DYNANAV

VEKTOR MAX

User's Manual

DynaNav Systems Inc.
Phone: (604) 465-0009
Toll Free: 1-(877) 333-9626
Fax: (604) 465-0084

Headquarters
1012- 18799 Airport Way Pitt
Meadows, BC - CANADA
V3Y 0H1

INTRODUCTION

OVERVIEW

The Vektor MAX™ is the latest guidance system in the market, giving the best cost-benefit among all other lightbar based guidance systems.

Focused on being practical, intuitive and easy to use, the system requires little training to use.

It's intuitive interface, helps any user to have a short learning curve. The practical and specially designed user interface, allows quick access to the most important features, and provides an effortless operation.

Being the simplest lightbar system to use and fastest to learn, the Vektor™ is suitable for any pilot in any country, and is an excellent choice for operations of all sizes, ensuring an increase in productivity.

INTRODUCTION

KEY FEATURES

Vektor MAX™ offers many features for navigation and aerial agricultural requirements.

See list of key features that will make a difference with your investment in Vektor:

- High-performance Quad-core Intel CPU with Full-HD mini HDMI video output;
- Rugged 6.5” color display with touch panel, and brightness control;
- Integrated flow controller inside the same unit;
- Rugged and extreme bright lightbar, dimmable for night work;
- Multiple constellation GNSS receiver (GPS, GLONASS, Galileo and BeiDou);
- Real time moving map with modern graphics showing swath details;
- Support for polygon files in KMZ/KML and ESRI Shapefile format;
- Overlap detection with warning on lightbar and AutoSpray™ automatic control;
- Polygon edge detection with lightbar countdown, and AutoSpray™;
- Area measurement, and polygon generation on-the-fly;
- Strategically designed graphical interface, for on-the-fly operation;
- Report on KMZ, PDF and Shapefile, for direct export to the USB flash drive;
- Navigation between coordinates (waypoints) with indication on the light bar;
- Easily mounted through 4 screws on the rear or through the front;
- Network WiFi for internet access and file transfer with the office;
- Aircraft-to-aircraft data communication with built-in long range radio;
- Connection with laser altimeter and altitude indication on the light bar;
- Compatible with Gate controller for Dry material;
- Compatible with prescription map for variable rate;
- Joystick support for simulation and training;
- Free software updates.

FIRST STEPS

SCREEN

After power on, the system will start loading all files and settings. The boot process is very fast and should take around 45 seconds. After this time, the initial screen of program is displayed.

Initial Screen:

From the initial screen you will have access to the following fe:

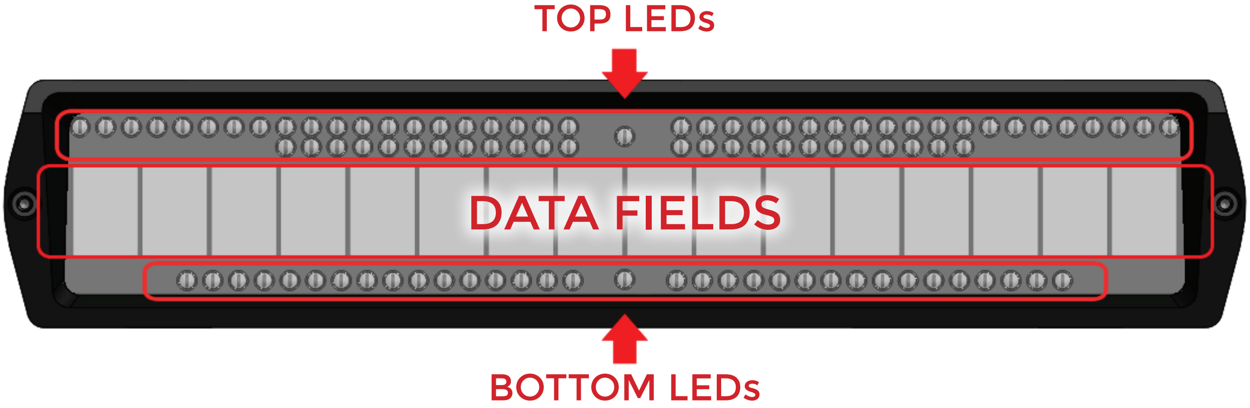
- Create a new Job
- Continue a saved job
- See reports of finished jobs
- Enter the settings menu
- Shutdown the system

FIRST STEPS

LIGHTBAR

When the Vektor MAX™ starts and opens the Initial screen, it will be ready for use. Before starting a new job, you should understand some basic concepts about the lightbar.

The light bar is divided into three sections:



TOP LEDs:

Indicates the distance and the direction of the aircraft to follow a straight line.

The first LEDs near the center are doubled for redundancy and reliability.

DATA FIELDS:

Section used to display warnings and other needed data during flight.

BOTTOM LEDs:

Indicates the angle of attack to the line that you should follow.

CENTER LEDs:

Each line has a central LED. This LED is always on, but will change color when the system is spraying. You will be fully aligned to the swath line, when only the center LEDs are lit.

SENSITIVITY OF GUIDES:

Each LED represents a certain distance or angle. This amount can be changed for each of the LEDs in the menu settings. This topic will be addressed further in this manual.

WORKING WITH THE SYSTEM

CREATING A NEW JOB

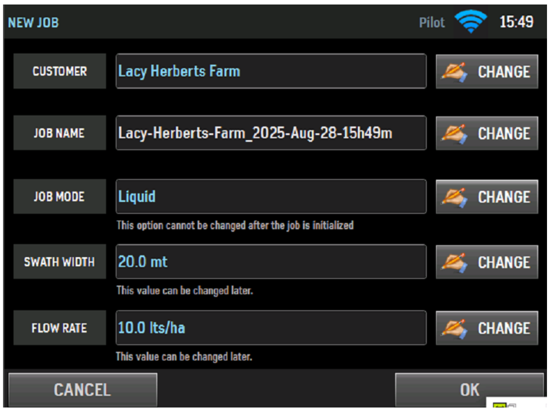
WHAT IS A JOB?

For Vektor MAX™, a job is the basis of everything that you will perform for a particular customer. Within a job, is placed all the data, which will later be used to generate a report.

So first of all, you must create a new job, so that the system can start recording all data.

On the initial screen, click "new job".

NEW JOB -> SET CUSTOMER



You can specify the customer's name before starting a new job. You must register all the customers in the system, which will then store them in an internal memory.

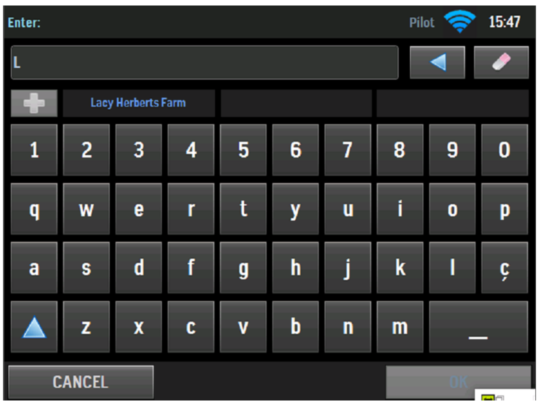
There is no need to register all customers at once, as you can add a new one when needed.

Press the button with the icon of a pencil to enter the desired value in the "Customer" field.

NEW JOB -> CUSTOMER INPUT

The system provides a smart keyboard to enter the customer's name. Start by typing the first letters of the name and, if previously entered, the system will suggest the full name. Otherwise the user can proceed typing more letters to complete the name.

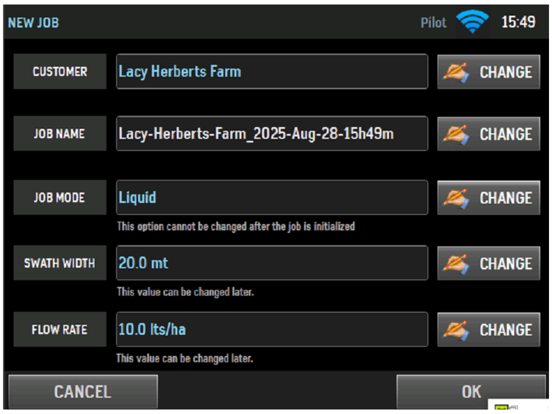
To disable the suggestions press the button "X" at any time. The keyboard will then behave like a normal keyboard.



WORKING WITH THE SYSTEM

CREATING A NEW JOB

NEW JOB -> JOB NAME



The **JOB NAME** is automatically generated based on the other fields and the current date and time.

If you want to change the name, or specify a different name, press the button with the icon of a pencil, and the keyboard will appear for you to type.

NEW JOB -> JOB MODE

After completing the field "Customer" you can provide the MODE "**JOB MODE**" field.

This field allows you to toggle the MODE, such as Liquid, Dry or Opening in inches/cm for certain dry gates.

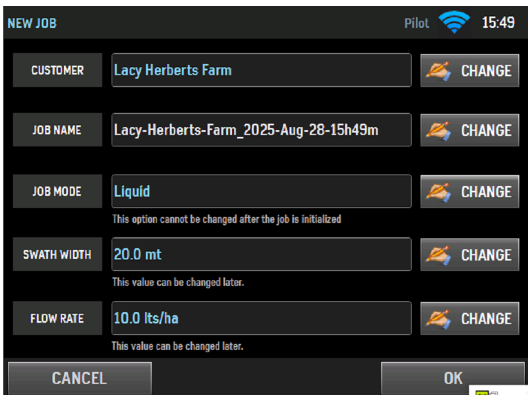
In the "JOB Mode" field, press the button with a pencil icon to toggle the desired value.

NEW JOB -> SWATH WIDTH

In the "**SWATH WIDTH**", you must specify the desired Swath Width to be used during the job. The field is automatically filled with the last value used.

To change the value, press the button with the icon of a pencil.

NEW JOB -> FLOW RATE



In the "FLOW RATE", you must specify the desired flow rate to be used during the job. The field is automatically filled with the last value used.

To change the value, press the button with the icon of a pencil.

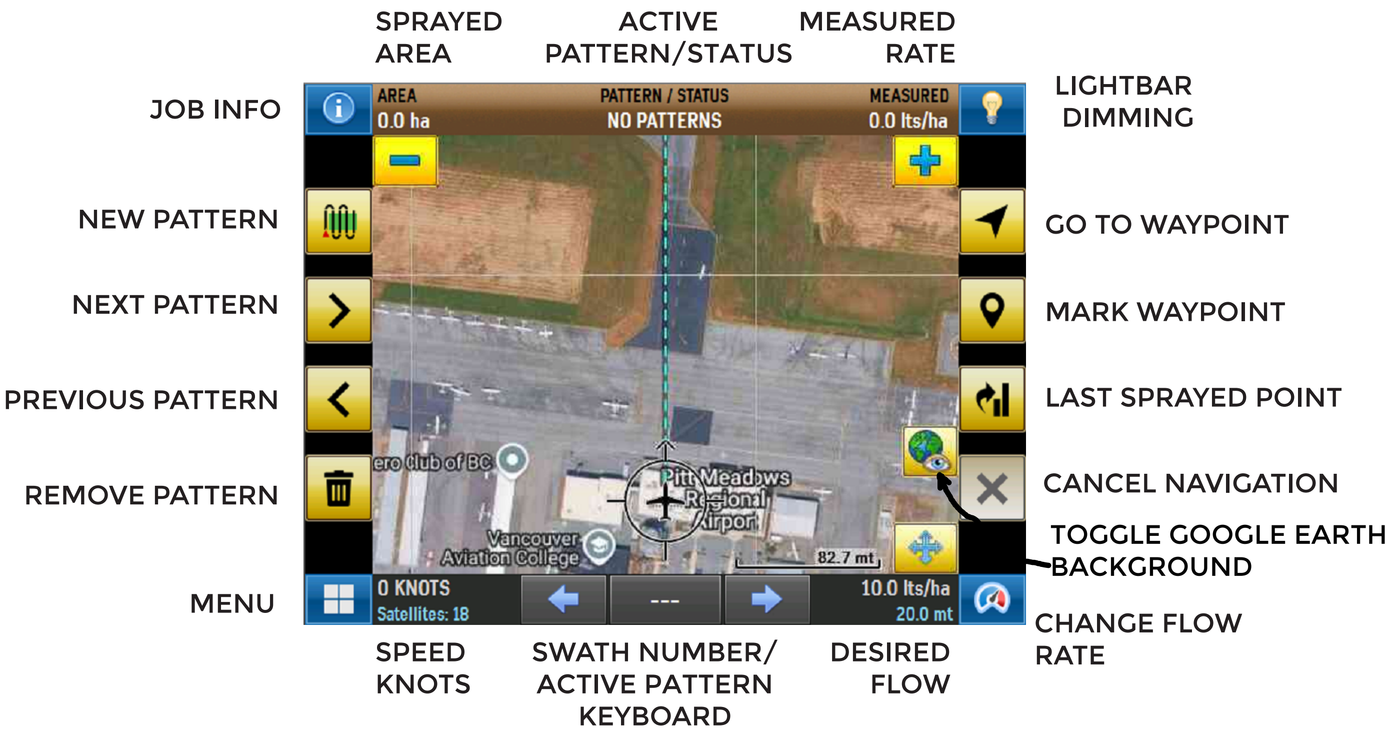
Remark: This value can be changed at any time during the application in the Moving Map Flow Icon.

Press the "OK" button when you are ready to proceed.

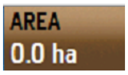
WORKING WITH THE SYSTEM

FLIGHT SCREEN

BUTTONS AND INDICATORS OF FLIGHT SCREEN



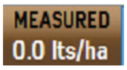
DESCRIPTION:

SPRAYED AREA: 

Displays the total flown area. When a pattern is selected, displays the area sprayed when that par-ticular pattern is selected. By doubble tapping this location the Area can be toggled between Total Area for all Pattern Areas, Total Area for current Pattern or Area per swath being applied.

ACTIVE PATTERN /STATUS: 

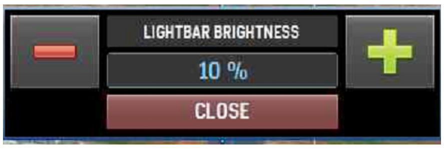
Displays the name of the active pattern at this time.

MEASURED RATE: 

Displays the instantaneous flow rate (read from sensor) for liquid or dry material.

LIGHTBAR DIMMING: 

Tap on this ICON to enter the lightbar dimming



WORKING WITH THE SYSTEM

SCREEN OPERATIONS

LAST SPRAYED POINT: 

Use this feature when you return to finish a swath that you had to interrupt during the spraying. If you start the sprayer before the last sprayed point, the system will give you a countdown timer on the lightbar when to turn off the sprayer exactly over the last sprayed point. If you don't start the sprayer before the point, the system will show a countdown timer for when you should start spraying. This way you can finish the swath going in the same or in the opposite direction as before.

GO TO WAYPOINT: 

By pressing this button, a list containing the waypoints from memory and the points of the job, will appear. After selecting the destination point the system enters navigation mode and the pilot guide to the chosen point.

MARK WAYPOINT: 

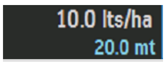
When this button is pressed, the position of the aircraft is stored immediately in memory, and a screen appears giving the user options for saving it as a waypoint.

CANCEL NAVIGATION: 

This button is enabled when in navigation mode, i.e. when flying to a waypoint. By pressing this button you exit navigation mode and the lightbar display guidance to the swaths.

