INSTALLATION, OPERATION, AND MAINTENANCE MANUAL
WELKER ODOREYES PULSEINJECT™ INJECTION SYSTEM
WITH XL4 CONTROLLER

DRAWING NUMBER
OE300VS

MANUAL NUMBER
IOM-231

REVISION
Rev. A, 06/25/2020

TABLE OF CONTENTS

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 PulseInject™ Injection System 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 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 PulseInject™ Injection System 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 PulseInject™ Injection System, 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 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 PulseInject™ Injection System With XL4 Controller is designed to infuse natural gas in the customer pipeline with vaporized odorant. This automatic injection system has three (3) primary components: the touch screen controller, the valve section, and the odorant supply tank. Each primary component plays an integral role in the operation of the PulseInject™ 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 flow switch in the valve section, allowing the system to respond to changing flow conditions. As pipeline conditions change, the controller increases or decreases the injection rate so that the PulseInject™ 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 valve section contains up to 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 PulseInject™ to better respond to and accommodate varying flow rates and limits interruption to operation in the event of solenoid maintenance. To prolong the operational life of the regulator and solenoids, the Welker F-5 Filter Dryer conditions the pneumatic supply. The flow switch communicates the solenoid operation to the controller to ensure proper odorization. For PulseInject™ systems used in cold climates, a heater with thermostat can be added to replenish heat lost during regulation.

Each odorant supply tank is equipped with a tank fill inlet, vent port, tank blanket pressure inlet, level gauge, and outlet to the pipeline. For added automation, an electronic level transmitter can be installed to communicate tank level to the controller. Regardless of volume or orientation, the odorant supply tank comes with 110% containment that is sloped to the drain for easy draining.

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 PulseInject™ Injection System With XL4 Controller 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: PulseInject™ Specifications	
Application	Liquid Odorant and Chemical Injection
Utility Requirements	Pneumatic Supply to Operate Injection Gas
Electrical Connections	**Controller:** AC 120 V, DC 24 V **Controller Solenoid and Flow Meter:** DC 24 V **Heater (Optional):** AC 110/220 V
Odorant Tank Volume	120 US Gallons (*454 L*) 250 US Gallons (*946 L*) 500 US Gallons (*1892 L*) 1000 US Gallons (*3785 L*) Others Available
Features	Odorant Tank Level Gauge Skid With 110% Containment Touch Screen Controller Valve Section (See *Table 2*)
Options	Flag Tracker Level Indicator Heater for Controller Enclosure NEMA 4 or NEMA 7 Enclosure for Controller

Table 2: Valve Section Specifications	
Materials of Construction	316/316L Stainless Steel, Kalrez®, Painted Carbon Steel, PTFE, and Viton®
Maximum Allowable Operating Pressure	1480 psig @ -20 °F to 120 °F (*99 barg @ -28 °C to 48 °C*)
Injection Volume	**Low Flow Rate:** .1 cc to .5 cc **High Flow Rate:** .5 cc to 15 cc
Injection Rate	Up to 15 Injections per Minute
Injection Pressure	Up to 1480 psig
Connections	**Odorant Injection Outlet:** ¼" Tubing **Odorant Inlet From Tank:** ⅜" Tubing **Odorant Purge:** ¼" FNPT **Pneumatic Supply Inlet From F-5 Filter:** ⅜" Tubing **Relief Valve Outlet:** ¼" FNPT **Sense Gas Inlet:** ¼" FNPT **Tank Blanket Pressure Outlet:** ⅜" Tubing **Vent to Filter:** ¼" FNPT
Electrical Connections	**Heater (Optional):** AC 110/220 V, ½" FNPT **Solenoid and Flow Meter:** DC 24 V, 1" FNPT
Digital Input	**DC 1–5 V Square Wave, Dry Contact, Open Collector**
Features	2-Way Solenoid Valves Blanket Pressure Regulator With Outlet Valve Differential Pressure Regulator Flow Meter NEMA 4 Enclosure Welker ALS-1 Analyzer Liquid Shutoff Welker F-5 Filter Dryer for Pneumatic Supply Welker F-9 Filter for Odorant Supply
Options	Heater With Thermostat Low Flow Instrument Regulator

1.5 Equipment Diagrams

Figure 1: PulseInject™ Valve Section Schematic

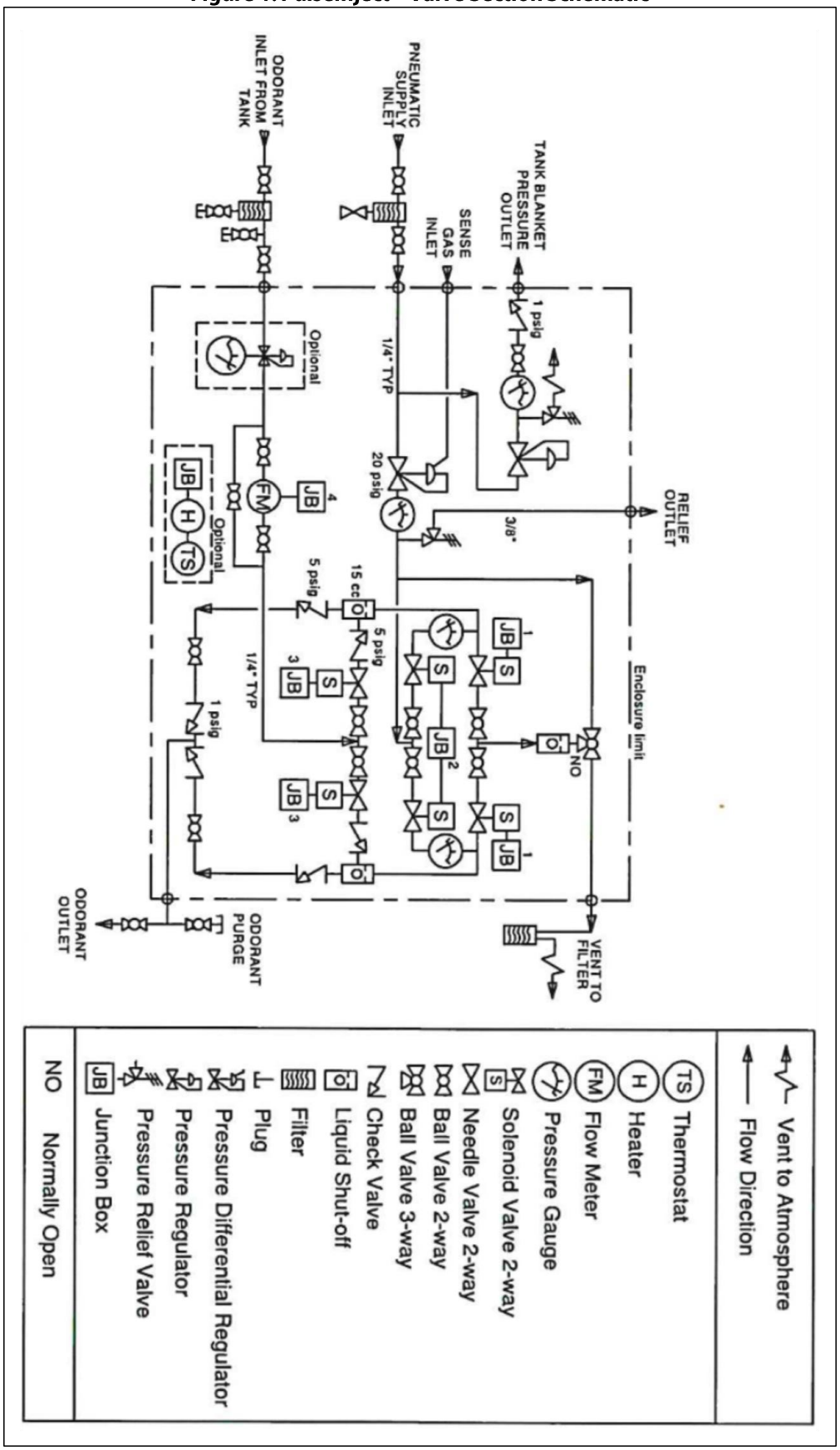
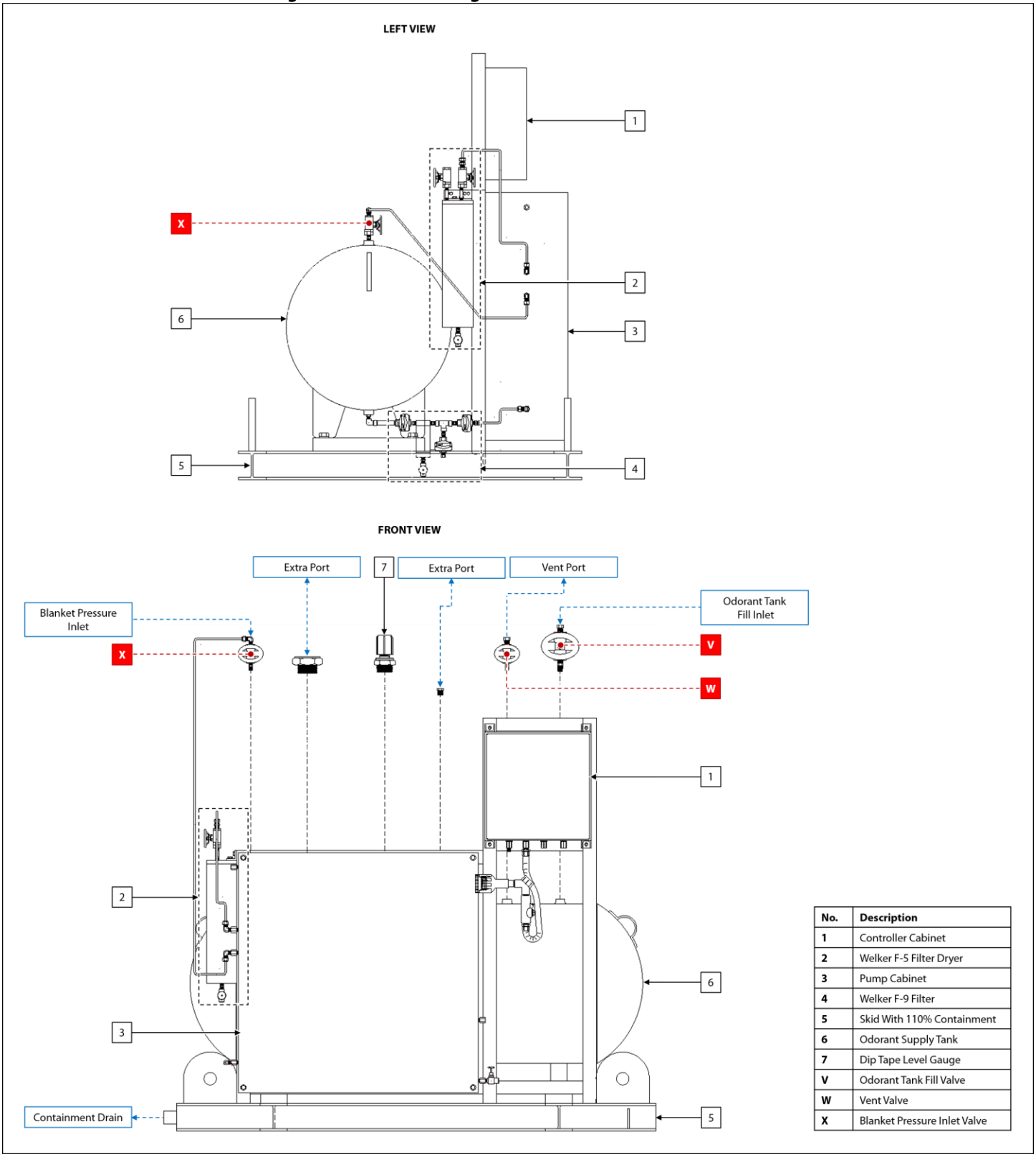
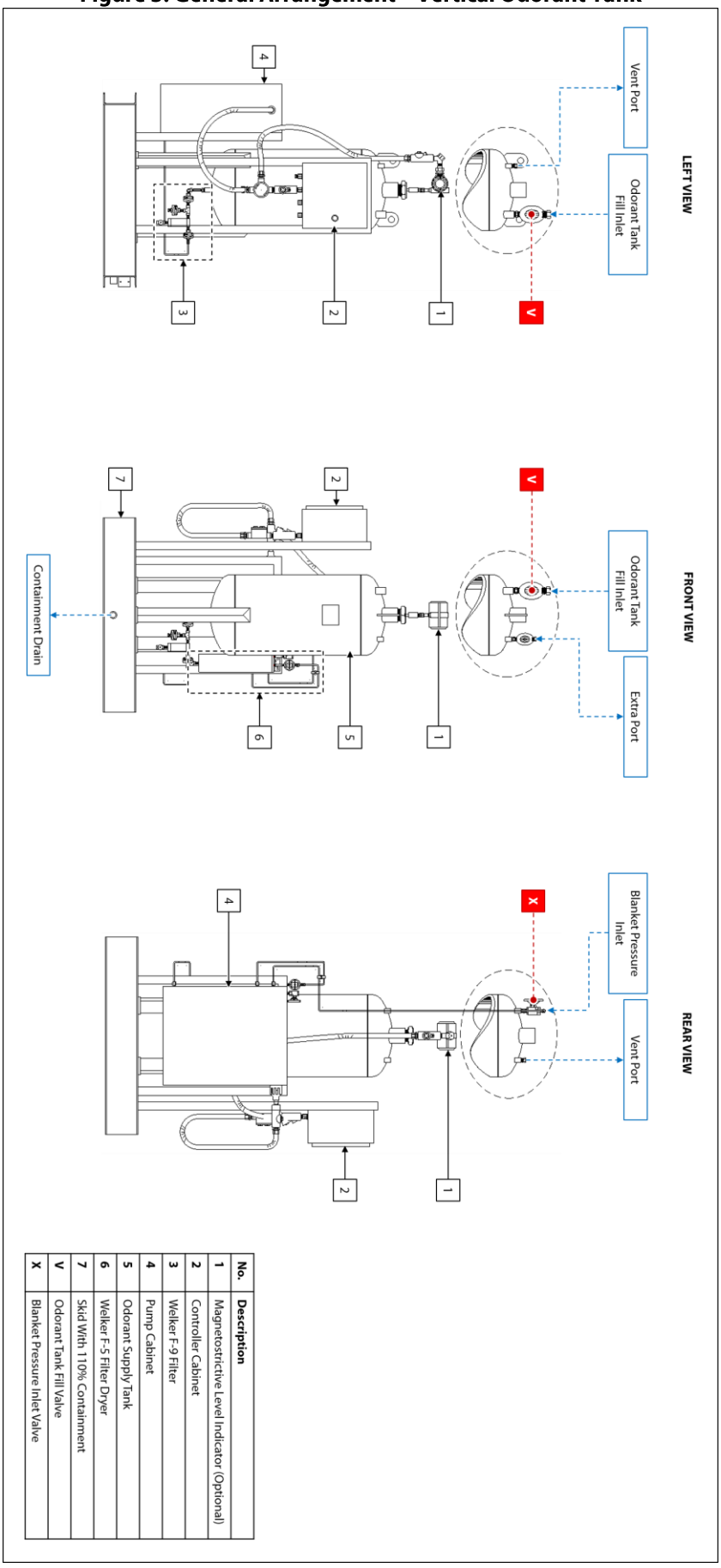


Figure 2: General Arrangement – Horizontal Odorant Tank



No.	Description
1	Controller Cabinet
2	Welker F-5 Filter Dryer
3	Pump Cabinet
4	Welker F-9 Filter
5	Skid With 110% Containment
6	Odorant Supply Tank
7	Dip Tape Level Gauge
V	Odorant Tank Fill Valve
W	Vent Valve
X	Blanket Pressure Inlet Valve

Figure 3: General Arrangement – Vertical Odorant Tank



No.	Description
1	Magnetostrictive Level Indicator (Optional)
2	Controller Cabinet
3	Welker F-9 Filter
4	Pump Cabinet
5	Odorant Supply Tank
6	Welker F-5 Filter Dryer
7	Skid With 110% Containment
V	Odorant Tank Fill Valve
X	Blanket Pressure Inlet Valve

Figure 4: PulseInject™ Valve Section Connections Diagram

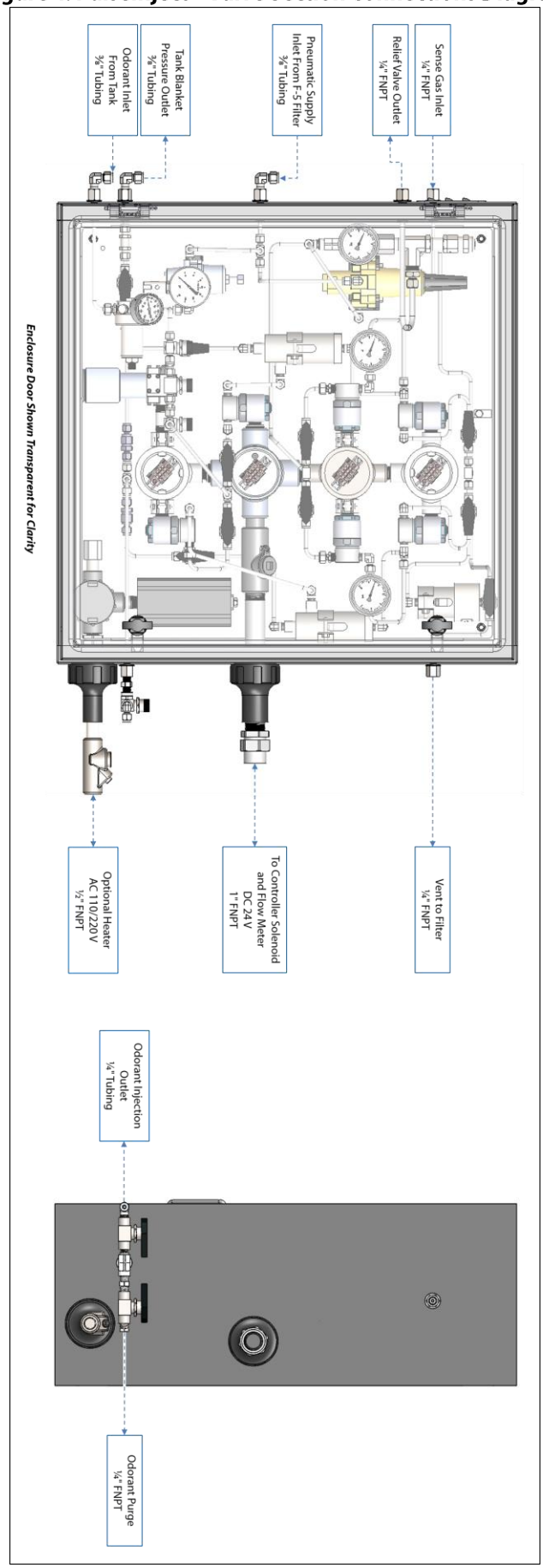
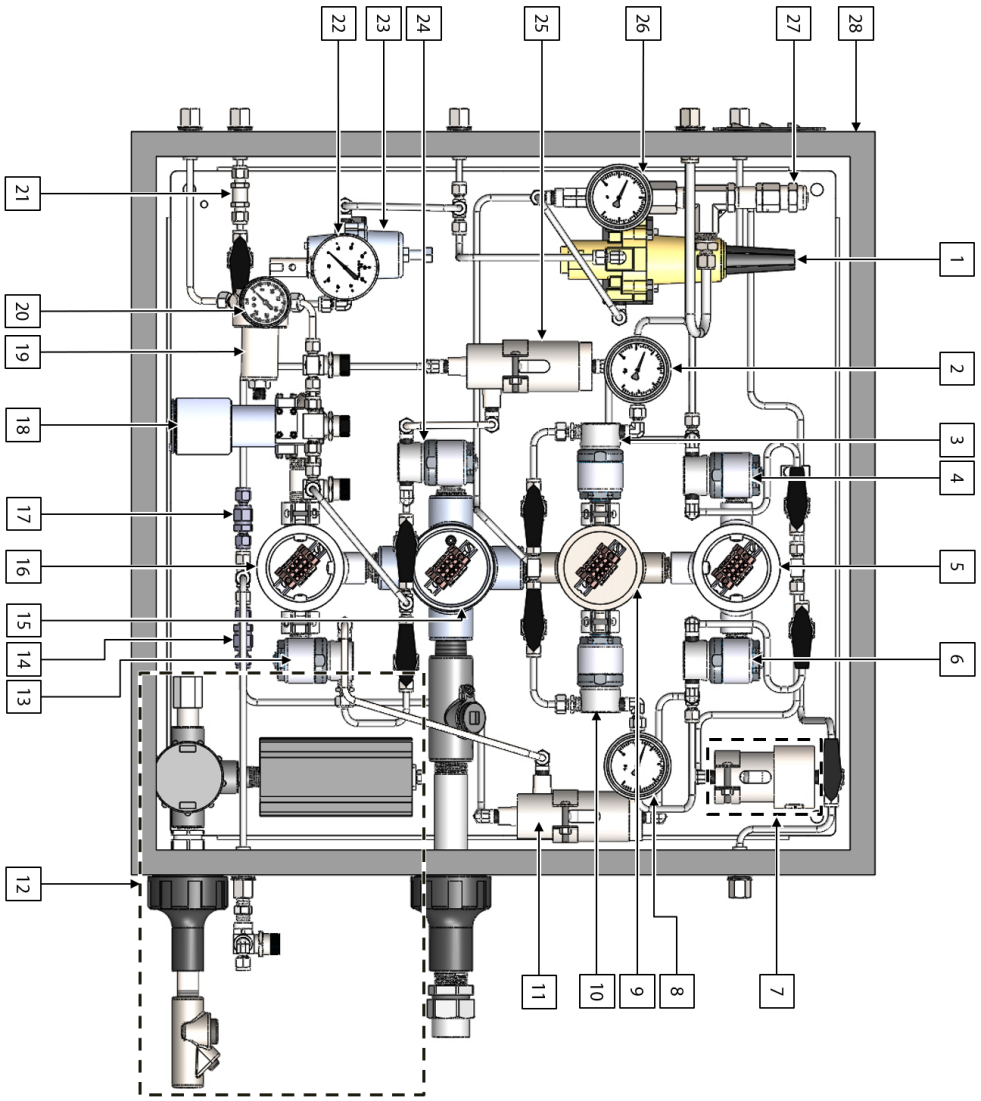


