Instruction Manual

GSM-3

3-Channel Programmable Gas Mixer

Read instructions carefully before operating this device.

❶ *This device is not to be used for Human Life Support applications.*
❷ *To avoid possible electrical shock, do not operate this device if is wet or has had liquids spilled onto it.*
❸ *Service or calibration procedures should only be performed by qualified personnel familiar with the electrical hazards of line-powered devices.*

Ardmore PA 19003 U.S.A.
(610)642-7719
info@cwe-inc.com

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www.cwe-inc.com

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USER INFORMATION:

Base Unit Serial Number: _____

Calibration gas: Channel A_____, Channel B_____, Channel C_____

Flow ranges: Channel A_____, Channel B_____, Channel C_____

GSM-CommVS Software version: _____

Gas correction factors (see Note):   enabled_____   not used_____

NOTE: If gas correction factors (K-Factors) are not used, this indicates the flow controllers for each channel are pre-calibrated with a specific gas for the highest accuracy.

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1.0 QUICK START GUIDE

This section provides a short guide to setting up and operating the GSM-3 Gas Mixer. A more detailed description will be found in later sections of this instruction manual.

❶ **Equipment set-up:** Place the GSM-3 in a convenient location. If a computer is to be used for remotely controlling the GSM-3, it should be located nearby.

❷ **Connect the tubing:** Connect the compressed gas sources to the gas inlets on the rear panel. Note that these are "one-touch" press-in tubing connectors. The gas outlet supplies the mixed gas.

❸ **Connect the cables:** Connect the serial port cable between your computer and the and the GSM-3 rear panel connector. If your computer does not have a serial port, use the supplied USB-Serial adapter.

❹ **Install the software:** Insert the GSM-CommVS CD in your computer. If the install program does not auto-start, select run, then browse to setup.exe on the CD. Follow the instructions to install the program.

❺ **Start GSM-COMMVS:** From the start menu, choose programs, and locate GSM-CommVS. Select it to run the program.

❻ **Select config file:** A dialog box will open asking you to select a configuration file. Select default.txt to select a generic configuration file, or *cancel* to go directly to the main screen.

❼ **Configure COM port:** At the bottom of the GSM-CommVS window, set your Comm port. Many computers will use the default COM1, but yours may be different. The program will not work if the correct COM port is not selected!

❽ **Set flow ranges:** If not already displaying the channel flow ranges (bottom right of screen), enter them now.

❾ **Power up the GSM-3:** Turn on the GSM-3 power. After a few introductory messages, the LCD will display the main screen. Select **LOCAL** if you want to begin making settings from the front panel, or **REMOTE** if you want to set up the GSM-3 from your computer.

❿ **Ready to go!** Using either the front panel controls (local mode) or the GSM-CommVS software, select the gasses you have connected to the inlets. Adjust the percentages for each and set the total flow desired.

⓫ **Configurations:** The GSM-3 allows you to store up to four mixtures, which can be immediately accessed using the stored mixture knob. The GSM-CommVS software similarly allows setting up four mixtures. These sets of mixtures can be saved as configuration files. Use the configuration menu at the top of the screen to save or load these files.

❶❷ **Save on exit:**   Use the exit pushbutton on the screen to close the program. A dialog box will open, asking you to save a configuration file. Select an existing file, or create a new one, or select *cancel* to exit without saving a configuration file.

❶❸ **Operating tips:**   Give your configuration files meaningful names to allow easy retrieval and use in the future. A few sample files are included as examples.

2.0 INTRODUCTION

The GSM-3 Gas Mixer allows you to easily create accurate, custom gas blends using up to three different gasses. All parameters (gas type, percent of each gas in the output mixture, and total flow) can be set using the front panel controls, or can be set using the provided GSM-CommVS software. The instrument automatically corrects for different gas densities and other properties when setting the mass flow controllers.

A typical application of the GSM-3 is to generate gas mixes for hypoxia, hypercapnia, or other respiratory gas challenge studies. Because these studies often involve a low concentration of one gas relative to the other gas components, one GSM-3 flow channel normally uses a different range flow controller. A typical configuration might be as follows (your instrument may be different):

> ***Note**: Each GSM-3 is customized to the user's requirements with the appropriate mass flow controllers installed (see page 2 for your configuration). Examples shown in this manual will probably differ from yours.*

Channel:	Nominal Range	Usable Range
GAS 1	0 – 10,000 ml/min	250 – 10,000 ml/min
GAS 2	0 – 10,000 ml/min	250 – 10,000 ml/min
GAS 3	0 – 1000 ml/min	20 – 1000 ml/min

For the best mixture accuracy, any of the channels should be set within the usable range shown above.

