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FRC
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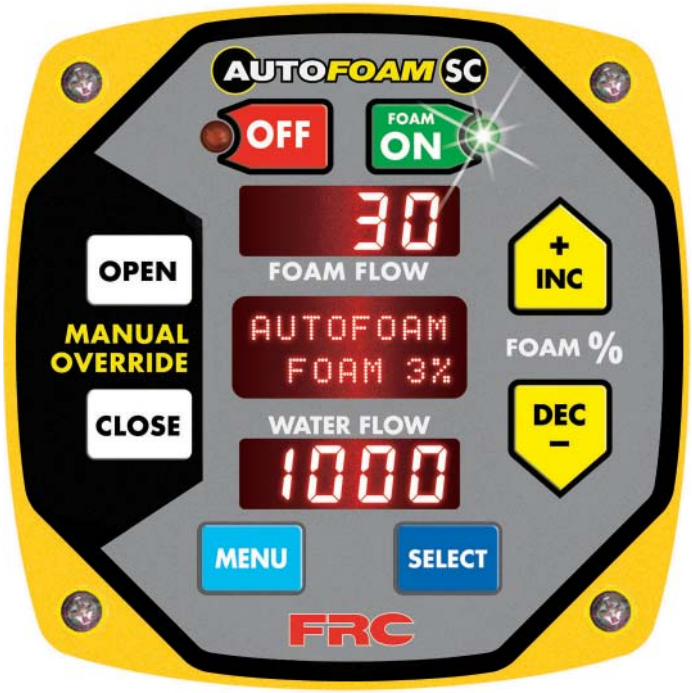
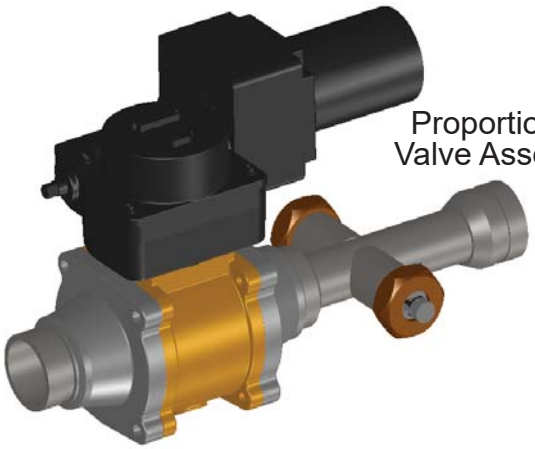
AUTOFOAM SC

SMART CONTROL
AUTOMATIC AROUND-THE-PUMP CLASS B FOAM SYSTEM
MODELS: FSB015, FSB030, FSB060, FSB120, FSB240





Proportioning Valve Assembly

Summing Box

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INTRODUCTION

Overview

The AutoFoam SC (Smart Control) is an around-the-pump automatic proportioning system for Class B foam.

The operator selects a foam percent mixture and the system provides a consistent foam solution at all discharges regardless of water flow fluctuations. A microprocessor controls the proportioning valve to automatically maintain accurate control over foam concentrate flow rates. The operator can override automatic operation by using the manual override buttons to control the proportioning valve.

Around-the-pump proportioning systems operate with an eductor installed between the water pump intake and pump discharge. A small flow of water from the pump discharge passes through the eductor and creates a vacuum at the inlet port that draws foam concentrate into the eductor.

The principle behind the AutoFoam system is straight forward. The flow rate on the discharge side of the pump is measured. A proportioning valve is opened to allow foam concentrate to flow and this flow rate is measured. The program compares the flow rates and adjusts the valve to provide the correct amount of foam concentrate. The foam concentrate is injected into the water flow through the eductor and into the intake side of the pump where it is mixed in the water flow. This produces the correct foam solution at the pump discharge. The AutoFoam constantly monitors foam concentrate and discharge water flow rates and adjusts the valve to ensure proper foam proportioning.

All operations, programming, and calibration are accomplished using the control module. (Calibration for the system is stored in memory on each of the major components. This allows for the replacement of components without requiring re-calibration of the system.)

Features

Complete Automatic Foam Proportioning

Push Button Control

Flow Totaling for Both Foam Concentrate and Water

Powers-Up at the Previous Proportioning Percent

Manual Override

USB Port

Multiple Discharge Sensors w/Summing Box (Optional)

Remote Auto/Off Switch (Optional)

Remote Control Head (Optional)

Specifications

System

Table 1. System Flow Rates

Model	FSB015	FSB030	FSB060	FSB120	FSB240
Proportioning Ratio	0.5 - 6 %	0.5 - 6 %	0.5 - 6 %	0.5 - 10 %	0.5 - 10 %
Concentrate Induction Flow Rate	0.5-15 GPM	0.5-30 GPM	1.5-60 GPM	2.0-120 GPM	10-240 GPM
Water Flow Rate Through Eductor @ 150 PSI	50 GPM	130 GPM	130 GPM	205 GPM	475 GPM
Maximum Discharge Flow Rate	3000 GPM	3000 GPM	3000 GPM	3000 GPM	3000 GPM

Control Module

Supply Power: 12/24 VDC

Supply Current: 0.3 Amps (1 Amp Maximum)

Dimensions: 4 7/8" by 4 7/8"

Summing Box

Supply Power: 12/24 VDC (From Control Module)

Dimensions: 5.8" by 3.7" by 1.9"

Proportioning Valve Assembly

Supply Power: 12/24 VDC

Supply Current: 3 Amps (18 Amps Maximum)

Dimensions: Refer to Proportioning Valve Assembly Dimensions

Eductor

Material: Stainless Steel (304)

Couplings: Victaulic (Grooved Type)

Dimensions: Refer to Eductor Dimensions

Flow Sensors

Type: Paddlewheel

Sensor Material: Acetal (Delrin) with Stainless Steel (316) Shaft

Excitation Voltage: 5 VDC

GENERAL DESCRIPTION

The AutoFoam SC has easy to use push button controls and highly visible displays.

Components

The system consist of the following components (Refer to Figure 1):

Control Module

Proportioning Valve Assembly

Eductor

Discharge Flow Sensor(s) and Sensor Housing(s)

Summing Box (Required with two or more discharge flow sensors.)

Cables

Control Module

The control module is waterproof and uses 4 7/8 by 4 7/8 inches of panel space. All controls and indicators are located on the front of the control module. (Refer to Controls and Indicators.) A USB port is accessible from the rear of the module.

Proportioning Valve Assembly

The proportioning valve assembly includes a specially machined ball valve to match the eductor size, an actuator, an electric motor, valve position sensing with electronic controls, two paddlewheel type flow sensors, and mounting flanges. Information is passed between the valve and the control module via a two wire datalink.

The valve housing is brass, the flow sensors are in stainless steel mounts.

Eductor

The eductor is installed between the water pump intake and pump discharge. The foam concentrate intake port of the eductor is attached to the proportioning valve. Pressurized water flows through the eductor and creates a particle vacuum at the foam intake port which pulls concentrate into the water stream. This mixture is injected at the pump intake to produce a foam solution at the discharge.

Discharge Flow Sensor(s)

The system is available with one discharge flow sensor or multiple discharge flow sensors. When a single sensor is installed it is mounted on the pump discharge manifold. It provides an input signal directly to the control module that is proportional to the discharge flow.

Systems with multiple discharge flow sensors require a summing box. Each discharge flow sensor is connected to the summing box, it provides the input signal to the control module via the two wire datalink.

Multiple mounting options are available for the flow sensor(s).

Summing Box

Note: The summing box is required when there is two or more foam discharge flow sensors.

The summing box is connected between the control module and multiple discharge flow sensors. It provides discharge flow information to the control module via a two wire datalink. Each summing box has inputs for six (6) flow sensors.

Remote Control Head (Optional)

This additional control head allows for remote operation of the system, and can be placed in another panel on the truck (away from the primary control head). **However, the remote unit cannot be used to change system parameters, calibrate the system, or view the error/fault history.** This can only be done through the primary control head.

Cables

Interconnecting cables are provided. (Refer to Wiring Section.)

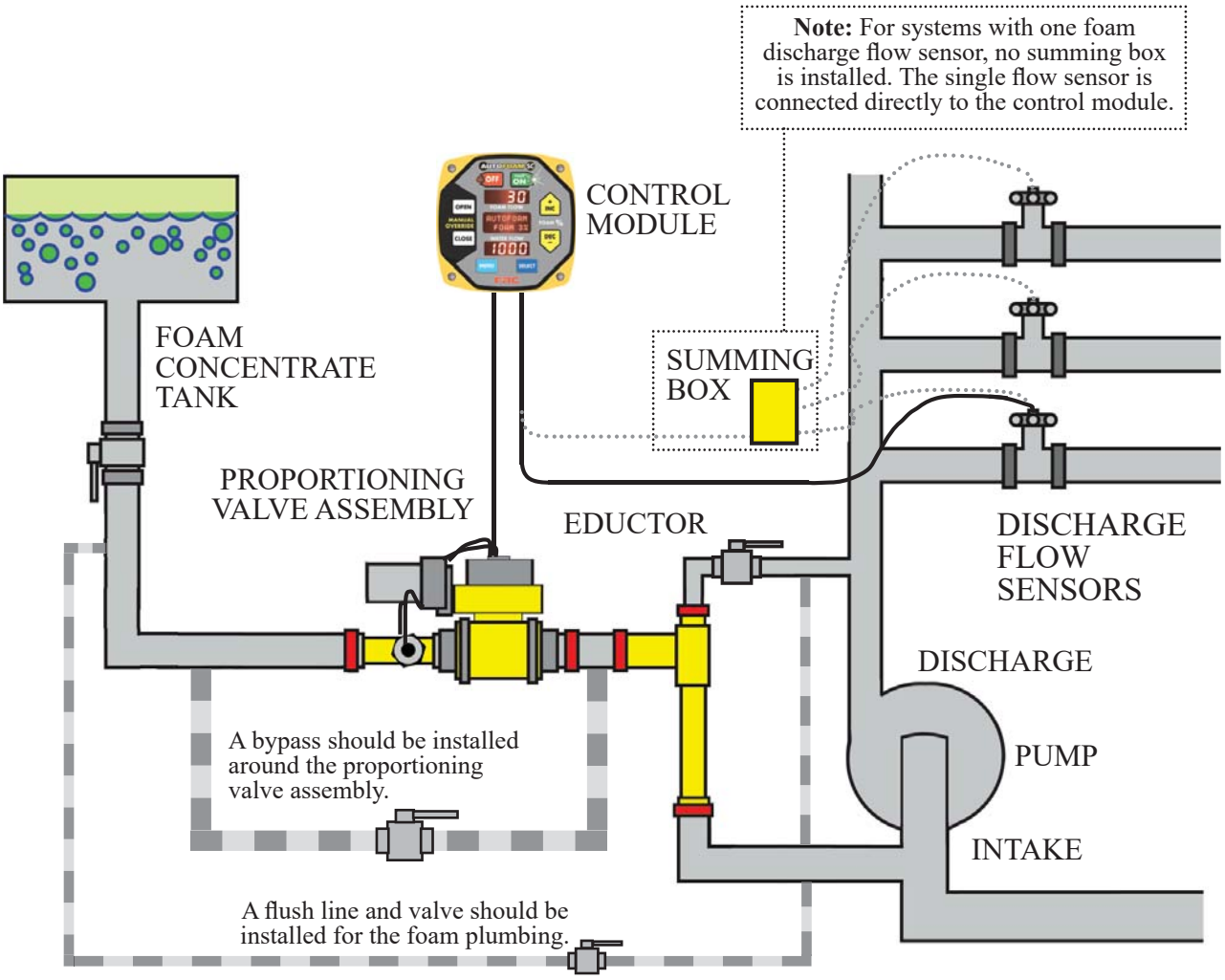


Figure 1. System Diagram

Controls and Indicators

All controls and indicators are located on the front of the control module. It contains the push button electronic controls, LEDs, and digital displays. (Refer to Figure 2.)

OFF Button

Press this button to turn the system off. Red LED is on. The proportioning valve automatically closes. The WATER FLOW display shows discharge flow rate.

FOAM ON Button

Press this button to put the system in the automatic mode. Green LED is on. It is used at start up and to exit the manual override mode.

FOAM FLOW Display

The display shows foam concentrate flow rate through the proportioning valve assembly to the eductor, fault warnings, error and program codes.

FOAM % Buttons

Press the INC or DEC buttons when in the automatic mode to raise or lower the amount of foam concentrate that is mixed into solution. The message display shows the selected percent.

The buttons are also used for reviewing stored data and during programming.

Message Display

The two line multifunction display shows the mode of operation and the selected percent of foam concentrate during normal operations.

