

## **FuelCell Addendum – Multi-Range Reformate Flow Controllers**

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### **Introduction**

This addendum describes the use of multi-range mass flow controllers for Reformate gases. For multi-range main gases (typically H<sub>2</sub> and O<sub>2</sub>), see the document *FuelCell 3 Addendum – Multi Range MFC Support*.

Multi-range controllers use a parallel combination of a small range MFC with a larger range MFC. This allows a combination of accurate control of small fuel flows with large maximum flow capabilities.

### **Software Support**

Requires FuelCell version 3.8d1 or later. The software version is displayed in the FuelCell program Help | About FuelCell... screen.

### **Hardware Support**

Requires the 890C Load Unit with Firmware version 3.17 or later. The firmware is displayed on the 850/890 LCD display screen during power up.

The multi-range flow control uses signals normally reserved for Reformate Simulation. Contact your Gas Control Unit supplier or Scribner Associates for information on accessing the Reformate Mass Flow Controller signals.

## Configure single channel Reformate Simulation

Before adding multiple mass flow controllers for a Reformate gas type, the system should be configured and tested using a single MFC for each gas type. Configure the system using only the smallest of the multiple MFCs. The larger MFCs will be added when Multi Range support is configured.

- Start the FuelCell program and select File | Instrument Configuration...
- Select the Reformate tab. Consult the main FuelCell software manual for information on configuring single MFCs for each reformate gas type.
- Configure the system to use the first available Tanks. Leave the higher tanks unassigned. These channels will be used for the multiple MFC support and will be manually configured later in this document.
- Save the configuration changes and exit the FuelCell program.
- Restart the FuelCell program and test single MFC reformate controls

Fuel Configuration		System Configuration		Alarms		Temp. Follower		Reformate		Impedance	
Simulator Type:	External	Gpib Board:	0	Gpib Address:	18						
Main Anode Gas Name:		H2		Main Cathode Gas Name:		Air					
<b>Tank 1:</b>	Tank Name:	CH4		Controller (Liters/Minute):	1						
	Gas Name:	CH4		Gas Concentration (PPM):	1E6						
<b>Tank 2:</b>	Tank Name:	N2		Controller (Liters/Minute):	1						
	Gas Name:	N2		Gas Concentration (PPM):	1E6						
<b>Tank 3:</b>	Tank Name:	CO2		Controller (Liters/Minute):	1						
	Gas Name:	CO2		Gas Concentration (PPM):	1E6						
<b>Tank 4:</b>	Tank Name:	Unused		Controller (Liters/Minute):	0						
	Gas Name:	Unused		Gas Concentration (PPM):	0						
<b>Tank 5:</b>	Tank Name:	Unused		Controller (Liters/Minute):	0						
	Gas Name:	Unused		Gas Concentration (PPM):	0						
Concentration Display Units:		Percent									

## Configure Multi Range MFC Reformate Simulation

Multi Range MFC support allows multiple MFCs to be used for the same Reformate gas type. Typically a small flow and large flow controller are used in parallel to provide accurate control at small flows while allowing a larger total capacity.

In the previous section, the CH<sub>4</sub> and CO<sub>2</sub> gasses were each configured for a single 1 liter/minute flow controller.

In this section, we will add a second parallel 2 liter/minute controller for the CH<sub>4</sub> gas and a parallel 5 liter/minute controller for the CO<sub>2</sub> gas.

The reformate configuration files are manually edited using a text editor.

- Using the Windows file explorer, go to *C:\FuelCell\* and open the file “*Reform.ini*” in Notepad.

- Add the FlowScale2 and ValveNo2 lines as shown below. For [TankGas1], FlowScale2=2 indicates that the second parallel controller has a maximum range of 2 liters/minute. ValveNo2=4 indicates that the second parallel controller is connected to reformate signal channel number 4.

- Save and close the modified *Reform.ini* file.

```
[TankGas1]
TankName=CH4
ComponentName=CH4
ComponentConc=1000000
PureFraction=2
FlowScale=1
ValveNo=1
FlowScale2=2
ValveNo2=4
```

```
[TankGas2]
TankName=N2
ComponentName=N2
ComponentConc=1000000
FlowScale=1
ValveNo=2
FlowScale2=5
ValveNo2=5
```

## **Operation of Multi Range MFCs**

The operation of the multi range mass flow controllers is completely transparent to the user. There are no additional controls and the user is not required to select which controller is used.

When the selected flow rate is less than the size of the first (smaller) controller, all gas will flow through the first controller.

When the selected flow rate exceeds the size of the first controller, additional gas will flow through the second (larger) controller.

The maximum allowable flow rate is the sum of the parallel controllers.