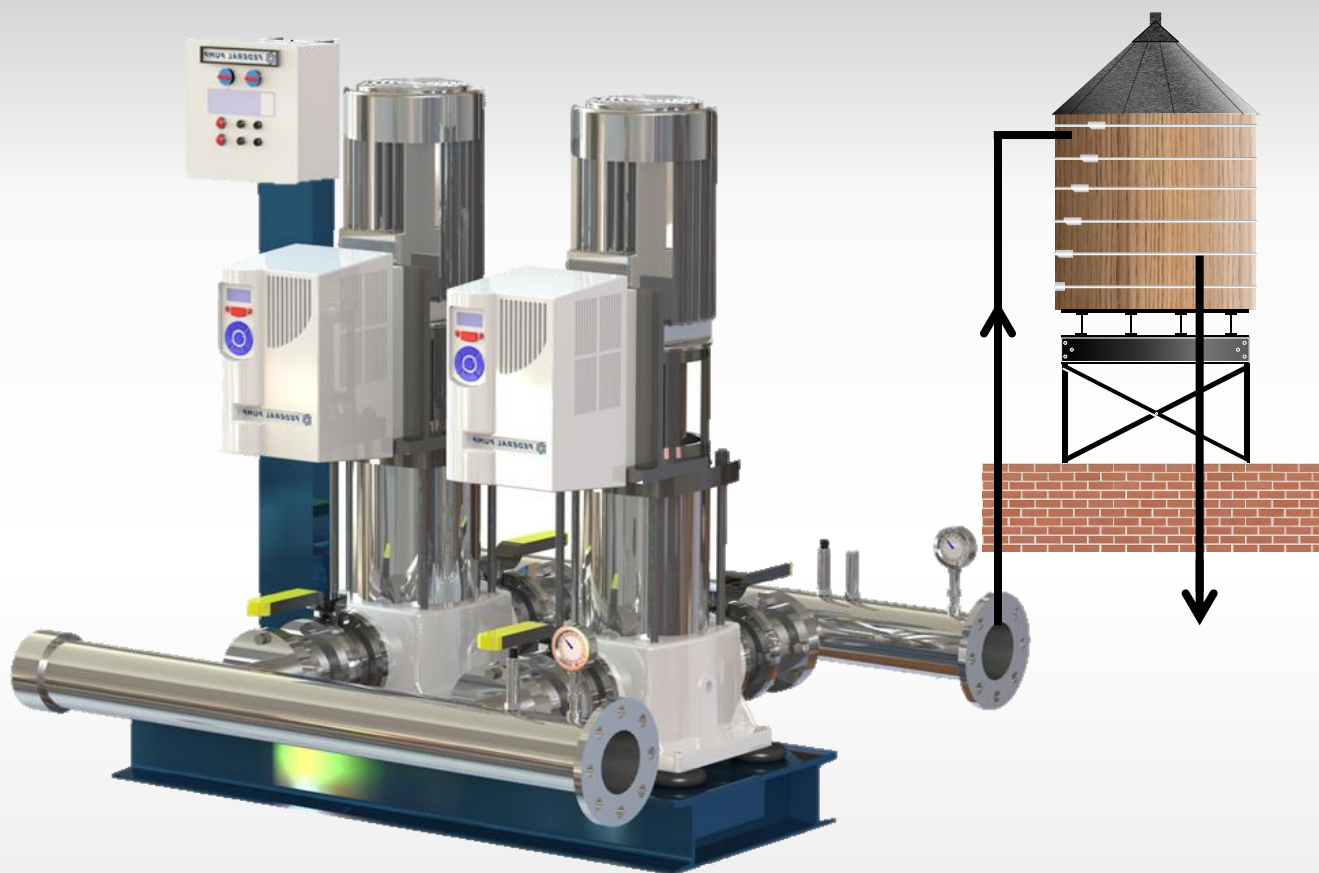


# VARIABLE SPEED TANK FILL SYSTEM (IOM MANUAL)



## APPLICABLE TO TYPE:

- |      |   |
|------|---|
| RT   | Tank Fill System  |
| VRTS | Variable Speed Tank Fill System (End Suction)           |
| VRTV | Variable Speed Tank Fill System (Vertical Multi-stage)  |
| VRTH | Variable Speed Tank Fill System (Horizontal Split-case) |
| VRTM | Variable Speed Tank Fill System (Radial Split-case)     |

## INTRODUCTION

Tank fill systems are pre-assembled and pre-wired units which provide control to the water level in buildings' roof tanks having varying water demand through the use of float switches, level transducers, pressure transducers and/or variable speed drives

