Soil Moisture Probe
Quick Installation, Removal and Storage Guide

March 2015

Version 4

Table of Contents

1.0 Soil Moisture Probe Components..... 3

2.0 Installation Items Needed..... 5

3.0 Probe Installation Procedure 6

3.0 Mast and Communication Module Installation 15

4.0 Tools Needed for Probe Extraction 25

5.0 Probe Extraction Procedure..... 25

6.0 Equipment Storage..... 29

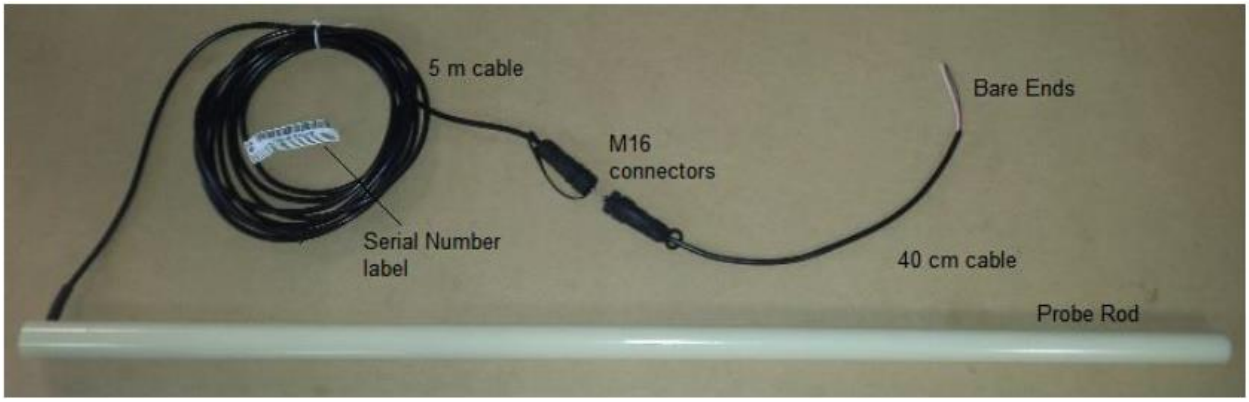
7.0 Troubleshooting 31

7.1 Problem Indicated by Green LED 31

7.2 Problem indicated by Yellow LED 32

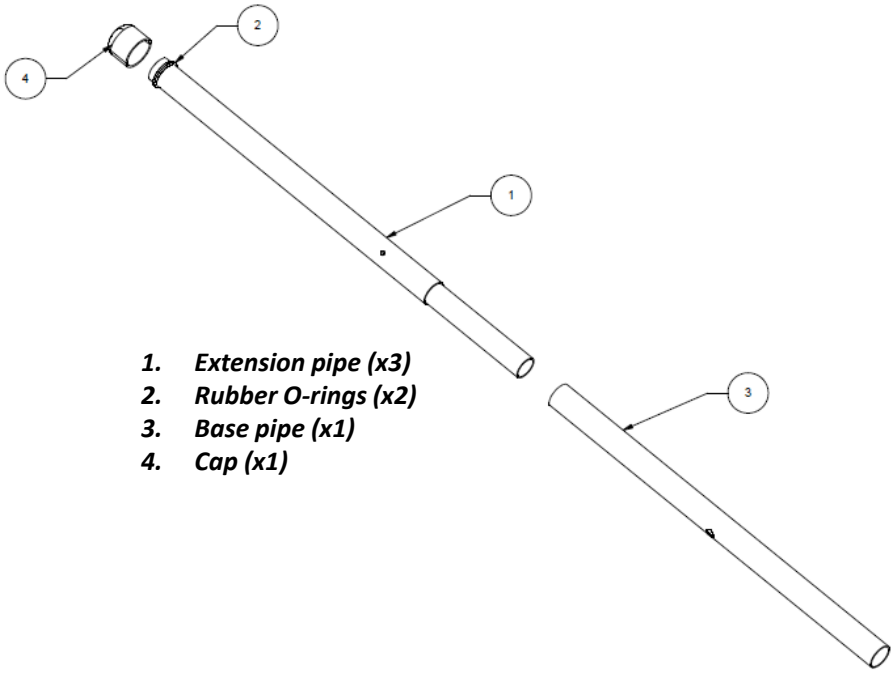
7.3 Problem indicated by the Blue LED..... 34

1.0 Soil Moisture Probe Components



Sentek Drill and Drop Soil Moisture Probe

(2 ft, 3 ft or 4 ft long)

