qMix™ Gas Mixing Feature

Create Custom Gas Mixtures in the Field and
Retain Measurement Accuracy Without Recalibration

Instruction Manual

Part Number: IM640i-qmix Rev.V6
June 2017

SIERRA®

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Definitions

The following terms are used frequently throughout this manual. They are presented here with their definitions for your information.

SIP – Smart Interface Program (SIP) software, the user interface for the 640i/780i

qTherm® – Proprietary math algorithm set that powers qMix

qMix™ – Gas mix creation software run through the SIP interface; mixtures created by qMix use the qTherm math algorithm set; +/- 3.0% of full scale accuracy.

Sierra's "Gas Database" – In the "qMix Gas Composition" SIP interface, the "Gas Database" section lists over 120 gases available to use to create your qMix gas mixtures; these gases have +/- 3.0% of full scale accuracy.

My Gases – In the "qMix Gas Composition" SIP interface, once you create a gas mix, your new gas is saved in your "My Gases" section. This provides a complete history of your gas mixtures including gas name, type (either qMix or qTherm), and composition percentage.

"My Gases Database" – To locate a complete history of qMix gases created and/or gases downloaded from Sierra's qTherm "Gas Database," click the "My Gases Database" button on the main menu. You can also upload gases to your meter from your "My Gases Database".

Dial-A-Gas® – Dial-A-Gas gives users a summary of current gases on the meter (in slots 2-4). Once you have created a new qMix gas and saved the gas to the appropriate gas slot on the meter, use the "Dial-A-Gas & Units" button on the main menu to select your gas to use on your meter; also specify degrees and pressure.

Sierra's qTherm® "Gas Database" – Sierra's available qTherm gases have higher accuracy (between +/- 0.5% to +/- 3.0% of full scale for the 780i and +/- 0.75% to +/- 3.0% of full scale for the 640i), resulting from actual gas calibrations at Sierra or updates to gas properties. Users can download gases from Sierra's qTherm "Gas Database" to their "My Gases Database" which enables them to upload qTherm gases to their meter. When a qTherm gas is uploaded to the meter, a gas upload credit is not used.

NIST – National Institute of Standards and Technology

AGA-8 – American Gas Association Report No. 8. This report defines how the density of natural gas should be calculated or measured. This feature is used to produce more accurate hydrocarbon gas mixtures.

Normalize Composition – Increases the percentage of each gas in your mixture by equal amounts in order to produce a total gas composition of 100%.

qMix Gas Mixing Feature

Empower Your Flow Meter to Do More!

qMix is a powerful, user-customizable gas mixing feature included with every QuadraTherm thermal mass flow meter. qMix provides the ultimate gas flow measurement field flexibility by allowing you to create custom gases or gas mixtures to compensate for gas compositional changes in the field. Use qMix when the gas composition changes in the pipe or when moving the meter to another location with a different gas composition. The major benefit is that now, for the first time with thermal technology, you can retain accuracy without returning the meter to the factory for recalibration.

If gas composition changes in the application, qMix helps you create custom gases or gas mixtures, save gas mixtures to your personal "My Gases Database", and load the new gas mixtures into the meter.

[Watch How qMix Works Video](#)

Video URL: www.sierrainstruments.com/qmix-tutorial

Get the Most Out of Your qMix Trial

Through an easy-to-use software interface, qMix allows you to:

- Field adjust and maintain flow meter accuracy if gas composition changes
- Avoid costly recalibration; once qMix license has been activated, no need to send unit back to the factory if gas composition changes
- Create and upload unlimited gas mixtures onto one meter–with purchase of qMix license
- Save custom gas mixtures onto your personal "My Gases Database" for later use
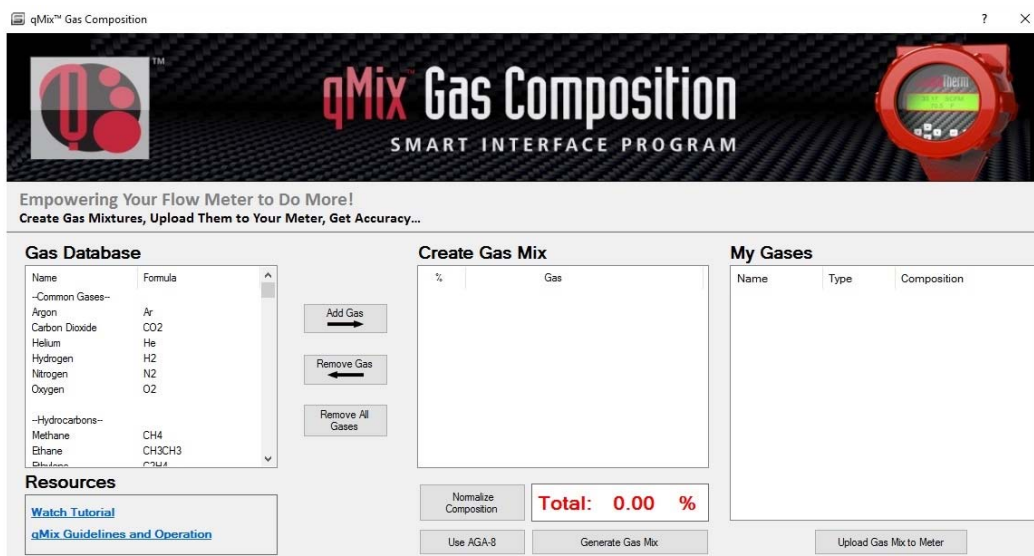- Benefit from Sierra's proprietary, ever improving qTherm "Gas Database" to download more accurate gases

Figure 1. "qMix Gas Composition" User Interface

Powering qMix with qTherm Gas Property Data

The value of the qMix gas mixing feature is the ability to retain flow measurement accuracy of +/- 3.0% without sending the meter back for recalibration. To ensure this high accuracy, qMix uses Sierra's proprietary qTherm math model algorithm set and National Institute of Standards and Technology (NIST) gas property data to assure the highest level of accuracy.

Table 1 gives an example of qTherm Dial-A-Gas options with the corresponding accuracy. qMix uses this same qTherm gas data to produce accurate gas mixtures. Sierra's proprietary gas database continuously improves with every calibration data point taken in our flow labs on every instrument sold.

qTherm Dial-A-Gas Selection Chart				
	780i Accuracy		640i Accuracy	
Gas	Actual Gas[1]	qTherm Dial-A-Gas[2]	Actual Gas[1]	qTherm Dial-A-Gas[2]
Air [3]	± 0.5%	N/A	±0.75%	N/A
Ammonia	N/A	± 3.0%	N/A	± 3.0%
Argon	± 0.5%	± 3.0%	±0.75%	± 3.0%
Carbon Dioxide	± 0.5%	± 3.0%	±0.75%	± 3.0%
Chlorine	N/A	± 3.0%	N/A	± 3.0%
Digester Gas (60% CH_4, 40% CO_2)	± 0.5%	± 3.0%	± 0.75%	± 3.0%
Helium	± 0.5%	± 3.0%	± 0.75%	± 3.0%
Hydrogen	± 0.5%	± 3.0%	± 0.75%	± 3.0%
Methane	± 0.5%	± 3.0%	± 0.75%	± 3.0%
Nitrogen	± 0.5%	± 3.0%	± 0.75%	± 3.0%
Oxygen	N/A	± 0.5%	N/A	± 0.75%
Propane	± 0.5%	± 3.0%	± 0.75%	± 3.0%
Other [4]–Consult Factory	Special Calibration Request (SCR)	Special Calibration Request (SCR)	Special Calibration Request (SCR)	Special Calibration Request (SCR)

Table 1: qTherm Dial-A-Gas Selection Chart

Notes: (1) % of reading at > 50% of full scale flow; add 0.5% of full scale below 50% of full scale flow
(2) % of full scale
(3) Air is standard on the instrument and cannot be removed
(4) The Sierra qTherm "Gas Database" is a proprietary gas property index that is continuously updated and improved

qMix Activation

There are two ways to activate the qMix app for your QuadraTherm 640i/780i: 1.) Purchase a qMix license per 640i/780i serial number upfront at point of purchase. 2.) Purchase a qMix license in the field for existing 640i/780i customers.

	Tutorial Video- Watch the qMix overview video to learn about activation and how to use qMix. www.sierrainstruments.com/qmix-tutorial

Upfront Purchase of a qMix License

The recommended way to activate the qMix app for your QuadraTherm 640i/780i is to purchase a qMix license for $350.00 per serial at time of purchase by using the model code "qMix" found the 640i/780i price list (must activate each meter per serial number).

With upfront purchase, the qMix app for your specified meter serial number will be completely activated and set up in the factory. You will have use of qMix on that particular meter for unlimited gas mix creations and uploads. Once you receive your meter with the activated qMix license, you are ready to create custom gases-just a few simple set up steps.

