The Leader in Submersible Technology

SMART CONTROLLER™ **STP-SC**

STP-SC 120 volt coil
STP-SCB 240 volt coil

Installation and Owner's Manual

Software Revisions 2.4, 2.5, 2.6 , and 2.7

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IMPORTANT SAFETY MESSAGES

FE Petro equipment is designed to be used to pump volatile hydrocarbon liquids such as gasoline and diesel fuel. Installing or working on this equipment means working in an environment in which these highly flammable liquids are present. **This presents a risk of severe injury or death if these instructions and standard industry practices are not followed. Read and follow this entire instruction booklet before installing or working on this equipment.**

⚠ WARNING

This symbol identifies a potentially hazardous situation which, if the instructions that follow it are not adhered to, could result in death or serious bodily injury.

⚠ CAUTION

This symbol identifies a potentially hazardous situation which, if the instructions that follow it are not adhered to, could result in serious property damage, including possible environmental contamination as a result of the leakage of fuel from the equipment.

NOTE

This symbol identifies particular instructions, which if not followed, could cause serious damage to the equipment or lead to equipment failure.

⚠ WARNING

Follow all federal, state, and local laws governing the installation of this product and the entire system. When no other regulations apply, follow NFPA 30, 30A, and 70 from the National Fire Protection Association. Failure to do so could result in severe injury, death, serious property damage and/or environmental contamination.

⚠ WARNING

Always disconnect both power supplies (110V or 220V Hook and the 200-240V input) before installing or servicing. Failure to do so could result in severe injury or death.

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.

INSTALLATION INSTRUCTIONS

1. Install STP per STP/IST Fixed and Variable Length Installation and Owner's Manual.
2. Remove cover of STP-SC and mount base to wall or other surface.

NOTE

The STP-SC shall be mounted indoors and can operate at temperature ranges of 50°-120° F (10°-49° C).

3. Connect input power of 200-240 VAC to L1 and L2 and Ground wire to terminals per Figure 2.
4. Connect dispenser hook signal to terminals, 120V supply and neutral for STP-SC or 240V supply and return for STP-SCB per Figure 2.
5. Using an ohmmeter, verify the motor leads (M1 and M2) are not shorted together or to ground.

⚠ WARNING

Damage to the STP-SC will occur if motor leads are shorted together or to ground.

6. Connect motor leads to M1 and M2 and Ground wires to terminals per Figure 2.

7. For Stand Alone controller configuration, set (SW1) poles 1-8 per Figure 1(Factory Set). For Master-Slave and/or Alternating Circuit configurations, go to **"Master-Slave/Alternating Circuit"** section.
8. Re-connect pigtail from cover to connector on left side of base and attach cover of controller to base. Then go to **"Calibration"** section to complete installation.

CALIBRATION

1. Turn on power supply to the STP-SC. The green light indicator will come on steady and the red light indicator will flash eight times indicating the STP-SC is Uncalibrated.(Note: If the STP-SC is so equipped, an audible alarm of eight beeps will also be present).
2. Press and hold the push-button on the front of the box until all three light indicators blink alternately. This will take approximately 10 seconds. At this point the push-button should be released.
3. The handle on the dispenser should then be lifted to turn the pump on. After approximately 16 seconds the controller will take a "snapshot" of the voltage, current and power. The three lights will quit alternating and only the green light will remain flashing. This will indicate the calibration has been completed and the dispenser handle can then be turned off. If the controller(s) will not calibrate, see the **"Troubleshooting Guide"** section.

NOTE

The STP-SC will only calibrate if there are no STP abnormalities (faulty wiring, etc.) and a dispenser handle is lifted within 10 minutes after calibration is initiated. Calibration must be done at zero flow; therefore, it is recommended to close the STP clamp valve or ball valve at the discharge of the STP prior to calibrating.

NOTE

If an electronic line leak detector is being used, it is important that the STP-SC be in the calibration mode (all three lights flashing alternately) before the dispenser handle is turned on. Otherwise, the STP-SC will not turn on and the line leak detector will likely detect a fault. If the line leak detector shows a fault, it will not provide a dispenser hook signal to the STP-SC and it will not be possible to calibrate the STP-SC until the line leak detector is reset.

NOTE

All STP-SC's must all be calibrated prior to operation.

NOTE

All three indicator lights will flash alternately in calibration mode.

NOTE

When calibrating systems with blending dispensers, all blended product STP-SC's must be calibrated simultaneously by selecting the mid-grade handle at the dispenser.

