SMARTBOX™

Auto CO$_2$ System

Models - *M1R-MSVF-4, M1TR-MSVF-8*

30/09/2015

EUTHANEX CORPORATION

Table of Contents

THIS MANUAL MUST BE READ BEFORE SETTING UP AND OPERATING THE AUTO CO$_2$ SYSTEM. The user should be thoroughly familiar with the contents of this manual prior to using the system with animals.

Only technicians that are properly certified should operate the Auto Co$_2$ System.

The user/owner of this equipment shall have the sole responsibility for any damage or injury resulting from operation that is not in accordance with the authorized instructions.
This includes, but is not limited to, operating the equipment outside of recommended safety levels, variation from specified operating instructions and not following standard laboratory safety procedures when working with anesthetic agents and volatile compressed gases.

The system and its components must only be modified or repaired by Euthanex authorized service technicians. Improper modification or repair may result in danger to personnel, harm or death to animal, and/or equipment damage. The user/owner of this equipment shall have the sole responsibility for any damage or injury resulting from improper maintenance and repair that is not done by authorized maintenance and repair personnel.

Parts that have failed, in whole or in part, exhibit excessive wear, are contaminated or are otherwise at the end of their useful life, should not be used and should be replaced with parts supplied by Euthanex Corporation. Tampering with the main control unit by unauthorized personnel automatically voids all warranties and specifications. The manufacturer assumes no responsibility for any malfunction or failure of the unit if tampering is suspected.

SmartBox Variable Flow Overview:

Introducing the SmartBox Variable Flow (MSVF) Auto Co_2 Rack Units, the industry's most advanced euthanasia system. This system features a fully automated control system that was developed specifically for euthanizing small rodents.

The MSVF system allows up to four independent levels to be euthanized per cycle. Flow is pre-set to deliver a specific amount of gas depending on the type of species and the number of levels being treated.

The MSVF main controller operates in three stages: CO_2 induction, dwell and evacuation The CO_2 induction stage delivers 59% flow rate of CO_2, humanely euthanizing the animals.   After all gas has been delivered, the dwell stage allows the gas to remain in the chamber for a pre-set amount of time, ensuring proper euthanasia. The final stage is evacuation. All gas is removed from the chambers by an independent blower, making it safe for the personnel to remove the cages.

The MSVF Auto CO_2 System is safe, cost effective, efficient, and above all, humane.

Control Panel Diagram Description:

1. Gas Input: This is the CO_2 input for the entire system. This will connect to a CO_2 tank or wall gas outlet. **Optimal input pressure is 35 psi.**

2. AC Power Cord: This provides power for the entire system. This will connect to a standard AC wall outlet.

3. Programmable Logic Controller (PLC): This is the user interface for the system and allows all system operation. Function keys perform the operation described on the screen.

4. Power Switch: This will turn system on and off.

5. ESC Data Line: These cables are connected to the back of the electronic safety locks. The locks are located on the left side of chamber C and D.

6. Exhaust Blower Outlet: Supplies the power to the exhaust blower box.

<u>Operating the System</u>:

Warning: Make sure all connections are secure and the regulator is delivering 35 psig.

1. Power the system by turning Power Switch clockwise to ON position. Home screen on Programmable Logic Controller (PLC) will appear.

2. From Home screen press F6 (Continue) to continue to Start screen. Password screen will appear. Enter assigned seven-digit password using the numeric keys and press enter. The default password is 5555555. Refer to the 'Assigning Password and Users' section to learn how to program user settings and passwords.
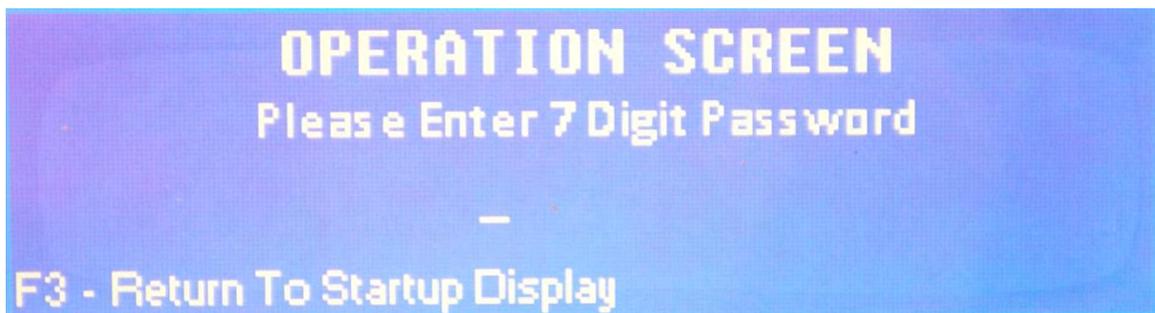
3. The status screen will appear as shown below. On this screen you can see any cycles that are in current operation. To start a new cycle press F5.

