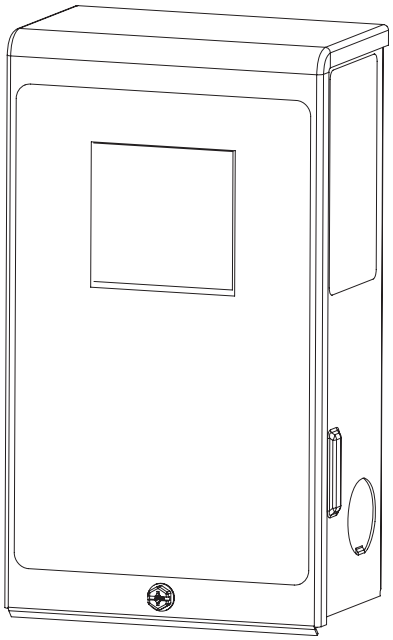
Franklin Electric
FUELING SYSTEMS

GUARDIAN SERIES™ SINGLE-PHASE CONTROLLER 220 VOLT

INSTALL GUIDE

223987103 r5

MODEL
SPGC-220



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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 Single Phase Guardian Series™ Controller (model SPGC-220) is a submersible turbine pump controller intended for use with single phase, 200–250 Volt, 50 or 60 Hertz rated FE PETRO® or similar competitive pump motor assemblies. The SPGC-220 provides the running and fault status of the attached pump motor assemblies when properly installed and calibrated according to the instructions contained in this guide. If used in a manner not specified herein, the operation and protection described in this guide may be compromised.

1.1 Regulatory Compliance

IMPORTANT INFORMATION - FOLLOW ALL INSTRUCTIONS

- The products contained within in this guide shall only be assembled and installed by a qualified person (see §2.7). *Use of non-qualified personnel, or any deviations from these recommended procedures, could result in damage or malfunction.*
- For Operating Parameters (including Electrical & Environmental), see §3.2.1
- For Certifications & Approvals, see §3.2.1
- For Required Tools, see §3.2.3
- For Wiring Diagrams, see §6.1

1.2 Documentation

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

1.2.1 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

 Disconnect main plug from electrical outlet

 Disconnect before carrying out maintenance or repair

 Lockout/Tagout Electrical Equipment

 General Warning

 Warning: Electricity

 Warning: Flammable Material

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

2 Safety/Security

2.1 General Safety Information

- Procedures in this document are only to be performed by people qualified and certified to perform them (see §2.3 and §2.7).
- 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.

2.2 Documentation Availability

Upon installation completion, this document shall be transferred by the qualified person or manufacturer to the owner, operator, or other responsible person of the facility where the installation is done.

- Save this guide for future use, and make sure to provide it to anyone who services this equipment (see §2.3).
- Always reference the guide(s) that came with the equipment for a complete list of installation and safety precautions. The most current Franklin Electric documentation can be found online at www.franklinfueling.com.

2.3 Installation & Service Access

Certified Installer or Service Technician*

Only Franklin Electric certified installers and service technicians are allowed to access both the controller interface and areas internal to the controller. *See §2.7 for information on certification training.*

Site Owner or Operator*

The site owner or operator of the controller is only allowed to access the user interface. *Access to areas internal to the console is prohibited.*

If your controller is serviced by someone who is not a Franklin Electric certified installer or service technician, **your warranty will be void.*

2.4 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.

2.5 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

2.6 Cyber Security

This product is designed to be connected to and to communicate information and data via a network interface. It is solely the owner's responsibility to provide and continuously ensure a secure connection between the product and the Owner's network or any other network (as the case may be).

The Owner shall establish and maintain appropriate measures (such as but not limited to the installation of firewalls, application of authentication measures, encryption of data, installation of anti-virus programs, etc.) to protect the product, the network, its system and the interface against any kind of security breaches, unauthorized access, interference, intrusion, leakage and/or theft of data or information. ***The Owner shall also ensure that the device and/or any connecting devices have the latest firmware version available to ensure device security features are up to date.***

The manufacturer, Franklin Electric, and its affiliates are not liable for damages and/or losses related to such security breaches, unauthorized access, interference, intrusion, leakage and/or theft of data or information.

2.7 Qualifications and Responsibilities

Completion of this course is required *before certification test access will be granted for any other course (online or live):*

- Fuel System Installation Safety

2.7.1 Qualifications for Installation Certification

To be considered "qualified" to install or service this product, individuals shall pass training from the following certification training courses (online or live):

FE Online or Live Certification Training

SCAN / CLICK

Controller Specialist

- Fixed & Variable Speed Pump Controllers (60 Hz Markets)

2.7.2 Responsibilities

The following responsibilities are for guidance only and are not limited to those listed here.

It is the responsibility of:

- The owner of the install site(s) to ensure that all controller installers and service technicians shall be certified, follow all local laws, rules and regulations, along with the instructions and the specifications listed in this document.
- The certified installers and service technicians to know the controller and its safe use.
- The certified installers and service technicians to have and maintain a valid Franklin Electric training certification.

3 Pre-Installation Overview

3.1 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.

3.2 Technical Overview

3.2.1 Specifications

Dimensions

- 8.5" (216 mm) High
- 5.0" (127 mm) Wide
- 3.0" (76 mm) Deep (not including mounting tabs)

Ratings

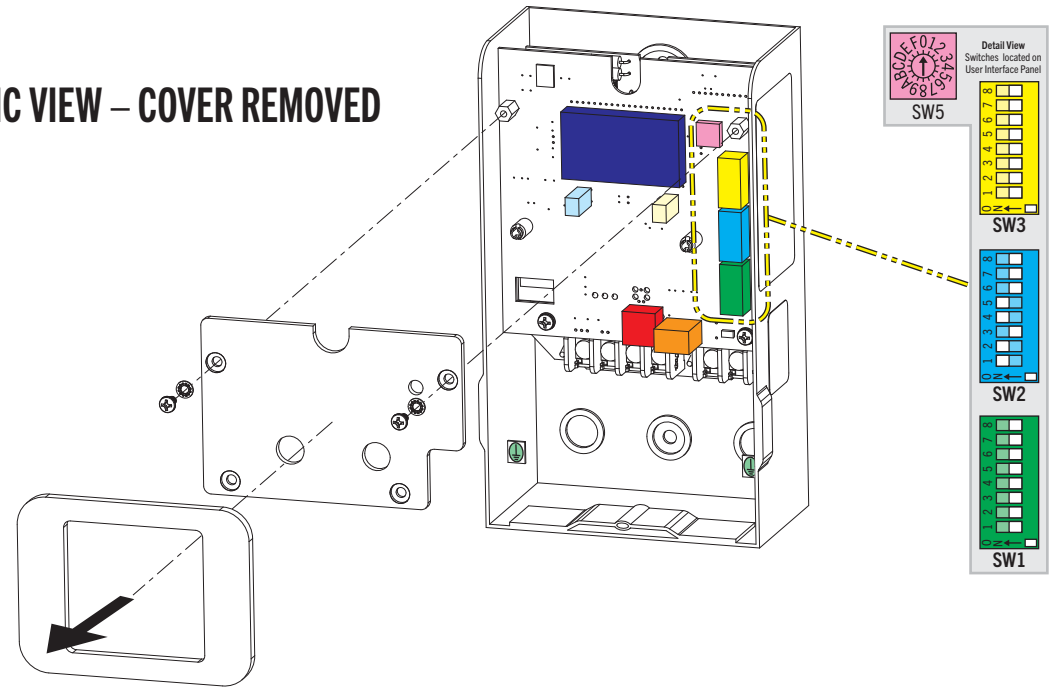
- **Supply Input**: 200–250 VAC, 1-Phase, 50/60 Hz, 14.5 A
- **Motor Contact**: 200–250 VAC, 1-Phase, 50/60 Hz, 2 hp (1.5 kW)
- **Switch hook**: 120–240 VAC, 50/60 Hz, 16 mA
- **Supply/Motor Wiring**: 10–14 AWG (2.5–6.0 mm^2), 90° C, 300 V minimum
- **Supply Hook Wiring**: 10–18 AWG (0.75–6.0 mm^2), 90° C, 300 V minimum

Environment

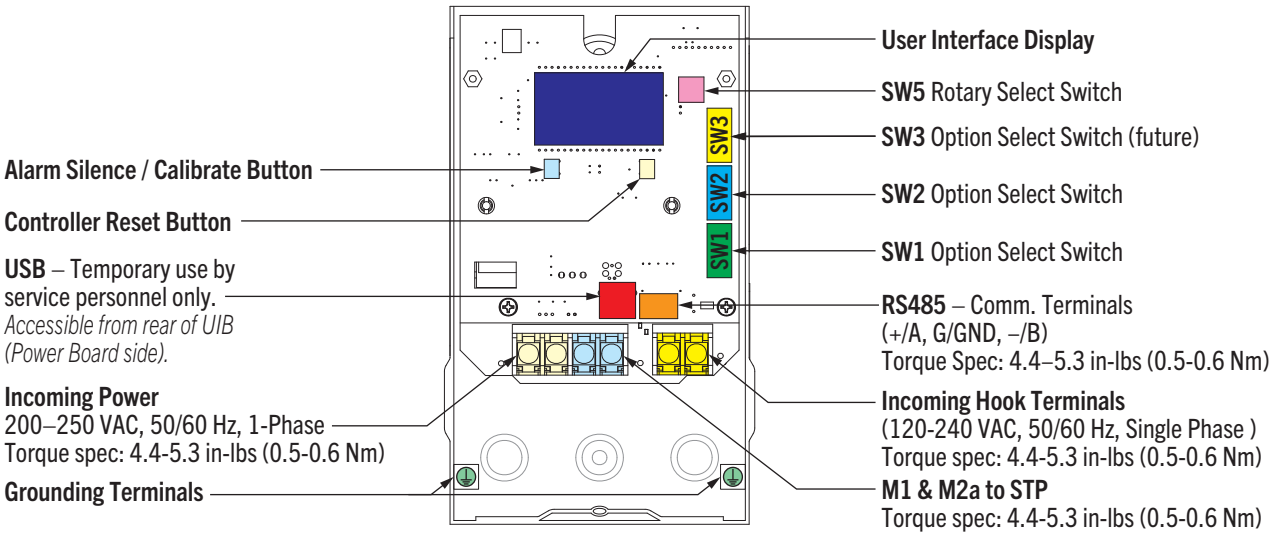
- **Location**: Non-hazardous, indoor location where explosive or flammable vapors are not present (classified as non-hazardous).
- **Altitude**: Up to 2000 m
- **Temperature**: 41° to 104° F (5° to 40° C)
- **Humidity**: 0–95%, non-condensing
- **Overvoltage**: UL 61010-1 CATEGORY III
- **Pollution**: UL 61010-1 DEGREE 2

