

# BP Controller 300 PSI

Installation and Operation Manual





# Table of Contents

<b>DOCUMENTATION CONVENTIONS .....</b>	<b>2</b>
<b>Section 1: System Description .....</b>	<b>3</b>
Function and Theory .....	4
System Components .....	4
<b>Section 2: System Installation .....</b>	<b>5</b>
Power Source .....	5
Selecting an Air Source .....	5
Determining PSI .....	6
General Operating Definitions .....	7
Battery Overdraw Protection .....	7
<b>Section 3: System Operation .....</b>	<b>9</b>
Quick Start Guide .....	9
Adjusting Cycle Timers .....	10
<b>Section 4: System Maintenance .....</b>	<b>13</b>
<b>Section 5: System Troubleshooting .....</b>	<b>13</b>
<b>Section 6: System Specifications .....</b>	<b>17</b>
<b>Section 7: System Schematics .....</b>	<b>18</b>
<b>Section 8: Parts and Accessories .....</b>	<b>20</b>
<b>NOTES .....</b>	<b>22</b>
<b>Declaration of Conformity .....</b>	<b>25</b>
<b>The Warranty .....</b>	<b>26</b>

## DOCUMENTATION CONVENTIONS

This document 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.

In order to ensure that your Controller has a long service life and operates properly, adhere to the cautions below and read this manual before use.

- Disconnect from power source when not in use.
- Controller power input source must not exceed maximum ratings.
- Controller must be wired to a negative ground system.
- Controller may not operate properly with excess wiring not supplied by manufacturer.
- Avoid spraying fluid directly at controller.
- Never submerge controller.
- Avoid pulling on wires to unplug controller wiring.
- Avoid using controller with obvious physical damage.
- To prevent controller damage, avoid dropping controller.



The BP Controller 300PSI cannot be made dangerous or unsafe because of failure due to EMC interference.



Do not operate this equipment if it has visible signs of significant physical damage other than normal wear and tear.



**Notice for consumers in Europe:**

This symbol indicates that this product is to be collected separately.

The following apply only to users in European countries:

- This product is designated for separate collection at an appropriate collection point. Do not dispose of as household waste.

**For more information, contact the seller or the local authorities in charge of waste management.**

# Section 1: System Description

## Function and Theory

The Bladder Pump (BP) Controller 300 PSI is a high-pressure pump controller that uses advanced electronic logic to control gentle low-flow sampling. Equipped with a high-pressure solenoid activated valve and self-relieving regulator, the BP Controller can purge depths down to 690' (210m).

This controller connects to any Bladder Pump (BP) system with the use of simple push-to-connect hose adapters. The two timers are adjusted to set the amount of time that the pump pressurizes (discharge cycle) and depressurizes (fill cycle). During the discharge cycle, the pump pressurizes squeezes the bladder, forcing the sample through the center discharge line. During the fill cycle, the compressed pump now exhausts through the controller vent allowing the pump to fill again, hydrostatically.

A user-friendly interface visually communicates operating status of the controller, as well as informing the user of low battery conditions. The BP Controller is compatible with Water Level Meter equipment by connecting a drawdown cable.

## System Components

The control panel is mounted inside a heavy-duty case for ease of mobility and long-term durability. Accessories for the BP Controller consist of high-pressure AIR IN (from supply) and AIR OUT (to pump) hoses, and an AC and DC Power Cord.

## Air Connections

The couplings on the AIR IN and AIR OUT Hose Assemblies are Push-to-Connect fittings; press the socket onto the plug until a 'click' is heard. It should be a secure fit which can not be pulled off when tugged. To remove the coupling, push down on the socket's jacket and the connection will 'pop' out (see Figure 1-1).

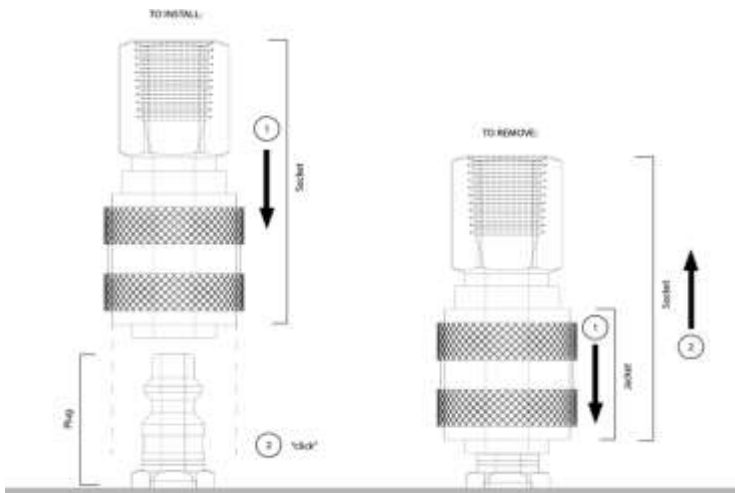


Figure 1-1: Push-to-Connect fitting

## Section 2: System Installation



The BP Controller requires dry, moisture free air. Disregarding this caution can increase the likelihood of unnecessary maintenance.

