



Operating Instructions

pH Detector

Table of Contents

Section 1

1-1	Warranty
1-2	Safety

Section 2

2-1	pH Detector Assembly and Set-up
2-5	Electronics Overview and Set-up

Section 3

3-1	Field Operations
3-4	Data-Logger Display
3-4	Calibration
3-7	pH Controller set-up
3-9	Probing

Section 4

4-1	Maintenance and Service
4-2	Wash system/Winterizing
4-3	Adjustments/Troubleshooting

SECTION 1 **pH Detector**

Sensor DataLogger Version 1.03

Warranty

Veris Technologies warrants this product to be free of defects in materials and workmanship for a period of one (1) year from the date of delivery to the purchaser. Veris Technologies will repair or replace any product returned to Salina, Kansas, which appears upon inspection to be defective in materials or workmanship. Veris Technologies will have shall have no obligation under this warranty for the cost of labor, down-time, transportation charges, or for the repair or replacement of any product that has been misused, carelessly handled, modified, or altered.

ALL OTHER WARRANTIES OF ANY KIND, WHETHER EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE AND ALL CLAIMS FOR CONSEQUENTIAL DAMAGES, ARE SPECIFICALLY DISCLAIMED AND EXCLUDED.

Safety

Look for Safety Symbol

The SAFETY ALERT SYMBOL indicates there is a potential hazard to personal safety involved and extra safety precaution must be taken. When you see this symbol, be alert and carefully read the message that follows it. In addition to design and configuration of equipment, hazard control and accident prevention are dependent upon the awareness, concern, prudence and proper training of personnel involved in the operation, transport, maintenance and storage of equipment.



Be Aware of Signal Words

Signal words designate a degree or level of hazard seriousness.

DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury. This signal word is limited to the most extreme situations, typically for machine components that, for functional purposes, cannot be guarded.



WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury, and includes hazards that are exposed when guards are removed. It may also be used to alert against unsafe practices.



CAUTION indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.



Important! Read the following SAFETY PROCEDURES before operating the Veris system:

- **Read and understand all instructions on safety decals**

WARNING

- Pinch point hazard: to prevent injury, stand clear when raising or lowering any part of the Veris implement.
- Install all transport locks before transporting or working underneath.
- Detach and store implements in an area where children normally do not play. Secure implement by using blocks and supports.

CAUTION

- Read Operations Manual before operating machine
- Review safety instructions with operators before operating machine and at least annually
- Riders obstruct the operator's view. They could be struck by foreign objects or thrown from the machine.
- Never allow children to operate equipment.
- To prevent possible electrical shock, or damage to the instrument, do not connect to any power source greater than twelve (12) volts DC.
- Do not grease or oil implement while it is in operation.
- Probe edges are sharp. Be careful when working in this area.
- Disconnect battery ground cable (-) before servicing or adjusting electrical systems or before welding on implement.
- Remove buildup of mud, oil or debris.
- Be very careful when mapping stubble fields with a gasoline engine vehicle. Be prepared if a fire starts.
- Keep a first aid kit and fire extinguisher handy.

SECTION 2 pH Detector Assembly and Set-up

OVERVIEW:

The pH Detector collects a geo-referenced pH reading each time the pH electrode is inserted into the soil. Here's how it works: 1) the operator pushes the probe chamber into the soil with his foot, 2) then pushes down on the hand lever, activating a door that moves soil and creates an opening for the measurement, 3) continues to push down on the hand lever to insert the pH electrode holder, 4) the pH electrode measures the soil at the bottom of the opening, and when complete, 5) the operator raises the probe handle, the electronics record the data and wash the electrode.

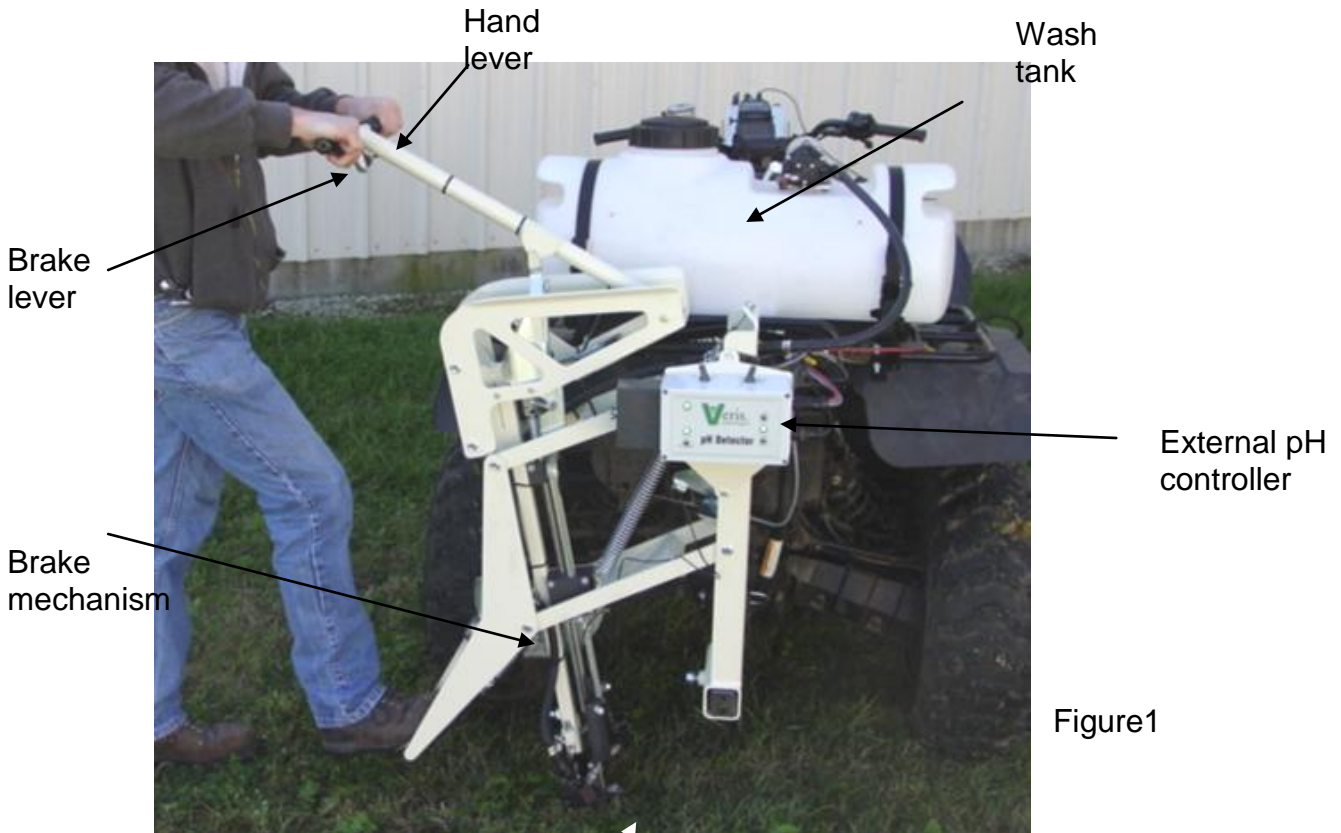


Figure1

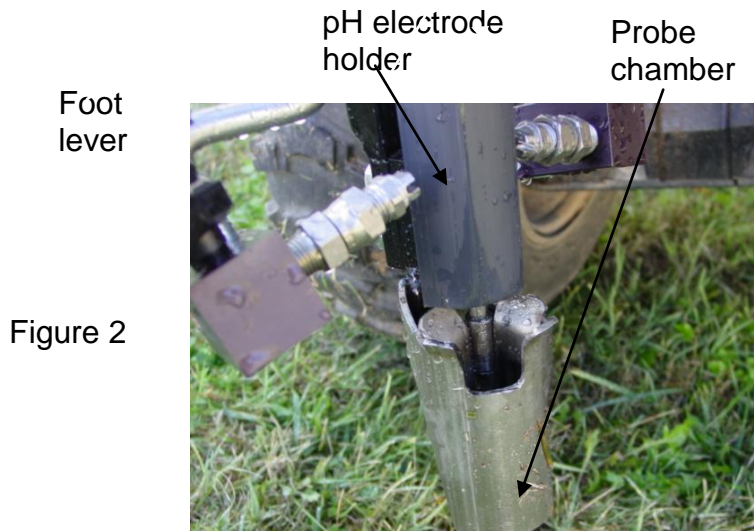


Figure 2

Tools required for Assembly and Field Operation adjustments

- 3/16" allen wrench
- 7/16", 1/2", 3/8", 9/16", 3/4" wrenches and/or sockets
- pliers

Handle installation: If probe handle was removed for shipping, reinstall by attaching pivot bolt, and installing pins and cotter hairpins at top and bottom of rod actuator (Figure 3). Install brake lever using 3/16" allen wrench, and zip-tie cable to handle (Figure 4).