When the MENU button is pressed, during calibration, or during programming the display shows stored data and program functions.

WATER FLOW Display

The display shows water or foam solution flow rate through the discharges.

If there is water flow on the discharge side of the pump, flow rate is displayed even if the system is off. When the summing box is installed the display shows the total flow through all flow sensors.

SELECT Button

Used to access stored data and program features.

MENU Button

Used to access system detailed information, stored data, and program features.

MANUAL OVERRIDE Buttons

Note: The system must be active in the automatic mode (green LED on) before using the manual mode.

Press and hold the OPEN or CLOSE button for three seconds to set the system in manual mode. The upper and lower displays flash to indicate the system is in manual mode and they continue to show correct foam concentrate and discharge flow rates.

In the manual mode the operator is in control of opening or closing the foam proportioning valve to set how much foam concentrate flows. To exit the manual mode the FOAM ON or the OFF button is pressed.

Remote Auto/Off Switch

A remote switch option is available.

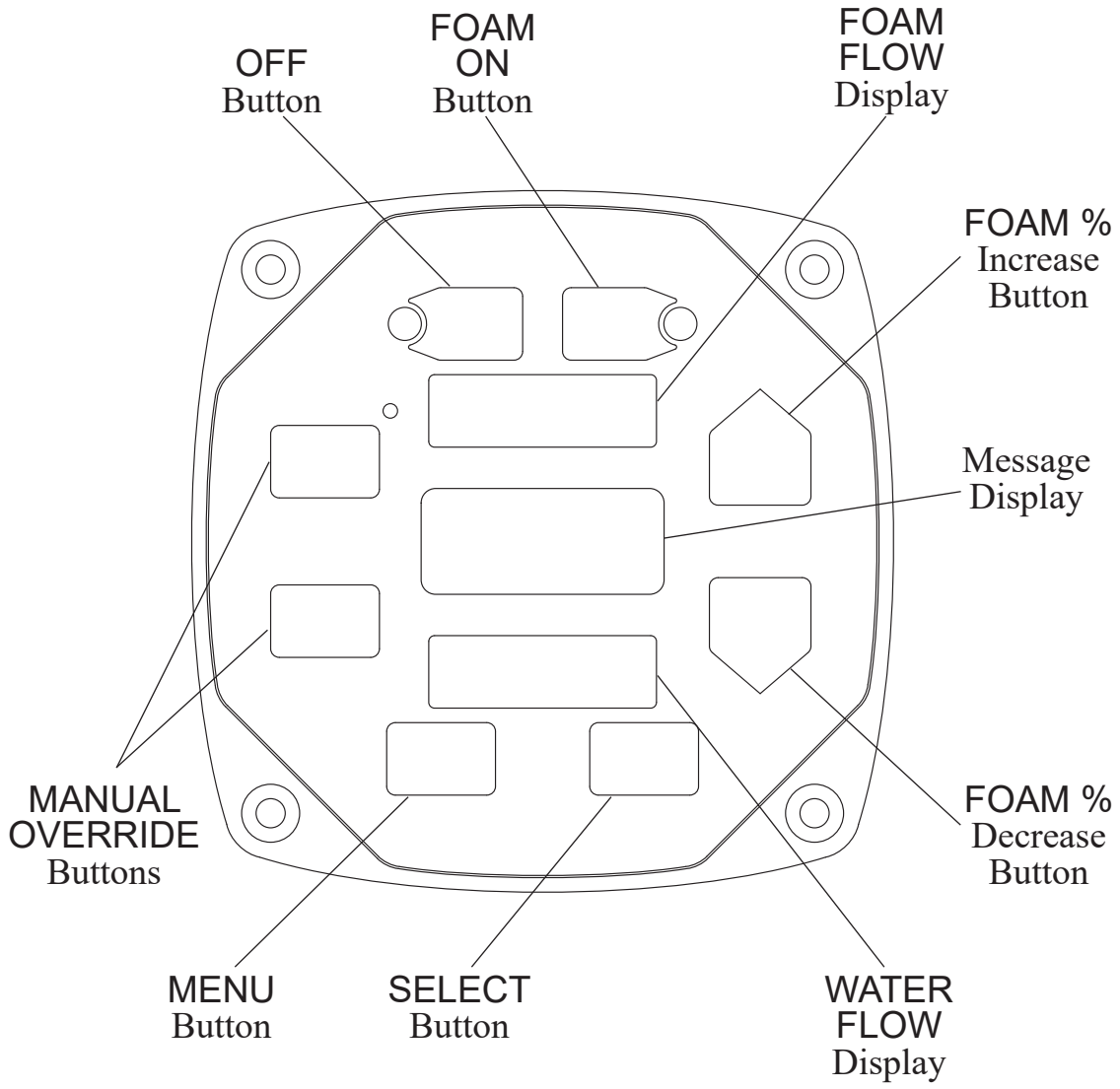


Figure 2. Controls and Indicators

INSTALLATION

Note: Plumbing systems are always unique and may cause small deviations in the factory calibration. It is recommended that the calibration of the discharge flow sensors be checked after the system installation.

Install Control Module

1. Measure and mark mounting location for control module panel cutout and mounting screw holes. Make sure there is clearance behind the panel before cutting holes. Refer to Figure 3 for layout and dimensions.
2. Cut out a 4 3/8" diameter hole and drill four holes for 10-32 mounting screws.
3. Place the control module in position and secure with four screws.
4. Connect the cable(s) to the module. (Refer to Wiring Section.)

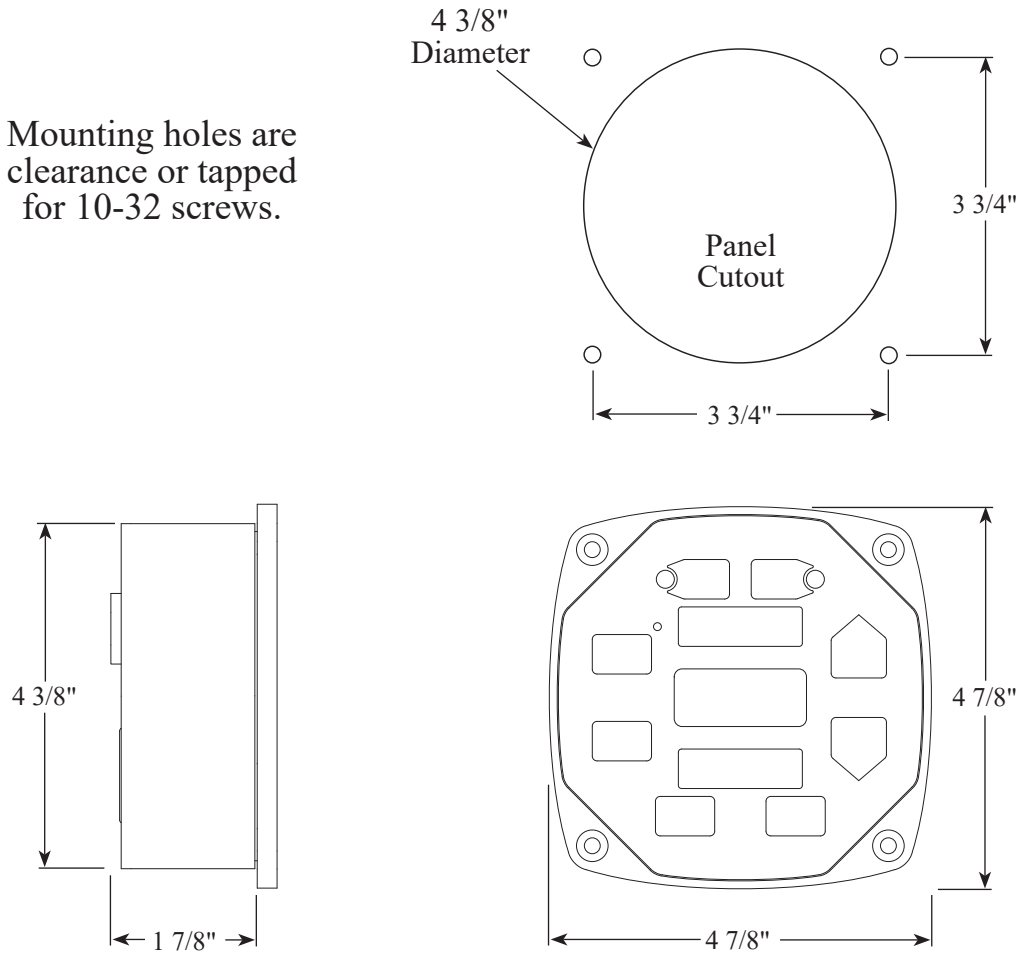


Figure 3. Control Module Dimensions

Install Summing Box

The summing box mounts with four screws. Make sure there is room to connect the cables. The summing box is required when there is more than one discharge flow sensor.

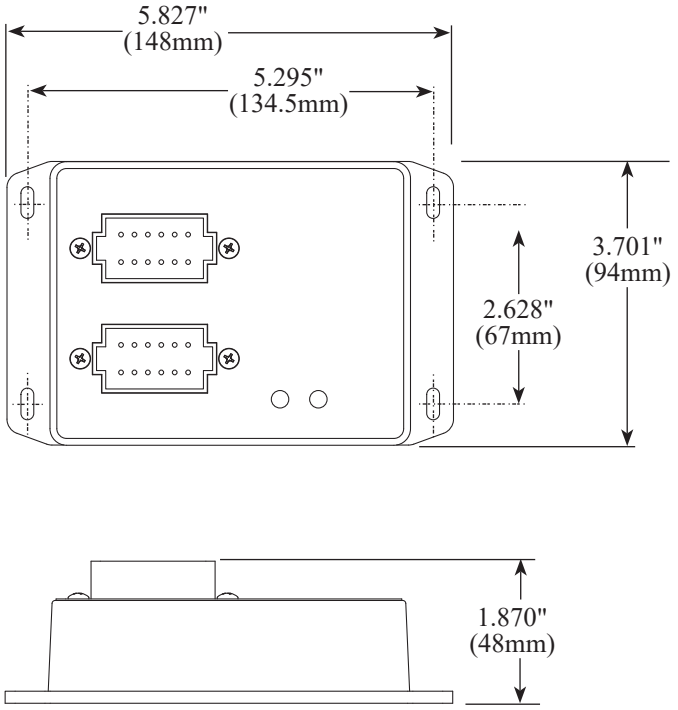
1. Measure and mark mounting location for summing box mounting screw holes. Make sure there is clearance for the module and cables before drilling holes. Refer to the Figure 4 for layout and dimensions.
2. Drill four holes, clearance or tapped, for #8 mounting screws.
3. Place box in position and secure with four screws.
4. Connect the cable(s) to the module. (Refer to Wiring Section.)

LED Indicators

Green LED: Flashing when there is no flow input; Steady on when flow input is detected.

Red LED: Flashing indicates that there is a CAN bus problem; Steady on when there is a conflict with the box address setting.

Mounting holes are clearance or tapped for #8 screws.



Switch Address	1	2
Box 1	ON	OFF
Box 2	OFF	ON
Box 3	ON	ON

When more than one summing box is installed, the addresses need to set. Remove the four screws on the bottom and open the box to access the dip switch to change the address setting.