### Power Source

Determine your power source, either 115 VAC or 12 VDC. Power connects are on the side of the control panel.

If using Water Level Meter Equipment, connect a drawdown cable to the 'AUX INPUT'.

### Selecting an Air Source

Air consumption depends on the volume of tubing and the size of deployed Bladder Pump. Follow the general guidelines and examples below to calculate the air consumption for specific sampling configurations.

#### Volume of Tubing

TUBE I.D.	TUBING LENGTH				
	1 ft./ 0.3 m	10 ft./ 3 m	50 ft./ 15 m	100 ft./ 30 m	690 ft./ 210 m
0.17 in/ 0.43 cm	0.3 in <sup>3</sup> / 5 cm <sup>3</sup>	3 in <sup>3</sup> / 50 cm <sup>3</sup>	15 in <sup>3</sup> / 246 cm <sup>3</sup>	30 in <sup>3</sup> / 492 cm <sup>3</sup>	207 in <sup>3</sup> / 3392 cm <sup>3</sup>
0.25 in/ 0.64 cm	0.6 in <sup>3</sup> / 10 cm <sup>3</sup>	6 in <sup>3</sup> / 100 cm <sup>3</sup>	30 in <sup>3</sup> / 492 cm <sup>3</sup>	60 in <sup>3</sup> / 984 cm <sup>3</sup>	414 in <sup>3</sup> / 6784 cm <sup>3</sup>
0.5 in/ 1.2 cm	2.4 in <sup>3</sup> / 39 cm <sup>3</sup>	24 in <sup>3</sup> / 393 cm <sup>3</sup>	120 in <sup>3</sup> / 1967 cm <sup>3</sup>	240 in <sup>3</sup> / 3933 cm <sup>3</sup>	1656 in <sup>3</sup> / 27137 cm <sup>3</sup>

#### Volume of Bladder Pumps

1.66 BP LENGTH	VOLUME
18 in/ 46 cm	39 in <sup>3</sup> / 640 cm <sup>3</sup>
36 in/ 91 cm	78 in <sup>3</sup> / 1278 cm <sup>3</sup>

*Calculation guideline:*

$$\begin{aligned}
 & \text{Volume of Tubing (in}^3\text{/cm)} \\
 & + \text{Volume of Bladder Pump (in}^3\text{/cm}^3\text{)} \\
 & = \text{Air Consumption per cycle (in}^3\text{/cm}^3\text{)}
 \end{aligned}$$

Example (use metric units when applicable):

When using an 18" bladder pump and 0.17" I.D. tubing, what size compressor is recommended to purge a sample 200' deep?

*Step 1: Determine air consumption per cycle.*

In this case the 1.66 BP 18" pump is used with 200' of 0.17" I.D. tubing.

$$\text{Volume of tubing} = 30 \text{ in}^3 * 2 = \mathbf{60 \text{ in}^3}$$

$$\text{Volume of pump} = \mathbf{39 \text{ in}^3}$$

$$\text{Total air consumption per cycle} = 60 \text{ in}^3 + 39 \text{ in}^3 = \mathbf{99 \text{ in}^3}$$

*Step 2: Determine air consumption per hour.*

Assuming the pump cycles no more than 6 times per minute, we can estimate maximum air consumption per hour.

$$99 \text{ in}^3/\text{cycle} * 6 \text{ cycles/min} * 60\text{min/hour} = \mathbf{35,640 \text{ in}^3/\text{hour}}$$
 or 21 ft<sup>3</sup>/hour

When using an air compressor use one reserve tank to ensure proper air supply to the pump. When using a Nitrogen Tank, see Figure 2-1 for Nitrogen Tank Volume vs. Bladder Pump consumption.

## Determining PSI

Determine the air pressure needed to operate the Bladder Pump based on the length of the air supply line to the pump (well depth).

Use this simplified formula:

$$0.5 \text{ PSI (per foot)} + 10 \text{ PSI (to account for tubing friction)} = \text{required PSI}$$

$$0.12 \text{ bar (per meter)} + 0.7 \text{ bar (to account for tubing friction)} = \text{required bar}$$

Example (use metric units when applicable):

For a pump 400' away from the air source

$$(400' * 0.5 \text{ PSI}) + 10 = \mathbf{210 \text{ PSI}}$$

As mentioned above, the additional 10 PSI (0.7 bar) is to account for the pump itself and friction loss along the airline tubing. When the length of the airline is 50' (15m) or less, there is no need for the additional pressure.

To determine minimum operating pressures for the specific Bladder Pump model you are using, consult the pump's specifications. Typically, the minimum operating pressure will be 5 PSI (0.4 bar) above static head.