CHANGE FLOW RATE: 

Press this button to change the desired flow rate. A screen will be displayed so that changes can be made. When the flow is changed, the flow controller (if enabled) will immediately respond by correcting for the new value.

DESIRED FLOW/SWATH WIDTH: 

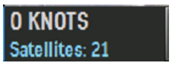
Flow set by the user indicator. While at the top of the screen you have the instant reading of the flow sensor, at the bottom you will always have the target flow information, close to the button that allows you to change it.

SWATH NUMBER/ ACTIVE PATTERN KEYBOARD: 

Use these buttons to change the current active swath number. To advance or return the swaths, press the arrows. To select a specific swath, press the button between the arrows, then a keyboard will appear on the screen for you to enter the number of the swath. The swath number by default is the position of the swath within the pattern. In pattern with no boundaries, such as Back-to-Back or Expand, the numbers will be positive to the right of the AB line and negative to the left. For all closed patterns, i.e. that contains a point C, the number signal is ignored. Also shows which pattern you are on.

WORKING WITH THE SYSTEM

SCREEN OPERATIONS

Speed in knots: 

The current speed you are flying in Knots or selected unit. By double tapping this area, you can change from MPH to KPH or KNOTS. Also shows number of Satellites (Below 6 is useless)

Job Info: 

Pressing this button will pop up a small summary of the job, and a small menu. Use this menu to finish and save the job, to adjust system settings, to view job information, to view total time, area and sprayed/used material. Details regarding this menu will be covered later in this manual.

New Pattern: 

Press this button to create a new Pattern. You will directed through a sequence of different screens to specify the Pattern details. If the selected pattern requires a point C, it can be marked manually by flying over it and pressing the grip switch, or it can be specified by the distance from the line AB. When you create a new Pattern a letter will be assigned. This letter will identify the pattern. That's because you can create multiple different Patterns within a job. The limit is 26 Patterns, that is, from "A" to "Z". Later in this manual, you will see some more details about this pattern letter.

Next Pattern: 

This button advances to the next Pattern, if there is any. As seen in the previous section, you can have more than one Pattern within a job, but only one can be active at the time. Using this button you select the next pattern in alphabetical order, which is the same order as they were created, as they receive the next letter available in the alphabet.

Previous Pattern: 

This button selects the previous pattern, if there is any. For example, if your current pattern is the Pattern "F", pressing this button will activate the Pattern "E".

Remove Active Pattern: 

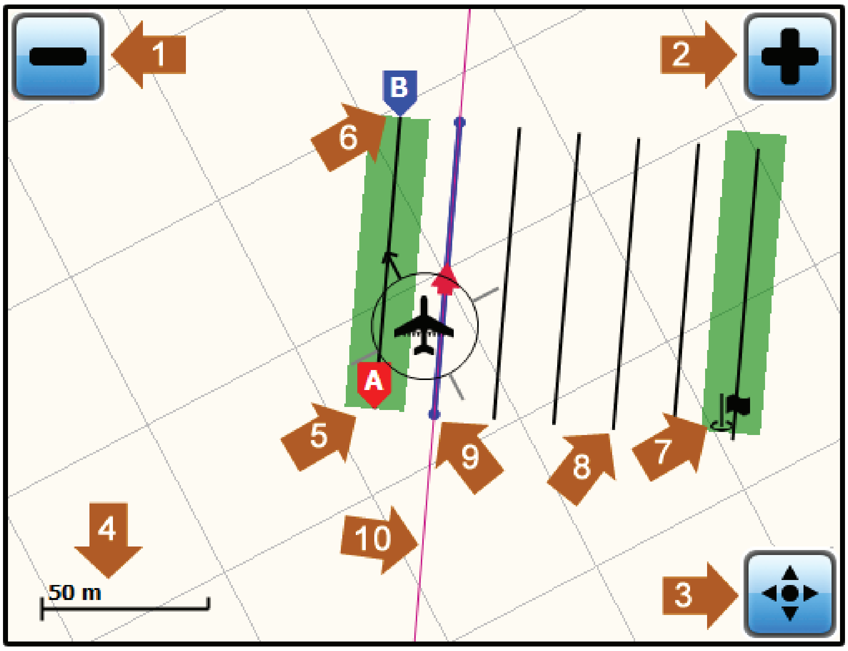
This button will remove the current active Pattern, and select the previous available. For example, if you are with Pattern "B" currently active, after pressing this button, pattern "A" is activated, while the Pattern "B" and its swath lines are erased from memory.

WORKING WITH THE SYSTEM

FLIGHT SCREEN - MAP

In the preceding pages, a brief explanation of the buttons around the map, which occupies the central region of the screen operations was given. Now we will see how the map works, and how you can change the view to review your job in detail.

Consider the image below:



Legend:

1. Zoom Out (if automatic Zoom is Enabled, overrides it by 10sec.)

2. Zoom In (if automatic Zoom is Enabled, overrides it by 10sec.)

3. Toggle map mode between “fixed ground” or “fixed aircraft”

4. Scale indicatorr

5. Icon indicating point “A”

6. Icon indicating point “B”

7. Icon indicating last sprayed point

8. Swath (not active)

9. Swath currently selected

10. Infinite line following the selected swath.

WORKING WITH THE SYSTEM

FLIGHT SCREEN - MOVING MAP

During the flight you will see the aircraft always in the center of the screen, or 1/3 from bottom if option selected, while the ground moves beneath it. If you want to see regions far from the aircraft, you can switch to the mode "fixed ground", so that you can PAN the map (i.e. you can move the map) to search the region of interest.

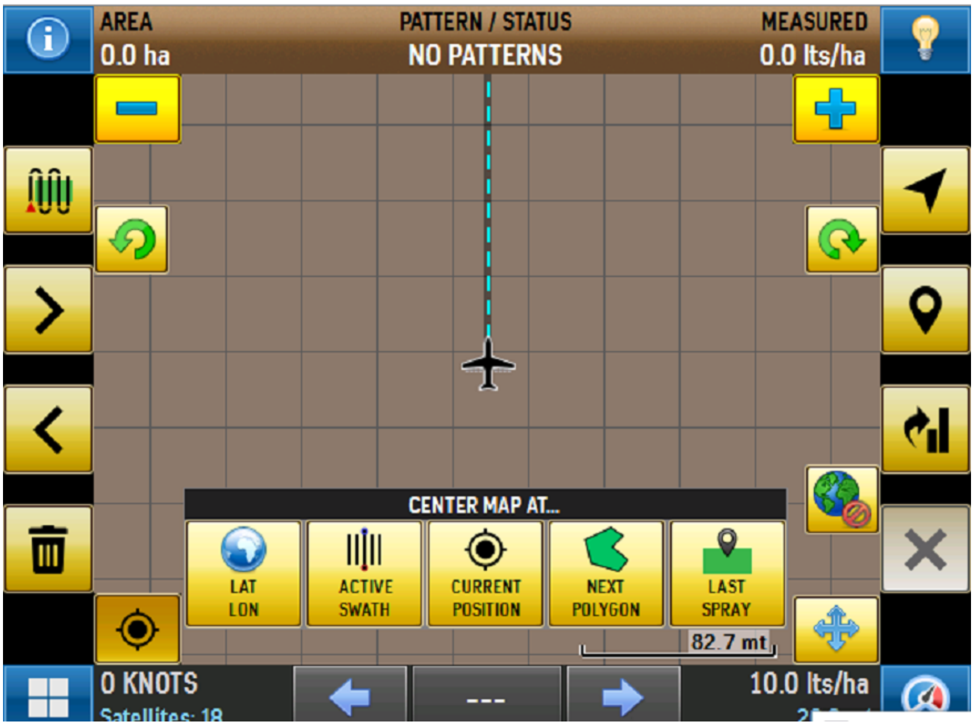
To switch between map modes use this button. You can move the map by touch and drag.

Toggle to center the map on the the set of Icons shown on the map below.

Toggle to turn Google Earth Background maps on/off. Requires HotSpot Tethering to Unit

Use these to zoom map in and out

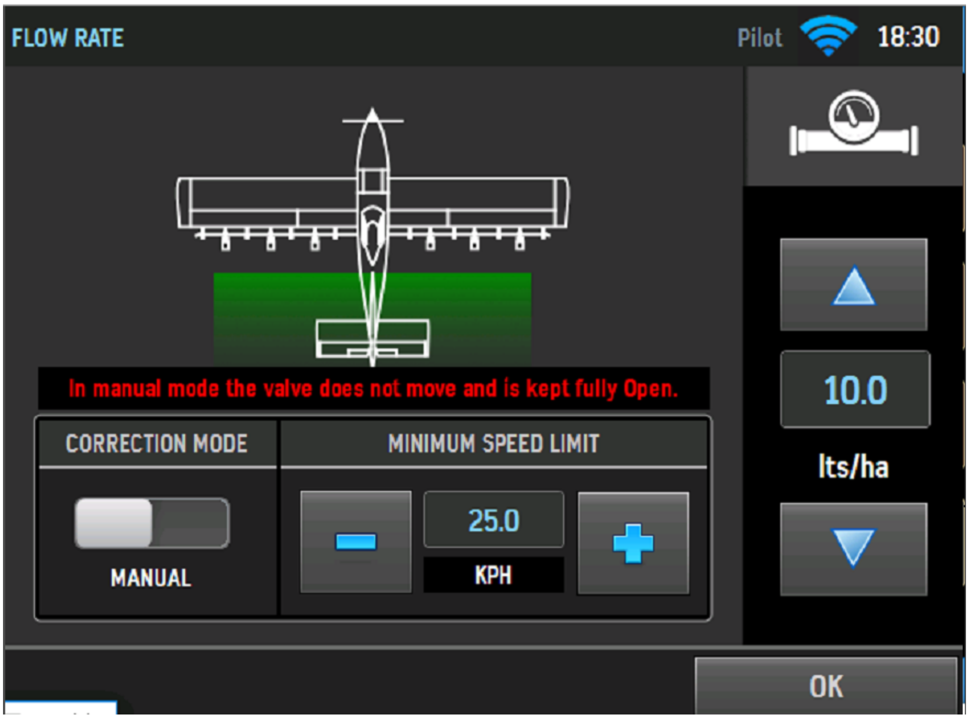
Use these to rotate map.



WORKING WITH THE SYSTEM

CHANGE FLOW RATE

During an application, you may need to change the target flow rate. The new flow will take place immediately, and the flow controller will react instantly. To change the target flow rate, click this bottom right button.



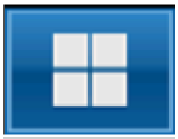
On the right side of the screen you can change the target flow rate using the arrow keys to increase or decrease the value by 0.1 each touch. Also, by touching the center flow rate, it will bring up a Keypad to change the rate directly with numbers. This change will change the flow controller immediately.

The **MINIMUM SPEED LIMIT** is usually for helicopters so that below this speed it maintains the flow rate so that the spray nozzles will still be atomizing with enough pressure.

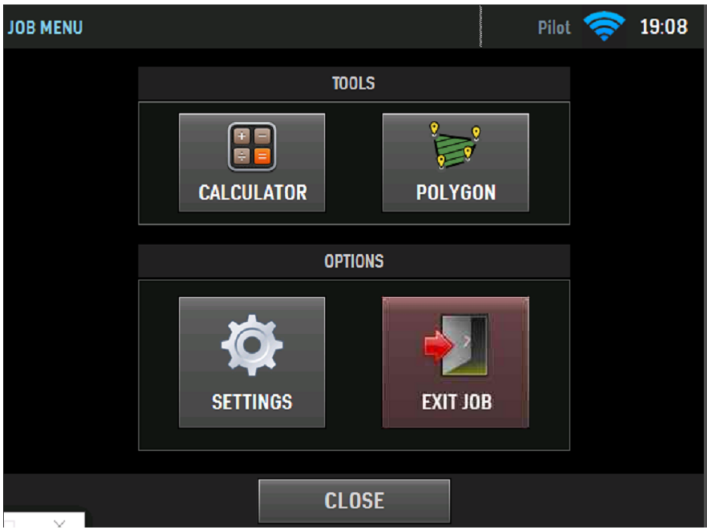
In case the flow controller seems to be not controlling the flow, by changing the **CORRECTION MODE** to **MANUAL**, this will open the valve fully so you can control with your money handle.

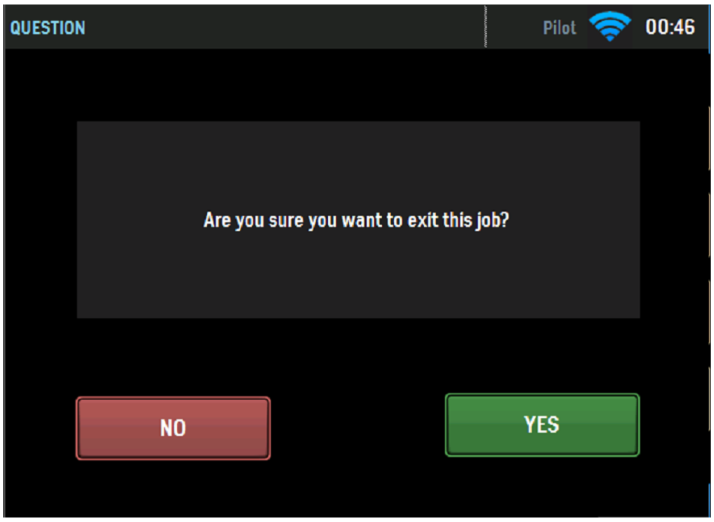
WORKING WITH THE SYSTEM

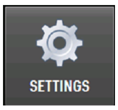
OPERATION MENU



To **EXIT JOB** as well as going to **SETTINGS, POLYGON MAKER** or **CALCULATOR,** push this Button on the Lower Left of the Moving Map Screen. The following screen will appear. If you push the EXIT JOB, the next screen gives the option to Exit.







Pushing the "**SETTINGS**" button, you have access to the following Settings page :

WORKING WITH THE SYSTEM

WHAT ARE PATTERNS

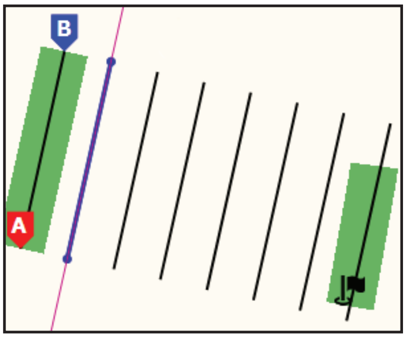
In this section we will explain what are swath lines and application patterns. Also we will evaluate different types of patterns available, and the best way to use them.

Inside a job, you can create one or more patterns to fly.

Swaths are the imaginary lines that the pilot must follow to get coverage of an area.

The swaths are parallel lines automatically calculated by Vektor MAX™ in a sequence according to pre-established concepts optimized for aerial operation. Depending on the shape of the area being treated, it is possible that one pattern is more appropriate than another.

Pattern examples:



As can be seen in the picture, a Pattern needs two points marked by the pilot (A and B).

These points will define an AB line that will be the base for all parallel lines.

Depending on the pattern type, a point “C” may be required to set how many swaths are necessary to cover the area. These patterns are also known as closed patterns.

Some patterns, like Back-to-Back and Expand, do not require a point C as they are projected to the infinite. These are known as open patterns, as they have no limitation. The pilot can keep advancing to the next swath forever.