The GSM-CommVS software provided allows the user to save any number of pre-set configurations for later use. These mixtures can then be downloaded and run on the GSM-3 itself.

Figure 1: GSM-3 Gas Mixer front panel

3.0 SETUP

Setting up the GSM-3 Gas Mixer is straightforward. The following instructions assume that a computer with a standard serial port is available.

1. Install the GSM-3 Gas Mixer in a location convenient to the gas sources, and near the computer that will be used with it. The unit can be rack mounted if desired.

2. Connect your pressurized gasses to the **GAS 1**, **GAS 2**, and **GAS 3** ports on the rear panel. These ports require 0.25" (6.35mm) O.D. semi-flexible tubing, which makes a press-fit connection. To disconnect any of the tubing connections, press in on the outer ring of the connector and pull out the tubing. Gas pressures should be in the range of 20 - 75 psi (1.4 – 5 bar).

   > ***Note**: **Most GSM-3's will be configured for specific gasses, which must be connected to the appropriate inlet.***

3. Connect the **GAS OUTLET** port using the same type tubing, or use one of the hose-barb adapters included with the system.

4. Connect the supplied serial port cable from your computer to the 9-pin female RS232 port on the rear of the GSM-3. If your computer does not have a serial port, install and use the supplied USB-Serial adapter. This adapter will create a virtual COM port, whose COM number can be located at: `Control Panel / System / Device Manager /Ports (COM & LPT) / USB-Serial COM4` (typical, but your COM port number may be different).

5. Install the GSM-CommVS software on your PC. Insert the CD in your computer, and run `Setup.exe`. We recommend accepting the default directories. The program will then be installed in: `C:\Program files\GSMComm`.

6. When the GSM-3 is turned on, select **LOCAL** to set up the instrument from the front panel, or **REMOTE** to use the GSM-CommVS software. Be sure to set the COM port to the actual port used on your computer.

4.0 OPERATION

The instructions below describe the procedure for setting up gas mixtures and running them from the instrument itself. The operation of the GSM-CommVS software is described later.
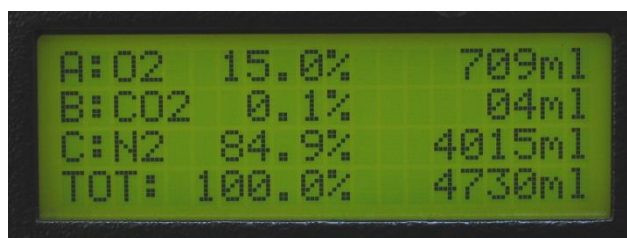

Figure 2: GSM-3 LCD panel

4.1 CREATING A GAS MIXTURE

Be sure the **LOCAL / REMOTE** switch is set to **LOCAL**.

Up to four custom gas mixtures can be created and stored in the GSM-3. To create, edit, or run any of these, use the **STORED MIXTURE** knob. When any of the stored mixtures is selected, its current settings will be displayed on the LCD panel.

Selecting gasses – Using the **GAS SELECT** knob, select either A, B, or C. While holding the **SELECT GAS / SET %** switch in the **SELECT GAS** position, rotate the **ADJUST** knob until the desired gas is shown on the display. Perform this procedure to set gasses A, B, and C.

> ***Note*: *Most GSM-3's will be configured for specific gasses for each of the three channels.***

Setting gas percentages – Each gas can be set to anywhere in the 0 – 100% range, with 0.1% resolution. The total should add up to 100%, or the flows will be inaccurate. The **ERROR** light will turn on and stay on until the gas fractions add up to 100 percent. To set a percentage, first point to A, B, or C using the **GAS SELECT** knob. While holding the **SELECT GAS / SET %** switch in the **SET %** position, rotate the **ADJUST** knob until the desired percentage is shown on the display. Repeat for the other gasses. Remember that the total should add up to 100%!

Setting flow – The GSM-3 allows you to set the total flow of the mixture only. Individual gas flows are computed and shown on the display, but the user cannot change these directly.

