

Catalytic Methanation

version 14.12

Start up

- 1) Verify that both Helium tank valves, the reactor feed and the GC carrier gas, are open. Line pressure should be around 60 psi. Do not adjust regulator.
(The He tank valves should be open at all times).
- 2) IMPORTANT: Monitor the pressure in the Helium tank providing GC carrier gas so that it does not drop below 100 psi.
- 3) Open the valves on the CO₂, and H₂ tanks located at the west end of the experiment. Line pressures should be around 50 psi. Do not adjust regulators.
- 4) Use CAEDM account to log into a PC located adjacent to the experiment. This will allow you to access the Labview VI and operate the reactor. Start up computer control by following the steps outlined in Labview.
- 5) Launch HP ChemStations (Instrument 1 Online) from the Programs menu on computer near the experiment. It takes several minutes to load.

Experimental Controls

Two computer systems are used to run this experiment. The reactor is controlled with the Labview Control System and the HP6890 gas chromatograph, GC, is controlled and data collected using the PC running HP ChemStation located adjacent to the experiment.

Using Labview:

From Catalysis Screen 1;

- 1) Confirm Main Power is on (small button turns green).
- 2) Turn on Heater Switch (button turns green).
- 3.) Set Reactor Heater temperature set point between 225C-325C (highlighted in orange in figure 1).
- 4.) Switch Reactor Pressure to automatic control (highlighted in green on figure 1) and set pressure set point between 12.5 and 25 psia.

From Catalysis Screen 2:

- 5.) Confirm that the Calibration Gas Valve is closed.
This valve should always remain CLOSED, if found to be otherwise, contact lab personnel.

6.) Select GC Sample Path to Reactor Exhaust Valve to (see blue box on fig 1).

These settings will adjusted according to the process you wish to perform. As an example, they could be used as follows:

GC Path set to reactor feed (GC analyzes feed composition; nothing fed to reactor).

GC Path set to reactor exhaust (analyzes product composition).

GC Path set to ALL OFF (reaction occurs without analyzing, but pressure is not controlled).

7.) Set the gas flow rates as desired (see aqua box on fig 1).

To change H₂ flow rate:

Enter desired H₂ flow rate and press **Enter**.

To change CO₂ flow rate:

Enter desired CO₂ flow rate and press **Enter**.

To change He flow rate:

Enter desired He flow rate and press **Enter**.

Note that from the initial startup of the cold reactor to a thermal steady state may take an hour. Starting the reactor before the beginning of the lab period is highly recommended.

GC Sampling Procedure

Using ChemStation:

1.) Log in to ChemStation as an Operator using your UO Lab Group's name.

2.) Under the RunControl menu, select the Sample Info window.

3.) Enter the name of your group again in the subdirectory box. When you press **Enter**, a dialog box will appear if the directory doesn't exist and it can be created now.

4.) In the Signal 1 Filename box, enter a new file name being sure to use the .D extension.

5.) Using the Sample Name and/or Comment boxes, describe your experimental run for later identification.

6.) Click OK.

7.) When the green Ready light appears in the top left corner of the ChemStation window, click the start button.

8.) Don't use the Stop button. Let the run finish automatically. This will take 15 minutes to complete, but new reactor conditions can be set immediately.

9.) When the run is finished, repeat steps 2 thru 8.

Shutdown

- 1) Set the following using the VI:
 Heater Power: OFF
 Reactor Temperature: 0C
 Reactor Pressure: Auto, 14.7 PSIA
 GC Sample Path: Reactor Exhaust
 He Flow: 4 SCCM
 H₂ Flow: 0 SCCM
 CO₂ Flow: 0 SCCM
- 2) Close cylinder valves for H₂, CO₂.
- 3) Quit ChemStation and logout.

Catalytic Methanation

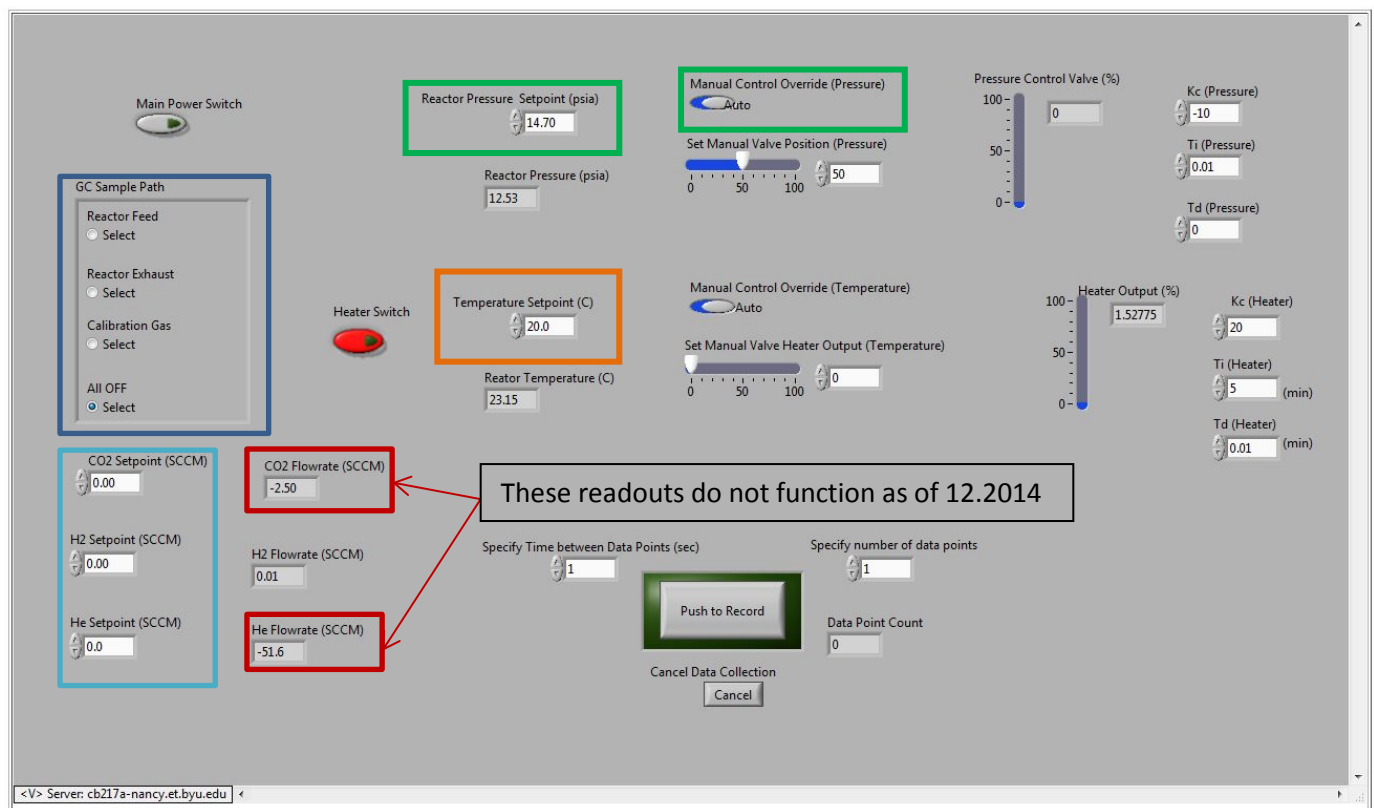


Figure 1 Labview VI screen capture for Catalytic Methanation Experiment