Integration to Fuel Truck Flowmeter Register

via

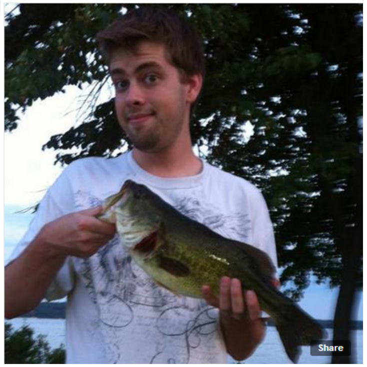
Java Native Interface

on

Windows Platforms

Team: Dec13-07

Team Members



Bryce Kvindlog

Yaze Wang

Jason Kaiser

Carl Garrett

Advisor

Professor Gurpur Prabhu

Client

Oakland Corporation

Introduction

Oakland Corporation

- Agriculture Software and IT Solutions
- Fuel Truck Point of Sale (FuelPOS)
- Liquid Controls Flow Meter

Business Challenges

- Outdated Software
- New Standards for Weights and Measures Laws

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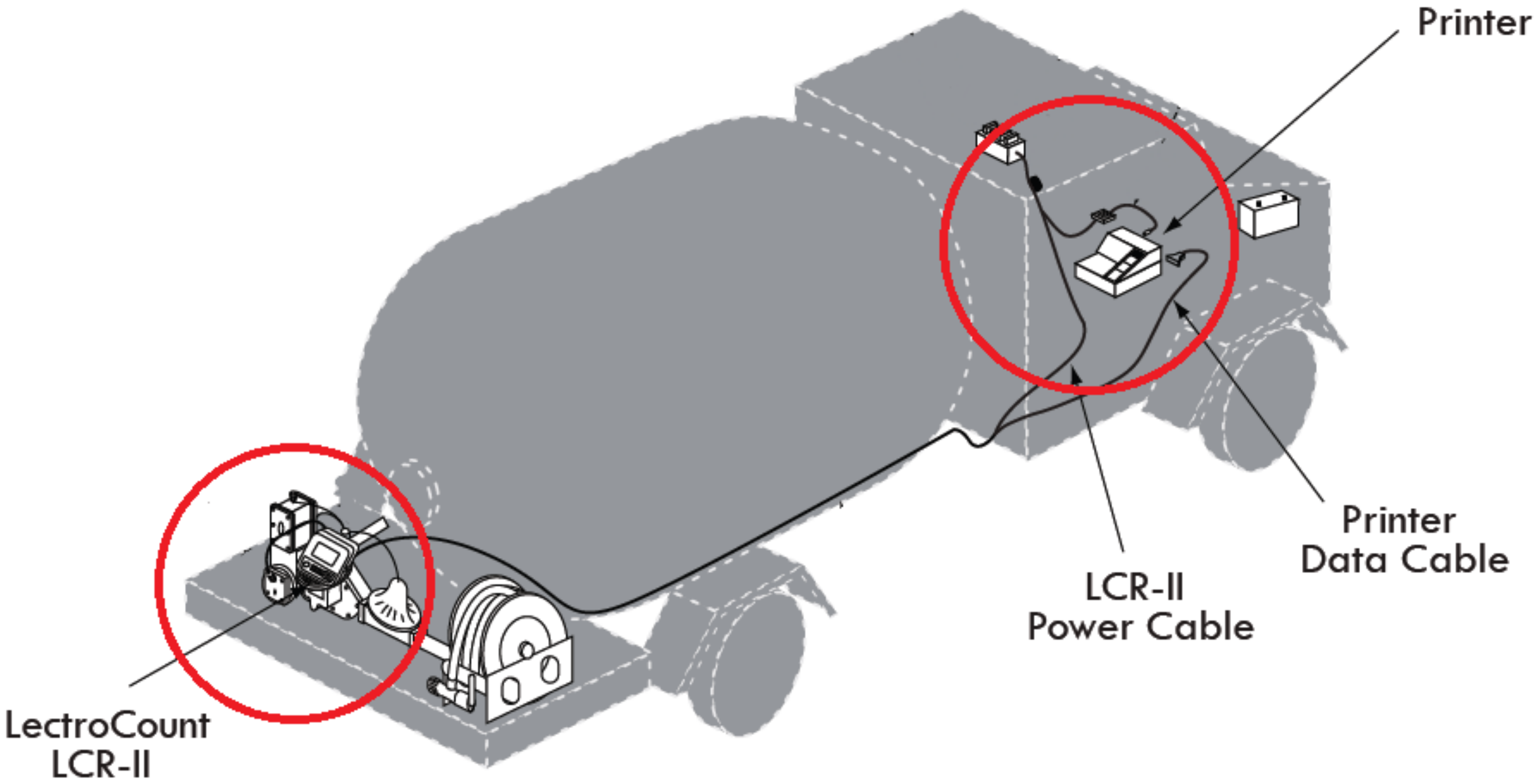
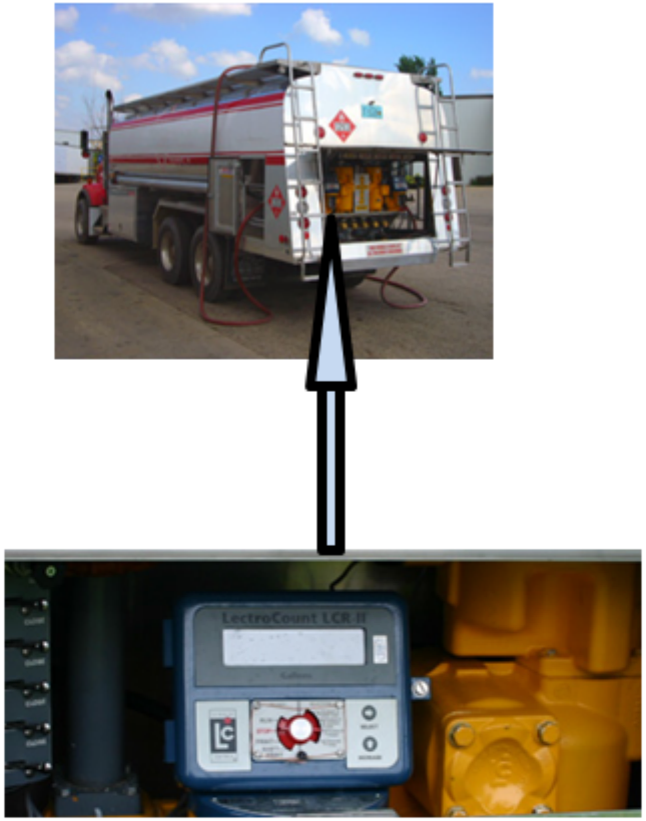
Fuel Truck Layout With Signal Meter



