



Battery Energy Estimator 300 User Manual



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Revision History

Revision	Date	Description
1	2018-04-14	Initial release



DANGER

- Connecting the Battery Energy Estimator 300 to any other power source than a qualified USB source could cause damage to the device.
- Connecting the output leads of the Battery Energy Estimator 300 to any power source could cause damage to the device.



WARNING

- Shorting the output leads of the Battery Energy Estimator 300 together will cause the device to reset.



1 Introduction

The Battery Energy Estimator 300 (BEE 300) is a battery life estimation meter is a key tool for every IoT engineering team. When developing a battery powered device it is necessary to measure the current consumption to estimate the battery life. The BEE 300 is the ideal low-cost tool to accomplish this. It provides clean power to the device under test and continually monitors the current consumption. Additionally, it incorporates a microprocessor that rapidly takes samples of the current signal and accumulates these values that represent the energy drained from batteries along with the elapsed time. With this data, the BEE 300 system then calculates the estimated life the device can operate on the defined batteries. The BEE 300's ease of use will have you up and running in just minutes!

1.1 Overview

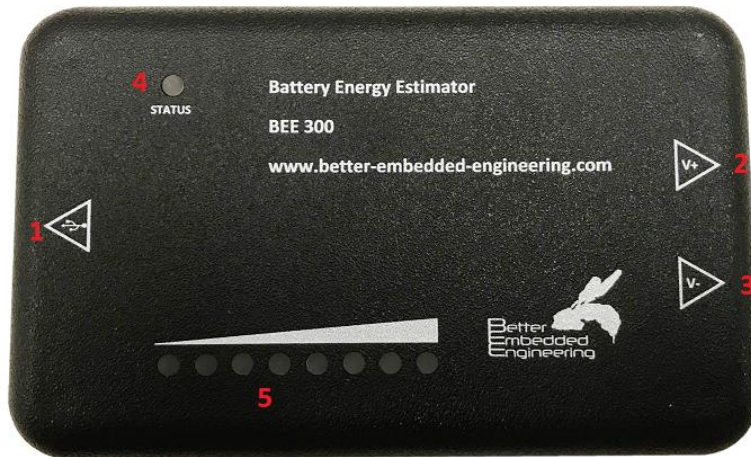


Figure 1: Battery Energy Estimator Overview

Table 1: Battery Energy Estimator Overview

Number	Name	Description
1	USB port connection	Connect to a USB port on the PC using the provided cable
2	Output positive power port	Connect to the DUT positive power terminal
3	Output negative power port	Connect to the DUT negative power terminal
4	Status LED	Orange – Calibrating Red – Failed Calibration Green (Solid) – Ready Green (Blinking) – Battery Accumulators active
5	Measurement LED bar graph	Visual graph of active current measurement



1.2 Kit Contents

The BEE 300 is shipped with the following contents.

- 1 Battery Energy Estimator 300 meter
- 1 USB cable
- 1 Set of Banana to Clip Test Leads (1 Red, 1 Black)

1.3 Functionality and Features

1.3.1 Power Conditioning

The BEE 300 utilizes the power from the USB port to power itself and the DUT. An independent ultra-low noise regulator is utilized to generate clean power to isolate the sensitive analog circuits within the BEE 300 from the noisy digital rail. This clean power rail is also utilized to power the DUT.

1.3.2 Instrumentation Amplifier

Multiple amplification stages are utilized to provide the required dynamic range to accurately measure the currents that are drawn in typical IoT devices.

1.3.3 Self-Calibrating

Upon powering on, the BEE 300 will perform a self-calibration of its analog measurement circuitry using its internal high accuracy test loads. This self-calibration will minimize offset and gain errors that are inherent in all measurement systems.

1.3.4 On Board Data Storage

The BEE 300 contains non-volatile FRAM to store all measurement parameters once per second. Without the FRAM, the data from a long duration test run could be lost during potential power outages, requiring the restart of the test. Since the FRAM is included, test data integrity is ensured.

1.3.5 User Feedback

The Status LED shows the current state of the BEE 300.

The measurement LED bar graph is provided to give the user instant current measurement feedback by simply glancing at the meter. It is comprised of 8 red LEDs and is updated with the last current measurement every 1 ms. Each LED represents ~5 mA.