Figure 4. Summing Box Dimensions

Install Proportioning Valve Assembly and Eductor

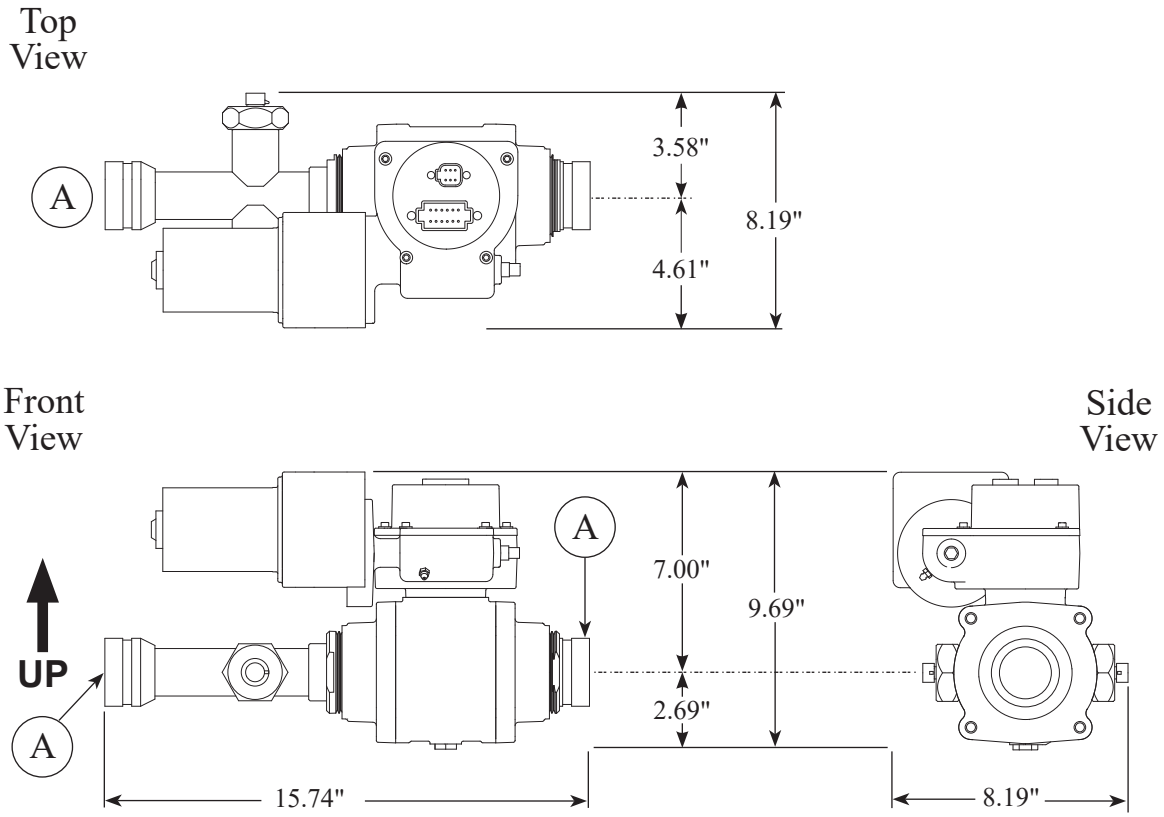
Note: It is important that the proportioning valve assembly and the eductor be mounted below the bottom of the foam tank.

Proportioning Valve Assembly Dimensions

Note: The proportioning valve assembly must be mounted with the motor assembly on top.

Note: The proportioning valve coupling size is as follows:

	FSB Models: 015/030/060	FSB Model: 120	FSB Model: 240
A	1.5	2.0	2.5



Dimensions in Inches ±0.015

Note: The proportioning valve assembly must be mounted with the motor on top as shown in these views.

Figure 5. Proportioning Valve Assembly Dimensions

Eductor Dimensions

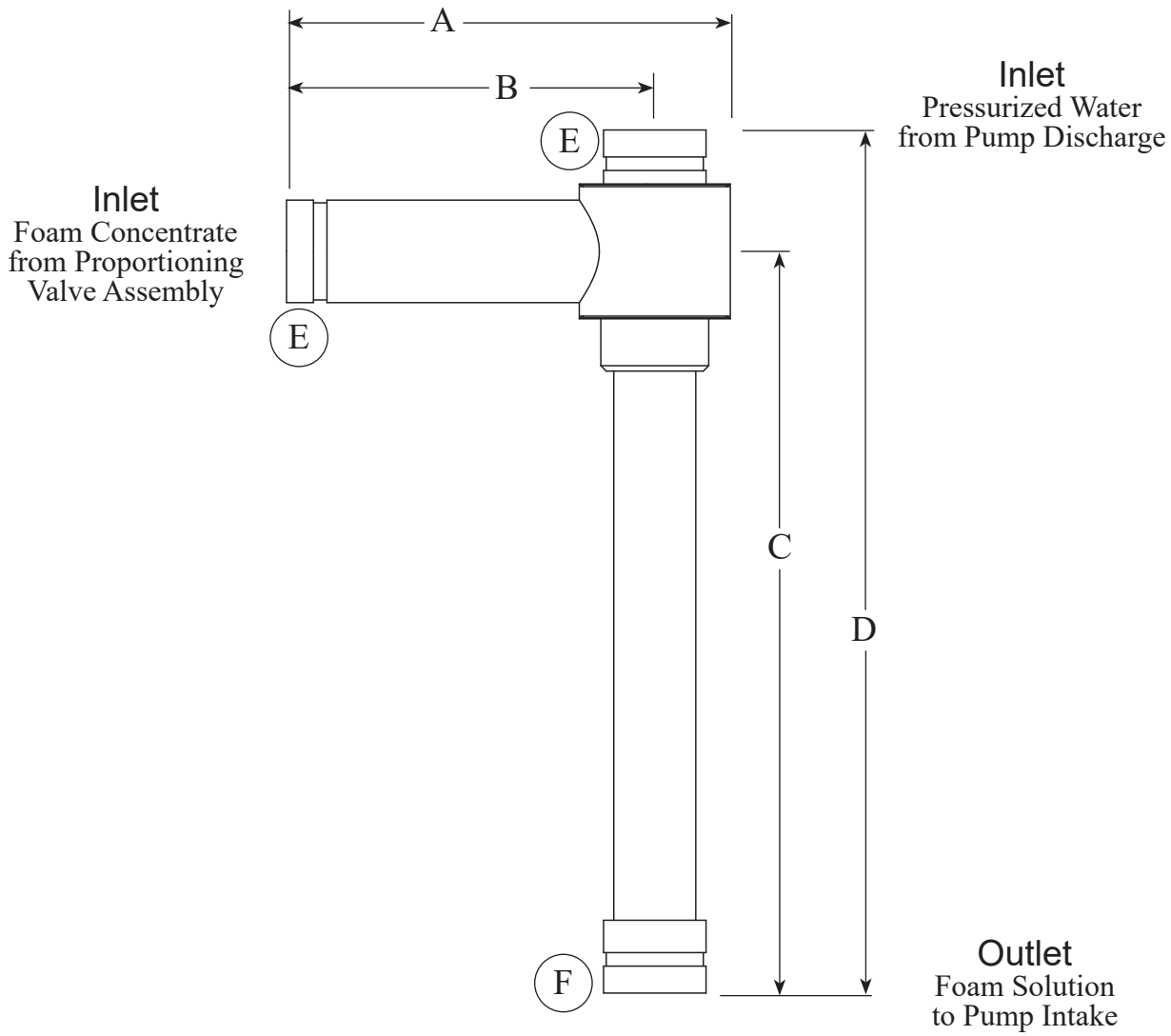


Table 2. Eductor Dimensions

	FSB Models: 015/030/060	FSB Model: 120	FSB Model: 240
A	4.28	10.29	7.5
B	3.33	8.54	5.2
C	10.19	17.19	21.0
D	12.50	20.00	26.0
Outer Diameter **E** **F**	1.900	2.375	2.875 3.5
Coupling Size **E** **F**	1.5 1.5	2.0 2.0	2.5 3.0
Recommended Minimum Interconnecting Pipe Sizes	1.5	2.0	2.5

Dimensions in Inches ±0.015

Figure 6. Eductor Dimensions

Plumbing Installation

Four (4) plumbing connections must be made. (Refer to Figure 7.) Recommended diameters for interconnecting plumbing and the bypass is:

FSB240 system	2.5"
FSB120 system	2.0"
FSB015/030/060 systems	1.5"

The flush line should be at least 0.5".

Reinforced hose may be used for foam system plumbing connections.

Note: It is important that the proportioning valve assembly and the eductor be mounted below the bottom of the foam tank.

Note: The proportioning valve assembly must be mounted with the motor on top.

1. Connect the **proportioning valve assembly inlet (A) to the foam concentrate tank outlet.**

   The piping into the proportioning valve assembly inlet must have a straight run of at least eight (8) inches. If a check valve is installed in this line it must be at least one (1) foot away from the proportioning valve assembly inlet.

2. Connect the **proportioning valve assembly outlet (B) to the eductor foam concentrate inlet (C).**

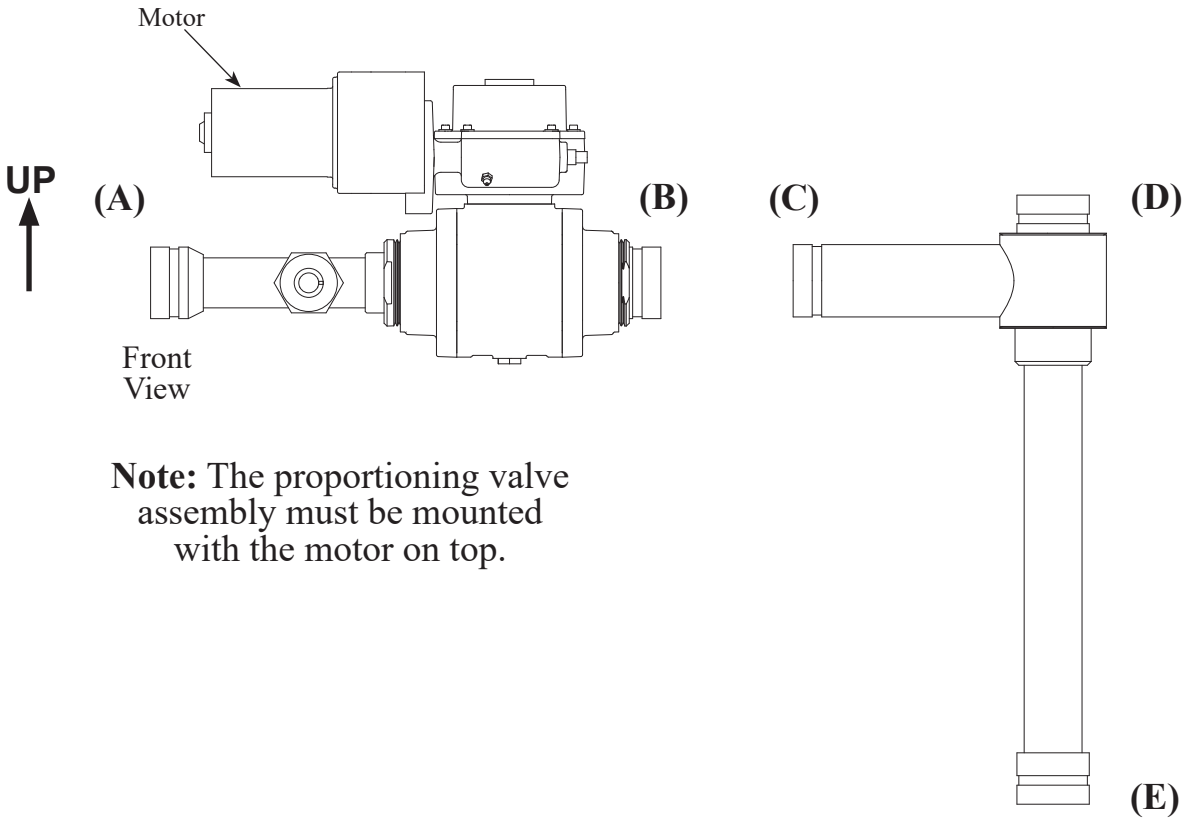
   It is recommended that a bypass valve be installed around the proportioning valve assembly.

3. Connect the **eductor pressurized water inlet (D) to the pump discharge.**

   It is recommended that a water shutoff valve be placed in this line. This valve should be at least six (6) inches away from the eductor.

4. Connect the **eductor outlet (E) to the pump intake**.

Proportioning Valve Assembly **Eductor**



Note: The proportioning valve assembly must be mounted with the motor on top.