1. Download the most current version of 640i/780i Smart Interface Portal (SIP) software onto your computer: www.sierrainstruments.com/640i-780i-SIP

2. Power up your meter and connect your 640i/780i to your computer using RS-232 or USB/RS-232 converter.

3. Open the SIP software on your computer and select "COM port" (See Figure 4 below).

4. Click the "qMix Gas Composition" button or select "qMix Gas Composition" from the function selector drop down on the main menu (See Figure 1).

|	
	Note: You can use one laptop with most current SIP version running the qMix software app to talk to ANY activated qMix meter. The laptop does NOT need an internet connection, but it does need an RS-232 connection to the activated meter.
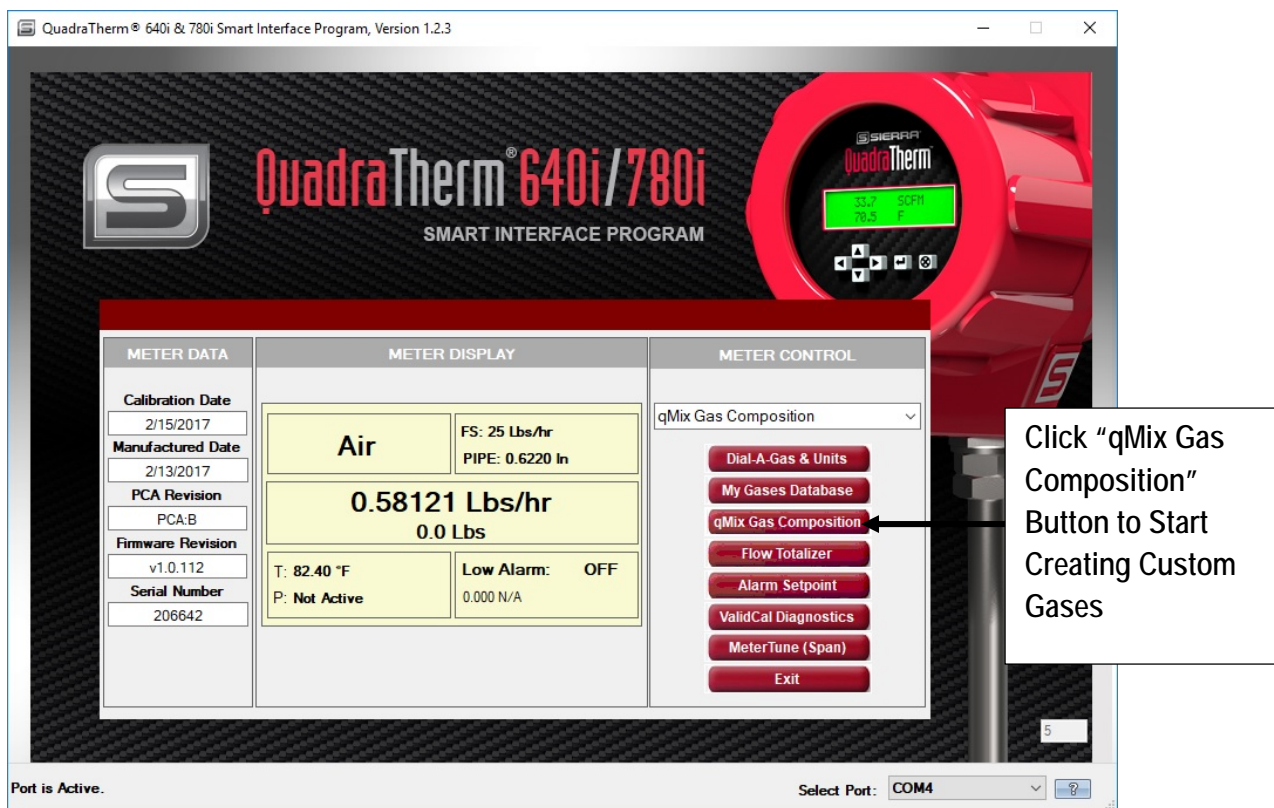
Figure 2. Main 640i/780i SIP Screen

Existing Customers: Purchase qMix License for Meters Already in the Field (firmware 1.0.87 or higher)

To continue using the qMix app for existing customers with QuadraTherm 640i/780i meters, you will need purchase a qMix license for $350.00 per serial number in the field. For existing customers, your 640i/780i must have firmware version 1.0.87 or higher to use qMix (See Figure 3). Also for those customers who have already purchased the qMix license, your meter will still need to be activated per procedure below, but no additional cost will be incurred.

To determine the firmware version of your meter, open the 640i/780i Smart Interface Portal (SIP) software and find your firmware version in the "firmware revision" text box in the "Meter Data" section (See Figure 2). Your local display on the meter will also show your firmware revision upon power up. If your meter is NOT firmware revision 1.0.87 or greater, the unit must be returned to the factory for a firmware upgrade via the normal RMA process at www.sierrainstruments.com/rma When you submit your RMA, you can also request your qMix license to be completely set up at the factory for $350.00 a licenser per serial number (see "Upfront Purchase" section above for more information).

	Note: Firmware is the code that resides inside the meter and typically needs to be updated at the factory or, if in the field, by a Sierra certified technician.
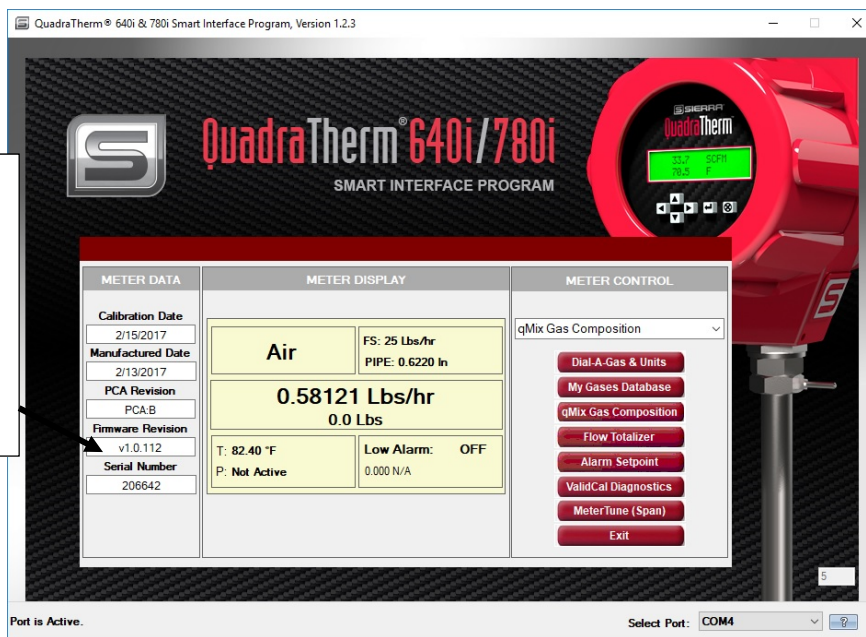
Figure 3. Firmware Revision Number in Meter Data Section

Activation Steps (firmware 1.0.87 or higher)

1. Download the most current version of Smart Interface Portal (SIP) software. Your SIP will also notify you to download the most current version of SIP.

2. Download SIP Software here. www.sierrainstruments.com//640i-780i-SIP .

3. Power up your meter and connect your 640i/780i to your computer using RS-232 or USB/RS-232 converter. Note: The qMix activation key resides in the meter firmware, so you must be connected to the meter from your laptop to activate qMix. You do not need to be connected to the internet.

4. Open the SIP software on your computer and select "COM port" (See Figure 4 below).
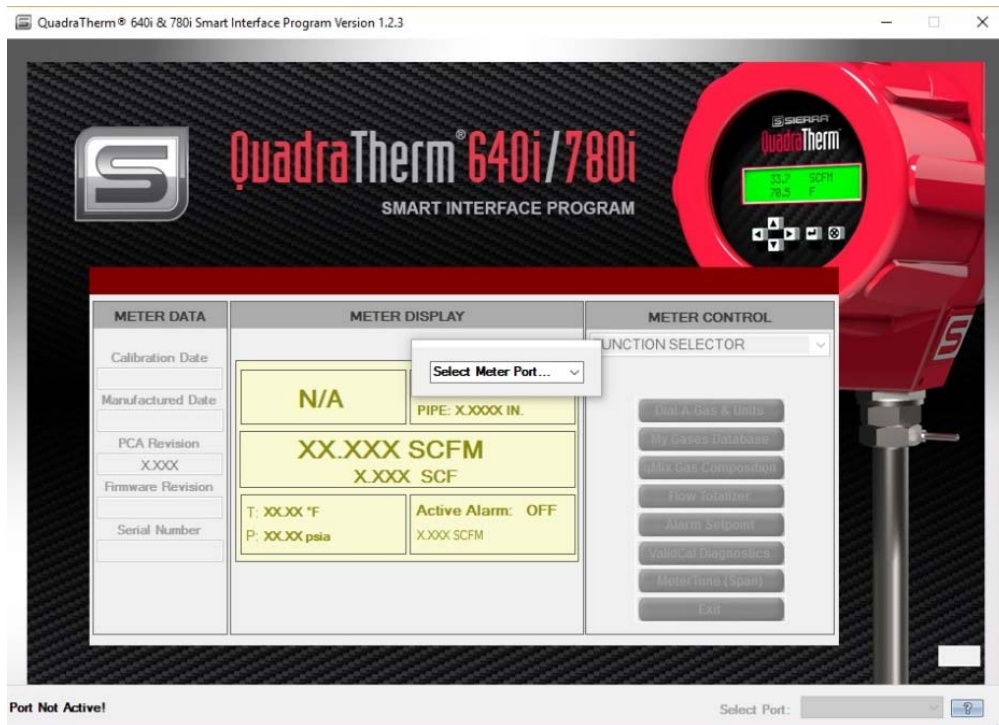
Figure 4. Select Com Meter Port to Use qMix

6. Click the "qMix Gas Composition" button or select "qMix Gas Composition" from the function selector drop down on the main menu (See Figure 5).