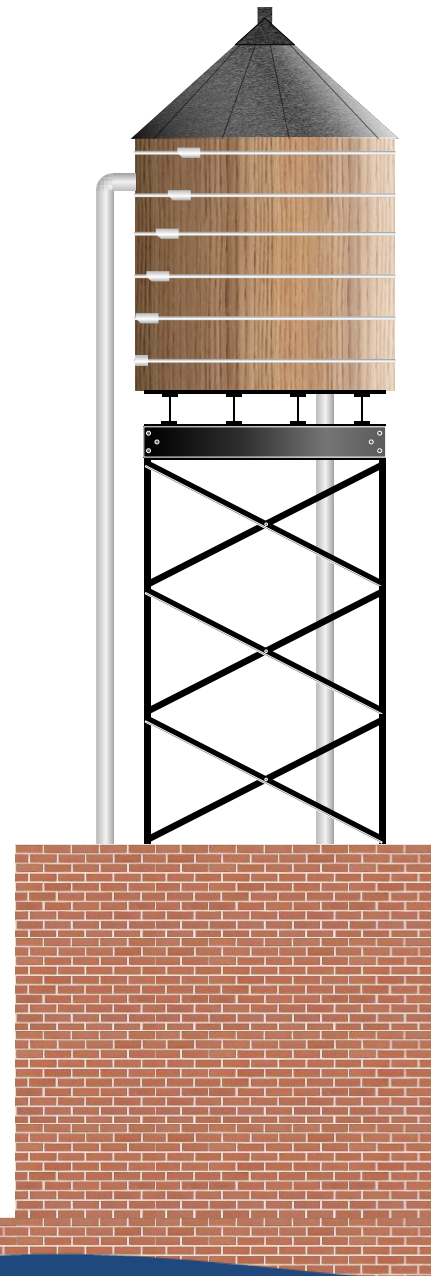
The system includes lead-free pumps, isolation valves, a temperature purge valve, suction and discharge headers, header pressure gauges, control switches or transducers, a steel base, (and variable speed drives) – monitor panels are optional. Operation of the systems is as follows:

**Simplex System:** The system anticipates a signal for water demand set to a water level. Once signaled, the pump turn on to fill a tank. System will remain on, and rest when a pre-set water level inside the tank is met.

**Duplex System:** The system anticipates a signal for water demand set to a water level. The lead pump turn on to fill a tank. When required, the lag pump is automatically started to run in parallel with the lead pump until the water level is met. The lag pump will then shut down. Lead and lag pumps are automatically alternated every 24 hours.

**Triplex System:** The system anticipates a signal for water demand set to a water level. The lead pump turn on to fill a tank. When required, the lag pump is automatically started to run in parallel with the lead pump until the water level is met. The lag pump will then shut down. Lead and lag pumps are automatically alternated every 24 hours. Third

pump is used as a standby or lag-lag operation. When required, the lag-lag pump is automatically started to run in parallel with the lead and lag pump *until the water level is met*.



## INSTALLATION MANUAL

### RECEIVING & PREPARING THE EQUIPMENT

**RECEIVING:** All Federal Pump prefabricated Tank Fill Type systems are assembled, factory wired, and tested prior to shipment. A protective plastic wrapping protects the system and manifold flanges during shipment. Immediately upon receipt of the shipment, inspect and check with the packing list and report to the transportation company's local agent of any damage or shortage. Inspect carton and wrappings before discarding. Parts and accessories may sometimes be wrapped individually and packed in the carton. Should you find the plastic wrapping removed or damaged upon the arrival of the equipment, note the incident on the carrier's Bill of Lading.

**STORAGE:** The plastic wrapping is not meant as mean to protect the equipment from the environment during storage. If the unit is received sometime in advance of when it can be put into use, it should be inspected, rewrapped or re-boxed and stored in a dry location. If the unit is to be stored for a long period of time, rotate the pump shaft periodically to protect the bearings. Units should not be stored where temperatures will be below 20°F or above 130°F. **SYSTEM SHOULD NEVER BE STORED OUTDOOR**

**LOCATION:** The location in which the system is to be installed must be dry and free of debris. Allow for three feet of clearance in front and behind the system base (The NEC requires a minimum of 36" clearance in front of the control panel door for access to the internals). There must also be sufficient room above the system for installation and removal of the motor (especially on vertical multistage pumps).

**ANCHORING:** Prefabricated systems should be leveled and bolted to a foundation or inertial base using all of the anchoring holes provided on the frame. These holes are typically  $\frac{5}{8}$ " in diameter. It is recommended that the base frame be grouted to increase stability and base longevity.

