

Small Diameter Probe Scavenger with Water Table Depression Pump and Geotech Environmental Control Module

Installation and Operation Manual



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DOCUMENTATION CONVENTIONS

This manual uses the following conventions to present information:



WARNING

An exclamation point icon indicates a **WARNING** of a situation or condition that could lead to personal injury or death. You should not proceed until you read and thoroughly understand the **WARNING** message.



CAUTION

A raised hand icon indicates **CAUTION** information that relates to a situation or condition that could lead to equipment malfunction or damage. You should not proceed until you read and thoroughly understand the **CAUTION** message.



NOTE

A note icon indicates **NOTE** information. Notes provide additional or supplementary information about an activity or concept.

READ THE FOLLOWING CAUTIONS & SUGGESTIONS BEFORE PROCEEDING



The Small Diameter Probe Scavenger is a sophisticated piece of equipment which must be installed, operated and maintained according to the procedures described in the system manual. Failure to follow these procedures or to observe the cautions included in this manual, may result in personal injury and will void the Standard Equipment Limited Warranty.

Installation

- Do not deploy the PSCAV until the well has been developed by qualified personnel. Silt and grit can damage the water pump and degrade its performance.
- Before deploying the system in the well, briefly test the water pump by turning the control switch to HAND.



Do not run the water pump dry for more than 5 seconds at a time.

- Mount your GEEM (or other control panel) under cover and in a location where it will never be submerged in water.
- All system wiring is to be carried out by a qualified electrician.
- For systems using a GEEM or other control panel with an integrated Tankfull probe, the PSCAV system will not run when the Tankfull probe is cut or disconnected.

Section 1: System Description

Function and Theory

The Small Diameter Probe Scavenger (PSCAV), built with a Water Table Depression Pump (WTDP), is an automatic pumping system designed to simultaneously recover water and hydrocarbons. A specially designed probe differentiates between hydrocarbons and water, allowing for retrieval of virtually 100% water-free oil. The water pump creates a “cone of depression” in the well, drawing in the hydrocarbons that contaminate the surrounding groundwater. The product pump then recovers the hydrocarbons floating on the water and pumps them into a product recovery tank. When the tank becomes full, an optional Tankfull probe can be used to shut down the product pump to prevent overflow.

The PSCAV can be built for product only applications where a separate WTDP pump may be installed or when there is not a need for a water pump. Figure 1-1 is an example of both units; the water pump and motor is not shown attached to the WTDP ready unit in this diagram.

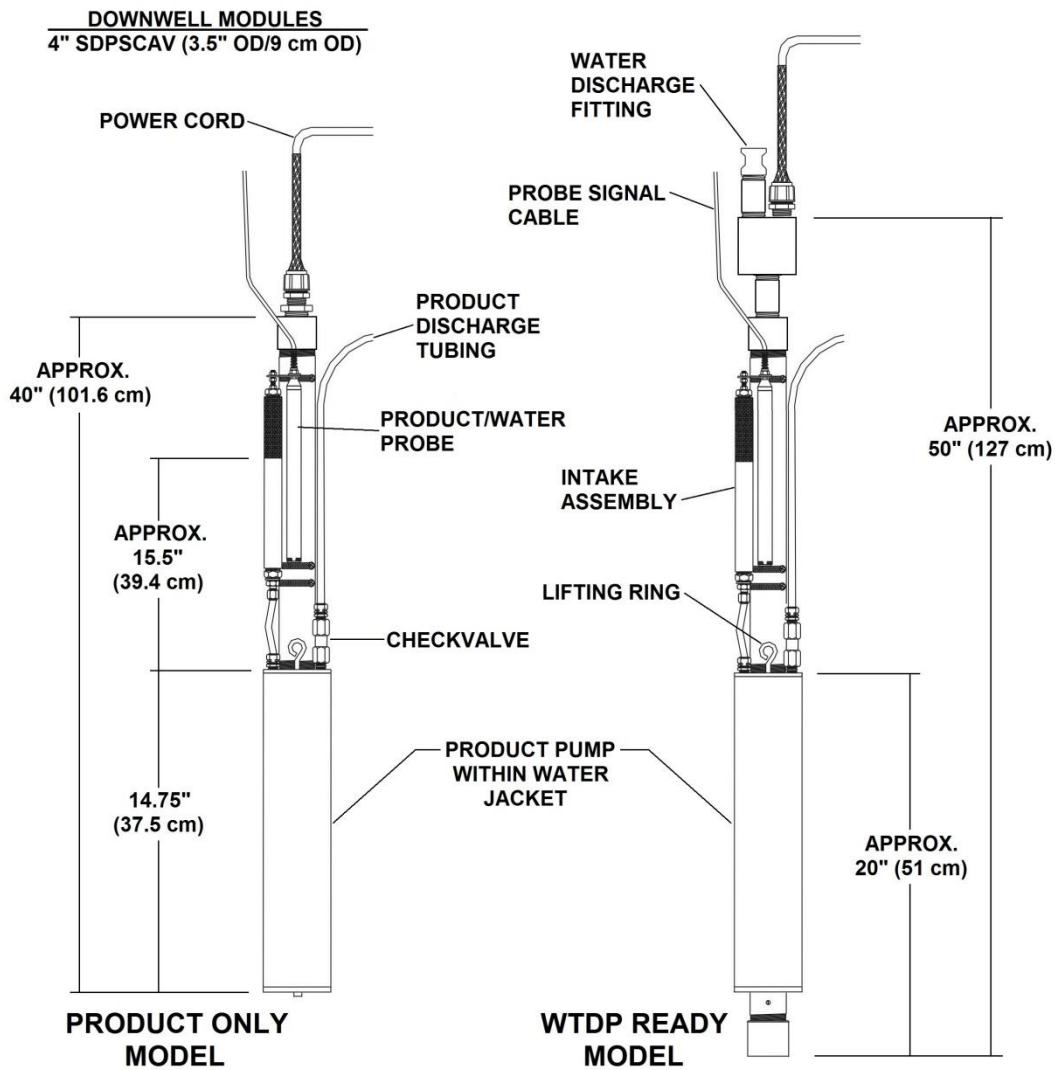


Figure 1-1: Small Diameter Probe Scavenger with Water Table Depression Pump.

When used with the optional Geotech Environmental Control Module (GECM), the standard PSCAV system will consist of a downwell assembly that includes a product pump, an intake assembly (optional), a product/water probe (optional), a Tankfull probe (optional), and a water pump (optional). *Section 8: Replacement Parts and Accessories* contains a breakdown diagram of a standard PSCAV unit followed by a list of definitions and part numbers. An extended list of optional components is also included. Major system components are described on the following pages.



PSCAVs are built for either Product only use or as WTDP ready (with water pump and motor). Throughout the rest of this manual, the term PSCAV will be used to describe the system in general.

PSCAV Modifications for Diverse Environments

For well environments that could cause premature wear to various PSCAV components, Geotech can provide limited upgrades to a standard PSCAV to increase the life of the unit. For example, a PSCAV unit modified for use with chlorinated LNAPL applications will have the following parts replaced:

Standard part	Upgraded part
Cable assembly	ETFE coated cable
Product/water Probe	Large diameter probes with PTFE coated cables and Stainless steel floats
PTFE check valve	SS check valve

These upgrades can provide longer life to the operational parts on the PSCAV. Discuss the possible need for any modifications to your PSCAV system with your Geotech Sales Representative.

System Components

Product Pump

The Geotech product pump (with motor) is a magnetically coupled gear pump system that operates on 12VDC. The product pump turns on and off in response to signals sent to the GECM by an attached conductivity/density probe and a second separate Tankfull probe. Descriptions of these probes can be found later in this section.

The following chart represents a Gallons per Minute (GPM) per Pounds per Square Inch (PSI) average for the product pump. However, flow results can vary for a variety of reasons, i.e. new gear set, worn gear set, worn motor/bushings, line loss or low voltage to product pump motor. An example of the Product Pump performance curve is shown in Figure 1-2.

PSI Range	GPM/LPM Flow Rate	Amps*
Open flow	.77 / 2.9	2.30
20 PSI (1.4 bar)	.72 / 2.7	3.00
40 PSI (2.7 bar)	.70 / 2.6	3.70
60 PSI (4 bar)	.66 / 2.5	4.45
65 PSI (4.5 bar)	<i>(a functional product pump/motor will stay under 5 amps at 65 PSI / 4.5 bar)</i>	
80 PSI (5.5 bar)	.61 / 2.3	5.10
100 PSI (6.9 bar)	<i>(a product pump/motor will decouple between 95 PSI and 105 PSI / 6.9 bar)</i>	

**Test results were obtained using a Geotech Power Supply with an average output of 14.5VDC.*

The product pump is designed to decouple between 95 PSI (6.5 bar) and 105 PSI (7.2 bar) or greater. The maximum pressure obtainable is 90 PSI (6.2 bar) to 95 PSI (6.5 bar) depending on the viscosity of the hydrocarbons being pumped. Factors that may reduce decoupling pressure, and therefore reduce maximum output pressure, include temperatures above 75°F (24°C), high fluid viscosities, abrasive fluids and pump wear. Once decoupling has occurred, the pump and motot can be recoupled by completely stopping and then restarting the unit.

**Product Pump Performance Curves
Normal Decoupling Pressures (70 degrees F water)**

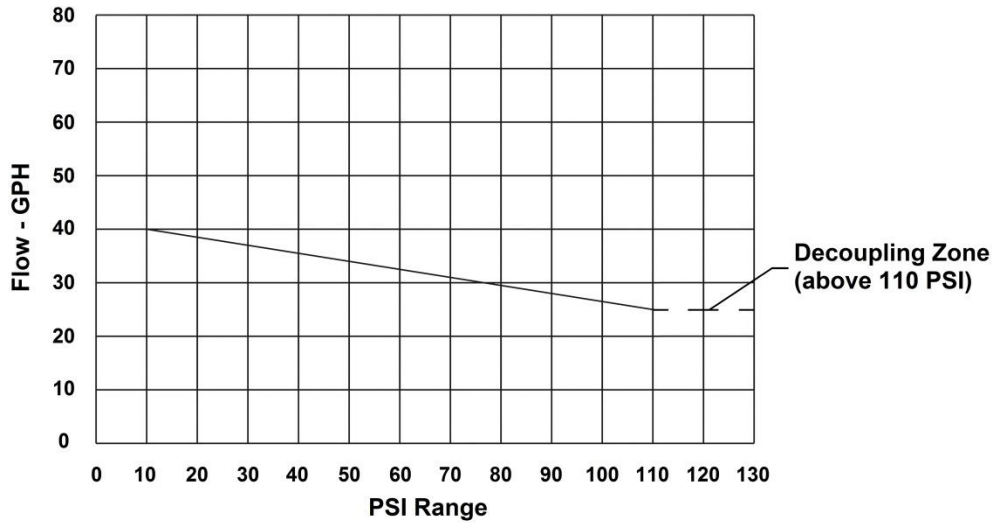


Figure 1-2A: Product Pump performance curve (gallons per hour/PSI)

**Product Pump Performance Curves
Normal Decoupling Pressures (21 degrees C water)**

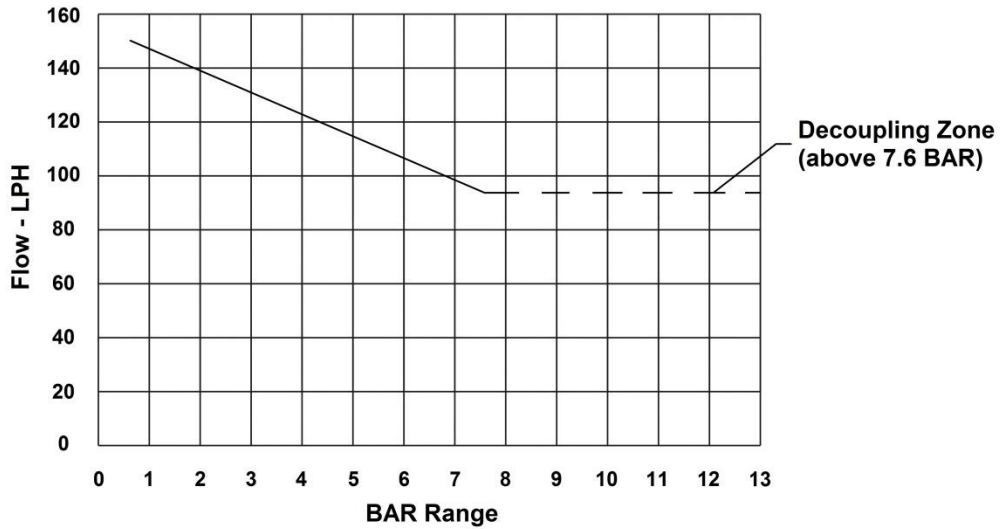


Figure 1-2B: Product Pump performance curve (liters per hour/BAR)

System Accessories

The following accessories must be ordered separately from the basic PSCAV system. Refer to *Section 8: Replacement Parts and Accessories* for a listing of available accessories for your PSCAV system.

Water Pump

A set of HI and LO water sensors are located on the Downwell Probe (see Figure 1-3). These sensors indicate the water level during installation and operation.

When the water level becomes too high, a signal is sent to the GECM to turn on the water pump for WTDP ready systems. The water pump will automatically lower the cone of depression in the well and shut off when the water float reaches the lower sensor. This function keeps the opening on the intake assembly as close to the product layer as possible. However, it may be necessary to re-adjust the PSCAV position within the well.

Water pumps are available with 2-wire or 3-wire motors and range in power from 1/3 to 20 horsepower (HP). 2-wire motors are available in Single-Phase only and feature built-in start components and thermal overload protection. 3-wire motors (through 1HP) include built-in thermal overload protection. A 3-Phase deep well submersible pump motor requires an external start component and can come with either an external start box or designated motor starter (installed within the GECM).

Start boxes and motor starters are supplied by Geotech as an option. Most motor/pump scenarios, including multiple pumps, can be controlled by one GECM with the appropriate motor starter(s) installed. Refer to *Appendix A: Submersible Water Pumps* for a list of water pumps available from Geotech.

Intake Assembly

The intake assembly is designed with an outer 60-mesh screen and a removable inner 100-mesh screen. Together they allow product or water to be captured and pumped to the surface via the product pump. When used in conjunction with the downwell probe assembly, the PSCAV system can be designated for product only collection from the surface of water within a well.

It is recommended that you use the PSCAV system to collect product that is acceptable to the internal 100-mesh screen of the intake. The Viscosity Chart (Figure 6-1) lists all of the products easily recovered with this intake assembly technology. If well conditions require something more aggressive, contact a Geotech Sales Representative.

The intake assembly comes with a unique set of modified worm clamps, which allow the intake and probe to be easily attached together on the PSCAV center pipe. A 6" (15 cm) piece of 3/8" poly tubing and brass compression fittings complete the connection. Figure 1-3 shows an example of the intake assembly along with a standard probe.



The stop collar that is just above the Water-HI switch must be placed horizontally centered to the weld of the intake screen to maximize product intake from the water surface.

Downwell Probe

The product and water pumps cycle ON and OFF in response to signals sent to the control panel by a level sensing probe. Figure 1-3 shows an example of a standard product and water probe which is commonly used with either a WTDP ready PSCAV or a PSCAV with a separate water pump.

The probe, when properly attached to the optional intake assembly, uses float actuated switches to assure that the product pump delivers hydrocarbon only. The Product float must be suspended in hydrocarbon for the product pump to run. Once the Product float reaches the upper switch, the product pump will turn on until the float magnet falls back below the switch. This assures that the product pump only runs when sufficient hydrocarbons are present in the well. The next float (HI/LO Water) is buoyant in water only and disables the product pump when it reaches the Water-HI switch. This prevents the product pump from running if the hydrocarbon/water interface in the well rises to the level of the product pump intake.

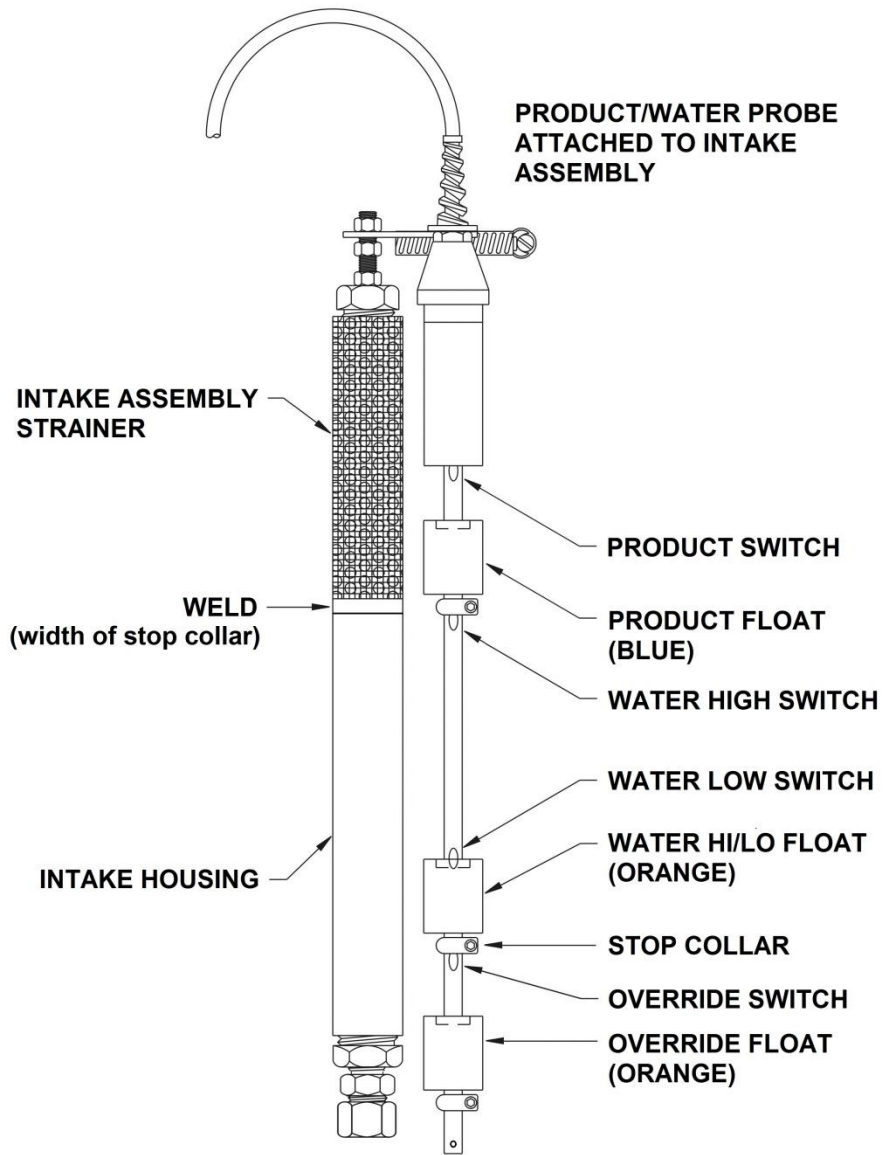


Figure 1-3: Intake assembly with downwell probe.

The water pump is controlled by the Water HI/LO and Override floats. The water pump turns on when the Water HI/LO float rises to the top of its travel. The pump continues to run until the float falls to the bottom of its travel. If a probe fault should cause the pump to continue running, the Override float will fall and shut off the pump.



The stop collar that is just above the Water HI switch must be placed horizontally centered to the weld of the intake screen to maximize product intake from the water surface. All probe wiring is rated Intrinsically Safe for Class 1, Div. 1, Group D hazardous locations.

Tankfull Probe

A second probe is used to shut off the product pump if the product recovery tank becomes full. This tankfull override probe (Figure 1-4), is a float actuated level sensor installed in the top of the recovery tank. When used with a GECM or other control panel, the PSCAV system will shut down whenever the Tankfull probe is disconnected or the line is cut.

