CROPTIMISTIC TECHNOLOGY INC. / SWAT MAPS

SWAT BOX and SWAT RTK

Assembly and Mapping Standard
Operating Procedures Manual

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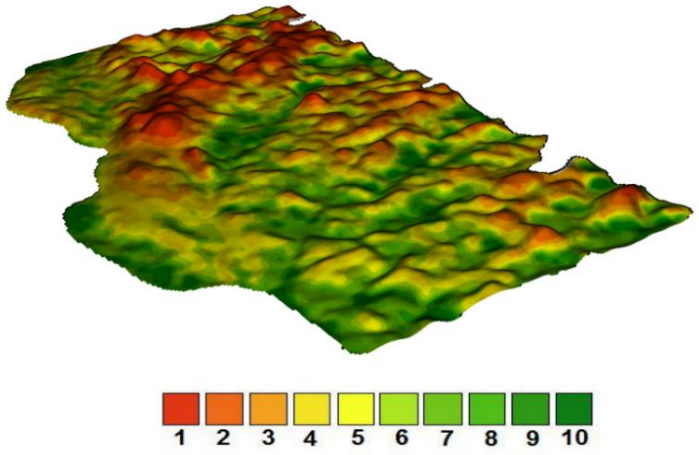
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1 INTRODUCTION

SWAT BOX is an automated electrical conductivity (EC) and elevation mapping system to be used for the creation of SWAT MAPS. Up until this point, to enter the variable rate mapping market required upfront research and integration time spent piecing together a mapping system. As well, to properly process and interpret EC data requires significant knowledge and experience. SWAT MAPS experts have accumulated many years of mapping experience and have been through the mapping system and process development pains. SWAT BOX is a ready out of the box mapping solution where after approximately 1 hour of installation time you can be mapping and live streaming EC and elevation data to SWAT MAPS experts. This system enables any agronomist, or service provider the ability to offer the patented SWAT MAPS variable rate mapping service to their customers.

SWAT BOX has been designed to be adaptable to a wide variety of mapping vehicles including trucks, ATVs, and agricultural equipment. The system is suspended just above the soil which results in considerably less maintenance than traditional EC sled systems and systems that engage the soil. No additional computer or software is required to operate the system. To view the live EC and elevation coverage map, personnel can simply monitor the live data with their cellular phone or tablet. Also, support personnel and map developers can log in remotely to troubleshoot and to ensure data being collected is of good quality. Simply mount SWAT BOX to the mapping vehicle, supply the system with 12 Volts, and drive the fields.



2 SAFETY

The following are safety guidelines when mapping, sampling, or ground truthing a field:

- Ensure someone knows your plans for the day such as where and when you will be mapping; fields to be mapped can be in remote areas with little contact with other people.
- Always wear your seatbelt when mapping as there can be hidden hazards in fields.
- Ask the customer if there are any known hazards in the field prior to mapping the field.
- A maximum speed of 50 kph (31 mph) in the field shall be adhered to.
- Have a first aid kit in the vehicle.
- Have a large water fire extinguisher and chemical fire extinguisher mounted to the mapping vehicle within easy reach of the operator in case of fire.
- When exiting your mapping vehicle, ensure you have your cell phone with you in case you are unable to get back into your vehicle.
- Avoid storing heavy parts inside the truck cab that could bounce around the vehicle while mapping rough fields.

3 WARRANTY

Warranty for up to 1 year from date of shipment from Croptimistic Technology headquarters for the original purchaser includes:

- Support over the phone and remote system login for troubleshooting.
    - Replacement parts will be shipped out to customer's location and customer will conduct the parts replacement, as necessary.
- After warranty expires a tech support fee of $150/hr plus travel costs will apply if customer requests service
- After warranty expires, replacement parts will be at customer's expense.
- Croptimistic has the right to refuse warranty if failure was caused by misuse of the SWAT BOX system and/or the operator manual was not adhered to.
- Warranty does not apply to damage caused by contact with hazards such as the ground, rocks, or man-made obstacles.

4 SWAT BOX ASSEMBLY

4.1 SWAT BOX COMPONENTS

The following are the basic components of the SWAT BOX as shown in *Figure 1*.

1. SWAT BOX Controller
2. Sensor enclosure
3. Power cable
4. Data cable (Qty. 2 – One Spare)
5. Hitch T-bar
6. Pivot mount assemblies (Qty. 2)
7. Washer Plates (Qty. 4)
8. Support arms (Qty.2)
9. Shock absorbers (Qty. 2)
10. Tether Straps (Qty. 2)
11. Hitch pin
12. Pivot pins (Qty. 2)
13. Shock and Tether Strap pins (Qty. 8)
14. T-Bar Clamp
15. Sensor Enclosure Hardware (Qty. 4)
16. Pivot Assembly Hardware (Qty. 8)
17. USB Extender Receiver (Spare Part)

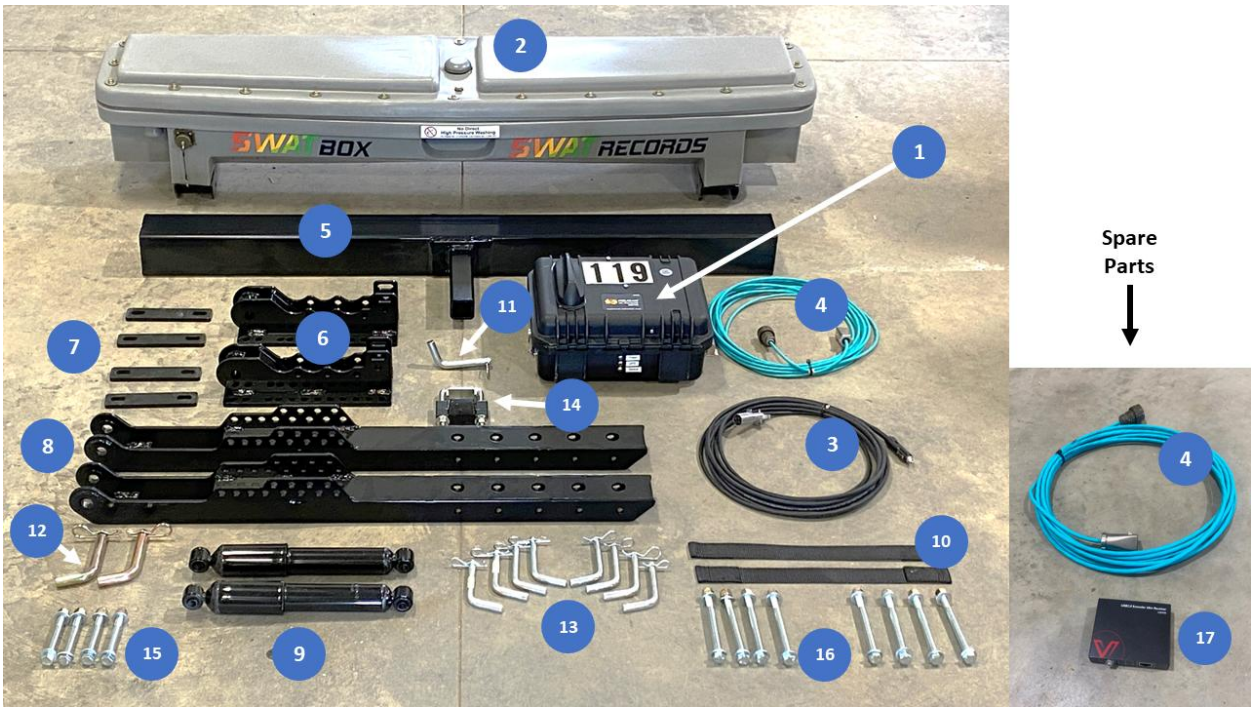


Figure 1- SWAT BOX Components

4.2 HITCH T-BAR ASSEMBLY

Slide the hitch T-bar into the hitch receiver tube and pin in place with the 5/8 in. diameter hitch pin as shown in *Figure 2*. The hitch receiver must be at least a Class III hitch which provides a minimum tongue weight rating of 1,000 lb (455 kg). If installing into a light hitch receiver such as on an ATV, the corners of the T-bar assembly should be ratchet strapped to another point on the ATV such as the front bumper or the back rack. This will prevent failure of lighter ATV hitch receivers.



Figure 2. Hitch T-bar inserted into hitch receiver

Install the anti-rattle hitch clamp with the U-bolt on the top as shown in *Figure 3*. This will limit the movement of the T-bar in the hitch receiver and result in more consistent readings from the sensor. Clean any mud or debris from the bottom of the hitch receiver where the anti-rattle clamp hook contacts; failing to do so could cause the T-Bar to twist off level when the clamp is tightened.

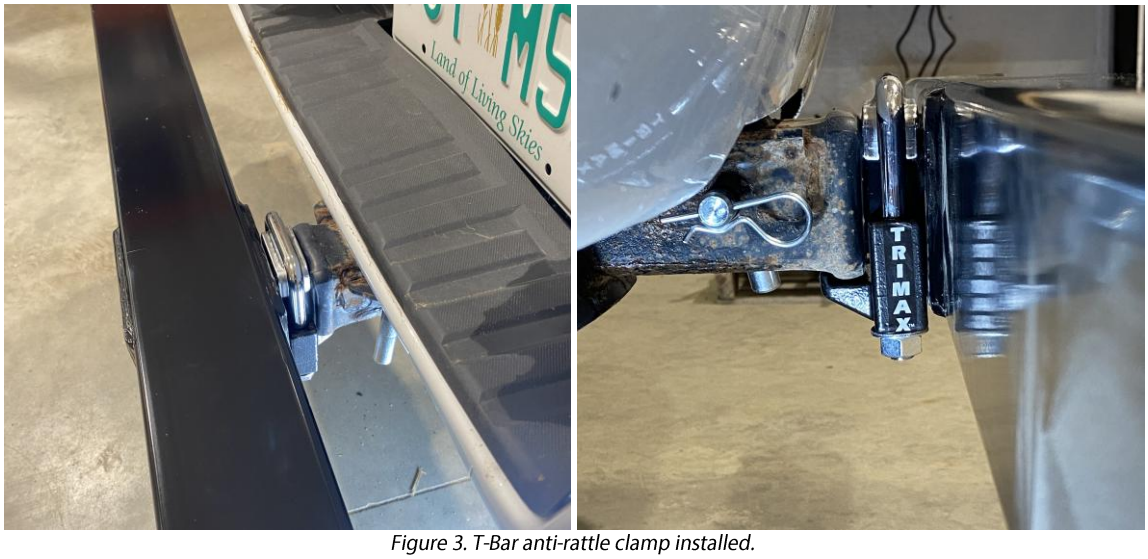


Figure 3. T-Bar anti-rattle clamp installed.

4.3 Pivot Mount Assemblies / Support Arms, and Washer Plate Assembly

The Pivot Mount Assemblies and Support Arms are shipped pre-assembled with the 3/4 in. pins, tether straps, and 1/2 in. pins pre-installed. Assemble the Pivot Mount Assemblies and Washer Plates to either side of the hitch T-bar as shown in *Figure 4*. Find the appropriate combination of bolt holes such that the bottom pivot hole on the Pivot Supports is approximately 12-14 in. (30-36 cm) off the ground with the mapping vehicle sitting level. Do not fully tighten the nuts yet in case the Support Arms attached to the Pivot Mount Assemblies need to be adjusted side to side when assembling the SWAT BOX enclosure (see 4.4 below).