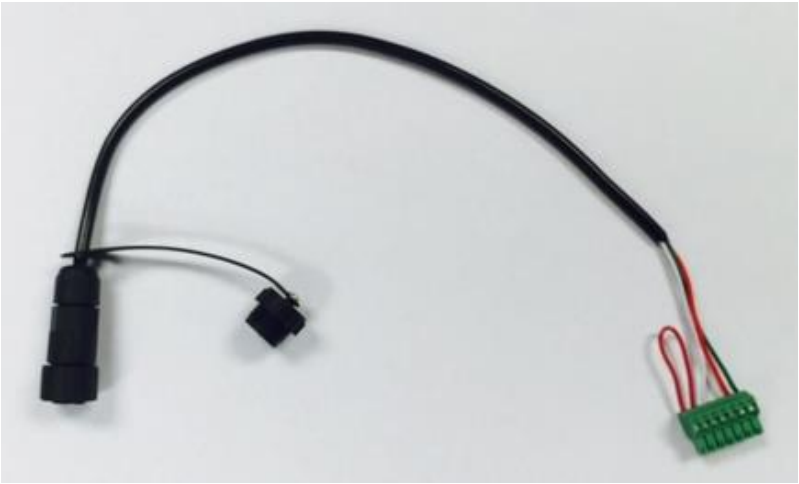


1. ***Extension pipe (x3)***
2. ***Rubber O-rings (x2)***
3. ***Base pipe (x1)***
4. ***Cap (x1)***

Support Mast Support

Communication Module

(Cellular Version shown))



Probe Cable

(Communication Module to Probe)

2.0 Installation Items Needed

The items below are needed to complete the Probe installation in heavy clay soils. Do not attempt to use a battery-powered drill. An electric drill such as the one shown below or a gas-powered drill also shown below will be required for probe installation in clay soils.

Note that the tapered drill bit is slightly longer than the probe to allow the hole to be slightly deeper. This allows some loose soil to collect at the bottom of the hole without obstructing full insertion of the probe.

Electric Drill and Generator

Or

Gas-power Drill

3.0 Probe Installation Procedure

Step 1: Site selection

Select a location near the crops but where the probe (underground portion) and the mast/radio (above ground portion) can be avoided by farm equipment. It's important that the probe be in an area where crop roots will develop as the plant matures.

Step 2: Tripod Installation

Place two (2) sheets of newspaper beneath the Stabilization Tripod at the selected probe site. This allows easy removal of the augured soil later.

Step 3: Set Screw Pins

Set the Screw Pins (3) in the holes at the corners of the Tripod as shown in the figure below.

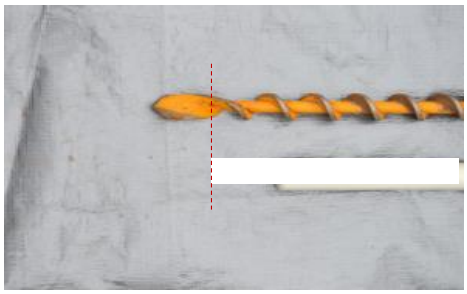
Step 4: Place Socket drive into the Drill and tighten with chuck key.

Step 5: Drill Screw Pins into Soil

Place one foot onto the center of the Tripod, position the socket on the screw pin and keep drilling until the head of the pin comes to rest on the top of the tripod. Repeat for the remaining 2 pins and then check the stability of the tripod. It should be held firmly in place.

Step 6: Insert Tapered Augur into Drill and Mark proper depth

Note: The same tapered bit is used for both 3 ft and 4 ft probes. If installing 3 ft probes, hold the probe next to the bit as shown in the figure below. Place a piece of electrical tape on the bit even with the other (top) end of the probe. The hole should only be drilled to this mark for 3 ft probes.



Step 7: Auguring

Insert the augur into the center of the Tripod keeping it as straight as possible. Start the Drill and move the augur constantly and gently 4" to 6" up and down during the drilling process. This enables movement of the soil from the augur flight upwards and out of the drilled hole.

Step 8: Wetting the Augur

Step 9: Augur the hole to depth

Step 10: Test the depth of the hole before Probe installation

Remove the soil from the augur.

Re-insert the augur carefully into the hole with the Drill switched off. Push the augur until the top end of the bit is level with the hole of the Tripod (see Figure above). If the augur will not go down to this level, give the augur a quick spin to take up the soil at the bottom of the hole, then stop the drill, remove the soil from the hole and clean it once again. Repeat this process until the augur can be fully inserted into the hole without spinning the bit.

The hole is now ready to accept the Probe.

Step 11: Remove the Screw Pins from the Tripod

Use the Drill in reverse to unscrew the Pins.

Step 12: Inspect the quality of the hole

Step 13: Prepare the small Trench for the Probe cable

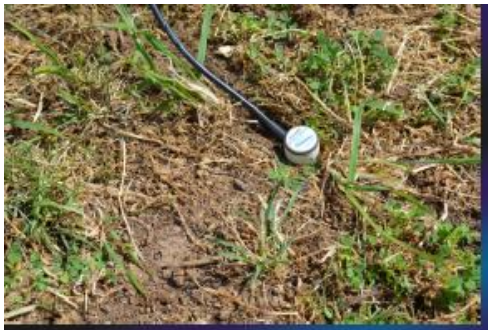
Caution: Do not bury the probe cable in the trench until the hole for the Mast is complete and the Mast is set in place.

Step 14: Preparation for Probe insertion

Step 15: Probe insertion

Insert the probe carefully into the hole pushing it all the way down until the top of the probe is level with the soil surface. The first sensor will now be located at 5cm depth.

Step 16: Probe seating



If the probe protrudes above the soil surface and you cannot push it any further by hand, gently step on it and use your body weight to push it into final position. If this does not work, use a rubber mallet to force penetration of the probe by gently tapping it with another hammer. The emphasis here is on "gently". Do not use any metal beating implements directly onto the probe.