Species	Total Time	Cycle Time	Status	Flow Rate
A	00:00:00	00:00:00	READY	1
B	00:00:00	00:00:00	READY	F4-Logout
C	00:00:00	00:00:00	READY	F5 - Start New Cycle
D	00:00:00	00:00:00	READY	

4. Select desired chambers to be treated: Press F2 for Chamber "A" Single Chamber, F3 for Chamber "B", F5 for "C", and F6 for "D".

```
F1-Back        SELECT CHAMBER(S)      F4-Continue
F3-Purge

F2 - A AVAILABLE                   F5 - C AVAILABLE


F3 - B AVAILABLE                   F6 - D AVAILABLE
```

Once the chamber selection is made the status for the chamber will change.

```
F1-Back        SELECT CHAMBER(S)      F4-Continue
F3-Purge

F2 - A SELECTED                    F5 - C AVAILABLE


F3 - B SELECTED                    F6 - D AVAILABLE
```

Press F4 to continue to species selection

5. Select type of animal to be euthanized: F2 for Mouse, F3 for Rat, F5 for Neonates and F6 for Other.
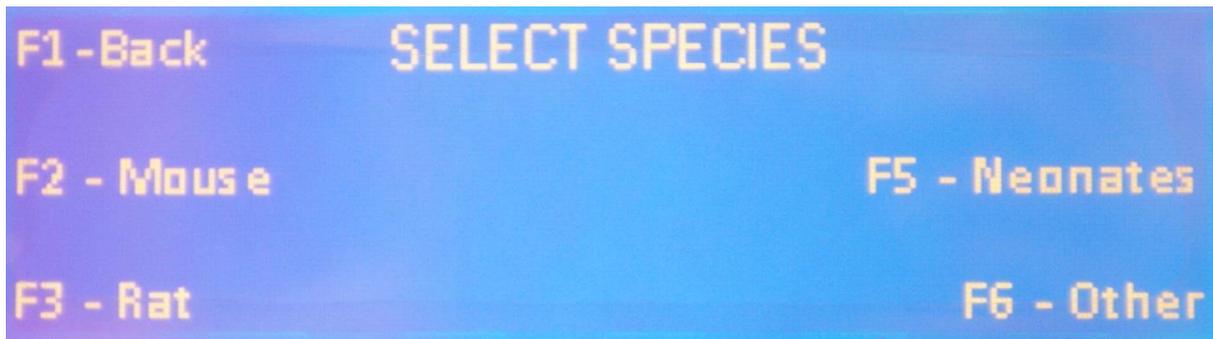
6. *Once the Species is selected the next screen will appear, this displays the door status. Place animals in desired levels and close doors. Latches must be fully turned to the right to ensure proper closure*. **Program will not continue if doors remain open**. **Select F6 to continue** *The screen shown below will continue to appear until all doors that are in use are closed.*
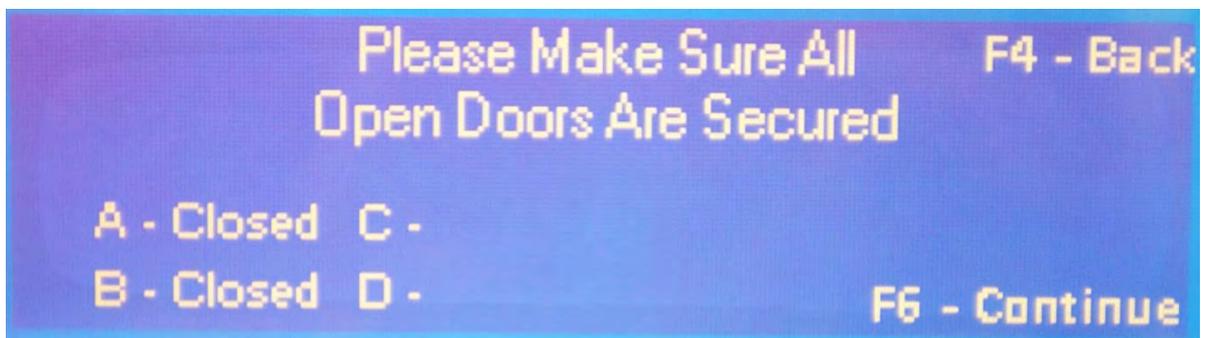
7. Select F5 to Start Gas Cycle.
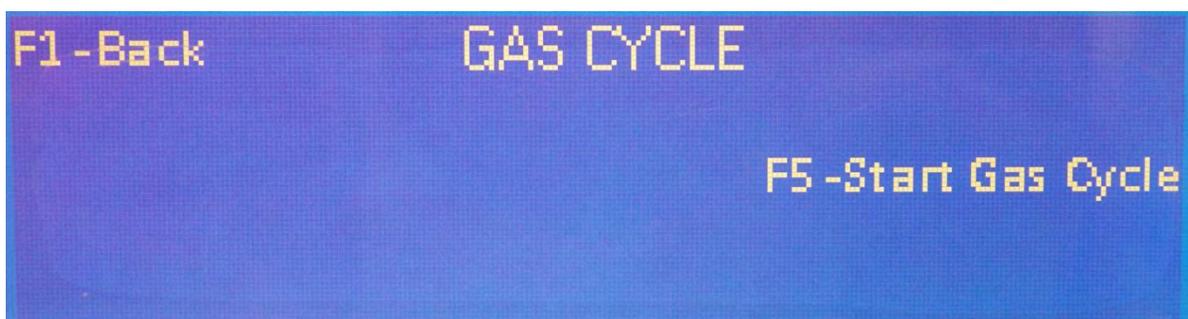
8. The program will now begin the gas cycle. The program will automatically cycle through all three stages: Gas In, Dwell and Purge

