

LFEV-ESCM User's Manual

ECE 492 – Spring 2013

Latest Revision: 16 May 2013

Prepared by: Nicholas Orzol

Abstract

The LFEV-ESCM Users Manual shows how to use the system from a basic standpoint. How to discharge and charge the batteries, as well as procedures for fixing common errors, are discussed here. For further details about the system, refer to the Maintenance Manual.

Contents

<u>EXECUTIVE SUMMARY.....</u>	<u>2</u>
<u>HOW TO DISCHARGE.....</u>	<u>3</u>
SETTING UP FOR DISCHARGE.....	3
TURNING ON SCADA	3
CLOSING THE SAFETY LOOP	4
CONNECTING TO THE LOAD	4
MONITORING DISCHARGE	5
ENDING DISCHARGE AND SHUTTING DOWN THE SYSTEM.....	6
COMMON ERRORS	6
<u>HOW TO CHARGE.....</u>	<u>8</u>
SETTING UP FOR CHARGING.....	8
BEGINNING CHARGING.....	8
MONITORING CHARGING	9
ENDING CHARGING AND SHUTTING DOWN THE SYSTEM.....	9
COMMON ERRORS	9

Executive Summary

Congratulations. You are now the proud owner of the Lafayette Formula Electric Vehicle Energy Storage, Control, and Management (LFEV-ESCM) system. Your product should already be assembled and ready for first time use. However, before using your system for the first time, it is recommended that you read this user document fully. The 2013 LFEV-ESCM team is not responsible for any damage caused to the system or its user for any negligence or ignorance that may have been prevented by reading this document.