Typical System Plumbing Layout

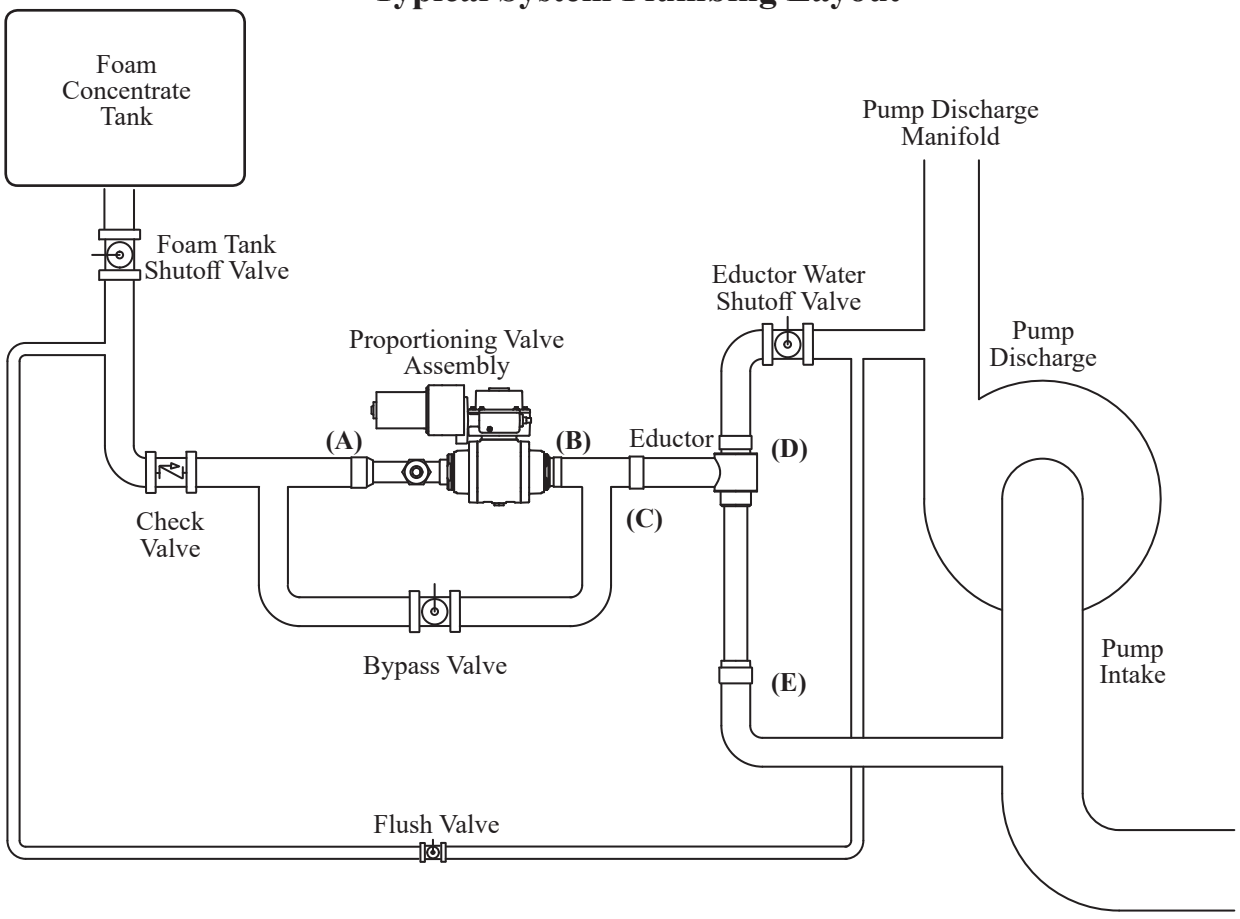


Figure 7. Proportioning Valve Assembly and Eductor

Install Flow Sensor(s)

There are several ways to install paddlewheel type flow sensors. Mounting options include saddle clamps, weldments, pipe tees, and special adapters. Each mount meets a particular plumbing requirement.

Flow sensors are interchangeable. It is recommended to check display accuracy if sensors are swapped and calibrated when necessary.

The maximum flow sensor pressure is 600 PSI.

Flow Sensor Location

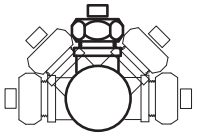
Locating the flow sensor in the plumbing system is critical. The flow of water at and around the sensor must be laminar, or smooth, to ensure accurate flow rate measurement. There must be enough straight pipe before the flow sensor for the water stream to stabilize into a uniform flow. Guidelines for selecting flow sensor locations are outlined in Figure 8.

Turbulent Water

When the flow sensor is mounted after an area in the plumbing that tends to increase water stream turbulence (a valve, increase in pipe diameter, etc.), it is critical that steps are taken to stabilize the flow. When a pipe is reduced in diameter, the water stream tends to be squeezed into a more uniform flow. This can help stabilize flow when there is not sufficient straight pipe up stream.

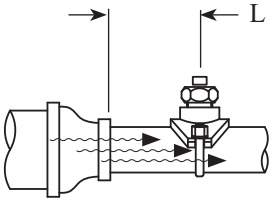
Flow Sensor Location Guide

The preferred location for mounting a flow sensor is on the top half of the pipe. The best orientation is vertical. If the sensor is mounted on the bottom of the pipe, it may be susceptible to dirt accumulation impacting operation.



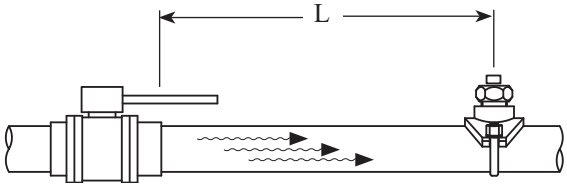
Best Orientation
is Vertical

When mounting a sensor after the pipe diameter is reduced, length L must be at least 2 times the pipe diameter.



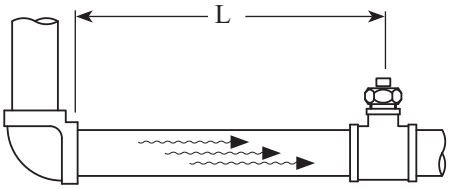
After Reduction
L > 2 X PIPE DIA.

When mounting a sensor after a valve, length L must be at least 14 times the pipe diameter.



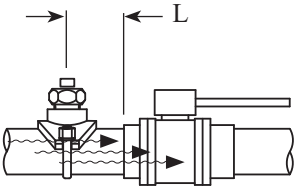
After Valve
L > 14 X PIPE DIA.

When mounting a sensor after an elbow, length L must be at least 6 times the pipe diameter.



After Elbow
L > 6 X PIPE DIA.

When mounting a sensor before a valve or an elbow, length L must be at least equal to the pipe diameter.



Before Valve or Elbow
L > 1 X PIPE DIA.

Figure 8. Flow Sensor Location Guidelines

Saddle Clamp Installation

Note: Ensure that the mounting location meets the requirements for uniform water flow. (Refer to Flow Sensor Location.)

Note: Ensure that there is enough room for the saddle clamp, sensor, and connector to fit. (Refer to Figure 9.)

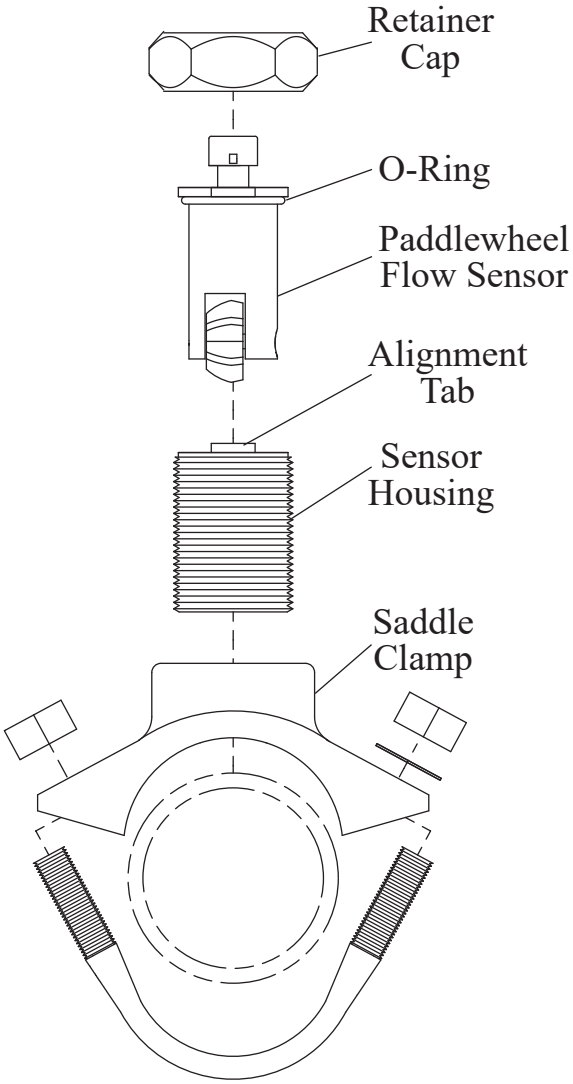
1. Drill and deburr a 1-11/16" to 1-3/4" diameter hole at mounting location.
2. Clean pipe surface in area where saddle clamp gasket seal.

Note: The sensor housing is epoxied in the saddle clamp with the alignment tab in the correct position and is not meant to be removed.

3. Place saddle clamp over hole with sensor housing centered.
4. Tighten saddle clamp nuts until the gasket makes a good tight seal.
5. Insert flow sensor into sensor housing. Align flat spot on sensor rim with alignment tab and make sure o-ring is in groove.

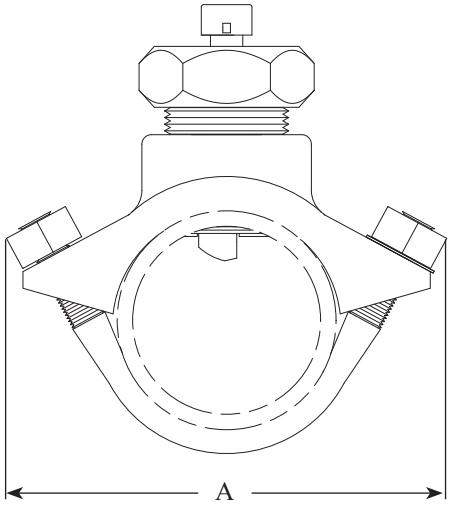
Note: The retainer cap is hand-tightened. There is an inside lip that stops the cap from turning when it makes contact with the alignment tab. This provides the correct pressure to make the seal at the o-ring. Make sure the flow sensor engages the alignment tab and does not rotate.

6. Install retainer cap and hand tighten.
7. Connect flow sensor cable. (Refer to Wiring Section.)



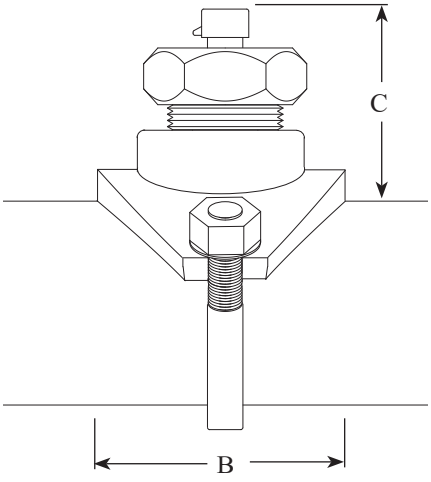
Note: When the retainer cap is tightened make sure the flow sensor engages the alignment tab and does not rotate.

Note: Allow a minimum of 2 inches clearance above the sensor for connector removal/ installation.



Pipe Size (Sch 40)	Dimensions A	B	C
2	5.5	3.9	2.9
2.5	5.5	3.9	2.8
3	5.9	3.9	2.8
3.5	6.8	4.3	2.8
4	6.8	4.3	2.8
5	8	4.3	2.8

Measurements are in inches.



Note: Dimensions are typical and are an aid to determine flow sensor mounting locations.

Figure 9. Saddle Clamp Installation

Weldment Installation

Note: Ensure that the mounting location meets the requirements for uniform water flow. (Refer to Flow Sensor Location Guide.)

Note: Ensure that there is enough room for the weldment, sensor, and connector to fit. (Refer to Figure 10.)

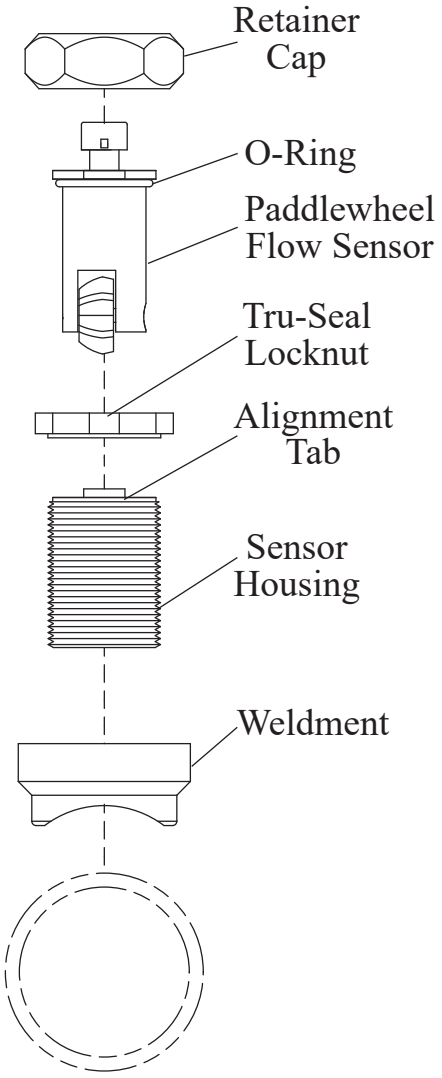
1. Drill and deburr a 1-11/16" to 1-3/4" diameter hole at mounting location.
2. Center weldment mount over hole and weld it to pipe. The weld must be continuous around the fitting with no gaps or voids.
3. Screw sensor housing into weldment far enough to make sure it goes through the pipe freely, then back it out.

Note: The paddlewheel sensor must be correctly aligned in the water stream. The alignment tab is used to set the position of the sensor. Make sure that the alignment tab is centered on the pipe centerline. (Refer to Figure 10.)

