

# 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:



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.



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.



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

## Section 1: System Description

### Water Table Depression Pump

#### Function and Theory

The Water Table Depression Pump (WTDP) is designed to facilitate the concentration and recovery of hydrocarbons. The system works by locally depressing the water table to create a “cone of depression” into which polluting hydrocarbons will flow with the surrounding groundwater.

Figure 1-1 compares recovery wells before and after a WTDP has been used to create a cone of depression. Note that the hydrocarbon layer becomes thicker after a cone of depression has been established.

- Static water level is the distance from the ground surface to the hydrocarbon/water interface.
- Drawdown is therefore the depth of the cone of depression.
- Radius of influence is the distance from the well center to the limit of the cone of depression.

Since the efficiency of hydrocarbon concentration and recovery is determined to a large extent by conditions in and around the recovery well, it is important that the well be drilled and developed under the supervision of a qualified hydrogeologist. Well development is the process of removing fine sediments and grit from the well and reducing compaction of the surrounding earth. Properly carried out, well development procedures will increase the rate at which water and hydrocarbon can flow into the well. Other suggestions for proper recovery well maintenance and operation are:

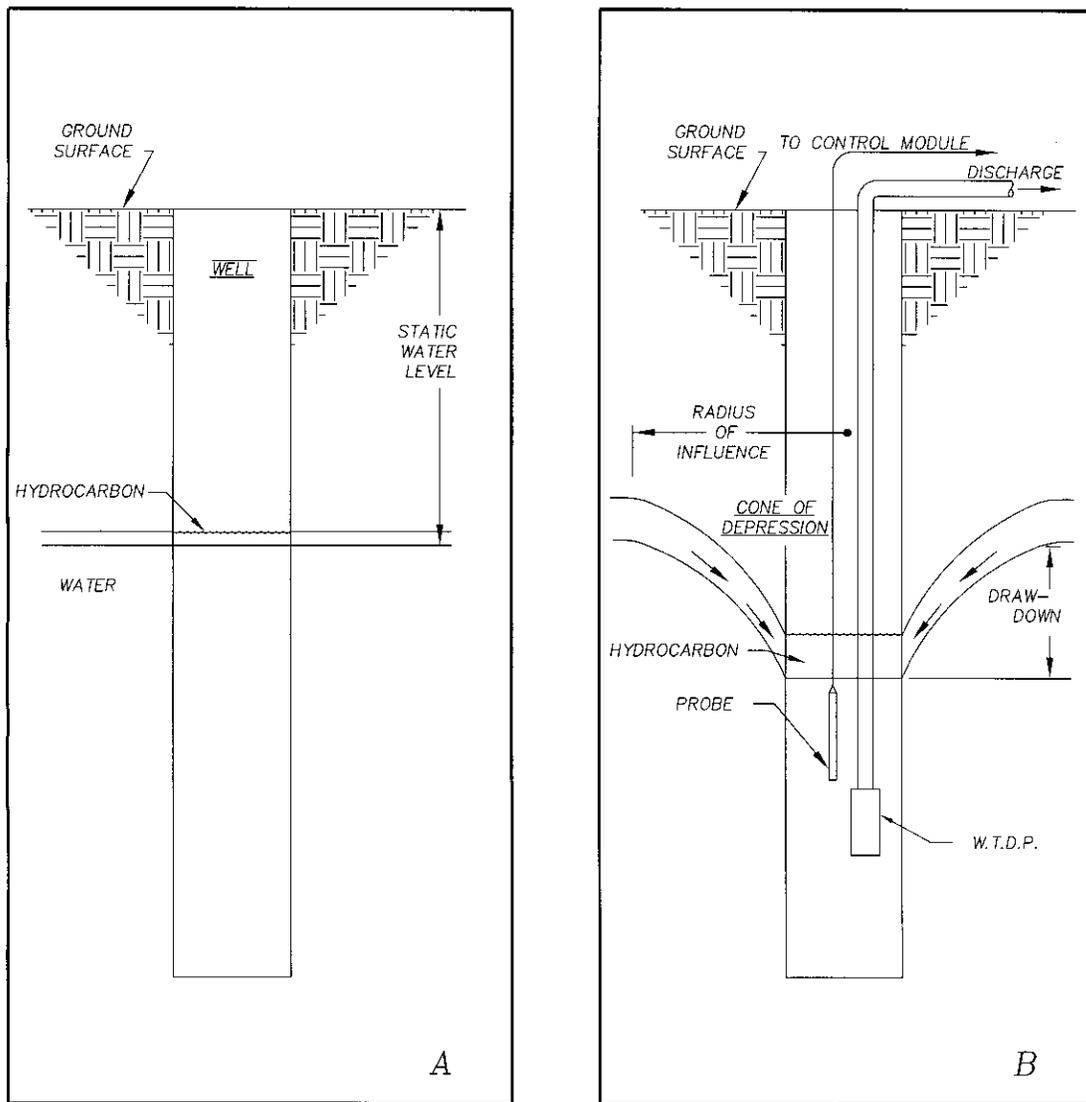
- Since there is a gradient of hydrocarbon dissolved in the water from the interface on down, the water pump intake should be positioned well below the hydrocarbon layer.
  - Water samples should be tested on a regular basis.
  - If hydrocarbon levels prove excessive, a water purification system can be used; contact Geotech Environmental Equipment, Inc. for further information.
- Establish monitoring wells at different distances and directions from the recovery well.
  - Monitor the cone of depression and any movements of the hydrocarbon plume.

#### System Components

The Water Table Depression Pumping system consists of a submersible or surface mounted pump, a Geotech Environmental Control Module (GECM) and an intrinsically safe level sensing probe or Pressure Transducer

#### Pump

Pump specifications are provided in *Appendix C – Submersible Pumps* of this manual. Refer to the appendices for detailed information on the pump.



**Figure 1-1:** A hydrocarbon recovery well before (A) and after (B) installation of a Water Table Depression Pump. Probe can also be a Pressure Transducer

### Positioning the Level Sensing Probe

On the WTDP level sensing probe, the cable is marked every foot with a 5 digit number. To position the probe at a predetermined depth in the well, simply lower the probe until the desired depth in feet is indicated by the last 2 digits of the number on the cable.

### Transducer

A pressure transducer operates based on user defined settings to turn the WTDP ON/OFF. Reference *Appendix B: Logic Statement* for functionality or the Pressure Transducer user manual for more information.

## **Geotech Environmental Control Module**

The Geotech Environmental Control Module (GECM) is a 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; a single panel can accommodate a wide variety of equipment control needs. A standard 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.

### How the GECM works

The GECM uses highly flexible microprocessor based electronics to provide a wide spectrum of capabilities that range from basic motor control to complex and sophisticated multi-panel networking. This built in versatility allows the GECM to be configured to match the unique requirements of a vast variety of industrial and remediation equipment control.

Basic motor control is achieved by use of magnetic motor starters. All standard motor starters have built in over current protection. More sophisticated motor control techniques can be achieved by use of a Variable Frequency Drive (VFD) that can interface directly with the GECM.

### Features and Options

The GECM is available with a host of options to accommodate site needs and customer preference.

- All components are housed in an easy to install weatherproof NEMA 4X (IP66) enclosure.
- A bright 16 x 2 character Vacuum Fluorescent Display (VFD) shows users exactly what is happening with each individual component within the system.
  - For example, a probe's float position or an output device's ON/OFF status can easily be viewed on the display, day or night.
- A 4-button keypad can be used to scroll through menus and status displays.
- Hand-Off-Auto (HOA) switch controls for direct control over individual system devices.
- System run lights and alarm lights, mounted on the panel itself or mounted atop the panel so that a GECMs operational status can be seen from a distance.
- Optional, pre-wired circular connectors are available for probe connections to make installation fast and simple.
- The design incorporates circuitry for wiring extensions into hazardous (classified) locations.
- For lower, short-circuit rated systems, fused disconnect options are available.
- Electro-mechanical runtime meters to track and monitor device active runtime.
- ON/OFF timers for managing time-sensitive systems in community environments.
- Remote monitoring of system faults and status via SMS (text message) telemetry, includes battery backup for power outage alerts.

In addition, each GECM will come with an Installation and Operation Manual containing device specifications unique to the unit's application. A GECM Field Wiring Diagram is also included with each manual. The GECM Field Wiring Diagram illustrates the internal layout of the GECM panel and also contains wiring information pertinent to device installation and troubleshooting.

