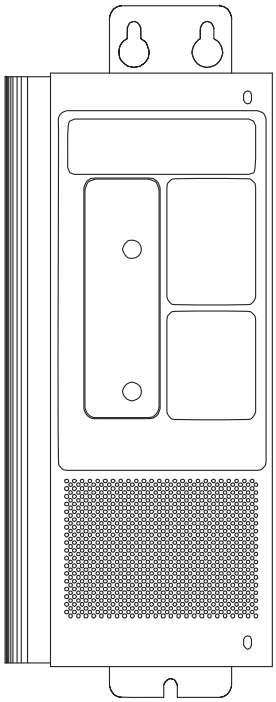
Franklin Electric
FUELING SYSTEMS

MAGVFC™ VARIABLE FREQUENCY CONTROLLER

INSTALL / OWNER'S GUIDE

228001101 r11

CONTROLLER P/N
5874202800



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CONVENTIONS USED IN THIS DOCUMENT

This document includes safety precautions and other important information presented in the following format:

NOTE: This provides helpful supplementary information.

IMPORTANT: This provides important supplementary information and instructions to avoid damaging hardware or a potential hazard.

⚠ **CAUTION**: This indicates a potentially hazardous situation that could result in minor or moderate injury if not avoided. This may also be used to alert against unsafe practices.

⚠ **WARNING**: This indicates a potentially hazardous situation that could result in severe injury or death if not avoided.

⚠ **DANGER**: This indicates an imminently hazardous situation that will result in death if not avoided.

OPERATING PRECAUTIONS

Franklin Electric equipment is designed to be installed in areas where volatile liquids such as gasoline and diesel fuel are present. Working in such a hazardous environment presents a risk of severe injury or death if you do not follow standard industry practices and the instructions in this document. Before working with or installing the equipment covered in this document, or any related equipment, read this entire document, particularly the following precautions:

IMPORTANT: To help prevent spillage from an underground storage tank, make sure the delivery equipment is well-maintained, that there is a proper connection, and that the fill adaptor is tight. Delivery personnel should inspect delivery elbows and hoses for damage and missing parts.

⚠ **CAUTION**: Use only original Franklin Electric parts. Substituting non-Franklin Electric parts could cause the device to fail, which could create a hazardous condition and/or harm the environment.

⚠ **WARNING**: Follow all codes that govern the installation and service of this product and the entire system. Always lock out and tag electrical circuit breakers while installing or servicing this equipment and related equipment. A potentially lethal electrical shock hazard and the possibility of an explosion or fire from a spark can result if the electrical circuit breakers are accidentally turned on while installing or servicing this product. Refer to this document (and documentation for related equipment) for complete installation and safety information.

⚠ **WARNING**: Before entering a containment sump, check for the presence of hydrocarbon vapors. Inhaling these vapors may cause dizziness/unconsciousness, and if ignited, can explode causing serious injury or death. Containment sumps are designed to trap hazardous liquid spills and prevent environmental contamination, so they can accumulate dangerous amounts of hydrocarbon vapors. Check the atmosphere in the sump regularly while work is in process. If vapors reach unsafe levels, exit the sump and ventilate it with fresh air before resuming work. Always have another person standing by for assistance.

⚠ **WARNING**: Follow all federal, state, and local laws governing the installation of this product and its associated systems. When no other regulations apply, follow NFPA codes 30, 30A, and 70 from the National Fire Protection Association. Failure to follow these codes could result in severe injury, death, serious property damage, and/or environmental contamination.

⚠ **WARNING**: Always secure the work area from moving vehicles. The equipment in this document is usually mounted underground, so reduced visibility puts service personnel working on it in danger from moving vehicles that enter the work area. To help prevent this safety hazard, secure the area by using a service truck or other vehicle to block access to the work area.

⚠ **DANGER**: Inspect the installation location for potential ignition sources such as flames, sparks, radio waves, ionizing radiation, and ultrasound sonic waves. If any potential ignition sources are identified, implement proper safety measures.

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1 Introduction

The MagVFC™ variable frequency controller provides control for 2 HP and 4 HP variable speed submersible turbine pumps (STPs). The MagVFC™ variable speed controller ramps the STPs up and down as-needed to provide optimal flow rates at all fueling points. The result is faster, more consistent flow rates than fixed speed systems at virtually the same cost of ownership.

1.1 Documentation

- This document is intended for qualified and certified installation persons.
- Instructions of this document are in English. All other language versions are translations of this original document.
- Illustrations in this document show a typical setup and are for instruction and description purposes only.
- Information given in this document is given as a guide only. It is the installer's responsibility to ensure that correct and safe procedures are followed at all times.
- This document and related documents are available from Franklin Electric at www.franklinfueling.com.

1.1.1 Symbol Legend


Wear Protective Headwear


Wear Eye Protection


Wear Protective Clothing


Wear High-Visibility Clothing


Wear Protective Gloves


Wear Safety Footwear


Refer to instruction guide


Ventilate Before & During Entering


Ensure Continuous Ventilation


Connect an earth terminal to the ground


Lockout/Tagout Electrical Equipment


Disconnect main plug from electrical outlet


Disconnect before carrying out maintenance or repair


General Warning


Warning: Industrial vehicles


Warning: Electricity


Warning: Flammable Material


No open flame; Fire, open ignition source and smoking prohibited

2 Safety/Security

2.1 General Safety Information

- Only perform procedures in this document that you are qualified and certified to perform.
- Personnel working on or with energized equipment must be authorized by relevant regulatory bodies to carry out such work and must have the appropriate training. Check with your employer and relevant regulatory body's rules for working with energized equipment.
- Obey all local laws, rules, regulations, and instructions in this document. In case of inconsistency or contradiction between information contained in this document and any laws, rules and regulations, obey the stricter of the two.
- Keep unqualified personnel at a safe distance during installation.
- If it is necessary to remove safety/security devices, immediately reinstall the safety/security devices after completing the work.

2.1.1 Documentation Availability

Installer

- This instruction booklet MUST be left with the owner of the service station at which the equipment is being installed.

Station Owner

- Retain these instructions for future use and provide them to persons servicing or removing this equipment.

Miscellaneous

- Always reference the Installation and Owner's Guide that came with the equipment for the most current and complete list of installation and safety precautions. Where applicable, this manual may also contain notations on equipment features present in software version 1.14 and greater.

2.2 Hazard Assessment

Prior to beginning work and prior to recommencing work after leaving and returning to the worksite, a worksite, *pre-job hazard assessment* must be performed to identify safety and environmental needs. At a minimum, this hazard assessment should:

- Identify possible hazards and risks.
- Identify the safety needs of the job.
- Identify the correct procedures, practices and equipment.
- Eliminate unsafe conditions and actions from the worksite.
- Identify the need for personal protective equipment.
- Inspect equipment before use.
- Confirm sheaths of all cables are secured and undamaged.
- Confirm plugs and connectors are properly connected and serviceable.
- Perform ongoing risk assessment during the project.

2.3 Required Personal Protective Equipment (PPEs)

These PPEs are required during all phases of installation.


Wear Protective Clothing


Wear Eye Protection


Wear High-Visibility Clothing


Wear Protective Gloves


Wear Protective Headwear


Wear Safety Footwear

3 Technical Overview

3.1 Dimensions & Clearances

FIGURE 3.1 – Dimensions

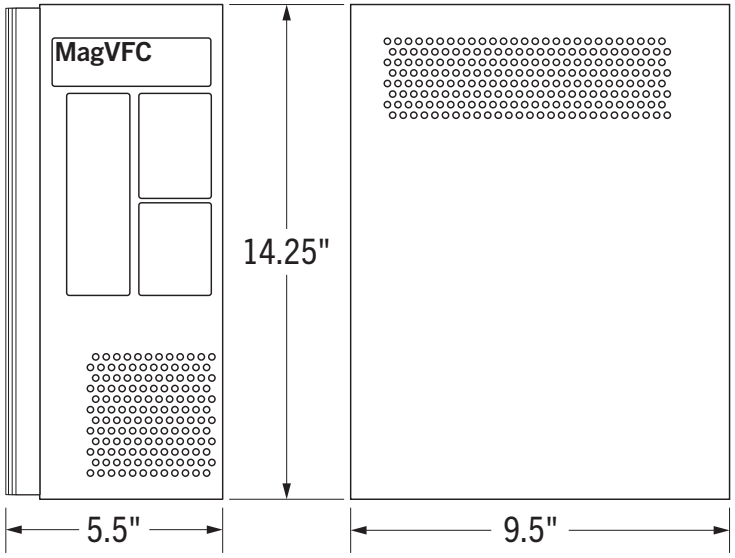
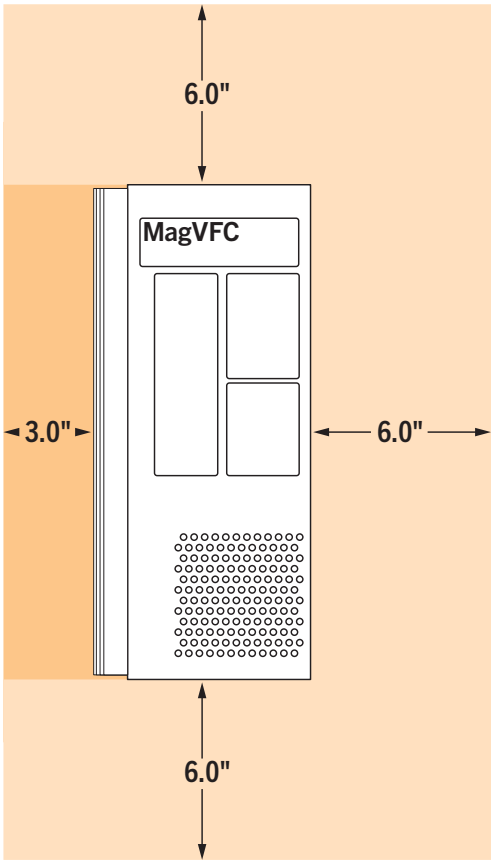


FIGURE 3.2 – Minimum Mounting Clearance

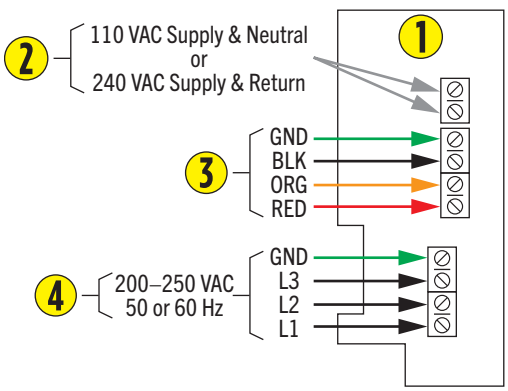


3.2 Field Wire Panel

TABLE 3.1 – Field Wire Panel

Component	Definition
① Field Wire Panel	The right side panel located under the MagVFC™ cover.
② Hook Terminals	Voltage signal from the dispensers to turn pump on. Requires a signal wire and a neutral. No polarity requirements at the Hook Terminal.
③ Pump Motor Terminals	Labeled GND, BLK, ORG, RED. Connect wires that go to the submersible pump at these terminals. If color codes are not matched at the submersible, the motor may run in reverse.
④ Input Power Terminals	Labeled GND, L3, L2, L1. Supplies power to MagVFC™ to supply the submersible pump. *Minimum 12 AWG wires size.*

FIGURE 3.3 – Field Wire Panel



MagVFC™ Electrical Specifications

MagVFC™ Incoming Line Draw:
Single Phase input = 18 A Max.
Three Phase Input = 20 A Max.

PMA VS4 Motor Draw = 15 A Max.
PMA VS4 Lead-to-Lead
Winding resistance = 1.2 Ohms ± 1 Ohm

PMA VS2 Motor Draw = 7 A Max.
PMA VS2 Lead-to-Lead
Winding resistance = 2.5 Ohms ± 1 Ohm

NOTE: Optimum performance of the VS4 is achieved with 3-Phase Incoming power.