Figure 4. Pivot supports and washer plates installed

4.4 SWAT BOX Enclosure to Support Arm Assembly

Assemble the SWAT BOX to the two Support Arms (see *Figure 5* and *Figure 6*) using the two holes at the end of the arms and the four ½ in. bolts, washers, lock nuts. The Support Arms and Pivot Mount Assemblies may need

to be adjusted left or right on the T-bar for proper alignment with the mount points on the bottom of the SWAT BOX. The decal and ethernet connector should face opposite to the direction of travel. For example, if mounting to the rear of the mapping vehicle, the decal and connector should face rearward. If mounting to the front of the mapping vehicle, the connector and decal should still face rearwards to protect it from damage. For ease of installation, the SWAT BOX can be hinged up as shown in *Figure 6* once the bolts are inserted. Use a washer under the head of the bolt and under the nut and tighten the bolts as tightly as possible. Once the SWAT BOX is installed on the Support Arms, tighten the 8 fasteners holding the Pivot Mount Assemblies to the T-Bar as tightly as possible.





Figure 5. Support arms assembled to the sensor enclosure (top view) *Figure 6. Support arms assembled to the sensor enclosure (side view)*

The bottom of the sensor enclosure should be approximately 12 in. (30 cm) off the ground and within 5 deg of level (tilted slightly down is fine). To adjust the angle of the support arms, adjust the tether strap by moving one of the 1/2 in. pins to another hole to allow the Support Arm angle to change (See *Figure 7*).

Once logged into the webpage interface, the height sensor should typically read 30 to 40 cm (12-15.5 in.) when the sensor enclosure is in operating position. If the enclosure ends up too close to the ground (or too high), the height can be adjusted by unbolting the Pivot Mount Assemblies and moving them up to another set of holes (or down) on the T-bar.



Figure 7. Support arms and tether straps assembled

4.5 SHOCK ABSORBER INSTALLATION

Install the shock absorbers only when in operating position using the 1/2 in. pins provided as shown in *Figure 8*. The shock absorbers should fit underneath the tether straps. Install using the pin holes that maximize the shock

absorber stroke. The shocks must be removed and stored when folding into transport position (see section 4.7). To remove the shocks, pull the pins and compress the shocks slightly. The tether straps can remain attached at all times.



Figure 8. Shock absorber installation

4.6 DATA CABLE INSTALLATION

Connect the Data Cable to the ethernet bulkhead connector at the rear of the enclosure and route back to the truck such that it will not get pinched by the support arms when they are folded up into transport as shown in *Figure 9*. A loose zip tie looped through the top hole in the left most washer plate works well to route the cable. Where the cable runs over the top of the sensor enclosure, duct tape should be used to hold the cable in place and prevent motion and stress on the connector end. Use zip ties or other methods to secure the ethernet cable to the truck box and route to the controller in the vehicle cab through a door or other small opening in the cab. Try to avoid pinching the cable too tightly in a door. Running through a window is not recommended. Plug in the opposite end of the ethernet cable into Port A or B of the controller. Locate the controller such that the three LED lights on the outside of the controller are visible to the driver.

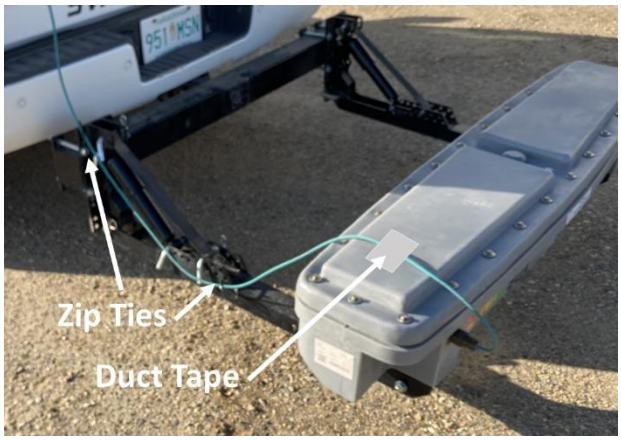


Figure 9. Data cable connected and routed

4.7 TRANSPORT POSITION

To fold into transport between fields, remove the shock absorbers by removing the shock absorber pins and compressing the shocks slightly so they can be removed. Then use the handle pocket on the rear of the sensor enclosure to lift and pivot the entire assembly upwards such that two of the shock pins can be installed on both sides to pin the enclosure into transport position as shown in *Figure 10*. Note: The Data Cable can be left connected or removed. If the Data Cable is removed, ensure the weather cap is installed at all times to prevent moisture and dirt from entering the connector. When reconnecting the Data Cable, ensure the cable and socket are clean, free of debris, and that dielectric grease is present (reapply dielectric grease as required).



Figure 10. SWAT BOX Transport Position

5 MAPPING DOCUMENTATION

Fields must be created in SWAT RECORDS before mapping! The tracking of a field as it goes through the SWAT MAPS process is done in SWAT Records desktop or mobile software.

If using the Desktop Software:
click on the appropriate farm and in the left-hand menu, go into **Mapping Logistics** then fill in the following information as shown in *Figure 11 (Note: maximize the window to view all fields if not visible)*:

Map? – Check the box to indicate the field is requiring mapping this year.
Ready to Map? – Check the box to indicate the field is ready for mapping.
Mapped By - Check the Done Mapping box to reveal the drop-down box. This step should be done by the person who mapped the field so their name can be recorded.
SWAT BOX - Select the SWAT BOX # that mapped the field.
Elevation - Select the elevation source used during mapping (RTK or LiDAR).

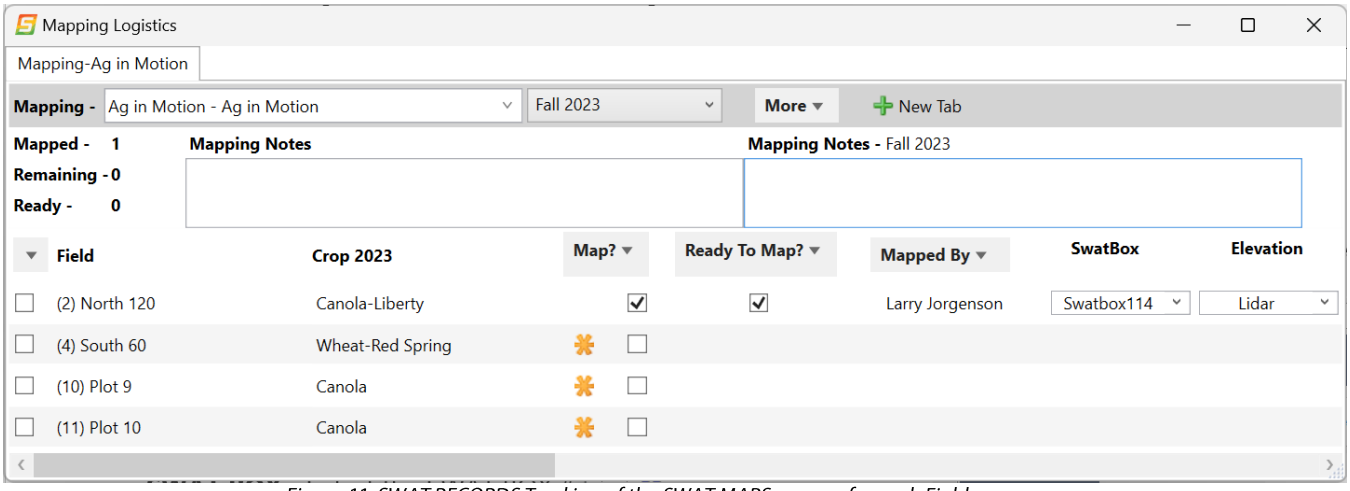


Figure 11. SWAT RECORDS Tracking of the SWAT MAPS process for each Field

If using SWAT Records mobile software:

1. Go to **SWAT RECORDS**
2. Then click on **Logistics**
3. Go into **Mapping**
4. **Select Field** and pick your field
5. Select the **season** you will be mapping in (you will have to change this if it's planned for next year)
6. Check off "Map this field?"
7. Check off "Ready to Map"
8. Once the mapping is complete, click on "Mapped"
9. Select your SWAT BOX number that you mapped with and select the elevation type (If you aren't using RTK use LiDAR. If you don't see your SWAT BOX number, please contact support@swatmaps.com
10. Check off "SWAT MAP Required?"
11. Go back to the home page and Sync Data

Visit https://support.swatmaps.com/swat-mapping-logistics for more information.

6 ERROR! REFERENCE SOURCE NOT FOUND.

The following sections describe the process for ensuring the SWAT BOX is setup properly for mapping.

6.1 POWERING UP SWAT BOX

To power up the system, plug in the cigarette lighter plug of the black power cable into an easily accessible power port that is preferably within sight of the driver seat. A red LED on the plug will illuminate when it has a good connection. Ensure this connection is not loose. Once the other end of the power cable is plugged into the black controller box, the blue power LED on the outside of the controller will flash quickly while the controller boots up then will be solid when ready.

It is recommended to remove the cigarette lighter plug from the end of the power cable and hard wire the power directly to a truck or ATV battery if the SWAT BOX will remain installed on a single mapping vehicle (White wire is negative, black wire is positive). A 3-amp inline fuse should be installed if hardwiring to the mapping vehicle battery.
Keep the black controller within sight of the driver's seat such that the LEDs on the side of the controller are visible to the operator.

Ensure the data cable is connected to the sensor enclosure bulkhead ethernet connector and the other end to the A or B port of the controller. For mapping with a single sensor, it doesn't matter which port is used; there are two ports here for cases where two sensor enclosures are being powered by one controller (e.g. when mounted to wide equipment). Ensure there is no moisture or dirt inside the ethernet connections at both ends. It is preferable to leave the data cable plugged into the sensor enclosure at all times even when folded up into transport. Do not pinch the data cable when folding into transport or closing a vehicle end gate.

Once the sensor enclosure is recognized by the controller, the orange GPS light will flash when stationary and be solid when travelling over 0.6 kph (0.4 mph). If the GPS light is not illuminated, there is a GPS communications error that needs to be addressed before continuing mapping. See the troubleshooting section of this manual for addressing issues.

6.2 DATA SYNC

SWAT BOX is equipped with a cellular data modem and SIM card. If a cellular data connection is available, the data that is logged by the controller will be automatically uploaded to the SWAT Records server where it can be accessed by the map developers.

The green Sync'd light on the side of the controller indicates when all the data that is saved to the SD card in the controller has been sync'd to the SWAT Records server. If a cellular data connection is not available, then the data will not sync to the server until a cellular data connection is acquired. Mapping can continue without the green sync'd light illuminated. Data will still be recorded to the controller even without a cellular data connection.

If a cellular data connection has not been established for a long time, cycling the controller power (in an area with a good cellular data connection) should restart the cellular modem's network search process and establish a data connection. If no cellular data connection can be established (e.g. in an area with no cell service) and if the data needs to be transferred immediately, the CSV swatlog file for the current day can be downloaded by clicking on the latest swatlog file on the main tab of the webpage interface, then emailing it to support@swatmaps.com.