**PIPING:** Prior to piping the system manifold to the water supply and discharge piping, identify a nearby operational floor drain with a minimum three inch drainage pipe. Failure to keep the floor drain clear and clean can result in significant water damage.

The diameter of the pipe connections to the system manifold must be equal to or larger in diameter. Federal Pump recommends that isolation valves and vibration isolation fittings to be installed in both the suction and discharge sides of the system. Bypass valve (or check valve) and piping is also recommended in the event that the system has to be isolated completed for major overhaul or replacement.

## INSTALLATION MANUAL

### CAUTIONS AND WARNINGS

**▲ CAUTION:** To prevent injury, ensure that all water pressure is relieved from the tank fill system, and system is bypassed prior to working being performed. Ensure that the electrical connection is disconnected locally, and tagged out.

**▲ WARNING:** It is strongly recommended that the system is protected by a form of thermal relief. Failure to install a thermal relief valve can result in premature pump failure, over pressurization, and/or leaks, resulting in property damage, series personal injury or death.

**▲ WARNING:** If the system shows any signs of corrosion, wear, and/or leaks, do not install the equipment and contact the manufacturer for more information.

#### PLEASE READ ALL INSTRUCTIONS PRIOR TO START-UP ON THE FEDERAL PUMP CORPORATION TANK FILL SYSTEM

The following instructions have been specifically prepared to familiarize you with the method of installing and operation your tank fill system. We would advise you to read this document and follow the recommendations given. If there is any question or concern regarding the installation of the equipment, you should contact the factory or the factory's representative.

**ELECTRIC POWER:** Check the electrical voltage to insure that it matches the control panel and motor voltage ratings.

**PUMP ROTATION:** Using the "HAND" position of the "H-O-A" switch, 'Bump' each pump (turn the pump on for one second) to be sure that the pump is rotating in the direction of the rotation arrow on the pump casing.

**SYSTEM PRESSURE:** Determine the required system pressure at the discharge of the tank fill system. Check the discharge isolation valve to ensure that it can endure the system pressure

**VALVING:** Insure that all gate valves on the pump suction and discharge connections are fully open. If there is a valved bypass line around the tank fill system, the bypass line valve should be completely closed.

**ADJUSTING THE LOW SUCTION SWITCH:** The unit is furnished with a PENN Series P70 low suction pressure cut-off switch, adjust the PENN switch to stop the pump at 10# below the normal available suction pressure.

# INSTALLATION MANUAL

## DESIGNS OPTIONS AND CONTROLS

### DESIGN OPTION “A” INSTALLATION

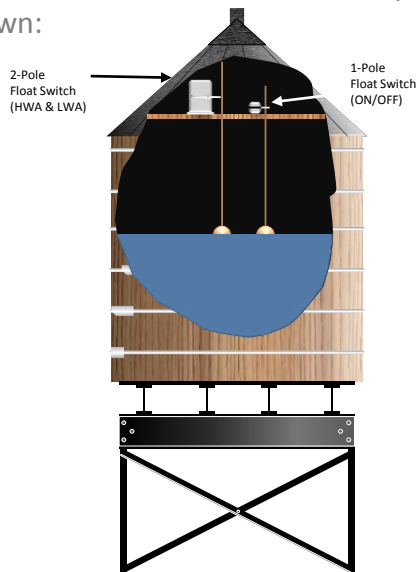
#### Float Switch

Before proceeding with the installation go through the following material check list to ensure that parts are present:

- ☐ Reverse Acting Single Pole Float Switch with pedestal (QTY. Equal to maximum number of pump(s) in operation by design)
- ☐ Two Pole Float Switch for High and Low Water Alarm conditions (QTY. 1 for every tank or partition)
- ☐ Tank Fill system mounted on steel frame with pump monitoring panel (QTY. 1)

#### System Connection:

1. Mount the Single Pole and Two Pole Float switches on the tank roof or platform as shown:



2. Bring the connection wires (QTY. 2 for every submersible transducer & QTY. 3 for each 2-pole switch) from the control mechanisms to the monitoring panel on the Tank Fill system.
3. Anchor the Tank Fill system onto an inertial base using its steel base frame.
4. Land the wires from the tank into the monitoring panel as shown in the wiring diagram.
5. Connect and suction and discharge manifold to its respective piping.
6. Bring and connect the specified power requirement to the Tank Fill system's monitor panel.
7. Turn on the monitoring panel to check for communication with the float switches by focusing a close contact on the float switches.