Click "qMix Composition" and Activation Window Will Appear.
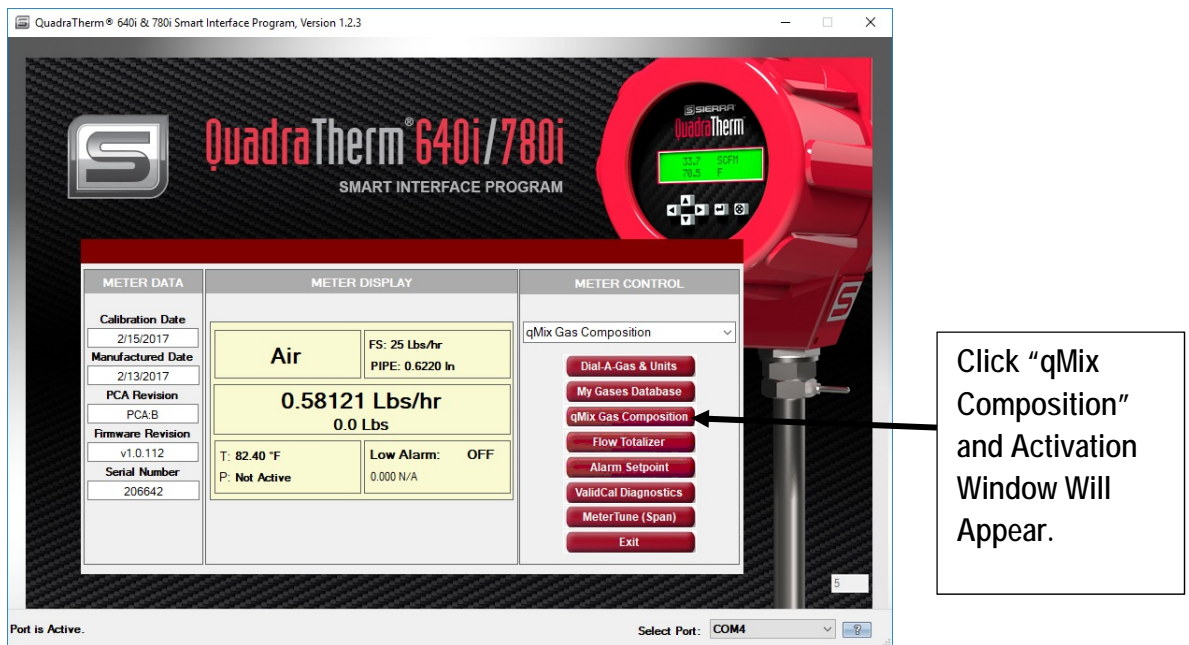
Figure 5. "qMix Gas Composition" Button in Meter Control Section

7. The qMix Activation window will appear. Call Sierra's Customer Support at 1-800-866-0200 and ask for Sierra Tech team to purchase a qMix license for your specified serial number. Follow the instructions in the activation window.
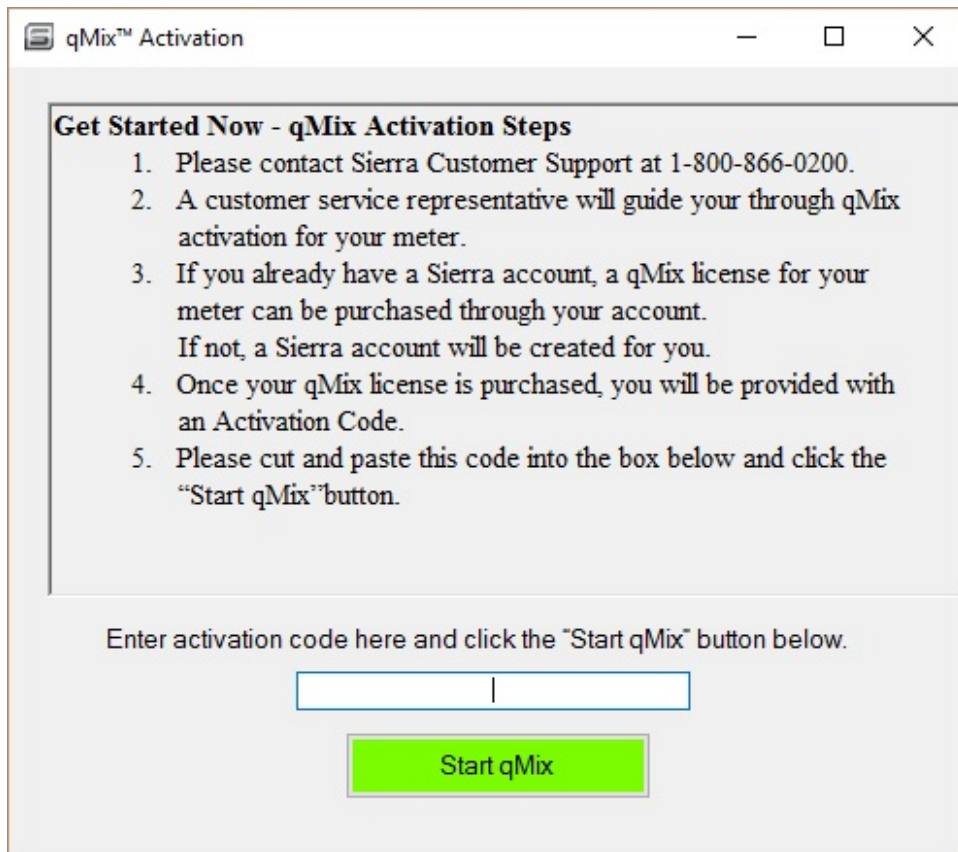
8. A Sierra Tech expert will create a Sierra Account on your behalf if you don't have a current Sierra Account.   You will purchase a qMix license for $350.00 per serial number for activation. This will be charged to the customer's credit card or PO.

9. The Sierra tech expert will generate a qMix activation key.

10. Copy and paste the qMix Activation key into the textbox and click "Start qMix" button (See above image under number 7).

11. Once the qMix software app is activated for a meter serial number, you will have use of qMix on that particular meter for unlimited gas mix creations and uploads. You can use one laptop with most current version SIP running the qMix software app to talk to ANY activated qMix meter. The laptop does NOT need an internet connection, but it does need an RS-232 connection to the activated meter.

12. Use the "qMix Gas Composition" screen to begin creating your custom gas mixtures (For detailed instructions on creating gas mixtures, see p. 14).

Overview of qMix Gas Composition User Interface

Figure 6. Overview of "qMix Gas Composition" User Interface

Create a New Gas Composition Using qMix

To learn how to create a new gas composition watch the **qMix How to Video** and follow the instructions on the following pages. Video URL: http://www.sierrainstruments.com/library/videos/qmix

1. If you are not already on the "qMix Gas Composition" page, then click the "qMix Gas Composition" button or select "qMix Gas Composition" from the function selector dropdown on the SIP main menu.
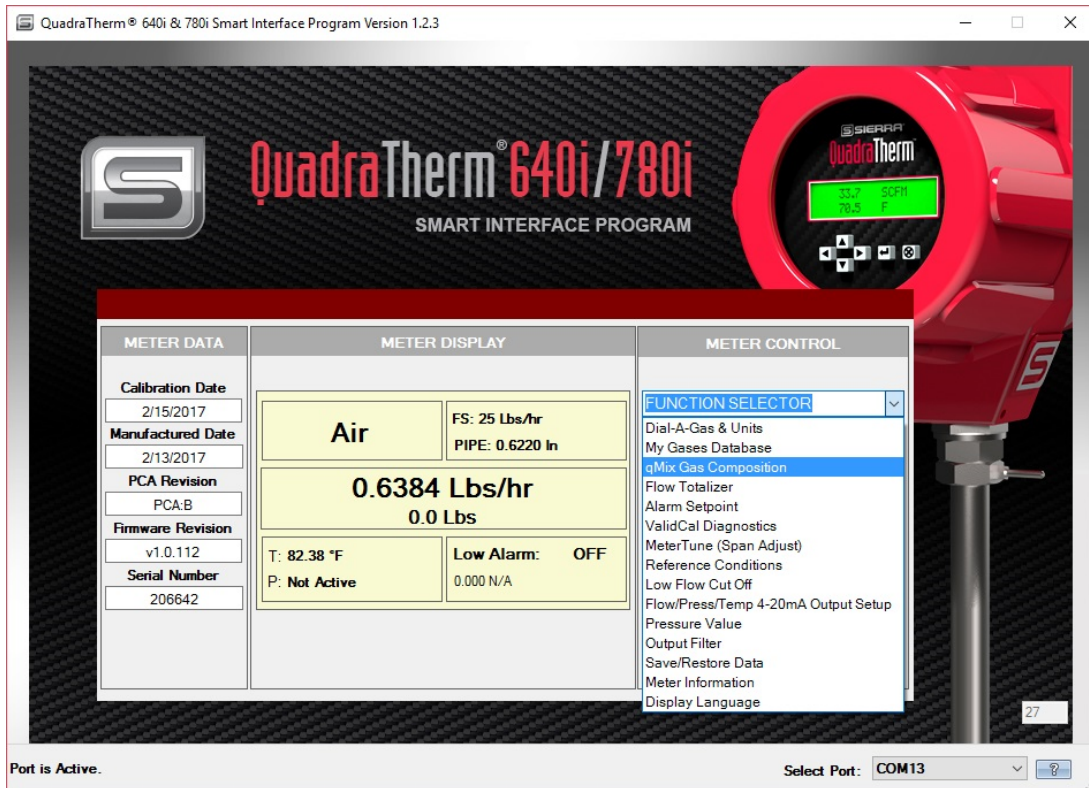
Figure 7. Choose "qMix Gas Composition" in Main Menu