3.2.2 Component Identification

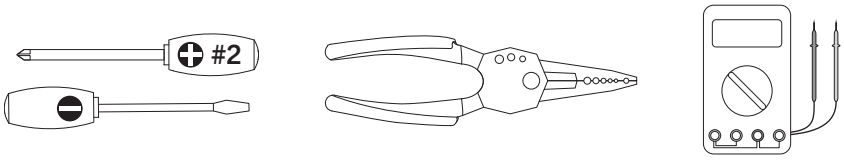
ISOMETRIC VIEW – COVER REMOVED



FRONT VIEW – COVER REMOVED



3.2.3 Required Tools



4 Installation



⚠ **WARNING**: Before installing any equipment:

- Ensure power to the electrical circuit breakers is *turned off, tagged, and locked-out at the power panel* ***before performing any installation or service work to this and any related equipment.***
  - Verify both power supplies (120–240 VAC hook and 208–240 VAC input) are disconnected before installing or servicing the equipment.
- Verify the equipment is properly grounded while in service.
- Follow all necessary safety steps as required by federal, state and local regulations in relation to working with electrical equipment.

IMPORTANT: Always use safe electrostatic discharge practices when connecting/removing power and any work associated with making electrical connections to the console and related connected components.

NOTE:

- See §6.1 for wiring diagrams fitting specific application needs.
- When the installation is complete, make sure this guide is left with the service station owner or operator (see §2.2).

4.1 Install Instructions

1. Perform a facility/worksite approved Lockout/Tagout procedure for the circuit breakers to be connected to the SPGC-220 and related systems (de-energize).
2. Install the STP according to its installation documentation.
3. Use an ohmmeter to verify that the motor leads (M1 and M2) are not shorted to ground.

   IMPORTANT: The unit can be damaged if the power is turned on when the motor leads are shorted together or to ground.
4. Install a 20 A circuit breaker, if not already installed, at the electrical power panel. This breaker should be dedicated to supplying power only to the SPGC-220 controller. Mark this circuit: *"SPGC-220 controller power ONLY"* on the circuit label at the back of the electrical power panel door.

   NOTE: Branch circuit protection and disconnection must be provided in accordance with all applicable local, state, and federal codes. Install the controller on an independent branch circuit protected by circuit breaker with no other devices on the circuit to avoid electrical noise that could cause faulty operation.

5. Select a location for the SPGC-220 that is indoors in an area *classified as non-hazardous* location where ambient temperature is controlled between 41–104° F (5–40° C).
6. Remove the cover, and install the base on a wall or other flat (vertical) surface.
    - Installation holes are located in mounting tabs on the back of the controller.
    - The controller must be installed level on a vertical surface at a height of 2–6' (0.6–1.9 m) where it is easy to view and access.
    - Choose fasteners that have sufficient load carrying capacity and are appropriate for the wall construction.

    IMPORTANT: Leave a minimum of 2" (5.1 cm) of space around the controller to allow room for installing conduit and wiring.

    ⚠ **WARNING**: To help avoid an explosion hazard that could result in environmental contamination, serious property damage, personal injury, or death, make sure you install the controller in a non-hazardous, indoor location where explosive or flammable vapors are not present (classified as non-hazardous).
7. Connect the 200–250 VAC input power to L1 and L2, and connect the ground wire to the terminals as shown in the STANDALONE wiring diagram (see §6.1.1). *Do not apply input power until you are instructed to do so.*
8. Connect the motor leads to M1 and M2, and connect the ground wire to the terminals as shown in the STANDALONE wiring diagram (see §6.1.1).
9. Connect the Dispenser Hook Signal to the terminals, 120–240 VAC Supply, and Return according to the STANDALONE wiring diagram or PRIMARY-SECONDARY wiring diagram, whichever is appropriate. The hook signal can come from a dispenser, isolation relay, or STP-DHI. For more information, refer to: p/n 223844101, STP-DHI Installation and the Owner's Manual.
10. If setting the controller to the STANDALONE configuration (Factory Default setting), make sure the SW1 and SW2 Poles 1–8 are set according to the STANDALONE wiring diagram. For PRIMARY-SECONDARY or ALTERNATING CIRCUIT configurations, please see the PRIMARY-SECONDARY/ALTERNATING CIRCUIT wiring diagram.
11. After completing all wiring connections, apply power.

    NOTE: See §6.1 for wiring diagrams fitting your application needs.

4.2 Configuration Instructions

4.2.1 Primary-Secondary / Alternating Circuit

NOTE: See §6.1 for wiring diagrams fitting your application needs.

- The PRIMARY-SECONDARY feature allows additional STPs to be turned on when there is an abnormal condition or an STP needs help due to loading (flow rate).
- The ALTERNATING CIRCUIT (AC) feature continuously alternates the lead pump, so it turns on a different STP each time all dispenser hook signals are shut off and at least one dispenser hook signal turns back on.
- The PRIMARY-SECONDARY/ALTERNATING CIRCUIT configuration combines the features of PRIMARY-SECONDARY and ALTERNATING CIRCUIT configurations.

⚠ **CAUTION**: Line leak detection performance can be affected when using multiple SPGC-220s. *It is not recommend using the ALTERNATING CIRCUIT feature in conjunction with certain electronic line leak detection systems. Some electronic line leak detector manufacturers require the Primary to always be turned on first*. Please refer to the manufacturer's requirements.

NOTE: The SPGC-220 is compatible with the STP-SCI in PRIMARY-SECONDARY or ALTERNATING CIRCUIT configurations.

1. Connect the communication cable to the RS-485 terminals (+/A, G/GND, –/B) and wire "+" together, "G" together and, "–" together, then wire the shielded cable drain wire to Ground (G) at one end only. Use at least 22 AWG three conductor shielded cable with drain wire.
2. Make sure the Dispenser Hook Signal is connected to the SPGC-220 Primary according to the PRIMARY-SECONDARY wiring diagram, the ALTERNATING CIRCUIT wiring diagram, and the PRIMARY-SECONDARY/ALTERNATING CIRCUIT wiring diagram. The hook signal can come from a dispenser, isolation relay, or STP-DHI. For more information, refer to:
   p/n 223844101, STP-DHI Installation and the Owner's Manual.

   NOTE: Make sure the incoming supply (L1, L2, and ground), and out-going wiring (M1, M2, and ground) are installed at each SPGC-220.
3. Configure PRIMARY-SECONDARY and ALTERNATING CIRCUIT features by setting SW2 Poles 3 and 4 according to Table 4.2.
4. Create a unique address for each controller by setting SW1, Poles 1–5 according to Table 4.1 .

TABLE 4.1 – SW1. (■ = ON)

Address	Pole 1	Pole 2	Pole 3	Pole 4	Pole 5
0					
1	■				
2		■			
3	■	■			
4			■		
5	■		■		
6		■	■		
7	■	■	■		
8				■	
9	■			■	
10		■		■	
11	■	■		■	
12			■	■	
13	■		■	■	
14		■	■	■	
15	■	■	■	■	
16					■
17	■				■
18		■			■
19	■	■			■
20			■		■
21	■		■		■
22		■	■		■
23	■	■	■		■
24				■	■
25	■			■	■
26		■		■	■
27	■	■		■	■
28			■	■	■
29	■		■	■	■
30		■	■	■	■
31*	■	■	■	■	■

NOTE:

- There can be only one Primary in a system but up to 31 Secondaries. *If using Turbine Pump Interface™ (TPI) with a Franklin Electric fuel management console,* ***the SPGC-220 cannot be configured to control address 31 (SW1 with Poles 1–5 ON).***
- When using TPI, *all controllers must be dip-switched as secondary units only.* The Fuel Management System (FMS) is then considered the Primary Controller.
- When configuring SPGC-220 for TPI, make sure EVO™ FMS has the latest firmware to support proper discovery and communication with the Guardian Series™ Smart Controller. If configuring SPGC-220 with TS-5 Series (blue box), program TPI communication as STP-SCI Smart Controller.

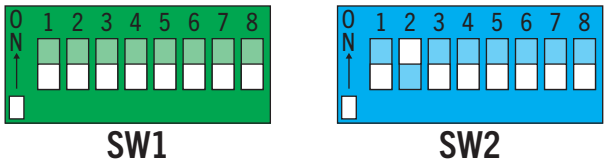
4.2.2 Factory Default Switch Settings

NOTE: See §3.2.2 for switch locations.

The STANDALONE configuration is the Factory Default setting (all selectable features off).

- Fault Readout
- Bypass
- Auto Restart
- Fault Shutdown
- Extended Run Disable

Switches located on User Interface Panel



NOTE:

- If SPGC-220 includes SW3 option select switch, leave all Poles in the OFF position (Factory Default).
- Rotary Select Switch (SW5), is to be left at position 0 (Factory Default), unless instructed by FE Tech Support to change it. If the Rotary Switch is moved from position 0, there could be calibration and operation issues with the SPGC-220.

TABLE 4.2 – Switch Definitions (P = Pole).