To set the total flow, rotate the **SELECT GAS** knob to the **TOTAL FLOW** position. Use the **ADJUST** knob to set the flow, which will be displayed on the LCD panel.

Storing the mixture -- After a mixture is configured, press the **EXECUTE** pushbutton, which will store the mixture and start it running. Press the **SHUT OFF FLOW** pushbutton to stop the flow. The mixture is now stored in non-volatile memory, and will be available even if the instrument has been turned off, and then on again.

The four stored mixtures can be created and stored as described above, and can be selected and executed any time the instrument is used.

4.2 NOTES ON GAS MIXTURES

No flowmeter or flow controller is "ideal"; i.e., it does not operate linearly over a zero – full scale range. The range of operation is known as the *turndown ratio*. This is simply the ratio of full-scale to minimum usable range. In the case of the GSM-3 controllers, this turndown ratio is approximately 50:1. For example, a 1000sccm (standard cc/minute) controller can accurately operate over a 20 – 1000sccm range.

The practical result of this information is that all possible combinations of mixtures and flows may not be accurate if *any* of the gas channels fall outside of the usable range for that channel. If any of the computed flows falls below the minimum usable flow, the **TOTAL FLOW** should be increased to raise the channel flow above the usable lower limit. The following example illustrates this condition:

Desired flow mixture, total flow = 1000 ml/min, initial settings:

Channel	Percent of mix	Computed channel flow
GAS 1 (O_2)	21.0%	210 ml/min (*bad!*)
GAS 2 (N_2)	78.0%	780 ml/min (good)
GAS 3 (CO_2)	1.0%	10 ml/min (*bad!*)

The flows for GAS 1 and GAS 3 fall below the minimum (250 and 20 ml/min, respectively). To obtain an accurate mixture, increase the total flow to move these individual flows into the usable ranges:

Total flow increased to 2000 ml/min:

Channel	Percent of mix	Computed channel flow
GAS 1 (O_2)	21.0%	420 ml/min (good)
GAS 2 (N_2)	78.0%	1560 ml/min (good)
GAS 3 (CO_2)	1.0%	20 ml/min (good)

If very low flows are routinely required, the GSM-3 can be retro-fitted with flow controllers for different ranges. Please contact the factory for details.

4.3 INDICATOR LIGHTS

The various indicator lights give important information about the operation of the GSM-3 Gas Mixer.

Active Mixture lights – These four red LED's indicate which mixture is currently selected by remaining steadily on. A blinking ACTIVE MIXTURE led indicates that a particular mixture is currently running (flow is being delivered). Even while one mixture is running, the STORED MIXTURE knob can be used to select another mixture for configuration. In this case, one of the LED's will be blinking (that mixture is running), and another is steadily on (indicating that that mixture is being displayed for editing, etc.).

Running light – This green led will turn on when gas is actually flowing; i.e., a mixture is currently running.

Error light – This red led will indicate setup errors, such as when the gas percentages do not add up to 100%.

This will also light when a gas source error is detected (see section 6.0).

4.4 IMMEDIATE ACTION CONTROLS

As described above, the **EXECUTE** pushbutton will immediately cause the currently selected mixture to run. Conversely, pressing the **SHUT OFF FLOW** pushbutton will immediately shut off the flow controllers.

4.5 LOCAL / REMOTE SWITCH

Set this switch to **LOCAL** to perform gas mixture setup and execution from the GSM-3 front panel. Set this switch to **REMOTE** to use the GSM-CommVS software to remotely control the instrument. Note that in remote mode, the **ACTIVE MIXTURE** LED's are not automatically on, indicating that the **STORED MIXTURE** switch setting is ignored, since this function is performed by the software.

5.0 REAR PANEL CONNECTIONS

Gas Inlets – These ports are used to connect any of the three inlet gasses. The connectors are compatible with ¼" OD semi-flexible tubing (urethane or similar). Press in the outer ring of the connector to withdraw the tubing.

Gas Outlet – This port provides the gas mixture created by the GSM-3.

Fuse – In case this fuse blows, replace it with one of the same current and voltage rating as the original. If the fuse blows repeatedly, the instrument should be returned for service.