Another method of transferring the data is to connect the black controller box to a home internet connection. To do this, plug an ethernet cable into the home modem and the other end into the ethernet connection at the bottom of the stack of computer boards inside the black controller box as shown in *Figure 12*. Power up the controller box by holding in the small black push button near the handle for six seconds (no external power needed). Once the data is sync'd press the black button for six seconds again to power down.



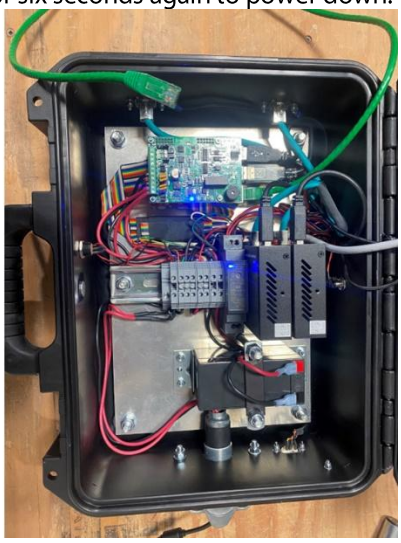


Figure 12. Ethernet port inside SWAT BOX controller (use when cellular modem can't establish connection)

6.3 LOGGING INTO THE SWAT BOX WEBPAGE INTERFACE

Once the controller is powered up, the SWAT BOX Wi-Fi network will be available for any electronics device to log in to. SWAT BOX will log data even if the operator is not logged into the Wi-Fi network and viewing the webpage interface.

6.3.1 SWAT BOX Wi-Fi login:

- Network name: **SwatboxX-AP** (X is number on top of controller – e.g. Swatbox100-AP)
- Wi-fi password: **cr0p_pr0** (0 are zeros, letters must be lower case, note the underscore)
- Note that your device will not have cellular data connection while it is logged into the SWAT BOX Wi-Fi network. When connected your device will indicate connected to the SwatboxX-AP Wi-Fi without internet.
- It is recommended to set your electronic device such that it connects to the SWAT BOX Wi-Fi network automatically when it is available.
- Occasionally your device may ask that you re-enter the Wi-Fi password after a certain time frame.
- If having issues logging into the Wi-Fi network, forget the network from your electronic device, disable and re-enable the Wi-Fi for your device, then try logging into the SWAT BOX network again ensuring the password is entered correctly (case is important).

6.3.2 SWAT BOX Webpage Login

- The following web browsers are recommended for best performance: Google Chrome, Microsoft Edge, Safari
- SWAT BOX webpage address: http://10.0.0.1
    - Software version v2.14.8/v3.5.8 and older – Username: **croppro**, Password: **swatbox**
    - Software version v2.14.9/v3.5.9 and newer – Username: **swatbox**, Password: **mappro**

6.3.3 Remote Webpage Login

- SWAT BOX service personnel can login remotely to each system to update software or for troubleshooting as long as a cellular data connection is available. If SWAT MAPS service providers want remote access to their SWAT BOX fleet, they can contact support@swatmaps.com for login information.

6.4 WEBPAGE MAIN TAB

Once logged into the webpage interface, the main tab as shown in *Figure 13* will show all sensor data, files to sync, date/time, controller voltage, GPS coordinates, all EC sensor data for A and B ports (For EM38 or TSM EC sensors), and RTK elevation data if connected to a third party RTK system. If communication is lost with any connected sensors the values will turn red and a brief alarm will sound to alert the operator. If upon powering up there is no sensor data displayed there is either no sensor connected or there is a communication problem that needs diagnosing.

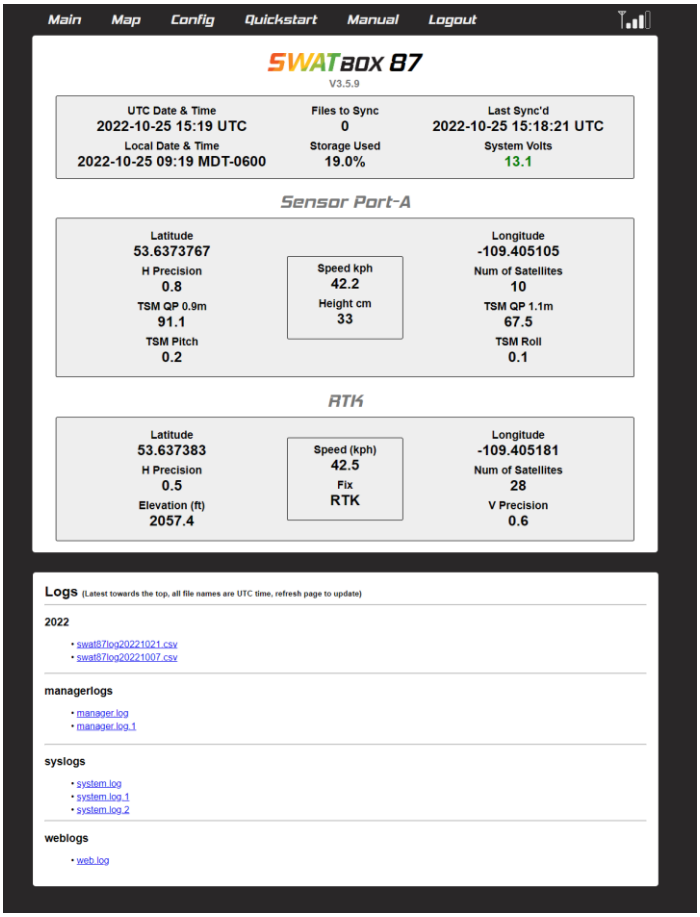


Figure 13. Webpage Interface Main Tab

The overall status at the top of the page shows the controller battery voltage. Ideally this voltage should be 12.0 to 13.9 Volts. If the power socket is not providing sufficient voltage, it may be necessary to hard wire the power

cable to the 12 Volt battery of the vehicle (White wire = negative, black wire = positive). At less than 9 Volts the system will automatically shut down.

The number above the Files to Sync area at the top-center of the screen, shows the number of files left to sync. Once all files are fully sync'd to the SWAT Records server, this value will show 0. During syncing this number will count down. When mapping with no cellular signal, this number will count up. This means that the data is being recorded locally on the controller storage but has yet to sync. Storage used will start around 19% which is the space used by the operating software. There will be enough storage to map for many hundreds of fields before the SD card may need to be cleared of data.

The cellular signal strength indicator is located in the upper right corner of the webpage (see *Figure 14)*. An "X" indicates no cellular connection. When a cellular connection is established, there will be signal strength bars shown.

The 2022 Log files at the bottom of the page are csv files of the data recorded for each mapping day. If cellular data is unavailable, these files can be clicked on and saved to the device being used for emailing. This is a backup in case of inability to transfer data through the traditional method (cellular or LAN). The manager logs, sys logs, and web logs are diagnostic files that SWAT BOX technicians may ask for during troubleshooting.

6.5 WEBPAGE MAP TAB

The map tab shows the live coverage map as shown in *Figure 14*. Mappers will want to keep this page displayed during mapping. The upper section is general system status information that is also displayed on the main tab. The middle section is the coverage map and live data display. The lower section is for adjusting the map display settings.

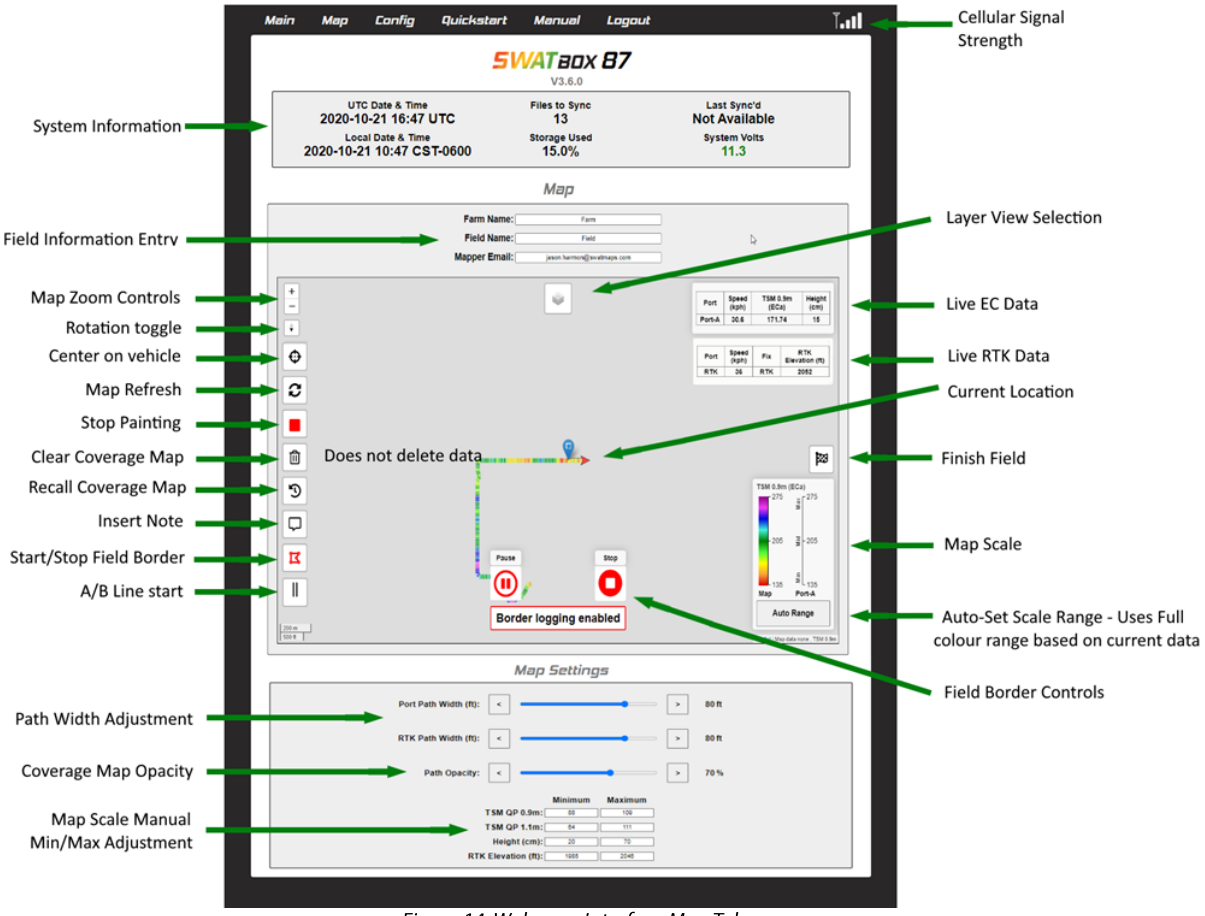


Figure 14. Webpage Interface Map Tab

The field name, farm name, and mapper email info MUST be entered in the cells just above the map for every field so the map developers know what field the data is assigned to. Ensure the spelling is correct. The map screen will be greyed out until this information is entered.

The red arrowhead at the center of the map shows the location of the SWAT BOX once it has recorded its first data point since start-up. Map coverage update rate will be approximately once per second.

The map background can be set to street view, satellite, view, or none with the layer selection button in the top center of the map. Satellite and Street view will only display if a cellular data connection is available. Do not leave the satellite background on when travelling down the road since this will result in excessive cell data usage. This same layers button will allow selection of viewing the EC and RTK elevation layers that are available. The live data cells in the top right of the map display will display the data for whatever data layer is selected for viewing.