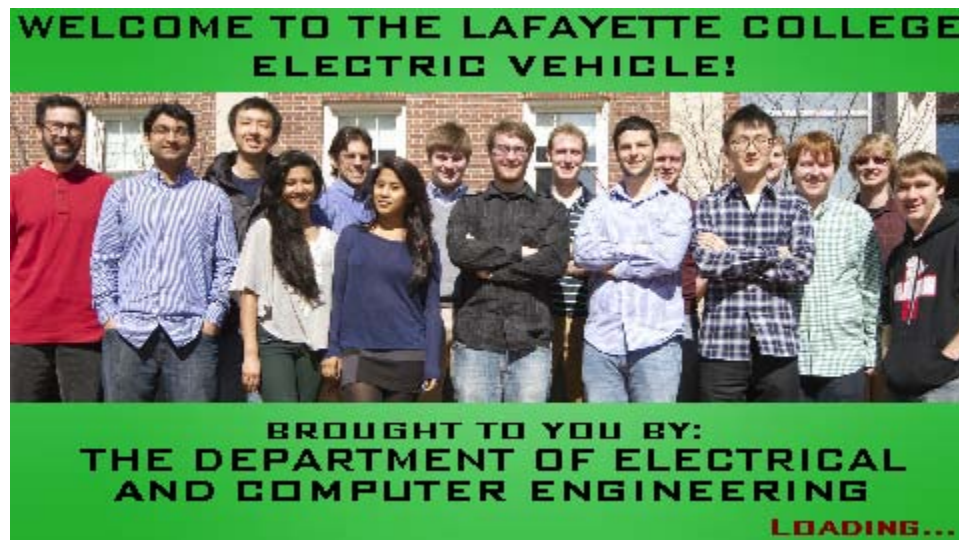
How to Discharge

Setting Up For Discharge

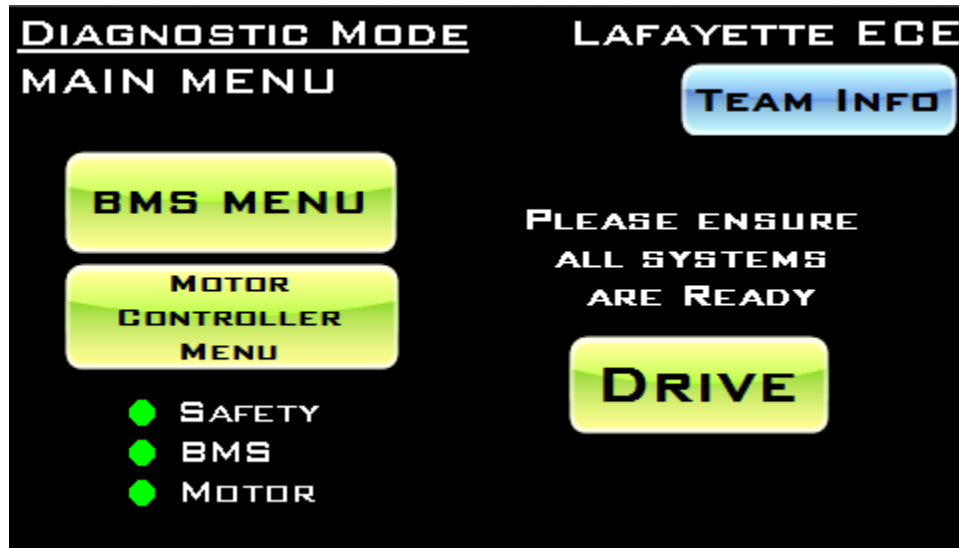
1. **PUT ON SAFETY GLASSES!** Whenever operating the system, it is extremely important to always wear protective eyewear, even while the system is idle.
2. Make sure all power to the system is off.
 - a. All switches in the Power Hub are off (none are lit).
 - b. The Red Keys in GLV Power are either vertical or removed.
3. Ensure that all connections are as shown on the ICD.
4. Make sure all safety loop connections are in their proper default state.
 - a. The Red Emergency Push Buttons are popped out. Twist them to the right to pop them out.
 - b. Make sure the Brake-Over-Travel-Switch is pushed to the left (located next to the big red buttons).
5. Connect the I2C cable to the front of the SCADA box.
6. Connect the Power Hub power cord to the wall if it is not already.

Turning On SCADA

1. Turn on the switch on the Power Hub labeled "GLV". The Power Hub Switch should turn red and the LED labeled "POWER" should light on the GLV Power Box as well.
2. Insert the Red Key to the GLV Power Box keyhole labeled "SCADA" and turn it to the right until it is in a horizontal position. The red light above the keyhole should light up.
3. SCADA should display the following welcome screen for about 4 seconds.



4. After the welcome screen has been displayed, the main menu screen will be displayed, as shown below. The Motor and BMS lights should be green. The Safety Indicator should be red.
 - a. If the BMS light is not green, then double check to make sure the I2C connector is connected to both the SCADA and the Pack.

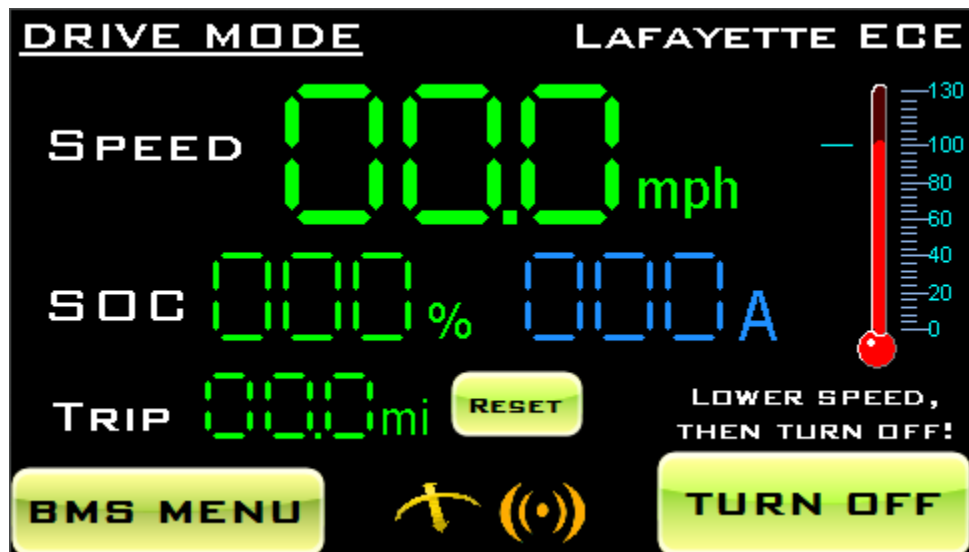


Closing the Safety Loop

1. Insert the other Red Key to the GLV Power Box keyhole labeled “Safety/Tractive” and turn it to the right until it is in a horizontal position. The red light above the keyhole should light up. The Safety Control Box’s LEDs should light. The green LED labeled IMD should light up, and the red LED labeled SL should be lit.
2. Press the Green Reset button on the Safety Control Box. The relays in the packs should make an audible click sound. The green LED labeled SL should now be lit instead of the red one. Additionally, the Safety indicator on the SCADA screen should now be green as well.
3. Check to ensure that the TSAL LED on the Load Controller is lit.