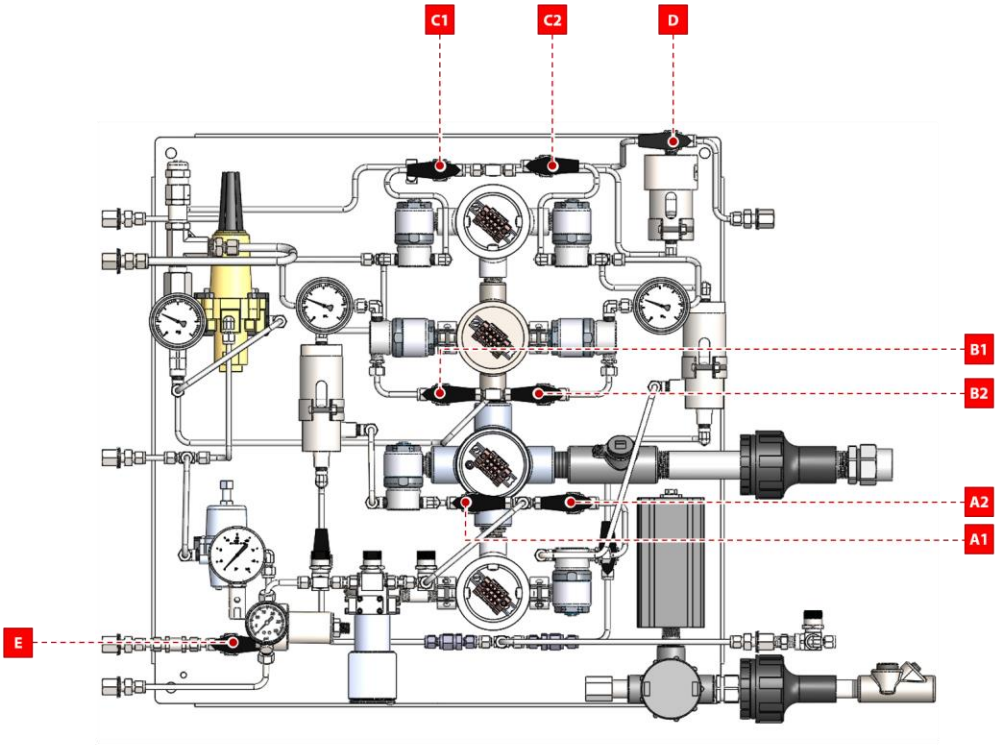
Figure 5: PulseInject™ Valve Section System Diagram



No.	Description
1	Pressure Regulator, Sense Gas
2	Pressure Gauge, Bank 1
3	Injection Solenoid, Bank 1
4	Vent Solenoid, Bank 1
5	Junction Box 1
6	Vent Solenoid, Bank 2
7	Welker ALS-1 Automatic Liquid Shutoff
8	Pressure Gauge, Bank 2
9	Junction Box 2
10	Injection Solenoid, Bank 2
11	Sight Volume Chamber, Bank 2
12	Optional Heater Assembly
13	Fill Solenoid, Bank 2
14	Check Valve, Bank 2
15	Junction Box 3
16	Junction Box 4
17	Check Valve, Bank 1
18	Odorant Flow Meter
19	Welker IR-4 Instrument Regulator (Optional for Low Volume)
20	Pressure Gauge (Optional for Low Volume)
21	Tank Blanket Pressure Outlet Check Valve
22	Pressure Gauge
23	Tank Blanket Pressure Regulator
24	Fill Solenoid, Bank 1
25	Sight Volume Chamber, Bank 1
26	Pressure Gauge
27	Relief Valve
28	Enclosure
Enclosure Door Not Shown for Clarity	

Figure 6: PulseInject™ Valve Section Valve Diagram

FRONT VIEW

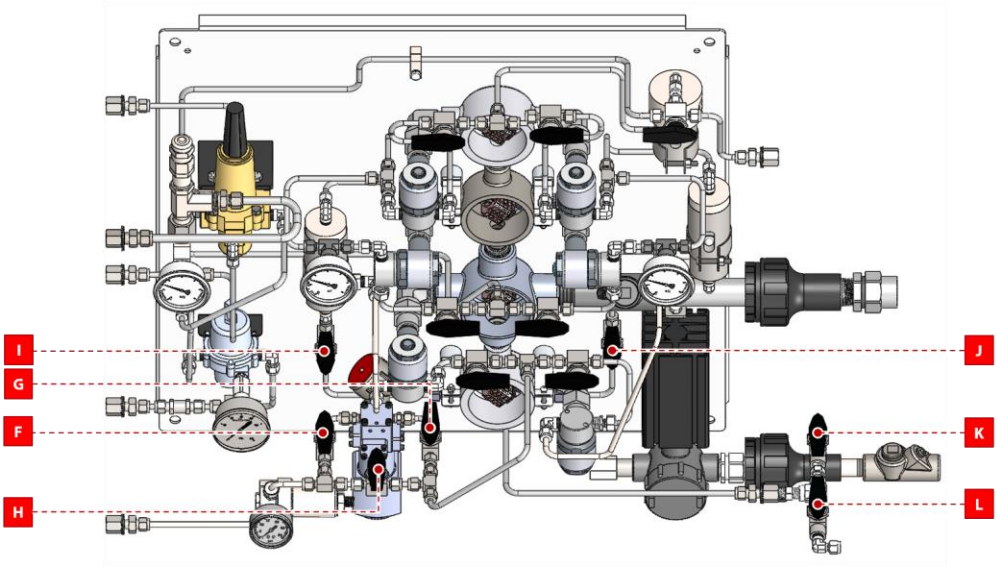


VALVE HANDLE ORIENTATION:
3-WAY LIQUID SHUTOFF VALVE D

PURGE POSITION

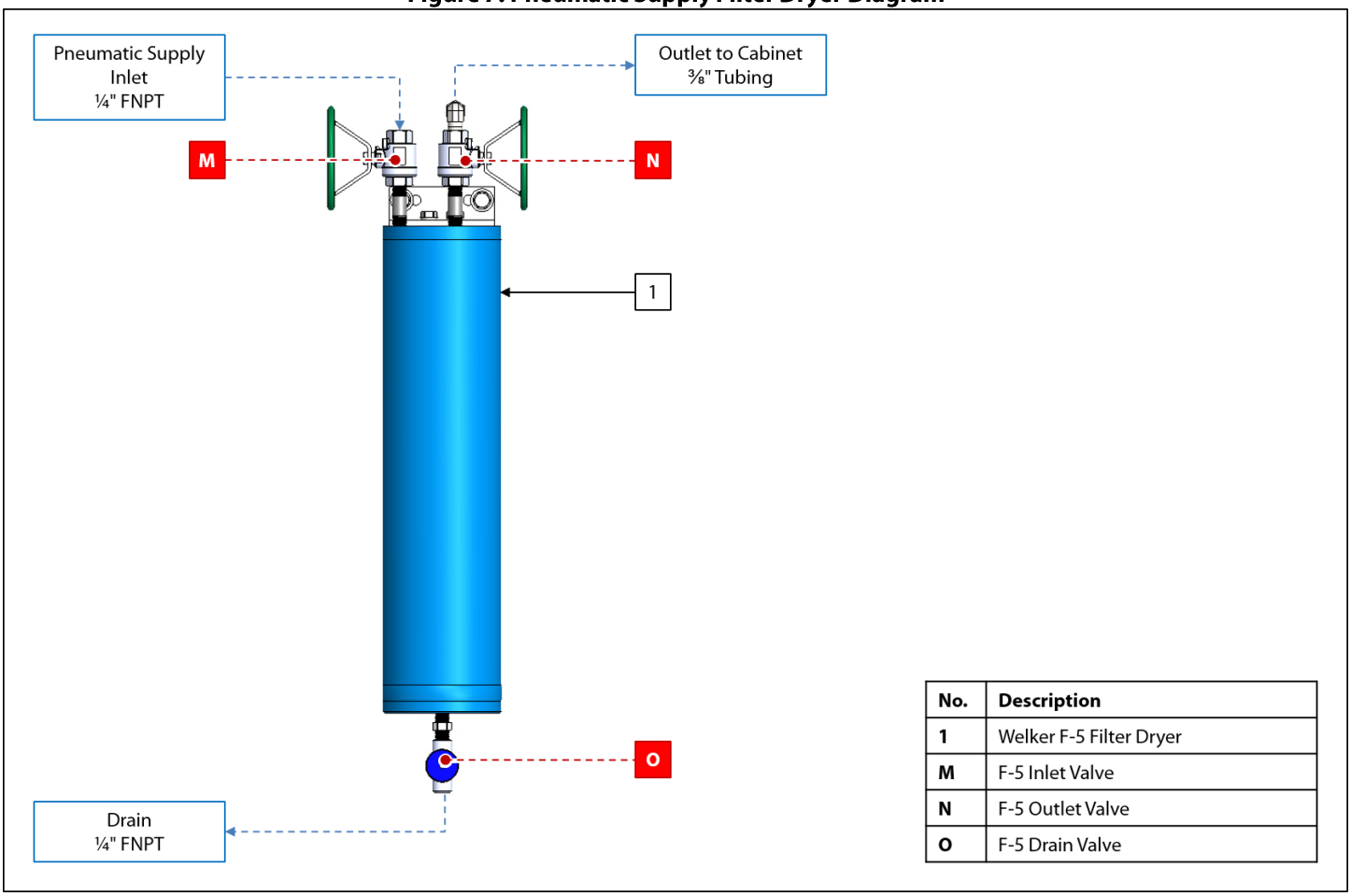
VENT POSITION

FRONT VIEW, ANGLED



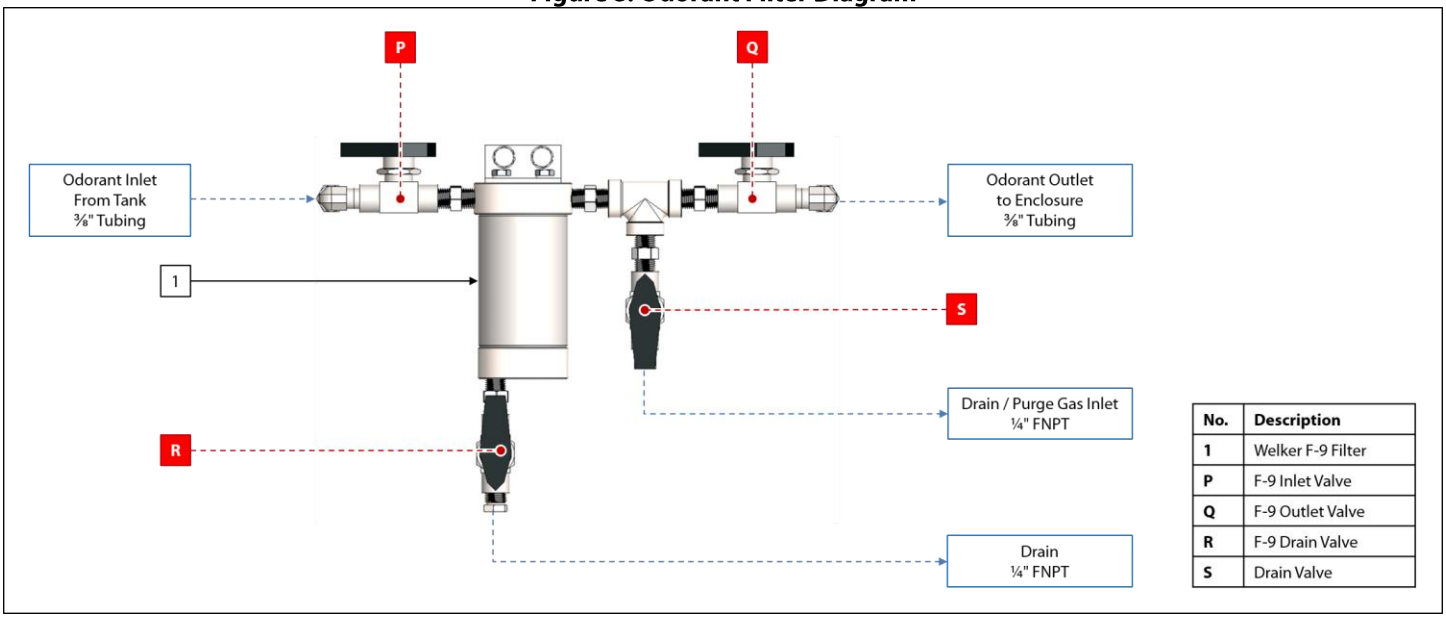
No.	Description
A1	Odorant Inlet Valve, Bank 1
A2	Odorant Inlet Valve, Bank 2
B1	Injection Gas Inlet Valve, Bank 1
B2	Injection Gas Inlet Valve, Bank 2
C1	Vent Outlet Valve, Bank 1
C2	Vent Outlet Valve, Bank 2
D	3-Way Liquid Shutoff Valve
E	Tank Blanket Pressure Outlet Valve
F	Odorant Flow Meter Inlet Valve
G	Odorant Flow Meter Outlet Valve
H	Odorant Flow Meter Bypass Valve
I	Injection Isolation Valve, Bank 1
J	Injection Isolation Valve, Bank 2
K	Odorant Prime/Purge Outlet Valve
L	Odorant Injection Outlet Valve
Shown Without Enclosure for Clarity	

Figure 7: Pneumatic Supply Filter Dryer Diagram



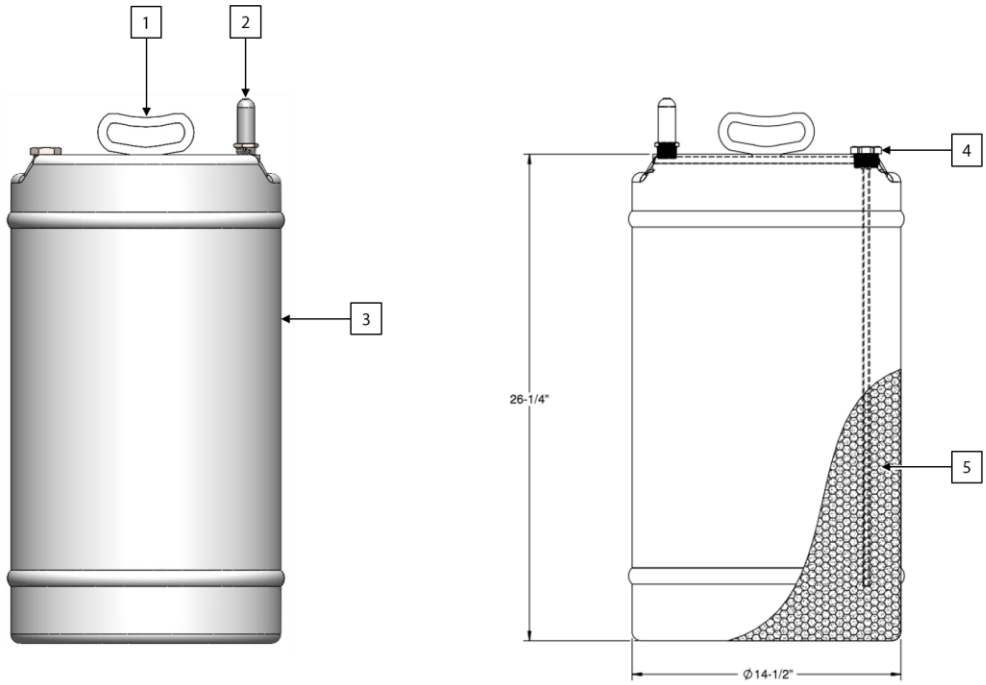
No.	Description
1	Welker F-5 Filter Dryer
M	F-5 Inlet Valve
N	F-5 Outlet Valve
O	F-5 Drain Valve

Figure 8: Odorant Filter Diagram



No.	Description
1	Welker F-9 Filter
P	F-9 Inlet Valve
Q	F-9 Outlet Valve
R	F-9 Drain Valve
S	Drain Valve

Figure 9: Welker Atmospheric Exhaust Filter



No.	Description
1	Handle
2	Muffler
3	Container, 15 US Gallons
4	Sample Probe
5	Filter Media

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 PulseInject™ 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 PulseInject™ 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.
3. Connect the skid drain port(s) to an appropriate draining location.

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 (minimum), connect from the outlet of the pipeline upstream of the regulated pressure drop to the inlet of the Welker F-5 Filter Dryer (*Figure 7*).
6. If necessary, connect the F-5 outlet to the pneumatic supply inlet on the valve section using customer-supplied ⅜" tubing (*Figure 7*).
7. If necessary, connect the odorant tank to the Welker F-9 Filter inlet using customer-supplied ⅜" tubing (*Figure 8*).
8. If necessary, connect the F-9 outlet to the odorant inlet on the valve section using customer-supplied ⅜" tubing (*Figure 8*).
9. Using customer-supplied ⅜" tubing, connect from the outlet of the pipeline downstream of the regulated pressure drop to the sense gas inlet on the valve section (*Figure 4*).
10. Using customer-supplied ¼" tubing (maximum), connect from the odorant injection outlet on the valve section to an injection point on the natural gas pipeline downstream of the regulated pressure drop (*Figure 4*).
11. If necessary, connect from the cabinet vent to the atmospheric exhaust filter using customer-supplied ¼" tubing (minimum) (*Figure 4* and *Figure 9*).
12. If desired, connect from the odorant purge to the odorant tank using customer-supplied ¼" tubing (*Figure 1*, *Figure 2*, and *Figure 4*).