LectroCount LCR-ii Installation and Parts, Liquid Controls 2013.
http://www.liquidcontrols.com/en/products/electronicprod/lectrocount_lcr-ii.html

Flow Meter Communication



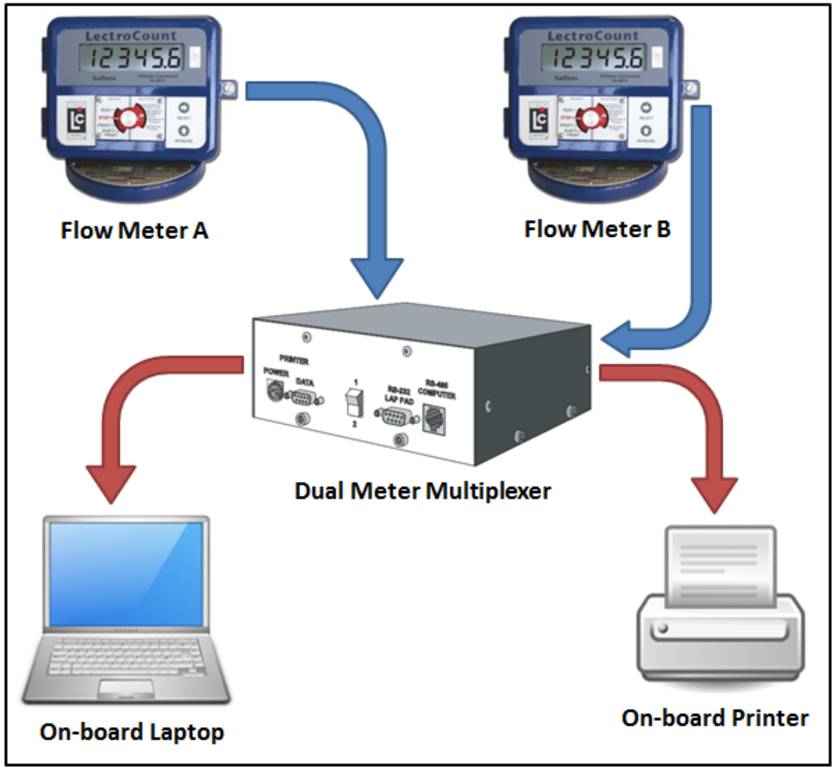
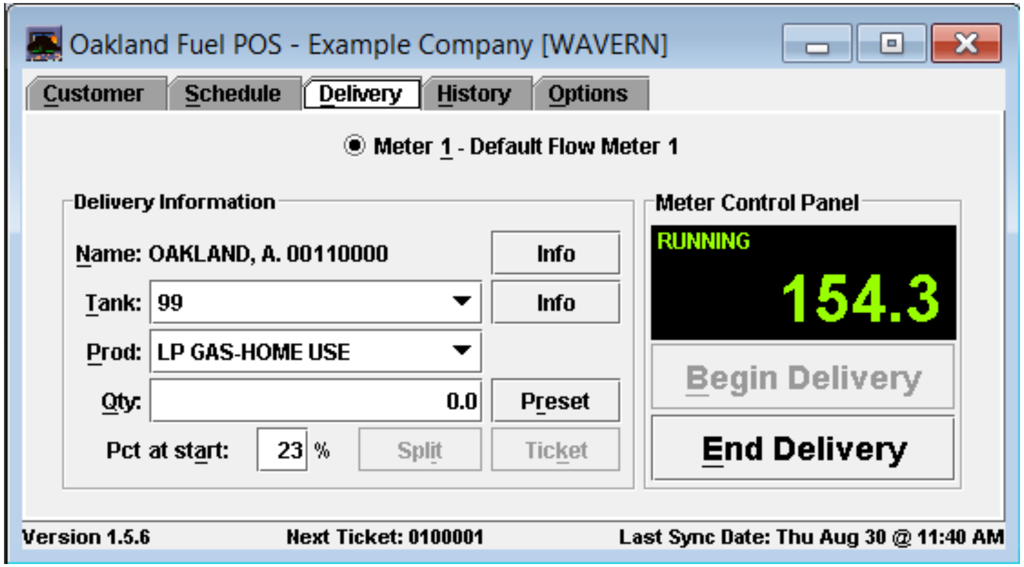


Figure 1.A Connection set up for the all relevant hardware equipment

LectroCount LCR-ii Installation and Parts, Liquid Controls 2013.
http://www.liquidcontrols.com/en/products/electronicprod/lectrocount_lcr-ii.html

Client Software GUI



Oakland Fuel POS - Example Company [WAVERN]