TABLE 3.1a – INPUT Wire Size / Run (Breaker Panel to Drive)

Wire Size (AWG)	Maximum Run (Feet)
10	650
12	400

⚠ **CAUTION**: Connecting INPUT POWER to the PUMP MOTOR TERMINALS *will damage* the MagVFC™.

⚠ **WARNING**:

- Do not install in hazardous location. Use only with FE Petro® PMA models VS2 and VS4.
- Apply power to the controller BEFORE allowing hook signal input. There should be NO hook signal present when applying power to the controller.

NOTE:

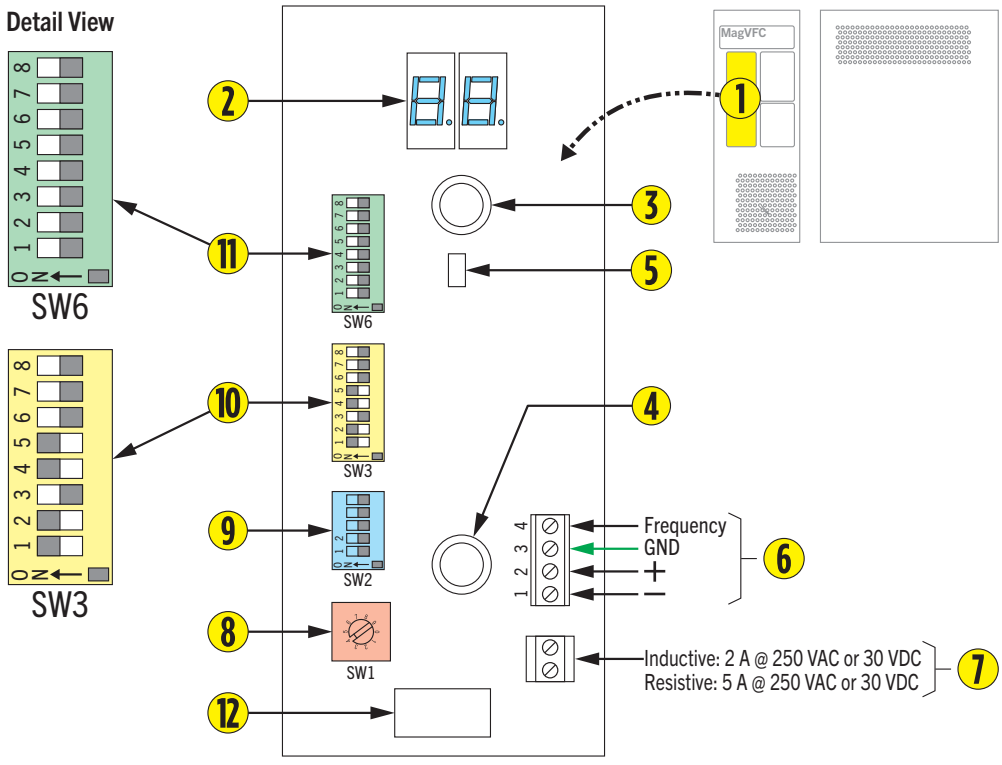
- Use 90° C copper wire rated 300 V minimum. Tighten line and motor terminals to 8 IN-LBS.
- Connect wires accurately. Connecting power wires to any other terminals will cause irreparable damage to the MagVFC™ controller.
- The MagVFC™ can only be used with FE Petro® Pump base models IST, IST VS4, STP VS4, STP VS2, PMA VS4, or PMA VS2. The MagVFC™ is not compatible with competitive makes of variable speed models. The MagVFC™ is compatible with the IST-VFC for communication in Primary-Secondary configurations only if the MagVFC™ has been upgraded to software revision 1.18 or higher. Refer to bulletin TB0106-01 for switch setting information.
- This drive provides motor overload protection required by the National Electrical Code (NEC). This protection limits the motor current to 100% of the drive full load current rating.
- This drive does not provide motor over-temperature sensing.
- This drive is suitable for use on a circuit capable of delivering not more than 5000 rms symmetrical amperes, 250 V maximum.
- This drive requires inverse-time circuit breakers rated 200–250 V, 30 A maximum for branch circuit short circuit protection.
- Integral solid state short circuit protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the NEC and any additional local codes.

3.3 User Interface Panel

TABLE 3.2 – User Interface Panel

Component	Definition
① User Interface Panel	The front panel located under the MagVFC™ cover.
② Pump Status Display	Displays codes indicating controller or pump status (see § 5 for details of codes).
③ Silence Alarm / Fault Readout Button	Push and it will turn off audible alarm. Push and hold button and the Pump status display will show the last three fault conditions the MagVFC™ encountered.
④ Reset Button	Resets controller of any fault condition.
⑤ Communication LED	Utsed in PRM-SEC controller configurations to indicate communication activity.
⑥ RS485 Connection	Used in PRM-SEC controller configurations (frequency connection not used in IST-VFC Mode).
⑦ Relay Contact	Normally open. The relay closes when the pump is running.
⑧ SW1	**Operational Pressure Switch**. Adjusts the submersible pump's operational pressure.
⑨ SW2	**Address Switches**. Used in PRM-SEC controller configurations.
⑩ SW3	**Configuration Switches**. "Factory Default" settings shown in Figure 3.4 (stand alone use in gasoline). For more configuration options, see "Options Select Switch Settings" for additional information.
⑪ SW6	**Configuration Switches**. "Factory Default" settings shown in Figure 3.4. For more configuration options, see § 4.3.1 for additional information.
⑫ Relay	Sold separately.

FIGURE 3.4 – User Interface Panel



4 Installation



NOTE:

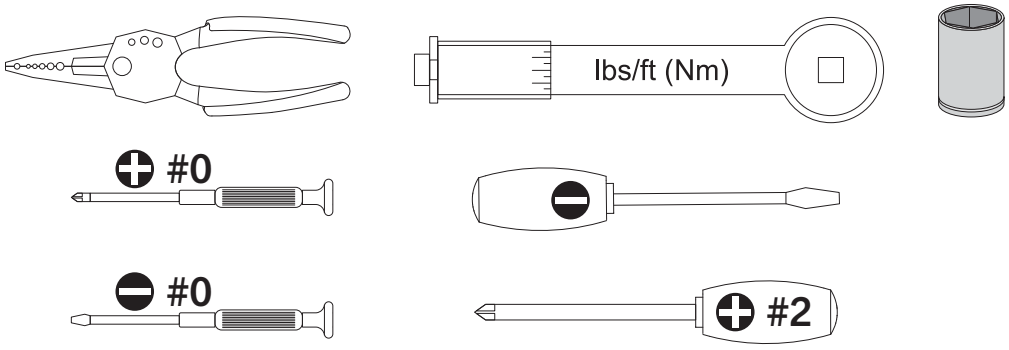
- When the installation is complete, make sure this guide is left with the service station owner or operator.
- Always reference the Installation and Owner's Guide that came with the equipment for the most current and complete list of installation and safety precautions. Where applicable, this guide may also contain notations on equipment features present in software version 1.14 and greater.
- See § 6 for wiring schematics.

4.1 Pre-Installation Inspection

Upon Receipt of Item(s)

- Verify all items are in accordance with the order.
- Check all items for damage.
- If any item shows damage or is not in accordance with the order, inform Franklin Electric *immediately*.
- Remove the packaging material.
    - Follow all local laws, rules and regulations regarding disposal of discarded parts, packaging material or items and any subsequent components.

4.2 Required Tools



4.3 Installation Instructions

NOTE: Steps 1–3 are also part of the installation instructions for the submersible pump. This is done to make sure all instructions are available if needed during installation. As a result, Steps 1–4 may already be complete.

1. Connect the electrical conduit with approved fittings to the submersible pump junction box.
2. Remove the submersible pump junction box cover, and remove the compression seal by loosening the screw (do not remove the screw). The seal has four holes to accommodate a ground wire and three-phase power from the MagVFC™.

   ⚠ **WARNING**: Not installing a ground wire increases the risk of potentially lethal electrical shock and equipment failure. All holes of the compression seal (contractors plug) must be filled with wires or a Celcon® rod to enable it to seal.
3. Verify that the power is "OFF" at the supply box. Pull four wires from the spot where the MagVFC™ unit will be mounted into the submersible pump junction box and feed through the compression seal. Slide the compression seal into place and tighten securely. Connect the three wires from the connector assembly to the 3-Phase power wires coming from the MagVFC™. Connect the fourth wire (ground) from inside to the pump junction box ground lug.

   NOTE: All wiring must conform to all applicable guidelines in accordance with all federal, state, and local codes. Failure to comply with all applicable guidelines could result in an unsafe installation. Use the following table for maximum wire length to wire gauge for submersible wiring:

TABLE 4.1 – OUTPUT Wire Size / Run (Drive to Motor)

Wire Size (AWG)	Maximum Run (Feet)
10	650
12	400
14	250

4. Replace the cover of the pump junction box and securely tighten.

   ⚠ **WARNING**: The compression seal is not a replacement for the vapor explosion seals required by the NEC. All materials used between the power supply box and the submersible pump junction box must be gasoline and oil resistant. All wiring used within the MagVFC™ must be rated 90° C, 300 V minimum. Failure to comply with these, and all applicable NEC guidelines, could result in an unsafe installation.
5. Hang the MagVFC™ on a vertical surface and remove the front panel screw and front cover. Install approved electrical conduits only at factory knockouts on the MagVFC™ enclosure.

   NOTE: Electrical interference can be created by several types of equipment in a station (fluorescent lighting, compressor, etc.). This interference may affect the operation of sensitive equipment such as tank monitors and electronic line leak detectors. *When installing the MagVFC™, Franklin Electric recommends that the power wires from the power source and the power wires to the IST or STP units with VS2 or VS4 suffix (pump) be in their own steel conduit which is not broken or*

routed through race ways. Franklin Electric also recommends that all equipment be installed per the manufacturer requirements for best results.

NOTE: The MagVFC™ must be mounted indoors in a non-hazardous location with ambient temperatures between 40° F (4° C) and 95° F (35° C).

NOTE: Mount controllers (see § 3.1) so they have 6" or more of clearance on the top, bottom and right side (cover side), and 3" or more clearance on the left side (heat sink side). Install with the heat sink fins vertical and the knock-outs down.

6. Connect the three motor control wires from the pump junction box to labeled terminals observing color coding of wires (BLACK to BLACK, ORANGE to ORANGE, RED to RED). Connect the ground wire from the submersible pump to the ground lug on the MagVFC™ circuit board. See § 3.2 for wiring details.

   ⚠ **WARNING**: To avoid the risk of potentially lethal electrical shock, fire, or explosion, always tag and lock circuit breakers in the off position before opening the MagVFC™.

   ⚠ **WARNING**: After disconnecting power to the MagVFC™, wait one minute after LED display blanks before opening the cover for servicing. Voltage stored in the capacitor bank of the MagVFC™ presents a risk of potentially lethal electrical shock even after power is disconnected.

   NOTE: If the motor power wires are not connected with the proper polarity, the motor will run in reverse rotation causing output pressures of approximately 17–29 PSI with a PMA VS4 and approximately 10–18 PSI with a PMA VS2 connected.

7. Connect 3-Phase, 200–250 V, 50 or 60 Hz power supply to terminals L1, L2 and L3. See § 3.2 for wiring details.

   NOTE: The MagVFC™ may be connected to single phase power only if used with FE Petro® pump motor model PMA VS2 with input power connected to L1 and L2. See § 3.2 for wiring details.

   NOTE: The PMA VS4 model pump motor requires three phase input voltage for optimum performance. Operating on single phase input, the performance of the PMA VS4 will be equivalent to that of a PMA VS2.

   ⚠ **WARNING**: Do not connect input power to any terminals other than L1, L2, and L3. Connecting input power to any other terminals will cause failure and permanent damage to the MagVFC™.

   ⚠ **WARNING**: There must be NO hook signal present when applying power to the controller.