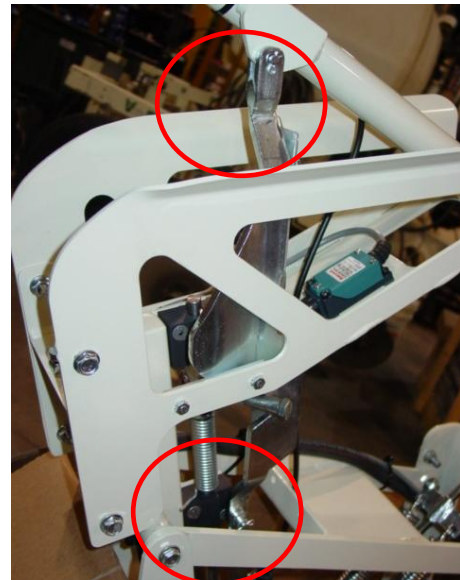


Figure 3a and 3b



Figure 4

Attaching pH Detector to ATV

Mount tank to rear rack of ATV using nylon straps or zip ties through holes in tank base(Figure 4).



Figure 5

Slide receiver hitch tubing inside lower main frame tube of pH Detector. If your ATV is equipped with large receiver hitch, slide receiver hitch tubing directly into ATV receiver hitch and pin (Figure 5). If your ATV has a hole, or small receiver hitch, it will be necessary to use end of hitch tubing with threaded holes. Attach L-bracket to these holes and bolt to ATV hitch hole (Figure 7).

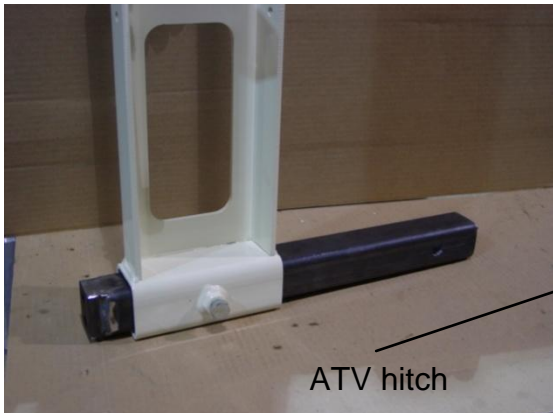
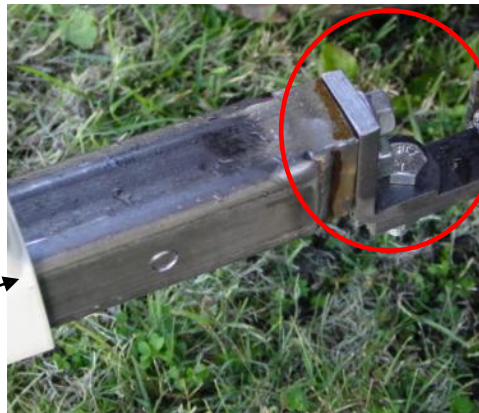


Figure 6



tighten bolts after unit has been positioned and stabilizer arms attached

Figure 7

Position pH Detector as close to rear of ATV as possible but don't restrict probe movement. Attach stabilizers to rear rack (Figure 8). These brackets can be bent to fit various racks. Once pH Detector assembly is in position, tighten all bolts including hitch bracket bolts (Figures 5 and 6).



Figure 8a and 8b

Bolt pH controller to unit (Figure 9).

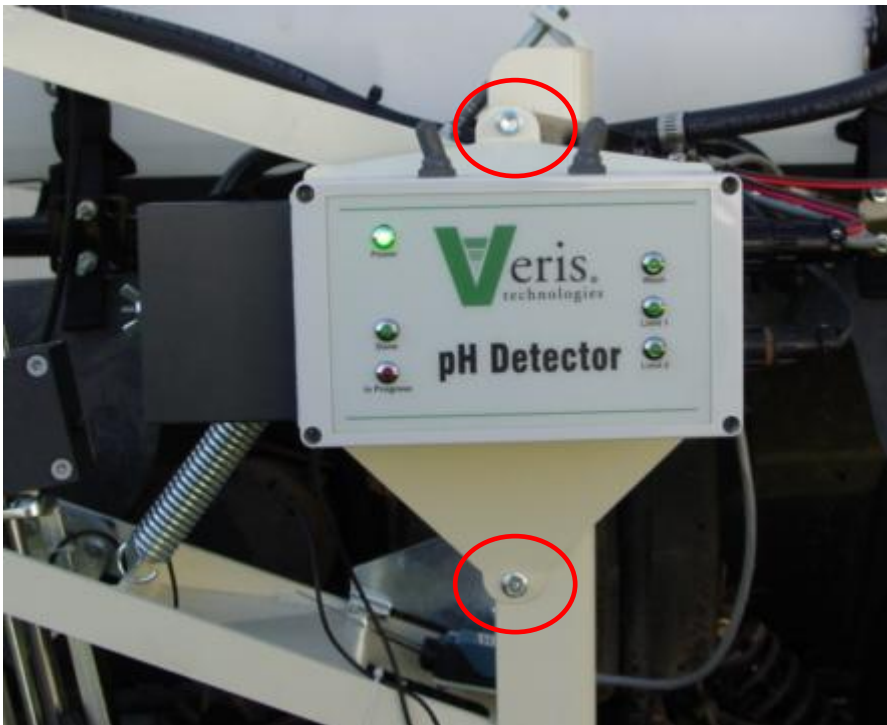


Figure 9

Electronics Overview and Set-up

The Veris Sensor Data-Logger kit includes the items shown in Figure 10.