2. Once on the "qMix Gas Composition" page, select a target gas from the "Gas Database" section on the left. To add target gas to your mix, click the "Add Gas" button or simply double click the target gas. Your target gas will appear in the "Create Gas Mix" section. Then enter the gas composition percentage for the target gas. For this example, 25% of Butane is added, so the total gas composition percentage is now 25%.
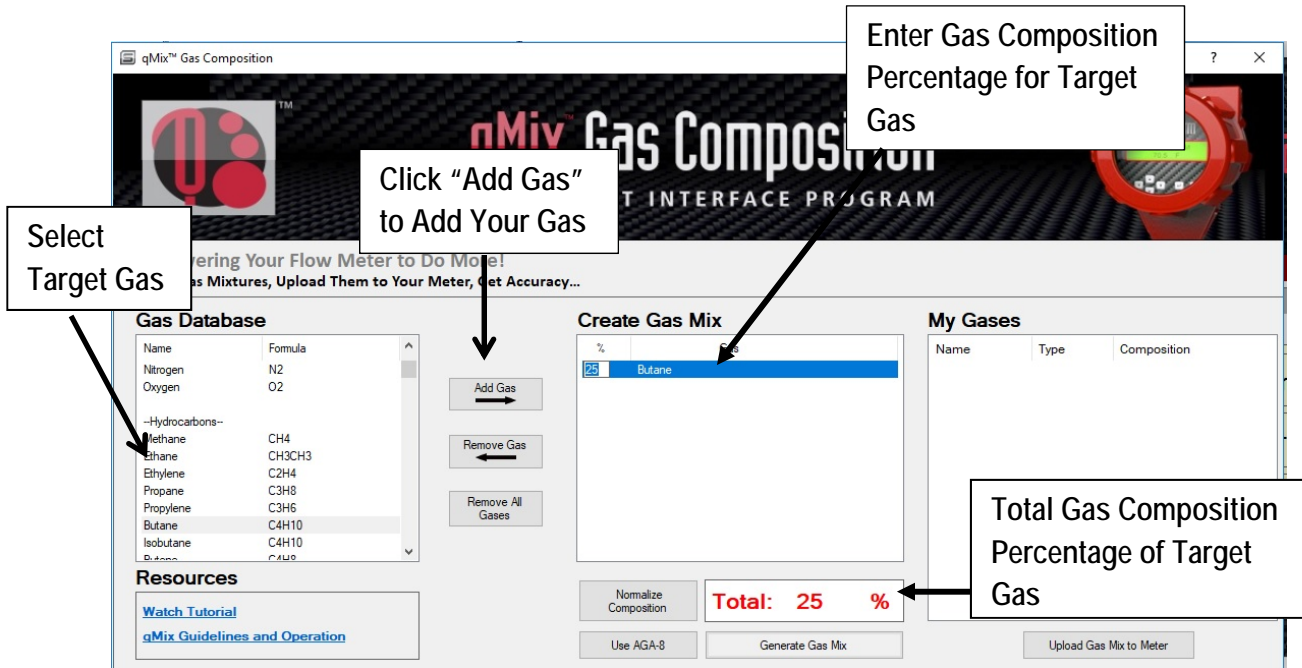
Figure 8. Add Target Gas and Define Gas Composition Percentage

3. To edit a gas composition percentage, go to the "Create Gas Mix" section. Click directly on the percentage value and enter the new percentage value. To remove a gas from the current mix, select the gas in the "Create Gas Mix" section and click the "Remove Gas" button. In both cases, the composition total will adjust accordingly.
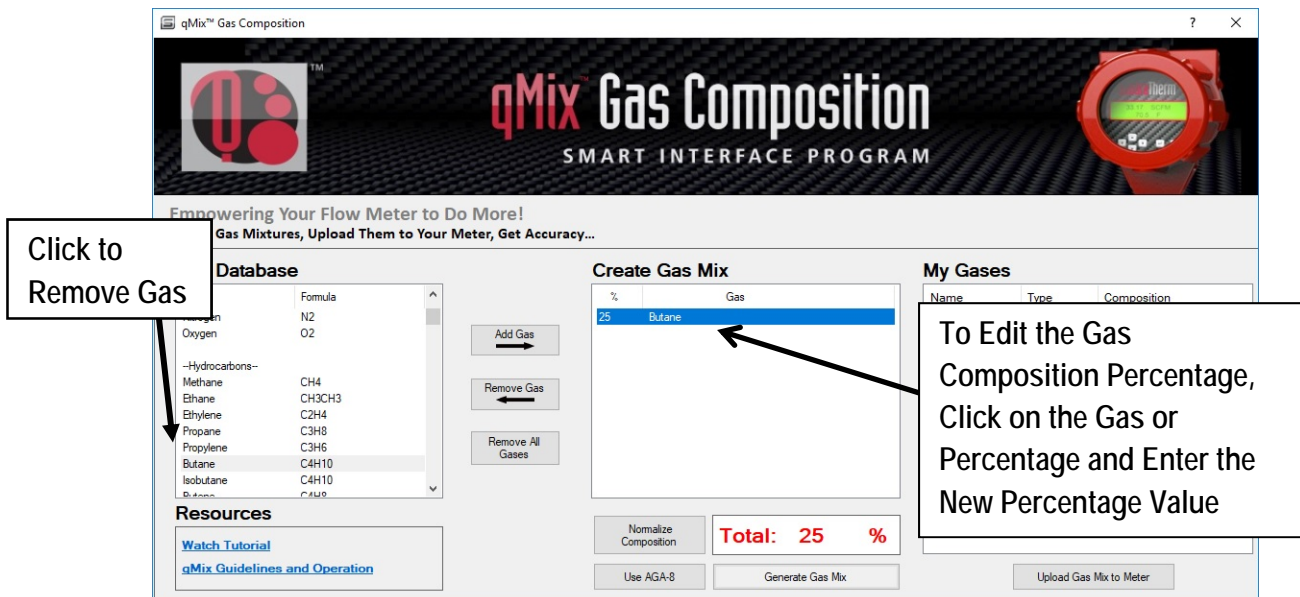
Figure 9. Edit Gas Composition or Remove Gas

4. Select the next target gas for your mixture from the "Gas Database" section and click "Add Gas". In this example, 73% of Hydrogen is added. The gas composition percentage total is now at 98%.
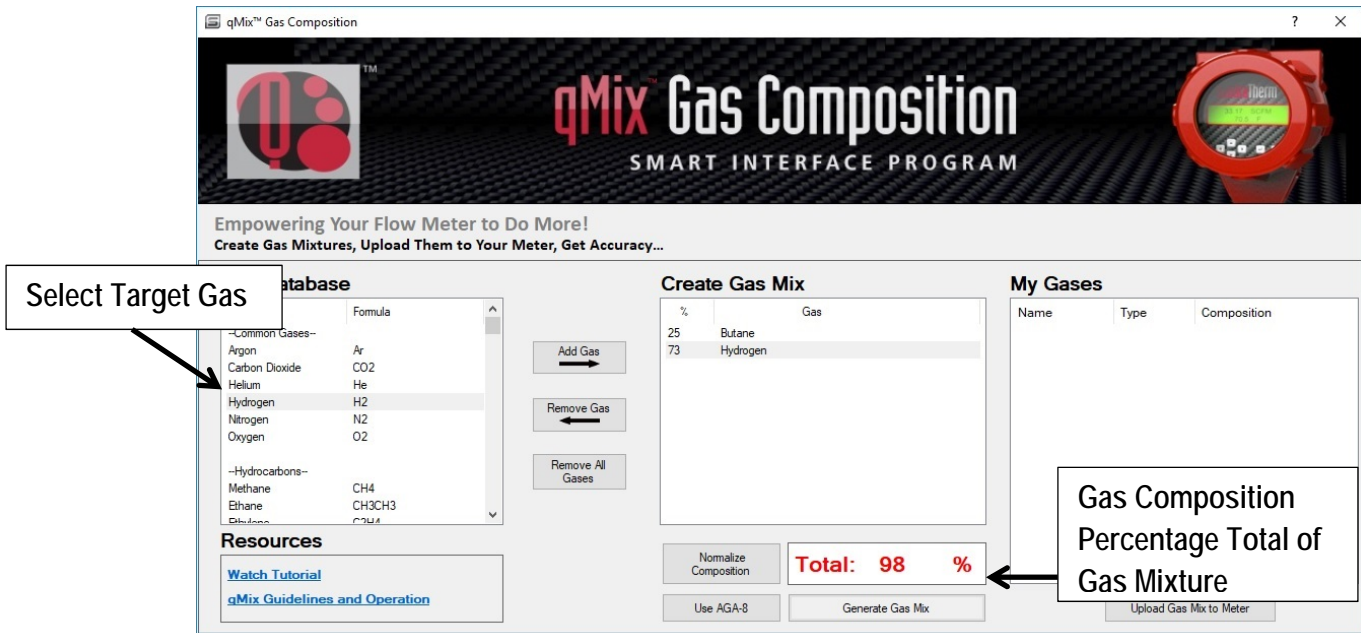
Figure 10. Add Second Target Gas to Mixture