Connecting to the Load

1. Press the switch labeled “Load” on the Power Hub.
2. Turn the Load on by pressing the AC Power button.
3. Ensure the Load is outputting zero current by turning the far right dial counter-clockwise until it will not turn any further.
4. Press the DC Load Button on the Load.
5. On the SCADA screen, press and hold the “Drive” button. The screen should change, and the relays in the Load Controller should make an audible click.

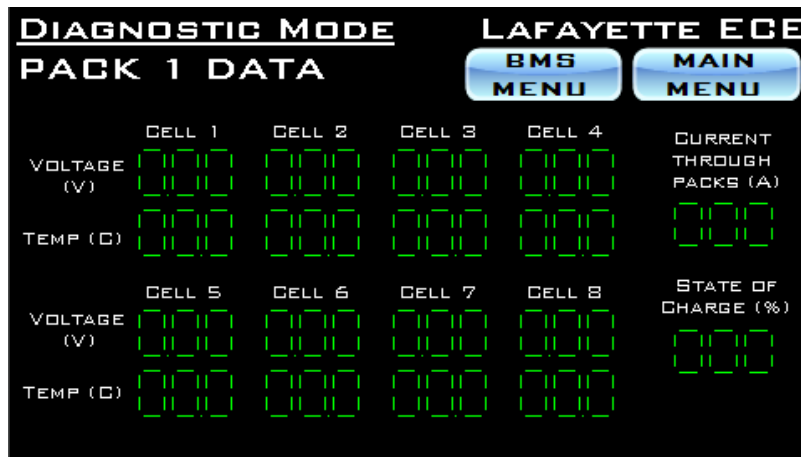


Monitoring Discharge

1. In order to change the amount of current being discharged, turn the far right dial on the Load clockwise until the display labeled "AMPS" is at the target value.
2. Press the "BMS Menu" button on SCADA to be brought to a diagnostics screen.



3. Press the "Pack 1" button to view diagnostics for the Pack.



- If anything hazardous should occur during discharge, press one of the big red buttons to trip the safety loop and immediately stop discharge. **ONLY DO THIS IF THERE IS AN EMERGENCY.**

Ending Discharge and Shutting Down the System

- Lower the current to zero by turning the far right dial on the load counter-clockwise until the AMP reading displays zero.
- Return to the Main Menu on the SCADA screen by clicking the Main Menu button if not already at the Main Menu.
- Press and hold the Turn Off button until the screen changes. An audible click from the Load Controller relays should be heard as well.
- Turn off the Load by first pressing the DC Load button and then the AC Power button.
- Turn off the Safety/Tractive Power by turning the right GLV Power key to the vertical position.
- Turn off the SCADA by turning the left GLV Power key to the vertical position.
- Turn off all switches on the Power Hub.

Common Errors

- The TSAL light does not turn on.**
 - Use banana jacks and a multimeter to read the voltage measurement across the tractive system measuring points. This should read approximately 0V.
 - If there is a constant non-zero voltage across the measuring points, consult an expert and refer to the maintenance manual. The problem lies within the TSAL circuitry or connections.
 - Safely shutdown the system.
 - The fuse holders are located in the back of the safety box next to high voltage lines. They require a Phillips head screwdriver.
 - It is not possible to tell which of the two fuses have blown so unscrew both of them. Determine which one of them has blown (glass casing should be dark or black)

- vi. Replace the fuse with a new one and screw the fuses back into their places.
 - vii. The system should now be ready to start again.
- 2. The SL light does not turn green when the Green Reset button is pressed.**
- i. Follow the Safety Loop Cable between boxes to ensure that it is properly connected. The Safety Loop Cable is the brown cable between each part of the system.
 - ii. Starting at the Safety Control box, the cable should route to the Emergency Shutoffs Panel.
 - iii. The Emergency Shutoffs Panel should have a cable that goes to SCADA.
 - iv. SCADA should have a cable that goes to the Pack.
 - v. The Pack should have a cable that goes to the Load Controller.
 - vi. The Load Controller should have an Safety Loop End Cap. This end cap uses the same plug as the Safety Cable, but consists of a single orange wire that connects to the ends of the plug.
 - vii. If each of these connections is present and secure then refer to the Maintenance Manual. There is most likely an internal Safety Controller wiring problem.
- 3. If turning the dial on the Load does not change the current display on the Load.**
- i. Ensure that the Load is on.
 - ii. Make sure that the Safety Loop is closed.
 - iii. Make sure SCADA is in the "Drive" state (can access drive screen).
 - iv. Make sure that the Load Controller's three LEDs are all on.
 - a. If the TSAL light is off, refer to Common Error #1.
 - v. Check the Discharging Fuse located near the negative pole of the Pack.