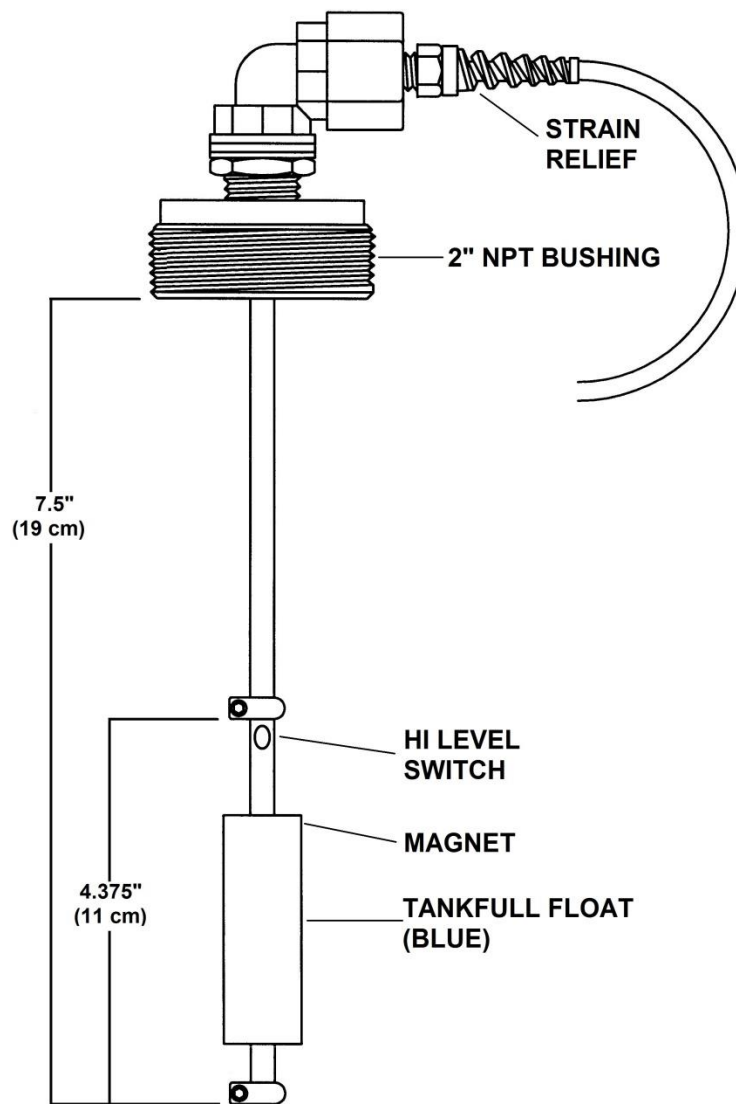


Figure 1-4: Tankfull Probe Assembly

Junction Boxes

To facilitate the wiring of the PSCAV system, Geotech offers ready to install power and signal junction boxes (Figure 1-5). The optional junction boxes contain terminal strips that allow the PSCAV cable assembly and downwell probe cable to be joined to customer installed, conduit enclosed wire runs from the wellhead. Explosion proof junction boxes can be provided (as shown in Figure 1-5, items A and C) or terminal connections can be housed within a NEMA 4 junction box (item B). Figure 2-1 contains a generic example of a common site installation, showing power and signal junction box placement.

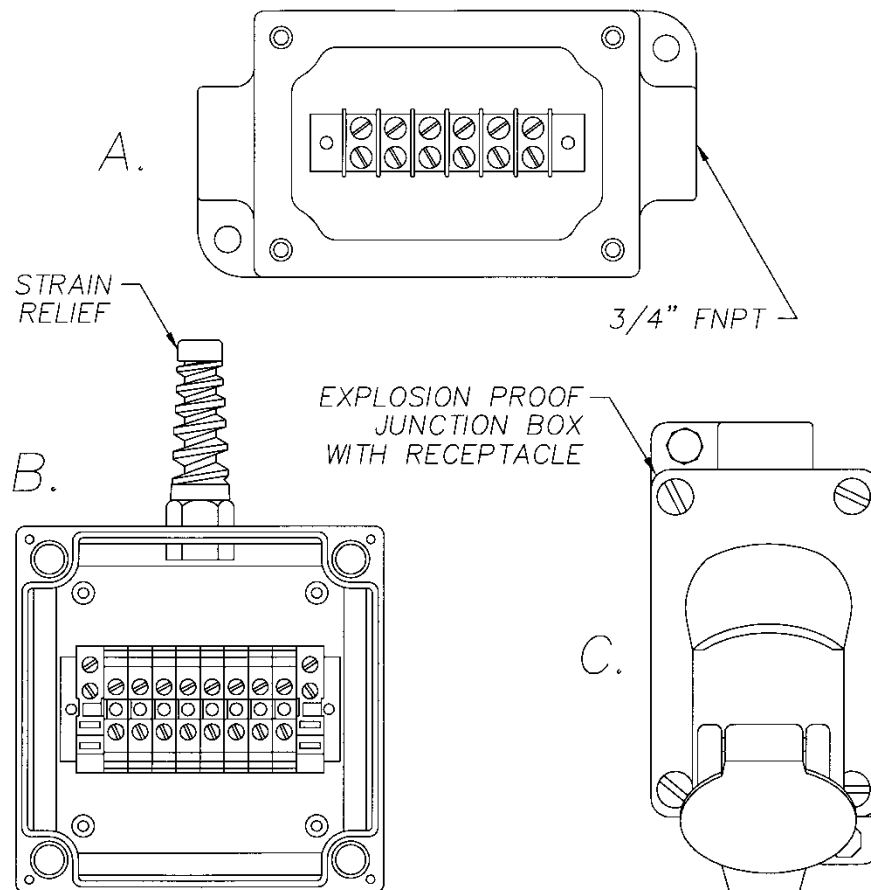


Figure 1-5: Junction boxes available for use with the PSCAV system.

(A) Explosion proof power junction box. (B) NEMA 4 signal junction box. (C) Explosion proof junction box with receptacle. Refer to the System Accessories section for part numbers.

Product Pump 12VDC Power Supply

Power Supplies are used to operate the 12VDC product pump motors built into the PSCAV system. An 115VAC or 230VAC Power Supply is available from Geotech. Power requirements are dependent on either the main power or an installed transformer within the GECM. A Power Supply is designed to receive two power leads from the GECM: HOT and NEUTRAL for 115VAC, or two HOT leads for Single-Phase 230VAC. The voltage is then converted to 12VDC (with an average output of 14.5VDC) for product pump operation. Figure 1-6 shows an example of a 230VAC to 12VDC Power Supply panel.

Each panel comes housed in a NEMA 4 enclosure with labeled terminal strips. A wiring diagram can be found on the inside cover of the enclosure. Install Power Supplies close to the well to reduce DC line loss between the power supply and the product pump. Two AC power wires will then run from a relay or terminal strip within the GECM to terminal strip TB1 on the Power Supply panel.

Single-Phase motors can be wired through the Power Supply box or directly to a motor starter within the GECM. 3-Phase water pump motors are wired directly to a designated motor starter within the GECM, bypassing the Power Supply.

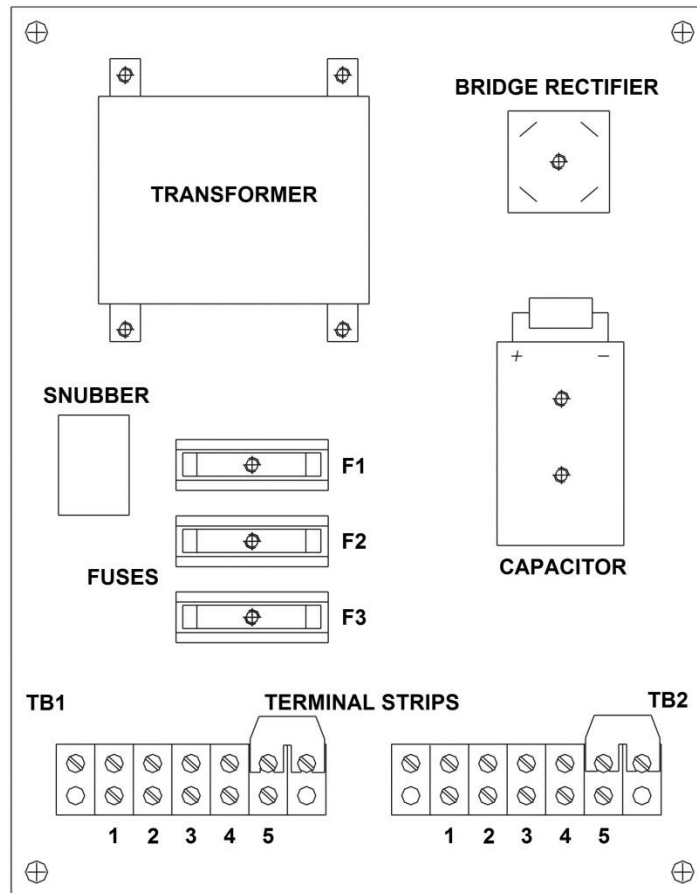


Figure 1-6: Example of the components to a 230VAC to 12VDC power supply

Geotech Environmental Control Module (GECM)

The Geotech Environmental Control Module (GECM) is a specifically designed, microprocessor based, industrial control panel for the operation of remediation and industrial equipment including, but not limited to Geotech branded equipment.

The GECM is designed for installation in an unclassified location, with Intrinsically Safe (IS) circuit extensions into hazardous (classified) locations.

The GECM has also been designed for ease of use and installation and can accommodate a wide variety of equipment control needs. A variety of equipment combinations can be controlled from just one control panel. A basic panel is capable of controlling up to eight devices from 24 IS probe inputs. Devices can vary from small signal relays to 75 HP motor starters. A panel can be easily expanded to accommodate up to 32 additional outputs and 96 additional IS probe inputs. This equipment should be installed in accordance with NEC NFPA 70.

A Geotech Small Diameter Probe Scavenger (PSCAV) with Water Table Depression Pump (WTDP) consists of a PSCAV product pump and Grundfos RF4 Water Pump which uses float density logic for product recovery. Automated control is provided by a Geotech Environmental Control Module (GECM) to be mounted on site by the customer. Plumbing, conduit, and wiring between system components will not be provided with the system. All system sensor devices are to be terminated at the GECM according to the system installation and wiring schematic provided with the system. See *Appendix B: GECM Logic Statement* for more information

A GECM Field Wiring Diagram is also included with each unit. The GECM Field Wiring Diagram illustrates the internal layout of the GECM panel and contains wiring information pertinent to device installation and troubleshooting.

Hoses

A 100' (30 m) of 3/8" nylon discharge hose (for attachment to the discharge fitting) is provided with each PSCAV system built. Additional discharge hoses and fittings supporting both product and water pump use can be obtained from Geotech.

Section 2: System Installation



The PSCAV system must be installed, operated, and maintained according to the procedures described in this manual. Failure to follow these procedures, or to observe the Warnings and Cautions included in this manual, may result in personal injury and will void the Standard Equipment Limited Warranty.

- Do not deploy any pumps until the well has been developed by qualified personnel. Excessive silt and grit can clog the intake float cartridge or damage the water pump, degrading the performance.
- Never run the product or water pump dry for more than 5 seconds at a time.
- Position the water pump so that the intake is no closer than 1' (30cm) from the bottom of the well.

Inspection

Inspect the PSCAV unit and accessories upon arrival. If any items are missing or damaged, make note of this on the shipping papers and immediately notify your Sales Representative at Geotech. In preparation for installation, remove any shipping straps and cable ties from around the intake float cartridge prior to deployment.

System Wiring

Throughout the wiring procedures described below, refer to the site installation drawing in Figure 2-1, the various wiring diagrams within this section, and to the separate Field Wiring Diagram provided with your GECM control panel.



All wiring must be carried out by a qualified electrician in accordance with the state and local codes. Conduit runs must conform to Article 501-5 of the 1990 National Electrical Code (NEC).

Install GECM

Even though the GECM electronics are enclosed within a NEMA 4 rated weatherproof box, it is advised that you place your GECM within a sheltered area, protecting the unit from direct exposure to water and sunlight.



Power must be disconnected and locked out at the panel or services before any installation procedures are attempted.

See *Appendix C: GECM System Installation* for further installation instructions.

Wiring Product and Water Pump Connections

The PSCAV system can be ordered with a variety of Grundfos water pumps attached. These pumps are operated with Single-Phase and 3-Phase motors. Product pumps are available only in 12VDC and are built and installed internally to the PSCAV by Geotech. If applicable, refer to the GECM Field Wiring Diagram and to the wiring diagrams on the following pages for installation and wiring instructions specific to your system.



Do not run any power wires within 2" (5 cm) of intrinsically safe (IS) wires or terminals. Reference NEC Article 508 for relevant codes.

When wiring to a GECM control panel run the pump power wires through the bottom of the enclosure and attach them to the WATER PUMP and PRODUCT PUMP POWER OUT terminals. Attach the ground wire to the chassis grounding lug next to the terminal block. Check tightness of terminal screws.

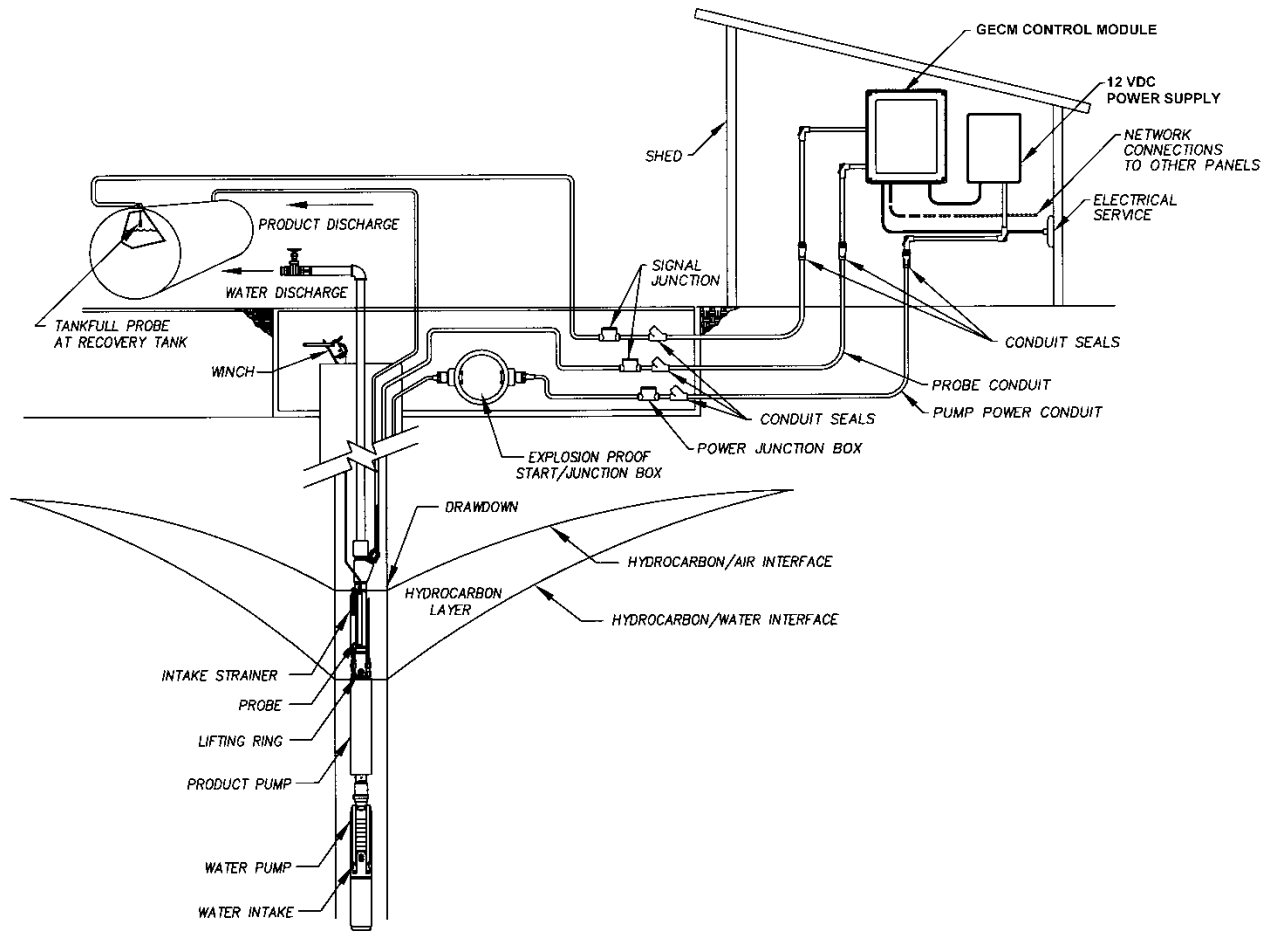


Figure 2-1: A WTDP ready PSCAV deployed with the optional GECM, power supply, Tankfull probe, and explosion proof accessories

Wiring a Single-Phase 115 or 230VAC PSCAV with Water Pump and 12VDC Product Pump Motors

Wire the water pump motor leads for a Single-Phase 115 or 230VAC motor through a wellhead junction box (optional) and attach the leads to labeled terminal strip TB2 within a 115 or 230VAC Power Supply. Single-Phase motor leads from a WTDP ready PSCAV will be black, red, and yellow (ground). Connect the ground wires **color-to-color** to positions 1, 2, and 3 on TB2.

Wire the GECM to the Power Supply by attaching a pair of HOT leads to positions 1 and 2 on TB1 (AC power to be converted to 12VDC for the product pump), and a pair of HOT leads to positions 3 and 4 on TB1 (115 or 230VAC Single-Phase power to run the water pump motor). These leads will generally come from labeled relays or terminal strips built onto the back panel of the GECM. Attach a ground wire from a designated ground lug to position 5 on TB1 (yellow/ground). Figures 2-2 and 2-3 show examples of 115 and 230VAC WTDP ready PSCAV wiring diagrams.

Terminal positions are labeled on all GECM back panels and on all Power Supply panels provided by Geotech. See the GECM Field Wiring Diagram and the Power Supply diagram for additional wiring instructions. Alternatively, the water pump power leads can also be run directly to a separate motor starter within the GECM, bypassing the Power Supply enclosure all together.

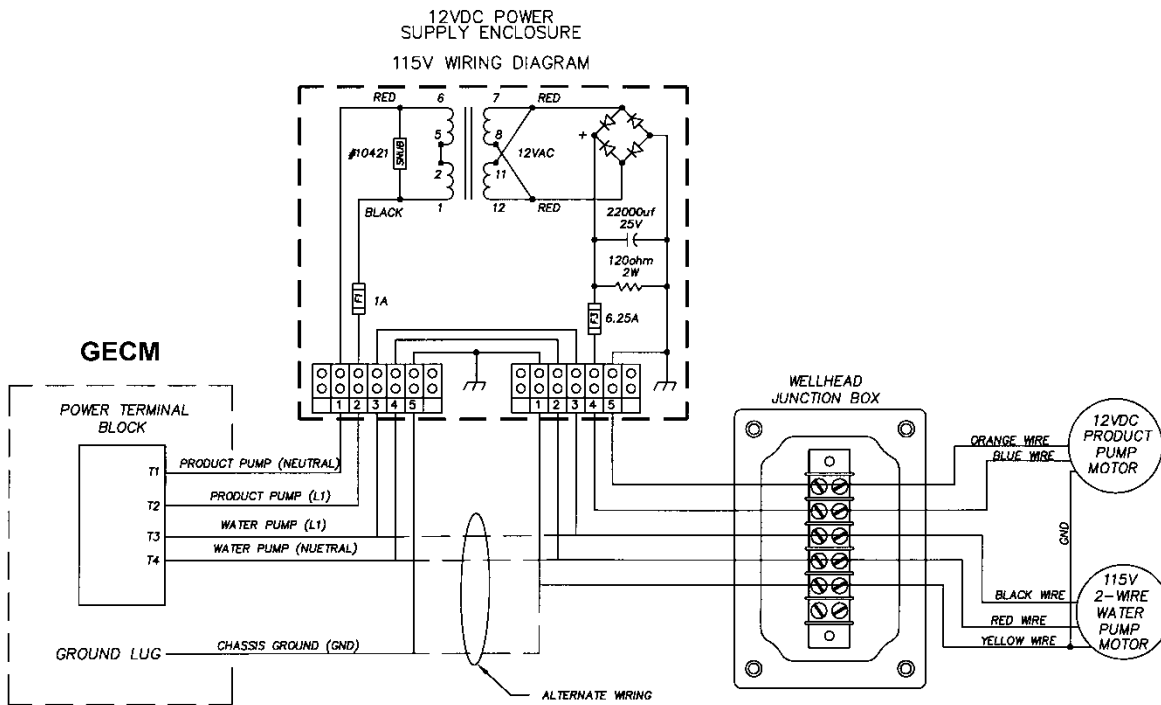


Figure 2-2: Wiring the 115VAC 2-Wire Water Pump and the 12VDC Product Pump Motors

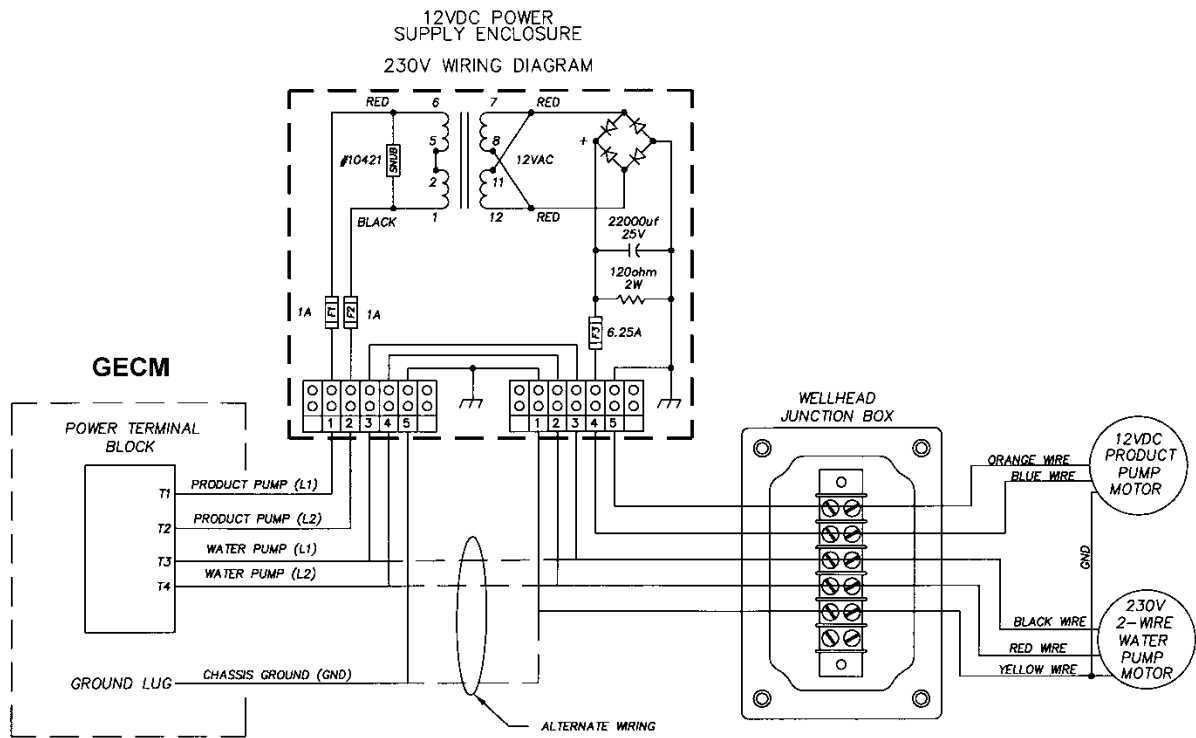


Figure 2-3: Wiring the 230VAC 2-Wire Water Pump and the 12VDC Product Pump Motors

Wiring a 3-Phase PSCAV with Water Pump and 12VDC Product Pump Motors

Wire the water pump motor leads for a 3-phase, 230VAC motor through a wellhead junction box (optional) and attach the leads to T1, T2 and T3 of an appropriate start box or to a motor starter labeled WTDP within the GECM.

