

bqEASY

Texas Instruments advanced fuel gauges, employing the Impedance Track™ algorithm offer an unmatched array of features and benefits. Sometimes, however, the wide range of configuration settings can make it seem a bit challenging to get started with the evaluation process. In addition, determining the correct chemistry model and producing the 'golden image' file can be time consuming. The bqEASY program is designed to greatly simplify the process of configuring, calibrating, selecting chemistry and performing learning cycles through the step-by-step use of a wizard program.

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1 Introduction

The challenges of evaluating the rich feature set of Texas Instruments advanced fuel gauges can be simplified by using the bqEASY program, as previously described. Optionally, the discharge portion of the chemistry and learning cycles may be performed automatically with the use of a simple add-in circuit connected between the target device or EVM and the EV2300.

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2 Software Installation

Software installation requires that the latest EV software be installed from the TI Website in the EVM tool folder for the part being used. As an example, for the bq20z80 EVM tool folder, navigate to <http://focus.ti.com/docs/toolsw/folders/print/bq20z80evm-001.html>. For the rest of this document we will use the bq20z80 EVM tool folder, but any of the EVM tool folders that support bqEASY can be used. The installation sequence is as follows:

1. Ensure that the EV2300 is **NOT** connected to the computer prior to installation of software.
2. Navigate to the TI website and get the latest EV software if you have not already done so. As described above, this can be found on the TI Website in the EVM tool folder for the part being used. As an example, go to the *bq20z80 EVM folder*.
3. Install this EV software following onscreen instructions. For further help on EV Software installation, please see any of the bq20zXX EVM User Guides. This can also be found in the EVM tool folder for the product being used.
4. When the EV software has been installed, verify its functionality by setting up the EV2300 and a known bq20zXX module. Ensure that the computer, EV2300, and bq20zXX module all are operating normally and that SMBus communication to the module is functioning. For further help please see the appropriate EVM user guide as described in step 3.
5. Also check the device EVM tool folder for any new bqChemistry file updates. These are updated more frequently than the EV software, so between EV software updates, we will create a self-extracting installer and post it in the EVM tool folder for the part being used. Install these updates if they are in the folder.
6. Now the bqEasy software will run inside the current EV software when it is executed by clicking the bqEasy button in the left-hand column of buttons below the *Calibrate* button in the EV software. (See [Figure 1](#))

