INSTALLATION, OPERATION, AND MAINTENANCE MANUAL

WELKER® ECOSYSTEM™ LIQUID WITH XL4 CONTROLLER

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TABLE OF CONTENTS

	SAFETY	**3**
1.	**PRODUCT INFORMATION**	**4**
1.1	Introduction	4
1.2	Product Description	4
1.3	Safety Warning	4
1.4	Specifications	5
1.5	Equipment Diagrams	6
2.	**INSTALLATION & OPERATION**	**11**
2.1	Before You Begin	11
2.2	Installation	11
2.3	Start-Up Procedures	13
3.	**XL4 TOUCH SCREEN CONTROLLER**	**15**
3.1	Understanding the Display	15
3.2	Navigating the Monitor Menus	18
3.3	Navigating the Setup Menus	26
4.	**MAINTENANCE**	**46**
4.1	Before You Begin	46
4.2	Maintenance	47
4.3	Alarm and Flow Meter Check Procedures	48
4.4	Troubleshooting Guidelines	50
	APPENDICES	**52**
	A: Referenced or Attached Documents	52
	B: Maintenance Schedule	53

IMPORTANT SAFETY INFORMATION
READ ALL INSTRUCTIONS

Notes emphasize information and/or provide additional information to assist the user.

Caution messages appear before procedures that could result in damage to equipment if not observed.

Warning messages appear before procedures that could result in personal injury if not observed.

This manual is intended to be used as a basic installation and operation guide for the Welker® OdorEyes® ECOsystem™ Liquid With XL4 Controller. For comprehensive instructions, please refer to the IOM Manuals for each individual component. A list of relevant component IOM Manuals is provided in Appendix A of this manual.

The information in this manual has been carefully checked for accuracy and is intended to be used as a guide for the installation, operation, and maintenance of the Welker® OdorEyes® equipment described in this manual. Correct installation and operation, however, are the responsibility of the end user. Welker® reserves the right to make changes to this manual and all products in order to improve performance and reliability.

BEFORE YOU BEGIN

Read these instructions completely and carefully.

IMPORTANT – Save these instructions for local inspector's use.

IMPORTANT – Observe all governing codes and ordinances.

Note to Installer – Leave these instructions with the end user.

Note to End User – Keep these instructions for future reference.

Installation of this ECOsystem™ Liquid is of a mechanical and electrical nature.

Proper installation is the responsibility of the installer. Product failure due to improper installation is not covered under the warranty.

If you received a damaged ECOsystem™ Liquid, please contact a Welker® representative immediately.

Phone: 281.491.2331
Address: 13839 West Bellfort Street
Sugar Land, TX 77498

SECTION 1: PRODUCT INFORMATION

1.1 Introduction

We appreciate your business and your choice of Welker® products. The installation, operation, and maintenance liability for this equipment becomes that of the purchaser at the time of receipt. Reading the applicable *Installation, Operation, and Maintenance* (IOM) *Manuals* prior to installation and operation of this equipment is required for a full understanding of its application and performance prior to use.*

If you have any questions, please call Welker® at 1.281.491.2331.

**The following procedures have been written for use with standard Welker® OdorEyes® parts and equipment. Assemblies that have been modified may have additional requirements and specifications that are not listed in this manual.*

1.2 Product Description

The Welker® OdorEyes® *ECOsystem™ Liquid With XL4 Controller* is designed to infuse, with liquid odorant, natural gas in the customer pipeline. This automatic injection system has three (3) primary components: the touch screen controller, the solenoid cabinet, and the odorant supply tank. Each primary component plays an integral role in the operation of the ECOsystem™ Liquid and can be customized to better suit each application.

The touch screen controller serves as the system's brain. It continuously receives feedback from the customer's gas flow meter and the odorant flow meter in the solenoid cabinet, allowing the system to respond to changing flow conditions. As pipeline conditions change, the controller increases or decreases the injection rate so that the ECOsystem™ Liquid continues infusing proportional to flow. On-site and remote troubleshooting and monitoring are made easier by time- and date-stamped audit data detailing system performance, alarm history, and odorant tank level.

The solenoid cabinet contains two (2) solenoid banks which control the injection of odorant from the odorant supply tank into the pipeline. Having two (2) sets of solenoids allows the ECOsystem™ Liquid to better respond to and accommodate varying flow rates and limits interruption to operation in the event of solenoid maintenance. The odorant flow meter communicates the solenoid operation to the controller to ensure proper odorization. A heater with thermostat is included in the solenoid cabinet to replenish any heat lost during regulation.

The odorant supply tank is equipped with a tank fill inlet, vent port, tank blanket pressure connection, and outlet to the pipeline. For added automation, a magnetostrictive level indicator and level gauge have been installed to communicate tank level to the controller. The odorant supply tank comes with 110% containment that is sloped to the drain for easy cleaning.

For this manual, the term "Programmable Logic Controller" (PLC) will refer to the PLC, DCS, or other signal control used by the customer.

Welker® may custom design the ECOsystem™ Liquid to suit the particular application and specifications of each customer.

1.3 Safety Warning

Wherever hazardous gases or vapor-producing liquids are used, transported, or stored, the potential for an accidental leak exists. Continuous monitoring of these hazards is essential to ensure personnel safety.

1.4 Specifications

The specifications listed in this section are generalized for this equipment. Welker® can modify the equipment according to your company's needs. **Please note that the specifications may vary depending on the customization of your equipment.**

Table 1: ECOsystem™ Liquid Specifications	
Application	Liquid Odorant and Chemical Injection
Materials of Construction	304 Stainless Steel, 316/316L Stainless Steel, Carbon Steel
Maximum Allowable Operating Pressure	**Tank:** 850 psig @ -35 °F to 120 °F (*58 barg @ -37 °C to 48 °C*)
Maximum Customer Blanket Gas Supply Pressure	800 psig (*55 barg*)
Utility Requirements	AC 120 V Power Source
Electrical Connections	**Controller Cabinet:** AC 120 V, ½" FNPT (3 Places)
Odorant Tank Volume	2000 US Gallons (*7570 L*)
Features	Flag Tracker Level Indicator Magnetostrictive Level Transmitter NEMA 4 Enclosure for Controller Skid With 110% Containment Solenoid Cabinet (See *Table 2*) Touch Screen Controller With Heated Display
Electrical Area Classification	NEC Class 1, Div. 2, Group C & D, T3

Table 2: Solenoid Cabinet Specifications	
Materials of Construction	316/316L Stainless Steel, Carbon Steel, and Kalrez®
Maximum Allowable Operating Pressure	1440 psig @ 35 °F to 120 °F (*99 barg @ 1 °C to 48 °C*)
Injection Volume	.5 cc to 15 cc
Injection Rate	Up to 15 Injections per Minute
Injection Pressure	Up to 500 psig (*34 barg*)
Connections	**Blanket Pressure Outlet to Tank:** ¼" FNPT **Differential Pressure Regulator Reference Pressure Inlet:** ¼" FNPT **Odorant Inlet From Tank:** ¼" FNPT **Odorant Outlet to Pipeline:** ¼" FNPT **Purge Outlet to Tank:** ¼" FNPT **Tank Blanket Pressure Gas Supply Inlet:** ¼" FNPT
Electrical Connections	**Controller Connection:** DC 24 V, 1" FNPT **Heater Power:** AC 120 V, ½" FNPT
Nominal Filter Rating	**F-5:** 3 Micron
Features	2-Way Solenoid Valves Blanket Pressure Regulator With Outlet Valve Differential Pressure Regulator Heater With Thermostat NEMA 4 Enclosure Odorant Flow Meter Welker® F-9 Filter for Odorant Supply Welker® F-5 Filter Dryer for Pneumatic Supply

1.5 Equipment Diagrams

Figure 1: ECOsystem™ Liquid Solenoid Cabinet Schematic

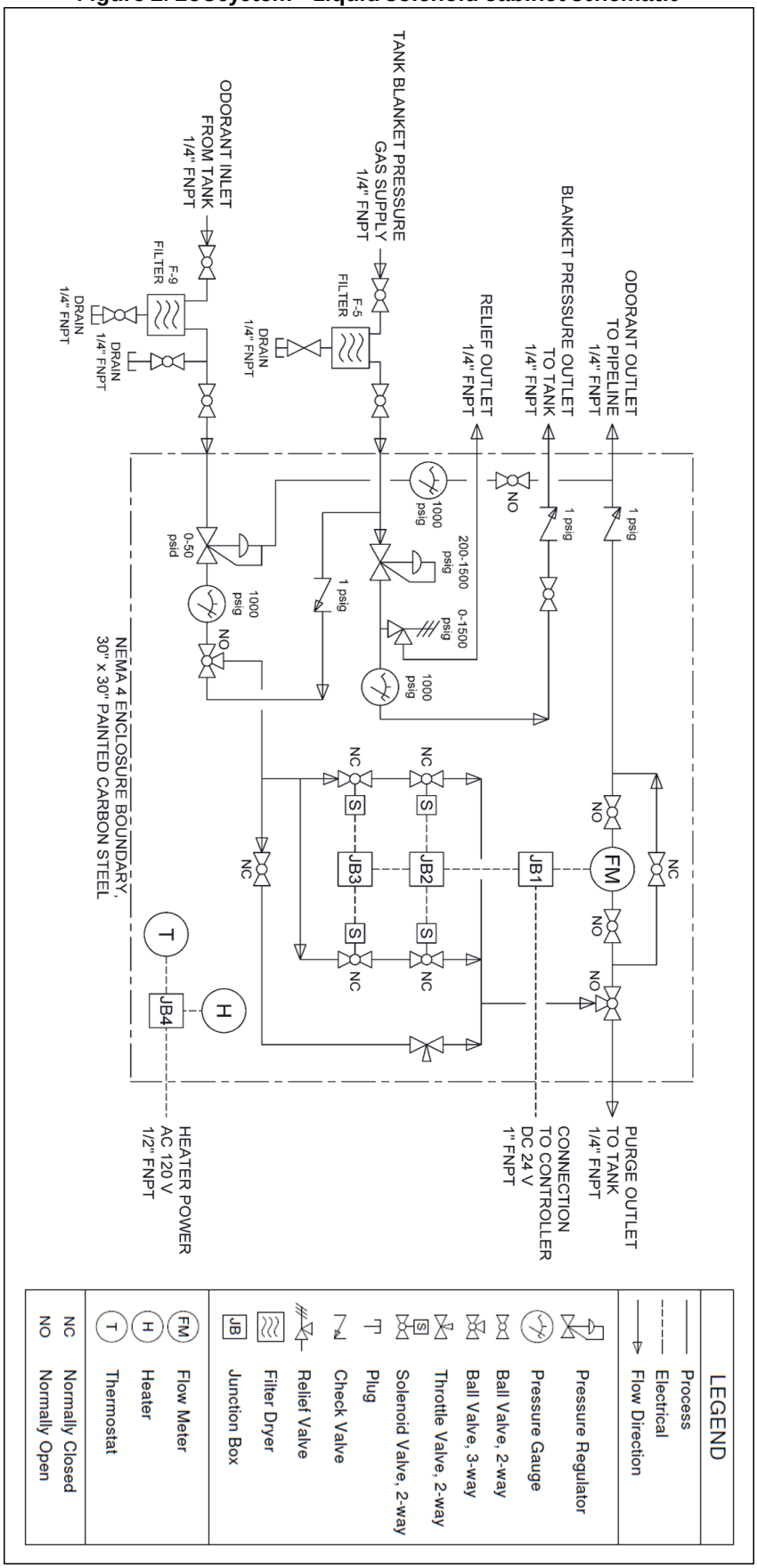
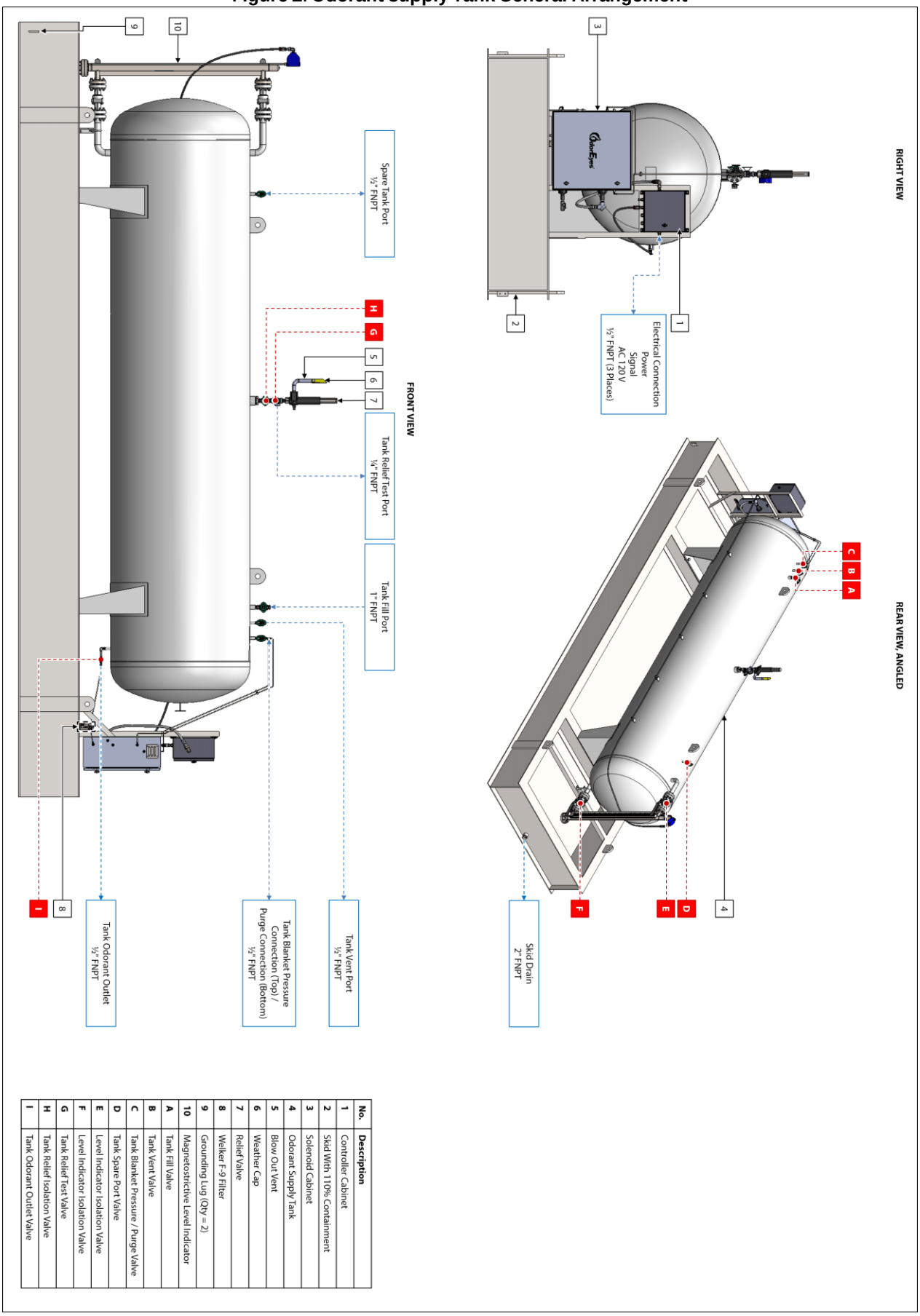


Figure 2: Odorant Supply Tank General Arrangement



No.	Description
1	Controller Cabinet
2	Skid With 110% Containment
3	Solenoid Cabinet
4	Odorant Supply Tank
5	Blow Out Vent
6	Weather Cap
7	Relief Valve
8	Welker F-9 Filter
9	Grounding Lug (Qty = 2)
10	Magnetostrictive Level Indicator
A	Tank Fill Valve
B	Tank Vent Valve
C	Tank Blanket Pressure / Purge Valve
D	Tank Spare Port Valve
E	Level Indicator Isolation Valve
F	Level Indicator Isolation Valve
G	Tank Relief Test Valve
H	Tank Relief Isolation Valve
I	Tank Odorant Outlet Valve