Step 18: Final Probe positioning

The final Probe position should look like this (see figure below). The Probe should be in firm contact with the soil and you should not be able to push it in any further by hand.

3.0 Mast and Communication Module Installation

Step 1: Install the Mast Base section

The Mast consist of four (4) sections; the Base and 3 Extension sections. The Base section is a single diameter piece (see figure below), 42" long with a hole near the center. This hole is for routing the Probe cable up through the inside of the Mast pipes to the Communication Module at the top. Using a posthole digger, dig a hole 18" to 24" inches deep within about 2 ft from the buried Probe. Make sure not to cut or nick the cable from the Probe.

Set the Base Section into the hole just dug and adjust depth so that the cable feed-thru hole in the side of the pipe is about 2" below the ground level See figure below). Do not backfill with dirt yet.

Step 2: Route Cable from the Probe

Remove the short Probe cable extension near the end by loosening and separating the M16 connector. Set the short end of the cable to the side and avoid getting any dirt or water in the either end of the connector.

Insert the long portion of the Probe cable through the Base Section pipe cable feed-thru hole and push it up through the top of the pipe. Carefully push the Probe M16 connector through without damaging the connector (see figure below). St the Base Section back into the hole and make sure it is straight upward.

Backfill the hole with soil up to just below the cable feed-thru hole in the pipe. Pack the soil tightly around the pipe and make sure the base is straight upward.

Step 3: Dig the Trench and Backfill around the Base Section and cable

Finish digging the trench between the probe and the Base Section. It should be at least 2" deep. Place the exposed cable in the trench and push any extra into the feed-thru hold in the pipe. Backfill around the Base Section pipe and the trench. Make sure Base Section pipe still pointing straight upward.

Step 4: Route Cable through the Extension Sections of Pipe

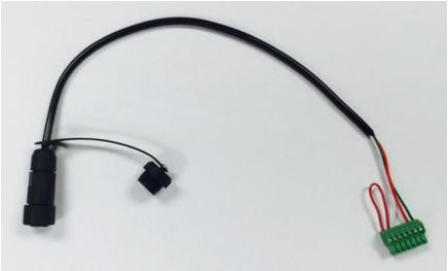
Feed the long section of Probe cable through the bottom of the first Extension Section (see figure below). *Note: All three (3) Extension Sections are identical and interchangeable*. The bottom end has a slightly smaller pipe diameter which allows it to be inserted into the Base Section now buried in the ground.

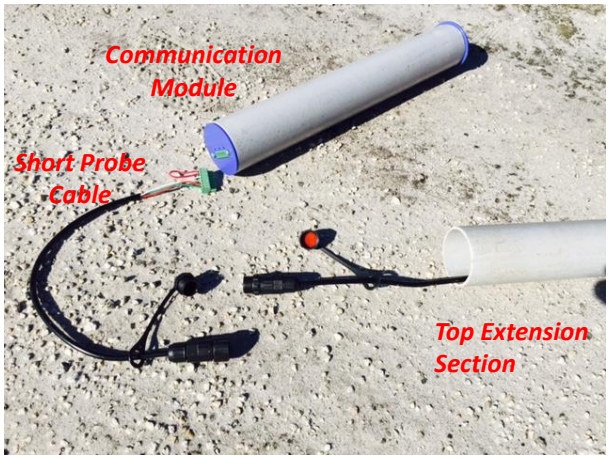
Step 5: Routing Cable through Extensions

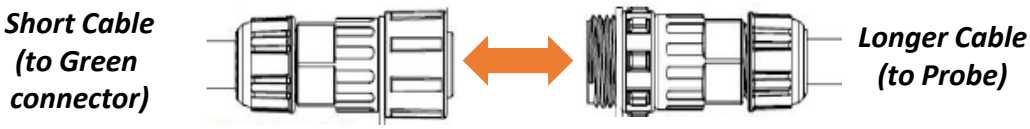
Connect the two remaining Extensions section and lay on the ground. Push the longer Probe cable through the narrow (bottom) end of the first, joined Extension Section until the end comes out the top of the second section (see figures below). Pull at least 2 ft of excess cable through the top and lay it on the ground.

Step 6: Probe Cable Connections

Find the short piece of the Probe cable Included with Communication Module (see figure below - left). Connect this short cable first to the longer cable from the probe (center figures below). Remove the connector protective caps, press the two black mating connectors together and screw the connectors together. Tighten firmly using your fingers.