SW1			SW2		
P	Description	Function	P	Description	Function
1	Address Bit 1	Use poles 1– 5 to set the addressing switches for PRIMARY-SECONDARY or AC configurations. See §4.2.1, PRIMARY-SECONDARY/AC, Step 4.	1	Fault Shutdown	When this is ON, an abnormal condition detected on any controller in a PRIMARY-SECONDARY or ALTERNATING CIRCUIT configuration causes all connected controllers to shut down.
2	Address Bit 2		2	Unused	The default position is ON.
3	Address Bit 4		3	PRIMARY-SECONDARY*	ON designates the SPGC-220 as the Primary controller. This switch must be set to OFF for SECONDARY and STANDALONE configurations.
4	Address Bit 8		4	ALTERNATING CIRCUIT**	ON designates this controller as the Primary Controller in a Alternating Circuit Set. This switch must be OFF on the Secondary controller of this Set, or when Stand-Alone
5	Address Bit 16		5	Extended Run Disable***	ON disables the Extended Run feature. OFF activates the Extended Run feature.
6	Fault Readout*	ON activates fault readout. Leave in OFF (default) position for normal operation.	6	DEF Mode****	ON enables use with Diesel Exhaust Fluid (DEF) submersibles (for model "DEF-PMA150A and DEF-PMA150B" only).
7	Bypass*	ON bypasses diagnostics for 10 minutes. Leave in OFF (default) position for normal operation.	7	Unused	Unused switches. The default position is OFF
8	Auto Restart***	When ON, the controller tries to restart the STP after an underload (UL) fault condition.	8	Unused	

*See §5, Troubleshooting, for more information.

**See §4.2.1, PRIMARY-SECONDARY/ALTERNATING CIRCUIT, Step 3 for configuration switch settings.

***See §4.2.3, Selectable Features , for details.

****DEF Mode is available only with SPGC-220 firmware revision 0.3.8 or higher (the firmware revision is displayed when the controller starts up and resets).

NOTE: Auto Restart, Fault Shutdown, Primary Secondary and Alternating Circuit switches should be OFF when using TPI. *TPI functionality is handled in the programming of the EVO™ Fuel Management System.*

4.2.3 Selectable Features

4.2.3.1 Auto Restart Mode (SW1, Pole 8)

When this mode is selected, with (SW1, Pole 8) in the ON position, if the controller detects an empty tank/under load condition, it shuts down the pump and it attempts to start the pump when a hook signal is removed and reintroduced to the controller. If the empty tank condition is still present, the controller shuts down the pump. If the empty tank condition is corrected (i.e., the tank is refilled), the controller runs the STP and clears the abnormal condition. In PRIMARY-SECONDARY configuration, if the Primary is in the under load condition, it waits until the Secondary controller calls for help before attempting to restart. By default (SW1, Pole 8 OFF), the pump will remain shut down after UL fault detection until manually restarting or power cycling the controller. *DO NOT activate Auto Restart Mode when using TPI. This is handled automatically within TPI functionality.*

4.2.3.2 Fault Shutdown Mode (SW2, Pole 1)

NOTE: When using TPI, *DO NOT* set this functionality with the controller DIP switches. This can be set within the FMS programming settings.

This is only for PRIMARY-SECONDARY and ALTERNATING CIRCUIT configurations. Select this mode only on the Primary controller (SW2 Pole 1 in the ON position) to cause the Primary and all connected Secondaries to shutdown if any controllers, Primary or Secondary, detect an abnormal condition. The Primary and all connected Secondaries will not run until the abnormal condition is corrected and the controllers are manually reset or power cycled. The fault shutdown is required if using a Veeder-Root™ PLLD in a PRIMARY-SECONDARY configuration. By default (SW2 Pole 1 in the OFF position), an abnormal condition will shut down only the controller that has detected the fault.

4.2.3.3 Extended Run Disable (SW2, Pole 5)

⚠ **CAUTION**: Do not disable the Extended Run if the system requires the pump to be off for line leak detection (i.e. mechanical leak detectors or electronic line leak detection). Disabling the Extended Run fault and running the STP continuously could mask a leak in the system.

This switch, in the ON position, disables the extended run fault detection of the SPGC-220. By default (SW2, Pole 5 in the OFF position), the Extended Run fault shuts off the STP if it has been running for 60 minutes without a change in the motor load. For example, this switch might be used with an emergency generator where the STP runs for extended periods at the same product flow (motor load).

4.2.3.4 DEF Mode (SW2, Pole 6)

When this mode is selected (SW2, Pole 6 ON), the SPGC-220 with rev 0.3.8 firmware or higher will detect abnormal conditions of the FE PETRO® model DEF-PMA150A or PMA150B operating in Diesel Exhaust Fluid (DEF) ONLY. By default, the SPGC-220 is intended for use with 1-Phase STPs operating in motor fuels, FE PETRO® and like competitive petroleum pump motor models only.

4.2.4 Calibration

NOTE:

- During calibration, the display will alternate “CAL” and the kilowatts reading of the attached pump motor.
- The SPGC-220 calibrates only when the STP has no abnormalities and a dispenser handle is turned on within 10 minutes of calibration starting.
- If a blending dispenser system is present, select the mid-grade handle at the dispenser to calibrate all blended product SPGC-220s simultaneously.
- If the controller loses power, it retains the calibration data.
- DEF Submersibles follow the same installation procedure as normal SPGC-220s but must be set to DEF mode (SW2 Pole 6 set to ON) before calibration.

IMPORTANT:

- All SPGC-220s must be calibrated before you operate them.
- Make sure there is no flow during calibration, otherwise the controller will incorrectly detect abnormal conditions.
- If using Electronic Line Leak Detection (ELLD), make sure the SPGC-220 is in Calibration Mode before turning on the dispenser handle. If the controller is not in Calibration Mode, the line leak detector senses a fault and does not provide a dispenser hook signal to the SPGC-220. This prevents the SPGC-220 from calibrating until the line leak detector is reset.
- Prior to calibration, verify the fuel level in the tank is above the motor intake.
- Prior to calibration, verify SW2 Pole 6 is switched to ON for DEF Mode, if applicable (Factory Default is SW2 Pole 6 OFF for petroleum pump motor assemblies).

Calibration Steps

1. Close either the STP clamp valve or a ball valve at the STP discharge, attach the cover of the controller to the base, and then turn on the power supply to the SPGC-220. *The display will flash “UnC” while an audible alarm beeps to indicate that the SPGC-220 is not calibrated.*
2. Press and hold the **Silence/Calibrate** button (for approximately 10 seconds) until the display alternates between “CAL” and the kilowatts reading of the attached pump motor (which should be 0.00 kilowatts until the PMA is running).
3. Release the **Silence/Calibrate** button to begin the calibration.

   NOTE: When working with PRIMARY-SECONDARY and ALTERNATING CIRCUIT configurations, put the Primary and all Secondaries into Calibration Mode before proceeding to the following step.
4. Lift a handle on a dispenser to turn the pump on. After approximately 16 seconds, the controller records the voltage, current, and power snapshot. When the snapshot is successfully recorded, the display alternates between “run” and the percent calibration reading (which should be close to 100 +/- 5 at deadhead with no flow). This indicates the calibration is complete. Turn off the dispenser handle, and open the STP clamp valve or ball valve. If the controller does not calibrate, the controller beeps and the display flashes red with a fault code that indicates the abnormal condition encountered during calibration. See § 5 “Troubleshooting”, to identify and correct this condition.

5 Display Definitions & Troubleshooting

NOTE: Reference §3.2.2 for Alarm Silence and Controller Reset button locations.

The SPGC-220 has a microprocessor that allows the unit to diagnose abnormal conditions and communicate them through an audible alarm and LEDs on the front panel. The following describes these indications:

- When the display is lit, the 200–250 VAC incoming power supply is applied to the SPGC-220.
- If the display alternates between "run" and a number (Percent of Calibration), the attached pump motor assembly (PMA) is running.
- If the display is "IdLE," even when a dispenser is activated, check the dispenser hook signal terminals on the SPGC-220. If 120–240 VAC is across the hook terminal, and the switch settings are correct, contact FE Technical Support for assistance.

  ⚠ **CAUTION**: If the display flashes "run," even when all the dispensers are turned off, there may still be power present at the SPGC-220 hook terminal. If this is the case, contact FE Technical Support for assistance.
- If the display flashes red, and the audible alarm is beeping, there is an abnormal condition. Note the flashing code on the display, and refer to the appropriate troubleshooting topic.

Display Conditions

Code	Definition
IdLE	POWER ON (PUMP OFF)
UL	UNDERLOAD (DRY RUN)
Lr	LOCKED ROTOR (AT STARTUP)
OL	OVERLOAD (WHILE RUNNING)
LI	LOW INCOMING (UNDER VOLTAGE)
HI	HIGH INCOMING (OVER VOLTAGE)
run	PUMP RUNNING
OC	OPEN CIRCUIT
unc	UNCALIBRATED
CAL	CALIBRATING
Er	EXTENDED RUN
rEL	RELAY FAULT

NOTE: See §5.3 for further information detailing display conditions, alarm codes, and related troubleshooting flowcharts.

5.1 Disabling The Audible Alarm

Press the **Silence/Calibrate** button briefly to silence the audible alarm without resetting the controller.

