board connected through USB.

This guide describes how to obtain the 3 pairs of log files without the use of a TI EVM or TI bqStudio software.

## 2 Required Data

The GPC tool requires a single .zip file containing seven text files as its input. The name of the .zip file is not important. Six of the files are data logs and the other is a configuration file describing various aspects of the battery pack.

### *2.1 Configuration File (1 ea)*

The configuration file is a text file named config.txt and is an ASCII text dictionary containing the following information:

- NumCellSeries = <number series cells>
- CellTermV = <cell termination voltage expressed a an unsigned decimal value>
- ChemType = <1 is LiCoO2(default), 2 is NiMH, 3 is Lead-Acid, 4 is LiFePO4, 5 is Lithium Titanate, 6 is NMC or NCA>
- VoltageColumn = <Zero based column number for the voltage data in your data logs>
- CurrentColumn = <Zero based column number for the current data in your data logs>
- TemperatureColumn = <Zero based column number for the temperature data in your data logs>
- ElapsedTimeColumn = <Zero based column number for the elapsed time data in your data logs>
- FitMaxSOC% = <Integer ranging from 8 to 14. Typical is 12>
- FitMinSOC% = <Integer ranging from 2 to 6. Typical is 6>
- LearnSOC% = <Integer ranging from 5 to 12. Typical is 7>

## 2.2 Data Log Files (6 ea)

- Continuous discharge at 2 different rates, from fully charged state until termination voltage is reached.
- Time (in seconds elapsed), Voltage (in millivolts), current (in milliamps where discharge current is negative), and direct cell temperature (in degrees Celsius, one decimal place is acceptable) are recorded and stored as separate columns separated by commas. Data files must be saved as .csv. Any text should be removed from files prior to submission.
- An easy recording method utilizes TI's bqStudio software utility called GPC Packager that reads data directly from a TI fuel-gauge.
- Make sure to set overtemperature limits in the fuel-gauge higher than the expected cell temperature during the test.
- The first rate should be average typical, and second should be average high for your application. Note that high rate should **not** be maximum peak current, but rather maximum average sustained rate that can practically occur in the application.
- Discharge does not have to be constant current, it can be any load pattern typical for your application, including constant power. It is OK to have zero current rows before and after the discharge.
- The size of each discharge log must not exceed 2MB.
- Fully charge the battery prior to application of the test pattern.
- Test at both rates has to be performed at 3 different temperatures. Typical temperatures for the test are 5°C, 30°C, 50°C. Note that cells heat-up during high rate discharge, so, if your maximum spec temperature is 70°C, you might use a chamber temperature of 50°C. See additional explanation on temperatures in Section 2.2.1.
- As result of all tests, 6 files are obtained.
- If the temperature was changed, the battery should reach thermal equilibrium for at least 2 hours prior to testing.

The GPC tool requires six continuous discharge logs as inputs. These are most easily thought of as being three pairs of files with each pair at a specific cell temperature. The ASCII format is very flexible and simple, and the columns can be in any order since the column positions are defined in the config.txt file.

Each of the files represents a separate discharge run of your battery pack at a given temperature and with a given load. Precision of the measurements is important in all aspects. The following names are given to the six distinct discharge logs:

hightemp_highrate.csv
hightemp_lowrate.csv

roomtemp_highrate.csv
roomtemp_lowrate.csv

lowtemp_highrate.csv
lowtemp_lowrate.csv

### 2.2.1 Temperature Parameters

The low temperature value is typically 0°C or 5°C but the correct value to use for that pair of logs is the expected low cell temperature limit in your application before the load is applied. Naturally, as you begin the discharge log there is some self-heating of the cells, this is part of what the log tracks.

The nominal temperature value is typically 25°C or 30°C but most importantly should be placed approximately in the center of the high and low temperature extremes. The exact value is not critical.

The high temperature value is typically 40°C or 50°C, but the correct value to use for that pair of logs is the expected high cell temperature limit in your application before the load is applied.

If the temperature was changed, the battery should be soaked at the new desired temperature for 2 hours prior to starting the discharge.

### 2.2.2 Example Config.txt File

```
NumCellSeries=6
CellTermV=3000
ChemType=1
VoltageColumn=1
CurrentColumn=3
TemperatureColumn=2
ElapsedTimeColumn=0
FitMaxSOC%=12
FitMinSOC%=6
LearnSOC%=7
```

### 2.2.3 Excerpted Example Data Log

In this excerpt, the columns are:

```
elapsed time, voltage, temperature, and current.
```

```
92, 25509, 50.9, 0
96, 25504, 50.9, 0
100, 25065, 50.9, -10102
104, 25019, 51, -10104
```

## Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

| Changes from A Revision (May 2015) to B Revision | Page |
|---|---|
| • Added ChemType for 6 (NMC or NCA) in Section 2.1. | 1 |

| Changes from Original (October 2014) to A Revision | Page |
|---|---|
| • Changed ChemTypes for 2, 3, 4, and 5 to NiMH, Lead-Acid, LiFePO4, and Lithium Titanate, respectively | 1 |

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