The formulas stated above are not absolute, and are meant to provide baseline information.









## General Operating Definitions

The BP Controller interface utilizes 'FILL TIME' and 'DISCHARGE TIME' to identify the alternating timed air cycles. The 'STATUS' light will indicate the current cycle or error code.

**FILL TIME** – During this cycle, the controller is exhausting compressed air from the BP system (tubing and pump) to allow hydrostatic fill of liquid within the pump.

**DISCHARGE TIME** – During this cycle, the controller is routing compressed air into the BP and squeezing the flexible bladder, which then displaces liquid up the discharge line.

**STATUS** – The LED on the control panel will visually communicate the status of the sampling system:

-  FLASH GREEN - DISCHARGE TIME cycle engages
-  FLASH BLUE - FILL TIME cycle engages
-  FLASH RED and GREEN - DISCHARGE TIME cycle, critical battery
-  FLASH RED and BLUE - FILL TIME cycle, critical battery
-  SOLID RED - controller has stop cycling, low battery
-  SOLID BLUE - waiting for water to refill in well  
*(Applicable if drawdown cable and Water Level Meter equipment attached)*

## Battery Overdraw Protection

The controller is designed to stop cycling if there is a potential for battery overdraw, as an overdrawn battery cannot be recharged and reused.

- A flashing red LED will indicate that your power source is in a critically low condition.
- A solid red LED will indicate that the controller has stop cycling to help protect against battery overdraw.

Operating Battery Voltage	11.7V to 14V
Critically Low Battery Voltage	11V to 11.6V
Low Battery Voltage	below 11V
*Recharge Voltage required to re-engage	12.8V

*\*If the controller's power source is connected to a solar panel for battery recharge, the battery will have to be recharged to 12.8V or above before the controller will continue cycling.*

# NITROGEN TANK VOLUME VS BLADDER PUMP CONSUMPTION

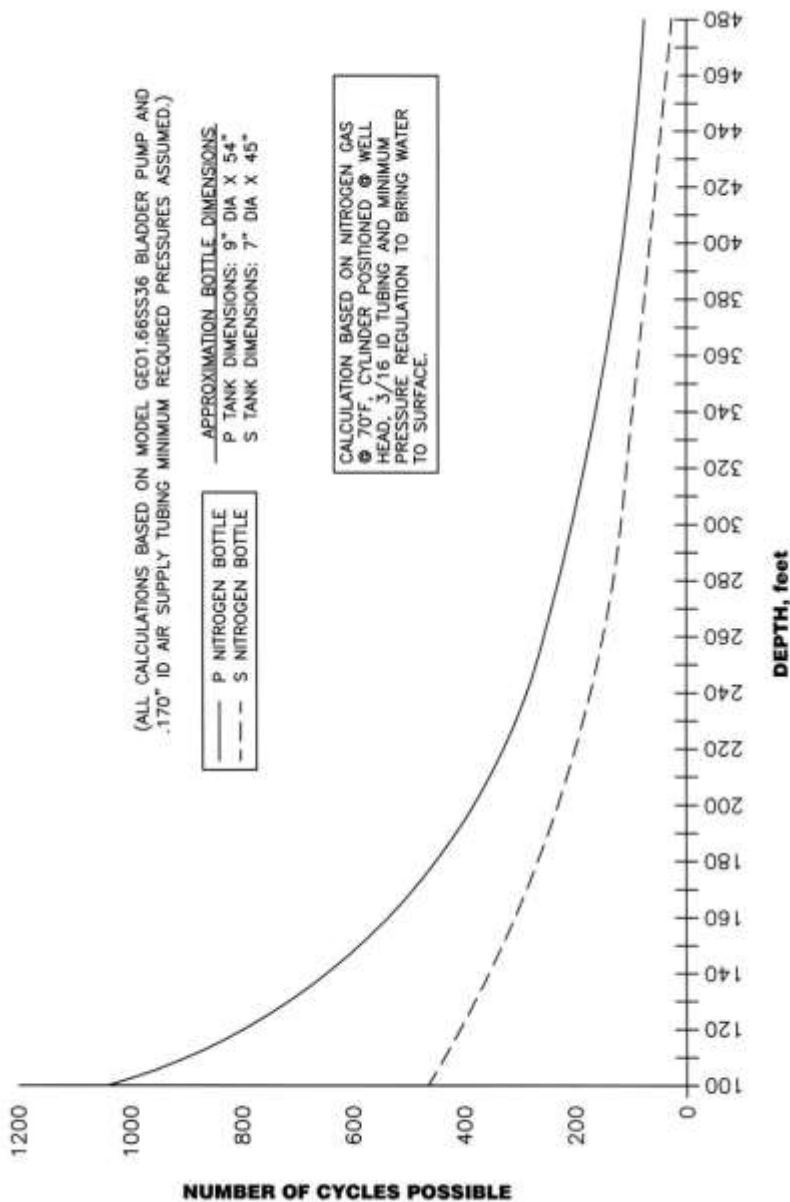


Figure 2-1: Nitrogen tank volume vs. Bladder Pump consumption

## Section 3: System Operation

The BP Controller 300 PSI has a *Normally Closed* valve. Therefore, if power is disconnected from the unit, the controller will automatically stop the flow of air. This helps to protect the integrity of the bladder and protects against draining the air source.