Species	Total Time	Cycle Time	Status	Flow Rate
A NEONATES	00:00:04	00:00:01	DWELL	3
B NEONATES	00:00:04	00:00:01	DWELL	F4 - Logout
C	00:00:00	00:00:00	READY	F5 - Start
D	00:00:00	00:00:00	READY	New Cycle

9. At any time a new cycle can be started. Press F5 (Start) to begin gas cycle. Any unused chambers can be added, (see step 4).

10. Once cycle is complete, doors may be opened and animals removed. Press F5 to start a new cycle. Press F4 to log out of the program.

<u>Changing Operating Specifications</u>:

Default flow rates and times were chosen to comply with the latest guidelines of the AVMA Panel on Euthanasia and through extensive testing performed by Euthanex. Flow rates and times are programmable and may be changed by a designated administrator. Refer to the "Recommended Settings" section to the view the factory presets for each cycle. Flow rates and times are password protected for security.

The MSVF main controller operates in three stages: CO_2 induction, dwell and evacuation. The euthanasia stage delivers the CO_2, humanely euthanizing the animals. After all gas has been delivered, the dwell stage allows the gas to remain in the chamber for a pre-set amount of time, ensuring proper euthanasia. The final stage is evacuation. All gas is removed from the chambers by an independent blower, making it safe for the personnel to remove the cages.

CO2 Time: This determines the amount of time "CO2" is to be delivered during the euthanizing stage.

Flow Rate: This is the pre-set amount of gas to be delivered for the number of chamber being used concurrently in a selected cycle. The gas flow rate is delivered in liters per minute (lpm).

Dwell: After all gas has been delivered, the dwell stage allows the gas to remain in the chamber for a preset amount of time, ensuring proper euthanasia.

1. From the Home Screen press F4 (Admin. Only).

2. Enter the Administrator 7 digit password (default is 7654321) and press Enter .
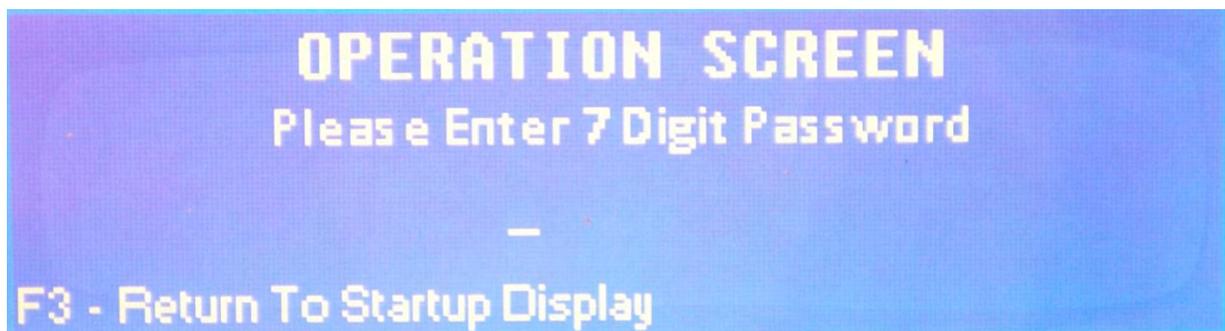
3. Select F5 (Operation Specifications).