4. Set sensor housing to dimension A in Figure 10. Make sure the alignment tab is centered on the pipe as shown (it can be on upstream or downstream side).
5. Install tru-seal locknut and tighten with 2" wrench using light to medium torque. Make sure the sensor housing alignment tab remains centered and the sensor housing does not rotate causing dimension A to change.
6. Insert flow sensor into sensor housing. Align flat spot on sensor rim with alignment tab and make sure o-ring is in groove.

Note: The retainer cap is hand-tightened. There is an inside lip that stops the cap from turning when it makes contact with the alignment tab. This provides the correct pressure to make the seal at the o-ring. Make sure the flow sensor engages the alignment tab and does not rotate.

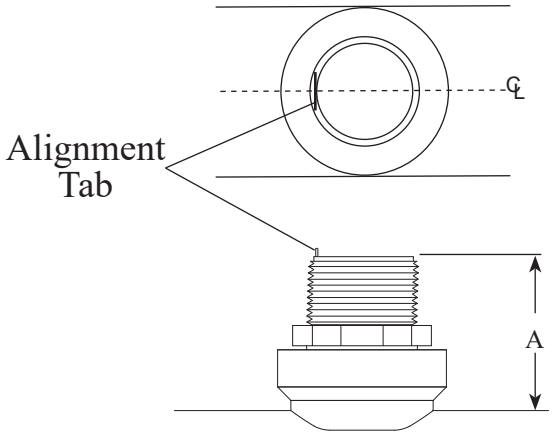
7. Install retainer cap and hand tighten.
8. Connect flow sensor cable. (Refer to Wiring Section.)



Pipe Size (Sch 40)	Dimension A
1.5	1.95 to 1.80
2	1.95 to 1.80
2.5	1.90 to 1.75
3	1.88 to 1.73
3.5	1.88 to 1.73
4	1.85 to 1.70
5	1.85 to 1.70
6	1.85 to 1.70

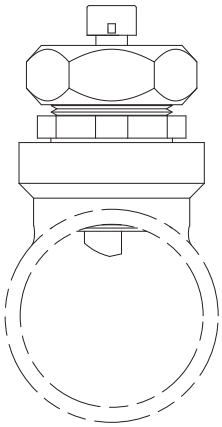
Measurements are in inches.

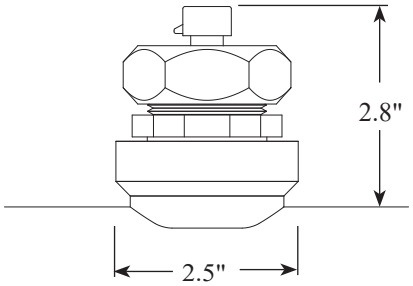
Make sure that the alignment tab is centered on the pipe centerline.



Note: Allow a minimum of 2 inches clearance above the sensor for connector removal/installation.

Note: When the retainer cap is tightened make sure the flow sensor engages the alignment tab and does not rotate.





Note: Dimensions are typical and are an aid to determine flow sensor mounting locations.

Figure 10. Weldment Installation

THEORY OF OPERATION

The operation of the AutoFoam SC system is controlled by software, selections the operator makes, and microprocessors housed in the control module, proportioning valve assembly, and the summing box. The programming enables the system to operate in three different modes.

Automatic Mode

This is the normal mode of operation. In this mode of operation the flow rate of foam concentrate is determined by the percent selected on the control module and inputs from the flow sensors. The microprocessors control the opening or closing of the proportioning valve to provide the correct foam solution at the pump discharge.

When in the automatic mode the flow sensors provide constant feedback of flow rate information. Dual flow sensors mounted on the proportioning valve assembly monitor foam concentrate flow rate. The discharge flow sensor mounted at the discharge side of the pump monitor the solution (foam concentrate and water mixture) flow rate. The flow rate information allows the system to maintain the selected foam proportioning regardless of discharge fluctuations.

The proportioning valve controls the amount of foam concentrate that flows into the eductor. The eductor injects the foam concentrate into the suction side of the pump. The flow rates are monitored, processed and displayed. The proportioning valve is adjusted to produce the selected foam proportion.

If input data from one of the dual foam concentrate flow sensors is lost the program will automatically use the information from the one that is operating properly. There is no loss in performance or accuracy of the system. If input data from both foam flow sensors is lost, the system switches over to the fixed program mode.

Fixed Program Mode

The system enters this mode when there is no (or low) input data from both foam concentrate flow sensors. In this mode of operation the position of the proportioning valve is set according to flow rate information stored in the program. In this mode POS.FEED and the percent selected is shown in the message display.

When in the fixed program mode, stored valve position data is used to adjust the proportioning valve. There is a sensor in the valve assembly that provides feedback on the valve position. The valve position is directly related to how much foam concentrate flows. The program uses the selected foam proportion percent and the discharge water flow rate to position the valve for the correct foam concentrate rate of flow.

Foam concentrate flow rate less than 10 GPM: At requested flow rates of 10 GPM or less there is no output from the flow sensors. This low flow rate is below the minimum that the flow sensors can detect and they do not provided flow rate data. This condition does not indicate a failure in the system. This condition normally exists when the proportioning percent selected and the water flow at the discharge sensor are low.

Foam concentrate flow rate greater than 10 GPM: If there is no output from the flow sensors a failure in the system is indicated. The upper display shows an E02 code when the system is turned off to alert the operator that a failure occurred. This condition would exist if both foam flow sensors are inoperable because of some mechanical failure. This could include clogged foam lines or sensors, disconnected sensor or proportioning valve assembly cables, open wiring, or no foam in the tank.

The system exits the fixed program mode and automatically operates in the automatic mode when input data from a foam concentrate flow sensor is detected.

Manual Mode

Note: The system must be active in the automatic mode (green LED on) before using the manual mode.

When the MANUAL OVERRIDE OPEN or CLOSE button is pressed and held for three seconds the system switches to manual mode. The message display flashes to indicate the system is in the manual mode. The displays continue to show correct foam concentrate and water flow rates.

When in the manual mode the operator is in control of the amount of foam concentrate that goes into solution. The OPEN and CLOSE push buttons are used to control the opening and closing of the proportioning valve. As the valve is opened or closed, the rate of flow of foam concentrate that is injected into solution is changed.

The message display shows the foam percent in solution. This is calculated automatically from the valve position and the discharge flow rate. There is no need for the operator to guess.

It is up to the operator to monitor the amount of foam in solution and make adjustments manually. The OPEN button increases the amount foam in the solution, the CLOSE button decreases the amount of foam in the solution.

To exit the manual mode the FOAM ON button is pressed to start the automatic mode or the OFF button is pressed to turn the system off.

OPERATION

Power

Note: When power is applied to the control module the message display shows the model number and the software program revision number for five (5) seconds. These can also be viewed by selecting P101 and P102 codes, refer to Programming Section.

On power-up the proportioning valve position is checked. If the valve is open, it is automatically closed:

OFF LED is on; FOAM FLOW display flashes OFF; message display shows VALVE CLOSING; WATER FLOW display shows the water flow rate through the discharge*.

When the system has power and the proportioning valve is closed:

OFF LED is on; FOAM FLOW display shows OFF; message display shows the date and time; WATER FLOW display shows the water flow rate through the discharge*.

*Single flow sensor or total from the summing box (multiple flow sensors).

Controls

OFF Button

Press to stop foam operations. When the OFF button is pressed, the proportioning valve position is checked. If the valve is open, it is automatically closed:

OFF LED is on; FOAM FLOW display flashes OFF; message display shows VALVE CLOSING; WATER FLOW display shows the water flow rate through the discharge.

FOAM ON Button

Press and hold this button for two (2) seconds to start foam operations in the automatic mode:

ON LED is on; FOAM FLOW display shows the foam concentrate flow rate through the proportioning valve; message display shows AUTO and the selected solution percent; WATER FLOW display shows the water flow rate through the discharge.

Remote Auto/Off Switch Option

The remote switch provides the same function as the FOAM ON and OFF buttons. Hold the momentary switch on for one second to put foam system into automatic mode. Press the switch to turn system the system off.

INC/DEC Buttons

The FOAM % INC and DEC buttons are used to change the percent of foam concentrate in solution. The message display shows the selected percent. The system automatically adjusts the proportioning valve to mix the correct solution for discharge.

OPEN/CLOSE Buttons

The MANUAL OVERRIDE OPEN or CLOSE buttons give the operator manual control of the proportioning valve and how mush concentrate is allowed to flow.

Press and hold a button for three (3) seconds to start foam operations in the manual mode:

ON LED is on; FOAM FLOW display shows the foam concentrate flow rate through the proportioning valve; message display flashes MANUAL and the calculated solution percent; WATER FLOW display shows the water flow rate through the discharge

MENU and SELECT Button

The MENU button allows the operator to gain access to system information and stored data, this is shown on the message display. The INC, DEC, and SELECT buttons are pressed to scroll, select, and perform reset functions.

Pump Intake and Discharge Pressure Requirements

WARNING: If the recommended pressure differential is not established, the foam system may operate at partial capacity or fail to inject foam.

Note: It is recommended to gate the pump intake pressure to less than 20 PSI and adjust the discharge pressure to greater than 140 PSI.

For efficient operation around-the-pump foam proportioning systems require a pressure differential between the pump intake and pump discharge. It is recommended that the pump intake pressure be less than 20 PSI. When operating with a higher intake pressure, follow the requirements for pressure differential shown in Table 3.

Table 3. Pump Pressure Requirements

Pump Intake Pressure	Minimum Pump Discharge Pressure
0*	85
20	140
40	200
50	240
70	300

***Note:** When pumping in draft consider the intake pressure to be 0 PSI.

Error Codes and Fault Warning Codes

If a monitored function is not within normal parameters the FOAM FLOW display flashes an error or fault code and the message display shows the description. (Refer to Table 4. Error Codes or Table 5. Fault Warning Codes.)

Error and fault codes are stored in memory with a date and time stamp. These can be reviewed using the MENU button. Refer to Detailed Information Section.

Table 4. Error Codes

FOAM FLOW Display	Message Display	Description
E01	FOAM # FAILED	No signal detected from one of the foam concentrate flow sensor
E02	LOW FOAM FLOW	Low foam concentrate flow rate; Proportioning valve in full open position
E03	V POS FAILED	No proportioning valve position sensor feedback; Motor current detected indicates motor operational
E04	VAL. NOT MOVING	No valve motion detected; No motor current detected indicates possible motor failure or high motor current detected indicates valve stuck
E05	NO VALVE DETECTED	No proportioning valve assembly signal

Table 5. Fault Warning Codes

FOAM FLOW Display	Message Display	Description
F01	FOAM LOW	Input from the TankVision Display
F02	NO FOAM	Proportioning valve open, no foam concentrate flow detected

Modes

There are three modes of system operation: Automatic, Fixed Program, and Manual. (Refer to Theory of Operation Section for more details.)

Automatic Mode

Press and hold the FOAM ON button for two (2) seconds. The system is on in the automatic mode. The ON LED is on, the FOAM FLOW display shows the foam concentrate flow rate through the proportioning valve, the message display shows AUTO and the selected solution percent, the WATER FLOW display shows the water flow rate through the discharge.

Fixed Program Mode

When there is no (or low) input data from both foam concentrate flow sensors the system is in the fixed program mode. The ON LED is on, the FOAM FLOW display flashes an F and the programmed foam concentrate flow rate*, the message display shows POS.FEED and the selected solution percent, the WATER FLOW display shows the water flow rate through the discharge.

*(The foam concentrate flow rate is controlled using valve position data stored in the program for discharge flow rates at set foam proportions.)

Manual Mode

Press and hold the MANUAL OVERRIDE OPEN or CLOSE button for three seconds. The system is in the manual mode. The ON LED is on, the FOAM FLOW display shows the foam concentrate flow rate through the proportioning valve, the message display flashes MANUAL and the calculated* solution percent, the WATER FLOW display shows the water flow rate through the discharge.

*(The solution percent is calculated using the foam concentrate flow rate and the water flow rate through the discharge.)

Detailed Information

The MENU button allows the operator to gain access to detailed information and some programming features.

Press the MENU button to open detailed information menu.

Press the INC and DEC buttons to scroll through the menu items.

Press the SELECT button to view detailed data.

Press the INC and DEC buttons to scroll through the detailed data.

Press the MENU button to exit.

The message display reverts to normal operation after ten (10) seconds if no button is pressed.