8. Connect dispenser hook signal to the two position terminal block on the MagVFC™ board. See § 3.2 for wiring details.

   NOTE: Dispenser hook terminals are capable of accepting voltages from 110 VAC through 240 VAC dispenser signals. The dispenser hook terminals require a signal wire from the dispenser and a neutral / return.

9. Configuration switches are factory set for PMA VS2 in gasoline, mechanical leak detectors, extended run active, and stand-alone operation (see § 3.3, “Detail View”). If you are using a different configuration, see § 4.3.1.

   ⚠ **WARNING**: Before making changes to the configuration switches, make sure power supply is locked and tagged out.

4.3.1 Options Select Switch Settings

10. To access configuration switches SW3 and SW6 (see §3.3, "Detail View"), remove the two screws from the plastic shield covering the "User Interface Board".

11. Set all DIP switches as desired per Tables 4.2 and 4.3.

TABLE 4.2 – SW3 Option Select Switch Settings

Pole	Position	Purpose
1	ON	Mechanical Leak Detection Systems or LS500 Electronic Line Leak Detection Systems.
	OFF	For Veeder-Root™ PLLD.
2	ON	For gasoline (factory setting).
	OFF	For diesel product.
	–	**NOTE**: Because gasoline has a different specific gravity than diesel fuel, the correct setting of Pole 2 is important to ensure that the MagVFC™ regulates pressure at the desired level.
3	ON	For Primary controller see §4.3.2 (not for TPI use).
	OFF	For Stand-alone operation or SEC configuration (factory setting (for TPI use)).
4	ON	See §4.3.4 for details (factory setting).
5	ON	See §4.3.4 for details (factory setting)
6	ON	When using PMAVS4 motor.
	OFF	When using PMAVS2 motor (factory setting).
	–	**NOTE**: Incorrect setting can cause the MagVFC™ to give false indications of short circuit or under load. Set SW3 Pole 6 properly to horsepower of pump connected.
7	ON	For automatic reset of under load fault. An empty tank will cause an under load fault. The MagVFC™ will automatically reset when the condition is corrected.
	OFF	Must push "Reset" button to clear the UL "Under Load" fault (factory setting). Leave in OFF position in IST-VFC "Compatibility" mode.
8	OFF	Default (factory setting).
	–	**NOTE**: For multiple MagVFC™ controllers working together, see Tables 4.4, 4.10, and 4.11 for details. **NOTE**: Not functional in IST-VFC "Compatibility" mode, set with SW2 Pole 5 per Table 4.9.

TABLE 4.3 – SW6 Option Select Switch Settings

Pole	Position	Purpose
1	ON	Will disable the "Extended Run Alarm" condition.
	OFF	The "Extended Run Alarm" is active (factory setting). Not functional in "IST-VFC Compatibility Mode", leave in "OFF" position.
	–	**NOTE**: See §5 for details of the "Extended Run Alarm".
2	OFF	Default (factory setting).
	–	**NOTE**: For "Primary-Secondary" and "Alternating Circuit" configurations only. See §4.3.2 for details (not for TPI use). **NOTE**: Not functional in "IST-VFC Compatibility Mode", set with SW2 Pole 5 per Table 4.9.
3	ON	For "IST-VFC Compatibility Mode", unit will then ONLY communicate with rev 1.5 software IST-VFCs in "Primary-Secondary" configurations (not for use in communicating "Primary-Secondary" with other MagVFC™s).
	OFF	Native MagVFC™ "Primary-Secondary" communication (factory setting).
	–	**NOTE**: Available in MagVFC™ software versions 1.18 and higher only.
4	ON	When the "Alternating Circuit" configuration is used, this will alternate submersibles every 30 minutes when a hook signal is continuous. This option is used to assist in keeping tanks balanced.
	OFF	When "Alternating Circuit" is not needed.
	–	**NOTE**: See Tables 4.9 and 4.10 for additional details. **NOTE**: With software version 1.22 or higher.
5	ON	With software version 1.24, feature "Proportional Alternating Circuit", allows setting the time each controller runs before it alternates. This feature will help manage tank levels but will not replace a syphon bar or managing levels via EVO™ Series consols or Incon® T5 Series consoles "Leveling" mode. See Table 4.11.
	OFF	When "Proportional Alternating Circuit" is not needed.
6	OFF	Not used. Leave in "OFF" position (factory setting).
7	OFF	Not used. Leave in "OFF" position (factory setting).
8	OFF	Not used. Leave in "OFF" position (factory setting).

12. Replace the cover of the MagVFC™.
13. Insert a 0–100 PSI pressure gauge into the ¼" line test port of the submerged pump (or other pressurized test location in the piping system). Turn power on to the MagVFC™ at the load center. Turn on the submerged pump at the dispenser and inspect the line and test port for leaks. If there are any leaks, immediately turn off the submerged pump at the dispenser and the load center. Repair the leaks.
14. Begin purging the air from the piping system by activating a dispenser handle and pumping product into an approved container. Verify that with the pump on, no product is dispensed and pressure reading on the gauge is equal to the related pressure from Table 4.12 (step 20), +5 to -7 PSI.

    NOTE: If pressure in the piping system is much lower than selected, it is possible that the polarity of the motor power wires is not correct. Turn off the pump at the power supply, (wait one minute after LED display blanks before opening the cover) and change the connection of any two wires at the pump or at the MagVFC™ motor terminals. Turn the pump back on and read the pressure gauge. The electrical connection which gives the higher reading on the pressure gauge, is the correct one.
15. Complete purging the remaining air from the piping system and dispensers. If using "Primary-Secondary" or "Primary-Secondary/Alternating Circuit" configurations, continue with §4.3.2, otherwise go to §4.3.4.

4.3.2 Primary-Secondary Control Configurations

When two IST pumps or STP units with VS4 or VS2 suffix are installed to be run in parallel, (discharging into the same line) three different modes (configurations) of operation are possible, see Table 4.4.

TABLE 4.4 – Control Configurations

Configuration	Definition
Primary-Secondary	When a hook voltage is present at the PRM, it will turn on. When demand for product increases (more nozzles open) the PRM will call the SEC controller to turn on. This will maintain the product flow rate in high demand situations. In this configuration, the SEC controllers(s) will run only when requested to do so by the PRM controller .
Alternating Circuit	The controllers will rotate which STP to turn on as the hook voltage turns on and off. Only one controller is on at a time in this configuration. Not available in IST-VFC "Compatibility" mode.
Primary-Secondary / Alternating Circuit	"Primary-Secondary/Alternating Circuit" is a combination of the above two configurations. The first controller to turn on rotates and when the demand for product increases, additional controllers will be called on to assist.

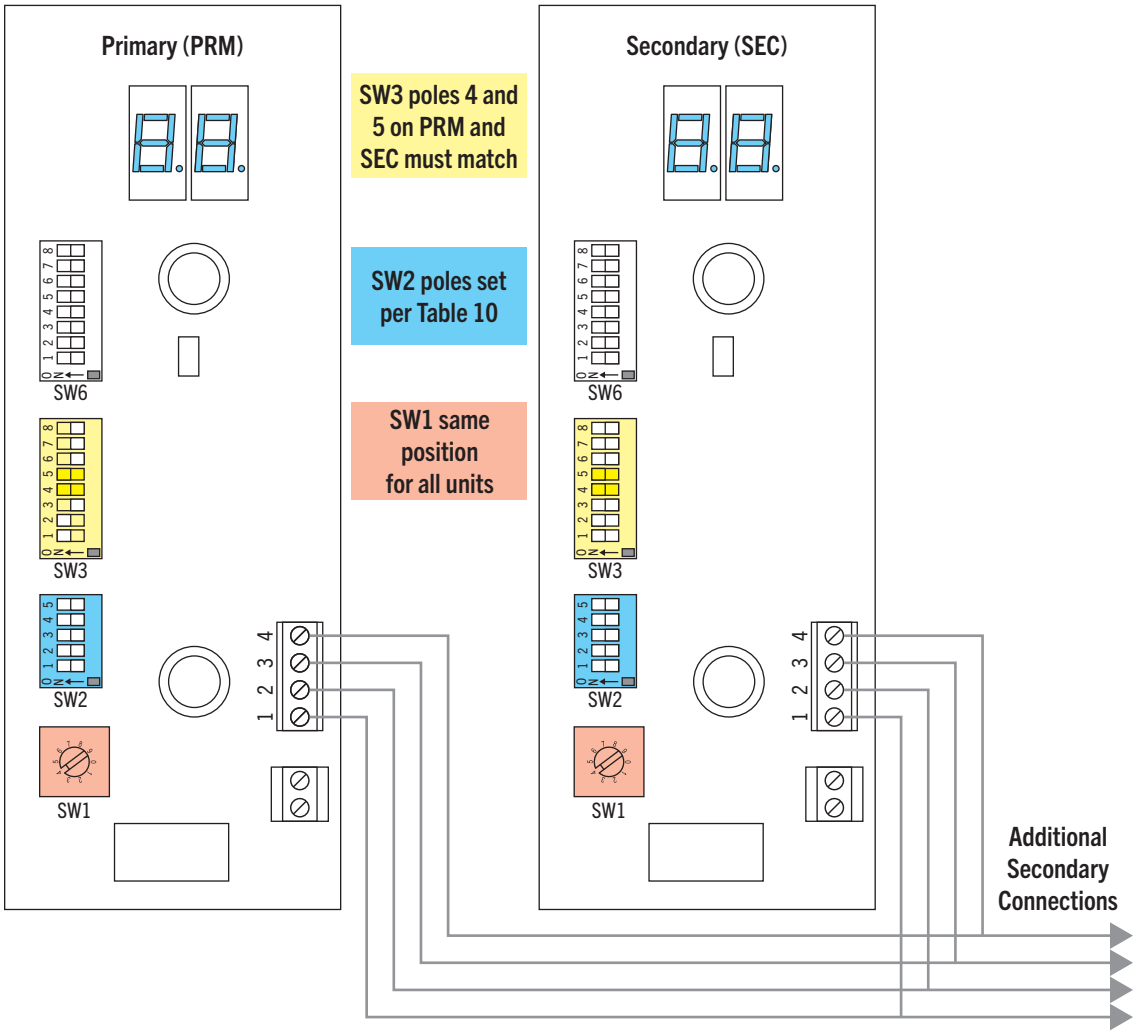
NOTE: For "Primary-Secondary" and "Alternating Circuit" configurations, the MagVFC™ can only be paired with other MagVFC™s. Because of enhanced communication protocols, the MagVFC™ is not capable of communication with the IST-VFC unless SW6 Pole 3 (IST-VFC Compatibility Mode) is switched ON. IST-VFC "Compatibility" mode is available in rev 1.18 software or higher MagVFC™s.

⚠ **WARNING**: To avoid the risk of potentially lethal electrical shock, explosion or fire, always tag and lock circuit breakers in the off position before removing the cover of the MagVFC™.

⚠ **WARNING**: After disconnecting power to the MagVFC™, wait one minute after LED display blanks before opening the cover for servicing. Voltage stored in the capacitor bank of the MagVFC™ presents a risk of lethal electrical shock even after power is disconnected.