### Quick Start Guide

1. Connect Power Supply to side of controller (see *Section 2 'Power Source'*).
2. Connect drawdown cable to Water Level Meter equipment (if applicable).
3. Set FILL TIME and DISCHARGE TIME knobs to approximately 30 seconds.
  - *A low cycle time limits the amount of initial pressurized air entering the pump, so as not to collapse the bladder.*
4. Flip BP Controller power switch to the ON position.
  - *After about 30 seconds, there should be a distinct 'click' when the solenoid valve shifts.*
  - *If the controller only cycles once and then displays a red light, there is not sufficient power from the battery. See Section 5: System Troubleshooting for more information.*
5. Connect 'AIR OUT' hose socket to the 'AIR OUT' plug on the control panel (1/4" coupling size). Connect the other end of the 'AIR OUT' hose to the pump airline on the wellhead (1/4" quick-connect fitting).  
*See Section 1 'System Components' for details on the air connection couplings.*
6. Connect the unpressurized 'AIR IN' hose socket to the 'AIR IN' plus on the control panel (3/8" coupling size). Connect the other end of the 'AIR IN' hose to the regulated air supply (compressor, bottle, tank, etc.)



The controller has an imbedded safety relief valve, which will exhaust compressed air that enters the system in excess of 350PSI (24 bar). To reset the relief valve and allow air through the controller, incoming air must be regulated to 300PSI (20.7 bar) or below.

7. Adjust the air source to the appropriate PSI (MAXIMUM: 300PSI/20.7 bar). See *'Determining PSI'* in *Section 2*.
8. Adjust the FILL TIME and DISCHARGE TIME based on pump and well specifications (see *'Adjusting Cycle Timers'* in *Section 3* for guidelines).
  - a. Let controller cycle until fluid starts pumping from discharge tubing.
  - b. Adjust DISCHARGE TIME so that the air supply turns off when fluid stops flowing from tubing.
  - c. Adjust FILL TIME to desired setting that allows pump to hydrostatically fill.
9. When pumping is complete, turn off air supply (exhaust excess air if applicable) and flip BP Controller power switch to the OFF position.

10. Use caution when disconnecting hoses, as the system may be slightly pressurized. Hoses and power adapters are stored in the accessory bag.

### **Water Level Meter Compatibility**

A connected Water Level Meter is used to control drawdown in the well, and when installed correctly will cause the BP Controller to cycle only when the Water Level Meter probe is submerged. The probe should be positioned at or above the pump's head.

The Water Level Meter with drawdown feature connects to the BP Controller through the "AUX INPUT" terminal.

Once connected, the probe of the Water Level Meter must be submerged in water to initiate the drawdown logic. If the Water Level Meter is accidentally disconnected, the BP Controller will enter a "Waiting for Water" status.

The BP Controller must be power cycled to exit Water Level Meter mode.

Follow the Water Level Meter's Installation and Operation Manual for additional information.

### **Adjusting Cycle Timers**

The FILL TIME and DISCHARGE TIME knobs have a large diameter for maximum resolution. The timers have a range from 5-120 seconds.

Adjust DISCHARGE TIME knob to approximately 10 seconds, and adjust FILL TIME knob to approximately 30 seconds. A 30 second exhaust cycle (FILL TIME) will be enough time to hydrostatically fill a bladder at approximately 100' (30.5m) deep.

The DISCHARGE TIME cycle can be adjusted by watching the sample line. When a steady stream of water stops during the cycle (STATUS light = green), set the DISCHARGE TIME back about five seconds.



**DO NOT OVER PRESSURIZE (EXCESS DISCHARGE TIME)** as this will cause excessive bladder wear.

Once the DISCHARGE TIME is adjusted, measure the volume of the sample and adjust the FILL TIME back about one second. Let the pump cycle a few times after each modification before adjusting again. Measure the volume of sample to make sure it is not decreasing. Continue to reduce the FILL TIME until the sample volume decreases. A decrease in sample volume indicates that the exhaust cycle (FILL TIME) is not long enough for the pump bladder to fill to its maximum capacity. Add one second to the FILL TIME at this point to make sure the maximum volume in the bladder is achieved.



Discharge and Fill times will vary depending on the depth of well and size of airline tubing. It may take a few cycles to see fluid as the pump fills the discharge tubing incrementally.