4. This now displays the programed species. The cursor will be at the CO2 time for Mouse. Use the keypad to input the desired time. Use the Enter ⏎ key to step to the next time to set. Repeat time input for each species. When complete press"F1", the changes will be saved.

5. Select F6 for chamber flow rates.

6. Use the numeric key Pad to enter the desired flow-rates. Once the desired value is entered press Enter ⏎. This will move the cursor to the next setting. Once flow rates have been set, the blinking cursor will disappear. Press F1 (Back) to save the chosen settings for this particular option. Once complete, press F1 (Back) repeatedly until you return to the home screen.

<u>Changing Log Out/ Fault / Purge Times:</u>

Log Out Time: Time of inactivity allowed before any user is logged out of the program.

Fault Time: The Fault function alerts the user to inadequate gas flow. Fault time is the amount of time with inadequate gas flow before the user is alerted.

Purge Time: Amount of time the exhaust blower is activated during the Purge stage of the gas cycle. Euthanex highly recommends using the default purge times.

1. From Administrator Options screen, press F3 (Log Out/ Fault / Purge Times).

2. Use the key pad to enter the desired times. Once the desired time is entered press Enter . This will move the cursor to the next setting, once all times have been set, the blinking cursor will disappear. Press F3 (Back) to save your settings.
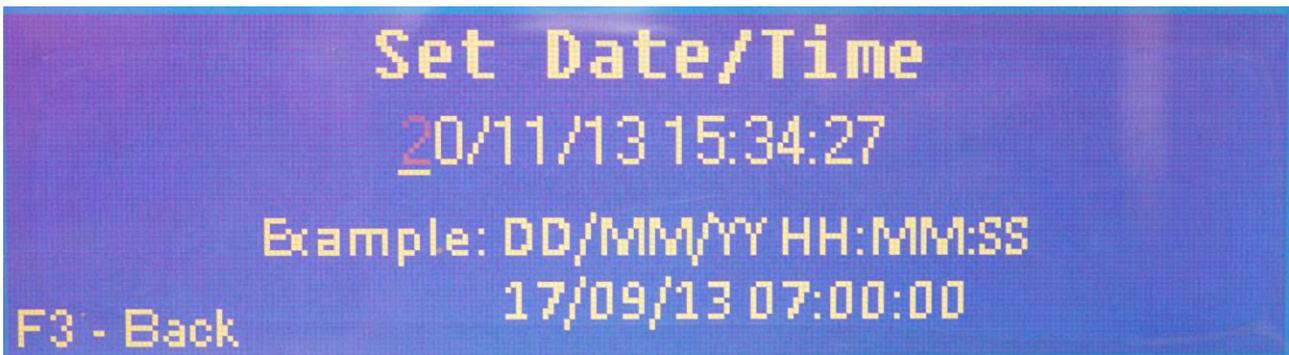
3. Press Log out to return the home screen.

Changing System Clock / Lockout Times:

1. From Administrator Options screen, press "F15" for system clock setting.

2. The cursor is blinking at the Day setting. Update dd/mo/yr, hr:mm using the keypad.

3. When complete us the "F3" to save the udates.

Lockout Times:

Lockout allows for the system use to be restricted to only Neonates during set times. Days of the week and hours during they day can be set. So the days and hours that are set "ON" all species can be selected.

1. From Administrator Options screen, press "F4" for lockout setting.

2. The cursor is at the "End Lockout Mode" time. Use the keypad to input the desired time to start the lockout. This is the time that only a Neonates can be selected.

3. When the time in filled in for "End Lockout Mode" the cursor moves to "Start Lockout Mode" Use the keypad to input the desired time to end the lockout. This is the time that all species can be selected.

4. Press the "F5" key to select the days that all species can be selected.

5. Press the "F#" key next to each of the days the lockout times are to be active. When the key is pressed the day will show selected (see above example). Once the days are selected use the "F8" key to save and return back to the main lockout settings screen.

6. Now press the "F1" key to change " Lockout Override" to "Set". This turns on the function. Use the "F6" key to save and return back to the Admin Ops screen.