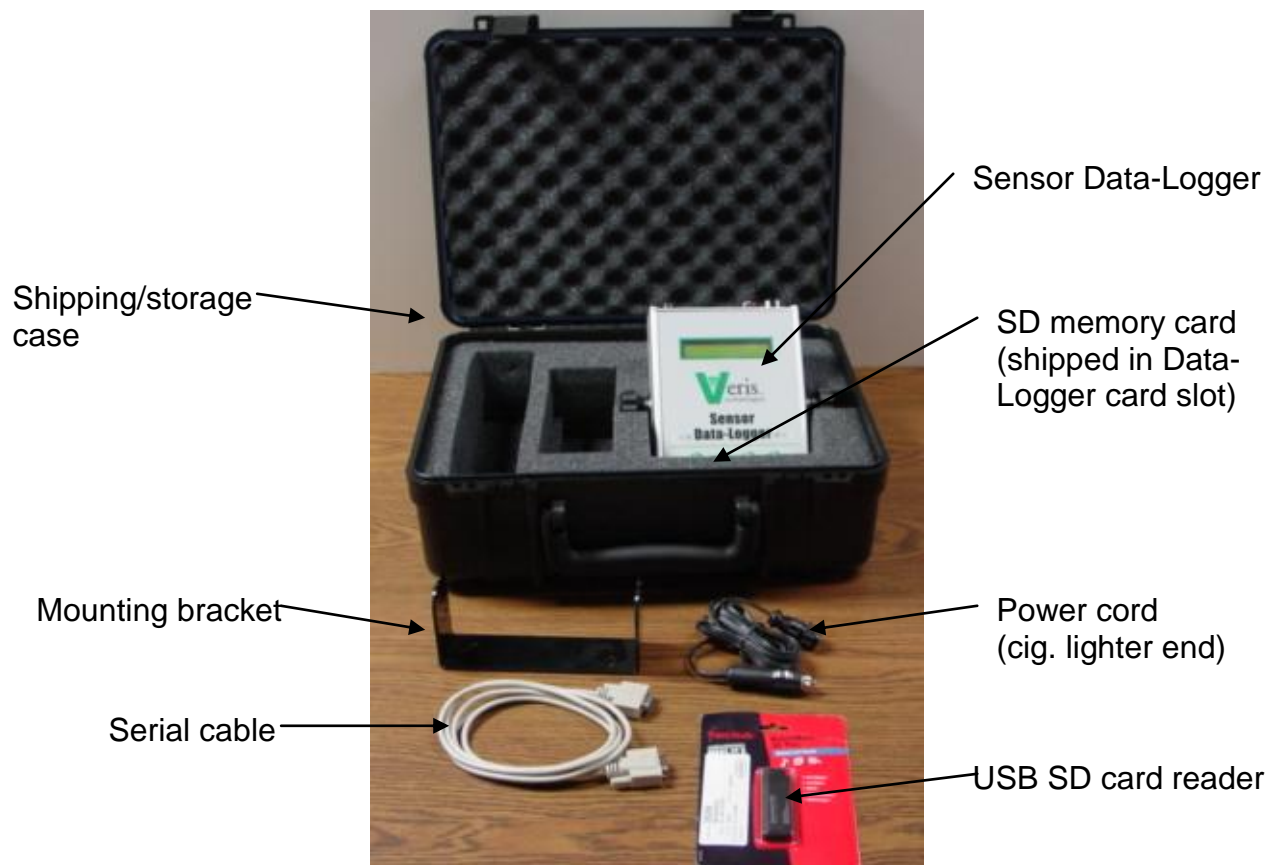


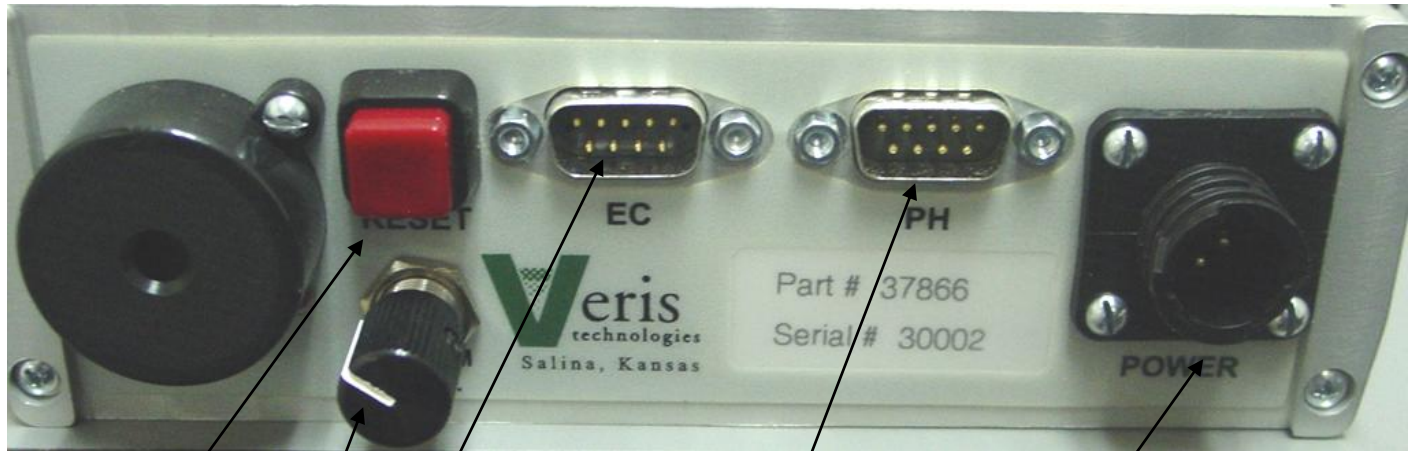
Figure 10

Use protective shipping/storage case to protect electronics components whenever electronics are shipped. Keep all diagnostics and operations manual with system when mapping.

The following electronic-related items are mounted on the pH Detector:

- pH controller
- 12 V power cable (from pH controller to battery)
- power distribution cable (from pH controller to pump and limit switch cables)
- limit switches (2)
- wash pump

Figure 11 DataLogger (rear)



Reset button:
Can be used to reboot DataLogger

Alarm Vol:
Used to adjust volume of auditory alarm

GPS input:
Connect GPS cable here. It is designed to accept GPS input in NMEA 0183 format via an RS232 connector. (GPS must send GGA and either VTG or RMC strings at a 1hz rate, at 4800 baud, 8 data bits, 1 stop bit, no parity.)

pH:
Serial cable from pH Controller attaches here.

Power port:
The Sensor Data-Logger is shipped with an accessory power cord. If an alternative connection is desired, make sure that the unit is properly connected to a power connection that is not controlled by the ignition switch. If connecting directly to the battery, we suggest a **3-amp** in-line fuse is installed between the battery and the instrument.

Figure 12 Data-Logger (front)



Memory Card slot:
SD memory storage card must be installed when booting up, and at all times data is being collected.

Data Status:
When lit, this green LED indicates data is being recorded to memory card. If not lit, EC values are negative or GPS signal not received.

Power:
When lit, this red LED indicates Sensor DataLogger is powered up.

On/Off:
Turns power to Sensor DataLogger on and off.

Important – Do not allow moisture to enter the Sensor Data-Logger, and do not pass strong magnets near the unit.

Mount instrument in a location that is as free as possible from vibration and electrical interference. Use adjustable mounting brackets to position electronics for optimal visibility.



Figure 13

Attach 12 volt leads to battery, making sure not to reverse polarity. Route wires under tank and seat but do not allow them to be pinched. Attach main power amp and power distribution cables connector to pH controller.

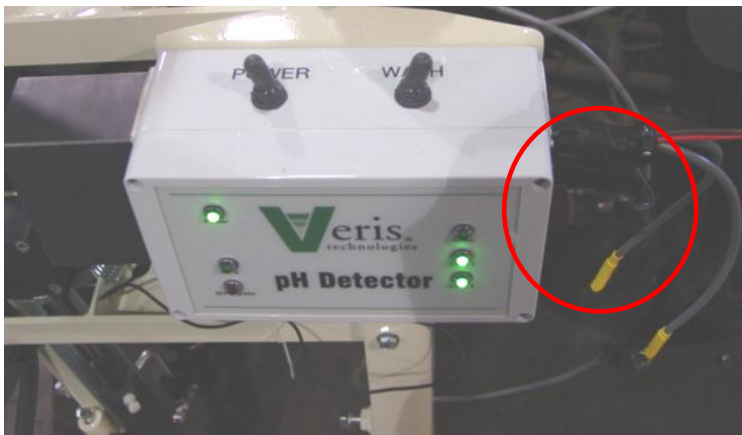


Figure 14

Attach the serial communication cable from external pH controller to the pH port on back of DataLogger.

SECTION 3 Field Operations

Testing functions:

Turn external controller power switch on, and check operation using status LED's. Power light should light, wash LED should light when wash pump switch is activated, and limit switch LED's should light when they are deployed. (In order to active the lower switch (#1), probe must be in soil.)

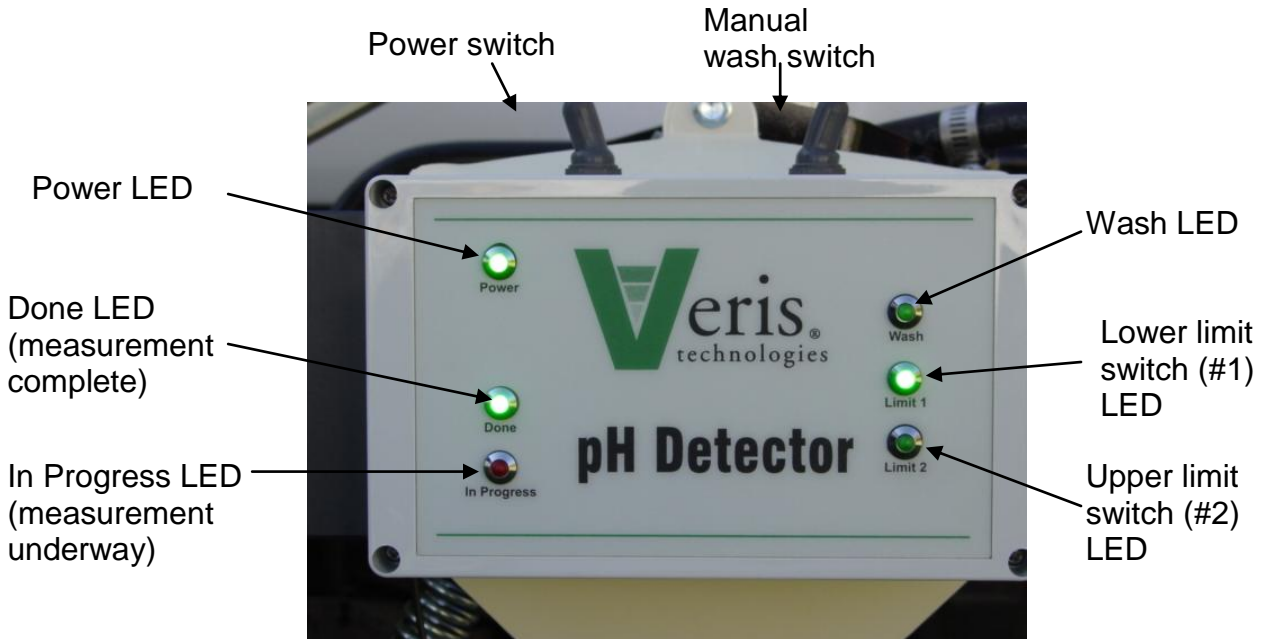


Figure 1

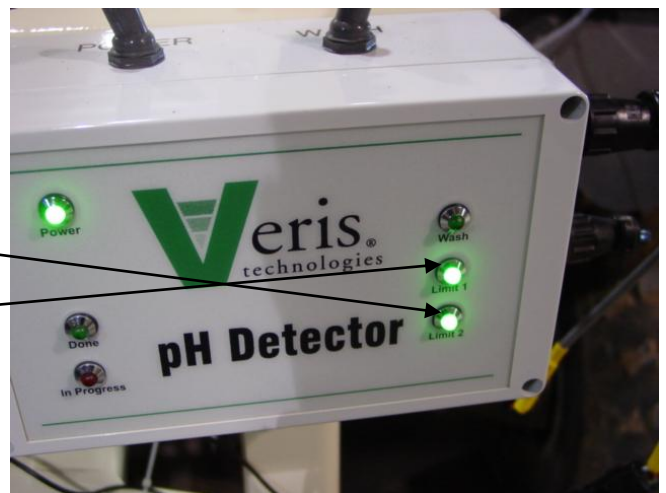
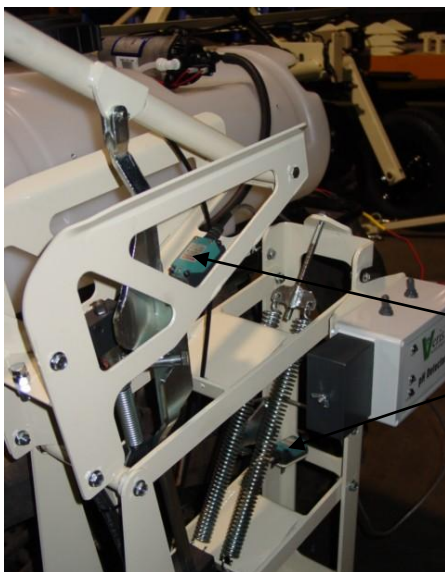


Figure 2a and 2b

-Flush and fill tanks with tap water; clean any foreign matter out of tank using clean-out cap. Make sure inlet is in sump (Figure 3), and strainer is attached to end of line (Figure 4).