Figure 3: ECOsystem™ Liquid Solenoid Cabinet Connections Diagram

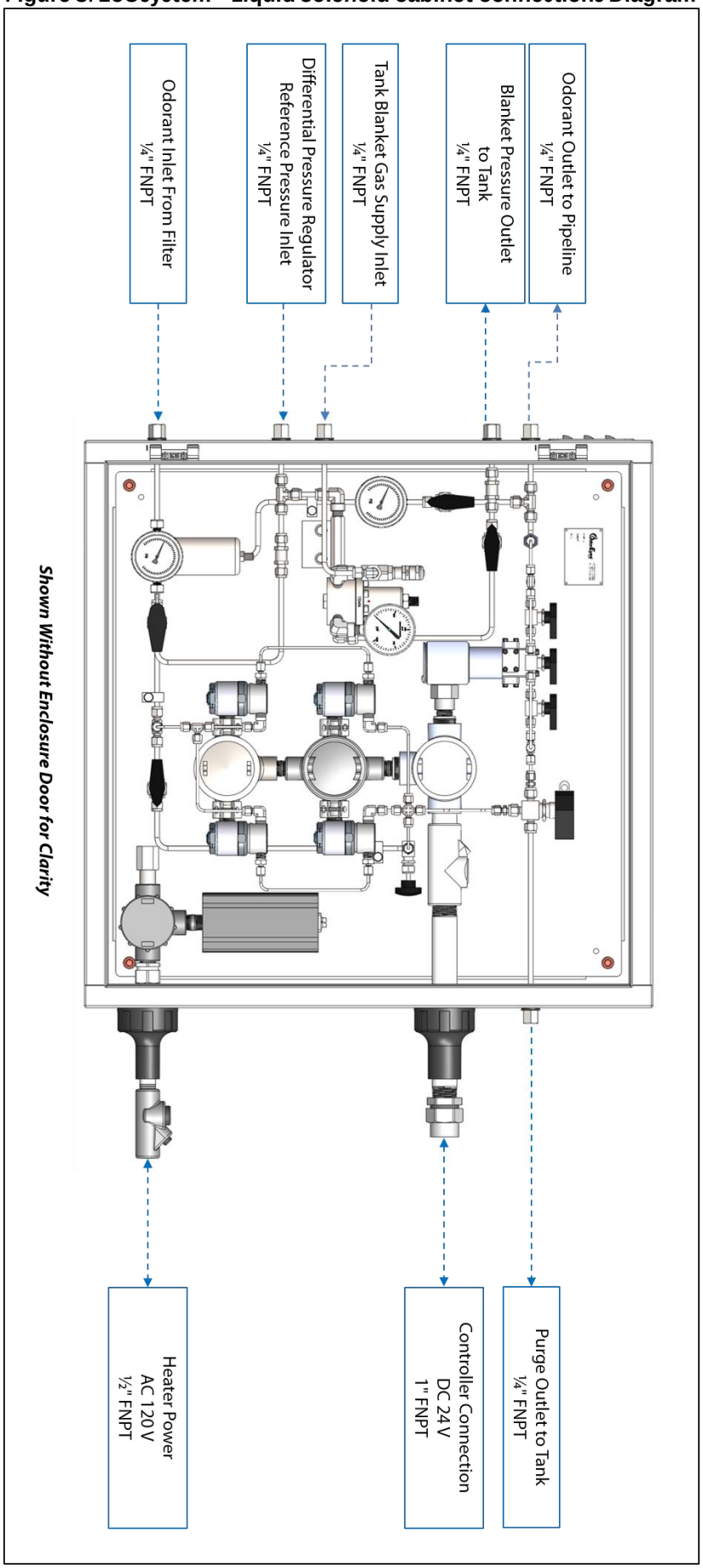
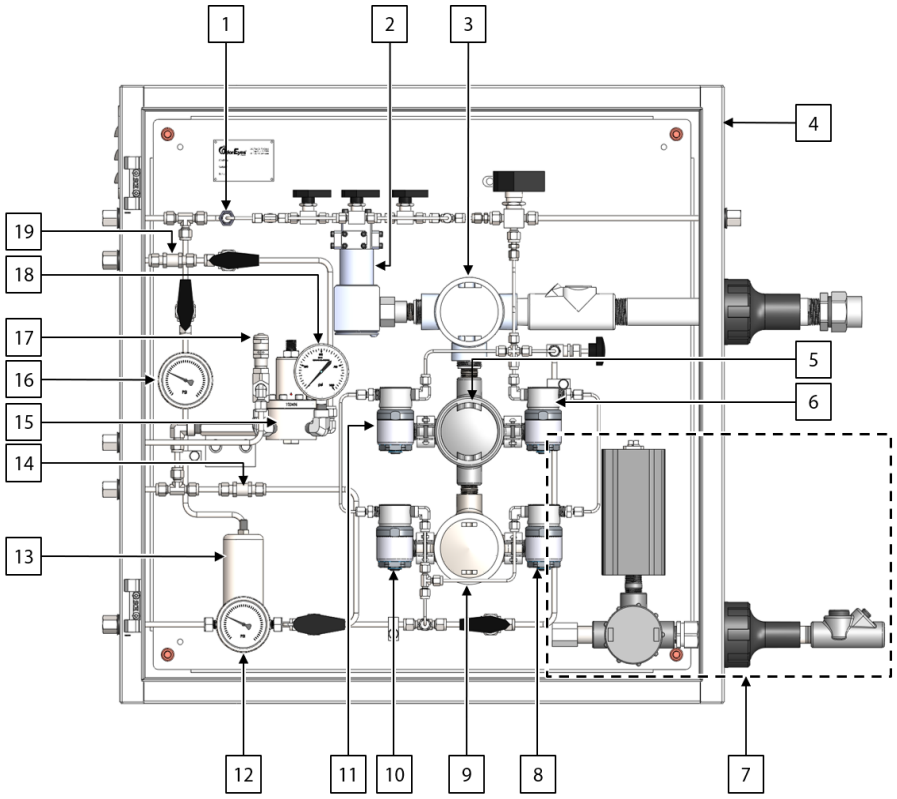
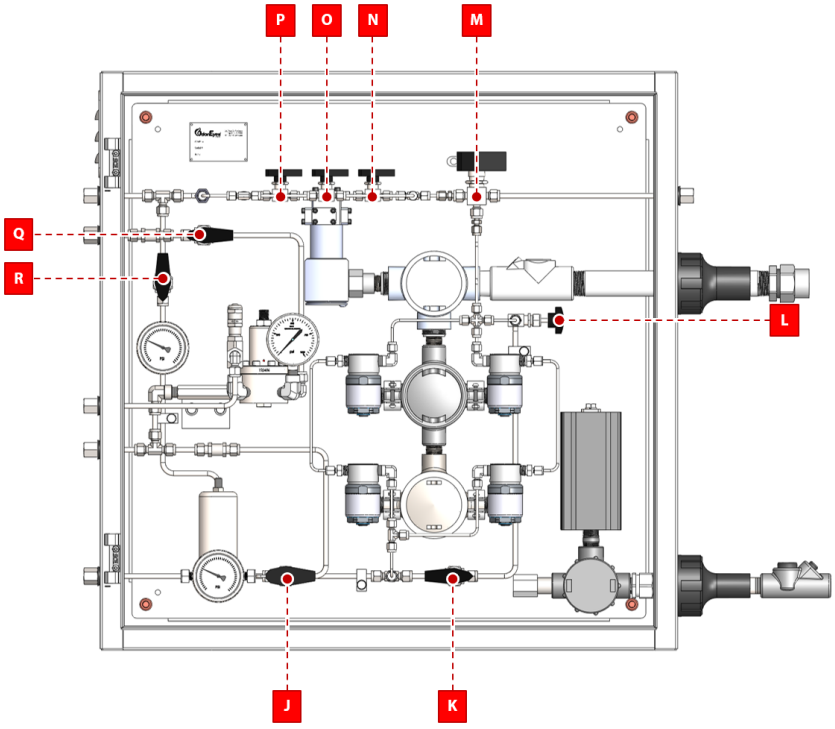


Figure 4: ECOsystem™ Liquid Solenoid Cabinet Diagram



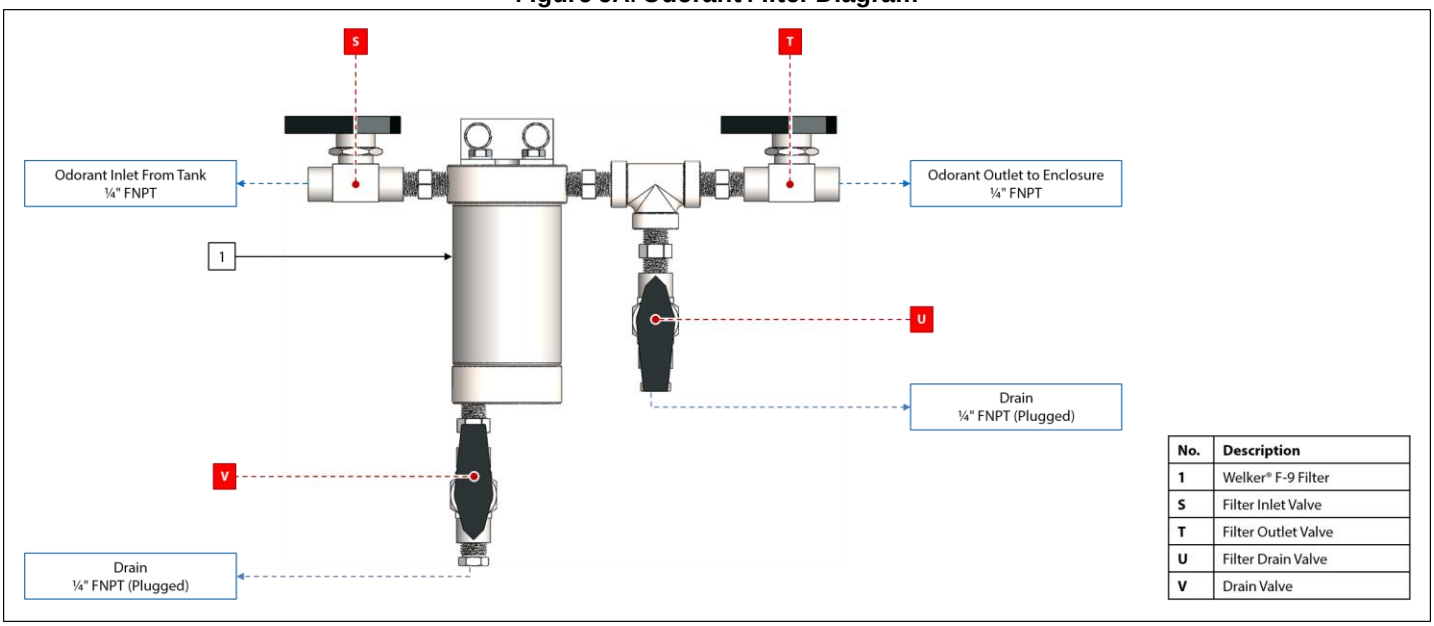
No.	Description
1	Odorant Outlet Check Valve
2	Odorant Flow Meter
3	Junction Box 1
4	Enclosure
5	Junction Box 2
6	Injection Solenoid, Bank 2
7	Heater Assembly
8	Fill Solenoid, Bank 2
9	Junction Box 3
10	Fill Solenoid, Bank 1
11	Injection Solenoid, Bank 1
12	Pressure Gauge
13	Differential Pressure Regulator
14	Tank Blanket Pressure Supply Check Valve
15	Tank Blanket Pressure Regulator
16	Pressure Gauge
17	External Adjustable Relief
18	Pressure Gauge
19	Tank Blanket Pressure Outlet Check Valve

Figure 5: ECOsystem™ Liquid Solenoid Cabinet Valve Diagram



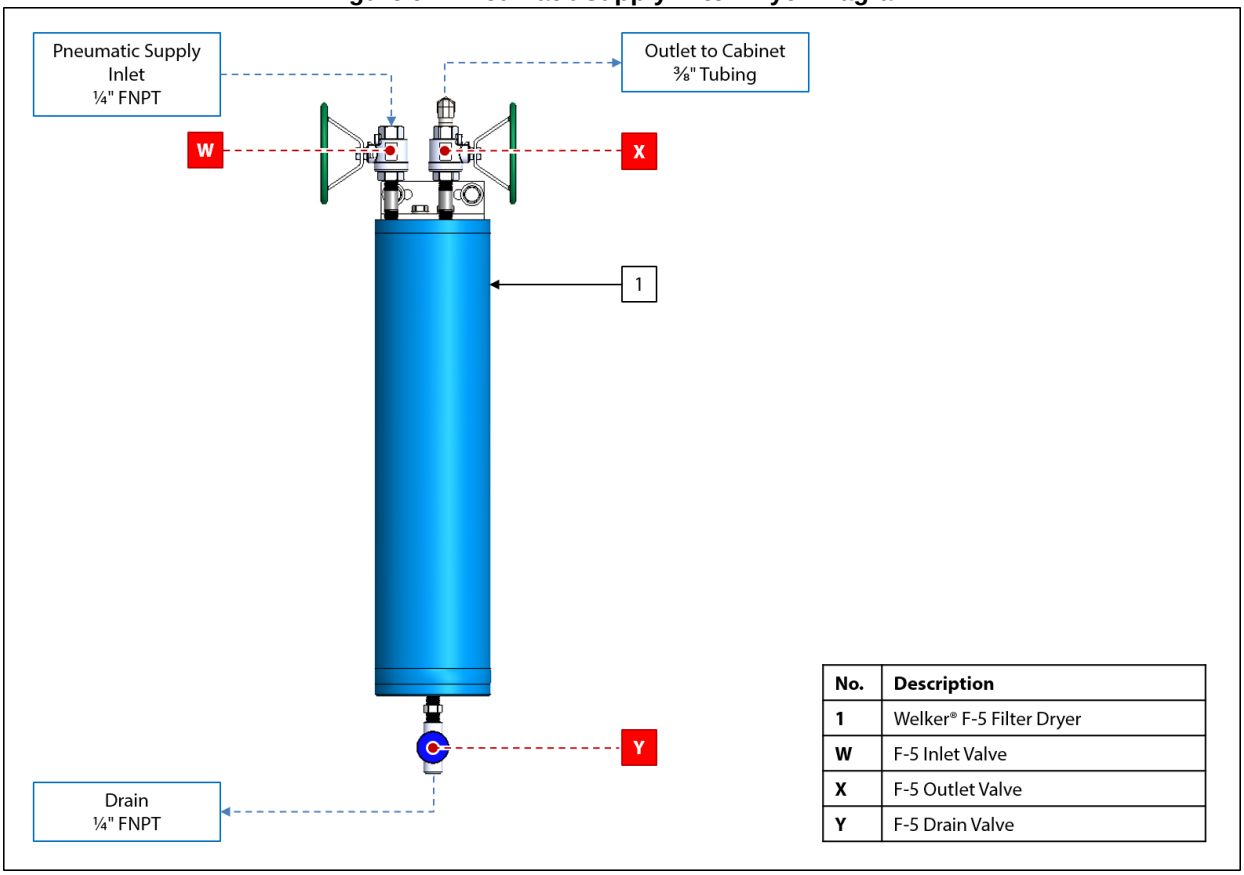
No.	Tag Color	Description
J	Orange	Odorant Inlet/Purge Inlet Switching Valve
K	Gold	Emergency Bypass Valve
L	Black	Throttle Valve
M	Red	Outlet/Purge Switching Valve
N	Blue	Odorant Flow Meter Inlet Valve
O	Purple	Odorant Flow Meter Bypass Valve
P	Blue	Odorant Flow Meter Outlet Valve
Q	Green	Tank Blanket Pressure Outlet Valve
R	Silver	Regulator Sense Valve

Figure 6A: Odorant Filter Diagram



No.	Description
1	Welker® F-9 Filter
S	Filter Inlet Valve
T	Filter Outlet Valve
U	Filter Drain Valve
V	Drain Valve

Figure 6B: Pneumatic Supply Filter Dryer Diagram



No.	Description
1	Welker® F-5 Filter Dryer
W	F-5 Inlet Valve
X	F-5 Outlet Valve
Y	F-5 Drain Valve

SECTION 2: INSTALLATION & OPERATION

2.1 Before You Begin

After unpacking the unit, check the equipment for compliance and any damage that may have occurred during shipment. Immediately contact a Welker® representative if you received damaged equipment.

When sealing fittings with PTFE tape, refer to the proper sealing instructions for the brand used.

The ECOsystem™ Liquid will ship skid-mounted and "hard-tube" connected with manufacturer-supplied fittings and hardware. However, the customer will need to supply some tubing and fittings in order to complete the installation of the system.

The ECOsystem™ Liquid must be installed in a section of the natural gas pipeline with a regulated pressure drop, such as a regulator station or gate station.

All electrical connections must meet local and national electric codes, and excessive weight added to the conduit run must be supported.

2.2 Installation

System Skid

1. Mount the skid to a flat, level surface, such as a concrete slab.
2. Connect a grounding wire to each grounding lug on the skid to safely ground the system (*Figure 2*).
3. Connect the skid drain port to an appropriate draining location (*Figure 2*).

System Connections

Welker® recommends using stainless steel tubing for all natural gas process lines, as plastic tubing can absorb odorant from the gas.

4. Ensure that all valves on the system are closed.
5. Using customer-supplied ¼" tubing, connect from the outlet of the pipeline upstream of the regulated pressure drop to the tank blanket pressure gas supply inlet on the solenoid cabinet (*Figure 3*).
6. If necessary, connect from the blanket pressure outlet on the solenoid cabinet to the tank blanket pressure connection on the tank using customer-supplied ¼" tubing (*Figure 2* and *Figure 3*).
7. Using customer-supplied ¼" tubing, connect from the outlet of the pipeline downstream of the regulated pressure drop to the differential pressure regulator reference pressure inlet on the solenoid cabinet (*Figure 3*).
8. If necessary, connect from the odorant tank to the Welker® F-9 Filter inlet using customer-supplied ¼" tubing (*Figure 2* and *Figure 6A*).
9. If necessary, connect from the purge outlet on the solenoid cabinet to the purge connection on the odorant tank using customer-supplied ¼" tubing (*Figure 2* and *Figure 3*).
10. Using customer-supplied ¼" tubing, connect from the odorant outlet on the solenoid cabinet to an injection point on the pipeline downstream of the regulated pressure drop (*Figure 3*).

Electrical Connections

Turn OFF the electrical supply prior to making electrical connections.

11. Connect a DC 24 V electrical supply to the controller (*Figure 3*). Refer to the industry standards for appropriate electrical connections to interface with the PLC. Refer to the *Installation, Operation, and Maintenance* (IOM) *Manual* for the XL4 controller for additional wiring instructions.

For systems used in hazardous locations, sealing compound is required to seal all fittings to restrict the passage of gases, vapors, or flames.

12. Connect the customer gas flow signal device to the controller.

The controller can accept analog, pulse, or Modbus input.

Flag Tracker Level Indicator

The float and gasket must be installed to the flag tracker level indicator prior to filling the odorant supply tank.

The float and gasket are packaged separately for shipment.

13. Remove the bottom drain flange from the base of the level indicator (*Figure 2*).
14. Install the float to the spring on the bottom drain flange. The top of the float should point up.

The top of the float is marked to ensure proper orientation.

The spring attached to the bottom drain flange cushions the float when the odorant supply tank is empty.

15. Replace the shipping gasket with the provided gasket.
16. Install the bottom drain flange with the float to the level indicator.

2.3 Start-Up Procedures

Odorant Supply Tank

1. Fill the odorant supply tank in accordance with company policy and procedure, taking care not to exceed 80% of the total volume of the supply tank.

> Never fill the odorant supply tank above 80% of its capacity. Allow at least 20% for product expansion, should the tank be exposed to increased temperatures.

2. Check the odorant supply tank for leaks and repair as necessary.

Differential Pressure Regulator

3. As necessary, open any valves between the outlet on the natural gas pipeline and the differential pressure regulator reference pressure inlet (*Figure 3*).
4. Open tank odorant outlet valve I (*Figure 2*).
5. Open filter inlet valve S and filter outlet valve T to allow odorant to reach the differential pressure regulator in the solenoid cabinet (*Figure 6A*).

Tank Blanket Pressure Regulator

6. As necessary, open any valves between the outlet on the natural gas pipeline and the tank blanket pressure gas supply inlet (*Figure 3*).
7. Open tank blanket pressure outlet valve Q (*Figure 5*).
8. Check the tank blanket pressure connections for leaks, and repair as necessary.

Priming the ECOsystem™ Liquid

9. Ensure tank blanket pressure outlet valve Q is open (*Figure 5*).
10. If necessary, set the low flow instrument regulator by first opening regulator sense valve R and then setting the low flow instrument regulator according to the recommended settings in Table 3 (*Figure 4*, *Figure 5*, and *Table 3*).

Table 3: Odorant Pressure Required for Injection Volume

Pressure Higher Than Injection Pressure (psig)	Recommended Injection Volume (cc)
15–50	0.5–15

11. Open odorant flow meter bypass valve O (*Figure 5*).
12. At the same time, **slowly** open odorant flow meter inlet valve N and odorant flow meter outlet valve P (*Figure 5*).
13. Direct the odorant inlet/purge inlet switching valve J (*Figure 5*) to the odorant inlet position.
14. The differential pressure regulator comes factory-set at 50 psig (*Figure 4*). See Table 4 for recommended settings. Refer to the *Installation, Operation, and Maintenance* (IOM) *Manual* for the differential pressure regulator for instructions on setting the differential pressure regulator.
15. Ensure outlet/purge switching valve M is in the odorant-to-pipeline position (*Figure 5*).
16. From the PLC, select Setup from the Home screen (*Figure 7*). Enter the Troubleshooting submenu and select Force Bank 1 Valves Open; hold for 2 to 3 seconds (*Figure 36*). Alternate pressing Force Bank 1 Valves Open and Force Bank 2 Valves Open until liquid is observed at the sight glass mounted at the injection point.