1.3.6 USB Communications

The BEE 300 uses a USB 2.0 connection to talk to the PC application to get the test data out of the unit. When the BEE 300 is connected to the PC, it will enumerate as a COM port. Check Device Manager to see which COM port number is assigned to the device.



1.3.7 Software Interface

A free user interface is available for download. This interface will provide all the necessary features to operate a BEE 300. Refer to the Operation section of this document for details.

1.4 Electrical Specifications

Table 2: Electrical Specifications

Parameter	Min	Nom	Max	Unit	Notes
Input Voltage	4.5	5.0	5.5	V	Provided by USB interface
Output Voltage	3.25	3.30	3.35	V	
Output Current	0	-	300	mA	
Sampling Frequency	-	62.5	-	ksps	Current measurement
Sample Bits	-	12	-	bits	
Measurement Resolution	-	0.5	-	uA	
Measurement Accuracy	-	2.5	-	%	From 0.1% to 100% full range
Operating Temperature	15	-	35	°C	Accuracy spec over this range
Storage Temperature	-40	-	85	°C	

2 Installation

The BEE 300 was designed for ease of use. Follow the steps below to get your BEE 300 up and running in just minutes.

2.1 Software

The Battery Energy Estimator software has been tested with Windows 10.

1. Download the software from www.better-embedded-engineering.com/downloads.
2. Unzip the setup package.
3. Double click the setup.exe file to initiate the software installation process.

2.2 Hardware

1. Use the provided USB cable to connect the BEE 300 into an available USB port on the PC.
2. Plug the other end of the USB cable into the BEE 300.
3. Connect in the provided test leads into the power output ports on the BEE 300, taking care to match the color-coded connectors.

3 Operation

3.1 Establish a Connection

The BEE 300 uses a COM port emulator over the USB connection. To establish communications, simply click the pull-down menu in the Communications window, and select the appropriate COM port. Once communications are established, the box below the pull-down menu will blink yellow.

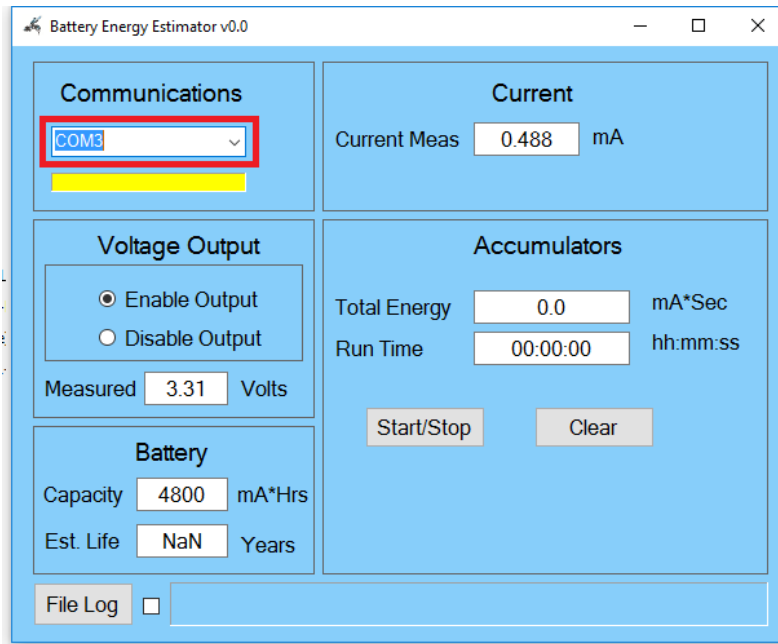


Figure 2: UI Connection

3.2 Connecting the DUT

The DUT is powered from the BEE 300. Simply connect the **RED** test lead to the positive power terminal of the DUT, and the **BLACK** test lead to the negative power terminal.

3.3 Adjusting the Battery Capacity

The battery life calculation is dependent on the capacity of the battery that is intended to power the DUT. The battery capacity can be entered to meet any battery type. Simply click in the battery capacity box and type in the desired value.