The following Fill cycle time guidelines are based on a 0.5" (1.3 cm) I.D. airline tube:

TYPE	DEPTH	DISCHARGE TIME
Standard Sampling	up to 172' / 52m	0-30 seconds
Deep Well Sampling	up to 345' / 105m	0-60 seconds
Max. Depth Sampling	up to 690' / 210m	0-120 seconds

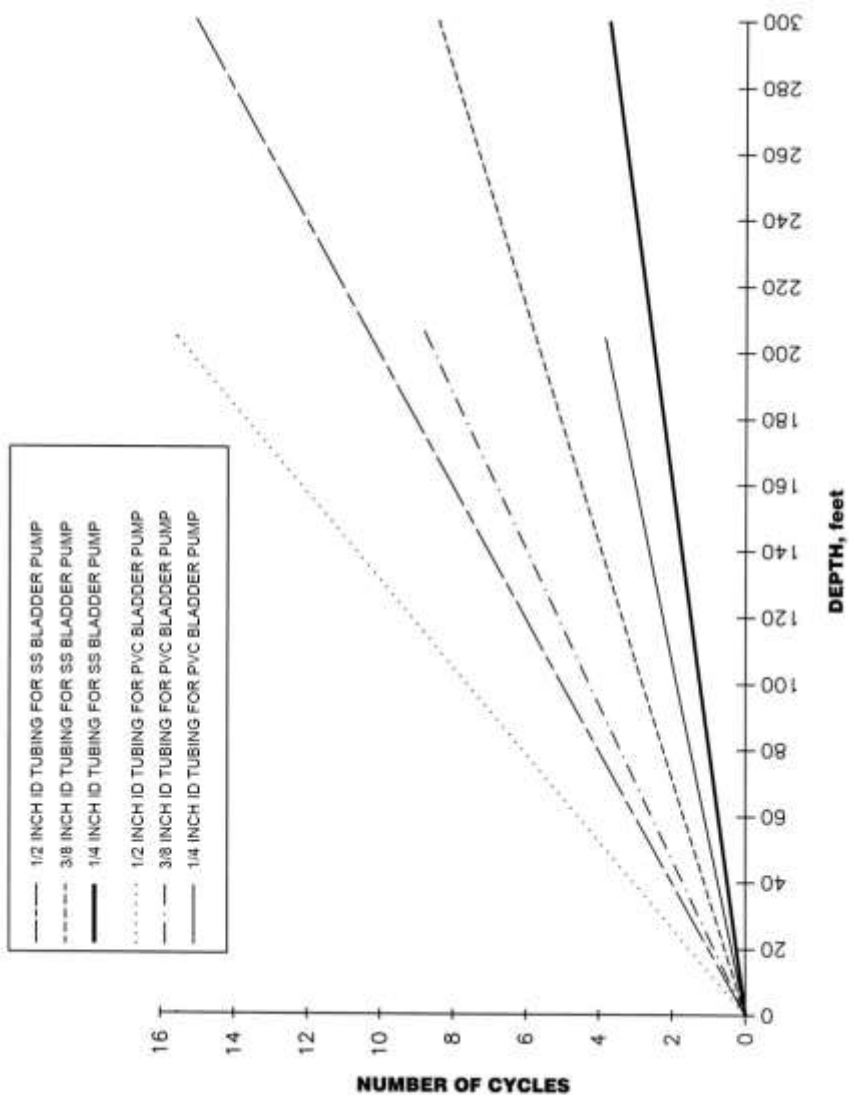


Figure 3-2: Cycles vs. Depth

## Section 4: System Maintenance

The BP Controller does not require a regular maintenance program; however, proper care will ensure reliability.

As stated in installation and operation, this unit requires dry, moisture-free air. To disregard will increase the likelihood of unnecessary maintenance or hardware replacement.

To keep your BP Controller reliable, follow these simple guidelines:

- Do not drop your BP Controller.
- Do not immerse your BP Controller.
- Do not subject your BP Controller to poor power supplies.
- Do not subject your BP Controller to extreme heat or cold when in use.

### Controller

Keep your BP Controller clean and dry. In the event that the controller is subjected to significant splashing or immersion, discontinue use and wipe the unit down immediately with a clean dry cloth.

Let the controller dry out in between uses by opening the heavy-duty case. When closed the heavy-duty case has a waterproof seal and will trap in unattended water.

### Power Cords

Always replace a kinked or damaged power cord.

### Air Connections

When build up is present, clean the AIR IN and AIR OUT coupling connections using a phosphate-free cleaning detergent and water solution.

### Solenoid

Qualified personnel may clean the solenoid. The following procedure outlines how to disassemble and clean a stuck solenoid piston:

- 1) Remove power source and all air connections.
- 2) Remove the four (4) screws holding the control panel faceplate to the heavy-duty case.
- 3) Lift the control panel faceplate from the heavy-duty case and turn it over to expose controller components.

- 4) Locate the solenoid. See Figure 4-1.