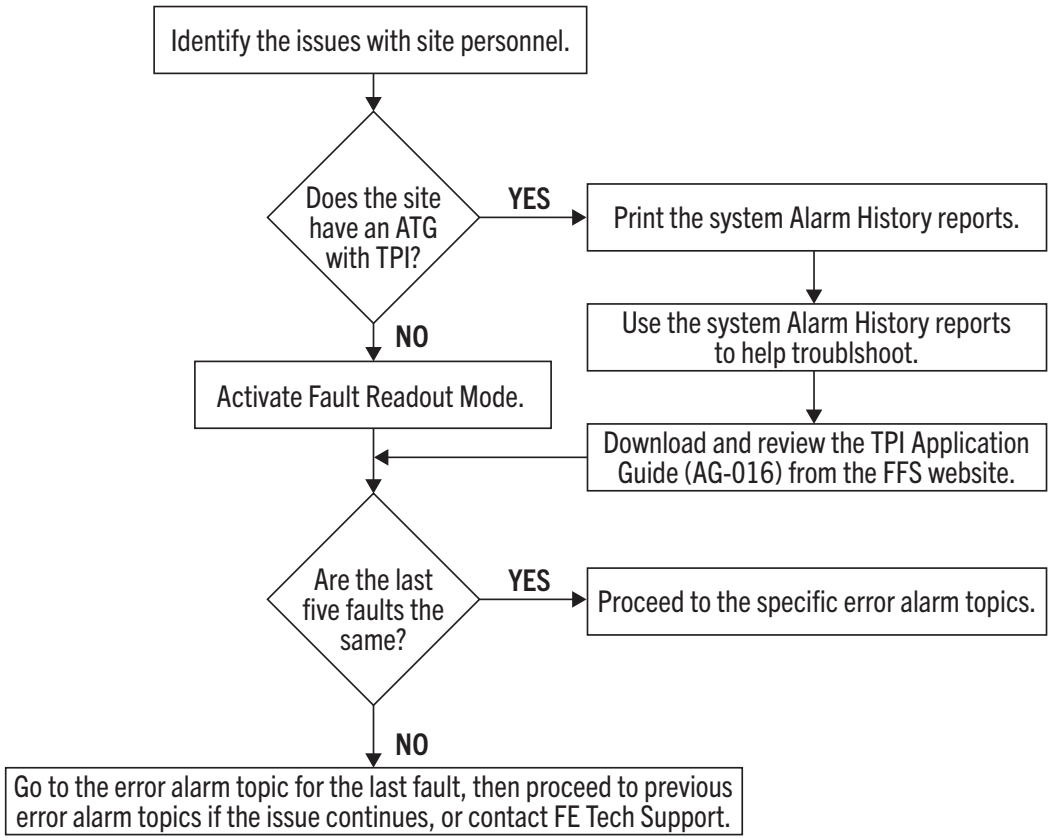
5.2 Resetting The Controller

Before correcting an abnormal condition (the display is flashing red and the alarm is beeping), do the following:

1. Note the flashing code shown on the display.
2. Reset the controller by pressing the **Reset** button for approximately three seconds.
3. Release the **Reset** button when the display goes blank.
4. Check for proper operation.
    a. **If the controller operates correctly**: The abnormal condition is resolved and normal operation is restored.
    b. **If the abnormal condition continues**: Correct the condition according to §5.4 and §5.3, reset the controller, then check for proper operation. *If the abnormal condition continues, contact FE Technical Support for assistance.*

5.3 Troubleshooting Warnings & Error Alarms

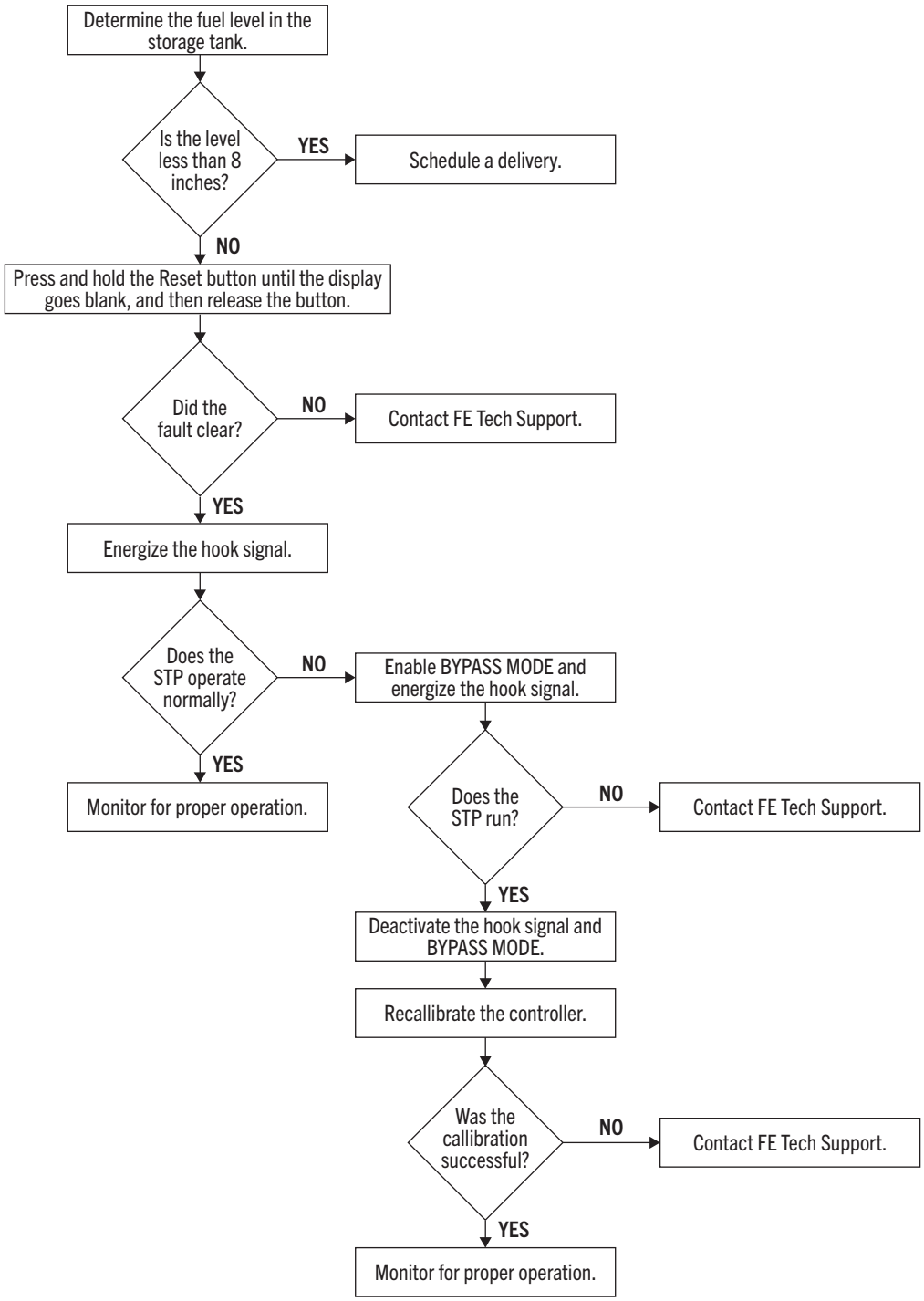
NOTE: Some ATGs include a Turbine Pump Interface™ (TPI) that can provide additional troubleshooting information. See TPI Application Guide, p/n **AG-016**, for more information.



5.3.1 Underload Error Alarm – UL

- Error code flashes: UL

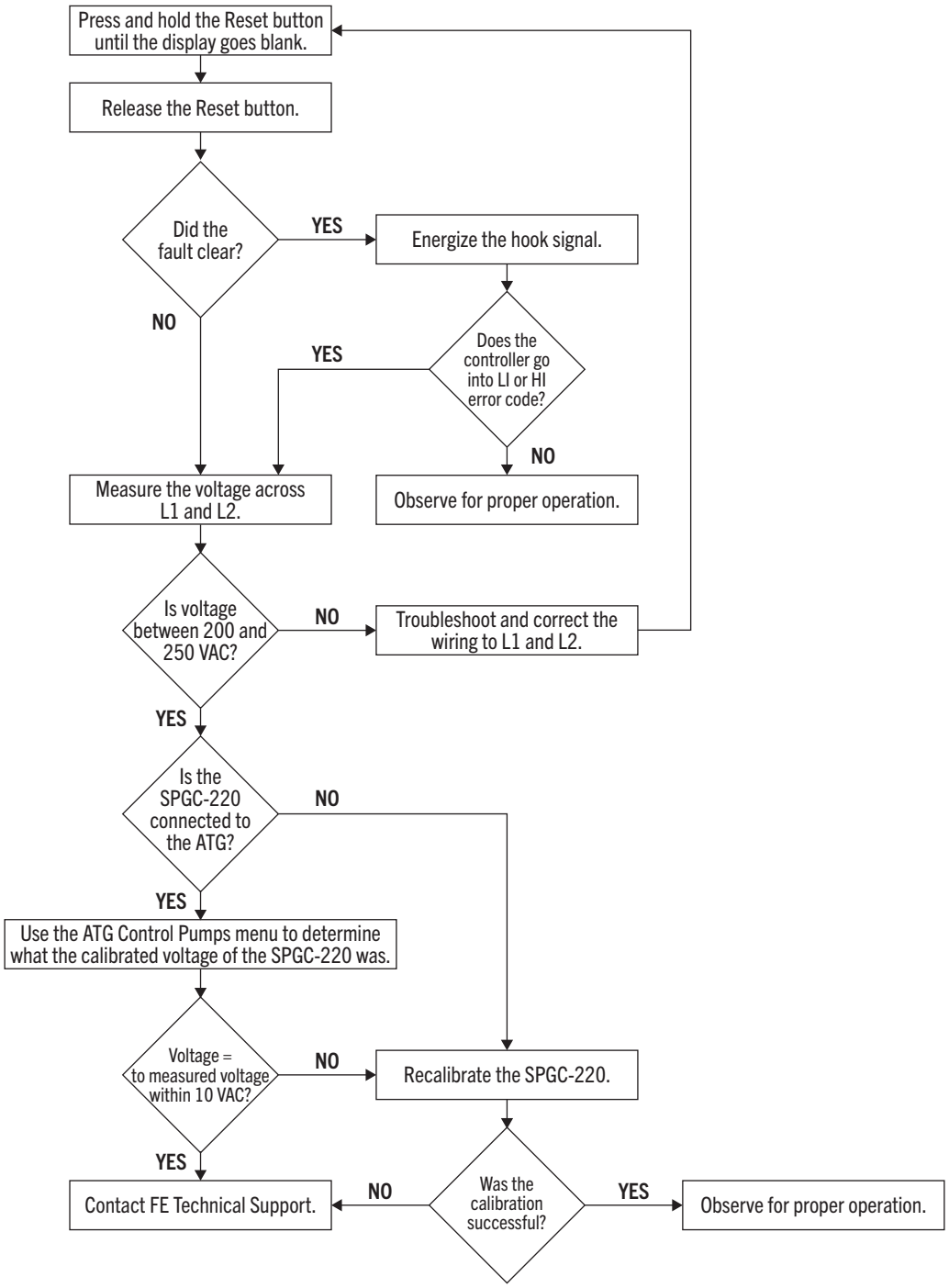
The UNDERLOAD ERROR alarm indicates that the SPGC-220 has detected that the motor power consumption (in watts) is below the acceptable range compared to the stored calibration value. This alarm is typically caused by dry running (due to a clogged intake) or improper calibration.



