

BP Controller 500 PSI

Installation and Operation Manual



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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 500PSI 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 500 PSI is an ultra-high-pressure pump controller that uses advanced electronic logic to control gentle low-flow sampling at great depths. Equipped with a high-pressure solenoid activated valve and regulator, the BP Controller can purge depths to 1000 feet/305 meters.

This controller connects to any Bladder Pump (BP) system with the use of simple push-to-connect hose adapters. The two timers set the length of time that the pump pressurizes (discharge cycle) and depressurizes (fill cycle). During the discharge cycle, the pump pressurizes and squeezes the bladder, forcing the sample through the center discharge line. During the fill cycle, the compressed air now exhausts from the pump 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. This controller includes an internal power source, drawn from two 9V batteries for optimal portability into remote locations.

The BP Controller is compatible with Water Level Meters by connecting a drawdown cable into the "AUX INPUT." WLM must be equipped with drawdown feature.

System Components

The control panel is housed inside a heavy-duty carry case for ease of mobility and long-term durability. Accessories included with the BP Controller consist of high-pressure AIR IN Hose (from supply) and AIR OUT Hose (to pump), two internal 9V batteries, an extra set of batteries, and both 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, pull up on the socket's jacket and the connection will 'pop' out.

Section 2: System Installation



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

CAUTION

Power Source

The BP Controller 500PSI includes an internal power source generated by two 9V alkaline batteries.

For direct plug in, either 115 VAC or 12 VDC, use an AC Power Supply or a DC cord connected to a 12V battery (see Specifications for voltage limitations). Power connects are on the side of the controller panel.

If using Water Level Meter Equipment with drawdown feature, connect the 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						
TUBING VOLUME						
TUBE I.D.	1 ft./ 0.3 m	10 ft./ 3 m	50 ft./ 15 m	100 ft./ 30 m	500 ft./ 150 m	1000 ft./ 300 m
0.17 in/ 0.43 cm	0.3 in ³ / 5 cm ³	3 in ³ / 50 cm ³	15 in ³ / 246 cm ³	30 in ³ / 492 cm ³	150 in ³ / 2460 cm ³	300 in ³ / 4920 cm ³
0.25 in/ 0.64 cm	0.6 in ³ / 10 cm ³	6 in ³ / 100 cm ³	30 in ³ / 492 cm ³	60 in ³ / 984 cm ³	300 in ³ / 4920 cm ³	600 in ³ / 9840 cm ³
0.5 in/ 1.2 cm	2.4 in ³ / 39 cm ³	24 in ³ / 393 cm ³	120 in ³ / 1967 cm ³	240 in ³ / 3933 cm ³	1200 in ³ / 19670 cm ³	2400 in ³ / 39330 cm ³

Volume of Bladder Pumps

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

Calculation guideline:

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

Example (use metric units when applicable):

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 ft³/hour

If you plan to use an air compressor, we advise that you use one with a reserve tank to insure proper air supply to the pump. If you plan to use a Nitrogen/CO2 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 800 ft. away from the air source

$$(800 \text{ ft.} * 0.5 \text{ PSI}) + 10 = \mathbf{410 \text{ PSI}}$$

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 ft./15 meters 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.

NOTE

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



SLOW RED (5 sec. pause) - controller has stop cycling, low battery



SLOW BLUE (2 sec. pause) - 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. Voltage below 10.8V will completely turn off the controller.

Operating Battery Voltage	11.7V to 18V
Critical Battery Voltage	10.9V to 11.6V
Low Battery Voltage	10.8V or below
*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