Serial Port – The RS232 serial port uses a standard 9-pin D-sub connection. This port should be connected to your computer using a straight-wired cable (not a crossover or modem cable). Use the supplied USB-Serial adapter if a true serial port is not available.

Analog Outputs – These BNC jacks provide an analog voltage corresponding to the flow rate of each of the three gasses in the current gas mixture.

6.0 GAS SUPPLY ERROR DETECTION

The GSM-3 monitors the **COMMAND** signals going to the mass flow controllers, and the actual flow **OUTPUT** signals. Theoretically, these should be the same after allowing for the response time of the flow controllers. If a gas supply to any of the three channels is disrupted (e.g., a gas tank runs out), the GSM-3 will detect this as an alarm condition.

> *Note*: *In cases where one or more channels are deliberately not connected or used, no error will be detected.*

Figure 3: LCD panel showing alarm condition

When a gas source error is detected, here is what happens:

1. The **ERROR** led will light, and the LCD display will appear as above.

2. The "CHECK GAS SOURCE" prompt is followed by the gas channel that is causing the error.

3. A series of beeps will sound, alerting the operator to an error condition.

4. The beeps will stop after three errors have been detected, but the alarm display and **ERROR** led will persist.

5. If no error condition is detected for 45 seconds, the message and **ERROR** led will clear.

6. You can immediately clear the error display by briefly pressing the **ADJUST** knob.

7.0 CALIBRATION USING CORRECTION FACTORS

When using the GSM-3 with gasses other than nitrogen, correction factors (also called K-factors) are used to correct for the density, viscosity, and other characteristics of the gas. These factors are automatically applied when you select a gas, either from the front panel or using the GSM-CommVS software.

> **Note: Most GSM-3's will be configured for specific gasses, which must be connected to the appropriate channel. These mass flow controllers are factory calibrated using the actual gasses, and DO NOT use correction factors.**

Although flows generated using these correction factors are generally accurate to within $\pm$3%, you can adjust them to provide the best accuracy under the specific

laboratory conditions of the user. The procedure described below explains how to do this.

1. Set up and run a gas mixture using the gas you want to calibrate. For example, 5.0% CO_2, 95% nitrogen.

2. Switch to **LOCAL CONTROL**.

3. Monitor the actual output concentration of the target gas (CO_2).

4. Press the **ADJUST KNOB** to display the "Adjust K-factor" menu:

> Set gas K-factor
> Select gas: AIR
> SHUT OFF to exit
> KNOB to accept

5. Rotate the **ADJUST KNOB** until the desired gas is displayed:

> Set gas K-factor
> Select gas: CO2
> SHUT OFF to exit
> KNOB to accept

6. When the target gas is shown, press the **ADJUST KNOB**. The following screen will appear, showing the current K-factor for that gas:

> Set gas K-factor
> CO2 K = 167
> SHUT OFF to exit
> KNOB to accept

7. Rotate the adjust knob to increase or decrease the displayed K-factor. *Increasing* it will cause a higher flow of that gas at the outlet, and *decreasing* it will result in a lower flow. In the example above, if a 5.0% CO_2 mixture is set up, but the actual measured concentration reads 4.6%, try increasing the K-factor by 13 (about 8%) to 180. After making this change, press the **ADJUST KNOB** to accept and store this change. The GSM-3 will re-start, and apply the new K-factor.

8. After re-starting, the previously run test gas mixture should be displayed. Run it, and note the output gas concentration. If the concentration still needs adjustment, repeat the above procedure activated by pressing the **ADJUST KNOB**. After this procedure is completed, the K-factor is stored and will be applied automatically whenever the GSM-3 is used.

8.0 SPECIFICATIONS

Flow controller type.. thermal mass flow controllers
Linearity (0 - 100%) .... $\pm$1%
Repeatability and hysteresis .... $\pm$0.15%
Long-term stability .... $\pm$0.2% full scale / 7500 hours continuous operation
Response time .... <1 second, typical
Operating temperature.. 0 - 50°C
Operating pressure range (25psi calibration pressure) ....0 – 100psi
Usable flow range (Note1) .... 0.02 – 1.0 x controller range
Analog outputs (for Gas 1, Gas 2, or Gas 3)............. 5.0V for channel full scale flow
Analog output connectors (rear panel)...BNC jacks
Serial communication format .... 19,200 baud, 8 data bits, no parity, 1 stop bit
Serial output connector (rear panel) .... DB9 female
Gas inlet and outlet connections .... ¼" One-Touch press-in connectors
Dimensions .... 19W x 5.25H x 12D in.
Power requirements.. 115/230V (switchable), 50VA

Note1: Actual flow depends on flow controllers installed in your system.