5.3.2 Incoming Voltage Alarm – LI or HI

- Error code flashes: LI or HI

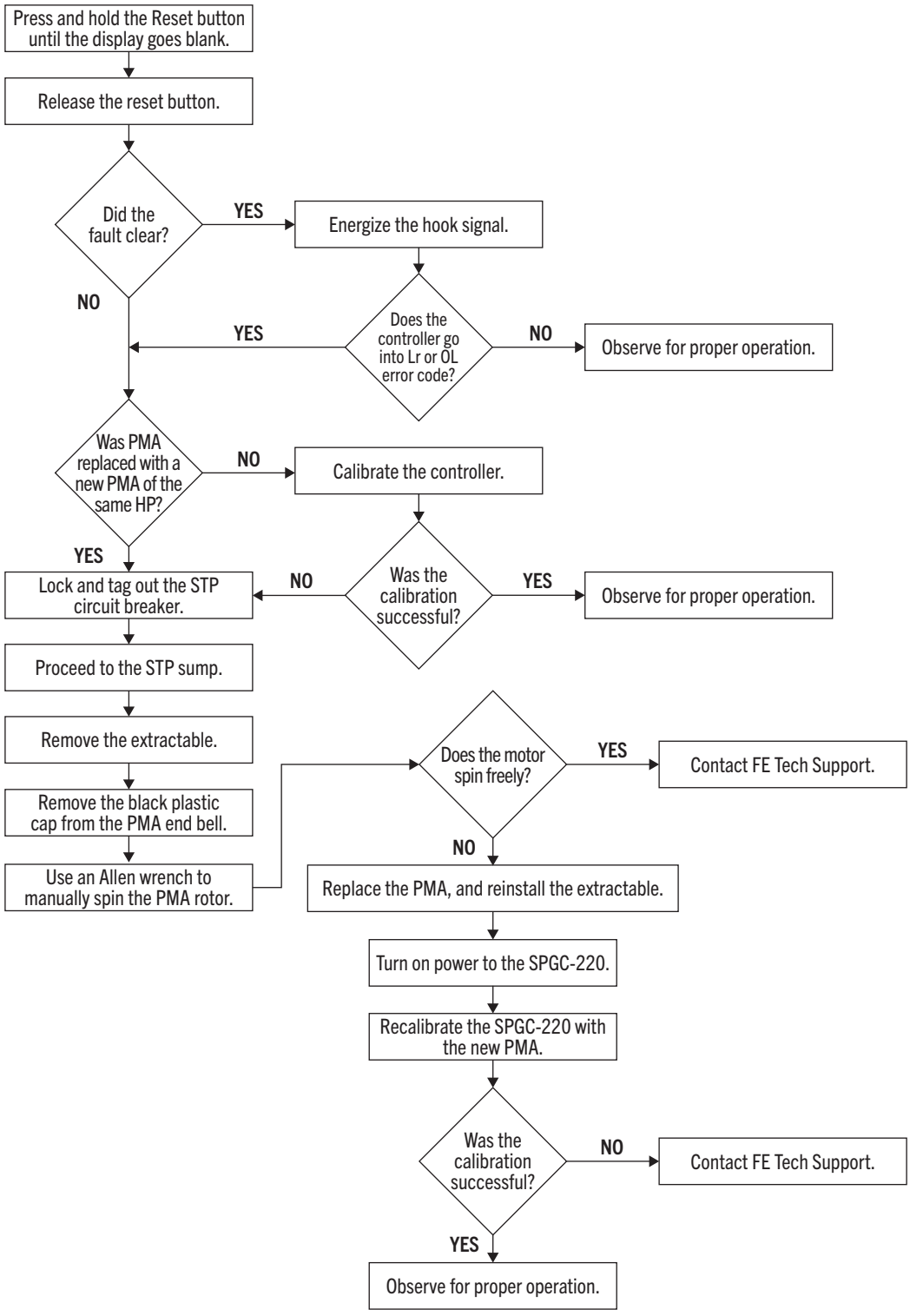
The LOW INCOMING (under-voltage) and HIGH INCOMING (over-voltage) alarms activate when the incoming voltage to the SPGC-220 (L1, and L2) is outside the acceptable range (LI activates below 185 V, HI activates above 260 V). The SPGC-220 automatically resets this alarm when the incoming voltage returns to the acceptable range (LI resets above 200 V, HI resets below 245 V).



5.3.3 Overload Alarm – Lr or OL

- Error code flashes: Lr or OL

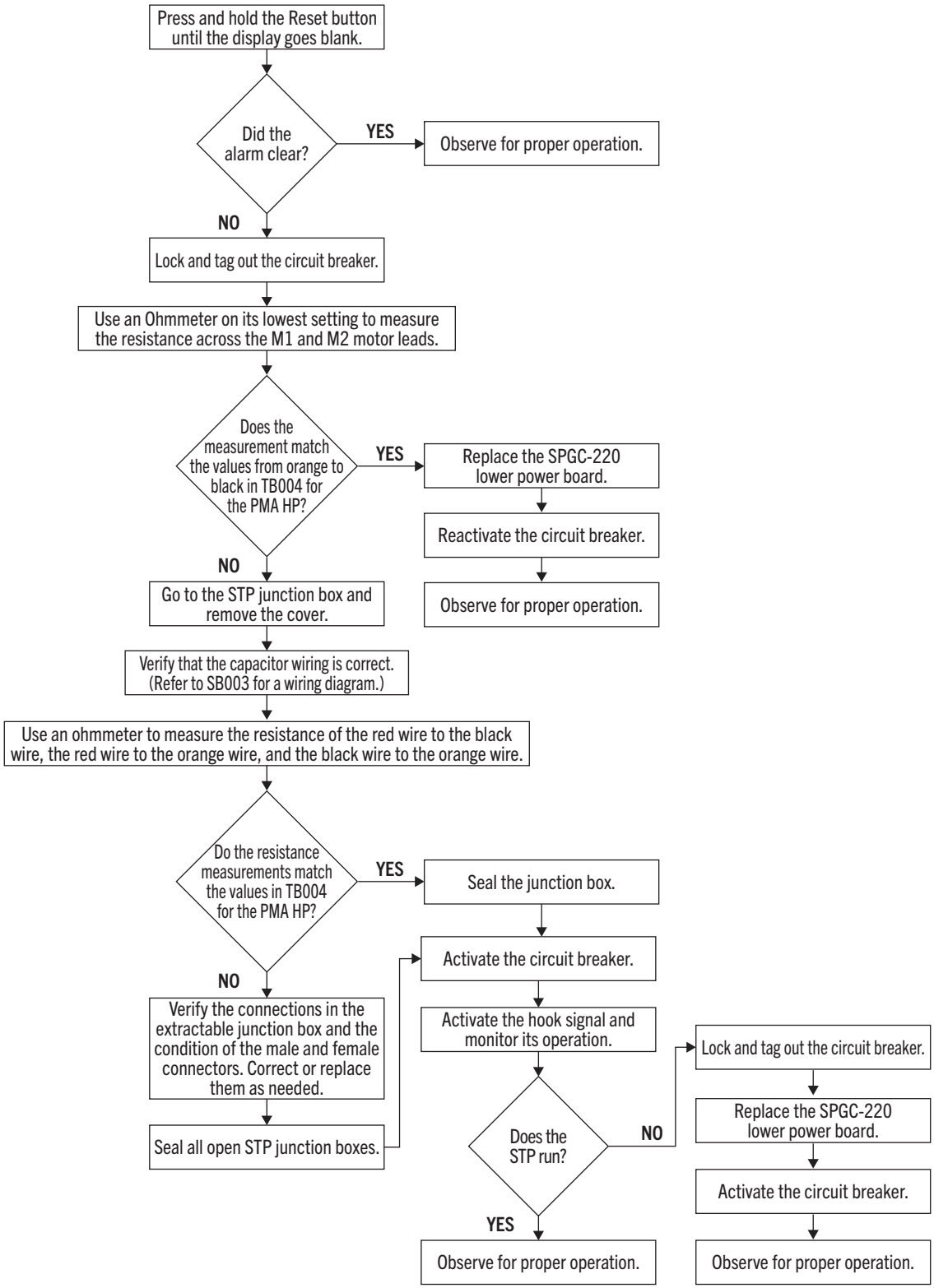
The OVERLOAD (while running) and LOCKED ROTOR (at startup) alarms indicate that the SPGC-220 has detected that the motor power consumption (in watts) is above the acceptable range compared to the calibration value. The OVERLOAD and LOCKED ROTOR alarms are usually caused by a locked PMA rotor (due to debris or damage) or improper calibration.



5.3.4 Open Circuit Alarm – OC

- Error code flashes: OC

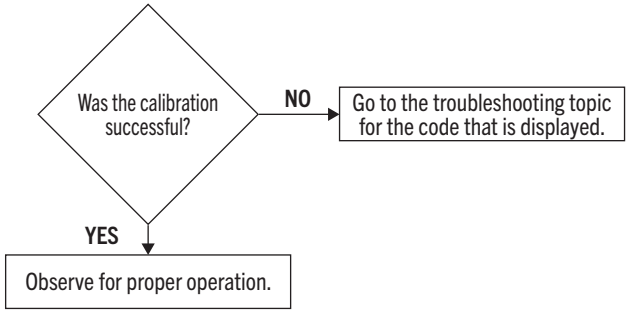
The OPEN CIRCUIT alarm activates when there is a hook signal and the SPGC-220 does not detect power consumption by the PMA (hook signal present without motor load). This alarm is typically caused by a broken output connection (wiring and/or relay) or a PMA thermal overload due to a locked rotor event.