**Figure 4-1:** Solenoid

- 5) Using a 3/32 Allen Wrench, remove the two retaining screws on the solenoid faceplate.
- 6) Remove the spring, bushing, and piston.



**Figure 4-2:** Removing Solenoid Parts



**Figure 4-3:** Solenoid Parts

- 7) Clean the piston and piston cavity with a lint-free cloth.
- 8) Lubricate the piston using a silicon based or aerosol lubricant.
- *Do not over lubricate.*



- 9) Using the end of a cotton swab, (or a thin, solid object) push the pin on the inside of the piston cavity to ensure the pin functions.
- 10) On the coil side of the solenoid, verify that the piston will easily move by depressing the silver button on the end of the solenoid.
  - *Repeat 2-3 times to ensure the button functions.*



**Figure 4-4:** Silver button on solenoid

- 11) Reassemble the solenoid by inserting the piston, bushing, and spring.
- 12) Compress the spring with the solenoid faceplate and refasten the two retaining screws.
- 13) Reattach the control panel faceplate to the heavy-duty case.
- 14) Reconnect the power and airlines. Resume operation.

## Section 5: System Troubleshooting

**Problem:** Unit will not turn on.

**Solution:**

- Check power source and cables for damage.
- If using a battery, see *Section 2, 'Battery Overdraw Protection'*.
- If using DC, verify that you have a 12 VDC power source. If on AC, verify that you are getting a consistent 115 VAC current.

**Problem:** Unit turns on but cycles rapidly, no pumping.

**Solution:**

- Discharge and Fill times not set correctly.
- Check and adjust Discharge and Fill cycle times (i.e., if discharge time too long and fill time too short, or discharge time too short). Review *Section 3: System Operation* for correct cycle times.

**Problem:** Turns on, cycles correctly but does not pump water.

**Solutions:**

- Check for tubing kinks.
- Pressure may be too low, check the gauge. Calculate based on 0.5 PSI per foot (.1 bar per meter) of head and add 10 PSI (.7 bar) for friction.
- Increase FILL TIME. The pump needs to depressurize to allow pump to fill.
- Solenoid may have moisture or debris build-up. See *Section 4: System Maintenance*.

**Problem:** Unit was working, but stopped cycling.

**Solutions:**

- Check power source.
- If using a battery, see *Section 2, 'Battery Overdraw Protection'*.
- If power source is good, check air source.
- Ensure the air source is using clean, dry air.

For further assistance contact Geotech at 1-800-833-7958.

## Section 6: System Specifications

Model: BP Controller, 300 PSI

### Maximum Ratings

Input DC Power Source	0.5-13.8 VDC
DC Current Draw	0.5 Amps
DC Input Surge Current	<50 Amps
Input AC Power Source	105-130 VAC
AC Current Draw	0.1 Amps
AC Input Surge Current	<15 Amps
Input AC Line Frequency	45-65 Hz
Maximum Power	15 Watts

### Performance

Operating Air Pressure	10 - 300 PSI (20.5 bar)
Max. Air Input	350 PSI (24 bar)
Operating Depth	0-690' (0-210m)
DISCHARGE Timer Range	10 to 120 seconds
FILL Timer Range	10 to 120 seconds
Minimum Timer Value	*5 seconds (Discharge & Fill)
Timer Resolution	1 second, between 10 – 120 seconds
Timer Accuracy	± 2 seconds

\*5 second minimum timer value with timer dial set between 0 and 10 seconds.

### Battery Performance

12V 8AH Battery Life	1300 cycles, 20 Hours @ 30 sec FILL & DISCHARGE timers (70°F)
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### Environmental

Operating Temperature Range	32° – 158°F (0-70° C)
Storage Temperature Range	-4° – 185°F (-20° to 85° C)
Position Effect	0.10% change at any angle
Vibration	No change after 10G RMS 20 to 2000 Hz
Shock	No change after 50Gs for 11minutes
EMI Emissions	Class A

### Physical

Enclosure	7" x 16" x 12" (18cm x 41cm x 30.5cm)
Enclosure Material	Structural resin
Weight	15 lbs (6.8 kg)