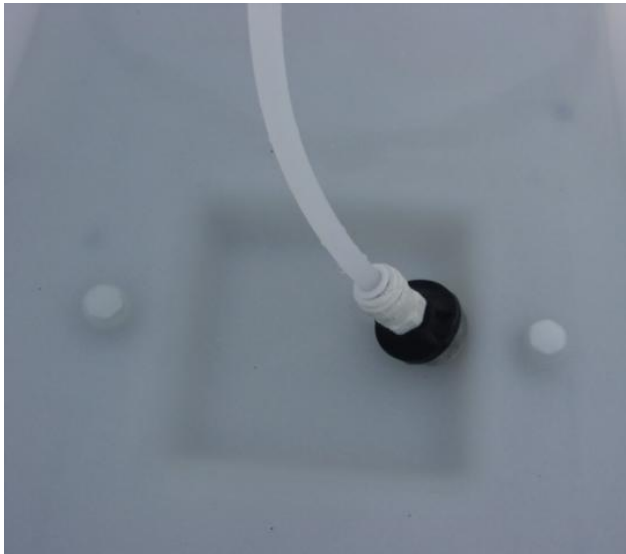


Figure 3



Figure 4

Pump priming: In order to prime the pumps, loosen quick coupler and operate pump until water flows (Figure 6).

Wash adjustment: This was set at the factory but may have slipped during shipping. Wash brackets should be opposite each other, with jets as close as possible to electrode holder, and still allow electrode holder movement. Jets should be 1/4" (6 mm) below electrodes. When wash jets are properly aligned, overspray is minimized and water bubbles out top of empty electrode holder as shown in Figure 5. To adjust wash jets, use 3/16" allen wrench to loosen set screws holding wash jet blocks and rods (Figure 6).



Figure 5

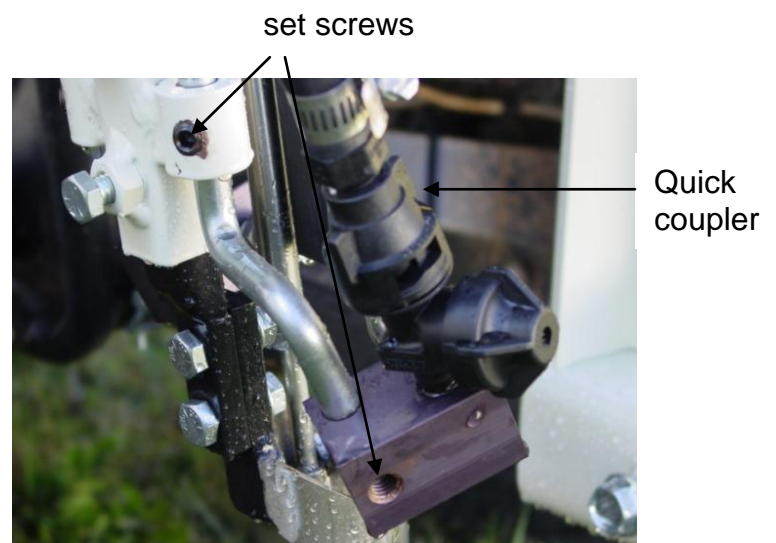


Figure 6

Insert pH electrode into electrode holder. Finger-tighten plastic screw as tightly as possible by hand. If a wrench is used, be careful not to over-tighten as damage to the electrode may occur



Figure 7

Route electrode cables away from sampling mechanisms to prevent damage. **Lower probe to maximum depth** and tie strap cable as shown in Figure 8. Do not tighten zip ties until probe has been moved full stroke to make sure wire slack is in correct area. Extra cable length should be outside of sampling mechanism, below pH controller (Figure 9).



Figure 8

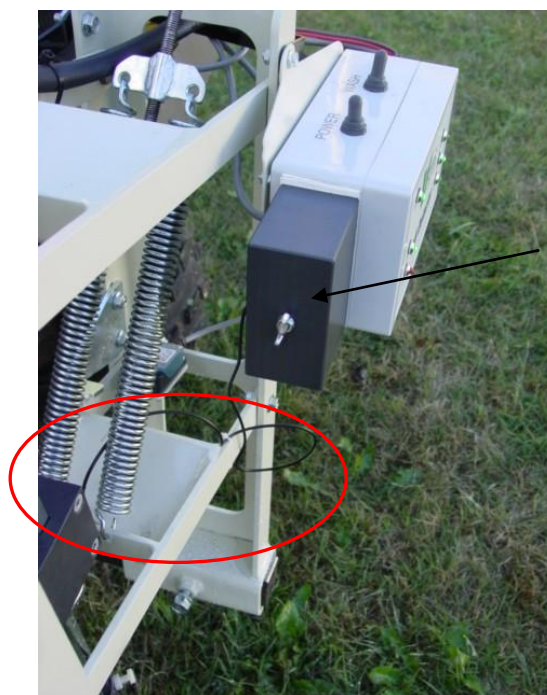


Figure 9

Install cover on external controller to keep moisture out of BNC and serial connector. When installing cover, route electrode wire under box; center box on white pad, and tighten wingnut finger tight. Keep cover installed even when electrode is removed.

Sensor DataLogger display

Here are the display readings that you will see when operating the Sensor DataLogger:

Starting up...

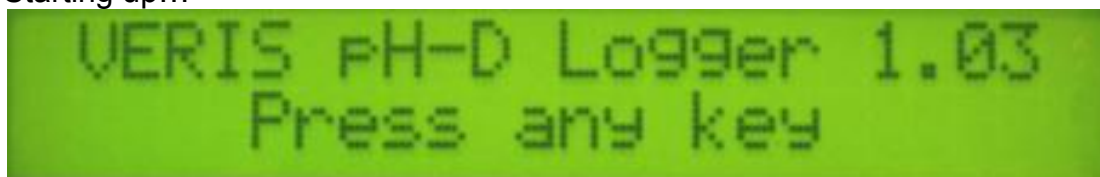


Figure 10

The unit is ready to operate. The DataLogger is informing you of the firmware version its programmable interface chip (PIC) contains.

Press any of the four keys, and the next screen will appear:

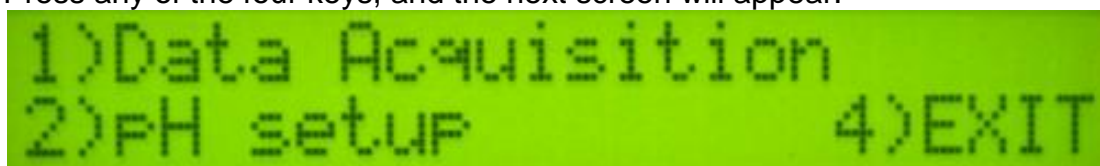


Figure 11

Press 2 and enter Setup menu. (Press 4 to Exit this window).

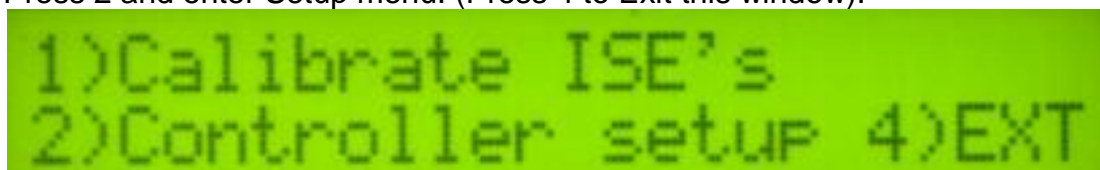


Figure 12

Press 1 to calibrate ion-selective (ISE) pH electrode.

Calibrating pH electrodes

Enter menu option 1) *Calibration*.