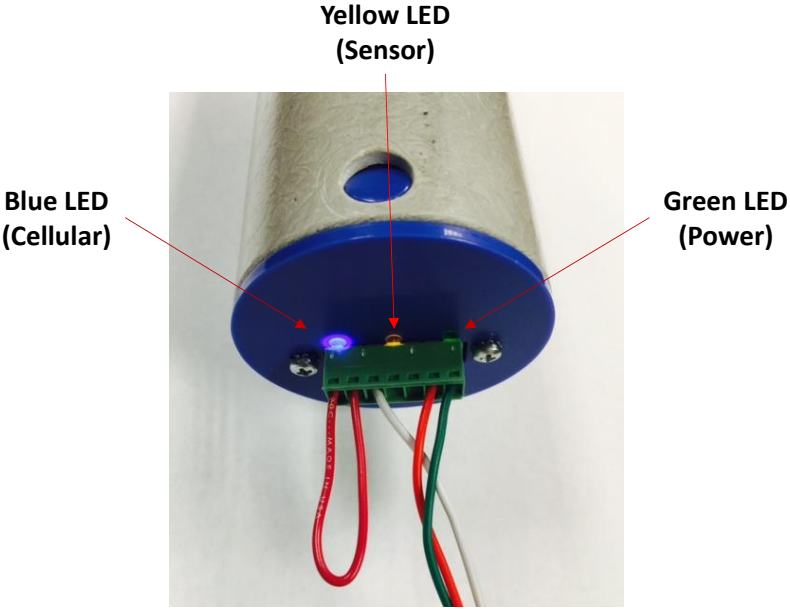


Step 7: Connecting the Communication Module

Plug the green connector from the short probe cable into the Communication Module's mating, green connector (see figure below). Note that is keyed and will only fit together if oriented the correct way. This will power on the module and the LEDs at the bottom near this connector will show status for a period of the next 2 minutes. **After this period, they will all go out to conserve battery power. If more than 2 minutes of viewing status is needed, disconnect and then reconnect the green connector. This will start another 2 minute cycle.**

Step 8: Verification of Proper Operation from the LED Display

The three (3) LEDs at the bottom of the Communication Module (see figure below) can be used to verify the entire system is fully functional and reporting measurements to the KTS Wireless Database. After connecting the Communication Module to the Probe Cable, the LEDs will become active. The interpretation of each LED is as follows:



a) Green LED: Battery Power Status

Verify that the Green LED on the bottom End Cap begins to blink when the green mating connector is inserted. Within about 45 seconds the blinking should stop and the LED should stay on constantly. This indicates that the battery charge is adequate. If the blinking continues for more than 60 seconds, the battery charge is too low and should be replaced. See Troubleshooting Section.

b) Yellow LED: Probe Connection

Verify that the Yellow LED also begins to blink. This indicates that the Communication Module is attempting to communicate with the Probe and retrieve sensor readings. If communications with the Probe is successful, this LED will stop blinking and turn on constantly. If it continues to blink, there is most likely a problem with the Probe cable connections. See the Troubleshooting Section.

c) Blue LED: Cellular Connection (Cellular and Gateway Versions only)

Verify that the Blue LED comes on within about 30 seconds and begins to blink slowly at first then faster. During the faster blink period, the Communication Module is attempting to complete the cell connection to the ASR Manager Database Server. If the connection is made successfully, the LED will turn on solid. If **slow** blinking continues until the LEDs go off (2 minute elapsed timeout), there is most likely a problem within the Communication Module. If **fast** blinking continues until this time, the cellular connection has a problem and the most likely reason is poor coverage. Make sure to hold the Communication Module as shown in the figure below (nearly vertical and at least shoulder height). This position more closing simulates where it will be when installed at the top of the Mast.

Proper Viewing angle

Wrong Viewing angle

In summary, all three LEDs should turn on constantly (not blinking) within about 60 seconds after the green connector is attached. The LEDs will normally power down after 2 minutes to conserve battery life.

Step 9: Installing the Communications Module

Once all the LEDs display the proper status (on solid) as outlined in the previous step, carefully push the excess Probe Cable into the top Extension section and slide the Communication Module into the top end of the Extension (see figure below). Remove the color-coded rubber band from the Communication Module tube as it is being inserted and place it near the top to the top, outside of the Extension Section, about 6" down from the top. This can be used to indicate the version of Communication Module used at this site. The color code is as follows:

Yellow: Cellular version

Red: Mesh version

White: Gateway version (cellular and mesh)

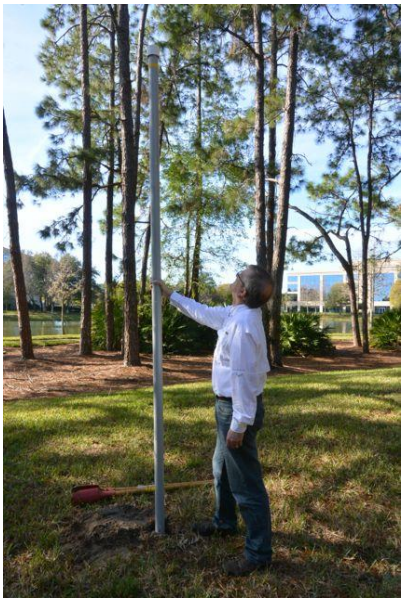
Step 10: Installing the O-rings and Cap

Slide the two (2), rubber O-rings provided over the top end of the Extension Section. They should be positioned about 1" apart and the top one about ¼ " from the top (see figure below). Slide the white PVC Cap over the end, clearing the Top End Cap of the Communication Module and sliding completely over both O-rings. Note: **The two (2), black rubber bands used to hold the Mast set together can be stored under the PVC cap until the Mast is removed at the end of the growing season.**

Slide this top Extension Section into Extension Section below (see figure below).