4.3.3 RS485

FIGURE 4.1 – Primary-Secondary Configuration



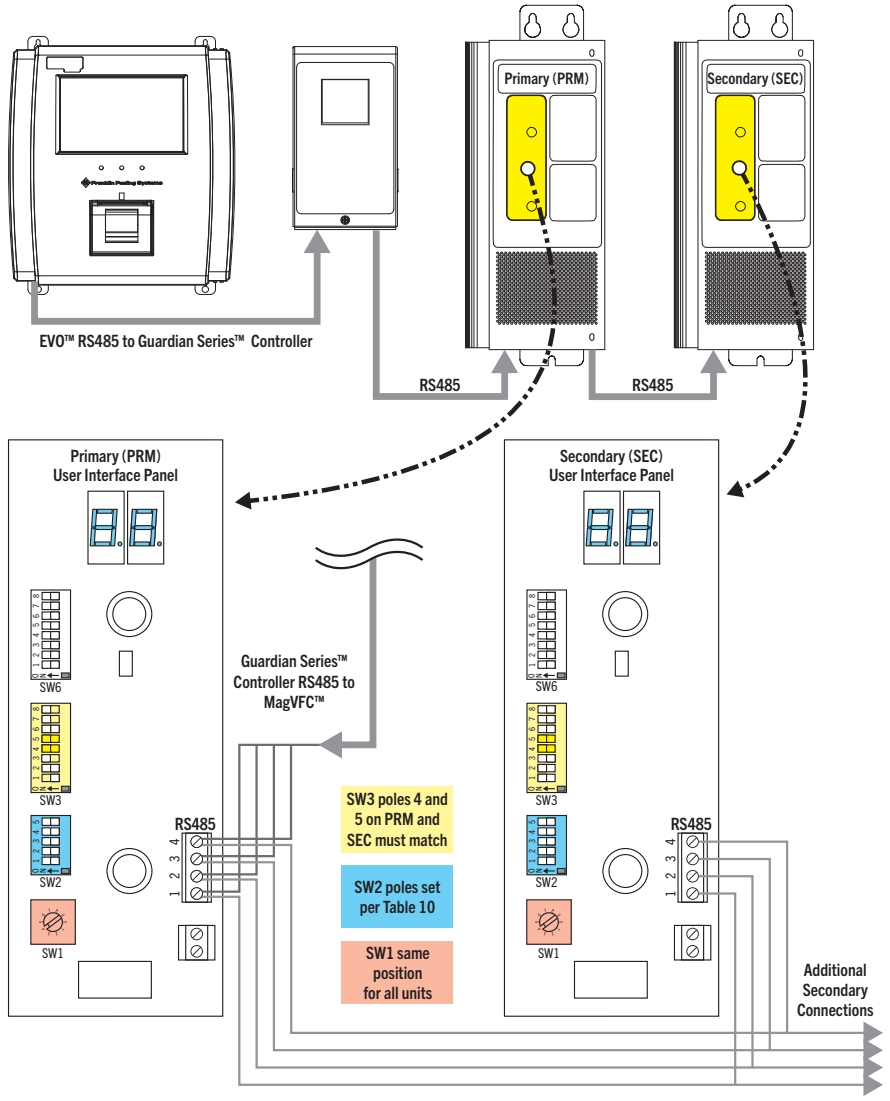
16. Wire the RS485, connecting the Primary controller MagVFC™ to the Secondary controller(s) MagVFC™ as shown in Figure 4. Wire per NFPA 30 A, and NFPA 70. Signal wires require at least 22 AWG (300 V minimum) 4 conductor shielded cable with a drain and within a common jacket. Cut wires to length so there is no excess wiring touching circuit board components.

    NOTE: When wiring a "Primary-Secondary" and/or "Alternating Circuit" configuration, connect the signal from the dispenser (hook) to the terminals of the Primary MagVFC™ only. The Primary controller will energize the Secondary controller(s) when needed without a signal from the dispenser.

    ⚠ **CAUTION**: Line leak detection performance can be affected when using multiple MagVFC™s. Franklin Electric does not recommend using the "Alternating Circuit" feature in conjunction with electronic line leak detection. Some electronic line leak detector manufacturers require that the Primary controller always turns on first. Please refer to the manufacturer's requirements.

4.3.3.1 MagVFC™ Turbine Pump Interface (TPI)

FIGURE 4.2 – Primary-Secondary Configuration



The MagVFC is used to control the 4" variable speed STP's, which range from 2–4 HP. When using TPI, a few dip-switch changes are needed on SW2 and SW3.

The SW2 pole (Native MagVFC™ Communication Addressing see Table 4.8) should be set for the correct address setting similar to the STP-SCI controllers. The MagVFC™ can be addressed for up to 31 controllers.

If using INCON® ELLD, SW3 settings are:

- SW3 Pole 1 should be in the on position.
- SW3 Pole 2 should be set for the product type, On for Gas off for Diesel.
- SW3 Pole 3 should be left off.
- SW3 Poles 4 and 5 should be set according to piping restriction.
- SW3 Pole 6 should be set to pump horsepower, On for 4 HP Off for 2 HP.
- SW3 Pole 7 can be turned off as TPI will auto reset after a delivery when an underload occurs.
- SW3 Pole 8 should remain off.

TABLE 4.5 – Not Applicable To IST-VFC Mode

Configuration	Controller	Switch	Pole	Position	Notes
Primary-Secondary	PRM	SW3	3	ON	
			8	OFF	
		SW2	ALL	OFF	
	SEC	SW3	3	OFF	
			8	OFF	Factory setting.
		SW2	*	*	
Alternating Circuit	PRM	SW3	3	OFF	
			8	ON	
		SW2	ALL	OFF	
	SEC	SW3	3	OFF	Factory setting.
			8	OFF	
		SW2	*	*	
		SW6	4	ON	To alternate after every 30 minutes of continuous hook signal.
Primary-Secondary / Alternating Circuit	PRM	SW3	3	ON	
			8	ON	
		SW2	ALL	OFF	
	SEC	SW3	3	OFF	
			8	OFF	
		SW2	*	*	

NOTE: *See Table 4.8.

TABLE 4.6 – For IST-VFC Compatibility Mode

Configuration	Controller	Switch	Pole	Position	Notes
Primary-Secondary	PRM	SW3	3	ON	
		SW6	3	ON	
	SEC	SW3	3	OFF	
		SW2	**	**	
Alternating Circuit	PRM	SW3	3	ON	
		SW6	3	ON	
	SEC	SW3	3	OFF	
		SW2	**	**	
Primary-Secondary / Alternating Circuit	PRM	SW3	3	ON	
		SW6	3	ON	
	SEC	SW3	3	OFF	
		SW2	**	**	

NOTE: **See Table 4.9 for “Primary-Secondary” and/or “Alternating Circuit”.

Another feature of the “Primary-Secondary” and/or “Alternating Circuit” configurations is the ability to have an Secondary controller take command for product delivery if one of the following alarm conditions is present with the Primary controller.

- UL – Under Load (Tank Empty).
- LI – Low Incoming Voltage.
- LU – Locked Rotor in PMA.
- HO – High Temperature in MagVFC™.
- OS – Over Speed.

TABLE 4.7 – SW6 Pole 2* - Secondary in command if alarm active on Primary

Configuration	Controller	Switch	Pole	Position	Notes
Primary-Secondary	PRM	SW6	2	**ON ***OFF	Required setting for VR PLLD. Factory default.
Alternating Circuit					
Primary-Secondary / Alternating Circuit					

NOTE: *This option only needs to be selected on the Primary controller.

NOTE: **If “ON”, an alarm condition on any controller (Primary or Secondary) will shutdown all controllers. The system will not run until the alarm situation is resolved and the “Reset” button is pushed or the “Fault Shutdown Option” switch is turned “OFF” and the “Reset” button is pushed.

NOTE: ***If “OFF”, an alarm condition will shutdown only the controller with the alarm.

17. When all connections are complete, reinstall the MagVFC™ covers and activate supply power. Verify that the front panel status indicator is displaying Id (Idle) for both Primary and Secondary controller(s).

    NOTE: When working with a “Primary-Secondary” or “Primary-Secondary/ Alternating Circuit” controller configurations, there can be only one Primary controller and up to 31 Secondary controllers. When connected properly, the yellow Communication LED will flash quickly on the Primary unit and flash in sequence through the Secondary controller(s). See §3.3 for LED location.

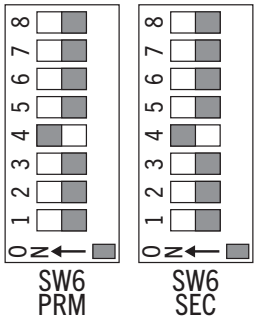
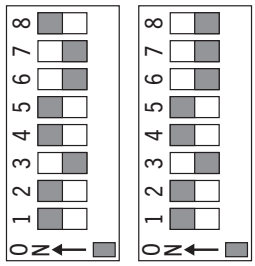
TABLE 4.8 – SW2 Native MagVFC™ Communication Addressing (■ = ON)

Controller	Pole 1	Pole 2	Pole 3	Pole 4	Pole 5
PRM					
SEC 1	■				
SEC 2		■			
SEC 3	■	■			
SEC 4			■		
SEC 5	■		■		
SEC 6		■	■		
SEC 7	■	■	■		
SEC 8				■	
SEC 9	■			■	
SEC 10		■		■	
SEC 11	■	■		■	
SEC 12			■	■	
SEC 13	■		■	■	
SEC 14		■	■	■	
SEC 15	■	■	■	■	
SEC 16					■
SEC 17	■				■
SEC 18		■			■
SEC 19	■	■			■
SEC 20			■		■
SEC 21	■		■		■
SEC 22		■	■		■
SEC 23	■	■	■		■
SEC 24				■	■

TABLE 4.9 – SW2 Compatibility Mode Addressing & IST-VFC Primary-Secondary Options (■ = ON)

Controller	Pole 1	Pole 2	Pole 3	Pole 4	*Pole 5
PRM					
SEC 1				■	■
SEC 2			■		■
SEC 3			■	■	■
SEC 4		■			■
SEC 5		■		■	■
SEC 6		■	■		■
SEC 7		■	■	■	■
SEC 8	■				■
SEC 9	■			■	■
SEC 10	■		■		■
SEC 11	■		■	■	■
SEC 12	■	■			■
SEC 13	■	■		■	■
SEC 14	■	■	■		■
SEC 15	■	■	■	■	■

TABLE 4.10 – Primary-Secondary 30 Minute Alternating Setup (Software Version 1.22 or Higher; ■ = ON)

SW6 Px	PRM	SEC	Notes	Reference
8			Not used.	
7			Not used.	
6			Not used.	
5			Primary-Secondary Turn On.	
4	■	■	Alternating Circuit Proportioning.	
3			IST / MAG.	
2			Primary-Secondary Shutdown.	
1			Extended Run.	
SW3 Px				
8	■		Alternating Circuit.	
7			Auto UL Reset.	
6			VS2 (On for VS4).	
5	■	■	Pipe Compensation.	
4	■	■		
3			Primary-Secondary.	
2	■	■	Gas (Off for Diesel)	
1	■	■	MLD (OFF for PLLD).	

4.3.3.1.1 MagVFC™ Proportional Alternating Circuit Feature (Software Version 1.24)

To enable the "Proportional Alternating Circuit" feature on the MagVFC™ with software version 1.24 or higher:

Set SW3 Pole 8 to "ON".

Set SW6 Pole 4 to "ON". This activates the "Timed Alternating Circuit" mode. This switch needs to be enabled on the Primary MagVFC™ only.

Set SW6 Pole 5 to "ON". This switch activates the "Proportioning" feature and needs to be enabled on the Primary MagVFC™ only.

Set SW2 to the desired address for pump run time. Each MagVFC™ address will be set based on the time it needs to run, see Table 4.11.

NOTE: This is different from the typical Primary MagVFC™ address of "0" (See Figure 4.2 for switch locations).

Any address can be set, as long as the addresses are unique between controllers. Typically addresses and run times will be chosen that are proportional to the tank sizes. The example below, shows three different size tanks and the addresses that run the pumps in proportion to the tank size.

