Request for Services (RFS)

Project:	Vortex Flowmeter Embedded System Proof of Concept
Creation Date:	2015-09-20
Last Revision Date:	2017-09-18
Version:	1.2
Status:	Proprietary and Confidential

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1 Introduction and Background

1.1 Purpose

Sierra Instrumentation is a global provider of products, services and solutions to consumers, commercial organization and government institutions throughout North America, Europe, and Asia. With more than 150 locations in over 50 countries, our Flow Measurement and Control Division is known for design and manufacture of innovative high-performance fluid flow measurement and control instrumentation for nearly any gas, liquid and steam application spanning across global industries as diverse as scientific research, semiconductor, wastewater treatment, iron and steel, clean energy, aerospace and biotech to name a few.

Sierra requires hardware development services in support of a new product development. Specifically, the company requires a proof concept embedded system design for the proposed Sierra 240 Vortex Flowmeter. Implementation of pre-production prototypes is a desirable follow-on contract. The scope of the work required includes evaluation, and testing of the proposed embedded system platforms.

In particular, Sierra wants to produce a product that meets this description:

Sierra's Model 240V In-line Volumetric Vortex Meter provides a direct reading of volumetric flow for liquids, steam or constant density gases. Product accuracy is ± 1% of rate for liquids and 0.7% of rate for gases and steam over a 30:1 range. The Model 220 is hazardous area approved for FM, CSA, ATEX and CE and available in flow body sizes from 1/4-inch up to 8-inches.
The Model 240V allows for a constant density input to calculate mass flow for incompressible fluids or constant density gas or steam flow. The product features loop power, simple installation with ANSI flanges and a 4-20 loop output. A separate totalizer pulse output is also standard. Smart electronics provides access to all measured variables and programming menus.

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1.2 Administrative

1.2.1 TECHNICAL CONTACT

Any questions concerning technical specifications or Statement of Work (SOW) requirements must be directed to either:

Name	Venkat Tata & Jahnavi Pinnamaneni
Address	1111 Engineering Drive, Boulder CO, 80309
Phone	NA
FAX	NA (are you kidding?)
Email	Venkat.Tata@colorado.edu; Jahnavi.Pinnamaneni@colorado.edu

1.2.2 CONTRACTUAL CONTACT

Any questions regarding contractual terms and working conditions or report format must be directed to:

Name	Tim Scherr
Address	ECOT 340, 1111 Engineering Drive, Boulder CO, 80309
Phone	303-735-7633
FAX	NA
Email	Timothy.scherr@Colorado.edu

1.3 DUE DATES

All Reports are due by 11:59 am MST on 2021/09/27. Any Report received at the designated location after the required time and date specified for receipt shall be considered late and receive a 10% per day penalty. Any late reports will not be evaluated for top prizes, including best project and smallest operational code.

1.4 SCHEDULE OF EVENTS

Event	Date
1. RFS Distribution to Vendors	2021/09/02
2. Platform Evaluation begins	2021/09/03
3. Questions from Vendors about scope or approach due	2021/09/08
4. Approximate Completion of Module 1	2021/09/13
5. Approximate Completion of Module 2	2021/09/16
6. Approximate Completion of Module 3	2021/09/19
7. Approximate Completion of Module 4	2021/09/24
8. Report and Deliverables Due Date	2021/09/27

1.5 Reference Documents
1. Project 1 Guide, which describes the 4 Test Modules to be completed.
2. Freescale Kinetis KL25Z Datasheet.
3. Freescale Kinetis KL25Z Reference Manual.
4. Freescale FRDM-KL25Z platform User's Guide.
5. Others, yet to be determined.

1.6 Scope
The scope of this document concerns the requirements for Sierra's Model 240V In-line Volumetric Vortex Meter product and work to evaluate a potential MCU to meet those requirements. It describes the product function, criteria for evaluating the performance of the product, and performance requirements to guide the evaluation work. It does not describe how the design is to be done, only what the outcome should be. The work required is limited to evaluation of potential solutions to the embedded system implementation for the product.

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2 Guidelines for Report Preparation

2.1 REPORT SUBMISSION

Award of the highest grade resulting from this RFS will be based upon the most responsive Vendor whose evaluation results will be the most advantageous to SIERRA in terms of cost, functionality, and other factors as specified elsewhere in this RFS.

Vendor's Report shall be submitted in several parts as set forth below. The Vendor will confine its submission to those matters sufficient to define its Report and to provide an adequate basis for SIERRA's evaluation of the Vendor's Report. In no case should the report exceed **5** pages long (not including the Cover, Table of Contents, or Appendix.)