Wire the GECM to a 230VAC Power Supply by attaching a pair of HOT leads to positions 1 and 2 on TB1 (AC power to be converted to 12VDC for the product pump). These leads will generally come from a labeled relay or terminal strip built onto the back panel of the GECM. Figure 2-4 shows an example of a 230VAC 3-Phase WTDP ready PSCAV wiring diagram.

Terminal positions are labeled on all GECM back panels and on all Power Supply panels provided by Geotech. See the GECM Field Wiring Diagram and the Power Supply diagram for additional wiring instructions.



A 115VAC Power Supply can also be used if the GECM has an appropriate transformer installed.

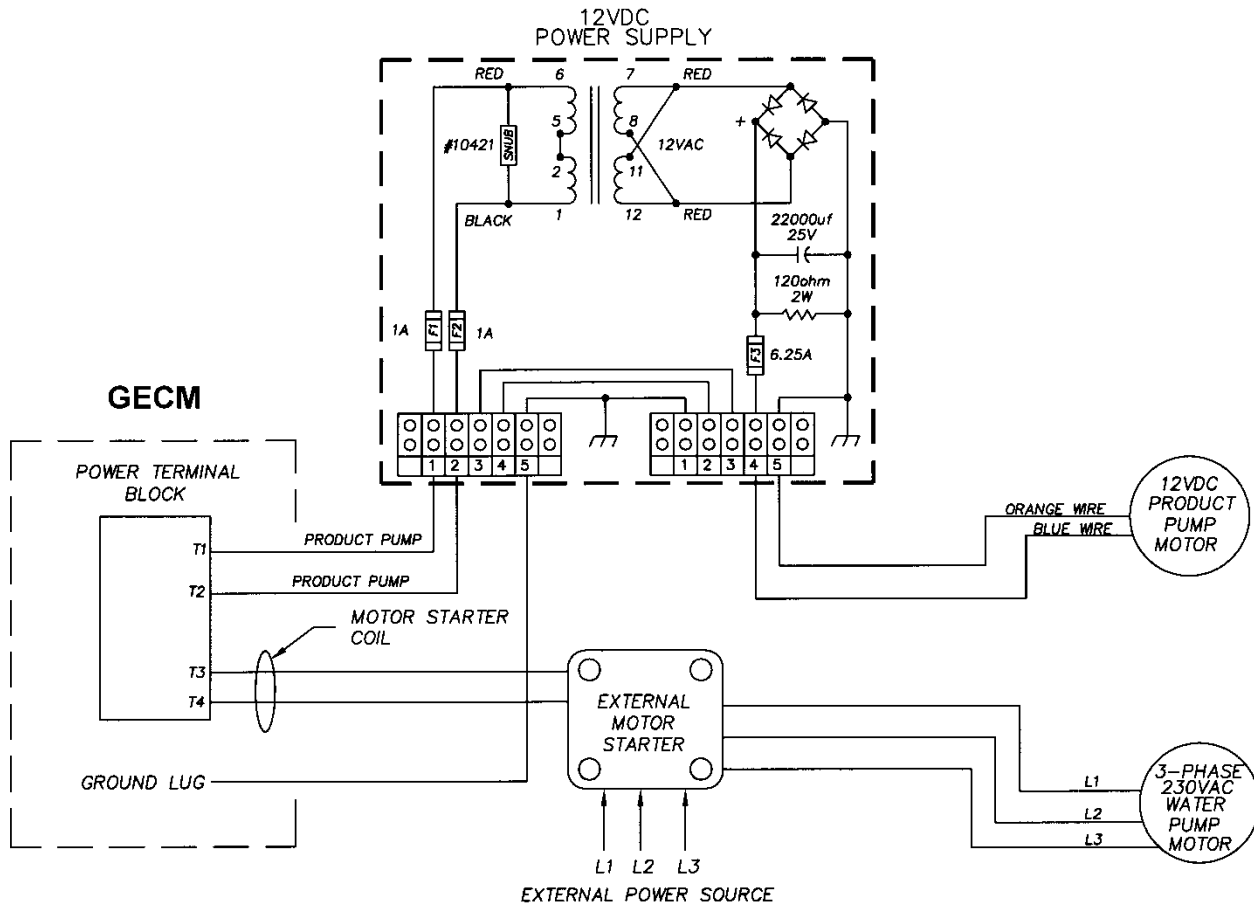


Figure 2-4: Wiring the 3-Phase Water Pump and the 12VDC Product Pump Motors.

Wiring a 12VDC Product Pump (w/o Water Pump)

Wire the product pump motor leads from a PSCAV system through a wellhead junction box (optional) and attach the leads to positions 4 (blue/common) and 5 (orange/ground) on terminal strip TB2 within a 115 or 230VAC Power Supply enclosure.

Wire the GECM to the Power Supply by attaching a pair of HOT leads to positions 1 and 2 on TB1 (AC power to be converted to 12VDC for the product pump). These leads will generally come from labeled relays or terminal strips built onto the back panel of the GECM. Attach a ground wire from a designated ground lug to position 5 on TB1 (yellow/ground). Figure 2-5 shows an example of a 115VAC PSCAV wiring diagram for a product pump only.

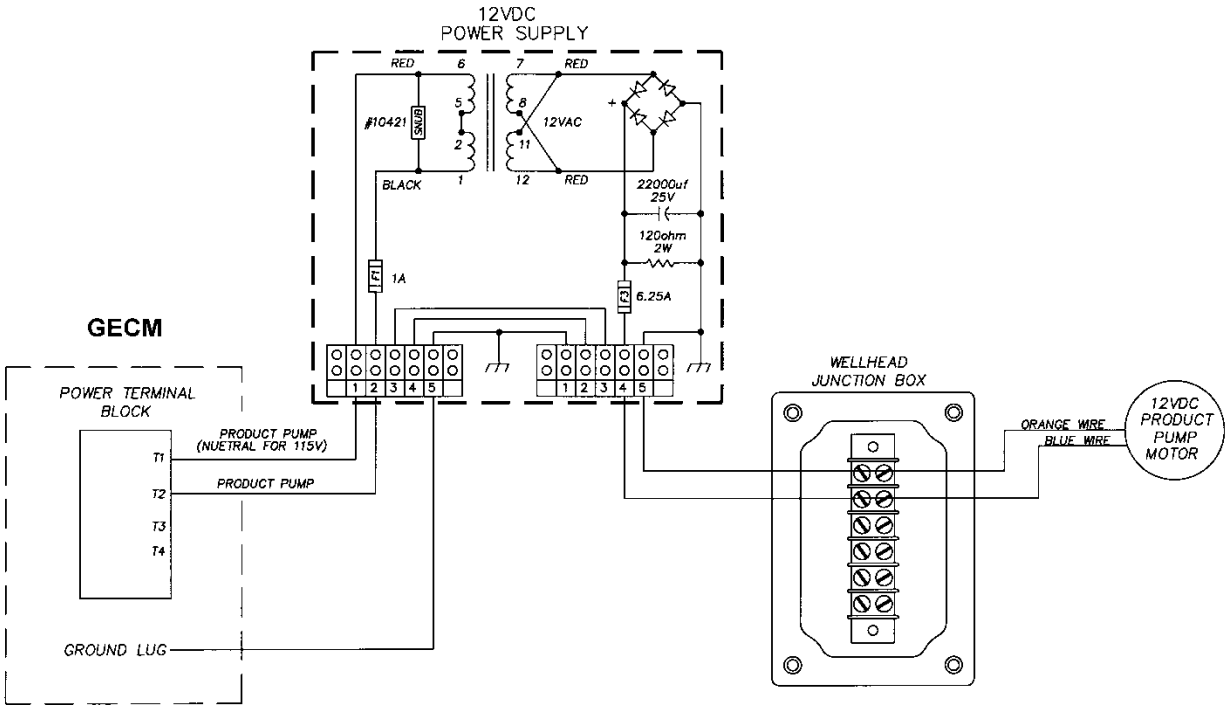


Figure 2-5: Wiring for Product Only pump motor

Wire Downwell Probe

Run the probe cable leads to a wellhead junction box and then to the GECM control panel. Run the cable through the access port on the side of the enclosure and attach its leads to the terminals on the PCB as shown on the GECM Field Wiring Diagram.

Small Diameter Probe (standard - mounted to the PSCAV)

Normally Closed = NC; Normally Open = NO

Float/function	Wires	Status
Product	Blue/Red	NO
Water High	Blue/White	NO
Water Low	Blue/Black	NC (held open by float)
Water Override	Green/Orange ground (or casing)	NC (held open by float)

Large Diameter Product Probe (mounted to the PSCAV)

Float/function	Wires	Status
Product	Green/Orange	NO
Water High	Blue & Yellow/White	NO
Water Low	Blue & Yellow/Black	NC (held open by float)
Water Present (continuity function)	Blue & Yellow/ground (or casing)	

Large Diameter Water Probe (shipped separately)

Float/function	Wires	Status
Water High	Blue & Yellow/White	NO
Water Low	Blue & Yellow/Black	NC
Water Override	Green/Orange	NC
Water Present (continuity function)	Blue & Yellow/ground (or casing)	

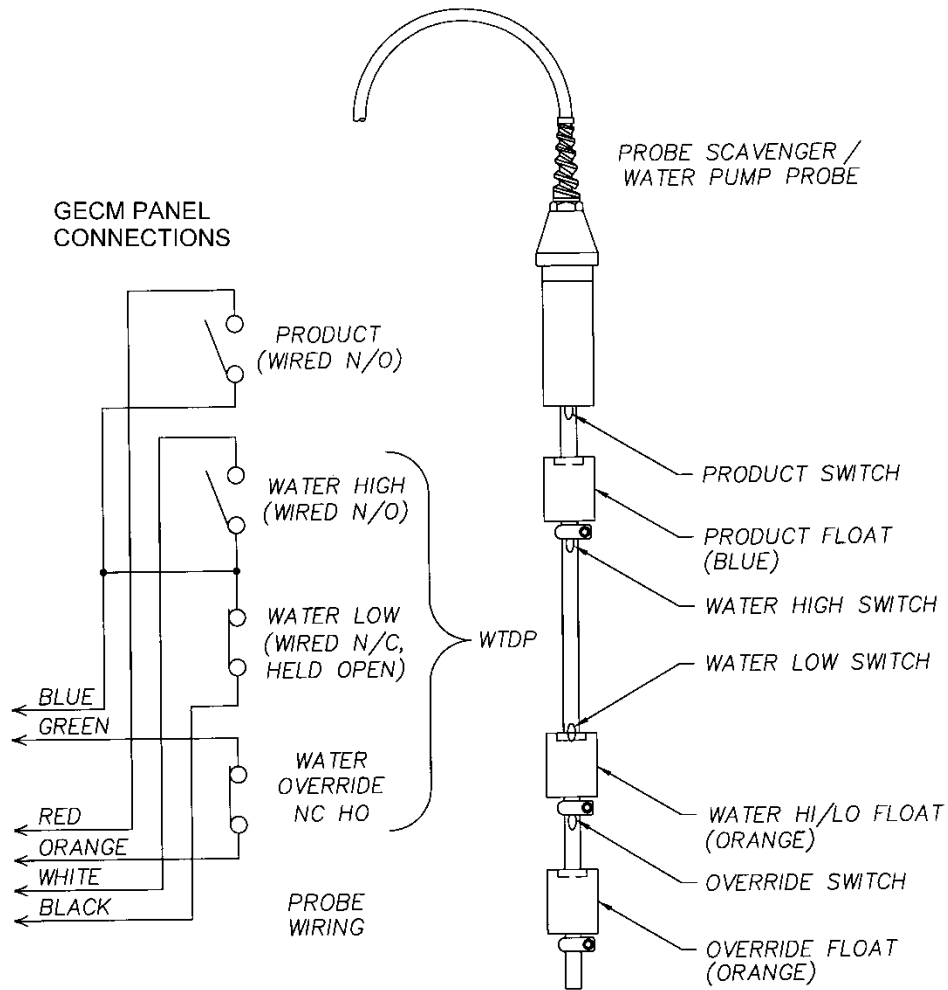


Figure 2-6: Wiring a standard PSCAV Downwell Probe to a GECM (requires Field Wiring Diagram)

Wire Tankfull Probe

After mounting the Tankfull probe in the product recovery tank, run the probe cable through the access port on the upper side of the GECM enclosure and attach the leads to a designated IS terminal strip on the GECM PCB (as shown in the GECM Field Wiring Diagram). Refer to Figure 2-7 for additional wiring details.

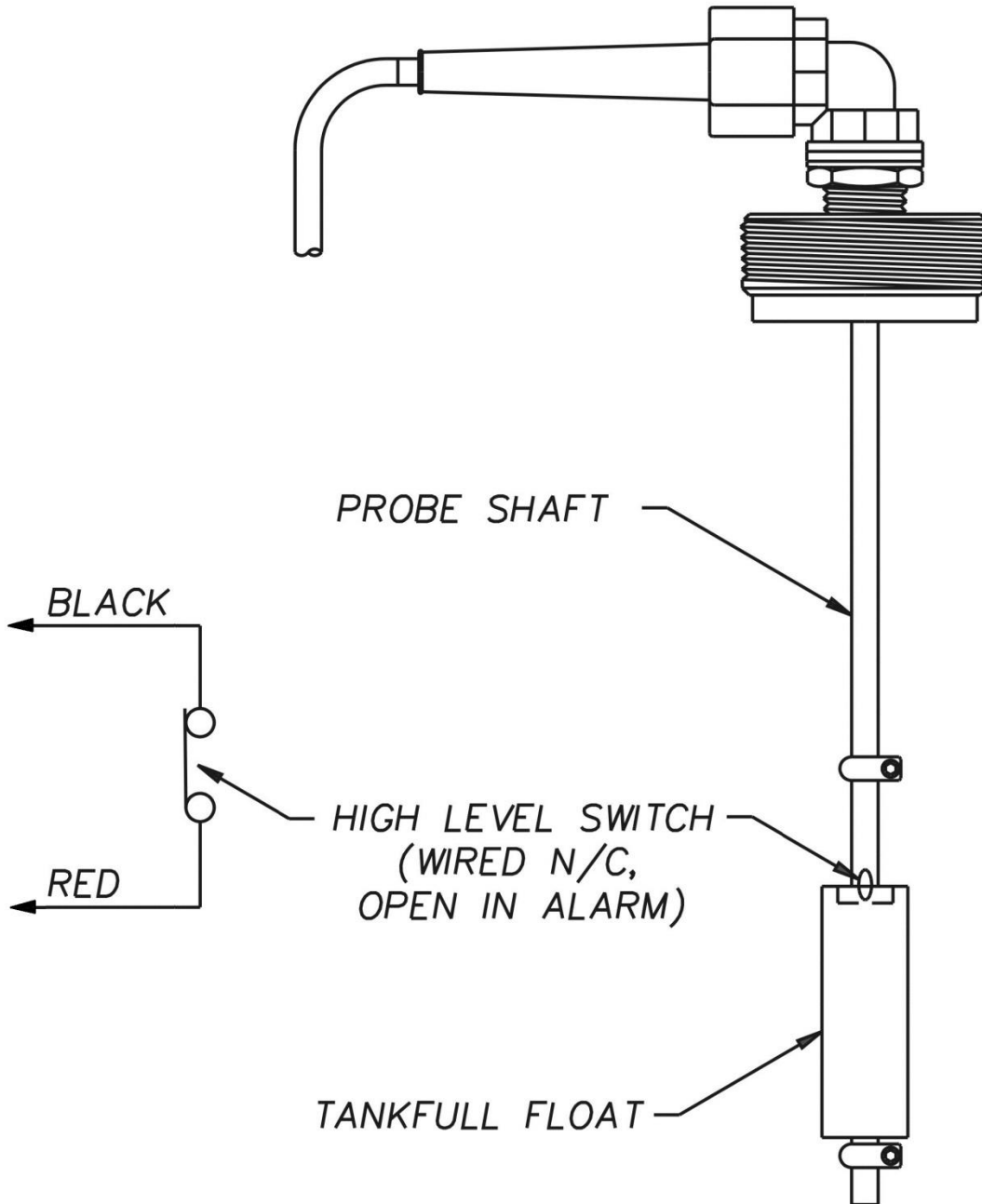


Figure 2-7: Wiring a Tankfull probe to the GECM (requires Field Wiring Diagram.)

System Pre-check

If ordered, the Intake Assembly and Downwell Probe will already be attached to the PSCAV center pipe (as shown in Figure 1-1). Confirm that the Intake Assembly and probe are firmly mounted to the unit and that the stop collar above the HI Water switch (Figure 1-3) is horizontally centered to the weld on the intake screen. This will maximize product intake from the water surface.

Before deploying a PSCAV system into the well, carry out the following unit preparation procedures.

Product Only Systems

Fill the pump water jacket with clean water by turning the PSCAV assembly upside down and removing the plug at the bottom of the water jacket.

Check all wiring. On product-only applications the orange and green wires will not be used or wired to the GECM. For WTDP ready PSCAV, verify exposed wiring to the water pump/motor are zip tied and out of the way from catching on the walls of the well.

System Deployment

1. Attach one end of the 3/8" nylon product hose to the compression fitting on the check valve (see Figure 2-8.)
2. Attach a winch cable to the eyebolt of the PSCAV system and carefully lower the assembly into the well.
 - As you place the unit into position, ensure that the water pump intake (WTDP applications) is no closer than 1' (30 cm) from the bottom of the well. This will prevent debris from entering the pump intake which can cause premature wear to the pump impellers.



Under no condition should a PSCAV system be suspended down the well by its power cord or discharge hoses.

3. Confirm that the output hose of the water pump is connected to suitable collection point or proper runoff.
 - Check local regulations.
4. Run the 3/8" nylon product discharge hose to the product recovery tank.
5. Set both the product and water pumps to OFF. Apply power to the GECM.
 - This will allow you to observe the control panel display for float positions.
 - See *Section 3: System Operation* "GECM Display Messages" for display information.
6. Adjust the position of the PSCAV assembly in the well until the product float is suspended in product.
7. GECM display will read water and product levels.
 - Refer *Section 3: System Operation* for display definitions. You may need to run the water pump in HAND until a stable "cone of depression" within the water table has been established.



