

## Software technical challenge

The Smart Module Electronics (SME) is a transmitter that connects to the Rheonics sensors and processes the analog signals to generate the measurements of Viscosity, Density, Temperature and others through different interfaces; like RS-232, TCP/IP, Modbus, etc.

For software development purposes, we designed an application that emulates the SME and provides part of its information in a measurement string. The measurement string is an ASCII string with a special formatting that sends the value of some of the measurement parameters.

The SME simulator application should be installed using the installer named 'SME\_SIM\_1.0.0.1.exe' in the installers folder and the string formatting can be found in the document: "SME output stream.pdf".

The main goal is to create an application that is capable of connecting with the SME simulator through serial port, TCP/IP and Modbus TCP, and process and display the measurement strings, each communication protocol is configured as follows:

- **RS-232:** you can use the com0com software to emulate two paired or bridge serial port (the installer is included in the installers folder), just select 1 of the emulated COM ports in the SME SIM and select the other emulated COM port in your application. The measurement string will be sent through this port every 1 second.
- **TCP/IP:** the IP address and port are specified in the SME SIM interface, there will be two messages, the first one will be a I32 flattened string that contains the size of the measurement string and the second one will be the measurement string. The measurement string will be also sent through this port every 1 second.
- **Modbus TCP/IP:** the IP address and port are specified in the SME SIM interface and the register mapping is specified in the 'Modbus-mapping.xlsx' file. The Modbus registers will update every 1 second.

### Application requirements

1. Create a public git repository where you are going to save the Labview project and its VIs, try to make as many commits as possible so we can track your application creation process.
2. Create a LabVIEW application that is capable of acquiring through RS-232, TCP/IP and Modbus the measurement string and values sent by the SME SIM.
3. Create 3 different interfaces to show the data of each protocol (could be a tab control or subpanels), each interface should have a table with all the received values from each protocol and 2 graphs with the following values: Viscosity and Temperature in the first graph, each with its own axis, Frequency and Damping Frequency in the second graph, each with its own axis.
4. As an optional requirement you can calculate the velocity and acceleration of the viscosity and display them on a graph each with its own axis.
5. Add the ability to record the data in a .csv file for each protocol, it should have the following data: Timestamp, Viscosity, Temperature, Frequency, Damping Frequency, Density, Error code. Allow the user to start/stop the logging when needed.

6. Create an additional window where you can load the csv logfile you created in the last step and make the following calculations: maximum viscosity, minimum viscosity, average viscosity, standard deviation of the viscosity. This new window should be accessible through a button in the main interface.
7. The maximum size of the interface should be 1920x1080 (could be smaller), it should be resizable and all the controls and indicators should adapt automatically, adding custom icons and decals is a plus.
8. Create an installer of your application, it should contain all the necessary libraries, so that it can be installed on a computer without any LabVIEW software installed.

At the end, send us the installer of your application and give us access to the git repository for revision.