## Section 7: System Schematics

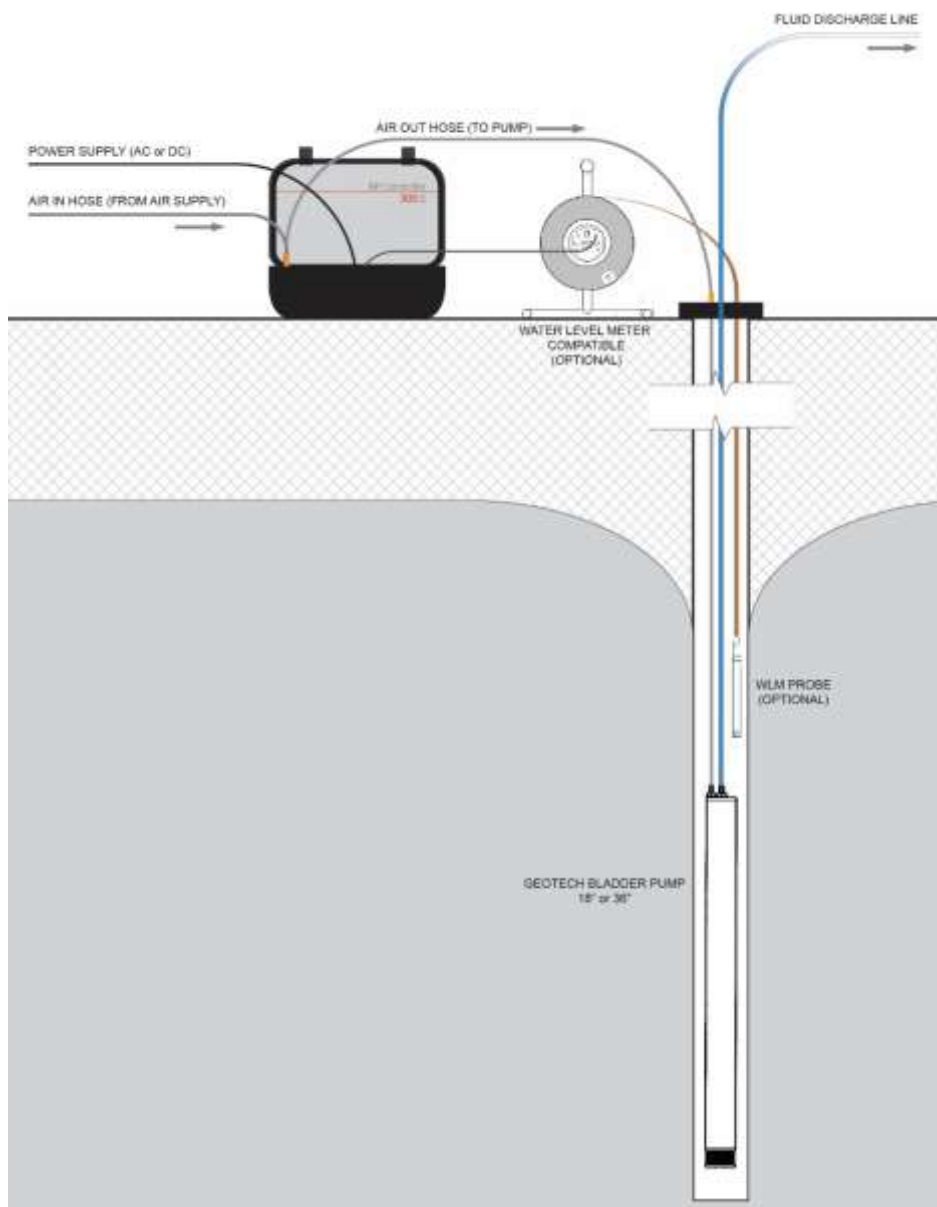


Figure 7-1: Site Schematic

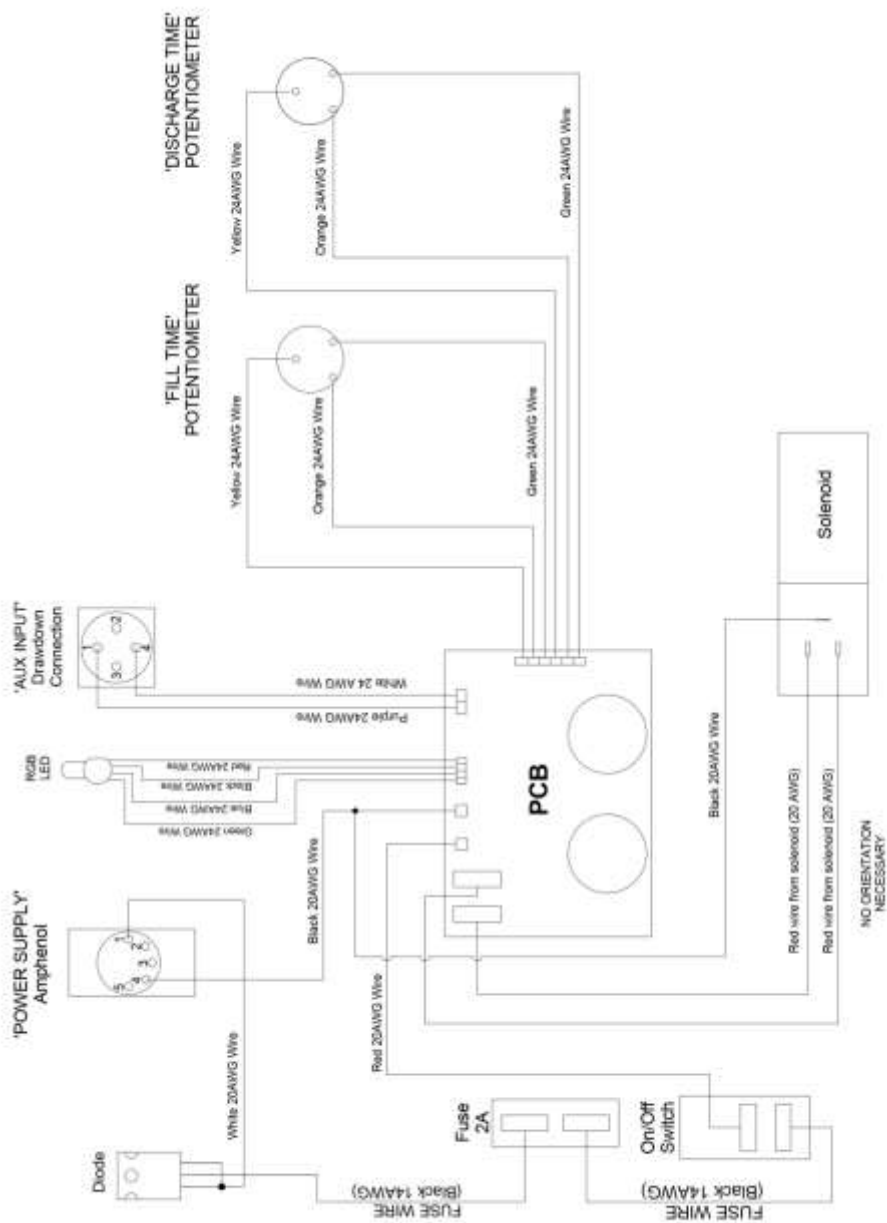


Figure 7-2: Wiring Diagram

## Section 8: Parts and Accessories

<u>Part Number</u>	<u>Part Description</u>
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### *Main Components*

81150042	BP, CONTROLLER, 300PSI, CE
51150064	ASSY, POWER SUPPLY, BP CONTR, CE BP CONTROLLER 300PSI
57500008	ASSY, POWER CORD, DC W/ AMP
51150074	ASSY, HOSE, AIR IN, BP CONTROLLER 300PSI
51150075	ASSY, HOSE, AIR OUT, BP CONTROLLER 300PSI
11150362	MANUAL, BP CONTROLLER, 300PSI, CE
11150360	FUSE, 2A/32V, BLADE
51150076	ASSY, PCB, BP CONTROLLER 300PSI, POTTED
51150134	BAG, ACCESSORY, BPC

### *Power Cord Adapters*

11150367	AC ADAPTER, PLUG-IN, US, 15W/30W
11150368	AC ADAPTER, PLUG-IN, EURO, 15W/30W
11150369	AC ADAPTER, PLUG-IN, UK, 15W/30W
11150370	AC ADAPTER, PLUG-IN, AUS, 15W/30W

<b>DOCUMENT REVISIONS</b>		
<b>EDCF#</b>	<b>DESCRIPTION</b>	<b>REV/DATE</b>
-	Initial Release	9/12/13
-	Updated Wiring Diagram – SP	10/9/13
-	Added to Section 6: Battery Life Information - SP	10/30/13
-	Updated Section 8: Parts & Accessories descriptions to match sales database – SP	11/18/13
-	Updated wiring diagram, add header to EC Declaration of Conformity – SP	1/22/14
Project 1392	Added metric where missing, added NC information, edited timer specifications, updated wiring diagram – SP	4/2/14
-	Updated back page info & EC Declaration of Conformity, SP	1/13/14