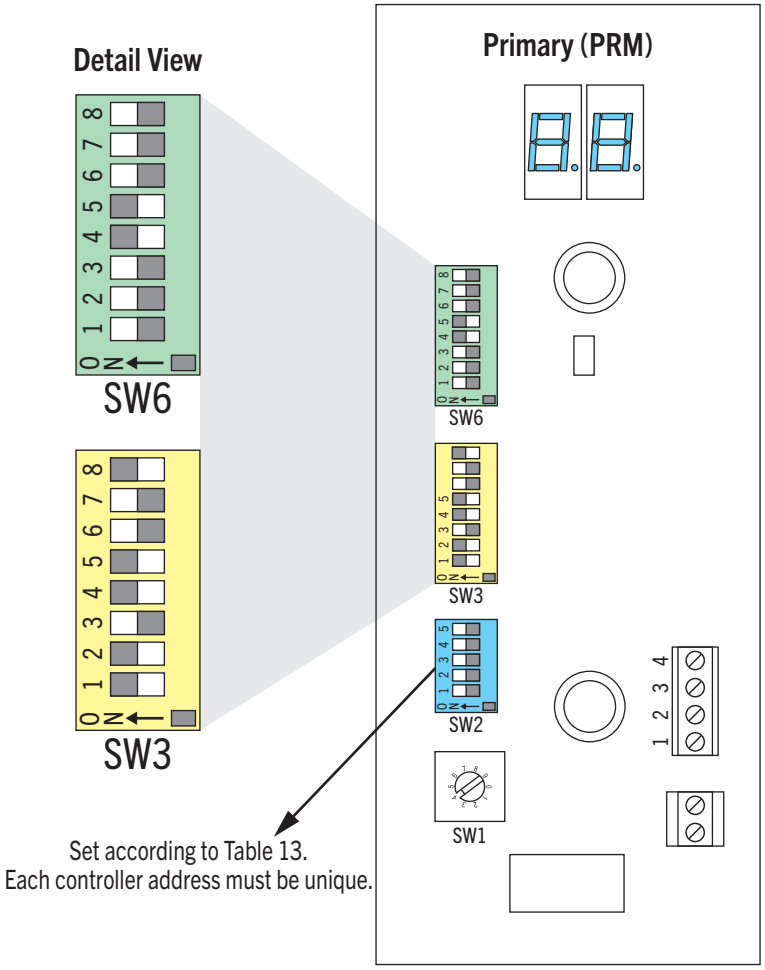
TABLE 4.11 – SW2 Proportional Alternating Circuit Feature (Software Version 1.24; ■ = ON)

Controller	P1	P2	P3	P4	P5	Timed AC Minutes ON
PRM 0						1.5
SEC 1	■					1.5
SEC 2		■				3.0
SEC 3	■	■				4.5
SEC 4			■			6.0
SEC 5	■		■			7.5
SEC 6		■	■			9.0
SEC 7	■	■	■			10.5
SEC 8				■		12.0
SEC 9	■			■		13.5
SEC 10				■		15.0
SEC 11	■	■		■		16.5
SEC 12			■	■		18.0
SEC 13	■		■	■		19.5
SEC 14		■	■	■		21.0
SEC 15	■	■	■	■		22.5
SEC 16					■	24.0
SEC 17	■				■	25.5
SEC 18		■			■	27.0
SEC 19	■	■			■	28.5
SEC 20			■		■	30.0
SEC 21	■		■		■	31.5
SEC 22		■	■		■	33.0
SEC 23	■	■	■		■	34.5
SEC 24				■	■	36.0
SEC 25	■			■	■	37.5
SEC 26		■		■	■	39.0
SEC 27	■	■		■	■	40.5
SEC 28			■	■	■	42.0
SEC 29	■		■	■	■	43.5
SEC 30		■	■	■	■	45.0
SEC 31	■	■	■	■	■	46.5

Example:

- For a Primary controller with a 20,000 gallon tank, when set to address 20 the pump will run for 30 minutes.
- For an Secondary controller with a 12,000 gallon tank, when set to address 12 the pump will run for 18 minutes.
- For another Secondary controller in an 8,000 gallon tank, when set to address 8, the pump will run for 12 minutes.

FIGURE 4.3 – Switch Settings for Proportional Alternating Setup



4.3.4 MagVFC™ Site Setup

18. Verify rotary switch on MagVFC™ is set to position 4. This will provide approximately 32 PSI output from the IST or STP units with VS2 or VS4 suffix, and serves as a good starting point for MagVFC™ calibration.

19. Using a five gallon capacity minimum approved container, go to the dispenser closest to the storage tank and perform a "Flow Rate Test". If the product being pumped is gasoline, consider following the "U.S. EPA Fuel Dispenser Flow Rate Test Procedure" (for 10 GPM maximum flow rate standard), where applicable.

    NOTE: It is necessary to perform a "Flow Rate Test" for each product available at the dispenser. This will confirm that all product outputs, including products blended at the dispenser, do not exceed the U.S. EPA 10 GPM maximum, where applicable.

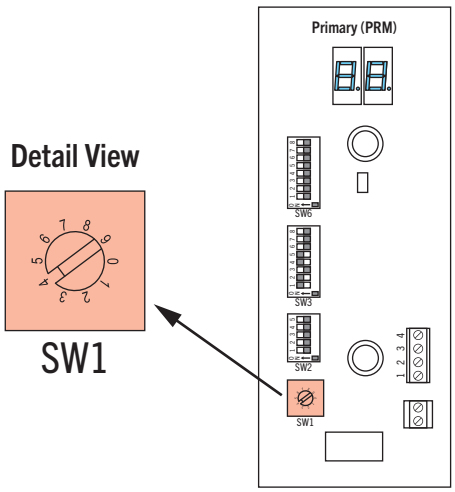
    NOTE: Use of flow restricters to control a maximum flow rate of 10 GPM per nozzle (as required by the U.S. EPA) are not required if the variable frequency controller is properly calibrated as defined in §4.3.4.

20. If output is above or below the desired range (i.e. 8-10 GPM), turn off the pump at the power supply, wait one minute after LED display blanks before opening the cover, remove the MagVFC™ cover, and adjust the rotary switch (SW1, see Table 4.12 and Figure 4.4). This switch will increase or decrease the system operating pressure according to Table 4.12. An increase in pressure will normally yield an increase in flow rate. A decrease in pressure will reduce flow rate. Replace the MagVFC™ cover and re-apply input voltage. Return to step 19 and check GPM with the new settings. Repeat until the output obtained is within the desired range in GPM.

TABLE 4.12 – SW1 Operational Pressure Switch Settings (see Fig. 4.3)

Position	Pressure (PSI)
0	24
1	26
2	28
3	30
4	32
5	34
6	36
7	38
8	40
9	42

FIGURE 4.4



⚠ **WARNING**: To avoid the risk of potentially lethal electrical shock, explosion or fire, always tag and lock circuit breakers in the off position before removing the cover of the MagVFC™.

⚠ **WARNING**: After disconnecting power to the MagVFC™, wait one minute after LED display blanks before opening the cover for servicing. Voltage stored in the capacitor bank of the MagVFC™ presents a risk of potentially lethal electrical shock even after power is disconnected.

NOTE: Additives in gasoline can change the specific gravity of gasoline, which may cause the pressures stated in Table 4.12 to vary.

21. Optimize "Pipe Compensation" settings by doing another "Flow Rate Test", this time with two other nozzles from the same product open at the same time as your test nozzle. If the flow rate at the test nozzle falls from the desired range with three nozzles open, increase SW3 Pole 4 and Pole 5 to the next highest compensation setting (0 to 1 or 1 to 2 for example). If output exceeds the desired range, decrease to the next lowest compensation setting (2 to 1 or 1 to 0 for example). Repeat this step until compensation setting is optimal for your installation. Factory setting is zero.

TABLE 4.13 – *SW3 - Piping Compensation (■ = ON)

Compensation	P4	P5	Notes
0	■	■	Least restrictive. Factory setting.
1	■		
2		■	
3			Most restrictive.

NOTE: An example of a “Small Restriction Piping System” would be 2" fiberglass running less than 150'. An example of a “Restrictive Piping System” would be 1½" convoluted flexible piping greater than 75' in length.

NOTE: When working with a “Primary-Secondary” or “Primary-Secondary/Alternating Circuit” configuration, the “Piping Compensation” must be identical in all controllers.

5 Display Definitions & Troubleshooting

The MagVFC™ displays the operating status of the controller (normal and abnormal) using reference codes. Codes such as “Status” (Table 5.1), “Error” (Table 5.2), and/or “Alarm” (Table 5.2) inform the user of the conditions present in the system.

TABLE 5.1 – Display Status Codes

Code	Definition	Description	Displayed
Id	Idle	No hook signal present, PMA is not running, and no fault codes present.	Least restrictive. Factory setting.
xx : yy	Software Revision	Software version of MagVFC™ where numeric value **xx** displays and then value **yy** to form the revision **xx.yy**. **Note**: If the display stops on **yy**, there may be an issue of low incoming voltage or loose input power connections.	Immediately after the MagVFC™ has been reset or turned ON.
Pr : NN	Pressure Regulate	**Pr** is the pressure setting of **NN** psi that the MagVFC™ is set to maintain. **Pr** and the numeric value **NN** of the set pressure will flash alternately on the display when running.	MagVFC™ is running and operating within pressure regulate setting.
PL	Power Limit	Displayed when MagVFC™ is operating at its power limit.	MagVFC™ is running and operating beyond pressure regulate setting.
Sr	Secondary Running	Displayed when an Secondary in a “Primary-Secondary” configuration is running.	Most restrictive.

NOTE: Table 5.2 lists system “Error” and “Alarm” codes with suggested solution(s).

NOTE: The MagVFC™ is equipped with a “Reset” button to clear faults and a “Silence Audible Alarm” button that turns off the audible alarm when depressed. Depressing the “Silence Audible Alarm” button does not clear the fault, it only silences the alarm. Pushing and holding the “Silence Audible Alarm” button will put the “Pump Status Display” in “Fault Readout Mode”, showing the last three fault conditions encountered by the MagVFC™. In example, F0 is followed by the code of the last fault encountered, F1 is second to last fault encountered, F2 is third to last fault encountered. Sequence through the codes by briefly pushing the “Silence Audible Alarm” button after each code is displayed until the “Pump Status Display” returns to normal status.

TABLE 5.2 – Troubleshooting Codes

Code	Condition	Potential Cause	Proposed Action
UL	Under Load, Tank Empty. Incorrect Horsepower Setting.	Low fuel level in the storage tank. Obstruction on intake of PMA. SW3 P6 set incorrectly for pump connected.	1. Push "Reset" on the MagVFC™. 2. If condition is corrected, check for proper operation of system. *If operating correctly do not continue to next step*. If condition is still present continue to next step. 3. Check SW3 P6 and verify it matches the horsepower of the pump connected. Connecting a VS2 motor with a SW3 P6 "ON" (4 HP), may cause this false indication when operating in SW1 positions 0 - 6. 4. Check fuel level in storage tank. If product is low, schedule fuel delivery. When delivery is complete (fuel level is above PMA end bell), push "Reset" on the MagVFC™. Check for correct system operation. 5. If condition is not corrected, it is possible that there is an obstruction on the inlet of the PMA.
LI	Low Incoming Voltage.	Voltage fluctuations or low input voltage.	1. Push "Reset" on the MagVFC™. 2. If condition is corrected, check for proper operation of system. *If operating correctly do not continue to next step*. If condition is still present continue to next step. 3. Use an AC voltmeter to verify incoming voltage is within 200–250 VAC. If voltage is not within this range, contact an electrician to correct.
Er	Extended Run.	Continuous hook signal applied for greater than 60 minutes without change in pumping product flow rate.	1. Disconnect power at load center. Lock and tag out circuit breaker. 2. Check voltage across hook terminals with all dispenser handles off. There should be no voltage applied. If voltage is present, contact an electrician to correct the problem. After the problem has been corrected, turn on input power and verify system is operating correctly.
rI	Voltage Unbalance or Capacitor Bank.	Unbalanced incoming voltage, sudden large load or failed MagVFC™ capacitor bank.	1. Push "Reset" on the MagVFC™. 2. Check incoming voltage and electrical loading. 3. If fault is cleared, observe the MagVFC™ in normal operation for approximately 10 minutes to see if it functions normally. 4. If error recurs, contact FE Technical Support.
OS	Over Speed.	MagVFC™ operating outside of range of operating frequency.	1. Push "Reset" on the MagVFC™. 2. Check for proper operation. If condition is still present, power down unit completely and wait 30 seconds. 3. Turn on power and check for proper operation. 4. If fault recurs, contact FE Technical Support.
HO	High temperature.	Excessive operating temperature in MagVFC™.	1. Verify that the fan is running properly. If not, replace the fan. 2. Check for excessive heat in area where control box is mounted. 3. Verify all louvers for ventilation are free from obstruction. Remove obstruction(s) and cycle power to reset MagVFC™. 4. If the condition persists, contact FE Technical Support.