5. If you have hydrocarbons in your mixture, you can utilize AGA-8 Equations of State in the mixture calculations, which have been determined to be more accurate. Click the "Using AGA-8" button. When activated, the button will turn green.
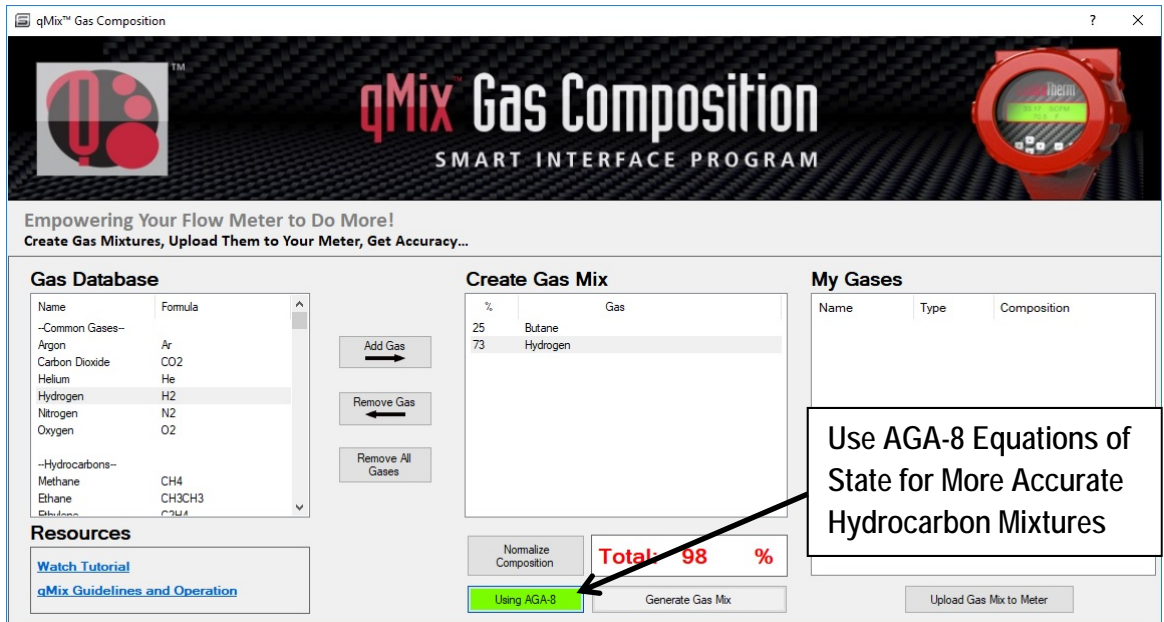
Figure 11. Use AGA-8 Equations of State for Higher Accuracy of Hydrocarbon Mixtures

6. To successfully generate a gas mixture, your total gas percentage must equal 100%. In this example, the gas composition percentage is 98%. If you try to generate the mixture a message will pop up prompting you to re-adjust or normalize your gas composition percentage to reach 100%. Click "OK" to continue.
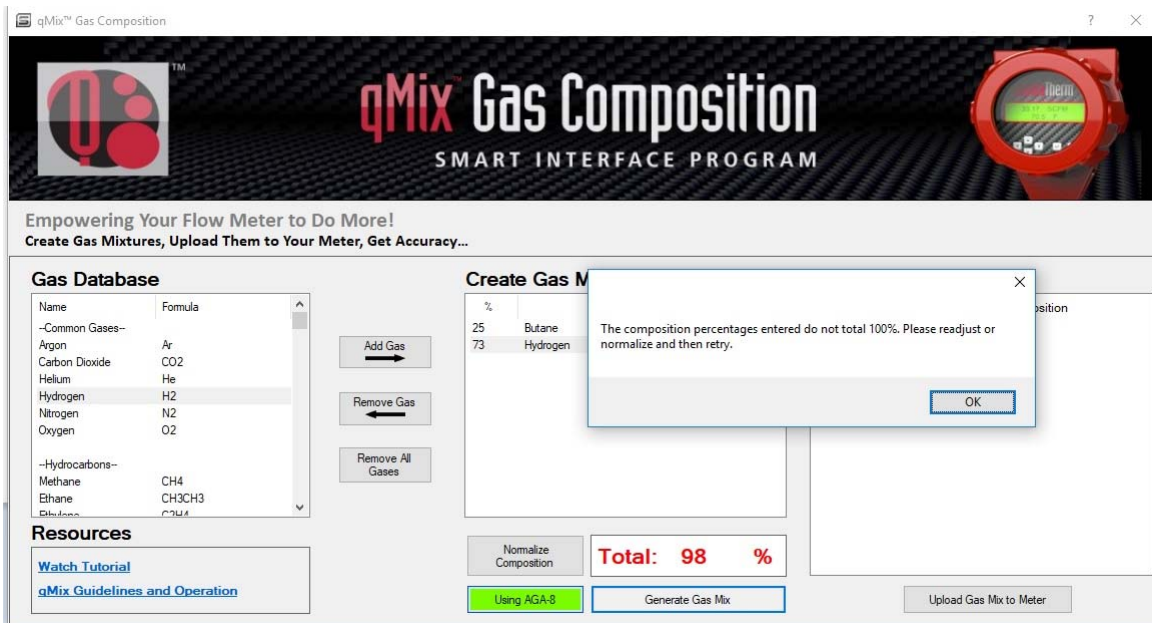
Figure 12. Mixture Must Equal 100%

7. To adjust your gas composition percentage to equal 100%, click the "Normalize Composition" button. This will increase each target gas equally to reach 100%.
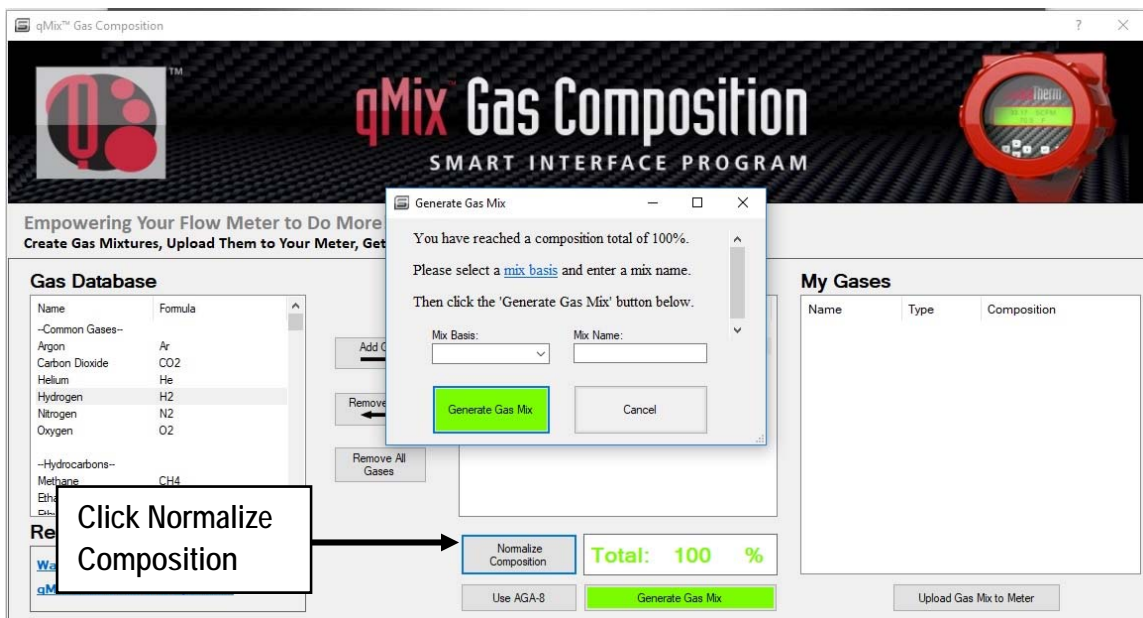
Figure 13. Normalize Gas Composition to Reach 100%