> Welker® recommends forcing the injection cycle a minimum of three times (3x) per bank. Note that the forced injection cycle will automatically alternate between both banks.

17. Close odorant flow meter bypass valve O (*Figure 5*).
18. The ECOsystem™ Liquid is now primed.

Purging the ECOsystem™ Liquid

19. Set the Injection Rate to 0 lbs/MM.
20. Direct the outlet/purge switching valve M toward the purge outlet to tank (*Figure 3* and *Figure 5*). Make certain the tank blanket pressure/purge valve C on the tank is open (*Figure 2*). Direct the odorant inlet/purge inlet switching valve J toward the purge inlet.
21. From the PLC, select Setup from the Home screen (*Figure 7*). Enter the Troubleshooting submenu and select either Force Bank 1 Valve Open or Force Bank 2 Valve Open, depending on which bank is needed to be purged (*Figure 36*). Press and hold for 1 to 2 seconds.

> Welker® recommends repeating the process a minimum of three times (3x) per bank to adequately purge the system.

22. Direct the outlet/purge switching valve M toward the odorant outlet to pipeline. (*Figure 3* and *Figure 5*). Valve C on the tank remains open (Figure 2).
23. Perform Maintenance at this point.
24. Once Maintenance is complete, to return to normal operation, follow the *Priming the ECOsystem™ Liquid* procedure.

Controller Configuration

25. Verify that the customer set points have been correctly set by the manufacturer.
26. Once the collection and injection of liquid odorant have been confirmed, the ECOsystem™ Liquid is operational.

3.1 Understanding the Display

The touch screen controller is used to modify system parameters and view current system information and current alarm status.

The touch screen controller is a menu-driven system. The Home screen is the top screen in the menu tree (*Figure 7*).

Figure 7: Home Screen

Monitor
Takes you to the monitoring screens where you can view current information about the operation of the odorizer.

Setup
Takes you to the setup screens where you can change any set point values in the odorizer.

From the Home screen, the user can access three (3) types of screens:

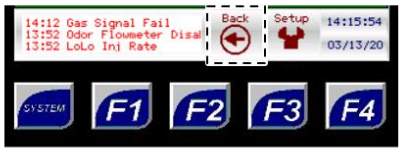
- **Menu –** From this type of screen, the user can access submenus.
- **Informational –** From this type of screen, the user can monitor the odorizer and view current operating conditions.
- **Setup –** From this type of screen, numeric and/or text values that affect the setup of the odorizer can be changed.

Navigating the Display

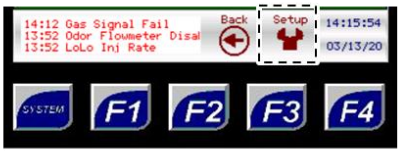
Figure 8: Toolbar and Function Keys

TOOLBAR

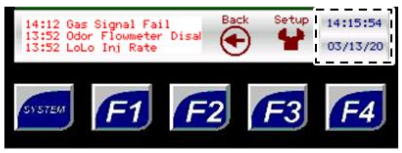
Alarms
View any active alarms.



Back Button
Takes you back one (1) level in the menu tree to the previous screen.



Setup Button
Takes you to the **Setup Menu** screen.

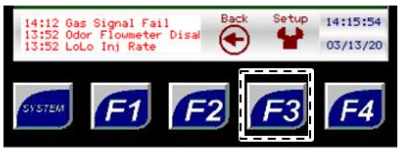


Current Date and Time
This is the current date and time in the odorizer. It can be changed from any screen.

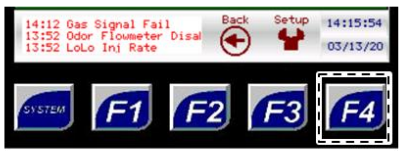
FUNCTION KEYS

F1 Key
Takes you to the **Home** screen.

F2 Key
Takes you to the **Current Alarms** screen.



F3 Key
Takes you to the **Home** screen.



F4 Key
Starts and stops the auto scroll function.

The toolbar appears on every screen except the Home screen.

The Back button does not appear on every screen.

If nothing on the screen is pressed for a certain amount of time, the sleep function will cause the backlight on the screen to turn off. To wake up the controller, press anywhere on the screen or press one of the function keys.

Viewing the Current Alarms

From any screen, press the F2 function key to go to the Current Alarms screen (*Figure 9*).

Figure 9: Current Alarms Screen

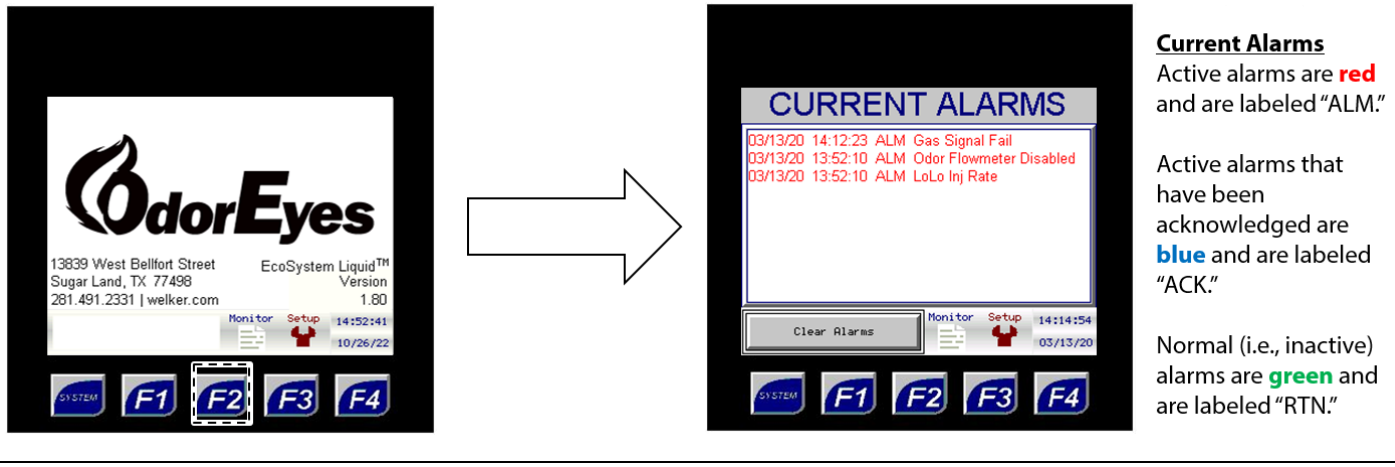


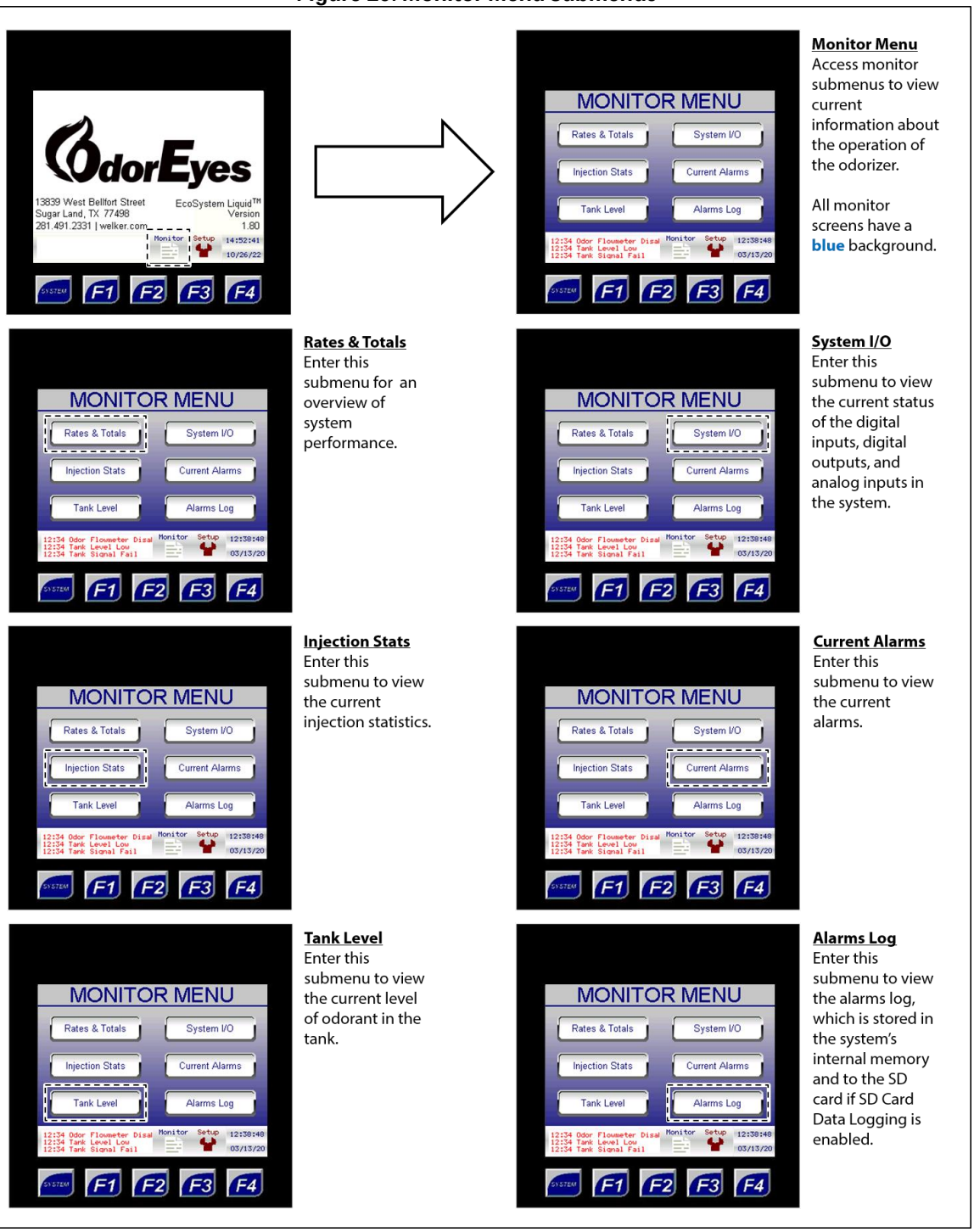
Table 4: Current Alarms	
Hi Inj Rate	Active if the injection output for a user-determined amount of cycles exceeds the allowable odorization rate The number of cycles can be set from the System Control submenu in the PLC.
Lo Inj Rate	Active if the injection output for a user-determined amount of cycles is below the allowable odorization rate The number of cycles can be set from the System Control submenu in the PLC.
Bank 1 Fail	Active if the total value of five (5) consecutive cycles from Bank 1 is less than 30% of the expected value
Bank 2 Fail	Active if the total value of five (5) consecutive cycles from Bank 2 is less than 30% of the expected value
Gas Signal Fail	Can only be active if Analog (4–20 mA) is selected as the gas source and the controller loses the 4–20 mA signal from the transmitter The controller will enter this gas flow fail mode when there is a gas flow signal loss.
Tank Signal Fail	Can only be active if an electronic level transmitter is used to track the odorant tank level and the controller loses the 4–20 mA signal from the transmitter **NOTE:** If this alarm is active, the controller will automatically switch to the odorant flow method to track the odorant tank level. The controller will use the value of odorant in the tank and subtract the appropriate volume with each cycle.
Tank Level Low	Active if the odorant tank level has dropped below the specified value
Odor Flowmeter Disabled	Active if the flow meter is disabled or turned off; must be manually disabled/re-enabled

3.2 Navigating the Monitor Menus

Through the Monitor menu, the user can access the Rates & Totals, Injection Stats, Tank Level, System I/O, Current Alarms, and Alarms Log to view current information for the odorizer.

Monitor screens are information screens: no values can be changed from these screens.

Figure 10: Monitor Menu Submenus



Monitor Menu
Access monitor submenus to view current information about the operation of the odorizer.

All monitor screens have a **blue** background.

Rates & Totals
Enter this submenu for an overview of system performance.

System I/O
Enter this submenu to view the current status of the digital inputs, digital outputs, and analog inputs in the system.

Injection Stats
Enter this submenu to view the current injection statistics.

Current Alarms
Enter this submenu to view the current alarms.

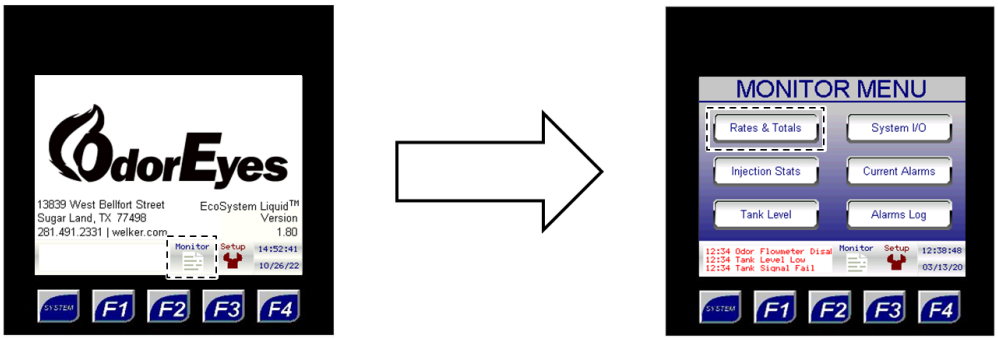
Tank Level
Enter this submenu to view the current level of odorant in the tank.

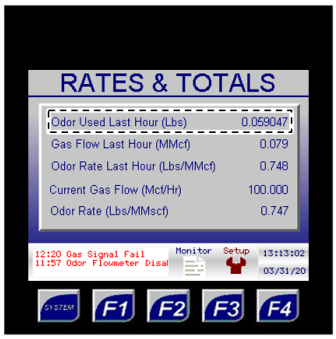
Alarms Log
Enter this submenu to view the alarms log, which is stored in the system's internal memory and to the SD card if SD Card Data Logging is enabled.

Rates & Totals

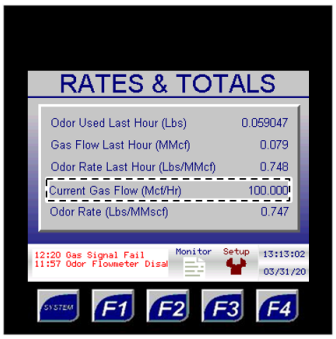
The Rates & Totals submenu provides the user with an overview of system performance.

Figure 11: Monitor Menu - Rates & Totals

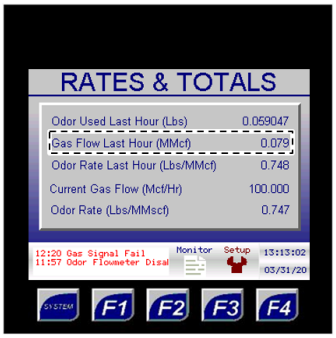




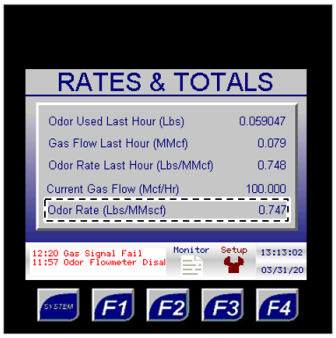
Odor Used Last Hour (Lbs)
The average number of pounds of odorant that have been injected into the pipeline over the previous hour.



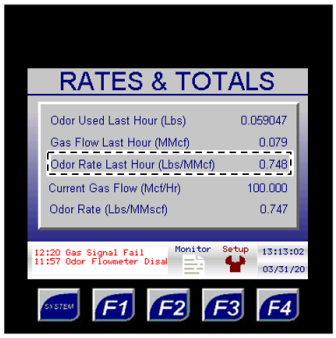
Current Gas Flow (Mcf/Hr)
The current volume of gas flowing in the pipeline relative to time.



Gas Flow Last Hour (MMcf)
The average amount of gas flow the odorizer has seen over the previous hour.



Odor Rate (Lbs/MMcf)
The current odorant usage by the system relative to gas flow (lb/MMcf).

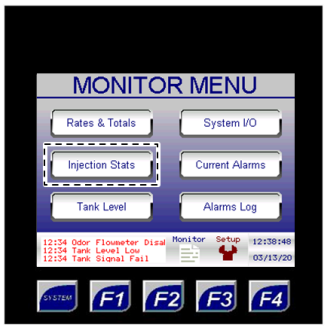


Odor Rate Last Hour (Lbs/MMcf)
The average odorization rate over the previous hour.

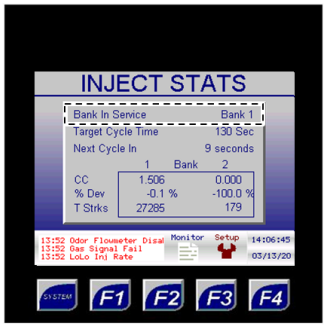
If the system status totals are used to track system performance, they should be periodically reset through the System Control submenu (*Figure 19*).

Injection Stats

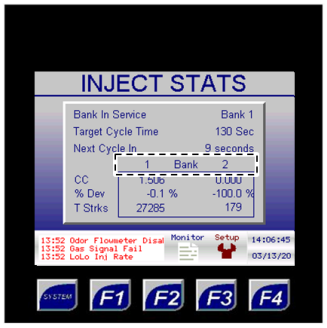
Figure 12: Monitor Menu – Injection Stats



Injection Stats
Screen displays an overview of the bank injection statistics.

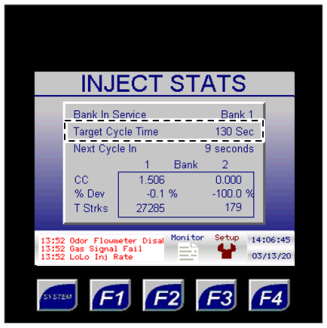


Bank In Service
This indicates which bank is currently injecting odorant into the pipeline.

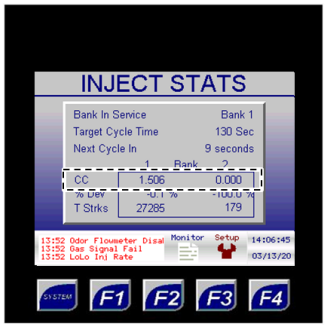


Bank
The (1) column displays statistics for bank 1.

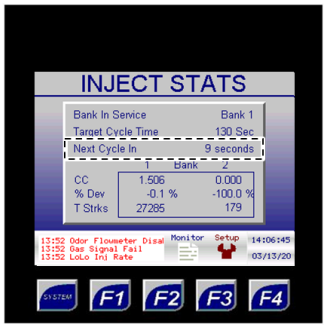
The (2) column displays statistics for bank 2.



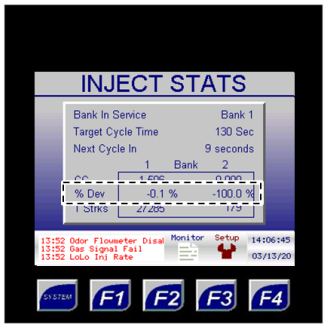
Target Cycle Time
This indicates the current cycle time (in seconds) of the bank in service.