NOTE

The calibration data is retained in non-volatile memory (i.e. it is saved in the event of power loss to the controller).

MASTER-SLAVE/ALTERNATING CIRCUIT

The Master-Slave feature allows the master to turn on additional STP's when the first STP operating needs help due to loading (flow rate) or an abnormal condition exists. The Alternating Circuit (AC) feature continuously alternates the lead pump, thus turning on a different STP each time all dispensers are shut off and at least one dispenser is turned back on. The Master-Slave/AC configuration combines the features of the Master-Slave and AC functions.

NOTE

Master-Slave will not work with PMA33, PMA75B, or PMAH150B.

1. Connect RS 485 (+, G, and –) to terminals with the drain wire of shielded cable to Ground (G) at one end only, per Figure 2.

NOTE

RS 485 Connection is only required if Master-Slave or Alternating Circuit operation is desired. Use three conductor shielded cable with drain wire (22 AWG minimum).

2. Connect dispenser hook signal between STP-SC's per Figure 2.

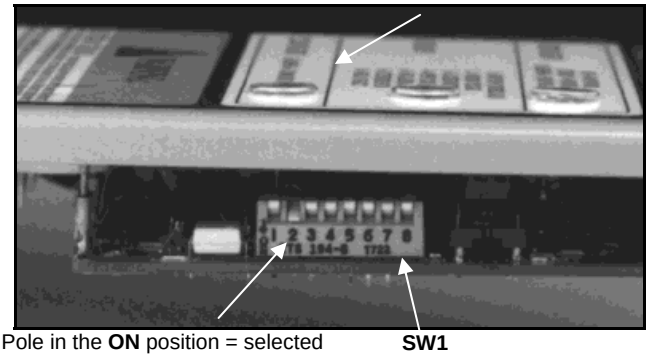
NOTE

Be sure L1, L2, M1, M2 and Grounds are installed at each STP-SC.

3. Set Master-Slave and Alternating Circuit features on (SW1) poles 3 and 4 per Figure 1.
4. Set (SW1) poles 5-8 per Table 1. The address must be set for each STP-SC.
5. Attach cover of controller to base. Then go to **"Calibration"** section to complete installation. It is recommended to calibrate all manifolded Master and Slave controllers at the same time.

NOTE

There can only be one Master in a system and up to 15 slaves.



Pole	Pole Description	*Stand Alone	**Master-Slave Only (1-15) Master	**Master-Slave Only (1-15) Slave	**Master-Slave/AC (1-15) Master	**Master-Slave/AC (1-15) Slave	**AC Only (1-15) Master	**AC Only (1-15) Slave
1	Not Used	NA	NA	NA	NA	NA	NA	NA
2	Stand Alone	On	Off	Off	Off	Off	Off	Off
3	Master Slave	Off	On	Off	On	Off	Off	Off
4	AC	Off	Off	Off	On	Off	On	Off
5-8	Address	NA	See Table 1		See Table 1		See Table 1	

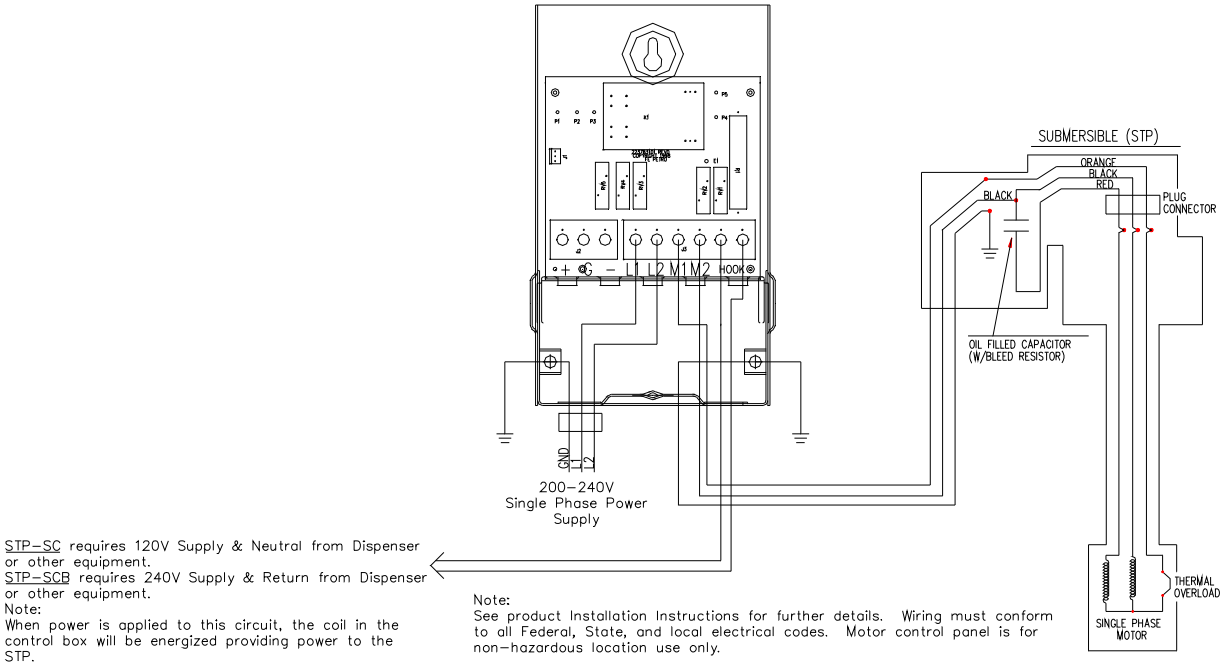
*Factory Setting
See **"Master-Slave/Alternating Circuit" section for definition