Step 11: Erect Extension Sections

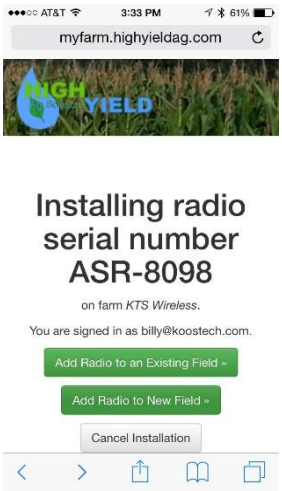
Once the Cap has been pressed on firmly, grasp the two, join Extension sections near the bottom and slide them into the lower Extension section on the Base. Carefully push the excess cable into the pipes (see figure below).



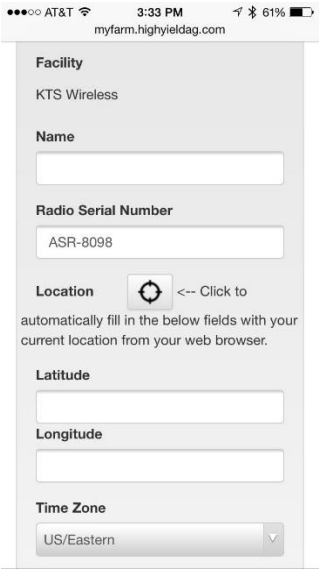
Step 11: Adding the New Field/Probe Location to My Farm Manager Database

The geographic coordinates (latitude and longitude) of the Probe location must be recorded and entered into the KTS Wireless Database. The QR code (see example below) contains the link to the My Farm Manager Login or Radio Install page.

Using your smartphone and the appropriate app, scan the QR code (figure above) to connect to the My Farm Manager Database. The Screen below should appear.

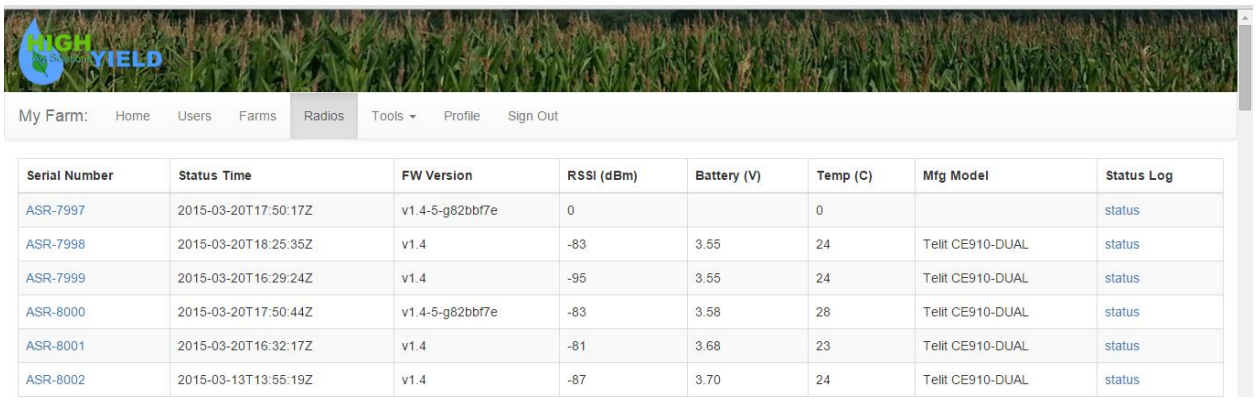


Click on Add Radio to an Existing Field or Add Radio to New Field, whichever is correct. The next screen will be displayed (see below). Enter the Field Name where the Radio/Probe is installed. Only one Radio/Probe can be installed in a field. If more than one is to be placed in the same Field, the names must be different. For example, South Corn Field – Probe 1 and South Corn Field – Probe 2 can be used. While standing near the installed probe, click on the Location button. This will cause the smartphone to automatically fill in the latitude and longitude into the fields using its internal GPS device. The time zone will also be filled in by the smartphone's browser. It can be changed manually, if necessary.



Step 12: Verifying its working

When the new probe is first added, it will attempt to connect with the My Farm Manager and verify its configuration. This will include reading the Radio SN, Receive Signal Strength Indicator (RSSI), Battery Voltage Level, Sensor Type (Moisture/Temp or Moisture/Temp/Salinity) and current software version. If a connection is established, the above information will be populated in the table on the Radios screen.