When the pump assembly passes through the hydrocarbon/water interface, fluid displacement will artificially raise the level of the interface in the well. This condition can persist for up to 48 hours depending upon the permeability of the earth surrounding the well. Readjustment of the PSCAV system level as a whole may be required.

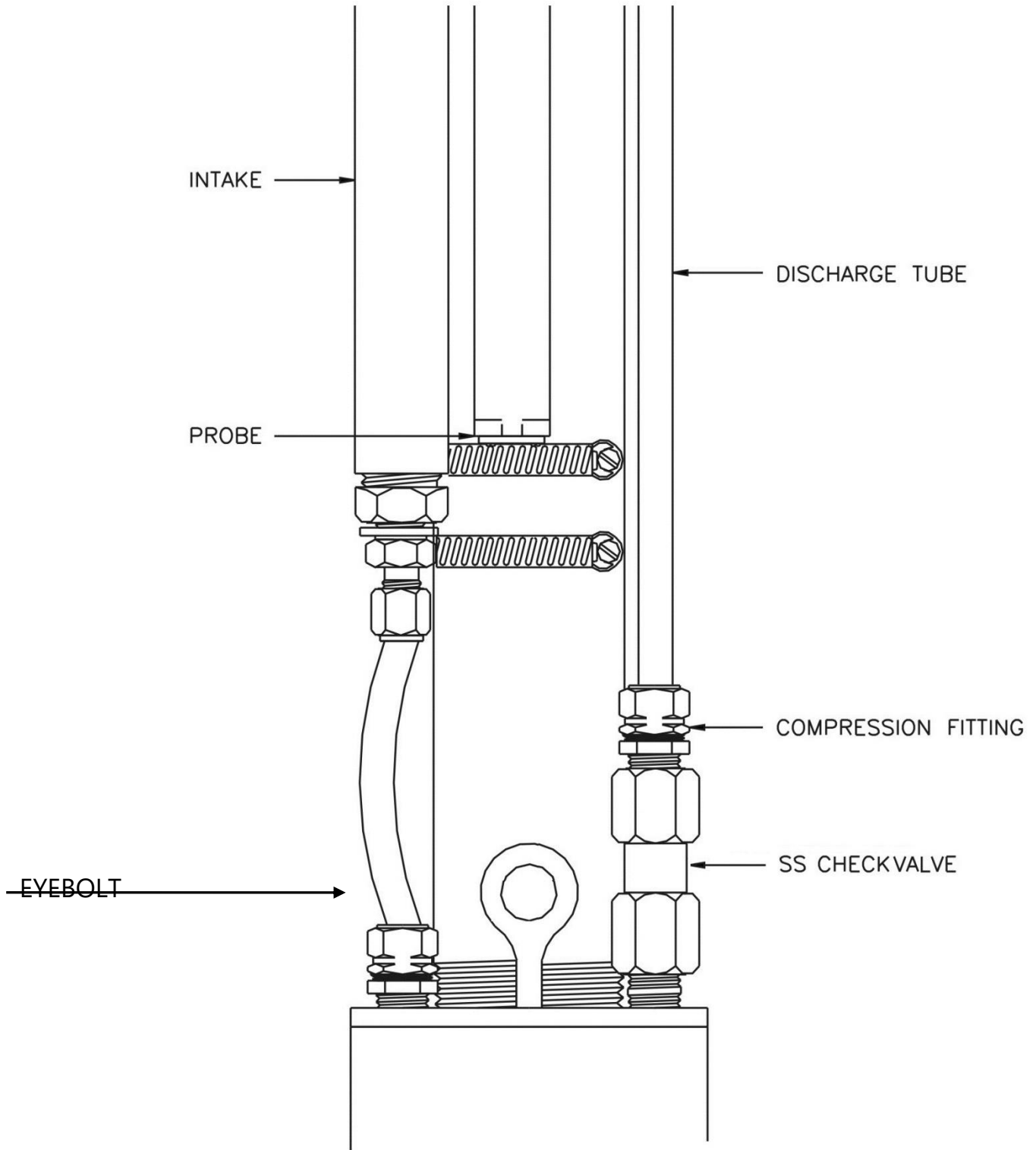


Figure 2-8: Location of Discharge Hose

Section 3: System Operation

System Startup

Verify product discharge line is securely connected to the product recovery containment vessel.



Before starting the pump, read the GECM control panel manual and become thoroughly familiar with all panel controls and indicators. Proceed as follows to start the system.

1. Visually inspect all power wire terminations are tied down and no loose wire ends are left unterminated.
2. System pre-check and deployment are complete.
3. Turn all HAND/OFF/AUTO switches to OFF.
4. Apply power to system through on-site breaker or integrated disconnect.
5. Open the water pump discharge valve completely by turning it counter-clockwise.
6. Turn the WATER PUMP CONTROL switch to AUTO.



The water pump side of the system should be purged if free phase hydrocarbon is present in the well at deployment. To do this, place the output hose in a suitable container and run the pump on HAND until the water runs clear. Dispose of purged hydrocarbon according to local codes.

7. With the water pump running on AUTO, establish a pumping level and throttle down the outflow by adjusting the discharge valve.
8. Reduce the rate of pump cycling as far as possible without going below the minimum flow rate recommended by the pump's manufacturer.
 - The pump should be valved to approach continuous operation while maintaining the desired water level.



Adjust the position of the down well assembly as explained in *Section 2: System Installation*.

9. Start the product pump by turning the PRODUCT PUMP CONTROL switch to AUTO.
 - If the product float is up and Water-HI is not, product pump will start.

Once startup has been achieved, the PSCAV system should function automatically.

GECM Display Messages

The following display messages are common to the operation of the WTDP ready PSCAV system.

PSCAV Displays

Line 1 messages:

```
HAND:Px H2Ox ORx
AUTO:Px H2Ox ORx
AUTO: TANKFULL          (condition)
AUTO: OVERRIDE          (fault)
AUTO:PROBE FAULT        (fault)
AUTO: AUX ALARM         (fault)
```

Line 2 messages:

```
PRODnnnn H2Onnnn
```

Where

x =H (high), M (middle), or L (low)
nnnn =ON, OFF or HAND

The “Px H2Ox ORx” portion of the display is representative of the fluid as read by the float positions along the probe. “Px” represents the Product level within the reservoir, “H2Ox” represents the position of the water float, and “ORx” represents the override float.

Multiple PSCAV Systems

Line 1 messages:

```
PSCAV SYSTEM #
PSCV#: TANKFULL          (condition)
PSCV#: OVERRIDE          (fault)
PSCV#: PROBEFAULT        (fault)
PSCV#: AUX ALARM         (fault)
```

Where

=1, 2, 3 or 4 (SDPS/PSCAV number)

Additional Messages for Multiple PSCAV Systems

```
PSCAV #: LEVELS          (fault)
OVERRIDE
```

```
PSCAV #: LEVELS          (fault)
PROBE FAULT
```

```
PSCAV #: LEVELS
Px H2Ox ORx
```

Where

=1, 2, 3 or 4 (SDPS/PSCAV number)
x =H (high), M (middle), or L (low)

Telemetry Messages on GECM Display -

Each GECM unit equipped and enabled with Telemetry will send a text message to the programmed phone numbers for every condition and fault for the specific device listed in the previous pages. The battery backup will send an additional “Power On” and “Power Outage” text message to inform the user of power status. Additional display and details correlating to the Telemetry package are listed below. Custom units may have varying Display and Telemetry alerts.

Startup sequence:

```
Waiting on Modem
Startup
```

This indicates the modem is going through initiation routines and connecting to the cellular network. This will happen every time the system is powered on, and when telemetry is enabled through the keypad.

Sending SMS alert:

```
Sending msg #--
To phone [x] of [X]
```

This indicates the modem is currently sending a message to programmed phone numbers. Text messages correspond to the device and display definitions listed in the previous pages.

Receiving SMS Query:

```
Query [x] match
```

This indicates the modem has successfully received a query text message. This screen is followed by the “Sending SMS alert” display which is responding to the query.

System’s response to text message “STATUS?” (case sensitive):

System Standby	System On, all HOA switches in the “OFF” position
System Running	One or all HOA switches in the “ON” position
System In Alarm	System experiencing fault, see last message received

If GECM is not responding to query messages, check that power is ON and that the antenna is attached. Damaged antennas should be replaced as soon as possible.

Geotech GECCM Telemetry User Interface Flow Chart

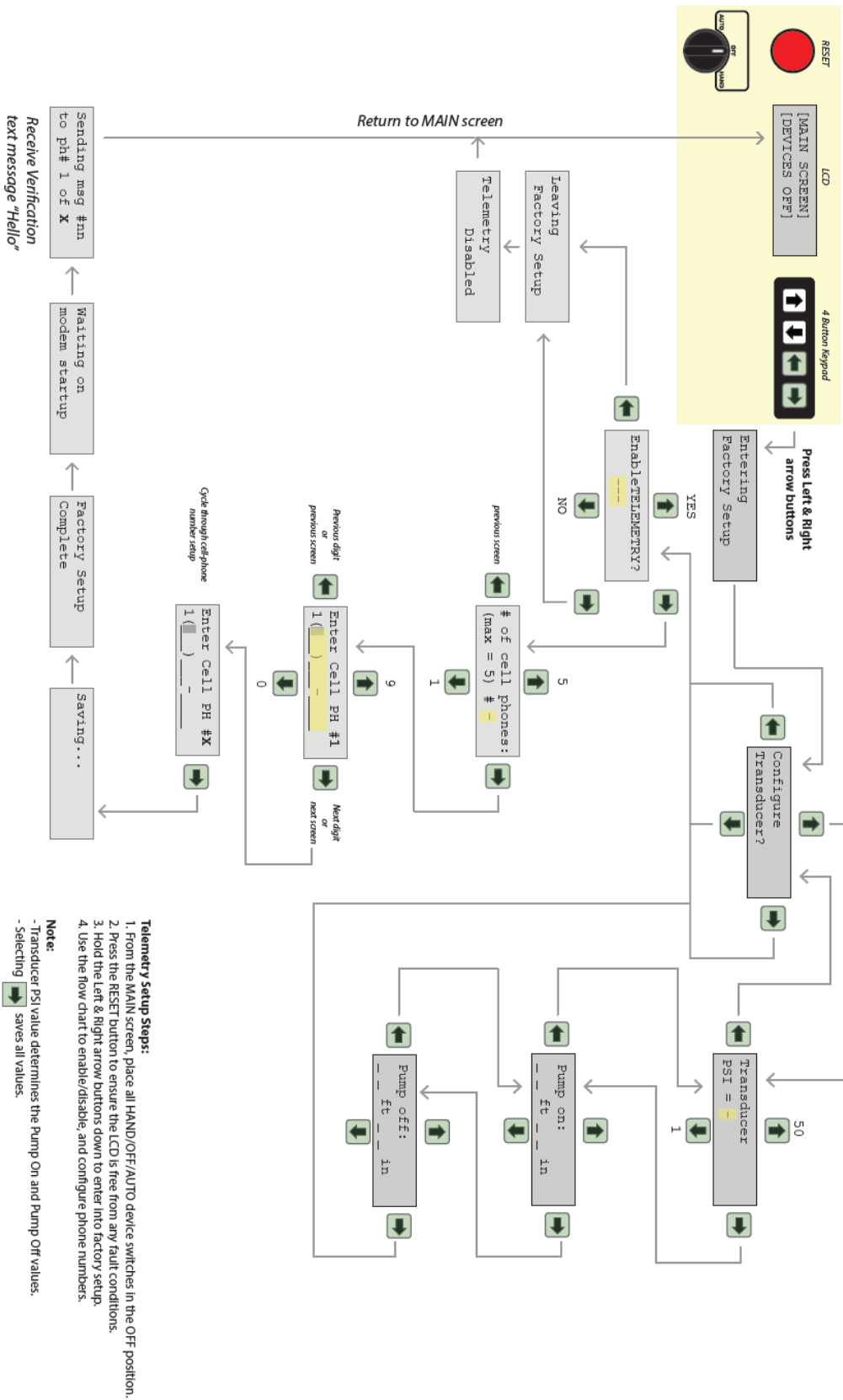


Figure 3-1: GECCM Telemetry User Interface Flow Chart

Section 4: System Maintenance

Clean Intake Strainer

The intake is a two-stage strainer that can easily be disassembled for cleaning. This should be done periodically to insure that the product pump will not run dry. Time elapsed between cleanings will depend upon well conditions.

In the event that frequent strainer cleanings are not considered a cost effective maintenance procedure, the inner 100-mesh strainer can be removed. By using a 1/2" MPT x 1/4" FPT threaded reducer bushing, the 60 mesh outer strainer can be used alone. However, the long-term effects on the product pump must be considered when the 100 mesh inner strainer is not used. Pumping damaging debris will quickly diminish the performance of the pump gears, lead to the need for pump repair or replacement, and increase the overall down time of the system. With proper usage and servicing, the two-stage intake strainer should substantially increase the life of the pump.



It is recommended that you use the PSCAV system to collect product that is acceptable to the internal 100 mesh screen of the intake (see also the Viscosity Chart in Figure 6-1.) If well conditions require something more aggressive, then contact your Geotech Sales Representative.

Because the downwell pump assembly must be removed from the well to perform maintenance on the intake strainer, Geotech recommends performing a general inspection of the entire assembly whenever the pump is removed. It is particularly important to inspect the flexible product hose. Replaced the hose if leaks or major kinks are discovered.

Clean Probes

Clean probe shafts and floats on a regular basis. Use phosphate detergent, warm water and a soft brush. The required frequency of cleanings depends on the site conditions and must be determined by the user. Failure to clean the probe will result in fouling that could cause system malfunction.

Water Pump Maintenance

The following is a schedule of water pump maintenance.

Water Table Depression Pump System Frequency of Maintenance Tasks / Quarterly Calendar												
Task	Week											
	1	2	3	4	5	6	7	8	9	10	11	12
Check flow rate to ensure minimum cycling frequency	•	•	•	•	•	•	•	•	•	•	•	•
Remove cover from probe and clean floats/conductivity sensors	•	•	•	•	•	•	•	•	•	•	•	•
Check start box for moisture accumulation		•		•		•		•		•		•
Take current draw readings and compare with motor specification				•				•				•
Inspect hoses and wires for cracks, cuts, and abrasions												•

Backup Check valve

Geotech recommends installing an alternate check valve in the event of a primary check valve failure. Installation can be carried out without removing the downwell pump assembly from the well. The backup check valve will consist of a white Acetal valve, two stainless steel reducer bushings and two brass compression fittings. This specific valve is not interchangeable with the check valve installed on the unit and is mounted as a backup only. Contact your Geotech Sales Representative for these parts when a backup check valve is needed.

To install an inline check valve

1. Cut the nylon discharge line at a convenient accessible location next to the wellhead.
2. Thread the stainless steel reducer bushings into the valve ends using PTFE tape on all male threads.
3. Orient the valve so that the arrow points in the direction of fluid flow.
4. Thread the compression fittings into the reducer bushing using PTFE tape.
5. Insert the cut ends of the discharge line into the compression fittings and tighten.

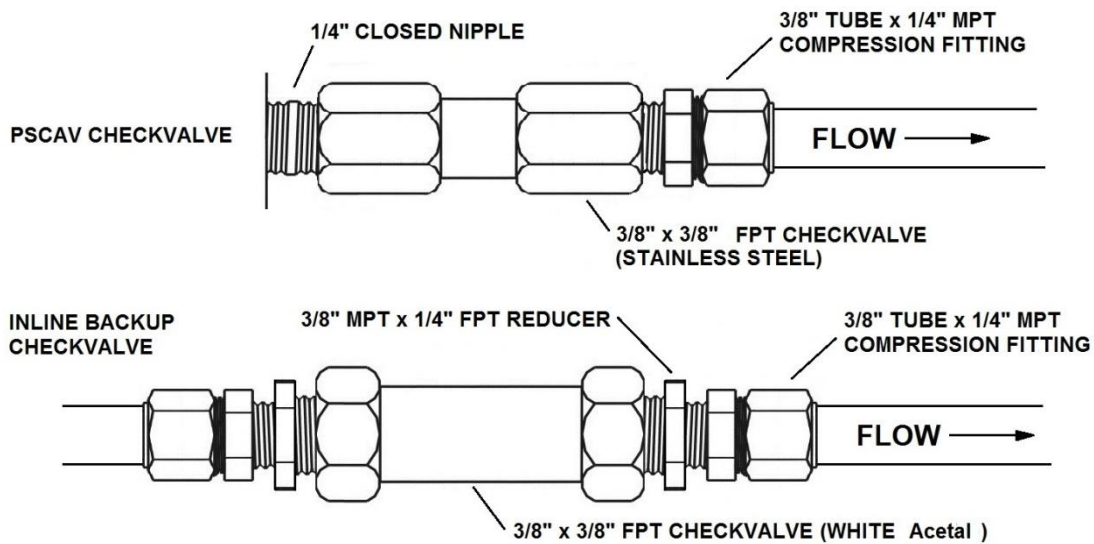


Figure 4-1: Parts configuration for standard and back up check valves.

Section 5: System Troubleshooting



These procedures are meant to be carried out by personnel qualified to work on electrical circuitry. If in doubt, obtain the services of a qualified electrician.

Getting Help

- Read the entire manual and become thoroughly familiar with all system components before initiating any of the following troubleshooting procedures.
- If the troubleshooting procedures in this section indicate a component failure, prepare a written list of all problems encountered while operating the equipment, then call Geotech Environmental Equipment for assistance.

Service Locations

Geotech Field Service personnel are trained on all aspects of the equipment and are dedicated to helping you maximize the efficiency and cost effectiveness of your PSCAV system. For technical support, call our Geotech Service office.

Geotech Environmental Equipment, Inc.
2650 East 40th Avenue
Denver, CO 80205
Toll Free Phone: (800) 833-7958
Commercial Phone: (303) 320-4764
Fax: (303) 322-7242
www.geotechenv.com

Troubleshooting Procedures

In the process of troubleshooting, it may be necessary to open the GECM control panel. In such cases, always disconnect the power before proceeding. Avoid shorting any power to the PCB or PCB cover. Because all probe wiring is rated Intrinsically Safe, probe connectors may be disconnected from their receptacles without disconnecting the power.

Troubleshooting the PSCAV is primarily a matter of checking the function of the intake strainer and the probes. The GECM is designed to be maintenance free. The water pump/motor is factory sealed with no field replaceable parts. Before proceeding with this section, refer to the troubleshooting section of your GECM User Manual.

Possible malfunctions are listed as follows:

Problem: Water pump running but no water delivered

Cause:

1. Discharge valve closed.
2. Discharge hose kinked or blocked.
3. Pump motor running backwards (3-Phase motors only).
4. Debris clogging intake.
5. Cut wire.

Solution:

1. Open valve.
2. Locate blockage and clear.
3. Reverse any two legs at the connection between the pump power cord and the control panel.
4. Pull unit and inspect all wiring.

Problem: Product pump will not run on AUTO, runs dry on HAND

Cause:

1. The intake is plugged with debris.
2. The product pump is mounted too low with respect to the intake.
3. The pump has decoupled from the motor.

Solution:

1. Remove the pump assembly from the well, disassemble the intake and clean the 100-mesh intake screen.
2. Remove the pump assembly from the well and confirm that the HI Product switch on the Downwell Probe is positioned above the weld on the product pump intake screen (see Figure 1-3).
3. Refer to Figures 1-2-1 and 1-2-2 and confirm that the output pressure generated by your system does not exceed the decoupling pressure of the pump.

Problem: Pump will not run on HAND or AUTO

Solution:

1. Confirm that power is reaching the GECM or other control panel.
2. If power is reaching the GECM, then check for a faulty Tankfull probe by unplugging its connector at the GECM and jumpering between receptacle sockets A and B. If the pump runs on HAND with the Tankfull disconnected, then the problem is most likely a faulty Tankfull probe or cable.
3. It is also possible that the recovery tank is full, or that the float on the probe has been re-installed upside down after being cleaned.
4. If the problem is not in the GECM or Tankfull probe, then a faulty product pump/motor or cord should be suspected. Remove the pump assembly from the well, move it and the GECM to a non-hazardous location and check the pump operation and power cord. A faulty product pump/motor should be replaced. If the pump will not run after carrying out these procedures, the wiring or the pump motor itself may require repair or replacement. Call your Geotech Sales Representative for assistance.

Problem: Pump Runs on HAND but not on AUTO

Cause: The most likely source of trouble in the AUTO mode is a probe circuit fault or a bad connection at the wellhead junction box.

Solution:

1. Use a continuity meter to check probe connections at the panel or at the terminal strip inside the wellhead junction box. If no bad connections are found, proceed as follows to determine if the probe fault is in one of the probes or in the panel's control circuitry.
2. If the probe is faulty then call Geotech for assistance.