CC
The volume of odorant the bank injected on its last stroke. The volume is given in cubic centimeters (cc).



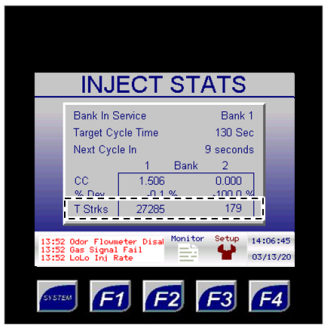
Next Cycle In
This is a countdown timer until the next cycle of the bank in service. The countdown time is given in seconds.



% Dev
The most recent cycle deviation of the bank from the user's set point.

If the bank is below its set point, it will show a negative percentage.

If the bank is above its set point, it will show a positive percentage.

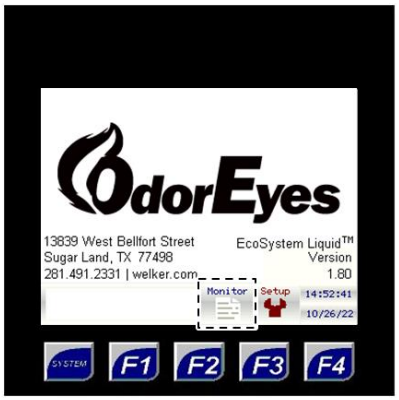


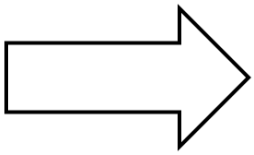
T Strks
The total number of cycles for the bank since the system was last reset by the user.

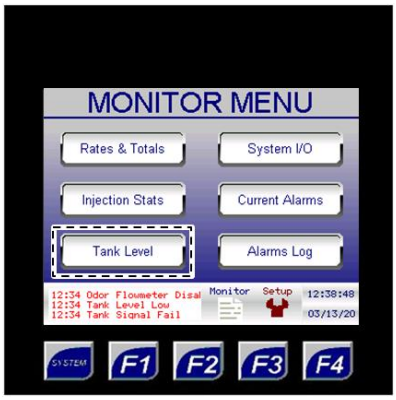
This should be reset after performing bank maintenance.

Odorant Tank Level

Figure 13: Monitor Menu - Tank Level







Tank Level
Enter this submenu to view the current level of odorant in the tank

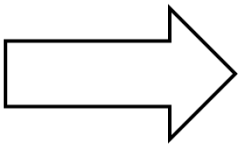
This screen displays the amount of odorant remaining in the odorant supply tank in inches, US gallons, pounds, and percent.

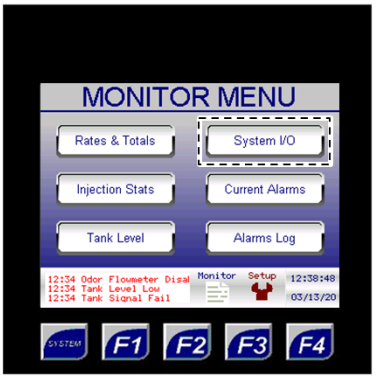
These values will either be from a transmitter or a calculation based on odorant usage.

System I/O

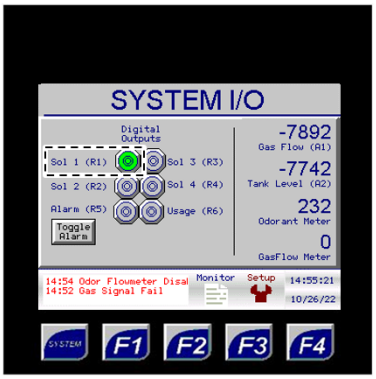
The System I/O submenu provides the user with an overview of the current status of digital inputs, digital outputs, and analog inputs in the system.

Figure 14: Monitor Menu – System I/O, 1 of 2

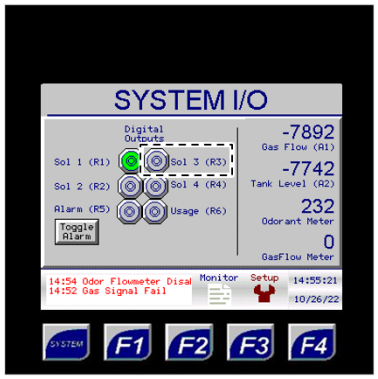




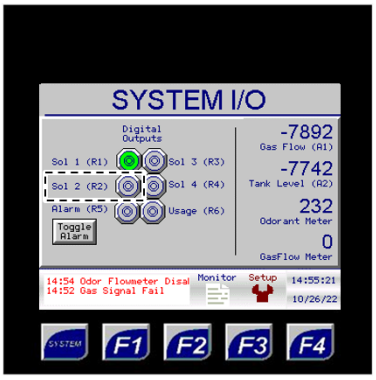
System I/O
Enter this submenu to view the current status of the digital inputs, digital outputs, and analog inputs in the system.



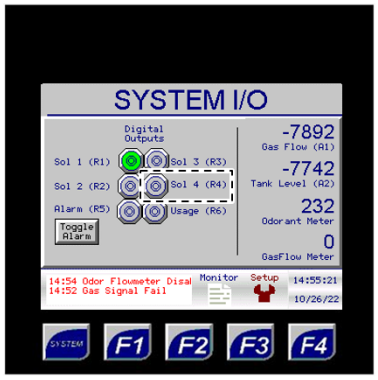
This will remain open while Bank 1 is active.



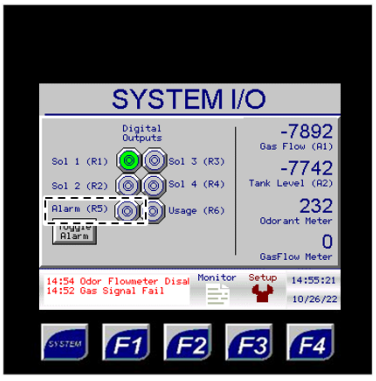
This will remain open while Bank 2 is active.



This will open and shut to control odorant flow when Bank 1 is active.

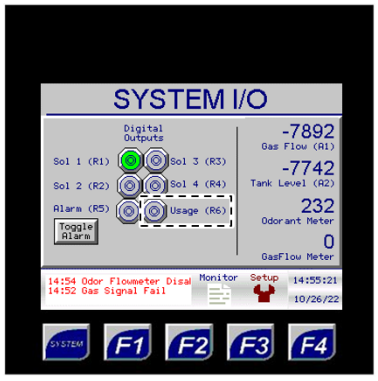


This will open and shut to control odorant flow when Bank 2 is active.



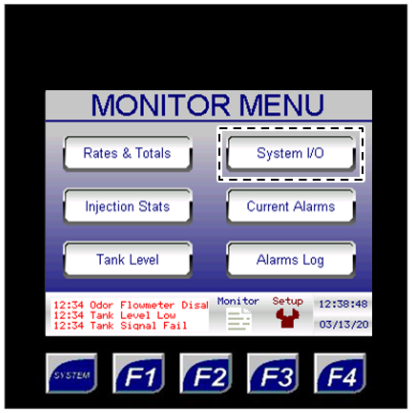
This indicates the alarm status.

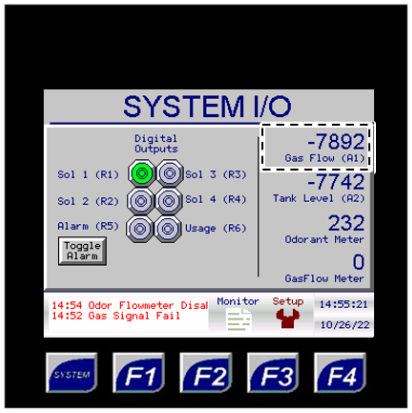
The alarm status is normally closed.



This will close every time a pre-determined amount of odorant is injected.

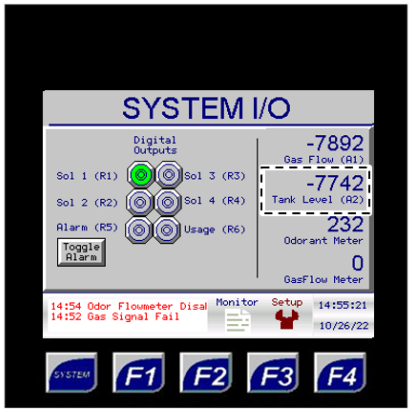
Figure 15: System I/O, 2 of 2



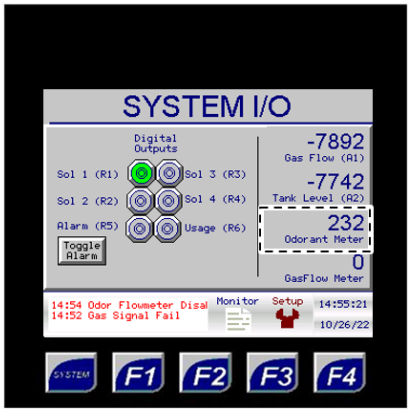


This analog signal is the raw count coming into the odorizer after the signal has been converted from milliamps. This value will vary according to the output from the customer gas flow meter.

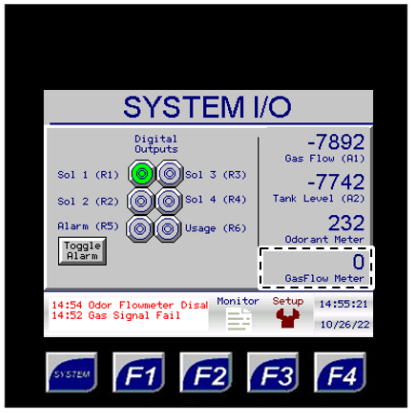
Analog Input Conversion	
Signal (mA)	**Raw Count**
4	6400
20	32000



This analog signal is the raw count coming out of the odorizer after the signal has been converted from milliamps. This value will vary according to customer specifications.



This value indicates how many high-speed pulses were received from the odorant flow meter. This value appears after each bank cycle and reverts to zero (0) after two (2) seconds.

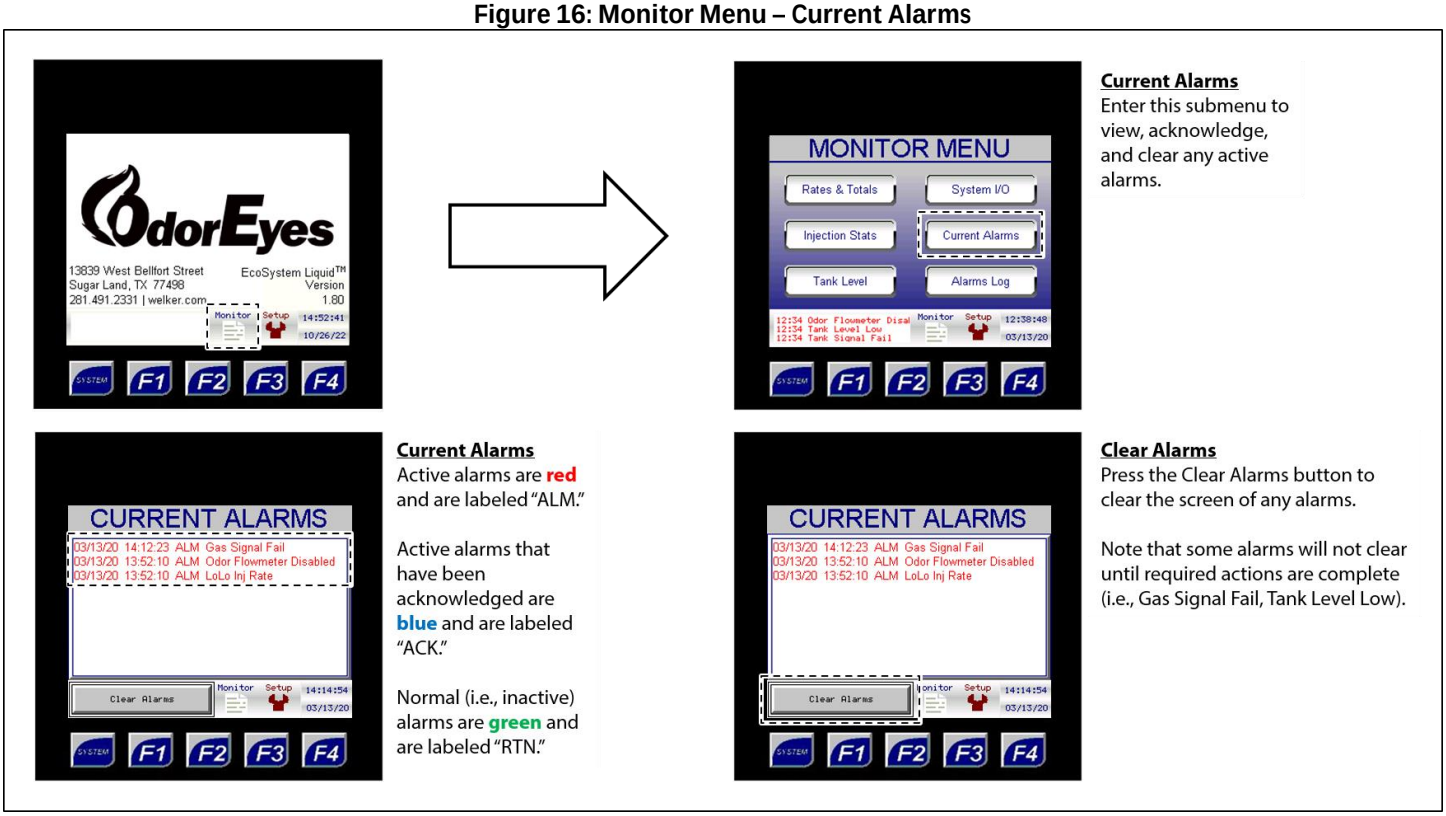


This value indicates how many high-speed pulses were received from the gas flow meter. Each pulse represents a fixed amount of gas that is configured in the Gas Flow Setup screen.

Current Alarms

The Current Alarms submenu provides the user with an overview of the current alarm status and allows the user to clear alarms that do not require certain actions.

Figure 16: Monitor Menu – Current Alarms

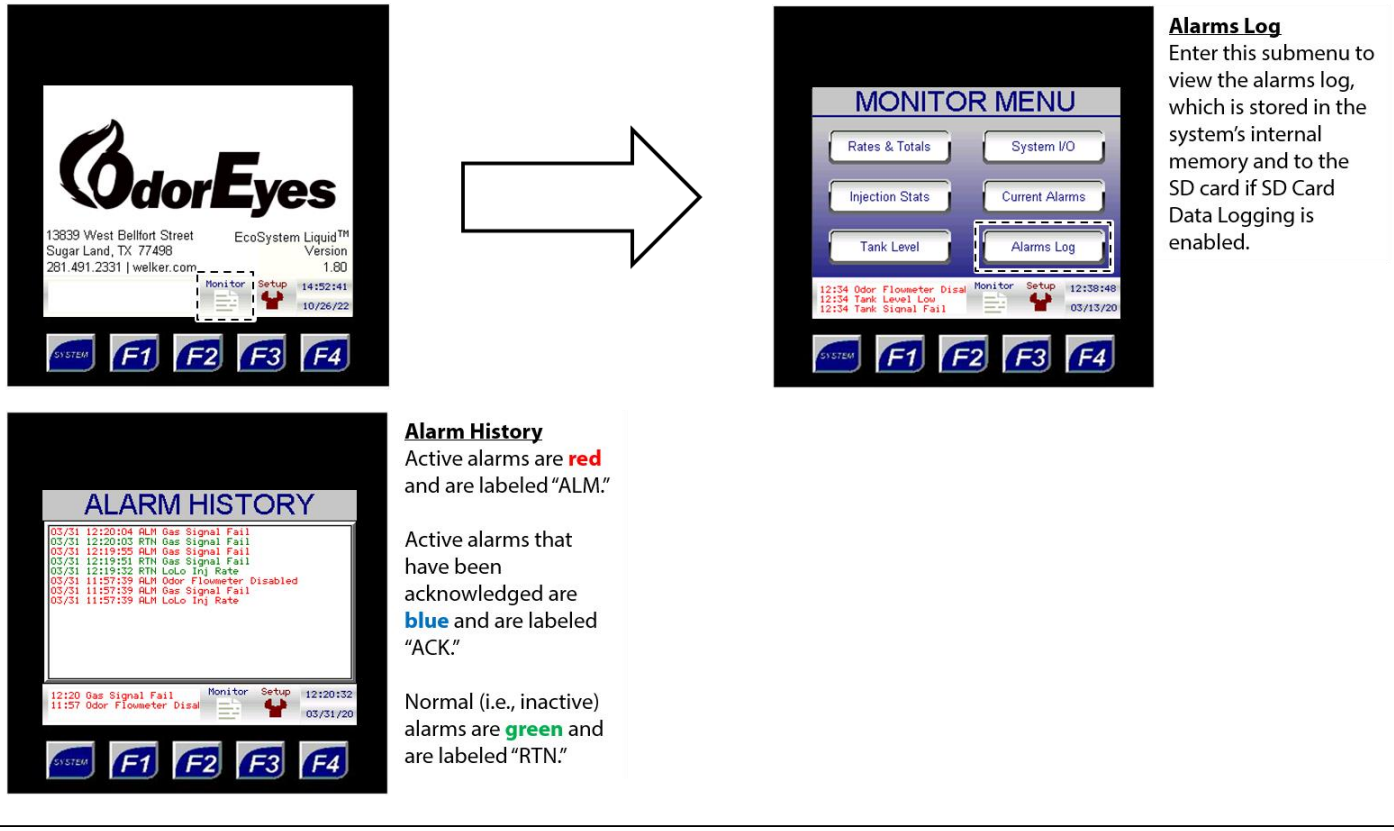


Alarms Log

From the Alarms Log submenu, the user can access the alarm logs stored on internal memory. Up to 428 alarm logs can be stored and viewed.

If SD Card Data Logging is enabled, the alarm logs will also be stored on the installed micro-SD card. The micro-SD card is equipped with 8 GB of storage.

Figure 17: Monitor Menu – Alarms Log



Alarms Log
Enter this submenu to view the alarms log, which is stored in the system's internal memory and to the SD card if SD Card Data Logging is enabled.

Alarm History
Active alarms are **red** and are labeled "ALM."

Active alarms that have been acknowledged are **blue** and are labeled "ACK."