### **Winch Assemblies**

Winch assemblies are available for the WTDP system. Mount the winch on the well casing as shown in Figure 1-2. 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 lbs. (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 inside the piping. Although it is unlikely that you will exceed the 400 lbs. (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 lbs. (.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**

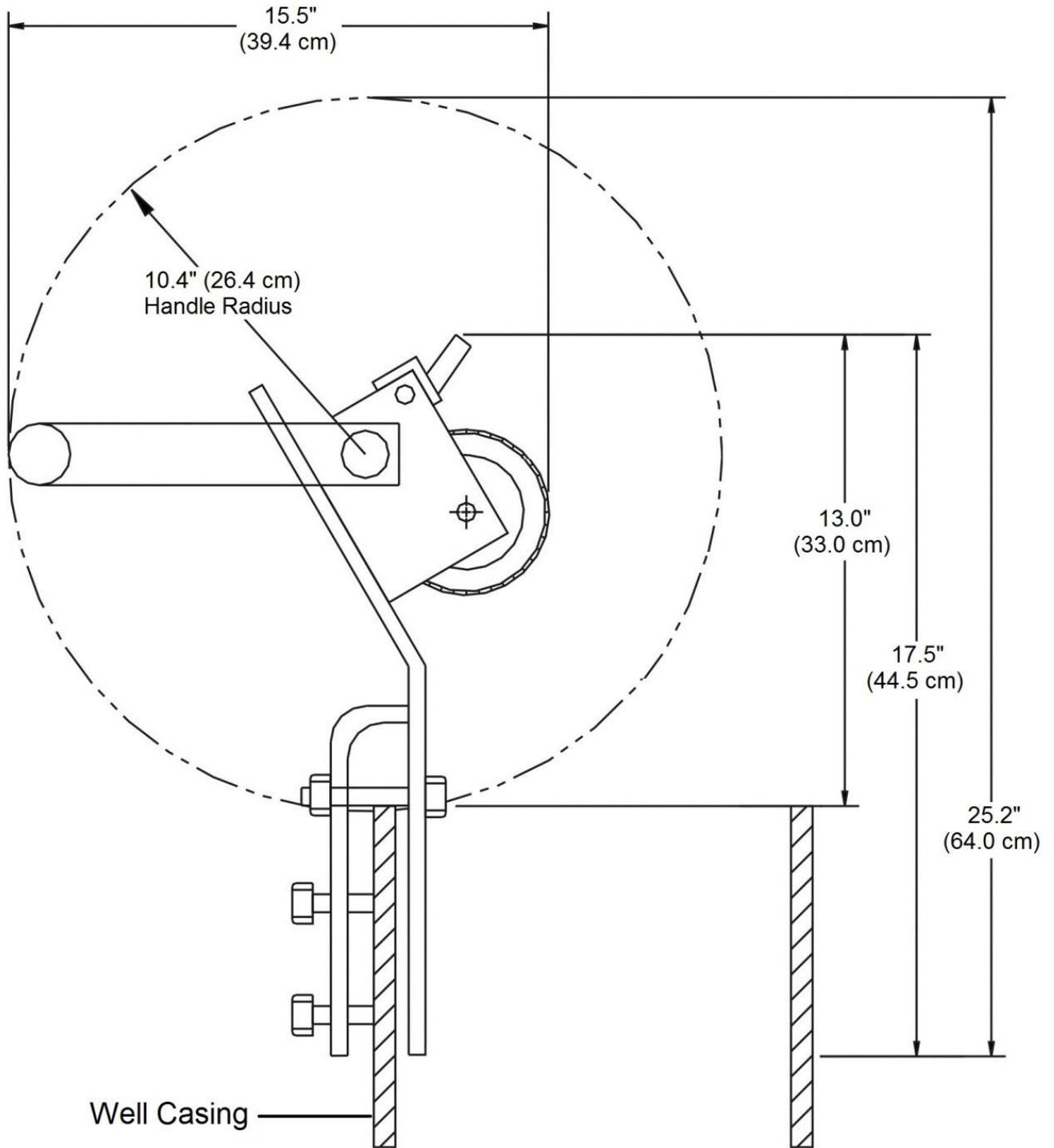
$$\text{Volume (cm}^3\text{)} = \pi \times [\text{inside radius of pipe (cm)}]^2 \times [\text{length of pipe (cm)}]$$

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

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

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

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 1-2:** Standard winch assembly attached to well head

## **Section 2: 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" (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 e.g., 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 be configured onsite with 115VAC/1PH, 230VAC/1PH or 3PH, or 460VAC/3PH (or a combination of both 1PH and 3PH) incoming power. Incoming power leads are normally connected to either a terminal strip or fused disconnect labeled L1 and L2 (single phase applications) or

L1, L2 and L3 (three phase applications). When configuring onsite, the transformer and motor starters must be wired correctly. See “Installing and Wiring Incoming Power to Motor Starters and Transformer” later in this section.

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.

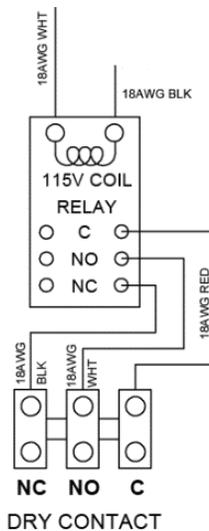


**DO NOT run power wires within two inches of IS wiring or terminals.**

Installing and implementing a Dry Contact

The GECM is equipped with a Dry Contact which will change state when the GECM encounter’s a fault condition. This is useful if there is an influent or effluent system that is not controlled directly by the GECM but is part of the process flow and needs to be alerted when the GECMs devices shutdown. Example of this includes an influent pump for a LOPRO Air Stripper system, or an air sparge system that cannot run if the SVE has shutdown.

The Dry Contact relay is connected to a 3-position terminal strip labeled NO (normally-open), NC (normally-closed), C (common); the user may choose if NO or NC is best suited for their application. See Figure 2-1 for example of a standard dry contact configuration.



**115V Coil Relay: CSA Load Rating**

Res.	10A	240VAC
	10A	30VDC
Gen. Use	7.5A	120VAC
	7A	240VAC
	7.5A	30VDC
	1/6HP	120VAC
	1/3HP	240VAC

**Figure 2-1:** Diagram of Dry Contact

IS Wiring Installation Guidelines

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

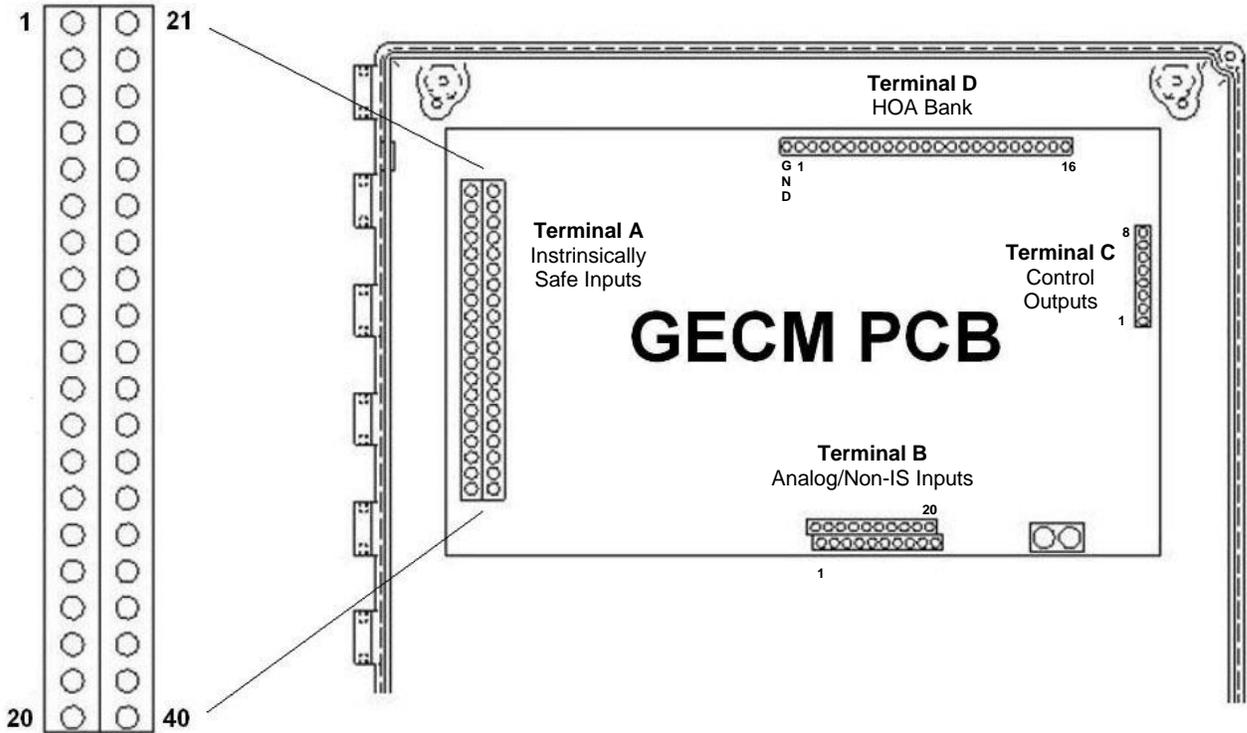
It is recommended that you use only Geotech supplied probe cable (P/N ORS418005) for IS wiring and Geotech supplied IS float probes with jacketed cable. The maximum length of a Geotech probe cable that can be connected to IS circuitry is 500’ (152 m).