● Meter 1 - Default Flow Meter 1

Name: OAKLAND, A. 00110000

Tank: 99

Prod: LP GAS-HOME USE

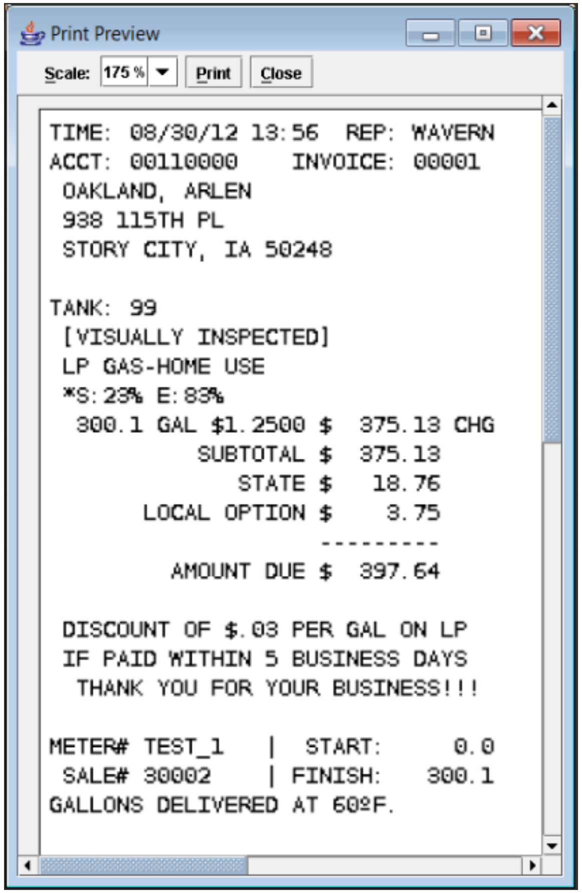
Qty: 0.0

Pct at start: 23 %

RUNNING

154.3

Version 1.5.6 Next Ticket: 0100001 Last Sync Date: Thu Aug 30 @ 11:40 AM



Print Preview

Scale: 175 %

```
TIME: 08/30/12 13:56  REP: WAVERN
ACCT: 00110000    INVOICE: 00001
 OAKLAND, ARLEN
 938 115TH PL
 STORY CITY, IA 50248

TANK: 99
 [VISUALLY INSPECTED]
 LP GAS-HOME USE
 *S: 23% E: 83%
  300.1 GAL $1.2500 $  375.13 CHG
           SUBTOTAL $  375.13
              STATE $   18.76
       LOCAL OPTION $    3.75
                     ---------
         AMOUNT DUE $  397.64

 DISCOUNT OF $.03 PER GAL ON LP
 IF PAID WITHIN 5 BUSINESS DAYS
  THANK YOU FOR YOUR BUSINESS!!!

METER# TEST_1    |  START:     0.0
 SALE# 30002     | FINISH:   300.1
GALLONS DELIVERED AT 60ºF.
```

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Project Goals

Improving Implementation

- Handles Modern Operating Systems
- Robust Error Handling

Adding More Functions

- Simultaneously Handles Up to Two Fuel Meters
- Printer Communicates Directly with Fuel Meters

Deliverables

- FlowMeter Implementation (JAR library)
- LCR Native Wrapper (32-bit DLL)

Design Constraints

- Java Runtime Environment 1.7.X
- Java API Version 7.X
- C++ Liquid Controls API
- Windows 7/8/8.1
- Run on Fuel Trucks

Design Solution

- Java Classes to represent fuel meters
  - Java classes will allow use of good object-oriented practices
- Java consistent wrapping of C++ functions
  - Wrap C++ API calls as Java functions with exceptions and classes for bit masked values
- C++ Device Communication
  - Using Liquid Controls API eliminates the need to rewrite, implement, and test functions in Java

Current State of Design

- Throw Java exception on errors, instead of returning a code
- Use enumerations that can be converted to values
- Thread safe java code
- C-focus approach vs. Java-focus approach