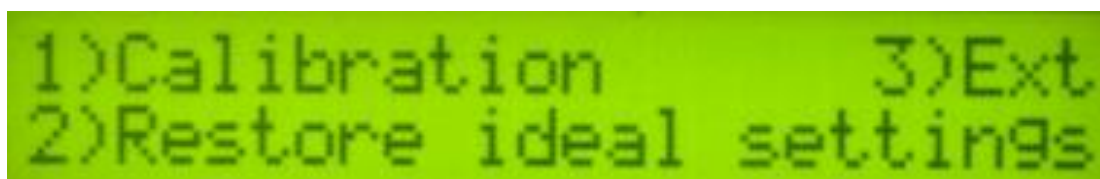


Figure 13

The instrument will prompt for the electrode to be inserted into pH buffer 4 solution; Slide cup with pH 4 buffer solution onto electrode holder, or remove electrode from holder for calibration. Press 1 to continue with calibration or 2 to exit. *Tips: Don't overfill solution. Cup only needs enough solution to immerse electrode tip and face. Don't reuse solutions.*



Figure 14

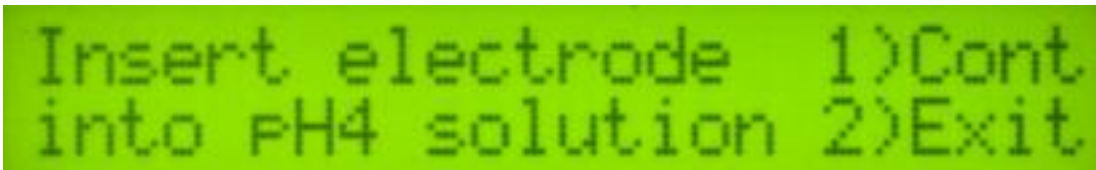


Figure 15

The instrument will read the electrodes for 10 seconds, displaying the output (as it counts seconds):

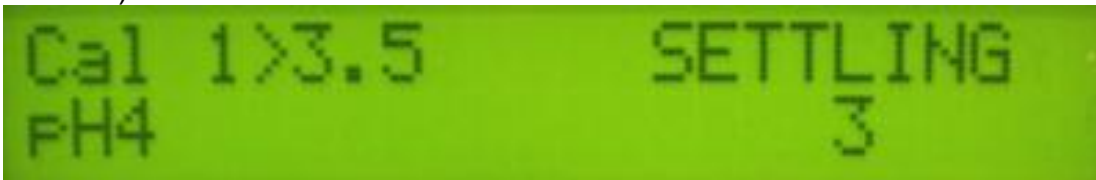


Figure 16

After 10 seconds, the instrument will display the final pH reading and offer the options to 1) *Accept pH 4 buffer readings*; 2) *Redo pH 4 buffer readings*; or 3) *Exit pH electrode calibration*. If the readings are satisfactory, press 1; if the readings are suspect, press 2 to return to re-do pH 4.

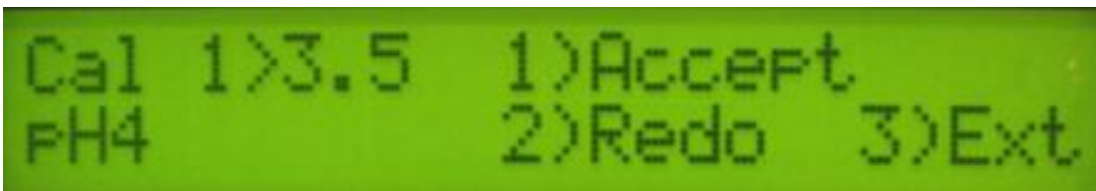


Figure 17

After accepting the pH 4 buffer readings, the Instrument will prompt for the electrode to be inserted into pH 7 buffer solution. Remove the pH 4 buffer solution cup from the electrode holder. Rinse the electrodes, electrode holder, and solution cup using the manual wash for at least 10 seconds. Slide the pH buffer 7 solution cup onto the electrode holder.

On the DataLogger, press 1 to continue with calibration. The DataLogger will read the electrodes for 10 seconds, displaying the output. After 10 seconds, the instrument will display the final pH reading and offer the options to 1) *Accept pH 7 buffer readings*; 2) *Redo pH buffer 7 readings*; or 3) *Exit pH electrode calibration*. If the readings are satisfactory, log pH 7 reading and press 1; if the readings are suspect, press 2 to return to pH 7 calibration step.

After accepting the pH 7 buffer readings, the electronics firmware will determine if the electrode's response is sufficient to provide suitable readings. A score is displayed for the electrode; the acceptable score range is between 75 and 102. If electrode is within this range, the instrument will display the following screen:

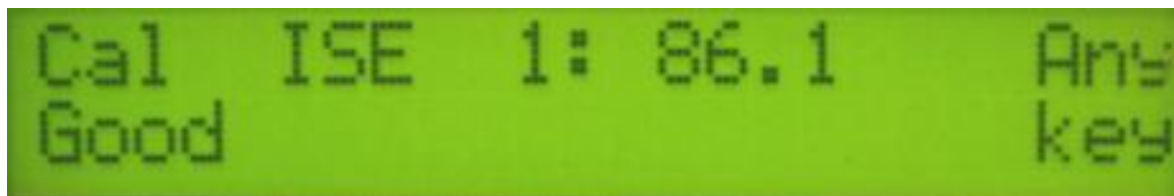


Figure 18

If an 'X' is displayed beside the electrode's score, this indicates that the electrode did not perform well enough for continued reliable use. No calibration settings are changed if calibration is unsuccessful. The electrode should be removed and either cleaned or replaced and the calibration procedure repeated.

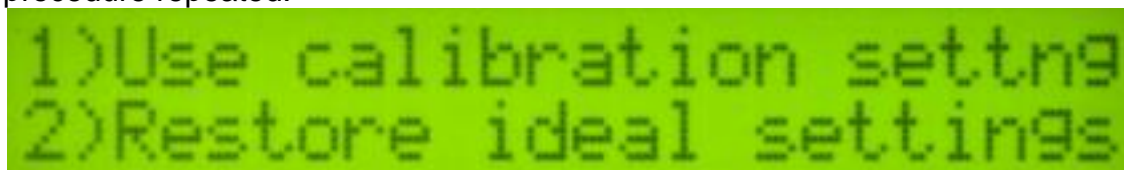


Figure 19

After calibration is complete, you will have the option to use the calibrated readings or reset to the ideal settings. *Tip: many operators use the ideal settings rather than calibration settings. One reason is this enables readings from one day to be compared to another. It is still important to perform the calibration step at least daily, even if ideal settings are used. The calibration process is important to test electrode quality.*

If electrode doesn't calibrate, check for film that develops on antimony tip after long storage periods; sand lightly with 80 grit sandpaper or emery cloth.

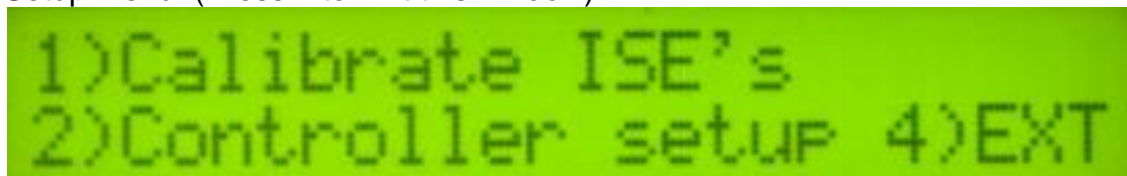
⚠ WARNING

- **Antimony is harmful if ingested into your skin, mouth, or lungs**

- Do not touch antimony electrode tip
- Do not ingest antimony material when sanding tip

pH Controller Set-up

After calibration, you may wish to change the pH Controller default parameters. Press 2 and enter Setup menu. (Press 4 to Exit this window).



```
1)Calibrate ISE's
2)Controller setup 4)EXT
```

Figure 120

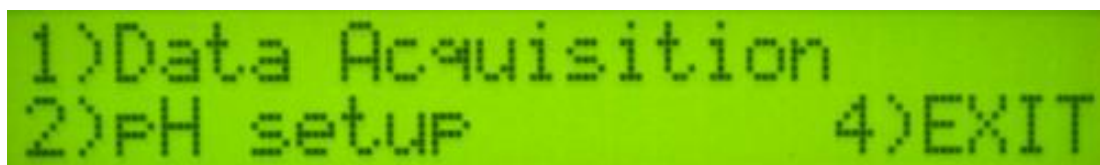


```
Max log time: 20
1)DN 2)UP 3)ENTER
```

Figure 21

Maximum log time is the longest time in seconds the pH controller will wait for the pH readings to settle. The controller usually cycles before this maximum time is reached. The minimum setting for the maximum log time is 20 seconds. (*Tip: use 20 seconds unless there is a special reason to allow a longer wait time*) Press 1 or 2 to adjust the sample time, press 3 to continue to the next screen.