The auto range button at the bottom right of the map automatically adjusts the color range based on the data collected since the system was last powered up. If the values on the screen are all the same color or there are some black data points hit the auto range button to reset the EC data within the legend colors. Occasionally an

erroneous data point will be logged which throws off the Min and Max values for the scale. In this case the Min and Max values can be manually adjusted at the bottom of the map tab until there is sufficient differentiation of colors on the map.

The plus and minus buttons on the left side of the map will zoom in and out of the map view.

The compass arrow button will turn the map rotation on and off. Map rotation set on will keep the vehicle marker near the center of the map and rotate and move the map as the vehicle drives and turns. Map rotation set off will keep the map stationary and move and rotate the vehicle marker. While map rotation is enabled: dragging the map to view is disabled.

The target button on the top left side of the map will auto-center the map such that the arrow (mapping vehicle location) is at the center of the screen. If the arrow is not present on the screen or the speed value at the top of the screen is red, then there are communication issues with the GPS sensor.

The refresh button on the left side of the map will update the map to show all data collected since the last power up.

The Notes button on the left side of the map as shown in *Figure 15* will allow entry of a note. The note can be typed in or a standard note can be selected from the pull-down list. The notes can be toggled on or off by selecting the Show note markers check box as shown in *Figure 16* in the layers pull down on the map screen.

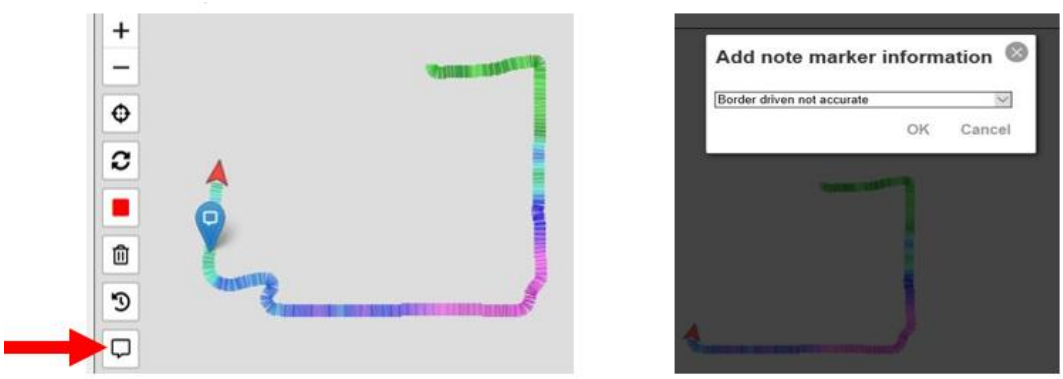


Figure 15. Add mapping notes button

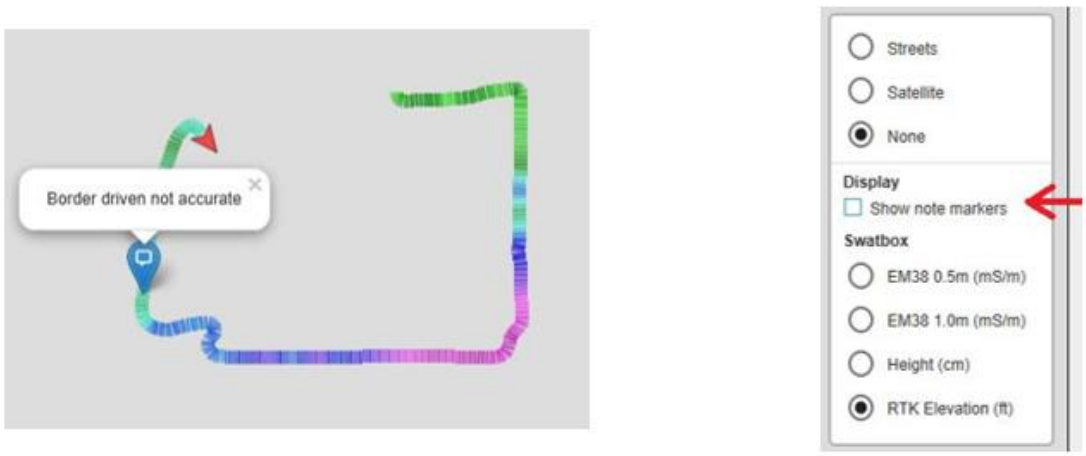


Figure 16. Toggle mapping notes on or off

Previously recorded data can be recalled to the map screen by first driving forward approximately 50 ft (15 m) such that there are a few data points on screen then selecting the recall map data button as shown in *Figure 17*.

Previous data files can be selected by date with the most recent at the top of the list. Multiple data files may be recalled until all desired mapping coverage is shown. It may take 10 to 20 seconds for large data files to be recalled to the map screen.

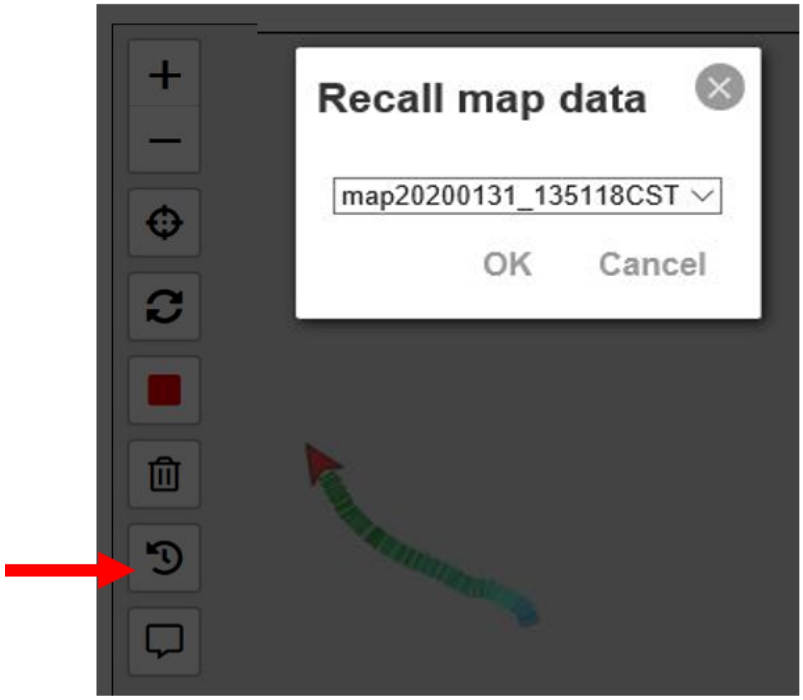


Figure 17. Recall map data button

The currently displayed map data can be cleared by selecting the trash can icon located at the top left corner of the map as show in *Figure 18*. This will not delete data. It will simply clear the screen of displayed data. It is recommended to clear the map screen with the trash can button just before mapping a field so no erroneous data is considered by the auto range button.

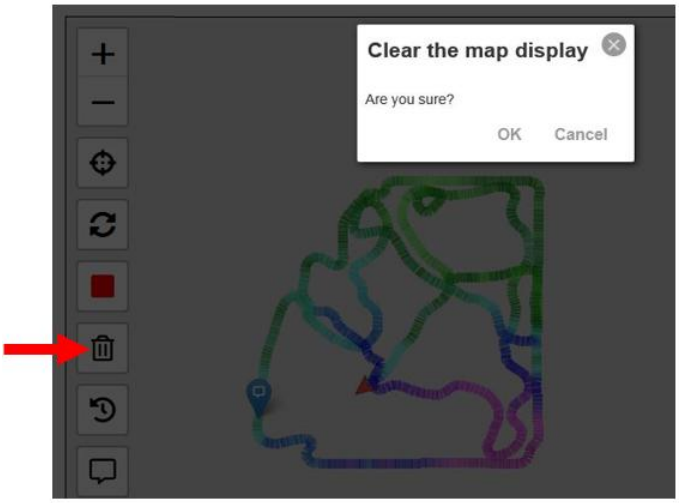


Figure 18. Clear map display button

The AB Line button, *Figure 19*, will allow a guidance line to be placed on the map while driving. Pressing the button once will drop an "A" point marker. Drive a minimum of 50m (164ft) and press the AB line button a second time, *Figure 20*, will place the "B" point. Once both points are set a guidance line will be projected along

the two points as well as to either side at a distance equal to the coverage path width setting. Pressing the button a third time, *Figure 21*, will remove the guidance lines from the screen.

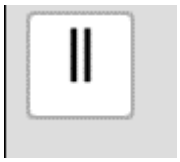


Figure 19



Figure 20



Figure 21

The coverage pass width can be adjusted below the map. This setting only adjusts the width of the rectangles being painted on the screen for the field coverage map. This setting does not change the data in any way. Generally, 80 ft (24.4 m) is a reasonable path width unless higher resolution is desired. If mapping a field less than 50 ac (20 Ha), consider a 60 ft (18.3 m) or less path width. If there are distinct areas of a field such as salinity, soil color or texture change, water runs, hills, and depressions, it is recommended to drive over those areas to achieve better definition of those distinct areas. Overlap will result in higher resolution of the map which is good. Keep in mind: data points are only recorded at the GPS location and not across the full pass width so more data is better than not enough when considering the resulting maps.

6.6 WEBPAGE CONFIG TAB

The config tab as shown in *Figure 22* is used to adjust settings for reading RTK elevation data into SWAT BOX as well as provides the option to offset the EC data of any layer.

