Operating Instructions

EC Force Probe

Table of Contents

Section 1
1-1 Warranty & Safety

Section 2
2-1 System Overview P4000
2-3 System Overview Electronics

Section 3
3-1 Software Installation Guide

Section 4
4-1 Field Operations – Electronics

Section 5
5-1 Probe Platform Installation
5-3 Platform Operation
5-4 EC - Force Probe Operation
5-6 Soil Coring
5-8 Soil Anchoring System
5-10 Probe Removal and Tractor Installation

Section 6
6-1 Maintenance and Lubrication
6-4 Probe Removal
6-5 Case Removal

Section 7
7-1 Troubleshooting

Section 8
8-1 Specifications
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 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 P4000
 • Escaping fluid under pressure can penetrate the skin causing serious injury. Avoid the hazard by relieving pressure before disconnecting hydraulic lines. Use a piece of

 • Use paper or cardboard, NOT BODY PARTS, to check for suspected leaks.
 • Wear protective gloves and safety glasses or goggles when working with hydraulic and high-pressure wash systems.
 • If an accident occurs, see a doctor immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result.

⚠️ WARNING
 • Pinch point hazard: to prevent injury, stand clear when raising or lowering any part of the Veris P4000.
 • 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.
 • Keep feet clear of foot and probe when lowering.
 • Do not probe where utility lines may be present. Use ‘Call Before You Dig’ services.
 • Use paper or cardboard, NOT BODY PARTS, to check for suspected leaks.
 • Wear protective gloves and safety glasses or goggles when working with hydraulic and high-pressure wash systems.
 • If an accident occurs, see a doctor immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result.

⚠️ 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.
 • Disconnect battery ground cable (-) before servicing or adjusting electrical systems or before welding on implement.
 • Remove buildup of mud, oil or debris.
 • Be prepared if a fire starts
 • Keep a first aid kit and fire extinguisher handy.
 • Be careful when touching the probe after use, the sapphire window gets hot.
Section 2
VERIS P4000 Probe Platform
System Overview

Before you begin using your P4000, it’s important to familiarize yourself with the basic components and controls.

Pre-operation checks:

1) Engine oil Level – refer to Honda GX 670 engine manual
2) Hydraulic fluid -- fluid level should be at or near upper black line on sight gauge of hydraulic reservoir. (Figure 1). If not add suitable ISO 32 hydraulic fluid with a viscosity index of 95-140. Unit is filled at factory with Mobilfluid 424.
3) Check gas level – unleaded gasoline only
4) Check for any loose fasteners or hydraulic leaks.

Controls:

1) **Engine controls** are located on the engine itself. (figure 2). Refer to Honda engine manual for detailed information.
Hydraulic Controls

All system monitoring and probe control functions are contained on the console mounted to the right of the probe, referred to as the “foot”. (Figures 3,4)

a) Voltage meter – monitors battery voltage
b) Side shift control – allows lateral movement of probe for multiple insertions at a given location.
c) Extension control -- used to extend probe from transport to field use position
d) Fold control – folds probe from transport to use position
e) Probe speed flow control – controls insertion speed of NIR/EC Force Probe to operator preference
f) Hydraulic pressure gauge – monitors system pressure during hydraulic cycling
g) Hour meter—monitors engine operation for routine maintenance
h) Foot Control – Raises and lowers foot
i) Rotation control – aids in soil core insertion in tough soils. Down is clockwise-direction required for coring.
j) Probe control – Raises and lowers probe assembly
k) Engine emergency stop – immediately shuts down engine if need arises.
l) 12VDC power switch for auxiliary and spectrometer power.

![Figure 3](image1)

![Figure 4](image2)
The first four connections are only used with the VIS NIR probe.

Only these three connections are used with the Force EC probe.
Cable that includes force and EC connections

Probe module #38145

Figure 7&8

Garmin GPS # 21221

GPS adaptor cable #30727

Note: This adaptor cable is required in order for compatibility with the provided Garmin GPS.

GPS serial adaptor cable #35482

This will connect the serial port of a GPS to the GPS port on the auxiliary case, for using an alternate GPS to the Garmin. External power is required for the GPS to function.

Figure 11 EC test load #10447
5-meter USB cable
#30281

Figure 12

Power cable
#39985

This is used to power the instrument from a vehicle (for field use).

Note: Only use 5-amp fuse

Figure 13

String Pot #SC160
String Pot Cable #38866

Figure 14

Figure 15 EC Dipole Tester #29689
Section 3
Software Installation and Setup

Software Installation
Note: For computers outside the United States of America, please make the following change to the computer’s regional settings before installing the Veris Spectrophotometer Software.

Step 1: Open control panel and double click on **Regional and Language Options**

Step 2: Click on **Customize**, the following screen will appear. The **Decimal symbol** needs to be a “.” while the **Digit grouping symbol** needs to be a “,”. The will ensure proper operation of the software. Once the changes have been made click **OK** and proceed with installation.