# INSTALLATION MANUAL

## DESIGNS OPTIONS AND CONTROLS

### DESIGN OPTION “B” INSTALLATION

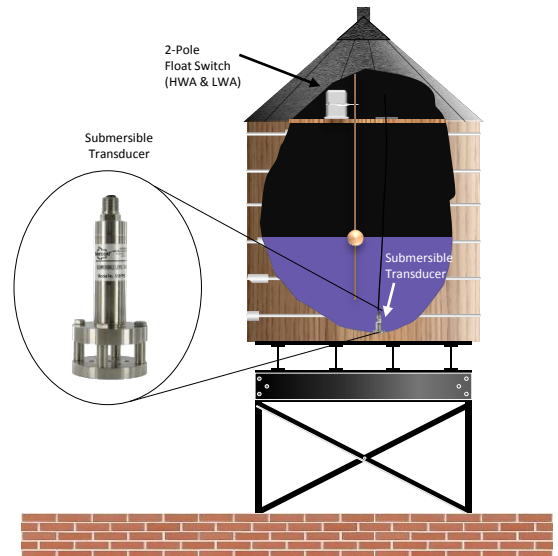
#### Submersible Transducer

Before proceeding with the installation go through the following material check list to ensure that parts are present:

- ☐ Free-standing Submersible Transducer with stainless steel mounting plate and grommet. (QTY. Equal to maximum number of pump(s) in operation by design)
- ☐ Two Pole Float Switch for High and Low Water Alarm conditions (QTY. 1 for every tank or partition)
- ☐ Tank Relay Panel (QTY. Equal to number of floor(s) where tank(s) is controlled by the system)
- ☐ Tank Fill system mounted on steel frame with pump monitoring panel (QTY. 1)

#### *(Possible alternatives to Two pole float switch for High and Low Water Alarm)*

- ☐ Single Pole Float Switch for High and Low Water Alarm conditions as well as Pump ON/OFF Operation (QTY. 3 for every tank or partition)



1. Mount the 2-Pole Float switches on the tank roof or platform as shown. Open a 8" diameter hole to feed the submersible transducer to bottom of the tank, and seal the tank with the mounting plate.
2. Wall mount the Tank Relay Panel in the line-of-sight of the tank or tank partitions. Connect 115V/1Phase power to the panel's circuit breaker, but do not turn on the Tank Relay Panel.
3. Bring the connection wires (QTY. 2 for every single pole switch, & QTY. 3 for every two pole switch) from the control mechanism to the Tank Relay Panel and land the wires according to the wiring diagram

# INSTALLATION MANUAL

## DESIGNS OPTIONS AND CONTROLS

### DESIGN OPTION “B” INSTALLATION (cont.)

#### Submersible Transducer

4. Turn on the Tank Relay Panel and confirms the level reading on the HMI touch screen on to match the water level inside the water tank.
5. Anchor the Tank Fill system onto an inertial base using its steel base frame.
6. Land the wires from the Tank Relay Panel into the monitoring panel as shown in the wiring diagram.
7. Connect and suction and discharge manifold to its respective piping.
8. Bring and connect the specified power requirement to the Tank Fill system’s monitor panel.
9. Turn on the monitor panel to check for communication with the Tank Relay Panel. The information on the Monitor Panel should match to that shown on the Tank Relay Panel

# INSTALLATION MANUAL

## DESIGNS OPTIONS AND CONTROLS

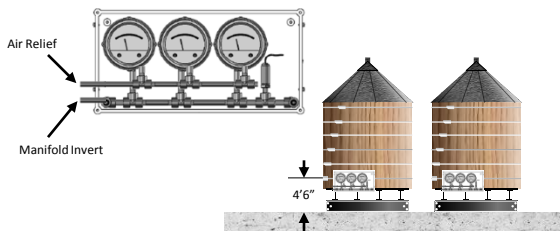
### DESIGN OPTION “C” INSTALLATION PRESURE MANIFOLD

Before proceeding with the installation go through the following material check list to ensure that parts are present:

- ☐ Pressure Manifold (QTY. Equal to number of tanks or tank partitions)
- ☐ Tank Relay Panel (QTY. Equal to number of floor(s) where tank(s) is controlled by the system)
- ☐ Tank Fill system mounted on steel frame with pump monitoring panel equipped with a HMI touch screen (QTY. 1)

#### System Connection:

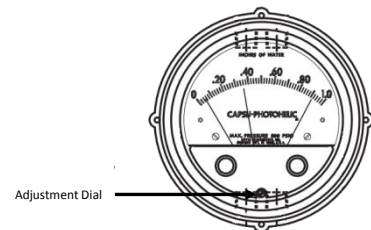
1. Measure 4’6” from the floor to the centerline of the Pressure Manifold invert, and wall or tank mount the manifold near tank.