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  
 Water Pump Probe  
 Tankfull Probe  
 Sump Probe  
 3 Position Probe

SDFS  
 WTDP Motors and Transfer Pumps  
 SDFS and PSCAV  
 LOPRO II and III Air Strippers  
 SVE and Custom Devices



**Figure 2-2:** Terminal Inputs

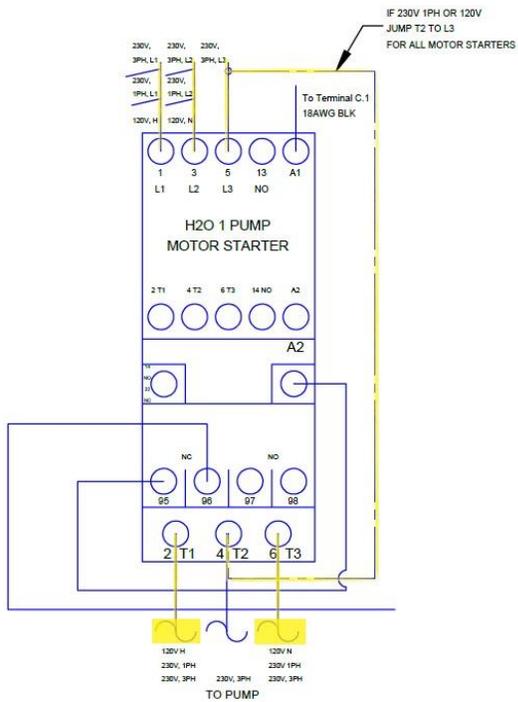
Installing and Wiring Incoming Power to Motor Starters

Most motor driven devices controlled by the GECEM (LOPRO, SVE, Sparge, WTDP, Transfer Pump) require the use of a motor starter. Motor starters are installed to the back panel when the GECEM 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. Refer to the wiring diagram for specific terminal connections. Attach all ground wires to the ground lug at the bottom of the panel.

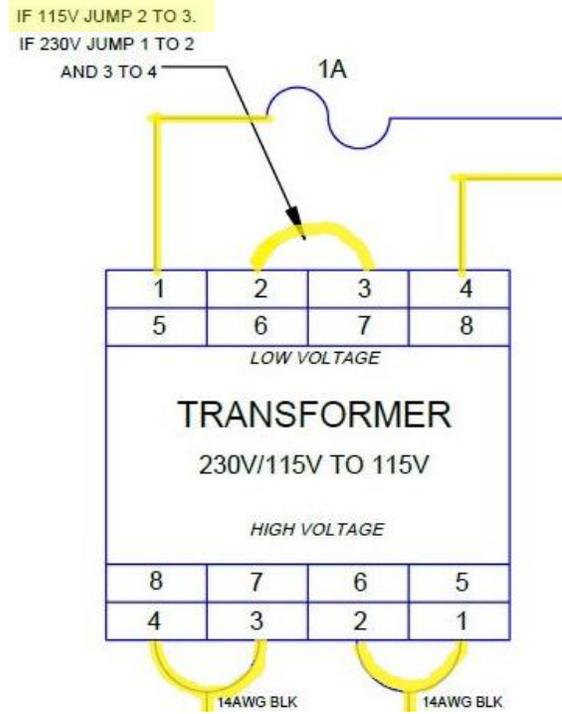
The Field Wiring Diagram shows a multi-configurable motor starter and transformer. The following sections are broken down into the different configurations of wiring the motor starter and transformer based on site power.

120V/230V 1PH Motor Starter and Transformer Wiring

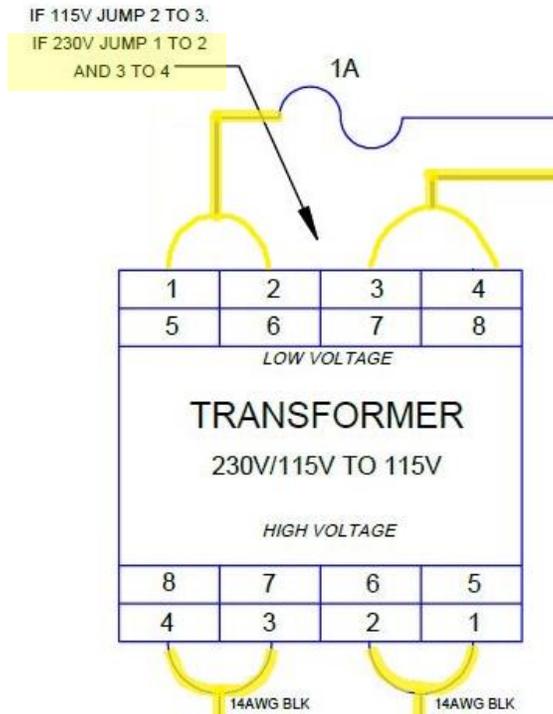
For wiring a 120V/230V 1PH Motor Starter and transformer, wire according to the highlighted items in Figure 2-3a-Figure 2-3c.



**Figure 2-3a:** 120V/230V 1PH Motor Starter Wiring



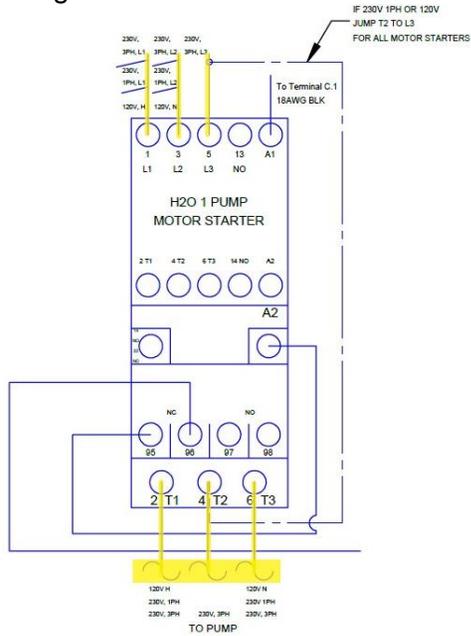
**Figure 2-3b:** 120V 1PH Transformer Wiring



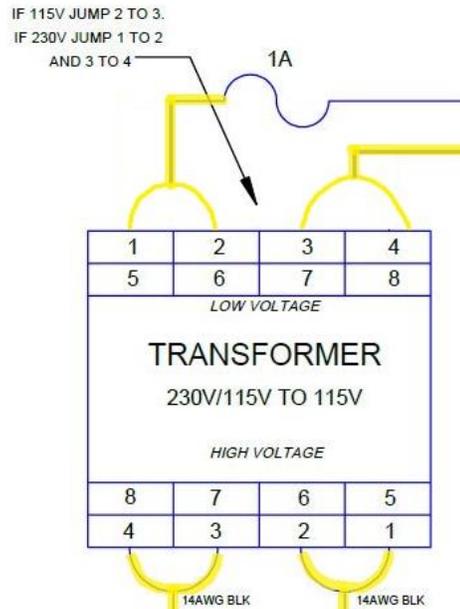
**Figure 2-3c:** 230V 1PH Transformer Wiring

## 230V 3PH Motor Starter and Transformer Wiring

For wiring a 230V 3PH Motor Starter and transformer, wire according to the highlighted items in Figures 2-4a and Figure 2-4b.



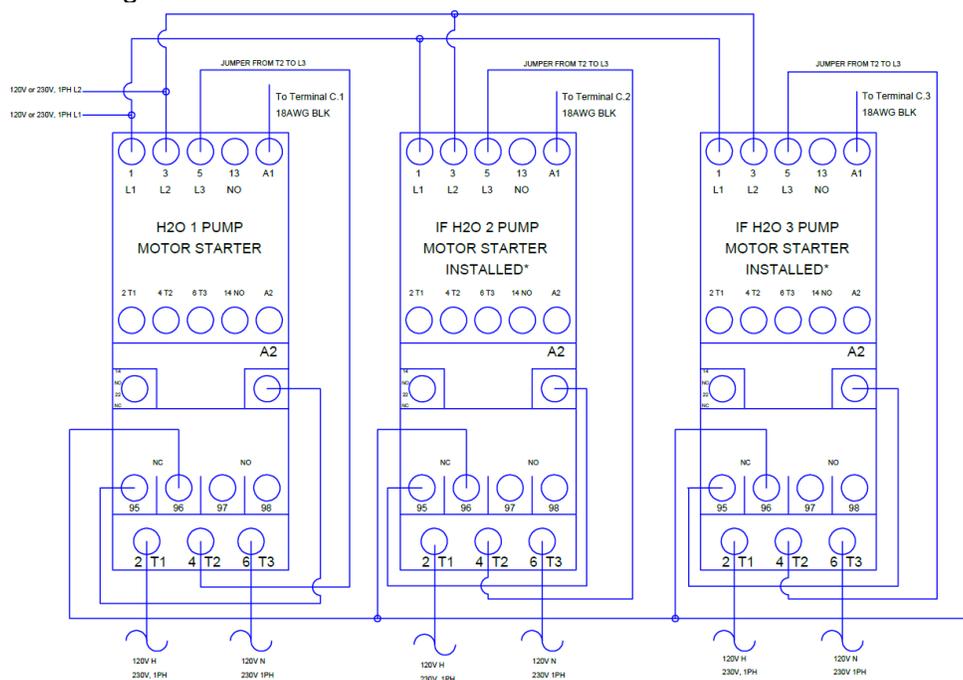
**Figure 2-4a:** Wiring 230V/460V 3PH Motor Starter



**Figure 2-4b:** Wiring for 230V/460V 3PH Transformer

## Multiple Motor Starters

See Figure 2-5 for wiring a 120V/230V 1PH WTDP with 3 motor starters.