TABLE 5.2 – Troubleshooting Codes

Code	Condition	Potential Cause	Proposed Action
LU	Locked Rotor Fault at PMA startup.	Foreign material in PMA or defective PMA.	1. Push "Reset" on the MagVFC™. 2. If condition is corrected, check for proper operation of system. *If operating correctly do not continue to next step*. If condition is still present continue to next step. 3. Disconnect input voltage at load center, lock and tag circuit breakers. 4. Remove two 9⁄16" bolts from extractable portion of the manifold. Disengage the ¾" securing bolt of the electrical connector and swing out of the way. 5. Pull extractable part of the pump.* 6. Remove black end cap from PMA and attempt to spin rotor with a 3⁄16" Allen wrench to determine if there is any binding. If binding or physical damage, continue with next step. If no binding or physical damage to the PMA, and it is a new installation, reinstall extractable. 7. Turn power on to the MagVFC™ unit and verify correct system operation. *If condition is corrected, do not continue to the next step*. If condition is still present, remove the extractable (repeat steps 3, 4, and 5) and continue to the next step. **NOTE**: PMA can have a locked rotor during startups if it has been exposed to a corrosive environment, such as a tank ballasted in water. 8. Remove four cap screws connecting the PMA with ¼" Allen wrench and remove the PMA from the motor discharge head. **NOTE**: Prior to mounting a new PMA, check lead assembly (wires inside the extractable portion to PMA) for shorted wires which may have caused the condition. 9. Replace with a new variable speed pump motor (PMAMVS4 or PMAVS2).* 10. Reinstall extractable by following reverse order of disassembly. 11. Turn on power to the MagVFC™ unit and verify correct system operation. **NOTE**: *PMA shell can be damaged by blows from hard surfaces; use care when removing or replacing. **NOTE**: Where motor wiring runs are extremely long and/or of a small wire diameter, a false LU (locked up) may be displayed on the MagVFC™. See Table 4.1 for wire size/run recommendations.

TABLE 5.2 – Troubleshooting Codes

Code	Condition	Potential Cause	Proposed Action
SU	Upper Rail Short.	Short Circuit condition in field wiring or component failure internal to the MagVFC™.	1. Push "Reset" on the MagVFC™. 2. Check for proper operation. 3. If fault re-occurs turn off power to MagVFC™, lock out and tag circuit breaker. Disconnect the wires to the STP at the controller terminals marked BLACK, ORANGE and RED. 4. Use wire nuts and cap each wire off to prevent any possible shorts in the controller. Turn power on to the MagVFC™ and observe the display. If the controller indicates an OC (Open Circuit) condition follow the troubleshooting steps for a short circuit. 5. If controller display indicates the SU (Upper Rail Short) condition then contact FE Technical Support.
OC	Open circuit from MagVFC™ to motor. (See note).	Connection broken from MagVFC™ to PMA.	1. Push "Reset" on the MagVFC™. 2. If condition is corrected, check for proper operation of system. *If operating correctly do not continue to next step*. If condition is still present continue to next step. **MagVFC™/PMA Connections** 1. Disconnect power at load center, lock and tag circuit breakers. 2. Remove the three motor control outputs from the MagVFC™ unit. 3. Using an ohmmeter on 200 setting, place leads between these three wires from the pump motor (this is the first step in determining where the open circuit has occurred). Correct reading between any two of the three wires should be 1.2 +/-1 ohms (VS4) and 2.5 +/-1 ohms (VS2). 4. Continue conductivity tests on the remaining combinations of wires (three total). Results, e.g. BLACK to RED = 2 ohms. Readings between any of the three motor control wires and ground should be an open circuit. If readings in this step are incorrect go to step 7. If readings are correct, contact FE Technical Support for assistance. 5. Go to the submerged turbine and remove the cover at the top of the extractable manifold; remove the three wire nuts. 6. Place an ohmmeter between the three wires leading to the pump motor as above. If readings are incorrect go to PMA replacement in 3 flashes section. If readings are correct, there is problem with the wiring between the MagVFC™ and this point. 7. Remove the junction box cover and do conductivity test on the wires from junction box to the extractable discharge head. If wires are not conducting, replace the male and female connectors of the submerged turbine. If there is no problem with these connections,d the wires from the MagVFC™ to the submerged turbine are suspect. Contact an electrician to correct the problem. 8. After the problem has been corrected turn on power to MagVFC™ and verify system is operating correctly. **Note**: Where motor wiring runs are extremely long and/or of a small wire diameter, a false OC (open circuit) may be displayed on the MagVFC™. See Table 4.1 for wire size/run recommendations.

TABLE 5.2 – Troubleshooting Codes

Code	Condition	Potential Cause	Proposed Action
SC	Short Circuit. Incorrect Horsepower Setting.	Short in connections from MagVFC™ to PMA. SW3 P6 set incorrectly for pump connected.	1. Push "Reset" on the MagVFC™. 2. If condition is corrected, check for proper operation of system. *If operating correctly do not continue to next step*. If condition is still present continue to next step. 3. Check SW3 P6 setting and verify that it matches the horsepower of the pump connected. Connecting VS4 motor with a SW3 P6 "OFF" (2 HP) setting, may cause this false indication. **MagVFC™/PMA Connections** 1. Disconnect power at load center, lock and tag circuit breakers. 2. Remove the three motor control outputs from the MagVFC™ unit. 3. Using an ohmmeter on 200 setting, place leads across any two of the three wires from the pump motor. Correct reading between any two of the three wires should be 1.2 +/-1 ohms (VS4) and 2.5 +/-1 ohms (VS2). 4. Continue conductivity tests on the remaining combinations (three total). Readings between any of the three motor control wires and ground should be greater than 80k ohms. If readings are incorrect proceed to step 8. If readings are correct, the possibility of a short circuit in the connections between the MagVFC™ and the PMA still exist. Contact FE Technical Support for additional troubleshooting assistance. 5. Go to the submerged turbine and remove the cover at the top of the extractable; remove the three wire nuts. 6. Place an ohmmeter between the three wires leading to the pump motor as above. If wires are shorted, go to PMA replacement in 3 flashes section. If readings are correct there is problem with the wiring between the MagVFC™ and this point. 7. Remove the junction box cover and do conductivity tests on wires from junction box to extractable discharge head. If wires are shorted to ground or each other, replace the male and female connectors of the submerged turbine. If there is no problem with these connections, the wires from the MagVFC™ to the submerged turbine are suspect. Contact an electrician to diagnose and correct the problem. 8. After the problem has been corrected turn on power to the MagVFC™ and verify system is operating correctly.

TABLE 5.2 – Troubleshooting Codes

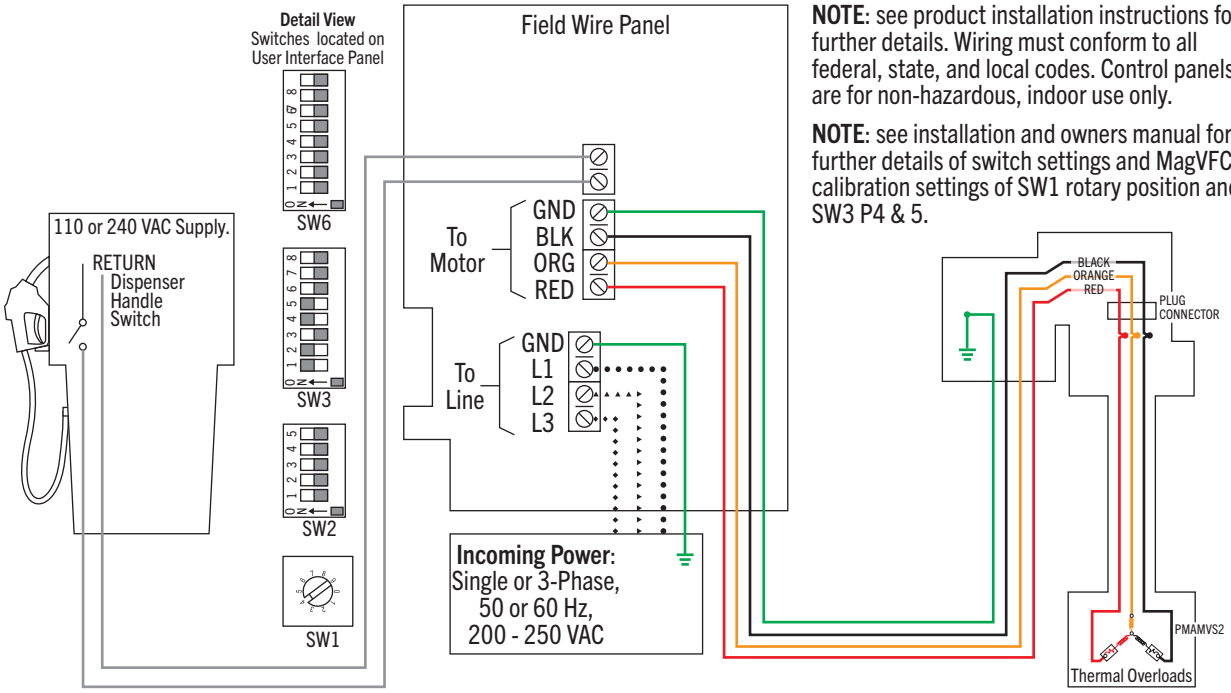
Code	Condition	Potential Cause	Proposed Action
Lr	Locked rotor fault with PMA running. (See note.)	Foreign material in PMA or defective PMA.	1. Push "Reset" on the MagVFC™. 2. If condition is corrected, check for proper operation of system. *If operating correctly do not continue to next step*. If condition is still present continue to next step. **PMA Inspection.** 3. Disconnect input voltage at load center, lock and tag circuit breakers. 4. Remove two 9⁄16" bolts from extractable portion of the manifold. Disengage the ¾" securing bolt of the electrical connector and swing out of the way. 5. Pull extractable part of the pump.* 6. Remove black end cap from PMA and attempt to spin rotor with a 3⁄16" Allen wrench to determine if there is any binding. If binding or physical damage, continue with next step. If no binding or physical damage to the PMA, and it is a new installation, reinstall extractable. 7. Turn power on to the MagVFC™ unit and verify correct system operation. *If condition is corrected, do not continue to the next step*. If condition is still present, remove the extractable (repeat steps 3, 4, and 5) and continue to the next step. **NOTE**: PMA can have a locked rotor during startups if it has been exposed to a corrosive environment, such as a tank ballasted in water. 8. Remove four cap screws connecting the PMA with ¼" Allen wrench and remove the PMA from the motor discharge head. **NOTE**: Prior to mounting a new PMA, check lead assembly (wires inside the extractable portion to PMA) for shorted wires which may have caused the condition. 9. Replace with a new variable speed (VS4 or VS2) pump motor.* 10. Reinstall extractable by following reverse order of disassembly. 11. Turn on power to the MagVFC™ unit and verify correct system operation. **NOTE**: *PMA shell can be damaged by blows from hard surfaces; use care when removing or replacing.

NOTE: In rare installations, a partial short can result from a nick in one of the pump power wires coupled with water in the electrical conduit from the MagVFC™ to the pump. This condition is not a direct short, so the MagVFC™ does not flash SC (short circuit). Instead, the MagVFC™ will see this condition as abnormally high power consumption, and flash Lr (locked rotor).