The pattern points are marked with the grip button, or a touch on the screen, pressing the buttons that will appear when the pattern is created. The current aircraft position is then used as the position for the A and B points.

Before starting a new pattern, we will analyze the different types available and review how to use each one of them.

WORKING WITH THE SYSTEM

TYPES OF PATTERNS

In this section, you can better understand each of the flight patterns available in the system.

Vektor MAX™ includes pre-defined flight patterns designed to optimize the spraying in an efficient manner, reducing the flight time. In addition, some patterns are optimized to maintain the turns always to the same side when repeating the pattern.

Vektor MAX™ Patterns:

Back to Back:

The simplest pattern, where you fly the next swath always to the same side (right/left) of the AB line.

Expand:

In this pattern you follow a sequence where the next swath alternates left/right using AB line as the center. On each pass, you get more distant from AB line which is marked in the center of the area.

Racetrack:

In this pattern you first fly the sides of the area to be covered. After that, you start flying a sequence of swaths that results in smooth and constant size turns. You spray advancing toward the point "C".

Auto Racetrack:

This is the same flight pattern as in the racetrack, but when you repeat the pattern, the first swath and/or the total swath count may change to keep the turns always to the same direction.

Quick Racetrack:

This pattern is similar to the previous, with an advantage of marking the point "C" in the middle of the area. In large areas, this can be a better choice compared to the "Racetrack".

Auto Quick Racetrack:

Same as the Quick Racetrack, but when you repeat the pattern, the first swath and/or the total swath count may change to keep the turns always to the same direction.

Reverse Racetrack:

In this pattern you fly as the racetrack, but the coverage progress advances in the opposite direction to the point "C", and the AB are marked in the middle of the area.

Squeeze:

With this pattern, you start on the sides of the area, then you get to fly in "circles" squeezing the area towards the center swath.

WORKING WITH THE SYSTEM

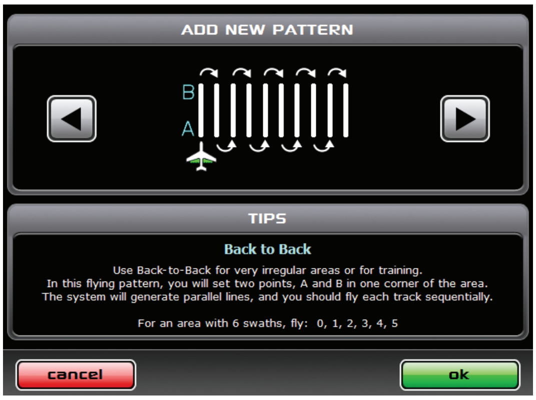
CREATING A PATTERN AND SETTING PARAMETERS

In this section, we will go through the steps of creating a pattern, and analyze the required parameters for it.

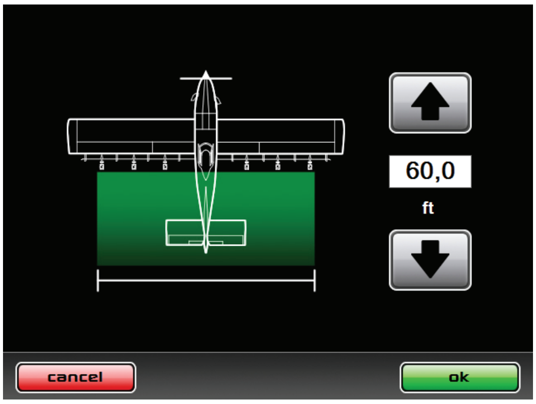
CREATING THE NEW PATTERN

In the flight screen, press the first button on top left "New Pattern". A screen will appear for you to select the desired type of pattern. Use the details on the previous page to select the most appropriate pattern type. Tap over the arrows to select other option. The small picture shows a small illustration for reference only.

Press "ok" when ready.



DEFINING THE SPACING OF SWATHS



After the type of pattern is specified, the next parameter required is to set the spacing between each line. The spacing is given in mts/feet according to the selected unit system.

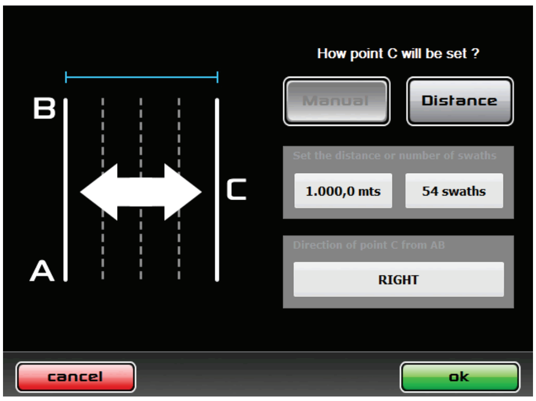
Use the arrows to change the spacing or tap over the number to open a keyboard.

MARKING POINT "C"

If you choose a pattern that requires a point "C", you can set it in two different ways:

Manually flying and marking through the grip switch

Inputting the distance in mts/feet or in number of swaths to the point "C". In this case, you also need to select whether the point "C" is to the left/right of AB line.



WORKING WITH THE SYSTEM

MANUALLY MARKING THE PATTERN BY FLYING

See this page for how to mark the pattern points "A", "B" and "C" if necessary.

There will always be the need to input the "A" and "B" points to create a pattern. Depending on the pattern and the options selected, you may need to also mark a "C" point to delimit the area, that is where the area ends in relation to AB line.

When you finish defining the pattern, as explained on the previous page, the system will ask for the point "A". The lightbar will also display the message: "MARK POINT A".

Mark a point by pressing the button installed on the airplane handle, or by pressing the button on the left side of the screen named "A"

Follow the same procedure to set point "B", and if necessary a point "C".

When marking the point "C", the system will automatically calculate the total number of swaths and show in the lightbar as you move away from the AB line. Example: If you set up a pattern with spacing of 30 feet, when you are 30 feet to the side of the AB line, the lightbar will display "2 SWATHS" (AB line + the swath where you are)

Also, while the point "C" is marked, the lightbar will display the alignment with the nearest swath, using the top and bottom LEDs. This allows you to get aligned with the swath line while marking the point "C", so once you mark it, you are ready to spray that same swath.

After marking the points required for the selected pattern, the new pattern will be created and a letter will be assigned to it as identification. As previously reported, it is possible to use up to 26 different patterns within a job. This feature is useful for areas with very irregular shapes where you cover the major portion with a pattern, and then "finish" using a simple pattern such as "Back to Back". You can also use in a job with multiple blocks, where you assign a new pattern for each new block.

Combining multiple pattern allows you to optimize the flight, allowing you to spray a different swath on a different pattern each time. This is useful when you have small areas close to each other.

Both lightbar and the screen, will show the identification of the active pattern, next to the selected swath number. Example: you are flying pattern 'D' and swath 20 is selected, the display should show "D+020".

WORKING WITH THE SYSTEM

THE FOLLOWING IS A PATTERN APPLICATION

In this section we will cover the detail when flying a pattern.

After creating a pattern and after marking points “A” and “B”, and also “C” when necessary, the system immediately begins to guide the pilot based on the swath number “0”, passing through the “A” points and “B”. Swaths to the right of the line AB are listed with positive values, while the swaths to the left of the line AB are listed with negative values.

Whenever a swath is selected, the light bar will indicate the distance and the angle of the aircraft’s position to this swath center line. Each LED on the lightbar corresponds to a distance or an angle, and its value can be changed through the settings menu.

When flying the pattern, the system display three fields of information on the lightbar according to the options chosen by the pilot. This setting can be changed at any time through the settings menu.

The central lightbar LED’s will change their color to indicate when the system is spraying or not. The LED will be blue when the system is spraying. But when inactive, the central LED will turn into purple.

When the lightbar upper indicator “runs” to the left, it means that you must compensate by moving towards that side. The bottom LED’s then should be moved to the same side in order to “fix” the error.

When the lightbar top LED row is with only the central LED on, it means that you are over the selected swath, and then you just need to keep your heading aligned.

Align the heading with the swath bearing by using the angle indication of the lower LEDs on the lightbar, until the bottom LED row indicator has only the central LED on.

When only the central LED’s are lit in both rows, it means that you are over and aligned to the selected swath.

Remark: Take in account the sensitivity of the first LEDs around the central LEDs, as configured by the pilot, to determine the accuracy of this alignment.

WORKING WITH THE SYSTEM

CHANGING THE SELECTED SWATH

After understanding how to create a pattern, you must understand how to change the swaths to cover the desired area.

The Vektor MAX™ system offers several ways to move forward and backward from the current swath, as for efficiency is necessary to provide quick access to this feature.

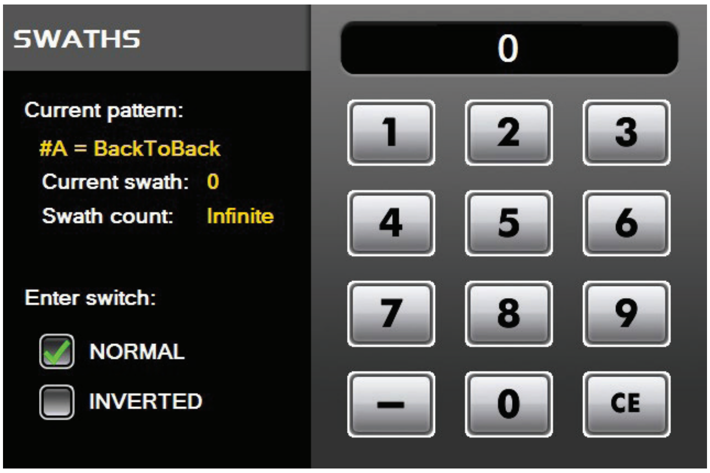
The ways to change the currently selected swath are: the buttons on the screen, the numeric keypad on the screen, or the button in the grip (if equipped).

The screen buttons are located in the lower part of the flight screen. Between the buttons is located the shortcut to the numeric keypad.

Through a pop-up screen with a keypad it is possible to type the number of the swath to be selected. This keyboard also provide other features, like the one to reverse the Enter switch.

The third way to change the selected swath is through the grip switches.

The "Enter" switch in the grip will advance to the next swath for each time it is pressed.



It is possible to invert the direction of the advance. To change the direction of advance, open the keypad, as shown in the image, and select "INVERTED" option for the "Enter switch". This is only useful when the aircraft is equipped with a single switch, instead of two switches as recommended.

By using two switches connected to the grip, the pilot can easily advance to the next or to the previous swath without any configuration.

Note: The keypad will accept only valid values. If your current pattern has for example ten swaths and you type "11", the value will not be accepted.

WORKING WITH THE SYSTEM

MULTIPLE PATTERNS

When creating a new pattern, it will create a reference letter. The first pattern created in the system will receive the letter "A" as a reference. When creating new patterns they will receive the next letter in alphabetical order.

You can switch between patterns, when creating a new one.

The buttons on the left side of the flight screen, are used for the following functions:

- **CREATE NEW PATTERN**
- **SELECT NEXT PATTERN**
- **SELECT PREVIOUS PATTERN**
- **REMOVE PATTERN FROM MEMORY**

Each swath of a pattern will be identified by a letter followed by a sign and 3 digits.

Example:

"F+010" = Pattern "F" Swath +10

"D-001" = Pattern "D" Swath -1 (negative swaths are on the left of AB)

This reference is used to store data in memory, so the pilot can switch between several patterns within the same job.

Another benefit of using multiple patterns is to work in more than one area at a time.

Since the patterns are stored in a job, the areas must be from the same client that was selected when the job was created. It is important to keep in mind that all counters such as the area totalizer, and timers will record the sum of all of these areas since you are working within the same job.

When a pattern is selected, the area displayed on the top left of the flight screen shows the area sprayed when that pattern is selected. That allows the pilot to count area for each individual pattern. *

* = This feature may not be available in old versions of the software.

WORKING WITH THE SYSTEM

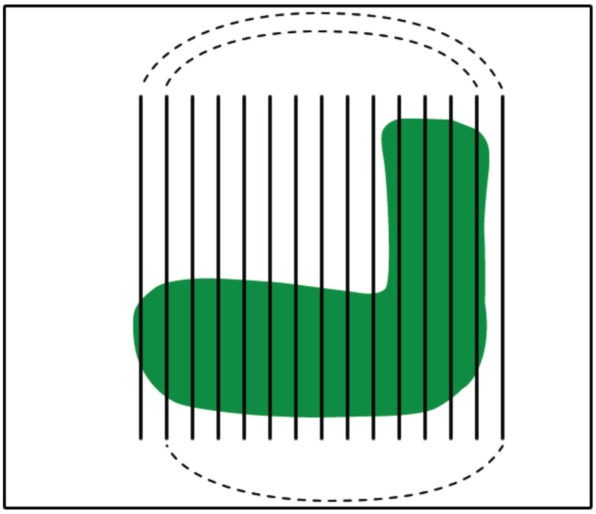
MULTIPLE PATTERNS

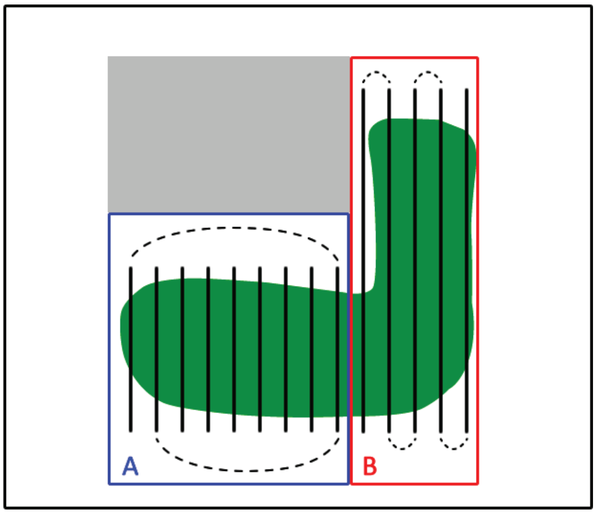
In this section the creation of multiple patterns will be addressed within a job, to increase productivity when dealing with certain types of areas.

Small areas tend to give more work to the pilot for having many irregular shapes and various corners. To optimize the flight time, it may be needed to split a big area, in smaller portions.

To solve this problem, the Vektor MAX™ offers the option to create multiple patterns within the same job.