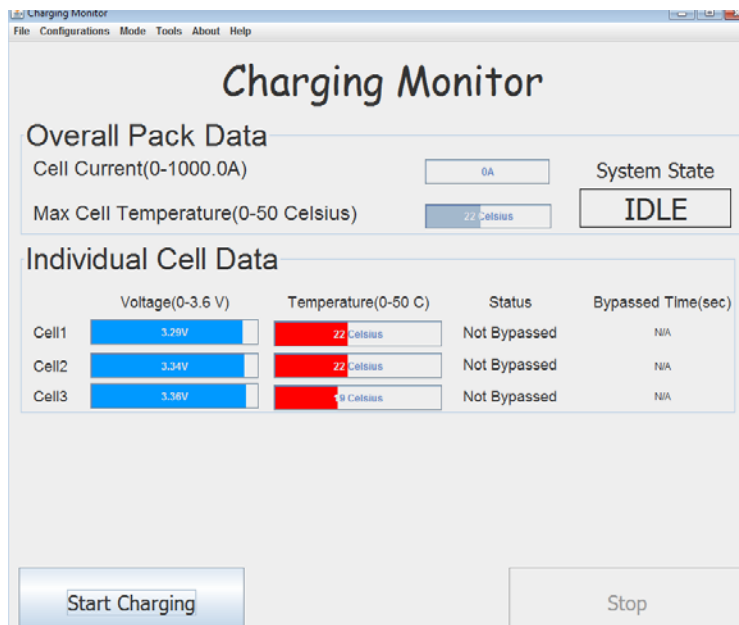
How to Charge

Setting Up for Charging

1. **PUT ON SAFETY GLASSES!** Whenever operating the system, it is extremely important to always wear protective eyewear, even while the system is idle.
2. Make sure all power to the system is off.
 - a. All switches in the Power Hub are off (none are lit).
 - b. The Red Keys in GLV Power are either vertical or removed.
3. Ensure that all connections are as shown on the ICD.
4. Connect the I2C cable to the back of the Pit Station Interface box.
5. Connect the USB cord from the Pit Station Interface box to the laptop.
6. Connect the Power Hub power cord to the wall if it is not already.

Beginning Charging

1. Turn on the switch labeled “Charger” on the Power Hub.
2. Power on the laptop.
3. Power on the Power Supply.
4. Once the Power Supply boots up, click the “prev” button. Use the two knobs to adjust the voltage to 15V and the current to 20A.
5. Press the “out” button on the Power Supply. The out button should now be lit. If it is not, press it again.
6. The Pit Station software should eventually start up automatically. If it does not (it may take a while) click the shortcut in the middle of the desktop.



7. Wait for the software to connect to each of the BMS boards. This is completed once each cell is displaying data for both temperature and voltage.
8. Press "Start Charging".
9. A parameter configuration prompt will appear. Press "Okay". The default settings are sufficient.
10. After several seconds, the Power Supply should start to make noise and the current reading should show 20A.

Monitoring Charging

1. The Pit Station screen shows the status of each cell's voltage, temperature, and the pack's current. If an error occurs, charging will stop and an error message is displayed on screen. If an error does occur, follow the on-screen instructions.

Ending Charging and Shutting Down the System

1. The Pit Station will end charging if the Stop button is pressed, if communication with the BMS boards is lost, if there is a voltage or temperature out of bounds condition, or if the timeout is reached. A voltage out of bounds condition usually indicates a completed charge.
2. After charging is ended, press the "out" button on the power supply.
3. Turn off the Power Supply.
4. Quit the Pit Station program by going to "File" then clicking "Quit".
5. Shut down the laptop.
6. Turn off all switches on the Power Hub.

Common Errors

1. **The software claims the BMS boards are not connected.**
 - i. Ensure that the I2C cable is connected to the front of the Pit Station Interface box and the Pack.
 - ii. Ensure that the USB cord is plugged in to the laptop and the Pit Station Interface box.
2. **After clicking "Start Charging" and confirming the parameters, the Power Supply never outputs any current.**
 - i. Check to make sure the charging cable is connected.
 - ii. Check the charging fuses in the pack. They are located on the positive end of the cap. Note that there are two.