Veris EC - Force Software Installation

The Veris EC - Force Software installer will guide the user through installation of the Veris operating software and the necessary drivers needed to run the Auxiliary case. **Note:** Do not plug in USB cable for case at this time.

Figure 1
Only install software in the default directory. If a different directory is chosen then the auxiliary case will not be able to find the correct drivers.

Figure 2

Figure 3
Click next to install software

Figure 4

Click finish to exit installer

Figure 6
Section 4
Field Operation - Electronics

The Force EC probe software will acquire a EC and force measurement for every 2cm the probe is inserted. Before opening software turn on power to the auxiliary case and connect via USB cable to the PC. To begin data acquisition open the software and select a file to be saved.

![Software Interface]

Any name or number can be used for the file name

After typing name click save to continue

Figure 1

Once a file is selected the software will search for connectivity with the auxiliary case. Three communication ports are used to process the data. After each connection is established the corresponding light will turn green. If no connection is made, the software will continue to the next port and try to establish a connection later. If no green light is given for any of the three ports the software will not be able to acquire data. In this scenario, check for 12V to the case and ensure the USB cable is connected. If a connection can still not be established, then unplug the USB cable, shut down power to the instrument, and restart the software. If no connection is made still then unplug the USB cable and restart the computer. Once the computer is back up, plug in the USB cable and open the software again.

![Software Interface with Ports]

![Software Interface with Green Lights]

Figure 2

Figure 3
Place the probe tip at the desired starting point, check to ensure the GPS signal light is green and press log or hit Enter and begin to insert the probe to store data. The log light will turn green indicating the software is in log mode. Data is collected and averaged every 2cm. Once the 2cm interval is reached the data light will flash and the data is written to the output file. Once the desired depth is reached pull the probe out and Log will be shut off. The log button will need to be pressed for again to start sampling another location.

The EC readings will give the following error codes:
-1 = **Low Current** this condition can occur when the probe is out of the ground, or in dry soils

-2 = **Low Voltage** this condition occurs when the dipole is shorted. Check EC tip isolation under the troubleshooting section

-4 = **High Voltage** this condition occurs when the dipole is open. Check EC tip isolation under the troubleshooting

Figure 4

Depth will be -1 until log is pressed.
Section 5
Field Operation
P4000-S

Installation

The P4000-S is designed to be installed in ¾ ton – 1 ton pickups and due to the wide range of bed and frame dimensions on the market, there are no mounting holes in lower frame flange. Some drilling and fabrication will be required. You may choose to perform this on your own, or may wish to have a local welding or truck shop do this for you.

Steps:

1) Properly lift probe assembly in folded position with a minimum of two nylon straps and lower into pickup bed.
2) Center side-to-side in bed and so rear portion of skid frame rail is 14” forward of farthest point on rear bumper (Figure 1). This will ensure that foot will not contact bumper when the skid is in the retracted position.
3) Ideally 4 mounting bolts (½” Gr5) are adequate for fastening the probe skid to the frame of the truck. Choose mounting location based on frame obstructions such as spring hangers, fuel tank hoses, etc. This will take some time, measuring both top and underneath the bed to make sure bolts will align with skid frame
4) Locate all four positions and fabricate “L” straps from at least 3/8” material and bolt or weld to frame. Make sure that fuel tanks, fuel line, and brake lines are not in danger of being drilled or welded. Drilling is preferable and two ½” bolts in the vertical position are adequate. (Figure 2)

Figure 1

14” from rear edge to rear of bumper
5) Using the “L” straps as templates, you can drill the hole through the bottom side of the skid frame rail. Tip: If you start out with small pilot holes (1/4” or less) it takes less effort to drill through the bed and frame rail, then drill out to full dimension from on top.

6) If for some reason you must locate one or two of lower “L” mounts ahead or behind the skid frame rail, you can fabricate some clips to hold down in place. Ideally at least two bolts should go through the skid frame to ensure that probe is properly connected to bed (Figure 3)

7) Securely bolt down and connect power cable to battery of vehicle.
Field Operation
Probe Platform

- Start engine and allow to warm a minute or two before cycling – a few minutes if during cold weather.
- Extend to full rear position
- Fold into upright position (figure 5)
- Lower foot to soil
- Raise probe (figure 6)
- Install Probe or core sampling components

Important!  -- When folding and retracting the platform make sure that probe mast clears engine muffler. This can be achieved by shifting left to right as you fold the unit.

CAUTION
KEEP FEET CLEAR OF FOOT AND PROBE
Field Operation
EC - Force Probe

Checking Electrical Signal Continuity and Electrode Isolation
It is recommended that you routinely check the EC signal to verify that all functions are working properly. See Maintenance and Lubrication Section for a step-by-step procedure. It is advisable to perform this test on a routine basis (weekly or every 20-25 hours of data collection) to ensure you are obtaining reliable data.