Table 6. Detailed Information

Message Display	Description
TOTAL WATER	* Shows total amount of water flow (in gallons or liters)
TOTAL FOAM	* Shows total amount of foam concentrate flow (in gallons or liters)
WATER FLOW	Shows water flow rate for each discharge (active with summing box and multiple discharge flow sensors)
FOAM LEVEL	Shows foam concentrate left in tank (input required from TankVision Display)
VALVE POSITION	Shows percent the valve is open
FAULT CODES	Shows stored faults with date and time, use the INC and DEC buttons to scroll

***Note:** The total water and total foam flow amounts are reset to zero when the system is powered down. These can be reset during operations if required.

Total Water or Total Foam Reset to Zero During Operations

1. Select TOTAL WATER or TOTAL FOAM from detailed information menu.
2. Press the SELECT button to show total flow.
3. Press and hold the SELECT button for five (5) seconds.
4. Press the INC button to select RESET? YES.
5. Press and hold the MENU button for five (5) seconds to show RESET DONE.
6. Press the MENU button to exit.

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PROGRAMMING

All program functions are password protected. A password is not needed to reset the total water and total foam flow rates to zero. (Refer to Detailed Information Section.)

Note: To exit programming modes, press and hold the MENU button for five (5) seconds.

Password Protected Programs

The following program functions are available to view and change after the password code has been entered.

Enter Password Code

1. Press and hold the SELECT button for 3 seconds. The FOAM FLOW display shows four dashes – – – – and the message display shows ENTER CODES. Release the button.
2. Press the INC and DEC buttons enter a code. Each time a button is pressed the first digit changes by 1. Set the first digit to the desired number.
3. Press the SELECT button to move the curser to the next digit. Press the INC and DEC buttons to change the digit.
4. Repeat step 3 and enter the password code.

   Result: When a correct password code is entered the FOAM FLOW display flashes the program (P) code and the message display shows the name of the program or a description of the program code.
5. Press the INC and DEC buttons to scroll through the codes.
6. Press and hold the MENU button for five (5) seconds to exit.

Calibration Password Codes 1111 to 1113

Provides access to programming required for system calibration procedures.

1111 - Water Flow Calibration

1112 - Foam Flow Calibration

1113 - Proportioning Valve Position Calibration

Refer to Calibration Section.

Operator Password Code 1221

Allows read only stored data to be viewed, date and time to be set, and access to set ID names for discharge flow sensors.

1221 - Operator Programs

Refer to Table 7. Operator Password Accessed Program Functions.

System Restore Password Code 2122

The system restore function is used when components of the system are replaced.

2122 - System Restore

Refer to Table 9. System Restore Code P2XX.

Table 7. Operator Password Accessed Program Functions

CODE	DESCRIPTION	MESSAGE DISPLAY	Press SELECT button to select; change value with INC or DEC button
P101	System Model	MODEL FSBXXX	(Read Only)
P102	Software Revision	PROG REV XXX.XX	(Read Only)
P103	Manufacturing Date	MFG DATE DDMMM'YY	(Read Only)
P104	Serial Number	SERIAL # XXX	(Read Only)
P105	Hardware Version	HARDWARE XXX	(Read Only)
P106	UID Number - Upper	UIDUPPER XX-XX-XX	(Read Only)
P107	UID Number - Lower	UIDLOWER XX-XX-XX	(Read Only)
P108	Current Date	SET DATE DDMMM'YY	Refer to Set Date Code P108
P109	Current Time	SET TIME HH:MM AM/PM	Refer to Set Time Code P109
P110*	Assign ID Names for Discharge Flow Sensors	SET FLOW	Refer to Set ID Names Code P110
P115	Sets the Display Flow Cut Off	SET CUT	Default value–10
P116**	Sets foam preset % at power up (Battery On). If the unit is turned from 'ON' to 'OFF', when turned back 'ON', the default foam percentage will be the **last value** used.	PRESET % LAST VAL (Default Setting)	'LAST VAL' or 'Set Foam Percentage' (0-10%)

*** Note:** This code (P110) is only available when a system has multiple discharge flow sensors. If no ID names are programmed, the system assigns FLOW 1, FLOW 2, FLOW 3, etc., based on each flow sensor input connection to the summing box(es).

**** Note**: Foam % is the Foam Percentage Range, which corresponds to a particular model.

Set Date and Time

Set Date Code P108

Enter password code 1221. (Refer to Password Protected Programs Section.)

1. Press the INC and DEC buttons and scroll to code P108.
2. Press the SELECT button.
   Result: The message display shows the date with the day flashing.
3. Press the INC and DEC buttons to change the day.
4. Press the SELECT button.
   Result: The month flashes.
5. Press the INC and DEC buttons to change the month.
6. Press the SELECT button.
   Result: The year flashes.
7. Press the INC and DEC buttons to change the year.
8. Press and hold the MENU button for five (5) seconds.
   Result: The the new date is saved and display shows code P109.
9. Press and hold the MENU button for five (5) seconds to exit.

Set Time Code P109

Enter password code 1221. (Refer to Password Protected Programs Section.)

1. Press the INC and DEC buttons and scroll to code P109.
2. Press the SELECT button.
   Result: The message display shows the time with the hours flashing.
3. Press the INC and DEC buttons to change hours.
4. Press the SELECT button.
   Result: The message display shows time with the minutes flashing.
5. Press the INC and DEC buttons to change the minutes.
6. Press the SELECT button.
   Result: The message display shows time with the AM/PM flashing.
7. Press the INC and DEC buttons to change the AM/PM.
8. Press and hold the MENU button for five (5) seconds.
   Result: The the new time is saved and display shows code P110.
9. Press and hold the MENU button for five (5) seconds to exit.

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Set Discharge Flow Sensor ID Names

This code applies to systems with multiple foam discharge flow sensors. There are twelve (12) names along with a two digit number that can be used to identify each foam discharge flow sensor.

If no ID names are programmed for the sensors, the factory defaults are FLOW 1, FLOW 2, FLOW 3, etc., based on the location of each flow sensor input connection to the summing box(es)

The summing boxes are identified, when the code is selected, and shown on the control module display as Sb #.# (#'s refer to box and input). The following example shows two summing boxes with a total of nine inputs:

First box six inputs Sb 1.1, Sb 1.2, Sb 1.3, Sb 1.4, Sb 1.5, Sb 1.6

Second box three inputs Sb 2.1, Sb 2.2, Sb 2.3.

The factory default ID name shown in the message display for the above example is FLOW 1 through FLOW 9.

Set Flow ID Name Code P110

Enter password code 1221. (Refer to Password Protected Programs Section.)

1. Press the INC and DEC buttons and scroll to code P110.
2. Press the SELECT button.

   Result: The FOAM FLOW display shows Sb 1.1, 1.1 flashes indicating summing box 1, input 1, message display shows the ID name.
3. Press the SELECT button (or press the INC or DEC button to scroll inputs).

   Result: The message display flashes the ID name.
4. Press the INC and DEC buttons to scroll the ID names (refer to Table 8).
5. Press the SELECT button to choose a name.

   Result: The message display flashes the ID number.
6. Set the number (press the INC and DEC buttons to change the digit , press the SELECT button to move the curser to the next digit).
7. Press the MENU button to return to step 3.
8. Press and hold the MENU button for five (5) seconds to exit.

Table 8. Discharge Flow Sensor ID Names Code P110

MESSAGE DISPLAY	DESCRIPTION
DIS. ##	Discharge
F DIS. ##	Front Discharge
REAR DIS ##	Rear Discharge
L/R DIS ##.	Left Rear Discharge
R/R DIS. ##	Right Rear Discharge
DECK GUN ##	Deck Gun
ROOF TUR ##	Roof Turret
CROSSLAY ##	Crosslay
PCON ##	Pre-Connect
L/R PCON ##	Left Rear Pre-Connect
R/R PCON ##	Right Rear Pre-Connect
FLOW ##	Factory default ID name

System Restore Function

The system restore function is used when components of the system are replaced. The control module, proportioning valve assembly, and the summing box each have memory that contains a copy of program settings and the system calibration.

When one of these components are replaced program settings and the system calibration is restored from the memory of an original component.

Note: Remove and replace one (1) component at a time. Perform the complete system restore procedure for the component, then proceed with replacing another.

System Restore Code P201 to P204

Enter password code 2122. (Refer to Password Protected Programs Section.)

1. Press the INC and DEC buttons and scroll to P code and the name of the component that was replaced (refer to Table 9).
2. Press the SELECT button.

   Result: The message display shows the component selected. The WATER FLOW display flashes NO.
3. Press the INC and DEC buttons to change NO to YES.
4. Press and hold the MENU button for five (5) seconds to save.

   Result: The message display flashes UPDATING SYSTEM and then shows RESTORE DONE.

The program automatically exits.

Table 9. System Restore Code P2XX

CODE	DESCRIPTION	MESSAGE DISPLAY	Press SELECT button to select; change value with INC or DEC button
P201	Control module is replaced	CONTROL MODULE	NO <> YES
P202	Proportioning valve assembly is replaced with two (2) new flow sensors installed	COMPLETE VALVE	NO <> YES
P203	Proportioning valve assembly is replaced using two (2) existing flow sensors	VALVE-NO SENSORS	NO <> YES
P204	The summing box has been replaced	SUMMING BOX	NO <> YES

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CALIBRATION

The components of the AutoFoam SC system are calibrated at the factory, but plumbing systems are unique and may cause small deviations in the factory calibration. It is recommended that the calibration be checked after system installation.

The control module, proportioning valve assembly, and the summing box each have memory that contains a copy of the system calibration. If one or two of these components are replaced the system calibration can be restored from the memory of an original component.

Calibrate Discharge Sensor(s) Password Code 1111

Note: Use a calibrated flow meter or pitot gauge on the discharge under test as a reference. When flowing water, ensure a constant pressure is maintained to obtain a steady flow rate.

For systems with multiple discharge flow sensors, calibrate each sensor separately.

1. Enter password code 1111. (Refer to Password Protected Programs Section.)

   Result 1: For single sensor system the message display shows WATER CAL.

   Result 2: For multiple sensor system the message display shows MULTIPLE FLOW CAL.

2. Press the SELECT button.

   Result 1: The WATER FLOW display shows the flow rate with the last digit flashing.

   Result 2: The FOAM FLOW display shows Sb 1.1, the message display shows the sensor ID name.

3. Multiple sensor system: (If single sensor go to step 4.)

   a. Press the INC and DEC buttons to scroll the ID name.

   b. Press the SELECT button for the sensor ID to calibrate.

   Result: The WATER FLOW display shows the flow rate with the last digit flashing.

4. Flow water through the discharge.

5. Set the flow rate shown on the WATER FLOW display to match the flow rate shown on the reference meter.

   Press the INC and DEC buttons to change the digit.
   Press the SELECT button to move the curser to the next digit.

6. Multiple sensor system: (If single sensor go to step 7.)
    a. Press and hold the MENU button for five (5) seconds to save.

        Result: The message display shows the next sensor ID name.

    b. Repeat steps 3 to 6 as necessary.
7. Press and hold the MENU button for five (5) seconds to save and exit.

Select a second reference flow rate and flow water for each discharge to verify the calibration. The flow rate shown on the WATER FLOW display should match the flow rate shown on the reference meter.

Once the system has calibrated the System Restore function, code P110 is used when a component is replaced. (Refer to Programming Section.)

Table 10. Calibration Failure Messages

MESSAGE DISPLAY	DESCRIPTION
NO FLOW DETECTED	No signal from the discharge flow sensor
ZERO CAL ERROR	A flow rate was not entered during the discharge flow sensor calibration procedure
VALV CAL FAILED	The proportioning valve position calibration has failed

Calibrate Foam Concentrate Flow Sensors Password Code 1112

The foam concentrate flow sensors are calibrated at the factory. They do not need to be re-calibrated if the valve is replaced. Check the calibration if a sensor is replaced.

1. Enter password code 1112. (Refer to Password Protected Programs Section.)

   Result: The message display shows FOAM FLOW CAL.

2. Press the SELECT button.

   Result: The FOAM FLOW display shows the flow rate with the last digit flashing.

3. Press and hold the MANUAL OVERRIDE OPEN button to fully open the proportioning valve.

4. Calculate the actual flow rate:

   a. Close the foam tank shutoff valve and fill the foam tank with a measured amount of water.

   b. Flow water at a rate of 600 GPM through any discharge.

   c. Open the foam tank shutoff valve.

   d. Time how long it takes for the foam tank to empty. Record the time in seconds. Record the displayed foam flow rate shown on the control module display.

   e. Divide the amount of water in the foam tank (total gallon volume) by the time it took to empty the tank and multiply by 60 seconds per-minute to get GPM.

      Example: (10 gallons/10 seconds) x 60 seconds/minute = 60 GPM

   f. This is the actual foam concentrate flow rate. For best accuracy repeat the procedure 2 to 3 times. Ensure there is consistency in the result. (Do not average results that vary greatly from one another.)