9.0 GAS CHARACTERISTICS

If not otherwise noted, the mass flow controllers used in the GSM-3 Gas Mixer are calibrated using nitrogen. Different gasses can be used by employing "K Factors", which are constants that correct for the densities of gasses relative to nitrogen. These correction factors are automatically applied when different gasses are used with the GSM-3 Gas Mixer. In case your gas is not one of those programmed into the instrument, you can choose among the pre-programmed gasses one that has similar characteristics to your gas. This way, the mixture will remain accurate.

Gas No.	Programmed gas	Symbol	Stored K-factor	K-Factor
1	Air	AIR	100	1.00
2	Nitrogen	N_2	100	1.00
3	Oxygen	O_2	101	0.99
4	Carbon dioxide	CO_2	167	0.74
5	Helium	He	70	1.42
6	Argon	Ar	70	1.42
7	Carbon monoxide	CO	100	1.00
8	Neon	Ne	70	1.42
9	Nitric oxide	NO	100	1.00
10	Nitrous oxide	N_2O	141	0.71
11	Sulfur hexaflouride	SF_6	255	0.26
12	Xenon	Xe	70	1.42
13	Methane	CH_4	139	0.72

Note: The **Stored K-factor** is the correction multiplier used by the internal GSM-3 software.

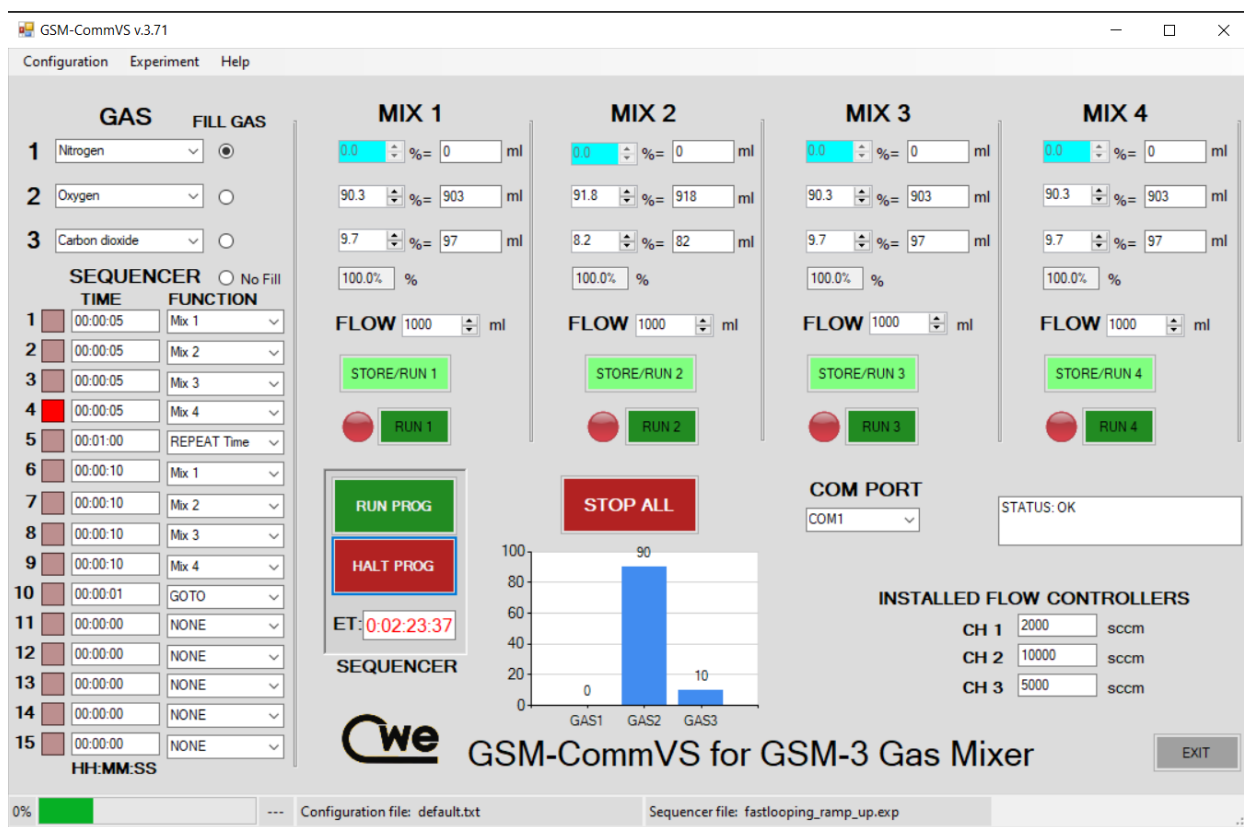| Other gasses	Symbol	K-Factor
Ammonia	NH_3	0.74
Butane	C_4H_{10}	0.26
Freon-14	CF_4	0.42
Chlorine	Cl_2	0.86
Chloroform	$CHCl_3$	0.39
Ethane	C_2H_6	0.50
Ethylene	C_2H_4	0.60
Ethylene oxide	C_2H_4O	0.52
Krypton	Kr	1.41