Operation
Begin field operation by lowering the foot to the soil. Remove hairpin from string pot piston (Figure 7). Set probe speed --- not recommended over 3cm/sec. This is adjustable via the probe speed flow control on the side of the control panel. (Figure 9)

Lower the EC - Force Probe until the EC tip is at the desired starting point, usually just below the surface of the soil. Press LOG in the EC – Force software to begin collecting data. After reaching the desired depth pull probe out to stop logging data.

Figure 7

Figure 8

CAUTION
KEEP FEET CLEAR OF FOOT AND PROBE.
**Speed**
Probe speed is not recommended over *30mm/sec*, for optimal data resolution. This is adjustable via the probe speed flow control on the side of the control panel. (Figure 9 above) A maximum probe speed of 50mm/sec should not be exceeded or else data could be missing from the output file.

**Field Condition**
Field should be in a uniform state. Probe after intensive primary tillage is not recommended. The soil must have a minimum of 10% available water, and cannot be frozen.

**Vehicle Requirements**
The probe may be mounted on a variety of vehicles. The 3 point configuration allows use on a 30-50hp tractor. While the optional skid platform requires a 4X4 pickup.
Field Operations
Soil Coring

Once you have completed probing, remove EC - Force probe as outlined in Section 6.

- Install drive coupler to rotating head by means of drive retainer (Figure 10)
- Install PETG liner onto cutting shoe and thread into sampling tube (Figure 11)
- Install sampling tube into drive coupler and push into soil.

Use slow and steady insertion speed and minimal rotation to push core sampler into the soil. A brief rotation at bottom of stroke will snap off the core in tight clay, giving you a fuller core as you retract. (Figure 12) Excessive rotation may affect the condition of your cores.
Remove sampler tube and remove cutting shoe from sampling tube by tapping and rotating, or by use of wrench (provided). (Figure 13)

Cap the lower end of core with black vinyl cap, and the top with red. (Figures 14-15)
Field Operations
Optional Anchoring System

In some field conditions it may be necessary to drive soil anchors into the soil to obtain adequate depth with probe or core sampler. If this is the case, you will need PN 40209 Anchoring Package.

Installation and Removal

- Retract probe until is in the most forward position.
- Side shift to the far right and lower foot.
- Place anchor in center of foot opening and lower probe drive until hex enters hex drive on probe. (Figure 16)
- Drive in slowly using Probe and Rotation controls. Apply adequate force to push as you rotate. If you rotate too rapidly, the anchor will simply auger a hole, and will not anchor properly --- Drive in until all flighting is below ground level and probe is at bottom of stroke.
- Raise foot, side shift to far left, and repeat this process. (Figure 17)
1. Extend platform out to full extension
2. Attached chain binders on each side of probe
3. Slip anchor plates over anchors and bind down each side (figure 18)

- Anchoring will limit your side travel somewhat, but you should still be able to take multiple cores with the anchors installed.
- **Do not use extension control while anchors are connected**
- Remove the anchors in reverse sequence.
- If anchors have shifted during use and you are unable to slide the hex head of the anchor back into the hex drive – use the foot to gently nudge the anchor back into re-alignment.

**Note:** Be careful when lowering the probe with the instrument cases in place. Remove left hand anchor first – otherwise you might push the head of the anchor into the instrument mount when lowering probe to remove RH anchor.
Field Operations
P4000T Removal and Tractor installation

The P4000 is designed to work equally well on a tractor, or as a skid mount unit.

Removing probe from skid –

- Install three point stabilizer stands into probe and temporarily lock in mid position with ¾” pinch bolt.
- Extend and unfold the probe.
- Lower foot to ground level.
- Remove fold cylinder pin, and carefully retract fold cylinder until it is fully retracted. You may have to gently move fold control valve back and forth to relieve pressure on pin for removal. (Figure 19)

- Carefully remove lower link pins and lower probe down by retracting foot cylinder
- Lower stabilizer stands and lock with ¾” bolt
- Retract probe platform and shut of engine. (Figure 20)
- Disconnect wiring and 4 hoses on bottom of console (Figure 21)
- Disconnect main Pressure and Tank hose from platform (Figure 22)
Installing on Tractor –

- All bushings and pins are provided for Category I and II three-point hitches.
- Connect lower links – make sure you include the stabilizer link bushings (Figure 24)
- Connect top link
- Raise three point to desired height and level with top link
- Install lower stabilizer mount on drawbar and tighten 5/8” bolts
- Connect LH and RH stabilizer to upper and lower points, adjust, and lock with jam nut.
- Connect hydraulic hoses noting P and T
- Retract stabilizer stands and engage hydraulics -- locking valve into detent with tarp strap or other device. Make sure that flow is correct or controls will be backward.
Section 6
Maintenance and Lubrication

Proper maintenance and lubrication of the Veris P4000G will allow you to collect high quality EC and force, and greatly extend the useful life of the unit. Veris Technologies strongly suggests that you follow the following guidelines:

MAINTENANCE: Storage of Auxiliary Instrument and EC – Force Probe
The auxiliary instrument and probe are water resistant; store system indoors or under roof. Water damage to electronic components is not covered by warranty.