8. Once your gas composition reaches 100%, select a mix basis and enter a mix name. You can choose between "Volume" and "Mass" in the "Mix Basis" dropdown. Volume is how much space an object takes and mass is the amount of matter an object contains. In this example, "Volume" is selected and the mixture is named "GasMix". Once these fields are entered, click the green "Generate Gas Mix" button.
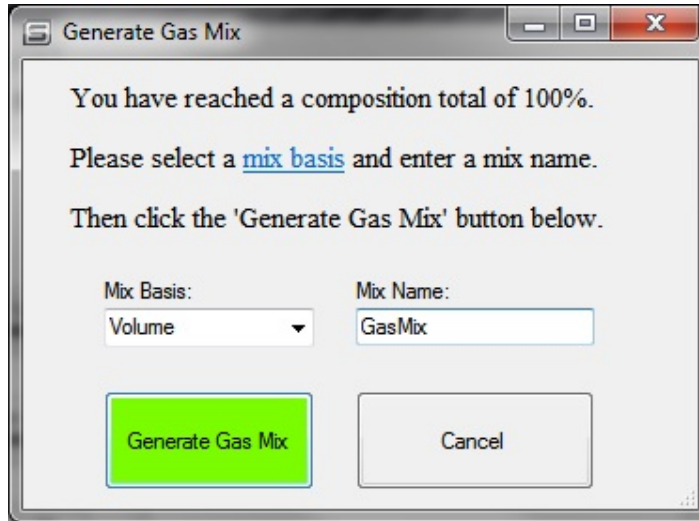
9. A progress icon will show your newly created gas mixture being saved to your "My Gases Database." Your gas mixture files are also saved to C:\SierraInstruments\640i\gas on your computer, along with all your other saved qMix or qTherm gases. Once complete, a message will notify you that your gas mixture was successfully saved. Click "OK" to continue.
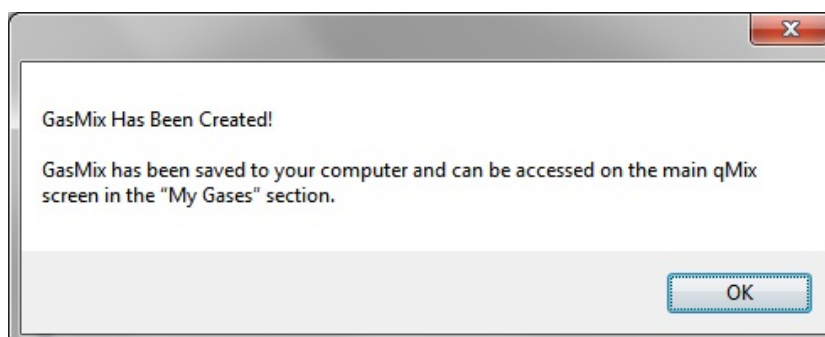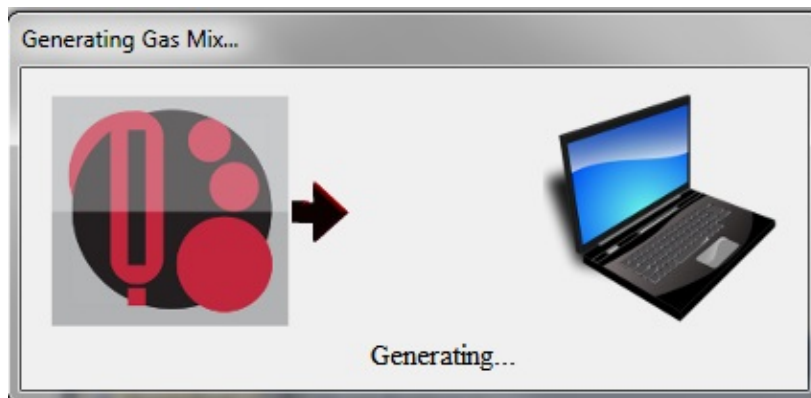
10. Your new gas mixture is now in your "My Gases" section which shows the name of your gas, the type (either qMix or qTherm), and the gas composition percentage.

Your New Gas Mixture Appears in Your My Gases Section Which Includes Gas Name, Type, and Gas Composition

# *Load Your Gas onto Your Meter* (with or without internet connection)

1. To upload a gas onto your meter, first select the gas or gas mixture you want to upload; then click the green "Upload Gas Mix to Meter" button.
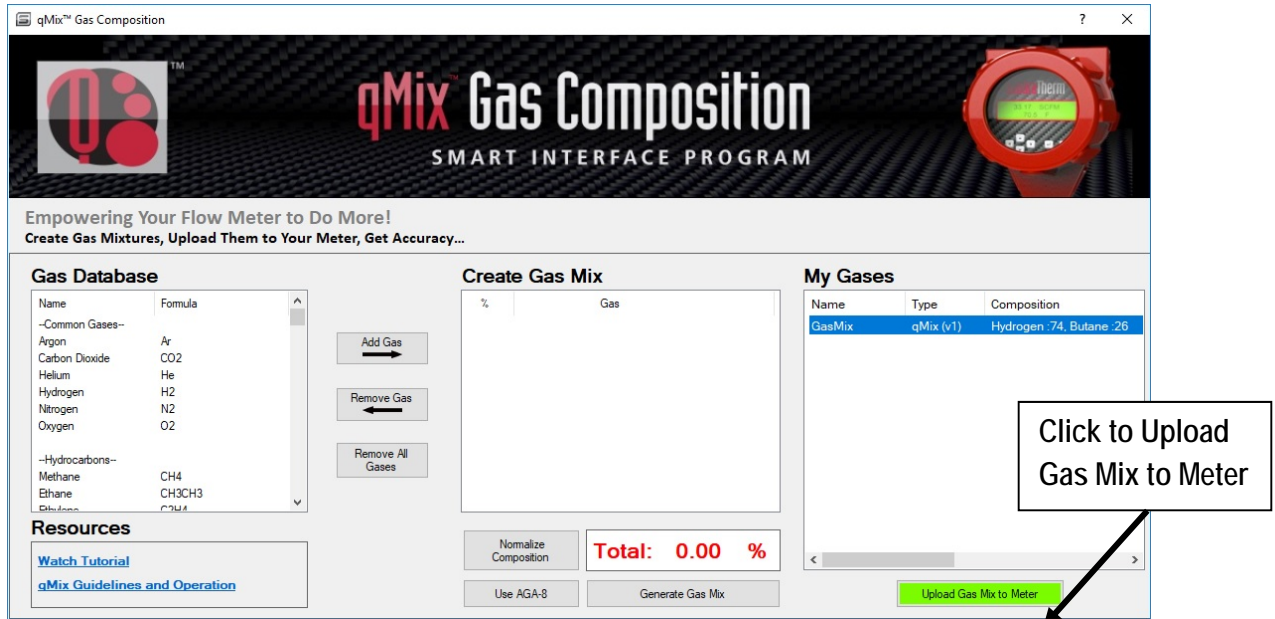

2. In order to upload your qMix gas to your meter, you must replace a current gas on your meter. If you click "Select a Gas Slot," you will see the current gases on your flow meter. In this case, Carbon Dioxide, Methane, and Argon are loaded in slots 2, 3, and 4. Slot 1 is always Air and can't be replaced. For this example, replace Carbon Dioxide in slot 2 with the new qMix gas mixture called GasMix. Click and highlight "2 – Carbon_Dioxide" to continue.
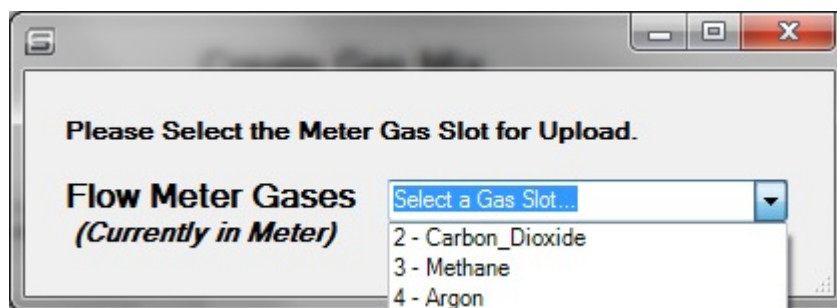
3. A message will appear asking if you would like to save the gas being replaced to your "My Gases" Database. It is recommended that you save the gas you are replacing, so you have the option to use it again in the future. Click "Yes" to continue.
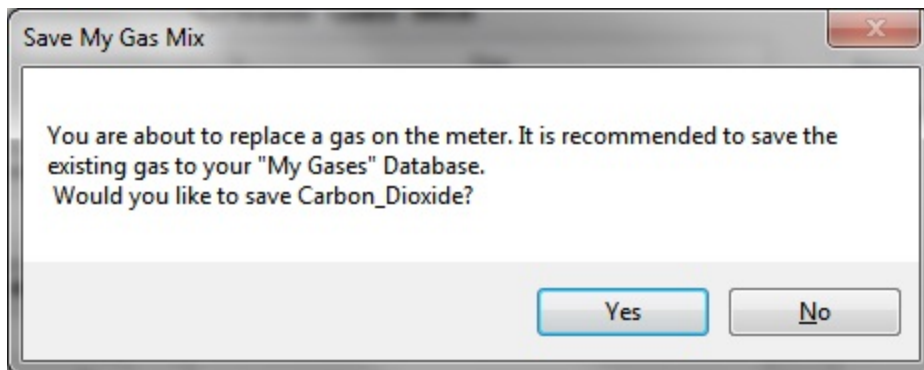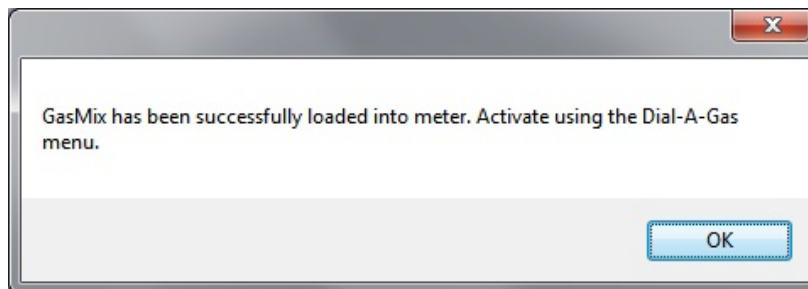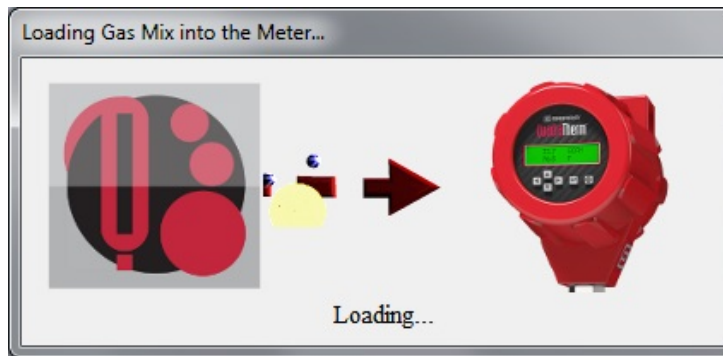