See a comparison between two situations illustrated below:





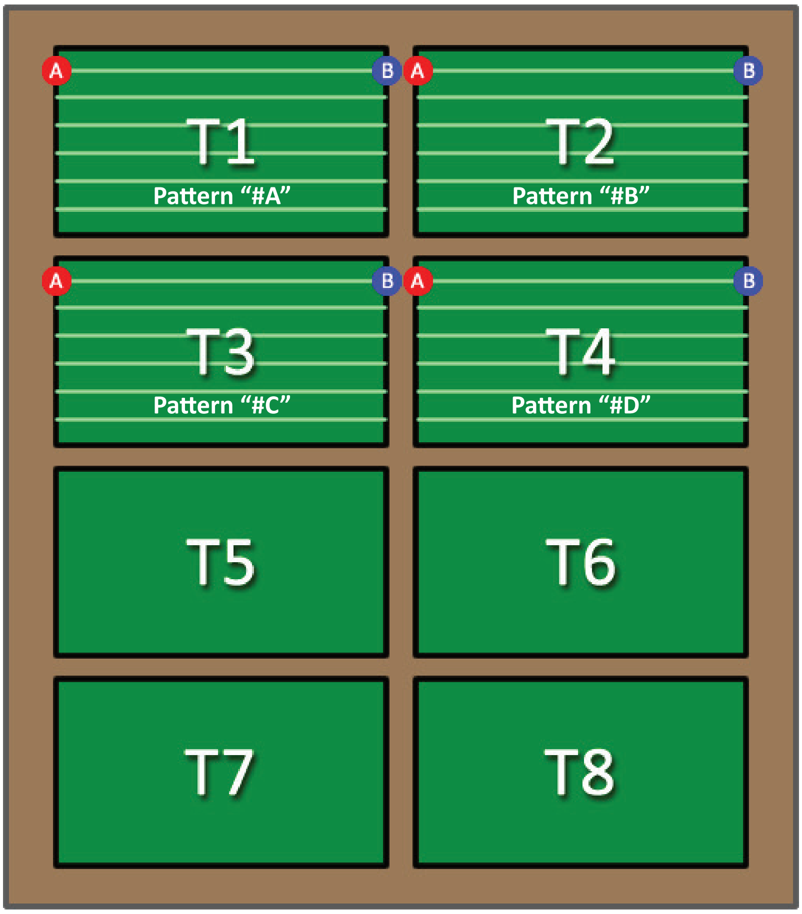
Note that in the situation illustrated in the figure on the left, the pilot is spraying over an area in a "racetrack" pattern. Due to the shape of the area to cover, the pilot must fly over a huge "empty" area without spraying any product. In the right figure, the area was divided into two smaller portions delimited by the blue and red rectangles, to optimize the application. Thus there is no need to fly over all the space shown in gray. This comparison illustrates how you can optimize your job using multiple patterns to cover different portions of an area.

To fly with multiple patterns, just create a new pattern. The current pattern will be stored in the memory and the new pattern created will be used by the system.

WORKING WITH THE SYSTEM

MULTIPLE PATTERNS

Another possible case where the use of multiple patterns may be usefulm is in the coverage of large areas divided into blocks. Below you can see an illustration of this scenario:



Note that in the above image the pilot must fly the blocks from T1 to T8. For each block a new pattern was created with their own points A and B. Each new pattern gets a new designator (eg “#A”, “#B”, “#C” ...) and is stored in memory. In the example illustrated above, the pilot can handle the field “T4” with the pattern “#D” for example, and if necessary return to previous, using “select previous strategy” .

Remember that in this case, the counters (area, time, etc.) will be added together as long as you are inside the same job, thus the report will present the total values.

NAVIGATION AND WAYPOINTS

CONCEPTS AND NAVIGATION PRINCIPLES

ATTENTION!

The Vektor MAX™ can not be used as a primary navigation tool for IFR or VFR navigation. It only provides features to help the pilot in his spraying job.

Waypoints:

A waypoint is a coordinate of a significant point for the pilot.

Each waypoint in the system, carries the following information:

Coordinate: Latitude and longitude of point's position.

Radius: Radius of coverage. The system assumes that you are at a point if your position to the point is less or equal the radius of coverage.

Name: Custom name (alias) that facilitates the identification of the point by the pilot. (e.g. "RUNWAY")

Icon: Small image that is shown on the map.

Waypoints are directly related to the navigation features of the equipment, since they are used to specify a destination.

The pilot can mark a waypoint in two ways: Flying over the desired coordinate and pressing a button, or by entering the coordinates manually.

Special points and polygons:

In addition to waypoints, you can navigate to special points such as the "A", "B" and "C" of a pattern, or to the position where the pilot stopped the spraying system, which is identified as "last sprayed point" .

There is also the option to navigate to a polygon. For each polygon in the job, you will find an entry in the list of job points. These points are identified with the prefix "POL:" and they will guide you to the center of the polygon that they represent.

NAVIGATION AND WAYPOINTS

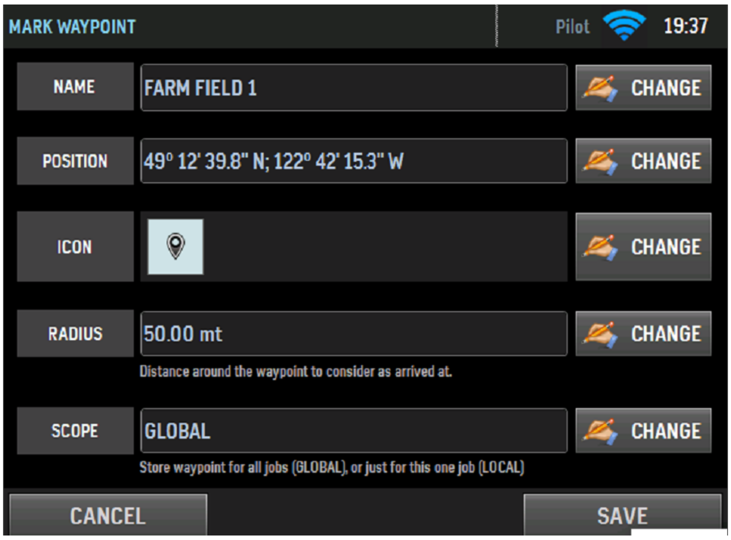
CONCEPTS AND NAVIGATION PRINCIPLES

In this section you will learn how to create a waypoint.

How to create a waypoint when flying:

During flight press the button the coordinates will be stored immediately.

After the coordinates are registered,



the system will display a screen to enter **WAYPOINT NAME**. After this and if necessary you can change the coordinates. The icon that represents the point on the map, can be changed by pressing the **CHANGE** Button. To edit any field, just press the **CHANGE** buttons .

After finished filling in the fields, just press “**SAVE**” to return to the main screen.

How to create a waypoint by coordinates:

The user can manually enter the coordinates without having to fly to the location of these coordinates.

To manually enter waypoints, it is necessary to access the settings menu. As the settings menu will be discussed in depth later in this manual, this function is not detailed on this page.

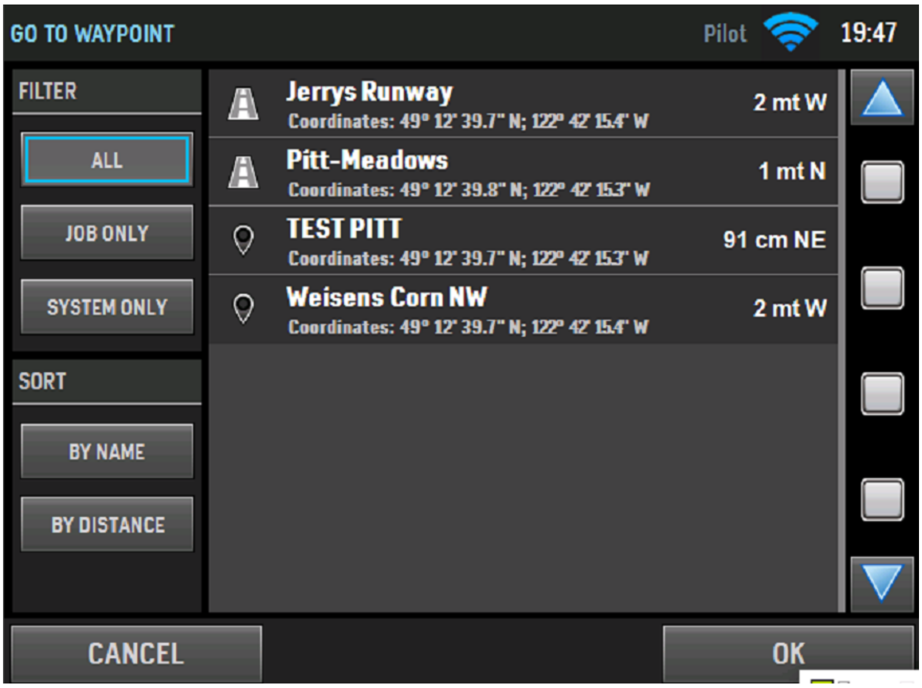
NAVIGATION AND WAYPOINTS

CONCEPTS AND NAVIGATION PRINCIPLES

In this section you will see how to navigate to a waypoint.

How to navigate to a waypoint and special points:

In the flight screen, press the button and a screen will appear listing all waypoints stored in memory, and special points of the active pattern at the time, as an "A" and "B", and the "last sprayed point."



Choose the destination point touch the waypoint to highlight the selected point, and press "**OK**".

The system will enter the navigation mode and the lightbar will display the estimated time of arrival at the point, and the distance to fly from your current position.

On the map you can see a straight line that connects the target point to the location where the aircraft is at the time it was selected. This line is used for guidance to the destination.

In navigation mode the lightbar LED's will indicate the alignment of the aircraft with the straight line created to the destination point.

NAVIGATION AND WAYPOINTS

CONCEPTS AND NAVIGATION PRINCIPLES

On this page will be explained how to get out of navigation mode and return to normal operation.

During the navigation mode, otehr features are disabled, such as creating and changing a pattern. The buttons that lead to these resources are left with a gray appearance and do not react when pressed.

Only the buttons “Mark waypoint” and “Cancel navigation” are available.

During the navigation mode you can create a new waypoint at any time by following the instructions as explained in the previous pages.

The top of the screen indicates the heading and bearing.

To exit the navigation mode, just press the button  on the right side of the screen, and the system will display back all the patterns.

The navigation mode, is also finished when the airplane enters in the radius of a waypoint, which can be set when creating the waypoint or through the settings menu.

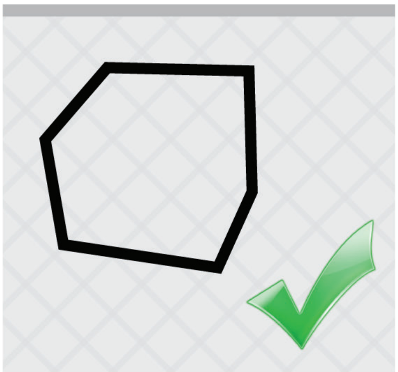
UNDERSTANDING POLYGONS

BASIC CONCEPTS

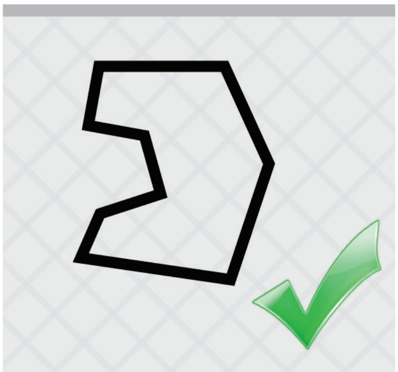
Vektor MAX™ allows the representation of regions using polygons.

For Vektor MAX™ a polygon is defined as: a set of points joined together by segments that don't cross each other.

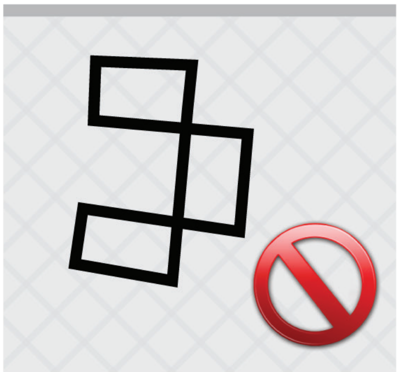
Check below illustrations of how the system understand the polygons:



1: VALID



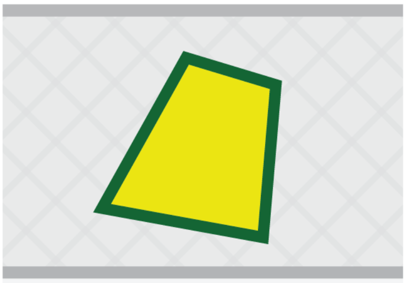
2: VALID



3: INVALID

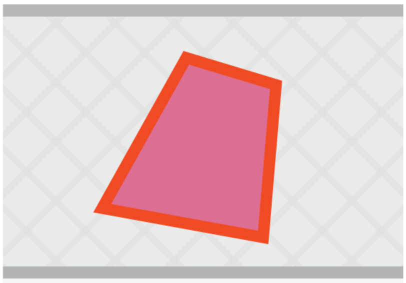
In the picture above, the polygon number 3 is not valid, as it is a self intersecting polygon. Any attempt to load a polygon like this, will be rejected by the system.

After being loaded, a polygon can have one of the three possible meanings to the system:



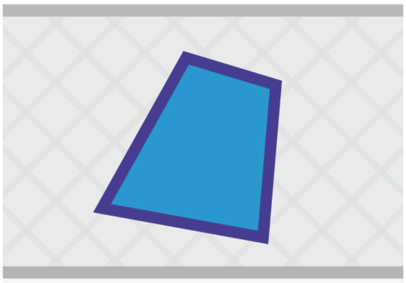
INCLUSION ZONE

Delimits a region where a product should be applied.



EXCLUSION ZONE

Delimits a region that should be protected from treatment.



TEMPORARY

A region with temporary meaning. Mainly used for measuring area.

UNDERSTANDING POLYGONS

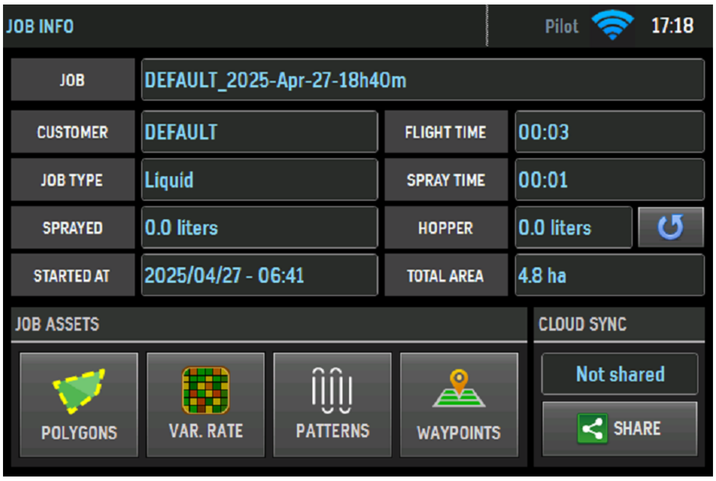
ADDING POLYGONS TO THE JOB

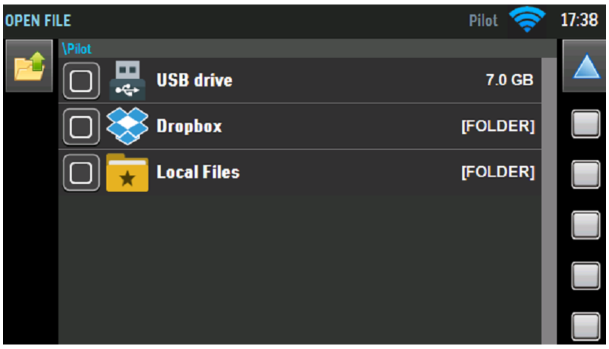
One of the big advantages in using polygons is in job planning. The polygon also plays an important role for orientation purposes, helping the pilot to get aware of fields' limits. Many GIS (Geographic Information System) softwares are available for free in the internet.

One of the most famous software is Google Earth, as of the moment of this publication, is licensed for free by Google Inc. even in the PRO version. The file format KML (and KMZ, its compressed version) turned into a standard widely used across the globe.