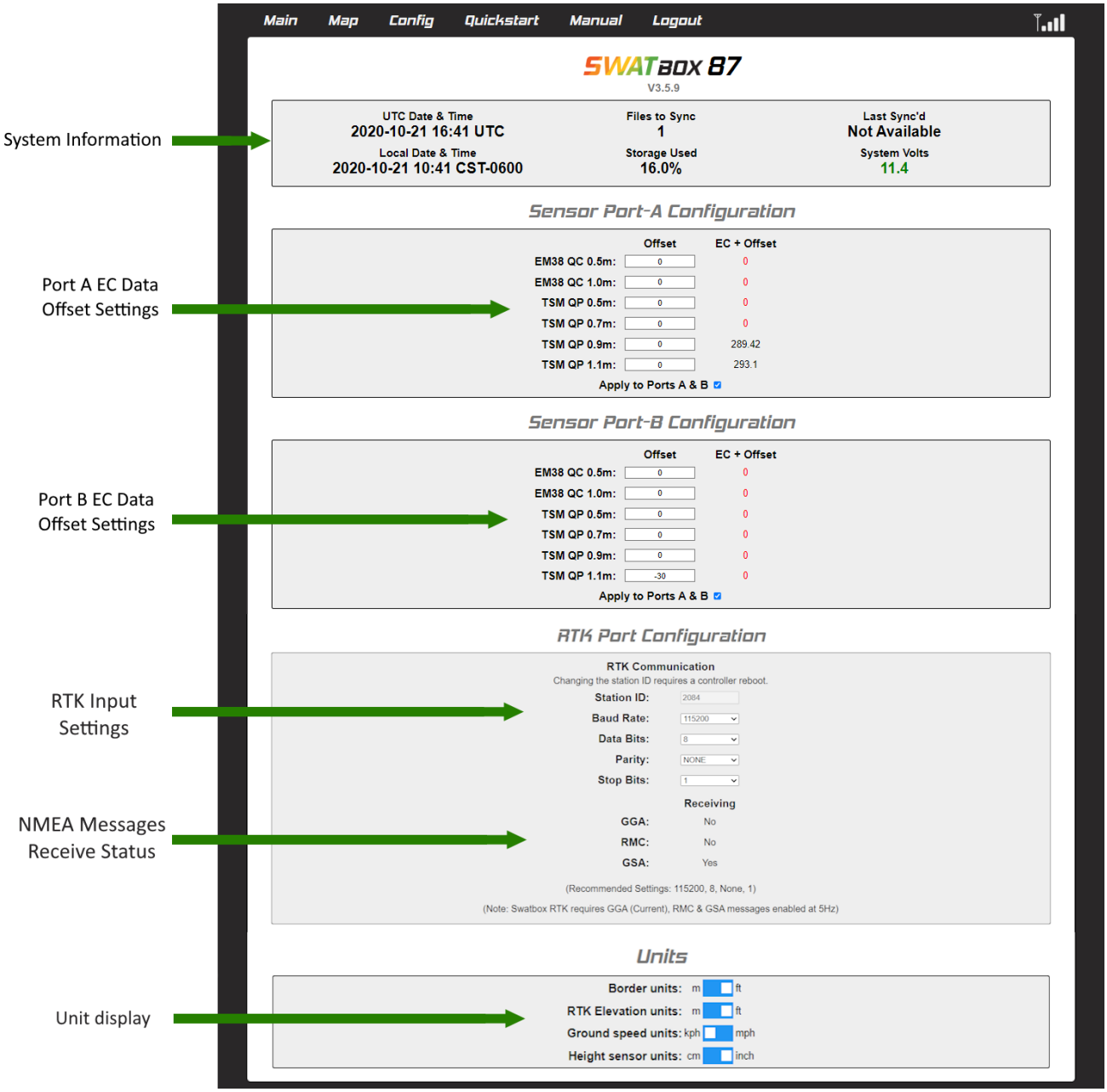


Figure 22. Webpage Interface Config Tab

For the RTK configuration, the baud rate must be set to match the baud rate of the RTK GPS system being used. These settings can be found in the monitor of the RTK GPS system. The message format must be set to 8, None, 1 unless otherwise instructed. The Station ID field only applies to the SWAT RTK Base station, and should be set to the Base station ID found on the base station display, or 0. If there is another base station within range of the mapping vehicle, it MUST be set to the base station ID.

The Port A and Port B configuration areas allow the EC data of any layer to be offset such that the EC + offset is the desired EC value. The default is to apply the same offset to the A and B ports as indicated by the checkbox.

These configuration settings are set from the factory and not required to be adjusted during mapping since EC maps created for SWAT MAPS are based on relative EC values. This setting is only used at initial system setup to adjust the EC values to within a typical range (e.g. 100-200). If the EC of a given location directly under the sensor enclosure is known, then the EC offset can be used to adjust the value of the EC + Offset to that same value. This value is what will be displayed and recorded on the map screen. This feature is similar to a calibration in that it will apply somewhat more meaning to the absolute EC values. This setting should not be adjusted while mapping of a field is in progress. It should be adjusted while stationary, within the border of a field, with the enclosure in the operating position. Do not park the vehicle near other vehicles or around any other objects that can affect the EC reading (e.g. metal objects, people wearing steel toed shoes, etc.).

The Unit Display settings allow for the customization of information being displayed in either metric or imperial units.

6.7 LOGGING RTK ELEVATION DATA INTO SWAT BOX CONTROLLER

SWAT BOX has the capability to log RTK elevation data from the optional SWAT RTK system or most commercially available GPS systems provided they output the NMEA message standard.

6.7.1 SWAT RTK System

If your controller is equipped with the optional SWAT RTK system, the following steps will get your SWAT RTK BASE Station ready to map elevation data with your SWAT BOX Controller.

1. Mount the GPS rover puck and short antennae onto the roof of the mapping vehicle using their magnetic bases. Connect the GPS Rover to connector "R" and the Antenna to connector "A" on the side of the SWAT BOX controller.

2. Setup a tripod in an area with an open view of the sky and at the highest elevation in the field that provides the best line of site throughout the whole field. Make sure the top of the tripod is level, and the legs are spread wide enough to provide a stable platform, and the head of the tripod is level.

3. Mount the Base Station to the tripod and attach the radio antenna so that it is pointing up as shown in *Figure 23.*



Figure 23. Base Station installed onto Tripod

4. Press and hold the Power Button on the Base Station until the SWATMAPS logo is replaced by the screen showing the firmware version as show in *Figure 24*. The Base Station will then automatically progress through its sequence to located itself and start broadcasting correction data to the GPS receiver in the SWAT BOX Controller.



Figure 24. Base Station Screen When Powering Up

5. The process for the base station to locate itself with sufficient accuracy will take between 3-6 minutes. The base station will begin to locate itself and calculate the error in its position. When the location is calculated to be less than 1m, it will provide sufficient RTK correction as shown in *Figure 25*.



Figure 25. Base Station Screen Showing RTK Correction Provided

6. Once 60 seconds has elapsed and the Mean is less than 1m, the base station will start broadcasting RTK correction data as shown in *Figure 26*.



Figure 26. Base Station broadcasting RTK correction signal

7. Validate that the Base Station starts transmitting ("Xmitting") correctional data as shown in *Figure 27*. If the Mean is not below 1 within 15 minutes (900 seconds) the Base Station will restart the process.



Figure 27.

Validate that the SWAT BOX is receiving the RTK correctional data, and the SWAT BOX interface is showing an RTK fix either in the top right of the mapping window as shown in *Figure 28*, or on the "Config" tab as shown in *Figure 29*.



Figure 28. RTK Fix confirmed on Map Tab

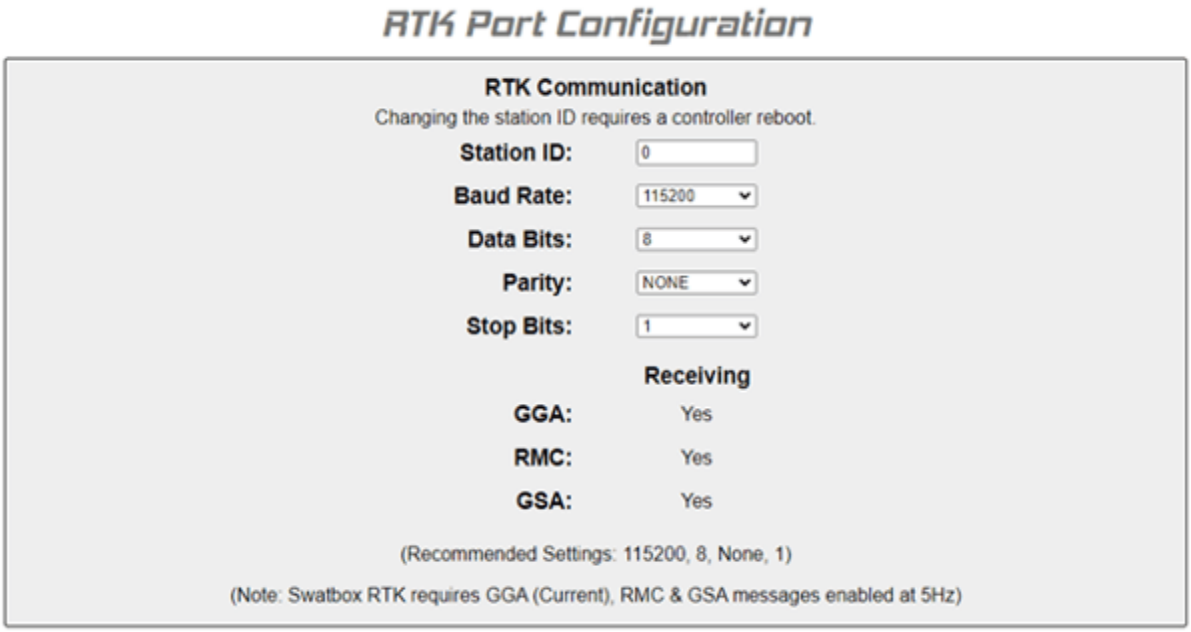


Figure 29. NMEA Messages from RTK system Confirmed as being Received in Config Tab

8. Battery charge indicator is in the top right corner of the display on the Base Station, and is displayed as a percentage. Use an external Power Bank to extend the runtime of the base station if required. Connect the power bank to the USB-C connector. The provided cable with a right-angle USB-C connector may be required if the head of the tripod obstructs a straight USB-C connector.
9. Turn the Base Station off by pressing and holding the power button until the shutdown message is displayed on the screen.
10. If any problems are encountered, refer to the SWAT RTK Troubleshooting section in the online SWAT Support Portal

6.7.2 Third Party RTK Systems

SWAT BOX controllers can also log data outputted by third party RTK GPS systems. It is highly recommended to use a portable base station style RTK correction system from companies such as Trimble, Raven, John Deere, Topcon, Outback, and Ag Leader. The following RTK systems may not provide accurate enough elevation data and are not recommended:

- Emlid Reach RS2 and RS2+
- Any cellular RTK correction service
- Any fixed base station correction service

A GPS-out cable with a female RS-232 serial connector (9-way D-sub connector) will be required to feed the RTK elevation data from whatever brand of GPS RTK system is being connected to SWAT BOX. Plug this cable into the serial port labelled RTK on the side of the SWAT BOX controller. Some RTK systems may require a "null modem cable" or adapter to output NMEA messages through the GPS-out cable. Consult your RTK supplier to find out. The pins being used at the SWAT BOX controller connection are Pin 2 for data transmission and Pin 5 for ground.

The GGA (Current, not Legacy message), GSA, and RMC messages must be turned ON in the monitor settings of the RTK system. If these messages are being received it will say yes beside each message listed at the bottom of the config page.

The logging frequency from the RTK GPS system should be set to 5Hz so the data points are close together. Do not enter any receiver offsets. The baud rate of the RTK system must be known so the baud rate can be adjusted to match in the config tab on the SWAT BOX webpage. A baud rate of 115,200 is recommended. Most message types will be:

Data bits - 8,
Parity - None,
Stop Bits - 1.

Elevation data that is not RTK quality is not suitable for surveying fields. If the elevation data is not RTK (RTK is a fix quality of 4), the elevation data will show as red or orange and will not be logged. Once the controller is properly receiving the RTK elevation data the GPS speed and coordinate values will turn black and will change when the vehicle is moving. If these values are red or orange, the controller is not reading RTK GPS values and will not record RTK elevation data. Recheck that the settings are correct on the webpage config tab and check that the RTK GPS system is set up properly to receive RTK correction from the base station as well as output the NMEA messages through the GPS-out cable connected to the SWAT BOX controller.

7 ERROR! REFERENCE SOURCE NOT FOUND.

The following sections cover proper mapping procedure with SWAT BOX. Make sure there is nothing conductive that can slide around in the mapping vehicle storage boxes since this could affect the EC readings.