**Figure 2-5:** Wiring Multiple 120V/230V 1PH Motor Starters

See Figure 2-6 for wiring 230V/460V 3PH WTDP with 3 Motor Starters

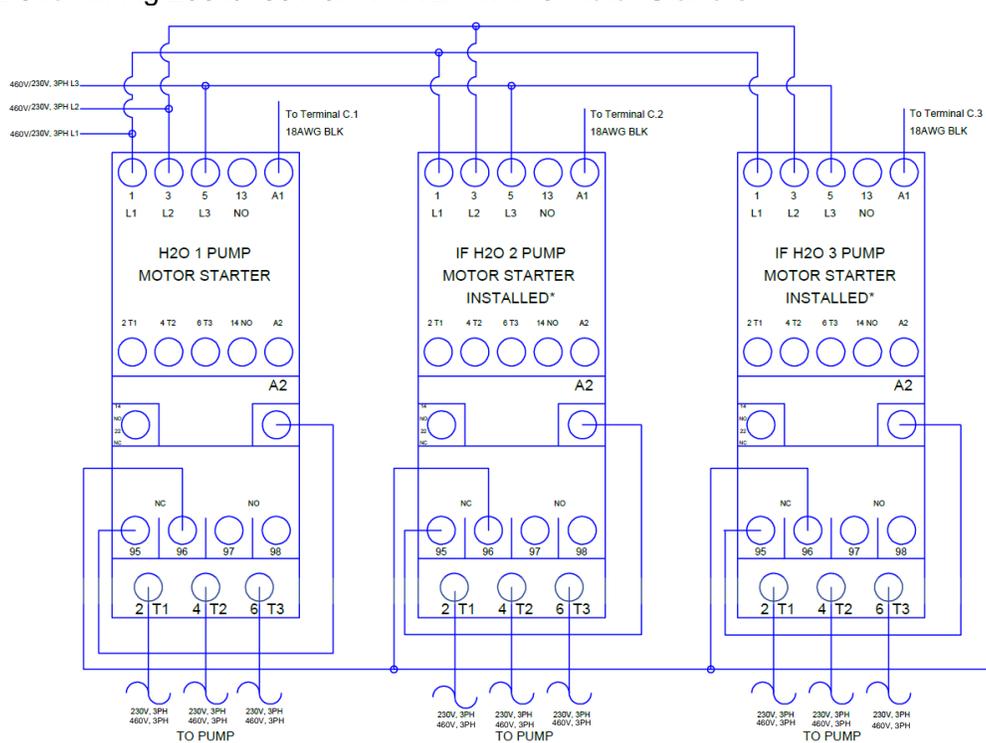


Figure 2-6: Wiring Multiple 230V/460V 3PH Motor Starters

### 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. Follow the instructions below to successfully update the GECM.

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.

Refer to System Pre-Check in Section 3: System Operation before installing Water Table Depression Pump.

### **Pump, Control Module, and Probe**

1. Lower the pump (submersible systems) or intake (surface mounted systems) into the well. Submersible pumps are equipped with a winch assembly when purchased separately.
  - Do not suspend the pump by its power cord or discharge hose.
  - Suspend the intake as far below the hydrocarbon/water interface as possible without resting it directly on the well bottom; this prevents debris from reaching the pump intake.



The system should be purged if free 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.

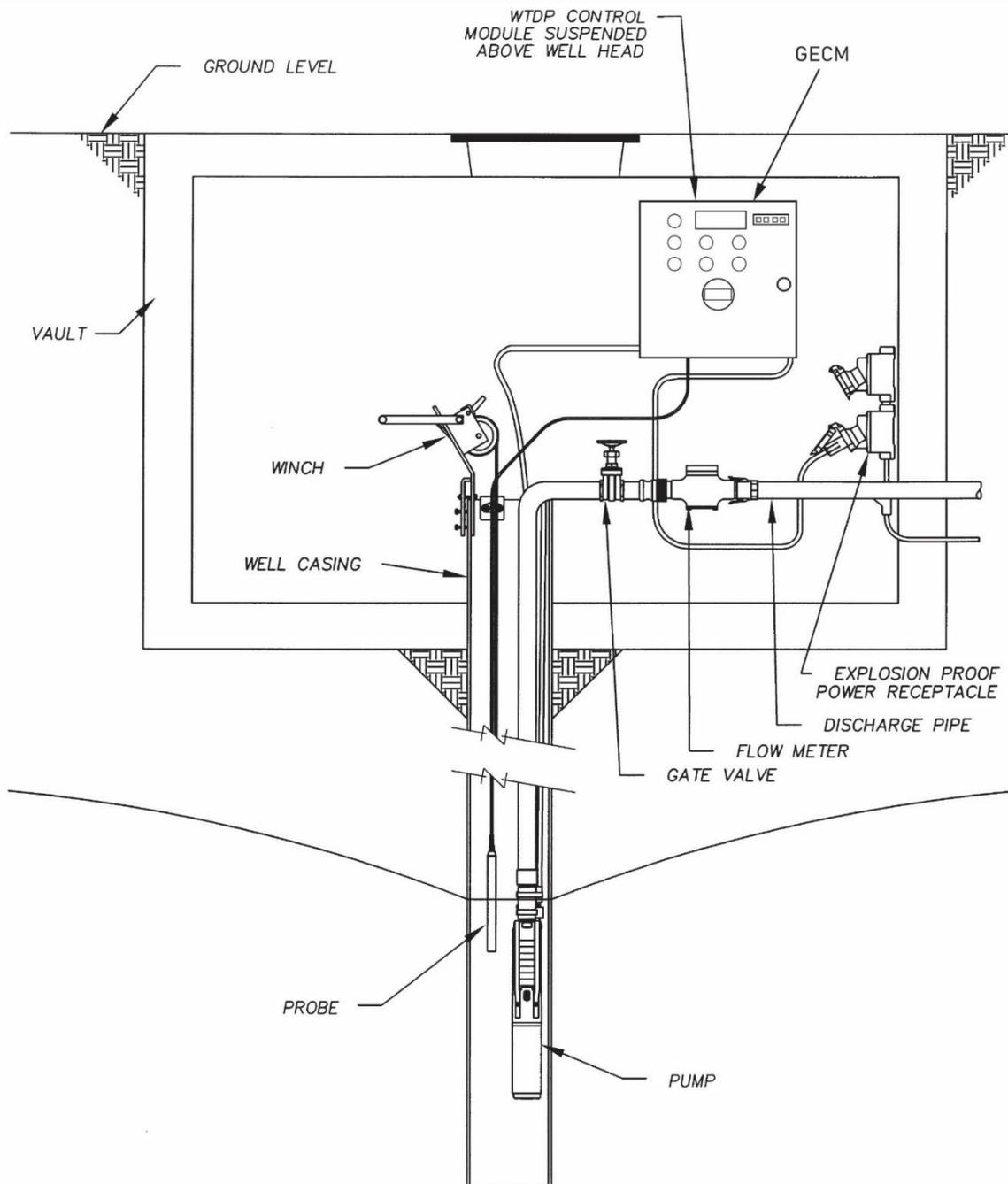
2. Deploy the control module adjacent to the well.
3. Mount vertically to reduce the possibility of intrusion by rain.
  - If using a vault, mount the control module as far above the well head as possible.
  - This will reduce the possibility of damage to the control module should the vault become flooded.
  - See Figure 2-7 for a typical vault layout.
4. Confirm that the output hose of the pump is connected to suitable piping or to a proper runoff.
  - Check local regulations.
5. Open the gate valve completely by turning it counterclockwise.
6. Attach the pump power cord to the control module.
7. Turn the control switch to OFF.
8. Confirm that the system power cord is plugged into a suitable power source and that a ground fault interrupter has been installed at the service.
9. Turn the control switch to AUTO.
10. Lower the probe into the well.
  - The pump will start when water contacts the HI sensor or user defined ON set point.
11. Establish a pumping level and throttle down the outflow with the gate valve.
12. Reduce the rate of pump cycling as far as possible without going below the minimum flow rate recommended by the pumps manufacturer.
  - Ideally, the pump should be made to run continuously.
13. With reference to the pump curves, run the pump until the water table is lowered one foot (30.5cm).
14. Use a flow meter to obtain a pumping rate.

- If a flow meter is not available, record the time required to fill a container of known volume.
- Determine how much pumping is required to obtain one foot of depression.

15. Lower the probe to the desired level of drawdown. Use the marks on the probe cable to determine depth.



The pump intake should be positioned at least 5' (1.5 m) below the level of drawdown. This will minimize intake of contaminated water.