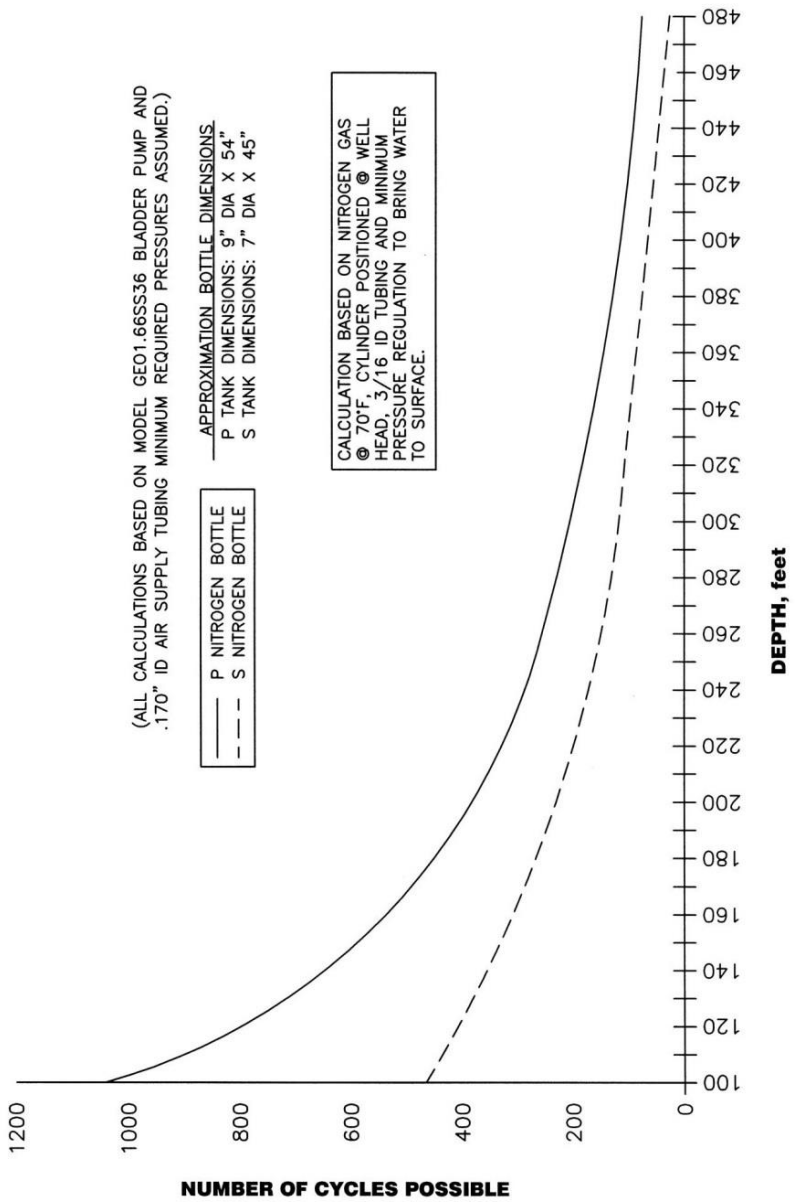


Figure 2.1: Nitrogen tank volume vs. Bladder Pump consumption

Section 3: System Operation

The BP Controller 500 PSI has a normally closed valve. Therefore, if power is disconnected from the unit, the controller will automatically stop the flow of air.

Quick Start Guide

1. Ensure fully charged internal batteries, or connect Power Supply to side of controller (see 'Power Source' in Section 2).
2. If applicable, connect drawdown cable for Water Level Meter equipment.
3. Set FILL TIME and DISCHARGE TIME knobs to approximately 15 seconds.
4. Flip BP Controller power switch to the ON position.
After a few 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: 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.
6. Connect the unpressurized 'AIR IN' hose socket to the 'AIR IN' plug 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 550PSI/ 38 bar. To reset the relief valve and allow air through the controller, incoming air must be regulated to 500PSI/ 34 bar or below.

NOTE

7. Adjust the incoming air source to a MINIMUM OF 100PSI, and a MAXIMUM of 500 PSI (34 bar). Adjust panel regulator between 0-500psi; 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 – a decrease in sample size indicates that FILL TIME is too short.
9. **When pumping is complete, turn off air supply, and set timer knobs to approximately 15 seconds. Run the unit for one cycle to exhaust excess pressurized air.** Flip BP Controller power switch to the OFF position.
10. Take caution in 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 timers have a range from 5-180 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 ft. (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 PUMP (EXCESS DISCHARGE TIME) as this will cause excessive bladder wear.

CAUTION

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 back 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.