2. Connect a ½” water line from the bottom or side of each water tank or partition into the invert of each manifold. Strainer and isolation valves are recommended to decrease the chance of clogging the internal of the manifold. Be careful of dis-similar metal corrosion when connecting the water tank to

the pressure manifold. Blockage of the water line will result in control failure. Heat trace or insulate the water line if necessary or used in unconditioned environment

3. Wall mount the Tank Relay Panel in the line-of-sight of the tank or tank partitions. Connect 115V/1Phase power to the panel’s circuit breaker, but do not turn on the Tank Relay Panel.
4. Connect the pressure transducer and photo-helic pressure sensor wiring from each Pressure Manifold to the Tank Relay Panel as shown in the wiring diagram.
5. Turn on the Tank Relay Panel and confirms the level reading on the HMI touch screen on to match the water level inside the water tank.
6. Inspect the photo-helic pressure sensors for the water level reading in “INCHES”. If the level does not match the HMI’s level reading, turn the adjustment dial to correct for discrepancies.





# INSTALLATION MANUAL


## DESIGNS OPTIONS AND CONTROLS

### DESIGN OPTION “C” INSTALLATION (cont.) PRESURE MANIFOLD

7. Anchor the Tank Fill system onto an inertial base using its steel base frame.
8. Connect and suction and discharge manifold to its respective piping.
9. Bring and connect the specified power requirement to the Tank Fill system’s monitor panel.
10. Tie the network card on the Tank Relay Panel to that of the system’s monitor panel with fiber optic cables.
11. Turn on the monitor panel to check for communication with the Tank Relay Panel. The information on the Monitor Panel should match to that shown on the Tank Relay Panel
12. If the system includes solenoids in the design, connect the N/O or N/C solenoids to the Tank Relay Panel. The panel will have the function to isolate tank and partition for cleaning and repair.

## OPERATION MANUAL

### MANUAL OPERATION

To operate the system or individual pump in the HAND position, first make sure the pump is off. This would ensure that parameters can be modified and that pump does not start unexpectedly. Refer to the keypad shown below and press the red(O) button to turn off a pump. Press the  button to toggle between LOC(local or HAND) and REM(remote or AUTOMATIC). The mode selected will display on the top right corner of the screen. Once the screen displays LOC, press the green(I) button to run the pump. Pay attention to the pump RPM and motor AMP draw shown on the screen once the pump is running and make sure that the data do not exceed those shown on the pump's motor (turn the pump off with pressing the red(O) button immediately if the data are exceeded).

Once the pump is running on HAND, it will run at the preset manual speed setting shown on the screen. User must go into the manual to adjust the minimum run speed to increase or decrease the pump rpm at HAND. Once adjusted, pump will accelerate to the new rpm setting. Note that this adjustment must be performed on every individual VFD; settings do not copy between drives automatically.

**▲ CAUTION:** By running pumps in HAND, system alarm will continue to operate.

**▲ WARNING:** While the system can operate beyond the labelled RPM shown on the motor, we do not recommend operating beyond such RPM without first consulting the factory.

**▲ WARNING:** If one or more pump continues to operate on hand, the temperature of the water can reach high enough to cause first degree burn. Temperature relief valve will be installed on the system and must be redirected to a drain.




## OPERATION MANUAL

### AUTOMATIC OPERATION

**▲ WARNING:** DO NOT run the pumps in automatic prior to system startup. Failure to do so could void the system warranty, over-pressurize the discharge piping, overheat the system, and cause mechanical seal failure.

Prior to putting the system in automatic, first check the presence and operation of all **remote components** for the tank fill system. *This might include, but not limited to: float switch, pressure switch, level transducer, pressure transducer, pressure manifold, and remote panel.* The remote components available will depend on the design option chosen and potential custom unit. Refer to the equipment summary for the shipped components.

Automatic operation would begin once one or more VFD are put in REM or AUTO . The commissioning agent or representative defines the set RPM that is necessary to fill the tank, the operation set points, as well as the alarm set point. In automatic, the pumps would turn ON/OFF based on the water level in the tank(s) or compartment(s) it which the system serves.

When the system starts automatically, the lead pump will ramp up to a set RPM. Once the RPM is met, the pump will remain on until the remote component(s) for the system signals the pump to turn off. When the lead pump is signaled to turn off, it will ramp down to a stop.

Any additional (lag & lag-lag) pump will turn on based on the remote component's adjustable feedback signal. As a standard for all design options, if all primary & secondary control mechanism are deemed faulty, the alarm conditions will control the tank level.