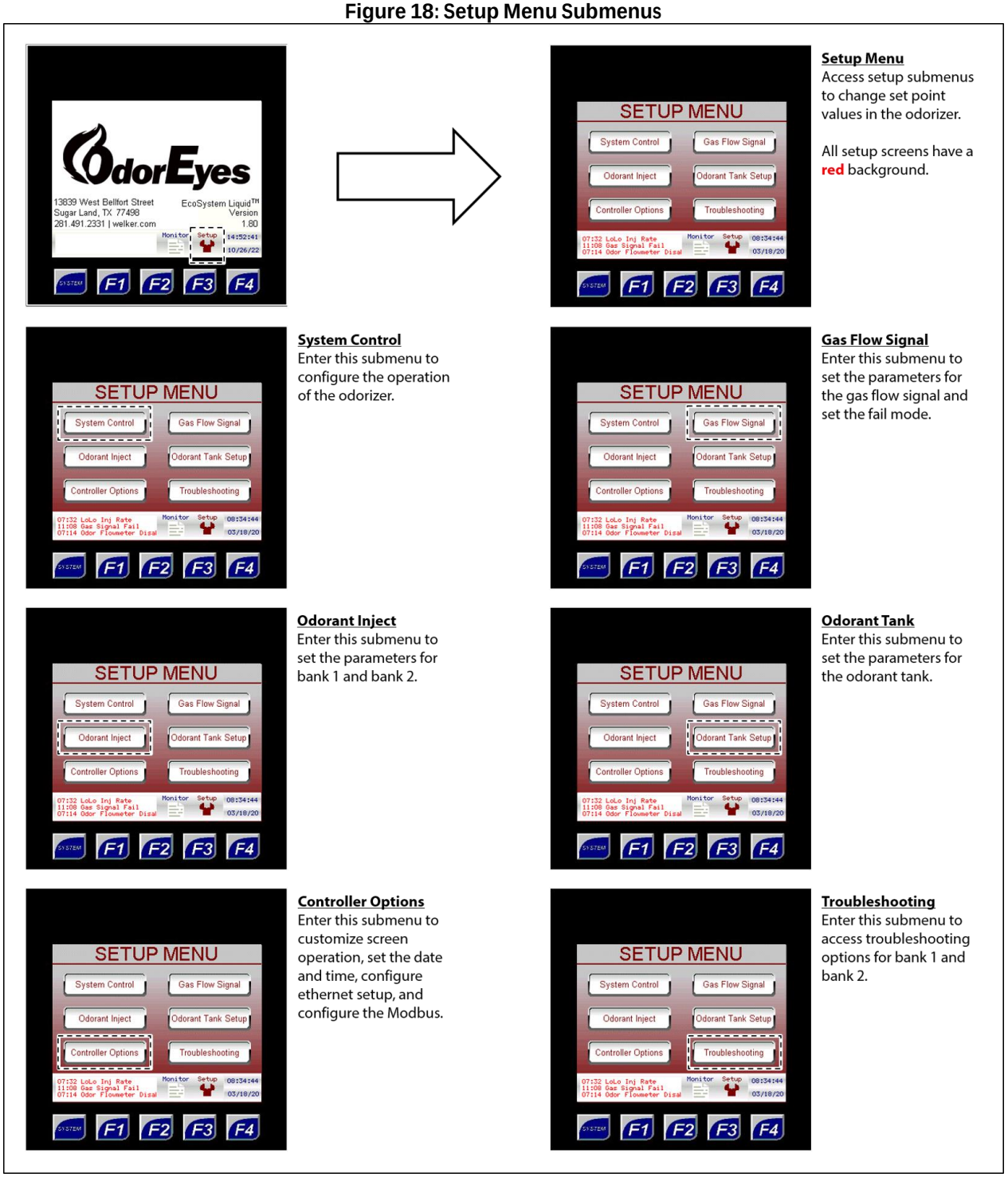
Normal (i.e., inactive) alarms are **green** and are labeled "RTN."

3.3 Navigating the Setup Menus

Through the Setup menu, the user can access the System Control, Odorant Inject, Controller Options, Gas Flow Signal, Odorant Tank Setup, and Troubleshooting submenus and change numeric and/or text values that alter the parameters and features of the odorizer.

Changing numeric and/or text values in the Setup submenus will alter how the system operates.

Figure 18: Setup Menu Submenus



Setup Menu
Access setup submenus to change set point values in the odorizer.

All setup screens have a **red** background.

System Control
Enter this submenu to configure the operation of the odorizer.

Gas Flow Signal
Enter this submenu to set the parameters for the gas flow signal and set the fail mode.

Odorant Inject
Enter this submenu to set the parameters for bank 1 and bank 2.

Odorant Tank
Enter this submenu to set the parameters for the odorant tank.

Controller Options
Enter this submenu to customize screen operation, set the date and time, configure ethernet setup, and configure the Modbus.

Troubleshooting
Enter this submenu to access troubleshooting options for bank 1 and bank 2.

Changing Values on Setup Screens

Numeric Values

1. To change a numeric value, press on the value to be changed. A keypad will appear on the screen.
2. Type the new value using the keypad.
3. Once the new numeric value has been entered, press ENTER to save the changes.

If the new value entered is outside the range of allowable values, the value will revert to the previous value once ENTER is pressed. The keypad will stay active, allowing another value to be entered.

Text Values

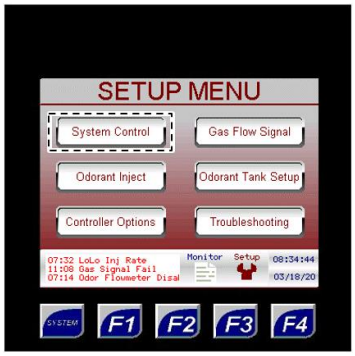
4. To change a text value, press on the value to be changed. A dropdown menu will appear on the screen.
5. Scroll through the value's options using the arrow keys in the dropdown menu.
6. Highlight the desired text value, and then press ENTER to save the changes.

If a mistake is made while entering the new value or if the value does not need to be changed, press the home button to discard the changes and return to the Home screen.

System Control

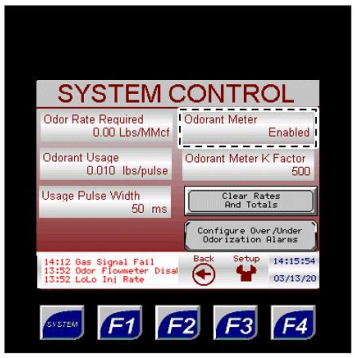
Through the System Control submenu, the user can set the general parameters for the odorizer.

Figure 19: Setup Menu – System Control



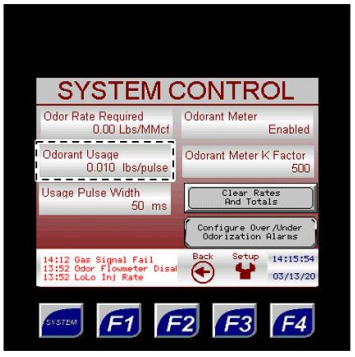
System Control
Enter this submenu to configure the operation of the odorizer.

Odor Rate Required
Set the number of pounds of odorant to pulse per million standard cubic feet (MMcf) of gas flowed.



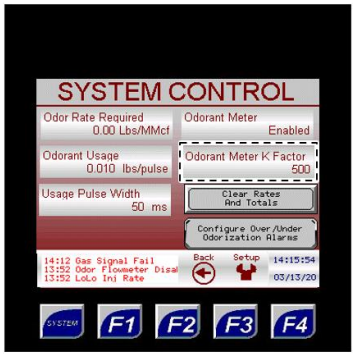
Odorant Meter
When enabled, each injection is measured, monitored, and recorded, and the cycle frequency will adjust based on this value.

When disabled, each cycle of the bank is presumed to be at its set value.

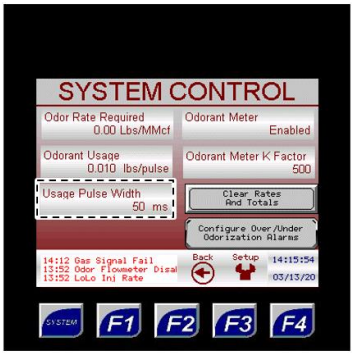


Odor Usage
Press to configure the amount of odorant, in pounds (lbs) used to generate a digital pulse output.

This is only for the odorant usage pulse output setting.



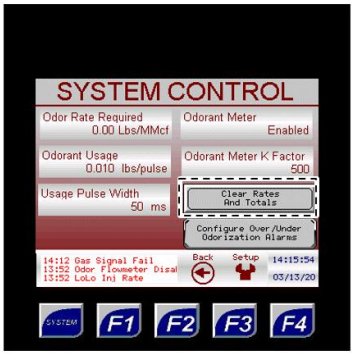
Odorant Meter K Factor
This value is factory-set for the odorant flow meter. This value represents how many revolutions of the meter it takes to equal 1 cc of liquid.



Usage Pulse Width
Press to configure the amount of time, in milliseconds (ms), that the digital pulse output will stay energized when activated.

This is also the minimum amount of time the digital pulse output will stay de-energized. Thus, the total minimum cycle time of a digital pulse output is two times (2x) the Usage Pulse Width setting.

This is only for the odorant usage pulse output setting.

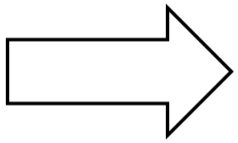


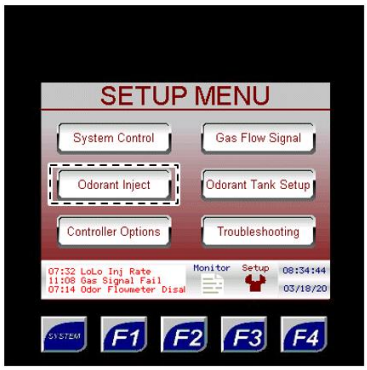
Clear Rates And Totals
Touching this field causes the gas flow and odorant usage totals to be reset to zero.

Odorant Inject

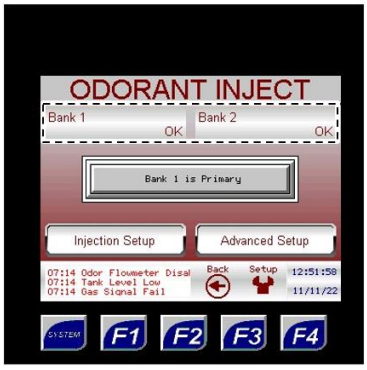
Through the Odorant Inject submenus, the user can input information for bank 1 and bank 2.

Figure 20: Setup Menu – Odorant Inject

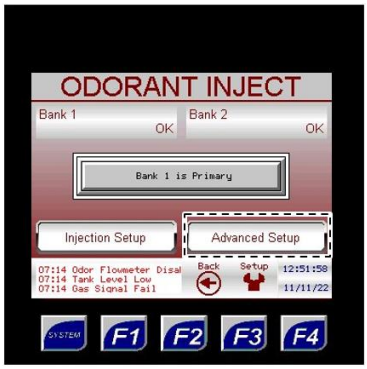




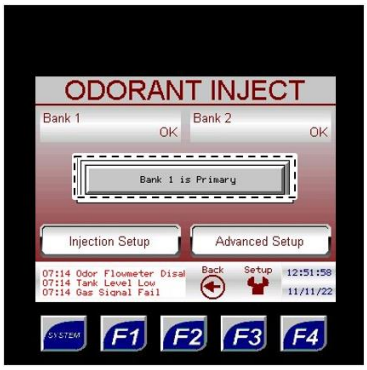
Odorant Inject
Enter this submenu to set the parameters for the odorant injection solenoids.



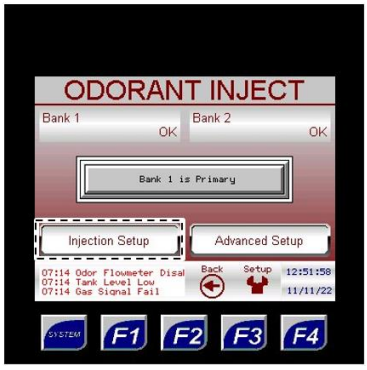
Bank 1 / Bank 2
View the current status of bank 1 and bank 2.



Advanced Setup
Enter this submenu to set the minimum cycle time and adjustment parameters for each bank.

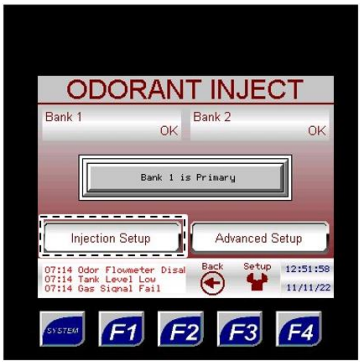


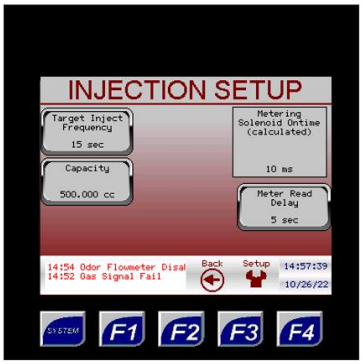
Bank Selection
Press to select whether Bank 1 or Bank 2 is Primary.



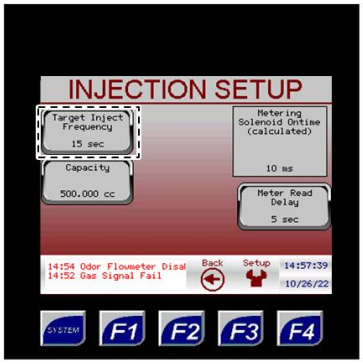
Injection Setup
Enter this submenu to set the known input of each injection, manually cycle the injection solenoid, reset the total number of injections, and reset the injection alarms.

Figure 21: Setup Menu – Odorant Inject Submenu

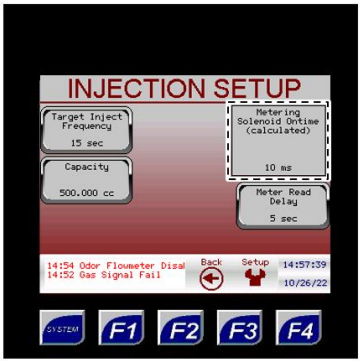




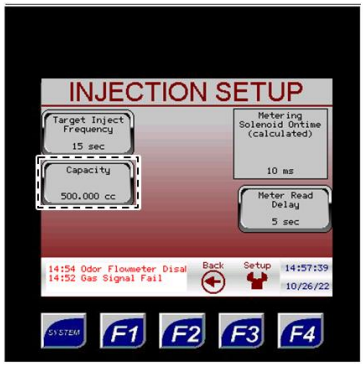
Injection Setup
Enter this submenu to set the known input of each injection, manually cycle the injection solenoid, reset the total number of injections, and reset the injection alarms.



Target Inject Frequency
Press to set the length of time between injections.

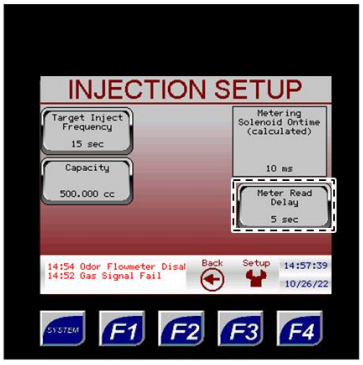


Metering Solenoid Ontime
Displays how long the injection solenoid is actuated.



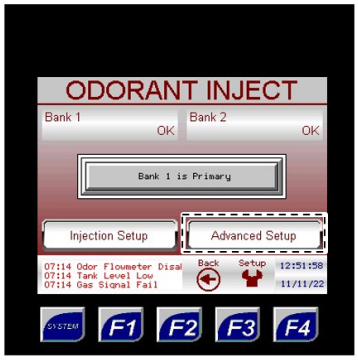
Capacity
Press to set the maximum volume of odorant the system can inject.

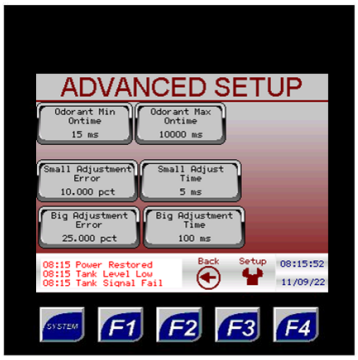
15 cc is the standard setting.



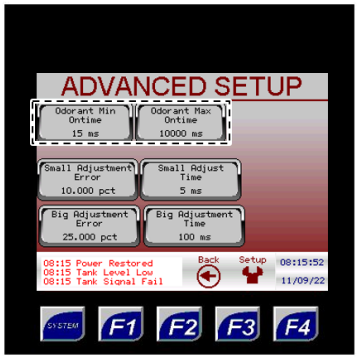
Meter Read Delay
Wait delay before reading odorant flow meter to ensure a good reading.

Figure 22: Odorant Inject – Advanced Setup

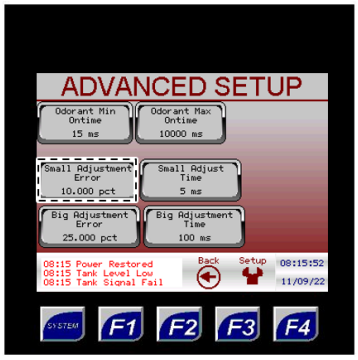




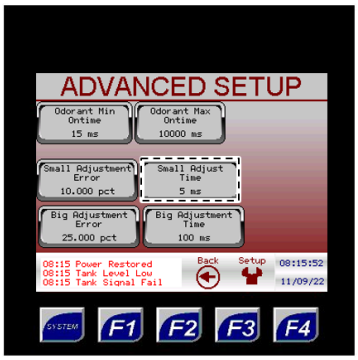
Advanced Setup
Enter this submenu to set the minimum cycle time and adjustment parameters for each bank.



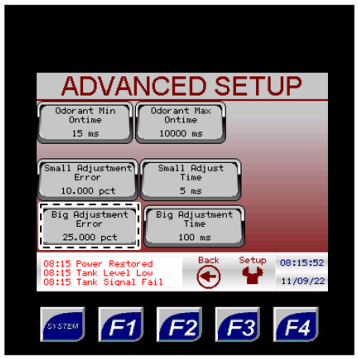
Odorant Min/Max Ontime
Press to set the minimum and maximum length of time the injection solenoid is allowed to actuate.



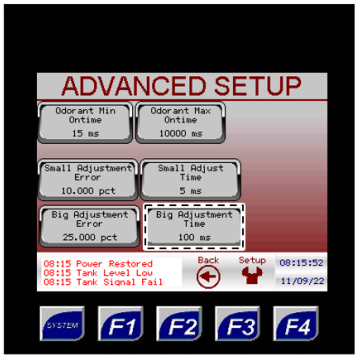
Small Adjustment Error
Press to configure the percent (%) value for small adjustment errors with the Odorant Fill Time.



Small Adjust Time
Press to set the amount of time, in milliseconds (ms), the fill solenoid adjusts when a small adjustment error is observed.



Big Adjustment Error
Press to configure the percent (%) value for big adjustment errors with the Odorant Fill Time.



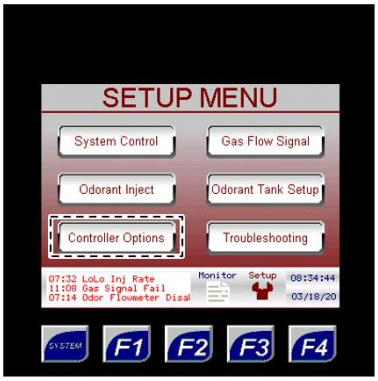
Big Adjustment Time
Press to configure the amount of time, in milliseconds (ms), the fill solenoid adjusts when a big adjustment error is observed.