7.1 PRIOR TO MAPPING – VERY IMPORTANT!

The EC readings can be affected by temperature variation from the beginning of mapping a field to the end, especially near freezing temperatures. To mitigate this issue, power-up the controller with the sensor enclosure plugged in at least 10 minutes before you reach the first field of the day. This will allow the coils in the EC sensor to reach operating temperature before mapping the field. After arrival at the field to be mapped, fold down the sensor enclosure into operating position, unplug the Data Cable from the controller and, plug the Data Cable back in to reset the internal temperature compensation of the EC sensor. The trash can button on the map screen can be pressed to clear any data that was recorded on the road. The map developers can delete any data that was recorded on the road with the sensor in transport position.

If logging third-party RTK elevation data, set the RTK base station up on a hill that is visible to all areas of the field and away from obstructions such as bins or trees; by the time you are ready to map it should have acquired a GPS Fix. The RTK GPS system and SWAT BOX are separate systems. The EC data uses the SWAT BOX GPS puck data. RTK is the only acceptable source of elevation data so make sure your RTK GPS signal Fix shows "RTK" in black before starting to map. Make sure the elevation data recording is activated on whatever RTK GPS system is being used otherwise no data will be recorded onto the RTK GPS system. SWAT BOX reads the RTK GPS output data directly into the SWAT BOX controller. Therefore, the RTK GPS system needs to be setup properly ahead of time. To ensure RTK data is being logged, view the RTK elevation layer from the data layer pull down in the top center of the map and make sure the RTK data is being painted on-screen once the mapping vehicle moves. If the elevation data is not RTK quality, the map will not be painted. The elevation value will be highlighted red if there is no GPS signal available or orange if there is a GPS signal, but it is not "RTK quality".

Entry of the Farm, Field names, and Mapper email are required prior to mapping a field as shown in *Figure 30.* Set the pass width to 80 ft (24.4 m) at the bottom of the Map tab unless a higher resolution is desired.

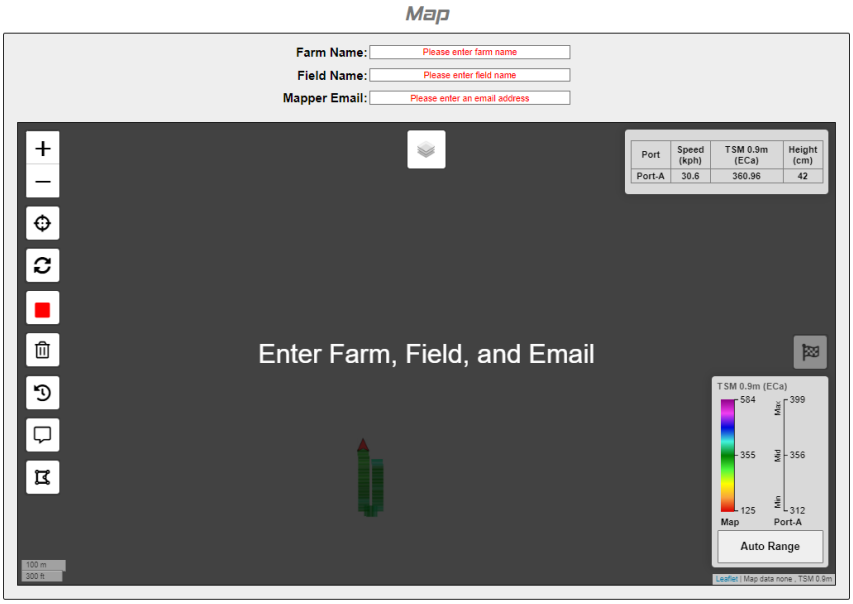


Figure 30. Farm, Field Name, and Mapper Email Entry

7.2 How to Properly Map the Field

If you are logging elevation data at the same time as EC, drive over all water runs, depressions, and knolls in addition to the 80 ft (24.4 m) passes. Knolls and depressions should be crossed in an "X" pattern to best define the shape of the topography. Go no wider than 80 ft (24.4 m) passes. If higher resolution is desired, make the passes narrower. Use narrower passes for fields smaller than 50 ac (20 Ha) or where narrow application equipment will be used.

If a water run is too deep, drive along the edge of the water run on both sides. Do not veer around objects such as rock piles or small bluffs. Drive a complete (counterclockwise) circle around them and record an internal border (instructions on border recording below).

Often salinity can occur parallel to a road ditch or in rings around sloughs. In this case narrower passes may be necessary in these areas, and the visible edge of the salinity should be mapped in greater detail than the standard grid pattern. Often areas of salinity will have sparse, grey stubble as compared to the rest of the field.

A speed limit warning will appear at the maximum recommended mapping speed of 50 kph (31 mph). This maximum speed should only be attained in fields that are very smooth with minimal topography variation. Mapping personnel are to use their best judgement and map at a reasonable safe speed considering field conditions and potential field hazards. For reference, 32 kph (20 mph) is a typical average mapping speed which will achieve a good balance of productivity, mapping vehicle reliability, and safety in most field conditions. In fields that are very rough an average speed lower than 20 kph (12 mph) may be necessary. If possible, drive parallel to seeding or tillage ridges. Slow down to approximately 10 kph (6 mph) on tight turns of 90 degrees or more. Seat belts must be worn at all times.

Avoid contacting rocks or tree roots with the sensor enclosure. If travelling through an abrupt water run slow down to avoid contacting the ground with the sensor enclosure at high speed. Straight North and South or East and West direction travel are fine unless there are old discer ridges or old fence line ridges in the field, then a 45-degree angle is preferred so that these features are properly captured.

The EC map should show natural variations with smooth transitions from color to color as shown in *Figure 31*. It may take 10 to 20 minutes of mapping before these smooth transitions are apparent. If there are streaks of the same color apparent there may be an issue with communications with the EC sensor or the installation of the sensor enclosure.

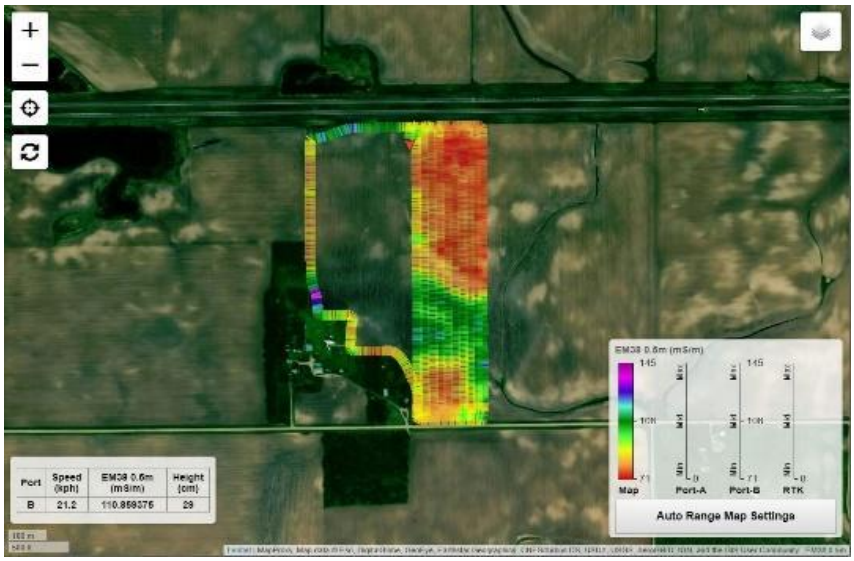


Figure 31. Smooth natural transitions between colors for the EC map

If EC data is logged that is outside of the typical range in a field (e.g. on a road), the auto range button will not set the color scale for the field properly. To set the scale manually enter the expected minimum and maximum EC range that your sensor typically sees in the manual minimum and maximum scale entries below the map to utilize the full color range. The system will retain your previously entered scale values even after a power cycle. EC data being recorded is not affected by the scale range so good data will be recorded regardless of the scale settings. If data is outside of the scale range for any of the sensors, the coverage map will paint black, which just means the scale range should be adjusted. The data is still fine in this case.

7.3 MERGING FIELDS

Two fields can be merged as one to create a single SWAT MAP. If mapping a new field that is adjacent to a field that has already been mapped simply drive into the previously mapped field for approximately 200 ft (61 m) at some point while mapping the new field. The EC and elevation data can then be matched up by the map developers.

7.4 EXTERNAL INFLUENCE ON EC DATA QUALITY

Overhead and underground power and pipelines can sometimes show up as straight distinct lines on the EC map. The operator should notify the map developers of any suspected man-made artifacts so the map developers can delete the erroneous data.

TV or other communications towers within an approximate 5 km (3 mile) radius of the field being mapped can sometimes affect the EC readings. The only way to tell if there will be interference is to start mapping the field and pay attention if there are abnormal streaks in the EC map. There is no easy solution to this issue. The best solution is to map in the direction headed directly for the tower or source of EM interference. The mapping vehicle will shield the EC sensor when travelling towards the source of interference. The map developers can then delete every other pass to make an acceptable EC map. Narrow the passes to 40 ft (12.2 m) in this case since every other pass will be deleted.

7.5 FIELD BORDER CREATION

Field borders must be recorded during mapping of all fields to ensure accuracy of the field area to create maps for. Start recording the external border on a straight side of the field (not on a curved portion). The field border start button on the left side of the map (icon looks like a red square) is used to start recording of a border. The border button will turn red and a message saying "Border Logging Enabled" will appear. Press the pause button at the bottom center of the map while recording a border if the actual border cannot be driven exactly as desired (could be too wet) then press record again to resume border recording when the mapping vehicle returns to the actual field border. Press the border button again to stop recording approximately 50 ft (15 m) ft from your start point which will complete the border. The border will be shown in white and black when recording is on.

The border offset option will appear when border creation is started. The SWAT BOX GPS or third party RTK GPS can be used to create the field border. The border needs to be offset as shown in Figure 32 since typically the GPS will be in the center of the mapping vehicle. Negative offset is to the left of the sensor and positive to right. For most mapping trucks the offset should be set to 10 ft (3.0 m) left. If you are using a narrow mapping vehicle such as an all-terrain vehicle a 6 ft (1.8 m) left offset will be sufficient. **Drive external borders clockwise and internal borders** (around sloughs, trees, rock piles) **counterclockwise** with the left tire on the edge of the field borders. That way the border offset never needs to be adjusted. Small internal borders that are less than 40 ft (1.2 m) in diameter do not need to be bordered. Borders are not required around power poles.

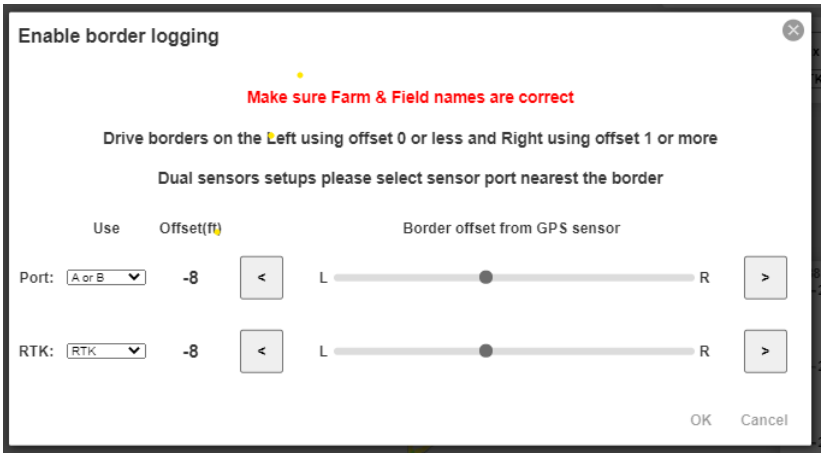


Figure 32. Field Border Offset Options

The blue balloons on the map screen indicate the beginning and end of borders as shown in *Figure 33*. These balloons can be toggled off in the layers pull down button using the Show border markers check box. When nearing the border start an alert will appear reminding the operator to end the border recording. Stop recording the border 50 to 100 ft (15 to 30 m) from the start point (Do not record a border past the start point).