All system designs are offered with the option for tank selection switch and solenoid control. Tank count would start from the left(tank 1) to right(tank 2) when user is facing the remote or control panel. If tank 1 is selected, the remote component feedback from tank 2 will continue to read and display, but the system will not react to tank 2; the pump will only turn ON/OFF based on the feedback from the tank selected. If both tanks are selected, control feedbacks from tank 1 will always take precedence over those from tank 2 as a standard practice.

Since tank fill systems can be utilized for domestic water, fire protection, and a combination of the two, the following are the standard alarm conditions for every system:

- High Water and High Fire Water
- Low Water and Low Fire Water
- Low Suction
- High System Pressure

Each alarm condition listed will have (1) set point for local and remote signaling—low water and low fire water will share (1) set point. Dry contacts for each alarm condition can be found in the system control panel. Design options “B” & “C” will have redundant dry contacts for alarm conditions in the remote panel. Each alarm has independent set points and manual or automatic reset capability.

## OPERATION MANUAL

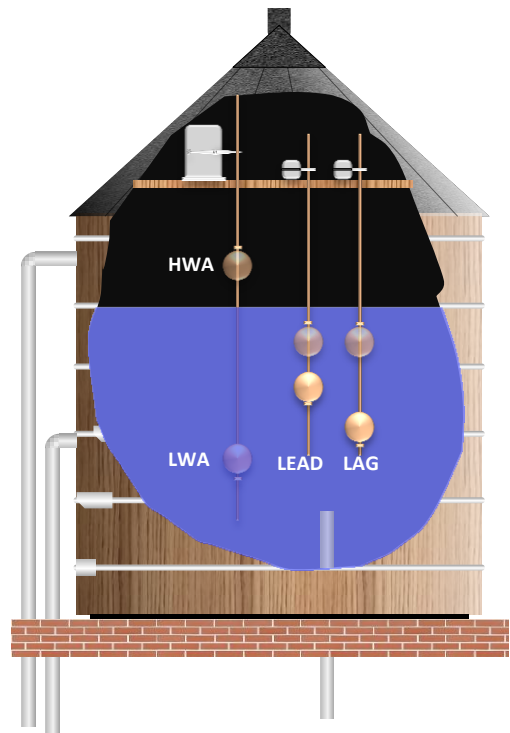
### SEQUENCE OF OPERATION (DESIGN OPTION “A”)

The following operation is assuming a plumbing system scenario with (2) fill tanks or compartments being used for combination domestic water and fire protection. Upon a drop in the water level within the domestic water range in the tank to a pre-determined set level, an reverse acting auxiliary float(lead) switch would close a contact, and the lead pump will turn on and ramp up to a set RPM. The pump will remain in operation until the same float switch opens. If the lead pump’s operating performance cannot satisfy the drain rate of the tank, a second reverse acting auxiliary float(lag) switch —with a lower set level— would close a second contact, and the lag pump will turn on and ramp up. The pump will remain in operation until the second float switch opens. Normal set level would turn both pumps off at the same time. In triplex or quadruplex systems where a lag-lag feature is available and selected, the Low Water Alarm contact will turn the third pump on and all the pumps will turn off at High Water Alarm.

High and Low water & fire water alarms share (1) float switch in the follow design. A 2-pole single throw float switch is used for the signal. The contacts are normally open and would close at high and low water.

Upon a liquid level drop below the low level switch set point, the low water alarm and low fire water alarm would sound. Up to (3) pumps will turn on and ramp up. Until the high water set level is reach, or if the pumps are turned off manually, will the pumps stop running. If the high level switch is actuated, the high level alarm will sound.

If the lag switch is activated without the lead switch signal, the lag pump will turn on, and float fault will display on the control panel. If the low level switch is actuated without lead and/or lag switch is activated, up to (3) pumps will turn on, and float fault will display on the control panel.