Advanced Setup screens should only be adjusted under the guidance of Welker® technical support. Contact Welker® if adjustments to the Advanced Setup screens are necessary.

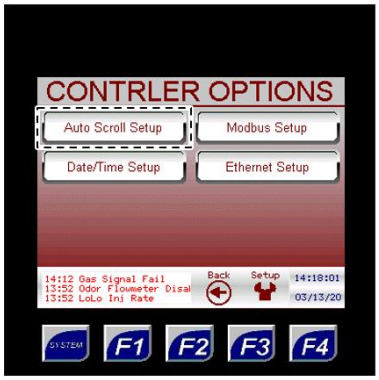
Controller Options

Through the Controller Options submenus, the user can customize the screen operation and set up communication for the controller.

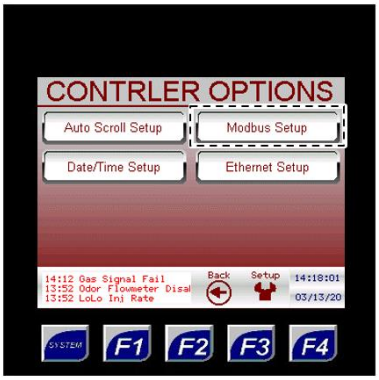
Figure 23: Setup Menu – Controller Options



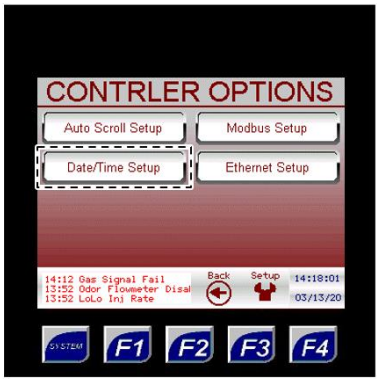
Controller Options
Enter this submenu to customize screen operation, set the date and time, configure Ethernet setup, and configure the Modbus.



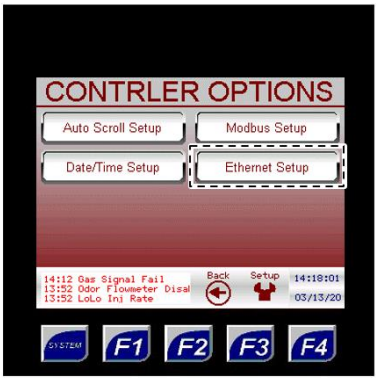
Auto Scroll Setup
Enter this submenu to customize screen operation.



Modbus Setup
If the Modbus input method is used, enter this submenu to configure the Modbus input and view the current status of the Modbus.



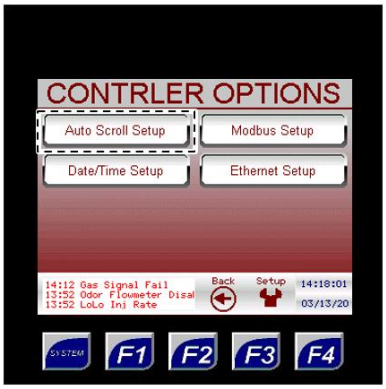
Date/Time Setup
Enter this submenu to change the date and time values and view the version of software the controller is running.

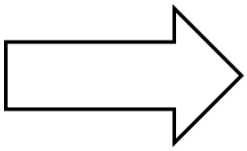


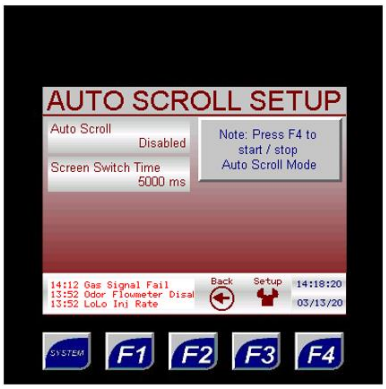
Ethernet Setup
Enter this submenu to configure the Ethernet connection and view its current status.

Auto Scroll Setup

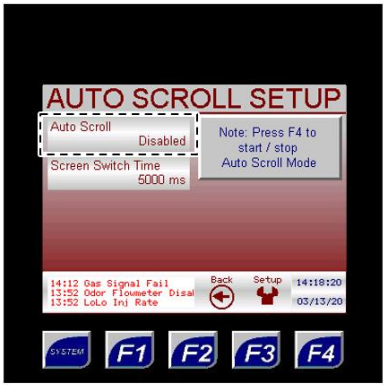
Figure 24: Controller Options – Auto Scroll Setup







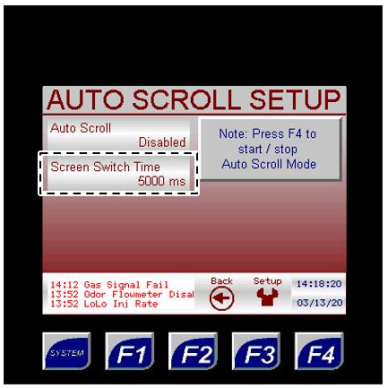
Auto Scroll Setup
Enter this submenu to customize screen operation.



Auto Scroll
When Auto Scroll is enabled, the touch screen controller will automatically scroll through six (6) pre-set screens.

See *Figure 25*.

Auto Scroll can be started or stopped at any time by pressing the F4 function key.

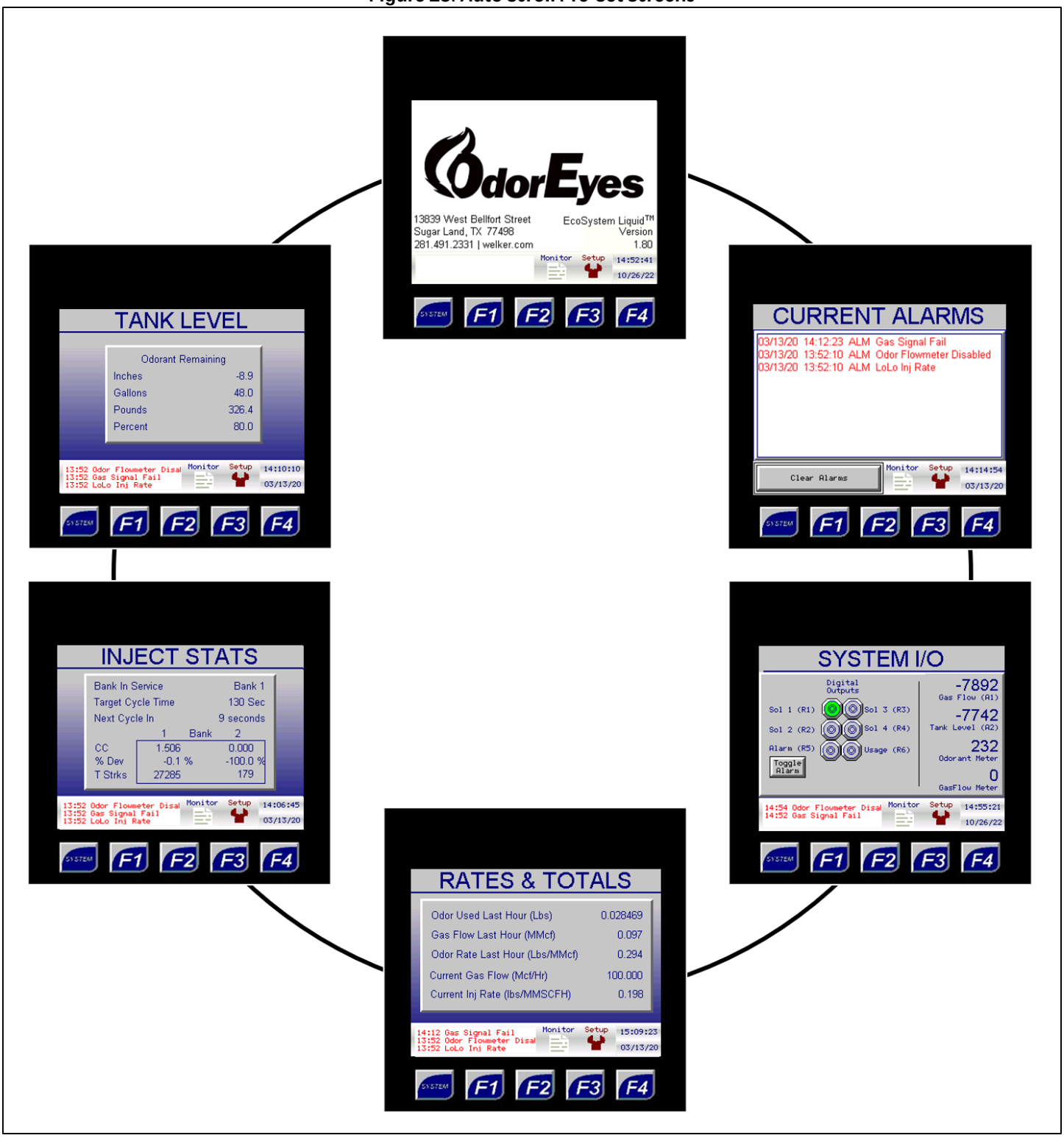


Screen Switch Time
When Auto Scroll is enabled, this is the length of time each of the pre-set screens will display before advancing to the next screen.

This value can be set by the customer.

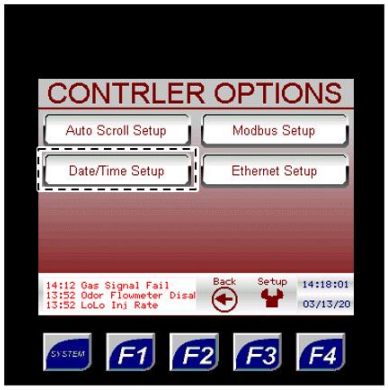
The Auto Scroll behavior can also be started by pressing the F4 function key.

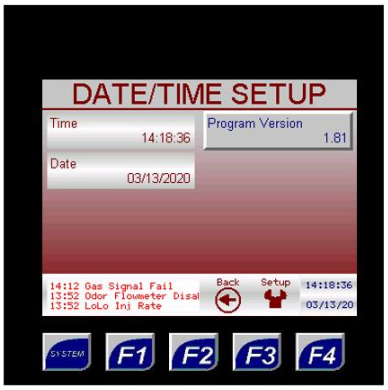
Figure 25: Auto Scroll Pre-Set Screens



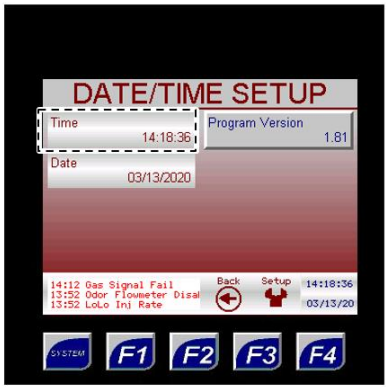
Date/Time Setup

Figure 26: Controller Options – Date/Time Setup



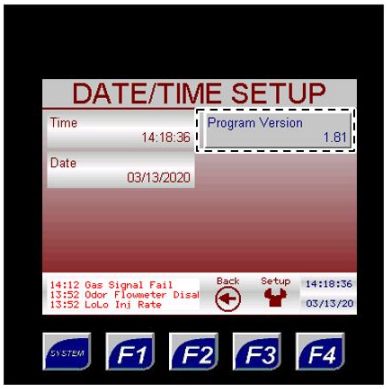


Date/Time Setup
Enter this submenu to change the date and time values and view the version of software the controller is running.

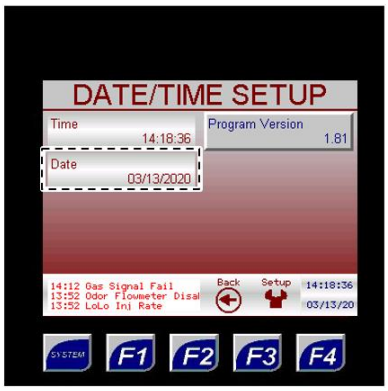


Time
Change the current time here.

The backup battery ensures that the current date and time will not be lost.



Program Version
This is the version of software the controller is currently running.

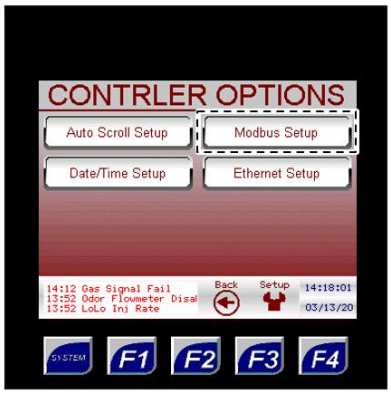


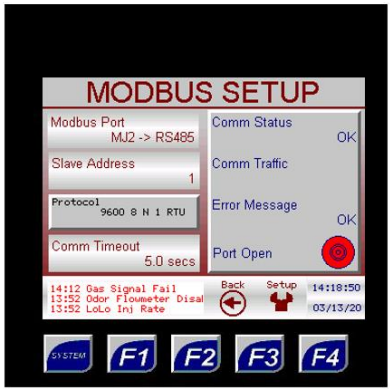
Date
Change the current date here.

The date and time can also be edited by selecting the current date and time on any screen.

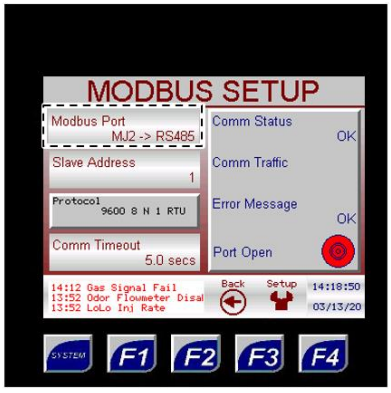
Modbus Setup

Figure 27: Controller Options – Modbus Setup

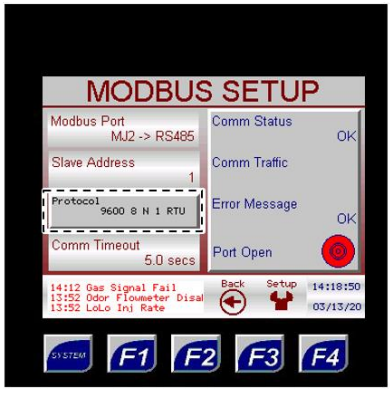




Modbus Setup
If the Modbus input method is used, enter this submenu to configure the Modbus input and view the current status of the Modbus.

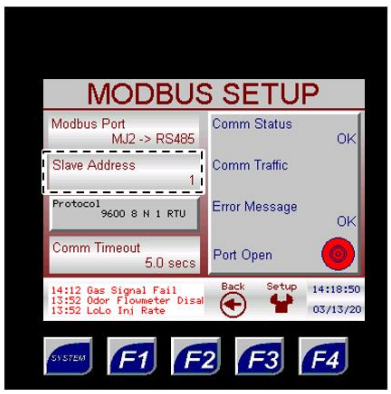


Modbus Port
Press to configure the port for the desired interface. MJ1 is for RS-232 and MJ2 is for RS-485.

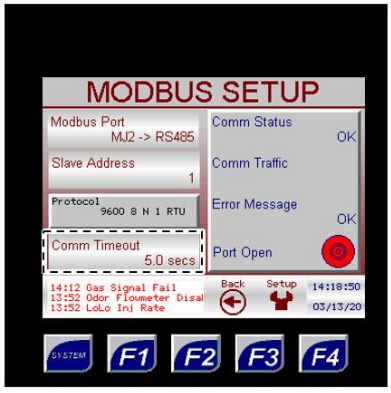


Protocol
The protocol setting applies to port MJ1 or MJ2 only.

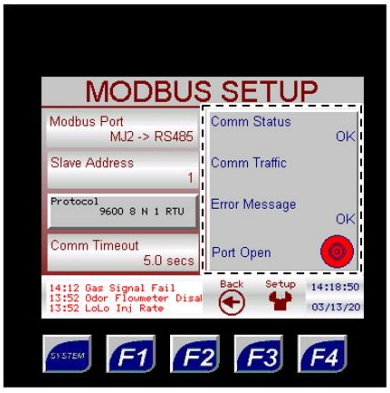
The protocol comes factory-set to Modbus RTU.



Slave Address
This value is the Modbus slave address for the odorizer.



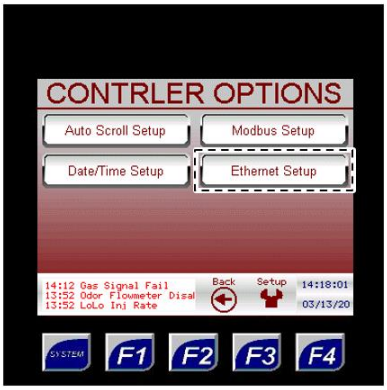
Comm Timeout
This value is the timeout between Modbus messages (in seconds).

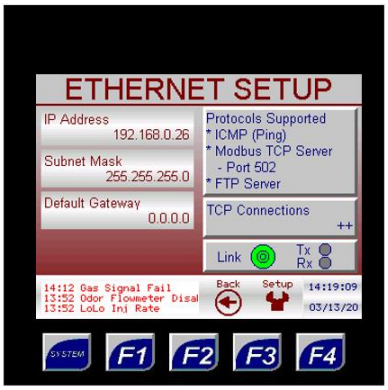


These fields display the current status of the Modbus for troubleshooting purposes.

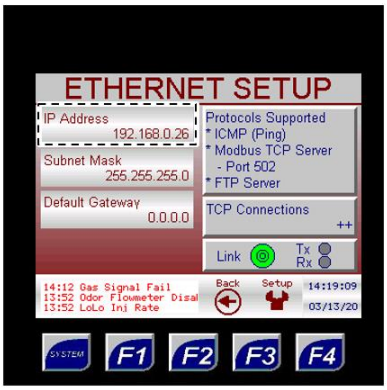
Ethernet Setup

Figure 28: Controller Options – Ethernet Setup



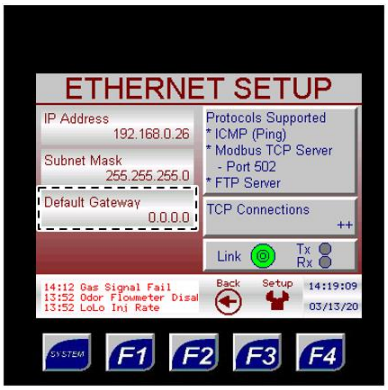


Ethernet Setup
Enter this submenu to configure the Ethernet connection and view its current status.



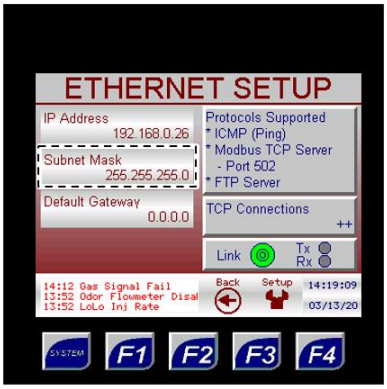
IP Address
Manually assign an IP address.

Pressing this field will bring up an on-screen keyboard for address entry.