MAINTENANCE: Electrical Continuity and Isolation
It is advisable to perform this test on a routine basis (weekly or every 20-25 hours of data collection) to ensure you are obtaining reliable data.

1) **Probe electrode isolation** – Check isolation of the dipole to the point with a Digital Multi Meter if the dipole is properly isolated, a reading of 12K ohm should be obtained.

Figure 1
Instrument EC Signal Testing – The Veris Auxiliary Instrument is shipped with an **Instrument Test Load** (Part No. 10447) that will enable you to quickly check the instrument to ensure that the EC circuit is functioning properly. To perform this test, do the following:

1) Disconnect the signal cable from the amp pin (signal) terminal on the auxiliary case.
2) Connect the test load to the signal terminal.
3) Turn on Auxiliary Instrument and start up software.
4) The display should show: (See Figure 3)
   
   \[
   \text{EC } 193 \pm 10
   \]
5) If the readings vary significantly (more than 10) contact Veris service department.
6) Once the test is complete, remove the test load and reinstall the implement signal cable.

---

**Figure 2**

**Test Load**

**Figure 3**
Probe EC Signal Testing – The EC – Force probe is shipped with a **EC dipole tester** (Part No. 29689) that will enable you to quickly check the probe and instrument to ensure the EC is functioning correctly. To perform this test, do the following:

1) Press one bolt of the dipole tester to the side of the probe tip and the other to the center brass dipole. (see figure 5 below) Depending on if the brass or the silver bolts are used the EC reading will be high or low. The high and low readings may vary depending on contact with the probe tip and the probe tip cleanliness. This is fine; the import thing is that the brass reading be lower than the silver. The difference between the two readings will be hundreds of EC values.

![Figure 4](image4.png)  
![Figure 5](image5.png)
Probe Removal

This procedure is needed when removing the probe for bench top use, road transport, or for soil coring.

**Step 1:**
Disconnect the force, EC, USB, and power cables to the auxiliary case.

**Step 2:**
Remove loom from clip.

**Step 3:**
Firmly grasp probe, and remove the mounting pin holding the probe on the platform.
Case Removal and Installation

When the auxiliary case needs to be removed for storage, repair, or bench top use follow these instructions.

First disconnect all wires connected to the auxiliary case.

The case is secured with two latches, and case and latch assembly can be removed as a unit.

![Figure 7](image1.png)

![Figure 8](image2.png)
Section 7
Troubleshooting

Troubleshooting EC module

Data missing from display reading –
1. Unit must be in contact with soil to record data points
2. Check GPS and DGPS signal; Veris instrument is programmed to eliminate all non-DGPS geo-referenced points.
3. Shut power off and restart
4. Check electrical continuity
5. Check input voltage, 12 v minimum required

No GPS data is coming in during acquisition
1. Check to ensure nothing is obstructing GPS signal (ex. buildings)
2. Is the GPS plugged into the correct port? (second one from the right on auxiliary case)
3. Check to make sure GPS adaptor is in place
4. Follow the steps of the GPS troubleshooting guide to further diagnose problem

Auxiliary data not updating or ports not setting up correctly
1. Shut down power, and restart cases
2. Unplug USB cables
3. Restart PC
4. Plug in USB cables and restart software

New hardware found wizard appears when I plug in my Auxiliary Instrument
1. Make sure the Veris EC – Force software has been installed properly.
2. If Veris EC – Force software has been installed, then proceed with the new hardware found wizard. Use the provided Digi EdgePort driver disk and source for driver when prompted by PC
Troubleshooting GPS

If GPS fails to come in it could be for a variety of reasons. If using the provided Garmin GPS make sure the GPS adaptor is in place (see figure 10 in system overview). Then following troubleshooting tree to isolate the problem.
Fuse Replacement

The fuse for the auxiliary case protects the voltage for the electrical conductivity board and the lamp. To replace the fuse open the case and locate the black fuse holder.

Fuse holder. Replace only with a 4-amp fuse.

Figure 2 Internal wiring of auxiliary case
Section 8
Specifications

Max ambient temperature to operate system: 110 degrees F
Max aux case temperature: 65 degrees C
Max aux case humidity: 90% RH
Max force sensor capacity: 22361 kPa or 3245 PSI
Max probe insertion speed: 50mm/s

WARNING: Damage to force sensor may occur if this specification is exceeded