Changing/Adding Users and Passwords:

The MSVF program allows up to 50 users with different assigned 7 digit passwords. These passwords only allow the user to perform operation cycles. These passwords also act as a user id, allowing the data log to track who has been operating the system by the 7 digit password. The administrator password allows total access. The administrator is the only password that will allow access to the "Administrator Options." The administrator default password is 5555555, this may be changed at any time. Please refer to "Administrator Password" section.

Adding New Users

1. From Administrator Options screen press F2 (Change User Info).

2. Enter new user number (01-49) then enter the desired 7-digit password press Enter ⏎ . Then press F5 (Save) to save the chosen user ID and password.

3. To enter additional user IDs and passwords, press F4 (Back) then press F2 (Change User Info) and follow step 2. Repeat this process until all users have been added.

4. When finished press F4 (Back) then Log Out. You will be returned to the home screen.

Changing Existing Passwords:

1. From Administrator Options screen press F2 (Change User Info).

2. Enter desired user number (01-50) then enter the new 7-digit password press Enter [↵]. Press F5 (Save) to save the chosen user ID and password.

3. When finished press F4 (Back) then Log Out. You will be returned to the home screen.

Changing the Administrator Password:

As stated above, only the administrator is allowed total access to the entire program. The administrator is assigned the #50 user id. The default administrator password is 5555555.

1. From Administrator Options screen press F2 (Change User Info).

 2. Enter user number 50, then enter the desired 7-digit password press Enter [↵] . Then press F5 (Save) to save the password.

3. When finished press F4 (Back) then Log Out. You will be returned to the home screen.

Troubleshooting:

Below are problems that may arise during operation and their common cause. Use the schematic included with this operation manual to help identify components mentioned in this troubleshooting guide. If you use this guide and still experience problems contact Euthanex Tech Support at 877-559-0159 or info@euthanex.com, a Euthanex representative will be available to assist you.

Gas is not being delivered and the fault light on the Side Control Box is lit:

1. Check that your gas supply contains adequate gas for the entire gas cycle.
2. If using tanks, be sure that all tank valves are completely open.
3. Check that all connections from the gas supply to the Control Panel are properly mated.
4. Be sure that the High Flow Regulator is open and set to 30 psig

Gas is being delivered at an incorrect flow rate:

1. Check that your gas supply contains adequate gas for the entire gas cycle.
2. If using tanks, be sure that all tank valves are completely open.
3. Check that all connections from the gas supply to the Control Panel are properly mated.
4. Be sure that the High Flow Regulator is open and set to 30 psig.
5. Be sure that the Electric Heater, inline from the gas supply to the regulator, is in operation. The heater acts intermittently, turning on when heat is required. A red light will activate when the heater is on. If the gas is not properly heated, it will not flow correctly.

The PLC display reads "Unit Not Connected.":

1. Be sure that the Data Line from the Control Panel to the input of Chamber "A" Side Control Box is properly connected.
2. Be sure that the Data Lines that connect the individual Side Control Boxes to each other are properly connected.
3. An end plug is installed in the final (the bottom) Side Control Box in the series. This allows the Control Panel to understand how many levels are present. Be sure that this end plug is installed in the final Side Control Box in your series.

The PLC display reads "Please Place Animals in Chamber and Close Door.":

1. As a safety precaution the system will not operate until all levels being utilized are properly closed and locked. Be sure that all doors are closed and that door latches on the chambers being utilized are properly latched by turning clockwise.

Gas does not completely evacuate from the chambers during the evacuation phase of the gas cycle:

1. Make sure the Blower Box is properly connected to the Control Panel.
2. Check that all Chamber Exhaust/Vent Lines are connected to the exhaust side of the chambers.
3. If using a tandem rack system, make sure that all of the Chamber Exhaust/Vent Lines that connect the two tiers of the system are properly connected.
4. If problem still exist, you may change the length time the blower is activated during the evacuation cycle. Please refer to "Changing Purge Time" section of the manual.

Animals are not being fully euthanized by the end of the gas cycle.

1. Be sure that all connections on the entire system are properly mated.
2. Check that your gas supply contains adequate gas for the entire gas cycle.
3. Be sure that the High Flow Regulator is open and set to 30 psig.
5. Be sure that you have chosen the correct chambers and levels containing animals prior to beginning the gas cycle.
6. You may simply need to revise your SOP for the particular species that you are having difficulties with. Try increasing the amount of time and flow being delivered for that cycle. The administrator for the system has the ability to change the settings, please refer to the "Changing Operating Specifications" section of the manual.