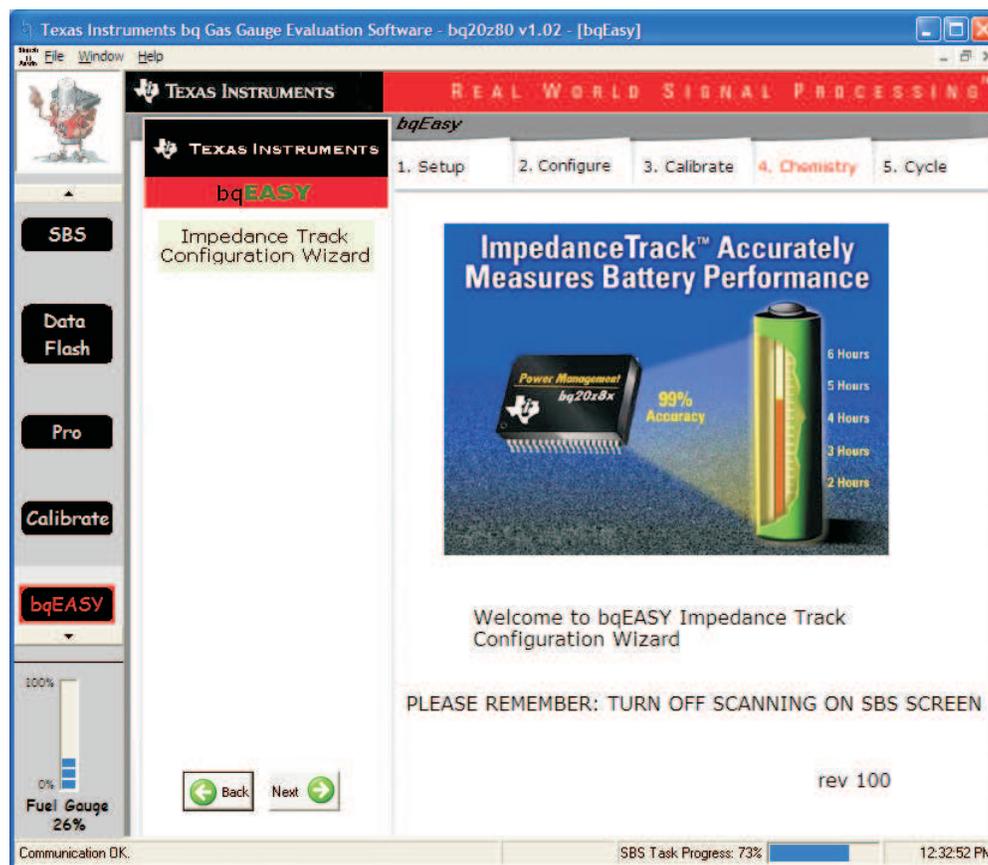
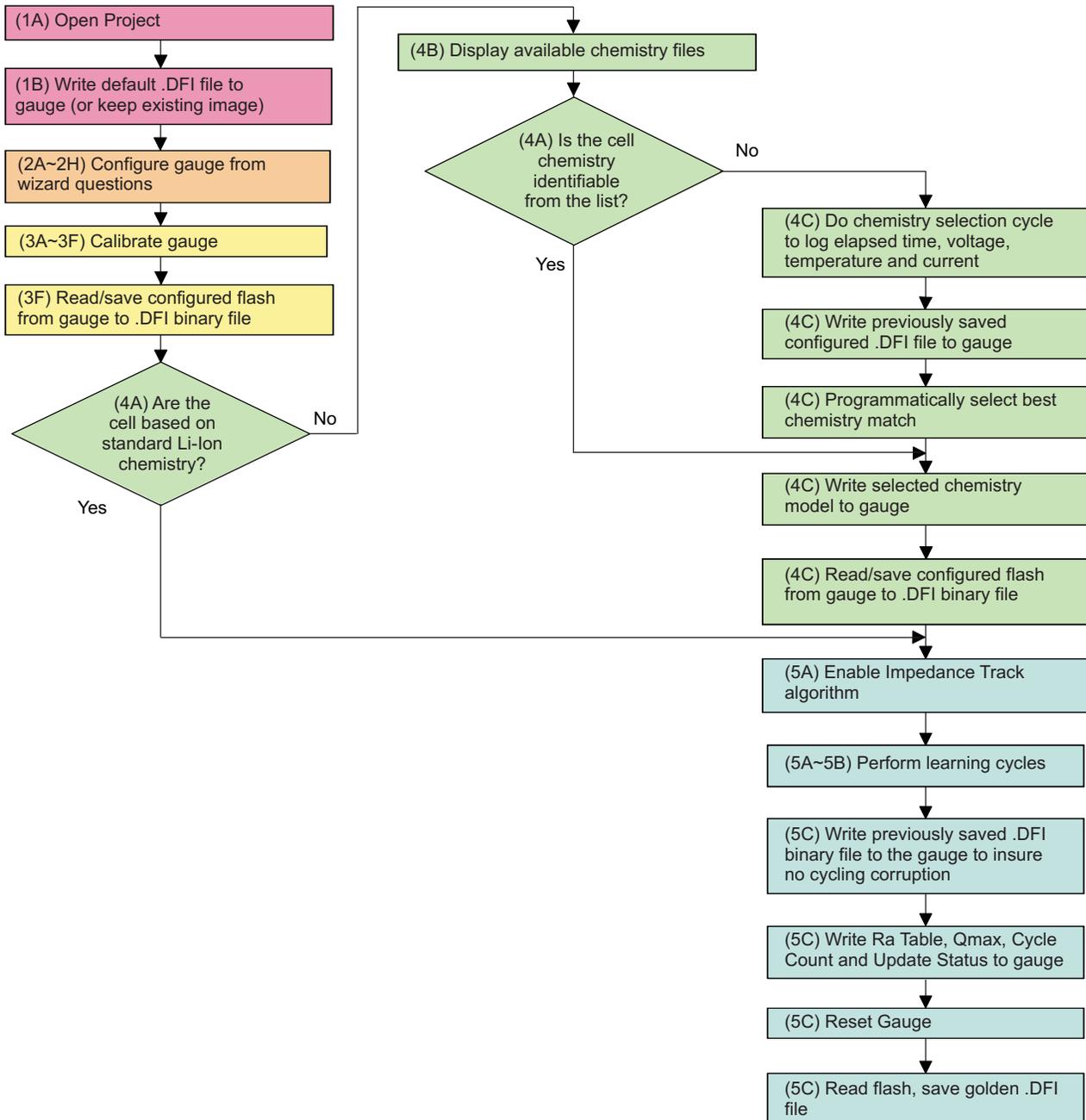