Vendor's Report(s) in response to this RFS must include a system block diagram and links to code, images and diagrams. We recommend storage of these items in a GIT repository. The submitted Reports are strongly suggested to include each of the following sections:

1. Executive Summary
2. Problem Statement and Objectives
3. Approach and Methodology for Evaluation
4. Module Test Results
5. List of Project Deliverables
6. Recommendations, including use of the Freescale MCU
7. Appendix: References
8. Appendix: Project Team Staffing

Refer to the submission guidelines document for writing the report.
The detailed requirements for each of the above-mentioned sections are outlined below.

3 DETAILED SIERRA PRODUCT REQUIREMENTS

3.1 SCHEDULE

This product must be developed within the next 18 months, ready for market. It is an evolution of existing products.

3.2 BUDGET

Budget for the embedded system is not to exceed $200 in production. This includes the PCB and connectors. Cost for the MCU should not be greater than $20.

3.3 PERFORMANCE (FEATURES)

Environmental:
1. Commercial Temp, 95% RH
2. Conforms to FCC EMC requirements
3. UL, CSA, and FM Certification
4. Compliant with ROHS requirements
5. 20 year Longevity (MTBF)
6. 20 year Availability

Inputs:
1. Vortex Frequency Sensor(Analog) sampled at 10 kSps
2. 2 Temperature Sensors
3. Touch Keypad
12 bit ADC required at 10 kSps

Outputs
1. Pulse output (Hi-voltage Digital) for totalizer
2. 3 LEDs (Power, flow detected, BIST indicator)
3. LCD Display in response to touch input
4. 4-20 current loop (PWM or DAC output)
5. Local Serial Port (for monitoring and data dumps)
Flow must be calculated every 100 ms based on frequency and temperature input.

Processing Requirement
Estimated 40 DMIPs

Power: DC supply with 24 volts on 4-20 current loop (4 mA minimum available power).
Average Power consumption must be less than 100 mW.

4 EVALUATION FACTORS

4.1   CRITERIA

Any award to be made pursuant to this RFS will be based upon the proposal with appropriate consideration given to technical, spelling, grammar, and management requirements. Evaluation of projects will be based upon the Vendor's responsiveness to the RFS. The following elements will be the primary considerations in evaluating all submitted Reports and in the selection of a Vendor or Vendors for Top Prizes:

30% Technical Report
10% Executive Summary and Recommendations
10% TA Design Review
10% Deliverables for each Project Modules 1-2
15% Deliverables for each Project Modules 3-4

5 SCOPE OF WORK

5.1   EVALUTION

At a minimum, the work to be performed includes:
- **Evaluate** the hardware and software capabilities of **the Freescale Kinetis K25LZ MCU** by using the FRDM-K25LV platform to perform a series of tests and also by design calculations.
- Draw a **system block diagram** showing the inputs, processor, and outputs for this product.
- Create an **algorithmic block diagram in Simulink** and simulate your system. Show simulation results in the report using simulated ADC data provided to you.
- Evaluate system performance by completion of the 4 assigned modules. See the Project 1 Guide for details. If a better processor choice is available, please recommend it.
- Evaluate hardware suitability by **suggesting on paper possible I/O interfaces including ADC input, +24 volt Pulse Out drivers, 4/20 circuit driver, LED drivers, LCD interface** and calculating required I/O current drive and voltage levels for the processor I/O. **Create a BOM** of major parts required in a circuit solution.
- **Measure simulated flow** using your prototype. You will be given captured data to use in the flow calculations. **Estimate power consumption** for your system as this occurs.
- Produce a **Technical Report** showing results of the proof of concept prototype.
- Provide a **conclusion** regarding the viability of the concept and recommendations for further development.

5.2   DELIVERABLES

At the conclusion of the project, SIERRA requires written documentation of the approach, findings, and recommendations associated with this project to be delivered to the contracting agent through D2L. An informal presentation of the findings and recommendations to senior management may also be required as part of a peer evaluation. The documentation should consist of the following:

1 DETAILED TECHNICAL REPORT
A document developed for the use of SIERRA's technical staff which discusses: the proof of concept platform, the evaluation methodology employed, detailed technical findings, and performance measurements or calculations relative to the requirements.

2 EXECUTIVE SUMMARY REPORT
A document developed to summarize the scope, approach, findings and recommendations, in a manner suitable for senior management (3 paragraphs or less).

3 SOFTWARE DESIGN FILES AND DOCUMENTATION
Deliverables should include
- All drawings, images, and design documents in Word or PDF electronic files
- Source code in zip format
- Doxygen Report in HTML or .rtf file.
- Test Data and Screenshots

6 Acronyms and Definitions

Item	Description
ATP	Acceptance Test Plan
SI	Sierra Instruments
RFS	Request For Services