Figure 1

SW1 Address	Pos-5	Pos-6	Pos-7	Pos-8
Master-0	Off	Off	Off	Off
Slave-1	Off	Off	Off	On
Slave-2	Off	Off	On	Off
Slave-3	Off	Off	On	On
Slave-4	Off	On	Off	Off
Slave-5	Off	On	Off	On
Slave-6	Off	On	On	Off
Slave-7	Off	On	On	On
Slave-8	On	Off	Off	Off
Slave-9	On	Off	Off	On
Slave-10	On	Off	On	Off
Slave-11	On	Off	On	On
Slave-12	On	On	Off	Off
Slave-13	On	On	Off	On
Slave-14	On	On	On	Off
Slave-15	On	On	On	On

Table 1

Wiring Diagram for Single Phase Submersible Turbine Pump controller models STP–SC (120V coil) & STP–SCB (240V coil). (Stand Alone Configuration)



Wiring Diagram for Single Phase Submersible Turbine Pump controller models STP–SC (120V coil) & STP–SCB (240V coil). (AC, Master–Slave, or Master–Slave & AC Configurations)

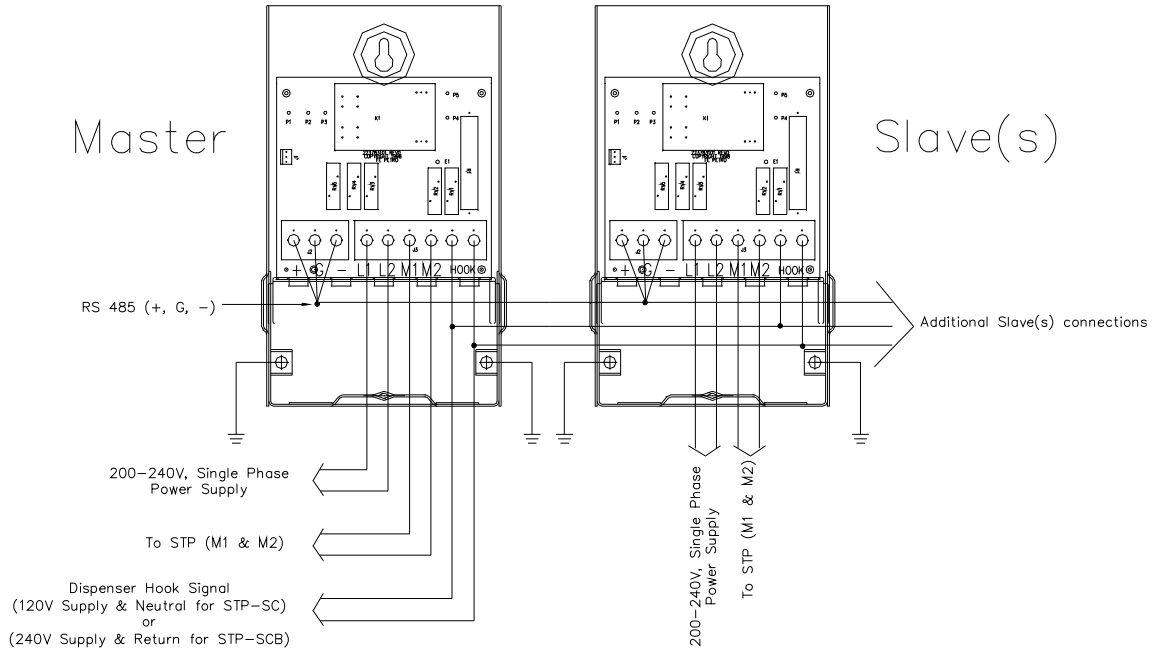


Figure 2

TROUBLESHOOTING GUIDE

To aid field service personnel the STP-SC is equipped with a microprocessor control that makes it possible for the unit to diagnose abnormal operating conditions, and communicate them via LEDs on the front panel and by an audible alarm. The following is a definition of all operation and abnormal operating codes.