Problem: Water Pump Runs Dry

Cause:

1. Discharge valve is closed
2. Discharge hose kinked or blocked.
3. Pump motor is running backwards (3-Phase motors only).

Solution:

1. Open valve.
2. Locate blockage and clear.
3. Reverse any two of the three power legs at the connection between the water pump power cord and the control panel.

Problem: Product Pump Performs Poorly

Cause:

1. The product pump motor is running backwards.
2. Voltage drop caused by long wire runs.
3. Product pump is worn from pumping grit and debris.

Solution:

1. Check the Field Wiring Diagram supplied with your GECM and confirm that the product pump is not wired backwards.
2. Increase gauge of pump power wires if runs are longer than approximately 100' (30 m).
3. Remove pump from well and check gears for wear. Pressure test the pump for discharge head capability (see Figure 1-2, for pump performance curve). If gears are worn, pump head must be replaced by a Geotech technician.

Tankfull Probe



The following applies to control panels with a Tankfull receptacle. As a safety measure, systems with an integrated Tankfull probe will shut down when the probe is disconnected or the cable is cut.

Normally Closed connection. Simulates that the Tankfull float is down. Pump will run. Removing the A – B jumper connection will simulate a Tankfull float up. Shuts pump off.

One common problem with the Tankfull probe not working is the float being installed upside down after cleaning.

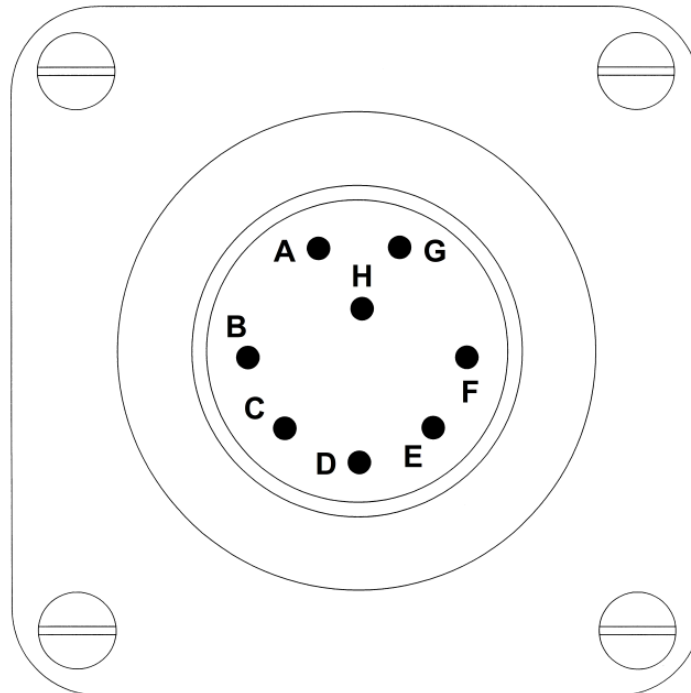


Figure 5-1: 8 pin Tankfull Probe receptacle.

GECM Troubleshooting

Use this section, in conjunction with the Display Definitions found in Appendix B, to troubleshoot any occurring system problems.



The RESET button must be depressed to clear a system fault or condition. This will also automatically restart any devices still set to AUTO.

No Apparent Power to the GECM

- Check all incoming wire connections.
- Check fuses and breakers at power source. (Fuses can also be found on the GECM PCB. These can blow from a voltage spike or incorrect voltage applied to the GECM. Allow a Geotech technician to service these fuses.)

No Display

- Press RESET button (also used to clear the screen).
- Fuse is blown in the GECM PCB or faulty electronics. Return to Geotech for service.

Product Pump Will Not Run

- Check device status at GECM.
- Check for blown fuses (especially at power supply).
- Check for a bad relay connection between GECM and power supply.
- Check wire connections between device and GECM.
- Check reservoir probe floats and verify that nothing is obstructing their movement.
- Check that hydrocarbons are still present in well and that the PSCAV unit is correctly positioned on the hydrocarbon/water interface.
- Check probe wiring to GECM.

Water Pump Will Not Run

- Check device status at GECM.
- Check for blown fuses.
- Check wire connections between device and GECM.
- Check reservoir probe floats and verify that nothing is obstructing their movement.
- Check water level probe floats (when separate water pump in use).
- Check that hydrocarbons are still present in well and that the PSCAV unit is correctly positioned on the hydrocarbon/water interface.
- Check probe wiring to GECM.
- Pump may have over-amped due to obstruction, dry running, or damage. Inspect pump and flow route.

Dry Contact Message

- Check for circuit conflicts between GECM and other devices or switches.
- Have the logic statements and operation of any custom built devices checked.

Probe Fault

- This error will occur when the HI-HI float is in the up position and the HI/LO float is in the down position. Check for free movement on all floats.
- A switch wire may have become disconnected or broken.

Override Message

- Water override float is down and the HI/LO float is up. Check for free movement on all floats.
- A switch wire may have become disconnected or broken.

Tankfull Message

- Product recovery tank is full.
- A switch wire may have become disconnected or broken.

Auxiliary (AUX) Alarm Message

- External system has sent a dry contact message to the GECM, instructing the GECM to shut down. Ensure external system's faults are cleared in order to resume normal operation.
- A wire may have become disconnected or broken, check wiring diagram.

Section 6: System Specifications

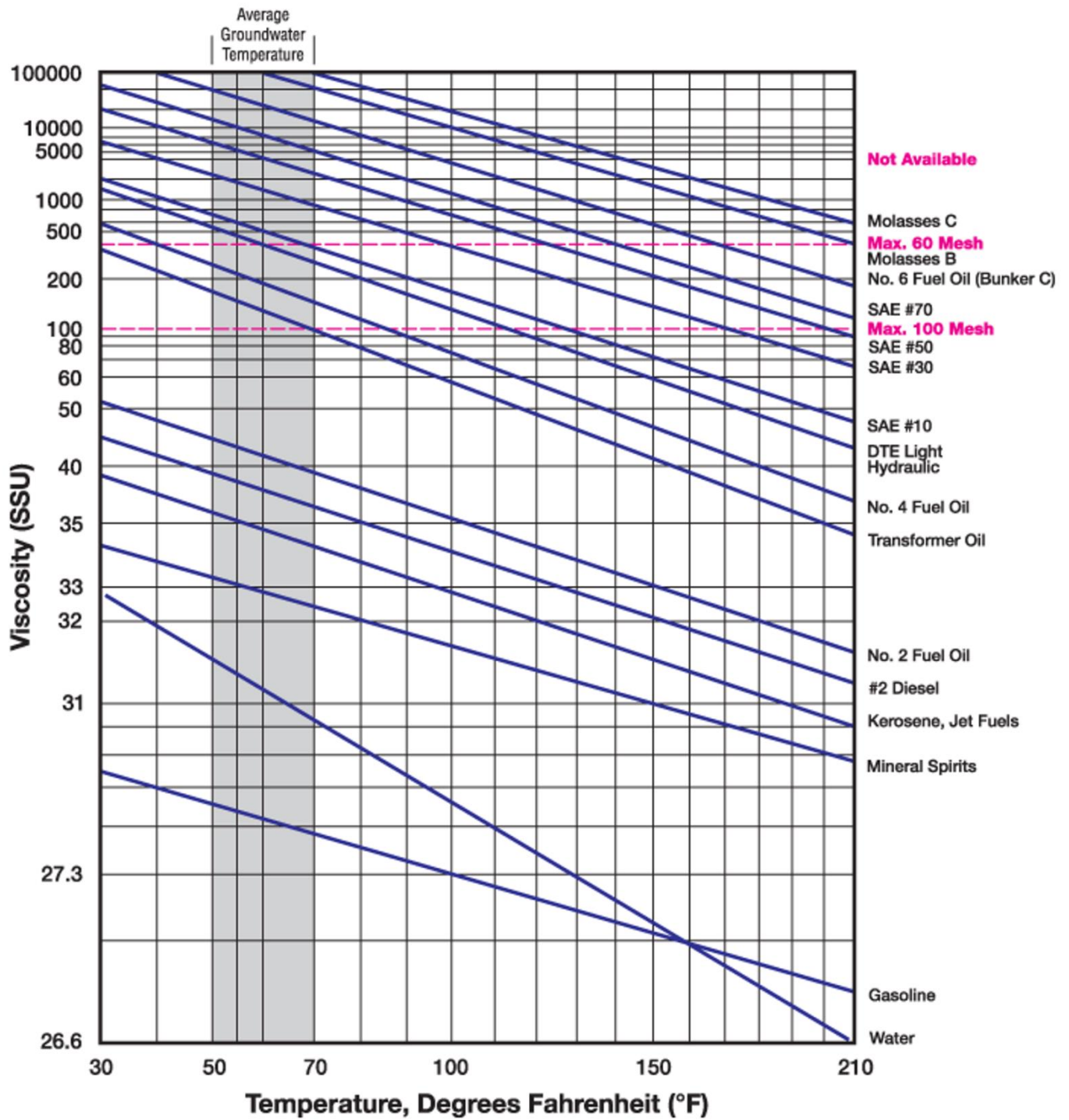


Figure 6-1: Viscosity chart and temperature

PSCAV Specification Sheet

System Type:

___ Product Only ___ WTDP Ready ___ ETFE Cable

WTDP Power Requirements:

___ Voltage ___ Phase ___ HP ___ Hz

Downwell Probe: Y / N

Part No. _____

Connector Attached: Y / N

Part No. _____

Connector Attached: Y / N

Part No. _____

Connector Attached: Y / N

Intake Assembly: Y / N

Power Supply: Y / N

___ 120V

___ 230V

Winch Assembly: Y / N

___ Standard

___ Heavy Duty

Cable / Hose Lengths:

Power Cord Length: _____ ft./m ___ Product Only ___ WTDP Ready

Discharge tubing length: _____ ft./m

Serial No. _____

P.I.D. _____

Inspected by: _____

Customer and Device Information

Customer Name:

Sales Order Number:

Build Date:

GECM Serial Number:

Device Name:	Serial Number:	Model Number:

GECM Wiring

Terminal A – IS Inputs

Lower Tier (1 thru 20)

1		IS +5VDC
2		IS +5VDC
3		IS +5VDC
4		IS +5VDC
5		IS Input
6		IS Input
7		IS Input
8		IS Input
9		IS Input
10		IS Input
11		IS Input
12		IS Input
13		IS +5VDC
14		IS +5VDC
15		IS +5VDC
16		IS +5VDC
17		IS +5VDC
18		IS +5VDC
19		IS +5VDC
20		IS +5VDC

Upper Tier (21 thru 40)

21		IS Input/ Water Sensor Input
22		IS Input/ Water Sensor Input
23		IS Input/ Water Sensor Input
24		IS Input/ Water Sensor Input
25		IS Input
26		IS Input
27		IS Input
28		IS Input
29		IS Input
30		IS Input
31		IS Input
32		IS Input
33		IS Input
34		IS Input
35		IS Input
36		IS Input
37		Normally Closed
38		Normally Closed
39		Normally Closed
40		Normally Closed

Terminal C - Relay/Motor Starter Control Outputs
(1 thru 8)

1		Relay/Motor Starter Control Output
2		Relay/Motor Starter Control Output
3		Relay/Motor Starter Control Output
4		Relay/Motor Starter Control Output
5		Relay/Motor Starter Control Output
6		Relay/Motor Starter Control Output
7		Relay/Motor Starter Control Output
8		Relay/Motor Starter Control Output

Terminal D – HOA Switch Inputs
(1 thru 24)

GND		Ground
1		Input
2		Input
GND		Ground
3		Input
4		Input
GND		Ground
5		Input
6		Input
GND		Ground
7		Input
8		Input
GND		Ground
9		Input
10		Input
GND		Ground
11		Input
12		Input
GND		Ground
13		Input
14		Input
GND		Ground
15		Input
16		Input

PSCAV Specifications and Test Form

PSCAV serial number:	
Probe serial number:	
2 nd probe serial number:	
Product only unit or WTDP:	
Standard cable or Tefzel:	
Unit cable length in feet:	
Product pump serial number:	
Polyamide or Kevlar gear set:	
Open flow of product pump:	
Flow of product pump at 65 PSI:	
Product pump decoupling PSI:	
For WTDP ready units -	
Water motor serial number:	
Water motor model number:	
Nameplate volts:	
Nameplate amps:	
Horsepower (HP):	
Phases (PH):	
Water pump serial number:	
Water pump model or type:	

Section 7: Winch Assembly and Operation

Winch assemblies are available for the PSCAV system. Mount the winch on the well casing as shown in Figure 7-1. Attach the winch cable to the lift cable on the unit. Carefully lower the unit into the well and suspend at the desired level.

The cable on a standard winch has a rated breaking strength of 2000 lb. (907 kg) using the recommended design ratio of 1 to 5. The rated break strength gives a maximum hanging weight of 400 lb. (181 kg).

Because each application is different, it is impossible for Geotech to anticipate the exact hanging weight of your system. Hanging weight is the sum of pump weight, the weight of all discharge piping, and the weight of any water trapped inside the piping. Although it is unlikely that you will exceed the 400 lb. (181 kg) maximum, Geotech highly recommends that you take the time to calculate the hanging weight of your system before deployment.

Use the following procedure to calculate hanging weight.

1. Weigh your pump assembly, including the intake and any attached probes.
2. The weight of the discharge piping can be calculated by weighing a sample length and multiplying by the number of feet suspended in the well. For example, 1.5" ID rubber hose weighs approximately 1 lb. (.45 kg) per foot (.3 m). Therefore, 100' (30 m) of this hose will weigh 100 lbs. (45 kg).
3. The weight of the water in the discharge piping can be estimated by calculating the volume of water in the piping and then converting the volume to weight as follows:

Volume in gallons

$$\text{Volume (in}^3\text{)} = \pi \times [\text{inside radius of pipe (in)}]^2 \times [\text{length of pipe (in)}]$$

$$\text{Gallons} = 0.00433 \times \text{Volume (in}^3\text{)}$$

$$1 \text{ Gallon (water)} = 8.325 \text{ lbs}$$

$$\text{Weight of Water (lbs)} = 8.325 \times \text{Gallons}$$

Volume in liters

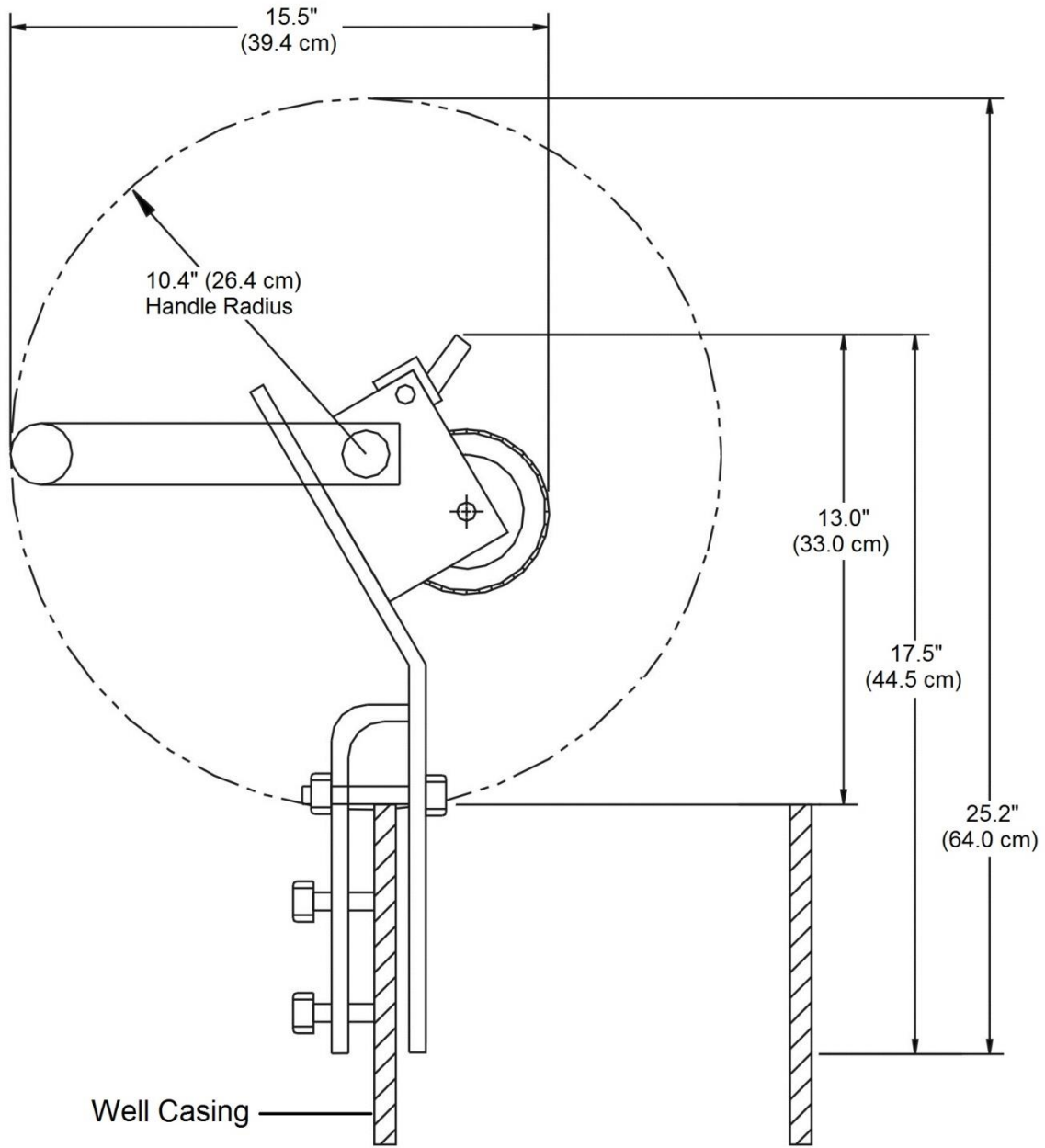
$$\text{Volume (cm}^3\text{)} = \pi \times [\text{inside radius of pipe (cm)}]^2 \times [\text{length of pipe (cm)}]$$

$$\text{Liters} = 0.001 \times \text{Volume (cm}^3\text{)}$$

$$1 \text{ Liter (water)} = 1 \text{ kg}$$

$$\text{Weight of Water (kg)} = \text{Total number Liters}$$

4. Find the sum of the pump weight, piping weight, and water weight. This sum will provide a close approximation of the total hanging weight. If the total hanging weight approaches or exceeds 400 lbs. (181 kg), then contact Geotech to discuss an optional winch cable with an increased break strength rating.



Note: Winch is 9" (22.9 cm) wide with handle attached.

Figure 7-1: Standard winch assembly attached to well head.

Section 8: Replacement Parts and Accessories

This section lists standard components and optional accessories supporting a PSCAV system and the upgraded ETFE PSCAV. Additional accessories and fittings not listed can be found within the Geotech catalog. Water pump requirements can be obtained from your local Geotech Sales Representative.