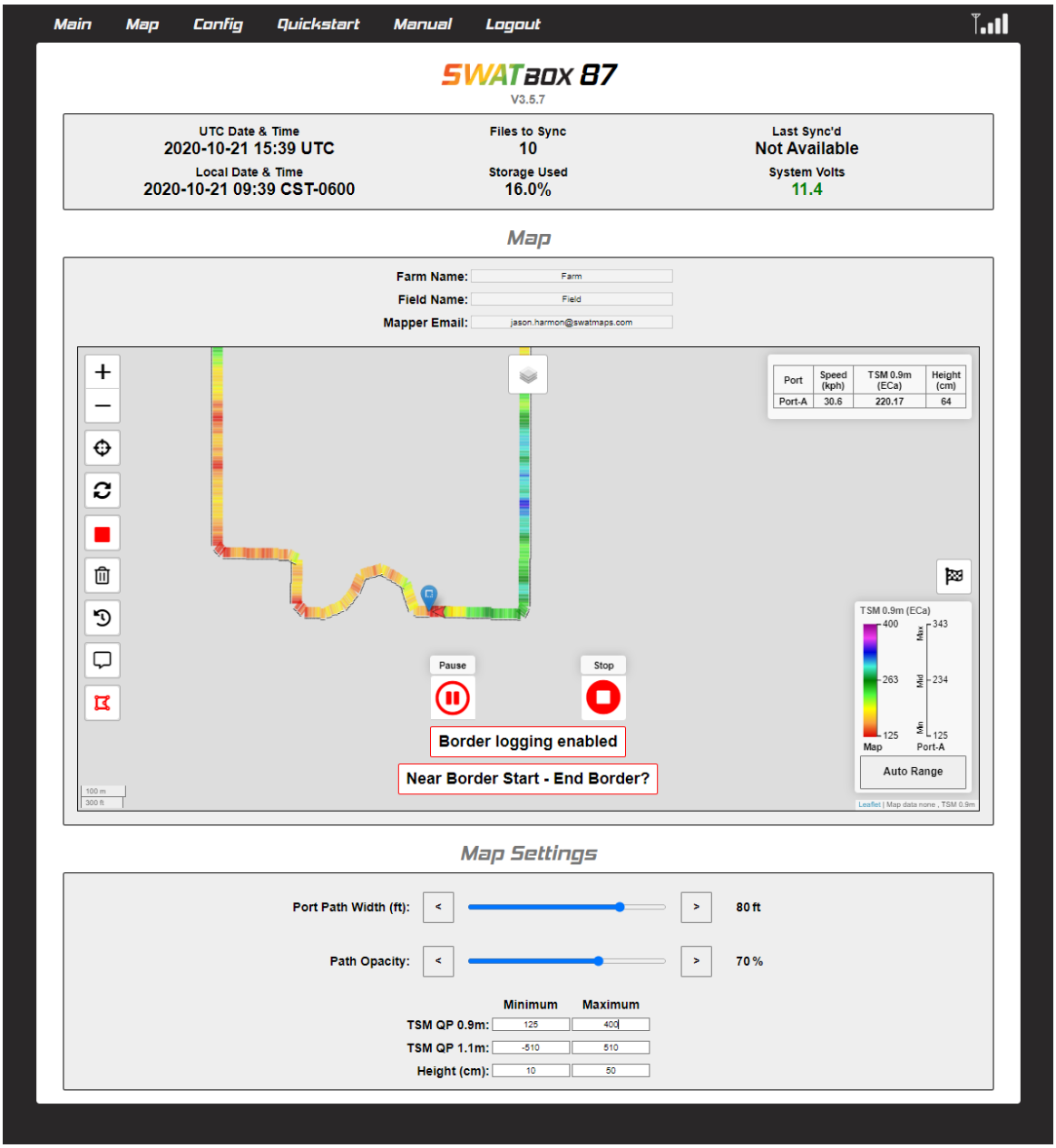


Figure 33. Field border creation with blue balloons indicating border start and end point.

7.6 AFTER FIELD IS MAPPED

Ensure, before leaving the field, that no portion of the field was missed by looking at the EC and RTK map layers. It is better to map too much area than not enough; if in doubt, map an area in question then determine later if should be part of the field being mapped. The map developers can always delete unnecessary data later.

If done mapping for the day, the Data Cable can be unplugged at the black control box which will stop data recording but will still maintain data syncing if there is Files to Sync noted at the top of the SWAT BOX web page. After a field is mapped press the checkered flag on the right side of the map as shown in *Figure 34*.

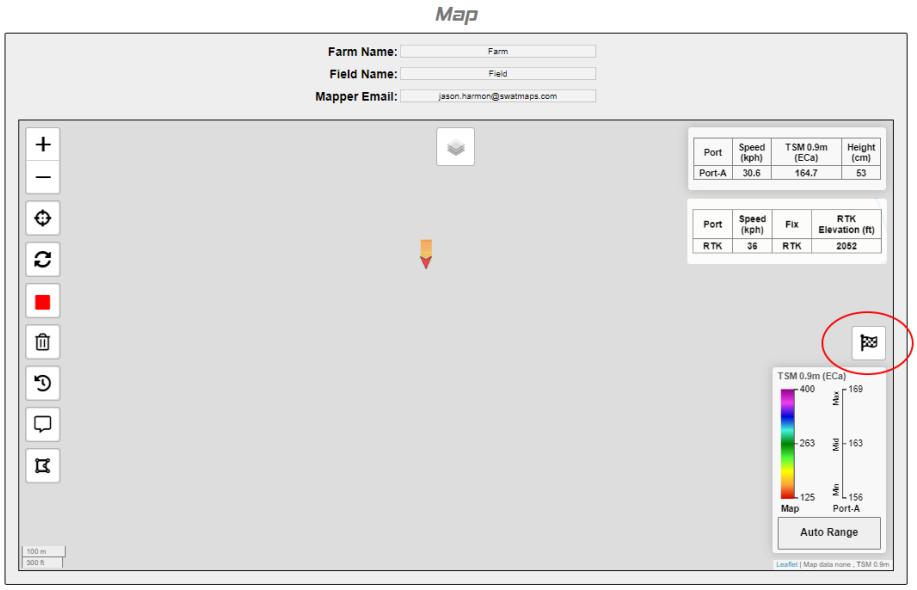


Figure 34. Checkered Flag Button for Finishing the Field

After pressing the checkered flag, prompts will ask if you want to clear or keep the field name, farm name, or Email for the next field as shown in *Figure 35*.



Figure 36. Prompts for clearing Farm, Field Names, and Mapper Email

Leave the controller powered up if the there are still files to sync (indicated at top of map page). If the controller has a cellular data connection, the data logged to the controller will be syncing constantly the green sync light on the side of the controller will be illuminated if all files are sync'd... If the green sync light is not illuminated, leave the controller powered up until all files are sync'd. The files to sync at the top of the webpage will read 0 once all files have been uploaded to the SWAT Records server. This number will count up if logging data without a cellular data signal and will count down once a cellular data signal is acquired. Data will always be recorded to the controller as long as there is data being painted on the map. Once all data is sync'd the controller can be powered down.

Once the controller is powered down, the previous coverage map will be cleared but can be reloaded with the map recall button. To clear the coverage map from the previous field, the trash can button on the left side of the map screen can be pressed or power to the controller can be cycled. If mapping all day, the map update rate may slow down if there is a lot of data to display on the map screen.

8 SWAT BOX MOUNTED TO EQUIPMENT

Because SWAT BOX is autonomous it can be mounted to equipment as shown in *Figure 37* and it will collect EC data automatically once powered with 12 Volts. For an equipment mount, the sensor enclosure must not be located near large volumes of conductive materials and the orientation of the sensor enclosure must not change in relation to conductive materials near to it. Dependent on the amount of soil variability expected equipment over 80 ft (24 m) in width may need two sensor enclosures installed to achieve the desired map resolution. An alternative source of elevation data such as LiDAR or existing RTK data is required to make SWAT MAPS. The operator of the equipment can log into the webpage and monitor the EC data as it is recorded if desired; however, this is not necessary. Seek advice from support@swatmaps.com when considering an equipment mount installation.



Figure 37. SWAT BOX Mounted to Equipment

9 MAINTENANCE AND STORAGE

If a message stating "New Software Update Available on Reboot" appears at the top of the webpage interface, that means there is a new software update available. It is not necessary to complete the update immediately. The update will occur automatically upon the next power up as long as the internal battery of the black controller has sufficient charge. If the software update does not complete, leave the controller plugged into a power source supplying at least 12 volts for 8 hours in order to charge the internal battery. To have the webpage interface appear properly with the new software it may be necessary to clear the cache of the web browser being used, then refresh the webpage. Instructions are readily available on the internet on how to clear cache for most browsers.

It is advisable to wash dirt and mud off the mapping vehicle, sensor enclosure, and mount components between farms to reduce the likelihood of soil and weed contamination between farms. Avoid direct pressure washer blast at the ethernet bulkhead connector or under the lid edge of the sensor enclosure. Keep the white sensor enclosure breather valve as shown in *Figure 38* free of snow and mud to ensure proper enclosure ventilation.



Figure 38. Sensor Enclosure Breather Valve near the grey GPS puck.

The sensing surface of the height sensor as shown in *Figure 39* may need periodic cleaning since dust, mud, or snow can build up on the sensing surface. If the height reading is constantly reading 20 cm or less and does not change then the sensor surface likely needs cleaning. A cloth towel can be used to wipe the surface of the sensor inside of the sensor cone. Any mud or snow build up around the sensor pocket should also be cleared.



Figure 39. The grey height sensor cone may need occasional cleaning

In the offseason,

- The system should be stored out of direct sunlight.
- Ensure the enclosure bulkhead connector cover is installed if the data cable has been disconnected. Keep ends of data cables clean and free of moisture.
- The controller should be stored in a dry, temperature-controlled area.
- When in storage, it is recommended to disconnect the internal battery in the controller (remember to reconnect it before powering up the next time). Check the battery voltage – if less than 12.0 V, connect external power to the controller and leave it for several hours/days to charge the battery. Alternatively, a 12 Volt battery charger can be used to charge the battery with a maximum 2-amp trickle charge.
- The screw terminals inside the black controller box can be checked for tightness with a small screwdriver after the mapping season to ensure all electrical connections are secure.
- The four 1/2 in. bolts securing the sensor enclosure to the support arms can be checked for tightness after each season as well. There must be no movement of components in this area.

10 TROUBLESHOOTING

Cannot log onto the SWAT BOX Wi-Fi network?

- Ensure the Wi-fi password is correct. Case is important. 0 are zeros. _ is an underscore.
- Turn off the tablet Wi-Fi, Forget the network, turn Wi-Fi back on and reconnect to the network with proper password.
- Cycle the power of the controller and attempt to login to the Wi-Fi network again.