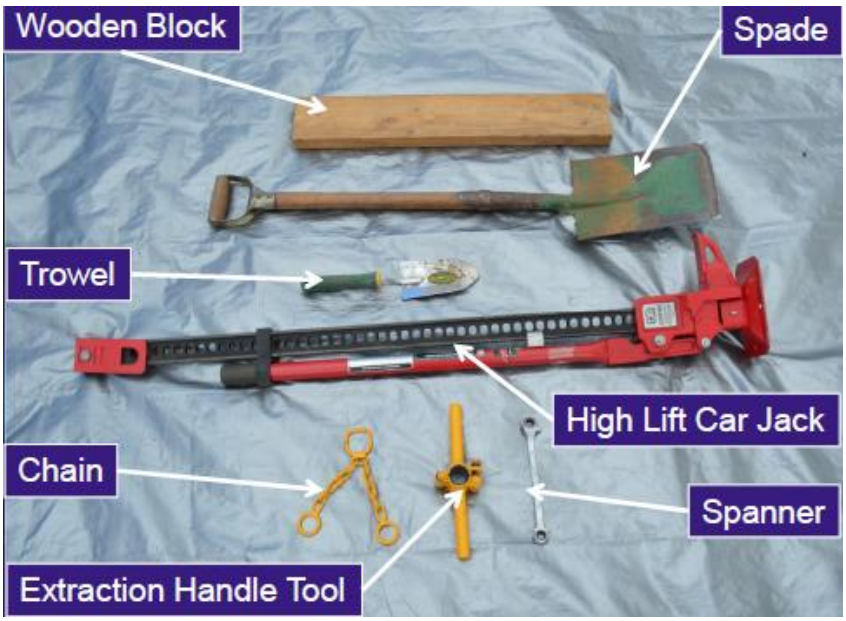


Serial Number	Status Time	FW Version	RSSI (dBm)	Battery (V)	Temp (C)	Mfg Model	Status Log
ASR-7997	2015-03-20T17:50:17Z	v1.4-5-g82bbf7e	0		0		status
ASR-7998	2015-03-20T18:25:35Z	v1.4	-83	3.55	24	Telit CE910-DUAL	status
ASR-7999	2015-03-20T16:29:24Z	v1.4	-95	3.55	24	Telit CE910-DUAL	status
ASR-8000	2015-03-20T17:50:44Z	v1.4-5-g82bbf7e	-83	3.58	28	Telit CE910-DUAL	status
ASR-8001	2015-03-20T16:32:17Z	v1.4	-81	3.68	23	Telit CE910-DUAL	status
ASR-8002	2015-03-13T13:55:19Z	v1.4	-87	3.70	24	Telit CE910-DUAL	status

Verify that the RSSI value is greater than -110 (dBm). A smaller negative number (e.g., -90) is better and greater than -100.

The software version number is also displayed. If a newer version is required, My Farm Manager will automatically initiate a download. This may take several minutes to complete.

4.0 Tools Needed for Probe Extraction



5.0 Probe Extraction Procedure

Step 1: Fitting the Extraction Handle Tool

Excavate the soil adjacent to the probe to a depth of about 8", allowing room to the rotation of the Extraction Handle Tool. Wipe any soil from the Probe. Fit the Extraction Handle Tool around the Probe approximately 1" below the cable entry point (see Figure below).

Step 2: Tighten the Extraction handle Tool

Tighten the nut firmly to clamp the Extraction Tool handle around the Probe.

Step 3: Test the Ease of Extraction

Test the ease of extraction by hand first. Give a sharp test as you attempt to lift the Handle Extraction Tool. If there is too much resistance, then a High Rise Car Jack or similar mechanical lever will be needed.

Step 4: Fitting the Chain

Fit the Extraction Chain onto the Extraction Handle Tool, one circular ring for each handle.

Step 5: Position the Car Jack

Position the High Rise Car Jack on a sturdy board laid across the hole in the soil. Refer to the car jack manual for safe operating procedures. Locate the square ring on the jack and apply tension.

Step 6: Probe Extraction

Use the lever to extract the Probe. Reposition and re-tension as required. Gently remove the Probe when it becomes free from the soil.

Step 7: Clean the Probe

The tapered augur bit should be thoroughly cleaned of all adhering soil. A convenient way to do this is to hold a stiff-bristled brush against it while operating the dill with the augur still attached. This will require two people, one with the brush and the other operating the drill. Rinse with water. Once clean and dry, the augur should be stored flat in a dry location.

6.0 Equipment Storage

Step 1: Preparation of Equipment

After the Mast, Probe, cable and Communication Module have been removed and separated, lay them out of the ground. **Note: Removing the green mating connector from the bottom of the Communication Module will power down the unit. It's not necessary to disconnect the internal battery cable.**

Step 2: Cleaning Probe, Mast Base Section and Cable

Use clean rag and water to clean the outside of the Probe. Make sure all soil is removed. Similarly, remove the soil from the Base Section of the Mast and the Probe cable.

Step 3: Remove the Black Rubber Bands from under the PVC Cap

Remove the two (2) Black rubber bands from underneath the PVC cap where they were stored during installation.

Step 4: Remove the Colored Rubber band

Remove the Colored rubber band from the top Extension Section of the Mast and place around the top of the Communication Module

Step 5: Communication Module Storage

Slide the Communication Module back into the top of the Mast Extension Section. Place the PVC cap back on.