6 Schematics

6.3.1 Basic Configurations

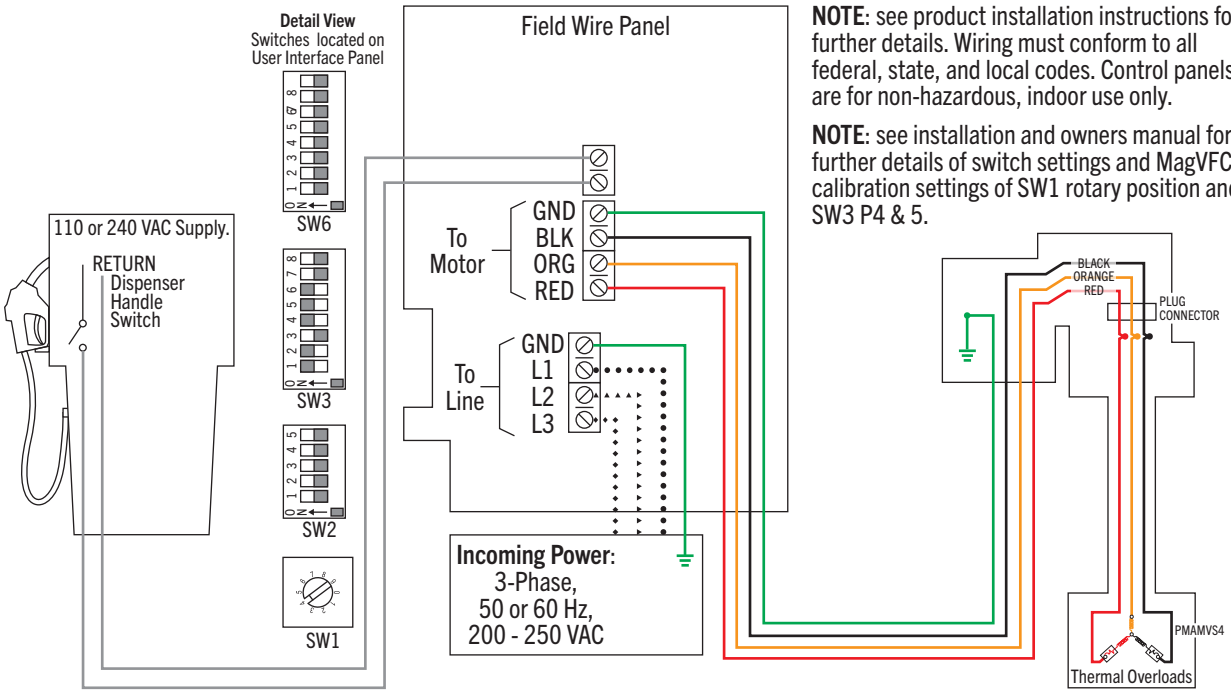
FIGURE 6.1 – Standalone MagVFC™ with PMAVS2 (variable speed, 2 HP)



NOTE: see product installation instructions for further details. Wiring must conform to all federal, state, and local codes. Control panels are for non-hazardous, indoor use only.

NOTE: see installation and owners manual for further details of switch settings and MagVFC™ calibration settings of SW1 rotary position and SW3 P4 & 5.

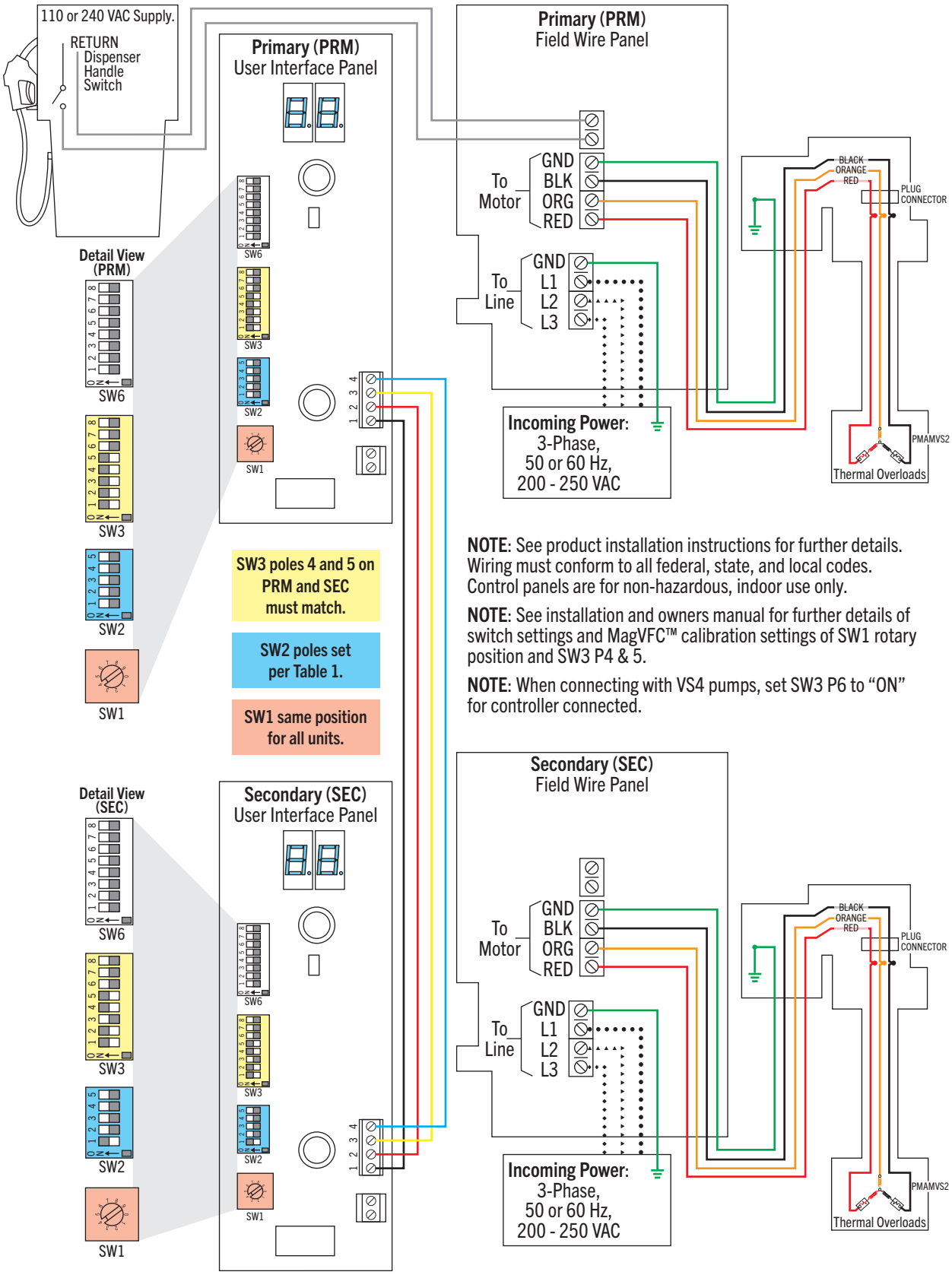
FIGURE 6.2 – Standalone MagVFC™ with PMAVS4 (variable speed, 4 HP)



NOTE: see product installation instructions for further details. Wiring must conform to all federal, state, and local codes. Control panels are for non-hazardous, indoor use only.

NOTE: see installation and owners manual for further details of switch settings and MagVFC™ calibration settings of SW1 rotary position and SW3 P4 & 5.

FIGURE 6.3 – Primary-Secondary configuration MagVFC™ with PMAVS2 (variable speed, 2 HP)

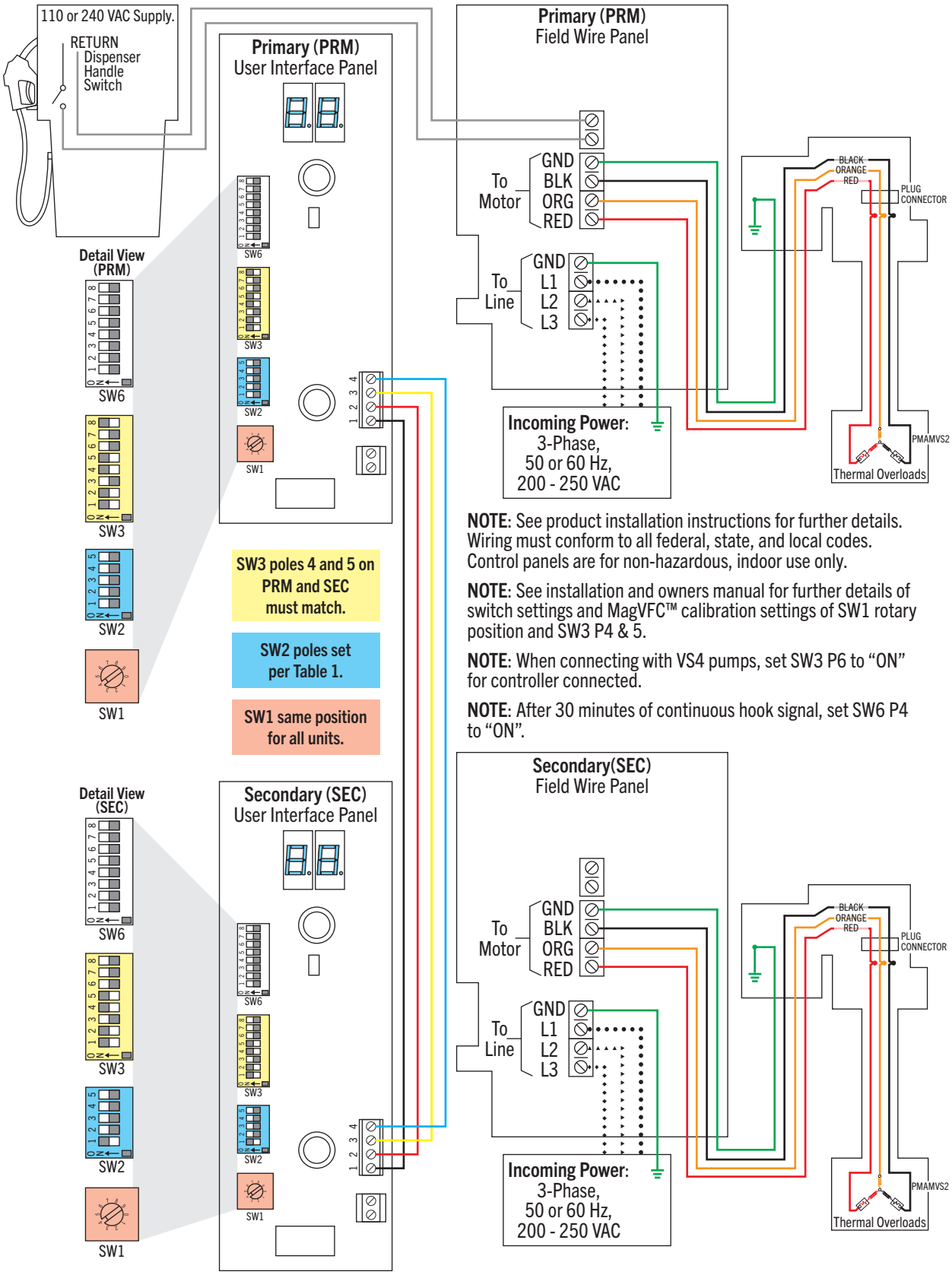


NOTE: See product installation instructions for further details. Wiring must conform to all federal, state, and local codes. Control panels are for non-hazardous, indoor use only.

NOTE: See installation and owners manual for further details of switch settings and MagVFC™ calibration settings of SW1 rotary position and SW3 P4 & 5.

NOTE: When connecting with VS4 pumps, set SW3 P6 to "ON" for controller connected.