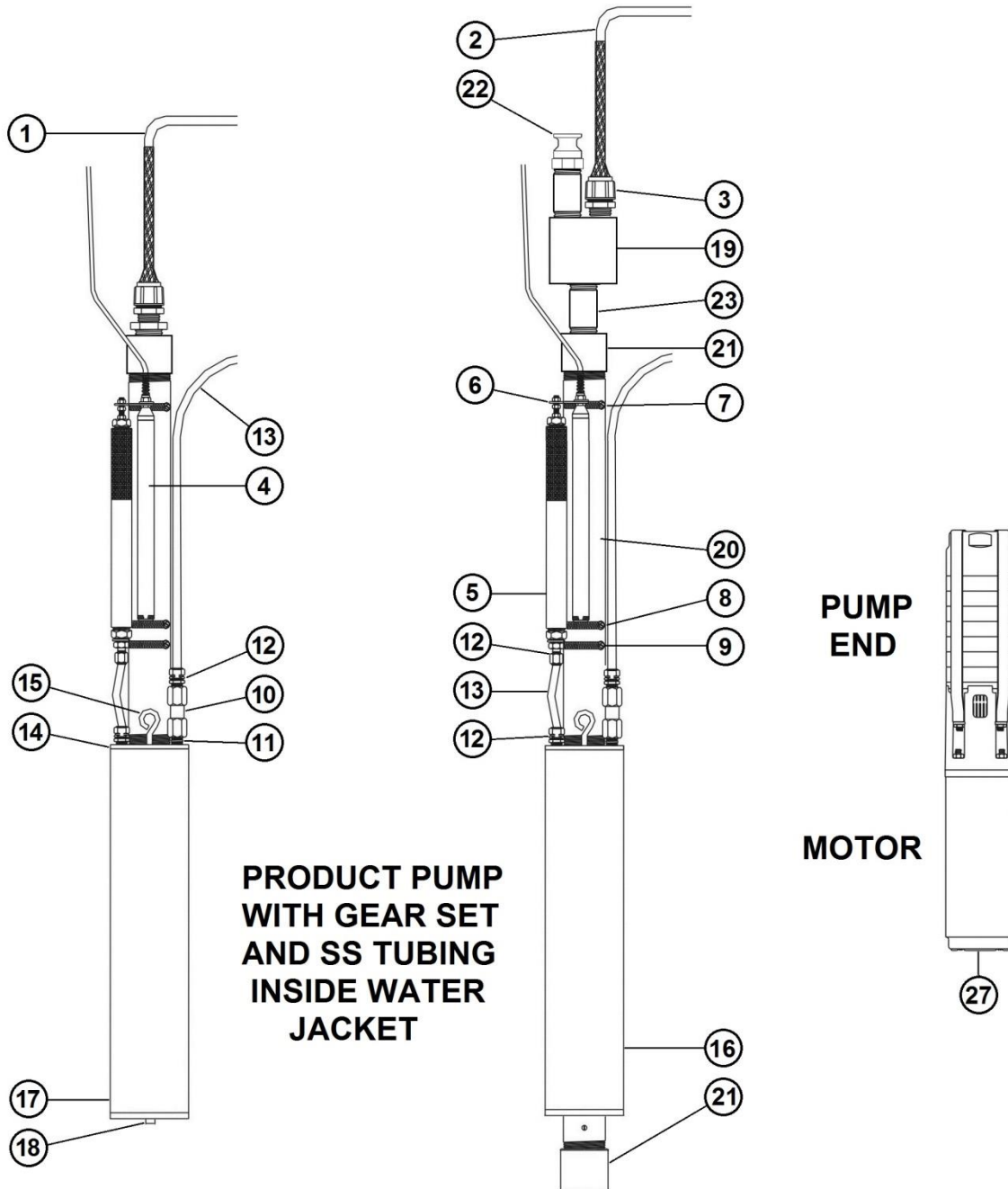


Figure 8-1: Standard PSCAV system components.

Item #	Part Description	Part Number
1	ASSY,CABLE,PRODUCT PUMP 100' FIELD REPLACEABLE	2104100
2	ASSY,CABLE,WTDP 100' FIELD REPLACEABLE	2104101
3	STRAIN RELIEF,NYL,3/4"NPT	10519
4	PROBE ASSY,SD,100'	2390072
4	PROBE,SM.DIA.,COND,25'	56120003
4	PROBE,SM.DIA.,DENS,100'	56120009
4	PROBE,SM.DIA.,DENS,25'	56120010
4	PROBE,SM.DIA.,COND,100'	56120011
4	PROBE,SM.DIA.,DENS,50'	56120013
	ASSY,WATER FLOAT,SM DIA	2020101
	PRODUCT FLOAT ASSY,SM DIA	2020102
	PRODUCT PUMP MOTOR ASSEMBLY	2020104
	TUBING,SS4,.375ODx1.625	ORS090008
	KIT,GEAR SET,MP,KEVLAR PRODUCT PUMP	16100001
5	INTAKE ASSY FOR PSCAV	2240023
6	CONN,INTAKE,SST	ORS698001
7	PROBE TOP CLAMP ASSY	2240014
8	PROBE BOT CLAMP ASSY	2240020
9	INTAKE COMP FTG CLAMP	2240015
10	CHECK VALVE,SST,1/4,1-2.5 PSI CRACKING PRESSURE	PPP006032
	CHECK VALVE,3/8"NPT,VITON SEAT ACETAL BODY SST SPRING	PPP006003
11	NIPPLE,SS,.25"xCLOSE	PPP009100
	BUSHING,SS4,.375"x.25"	PPP012057
12	CMPRSN,BRS,3/8x1/4MPT	PPP019002
13	HOSE,NYL,.375"OD,.05"WALL	PPP001051
14	CAP,WATER JKT,SS,3.5OD	ORS689002
15	BOLT,SS8,1/4-20x2",EYE,FORGED	PPF067003
16	WATER JACKET,SS,16",WTDP READY	ORS689001
17	WATER JACKET,16"Lx3 3/8"	00290
18	PLUG,SST,1/4"MPT,SQ HD	PPP038014
19	WELDMENT,CABLE EXIT SDFS	ORS758002
20	NIPPLE,SS4,1.5"x24"	PPP009102
21	COUPLING,SS4,1.5"x1" BAR STOCK ONLY	PPP021036
22	QDISC,BRS,1"Mx1"FNPT	PPP007041
23	NIPPLE,SS,1"x3"	PPP009093

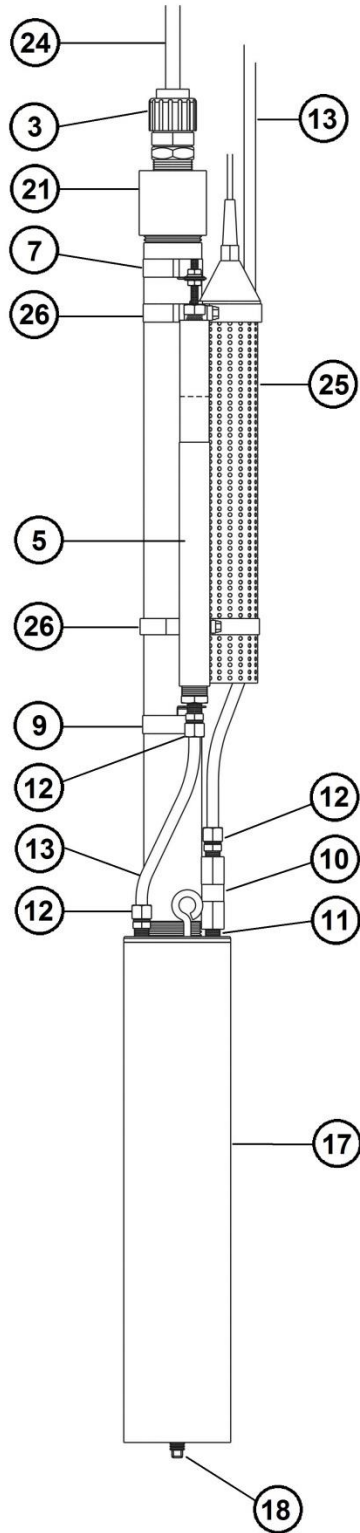


Figure 8-2: Upgraded PSCAV system with ETFE power cord, polyamide gearset and a larger probe with SS floats.

Components for modified units:

Item #	Part Description	Part Number
24	CABLE, 14/4, ETFE, YELLOW	00357
	PROBE, DENS, WATER, W/FEP, 2005	56120001
25	PROBE, DENS, PRODUCT, W/FEP, 2005	56120002
	FLOAT, SS, .93SG WATER	ORS190004
	FLOAT, SS, .60 SG, 1.0" DIA PRODUCT	ORS190005
26	CLAMP, SS3, WORM GEAR, 65.89MM	11400007

See Appendix A: Submersible Water Pumps for available water pumps.

Additional Parts and Accessories

Part Description	Part Number
POWER SUPPLY, 115V/12V	2391055
POWER SUPPLY, 230V/12V	2392055
ASSY, WINCH, STD DUTY, 71FT 1000LB MAX	2020005
ASSY, WINCH, HEAVY DUTY, 110FT 2500LB MAX	2030001
JUNCTION BOX, SIGNAL	2390065
JUNCTION BOX, XP	2390066
POWER RECEPTACLE ASSY, 115V, EP	1011907
POWER RECEPTACLE ASSY, 230V, EP	1022903
TANKFULL PROBE, 25', NO CONN	2390073
TANKFULL PROBE, 2005	56020009
MANUAL, TEST KIT, HYDROCARBON VISCOSITY	26030020
TEST KIT, HYDROCARBON VISCOSITY	86020001
MANUAL, GECM	16110163
MANUAL, SD PROBE SCAVENGER WTDP READY	10438
GECM, PSCAV, 6 WELL SYSTEM	86110009
GECM, 115V, 4" PROBE SCAVENGER, WTDP	86110012
GECM, 230V, 4" PROBE SCAVENGER, WTDP	86110013
GECM, 115V, 4" PROBE SCAVENGER, PROD ONLY	86110014
GECM, 230V, 4" PROBE SCAVENGER, PROD ONLY	86110015
GECM, 230V, 4" PROBE SCAVENGER WTDP, W/TRANSDUCER	86110023

Appendix A – Submersible Water Pumps

Refer to the installation and operation manuals included with your pump and motor. The following pages will include cable and motor specifications as well as start box schematics.

Table A-1: Two or Three Wire Cable, 60 Hz (Service Entrance to Motor – Maximum Length in Feet)

Motor Rating		AWG Copper Wire Size												
Volts	HP	14	12	10	8	6	4	3	2	1	0	00	000	0000
115	1/3	130	210	340	540	840	1300	1610	1960	2390	2910	3540	4210	5060
	1/2	100	160	250	390	620	960	1190	1460	1780	2160	2630	3140	3770
230	1/3	550	880	1390	2190	3400	5250	6520	7960	9690	11770			
	1/2	400	650	1020	1610	2510	3880	4810	5880	7170	8720			
	3/4	300	480	760	1200	1870	2890	3580	4370	5330	6470	7870		
	1	250	400	630	990	1540	2380	2960	3610	4410	5360	6520		
	1 1/2	190	310	480	770	1200	1870	2320	2850	3500	4280	5240		
	2	150	250	390	620	970	1530	1910	2360	2930	3620	4480		
	3	120*	190	300	470	750	1190	1490	1850	2320	2890	3610		
	5	0	0	180*	280	450	710	890	1110	1390	1740	2170	2680	
480	7 1/2	0	0	0	200*	310	490	610	750	930	1140	1410	1720	
	10	0	0	0	0	250*	390	490	600	750	930	1160	1430	1760
	15	0	0	0	0	170*	270*	340	430	530	660	820	1020	1260

Lengths without the asterisk (*) meet the U.S. National Electrical Code ampacity for either individual conductors or jacketed 60°C cable. Lengths marked * meet the NEC ampacity only for individual conductor 60°C cable in free air or water, not in conduit. If cable rated other than 60°C is used lengths remain unchanged, but the minimum size acceptable for each rating must be based on the NEC Table column for that temperature cable.



Flat molded cable is considered to be jacketed cable.

Maximum lengths shown maintain motor voltage at 95% of service entrance voltage, running at maximum nameplate amperes. If service entrance voltage will be at least motor nameplate voltage under normal load conditions, 50% additional length is permissible for all sizes. This table is based on copper wire. If aluminum wire is to be used, it must be two sizes larger.

Example: If the table calls for 12AWG copper wire, 10AWG aluminum wire would be required.

The portion of the total cable length which is between the supply and single phase control box with line contactor should not exceed 25% of the total maximum allowable, to ensure reliable contactor operation. Single-phase control boxes without line contactors may be connected at any point in the total cable length.

Lengths represent a 5% voltage drop. If 3% is required, multiply by .6 for maximum feet. Contact manufacturer for 75°C or 90°C cable lengths.



The portion of the total cable between the service entrance and a 3Ø motor starter should not exceed 25% of the total maximum length to assure reliable started operation.



Use of smaller than recommended cable voids warranty, can cause failure of the motor to start and operate properly, and may cause cable overheating.

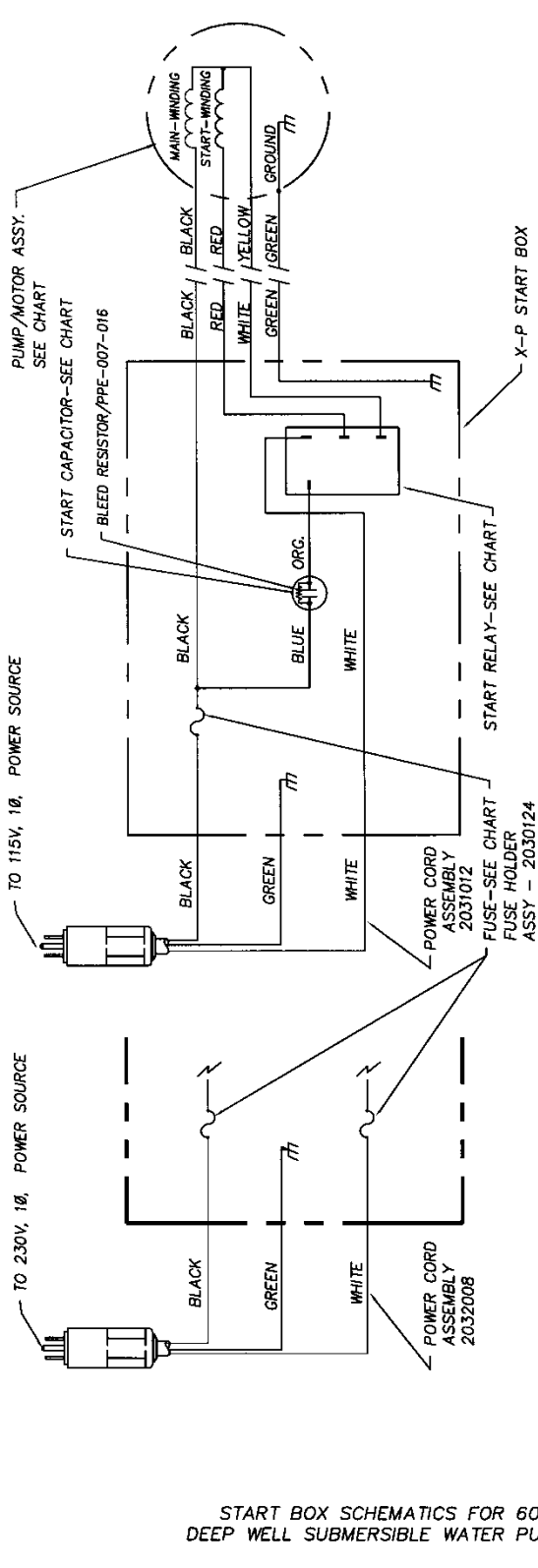
Table A-2a: 3-Phase Cable, 60 Hz (Service Entrance to Motor – Maximum Length in Feet)

Motor Rating		AWG Copper Wire Size													MCM Copper Wire Size					
Volts	HP	14	12	10	8	6	4	3	2	1	0	00	000	0000	250	300	350	400	500	
200V 60 Hz Three Phase Three Wire	1/2	710	1140	1800	2840	4420														
	3/4	510	810	1280	2030	3160														
	1	430	690	1080	1710	2670	4140	5140												
	1 1/2	310	500	790	1260	1960	3050	3780												
	2	240	390	610	970	1520	2360	2940	3610	4430	5420									
	3	180	290	270	740	1160	1810	2250	2760	3390	4130									
	5	110*	170	280	440	690	1080	1350	1660	2040	2490	3050	3670	4440	5030					
	7 1/2	0	0	200	310	490	770	960	1180	1450	1770	2170	2600	3150	3560					
	10	0	0	0	230*	370	570	720	880	1090	1330	1640	1970	2390	2720	3100	3480	3800	4420	
	15	0	0	0	160*	250*	390	490	600	740	910	1110	1340	1630	1850	2100	2350	2570	2980	
	20	0	0	0	0	190*	300*	380	460	570	700	860	1050	1270	1440	1650	1850	2020	2360	
	25	0	0	0	0	0	240*	300*	370*	460	570	700	840	1030	1170	1330	1500	1640	1900	
	30	0	0	0	0	0	0	250*	310*	380*	470	580	700	850	970	1110	1250	1360	1590	
	230V 60 Hz Three Phase Three Wire	1/2	930	1490	2350	3700	5760	8910												
3/4		670	1080	1700	2580	4190	6490	8060	9860											
1		560	910	1430	2260	3520	5460	9780	8290											
1 1/2		420	670	1060	1670	2610	4050	5030	6160	7530	9170									
2		320	510	810	1280	2010	3130	3890	4770	5860	7170	8780								
3		240	390	620	990	1540	2400	2980	3660	4480	5470	6690	8020	9680						
5		140*	230	370	590	920	1430	1790	2190	2690	3290	4030	4850	5870	6650	7560	8460	9220		
7 1/2		0	160*	260	420	650	1020	1270	1560	1920	2340	2870	3440	4160	4710	5340	5970	6500	7510	
10		0	0	190*	310	490	760	950	1170	1440	1760	2160	2610	3160	3590	4100	4600	5020	5840	
15		0	0	0	210*	330	520	650	800	980	1200	1470	1780	2150	2440	2780	3110	3400	3640	
20		0	0	0	0	250*	400	500	610	760	930	1140	1380	1680	1910	2180	2450	2680	3120	
25		0	0	0	0	0	320*	400	500	610	750	920	1120	1360	1540	1760	1980	2160	2520	
30		0	0	0	0	0	260*	330*	410*	510	620	760	930	1130	1280	1470	1650	1800	2110	
460V 60 Hz Three Phase Three Wire		1/2	3770	6020	9460															
	3/4	2730	4350	6850																
	1	2300	3670	5770	9070															
	1 1/2	1700	2710	4240	6730															
	2	1300	2070	3240	5150	8050														
	3	1000	1600	2520	3970	6200														
	5	590	950	1500	2360	3700	5750													
	7 1/2	420	680	1070	1690	2640	4100	5100	6260	7680										
	10	310	500	790	1250	1960	3050	3800	4680	5750	7050									
	15	0	340*	540	850	1340	2090	2600	3200	3930	4810	5900	7110							
	20	0	0	410*	650	1030	1610	2000	2470	3040	3730	4580	5530							
	25	0	0	0	530*	830	1300	1620	1990	2450	3010	3700	4470	5430						
	30	0	0	0	430*	680	1070	1330	1640	2030	2490	3060	3700	4500	5130	5860				
	40	0	0	0	0	500*	490	980	1210	1490	1830	2250	2710	3290	3730	4250				
50	0	0	0	0	0	640*	800	980	1210	1480	1810	2190	2650	3010	3420	3830	4180	4850		
60	0	0	0	0	0	540*	670*	830*	1020	1250	1540	1850	2240	2540	2890	3240	3540	4100		
75	0	0	0	0	0	0	0	680*	840*	1030	1260	1520	1850	2100	2400	2700	2950	3440		
100	0	0	0	0	0	0	0	0	620*	760*	940*	1130	1380	1560	1790	2010	2190	2550		
125	0	0	0	0	0	0	0	0	0	0	740*	890*	1000*	1220	1390	1560	1700	1960		
150	0	0	0	0	0	0	0	0	0	0	0	760*	920*	1050*	1190*	1340	1460	1690		
175	0	0	0	0	0	0	0	0	0	0	0	0	810*	930*	1060*	1190*	1300	1510		
200	0	0	0	0	0	0	0	0	0	0	0	0	0	810*	920*	1030*	1130*	1310		

Table A-2b: Three Phase Cable, 60 Hz (Service Entrance to Motor – Maximum Length in Feet) (continued)