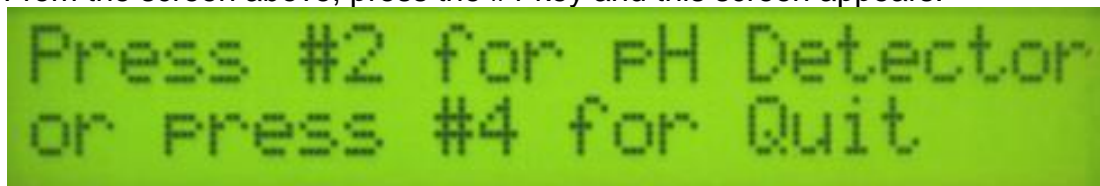
pH Data Recording



```
1)Data Acquisition
2)PH setup          4)EXIT
```

Figure 22

From the screen above, press the #1 key and this screen appears.



```
Press #2 for PH Detector
or Press #4 for Quit
```

Figure 23

Select #2 pH to collect pH data. #4 returns you to the initial start-up screen. Pressing #2 brings up the next screen:

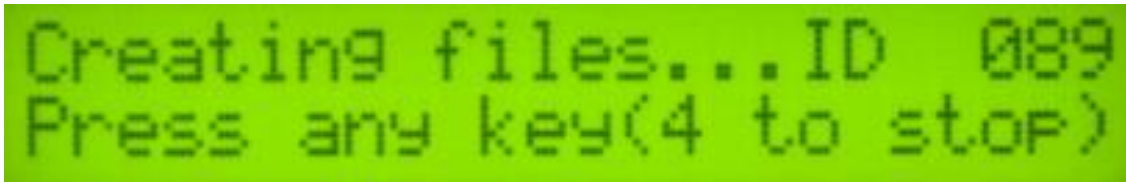


Figure 24

The DataLogger is displaying the map file number it is creating, in case you want to record it along with any other information about the field. Press any key to begin new map file. After starting the file, pressing the #4 key will stop the file. If DataLogger freezes at the screen shown in Figure 23 or Figure 24, check formatting of SD card—must be FAT format.

USING A VERIS SD CARD IN OTHER DEVICES CAN CAUSE FILE CORRUPTION.

If memory card was not inserted during boot-up, the following screen will appear:

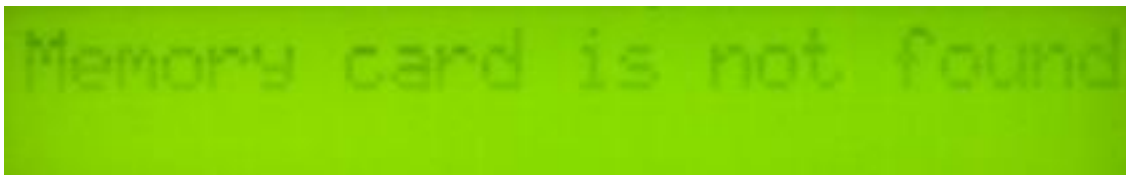


Figure 25

Install card and re-start DataLogger. NEVER REMOVE CARD WHILE LOGGING DATA.

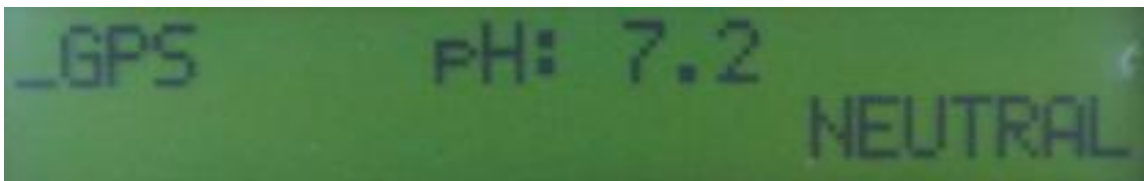


Figure 26

The display is showing the pH value from the pH electrode, the status of the sampling mechanism (raised/neutral), and whether you have GPS or DGPS (differentially corrected) signal. At any time during the mapping process, you can press the 4 key to stop the file. If you create more than one file from the same field, you can bring the files into a spreadsheet program and combine them prior to mapping.

Probe Operations

Release the brake and step on the foot lever to insert the probe chamber into the soil (Figure 27). This movement will activate the upper limit switch to initiate the electronic process, and a brief wash burst will occur.



Figure 27a and 27b

Once the probe chamber is in the soil, insert the electrode holder by continuing to lower the handle. In tight soil, it may be necessary to assist door opening with hand lever (Figure 28). The software requires full electrode holder insertion indicated by the lower proximity switch in order to begin logging. Release brake lever when electrode holder is completely inserted into probe chamber.

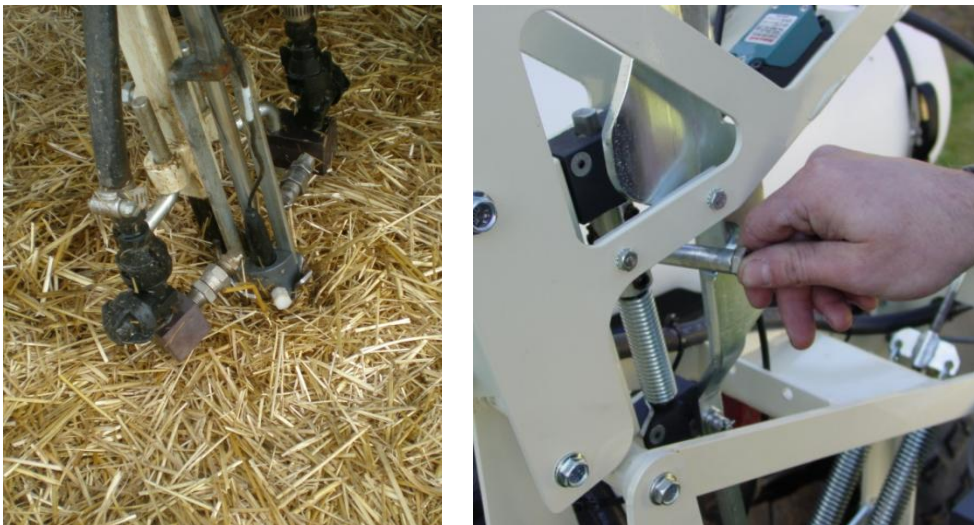


Figure 28a and 28b

After the probe has been inserted and while the electrode is being held against the soil, the status text will change to the following:

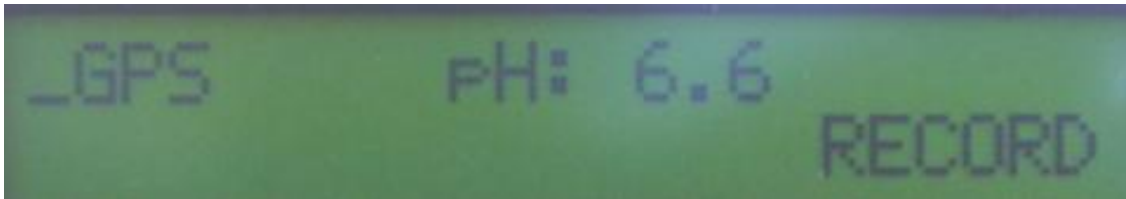


Figure 29

Allow the sampler to remain in the soil while the readings settle, as indicated by the In Progress red LED (Figure 30). When the Done green LED lights, the measurement is complete (Figure 31). The pH readings on the display show what the electrode is reading at every second. The minimum recording time is 7 seconds; the maximum time is determined in the pH settings menu. The pH value that is recorded is the final values at the end of the logging duration. The final pH value is logged along with the DGPS position where the sample was collected. When the Ready green LED lights, release the brake and raise the probe chamber out of the soil and the electrode holder out of the probe chamber. A spring-loaded pin will hold the probe in the top position for automated electrode cleaning. **DO NOT MOVE VEHICLE WHEN PROBE IS IN SOIL.**



Figure 30



Figure 31

If the electrodes take longer than **10 seconds** to settle, a warning will appear by the readings that indicates the number of seconds the reading has required (Figure 32). When the maximum log time is reached, a T will appear indicating that the measurement has 'timed out', and the unit initiates a new sample cycle (refer to pH Controller settings for adjusting the log time).

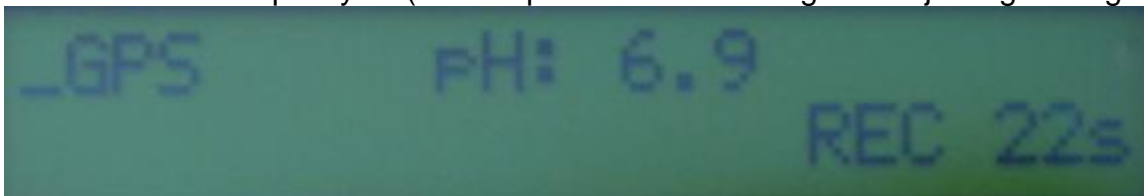


Figure 32

This time warning is to let the operator know that a measurement cycle is requiring excessive time. While an occasional cycle may exhibit this warning. see the troubleshooting section if this occurs frequently.