10.0 GSM-CommVS SOFTWARE

Figure 4: GSM-CommVS screen

The GSM-CommVS software provided with the GSM-3 system is used to remotely control the instrument. All the functions available on the front panel of the GSM-3 can be performed using this software. In addition, multiple configuration files can be easily created and saved to disk on the computer for later use, and automated timed switching of gas mixtures can be performed..

The following instructions assume that the GSM-CommVS software has been successfully installed. Many of the instructions should be familiar, since they duplicate the functions of the instrument described in earlier sections of this manual.

Setting the COM port -- Use the **COM PORT** control on the screen to select the COM number of the serial port on your computer. This is often COM1, but may be different on your computer. The control will automatically be populated with the available serial ports on your computer. If you are using a USB-Serial Port adapter, you can find the assigned COM port number by looking at: `Start / Control Panel / System / Hardware / Device Manager / Ports.`

Set flow ranges – Enter the flow ranges of the installed flow controllers in your instrument in the three labeled text boxes near the bottom right of the main screen. These values are saved with any mixture configuration setting files (see below), and are automatically re-entered whenever a configuration file is loaded.

Load and Save Configuration -- These operate as you might expect: `Load configuration` will retrieve from disk a set of previously stored settings; `Save configuration` will save the current settings to a file of your choice. You might try loading one of the pre-configured files to see how this works (e.g., the `hypoxia` file). The name and path of the file in use will be displayed in the status bar at the bottom of the screen.

Selecting gasses – On the left side of the screen, you can select any of the programmed gasses using the drop-down menus. These should correspond to the actual gasses connected to the **GAS 1**, **GAS 2**, and **GAS 3** inlets.
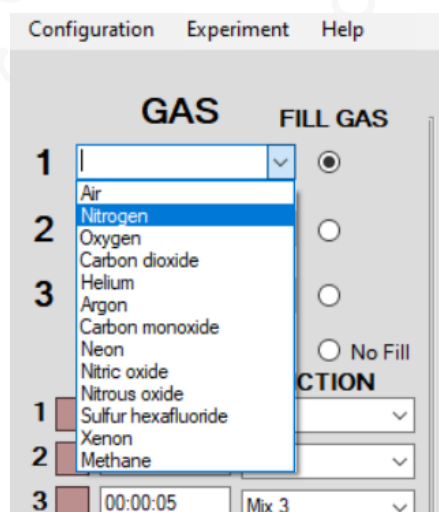

Figure 5: Gas selection drop-down menu

Fill Gas – For the individual channel concentration settings to make sense, they must add up to 100 percent. In most cases, two of the three gasses are of primary interest, and the third gas (often Nitrogen) makes up the balance of the mixture. Use the **FILL GAS** buttons to select the gas that will make up this balance. Then, this gas concentration will automatically be adjusted when the other two gas percentages are changed.

Mixture settings – Enter the desired gas percentages in the appropriate boxes by using the spin controls next to each box. If any computed flow is outside the range of the channel flow controller, it will be shown in red, and a warning message will appear in the status box at the bottom of the screen. If any flow is shown to be too low, it is often possible to bring it back into a usable range by increasing the **TOTAL FLOW** (see below).