Step 6: Banding the Mast and Probe Together

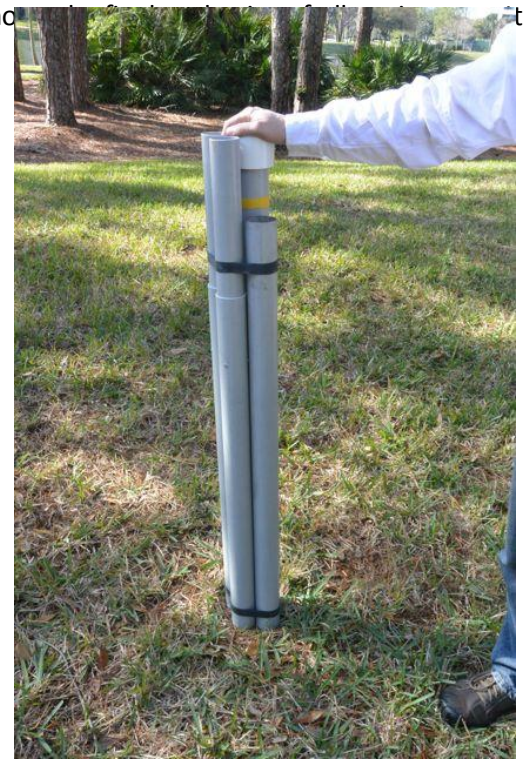
Place the Probe in the center of the four (4) Mast Sections as shown in the figure below. Wrap the larger, Black rubber bands around all the sections, one near both ends.

Step 7: Cable storage

Connect the short and long section of the Probe cable together by screwing the two Black, M16 connectors together. Push the entire length of cable into the top of the Base Section pipe.

Step 8: Ready for Storage

The figure below sho[illegible]t is now ready for storage in a clean, dry location.

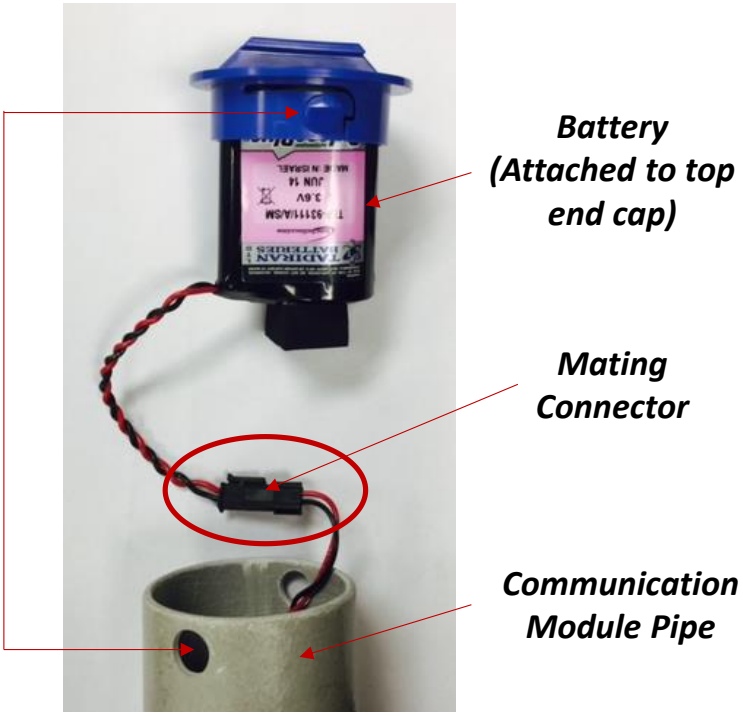


7.0 Troubleshooting

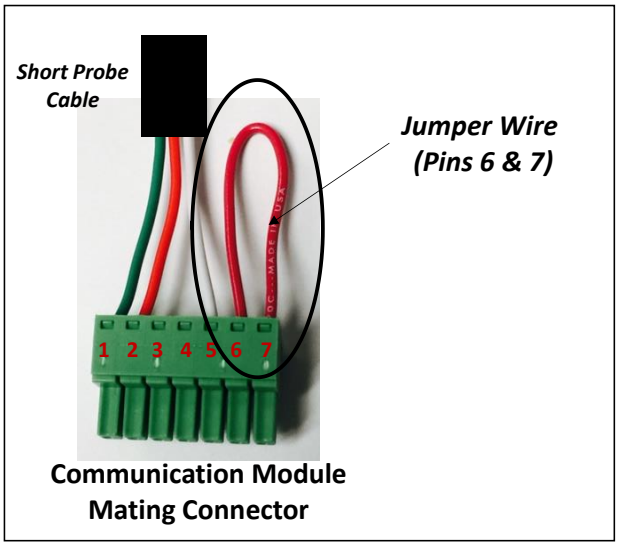
7.1 Problem Indicated by Green LED

If the Green LED does not start blinking within a few seconds after the green connector is pressed into the Communications Module, then check the following:

1. Remove the top end cap (one without the connector) and check that the battery cables are mated securely (see figure below).



2. If this connection is made properly, next verify that the small loop wire is present and the connection are good (fee figure below). If not, repair as necessary and make sure that a reliable connection is made between Pins 6 and 7 and the jumper is securely in position.



3. If the problem is still present and the Green LED is still not on solid, the battery is likely discharged and must be replaced. Contact your Dealer or High Yield Ag Solutions to purchase a new battery. It will be supplied with a new top end cap. Dispose of the old battery properly.