Electrical Connections

Turn OFF the electrical supply prior to making electrical connections.

13. Connect a DC 24 V electrical supply to the controller (*Figure 4*). 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.

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

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

15. If the PulseInject™ is not equipped with the optional flag tracker level indicator, installation is now complete; proceed to *Section 2.3, Start-Up Procedures*. If the PulseInject™ is equipped with the optional flag tracker level indicator, continue to step 16.

Flag Tracker Level Indicator (Optional)

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.

16. Remove the bottom drain flange from the base of the level indicator.
17. 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.

18. Replace the shipping gasket with the provided gasket.
19. 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.

Pneumatic Supply Pressure Regulator

3. As necessary, open any valves between the outlet on the natural gas pipeline and the F-5 inlet (*Figure 7*).
4. Open F-5 inlet valve M and F-5 outlet valve N (*Figure 7*).
5. Apply natural gas to the pneumatic supply inlet on the valve section to pressurize the sense gas pressure regulator (*Figure 4* and *Figure 5*).

> The pneumatic supply pressure regulator comes factory-set to the setting required to operate the solenoids.

Tank Blanket Pressure

6. Open tank blanket pressure outlet valve E (*Figure 6*).
7. Check the tank blanket pressure connections for leaks and repair as necessary.

Priming the PulseInject™

8. Open tank blanket pressure outlet valve E (*Figure 6*).
9. If necessary, set the tank blanket pressure regulator according to the recommended settings in Table 3 (*Figure 5* and *Table 3*).

Table 3: Odorant Pressure Required for Injection Volume	
Pressure (psig)	**Recommended Injection Volume (cc)**
7–8	.1–.5
15–50	.5–15

The optional low flow instrument regulator is required to maintain 7–8 psig (*Figure 3*).

10. If applicable, set the low flow instrument regulator (*Figure 5* and *Table 3*).
11. Open odorant flow meter bypass valve H (*Figure 6*).
12. At the same time, **slowly** open odorant flow meter inlet valve F and odorant flow meter outlet valve G (*Figure 6*).
13. Open odorant inlet valves A1 and A2 (*Figure 6*).
14. Open bank 1 injection isolation valve I and bank 2 injection isolation valve J (*Figure 6*).
15. The sense gas pressure regulator comes factory-set at 50 psid (*Figure 5*). See Table 4 for recommended settings. Refer to the *Installation, Operation, and Maintenance* (IOM) *Manual* for the sense gas pressure regulator for instructions on setting the pressure regulator.

Table 4: Minimum Injection Distance		
Injection Pipeline Pressure (psig)	**ft/s @ 25 psid**	**ft/s @ 50 psid**
50	33	51
100	24	36
250	15	22
500	11	16
750	9	13
1000	8	11
1250	7	10
1500	6	9

16. Open bank 1 injection gas inlet valve B1 and bank 2 injection gas inlet valve B2 (*Figure 6*).
17. Open bank 1 vent outlet valve C1 and bank 2 vent outlet valve C2 (*Figure 6*).
18. Ensure 3-way liquid shutoff valve D is in the vent position (*Figure 6*).

Welker recommends operating each bank alternately instead of simultaneously to ensure each bank is working properly.

19. Ensure odorant prime/purge outlet valve K is in the closed position (*Figure 6*).
20. Ensure odorant prime/purge outlet valve K is connected to either the tank or the atmospheric exhaust filter (shipped separately).

Welker recommends the Welker Atmospheric Exhaust Filter for use with this unit if the odorant is not connected to the tank or pipeline (*Figure 9*).

21. Open odorant prime/purge outlet valve K (*Figure 6*).

22. From the PLC, select Setup from the Home screen (*Figure 10*). Enter the Troubleshooting submenu and select Force Injection Cycle (*Figure 39*).

> 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.

23. Close odorant flow meter bypass valve H (*Figure 6*).
24. Close odorant prime/purge outlet valve K (*Figure 6*).
25. Open odorant injection outlet valve L (*Figure 6*).

> STOP
>
> The bank 1 pressure gauge and bank 2 pressure gauge should both read 0 psig (*Figure 5*). If either pressure gauge has a reading over 0 psig, a buildup of pressure has occurred somewhere within the system. The system must be purged before odorant injection can begin. See *Section 2.3, Start-Up Procedures*, for instructions on purging the system.

26. The PulseInject™ is now primed.

Purging the PulseInject™

27. Turn 3-way liquid shutoff valve D to the purge position (*Figure 6*).
28. Close odorant injection outlet valve L (*Figure 6*).
29. Open odorant prime/purge outlet valve K (*Figure 6*).
30. From the PLC, select Setup from the Home screen (*Figure 10*). Enter the Troubleshooting submenu and press the ON button from the Purge display (*Figure 39*).

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

31. Open odorant injection outlet valve L (*Figure 6*).
32. Close odorant prime/purge outlet valve K (*Figure 6*).
33. Turn 3-way liquid shutoff valve D to the vent position (*Figure 6*).
34. From the PLC, select Setup from the Home screen (*Figure 10*). Enter the Troubleshooting submenu and select Force Injection Cycle (*Figure 39*).

> Welker recommends forcing the injection cycle a minimum of two times (2x) per bank. Note that the forced injection cycle will automatically alternate between both banks.

> STOP
>
> The bank 1 pressure gauge and bank 2 pressure gauge should both read 0 psig (*Figure 5*). If either pressure gauge has a reading over 0 psig, a buildup of pressure has occurred somewhere within the system. Repeat steps 27–34 until both bank 1 and bank 2 pressure gauges read 0 psig before continuing.

35. The system is now reset.

Controller Configuration

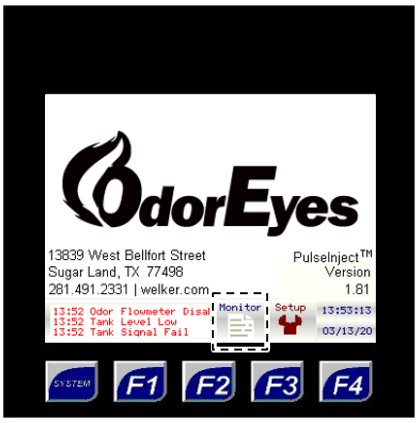
36. Verify that the customer set points have been correctly set by the manufacturer.
37. Once the collection and injection of liquid odorant have been confirmed, the PulseInject™ is operational.

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 10*).

Figure 10: 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:

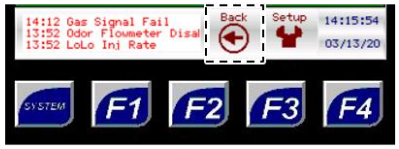
- **Menu –** From this type of screen, the user can access submenus.
- **Informational –** From this type of screen, the user can monitor the odorizer and view current operating conditions.
- **Setup –** From this type of screen, numeric and/or text values that affect the setup of the odorizer can be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

Navigating the Display

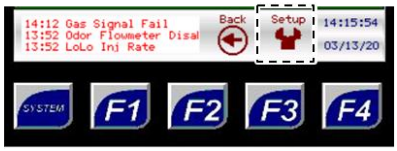
Figure 11: Toolbar and Function Keys

TOOLBAR

Alarms
View any active alarms.



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



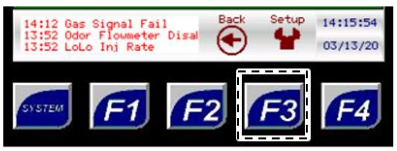
Setup Button
Takes you to the **Setup Menu** screen.

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 12*).

Figure 12: Current Alarms Screen

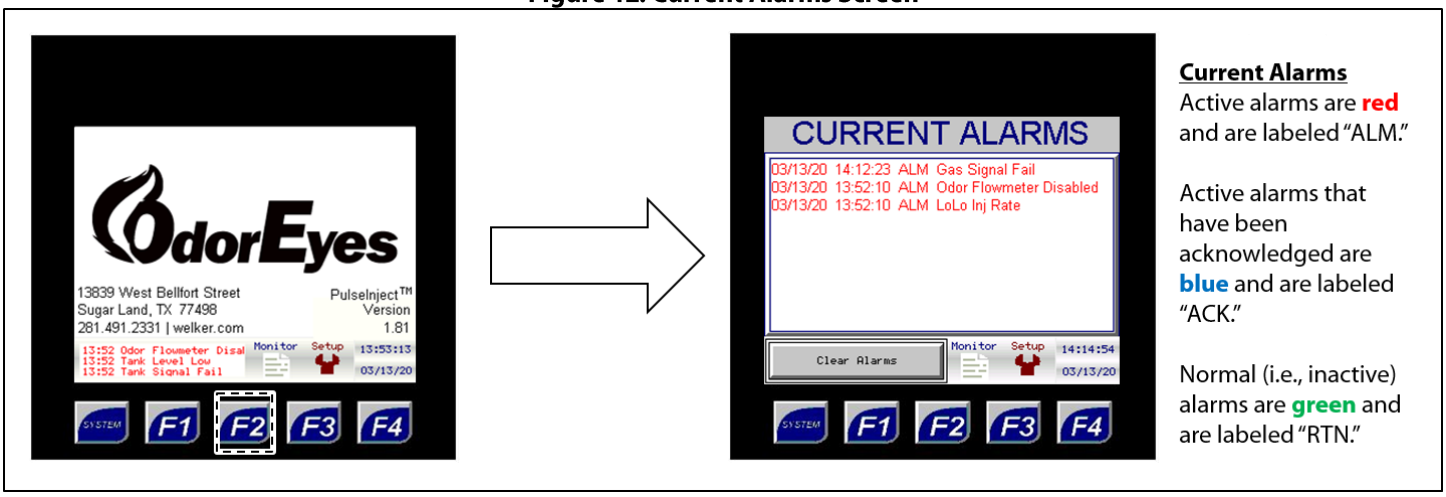


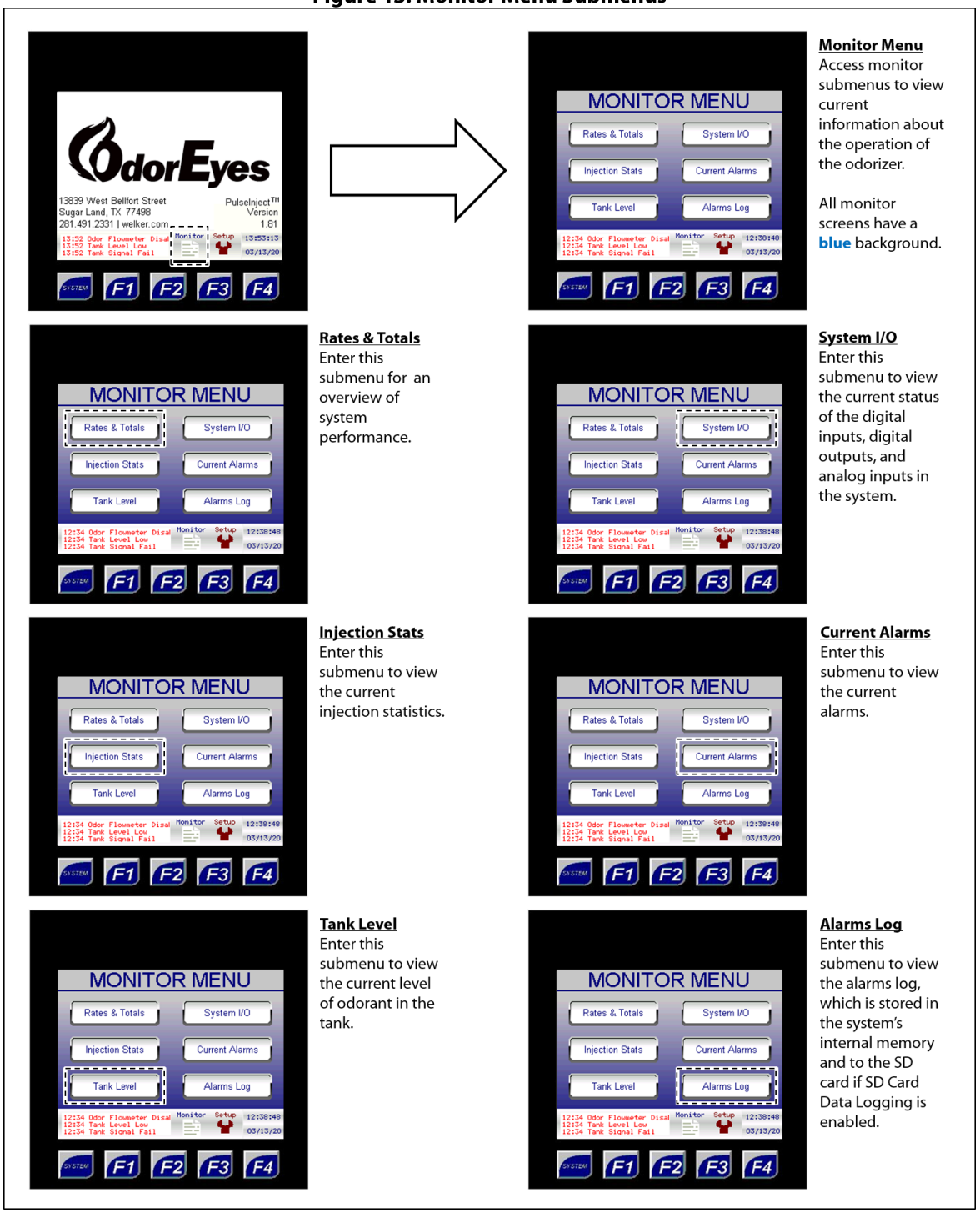
Table 5: Current Alarms	
Hi Inj Rate	Active if the injection output for a user-determined amount of cycles exceeds the allowable odorization rate The number of cycles can be set from the System Control submenu in the PLC.
Lo Inj Rate	Active if the injection output for a user-determined amount of cycles 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 13: 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.

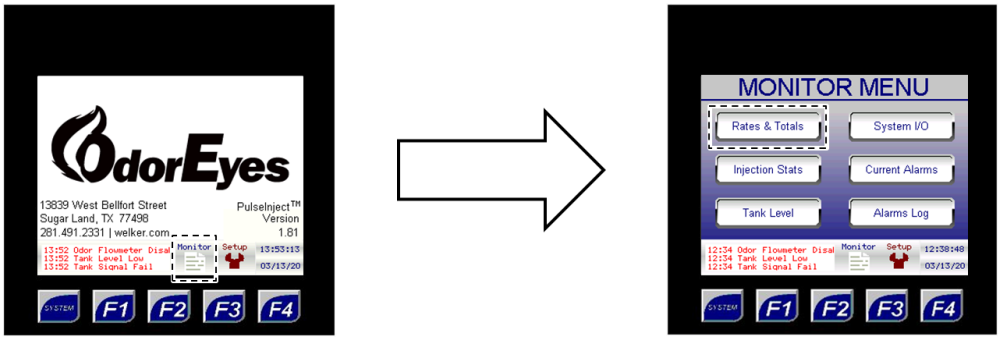
Tank Level
Enter this submenu to view the current level of odorant in the tank.

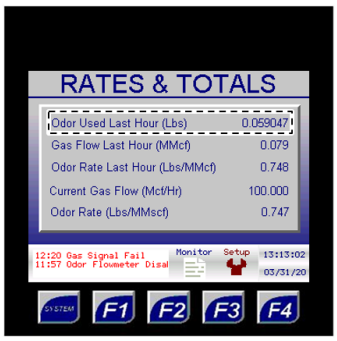
Alarms Log
Enter this submenu to view the alarms log, which is stored in the system's internal memory and to the SD card if SD Card Data Logging is enabled.

Rates & Totals

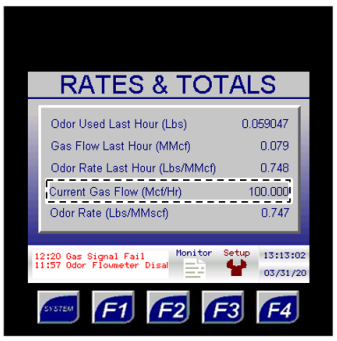
The Rates & Totals submenu provides the user with an overview of system performance.

Figure 14: Monitor Menu - Rates & Totals

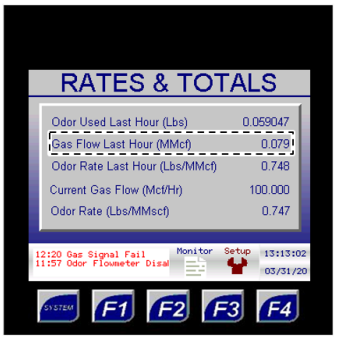




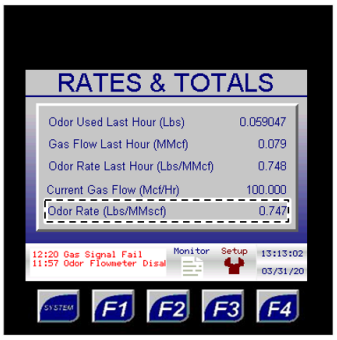
Odor Used Last Hour (Lbs)
The average number of pounds of odorant that have been injected into the pipeline over the previous hour.



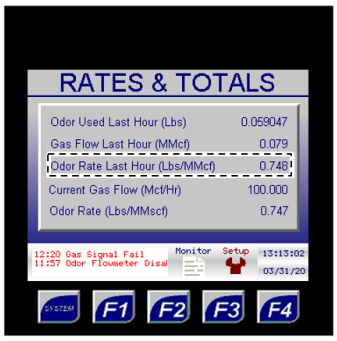
Current Gas Flow (Mcf/Hr)
The current volume of gas flowing in the pipeline relative to time.



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).

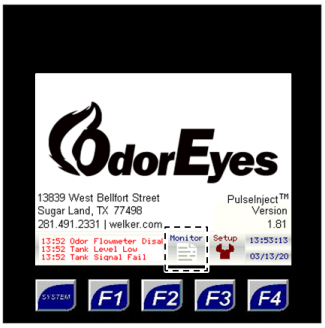


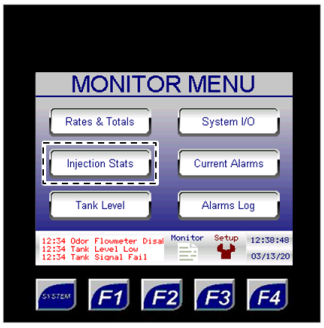
Odor Rate Last Hour (Lbs/MMcf)
The average odorization rate over the previous hour.

If the system status totals are used to track system performance, they should be periodically reset through the System Control submenu (*Figure 22*).

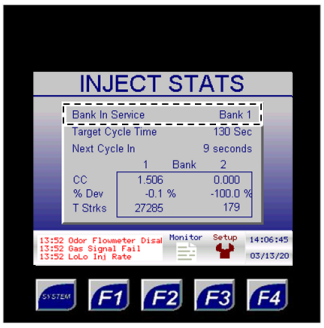
Injection Stats

Figure 15: Monitor Menu – Injection Stats

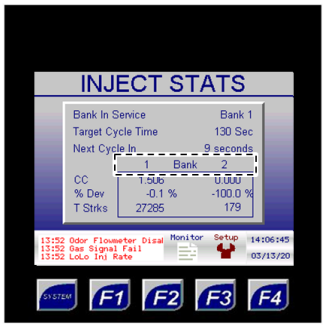




Injection Stats
Screen displays an overview of the bank injection statistics.