2005	Instruction steps for maintaining solenoid, minor style edits, SR	11/21/16

## NOTES



## NOTES

## NOTES

## EC Declaration of Conformity

Manufacturer:

Geotech Environmental Equipment, Inc.  
2650 E 40th Avenue  
Denver, CO 80205

Declares that the following products,

Product Name: BP (Bladder Pump) Controller 300PSI

Model(s): 81150042

Year of manufacture: 2013

Conform to the principle safety objectives of 2006/95/EC Low Voltage Directive (LVD) by application of the following standards:

EN 61010-1: 2010

Year of affixation of the CE Marking: 2013

Conform to the protection requirements of 2004/108/EC Electromagnetic Compatibility (EMC) by application of the following standards:

EN 61000-6-1: 2007

EN 61000-6-3: 2012

EN 61326-1: 2013, emissions Class A

EMC conformity established 09/01/2013.

Production control follows the ISO 9001:2008 regulations and includes required safety routine tests.

This declaration issued under the sole responsibility of Geotech Environmental Equipment, Inc.

A handwritten signature in black ink that reads "Joseph Leonard".

Joe Leonard  
Product Development

Serial number \_\_\_\_\_

## 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 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 the equipment for a fee, which will be applied to the repair order invoice.



**Geotech Environmental Equipment, Inc.**

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website: <http://spanish.geotechenv.com>

Printed in the United States of America