**Figure 2-7:** Water Table Depression Pump Deployed in Vault

## Section 3: System Operation

### User Interface

#### Display & Keypad

Each GECM is equipped with a 16 x 2 character, extended temperature Display. Information regarding device status, probe levels (when applicable), and any alarm conditions are displayed. In an alarm condition, the display readout will show the most recent fault which halted system operation. Once fault condition is corrected the red RESET button can be pressed to resume system operation.

A 4-button keypad enables menu and scroll views on the Display for all systems. Continued scrolling will provide access to various information and diagnostics screens and allows for the telemetry module to be configured and enabled/disabled. The keypad will provide an in-depth view of how the system is operating.

Custom panel application displays may vary according to customer requirements. Any custom display definitions will be included within the device specific GECM manual. Equipment status and alarm condition displays are specific to each panel and its required control application.

A list of standard displays and their definitions can be found in *Section 4: Display Definitions* of this manual. A description of the abbreviated display responses/acronyms can be referenced in Appendix D.

#### HOA Switches & Indicator Lights

In addition to a Display and 4-button keypad, the GECM will provide HAND/OFF/AUTO (HOA) switches that control each device.

HAND has a spring return and must be held in position to directly power the device, regardless of switch input.

OFF will shutdown all controls and automation to the specific device. The GECM will remain powered on.

AUTO latches the hardware and will run the device autonomously with inputs from various switches.

AUTO should be used normally, but HAND may be used to verify device operation, e.g., “bumping” the device motor.

To “bump” a device’s motor when the GECM is in a fault condition, adjust device’s HOA switch to OFF position, then press the RESET button. HAND will now be active and will help to ensure devices are still in operational condition.

In the case of a fault condition where devices are powered down, AUTO will provide no device power.



**Figure 3-1:** Example of a HAND/OFF/AUTO (HOA) Switch

## RESET Button

Each GECM is designed to automatically shut down the system and associated devices whenever a fault occurs. Once the fault has been corrected the system can be easily turned back on by pressing the red RESET button. This will clear the firmware fault and automatically turn on any equipment still set to AUTO. If you do not want a given device to turn back on, then set the appropriate switch to OFF prior to using the RESET button.

Momentarily pressing the RESET button may also restore a blank or faulty display. However, contact Geotech should display problems occur that will not clear up with this method.

## Telemetry Enable/Disable and Configuration

Stay in touch with deployed remediation systems via SMS (text message) Telemetry embedded within any GECM. Systems equipped with Telemetry are optimized for simple send-and-receive queries that make remote sites convenient to monitor.

Each control panel can be programmed with up to 5 cell-phone numbers. When the system enters into a fault condition, the programmed numbers will be notified through text message. POWER ON and POWER OUTAGE alerts are facilitated by an incorporated short-life battery backup.

In addition, the control panel may be queried for operating status updates. Custom queries and configurations are available depending on site requirements. The unit must be powered on and the specified antenna connected to facilitate successful communication.

Systems are connected through a cellular network and accounts are managed through Geotech. Costs will depend on size of systems, frequency of alert conditions and commands, and location relative to cellular service. Antenna types will depend on location and proximity to cell towers.

A list of standard messages and their definitions can be found in *Section 4: Display Definitions* of this manual. A description of the abbreviated display responses/acronyms can be referenced in Appendix D.

### Setup Steps:

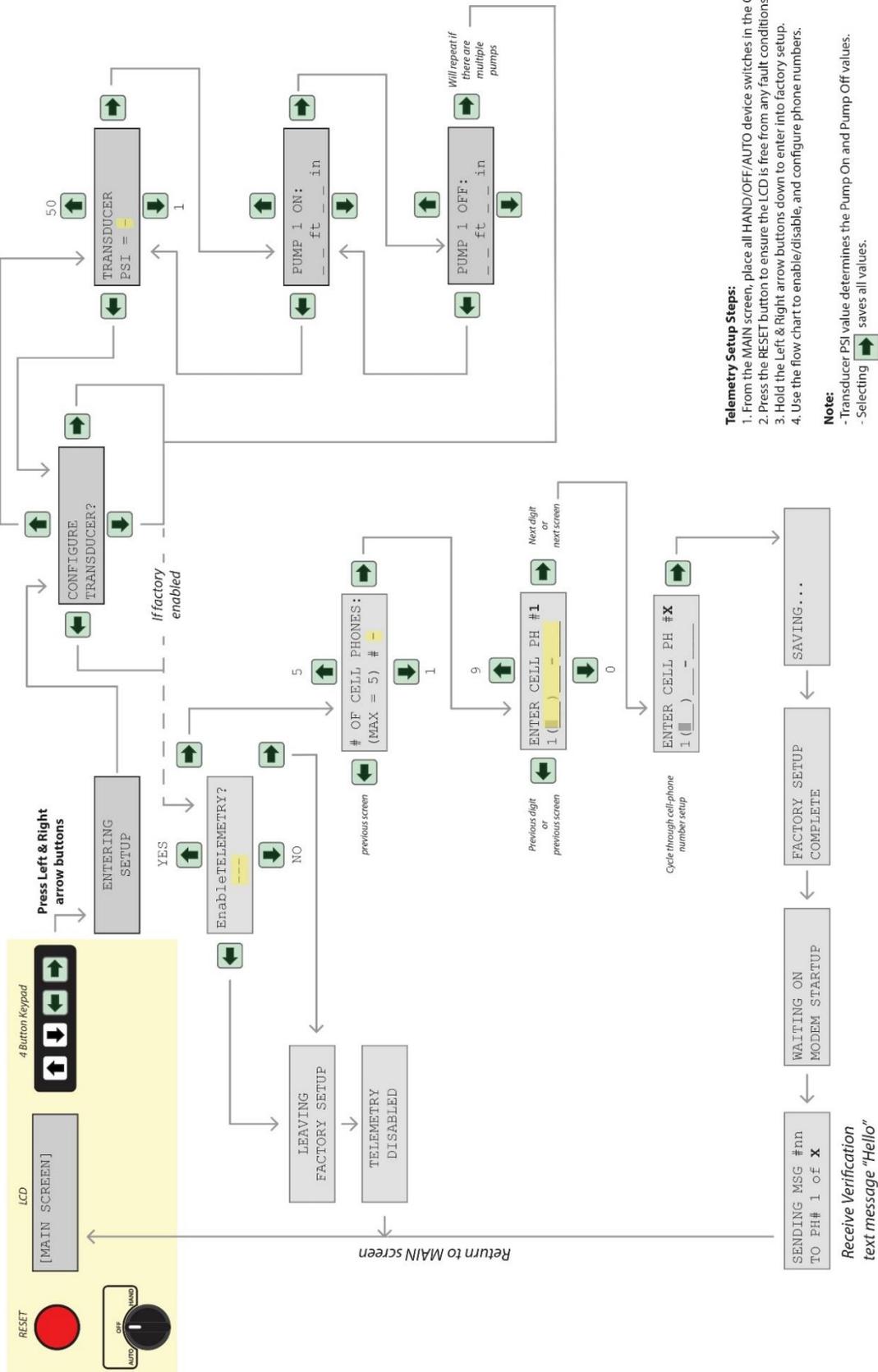
1. From the MAIN screen, place all HOA switches into the OFF position.
2. Press the RESET button to clear the GECM and its display of any fault conditions.
3. Simultaneously hold the LEFT & RIGHT arrow buttons on the 4-button keypad to enter into the Operator Setup menu.
4. Use the flow chart (Figure 3-2) to enable and configure, or disable telemetry settings.

Once configured, using the UP/DOWN arrows on the keypad will display the programmed phone numbers.



Disabling Telemetry through the Operator Setup menu does not affect the cellular service plan, but is rather useful when installing/testing/troubleshooting. Please contact your Geotech Customer Service Representative for all cellular plan service details.

# Geotech GECM Operator Setup Flow Chart



**Figure 3-2: Telemetry Enable/Configure User Interface flow chart**

*\*This screen can only be configured if the GECM is operating a pressure transducer or if telemetry is enabled.*

## Section 4: Display Definitions

The following pages describe status and fault displays used in a standard GECM configuration. Status and fault displays generated for unique GECM/system configurations will be further detailed within the Logic Description and individual device manual.

Fault and condition messages will require a system inspection and that the device be RESET at the GECM. Use this section, in conjunction with the individual device manual, to troubleshoot any fault or condition messages.

The following displays are common to the equipment shown. In general, there are several types of messages that can be displayed and they include System Status, Unit Status, System Faults, and Diagnostics. When the GECM is setup to control more than one system, the System Status display shows a high-level view of the status of the different systems. A more detailed status is provided in the Unit Status messages, accessed by the up/down buttons to scroll through the different screens. Access between the status screens and the diagnostic screens is accessed by pressing the right/left buttons.



A GECM controlling more than one system configuration will take advantage of up/down arrow buttons to review individual system displays.