## OPERATION MANUAL

### SEQUENCE OF OPERATION (DESIGN OPTION “B”)

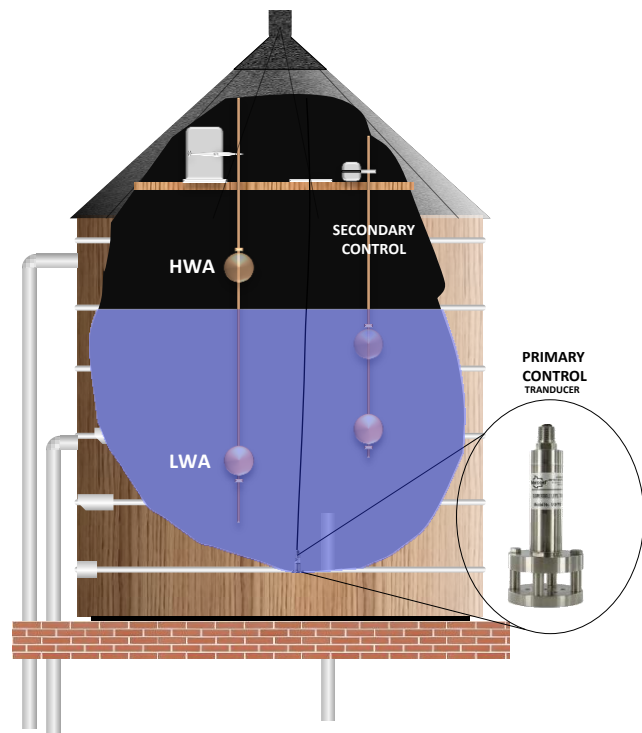
The following operation is assuming a plumbing system scenario with (2) fill tanks or compartments being used for combination domestic water and fire protection. The primary control would be a submersible level transducer, while the optional secondary control is a reverse acting auxiliary float switch.

For the following system, the primary control is through the level transducer and it will output the tank level to the remote and control panel continuously. Upon a drop in the water level within the domestic water range in the tank to a pre-determined set level, the PLC in the control panel would close a contact, and the lead pump will turn on and ramp up to a set RPM. The pump will remain in operation until a user input set level is satisfied. If the lead pump's operating performance cannot satisfy the drain rate of the tank, and a second set level is met, the PLC would close a second contact, and the lag pump will turn on and ramp up. The pumps will remain in operation until the off set level is met. Normal set level would turn both pumps off at the same time. In triplex or quadruplex systems where a lag-lag feature is available and selected, the Low Water Alarm contact will turn the third pump on and all the pumps will turn off at High Water Alarm.

High and Low water & fire water alarms share (1) float switch in the follow design. A 2-pole single throw float switch is used for the signal. The contacts are normally open and would close at high and low water.

Upon a liquid level drop below the low level set point, the low water alarm and low fire water alarm would sound. Up to (3) pumps will turn on and ramp up. Until the high water set level is reach, or if the pumps are turned off manually, will the pumps stop running. If the high level switch is actuated, the high level alarm will sound.

If the primary control's analog output signal goes beyond its nominal range (4-20mA), the transducer fault will display on the control panel, and secondary reverse acting auxiliary float switch will take over the ON/OFF operation for lead and lag pump simultaneously. Turn (1) pump off if necessary



## OPERATION MANUAL

### SEQUENCE OF OPERATION (DESIGN OPTION "C")

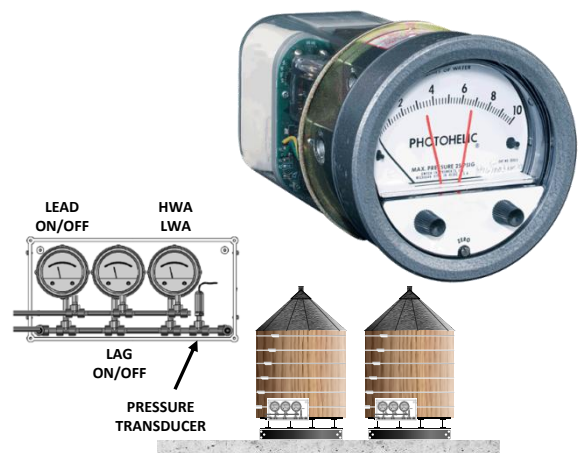
The following operation is assuming a plumbing system scenario with (2) fill tanks or compartments being used for combination domestic water and fire protection. The primary control would be a pressure transducer, while the optional secondary control and the standard water level alarm are photo-helic pressure gauge and switches.

For the following system, the primary control is through the pressure transducer inside the mounted pressure manifold and it will output the tank level to the remote and control panel continuously. Upon a drop in the water level within the domestic water range in the tank to a pre-determined set level, the PLC in the control panel would close a contact, and the lead pump will turn on and ramp up to a set RPM. The pump will remain in operation until a user input set level is satisfied. If the lead pump's operating performance cannot satisfy the drain rate of the tank, and a second set level is met, the PLC would close a second contact, and the lag pump will turn on and ramp up. The pumps will remain in operation until the off set level is met. Normal set level would turn both pumps off at the same time. In triplex or quadruplex systems where a lag-lag feature is available and selected, the Low Water Alarm contact will turn the third pump on and all the pumps will turn off at High Water Alarm.