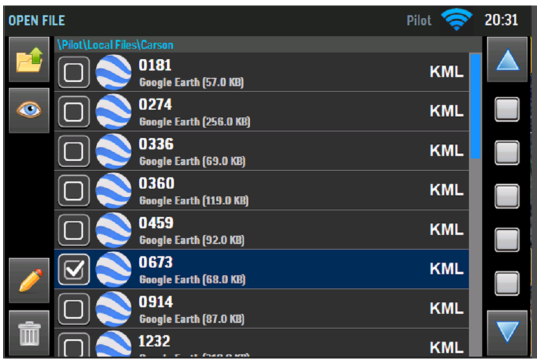
Google Earth is able to generate files including many data, like polygons for example. This way, the user can quickly plan a new job through Google Earth, and get it into Vektor MAX™ by using a simple USB flash drive or through WiFi network.

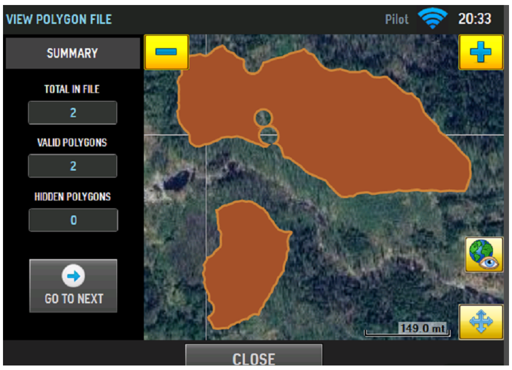
When you create a new job, you have the chance to import data into this job:





By pushing the POLYGONS button, you will be brought to ADD polygons. Next you will open the file location of where the Polygons are. Again, DropBox will be replaced a DynaNav Cloud Service.
From there you can VIEW POLYGON FILE. then CLOSE and hit OK to Import the file to this JOB.

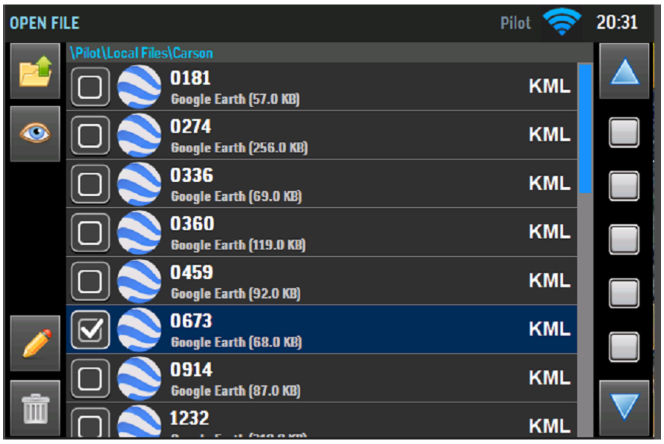


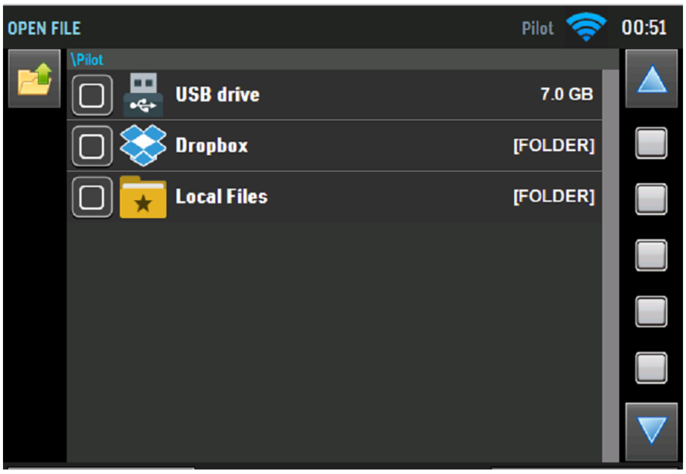


UNDERSTANDING POLYGONS

IMPORTING FILES BY USB

After pressing the button to add polygons to the job, a new screen will appear, where the user will be able to select from all the files found in any common media storage device connected to the Vektor MAX™ USB port.





The screen shown above, is used for selecting files from USB. It has an icon of a USB connector. When the icon appears in red, it means that there is no device connected to the USB port, while the green color means that a device was found and all the files are in the list.

The user can see all files found on folder and subfolders. As can be seen in the images above, when the file is inside a folder, the folder's name also appears on the list.

By the example above, we can take the following conclusions: a flash drive was found in the USB port. Two files have been found. Both files are inside a folder named "MyPolygons". Both files are in the format KMZ.

The user needs to select the right file and press "ok" on the lower right corner of the screen, so the system can open the selected file and extract all the polygons from it.

Each file may contain one or more polygons.

The Vektor MAX™ system is able to deal with up to 5000 vertices per polygon, and up to 50000 vertices per job.

UNDERSTANDING POLYGONS

SETTING POLYGON TYPE AFTER LOADING

Once the polygons were extracted from the file, the user must specify for each polygon, the type of region represented by that polygon.

This procedure is done by selecting the polygon, and marking it as "Inclusion" or "Exclusion" as it is shown in the picture below:

Note that when a polygon is marked as inclusion, it is shown in the list with a sign "[+]" preceding its name. When the polygon is marked as exclusion, it receives the symbol "[-]" before it's name.

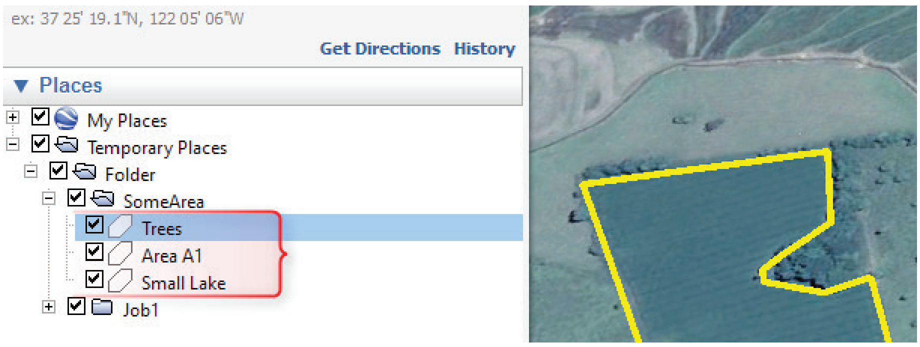
All polygons that are listed under the title "Current job polygons" will appear on the map.

If you want to remove a polygon, use the "Remove" button.

In the image above, there are two polygons ready for use. The names that appear on the list were defined in software used to create them. When you use polygons created by other persons, make sure that the polygons are properly identified by intuitive names.

The polygons listed in the above image, were generated through the Google Earth software.

See on the image on the right, how the nomenclature of the polygons were defined.

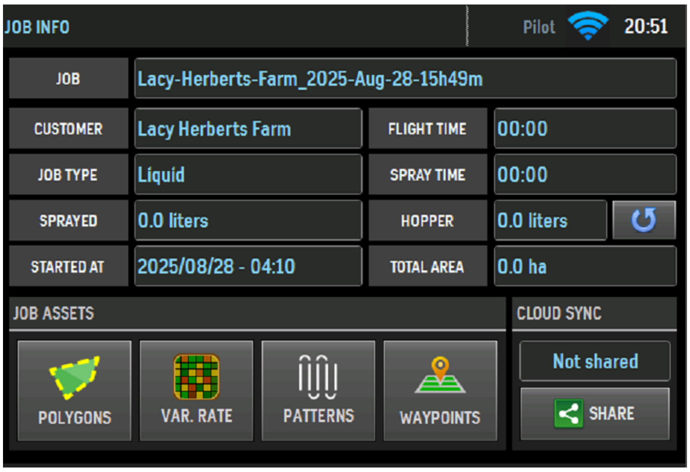


MARKING A POLYGON ON-THE-FLY

MARKING A POLYGON AND MEASURING ITS AREA

One advanced feature in Vektor MAX™ is the tool to mark polygons during the flight and measure it's area. This functionality also allows the pilot, who doesn't have a polygon file, to create the polygon by marking points around the edges of the area to be treated, and then take advantage of all the benefits of polygons.

To use this tool, the user must be inside a job. On the flight screen, press the button to open the job summary/menu (blue button, in the left upper corner)



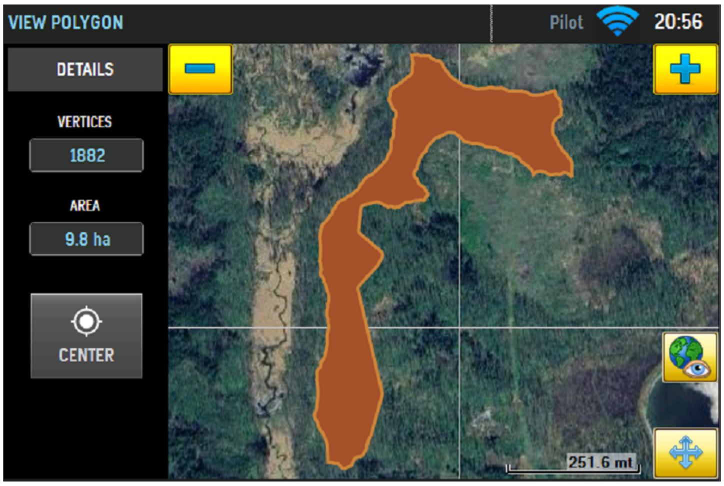
As illustrated in the picture on the left, find the button with the ruler and compass symbol.

By pressing the button, indicated on the image, the main screen will switch to the mode of "marking polygons".

During this procedure, the main screen will show a panel on the right side, with four buttons. All other functions will remain locked during the process.

On the moving map, you can visualize the shape that the polygon is taking as you mark the vertices. The area indicator, on the side of the screen, shows the polygon's area and not the applied area, when marking a polygon.

In the light bar, the information presented, shows on the left field, the distance from current location to the last point marked. In the right field is shown the total area of the polygon.



During the procedure to mark polygons, the polygon being marked will appear with a semi-transparent blue fill, which indicates a temporary polygon (page 28).

MARKING A POLYGON ON-THE-FLY

SETTING POLYGON POINTS AND INSERTING IN THE JOB

To mark the polygon points, the pilot may use the button installed on the airplane handle (the same button used to advance to next swath). Also, on the screen, the system will show a side panel with four buttons whose functions are described below:

ADD POINT TO THE POLYGON

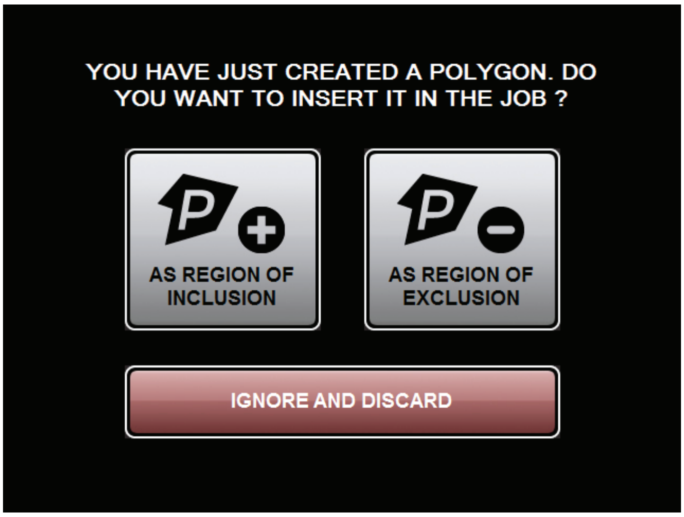
REMOVE LAST MARKED POINT

CREATE POLYGON

CANCEL AND ERASE POLYGON

Canceling the polygon marking, will discard the polygon.

If you want to save the polygon within the current job, to use it as an inclusion or exclusion area, press “create polygon” and a screen will appear so you can specify if the polygon represents an area of inclusion or exclusion (page 28):



After selecting the desired option, the polygon will be inserted into the map and will function normally as if it had been imported from a file. Press the red button (as in the image above) to discard the polygon.

CLOSING A JOB

EXIT JOB

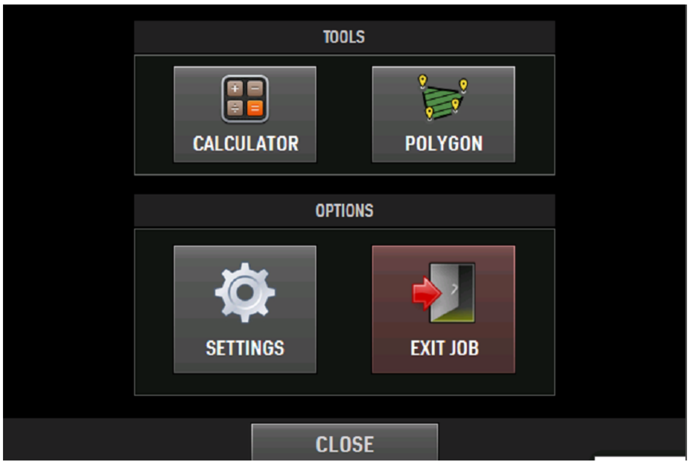
All stored data is associated with a job and it is stored in computer's memory. For this reason it is always necessary to start a job before any feature can be used.

Once you leave the flight screen, the job should be saved or discarded.

To finish a job, go to the JOB MENU and press "EXIT JOB". A screen will appear with the option to exit YES or NO.

Next you choose whether to MARK JOB AS FINISHED choose YES or NO. The job is saved in the memory.

The job will be stored in the memory under the name given at the time of its creation.

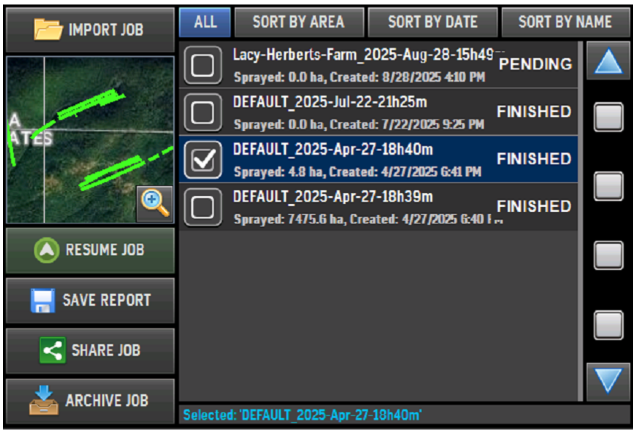


After a job is saved, the system will return to the initial screen. To continue a job then simply press "continue job" and search for its name in the list of jobs stored in memory.

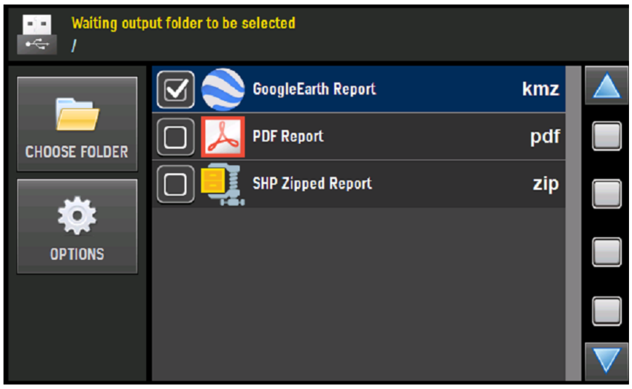
CLOSING A JOB

SAVE REPORT

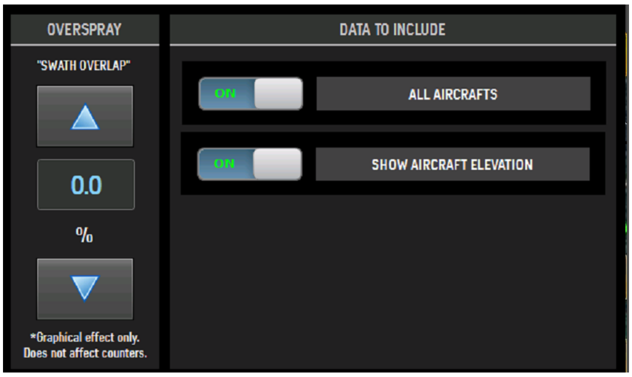
From the **HOME SCREEN**, touch the **MY JOBS** Button and check the box of the job(s) you want to **SAVE REPORT**.