Green light on steady Power (200-240V) is applied to the STP-SC.

Green light flashing Pump Motor Assembly (PMA) is running.

NOTE

If the green light stays steady, even when a dispenser is energized, double check the dispenser hook signal terminals on the STP-SC. Verify that there is 120V for the STP-SC or 240V for the STP-SCB across the two terminals for the hook (Figure 2). If the green light remains steady, power is supplied to the "HOOK" connector, and all switch settings are correct, call FE Petro Technical Service for assistance.

NOTE

If the green light constantly flashes, even when all the dispensers are turned off, there may be some power still applied to the STP-SC Hook Connector. If this condition exists call FE Petro Technical Service for assistance.

For STP-SC's equipped with an audible alarm

Red Light Flashing/ Alarm Beeping Abnormal condition. Determine the number of flashes/beeps and refer to the appropriate row on the guide below.

Disabling the audible alarm

To silence the audible alarm, depress the push button briefly. This only silences the alarm; it does not reset the controller.

Reset

Before correcting an abnormal condition (red light flashing/alarm beeping), note the number of flashes/beeps, reset the controller by depressing the push button on the front of the control box for between three and ten seconds (all indicator lights will go out) and check for proper operation. If operating correctly, do not continue servicing unless the abnormal condition is still present. If the controller indicates the abnormal condition is still present, correct the condition according to the following troubleshooting guide, reset the controller and check for proper operation. **Contact FE Petro Technical Services for further assistance, if applicable.**

For STP-SC's NOT equipped with an audible alarm

Red light flashing Abnormal condition. Determine the number of flashes and refer to the appropriate row on the guide below.

Reset

Before correcting an abnormal condition (red light flashing), note the number of flashes, reset the controller by briefly depressing the push button (reset button) on the front of the control box and check for proper operation. If operating correctly, do not continue servicing unless the abnormal condition is still present. If the controller indicates the abnormal condition is still present, correct the condition according to the following troubleshooting guide, reset the controller and check for proper operation. **Contact FE Petro Technical Services for further assistance, if applicable.**

Flashes /Beeps	***Condition***	***Potential Causes***	***Proposed Action***
1	Dry Run (Under-load)	Low fuel level in the storage tank Or Obstructions in Motor Intake	1. Check fuel level in storage tank; schedule fuel delivery, when delivery is complete and fuel level is above PMA end bell, push reset button on STP-SC. Check for correct system operation. If fuel levels are within acceptable range, the STP-SC may need to be recalibrated if it was previously calibrated with air in the lines or with product flow.
2	Low Incoming Voltage	Voltage fluctuations or low input voltage	**NOTE: STP-SC will automatically restart when the voltage returns to acceptable operating range.** 1. Use AC voltmeter to verify incoming voltage is within the 200-240VAC acceptable range. If voltage is not within this range, contact an electrician to correct problem. If voltage is within acceptable range and condition is still present after resetting, recalibrate controller per **"Calibration"** section.
3	Locked Rotor	Short in wiring from STP-SC to PMA Or Incorrectly wired through capacitor Or Foreign material in PMA or rotor within motor is locked up	1. Check and verify wiring is correct from STP-SC to motor (shorts or incorrectly wired capacitor). If condition is corrected, check for proper operation. If operating correctly, do not continue with next step. If condition is still present, continue to next step. ***PMA Replacement/Inspection*** 2. Disconnect input voltage at load center, lock and tag out circuit breakers. 3. (See PMA Replacement Instructions P/N 400289002) Disengage the 3/4" securing bolt of the electrical connector and swing out of the way. Remove two 9/16" bolts from extractable portion of the manifold. 4. Pull extractable part of the pump. **NOTE: Pump Motor Assembly shell can be damaged by blows from hard surfaces, use care in removing.** 5. Remove black end cap from PMA and attempt to spin rotor with a 3/16" Allen wrench to determine if there's any binding. If rotor does not spin freely and/or there is physical damage (note this on a warranty claim form for FE Petro use), proceed with step 7. If no binding or physical damage to PMA, reinstall extractable by following the previous steps in reverse order and then 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.** 6. Turn on power to the STP-SC unit and verify correct system operation. If condition is corrected, do not continue to next step. If condition is still present, remove the extractable by repeating steps 2 through 4 and then continue to next step. 7. Remove four 5/16" cap screws that connect the PMA with a 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 and proper alignment, which may have caused the condition.** 8. Replace with new PMA. **NOTE: Pump motor shell can be damaged by blows from hard surfaces, use care in replacing.** 9. Re-install extractable and secure by following reverse order of disassembly. 10. Turn on power to the STP-SC unit and verify correct system operation.