Figure 1. bqEasy in EV Software

3 Program Navigation and Flowchart

The sequence of operation of bqEASY can be understood by reviewing the basic flowchart in [Figure 2](#). Using the program is simple – just start a new project and follow the steps sequentially from 1A to 5C. You can use the Next button, or click on the top tabs and left subsection labels to move to any desired page. Some operations must be completed in sequence due to data dependencies, or to implement the proper flow. Therefore it is recommended that the prescribed sequence be followed, at least at first.



NOTE: Corresponding Program Step Screen Numbers are Shown in Parenthesis

Figure 2. bqEASY Flowchart

4 Simplified Configuration Procedures

These simplified configuration procedures can be used to quickly set up the parameters without navigating through the entire user interface.

1. Simple configuration of the Gas Gauge with default or custom data:
 - a. Open the current EV software and click the bqEasy button in the left-hand column of buttons below the "Calibrate" button in the EV software.
 - b. Click the "2. Configure" tab at the top row of bqEASY tabs. (Note: You can skip the 1st tab)
 - c. Answer all questions or leave defaults for all of tab "2", but be sure to click the ok button at the bottom of each tab "2" page to ensure that a Completion Checkmark appears for each page.
 - d. On page 2H, when you click the "OK" button, the software will ask you to write to the data flash memory. Click "Yes" for OK to write to the data flash.

Your Gas Gauge Module now has the data flash configured as you declared with all the information entered in tab "2. Configure".

2. Simple installation of the Chemistry data using bqEASY if the chemistry is a known chemistry available in the bqEASY software:
 - a. Open the current EV software and click the bqEasy button in the left-hand column of buttons below the "Calibrate" button in the EV software.
 - b. Click the "4. Chemistry" tab at the top row of bqEASY tabs. (Note: You can skip all tabs prior to this)
 - c. Either select "Use Default Chemistry", or click "Enable Chemistry Selection" and select the correct chemistry from the list.
 - d. If you cannot find the proper chemistry, check the device EVM tool folder on the TI website for any new bqChemistry file updates as described in the Software Installation section.

The software will now configure all data flash locations on Your Gas Gauge Module that deal with chemistry functions. No other data flash locations will be modified.

5 Files

bqEASY uses four types of files to configure a fuel gauge.

1. **.ENCR** – These are default data-flash definition files found in the \bq_Evaluation_Software folder. The ENCR file is basically a copy of the entire data-flash from a fresh Gas Gauge prior to any data-flash updates either by the user or the Gas Gauge. They are unique for each version of each TI fuel gauge product. If you should be working with a new version fuel gauge and an older version of bqEASY, the correct file may not be present. This will require a new version of the EV software with bqEASY. Navigate to the TI website in the EVM tool folder for the device being used, and download the latest version, or contact TI. For bqEASY, the ENCR files act mainly as a dictionary to look up the address for a given data-flash location. For bqEVSW, they define screen parameters including address, display formulas and data type. An error message will appear if the correct .ENCR file cannot be found.
2. **.CHEM (Chemistry Files)** – These are read-only files found in the ..\bq_Evaluation_Software\Plugins\Chemistry folder of the application. When a new Li-Ion battery chemistry is developed, a new Impedance Track model is required to define the chemical model. During automated chemistry selection, each of these files is scanned in order to select the best match with the recorded data. If you are working with a newly developed chemistry, it is possible that an acceptable match will not be found. If this is the case, please check for updated bqEasy software or bqChemistry files on the TI website in the EVM tool folder for the part being used.
3. **.DFI (Data-Flash Image Files)** – These are binary images of the fuel gauge data-flash with modified values based on the application. Because of the binary format, it is quick and easy to transfer them to and from a gauge. Each fuel gauge model and firmware version has a unique read-only .DFI which is found in the ..\bq_Evaluation_Software\Plugins\Device_Defaults folder of the application. During the bqEASY process, intermediate versions of .DFI files are recorded with current updated data in order to prevent the possibility of corruption. Then, the final output of bqEASY is also a .DFI file which is the 'golden image' that will be programmed into each production unit. This output file will be placed in the ..\bq_Evaluation_Software\Plugins\Projects folder.
4. **.EZY (bqEASY Project Files)**– These are read-write text files which record header information regarding a project, answers to the wizard questions, and status regarding the stage of completion (the red check marks). They are kept in the ..\bq_Evaluation_Software\Plugins\Projects folder.