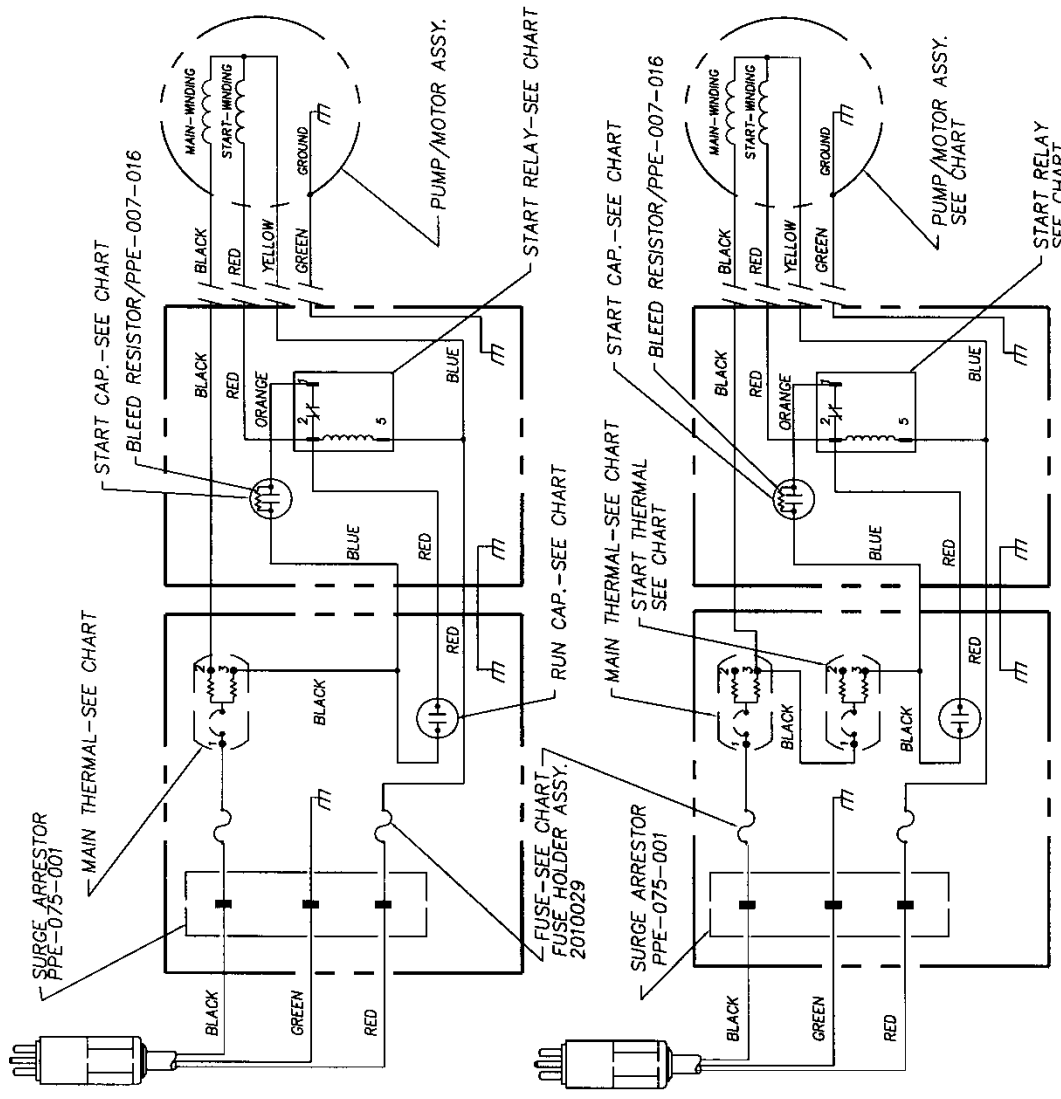
Motor Rating		AWG Copper Wire Size													MCM Copper Wire Size						
Volts	HP	14	12	10	8	6	4	3	2	1	0	00	000	0000	250	300	350	400	500		
460V 60 Hz Three Phase Three Wire	1/2	3770	6020	9460																	
	3/4	2730	4350	6850																	
	1	2300	3670	5770	9070																
	1 1/2	1700	2710	4240	6730																
	2	1300	2070	3240	5150	8050															
	3	1000	1600	2520	3970	6200															
	5	590	950	1500	2360	3700	5750														
	7 1/2	420	680	1070	1690	2640	4100	5100	6260	7680											
	10	310	500	790	1250	1960	3050	3800	4680	5750	7050										
	15	0	340*	540	850	1340	2090	2600	3200	3930	4810	5900	7110								
	20	0	0	410*	650	1030	1610	2000	2470	3040	3730	4580	5530								
	25	0	0	0	530*	830	1300	1620	1990	2450	3010	3700	4470	5430							
	30	0	0	0	430*	680	1070	1330	1640	2030	2490	3060	3700	4500	5130	5860					
	40	0	0	0	0	500*	490	980	1210	1490	1830	2250	2710	3290	3730	4250					
	50	0	0	0	0	0	640*	800	980	1210	1480	1810	2190	2650	3010	3420	3830	4180	4850		
	60	0	0	0	0	0	540*	670*	830*	1020	1250	1540	1850	2240	2540	2890	3240	3540	4100		
	75	0	0	0	0	0	0	0	680*	840*	1030	1260	1520	1850	2100	2400	2700	2950	3440		
	100	0	0	0	0	0	0	0	0	620*	760*	940*	1130	1380	1560	1790	2010	2190	2550		
	125	0	0	0	0	0	0	0	0	0	0	740*	890*	1000*	1220	1390	1560	1700	1960		
	150	0	0	0	0	0	0	0	0	0	0	0	760*	920*	1050*	1190*	1340	1460	1690		
175	0	0	0	0	0	0	0	0	0	0	0	0	810*	930*	1060*	1190*	1300	1510			
200	0	0	0	0	0	0	0	0	0	0	0	0	0	810*	920*	1030*	1130*	1310			
575V 60 Hz Three Phase Three Wire	1/2	5900	9410																		
	3/4	4270	6810																		
	1	3630	5800	9120																	
	1 1/2	2620	4180	6580																	
	2	2030	3250	5110	8060																
	3	1580	2530	3980	6270																
	5	920	1480	2330	3680	5750															
	7 1/2	660	1060	1680	2650	4150															
	10	490	750	1240	1950	3060	4770	5940													
	15	330*	530	850	1340	2090	3260	4060													
	20	0	410*	650	1030	1610	2520	3140	3860	4760	5830										
	25	0	0	520*	830	1300	2030	2530	3110	3840	4710										
	30	0	0	430*	680	1070	1670	2080	2560	3160	3880	4770	5780	7030	8000						
	40	0	0	0	500*	790	1240	1540	1900	2330	2860	3510	4230	5140	5830						
	50	0	0	0	0	640*	1000	1250	1540	1890	2310	2840	3420	4140	4700	5340	5990	6530	7580		
	60	0	0	0	0	0	850*	1060	1300	1600	1960	2400	2890	3500	3970	4520	5070	5530	6410		
	75	0	0	0	0	0	690*	860*	1060*	1310	1600	1970	2380	2890	3290	3750	4220	4610	5370		
	100	0	0	0	0	0	0	0	790*	970*	1190*	1460	1770	2150	2440	2790	3140	3430	3990		
	125	0	0	0	0	0	0	0	0	770*	950*	1160*	1400	1690	1920	2180	2440	2650	3070		
	150	0	0	0	0	0	0	0	0	0	800*	990*	1190*	1440	1630	1860	2080	2270	2640		
175	0	0	0	0	0	0	0	0	0	870*	1050*	1270*	1450*	1650	1860	2030	2360				
200	0	0	0	0	0	0	0	0	0	0	920*	1110*	1260*	1440*	1620	1760	2050				
460V-60 Hz Three Phase Six Wire	150	0	0	0	0	0	0	0	510*	630*	770*	950	1140	1380	1570	1790	2000	2180	2530		
	175	0	0	0	0	0	0	0	0	550*	680*	830*	1000	1220	1390	1580	1780	1950	2270		
	200	0	0	0	0	0	0	0	0	0	590*	730*	880*	1070	1210	1380	1550	1690	1970		
575V-60 Hz Three Phase Six Wire	150	0	0	0	0	0	0	650*	800*	990*	1210	1480	1780	2160	2450	2790	3120	3410	3950		
	175	0	0	0	0	0	0	0	0	700*	860*	1060	1300	1570	1910	2170	2480	2780	3040	3540	
	200	0	0	0	0	0	0	0	0	760*	930*	1140	1370	1670	1890	2160	2420	2640	3070		

REF. DWGS	CE-31	CE-24	CE-6	CE-36	REF. DWG CE-11	REF. DWG CE-13
1/3HP ASSEMBLIES	115VAC	230VAC	115VAC	230VAC	3/4HP, 230VAC ASSEMBLY	1HP, 230VAC ASSEMBLY
RESISTANCES AT MOTOR			RESISTANCES AT MOTOR		RESISTANCES AT MOTOR	RESISTANCES AT MOTOR
BLACK to YELLOW	1.5-1.9 ohm	6.0-7.4 ohm	1.0-1.3 ohm	4.2-5.2 ohm	BLACK to YELLOW	2.2-2.8 ohm
RED to YELLOW	5.7-7.1 ohm	23.4-28.6ohm	3.8-4.7 ohm	15.5-19.6 ohm	RED to YELLOW	9.5-11.7 ohm
CURRENT AT MOTOR			CURRENT AT MOTOR		CURRENT AT MOTOR	CURRENT AT MOTOR
RUNNING CURRENT	7.0 AMP	3.5 AMP	9.6 AMP	4.8 AMP	RUNNING CURRENT	8.0 AMP
LOCK ROTOR CURRENT	32.8 AMP	16.4 AMP	46.0 AMP	23.1 AMP	LOCK ROTOR CURRENT	42.0 AMP



START BOX SCHEMATICS FOR 60Hz DEEP WELL SUBMERSIBLE WATER PUMPS

ASSEMBLY #	PUMP/MOTOR	START CAPACITOR	START RELAY	FUSE SIZE
2031037	1/3HP, 115V, 60HZ, 1PH.	159-191uF, 115VAC	SOLID STATE, 1/3HP, 115V	ABC 25 AMP
	PPE-018-062	PPE-008-064	PPE-014-097	PPE-011-012
2032059	1/3HP, 230V, 60HZ, 1PH.	43-53uF, 230VAC	SOLID STATE, 1/3HP, 230V	ABC 15 AMP
	PPE-018-039	PPE-008-051	PPE-014-098	PPE-011-008
2031035	1/2HP, 115V, 60HZ, 1PH.	250-300uF, 115VAC	SOLID STATE, 1/2HP, 115V	ABC 30 AMP
	PPE-018-016	PPE-008-036	PPE-014-099	PPE-011-001
2032106	1/2HP, 230V, 60HZ, 1PH.	59-71uF, 230VAC	SOLID STATE, 1/2HP, 230V	ABC 15 AMP
	PPE-018-061	PPE-008-047	PPE-014-100	PPE-011-008
2032010	3/4HP, 230V, 60HZ, 1PH.	86-103uF, 230VAC	SOLID STATE, 3/4HP, 230V	ABC 20 AMP
	PPE-018-014	PPE-008-095	PPE-014-101	PPE-011-014
2032053	1HP, 230V, 60HZ, 1PH.	105-126uF, 230VAC	SOLID STATE, 1HP, 230V	ABC 25 AMP
	PPE-018-015	PPE-008-009	PPE-014-102	PPE-011-012



1.5 HP SCHEMATIC
REF. DRAWING: CE-12

1.5HP, 230VAC ASSEMBLY	
RESISTANCES AT MOTOR	
BLACK to YELLOW	1.5-1.9 ohm
RED to YELLOW	6.2-8.5 ohm
CURRENT AT MOTOR	
RUNNING CURRENT	9.1 AMP
LOCK ROTOR CURRENT	52.0 AMP

2 HP SCHEMATIC
REF. DRAWING: CE-5

2HP, 230VAC ASSEMBLY	
RESISTANCES AT MOTOR	
BLACK to YELLOW	1.6-2.3 ohm
RED to YELLOW	5.2-7.1 ohm
CURRENT AT MOTOR	
RUNNING CURRENT	10.0 AMP
LOCK ROTOR CURRENT	51.0 AMP

START BOX SCHEMATICS FOR 60Hz DEEP WELL SUBMERSIBLE WATER PUMPS

ASSEMBLY #	PUMP/MOTOR	START CAP.	RUN CAP.	START RELAY	FUSE SIZE	THERMALS
2032057	1.5 HP, 230V, 60Hz, 1PH.	105-126uF, 220VAC	10uF, 370VAC	MECH., 230V, 60Hz	ABC 30 AMP	MAIN: PPE-066-001
	PPE-018-043	PPE-008-009	PPE-008-023	PPE-014-104	PPE-011-011	START: NONE
2032022	2HP, 230V, 60Hz, 1PH.	104-126uF, 220VAC	20uF, 370 VAC	MECH., 230V, 60Hz	ABC 30 AMP	MAIN: PPE-066-011
	PPE-018-023	PPE-008-113	PPE-008-044	PPE-014-104	PPE-011-001	START: PPE-066-010

Figure A-2

Appendix B – GECM Logic Statement

Small Diameter Probe Scavenger (PSCAV) with Water Table Depression Pump (WTDP) GECM Logic Statement

System Description

A Geotech Small Diameter Probe Scavenger (PSCAV) with Water Table Depression Pump (WTDP) consists of a PSCAV product pump and Grundfos RF4 Water Pump which use float density logic for product recovery. Automated control is provided by a Geotech Environmental Control Module (GECM) to be mounted on site by the customer. Plumbing, conduit and wiring between system components will not be provided with the system. All system sensor devices are to be terminated at the GECM according to the system installation and wiring schematic provided with the system.

GECM Control Panel Components

- (2) Hand/Off/Auto switches (1 for Product Pump, 1 for Water Pump)
- Motor Starter with thermal overload protection (1 for Water Pump)
- Relay and terminal strip assembly for control of SDFS Product Pump Power Supply (see notes)
- Reset Button
- 4-button Keypad

GECM Control indicator components

- 16 x 2 character LCD Screen
- (2) Green Run Lights (1 for Product Pump, 1 for Water Pump)
- (2) Red Fault Lights (1 for Product Pump, 1 for Water Pump)

System Operation

Abbreviations used:

Hi = High

Lo = Low

HOA = Hand/Off/Auto

Down well Level Probe

The product pump and water pump cycle on and off in response to signals sent to the GECM by float actuated Hi and Lo switches built into specific points within the Down well Level Probe shaft.

Product Pump Operation

When the blue product float rises to the top of its travel, the product turns on and continues to run until the float falls below the switch. After the blue float falls, the product pump will run for an additional 3-5 seconds to reduce the product layer to 2" or less in overall thickness. The Orange Float (Hi/Lo Water) is buoyant in water only and disables the product pump when it reaches the Water High switch. This prevents the product pump from running if the hydrocarbon/water interface in the well rises to the level of the product pump intake.

Water Pump Operation

The water pump is controlled by the Water Hi/Lo switches actuated by the PSCAV Hi/Lo Orange Float. The water pump turns on when the Hi/Lo float rises to the top of its travel. The pump continues to run until the Hi/Lo float falls to the bottom of its travel. If a probe fault should cause the water pump to continue running, the Override float will fall and shut off the water pump. The LCD screen on the GECM panel will indicate an "OVERRIDE" alarm

condition and the Red Water Fault Light will illuminate. This alarm condition is set up as a latching control for the water pump, IE; a manual reset is required in order for the water pump to resume operation.

Probe Fault Alarm

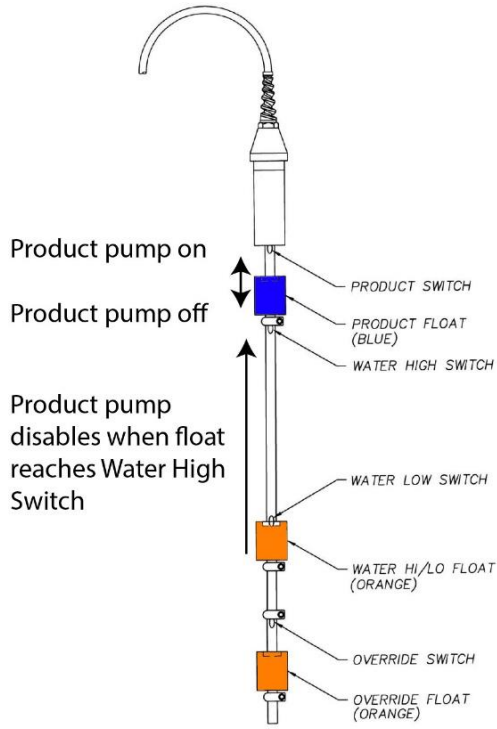
A Probe Fault Alarm condition can occur in the Down Well Level probe when:

- There is non-sequential movement of the floats and switches
- The probe is installed to the GECM incorrectly
- There's a break in the wiring
- There's a break in the probe itself

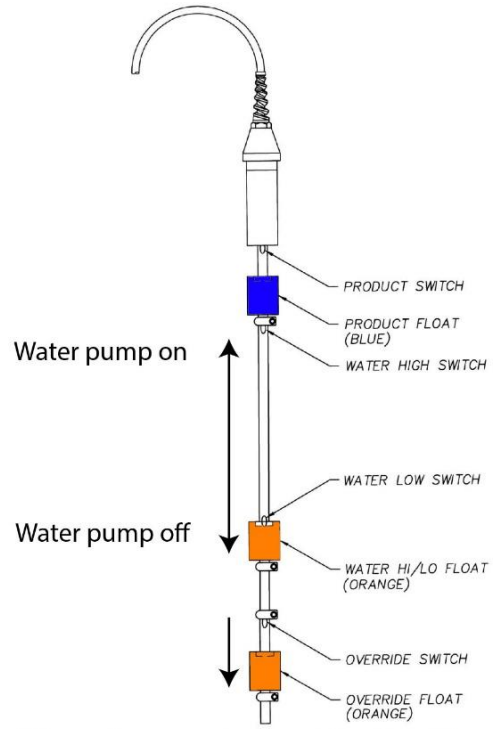
The Probe Fault alarm condition will shut down the system. The LCD screen on the GECM will indicate a "PROBE FAULT" alarm condition and both Red Fault Lights will illuminate. This alarm condition is set up as a latching control, IE; a manual reset is required.

Tankfull Alarm

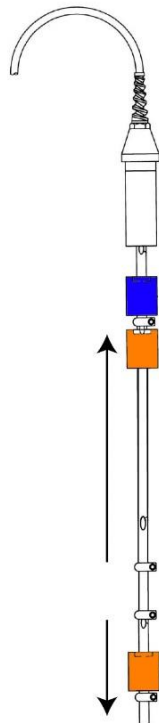
A second probe may be used to shut off the appropriate devices for the system when the customer supplied recovery and/or holding tank becomes full. This Tankfull Probe is a single float activated level sensor installed in the top of the recovery and/or holding tank. When the float rises to the top of its travel. The PSCAV product pump will shut down, but the water pump will continue to operate normally. The LCD screen on the GECM will indicate a "TANKFULL" alarm condition and the Red Product Fault Light will illuminate. This alarm condition is set up as a latching control, IE; a manual reset is required.



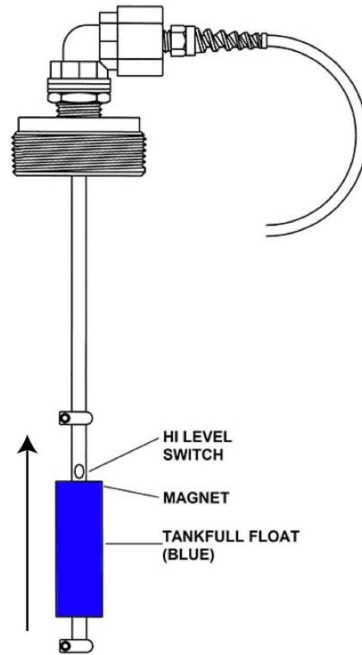
Product Pump Operation



If the water pump is on and the Override float falls to the bottom:
OVERRIDE alarm condition



Non-sequential movement of the floats and switches:
PROBE FAULT alarm condition



The Tankfull Probe float rises to the top of its travel.
TANKFULL alarm condition

Figure B-1: Probe Operation and Alarm Conditions

Auxiliary (Aux) Shutdown Alarm

An Auxiliary Shutdown Alarm can be connected to integrate with other site specific systems. This is a normally closed switch and will open upon alarm. All running devices will shut down. The LCD screen on the GECM will indicate an AUX SHUTDOWN alarm condition and both Red Fault Lights will illuminate. This alarm condition is set up as a latching control, IE; a manual reset is required.

Telemetry

For all of the above alarm conditions, each GECM panel may be equipped with SMS Telemetry packages that will send alarm-specific text messages to specified phone numbers over a cellular network.

Notes

- The water pump will continue to operate normally if the product pump goes into any alarm.
- The product pump motor is 12VDC and is interfaced to the GECM through a separate 12 Volt Power Supply housed in a NEMA 4 enclosure.
- The Product and Water Pumps are controlled by HOA switches. Each HOA switch is labeled to show which device it controls. HOA switches must be in the AUTO position for the devices to run autonomously. At any time, if a switch is placed in the HAND position, power will be applied to the respective device. If system is in an alarm condition, the HOA switch must be in the OFF position and the RESET button must be pressed in order to allow HAND operation.
- A Form C Dry Contact relay assembly is incorporated into the GECM panel. Upon any of the above mentioned alarm conditions, the Dry Contact will change state sending an output signal (normally closed to open, or normally open to closed) to any customer supplied system interface.

Small Diameter Probe Scavenger (PSCAV) with Water Table Depression Pump (WTDP), Transducer, and Conductivity Probe GECM Logic Statement

System Description

A Geotech Small Diameter Probe Scavenger (PSCAV) with Water Table Depression Pump (WTDP) consists of a PSCAV product pump and Grundfos RF4 Water Pump, Pressure Transducer, and Conductivity Probe which uses float density and user defined pressure logic for product recovery. Automated control is provided by a Geotech Environmental Control Module (GECM) to be mounted on site by the customer. Plumbing, conduit and wiring between system components will not be provided with the system. All system sensor devices are to be terminated at the GECM according to the system installation and wiring schematic provided with the system.