Java Wrapper API

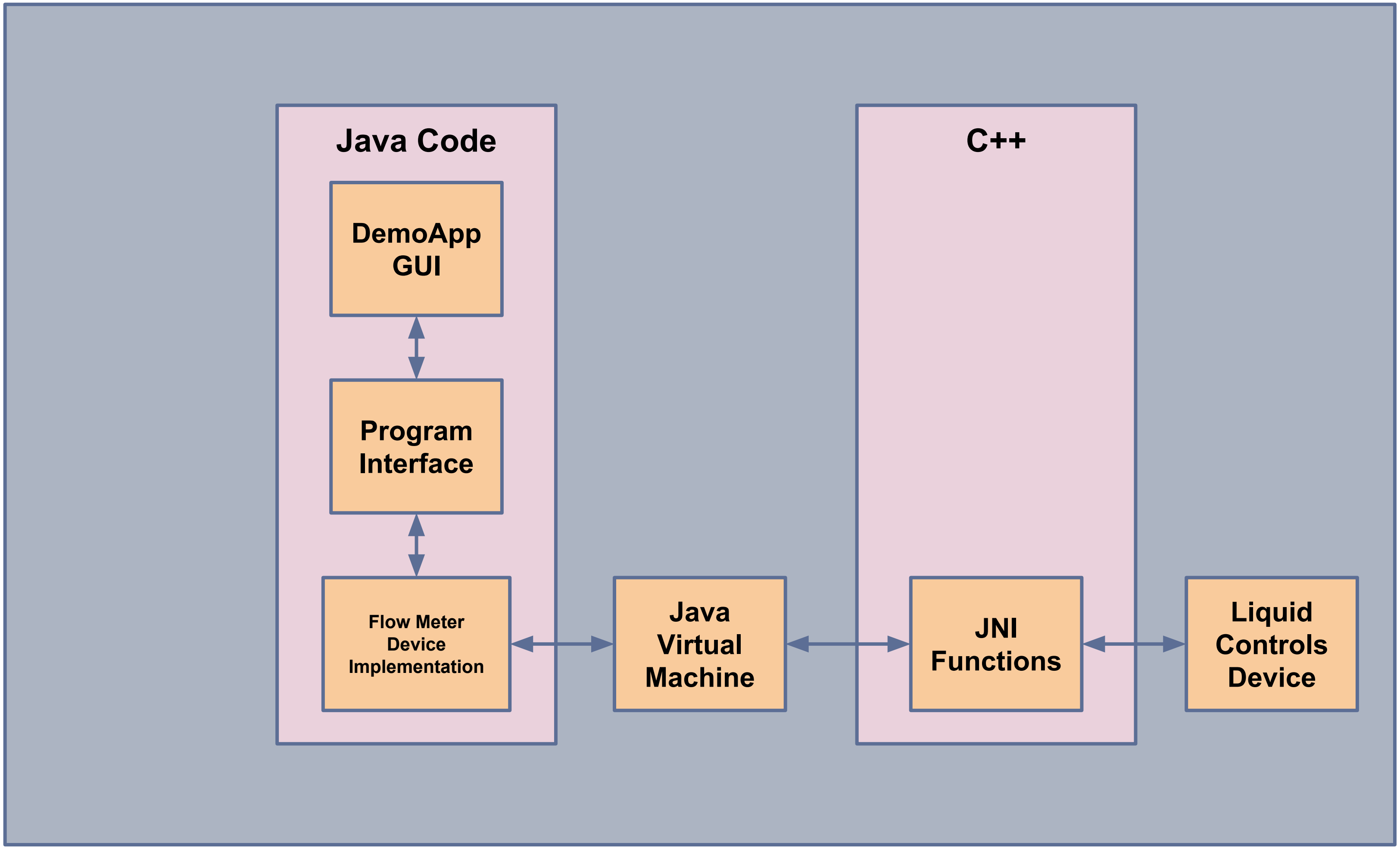
- Advantages
  - Program changes only require changes to Java implementation
  - C++ methods only need to be changed after API changes
  - Object-oriented design patterns can be followed
  - Easier client maintainability

- Disadvantages
  - Functions will be slower due to frequent calls through native interfaces
  - Time consuming mirroring of functionality

Liquid Controls API to Java Wrapper

- C methods use pointers to return multiple structures
  - Convert return variables to single class
- Bit-masked to integral types
  - Used to represent boolean fields
  - Convert to a Java object
- Return codes used to determine errors
  - Parse return codes and throw Java exceptions

Block Diagram For Real System



Technical Challenges

- Development Environment
  - Source control
  - Compiler/Linking
- Integration Difficulty
  - Developed on Windows 8 + Tested on Windows 7 = Hidden library dependencies
- Dealing with 32 bit and 64 bit environment
- Confusing Documentation

Testing Overview

- Pre Meter Testing
  - Using data from a testing meter (MockAPI)
  - Tested functionality which does not require the meter hardware.
    (e.g. disconnection errors, & wrapper functionality)
- Post Meter Testing
  - Is being done with a physical meter.
  - Testing involves both white box and black box testing methods.
  - Ensure all requirements are met thoroughly.