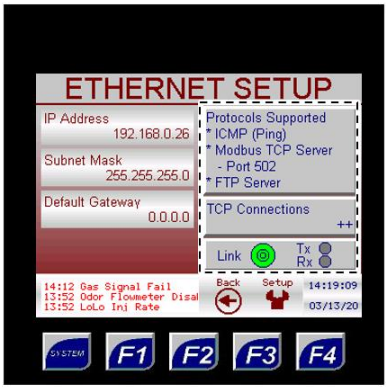
Default Gateway
Manually assign the default gateway.

Pressing this field will bring up an on-screen keyboard for gateway entry.



Subnet Mask
Manually assign the subnet mask.

Pressing this field will bring up an on-screen keyboard for subnet mask entry.

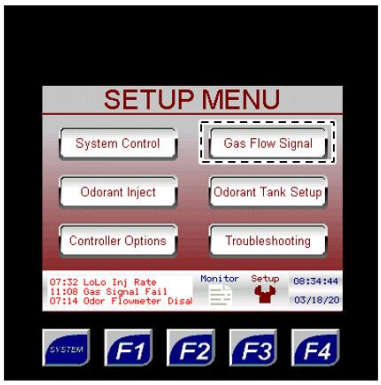


This column displays general and diagnostic information about the Ethernet connection.

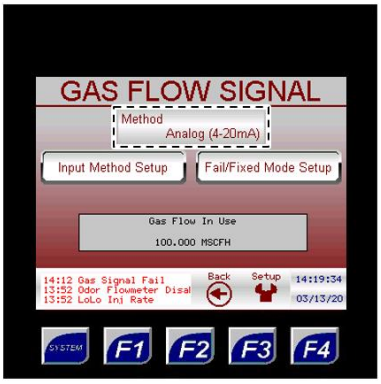
Gas Flow Signal

Through the Gas Flow Signal submenus, the user can set up the parameters of the odorant gas flow input signal.

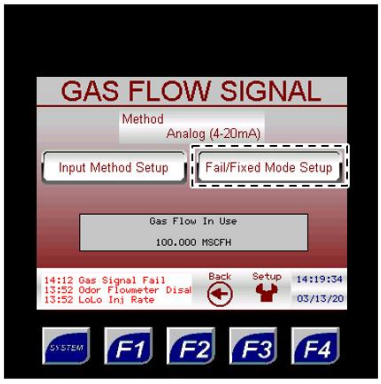
Figure 29: Setup Menu – Gas Flow Signal



Gas Flow Signal
Enter this submenu to set the parameters for the gas flow signal and set the fail mode.

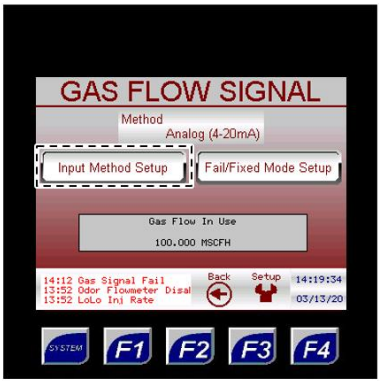


Method
Toggle this field to switch between two (2) methods for the gas flow input signal:
1. analog input
2. pulse input



Fail/Fixed Mode Setup
Enter this submenu to select the desired fail mode, enable or disable the fixed mode, and set up applicable parameters.

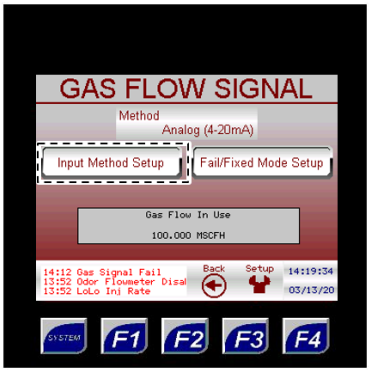
See *Figure 31*.

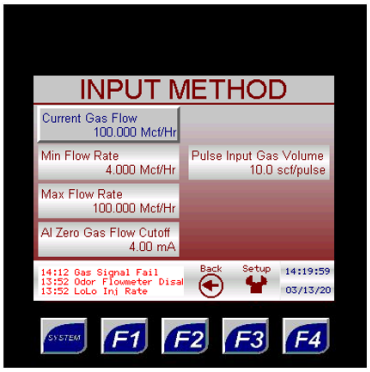


Input Method Setup
Enter this submenu to set up the applicable parameters for the chosen input method.

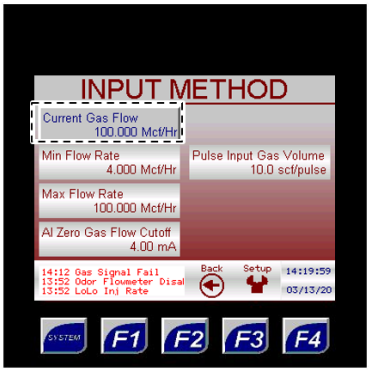
See *Figure 30*.

Figure 30: Gas Flow Signal – Input Method Setup

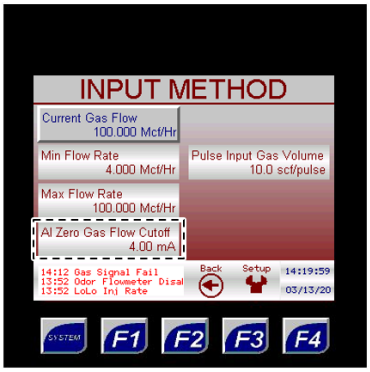




Input Method Setup
Enter this submenu to set up the applicable parameters for the chosen input method.

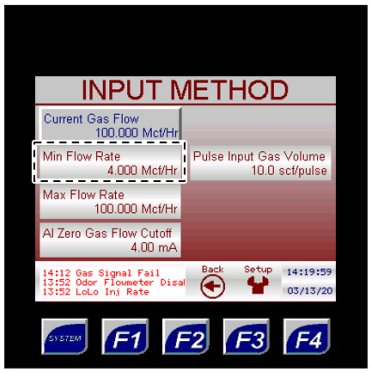


Current Gas Flow
This value is the current gas flow signal for the pipeline (Mcf/h).



Al Zero Gas Flow Cutoff
This value is only active if the analog input method is used.

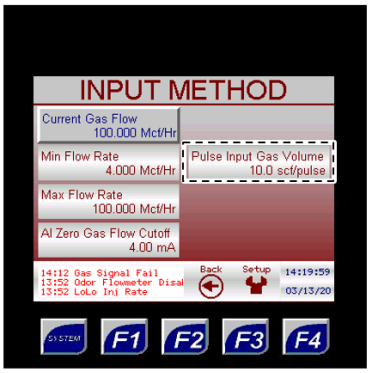
Any values below this gas flow low cutoff value (in milliamps) will be treated as zero gas flow (0 Mcf/h).



Min Flow Rate
If analog input is used, this value is the 4 mA signal.

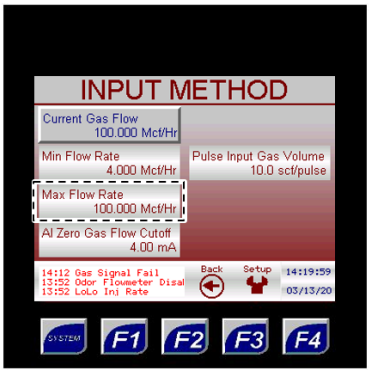
If pulse input is used, this value is the minimum actual gas flow.

In most cases, this value comes factory-set to zero (0) Mcf/h.



Pulse Input Gas Volume
This value is the total standard cubic feet of gas that each pulse input to the controller represents.

This value is used for the pulse input method only.

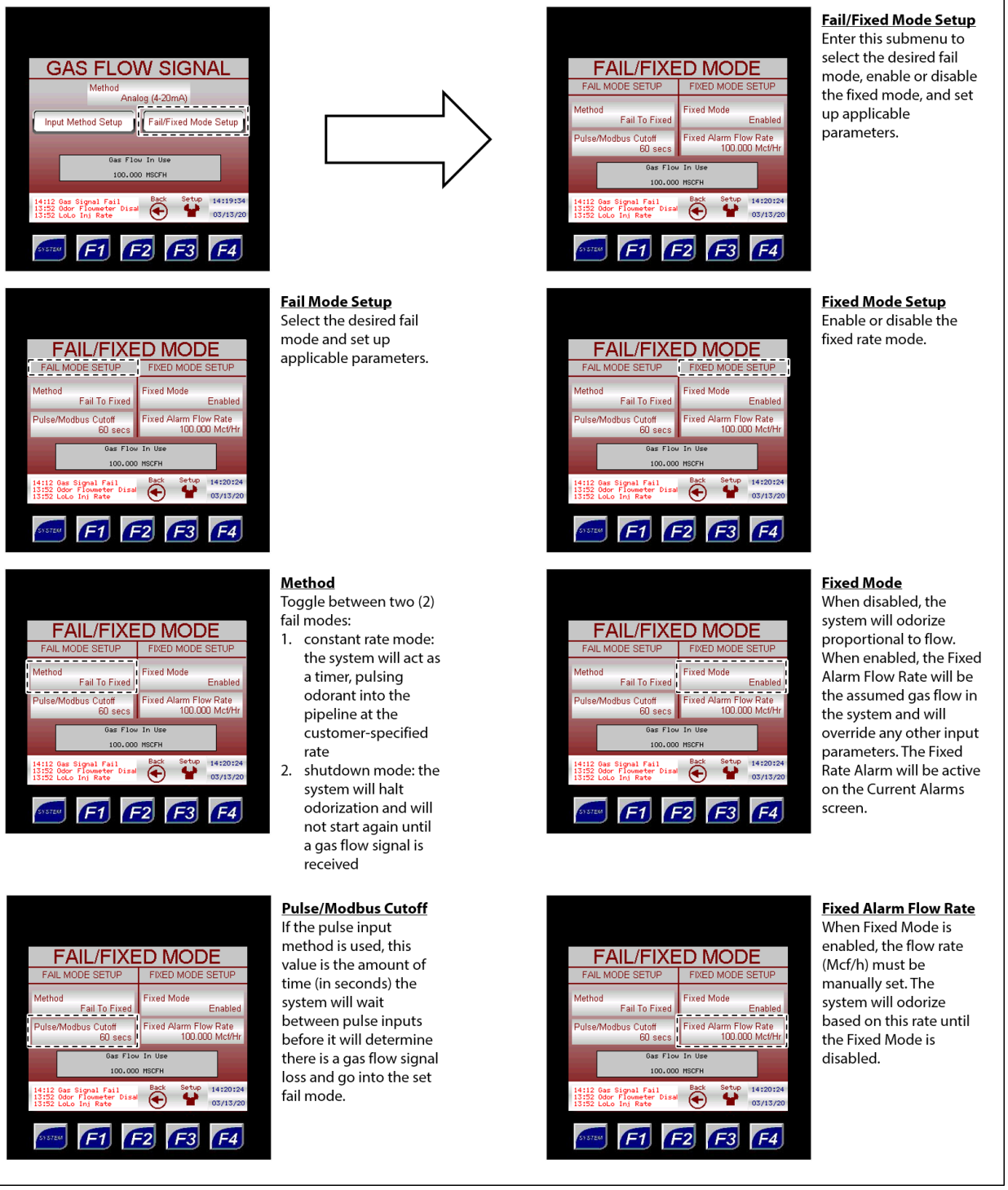


Max Flow Rate
If analog input is used, this value is the 20 mA signal.

If pulse input is used, this value is the maximum actual gas flow.

If the gas flow signal will be analog, the analog signal must be 4–20 mA powered by the user.
If the gas flow signal will be pulse, the pulse will be a digital pulse powered by the controller.

Figure 31: Gas Flow Signal – Fail/Fixed Mode Setup



Fail/Fixed Mode Setup
Enter this submenu to select the desired fail mode, enable or disable the fixed mode, and set up applicable parameters.

Fail Mode Setup
Select the desired fail mode and set up applicable parameters.

Fixed Mode Setup
Enable or disable the fixed rate mode.

Method
Toggle between two (2) fail modes:

1. constant rate mode: the system will act as a timer, pulsing odorant into the pipeline at the customer-specified rate
2. shutdown mode: the system will halt odorization and will not start again until a gas flow signal is received

Fixed Mode
When disabled, the system will odorize proportional to flow. When enabled, the Fixed Alarm Flow Rate will be the assumed gas flow in the system and will override any other input parameters. The Fixed Rate Alarm will be active on the Current Alarms screen.

Pulse/Modbus Cutoff
If the pulse input method is used, this value is the amount of time (in seconds) the system will wait between pulse inputs before it will determine there is a gas flow signal loss and go into the set fail mode.

Fixed Alarm Flow Rate
When Fixed Mode is enabled, the flow rate (Mcf/h) must be manually set. The system will odorize based on this rate until the Fixed Mode is disabled.

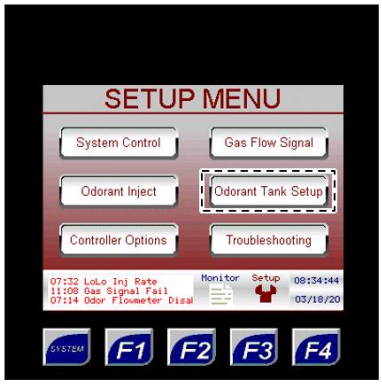
Setting the Fail Mode to Shutdown will halt odorization until the alarm is cleared.
Setting the Fail Mode to Constant Rate will allow odorization to continue at a specified rate.

If the gas flow value does not change during the Pulse/Modbus Cutoff time, the system will alarm for loss of flow and will enter the specified Fail Mode. The alarm will clear on the next pulse input or change in Modbus gas flow, and the system will resume normal operation.

Odorant Tank

Through the Odorant Tank submenus, the user can input information for the odorant tank.

Figure 32: Setup Menu – Odorant Tank



Odorant Tank Setup
Enter this submenu to set the parameters for the odorant tank and temperature transmitter.

Method
Toggle this field to switch between the two (2) methods for tracking the odorant tank level:
1. odorant flow
2. electronic level transmitter

Low Level Alarm
The low level alarm set point is a percent value at which the system will trigger an alarm for low odorant level in the tank.

Tank Level Setup
Enter this submenu to set up the parameters for how the tank level will operate.

See *Figure 33.*

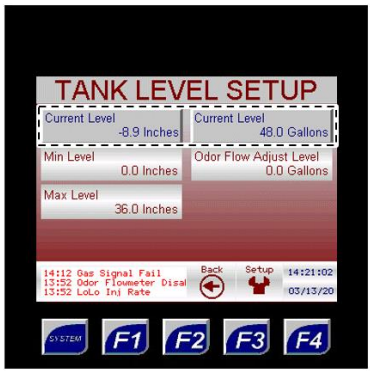
Tank Volume Setup
Enter this submenu to view the tank volume settings and access the strapping tables.

See *Figure 34.*

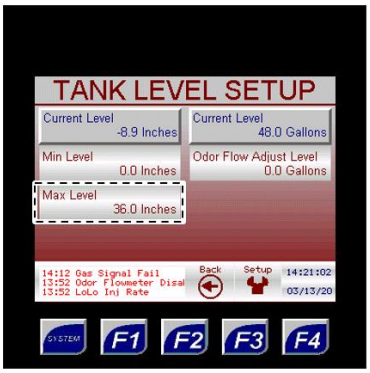
When using an electronic level transmitter to track the odorant tank level, the Method should be set to Transmitter.
When estimating the odorant tank level based on odorant usage, the Method should be set to Calculated.

Figure 33: Odorant Tank – Tank Level Setup

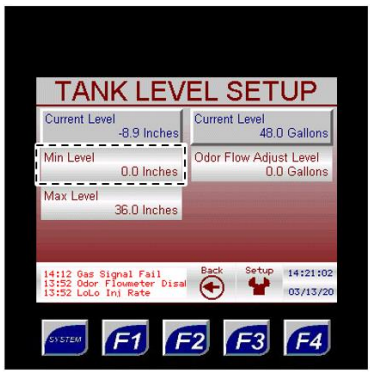
Tank Level Setup
Set up the parameters for how the tank level will operate.



Current Level
View the current level of the tank in inches and US gallons.



Max Level
If the electronic level transmitter method is used, this value is the 20 mA signal.



Min Level
If the electronic level transmitter method is used, this value is the 4 mA signal.

This value is typically factory-set at 0.0 inches.

Odorant Flow Adjust Level
If the odorant flow method is used, this value is the 4 mA signal.

This value is typically factory-set at 0.0 gallons.

The Current Level numeric value cannot be directly changed. Instead, the user must enter a value in the Odorant Flow Adjust level field to increase or decrease the Current Level by the specified amount.

- To decrease the Current Level, enter the volume to be subtracted from the current level as a negative number in the Odorant Flow Adjust Level field, and then press ENTER to save the changes. The Current Level should have decreased by the amount entered, and the Odorant Flow Adjust Level should have reverted to 0.0 gallons.
- To increase the Current Level, enter the volume to be added to the current level in the Odorant Flow Adjust Level field, and then press ENTER to save the changes. The Current Level should have increased by the amount entered, and the Odorant Flow Adjust Level should have reverted to 0.0 gallons.

Figure 34: Odorant Tank – Tank Volume Setup

Tank Volume Setup
Enter this submenu to view the tank volume settings and access the strapping tables.

Size
This is the volume of the tank in US gallons.

Odorant Density
The odorant density will vary according to the odorant used.

The odorant density should be published by the odorant manufacturer in pounds/US gallons at 60 °F.

Volume Conversion
This value is the volume of liquid odorant per inch. This is used only with vertical odorant tanks.

Strapping Table
Toggle this field to enable or disable the tank strapping field.

For horizontal odorant tanks, this field should be **enabled**. For vertical odorant tanks, this field should be **disabled**.

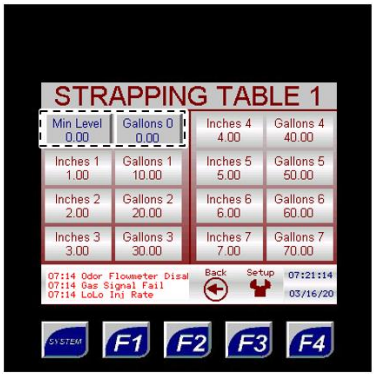
Strapping Table Pg 1, 2, 3
If strapping is enabled, view the tank depth and tank volume for each strapping point.

See *Figure 35*.

Figure 35: Tank Volume Setup – Strapping Tables

The strapping table page number.

Each page displays the tank depth in inches and the tank volume in US gallons for multiple strapping points.

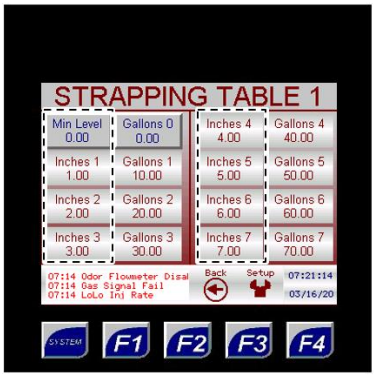


The minimum strapping point for the tank is displayed on page 1.

It is zero (0) inches and zero (0) US gallons.