GECM Control Panel Components

- (2) Hand/Off/Auto switches (1 for Product Pump, 1 for Water Pump)
- Motor Starter with thermal overload protection (1 for Water Pump)
- Relay and terminal strip assembly for control of SDFS Product Pump Power Supply (see notes)
- Reset Button
- 4-button Keypad

GECM Control indicator components

- 16 x 2 character LCD Screen
- (2) Green Run Lights (1 for Product Pump, 1 for Water Pump)
- (2) Red Fault Lights (1 for Product Pump, 1 for Water Pump)

System Operation

Abbreviations used:

Hi = High

Lo = Low

HOA = Hand/Off/Auto

Down well Level Probes

The product pump and water pump cycle on and off in response to signals sent to the GECM by float actuated Hi and Lo switches built into specific points within the Down well Level Probe shaft. The Water Pump cycles on and off in response to signals sent to the GECM by the user defined set points of the Pressure Transducer.

Product Pump Operation

When the blue product float rises to the top of its travel, the product turns on and continues to run until the float falls below the switch. After the blue float falls, the product pump will run for an additional 3-5 seconds to reduce the product layer to 2" or less in overall thickness. The Orange Float (Hi/Lo Water) is buoyant in water only and disables the product pump when it reaches the Water High switch. This prevents the product pump from running if the hydrocarbon/water interface in the well rises to the level of the product pump intake.

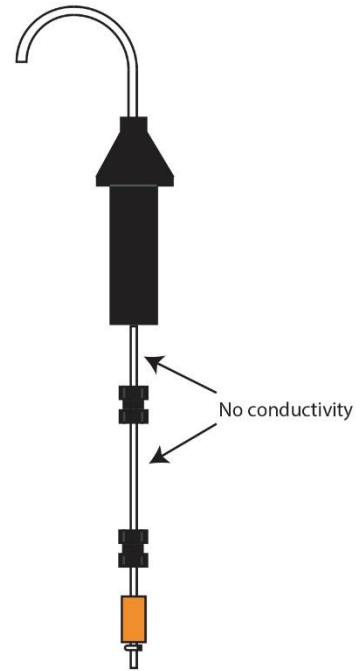
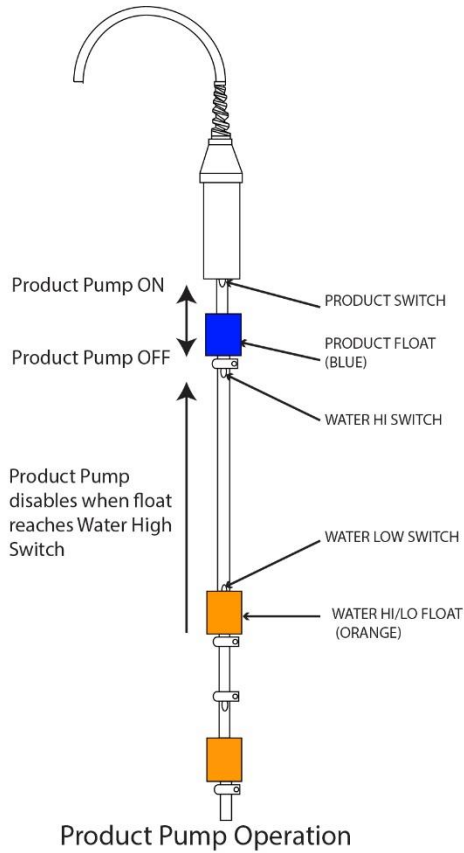
Water Pump Operation

The Water Pump is controlled by a Pressure Transducer (4-20mA). The water pumps turns ON when the Pressure Transducer is submerged in water to the user defined depth. The pump continues to run until the water above the Pressure Transducer is reduced to the user defined depth. A 2nd probe, a WTDP Conductivity Probe, will be placed in the well to prevent the Water Pump from running if the probe sense no conductivity (product or

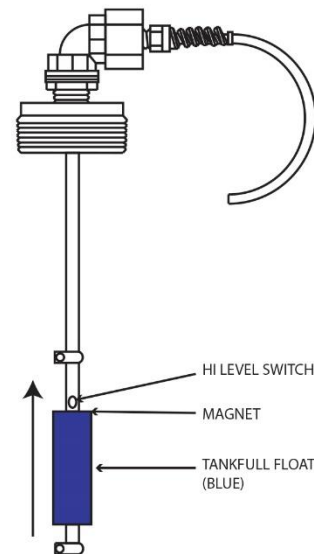
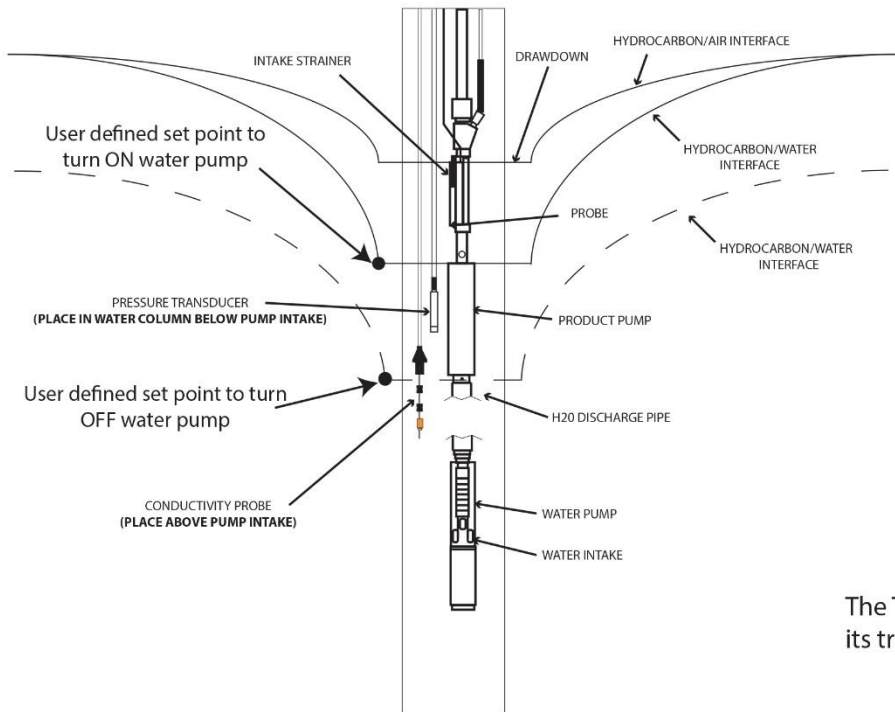
air). The LCD screen on the GECM panel will indicate an "Override" alarm condition and the Red Fault Light will illuminate.

Tankfull Alarm

A second probe may be used to shut off the appropriate devices for the system when the customer supplied recovery and/or holding tank becomes full. This Tankfull Probe is a single float activated level sensor installed in the top of the recovery and/or holding tank. When the float rises to the top of its travel. The PSCAV product pump will shut down, but the water pump will continue to operate normally. The LCD screen on the GECM will indicate a "TANKFULL" alarm condition and the Red Product Fault Light will illuminate. This alarm condition is set up as a latching control, IE; a manual reset is required.



If the Conductivity probe does not sense conductivity: OVERRIDE alarm condition



The Tankfull Probe float rises to the top of its travel: TANKFULL alarm condition

Figure B-2: Probe Operation and Alarm Conditions

Auxiliary (Aux) Shutdown Alarm

An Auxiliary Shutdown Alarm can be connected to integrate with other site specific systems. This is a normally closed switch and will open upon alarm. All running devices will shut down. The LCD screen on the GECM will indicate an AUX SHUTDOWN alarm condition and both Red Fault Lights will illuminate. This alarm condition is set up as a latching control, IE; a manual reset is required.

Telemetry

For all of the above alarm conditions, each GECM panel may be equipped with SMS Telemetry packages that will send alarm-specific text messages to specified phone numbers over a cellular network.

Notes

- The water pump will continue to operate normally if the product pump goes into any alarm.
- The product pump motor is 12VDC and is interfaced to the GECM through a separate 12 Volt Power Supply housed in a NEMA 4 enclosure.
- The Product and Water Pumps are controlled by HOA switches. Each HOA switch is labeled to show which device it controls. HOA switches must be in the AUTO position for the devices to run autonomously. At any time, if a switch is placed in the HAND position, power will be applied to the respective device. If system is in an alarm condition, the HOA switch must be in the OFF position and the RESET button must be pressed in order to allow HAND operation.
- A Form C Dry Contact relay assembly is incorporated into the GECM panel. Upon any of the above mentioned alarm conditions, the Dry Contact will change state sending an output signal (normally closed to open, or normally open to closed) to any customer supplied system interface.

Appendix C – GECM System Installation

Inspection

Inspect all components for physical damage. Installing and operating damaged equipment is dangerous and should not be performed. Verify that all components have arrived as per the Sales Order or packing list.

GECM Panel Installation

Even though the GECM electronics are enclosed within a NEMA 4 rated weatherproof box, it is advised that you place your GECM within a sheltered area, protecting the unit from direct exposure to water and sunlight.

Input Power Guidelines

All wiring must be carried out by a qualified electrician and be in accordance with state and local codes. Conduit runs must conform to current U.S. National Electrical Code (NEC). Do not run any power wires within 2 inches (5 cm) of intrinsically safe (IS) wires or terminals (NEC Article 508 for relevant codes.) All equipment and controls are to be installed in accordance with Article 430 and 504 of the NEC.

See also the GECM Field Wiring Diagram for specific connections to the back panel and Printed Circuit Board (PCB). Geotech provides a detailed Field Wiring Diagram with every GECM built. Copies of these diagrams can be obtained from Geotech when needed.

Access Ports and Conduit Hubs

To facilitate wiring, Geotech installs access ports and conduit hubs to the GECM enclosures that are hard mounted to the system being manufactured, i.e., a LOPRO or SVE. A GECM enclosure will not have this wiring option when built and shipped separately.

When installing a GECM enclosure ensure that ports installed for IS wiring are placed within the upper sides of the enclosure (close to the PCB) and that all conduit hubs for main power, blowers, and pumps are installed along the bottom. To maintain the NEMA 4 weatherproof characteristics of your panel use weatherproof conduit hubs.

Install Chassis Ground

Before beginning the panel hookup procedures, run a wire from the bottom ground lug on the GECM back panel to a good earth ground, i.e., the circuit breaker panel enclosure.

Install IS Ground

Connect IS ground wires to the upper ground lug on the GECM back panel.

Wire Main Power

The GECM is built to run with single phase 115VAC or 230VAC. Incoming power leads are normally connected to either a terminal strip or fused disconnect labeled L1 and L2 (for 115VAC) or L1, L2 and L3 (for 230VAC and/or three phase applications). When a fused disconnect is installed for three phase power to the motor starters, Geotech will complete all wiring on the GECM side of the components.

The following wiring descriptions are for standard GECM configurations. In conjunction with the GECM Field Wiring Diagram, always refer to the system diagrams and labels found within the device User Manuals, including those diagrams provided with custom-built panels.

Install Incoming Power to Motor Starters

The motor starters is installed to the back panel when the GECM is built. Run main power for the individual motor starters through the bottom of the enclosure. Each motor starter is labeled for the device they support. Single-phase power leads are wired to terminals L1 and L2. 3-Phase power leads are attached to terminals L1, L2, and L3. Attach all ground wires to the ground lug at the bottom of the panel.



DO NOT run power wires within two inches of IS wiring or terminals.

Installing an 115VAC/230VAC to 12VDC Power Supply

Geotech provides 115VAC and 230VAC Power Supply's which are needed to operate the 12VDC product pump motors contained within SDFS and PSCAV systems. Power requirements and control are dependent upon the GECM and are probe activated.

The GECM back panel will contain labeled relays or terminal strips (labeled PRODUCT PUMP) from which hot leads will be connected. These leads will then go to a designated power supply box and be converted to 12VDC for product pump operation.



Power supply boxes should be installed as near to the well as possible to reduce DC line loss in the cable connecting the product pump to the box.

Use the GECM Field Wiring Diagram to complete all wire connections between the GECM and the power supply box.

IS Wiring Installation Guidelines

The GECM incorporates circuitry for IS circuit extensions into hazardous locations. All IS wiring must be at least 2" (5cm) (from all other non-IS wiring. All IS wire terminations must be securely tightened in screw terminals on the GECM PCB.

It is recommended that you use only Geotech supplied probe cable (P/N ORS418005) for IS wiring and Geotech supplied IS float probes with jacketed cable. The maximum length of a Geotech probe cable that can be connected to IS circuitry is 500 ft. (152 m).

Wiring Reservoir, Tankfull, Sump and Water Pump Probes

These devices are wired to designated ports on the GECM PCB and are defined on the GECM Field Wiring Diagram provided. Wiring diagrams for the various equipment probes and devices can be found within the user manuals for the device they support. Common probes built by Geotech support the operation of the following devices:

Reservoir Probe	SDFS
Water Pump Probe	WTDP Motors and Transfer Pumps
Tankfull Probe	SDFS and PSCAV
Sump Probe	LOPRO II and III Air Strippers
3 Position Probe	SVE and Custom Devices

Using a MeLabs Field Programmer

If for any reason the GECM needs to undergo a firmware update, Geotech will provide the new software on a MeLabs Field Programmer. To successfully update the GECM, follow the instructions below:

1. Verify SD card is properly inserted into card slot. Press the back of the SD card to ensure it is inserted as far as it will go. There will be a click to release or lock the card in.
** Do this a couple time to verify the card is in proper position. A small portion of the card will stick out from the end of the programmer housing.*
2. Open GECM door and inner panel to gain access to controller board.
3. Remove the PCB Enclosure using a 5/16" wrench/nut driver or #2 Philips screwdriver.
4. At the top near the middle will be a 6 pin jack
** Black phone jack like housing.*
5. Plug the cable of field programmer into the jack.
6. With power applied to the unit, the LED will be lit up GREEN.
7. Press the program button on the face of the field programmer.
8. During programming LED will be a solid RED.
**If LED Flashes RED call Geotech at 1-800-833-7958 or 303-320-4764.*
9. When programming is completed, the LED will return to a solid GREEN.
10. Remove cable from controller board, reinstall the PCB enclosure and close up the GECM.

Unit is now ready for use.

Appendix D - Decontamination Procedures

Some common decontamination solutions are listed below along with the contaminants they are effective against:

<u>Solution</u>	<u>Effective Against</u>
Water polar	Short-chain hydrocarbons, inorganic compounds, salts, some organic acids, other compounds.
Dilute Acids	Basic (caustic or alkaline) compounds, amines, hydrazines.
Dilute Bases	Acidic compounds, phenols thiols, some nitro- and sulfonic compounds.
Organic solvents	Non-polar compounds (such as some organic compounds)

The use of organic solvents is not recommended because:

- 1) Organic solvents can permeate and/or degrade the protective clothing and
- 2) They are generally toxic and may result in unnecessary employee exposure to hazardous chemicals.

When in doubt, use a dish washing liquid detergent. As a decontamination solution, it is readily available, is the safest of all the above, and is usually strong enough if used generously. The use of steam can also be effective for decontamination. A water-laser (pressurized water) is exceptionally valuable.

The following substances are noted for their particular efficiency in removing certain contaminants or for decontaminating certain types of equipment.

<u>Solution</u>	<u>Effective Against</u>
Penetone	PCB Contamination (penetone may also remove paint, it is a good idea to spot-test before use)
Phosphate free detergent	contaminated pumps
Ivory liquid	Oils
Diluted HTH	Cyanides
Radiac	Low-level radioactivity
Isopropanol	Biological agents (should not be used on rubber products because it will break down rubber)
Hexane its	Certain types of lab or sampling equipment (use of hexane is discouraged due to flammability and toxicity)
Zep	General Purpose cleaning
Phosphate free detergent	General Purpose cleaning

Decontamination Solutions to Avoid

Some decontamination solutions should be avoided because of their toxicity, flammability, or harmful effects to the environment.

Halogenated hydrocarbons, such as carbon tetrachloride, should not be used because of their toxicity, possible incompatibility, and some because of their flammability.

Organic decontamination solutions should not be used on personal protective equipment (PPE) because they may degrade the rubber or other materials comprising the PPE.

Mercurials are sometimes used for sterilization. They should be avoided because of their toxicity.

Chemical leaching, polymerization, and halogen stripping should be avoided because of possible complications during decontamination.

Sandblasting, a method of physical removal, should be avoided because the sand used on the contaminated object usually needs to be disposed of as hazardous waste, a very costly proposition. In addition, sandblasting exposes personnel to silica, a carcinogen.

Freon is known to be particularly effective for the cleansing of PCB's but its effect on the ozone layer is extremely harmful. Its use is discouraged.

Strong acids or bases should not be used when cleaning metals and gaskets or tools or other equipment because of the possibility of corrosion.

Disposal of Decontamination Solutions and Waste Water

All solutions and water used for decontamination must be collected. If lab analysis indicates that the water and/or solutions exceed allowable contamination levels, they must be treated as hazardous waste. Alternatively, the solutions and water may be treated on-site to lower the contamination levels and render them non-hazardous.

Containers such as 55-gallon drums should be available for storage of wastes.

Spent decontamination solutions can be collected by using heavy-duty plastic sheets, visqueen sheets, kiddie pools, or if needed, a larger containment basin. The decontamination of equipment must be performed on the sheets or in the basins. They could be placed on a slight angle so that the spent decontamination solutions drain into a collection basin or drum.

Recommended Supplies for Decontamination of Personnel, Clothing and Equipment

The list below contains recommendations for supplies, which would be on hand for the decontamination of personnel, clothing and equipment. Depending on the site activities, not all of these items may be needed. Alternatively, some additional items not listed here may be required.

- Drop cloths of plastic or other suitable material, such as visqueen, for heavily contaminated equipment.
- Disposal collection containers, such as drums or suitably lined trash cans for disposable clothing and heavily contaminated personal protective clothing or equipment to be discarded.
- Lined box with adsorbent for wiping or rinsing off gross contaminants and liquid contaminants.
- Wash tubs of sufficient size to enable workers to place booted foot in and wash off contaminants (without a drain or with a drain connected to a collection tank or appropriate treatment system).

- Rinse tubs of sufficient size to enable workers to place booted foot in and wash off contaminants (without a drain or with a drain connected to a collection tank or appropriate treatment system)
- Wash solutions selected to wash off and reduce the hazards associated with the contaminated wash and rinse solutions.
- Rinse solution (usually water) to remove contaminants and contaminated wash solutions
- Long-handled, soft-bristled brushes to help wash and rinse off contaminants.
- Lockers and cabinets for storage of decontaminated clothing and equipment.
- Storage containers for contaminated wash and rinse solutions.
- Plastic sheeting, sealed pads with drains, or other appropriate method for containing and collecting contaminated wash and rinse water spilled during decontamination.
- Shower facilities for full body wash or at a minimum, personal wash sinks (with drains connected to a collection tank or appropriate treatment system).
- Soap or wash solution, washcloths and towels.
- Clean clothing and personal item storage lockers and/or closets.

Revision History		
Project Number	Description	Date
1555	Added GECM information to user manual. Updated formatting. – StellaR	6/18/2018
1555	Changed title to include GECM. Updated Logic Statement – StellaR	4/24/2019
1770	Added Conductivity with transducer, - StellaR	6/7/2019
1770	Changed logic statement image for accuracy – StellaR	6/11/2019
1555	Updated parts list with current part number options – StellaR	8/27/2019

The Warranty

For a period of one (1) year from date of first sale, product is warranted to be free from defects in materials and workmanship. Geotech agrees to repair or replace, at Geotech's option, the portion proving defective, or at our option to refund the purchase price thereof. Geotech will have no warranty obligation if the product is subjected to abnormal operating conditions, accident, abuse, misuse, unauthorized modification, alteration, repair, or replacement of wear parts. User assumes all other risk, if any, including the risk of injury, loss, or damage, direct or consequential, arising out of the use, misuse, or inability to use this product. User agrees to use, maintain and install product in accordance with recommendations and instructions. User is responsible for transportation charges connected to the repair or replacement of product under this warranty.

Equipment Return Policy

A Return Material Authorization number (RMA #) is required prior to return of any equipment to our facilities, please call our 800 number for appropriate location. An RMA # will be issued upon receipt of your request to return equipment, which should include reasons for the return. Your return shipment to us must have this RMA # clearly marked on the outside of the package. Proof of date of purchase is required for processing of all warranty requests.

This policy applies to both equipment sales and repair orders.

FOR A RETURN MATERIAL AUTHORIZATION, PLEASE CALL OUR
SERVICE DEPARTMENT AT 1-800-833-7958.

Model Number: _____

Serial Number: _____

Date: _____

Equipment Decontamination

Prior to return, all equipment must be thoroughly cleaned and decontaminated. Please make note on RMA form, the use of equipment, contaminants equipment was exposed to, and decontamination solutions/methods used.

Geotech reserves the right to refuse any equipment not properly decontaminated. Geotech may also choose to decontaminate equipment for a fee, which will be applied to the repair order invoice.

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