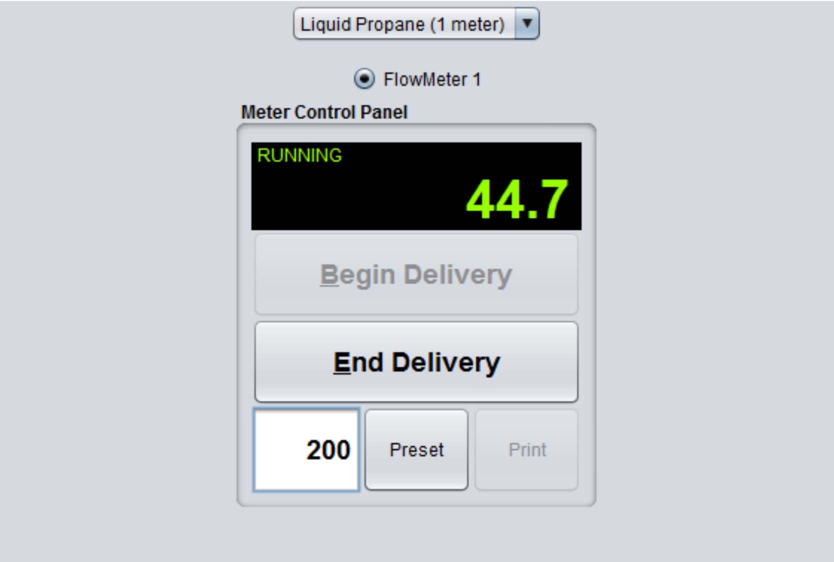
Testing Objectives

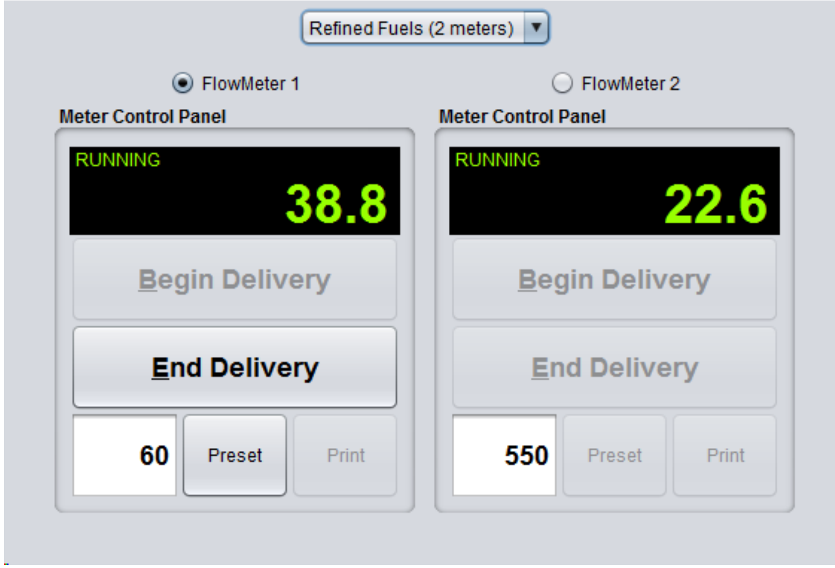
- Test error conditions thoroughly
  - Will be tested with a variety of methods, largely involving JUNIT tests.
- Test the wrapper: Integration Test
  - Will be tested using white box.
  - Tests will be written to ensure each function operates as intended.
- Testing for the implemented project
  - Will involve black box testing methods.
- Testing with client's code: Regression Testing

Test Case: Preset Delivery

1. Open connection to the device.
2. Assign a preset volume on the device
3. Tell the device to start the delivery
4. Keep checking on the device until it indicates the delivery has paused
5. Tell the device to stop the delivery

FuelPOS Test GUI





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Q & A Time

Any Questions?