High and Low water & fire water alarms share (1) photo-helic pressure gauge and switch in the follow design. A 2-pole double throw pressure switch is used for the signal. The contacts are normally open and would close at high and low water.

Upon a liquid level drop below the low level set point, the low water alarm and low fire water alarm would sound. Up to (3) pumps will turn on and ramp up. Until the high water set level is reach, or if the pumps are turned off manually, will the pumps stop running. If the high level switch is actuated, the high level alarm will sound.

If the primary control's analog output signal goes beyond its nominal range (4-20mA), the transducer fault will display on the control panel, and photo-helic pressure gauge & switches will take over the ON/OFF operation for lead and lag pump((1) switch for each operation).



## MAINTENANCE MANUAL

### SET POINTS AND MAINTENANCE

**⚠ CAUTION:** Prior to powering down any system for maintenance, take a photo of the display or alarm lights. Note any changes after maintenance and contact the factory or its local representative if help is needed.

For each of the design, the following set points are necessary in order for the system to function as designed (set point adjust can be made either through float ball adjustment, pressure switch, photo-helic switch dial adjustment, or HMI display input):

- Low Suction Cut Off
- Low Water (Fire Water) Alarm
- High Water (Fire Water) Alarm
- High Pressure Alarm
- Lead Pump On Level
- Lag Pump On Level
- Pumps Off Level

For all standard systems, digital output for alarm conditions shown above are provided in the control panel. BMS and Fire Alarm contractors would connect their inputs from these terminals.

Since the following manual can apply to an array of Federal Pump pump models, please refer to the following chart and use the maintenance manual for the associated pump to service the pump.

| SYSTEM SERIES | PUMP SERIES USED |
|---------------|------------------|
| RT, VRTS      | CC, CG, CK       |
| VRTV          | VM               |
| VRTH          | SC               |
| VRTM          | HP               |

Pumps and motors in the system are expected to be serviced at least once a year. Pumps should never idle for more than (3) months without rotation.

Remote components for the system should be inspected twice a year to insure proper operation. Equipment that are exposed to the environment must be insulated and heat traced—especially for pressure manifold in design option “C”.



## ***Federal Pump Corporation Factory Warranty***

Equipment or parts manufactured by Federal Pump Corporation ("Seller") which fail to function properly because of defects in material or workmanship and which are returned to Seller with shipping charges prepaid, within one year from date of shipment (invoice date) will be repaired or replaced by Seller, FOB the factory, at Seller's expense. Equipment or parts furnished by Seller, but manufactured by others (such as motors, switches, control panels, etc.) are the responsibility of the manufacturer under its warranty, if any, and Buyer's sole recourse will be to such manufacturer. If Seller determines that the failure to function properly (of equipment or parts returned) is not due to defective material or workmanship but rather to misapplication or mishandling after receipt by Buyer, Seller will repair or replace the equipment or parts upon Buyer's authorization, and bill Buyer for material and labor required for the repair or replacement. The forgoing sets forth Seller's only warranty with respect to, and Seller's entire liability, for any claim or damages whatsoever arising out of the supplying of the equipment hereunder or its use. The foregoing warranty is made by Seller and accepted by the person to whom Seller's applicable invoice is directed ("Buyer") in lieu of all other warranties, express or implied, of Seller and in lieu of all other obligations or liabilities of Seller. No other representation or warranty on the part of seller, express or implied, shall apply to the equipment supplied hereunder or referred to herein, or to its performance, all such other warranties (including any warranty of merchantability or fitness for any purpose) being hereby disclaimed. In no event will Seller be responsible for loss of business or profits or any other similar or dissimilar consequential or incidental damages or losses. If warranty repairs or replacements of parts are to be accomplished locally in lieu at Seller's factory, they must be agreed to in writing, by Seller in advance of the work being done, and with the exact cost of the work stated in a letter of authorization from Seller. No expenses incurred will be paid by Seller unless so agreed to in advance. Seller's standard warranty extends for twelve months from date of shipment. If the standard warranty is to be extended to eighteen months from date of shipment, add 6% to the purchase price of the equipment. If the standard warranty is to be extended to twenty-four months from the date of shipment, add 12% to the purchase price of the equipment. If the standard warranty is to be extended to thirty months from date of shipment, add 18% to the purchase price of the equipment. If the standard warranty is to be extended to thirty-six months from date of shipment, add 24% to the purchase price of the equipment. Extended warranties are effective only if the equipment is properly stored and adequately protected from weather, excessive condensation, atmospheric conditions and physical damage, and only if the equipment has been properly installed and not misused or mishandled.

If you have a claim under the provision of the warranty,  
contact Federal Pump Corporation or your local authorized  
representative.