6 Completion Checkmarks

As the wizard questions and tasks are completed, completion checkmarks appear in two places – along the task list on the left and on the category tabs on top. A checkmark on a top tab will only appear after all tasks in the category have been completed. For example, in Figure 3 all of the *Setup* tasks and all of the *Configure* tasks have been completed.

Completion marks are saved in the .EZY project text file. When a completed or partially-completed project file is opened, the user is given the chance to erase the checkmarks.

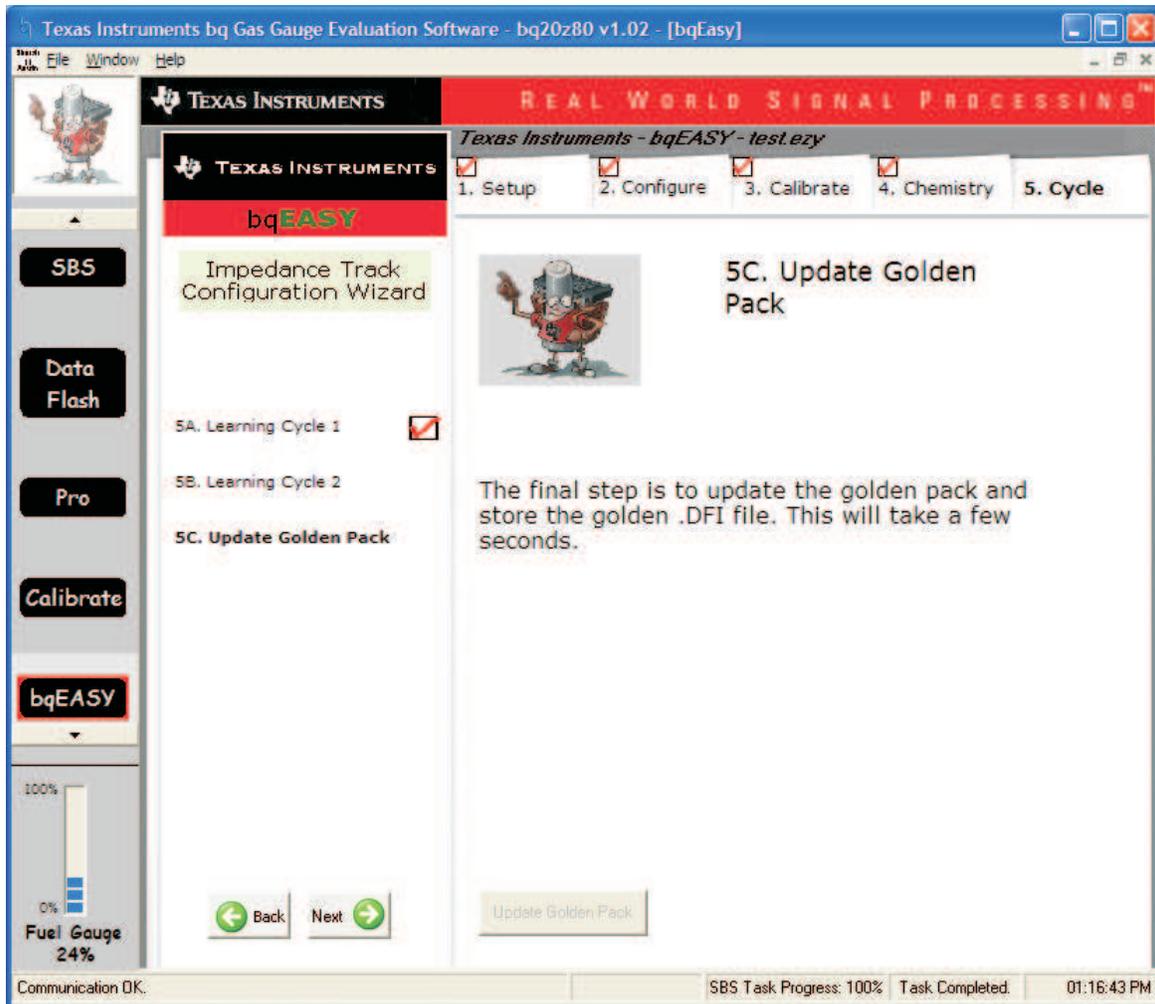


Figure 3. Completion Checks for Categories (tabs) and Tasks (above "Back/Next" buttons)

7 Device Detection

BqEASY is designed to work with a fuel gauge present and already communicating with the bqEVSU evaluation software through the EV2300 USB interface. When the Evaluation software is started, it reads the device type and displays it on the upper title block. For example, in [Figure 3](#) you can see that the bqEASY software detected a bq20z80 that is running firmware version 1.02. This information is used by bqEASY to select the correct default data-flash image (.DFI) and data-flash configuration file (.ENCR) for this particular device. To ensure that the device has not changed, bqEASY also checks the device type when the bqEASY button is pressed. If the correct files are not found, first check the TI website in the EVM tool folder for the part being used, and download the latest version of EV software with bqEASY support. If that does not help, then contact TI.

1. Setup

Step 1A allows the user to open an existing project file, or start a new project. A new project will be given a project file with the .EZY extension.

Step 1B is used to optionally load the default data-flash image for the detected device. If you are starting from a known new device, this step may be skipped.