When push the **SAVE REPORT** Button, you need to select the type of report from the list. They are **GoogleEarth Report**, **PDF Report** and **SHP Zipped Report** (Shape File).



After you have checked the Type of Report, you can select the **OPTIONS** which can include **"OVERSPRAY"** which allows the report to have a percentage of **"SWATH OVERLAP"** for the Report only. It does not affect the original actual Job Data.



From there, you need to **CHOOSE FOLDER** to save the Reort to. It can be to the USB Drive and any specific folder in the **USB** you want to store it. Also it can be store in a Local Folder on the unit for future collection. At this time, DropBox is not functional. This will be replaced in the near future with a **DynaNav Cloud Service** for live updates when connected to the Internet.

The **GOOGLE EARTH** reports can be saved and then opened in a computer, using the software Google Earth that is available for free. It is a full **AS APPLIED** report with Sprayed Polygons, Full 3D Flightpath, the events of Spray ON & OFF, the Flow Rate during the Spray, as well as Pilot and Aircraft information.

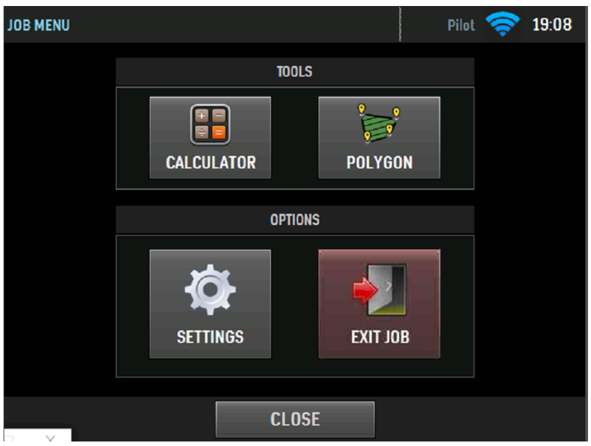
SETTINGS MENU

ACCESSING THE SETTINGS MENU

The settings menu can be accessed at any time. This menu contains all the settings that can be changed in the equipment.

When the system is not in flight screen, the menu settings can be accessed through the initial screen:

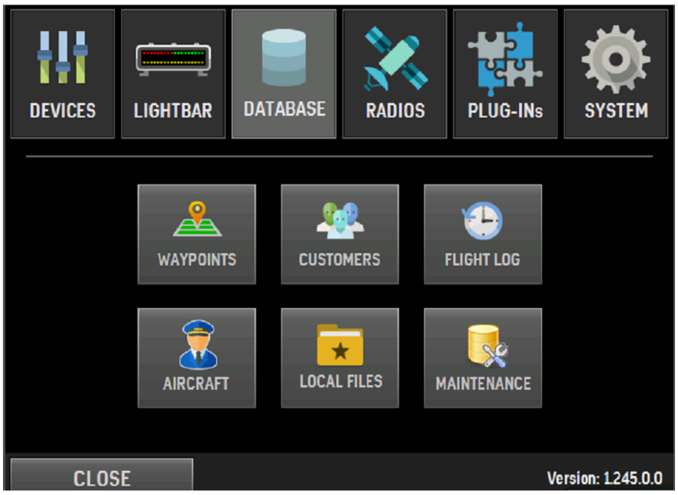
When the system is in the operation screen, the settings menu will be accessible through the job summary/menu: 

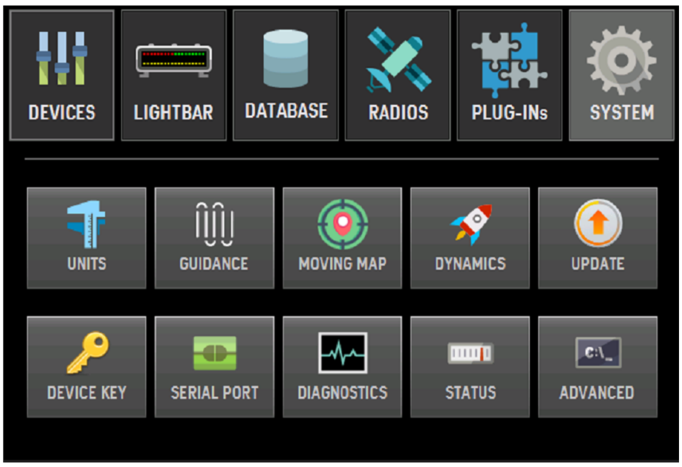


Through one of the two different ways shown above, you can access the settings menu at any time.

SETTINGS MENUS

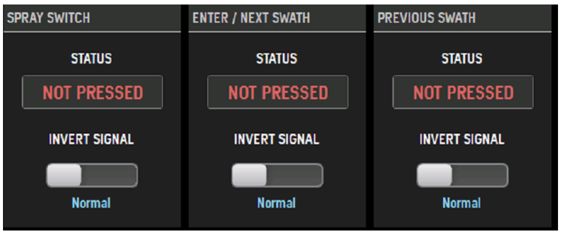
Because **Vektor MAX** has so many features, the menu was divided into 6 sections. Each sections Icons are self mostly explanatory.



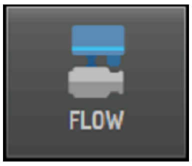


SETTINGS MENU

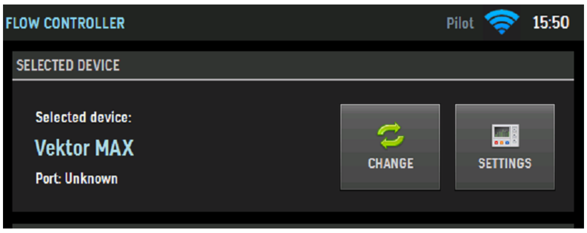
DEVICES > SWITCHES > FLOW

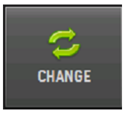


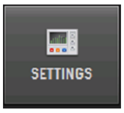
This setting is to make sure your switches are working correctly. If you happen to have a switch that is not Normally open, you can INVERT for correct operation

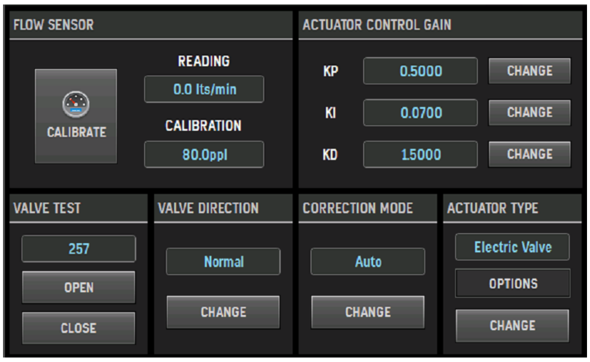


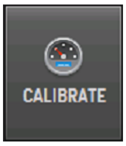
This window shows the selected Flow Controller Device. Now it shows the Vektor MAX Flow controller that has been selected in the CHANGE button. The second button SETTINGS is to open the window to see and adjust the settings for the selected Flow Control.



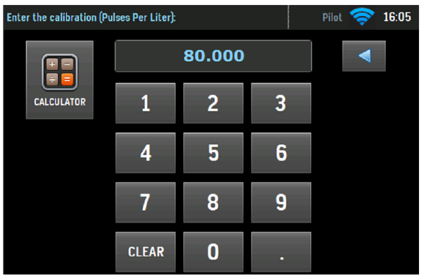


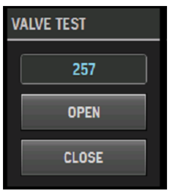




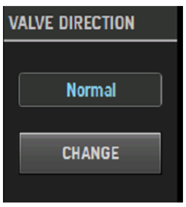


When you push the CALIBRATE button it will bring up the Keypad where you will enter the calibration number of the Flow Meter that you have installed on the Aircraft/Helicopter. this number will show as either PPL (Pulses per Liter) or PPG (Pulses per Gallon).

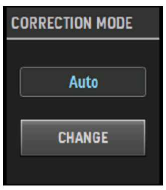




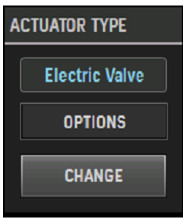
The VALVE TEST lets you push the OPEN and CLOSE buttons to fully open/close the Valve with positional feedback



The VALVE DIRECTION should be normal, however, if the Valve motor wires are backwards, then temporarily the direction can be reversed.



The CORRECTION MODE is either Auto or Manual. If you use the Valve Test, it will change to Manual Mode

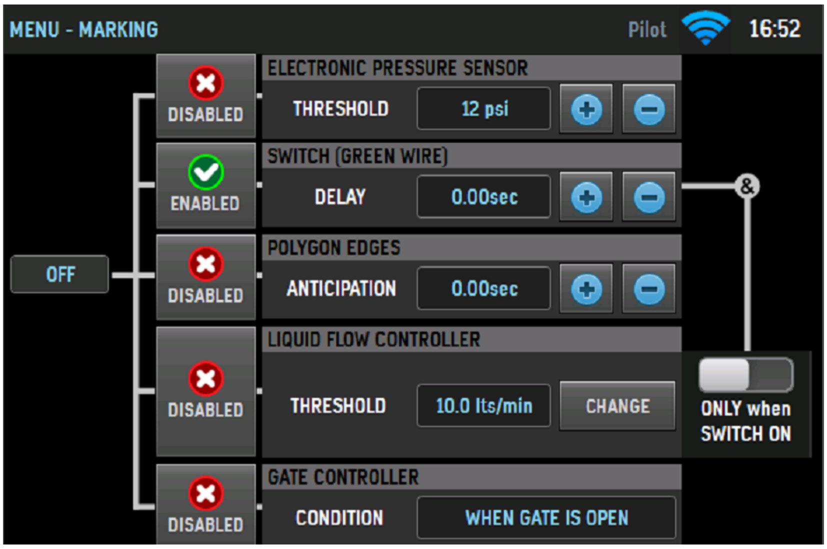


The ACTUATOR TYPE can be change from Electric Valve to Isolair Motor to run an Electric Motor Driven Pump. This also works for Hydraulic Motor driven Pumps for Flow Control.

SETTINGS MENU

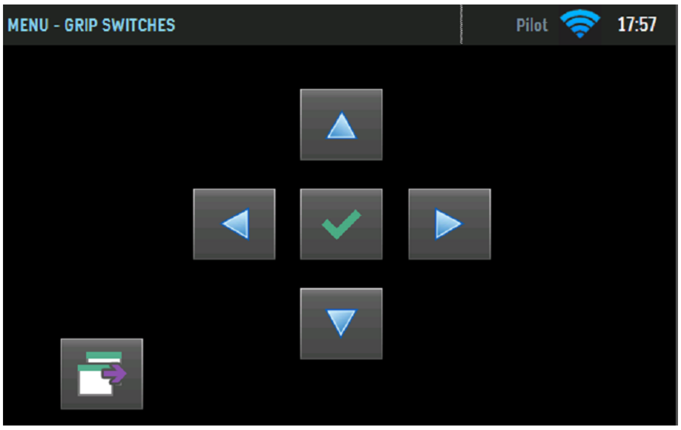
DEVICES > MARKING> GRIP SWITCHES > ALTIMETER

MARKING selections can be customized to suit your requirements.

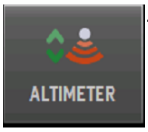


If **ELECTRONIC PRESSURE SENSOR** is connected to the Vektor MAX, then this can be Enabled and the **THRESHOLD** is set to your disired spray on transition pressure for Marking. If this is used the **SWITCH (GREEN WIRE)** should not be used.
If using **AUTOBOOM**, then **POLYGON EDGES** can be enabled to Mark. You can use the **LIQUID FLOW** for marking only when the switch is on and having the Green wire wired for use with Money handle switch. If the system is using a Gate Controller system for dry material Flow Control, the **GATE CONTROLLER** can be enabled using the Gate Command for Open/Close

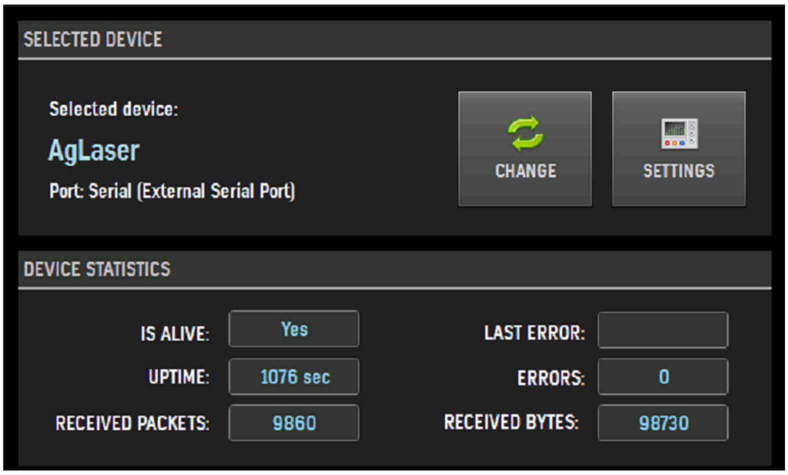
If using the Optional **DynaGrip Kit** on your control stick, then this **GRIP SWITCHES** menu can be used to test or use the touchscreen to operate.



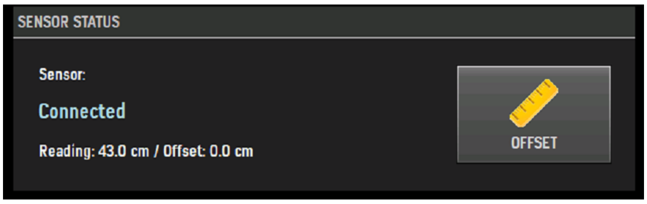
This **DynaGrip** option has a 5 way TopHat switch and an Enter Switch on the p|ilots grip that is shown in this window to the right. The settings of this top hat can be customized for different control options.
The standard operation is the Up/Down direction is for zooming the map. it shows LEFT, RIGHT, UP and DOWN. The center button with Green Checkmark is ENTER. the Icon on the lower left of the screen is refered to as the WINDOW button (the push directly in on the 5 Way TopHat switch.



The **ALTIMETER** is where you can select the Laser Altimeter that is installed and connected to the Vektor

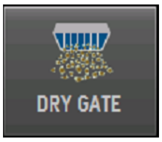


This winow shows the Connected device as well as the Packets being received. By going into **SETTINGS**, you can put an offset in to show the actual altitude from your Booms.