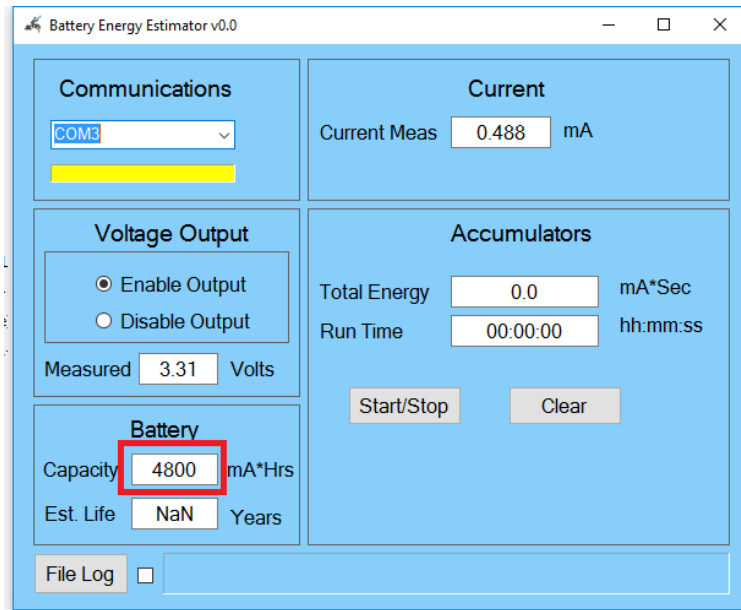


Figure 3: UI Battery Capacity

3.4 Conducting a Battery Life Measurement

1. Click the Clear button to zero the accumulators.

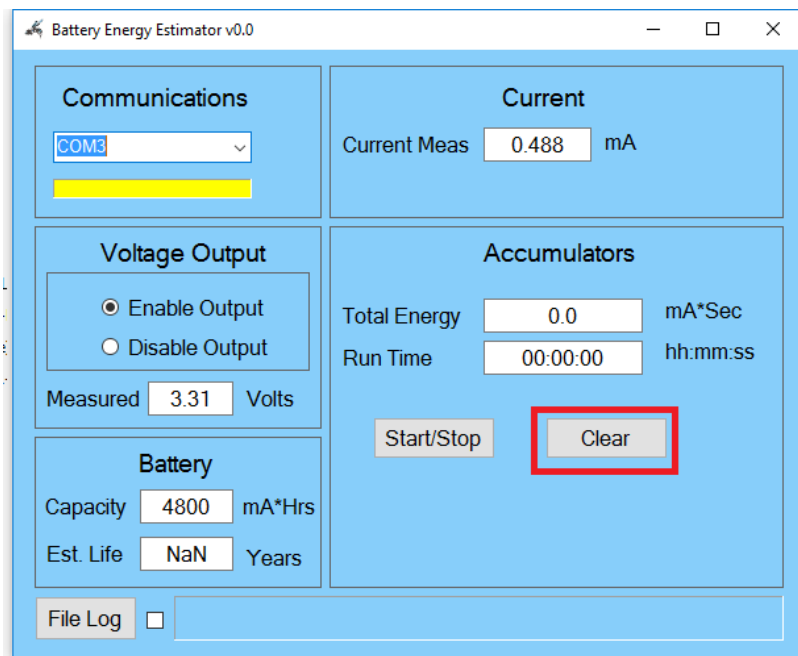


Figure 4: UI Clear Accumulators



2. Ensure the Enable Output is selected.

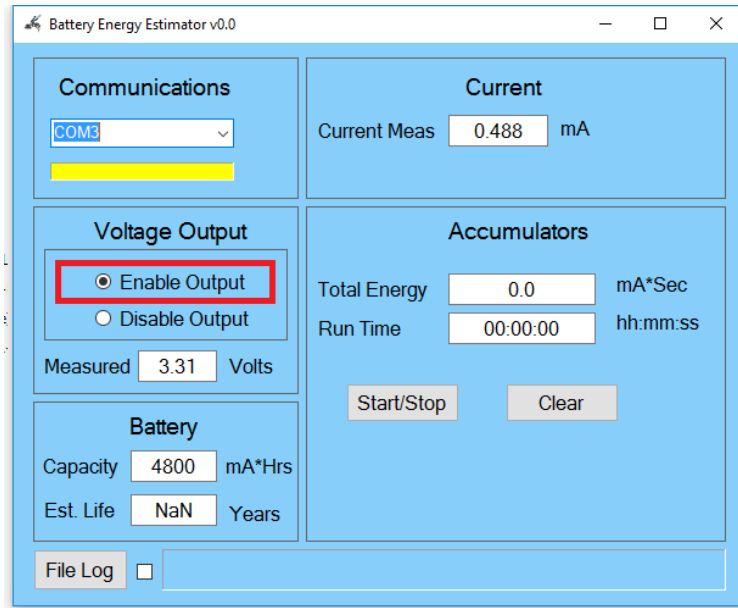


Figure 5: UI Enable Output

3. Click the Start/Stop button to start the accumulators.

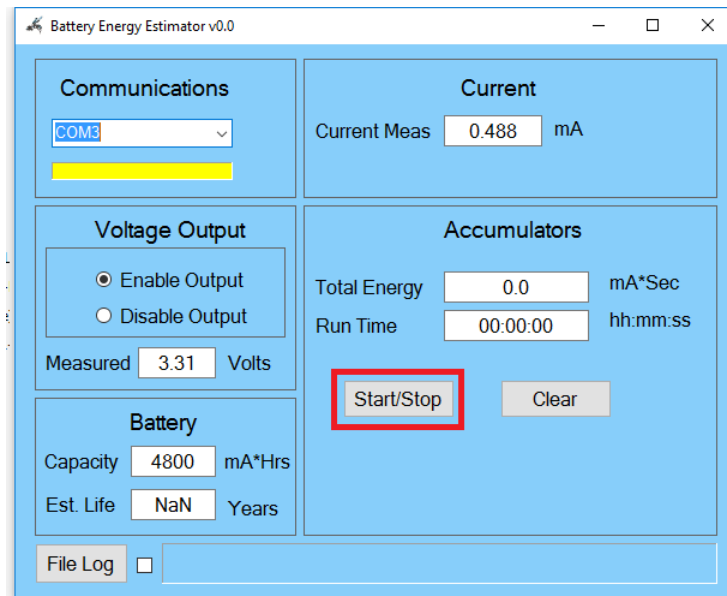


Figure 6: UI Start/Stop Accumulators



4. Allow the test to run long enough to capture enough information until the estimated life calculation stabilizes.

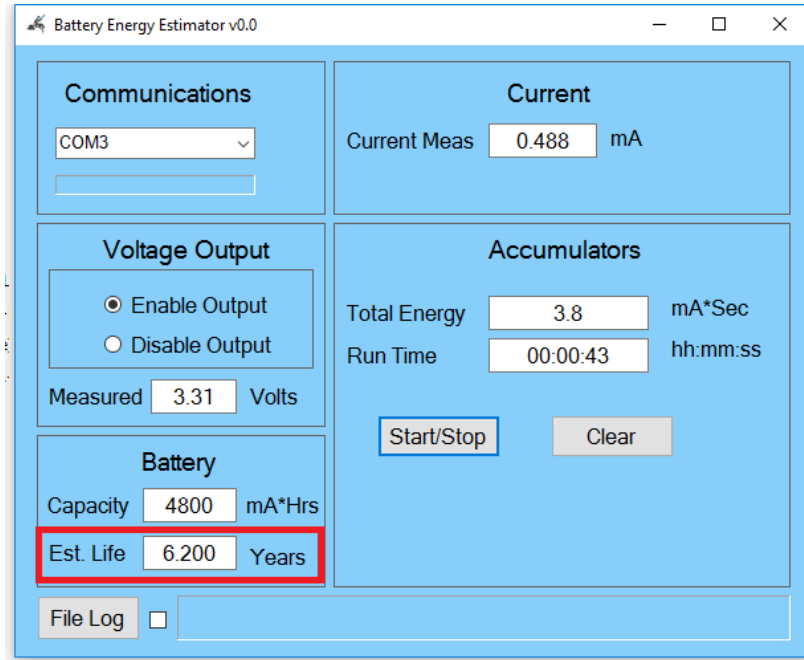


Figure 7: UI Estimated Life Result

3.5 Logging the Data

The UI will automatically ping the BEE 300 once every 1 sec for its latest data. This information can be stored in a log file for later review if necessary. Simply press the File Log button, change the default file name and location if desired, and click OK. The path to the file will be made visible in the box to the right of the File Log button. If data is being logged to this file, the File Log check box will be checked. Data is stored in a comma delimited .csv file.



4 Contact Information

For additional information, go to www.better-embedded-engineering.com. For inquiries, please write us an email at support@better-embedded-engineering.com.