# Calibration and Accuracy

ECE 492 - Spring 2015

## Abstract

This document outlines the various sensors involved in the LFEV, including their margin of error as well as how they are calibrated.

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# Introduction

This document outlines how each group plans to evaluate the accuracy of the measurements made in terms of its error. This document will outline the uncertainty associated in all measurements. It will include analytical estimates of measurement uncertainty and a justification as to why that amount of uncertainty is acceptable. This document will work alongside the Acceptance Test Plan (ATP) for testing purposes to demonstrate that uncertainty verified in practice is within the analytical range and acceptable.

This document should be referred to before any modification is made to either the sensors or the software they interface with.

The concept of calibration encompasses three procedures:

1. **Primary Calibration** - Determining the error of some system parameter with reference to a "gold standard".
2. **Operational Calibration** - Applying the error calculated during Primary Calibration to the measured values of system parameters during operation. This necessary because the reference used for primary calibration usually cannot be accessed by the system on a continuous basis, or in a convenient manner.
3. **Calibration Verification** - Ensuring that the calibration has not drifted over time.

# GLV

All raw data collected by sensors within the GLV system are directly sent to the VSCADA computer to be calibrated via a calibration file. The unit conversions and calibrations will be determined by the GLV team by looking through sensor data sheets and though in-lab testing.

Things to be calibrated:

Battery, any sensors used

# Dynamometer

The sensors on the dynamometer system give feedback regarding the state of the motor and the motor controller. The sensors used by the dyno team will be proven and demonstrated to be accurate within reason for the scope of their use. The sensors will also be calibrated such that the VSCADA team will be able to account for any variance in sensor accuracy.

Things to be calibrated:

Torque sensor, optical encoder, motor current sensor, controller voltage sensor, motor temperature sensor, dynamometer sensors

# TSV

There are several sensors within the TSV battery packs. These include per cell measurements of current, voltage, charge, and temperature, as well as an ambient temperature measurement. All of these sensors come from the AMS boards and are handled by the breakout board before being passed on to the PacMan. The AMS boards report raw data without calibration to the PacMan. The PacMan API contains functions for calibrating the different sensors on the AMS boards, that is how it handles the voltages that are returned by the breakout board.

Things to be calibrated:

Battery packs, see LFEV 2014 documents on their calibration and accuracy

# VSCADA

VSCADA computer acquires data from other vehicle systems through a variety of different ports and protocols. The VSCADA team will implement a network protocol to be used by other vehicle subsystems for the transmission of sensor data. This protocol will be capable of sending and receiving basic sensor data. Once digital data arrives on the VSCADA computer, a configuration file, unique to the transmitting sensor, will specify the interpretation of the raw data. Each sensor configuration file will be written by the VSCADA team, with the help of the relevant team.These modular sensor configuration files will describe how raw sensor data is converted into linearized unit of measurement. The configuration files need to be created or updated when new sensors are added.