Cannot log on to webpage or webpage does not display properly?

- Ensure tablet is logged onto the SWAT BOX Wi-Fi network.
- Ensure case of login and passwords are correct.
- Clear cache and cookie history of your browser then log in again.
- Use browsers such as Google Chrome, Microsoft Edge, or Safari.
- Cycle power of the SWAT BOX controller.

Cannot acquire a cellular data connection?

- There is a cellular strength indicator in the top right corner of the web interface. If there is an X through this indicator, there is no cellular connectivity
- In the case of no cellular data connection and if the data needs to be transferred immediately, the CSV swatlog file for the current day can be downloaded by clicking on it on the webpage view, then emailing it to the map developer.
- Sometimes resetting power to the controller in a known strong cell signal area will result in the cellular modem reacquiring a data connection.
- For generation II systems with the white 3G USB style modems inside the black controller box, a slow flashing green light means the modem is searching for a cellular network but has not yet connected. If the light is a solid light blue there is a connection, but it may be a weak connection. If the light on the modem is solid dark blue, it has a strong data connection. It is normal for the modem status to fluctuate as the mapping vehicle travels, especially in rural areas. See *Figure 40* below for more details on the status light for the white 3G USB style modems:

LED COLOR	SERVICE	LED STATE	DESCRIPTION
Green	2G --	Blinking twice every 3s	Powered on
		Blinking once every 3s	Registering with a 2G network.
		Solid	Connected to a 2G network.
Blue	3G --	Blinking once every 3s	Registering with a 3G/3G+ network.
		Solid	Connected to a 3G network.
Cyan	3G+	Solid	Connected to a 3G+ network.
Off	--	--	Removed

Figure 40. Generation II (white) 3G Modem LED Activity

- For generation II systems with the black 4G USB style modem, the small LED will flash red if there is no

cellular connection, yellow for a weak connection and, green if it has a good connection. Cycle controller power in a known good cell area if it is struggling to connect.

- For generation III systems with the Sierra Wireless modems on the bottom side of the controller lid, the signal light will flash yellow if it has a poor connection and will be solid green if it has a good connection. See *Figure 41 and 42*, below, for further details on indicator lights for generation III systems:

LED Behavior

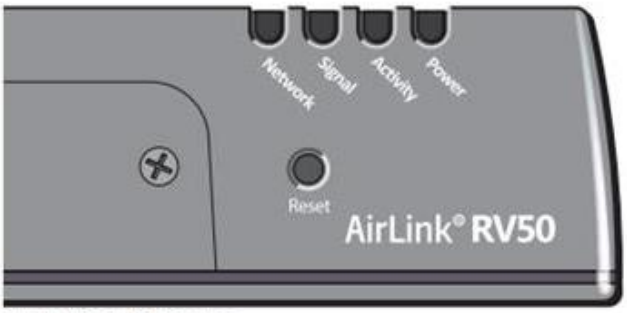


Figure 3-17: LED location

Table 3-10: LED Behavior

LED	Color/Pattern	Description	LED Power Saving Mode[a]
Power	**Off**	No power or input voltage ≥ 36 VDC or ≤ 7 VDC	
	Solid Green	Power is present.	
	Green with Amber Flash	Power is present and the gateway has a GPS fix.	
	Solid Red	Standby mode	
	Flashing Green	When you press the reset button, flashing green indicates when to release the reset button to reboot the gateway.	
	Flashing Red	When you press the reset button, flashing red indicates when to release the reset button to reset the gateway to the factory default settings.	
	Flashing Amber	When you press the reset button for more than 20 seconds, flashing amber indicates when to release the reset button to enter Recovery mode. (See Recovery Mode on page 45.)	
Signal	**Solid Green**	Good signal (equivalent to 4–5 bars)	Off
	Solid Amber	Fair signal (equivalent to 2–3 bars)	Off
	Flashing Amber	Poor signal (equivalent to 1 bar) If possible, Sierra Wireless recommends moving the gateway to a location with a better signal.	
	Flashing Red	Inadequate (equivalent to 0 bars) Sierra Wireless recommends moving the gateway to a location with a better signal.	

Note: The quality of the signal strength is measured using the appropriate parameters for the radio technology in use.

Figure 41. Sierra Wireless modem indicator lights (continued next page)

LED	Color/Pattern	Description	LED Power Saving Mode[a]
Network	Solid Green	Connected to an LTE network	Off
	Solid Amber	Connected to a 3G or 2G network	Off
	Flashing Green	Connecting to the network	
	Flashing Red	No network available	
	Flashing Red/ Amber	Network Operator Switching is enabled, but the gateway is unable to locate the required firmware. For more information, refer to the ALEOS Software Configuration User Guide (Admin chapter).	
Activity	Flashing Green	Traffic is being transmitted or received over the WAN interface.	
	Flashing Red	Traffic is being transmitted or received over the serial port. This behavior only appears if the RV50 Series gateway is configured to display it. For more information, refer to the ALEOS Software Configuration Guide (Serial chapter).	
	Flashing Amber	Traffic is being transmitted or received over both the WAN interface and the serial port. This behavior only appears if the RV50 Series gateway is configured to display it. Refer to the ALEOS Software Configuration Guide (Serial chapter).	
ALL	Green LED chase	Radio module reconfiguration/firmware update or Network Operator Switching is in progress.	
	Amber LED chase	ALEOS software update is in progress.	

Figure 42. Sierra Wireless modem indicator lights continued.

No sensor values being displayed or intermittent display of values (Sensor connection alarm will sound like a "whoop whoop" and sensor values will highlight red).

- For generation II controllers, check voltage input into the controller at the voltage booster (red LCD display). The small black push button beside the display toggles between input and output voltage. The input voltage should be greater than 11.0 Volts and the output voltage should be 13.7 to 14.3 Volts. If the input voltage is below 11.0 Volts, check the connection at the vehicle power supply socket. Try a different power socket or consider hard wiring the SWAT BOX power cable to the vehicle battery (white wire = negative, black wire = positive).
- For generation III controllers with Sierra Wireless modems, the system voltage displayed on the webpage is the supply voltage. This voltage should be at least 12.0 Volts.
- Check power cable connections and data cable connections to ensure they are clean and free of moisture.
- Check for damage or pinching of the ethernet data cable from the controller to the sensor enclosure. If damage is found or suspected, swap out the cable with a spare if available.
- If the voltage regulator light (grey rectangular hardware below the black USB extenders in the controller box – see *Figure 12*) is illuminated blue, that means there is a good power supply to the sensor enclosure and the problem is likely within the sensor enclosure. The small grey screw on top of the voltage regulator should be turned all the way clockwise for maximum voltage output to the sensor enclosure.
- If the USB extender in the black controller box for the port being used (A or B) has a red light indicating it is getting power and the blue signal light is blinking quickly, then the controller is communicating with the sensor enclosure as expected.
- If the status light on the USB extender sender unit in the controller box for the port being used (A or B) is slowly pulsing blue, there is a sensor communication problem between the controller and the USB extender receiver inside the sensor enclosure. Likely problem areas would be damaged ethernet data

cable, poor ethernet connection at the sensor enclosure or black controller box due to moisture or dirt, or failed USB extender inside the sensor enclosure.

- If the connection between the controller and the sensor enclosure is good and the voltage regulator and USB extenders are operating normally, then there may be a connection problem or sensor failure inside the sensor enclosure. Contact SWAT MAPS support if this is the case.

Loss of GPS alarm activated (short chime and GPS and speed values highlighted orange on display)

- Brief loss of GPS signal may occur at start up of the system
- Brief loss of GPS signal may occur near trees or buildings, but should recover within a few seconds
- Move to a high area of the field and change orientation of the mapping vehicle to reacquire GPS lock
- If loss of GPS lock occurs often in a field, check cleanliness of the ethernet data cable connections and cycle power to the controller

Map color resolution is poor even after pressing the map auto range button

- There may be a few erroneous data points that were recorded since the last power up such as data recorded on the road, or when moving the sensor enclosure from transport to operating position. These erroneous data points are outliers that will affect the color range scale for each sensor. The minimum and maximum values to be included in the map color range can be adjusted manually below the map page in order to leave out the erroneous values. If a data point falls outside of the set data range the data points will appear as black rectangles. These erroneous values will be removed later during the map development process.

One of the connected sensor values is red and not changing

- This indicates a connection problem at the USB connection at the USB Extender inside the sensor enclosure or a sensor failure. Service is required.

SWAT RTK Range issues

- Look for loose connections or damaged cables.
- Ensure antennae on top of the mapping vehicle is installed and its connector fully hand tightened to the base station socket labelled “A”
- Ensure the short antenna on top of the mapping vehicle is fully threaded onto its magnetic base.
- Ensure the GPS rover on top of the mapping vehicle is connected to the socket labelled “R” on the side of the SWAT BOX controller.

11 TECHNICAL SPECIFICATIONS

Technical specifications are as follows:

- Power Requirements: 12 VDC, 1 Amp
- Cellular data connection: 4G LTE or 3G HSPA/HSPA+
- Local Wi-Fi connection: 2.4GHz, 802.11n wireless
- Bluetooth connection: Bluetooth 4.1+
- Hitch receiver rating required: 2 in. X 2 in. square receiver tube, Class III or higher (1,000 lb rated tongue weight)
- Overall weight: 223 lb (101 kg)
- Weight of sensor enclosure: 70 lb (32 kg)
- Overall width of sensor enclosure: 61 in. (1.55 m)
- Overall length behind hitch in operating position: 50 in. (1.27 m)
- Overall length behind hitch in transport position: 16 in. (0.41 m)
- Overall height in operating position: 14 in. (0.36 m)
- Overall height in transport position: 41-46 in. (1.04 to 1.17 m)
- SWAT BOX EM sensor specifications:
    a) **Geonics EM38**
    Operating frequency: 14.5KHz
    Sampling Rate: 10 Hz
    See here for more details: http://www.geonics.com/html/em38.html
    b) **GeoProspectors TSM**
    Power consumption: 3 W
    Sampling rate: 5 Hz
    Input voltage: 12VDC
    See here for more details: http://www.geoprospectors.com/gb/products-services/agriculture/
    c) **GeoSensors R3**
    Power consumption: 3 W
    Sampling rate: 5 Hz
    Input voltage: 12VDC
    See here for more details: https://www.geosensors.ca/

12 CERTIFICATIONS

Celltech

STATEMENT OF COMPLIANCE

The submitted sample of the listed equipment has been evaluated in accordance with and conforms to the Following Rules:

Date of Issue	10 May 2019
Applicant name	Phantom Ag Ltd
Applicant address	206 1st Ave North Naicam, SK, S0K 2Z0 Canada
Manufacturer Name & Address	206 1st Ave North Naicam, SK, S0K 2Z0 Canada
Model Name	SwatBox G3
Report Serial No.	45461505 R1.0

CFR Title 47 Part 15 Subpart B:	Telecommunication Radio Frequency Devices Unintentional Radiators
ICES 003	Information Technology Equipment (ITE) — Limits and methods of measurement

This statement of compliance is for the exclusive use of Celltech's Client and is provided pursuant to the agreement between Celltech and its Client. The observations and test results referenced from this Statement of Conformity are relevant to the sample tested.

Note: This declaration is part of the full test report(s) and should be read in conjunction with it.

FC
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