### LCD Display Messages

#### System Status

If the GECM is setup to control more than one system, the System Status message provides a quick-view of the status of the different systems. If the GECM is only controlling a single system, the only the Unit Status message for single system will be shown (see “Unit Status” section below):

```
1 :XXXXXX 2 :XXXXXX  
3 :XXXXXX
```

Where XXXXX can be one of the following messages depending upon the configuration of the system, and the type of water level probes that are used:

ERROR	There is an error detected in the water level probe
FAULT	The unit is a latching fault condition that requires a manual reset
H20x	The status of the water level as determined by a float probe, where x can be H (high), M (middle), or L (low) water marks.
ORL	The override float on a float probe is in low
NOH20	There is no water (H20) detected (requires a conductivity probe)
PROBE	There is no float probe detected
YY.Y'	The height of the water column in feet (requires pressure transducer)

## Unit Status

The Unit Status message provides a detailed view of the status of a single unit. If the GECM is setup to control a single unit, only Unit Status message for the single system will be shown and the System Status message is not used. Use the up/down buttons to navigate through the System Status and all of the Unit Status screens.

If a pressure transducer is used as the water level sensor, the Unit Status message will show:

```
#X:xxxx  HHHHH  
WP:zzz   YY.Y'
```

Where:

#X is the system unit number (1, 2, or 3).

xxxx is the status of the unit and will show:

HAND	HOA switch is in hand mode
OFF	HOA switch is in off mode
AUTO	HOA switch is in auto mode
FAULT	The system had a latching fault requiring a manual reset

HHHHH is the status of the conductivity probe (if used):

NO H2O	No water is detected
H2O	Water is detected by the conductivity probe

WP:zzz is the status of the water pump, where zzz can be:

OFF	The water pump is off
ON	The water pump is on

YY.Y' is the height of the water column in feet, but if the probe is out of range will show ERROR.

If a float probe is used as the water level sensor, the Unit Status message will show:

```
#X:xxxx  HHHHH  
WP:zzz  ORv VVVV
```

Where:

#X is the system unit number (1, 2, or 3).

xxxx is the status of the unit and will show:

HAND	HOA switch is in hand mode
OFF	HOA switch is in off mode
AUTO	HOA switch is in auto mode
FAULT	The system had a latching fault requiring a manual reset

HHHHH is the status of the conductivity probe (if used):

NO H2O	No water is detected
H2O	Water is detected by the conductivity probe

WP:zzz is the status of the water pump, where zzz can be:

OFF	The water pump is off
ON	The water pump is on

ORv is the status of the override float and can be:

ORL	The override float is low
ORH	The override float is high

VVVV is the status of the water float and can be:

H20L	The water level float is low
H20M	The water level float is medium
H20H	The water level float is high
ERROR	The probe is not detected or the floats moved out of sequence

### System Faults

If there is a system level fault, the display will show one of the following fault messages:

TANK FULL	The tank full float triggered a system alarm
AUX SHUTDOWN	An external aux signal (supplied by customer) was detected
SYSTEM ERROR	The system has an internal error – please send back for service
POWER OUTAGE	When outfitted with telemetry, a power source failure has occurred

### Diagnostics

There are several diagnostic screens available. The diagnostic screens are accessed by pressing the right button (when not in a fault mode). To return to status screens, press the left button. To navigate through the different diagnostic screens, press the up/down arrow buttons.

#### *Version*

A standard GECM system will display the version number of the software as a date code:

```
GECM WTDP  
Ver:  YYYYMMDD
```

If this is a custom build, the order number will be shown as:

```
GECM WTDP  
ORDER#:  XXXXXX
```

#### *Telemetry*

This display shows if the Telemetry has been enabled:

```
TELEMETRY  
XXX
```

Where XXX can be YES or NO

#### *Lifetime*

This display shows lifetime information of the GECM:

LIFETIME: XXX  
DDDD:HH:MM:SS

Where XXX is the number of power cycles. The 2<sup>nd</sup> line of the display is the total on time in days (DDDD), hours (HH), minutes (MM), and seconds (SS).

### *Telemetry Cell Phone*

These diagnostic displays show the different phone numbers (up to 5) that are setup if the GECM is enabled with telemetry option:

CELL PHONE #X:  
0 (000) 000-0000

### **Telemetry Messages from a GECM**

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 Message*

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 MSG #” display which is responding to the query.

### *System's response to text message “STATUS?” (case sensitive)*

When the system is in a system fault mode:

GECM: Tank Full	The system is in a tank full fault mode
GECM: AUX Alarm	The system is in an AUX shutdown fault mode
GECM: SYSTEM ERROR	An internal error was detected

When the system is in **not** a system fault mode, the GECM will respond to the "STATUS?" request by providing information similar to what is on the System Status screen:

```
GECM Status -  
#1:XXXXX  
#2:XXXXX  
#3:XXXXX
```

Where XXXXX can be one of the following messages depending upon the configuration of the system, and the type of water level probes that are used:

Off	The unit's HOA switch is in the Off position
Error	There is an error detected in the water level probe
FAULT	The unit is a latching fault condition that requires a manual reset
H20x	The status of the water level as determined by a float probe, where x can be H (high), M (middle), or L (low) water marks.
ORL	The override float on a float probe is in low
NoH20	There is no water (H20) detected (requires a conductivity probe)
Probe	There is no float probe detected
YY.Y'	Height of the water column in feet (requires pressure transducer)

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.

## Section 5: Troubleshooting Guide

Use this section, in conjunction with *Section 4: Display Definitions*, to troubleshoot any 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, refer to wiring diagram. (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 or non-sensible alpha-numeric –

- Press RESET button.
- Fuse is blown in the GECM PCB or faulty electronics. Return to Geotech for service.

### Water Pump Will Not Run –

- Check device status on GECM display.
- Check for blown fuses.
- Check wire connections between device and GECM.
- Check water level probe floats (when separate water pump in use).
- 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.

### WTDP Probe Fault –

- This error will occur when the HIHI 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.

### Tankfull Message –

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

### **Auxiliary (AUX) Alarm Message -**

- External system (for example: an influent pump on LOPRO) has sent a dry contact message to the GECM, instructing the GECM to shutdown. Ensure external system's faults are cleared in order to resume normal operation.
- A wire may have become disconnected or broken, check wiring diagram.

### **Pressure Transducer Fault -**

- This error will occur when the signal from the probe goes out of range. Check wiring to GECM and/or for broken cable.

### **System keeps going into an alarm after reset -**

- Turn all HOA switches into the OFF position and press RESET.

## Section 6: System Specifications

### Electrical:

Operating Power: 10 Watts

Input Voltage: 115VAC (1PH), 230VAC (1PH and 3PH), or 460VAC (3PH)

(See individual device wiring diagrams and *Appendix A: Customer and Device Information* for detailed electrical specifications)

### Environmental Conditions:

0-104° F (-17.8 - 40° C)

A normal barometric pressure of one atmosphere.

(Enclosure heaters and cooling fans available can extend the temperature range to -30 to 110° F (-34 to 43° C)

### Mechanical:

Main enclosure: NEMA 4X (IP66)

Enclosure material: Fiberglass

External height: 18" (45.7 cm)

External width: 16" (40.6 cm)

External depth: 10" (25 cm)

Weight: 15 to 45 lbs (6.8 to 20 kgs) (depending on installed options)

Polyester mounting brackets and stainless steel attachment screws are provided with each enclosure. In some systems, such as a LOPRO III Air Stripper or a system housed inside a Hazardous Materials enclosure, the GECM is pre-mounted to the larger skid assembly. GECMs may be ordered and specified to be "shipped as loose", however electrical competency will be required for safe site installation.

