

CLD Exercise 13: Flow Rates

Objective

Develop a state machine that simulates flow rates and flow rate change using the given application front panel (Figure 1).

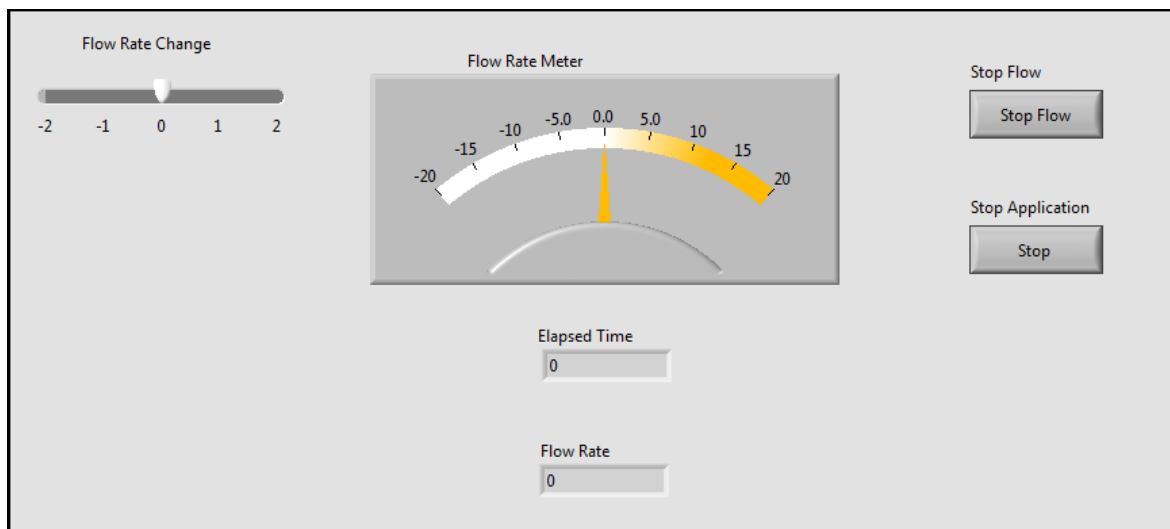


Figure 1. Application Front Panel

General Operation

The flow rate starts at zero. The **Flow Rate Change** slide will increment/decrement the flow rate. The **Flow Rate Meter** displays the current flow rate. The **Stop Flow** button will change the flow rate toward zero, at a rate of change of one, until the flow rate is zero. The **Elapsed Time** counts up time when the flow rate is not zero.

Application Terminology

The Flow Rate

The current rate of flow is a unitless measure. It can increase or decrease based on the value of the **Flow Rate Change** control. The flow rate must go to zero when the **Stop Flow** control is pushed. The flow rate is calculated on one quarter second interval timing.

Flow Rate Change

This control will increase or decrease the flow rate by its value.

Flow Rate Meter and Flow Rate Indicator

The current flow rate. The value must be limited to +/- 20.

Elapsed Time

The time elapsed since the flow became non-zero. This value resets whenever the flow rate reaches zero. When the flow rate changes its flow direction, or positive/negative sign, the **Elapsed Time** resets to zero when the flow crosses the value of zero.

Initialization

The application must initialize as shown in Figure 1, and the front panel controls and indicators must be in the following states.

- **Flow Rate Change:** Set to zero
- **Flow Rate:** Set to zero
- **Elapsed Time:** Set to zero

Operation

VI run

The application is at zero flow rate and zero flow rate change. The application will not change until the flow rate is changed using the **Flow Rate Change**.

Set Flow Rate Change

- The flow rate will begin to change by the amount of the **Flow Rate Change**.
- The **Flow Rate** displays in the **Flow Rate Meter** and **Flow Rate** indicator.
- When the flow rate change is zero the flow rate will maintain its current value.

Press Stop Flow

- The flow rate will begin to change value at a flow rate change of +1/-1 to go to zero.
- The **Flow Rate Change** is set to zero.
- The **Elapsed Time** goes to zero.

Questions

What changes would be required to maintain a running total of the absolute total flow?
(Note: negative flow contributes to absolute flow)

What strategy for file logging the flow rate and absolute flow rate would work best, without affecting the quarter second timing?