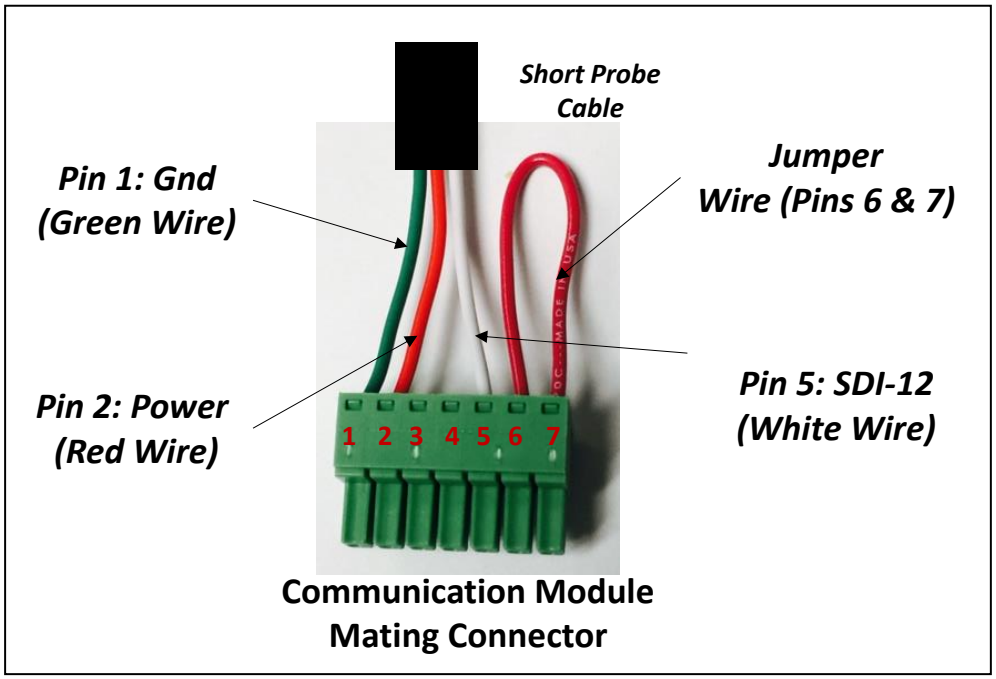
4. Replacing the battery: Disconnect the green probe connector from the bottom end cap mating connector. Next, disconnect the black battery mating connector. Remove the old battery/cap assembly. Connect the cable from the new battery/cap assembly to the Communication Probe cable. Push the excess cable into the top of the pipe, push the battery into the pipe and align the clips on the side of the top end cap with the holes in the pipe. Press the cap into the pipe until both clips snap securely into the holes.

5. Test the new battery: Connect the green probe connector at the bottom end cap. Verify that the Green LED begins to blink and then turns on solid after 5 – 10 sec. This indicates that the battery is good.

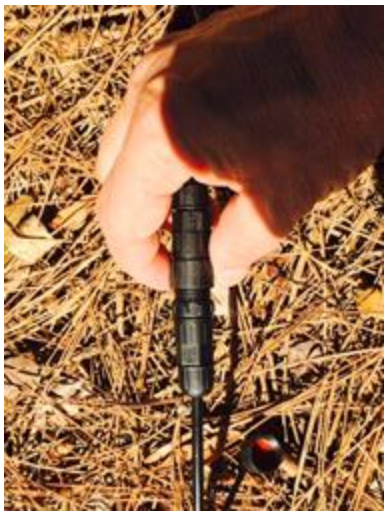
7.2 Problem indicated by Yellow LED

If the Yellow LED blinks but does not turn on solid after 30 sec, there is likely a bad connection between the Probe cable and the Communication Module.

1. Check the Green Connector: Examine the end of the short Probe cable with the green plastic connector (see figure below). Verify that the Pins 1, 2 and 5 are made securely with the color-coded wires shown in the figure below. Make sure that the terminal block screws on the green mating connector are tightened securely (small, 0.01" flat blade screwdriver required).



2. Check the circular black (M16) connectors: Verify that the short probe cable is properly mated to the longer cable from the probe (see figure below). The threaded coupler should be finger tight.



3. If both of these connections look good, inspect the entire length of cable between the probe and the green connector (short and longer sections). Verify that there are no cuts or damaged sections.
4. The Yellow LED is still not on sold and an extra probe or Communication Module is available, replace them, one at a time, to determine of the problem is in the Communication Module or the Probe.
5. Contact your Dealer to coordinate the repair of the failed unit.

7.3 Problem indicated by the Blue LED

This LED is used to indicate the status of the Network connection between the Communication Module and the KTS Wireless Database. If a cellular connection is used, the Blue LED should blink slow (once per second) during the first 5 seconds after initial power up and then blink much faster (5 times per second) for about 30 sec. It should eventually turn on solid indicating a complete, end-to-end connection has been made successfully. <u>All LEDs will normally turn off after 5 minutes to conserve battery power.</u>

1. **Continues to blink at the slow rate (once per second) for more than 5 sec after power-up:** If this occurs, an internal problem has occurred within the Communications Module. Contact you Dealer to coordinate the repair process.

2. Continues to blink at the fast rate (5 times per second) for more than about 60 sec after power-up: If this occurs, the most likely problem is the cellular connection to the carrier's base station (i.e., poor cell coverage). Make sure that Communication Module is held properly (straight up and down and about shoulder height) while observing the Blue LED.

3. If the problem persists, try moving to a near-by site that may offer better coverage.