## Section 7: Parts and Accessories

Description	Part #
GECM,WTDP,SINGLE,W/TRANS INPUT CONTROL,115V 2HP/230V 4HP	86110024
GECM,WTDP,DOUBLE,W/TRANS INPUT CONTROL,115V 2HP/230V 4HP	86110025
GECM,WTDP,TRIPLE,W/TRANS INPUT CONTROL,115V 2HP/230V 4HP	86110026
GECM,WTDP,SINGLE,115V 2HP/230V 4HP	86110027
GECM,WTDP,DOUBLE,115V 2HP/230V 4HP	86110028
GECM,WTDP,TRIPLE,115V 2HP/230V 4HP	86110029
GECM,WTDP,SINGLE,460V 7HP	86110030
GECM,WTDP,DOUBLE,460V 7HP	86110031
GECM,WTDP,TRIPLE,460V 7HP	86110032
GECM,WTDP,SINGLE,W/TRANS INPUT CONTROL,460V 7HP	86110033
GECM,WTDP,DOUBLE,W/TRANS INPUT CONTROL,460V 7HP	86110034
GECM,WTDP,TRIPLE,W/TRANS INPUT CONTROL,460V 7HP	86110035
GECM,WTDP,SINGLE,115V 2HP/230V 4HP, W/VFD	86110036
GECM,WTDP,DOUBLE,115V 2HP/230V 4HP,W/VFD	86110037
GECM,WTDP,TRIPLE,115V 2HP/230V 4HP,W/VFD	86110038
GECM,WTDP,SINGLE,W/TRANS INPUT CTRL,115V 2HP/230V 4HP,W/VFD	86110039
GECM,WTDP,DOUBLE,W/TRANS INPUT CTRL,115V 2HP/230V 4HP,W/VFD	86110040
GECM,WTDP,TRIPLE,W/TRANS INPUT CTRL,115V 2HP/230V 4HP,W/VFD	86110041
GECM,WTDP,SINGLE,W/TRANS INPUT CTRL,460V 7HP,W/VFD	86110042
GECM,WTDP,DOUBLE,W/TRANS INPUT CTRL,460V 7HP,W/VFD	86110043
GECM,WTDP,TRIPLE,W/TRANS INPUT CTRL,460V 7HP,W/VFD	86110044
HOA SWITCH	16110042
INDICATOR LIGHT, GREEN, GECM	16110112
INDICATOR LIGHT, RED, GECM	16110088
SWITCH, ELCTROMECHANICAL, EMERGENCY STOP, NO/NC	19600042
ASSEMBLY, FUSIBLE DISCONNECT, 30AMP, 1PH, CLASS J, TIME DELAY	86110010
ASSEMBLY, FUSIBLE DISCONNECT, 30AMP, 3PH, CLASS J, TIME DELAY	86110005
ASSEMBLY, FUSIBLE DISCONNECT, 100AMP, 3PH, CLASS J, TIME DELAY	86110007
ASSEMBLY, FUSIBLE DISCONNECT, 60AMP, 3PH, CLASS J, TIME DELAY	86110006
METER, HOUR, 115V, 50/60, GECM	16110045
TIMER, 7DAY CYCLE, GECM	16110044
TIMER, EM, 1POLE, 120V, 24HOUR	16110138
FUSE HOLDER ASSEMBLY	2010029
FUSE, 1A, 250V, SLO-BLO	PPE011026
RELAY, 110V, DPDT, 10AMP	PPE014090
RELAY, 230V, DPDT, 10AMP	PPE014091
GECM TELEMETRY MODULE	86200003
ANTENNA, ADJUST, DUCK, 4"	16200013
MOTOR STARTER,10-16A,115V,1PH, 115V COIL	16110048

ASSY,WINCH,STD DUTY,71FT 1000LB MAX	2020005
ASSY,WINCH,HEAVY DUTY,110FT 2500LB MAX	2030001
TANKFULL PROBE,W/CONNECTOR	56020009
PROBE,SM.DIA.,DENS,100',2005	56120009
PROBE,SM.DIA.,DENS,25',2005	56120010
PROBE,SM.DIA.,DENS,50',2005	56120013
JUNCTION BOX,SIGNAL	2390065
JUNCTION BOX,XP	2390066
MANUAL,GECM,WTDP	16110239

\*GECM base unit does not include motor starters. Motor starters and power supply relays must be specified per system.

**Appendix A – Customer and Device Information**

Customer Name:

Sales Order Number:

Build Date:

GECEM Serial Number:

Voltage/Phase:

Device Name:	Serial Number:	Model Number:

**Water Depression Pump Specifications**

Downwell Probe: Y / N

Part No. \_\_\_\_\_

Connector Attached: Y / N

Part No. \_\_\_\_\_

Connector Attached: Y / N

Winch Assembly: Y/ N

\_\_\_\_ Standard

\_\_\_\_ Heavy Duty

<b>For WTDP ready units -</b>	
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:	

## Appendix B – Logic Statements

### Water Table Depression Pump (WTDP) with WTDP Probe

#### System Overview

A Geotech Water Table Depression Pump (WTDP) System consists of a Grundfos RF4 Water Pump which uses float density logic for water table control. Automated control of up to three (3) WTDPs 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.

#### System control components

- Hand/Off/Auto switches (Water Pump)
- Motor Starter with thermal overload protection (Water Pump)
- Reset Button
- 4-button Keypad

#### System Indicator Components

- 16 x 2 character LCD Screen
- Green Run Lights (Water Pump)
- Red Fault Lights
- Run Time Hour Meters

#### System Operation

Abbreviations used:

Hi = High

Lo = Low

HOA = Hand/Off/Auto

#### WTDP Probe

The WTDP pump is controlled by the Water Hi/Lo switches actuated by the WTDP probe Hi/Lo float and the Override 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. See Figure B-1.

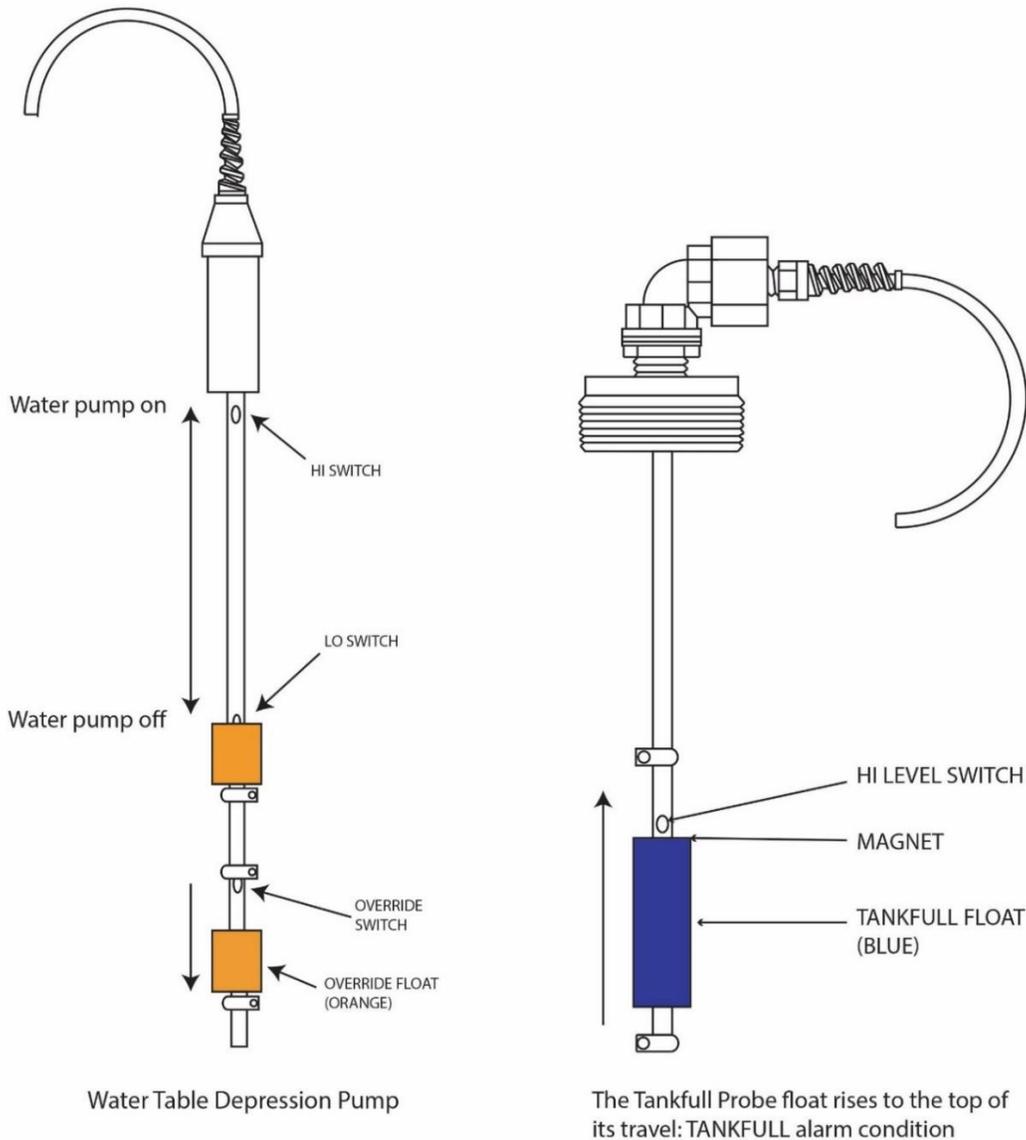
#### Water Pump Operation

The water pump is controlled by the Water Hi/Lo switches actuated by the WTDP probe 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 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 Fault Lights for the specific pump will illuminate. This alarm condition is set up as a latching control for the water pump, i.e., a manual reset is

required in order for the water pump to resume operation. Each additional pump will run independently from each other.

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 WTDP pump will shut down. The LCD screen on the GECM will indicate a “TANKFULL” alarm condition and all Red Fault Lights will illuminate. This alarm condition is set up as a latching control, i.e., a manual reset is required. See Figure B-1.



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

**Figure B-1: Probe Logic**

## Probe Fault Alarm

A Probe Fault Alarm condition can occur in the WTDP probe when:

- 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 corresponding pump. The LCD screen on the GECM will indicate a "PROBE FAULT" alarm condition and the Red Fault Light for the specific pump will illuminate. This alarm condition is set up as a latching control, i.e., a manual reset is required.

## 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 all Red Fault Lights will illuminate. This alarm condition is set up as a latching control, i.e., 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 is 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. If there is no active fault and a switch is placed in the HAND position, power will be applied to the respective device.
- A Dry Form C Contact relay assembly is incorporated into the GECM. 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.