5.3.5 Uncalibrated Alarm – unc

- Error code flashes: unc

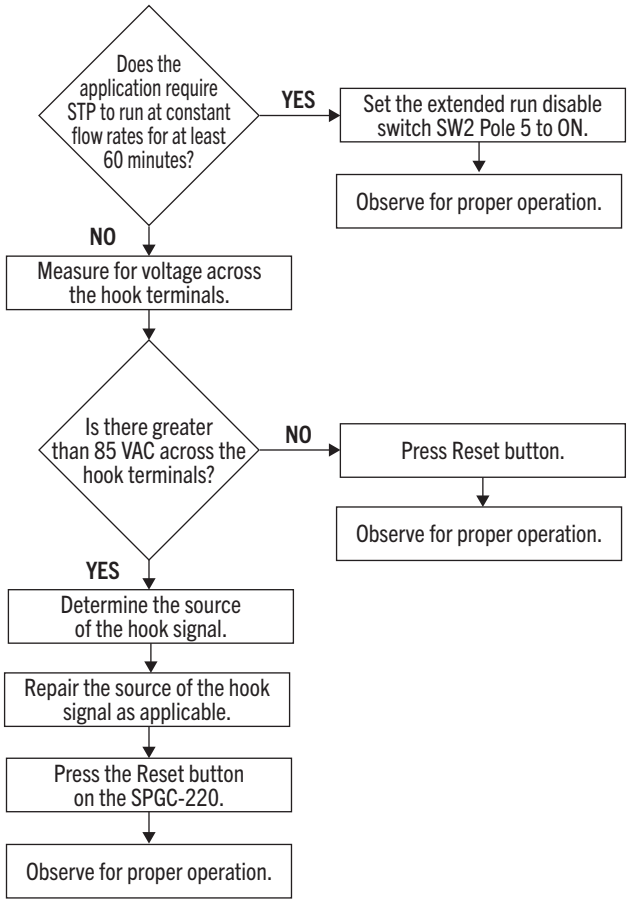
SPGC-220s must be calibrated before they can be used. See §4.2.4 of this document for the calibration procedure.



5.3.6 Extended Run Alarm – Code Er

- Error code flashes: Er

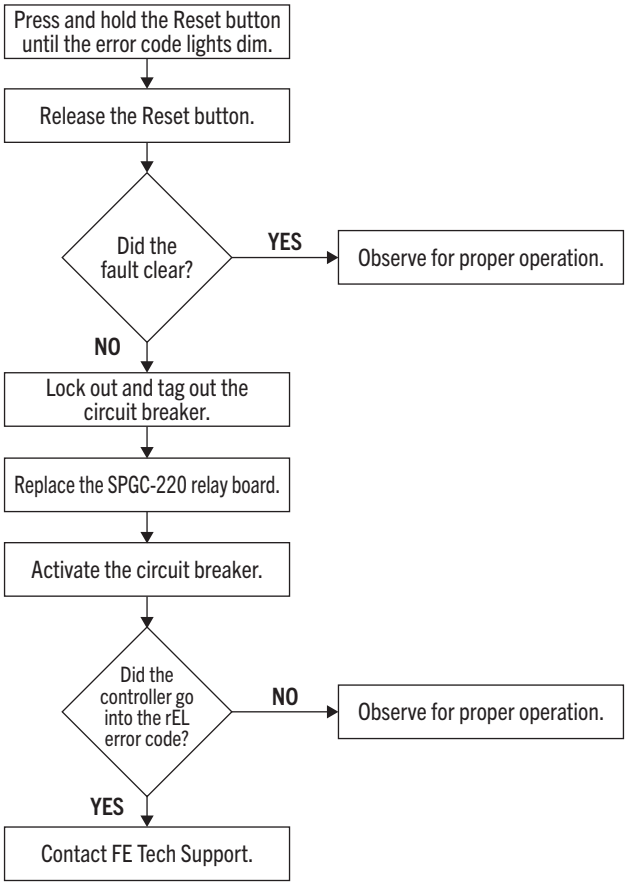
The EXTENDED RUN alarm indicates that the SPGC-220 has run for 60 consecutive minutes with no change in power consumption.



5.3.7 Relay Fault Alarm – rEL

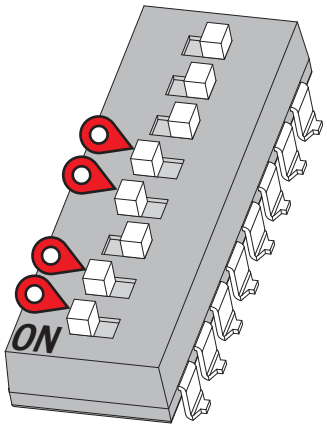
- Error code flashes: rEL

The RELAY FAULT alarm indicates the SPGC-220 is running the PMA without a proper hook signal. This alarm is typically caused by a Smart Controller relay contact failure.



5.4 Selectable Features To Aid Troubleshooting

5.4.1 Fault Read Out Mode (SW1, Pole 6)



To enable this mode,

1. Turn off power to the SPGC-220.
2. Remove the console cover.
3. Turn ON SW1 pole 6.
4. Reinstall the cover.
5. Turn on power to the SPGC-220 (to see the fault readout).

In Fault Read Out Mode, the controller displays the last five abnormal conditions, starting with the most recent one. First, the controller shows “F1” on the display and then shows the most recent abnormal condition. Next, it shows “F2” on the display and then shows the abnormal condition that preceded the most recent abnormal condition. The controller follows this sequence through “F5”, which is the oldest abnormal condition that is reported, and then repeats the sequence, starting with “F1”, as long as it is in Fault Read Out Mode. If there are less than five abnormal conditions, the controller still flashes “Fn” (where n=1 through 5) and then a blank display.

5.4.2 Bypass Mode (SW1, Pole 7)

When this mode is selected, with the switch in the ON position, the controller operates as a standard relay control box. It will not indicate or shutdown due to an abnormal condition, with the exception of an over current condition. The Bypass Mode is active for a maximum 10 minutes, after which, the controller reverts to its normal operation. Push the **Reset Button** to allow the controller to run in Bypass Mode for another 10 minutes (the display alternates between “bP” and a countdown of the bypass time remaining in seconds).

6 Appendix

6.1 Wiring Diagrams

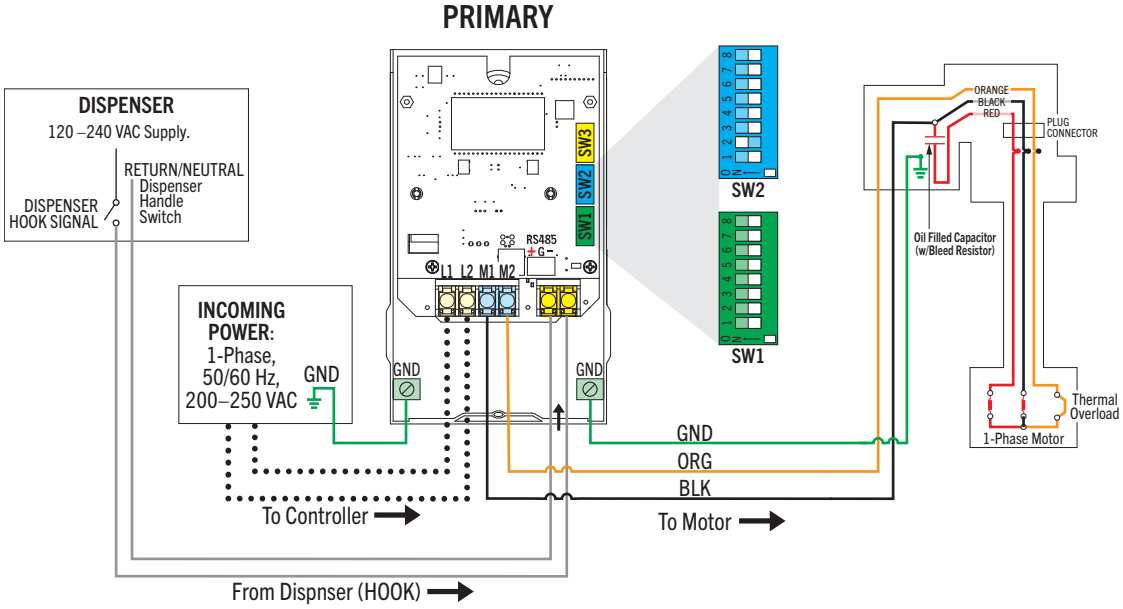
- The lockout switch is not a substitute for properly locking out and tagging out the electrical circuit when servicing this equipment.
- Wiring must conform to all applicable federal, state, and local codes.
- SPGC-220 controllers are for non-hazardous, indoor use only.
  See §4.1, Step 4.
- Route RS-485 wiring (where applicable) a minimum of ¼" (6 mm) away from power wiring.
- See Configuration Instructions (§4.2) for more information on:
  - Switch Settings (§4.2.2).
  - Selectable Features (§4.2.3).
  - Calibration (§4.2.4).

6.1.1 Standalone

IMPORTANT: Reference §6.1 for additional wiring information.

NOTE:

- Factory Default switch settings are shown.
- See TPI Application Guide, p/n AG-016, for more information.