Total Flow – Enter the total flow rates in the **FLOW** boxes (labeled with "ml"). The total flow will be limited to that available from the installed flow controllers; i.e., if you have two 1000sccm and one 100sccm controllers, the total flow will be limited to 2100sccm.

Store / Run button – Clicking any of these light-green buttons causes the selected mixture to be downloaded to the GSM-3 and immediately executed. It will be stored in the GSM-3 for later use. Each mixture must be separately downloaded.

Run button – These dark-green buttons cause the GSM-3 to immediately execute the corresponding stored program. A small red indicator next to the button will show which mixture is running. Note that these **RUN** buttons execute the program currently stored on the GSM-3 in the corresponding location (Mix 1 – 4). Therefore, if the GSM-3 has been previously configured with stored programs, these will be run (which may be different from those shown on the software screen).

Stop All button – Click this button to turn off all the flows immediately.

Timed experiments – An important and useful feature of the GSM-CommVS software is the ability to run pre-programmed, timed experiments.
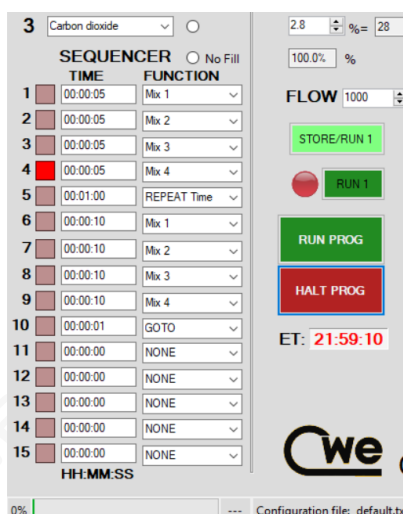

Figure 6: Timed experiment setup

The **SEQUENCER** panel allows a timed sequence of gas mixtures to be delivered, and either repeated indefinitely, or terminated after one sequence has completed. The setup is very straightforward: In the right-hand box, use the drop-down menu to select a **FUNCTION** for that step in the sequence. This can be either **Mix 1**, **Mix 2**, **Mix 3**, **Mix 4**, **REPEAT**, **REPEAT Time**, **PAUSE**, **XPAUSE**, **GOTO**, **STOP**, or **NONE**. In the left-hand box, enter the desired duration of that step in **HH:MM:SS** (Hours, Minutes, Seconds) format.

These functions are somewhat self-explanatory; **Mix 1 - 4** runs the specified mixture for the programmed time. **REPEAT** starts the sequence again from the top. **REPEAT Time** repeats commands above it for a specified time. When that time has elapsed, execution goes to the following command. **PAUSE** waits for the programmed time, without changing or stopping any running mixtures (if any). **GOTO** causes execution to jump to the command line number programmed into the seconds (SS) section of the time panel. **STOP** turns off all flows and halts the sequencer.

Note that you must set up each of the four mixtures in advance, although you can change any mix parameter (and sequencer times) while the sequencer is running.

Exit button – Click this to exit the program. A dialog box will open asking you to save the configuration file. Select an existing file, create a new file, or simply select *cancel* to skip this and exit immediately.

11.0 Appendix A: GSM-3 Communication protocols

The GSM-CommVS software communicates with the GSM-3 Gas Mixer hardware via the serial protocol described below. This description is provided in case the user wants to develop his own custom control software using, for example, Labview or Visual Basic.

In addition, the file format of the configuration files used by the GSM-CommVS program is described. These text files can be easily created using Notepad or any text editor.

Direct communication with GSM-3 Gas Mixer:

Serial protocol 19,200,N,8,1

One-byte commands (immediate execution) are sent as simple ASCII text:

> "1" = execute stored program 1
>
> "2" = execute stored program 2
>
> "3" = execute stored program 3
>
> "4" = execute stored program 4
>
> "9" = halt any running program

Normal program string (12 bytes):

These are actual values (not ASCII text), and usually sent as chr(x) or chr$(x) by the control software. For example, if you want to send the value 12, you would send chr$(12), and NOT "12" as text. No termination characters should be sent; just send the 12 bytes as shown below.