At any time during the mapping process, you can press the #4 key to stop the file. If you create more than one file from the same field, you can bring the files into a spreadsheet program or GIS and combine for whole field map display.

After #4 key is pressed during Data Acquisition, the following screen will be displayed: (if data was collected during Data Acquisition)

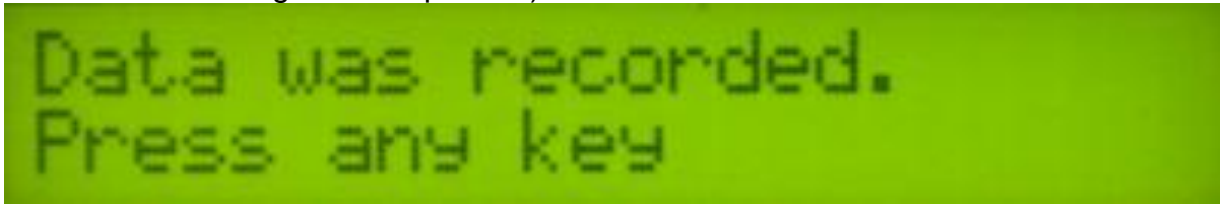


Figure 33

DATA IS ONLY STORED ON THE SD CARD. NO INTERNAL FILES ARE CREATED.

If no data was logged during Data Acquisition, the following screen will be displayed:

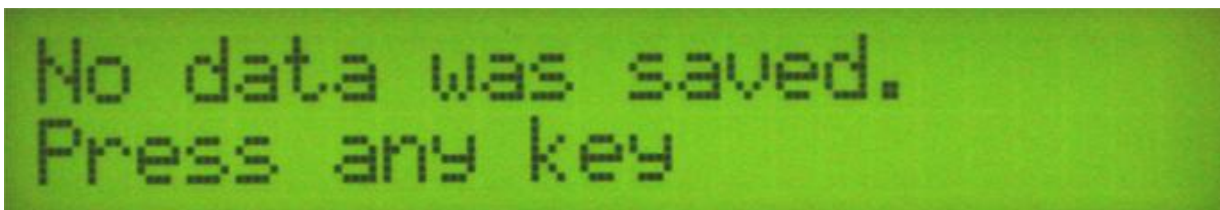


Figure 34

Data Files

The DataLogger records four files for each data collection:

1. VPHFxxx.dat: your data file
2. VPHLxxx.dat: all logged soil data in millivolts
3. VPHWxxx.dat: all logged wash data in millivolts
4. Verisxxx.INF: calibration information for this file

File format for VPHF files is as follows:

	Col A: long.	Col B: lat.	Col. C pH	Col. D elevation	Col. E: sample #
	A	B	C	D	E
1	-97.61978	38.851630	8.08	369.8	1
2	-97.619770	38.851637	7.12	371.5	2
3	-97.6198	38.851638	6.71	372.5	3
4	-97.619803	38.851640	6.99	372.4	4
5	-97.6198	38.851638	6.73	372.7	5
6	-97.619802	38.851640	6.94	372.5	6
7	-97.619802	38.851640	6.94	372.5	7
8	-97.619803	38.851637	6.95	372.7	8
9	-97.619805	38.851642	6.88	372.2	9

Figure 35

Data quality tips

As you collect pH data, monitor the performance of the system by observing the following:

- During 'Cycling' phase or during manual washing, *does pH electrode readings get close to the wash water pH?* If not, electrode may not be cleaning properly.
- During 'Recording' phase, *does electrode reading move to expected soil pH level?*
- Is there any residue in the cavity prepared by the probe chamber?
- Is depth of probe insertion consistent?

SECTION 4 Maintenance and Service

pH Electrodes

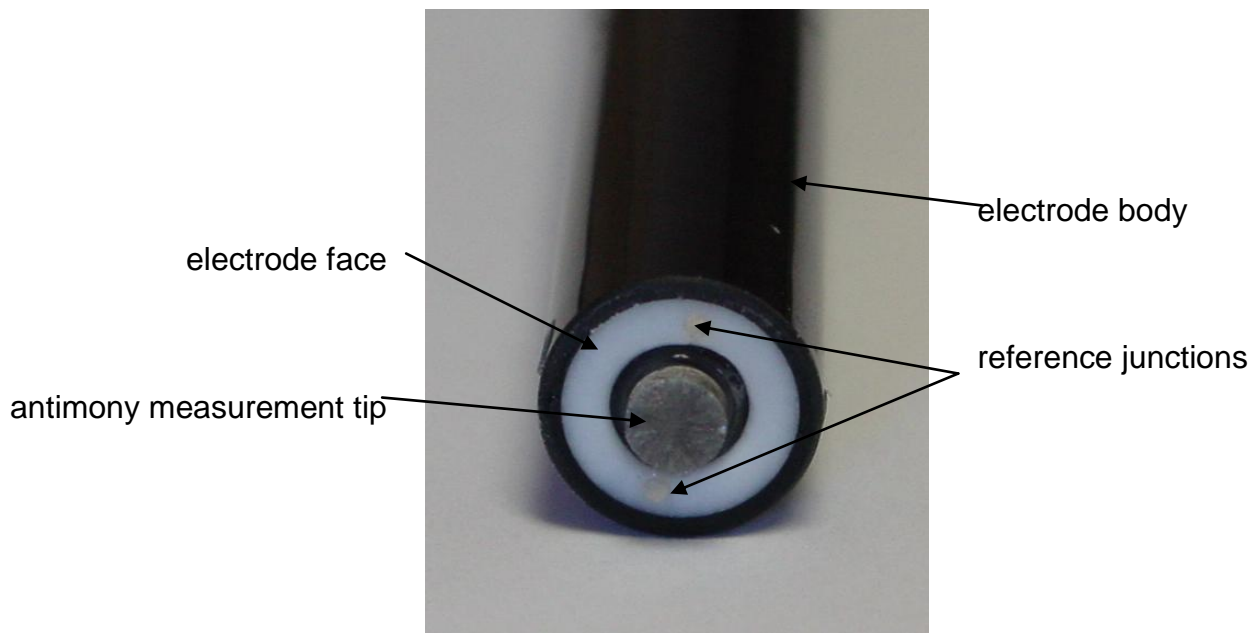


Figure 1

⚠ WARNING

- **Antimony is harmful if ingested into your skin, mouth, or lungs**

- Do not touch antimony electrode tip

- Do not ingest antimony material when sanding tip

- Always use proper soaker solution: Veris part #23395

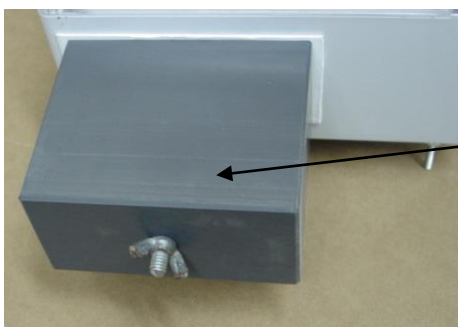
- Keep moist; put in soaker solution if mapping (washing) is interrupted for one hour or more

- If soaker solutions is unavailable, use pH buffer 4; never soak in distilled or de-ionized water

- remove from holder and place in individual soaker bottles in freezing temperatures and when unit will be idle for long periods

- keep cover over BNC ports on external controller whether electrodes are attached or unattached

- if film develops on antimony tip, sand lightly with 80 grit sandpaper or emery cloth.



Leave cover on whenever unit is in operation or stored outdoors. Do not allow moisture into BNC or serial connections.

Figure 2

Wash System

If wash water develops algae, flush and fill tanks with tap water; clean any algae or other foreign matter out of tank. Clean filter at least once per week of operation.



Clean filter at end of suction line weekly.

Figure 3

Winterizing:

When temperatures are dipping below freezing, prevent freeze damage to the wash system as follows: drain tank, open up check diaphragms and drain, and run pumps until empty. If unit is to be left outside for long periods of time over winter, it is advisable to add RV antifreeze to tank and run pumps for a couple of minutes to fill all lines with anti-freeze. Purge system of anti-freeze before collecting any pH data.



Open up check diaphragms and allow lines to clear.

Figure 4

Adjustments/troubleshooting:

Electrode holder won't go into soil:

- 1) If door is not completely open when electrode holder tries to enter, electrode breakage may result (Figure 5). Raise electrode holder and see if door closes completely. If rock or other obstruction is present, clear it and see if door closes properly.



Figure 5a



Figure 5b

- 2) Verify that door hand lever hasn't slipped. If door is closed but lever is not in notch, loosen lever bolt and set screws, reposition lever to notch, and retighten bolt and set screws. (Figure 6).