## **Water Table Depression Pump (WTDP) with Transducer and optional Conductivity Probe**

### **System Description**

A Geotech Water Table Depression Pump (WTDP) consists of a Grundfos RF4 Water Pump, Pressure Transducer, and optional Conductivity Probe which uses user defined pressure logic for water table control. Automated control of up to three (3) WTDPs 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**

- Hand/Off/Auto switches (Water Pump)
- Motor Starter with thermal overload protection (Water Pump)
- Reset Button
- 4-button Keypad

### **GECM Control indicator components**

- 16 x 2 character LCD Screen
- Green Run Lights (Water Pumps)
- Red Fault Lights
- Run Time Hour Meters

### **System Operation**

Abbreviations used:

Hi = High

Lo = Low

HOA = Hand/Off/Auto

#### Down well Pressure Transducer

The water pump cycles on and off in response to signals sent to the GECM based on the user defined set points of the Pressure Transducer. See Figure B-2.

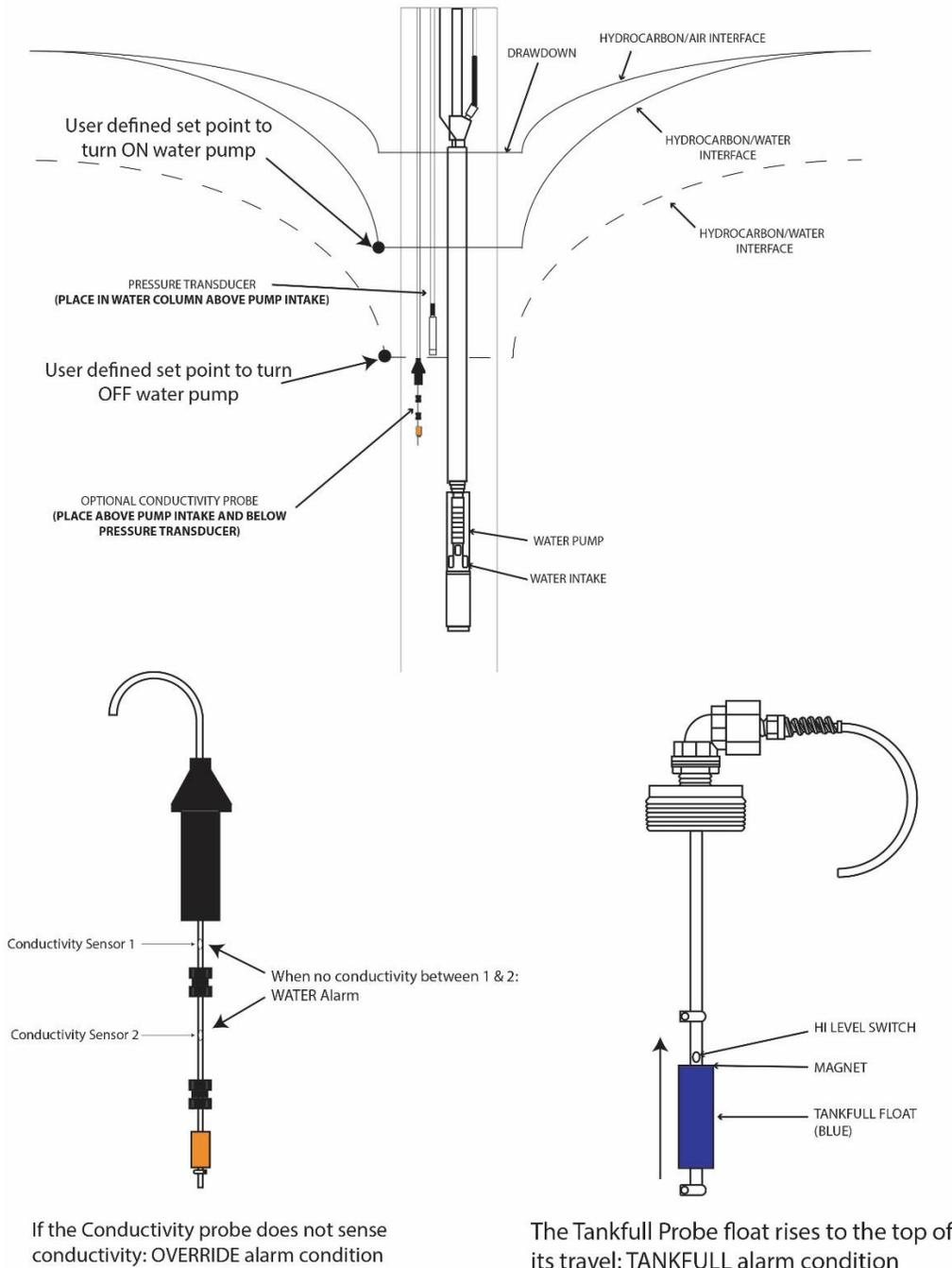
#### Water Pump Operation

The Water Pump is controlled by a Pressure Transducer (4-20mA). The water pump turns ON when the Pressure Transducer is submerged in water at the user defined depth. The pump continues to run until the water above the Pressure Transducer is reduced to the user defined depth. Each additional pump will run independently of each other. See Figure 3-2 to configure settings on the GECM.

In addition to a Pressure Transducer, an optional Conductivity Probe can be placed in the well to prevent the Water Pump from running when the probe does not sense conductivity (product or air). The LCD screen on the GECM panel will indicate an "OVERRIDE" alarm condition and the Red Fault Light will illuminate. See Figure B-2.

## 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 WTDP will shut down. The LCD screen on the GECM will indicate a "TANKFULL" alarm condition and all Red Fault Lights will illuminate. This alarm condition is set up as a latching control, i.e., a manual reset is required. See Figure B-2.



**Figure B-2: WTDP Conductivity and Transducer Logic**

### Pressure Transducer Fault Alarm

A Pressure Transducer Alarm condition can occur when:

- The transducer is installed to the GECM incorrectly
- There's a break in the wiring
- If the GECM reads anything out of range

The transducer fault alarm condition will shut down the individual pump unit within the system. The LCD screen on the GECM will indicate a transducer error message "TRANSDUCER FAULT" alarm condition and the Red Fault Light will illuminate. This alarm condition is set up for latching control i.e., a manual reset is required.

### 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 all 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 is 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. If there is no active fault and a switch is placed in the HAND position, power will be applied to the respective device.
- 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 – 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 C-1: Two or Three Wire Cable, 60 Hz (Service Entrance to Motor – Maximum Length in Feet)**

Motor Rating		AWG Copper Wire Size												
Volt s	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		
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 C-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	810*	930*	1060*	1190*	1300	1510				
200	0	0	0	0	0	0	0	0	0	0	0	0	810*	920*	1030*	1130*	1310				

**Table C-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	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	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			

## Appendix D - Glossary of Acronyms

AUX	Auxiliary
BLWR	Blower
ECM	Electronic Control Module
GECM	Geotech Environmental Control Module
H2O	Water
H2OL	Water level low (as determined by a water HI/LO float)
H2OM	Water level middle (as determined by a water HI/LO float)
H2OH	Water level high (as determined by a water HI/LO float)
HI	High
HOA	Hand-Off-Auto (switch)
HP	Horse Power
IS	Intrinsically Safe
JB	Junction Box
LH	HI/LO float high (Sump probe, 3 position probe)
LL	HI/LO float low (Sump probe, 3 position probe)
LM	HI/LO float middle (Sump probe, 3 position probe)
LO	Low
LOPRO	Low Profile Air Stripper
NOH2O	No water present (as detected by a conductivity probe if present)
ORH	Override float (water) high (SDFS/PSCAV probe)
ORL	Override float (water) low (SDFS/PSCAV probe)
ORS	Oil Recovery Systems
PCB	Printed Circuit Board
PH	Phase (electrical term)
PH	Product float high (SDFS/PSCAV probe)
PL	Product float low (SDFS/PSCAV probe)
PM	Product float middle (SDFS/PSCAV probe)
PSCV	Probe Scavenger (4" Small Diameter PSCAV)
PSCAV	Probe Scavenger (4" Small Diameter PSCAV)
PSI	Pressure per Square Inch
PROD	Product pump
RES	Reservoir (SDFS)
SDFS	Small Diameter Filter Scavenger
SN	Serial Number
SPRG	Air Sparge unit
SVE	Soil Vapor Extractor (Extraction)
VAC	Voltage Alternating Current
VDC	Voltage Direct Current
VFD	Variable Frequency Drive, or Vacuum Fluorescent Display
WTDP	Water Table Depression Pump
XFER	Transfer Pump

**DOCUMENT REVISIONS**

PROJECT #	DESCRIPTION	DATE
1795	Release, StellaR	8/1/2019
1795	Added 460V notes and PN, StellaR	11/25/2019
1795	Clarified wiring from Geotech for 460V 3PH systems, StellaR	12/16/2019

## NOTES

## NOTES

## 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 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 of Purchase: \_\_\_\_\_

## 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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