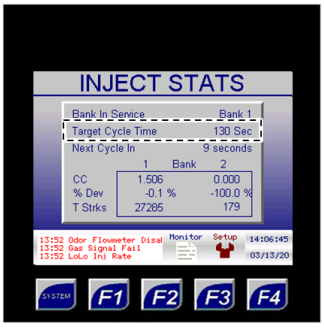


Bank In Service
This indicates which bank is currently injecting odorant into the pipeline.

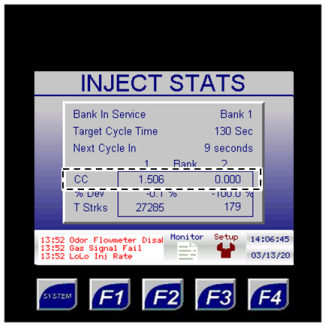


Bank
The (1) column displays statistics for bank 1.

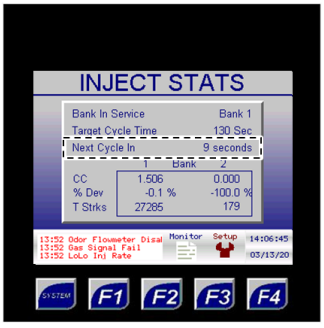
The (2) column displays statistics for bank 2.



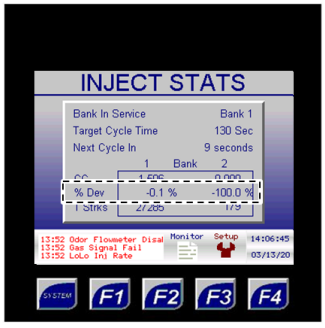
Target Cycle Time
This indicates the current cycle time (in seconds) of the bank in service.



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



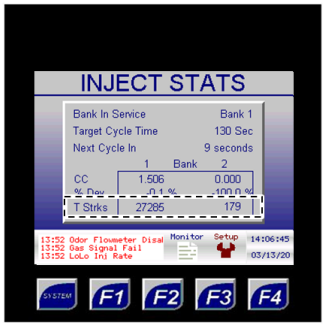
Next Cycle In
This is a countdown timer until the next cycle of the bank in service. The countdown time is given in seconds.



% 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.

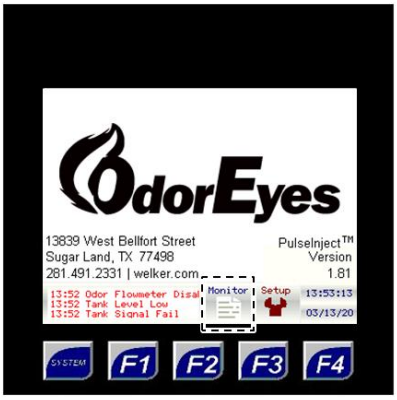


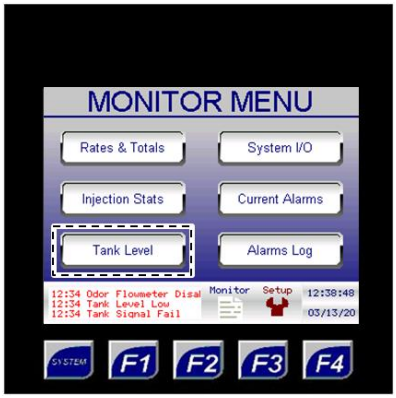
T Strks
The total number of cycles for the bank since the system was last reset by the user.

This should be reset after performing bank maintenance.

Odorant Tank Level

Figure 16: Monitor Menu – Tank Level





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

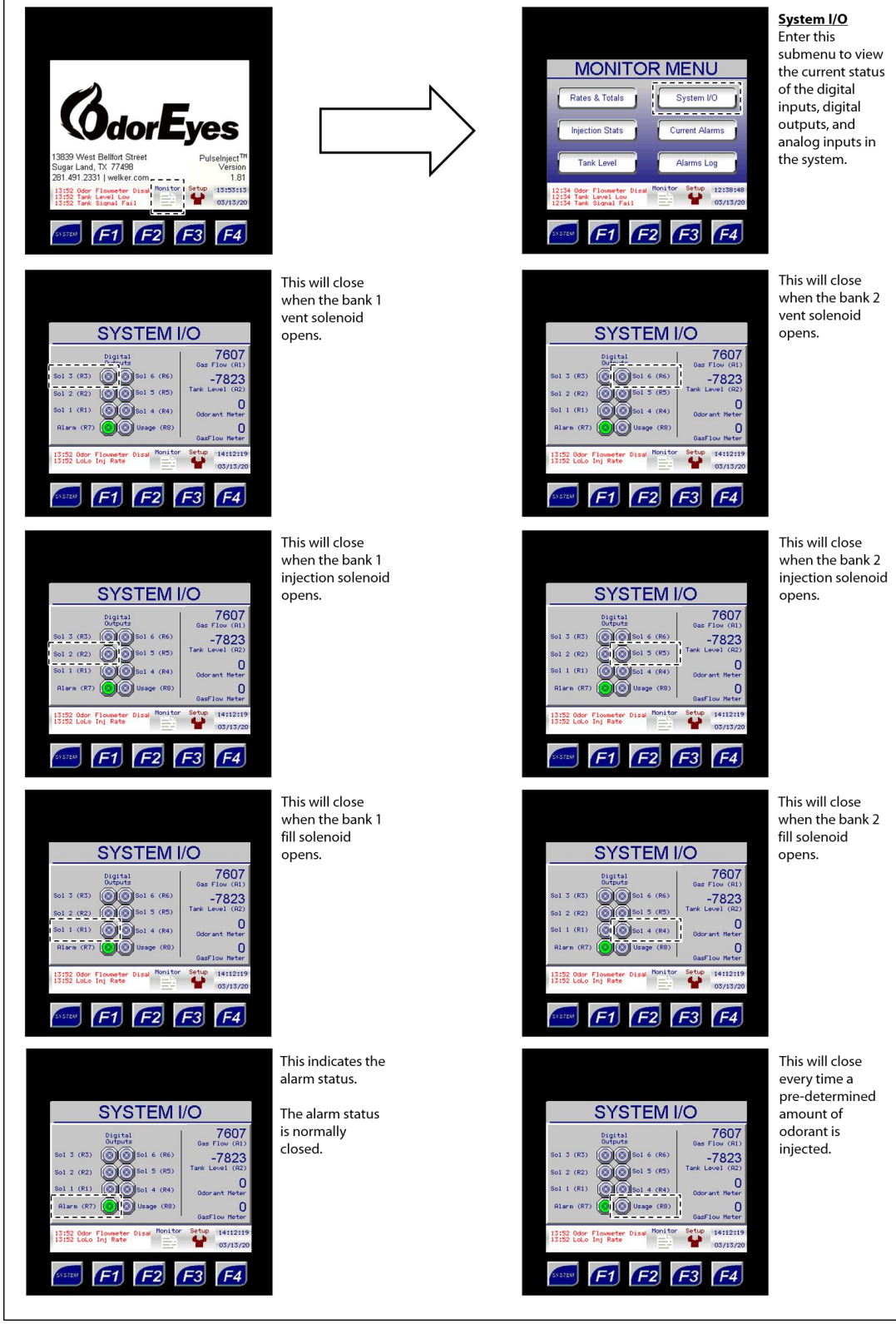
This screen displays the amount of odorant remaining in the odorant supply tank in inches, US gallons, pounds, and percent.

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 17: 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 close when the bank 1 vent solenoid opens.

This will close when the bank 2 vent solenoid opens.

This will close when the bank 1 injection solenoid opens.

This will close when the bank 2 injection solenoid opens.

This will close when the bank 1 fill solenoid opens.

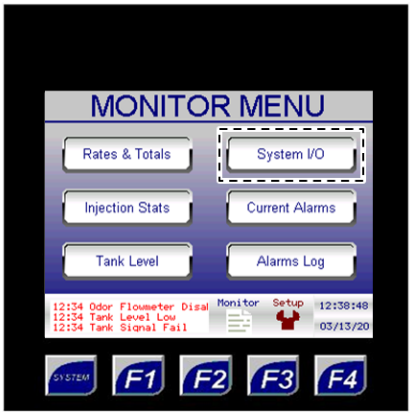
This will close when the bank 2 fill solenoid opens.

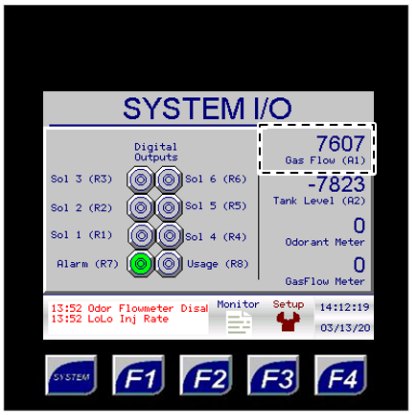
This indicates the alarm status.

The alarm status is normally closed.

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

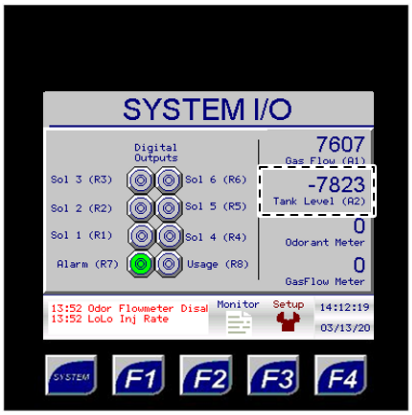
Figure 18: System I/O, 2 of 2



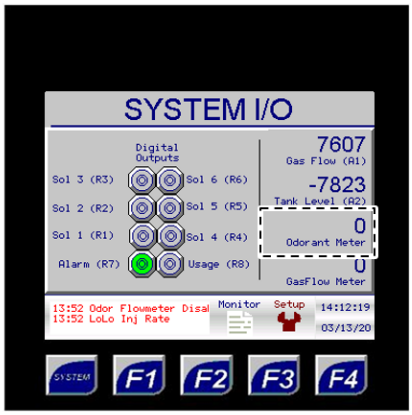


This analog signal is the raw count coming into the odorizer after the signal has been converted from milliamps. This value will vary according to the output from the customer gas flow meter.

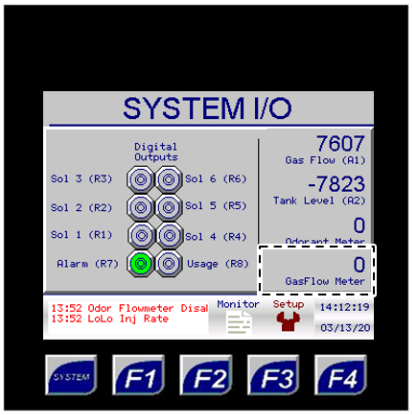
Analog Input Conversion	
Signal (mA)	**Raw Count**
4	6400
20	32000



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.

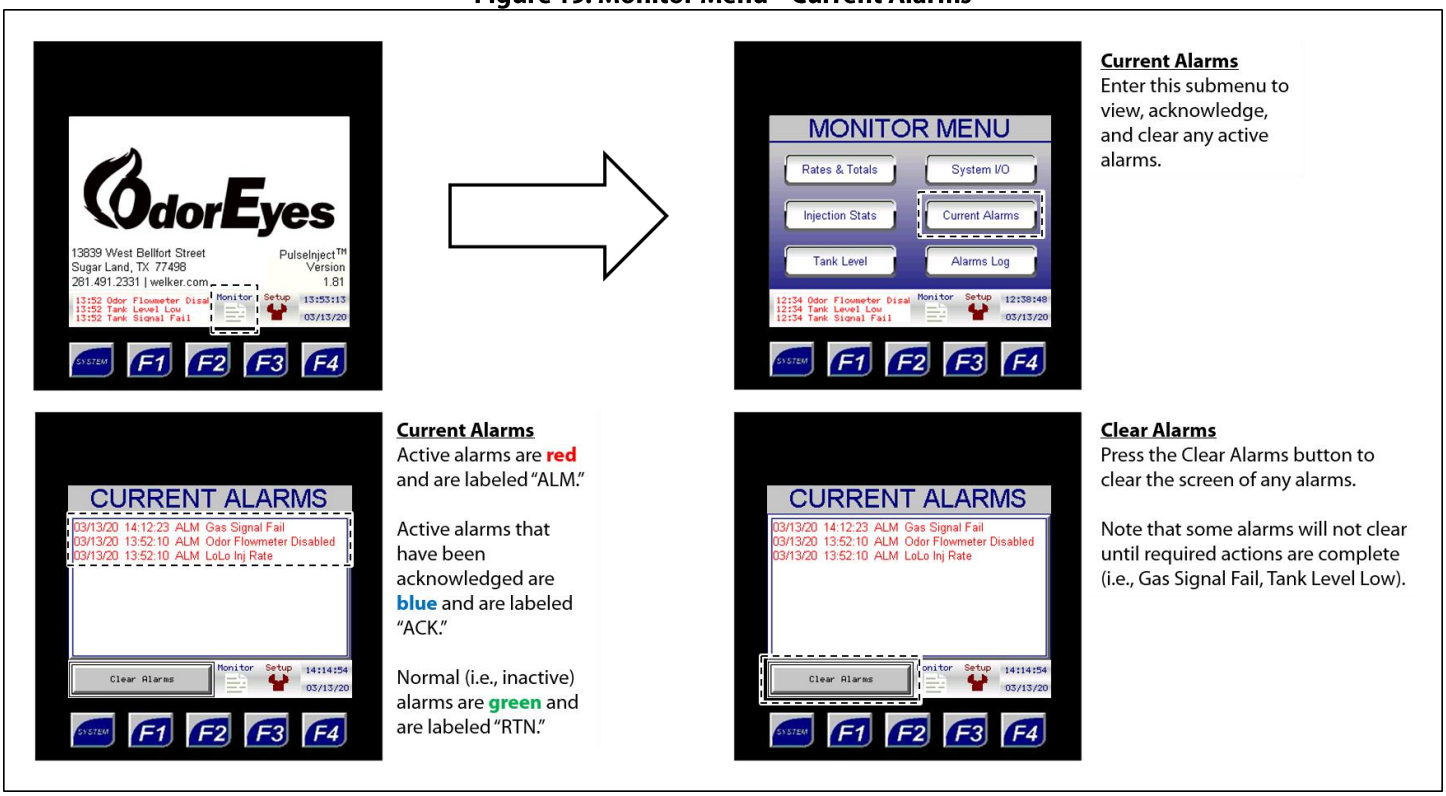


This value indicates how many high-speed pulses were received from the gas flow meter. Each pulse represents a fixed amount of gas that is configured in the Gas Flow Setup screen.

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 19: Monitor Menu – Current Alarms

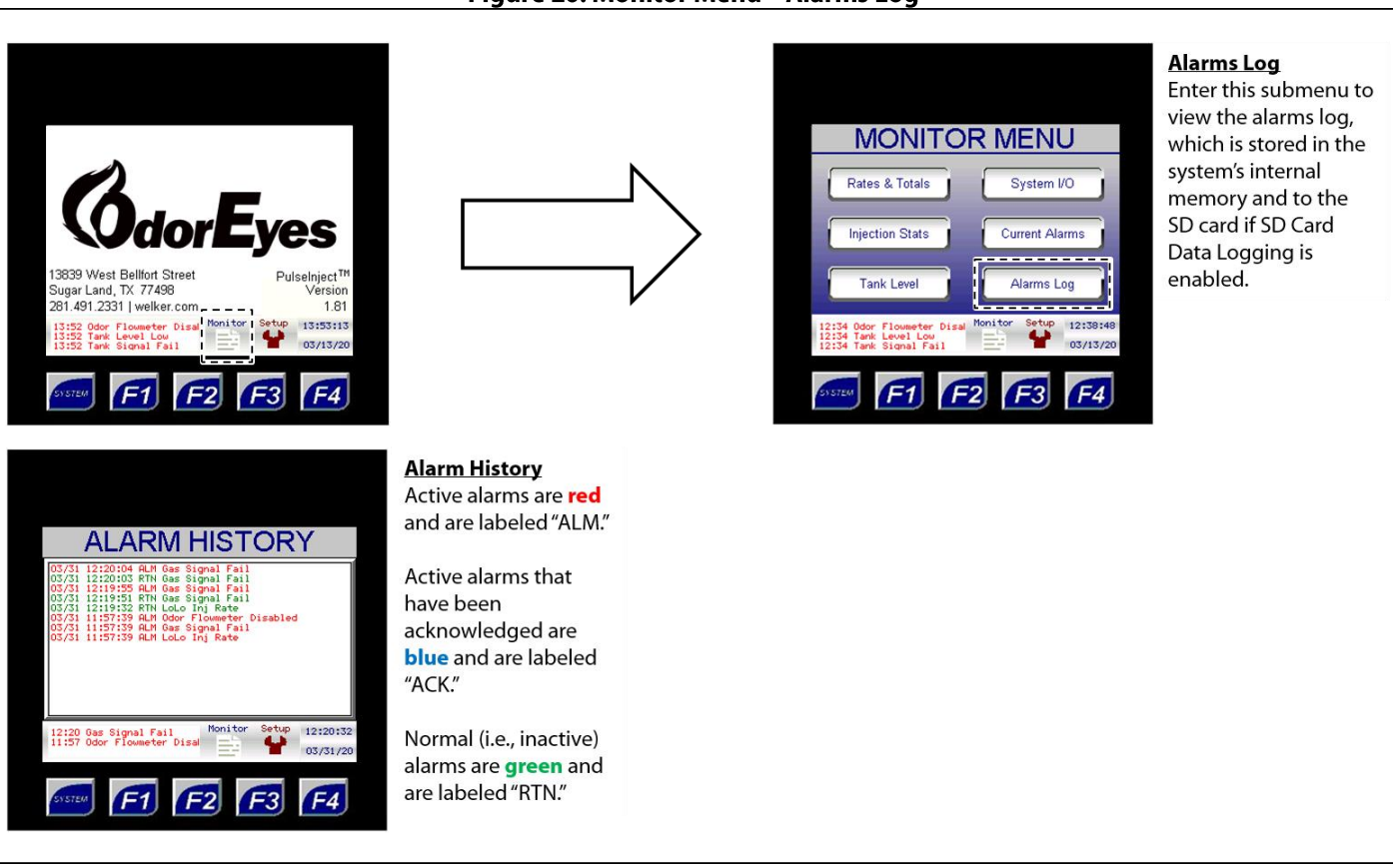


Alarms Log

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 20: 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."