FIGURE 6.4 – Alternating Circuit configuration MagVFC™ with PMAVS2 (variable speed, 2 HP)



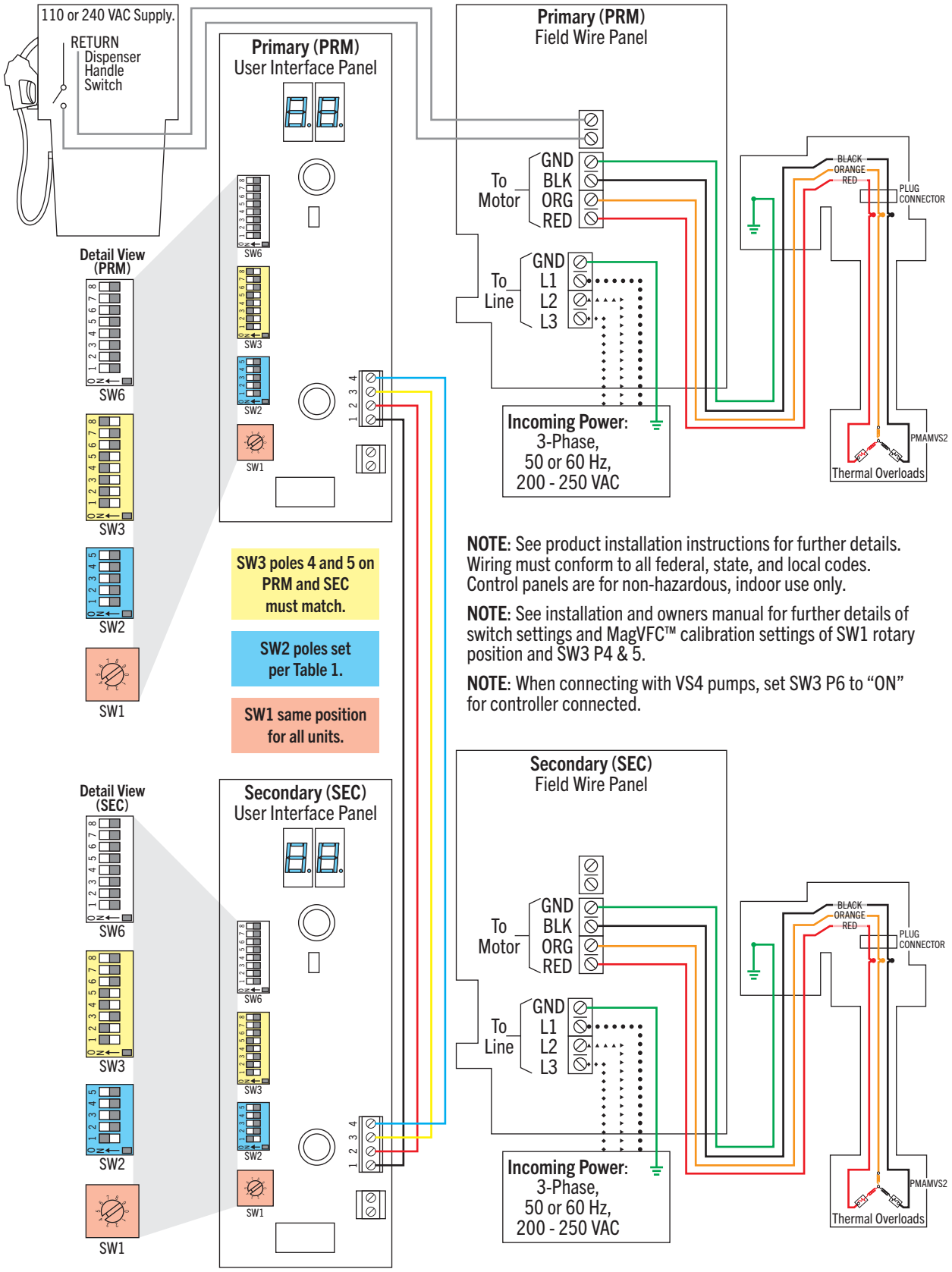
NOTE: See product installation instructions for further details. Wiring must conform to all federal, state, and local codes. Control panels are for non-hazardous, indoor use only.

NOTE: See installation and owners manual for further details of switch settings and MagVFC™ calibration settings of SW1 rotary position and SW3 P4 & 5.

NOTE: When connecting with VS4 pumps, set SW3 P6 to "ON" for controller connected.

NOTE: After 30 minutes of continuous hook signal, set SW6 P4 to "ON".

FIGURE 6.5 – Primary-Secondary/Alternating Circuit configuration MagVFC™ with PMAVS2 (variable speed, 2 HP)



NOTE: See product installation instructions for further details. Wiring must conform to all federal, state, and local codes. Control panels are for non-hazardous, indoor use only.

NOTE: See installation and owners manual for further details of switch settings and MagVFC™ calibration settings of SW1 rotary position and SW3 P4 & 5.

NOTE: When connecting with VS4 pumps, set SW3 P6 to "ON" for controller connected.

6.3.2 IST-VFC Compatibility Mode Configurations

FIGURE 6.6 – Secondary MagVFC™ Replacement IST-VFC Compatibility Mode

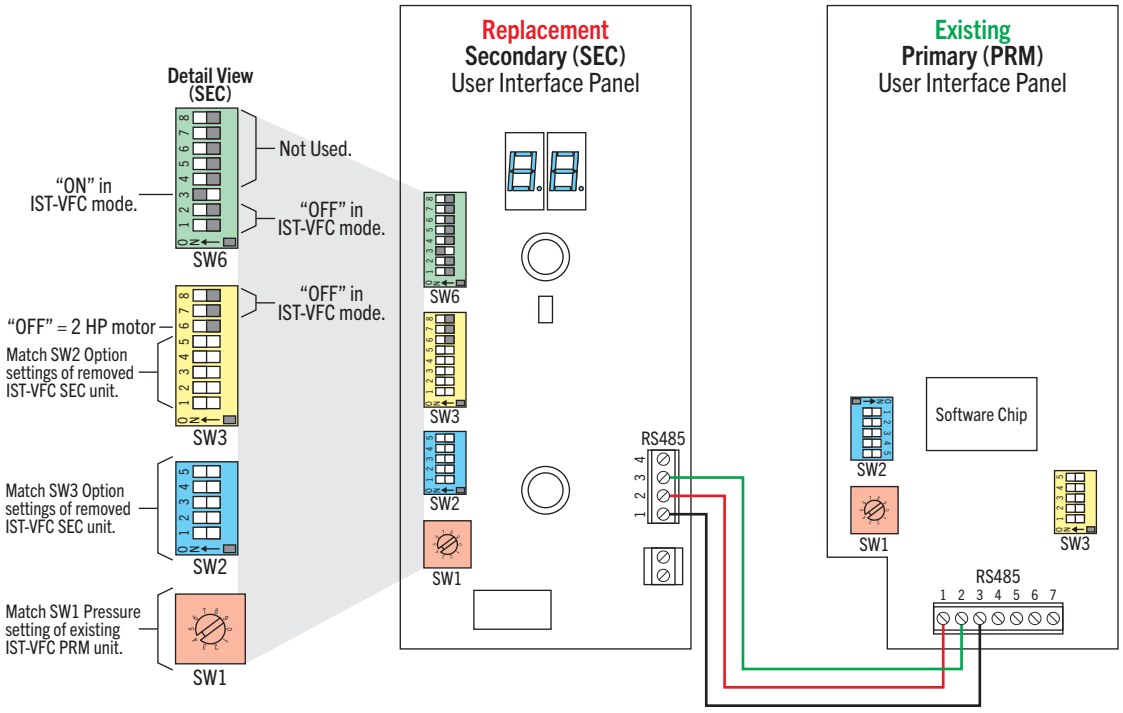
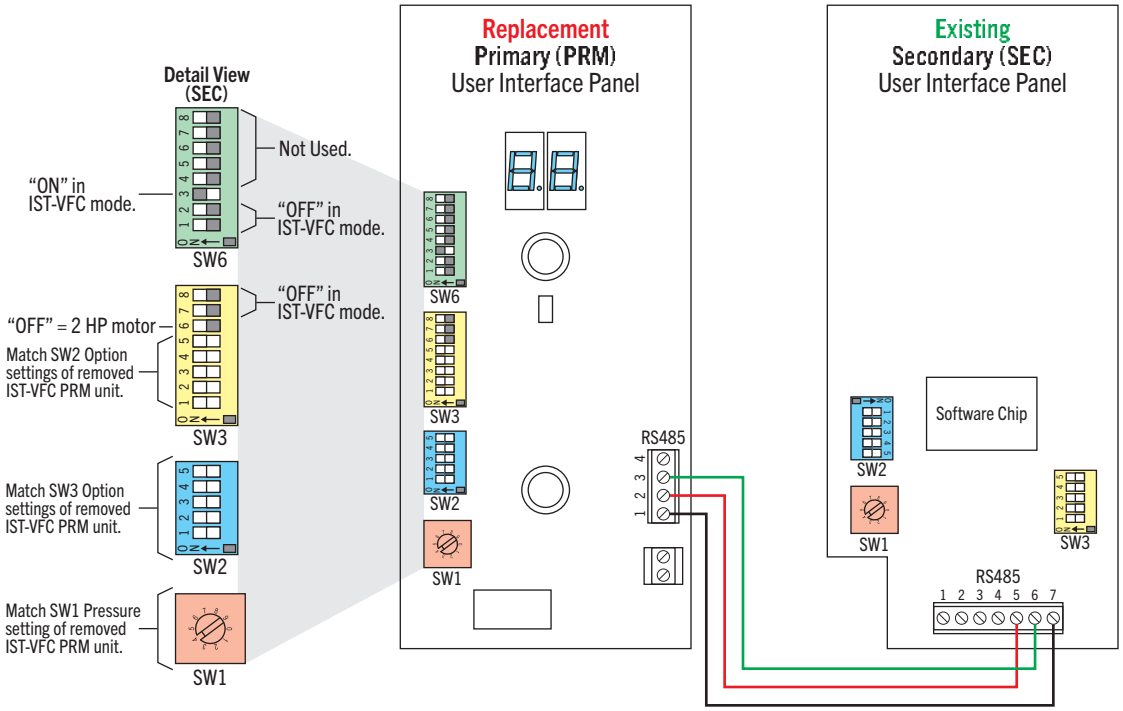


FIGURE 6.7 – Primary MagVFC™ Replacement IST-VFC Compatibility Mode



7 Appendix

7.1 Replacement Parts

TABLE 7.1 – MagVFC™ Replacement Parts

Description	Part Number
Fan Assembly	223919930
User Interface Board	225040930
Normally Open Relay	228289930
Window Lens	402623930

7.2 Document Tables

TABLE 7.2 – Table Locations

Table	Page(s)	Description
3.1	4	Field Wire Panel
3.1a	5	INPUT Wire Size / Run (Breaker Panel to Drive)
3.2	6	User Interface Panel
4.1	8	OUTPUT Wire Size / Run (Drive to Motor)
4.2	10	SW3 Option Select Switch Settings
4.3	11	SW6 Option Select Switch Settings
4.4	12	Control Configurations.
4.5	15	Not Applicable To IST-VFC Mode
4.6	15	For IST-VFC Compatibility Mode
4.7	16	*SW6 P2 - Secondary in command if alarm active on Primary
4.8	17	SW2 Native MagVFC™ Communication Addressing
4.9	18	SW2 Compatibility Mode Addressing & IST-VFC Primary-Secondary Options
4.10	18	Primary-Secondary 30 Minute Alternating Setup (Software Version 1.22 or Higher)
4.11	19	SW2 Proportional Alternating Circuit Feature (Software Version 1.24)
4.12	21	SW1 Operational Pressure Switch Settings
4.13	22	*SW3 - Piping Compensation
5.1	23	Display Status Codes
5.2	24–28	Troubleshooting Codes
7.1	34	MagVFC™ Replacement Parts
7.2	34	Table Locations

7.3 Glossary

ATG ..... Automatic Tank Gauge.

FE..... Franklin Electric

NEC..... National Electrical Code

PLLD ..... (Electronic) Pressurized Line Leak Detection

PMA ..... Pump Motor Assembly

PRM ..... Primary (Main) Controller

Px..... Indicates a “Pole” where “x” represents a specific DIP ID in a SWx style switch

SEC ..... Secondary Controller (subordinate to Primary controller)

STP ..... Submersible Turbine Pump

SWx..... Indicates a “Switch” where “x” represents a specific switch ID either dial or DIP bank

TPI..... Turbine Pump Interface



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