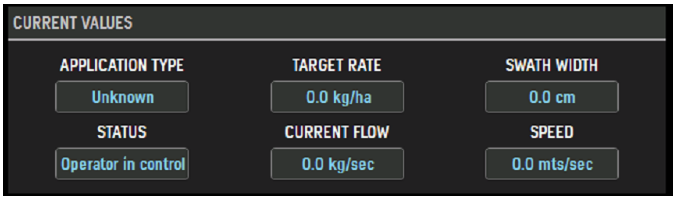
SETTINGS MENU

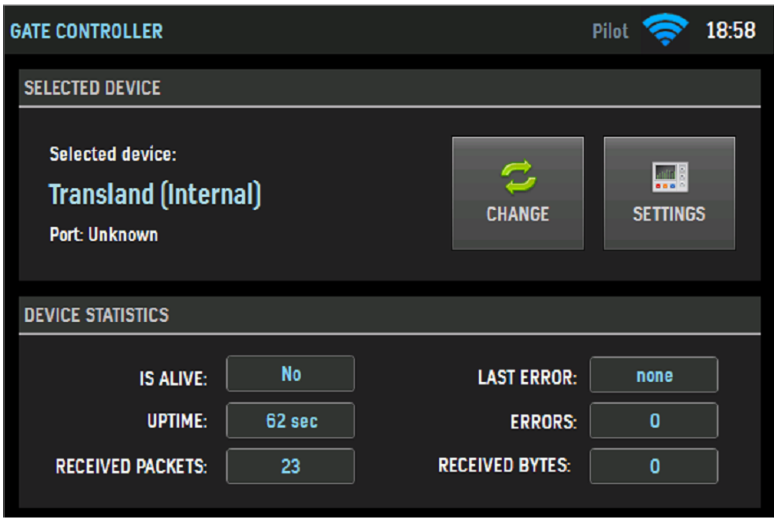
DEVICES > DRY GATE > SCREEN

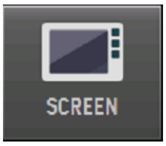


The **DRY GATE** button brings you to the screen on the right where you can select from different Dry Gates that are connected to the Vektor Max.

When the **SETTINGS** button is selected, you can adjust see the **CURRENT VALUES** that the Controller is currently using.



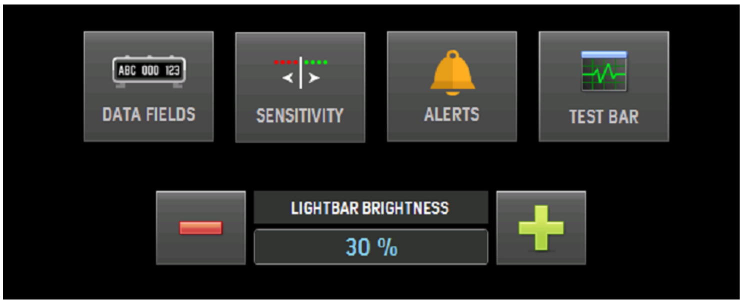




By Pushing the **SCREEN** Button, you will enter a **TOUCH SCREEN CALIBRATION** window where you can run the software to calibrate where you touch is correct.

LIGHTBAR > DATA FIELDS

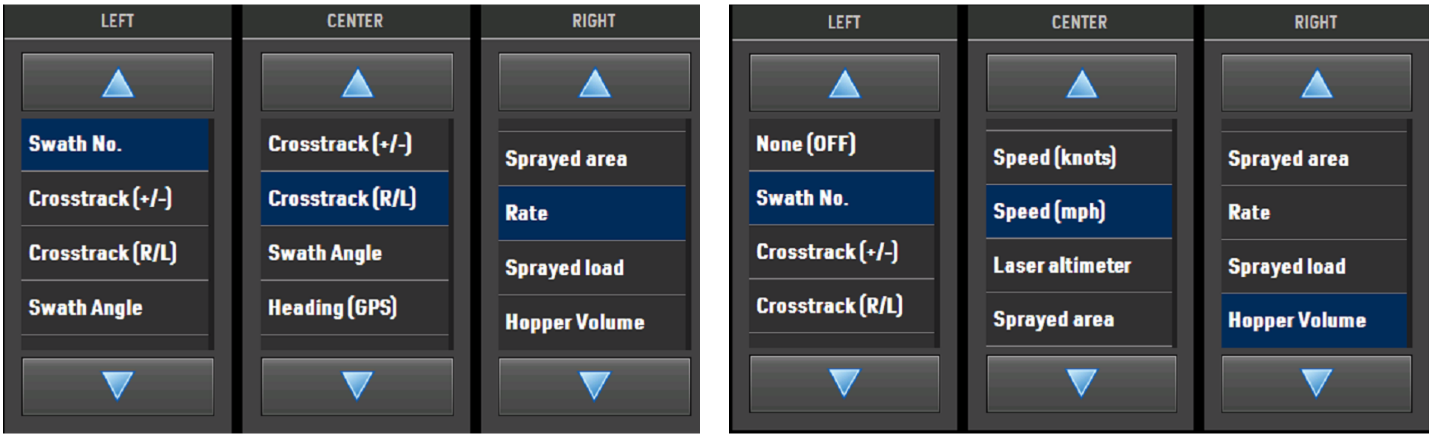
When entering the **LIGHTBAR** area, there will be many settings that can be adjusted to meet you needs. the first thing is you can adjust the **LIGHTBAR BRIGHTNESS**.



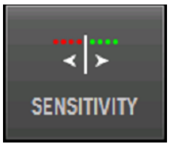
When entering the **DATA FIELDS** you can change what you see on the lightbar for each of the three fields on the lightbar. You get to choose what shows during **SPRAY ON** as well as **SPRAY OFF**

SETTINGS MENU

LIGHTBAR > DATA FIELDS > SENSITIVITY > ALERTS > TEST BAR

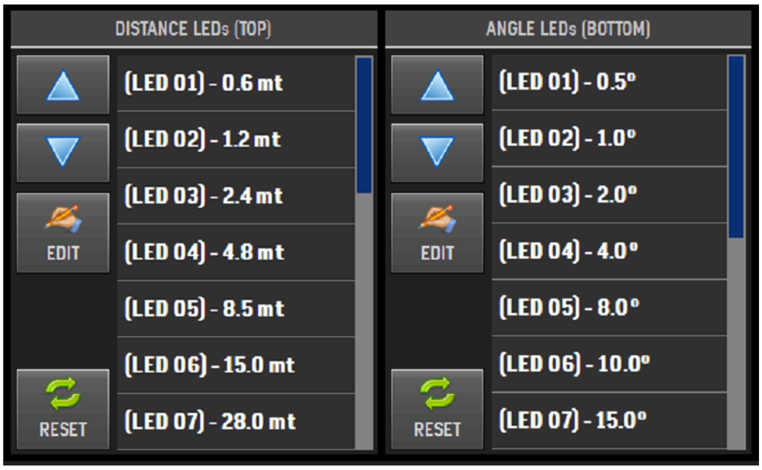


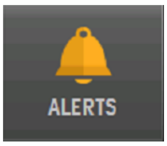
Example: SPRAY ON SPRAY OFF



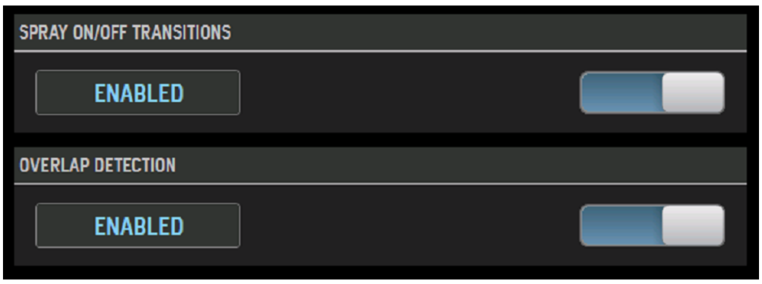
The Lightbar Sensitivity has defaults for the DISTANCE LEDs and the ANGLE LEDs. However you can adjust these as you require.

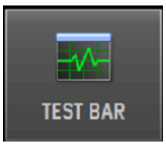
If you are having difficulty tuning these up, you can always hit the RESET to bring back the Defaults.





ALERTS are in 2 ways, the SPRAY ON/OFF TRANSTIONS is for a countdown timer on the lightbar when approaching a transition point. This point can be polygon edge or a spray off point in a partly sprayed swath. The OVERLAP DETECTION is if you are spraying over and area already covered, the Lightbar will display "OVERLAP". These can be ENABLED or DISABLED

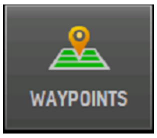




When you press the TEST BAR button the lightbar will go through a sequence of turning on the LEDs one at a time then trun them off in a sequence one at a time. Each segment will go through the complete alphabet to test each segment of the alphanumeric digits. this way you can make sure the lightbar is fully functional

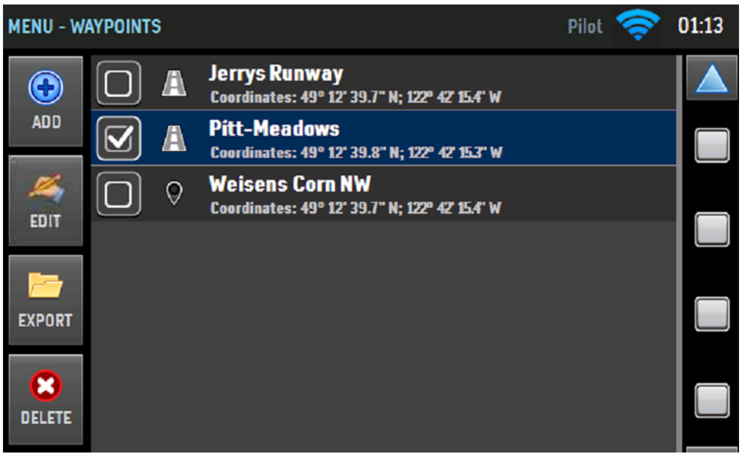
SETTINGS MENU

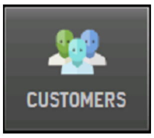
DATABASE > WAYPOINTS >CUSTOMERS >FLIGHTLOG > AICRAFT/PILOT



This opens a WAYPOINTS menu where you can ADD Waypoints that get permanently stored.

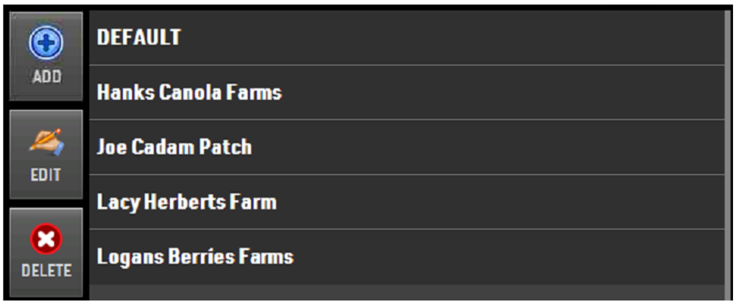
Also this is where you can EDIT Points that you have temporarily added while you were flying such as a point of interest, or a farmers landing strip, etc.
Further to this, you can EXPORT any of these waypoints and DELETE them if no longer useful. The list is automatically alphanumerically sorted.

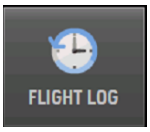




This opens a CUSTOMERS menu where you can ADD Customers that get permanently stored.

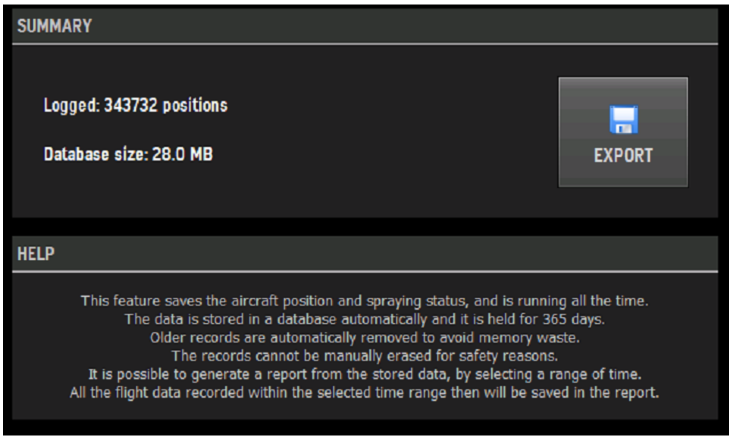
Also this is where you can EDIT Customer Names that you have temporarily added while you were creating a New Job.

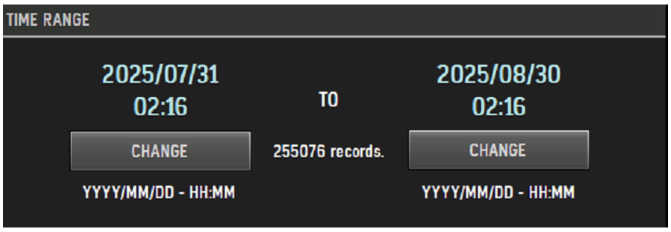


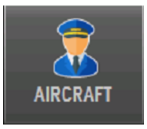


This FLIGHT LOG stores a 1 year buffer of the complete flightline and spray on/off.

You can Select a Date/Time Range to EXPORT the data from this Back Up FLIGHT LOG which will give you a Google Earth As Applied Map

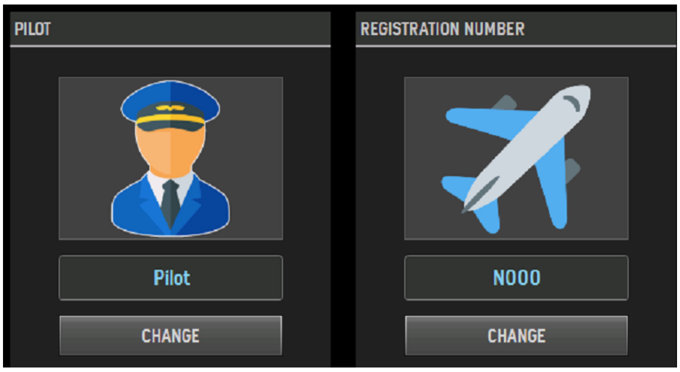






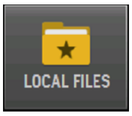
This AIRCRAFT Button is where you can change the PILOT Name as well as the Aircraft REGISTRATION NUMBER.

This PILOT and AIRCRAFT REGISTRATION will be added as part of the job record that is exported from this unit.