4. If you click "Yes" a progress icon will appear and a window will notify you that your gas was successfully saved to your "My Gases" Database. Click "OK" to continue.
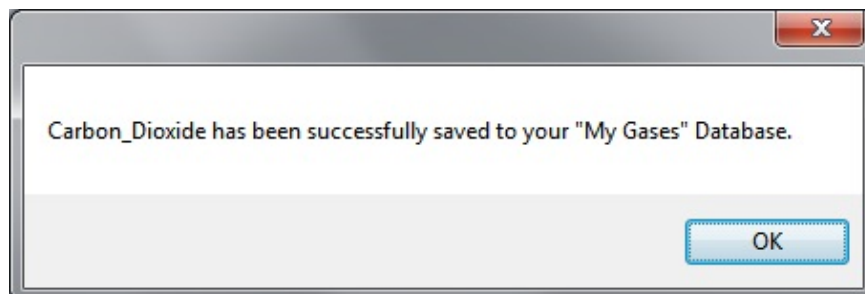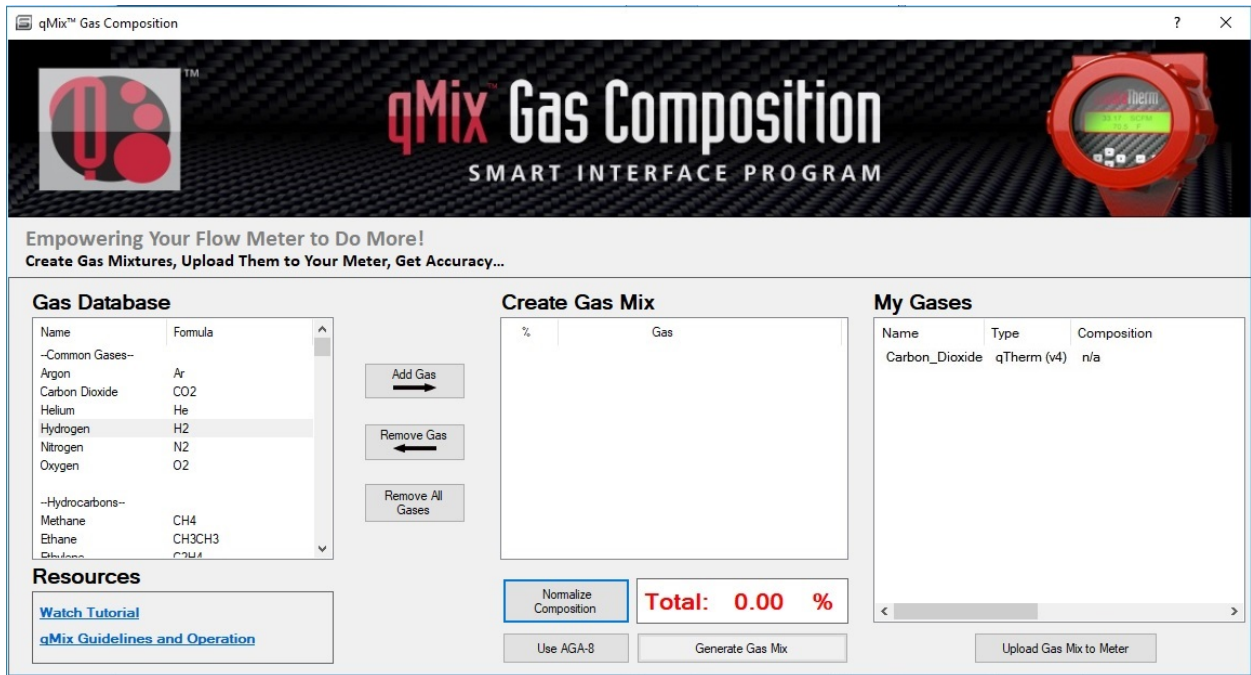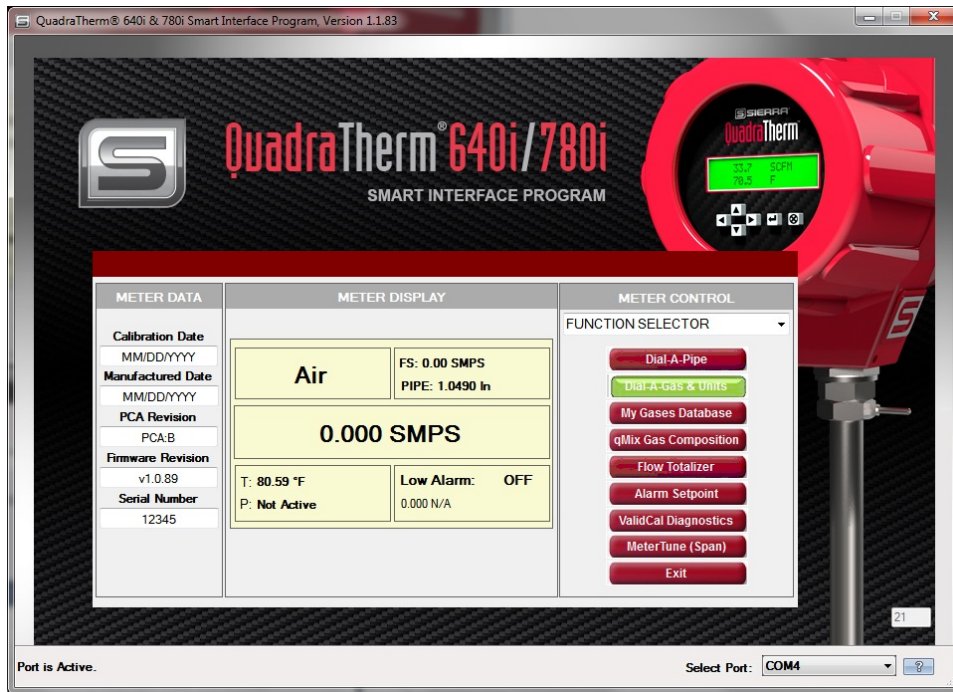
5. A progress icon will appear showing the gas being uploaded onto your meter. Once complete, a message will appear notifying you that your gas was successfully loaded onto your meter. Click "OK" to continue.

6. To activate your new gas, go to your SIP main menu and click the qTherm "Dial-A-Gas & Units" button or select it from the function selector drop down.

7. Click the "Selected Gas" dropdown and choose your new qMix gas.
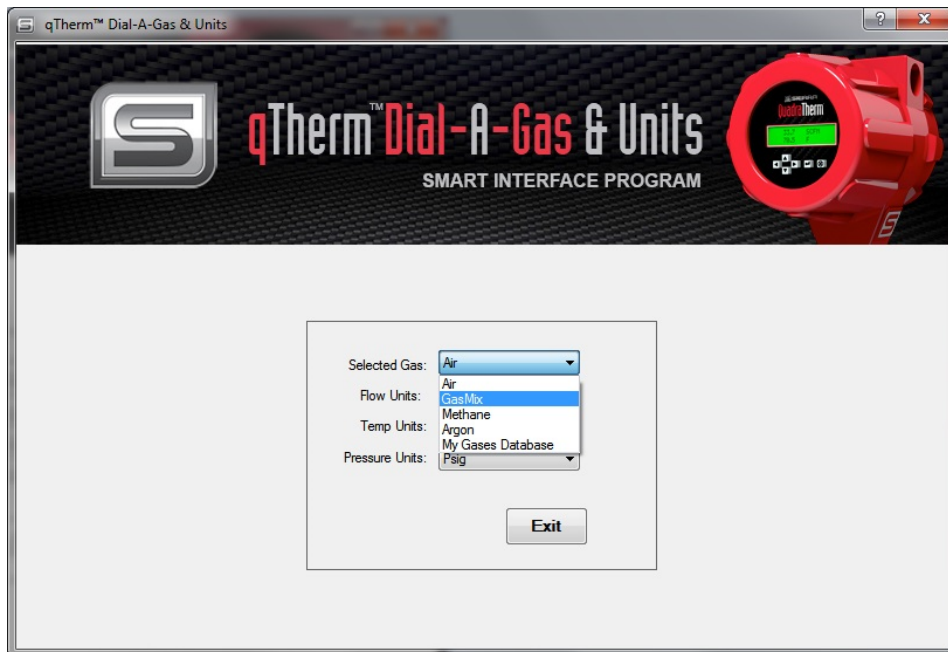
8. You can also adjust your meter gases by clicking the "My Gases Database" button or selecting it from the function selector drop down on the SIP main menu. To view your current gases in your available slots, click "Choose New Gas Location" (follow the same steps 1-6 above to upload your gas onto the meter).
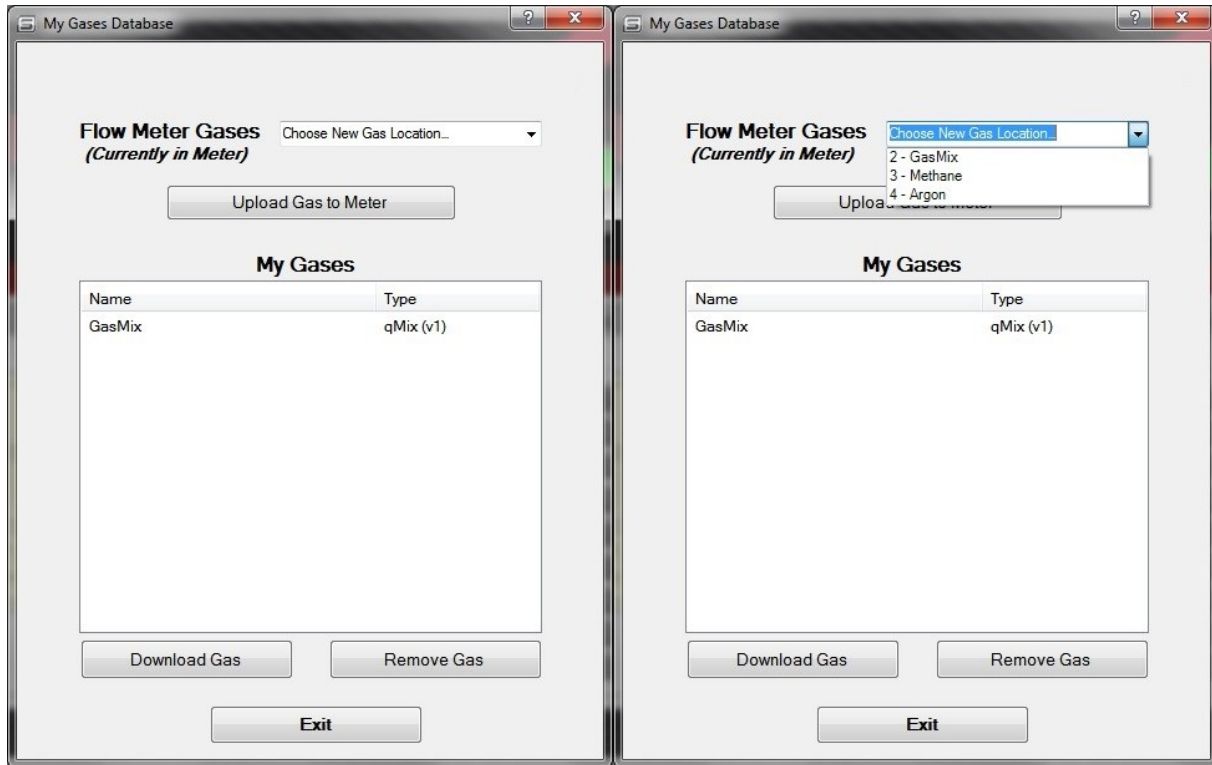
Download Gases from the Sierra qTherm® "Gas Database"