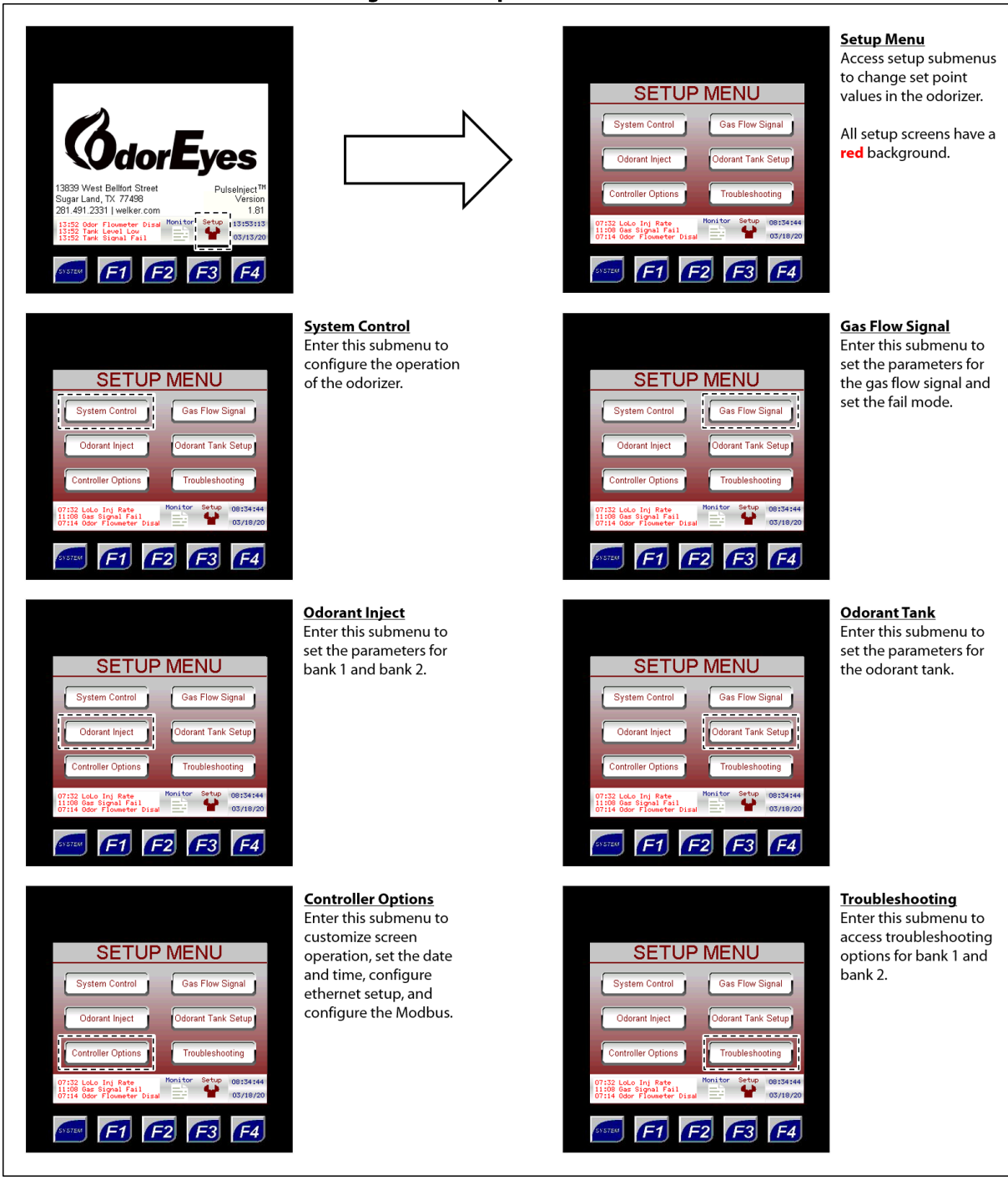
Normal (i.e., inactive) alarms are **green** and are labeled "RTN."

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 21: 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

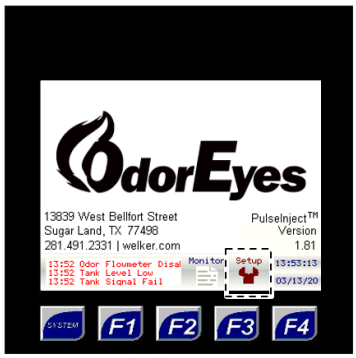
4. To change a text value, press on the value to be changed. A dropdown menu will appear on the screen.
5. Scroll through the value's options using the arrow keys in the dropdown menu.
6. Highlight the desired text value, and then press ENTER to save the changes.

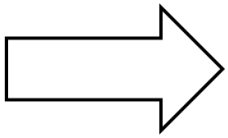
If a mistake is made while entering the new value or if the value does not need to be changed, press the home button to discard the changes and return to the Home screen.

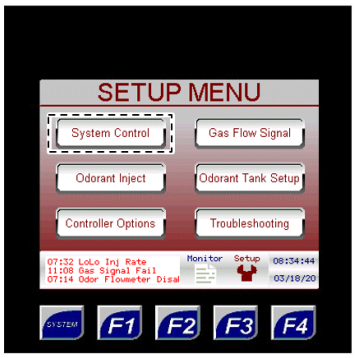
System Control

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

Figure 22: Setup Menu – System Control





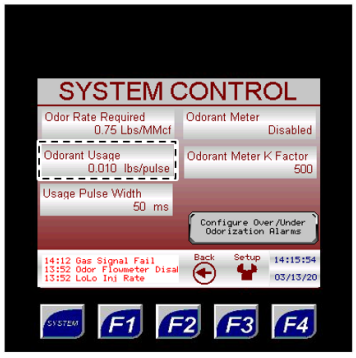


System Control
Enter this submenu to configure the operation of the odorizer.

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

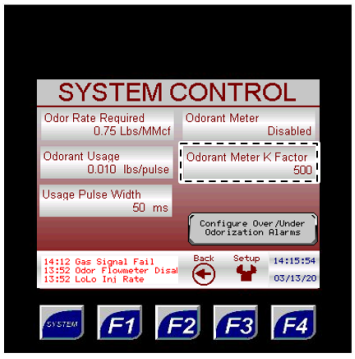
Odorant Meter
When enabled, each injection is measured, monitored, and recorded, and the cycle frequency will adjust based on this value.

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

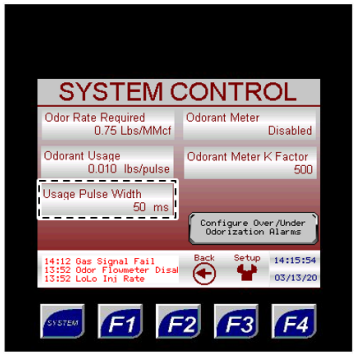


Odor Usage
Press to configure the amount of odorant, in pounds (lbs) used to generate a digital pulse output.

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.

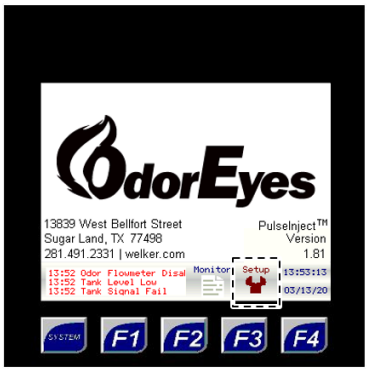
This is also the minimum amount of time the digital pulse output will stay de-energized. Thus, the total minimum cycle time of a digital pulse output is two times (2x) the Usage Pulse Width setting.

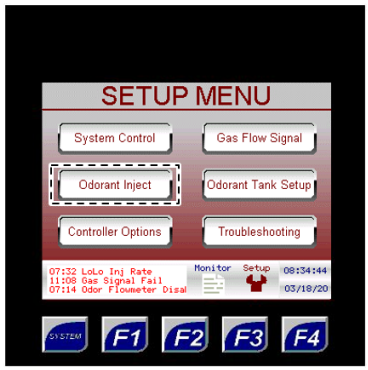
This is only for the odorant usage pulse output setting.

Odorant Inject

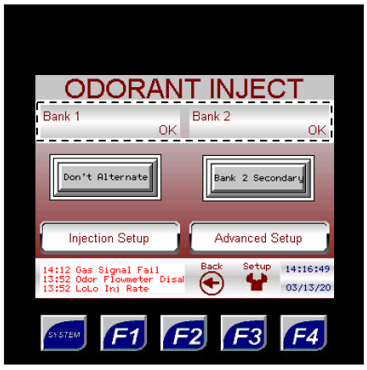
Through the Odorant Inject submenus, the user can input information for bank 1 and bank 2.

Figure 23: Setup Menu – Odorant Inject

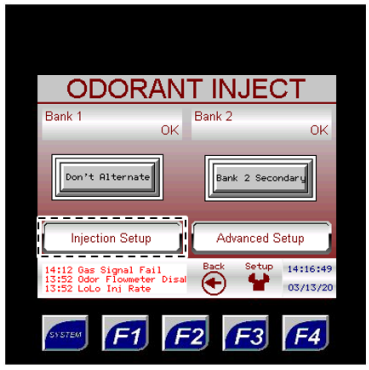




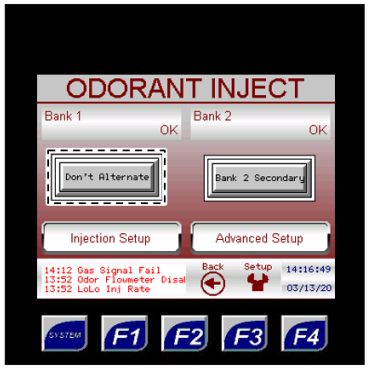
Odorant Inject
Enter this submenu to set the parameters for the odorant injection solenoids.



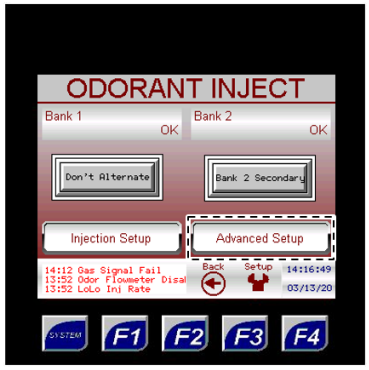
Bank 1 / Bank 2
View the current status of bank 1 and bank 2.



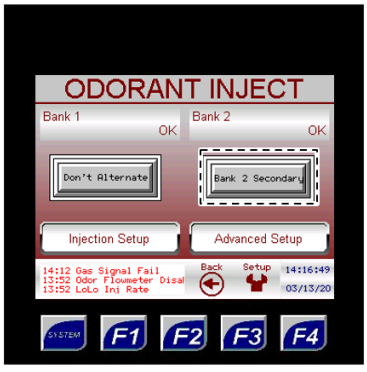
Injection Setup
Enter this submenu to set the known input of each injection, manually cycle the injection solenoid, reset the total number of injections, and reset the injection alarms.



Press to configure the alternating schedule between bank 1 and bank 2.

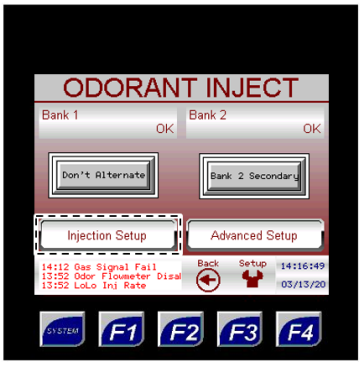


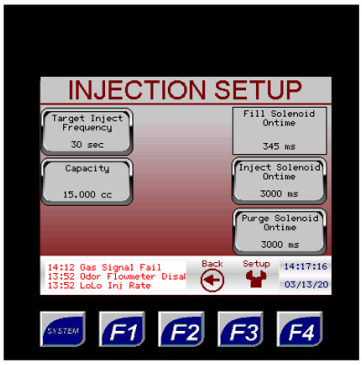
Advanced Setup
Enter this submenu to set the minimum cycle time and adjustment parameters for each bank.



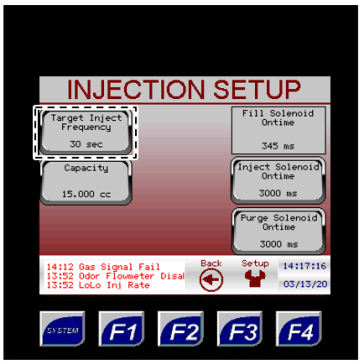
Press to set which bank is primary.

Figure 24: Odorant Inject – Injection Setup

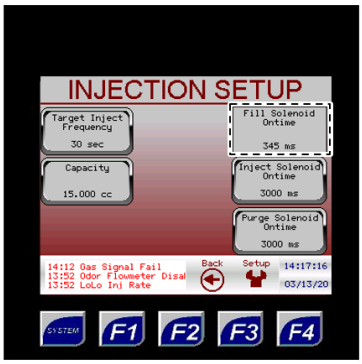




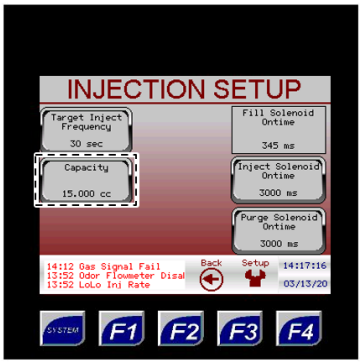
Injection Setup
Enter this submenu to set the known input of each injection, manually cycle the injection solenoid, reset the total number of injections, and reset the injection alarms.



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

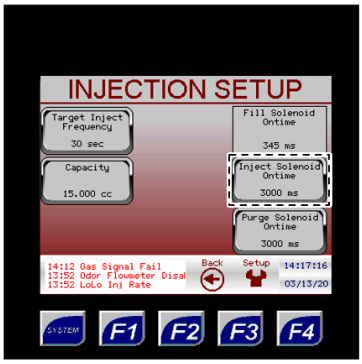


Fill Solenoid Ontime
This is a read-only calculated value. If it shows zero (0), the setup has not been fully completed.

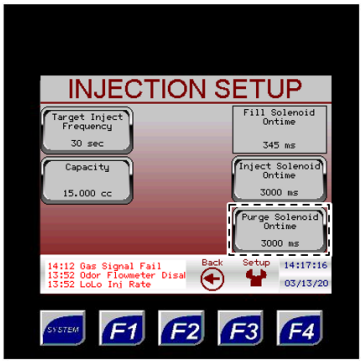


Capacity
Press to set the maximum volume of odorant the system can inject.

15 cc is the standard setting.



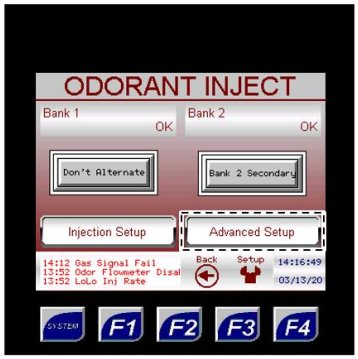
Inject Solenoid Ontime
Press to set how long the injection solenoid is actuated.

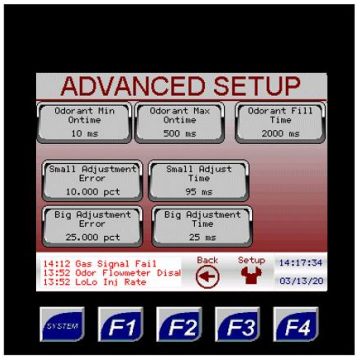


Purge Solenoid Ontime
Press to set how long the purge solenoid is actuated.

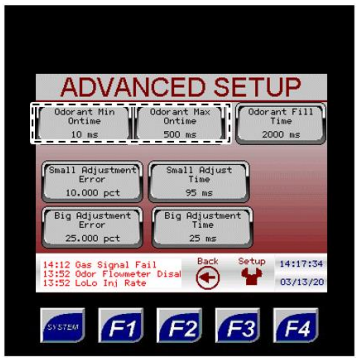
See *Table 4: Minimum Injection Distance,* for additional information.

Figure 25: Odorant Inject – Advanced Setup

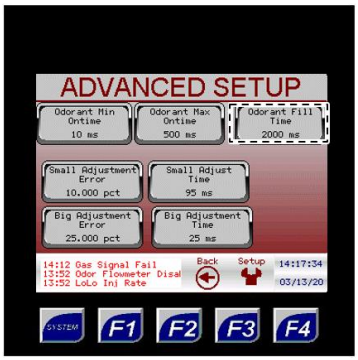




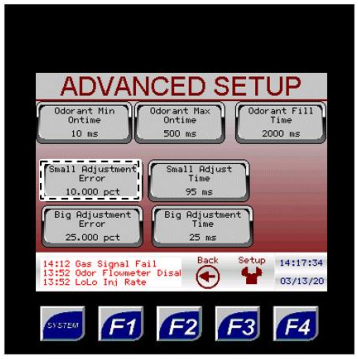
Advanced Setup
Enter this submenu to set the minimum cycle time and adjustment parameters for each bank.



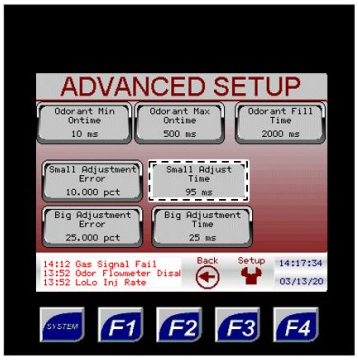
Odorant Min/Max Ontime
Press to set the minimum and maximum length of time the injection solenoid is allowed to actuate.



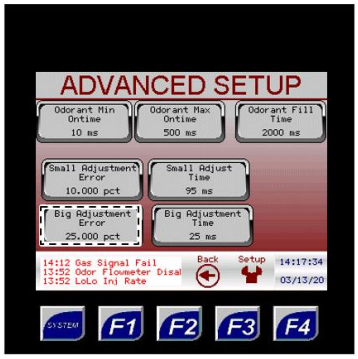
Odorant Fill Time
Press to set the length of time odorant is allowed to fill.



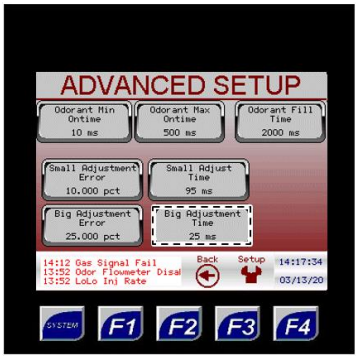
Small Adjustment Error
Press to configure the percent (%) value for small adjustment errors with the Odorant Fill Time.



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.



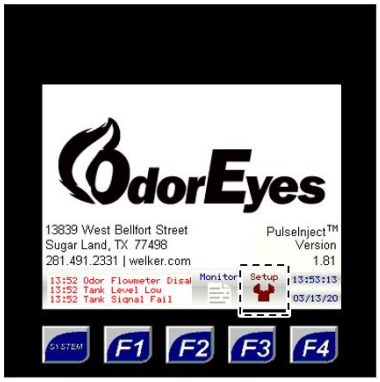
Big Adjustment Time
Press to configure the amount of time, in milliseconds (ms), the fill solenoid adjusts when a big adjustment error is observed.

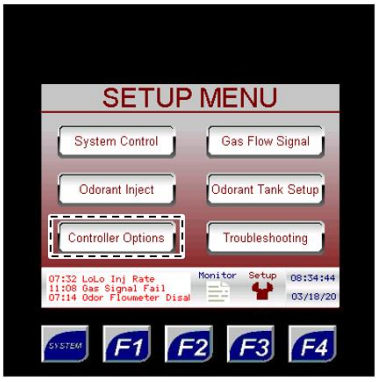
Advanced Setup screens should only be adjusted under the guidance of Welker technical support. Contact Welker if adjustments to the Advanced Setup screens are necessary.

Controller Options

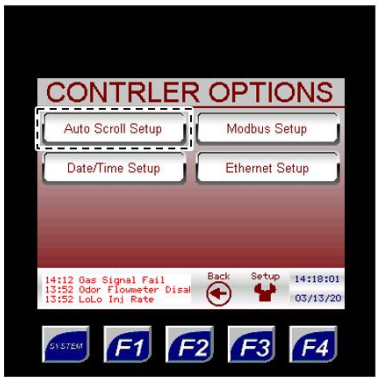
Through the Controller Options submenus, the user can customize the screen operation and set up communication for the controller.