Gas exposure limits are being exceeded:

1. Be sure that all connections on the entire system are properly mated.
2. Make sure the Blower Box is properly connected to the Control Panel.
3. Check that all Chamber Exhaust/Vent Lines are connected to the exhaust side of the chambers.
4. If using a tandem rack system, make sure that all of the Chamber Exhaust/Vent Lines that connect the two tiers of the system are properly connected.
5. Be sure that the 4" Duct Exhaust is properly connected and that the house exhaust is pulling from 100-150 CFM.
6. It is crucial to gas containment that the doors of the chambers are properly latched during the gas cycle. Be sure that all doors are closed and that door latches on the chambers being utilized are properly latched by turning clockwise.
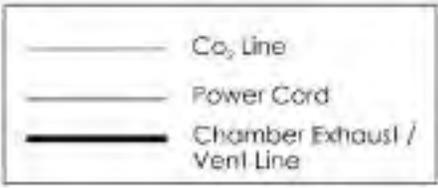
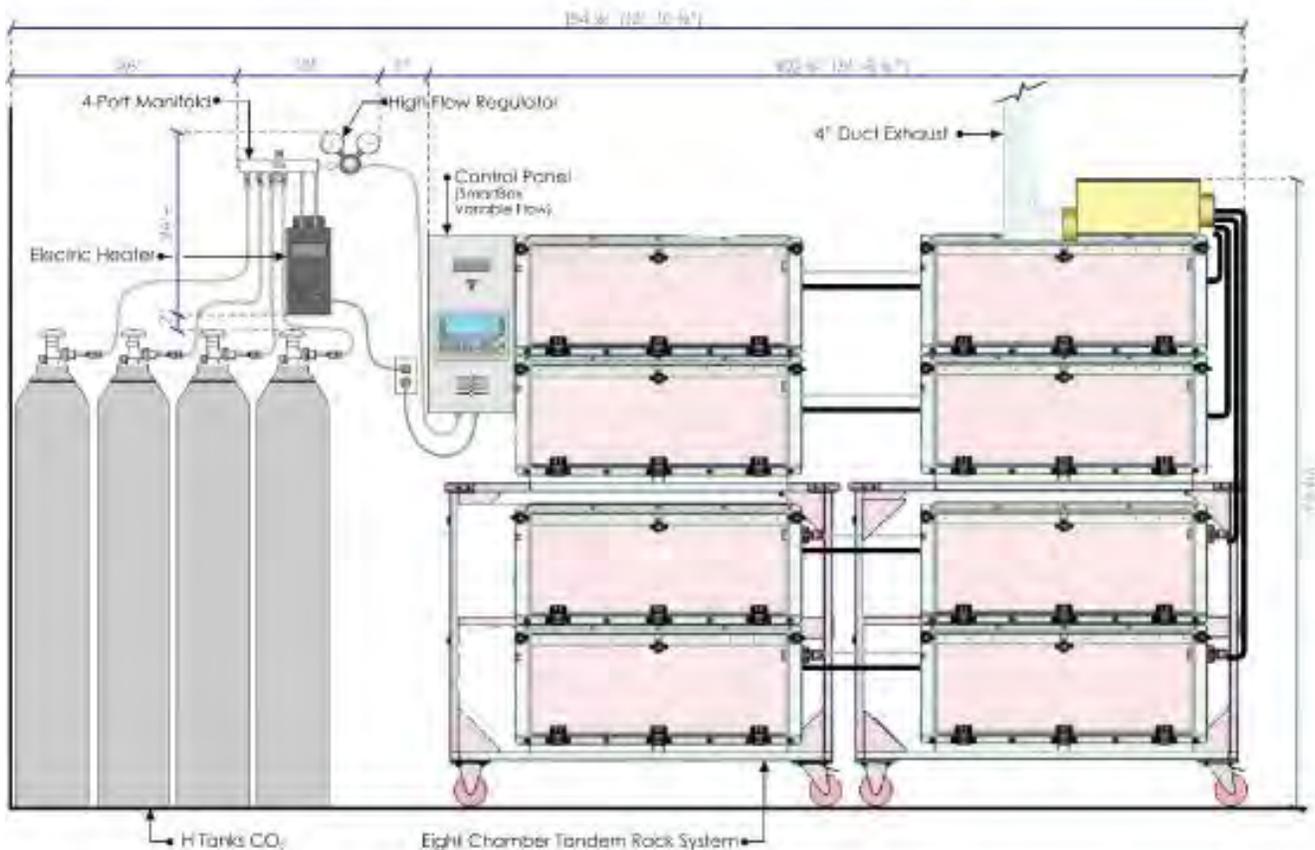Schematics & Flow Rate Settings:
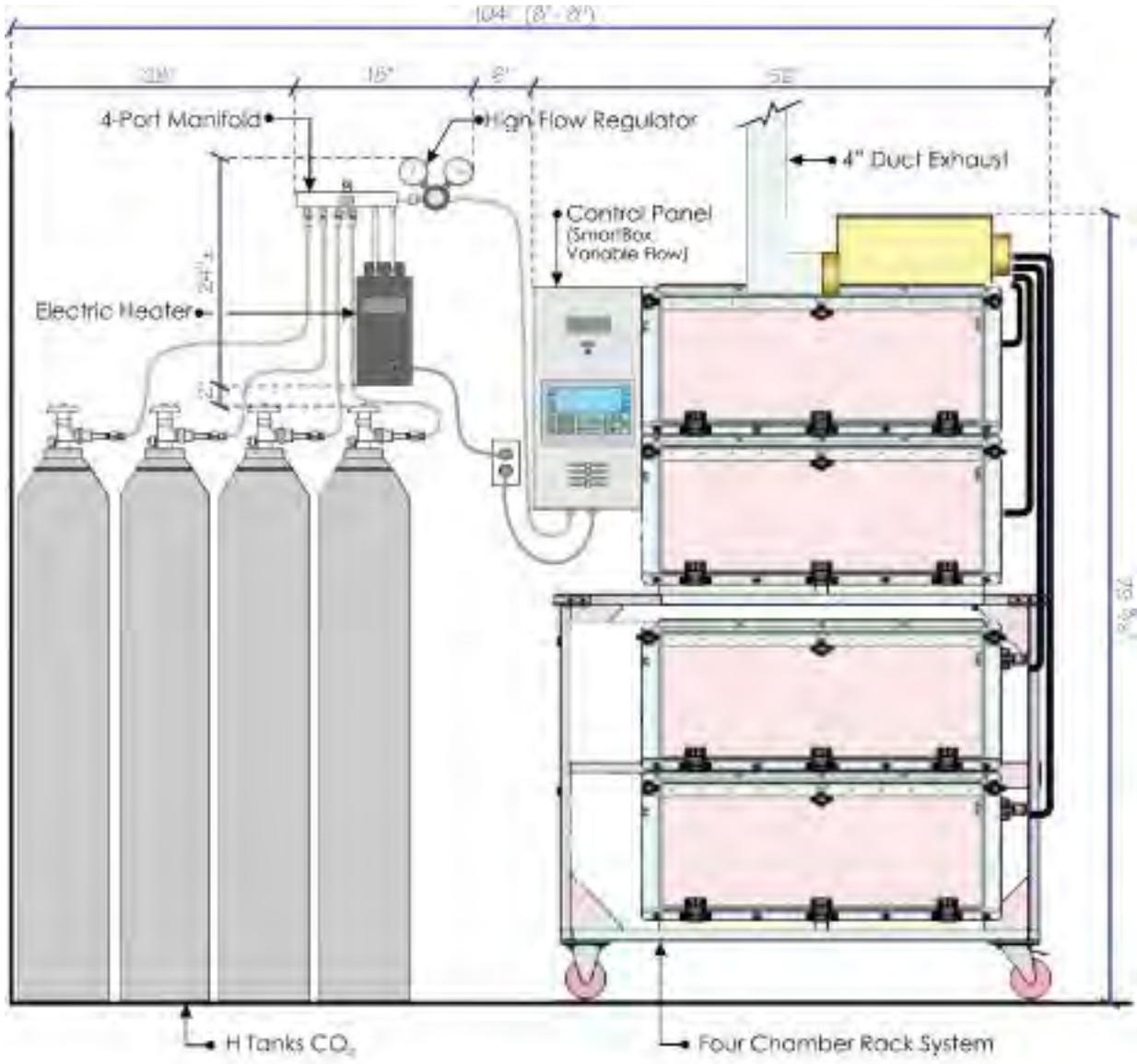
SMARTBOX Auto CO₂ System / MSVF-4