The example program in the table below would set up the GSM-3 to do:

Mix position #1, gas1 = oxygen, %gas1 = 20.9, gas2 = carbon dioxide, %gas2 = 0.1, gas3 = nitrogen, %gas3 = 79.0, total mix flow = 1000 ml/min

Byte	Description and range		Example	Meaning
1	Mix number	(1 – 4)	chr$(1)	Mix = 1
2	gas1	(1 - 13)	chr$(3)	oxygen
3	pct1.highbyte	(0 – 255)	chr$(0)	20.9%
4	pct1.lowbyte	(0 – 255)	chr$(209)	
5	gas2	(1 - 13)	chr$(4)	carbon dioxide
6	pct2.highbyte	(0 – 255)	chr$(0)	0.1%
7	pct2.lowbyte	(0 – 255)	chr$(1)	
8	gas3	(1 - 13)	chr$(2)	nitrogen
9	pct3.highbyte	(0 – 255)	chr$(3)	79.0%
10	pct3.lowbyte	(0 – 255)	chr$(22)	
11	totalflow.highbyte	(0 – 255)	chr$(3)	1000 ml/min
12	totalflow.lowbyte	(0 – 255)	chr$(232)	

Notes: Gas identification number is the same as in the table in Section 7.0. For example, oxygen = 3.

Configuration file format:

This is the file format used by the GSM-CommVS program to save and load configuration data. Note that this is a simple test string of numbers, with comma delimiting.

Example:

2,3,1,209,1,790,1000,150,1,849,1000,120,1,879,1000,100,1,899,1000<cr>

This is interpreted as follows:

gas1, gas2, gas3, %gas1, %gas2, %gas3, total flow, %gas1, %gas2, %gas3, total flow, %gas1, %gas2, %gas3, total flow, %gas1, %gas2, %gas3, total flow, <ret>

(red = mix1 values, green = mix2 values, blue = mix3 values, orange = mix4 values)

12.0 Appendix B: Disabling the Gas Source Alarm Function

The Gas Source Alarm function can be disabled if necessary, as follows:

1. Disconnect the power cord from the unit.

2. Locate the **ALARM JUMPER BLOCK** (see photo below).

3. Place Jumpers on positions 1, 2, and 3 as shown by arrows below. Leave the 4th pair of pins uncovered.

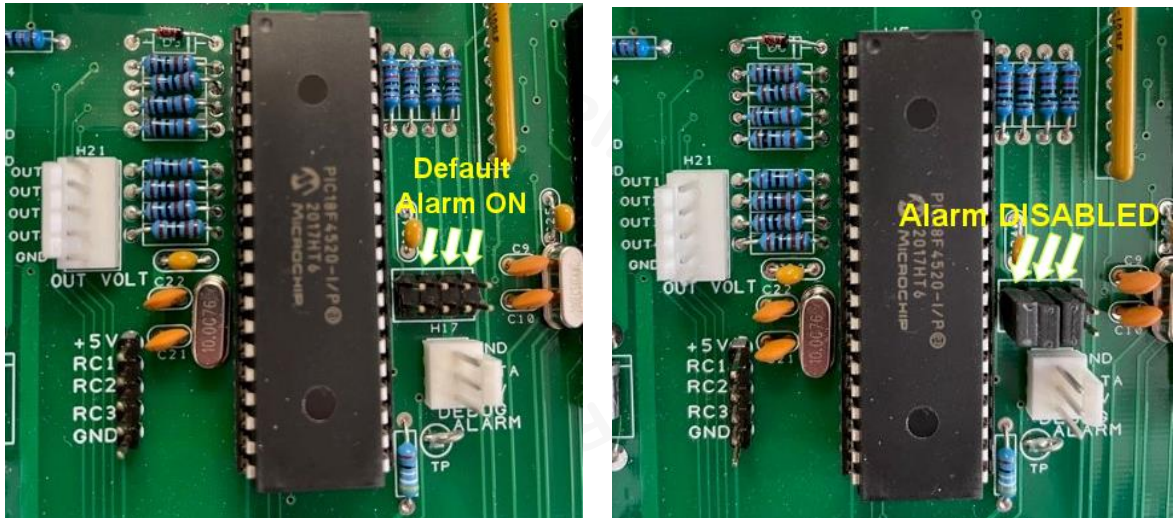4. Replace the top cover and reconnect the power cord.

Figure 7: GSM-3 Alarm PCB showing Jumper locations.
Left: Default, Alarm enabled; Right: Alarm disabled