2. Configure

A series of eight screens is used to collect information about the battery pack application to enable automatic configuration of the most critical data-flash parameters.

3. Calibrate

If you wish to proceed with either automatic chemistry selection or 'golden' unit learning cycles, the Impedance Track fuel gauge must be accurately calibrated. The bqEASY screens simply ask the user to use the calibration screen of the bqEVSU for this purpose.

4. Chemistry

The chemistry choices presented in section 4B are based on files in the \Chemistry folder of the bqEASY application. The latest files are available for downloading from the ti.com website.

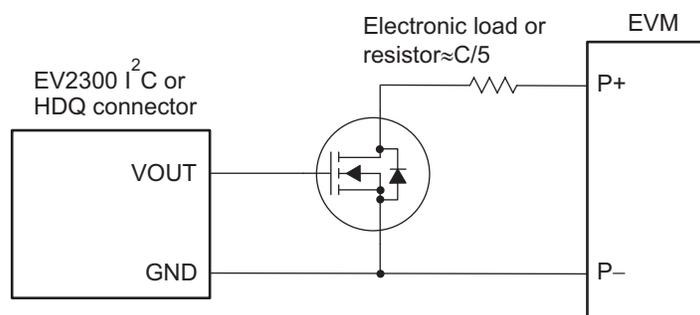
Automation of the chemistry-selection cycle is made possible using a simple load and switch as depicted in [Figure 4](#). The switch can be implemented with either a low V_{GS} -threshold FET or a small relay such as the OMICRON G6RN-1 with a 5-VDC coil. Multiple 2N7000 FETs can be paralleled if nothing else is available.

The load can be either a power resistor or an electronic load set to a discharge rate of C/5.

Hint: Follow the instructions exactly, or errors may result. Ensure that the most-negative cell block in the pack is charged as closely as possible to 4.20 V.

5. Cycle

When preparing for mass production, cell learning is required, but only on one 'golden' pack. The chemical information learned from one pack will be quickly transferred to all production units prior to calibration. Doing this correctly requires a series of charge and discharge cycles. The discharge part can be automated with bqEASY if the simple load circuit for the chemistry selection is available. Follow the screen instructions.



Use – channel FET with low V_{GS} or small 5-V coil relay such as Omron G6RN-1

Figure 4. Example Load

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