SCALE: 3/4"= 1'-0"

INSIDE CHAMBER DIMENSIONS

32.0" W X 30.5" D X 12.5" H

REQUIREMENTS

Electric	120V 5 AMP
4" House Exhaust	100 CFM
CO₂ Supply	30 PSI @ 550 SCFH

———	CO₂ Line
———	Power Cord
▬▬▬	Chamber Exhaust / Vent Line

SMARTBOX Auto CO₂ System / MSVF-8

SCALE: 3/4"= 1'-0"

⎯⎯	CO₂ Line
⎯⎯	Power Cord
▬▬	Chamber Exhaust / Vent Line
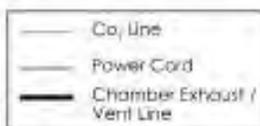
REQUIREMENTS

Electric	120V 5 AMP
4" House Exhaust	150 CFM
CO₂ Supply	30 PSI @ 550 SCFH

Labels in diagram:
- 4-Port Manifold
- High Flow Regulator
- 4" Duct Exhaust
- Control Panel (SmartBox Variable Flow)
- Electric Heater
- H Tanks CO₂
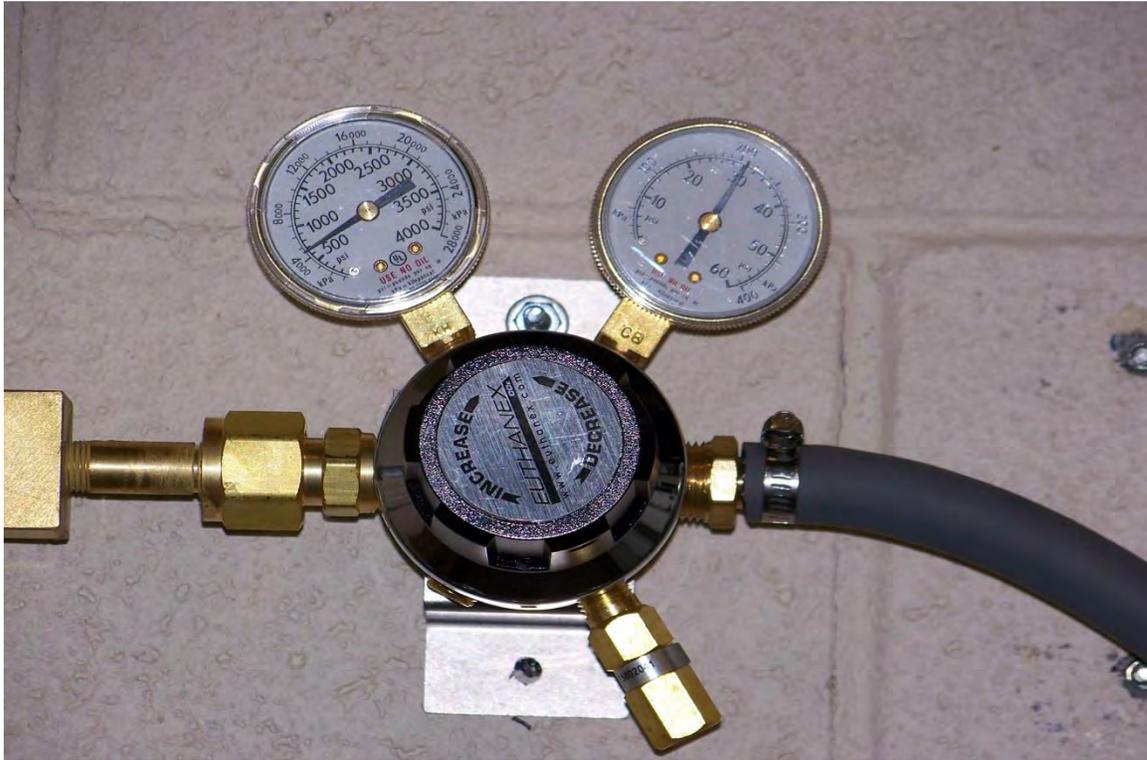- Eight Chamber Tandem Rack System

INSIDE CHAMBER DIMENSIONS

32.0" W X 30.5" D X 12.5" H

E-Z SYSTEMS
1.877.559.0159

Purge is 4 minutes.

Replacing CO2 Tanks:

WARNING: DO NOT REPLACE TANKS WHILE PRESSURE IS PRESENT IN EITHER GUAGE.

1. Shut off all tanks.

2. Go into the main screen that is used to start a cycle. Select a "Chamber"
    then Press the "F9" to purge.

3. Please confirm the regulator's gauges show no pressure.

4. You may now disconnect the Co2 lines from the tanks.

5. When replacing new CO2 tanks, use a CO2 compression disc or Teflon tape to prevent leaking.

6. Securely tighten each line with wrench. You may now open the tanks and adjust your regulator.