Figure 26: Setup Menu – Controller Options

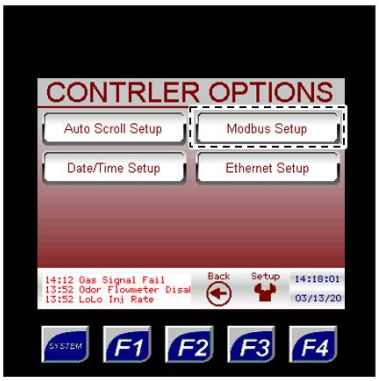




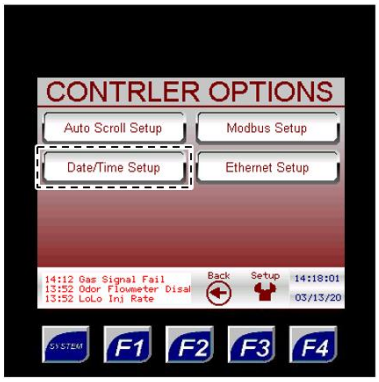
Controller Options
Enter this submenu to customize screen operation, set the date and time, configure ethernet setup, and configure the Modbus.



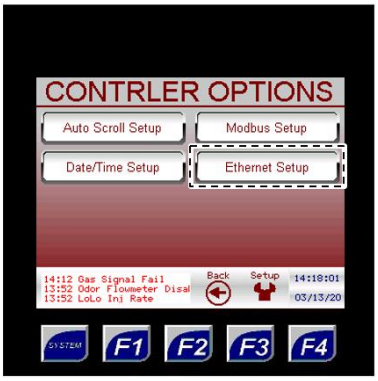
Auto Scroll Setup
Enter this submenu to customize screen operation.



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.



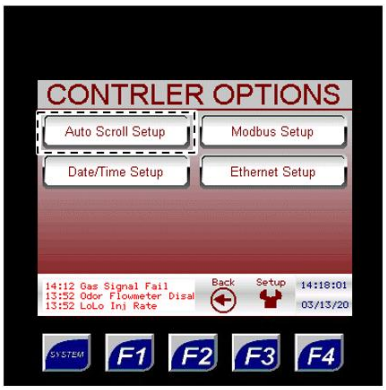
Date/Time Setup
Enter this submenu to change the date and time values and view the version of software the controller is running.



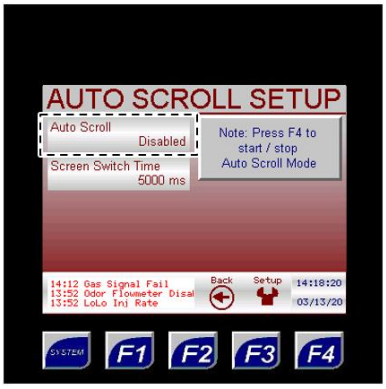
Ethernet Setup
Enter this submenu to configure the Ethernet connection and view its current status.

Auto Scroll Setup

Figure 27: Controller Options – Auto Scroll Setup



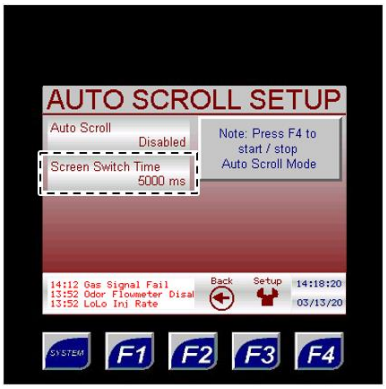
Auto Scroll Setup
Enter this submenu to customize screen operation.



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

See *Figure 28.*

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

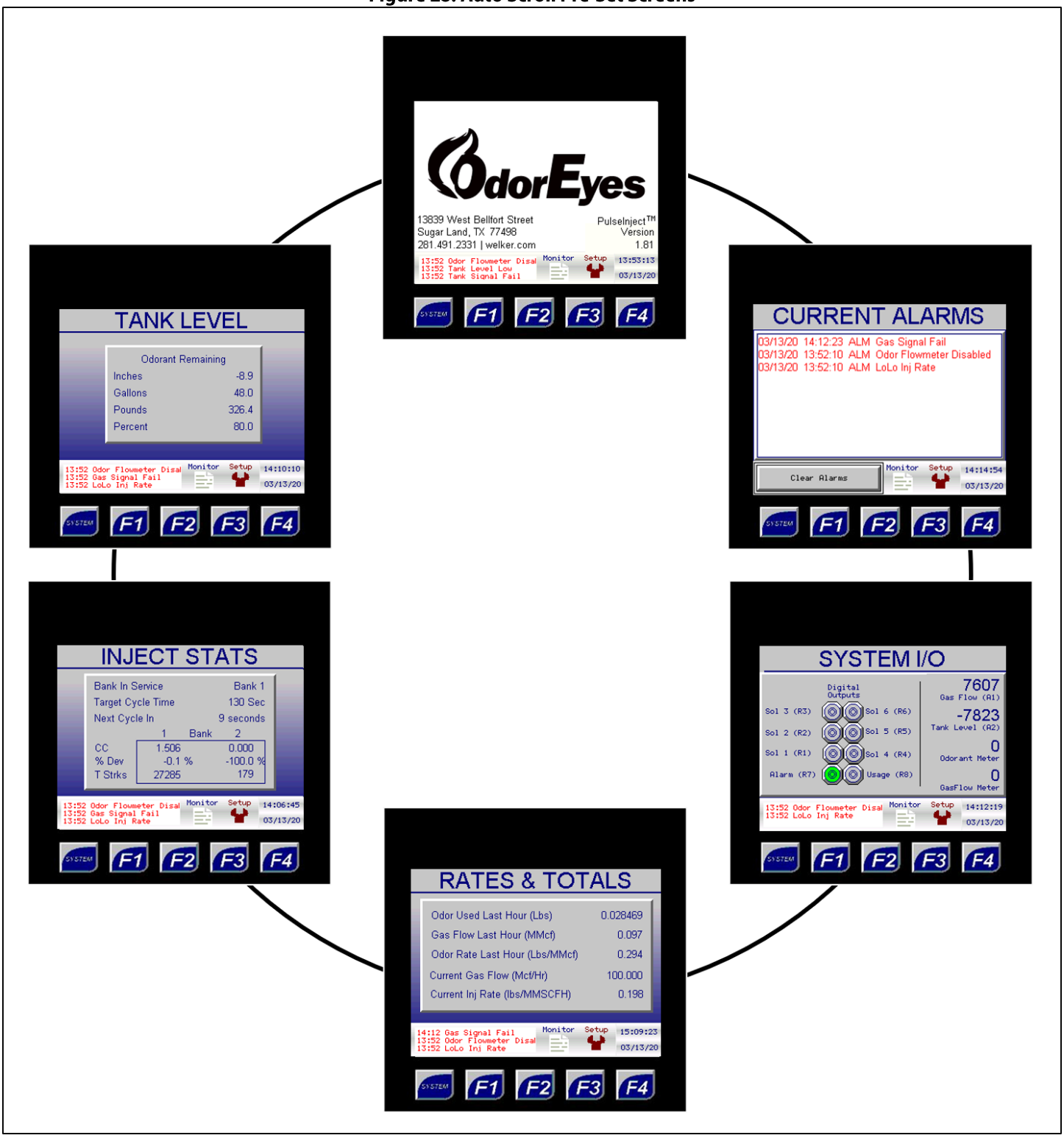


Screen Switch Time
When Auto Scroll is enabled, this is the length of time each of the pre-set screens will display before advancing to the next screen.

This value can be set by the customer.

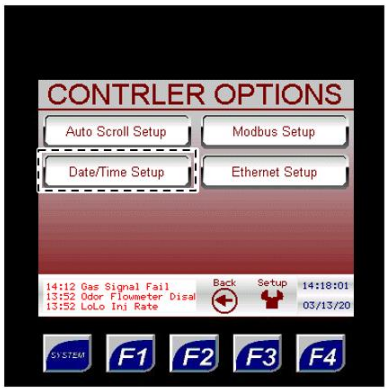
The Auto Scroll behavior can also be started by pressing the F4 function key.

Figure 28: Auto Scroll Pre-Set Screens

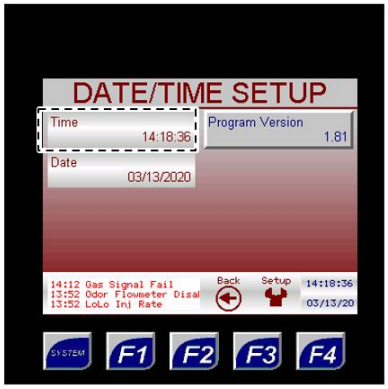


Date/Time Setup

Figure 29: Controller Options – Date/Time Setup

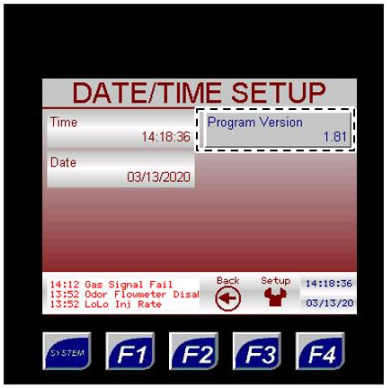


Date/Time Setup
Enter this submenu to change the date and time values and view the version of software the controller is running.

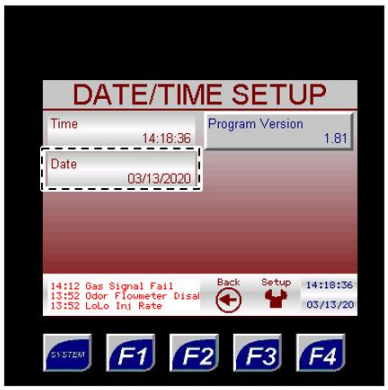


Time
Change the current time here.

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.

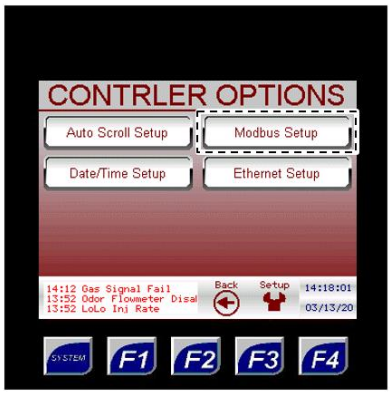


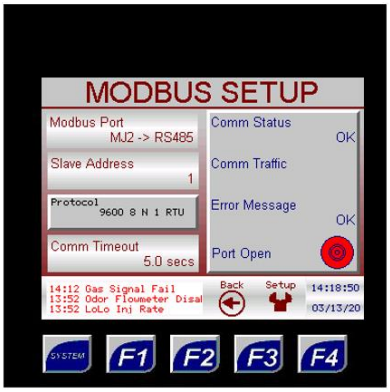
Date
Change the current date here.

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

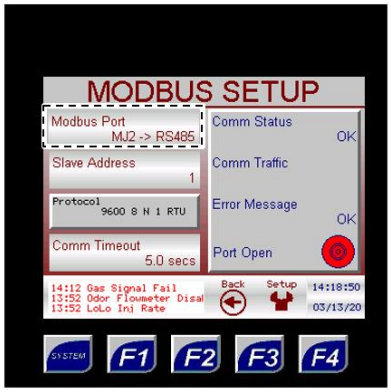
Modbus Setup

Figure 30: Controller Options – Modbus Setup

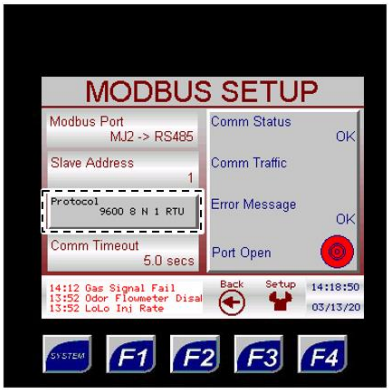




Modbus Setup
If the Modbus input method is used, enter this submenu to configure the Modbus input and view the current status of the Modbus.

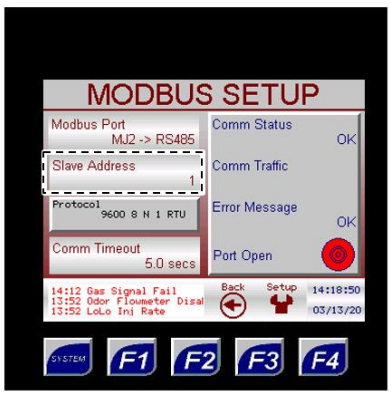


Modbus Port
Press to configure the port for the desired interface. MJ1 is for RS-232 and MJ2 is for RS-485.

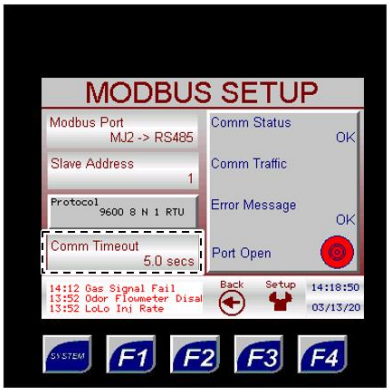


Protocol
The protocol setting applies to port MJ1 or MJ2 only.

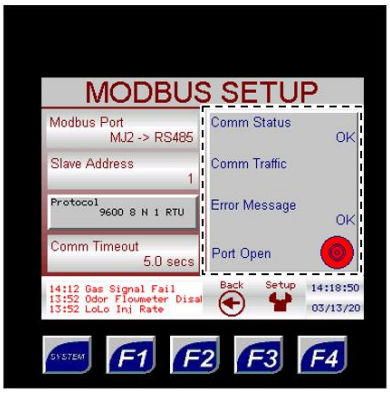
The protocol comes factory-set to Modbus RTU.



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

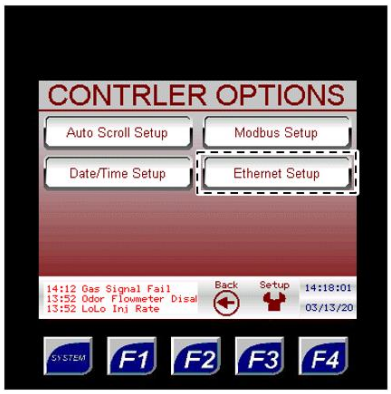


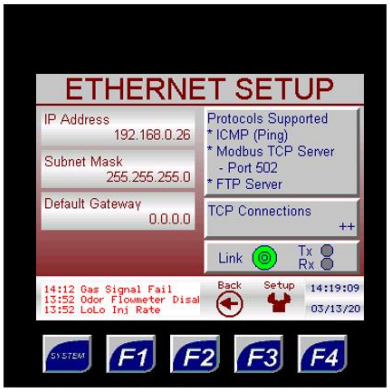
Comm Timeout
This value is the timeout between Modbus messages (in seconds).



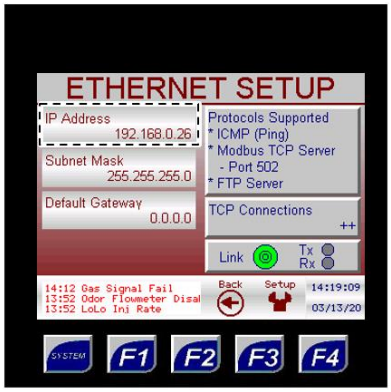
These fields display the current status of the Modbus for troubleshooting purposes.

Figure 31: Controller Options – Ethernet Setup



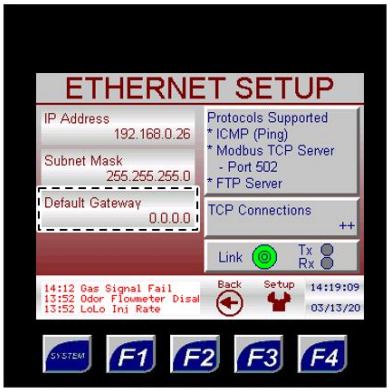


Ethernet Setup
Enter this submenu to configure the Ethernet connection and view its current status.



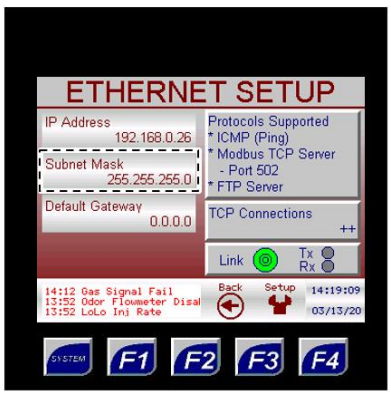
IP Address
Manually assign an IP address.

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



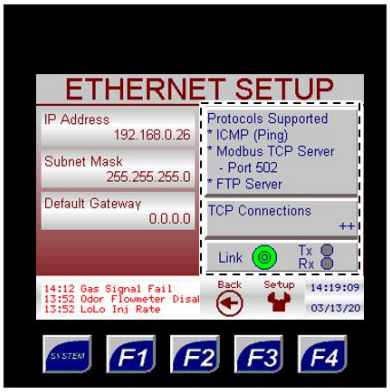
Default Gateway
Manually assign the default gateway.

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.

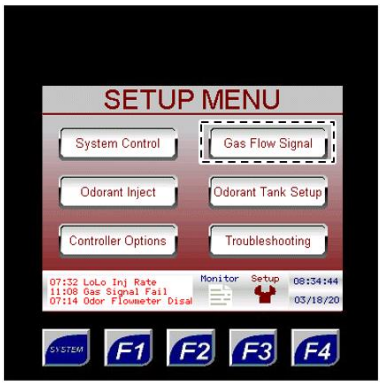


This column displays general and diagnostic information about the Ethernet connection.

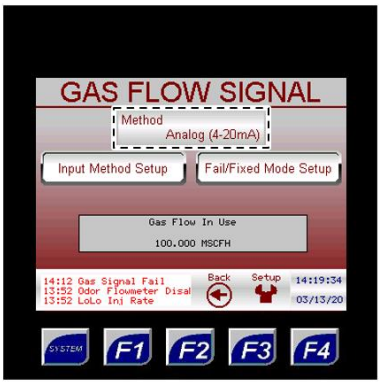
Gas Flow Signal

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

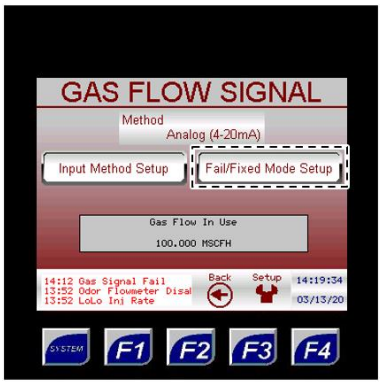
Figure 32: Setup Menu – Gas Flow Signal



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

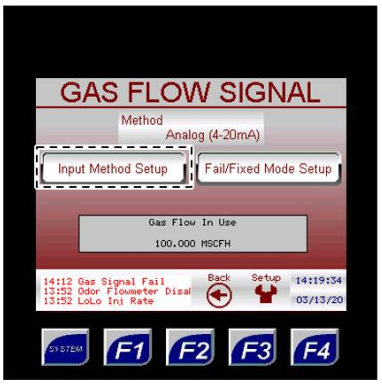


Method
Toggle this field to switch between two (2) methods for the gas flow input signal:
1. analog input
2. pulse input



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

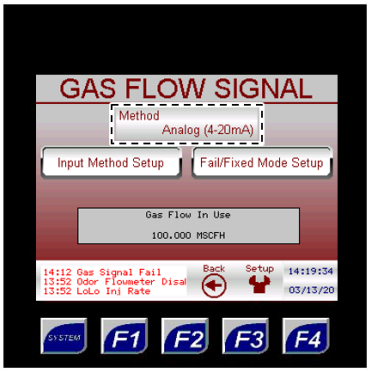
See *Figure 34.*

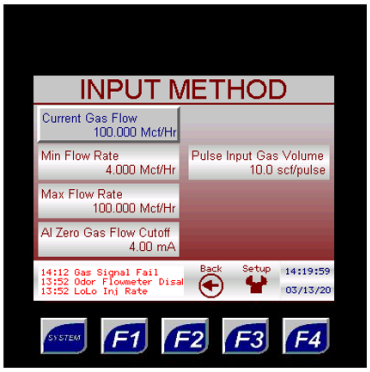


Input Method Setup
Enter this submenu to set up the applicable parameters for the chosen input method.