The right column of each table displays the tank volume in US gallons per inch.

Each table row is a single strapping point.



The left column of each table displays the tank depth in inches.

Each table row is a single strapping point.

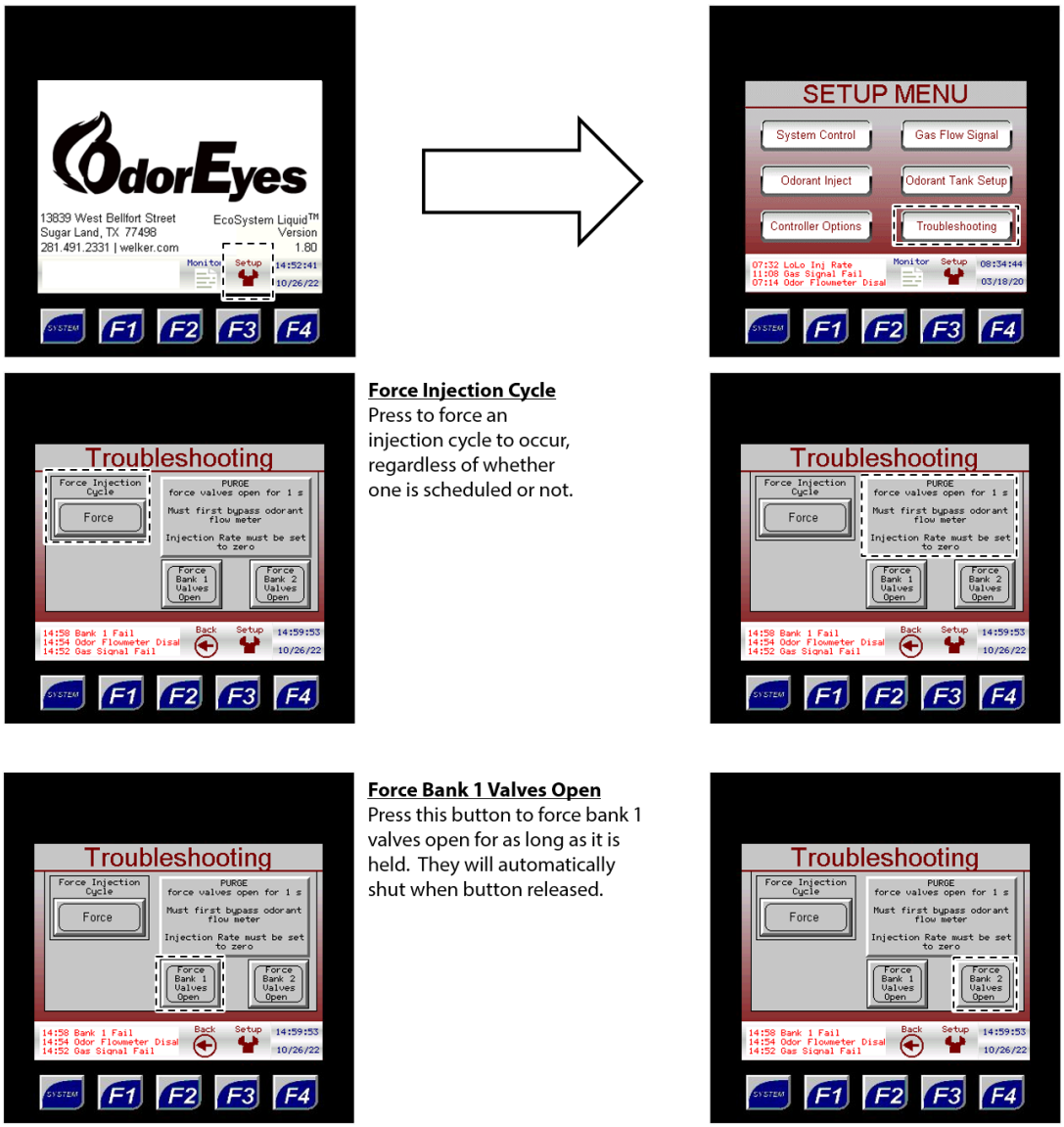
The maximum strapping point for the tank is displayed on the last page.

The maximum strapping point will depend on the tank size and volume.

If the odorant tank is horizontal, the strapping points will be calculated and entered at the factory.

Through the Troubleshooting submenu, the user can access troubleshooting options for bank 1 and bank 2.

Figure 36: Setup Menu – Troubleshooting



Troubleshooting
Enter this submenu to access troubleshooting options for bank 1 and bank 2.

Force Injection Cycle
Press to force an injection cycle to occur, regardless of whether one is scheduled or not.

Purge
Before attempting to purge, read, then follow the steps in Section 2.3 Start-Up Procedures – Purging the ECOsystem™ Liquid.

Force Bank 1 Valves Open
Press this button to force bank 1 valves open for as long as it is held. They will automatically shut when button released.

Force Bank 2 Valves Open
Press this button to force bank 2 valves open for as long as it is held. They will automatically shut when button released.

SECTION 4: MAINTENANCE

4.1 Before You Begin

1. **Welker® recommends that the unit have standard yearly maintenance.** Based on the operating conditions and/or site requirements, adjustments to the maintenance schedule may be necessary.
2. **Refer to *Appendix B, Maintenance Schedule,* for the itemized Welker® recommended maintenance schedule for the ECOsystem™ Liquid.**
3. Prior to maintenance or disassembly of the unit, it is advisable to have a repair kit available for repairs of the system in case of unexpected wear or faulty seals.

New seals supplied in spare parts kits should be lightly lubricated before being installed to ease the installation of the seals and reduce the risk of damage when positioning them on parts. Wipe excess lubricant from the seals, as it may adversely affect analytical instrument results.

For sample-exposed seals, Welker® recommends non-hydrocarbon-based lubricants, such as Krytox®.
For non-sample-exposed seals, Welker® recommends either non-hydrocarbon-based lubricants or silicone-based lubricants, such as Molykote® 111.

After the seals are installed, the outer diameter of shafts and inner diameter of cylinders may be lubricated to allow smooth transition of parts.

4. All maintenance and cleaning of the unit should be performed on a smooth, clean surface.
5. Welker® recommends having the following tools available for maintenance. Please note that the exact tools required may vary by model.
    a. Adjustable Wrenches
    b. Flat Head Screwdriver
    c. Hex Key Set
    d. Odorant Capture Cylinder or Bucket
    e. OdorXice™ Odorant Eliminator
    f. Pipe Wrench
    g. Strap Wrench
    h. Teflon® Tape

4.2 Maintenance

1. During operation, monitor the system for leaks. If leaks are present, halt operation and repair as necessary.
2. Occasionally, a system component may need to be repaired or replaced for manufacturer recommended maintenance. To perform maintenance on components:
    a. Turn OFF all electrical power to the system.
    b. Depressurize the system and close all valves.
    c. Perform *Purging the ECOsystem™ Liquid* as detailed in *Section 2.3, Start-Up Procedures*.
    d. Disconnect the tubing and remove individual system components for maintenance.
    e. For complete and proper maintenance on individual system components, refer to their respective *Installation, Operation, and Maintenance* (IOM) *Manual*. A list of component *Installation, Operation, and Maintenance* (IOM) *Manuals* is available in *Appendix A, Referenced or Attached Documents*, in this manual.
    f. After performing necessary maintenance on system components, reconnect all instrument tubing.
    g. Reinstall the system according to the instructions in *Section 2.2, Installation*, and *Section 2.3, Start-Up Procedures*.

4.3 Alarm and Flow Meter Check Procedures

HiHi and LoLo Inj Rate Alarms

The HiHi alarm indicates too much odorant is being injected per pulse. The LoLo alarm indicates too little odorant is being injected per pulse.

1. Select Odorant Inject from the Setup Menu in the PLC, and then press Injection Setup (*Figure 20*).
2. Verify the injection settings and make the appropriate changes as needed.
3. From the Current Alarms screen, press Clear Alarms and return the ECOsystem™ Liquid to normal operation (*Figure 10*).

Gas Signal Fail Alarm

The Gas Signal Fail alarm indicates a loss of signal from the flow meter.

4. From the Monitor Menu in the PLC, select System I/O (*Figure 14* and *Figure 15*). If the Gas Flow reading is less than -7500, there is no signal coming from the flow meter. If the reading is a negative number between 0 and -7500, an error code from the flow meter may be indicated. Refer to the *Installation, Operation, and Maintenance* (IOM) *Manual* for the flow meter for instructions on maintaining the flow meter.
5. Check the wiring on the flow meter to ensure proper operation (*Figure 4*). Refer to the *Installation, Operation, and Maintenance* (IOM) *Manual* for the flow meter for instructions on wiring the flow meter.

Tank Signal Fail Alarm

The Tank Signal Fail alarm can only be active if an electronic level transmitter is used to track the odorant tank level and the controller loses the 4–20 mA signal from the transmitter.

6. From the Monitor Menu in the PLC, select System I/O (*Figure 14* and *Figure 15*). If the Tank Level reading is less than -7500, there is no signal coming from the magnetostrictive level indicator. If the reading is a negative number between 0 and -7500, an error code from the magnetostrictive level indicator may be indicated. Refer to the *Installation, Operation, and Maintenance* (IOM) *Manual* for the magnetostrictive level indicator for instructions on maintaining the magnetostrictive level indicator.
7. Check the wiring on the magnetostrictive level indicator to ensure proper operation (*Figure 2*). Refer to the *Installation, Operation, and Maintenance* (IOM) *Manual* for the magnetostrictive level indicator for instructions on wiring the magnetostrictive level indicator.

Bank 1 and Bank 2 Fail Alarms

The Bank 1 or Bank 2 Fail alarms will be active if the total value of five (5) consecutive pulses from Bank 1 or Bank 2 deviates by more than the user-configured percent of the expected value.

8. Verify the backup solenoid valve bank is operating properly. If it is not operating properly, check the odorant flow meter to ensure proper operation (*Figure 4*).
9. If the backup solenoid valve bank is working properly, clear all alarms and switch operation back to the failed solenoid valve bank.
10. Observe and record the measured odorant delivery.
11. If the system returns to normal operation, continue observations for a short time and then place back into service.
12. If the same solenoid valve bank fails again, verify once again that the backup solenoid valve bank is operating properly.
13. If the backup solenoid valve bank is operating properly, leave the backup solenoid valve bank in operation and perform maintenance on the failing solenoid valve bank.

When troubleshooting is complete, set the Odor Rate Required value back to the original value to resume normal operations.

Odorant Flow Meter Check Procedures

14. Check the odorant flow meter to ensure proper operation (*Figure 4*).
15. Unscrew the access cap on the odorant flow meter and verify the lights inside are blinking. If there are no blinking lights, Failure 9 has occurred. See *Table 5, ECOsystem™ Liquid Troubleshooting Guidelines*, for a description of the failure and possible solutions.
16. From the Monitor Menu in the PLC, select System I/O (*Figure 14* and *Figure 15*).
17. From the System I/O submenu, verify the Odorant Meter field changes when the odorizer cycles (*Figure 14* and *Figure 15*).
18. If there are blinking lights within the odorant flow meter but no change occurs in the Odorant Meter field, the remote terminal unit (RTU) may need to be replaced.
19. Verify the wiring is correct for the odorant flow meter and replace the RTU, if necessary.
20. If problems persist, check the odorant flow meter, odorant filter, and system check valves for blockages (*Figure 4* and *Figure 6A*).

Return to Operation

21. Ensure all valves are in the correct position. See *Section 2.3, Start-Up Procedures,* for instructions on setting the valves to the proper position.
22. From the PLC, touch the alarm field at the bottom left of the screen. This will take you to the Alarm History screen (*Figure 17*).
23. From the Alarm History screen, select any alarm (*Figure 17*). Press Clr All at the bottom of the screen to clear the alarms.
24. From the Setup Menu in the PLC, select System Control, and then press Odor Rate Required (*Figure 19*).
25. Set Odor Rate Required to the previous value that was recorded before the Troubleshooting procedures.
26. The ECOsystem™ Liquid is now operational.

4.4 Troubleshooting Guidelines

Failure to open or failure to close indicates the solenoid did not open or close completely. The solenoid may have opened or closed partially, resulting in a small leak.

Table 5: ECOsystem™ Liquid Troubleshooting Guidelines

Issues	Possible Causes	Solutions
The Odorant Overflow Alarm is active.	The primary solenoid on the failed solenoid valve bank is not sealing fully.	After the unit automatically switches to the backup solenoid valve bank, replace the primary solenoid on the failed bank. It is recommended, but not required, to replace the isolation solenoid at the same time.
	Odorant is leaking past both solenoids of one or both solenoid valve banks.	Look at the sight glass at the injection point to see if odorant is currently dripping. Check the I/O screen to see if the odorant counter is increasing. If either of these events are occurring, isolate one bank at a time and see which solenoid valve bank is leaking. Replace both solenoids on the leaking solenoid valve bank(s).
The OverOdorization (HiHi) alarm is active.	If this is the only alarm, the odorant is flowing through the system too quickly for the solenoid valve to properly control the injection rate.	Observe the differential pressure regulator pressure gauge to verify the pressure on the tank. Verify the injection pressure. If the pressure on the tank is more than 5 psig higher than the injection pressure, reduce the pressure on the tank blanket gas regulator by 5 psig. Clear all alarms and return to operation. If the alarm returns, repeat this procedure.
The UnderOdorization (LoLo) alarm is active.	Odorant is flowing through the system too slowly to keep up with the natural gas flow rate.	Observe the differential pressure regulator pressure gauge to verify the pressure on the tank. Verify the injection pressure. If the pressure on the tank is less than 20 psig higher than the injection pressure, increase the pressure on the tank blanket gas regulator by 5 psig. Clear all alarms and return to operation. If the alarm returns, there may be some obstruction to the flow. Perform maintenance on the odorant filter and continue troubleshooting.

Table 5: ECOsystem™ Liquid Troubleshooting Guidelines (Continued)		
Issues	**Possible Causes**	**Solutions**
The Odorant NoFlow Alarm is active.	Tank odorant outlet valve I is closed.	Open tank odorant outlet valve I.
	Filter inlet valve S and/or filter outlet valve T is closed.	Ensure filter inlet valve S and/or filter outlet valve T is open.
	Odorant inlet/purge inlet switching valve J is closed.	Open odorant inlet/purge inlet switching valve J.
	The failed solenoid valve bank has a solenoid that is not opening.	Replace both solenoid valves on the failed solenoid valve bank and return to operation.
	The odorant flow meter and/or odorant filter may have failed.	If both solenoid valve banks have failed, verify all valves are in the proper position for odorization. Observe the differential pressure regulator pressure gauge to verify the pressure on the tank. Verify the injection pressure. If the pressure on the tank is less than 5 psig than the injection pressure, increase the pressure on the differential pressure regulator by 5 psig. Record the odorant totalization from the I/O screen and clear all alarms. Look at the injection point sight glass to see if odorant is dripping. Observe the odorant totalization from the I/O screen. If the sight glass is showing odorant but the odorant totalization is not increasing, the odorant flow meter may have failed. Unscrew the lid on the odorant flow meter and observe inside. If a blue light flashes when the solenoids toggle, the odorant flow meter is measuring the odorant but not sending a signal to the controller. Contact Welker® for instructions on how to maintain the odorant flow meter. If no odorant is observed in the injection point sight glass and the odorant totalization from the I/O screen does not increase, service the odorant filter. If the problem persists after filter maintenance, close odorant flow meter inlet valve N and odorant flow meter outlet valve P, and then open odorant flow meter bypass valve O. Force the solenoids open. If odorant is still not flowing, contact Welker® for additional support.

APPENDIX A: REFERENCED OR ATTACHED DOCUMENTS

Welker® *Installation, Operation, and Maintenance* (IOM) *Manuals* suggested for use with this unit:

- IOM-025: Welker® IR-1, IR-2, IR-4, and IR-6 Instrument Regulators
- IOM-035: Welker® SP-1, SP-1W, SP-2, SP-3, SP-5, and SP-F Sample Probes
- IOM-169: Welker® F-5 Filter Dryer
- IOM-213: Welker® F-9 and F-10 Filters
- IOM-229: Welker® ECOsystem™ Pulse Bypass System With XL4 Controller
- IOM-238: Welker® ISPE Instrument Regulator

Other *Installation, Operation, and Maintenance* (IOM) *Manuals* suggested for use with this unit:

- Emerson Electric Co. Anderson Greenwood, Crosby, & Varec Pressure Relief Valves (Welker® IOM-V440)
- Horner APG, LLC XL4 OCS Modules (Welker® IOM-V369)
- Hy-Lok Corporation Relief Valves RV Series (Welker® IOM-V362)
- Inline Industries, Inc. 201F Ball Valve (Welker® IOM-V222)
- INTERTEC Instrumentation Ltd. CP MULTITHERM C Electric Heater (Welker® IOM-V104)
- INTERTEC Instrumentation Ltd. TS Thermostat (Welker® IOM-V105)
- Max Machinery, Inc. Positive Displacement Flowmeters Models P001, P002, 213, 214, and 215 (Welker® IOM-V106)
- Peter Paul Electronics Co., Inc. Series 20 Hazardous Location High Pressure 2-Way Solenoid Valves Model EH22 (Welker® IOM-V441)
- Power-Sonic Corporation PS-1270 12 Volt 7.0 AH Rechargeable Sealed Lead Acid Battery (Welker® IOM-V223)
- Quest-Tec Solutions Magne-Trac™ Level Indicators (Welker® IOM-V367)
- Swagelok Company Check Valves C, CA, CH, CP, and CPA Series (Welker® IOM-V076)
- Swagelok Company Integral-Bonnet Needle Valves O, 1, 18, 20, and 26 Series (Welker® IOM-V136)
- Swagelok Company One-Piece Instrumentation Ball Valves 40 G Series and 40 Series (Welker® IOM-V085)
- WIKA Bourdon Tube Pressure Gauges Type 232.53 and Type 233.53 (Welker® IOM-V171)

Welker® drawings and schematics suggested for use with this unit:

- System Drawing: BSYS0157 (Tank and Skid)
- System Drawing: OE500VS.1 (Solenoid Cabinet)

APPENDIX B: MAINTENANCE SCHEDULE

Welker® recommends keeping high-wear parts on hand and replacing these parts immediately when worn or damaged.

Refer to the *Installation, Operation, and Maintenance* (IOM) *Manual* for each component for maintenance instructions.

Table B1: ECOsystem™ Liquid Maintenance Schedule

Action	Weekly	Every 12 Months	As Necessary
Confirm proper functioning of the heater.	X		
Verify pressure on the differential pressure regulator gauge and tank blanket pressure.		X	
Open filter drain valve V to allow moisture to drain from the filter.			X
Rebuild the F-9 using a Welker® repair kit. • Replace the O-rings and filter element.			X
Inspect the tubing, valves, and fittings on the system for leaks.			X
Replace the controller battery.			X
Maintain the flow meter.			X
Maintain the regulators.			X
Maintain the relief valve.			X
Maintain the solenoids.			X

NOTES

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