6. Set the flow rate shown on the FOAM FLOW display to match the calculated flow rate.

   Press the INC and DEC buttons to change the digit.
   Press the SELECT button to move the curser to the next digit.

7. Press and hold the MENU button for five (5) seconds to exit.

Calibrate Proportioning Valve Position Password Code 1113

The following procedure initiates an automatic calibration program for the proportioning valve.

Note: The proportioning valve is calibrated at the factory, there is no need to perform this calibration during installation.

1. Enter password code 1113. (Refer to Password Protected Programs Section.)

   Result: The message display shows VALVE CAL.

2. Press the SELECT button.

   Result: The message display shows AUTO CAL

3. Press the SELECT button to activate the auto calibration program.

   Result: The message display flashes CAL IN PROGRESS then shows VALVE CAL DONE.

The program automatically exits.

Note: The valve motor shaft rotates 13 times from closed to full open.

MAINTENANCE

Flushing the System

It is recommended that the system is flushed after each use to remove the foam concentrate from the flow sensors, proportioning valve, and plumbing. Make sure that the valve to the foam tank is closed when flushing the system so that no water gets into the foam tank.

1. Ensure that the pump intake and discharge pressures are within minimum requirements. (Refer to Table 3. Pump Pressure Requirements.)
2. Ensure that the bypass valve and foam tank shutoff valve are closed. Open the flush valve and the eductor water shutoff valve if installed.
3. Press FOAM ON button.
4. Open discharge and pump water.
5. Press and hold MANUAL OVERRIDE OPEN button. Run the proportioning valve to the fully open position.
6. Press the OFF button when the system is flushed out.

Cleaning the Paddlewheel Sensors

The paddlewheel type flow sensors need to spin freely to generate flow rate data. Should the sensor get clogged and stuck, it can be removed for cleaning.

Remove the retainer cap which holds the paddlewheel sensor in the housing and slide the sensor out.

Use plain water to clean the paddlewheel sensors. Do not use solvents.

Be careful when reinstalling the paddlewheel sensor. The paddlewheel only seats properly when in the correct orientation. (Refer to Install Flow Sensor Section.)

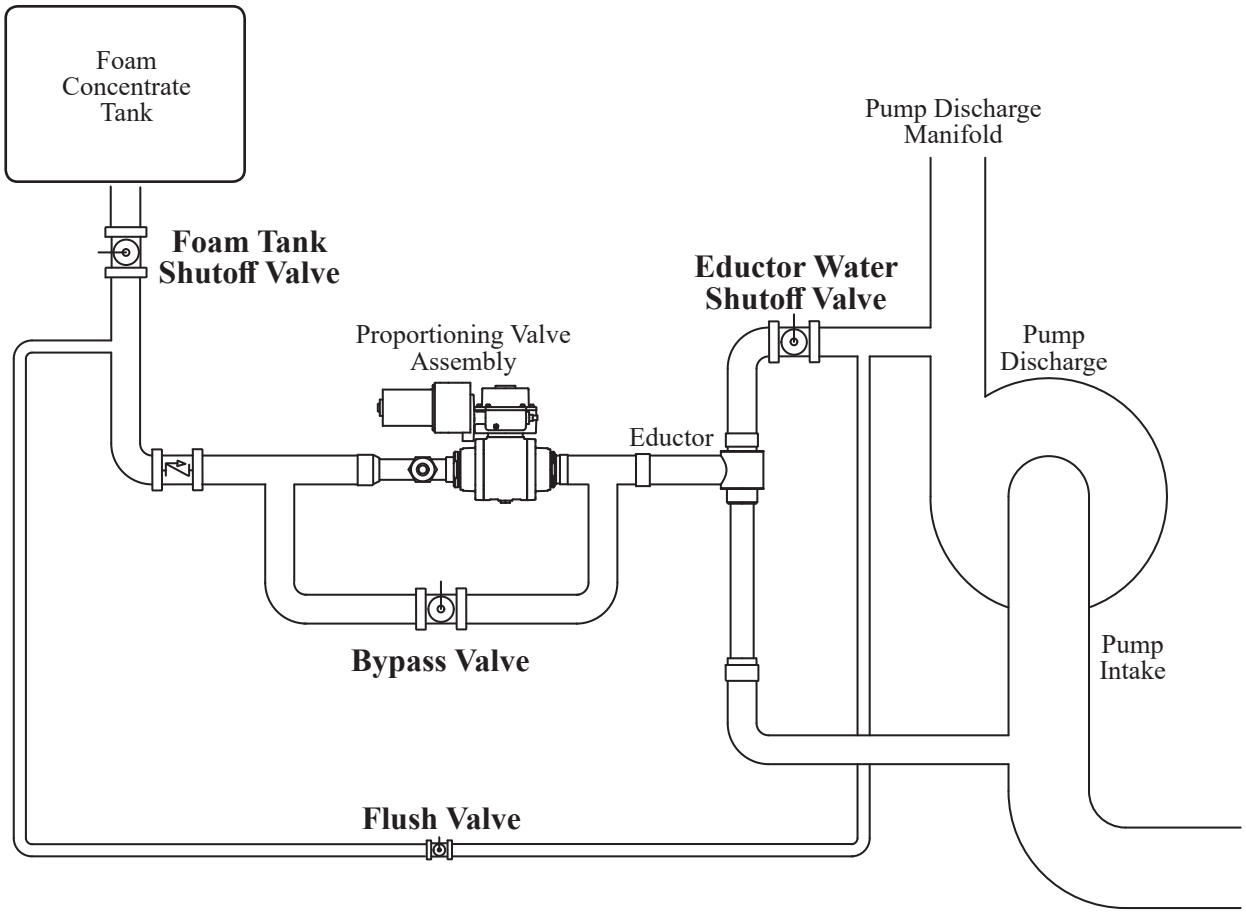


Figure 11. Flushing the System

WIRING

The following figures include wiring diagrams, connector pin outs, and cable information.

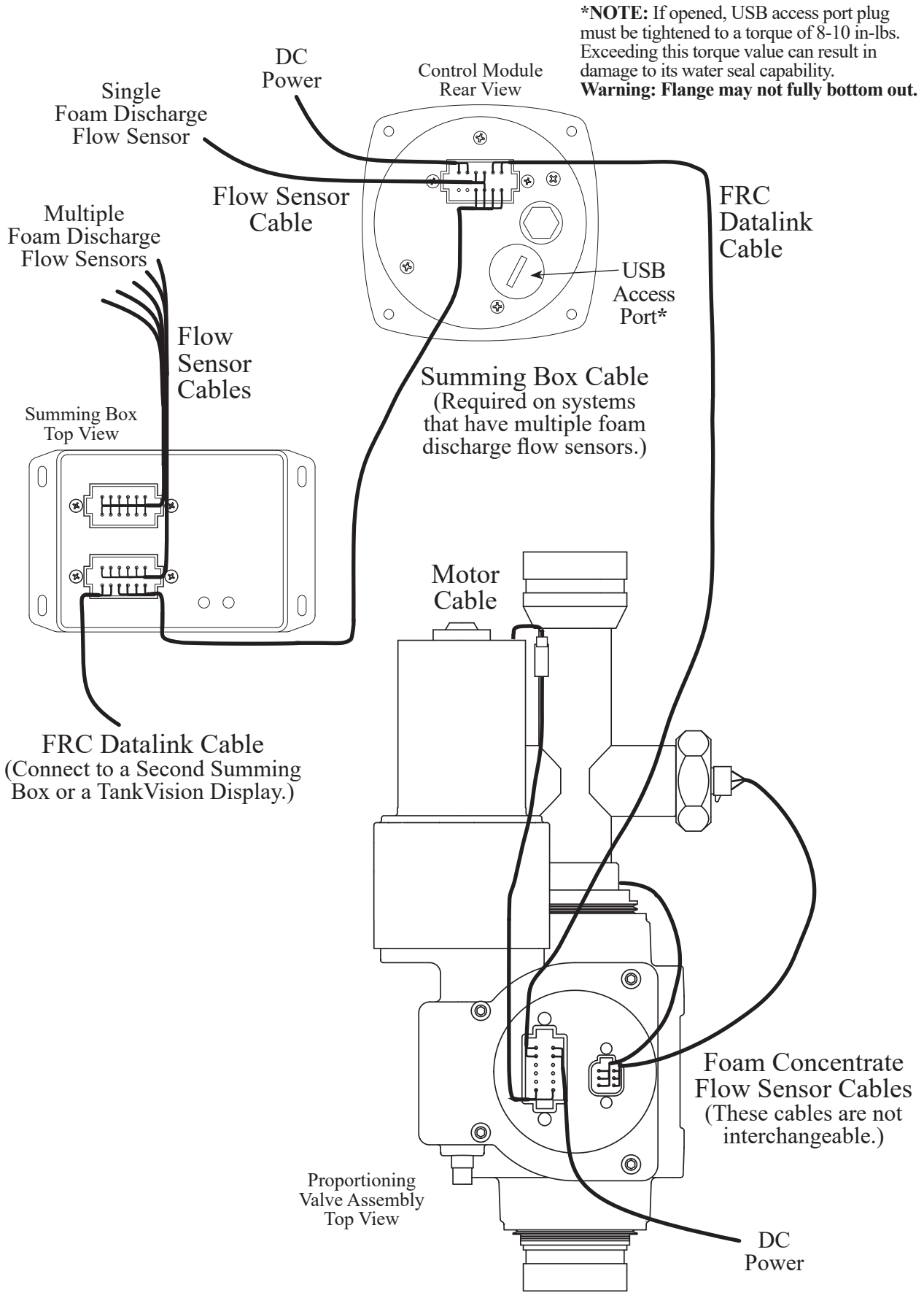


Figure 12. System Wiring

Control Module

The control module communicates with the proportioning valve and the discharge flow sensors via the FRC datalink.

The control module provides supply power to the summing box(es).

Notes:

- The proportioning valve is connected to FRC datalink pins 5 and 6.

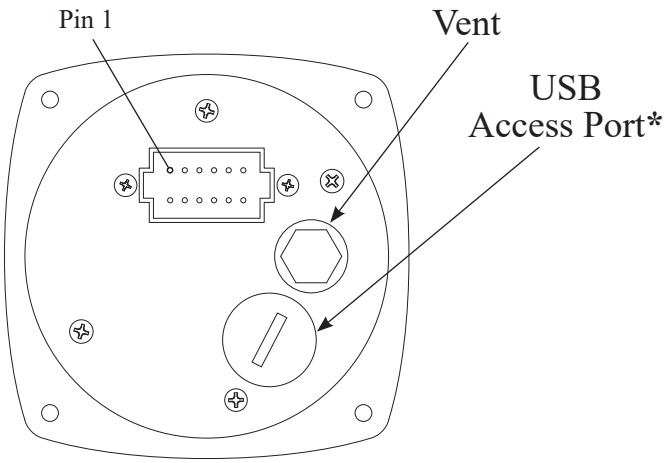
- Systems with a single discharge flow sensor:
  The sensor cable is attached to pins 3, 4, and 9.

- Systems with two or more discharge flow sensors:
  Summing box(es) must be installed
  The summing box is connected to pins 7, 8, 9, and 10.

12-Pin Connector/Cable

Pin/Wire	Description
1/Red	Supply Power 12/24 VDC
2/Black	Supply Ground
3/Red	Sensor +5 VDC
4/White	Sensor Signal
5/Black	FRC Datalink (–)
6/Red	FRC Datalink (+)
7/White	FRC Datalink (+)
8/Green	FRC Datalink (–)
9/Black	Sensor Ground
10/Red	Power Out 12/24 VDC
11	Programmable I/O
12	Programmable I/O

***NOTE:** If opened, USB access port plug must be tightened to a torque of 8-10 in-lbs. Exceeding this torque value can result in damage to its water seal capability.
Warning: Flange may not fully bottom out.