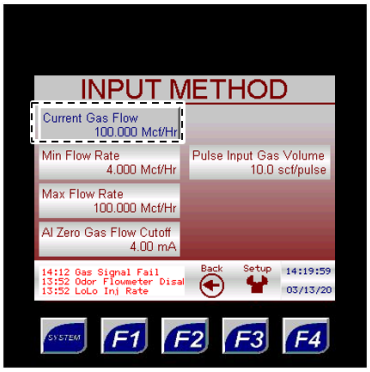
See *Figure 33.*

Figure 33: Gas Flow Signal – Input Method Setup

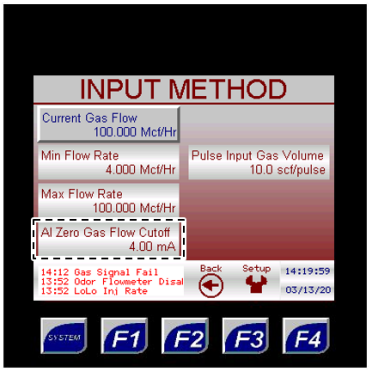




Input Method Setup
Enter this submenu to set up the applicable parameters for the chosen input method.

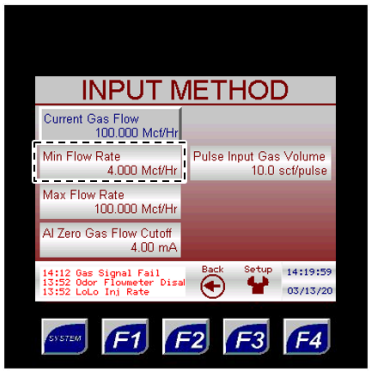


Current Gas Flow
This value is the current gas flow signal for the pipeline (Mcf/h).



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

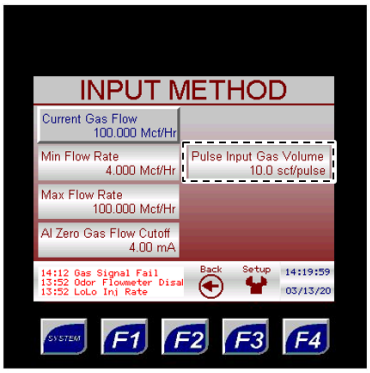
Any values below this gas flow low cutoff value (in milliamps) will be treated as zero gas flow (0 Mcf/h).



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

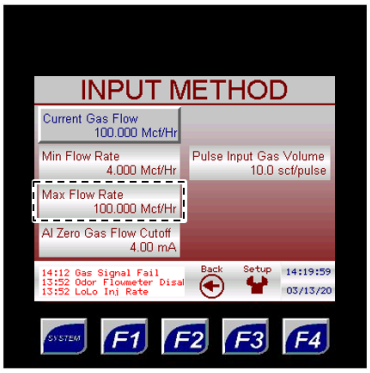
If pulse input is used, this value is the minimum actual gas flow.

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.

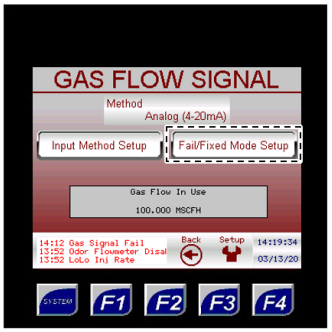


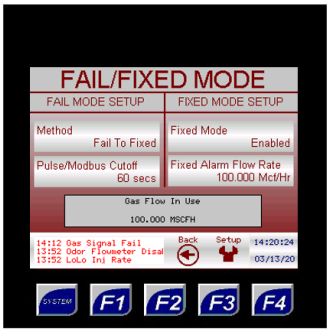
Max Flow Rate
If analog input is used, this value is the 20 mA signal.

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

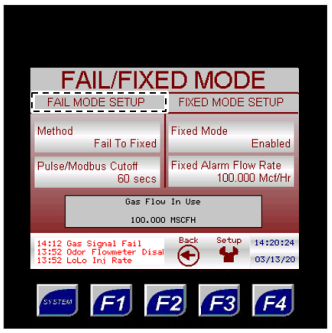
If the gas flow signal will be analog, the analog signal must be 4–20 mA powered by the user.
If the gas flow signal will be pulse, the pulse will be a digital pulse powered by the controller.

Figure 34: Gas Flow Signal – Fail/Fixed Mode Setup

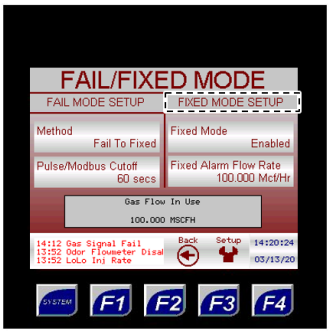




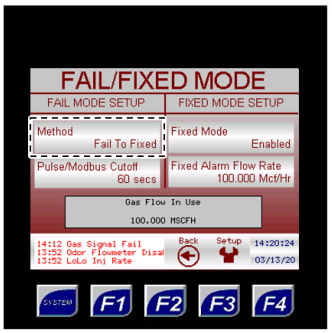
Fail/Fixed Mode Setup
Enter this submenu to select the desired fail mode, enable or disable the fixed mode, and set up applicable parameters.



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

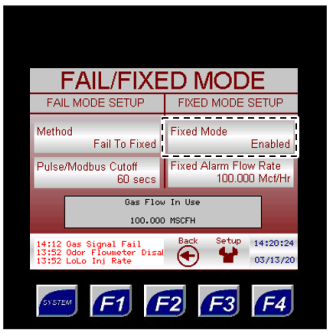


Fixed Mode Setup
Enable or disable the fixed rate mode.

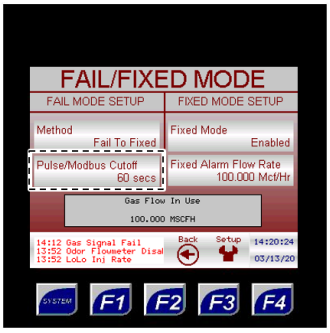


Method
Toggle between two (2) fail modes:

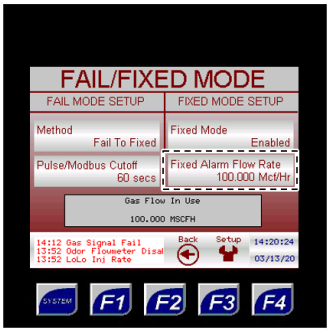
1. constant rate mode: the system will act as a timer, pulsing odorant into the pipeline at the customer-specified rate
2. shutdown mode: the system will halt odorization and will not start again until a gas flow signal is received



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.

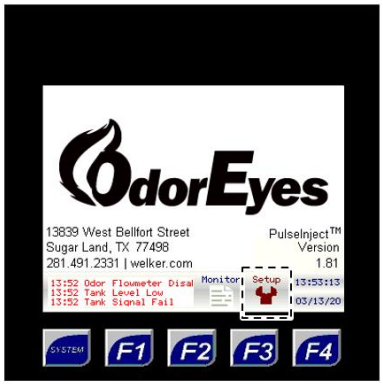
Setting the Fail Mode to Shutdown will halt odorization until the alarm is cleared.
Setting the Fail Mode to Constant Rate will allow odorization to continue at a specified rate.

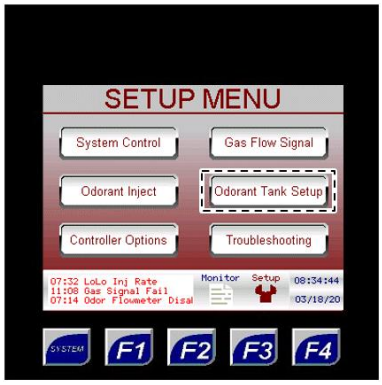
If the gas flow value does not change during the Pulse/Modbus Cutoff time, the system will alarm for loss of flow and will enter the specified Fail Mode. The alarm will clear on the next pulse input or change in Modbus gas flow, and the system will resume normal operation.

Odorant Tank

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

Figure 35: 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 36.*

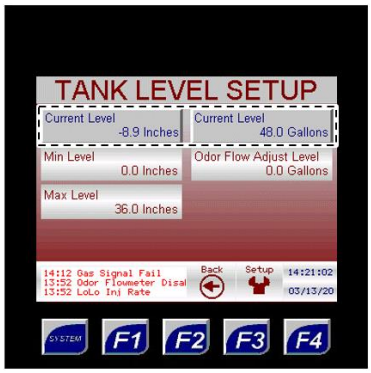
Tank Volume Setup
Enter this submenu to view the tank volume settings and access the strapping tables.

See *Figure 37.*

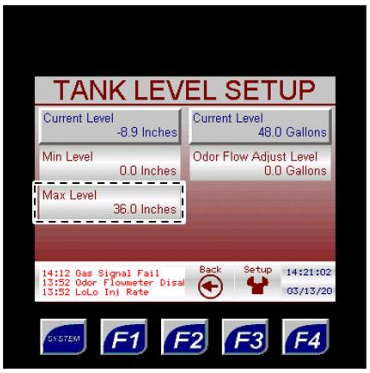
When using an electronic level transmitter to track the odorant tank level, the Method should be set to Transmitter. When estimating the odorant tank level based on odorant usage, the Method should be set to Calculated.

Figure 36: Odorant Tank – Tank Level Setup

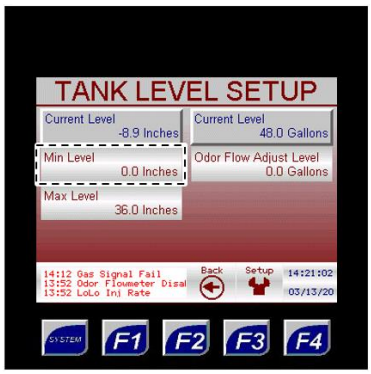
Tank Level Setup
Set up the parameters for how the tank level will operate.



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 Odor 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 Odor Flow Adjust Level field, and then press ENTER to save the changes. The Current Level should have decreased by the amount entered, and the Odor 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 Odor Flow Adjust Level field, and then press ENTER to save the changes. The Current Level should have increased by the amount entered, and the Odor Flow Adjust Level should have reverted to 0.0 Gallons.

Figure 37: 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**.

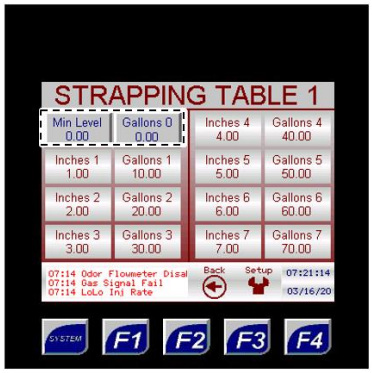
Strapping Table Pg 1,2,3
If strapping is enabled, view the tank depth and tank volume for each strapping point.

See *Figure 38*.

Figure 38: 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.

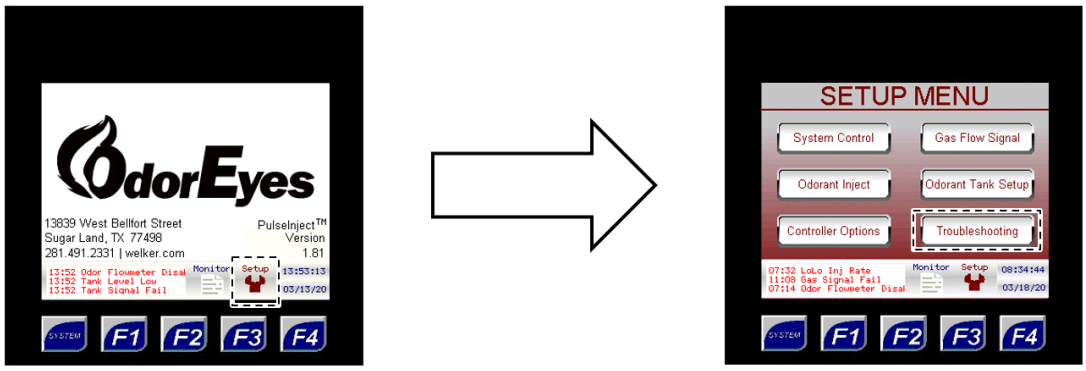
The maximum strapping point will depend on the tank size and volume.

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

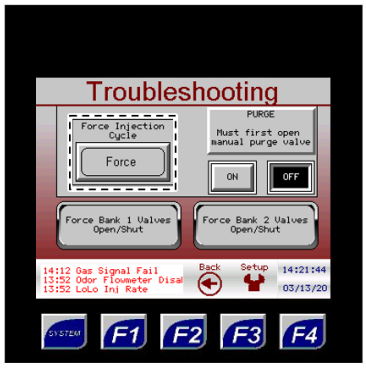
Troubleshooting

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

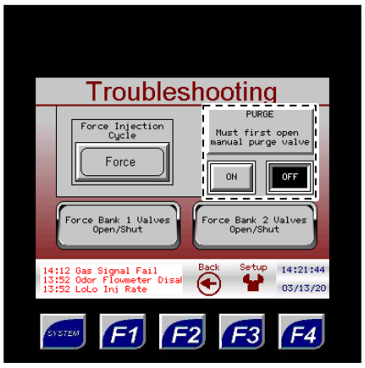
Figure 39: Setup Menu – Troubleshooting



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

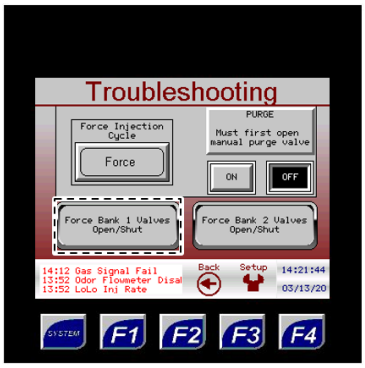


Force Injection Cycle
Press to force an injection cycle to occur, regardless of whether one is scheduled or not.

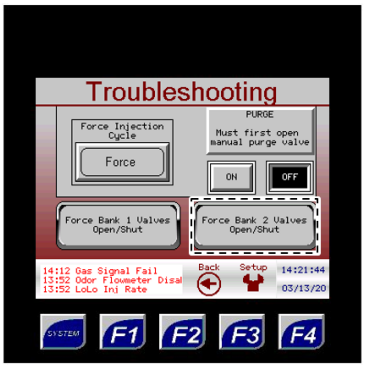


Purge
Press to purge excess odorant from the system.

Note that the liquid shutoff valve should be pointing to the purge side, the odorant injection outlet valve should be closed, and the odorant prime/purge outlet valve should be open before running the purge cycle.



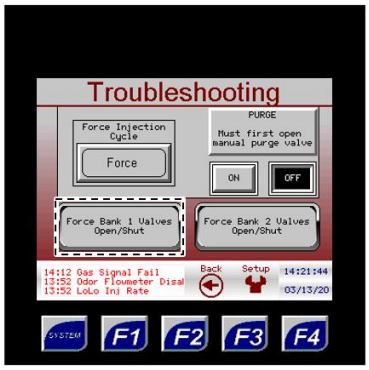
Force Bank 1 Valves Open/Shut
Enter this submenu to open or shut individual solenoids from bank 1.

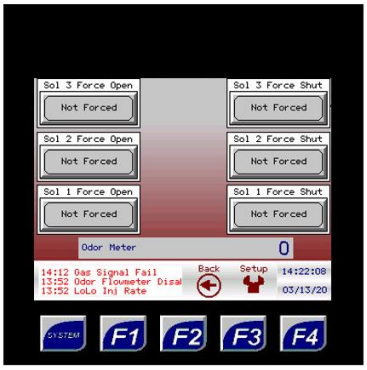


Force Bank 2 Valves Open/Shut
Enter this submenu to open or shut individual solenoids from bank 2.

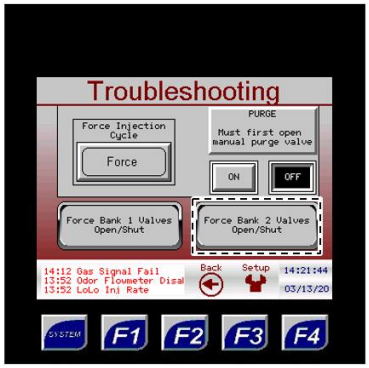
Through the Force Bank 1/2 Valves Open/Shut submenus, the user can open or shut individual solenoids from either bank. Note that individual solenoids will remain open or shut until the user reverses this action.

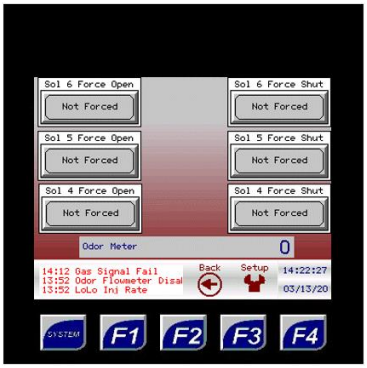
Figure 40: Troubleshooting – Force Valves Open/Shut



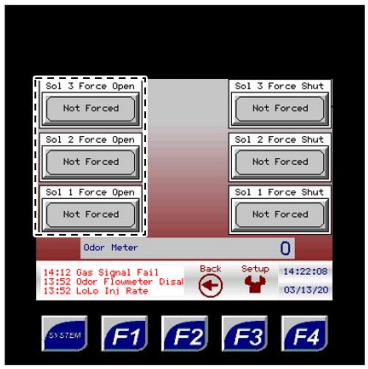


Force Bank 1 Valves Open/Shut
Enter this submenu to open or shut individual solenoids from bank 1.



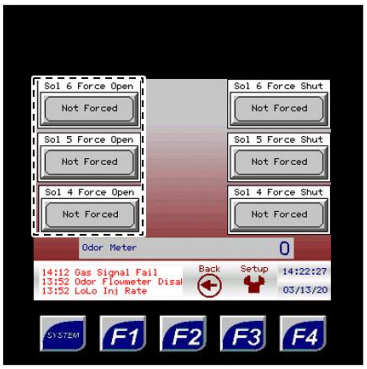


Force Bank 2 Valves Open/Shut
Enter this submenu to open or shut individual solenoids from bank 2.



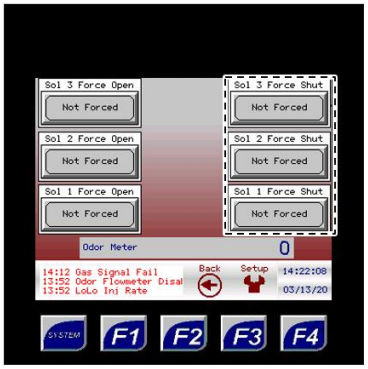
Sol 1/2/3 Force Open
Press to select an individual solenoid from bank 1 to force open.

Note that solenoid 1 is the fill solenoid, solenoid 2 is the injection solenoid, and solenoid 3 is the vent solenoid.



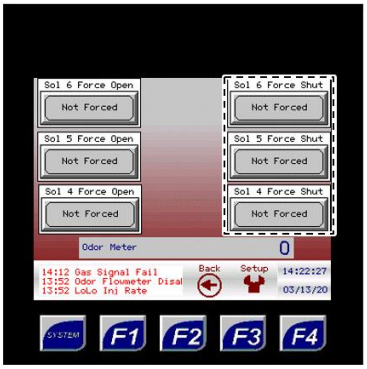
Sol 4/5/6 Force Open
Press to select an individual solenoid from bank 2 to force open.

Note that solenoid 4 is the fill solenoid, solenoid 5 is the injection solenoid, and solenoid 6 is the vent solenoid.