Flashes /Beeps	***Condition***	***Potential Causes***	***Proposed Action***
4	Open Circuit Or Locked Rotor w/ Thermal Overload Open Or Relay Fault	Connection broken from STP-SC to PMA Or Incorrectly wired through capacitor Or Relay Failure	1. Wait 5 minutes before pushing the reset button on the STP-SC. This will allow the motor thermal overload to reset if locked rotor has occurred. Check for proper operation of system; if operating correctly do not continue to next step. If condition is still present continue to next step. 2. Disconnect power at load center, lock and tag out circuit breakers. 3. Remove the two motor control outputs (M1 and M2) from the STP-SC unit. 4. Using an ohmmeter (low range setting), place leads between two wires going to the STP, this is the first step in determining where the open circuit has occurred. Correct readings between M1 and M2 wires (orange and black) should match that of the motor being used +/-1 ohms. These readings can be found in TB004 or the STP/IST Fixed & Variable Length Installation and Owner's Manual. Readings between any of the motor wires and ground should be an open circuit. If readings in this step are incorrect, continue with the next step. If readings are correct go to step 7. 5. Check and verify capacitor wiring is correct in STP junction box. Refer to the STP/IST Fixed & Variable Length Installation and Owner's Manual for wiring diagram or SB003. If condition has been corrected, do not continue with next step. If wired correctly and condition is still present, continue with next step. 6. Go to the submerged turbine and remove the cover at the top of the extractable manifold. Remove the three wire nuts and continue conductivity tests on the three wires going to the motor. Readings between any of the motor wires and ground should be an open circuit. If readings are incorrect and there are no problems with the lead assembly wiring, go to **"PMA Replacement/Inspection"** in 3 flash section. If readings are correct, there is problem with the wiring between the STP-SC and this point, continue with next step. 7. Remove the junction box cover and do conductivity test on wires in the junction box after the capacitor through the extractable discharge head (orange to orange, red to red, and black to black). If wires are not conducting, replace the male and female connectors of the STP. See STP/IST Fixed & Variable Length Installation and Owner's Manual for replacement parts. Check for proper operation. If operating correctly, do not continue. If conductivity readings are correct and the condition is still present, continue to next step. 8. Lower Board relay may be stuck open or damaged. Replace Lower Board (Relay Assembly); see **"Replacement Parts"** section for part number. Turn on power to the STP-SC unit and verify correct system operation.
5	Uncalibrated	New Installation	1. Calibrate STP-SC per **"Calibration"** section. **NOTE: All STP-SC's must be calibrated prior to operation.** If condition is corrected, do not continue to next step. If condition is still present, continue to next step. 2. Check the following: • Calibration is done at no flow (close STP clamp valve or ball valve in line). • Dispenser hook signal is applied within 10 min. when set in calibration mode. • No open circuits between controller and motor. • Lines have been purged of air. • Locked Rotor
6	Extended Run	Continuous Hook Signal applied for more than 60 min. without pumping product	1. Disconnect power at load centers, lock and tag out circuit breakers. 2. Check voltage across hook terminal 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 power to the STP-SC and verify system is operating correctly.
7	Relay Fault	Relay contact failure	1. Disconnect power at load centers, lock and tag out circuit breakers. 2. Replace Lower Board (Relay Assembly), see **"Replacement Parts"** section. 3. Turn on power to the STP-SC unit and verify correct system operation.

REPLACEMENT PARTS

Upper Board (Control): P/N 223835901
Lower Board (Relay Assembly) 120V coil: P/N 223840901
Lower Board (Relay Assembly) 240V coil: P/N 223840902

Contact FE Petro for additional troubleshooting information at 1-800-225-9787.