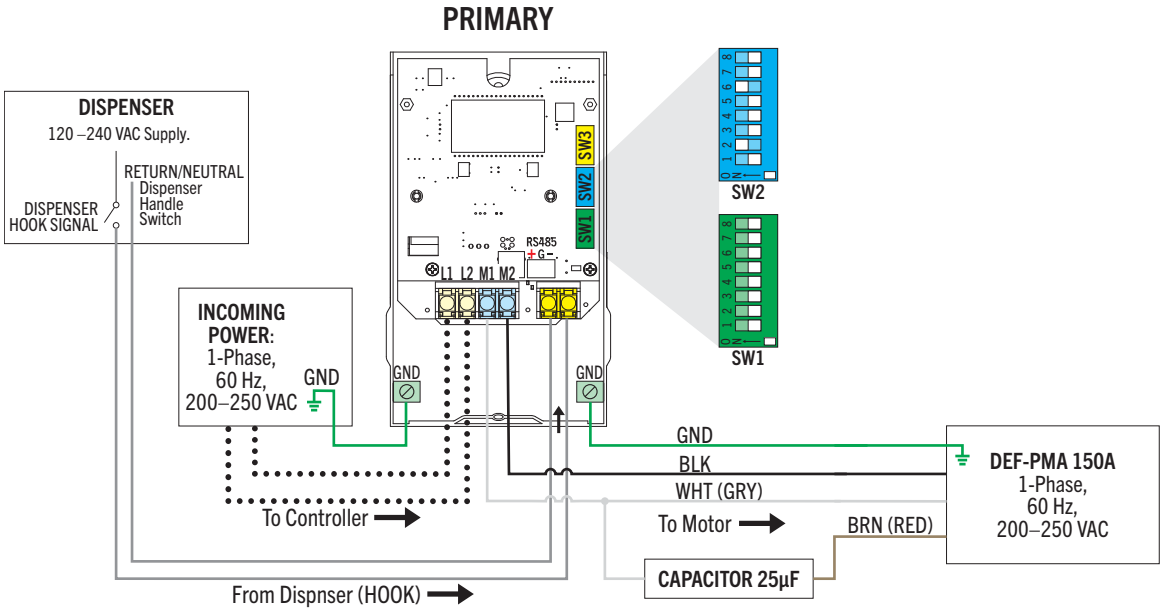


6.1.2 DEF-PMA 150A 1-Phase 60 Hz

IMPORTANT: Reference §6.1 for additional wiring information.

NOTE:

- Set SW2, Pole 6 to ON for DEF Mode (see §4.2.3.4).
- The 1-Phase DEF PMA capacitor may be installed near the motor control panel, or in the tank sump. *Make sure it is in a suitable enclosure to meet applicable codes.*

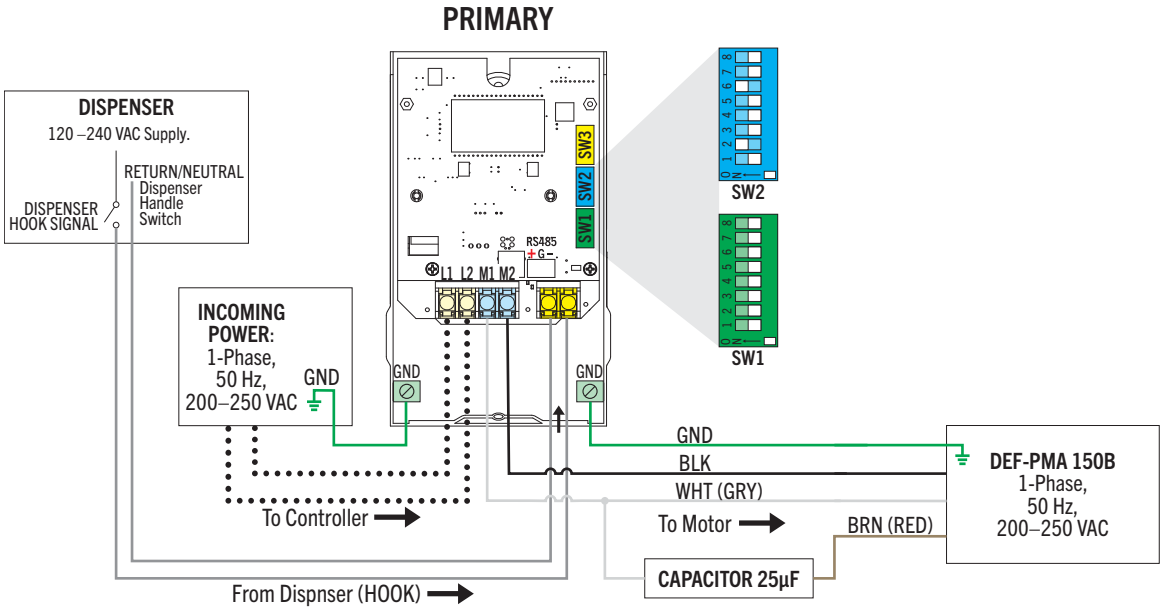


6.1.3 DEF-PMA 150B 1-Phase 50 Hz

IMPORTANT: Reference §6.1 for additional wiring information.

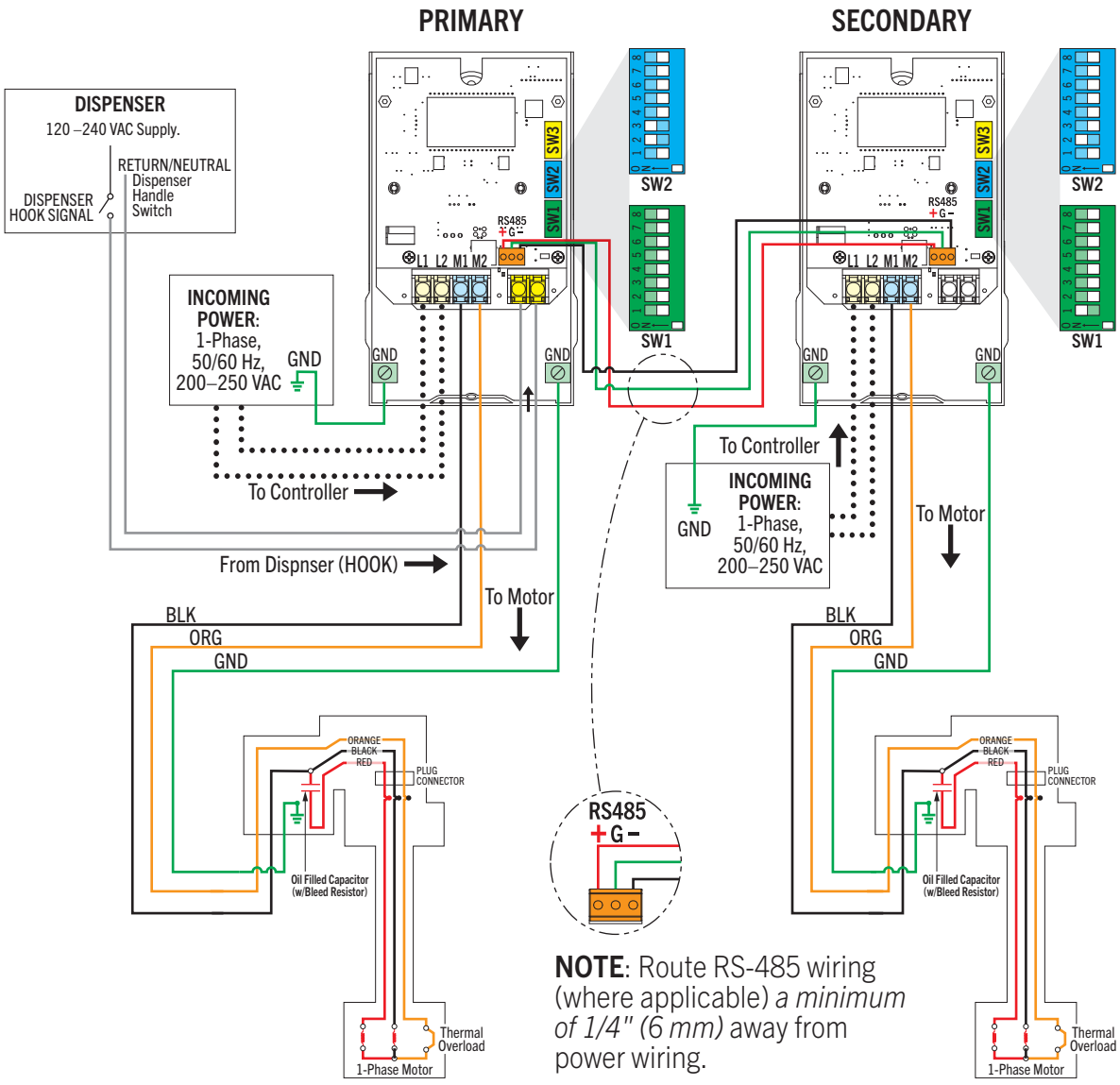
NOTE:

- Set SW2, Pole 6 to ON for DEF Mode (see §4.2.3.4).
- The 1-Phase DEF PMA capacitor may be installed near the motor control panel, or in the tank sump. *Make sure it is in a suitable enclosure to meet applicable codes.*