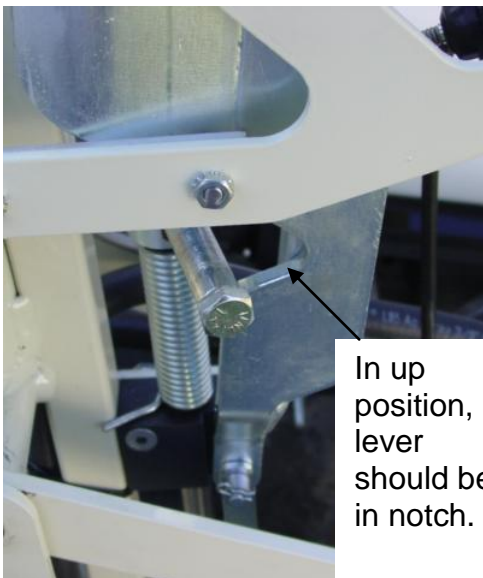


Figure 6a



Figure 6b

3) Verify that bottom jam nut on pivot rod hasn't slipped. If hand lever does not move door, retightening pivot rod jam nut is required. Retighten by holding top of rod with adjustable wrench and tightening jam nut with 1/2" wrench (Figure 7).

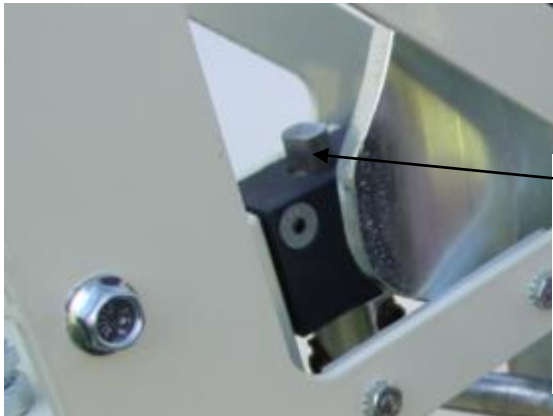


Figure 7a

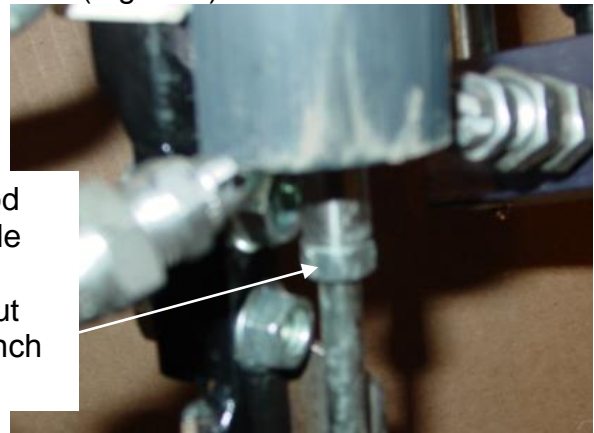


Figure 7b

Hold top of rod with adjustable wrench and tighten jam nut with 1/2" wrench

Limit switches aren't working properly:

- activate manually to see if LED's light; if LED's do not light, check power and connections
- if LED's light, but are reversed from Figure 8, disconnect weather-pack connectors and re-connect to other switch.

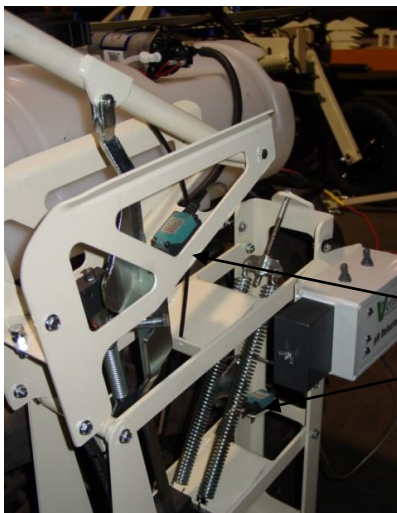


Figure 8

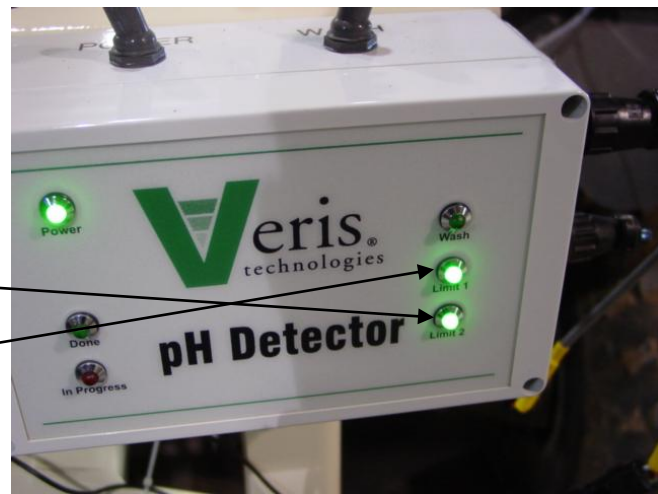


Figure 8b

limit switches:

upper (#2)

lower (#1)

-If limit switch LED's show switch is working, check adjustments: In raised position, lower switch needs to be in activated position, as shown in Figure 9. To adjust, loosen bolt holding switch and pivot to desire position.

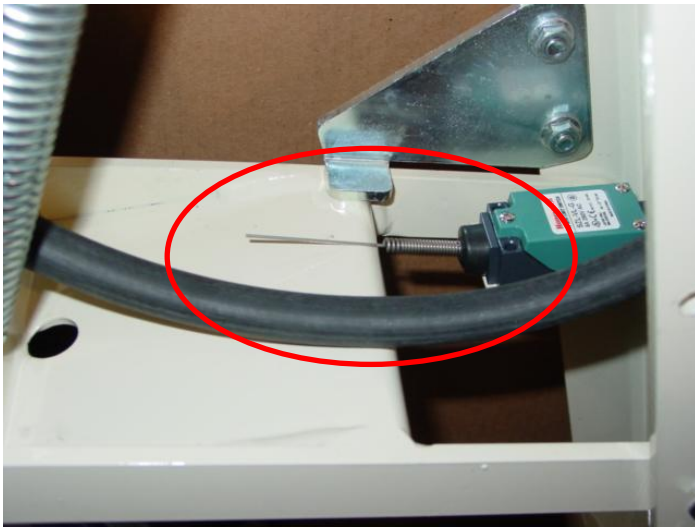


Figure 9

Upper switch needs to be in activated position only when electrode holder is fully inserted into the probe chamber (Figure 10). To adjust activation bar, loosen bolt and slide to desired position



Figure10

Excessive movement of assembly while driving: tighten up spring tension on main springs (Figure 11).



Tighten adjustment bolt to increase spring tension

Figure 11

Probe doesn't stay locked in up position for washing: tighten spring plunger to increase pressure (Figure 12.)

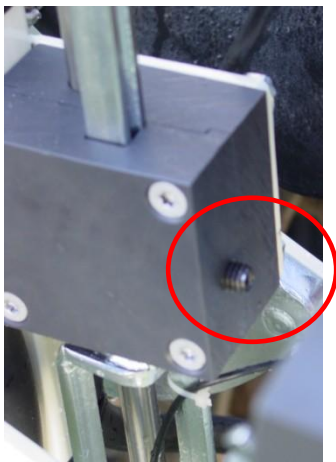


Figure 12

Sampler comes out of the soil when measuring (even a small movement reduces measurement accuracy): tighten brake by tightening bolt shown in Figure 13, but don't overtighten. Also, check spring pressure on parallel linkage—if excessive, loosen tension.



brake adjustment bolt;
loosen jam nut and turn
clockwise to increase
brake tension; re-tighten
jam nut.

Figure 13.

Lubrication

Weekly:

Apply dry powdered graphite to slides in wear blocks shown in Figure14.

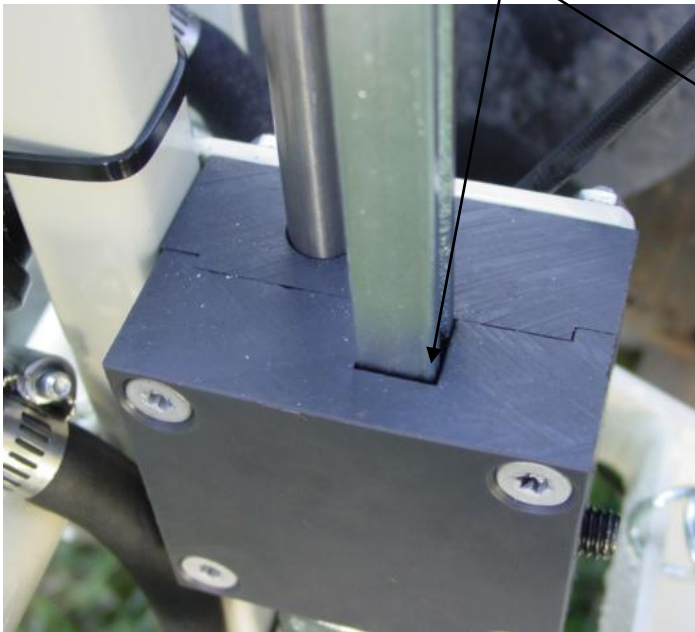


Figure 14a



Figure 14b