Control Module
Rear View

Figure 13. Control Module Wiring

Proportioning Valve Assembly

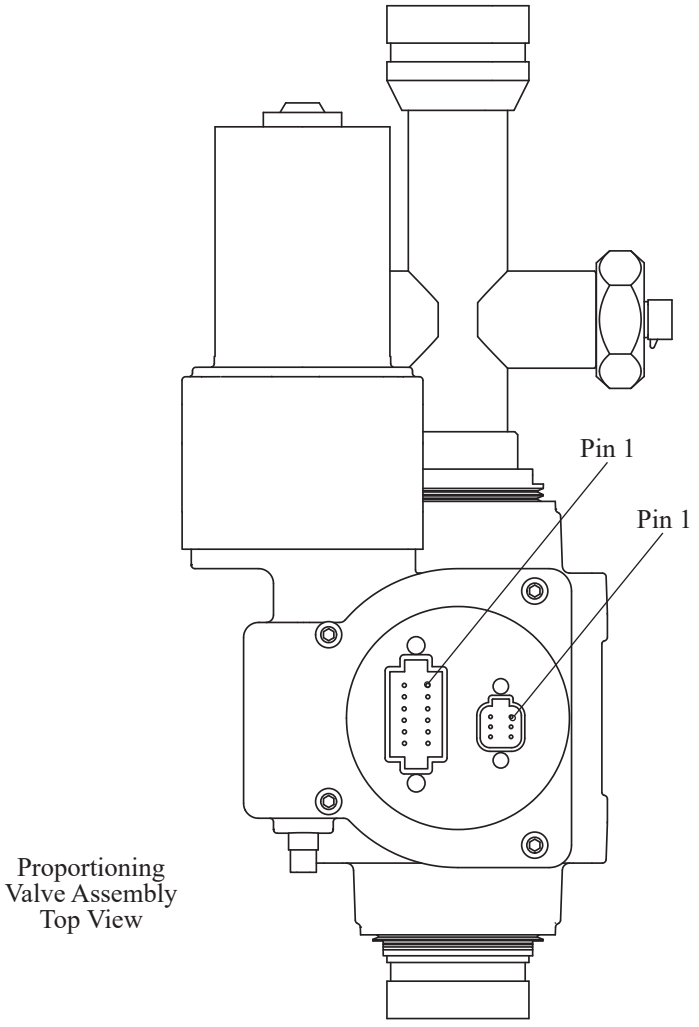
The foam concentrate flow sensor cables can not be swapped.

12-Pin Connector/Cable

Pin/Wire	Description
1/Red	Supply Power 12/24 VDC
2/Black	Supply Ground
3	N/C
4	N/C
5	N/C
6/Black	Motor Control (–)
7/Red	Motor Control (+)
8	N/C
9	N/C
10	N/C
11/Red	FRC Datalink (+)
12/Black	FRC Datalink (–)

6-Pin Connector/Cable

Pin/Wire	Description
1/Red	Sensor +5 VDC
2/Black	Sensor Ground
3/White	Sensor Signal
4/Red	Sensor +5 VDC
5/Black	Sensor Ground
6/White	Sensor Signal



Proportioning Valve Assembly Top View

Figure 14. Proportioning Valve Assembly Wiring

Flow Sensor

Systems with a single discharge flow sensor: The sensor cable is connected directly to the control module.

Systems with multiple flow sensors: The sensor cables are connected to a summing box. The summing box is connected to the control module via a supply power and FRC datalink cable.

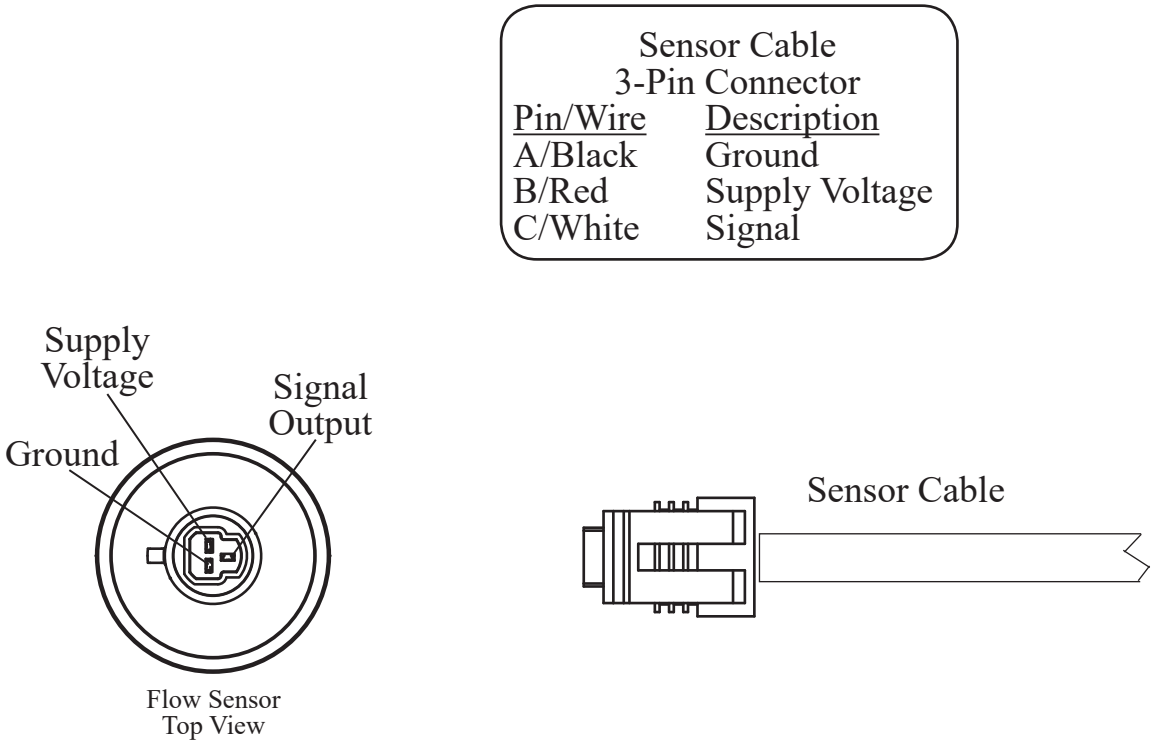


Figure 15. Flow Sensor Wiring

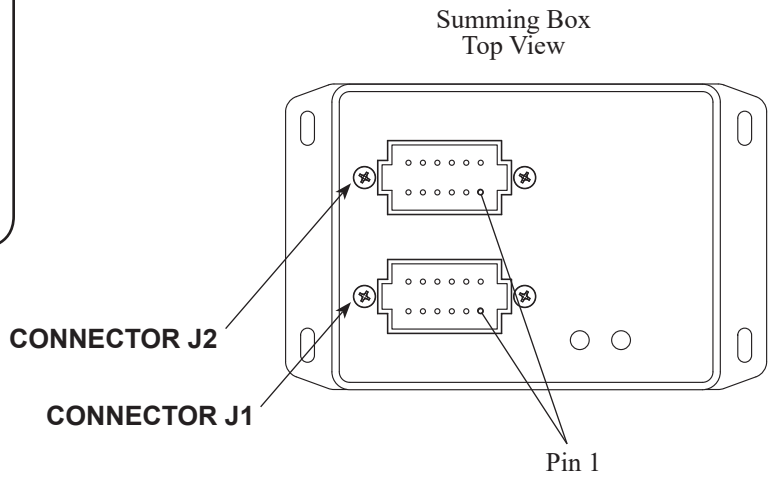
Summing Box

The summing box has two 12-Pin connectors. Each box has inputs for six (6) discharge flow sensors. Multiple boxes are interconnected using the FRC datalink. Power is provided by the control model.

Note: When more than one box is installed the address of each box must be set. Refer to Installation Section.

CONNECTOR J2
12-Pin Connector/Cable

Pin/Wire	Description
1/Red	Sensor +5 VDC
2/Black	Sensor Ground
3/White	Sensor 3 Signal
4/Red	Sensor +5 VDC
5/Black	Sensor Ground
6/White	Sensor 4 Signal
7/Red	Sensor +5 VDC
8/Black	Sensor Ground
9/White	Sensor 5 Signal
10/Red	Sensor +5 VDC
11/Black	Sensor Ground
12/White	Sensor 6 Signal



CONNECTOR J1
12-Pin Connector/Cable

Pin/Wire	Description
1/Red *	Supply Power 12/24 VDC
2/Black*	Supply Ground
3/Green*	FRC Datalink (–)
4/White*	FRC Datalink (+)
5/Black	FRC Datalink (–)
6/Red	FRC Datalink (+)
7/Red	Sensor +5 VDC
8/Black	Sensor Ground
9/White	Sensor 1 Signal
10/Red	Sensor +5 VDC
11/Black	Sensor Ground
12/White	Sensor 2 Signal

*Four conductor cable from control module.

Figure 16. Summing Box Wiring

Remote Auto/Off Switch

The remote switch provides the same function as the FOAM ON and OFF buttons.

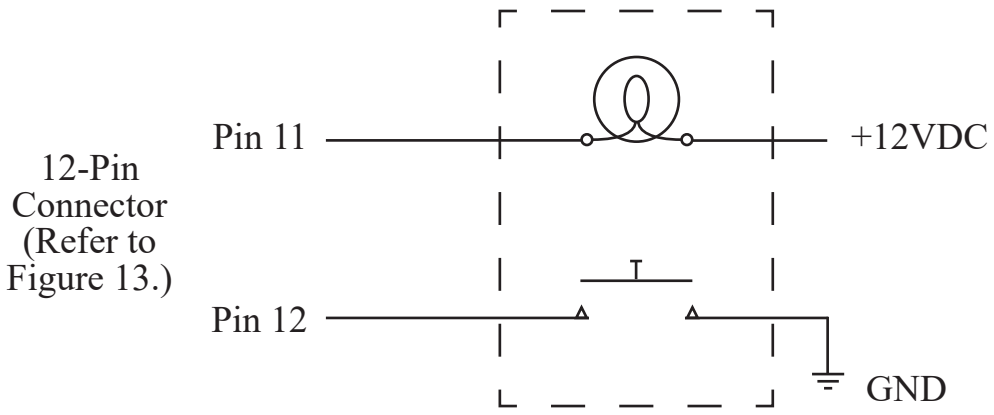
Momentary on Switch

Hold the switch on for one second to put the foam system into automatic mode.

Press the switch to turn the system off.

Indicator Light

The control module pin 11 shunts 300 mA maximum current.



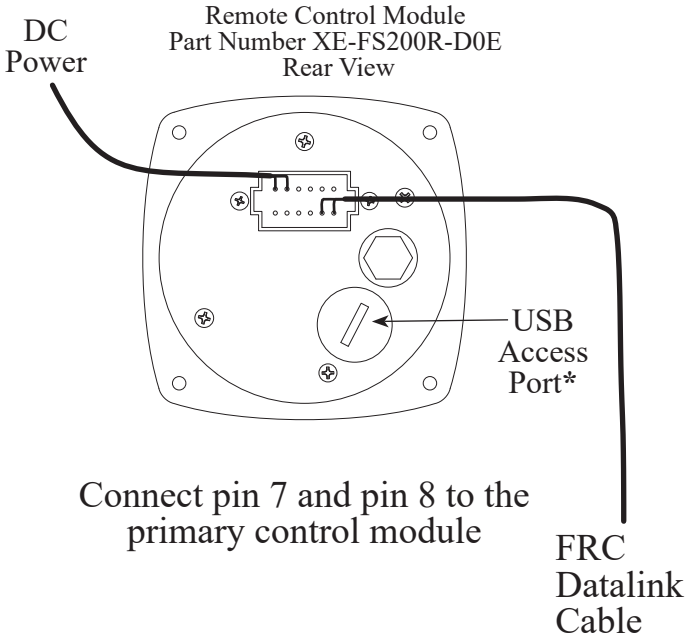
Remote Auto/Off Switch
and Indicator Light

Figure 17. Remote Auto/Off Switch Wiring

Optional Remote Control Module

12-Pin Connector/Cable

Pin/Wire	Description
1/Red	Supply Power 12/24 VDC
2/Black	Supply Ground
3/Red	N/A
4/White	N/A
5/Black	N/A
6/Red	N/A
7/White	FRC Datalink (+)
8/Green	FRC Datalink (–)
9/Black	N/A
10/Red	N/A
11	N/A
12	N/A



***NOTE:** If opened, USB access port plug must be tightened to a torque of 8-10 in-lbs. Exceeding this torque value can result in damage to its water seal capability.
Warning: Flange may not fully bottom out.

Figure 18. Optional Remote Control Module Wiring

NOTES

DANGER

PERSONAL RESPONSIBILITY CODE

The member companies of FEMSA that provide emergency response equipment and services want responders to know and understand the following:

1. Firefighting and Emergency Response are inherently dangerous activities requiring proper training in their hazards and the use of extreme caution at all times.
2. It is your responsibility to read and understand any user's instructions, including purpose and limitations, provided with any piece of equipment you may be called upon to use.
3. It is your responsibility to know that you have been properly trained in Firefighting and/or Emergency Response and in the use, precautions, and care of any equipment you may be called upon to use.
4. It is your responsibility to be in proper physical condition and to maintain the personal skill level required to operate any equipment you may be called upon to use.
5. It is your responsibility to know that your equipment is in operable condition and has been maintained in accordance with the manufacturer's instructions.
6. Failure to follow these guidelines may result in death, burns or other severe injury.

FEMSA

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