6.1.4 Primary-Secondary

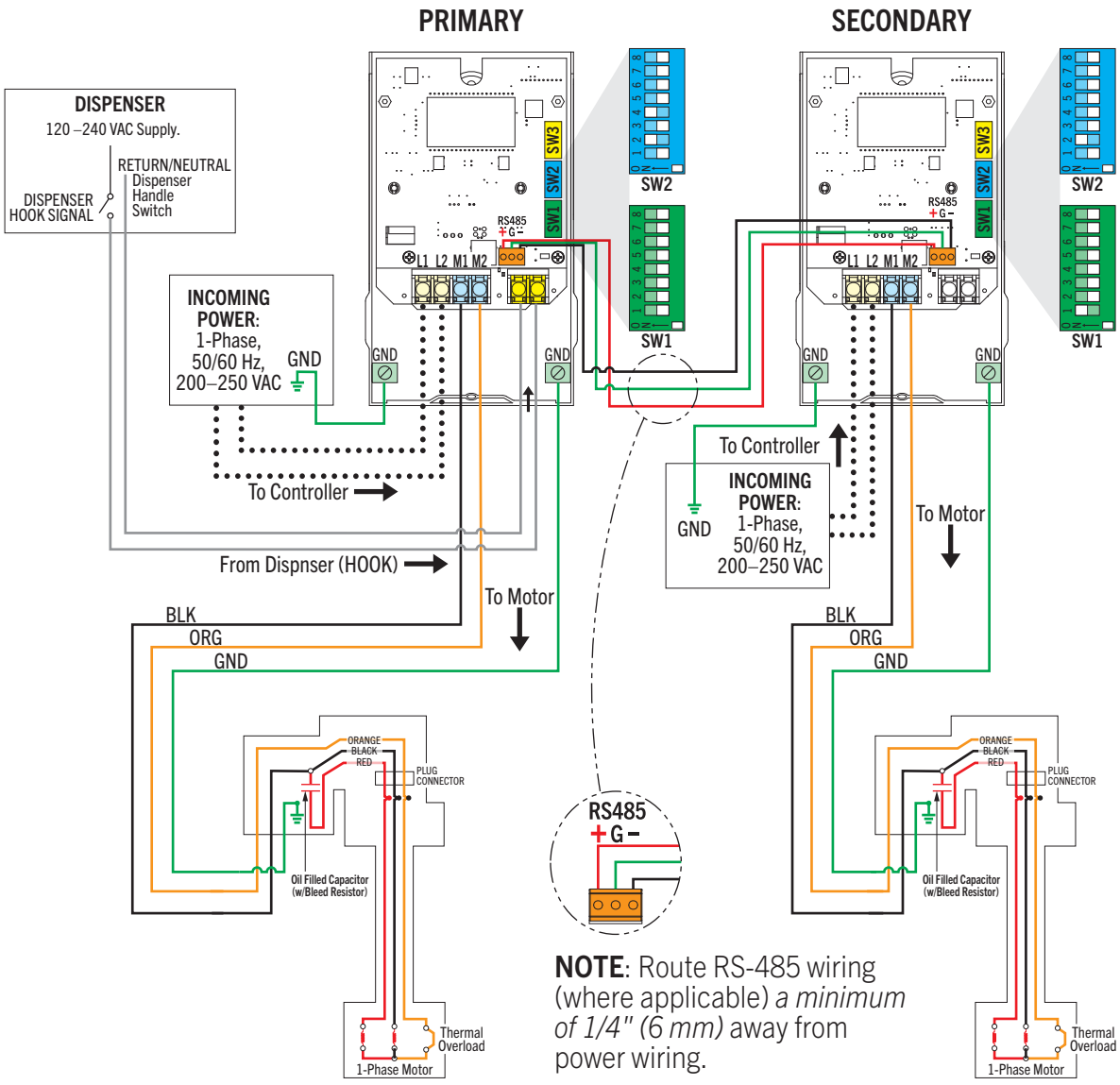
IMPORTANT: Reference §6.1 for additional wiring information.



NOTE: Route RS-485 wiring (where applicable) *a minimum of 1/4" (6 mm)* away from power wiring.

6.1.5 Alternating Circuit

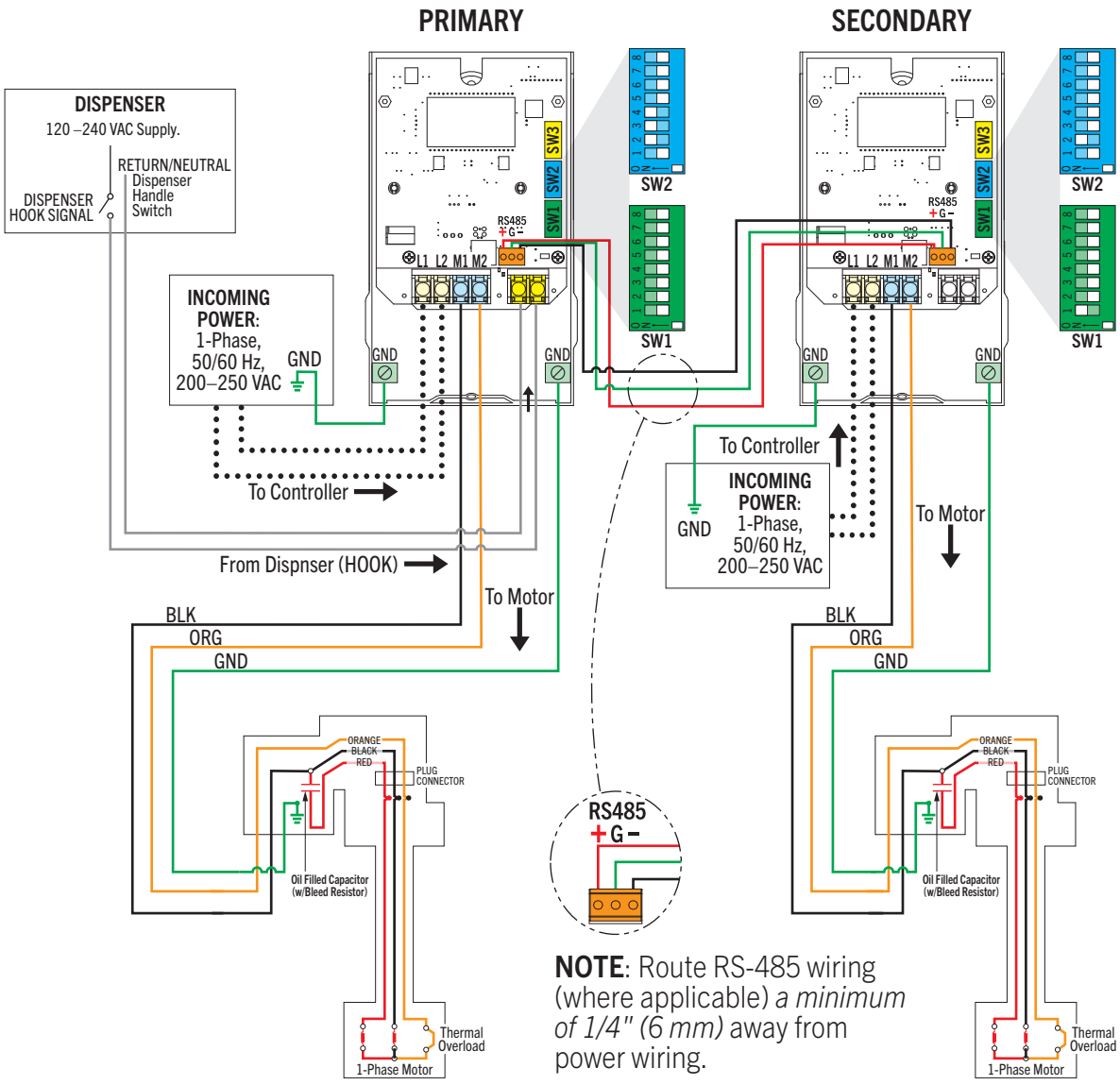
IMPORTANT: Reference §6.1 for additional wiring information.



NOTE: Route RS-485 wiring (where applicable) *a minimum of 1/4" (6 mm)* away from power wiring.

6.1.6 Primary-Secondary / Alternating Circuit

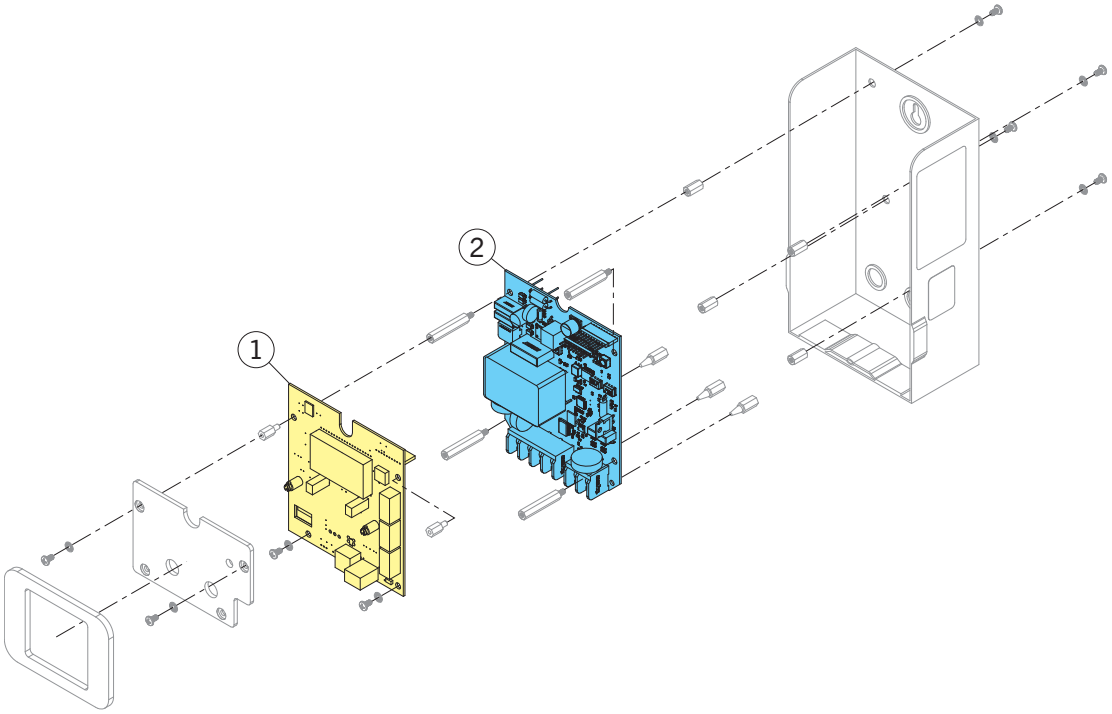
IMPORTANT: Reference §6.1 for additional wiring information.



NOTE: Route RS-485 wiring (where applicable) *a minimum of 1/4" (6 mm)* away from power wiring.

6.2 Replacement Parts

Replacement parts can be found at www.franklinfueling.com.



Item	Part Number	Description
1	225000932	SPGC-220 ***upper*** *(user input)* replacement board
2	225005932	SPGC-220 ***lower*** *(power, relay)* replacement board

6.3 Related Documents

Documentation can be found at www.franklinfueling.com.

Part Number	Description
223844101	STP-DHI Installation and Owner's Manual
AG-016	TPI Application Guide

6.4 Glossary

DEF ..... Diesel Exhaust Fluid

ELLD..... Electronic Line Leak Detection

FMS..... Fuel Management System

IS..... Intrinsically Safe

LCD ..... Liquid Crystal Display

MLD ..... Mechanical Leak Detection

NC..... Normally Closed

NO..... Normally Open

PC ..... Personal Computer

PMA ..... Pump Motor Assembly

RS-485..... An IEEE standard for serial communications using shielded or unshielded twisted pair cables.

STP ..... Submersible Turbine Pump

TPI..... Turbine Pump Interface™

UIB..... User Interface Board

USB..... Universal Serial Bus

6.5 Notes



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