NOTE

Guidelines

While first implementing the BP Controller and system, it may take a number of cycles to see liquid at the top. Considering pump size, tubing sizes, and deployment depth, follow the guidelines below to help anticipate timing:

Pump Model	Volume per cycle (oz) (in ³)	Discharge Tubing ID Size (in)	Tubing filled per cycle (ft)	Max Depth (ft)	# of Cycles to see Liquid (@ Max Depth)
1.66" OD, x 36" Long	21.1 38	0.17	125	1000	8
1.66" OD, x 18" Long	10.5 19	0.17	62	1000	16
1.66" OD, x 36" Long	21.1 38	0.25	63	1000	16
1.66" OD, x 18" Long	10.5 19	0.25	31	1000	32
1.66" OD, x 36" Long	21.1 38	0.5	16	1000	63
1.66" OD, x 18" Long	10.5 19	0.5	8	1000	126

For systems greater than 200ft, it is recommended to use ¼" I.D. x 3/8" O.D. tubing; the larger tubing increases air consumption, but accelerates the "FILL TIME" cycle and decreases overall pumping time. Talk with your Geotech Sales Representative for more information.

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.
- Do not subject your BP Controller to dusty/particulate heavy environments.

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 carry-case. When closed the carry-case has a waterproof seal and will trap in unattended water.

Power Cords:

Always replace a kinked or damaged power cord.

Air Connections:

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

Section 5: System Troubleshooting

Problem: Unit will not turn on.

Solution:

- Check power source and cable connections; check for damage to cords.
- If using a battery, ensure charged/new batteries (2x 9V). See Section 2, 'Battery Overdraw Protection'.
- If using DC, verify that you have a 12 VDC power source. If using 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 for correct cycle times.

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

Solution:

- Check for tubing kinks and air leaks at tubing connections.
- 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.
- Listen for a clicking sound within the controller. If clicking sound is absent, the solenoid may have moisture or debris build-up. Maintenance may be in order.
- Review Section 3: System Operation – Guidelines.

Problem: Unit was working, but stopped cycling.

Solution:

- Check power source.
- If using a battery, see Section 2, 'Battery Overdraw Protection'.
- If power source is good, check air source.
- If air source is good - have you been using clean dry air? If not contact Geotech at 1-800-833-7958

Problem: Unit turned off and disconnected from air supply, but gauge still reads pressure.

Solution:

- There is a small amount of pressurized air in the system. Turn the timers counter clockwise, turn on the system, and let the air exhaust.

Problem: Turns on, status light is correct, but does not alternate pressure to the well.

Solution:

- The controller requires a minimum of 100psi incoming air to operate the solenoid valve. Ensure that a minimum of 100psi is supplied to the controller. Use the panel regulator to adjust below 100psi for shallow applications.

Problem: Loud popping noise occurred when air supplied to controller.

Solution:

- The bypass safety valve was activated by supplying pressurized air in excess of 550psi. Regulate incoming air to less than 550psi to allow the air to move through the system.

Problem: Water Level Meter equipment was working, but now controller will not get out of “Waiting for Water” status.

Solution:

- The well is not recharging as expected.
- Check that the Water Level Meter is attached, and that all cabling is in sound condition; ongoing “Waiting for Water” is indicative of a disconnection.

Section 6: System Specifications

Model: Bladder Pump Controller, 500 PSI

Maximum Ratings

Input DC Power Source	0.5-26 VDC
Operating DC Power Range	10.9-18VDC
DC Current Draw	0.5 Amps pulse for 50ms
Average DC Power Draw	1/10 Watt
DC Input Surge Current	<15 Amps
Input AC Power Source	100-240 VAC
AC Current Draw	0.1 Amps max
Average AC Power Draw	1/9 Watt (due to power supply efficiency)
AC Input Surge Current	<3 Amps
Input AC Line Frequency	45-65 Hz
Maximum Power	15 Watts pulse for 50mS

Performance

Minimum Incoming Air Supply	100 PSI (7 bar)
Operating Air Pressure	0 - 500 PSI (34 bar)
Max. Air Input	550 PSI (38 bar)
Operating Depth	0 -1000 feet (0 - 305 m)
DISCHARGE Timer Range	5 to 180 seconds
FILL Timer Range	5 to 180 seconds
Timer Resolution	3 seconds
Timer Accuracy	± 3 seconds

Battery Performance @ 70°F

12V 8AH Battery Life	50,000 cycles
Internal Battery Life (2x 9V, alkaline)	30,000 cycles

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 19 x 14 in. (18 x 48 x 35 cm)
Enclosure Material	Structural resin
Weight	25 Pounds (11.4 kg)