Sol 1/2/3 Force Shut
Press to select an individual solenoid from bank 1 to force shut.

Note that solenoid 1 is the fill solenoid, solenoid 2 is the injection solenoid, and solenoid 3 is the vent solenoid.



Sol 4/5/6 Force Shut
Press to select an individual solenoid from bank 2 to force shut.

Note that solenoid 4 is the fill solenoid, solenoid 5 is the injection solenoid, and solenoid 6 is the vent solenoid.

SECTION 4: MAINTENANCE

4.1 Before You Begin

1. **Refer to *Appendix B, Maintenance Schedule,* for the itemized Welker recommended maintenance schedule for the PulseInject™.**
2. 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.

3. All maintenance and cleaning of the unit should be performed on a smooth, clean surface.
4. 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. Disconnect the tubing and remove individual system components for maintenance.
    d. 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.
    e. After performing necessary maintenance on system components, reconnect all instrument tubing.
    f. 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 23*).
2. Verify the injection settings and make the appropriate changes as needed.
3. From the Current Alarms screen, press Clear Alarms and return the PulseInject™ to normal operation (*Figure 13*).

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 17* and *Figure 18*). 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 5*). 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 17* and *Figure 18*). 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 3*). 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 is less than 30% of the expected value.

8. Check the pressure gauges for Bank 1 and Bank 2, and then record the values (*Figure 5*).
9. From the PLC, press F2 to view the Current Alarms screen, and then verify whether one bank or both banks have failed (*Figure 13*).
10. If only one bank has failed, watch the pressure gauge of the working bank for approximately 5 cycles and record the various pressures that are measured (*Figure 5*).
11. From the Setup Menu in the PLC, select System Control, and then press Odor Rate Required (*Figure 23*).
12. Record the current value, and then set the Odor Rate Required value to zero (0).

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

13. Check for liquid in the sight volume chamber of the failed bank and the automatic liquid shutoff (*Figure 5*).
14. If no liquid is visible, continue to step 15. If liquid is visible, proceed to step 32.

No Visible Liquid in Sight Volume Chamber

15. Record the pressure gauge measurement on the failed bank (*Figure 5*).

If the pressure gauge measurement on the failed bank is at injection pressure, follow steps 16–21.
If the pressure gauge measurement on the failed bank is at pipeline pressure and below injection pressure, follow steps 22–26
If the pressure gauge measurement on the failed bank reads zero (0), follow steps 27–31.

16. From the Setup Menu in the PLC, select Troubleshooting (*Figure 39*).
17. From the Troubleshooting submenu, select Force Bank 1 Valves Open/Shut or Bank 2 Valves Open/Shut (*Figure 40*).
18. Press Sol 3 Force Open (Bank 1) or Sol 6 Force Open (Bank 2) (*Figure 40*).

After forcing the vent solenoid open, the controller screen should display the solenoid in green and say "Forced."

19. Monitor the pressure gauge on the failed bank. If the pressure drops slightly and gas is pushing out of the atmospheric exhaust filter, Failure 4 has occurred. See *Table 6, PulseInject™ Troubleshooting*, for a description of the failure and possible solutions.
20. If the pressure remains constant and no gas is pushed out of the atmospheric exhaust filter, Failure 5 has occurred. See *Table 6, PulseInject™ Troubleshooting*, for a description of the failure and possible solutions.
21. If the pressure returns to zero (0), press Sol 3 Force Open (Bank 1) or Sol 6 Force Open (Bank 2) to return the solenoid to normal operating status (*Figure 40*).

After closing the solenoid, the controller screen should display the solenoid in gray and say "Not Forced."

22. From the Setup Menu in the PLC, select Troubleshooting (*Figure 39*).
23. From the Troubleshooting submenu, select Force Bank 1 Valves Open/Shut or Bank 2 Valves Open/Shut (*Figure 40*).
24. Press Sol 3 Force Open (Bank 1) or Sol 6 Force Open (Bank 2) (*Figure 40*).

After forcing the vent solenoid open, the controller screen should display the solenoid in green and say "Forced."

25. Monitor the pressure gauge on the failed bank. If the pressure drops slightly and gas is pushing out of the atmospheric exhaust filter, Failure 8 has occurred. See *Table 6, PulseInject™ Troubleshooting,* for a description of the failure and possible solutions.
26. Press Sol 3 Force Open (Bank 1) or Sol 6 Force Open (Bank 2) to return the solenoid to normal operating status (*Figure 40*).

After closing the solenoid, the controller screen should display the solenoid in gray and say "Not Forced."

27. From the PLC, press F2 to view the Current Alarms screen, and then select the desired alarm (*Figure 13*).
28. Clear the alarm and attempt to return the PulseInject™ to normal operations.
29. Check the sight volume chamber for the failed bank (*Figure 5*). If odorant visibly enters the sight volume chamber but is not measured on the Injection Stats screen, Failure 9 has occurred (*Figure 17* and *Figure 18*). See *Table 6, PulseInject™ Troubleshooting,* for a description of the failure and possible solutions.
30. If odorant does not visibly enter the sight volume chamber and is not measured on the System I/O screen, Failure 1 has occurred (*Figure 17* and *Figure 18*). See *Table 6, PulseInject™ Troubleshooting,* for a description of the failure and possible solutions.
31. If the problem persists, check the odorant filter and system check valves for blockages (*Figure 5* and *Figure 8*).

Visible Liquid and Closed Automatic Liquid Shutoff

32. Purge the odorant line into the odorant tank or an appropriate container.
33. Close odorant injection outlet valve L and open odorant prime/purge outlet valve K (*Figure 6*).
34. Set 3-way liquid shutoff valve D to the purge position (*Figure 6*).
35. From the Setup Menu in the PLC, select Troubleshooting (*Figure 21*).
36. From the Troubleshooting submenu, press On to purge the odorant line. Repeat this process if necessary (*Figure 39*).
37. Set 3-way liquid shutoff valve D to the vent position (*Figure 6*).
38. If liquid did not purge from the odorant line, check the pressure gauge on the failed bank (*Figure 5*).
39. If the pressure gauge on the failed bank is at injection pressure, Failure 7 has occurred. See *Table 6, PulseInject™ Troubleshooting,* for a description of the failure and possible solutions.
40. If the pressure gauge does not show a rise in pressure, repeat steps 32–37.
41. If gas is pushing out of the atmospheric exhaust filter, Failure 6 has occurred. See *Table 6, PulseInject™ Troubleshooting,* for a description of the failure and possible solutions.
42. If no gas is pushed out of the atmospheric exhaust filter, Failure 3 has occurred. See *Table 6, PulseInject™ Troubleshooting,* for a description of the failure and possible solutions.
43. If liquid did purge from the odorant line, check the pressure gauge on the failed bank (*Figure 5*).
44. If the pressure gauge on the failed bank is at zero (0) or dropping below the injection pressure, Failure 6 has occurred. See *Table 6, PulseInject™ Troubleshooting,* for a description of the failure and possible solutions.
45. If the pressure gauge on the failed bank is at or above pipeline pressure, go to the Setup Menu in the PLC and select Troubleshooting (*Figure 21*).
46. From the Troubleshooting submenu, select Force Bank 1 Valves Open/Shut or Bank 2 Valves Open/Shut (*Figure 40*).
47. Press Sol 3 Force Open (Bank 1) or Sol 6 Force Open (Bank 2) (*Figure 40*).

After forcing the vent solenoid open, the controller screen should display the solenoid in green and say "Forced."

48. Press Sol 3 Force Open (Bank 1) or Sol 6 Force Open (Bank 2) to return the solenoid to normal operating status (*Figure 40*).

After closing the solenoid, the controller screen should display the solenoid in gray and say "Not Forced."

49. If the pressure gauge on the failed bank does not read zero (0), Failure 5 has occurred. See *Table 6, PulseInject™ Troubleshooting,* for a description of the failure and possible solutions.
50. Check the sight volume chamber for the failed bank. If it refills with odorant, Failure 2 has occurred. See *Table 6, PulseInject™ Troubleshooting,* for a description of the failure and possible solutions.
51. Clear the alarms and return the PulseInject™ to normal operations.

Odorant Flow Meter Check Procedures

52. Check the odorant flow meter to ensure proper operation (*Figure 5*).
53. 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 6, PulseInject™ Troubleshooting,* for a description of the failure and possible solutions.
54. From the Monitor Menu in the PLC, select System I/O (*Figure 17* and *Figure 18*).
55. From the System I/O submenu, verify the Odorant Meter field changes when the odorizer cycles (*Figure 17* and *Figure 18*).
56. 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.
57. Verify the wiring is correct for the odorant flow meter and replace the RTU, if necessary.
58. If problems persist, check the odorant flow meter, odorant filter, and system check valves for blockages (*Figure 5* and *Figure 8*).

Return to Operation

59. 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.
60. From the Setup Menu in the PLC, select Troubleshooting (*Figure 21*).
61. From the Troubleshooting submenu, select Force Bank 1 Valves Open/Shut (*Figure 40*).
62. Verify that all fields say "Not Forced" and each display is gray (*Figure 40*).
63. From the Troubleshooting submenu, select Force Bank 2 Valves Open/Shut (*Figure 40*).
64. Verify that all fields say "Not Forced" and each display is gray (*Figure 40*).
65. From the PLC, touch the alarm field at the bottom left of the screen. This will take you to the Alarm History screen (*Figure 20*).
66. From the Alarm History screen, select any alarm (*Figure 20*). Press Clr All at the bottom of the screen to clear the alarms.
67. From the Setup Menu in the PLC, select System Control, and then press Odor Rate Required (*Figure 23*).
68. Set the Odor Rate Required to the previous value that was recorded before the Troubleshooting procedures.
69. The PulseInject™ is now operational.

4.4 Troubleshooting

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 6: PulseInject™ Troubleshooting

Failure #	Issues/Signs/Risks	Possible Causes	Solutions
1	No odorant flow is measured, and the bank pressure gauge is at 0 psig. There is no visible odorant in the sight volume chamber or at the injection point. The fill solenoid is not indicated on in the System I/O screen. The bank pressure cycles from zero (0) psig to injection pressure. There is a risk of no odorant injection from this bank.	The odorant fill solenoid failed to open.	Ensure there is an adequate power supply and connection to the solenoid. Refer to the *Installation, Operation, and Maintenance* (IOM) *Manual* for the solenoid for instructions on maintaining the solenoid. Replace the solenoid. Refer to the *Installation, Operation, and Maintenance* (IOM) *Manual* for the solenoid for instructions on replacing the solenoid.
2	High odorant flow is measured and the bank pressure gauge is at or near zero (0) psig. There is possible visible odorant in the sight volume chamber. The automatic liquid shutoff may close and lock all pressure from venting to the atmospheric exhaust filter. The bank pressure cycles from zero (0) psig to injection pressure. There is a risk of large injections with long delays between injection cycles.	The odorant fill solenoid failed to close.	Ensure there is an adequate power supply and connection to the solenoid. Refer to the *Installation, Operation, and Maintenance* (IOM) *Manual* for the solenoid for instructions on maintaining the solenoid. Replace the solenoid. Refer to the *Installation, Operation, and Maintenance* (IOM) *Manual* for the solenoid for instructions on replacing the solenoid.

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 6: PulseInject™ Troubleshooting (Continued)

Failure #	Issues/Signs/Risks	Possible Causes	Solutions
3	Odorant remains in the sight volume chamber, and the float ball may eventually get pushed to the top and seal. The automatic liquid shutoff may close and lock all pressure from venting to the atmospheric exhaust filter. No odorant flow is measured in the next three to five (3–5) cycles. The bank pressure cycles from zero (0) to ten (10) psig maximum, eventually staying at zero (0) psig if the sight volume chamber is sealed. There is a risk of no odorant injection from this bank.	The injection solenoid failed to open.	Ensure there is an adequate power supply and connection to the solenoid. Refer to the *Installation, Operation, and Maintenance* (IOM) *Manual* for the solenoid for instructions on maintaining the solenoid. Replace the solenoid. Refer to the *Installation, Operation, and Maintenance* (IOM) *Manual* for the solenoid for instructions on replacing the solenoid. Purge the system and reset operation. See *Section 2.3, Start-Up Procedures*, for instructions on purging the PulseInject™.
4	High pressure gas intermittently vents out of the atmospheric exhaust filter. The bank pressure gauge remains at injection pressure, briefly dropping when the vent is open. No odorant flow is measured during the next cycle. There is no visible odorant in the sight volume chamber or at the injection point. There is a risk of no odorant injection from this bank.	The injection solenoid failed to close.	Ensure there is an adequate power supply and connection to the solenoid. Refer to the *Installation, Operation, and Maintenance* (IOM) *Manual* for the solenoid for instructions on maintaining the solenoid. Replace the solenoid. Refer to the *Installation, Operation, and Maintenance* (IOM) *Manual* for the solenoid for instructions on replacing the solenoid.

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 6: PulseInject™ Troubleshooting (Continued)

Failure #	Issues/Signs/Risks	Possible Causes	Solutions
5	The bank pressure gauge remains at injection pressure. No odorant flow is measured during the next cycle. There is no visible odorant in the sight volume chamber. There is a risk of no odorant injection from this bank.	The vent solenoid failed to open.	Ensure there is an adequate power supply and connection to the solenoid. Refer to the *Installation, Operation, and Maintenance* (IOM) *Manual* for the solenoid for instructions on maintaining the solenoid. Replace the solenoid. Refer to the *Installation, Operation, and Maintenance* (IOM) *Manual* for the solenoid for instructions on replacing the solenoid.
6	The sight volume chamber may overfill with odorant during the next cycle. The injection will not push odorant into the pipeline. High flow injection pressure gas may vent to the atmospheric exhaust filter intermittently. The bank pressure gauge may cycle from zero (0) psig to injection pressure and back to zero (0) psig. The automatic liquid shutoff may close. The injection sight volume chamber may seal. There is a risk of oversaturating the atmospheric exhaust filter. There is a risk of large injections with long delays between cycles. There is a risk of no odorant injection from this bank.	The vent solenoid failed to close.	Ensure there is an adequate power supply and connection to the solenoid. Refer to the *Installation, Operation, and Maintenance* (IOM) *Manual* for the solenoid for instructions on maintaining the solenoid. Replace the solenoid. Refer to the *Installation, Operation, and Maintenance* (IOM) *Manual* for the solenoid for instructions on replacing the solenoid.

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 6: PulseInject™ Troubleshooting (Continued)

Failure #	Issues/Signs/Risks	Possible Causes	Solutions
7	The injection will not push odorant into the pipeline. Odorant remains in the sight volume chamber. No odorant flow is measured during the next cycle. The automatic liquid shutoff may close. The injection sight volume chamber may seal. The bank pressure gauge alternates between zero (0) psig and injection pressure. There is a risk of no odorant injection from this bank.	The injection check valve(s) failed to open.	Replace the check valve(s). Refer to the *Installation, Operation, and Maintenance* (IOM) *Manual* for the check valve for instructions on replacing the check valve(s).
8	High pipeline pressure gas intermittently vents out of the atmospheric exhaust filter during the cycle. The bank pressure gauge remains at pipeline pressure. The sight volume chamber will not fill during the next cycle. There is a risk of no odorant injection from this bank or both banks.	The injection check valve(s) failed to close.	Replace the check valve(s). Refer to the *Installation, Operation, and Maintenance* (IOM) *Manual* for the check valve for instructions on replacing the check valve(s).

Table 6: PulseInject™ Troubleshooting (Continued)			
Failure #	**Issues/Signs/Risks**	**Possible Causes**	**Solutions**
9	No odorant flow is measured. The system is no longer injecting proportional to pipeline flow. There is a possible blockage of the odorant inlet to the system. The ability of bank 1 and bank 2 to inject odorant are affected. The bank pressure gauge cycles from zero (0) psig to injection pressure. There is a risk of large injections with long delays between cycles.	The odorant flow meter has failed.	Ensure there is an adequate power supply and connection to the flow meter. Refer to the *Installation, Operation, and Maintenance* (IOM) *Manual* for the flow meter for instructions on maintaining the flow meter. Verify adequate pressure is going into the flow meter. Replace the flow meter. Refer to the *Installation, Operation, and Maintenance* (IOM) *Manual* for the flow meter for instructions on replacing the flow meter.

Table 6: PulseInject™ Troubleshooting (Continued)			
Failure #	**Issues/Signs/Risks**	**Possible Causes**	**Solutions**
		Valves upstream of the PulseInject™ are closed and not allowing odorant to fill the system.	Open all valves upstream of the PulseInject™ that allow odorant flow into the system.
		Odorant level and tank blanket pressure are empty or not adequate.	Fill the tank with odorant and ensure adequate blanket pressure is applied to the tank (*Figure 2* and *Figure 3*).
		If equipped, the low flow instrument regulator pressure dropped and resulted in no flow to the system (*Figure 5*).	Set the low flow instrument regulator to 7–8 psig. Refer to the *Installation, Operation, and Maintenance* (IOM) *Manual* for the instrument regulator for instructions on setting the instrument regulator.
		There is blockage in the odorant filter (*Figure 8*).	Clear any blockage from the odorant filter. Refer to the *Installation, Operation, and Maintenance* (IOM) *Manual* for the odorant filter for instructions on maintaining the odorant filter.
10	Bank 1 and bank 2 have failed.	The flow meter is not functioning properly (*Figure 5*).	See *Section 4.3, Alarm Procedures*, to follow the flow meter check procedures. If necessary, replace the flow meter. Refer to the *Installation, Operation, and Maintenance* (IOM) *Manual* for the flow meter for instructions on replacing the flow meter.
		One or more solenoids have failed (*Figure 5*).	Ensure there is an adequate power supply and connection to the solenoid. If necessary, replace the solenoid. Refer to the *Installation, Operation, and Maintenance* (IOM) *Manual* for the solenoid for instructions on maintaining the solenoid.

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-033: Welker RV-1, RV-2, RV-2CP, and RV-3 Relief Valves
- IOM-077: Welker ALS-1 Analyzer Liquid Shutoff
- IOM-169: Welker F-5 Filter Dryer
- IOM-213: Welker F-9 and F-10 Filters

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

- Emerson Process Management Regulator Technologies, Inc. Fisher™ 67C Series Instrument Supply Regulators (Welker IOM-V048)
- GE Oil & Gas Mooney Series 20/20S/20H/20HS Pilot Regulators (Welker IOM-V101)
- Horner APG, LLC XL4 OCS Module (Welker IOM-V369)
- Max Machinery, Inc. Positive Displacement Flowmeters Models P001, P002, 213, 214, and 215 (Welker IOM-V106)
- Peter Paul Electronics Co., Inc. Series 20 Model EH22 Hazardous Location High-Pressure 2-Way Solenoid Valves (Welker IOM-V441)
- Saginaw Control & Engineering EL Enclosure Model SCE-30EL3012LP (Welker IOM-V265)
- Solutions With Innovation L505 Visual Level Indicator Dip-Tape Visual Level Indicator (Welker IOM-V037)
- Swagelok Company Check Valves C, CA, CH, CP, and CPA Series (Welker IOM-V076)
- Swagelok Company One-Piece Instrumentation Ball Valves 40 G Series and 40 Series (Welker IOM-V085)
- Swagelok Company Proportional Relief Valves R Series (Welker IOM-V086)
- 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: OE300VS

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: PulseInject™ Maintenance Schedule

Action	Weekly	Every 12 Months	As Necessary
If applicable, confirm proper functioning of the heater.	X		
Open F-5 drain valve O to allow moisture to drain from the filter.	X		
Verify the pneumatic supply pressure and tank blanket pressure.		X	
Rebuild the F-5 using a Welker repair kit. • Replace the O-rings and filter cartridge.		X	
Open F-9 drain valve R 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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