You can also download gases from Sierra's qTherm "Gas Database" and save them to your "My Gases Database." Sierra qTherm gases have a higher accuracy (between +/- 0.5% to +/- 3.0%), generally a result of actual gas calibrations at Sierra or updates to gas properties. The qTherm "Gas Database" is continually growing as new gases and mixtures are added or updated.

1. To access the Sierra qTherm "Gas Database", click the "My Gases Database" button on the SIP main menu or select it from the function selector dropdown. Click the "Download Gas" button to view the available qTherm gases.
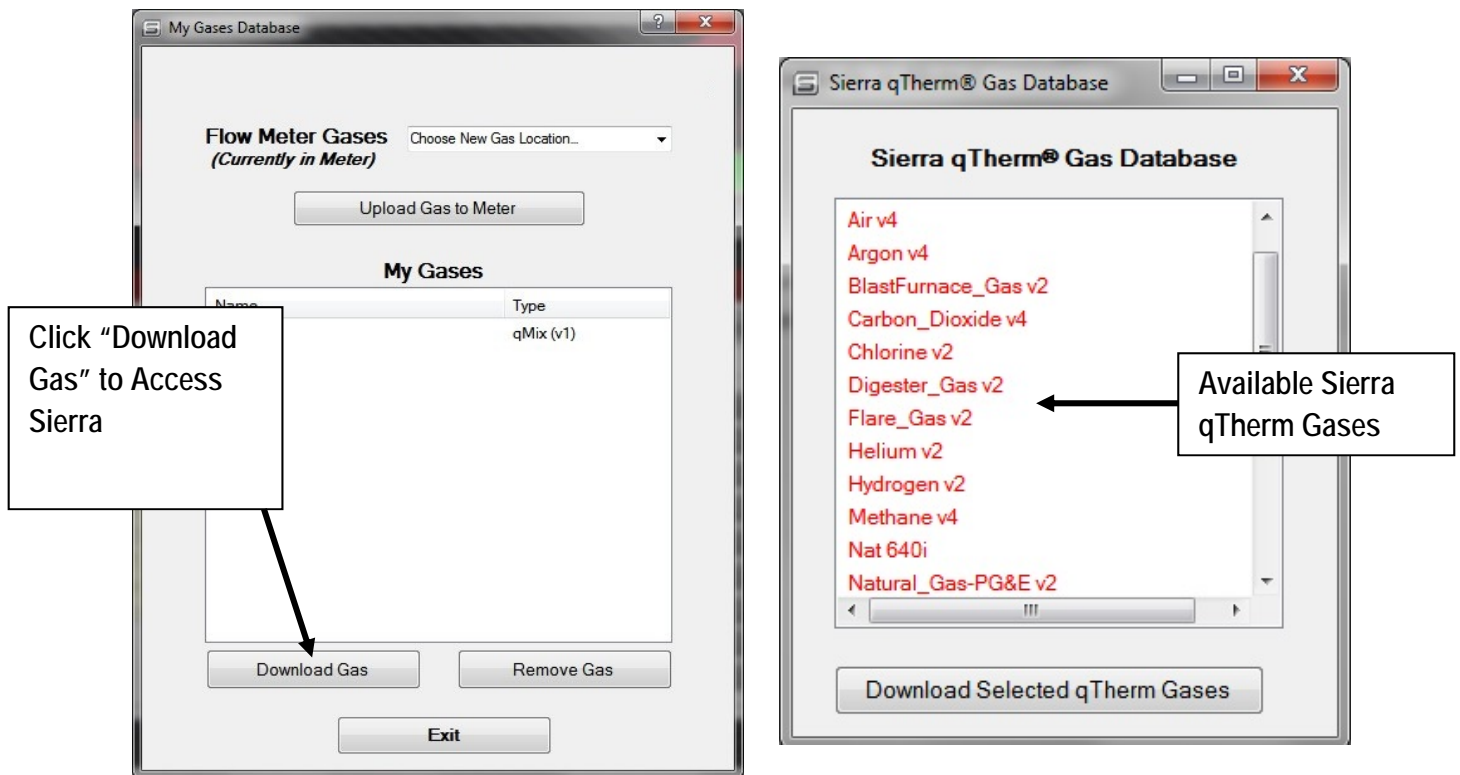
2. Select the qTherm gas you would like to download to your "My Gases Database." Select a gas or multiple gases from this list by holding down the shift button. Then click the "Download Selected qTherm Gases" button. This will cause the selected qTherm gases to turn black to signify that you own them and are no longer available for download.

Your Selected qTherm Gas Will Turn Black Once Downloaded

Download Your Selected qTherm Gas to your My Gas Database.
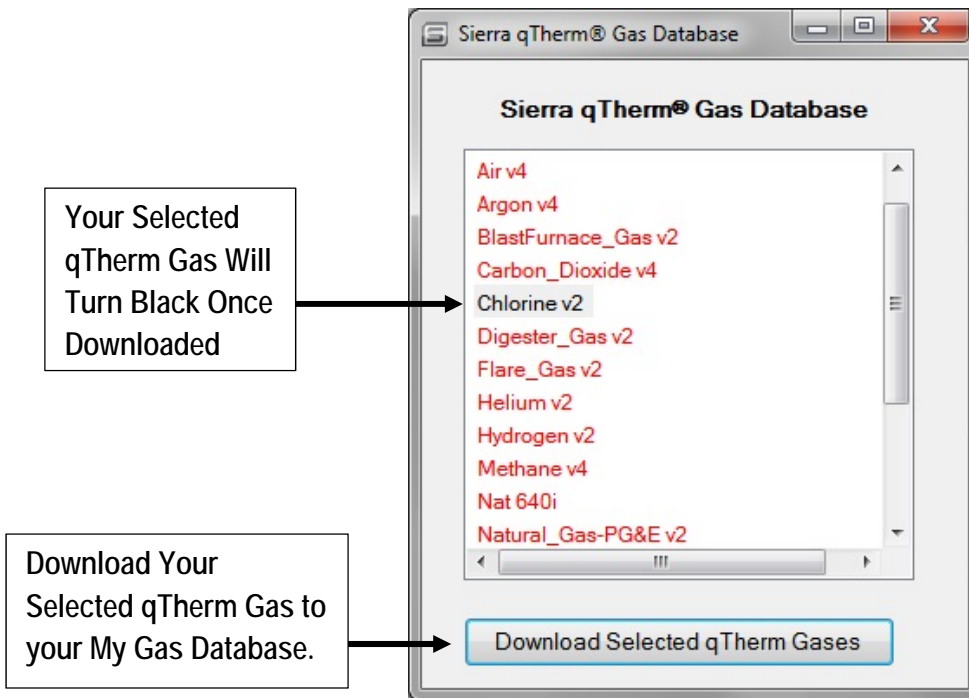
3. Your qTherm gas will now appear in your "My Gases Database." To load a qTherm gas into one of the three available slots on your meter, please follow steps 1-6 on pages 20- 23, with the only difference being that qTherm gases do not require you to use an Upload Gas Credit.

Chlorine is Now Located in Your My Gases Database; You Can Select your New Gas to Load to Your Meter Slots.