Section 7: System Schematics

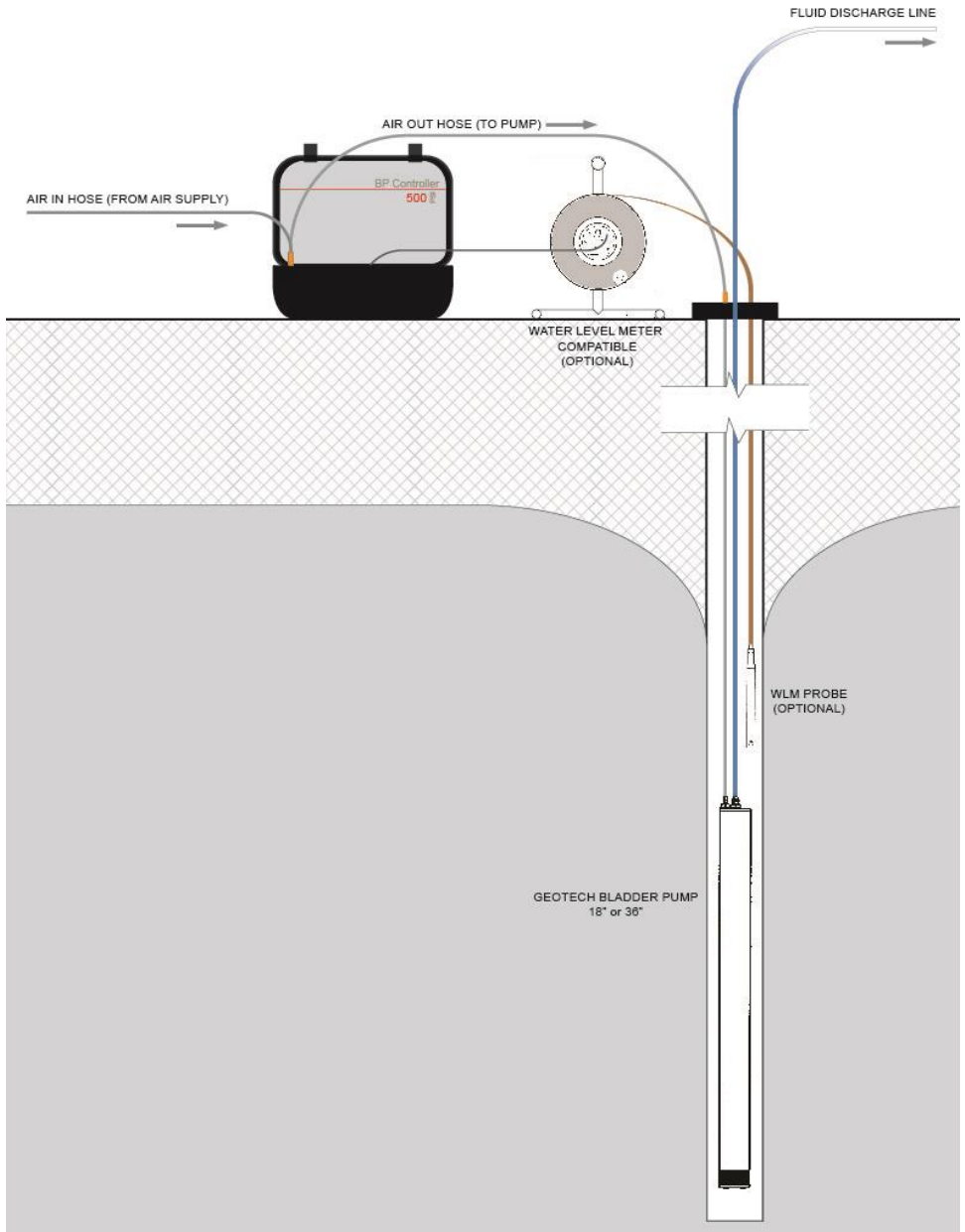


Figure 7.1 – Site Schematic

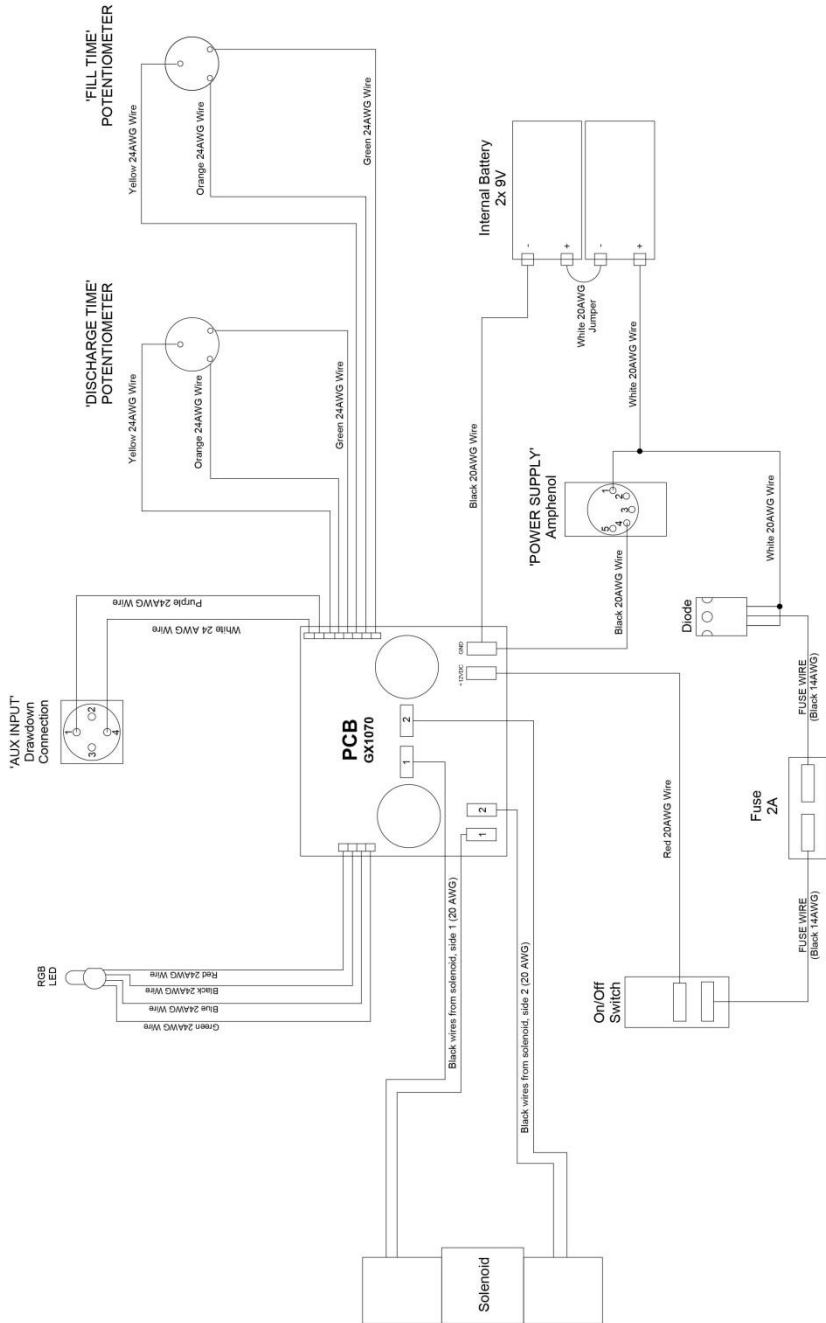


Figure 7.2 – Wiring Diagram

Section 8: Parts and Accessories

Part Number Part Description

Main Components

81150043	BP, CONTROLLER, 500PSI
51150064	ASSY, POWER SUPPLY, BP CONTROLLER
57500008	ASSY, POWER CORD, DC W/ AMP
51150135	ASSY, HOSE, AIR IN, BP CONTROLLER 500PSI
51150136	ASSY, HOSE, AIR OUT, BP CONTROLLER 500PSI
11150190	MANUAL, BP CONTROLLER, 500PSI
11150360	FUSE, 2A/32V, BLADE
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

DOCUMENT REVISIONS

EDCF#	DESCRIPTION	REV/DATE
-	Initial Release	01/19/14

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 500PSI

Model(s): 81150043

Year of manufacture: 2014

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: 2014

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 12/05/2014

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.



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.



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