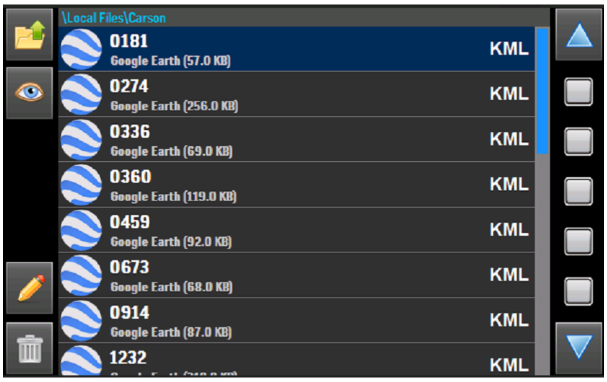


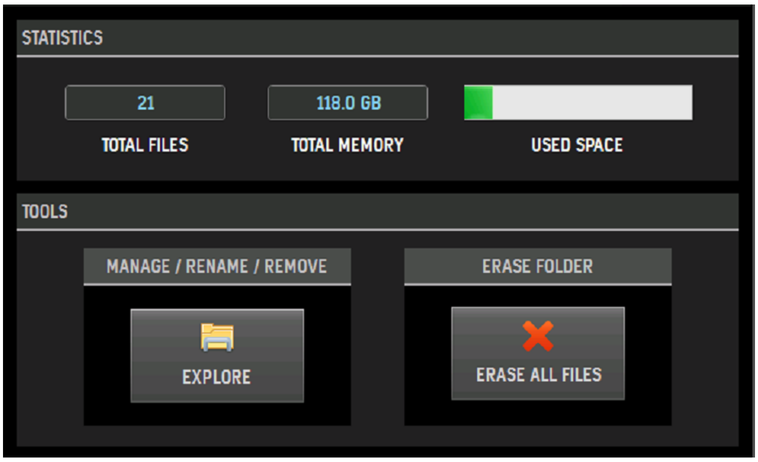
SETTINGS MENU

DATABASE > LOCAL FILES > MAINTENANCE

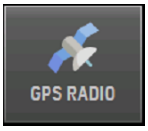


The LOCAL FILES is where you can see the statistics of your memory space, also MANAGE/RENAME/REMOVE files.

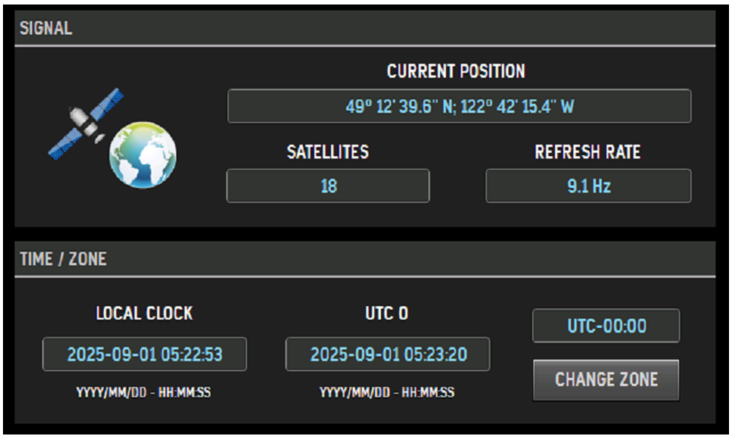




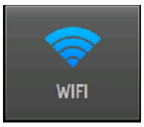
RADIOS > GPS > WIFI



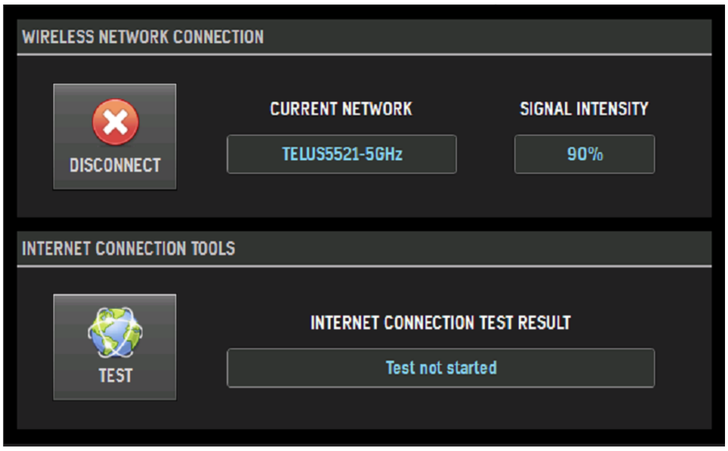
GPS RADIO window is where you can get all of the information on the GPS Receiver.



This GPS window gives information about teh GPS SIGNAL as well as the CURRENT POSITION in Lat & Long D.M.S.
The TIME / ZONE will display both Local Time as well as UTC time. In oorder to display Locaal Time,you need to use the CHANGE ZONE to enter your Time Zone.



This WIFI buttonis where you go to the WIRELESS NETWORK CONNECTION Window.

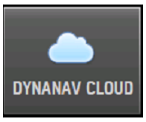


In this window, you click on the CURRENT NETWORK area to select from the list your WiFi connection you want. This can be your Office/Hangar Wifi or your HotSpot on your Phone. Once selected and the Password entered, you will have a connection to that and will show your SIGNAL INTENSITY. If you are connected, you can push the TEST Button to see that you get a Ping and how long it is.

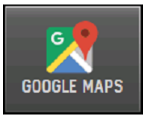
SETTINGS MENU

PLUG-INs > DYNANAV CLOUD > GOOGLE MAPS > POLYGON MAKER

The DROPBOX is no longer supported.

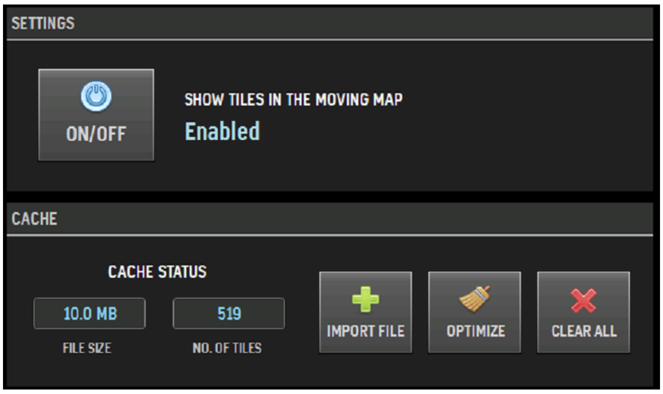


DYNANAV CLOUD Is for our Future Cloud Based File Transfer and live updates between Air and Office.



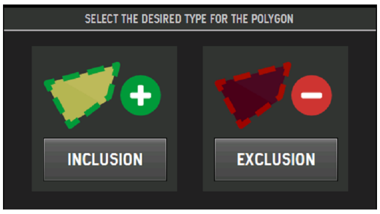
GOOGLE MAPS is where you can Enable Google Earth Back ground Maps.

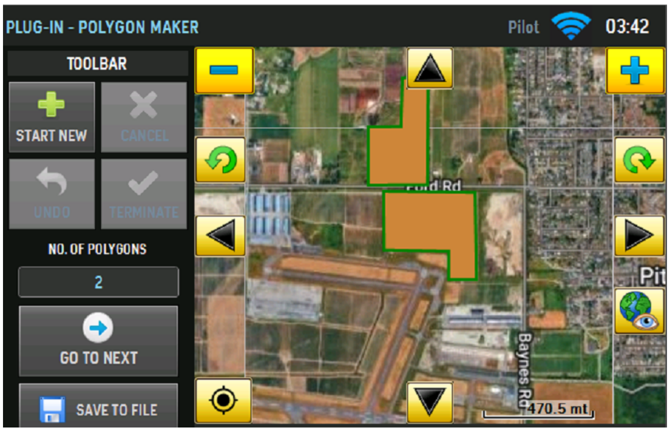
When WiFi Enabled, the GOOGLE MAPS will show up in the Working Map while doing a job as well as in the POLYGON MAKER and the review windows.



When you press the POLYGON MAKER Button, this POLYGON MAKER window pops up.

When you push the START NEW Button, you will be asked to Select The Desired Type of Polygon, whether it is an INCLUSION or EXCLUSION.

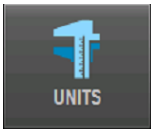




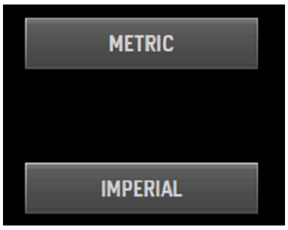
When you select whether Inclusion or Exclusion, it will bring up a Keyboard to enter the name you want for this Polygon Area. After you have marked out your Polygon, hit the Terminate buttom and it will show the Area filled in. If you want multiple polygons for this area, then repeat this for each area. once done, then SAVE TO FILE.

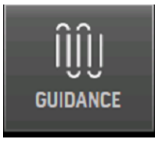
SETTINGS MENU

SYSTEM> UNITS > GUIDANCE > MOVING MAP > DYNAMICS > SERIAL PORT

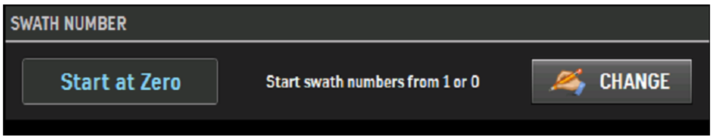


UNITS is where you get to select between METRIC and IMPERIAL

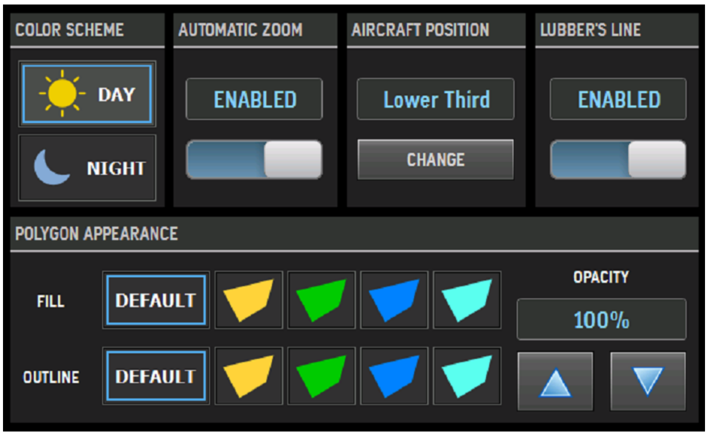




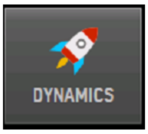
GUIDANCE is where you can CHANGE between starting you SWATH NUMBER at either 0 or 1



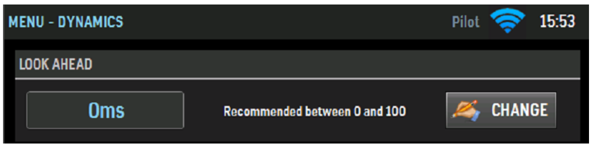
This MOVING MAP window is where you can do adjustments to the Moving Map on your touchscreen.

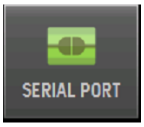


The DAY and NIGHT modes are for bright Day operations as well as Night operations. When you have dimmed the display for night, this NIGHT mode also changes the display for betteer dimming at night.
AUTOMATIC ZOOM mode automatically zooms the map when you are on line.
AIRCRAFT POSITION is where you can change where the aircraft shows on the Moving Map. this can be the Middle (Default) or Lower Third.
LUBBER'S LINE, when ENABLED is a dotted line that shows up on the Moving Map in the Navigation window for better alignment to the field being worked on.
POLYGON APPEARANCE is where you can change the FILL, OUTLINE and OPACITY of the polygons on the moving map.

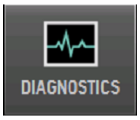


DYNAMICS is for the Moving Map and the Polygon to LOOK AHEAD by a small amount for the pilot to anticipate when to turn on and off.

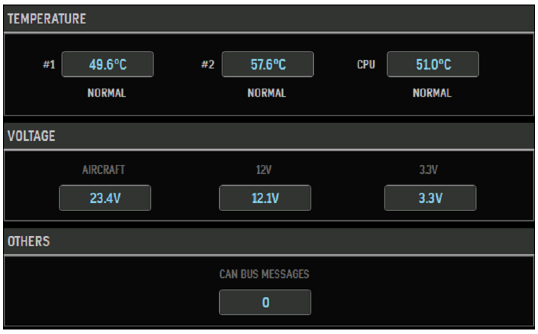


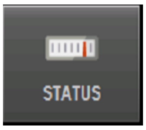


SERIAL PORT gives a report of what SERIAL PORTS are available for what.



DIAGNOSTICS is for Technicians purpose.



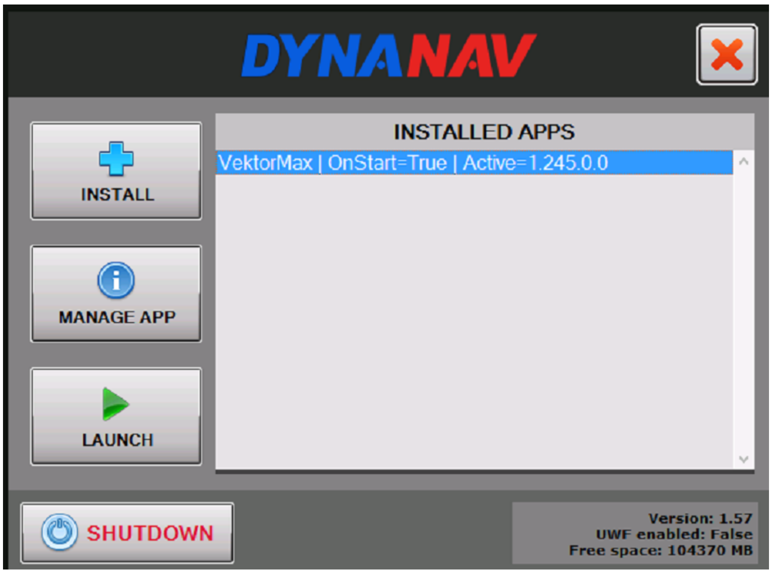


STATUS is to show the Internal Temperatures of the PC Board and CPU. Also it gives the VOLTAGE of the AIRCRAFT input, the internal 12V and 3.3V. If a CAN BUS device is connected, it will give a live count

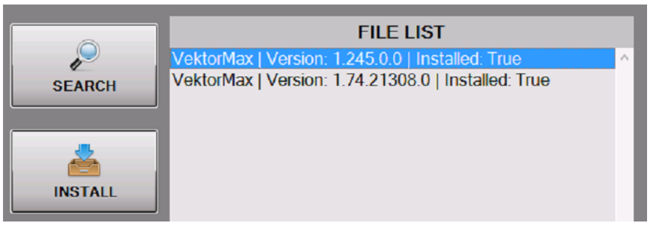
SETTINGS MENU

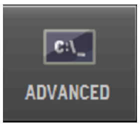
SYSTEM > UPDATE > ADVANCED

UPDATE button when accessed will close down your program and bring up this UPDATE window.



From here you willpush the INSTALL button, then push the SEARCH button. It will come up with a FILE LIST of available Update versions. Select and highlight the one you want and push the INSTALL button. once installed, then push the CANCEL button and in the list of INSTALLED APPS, highlight the one you want and LAUNCH





This ADVANCED area is for the Support Team to access necessary items for troubleshooting and support. It is Password protected.

SWITCHING OFF THE SYSTEM

SHUTTING DOWN THE SYSTEM

Like all electronic systems that have persistent memory to store information, the system requires a process to be shut down properly.

ATTENTION:

Powering down the system without waiting for the shutdown process can damage the working files, corrupt the operating system data and cause irreparable damage. Various protection mechanisms are used for the system to automatically recover from an improper shutdown, however there is no guarantee that the saved files will be recovered.

To avoid improper shutdown problems take the following precautions:

Avoid start the engine after the system is running.

Make sure the battery is in good condition and has voltage greater than 12V DC.

Do not make changes in the power cable. Use the cable supplied with the system.

Do not touch the metal contacts of connectors.

Avoid connecting problematic USB devices in the system.

Do not remove the SD card from the system while it is working.

The shutdown process can be triggered by the "Shutdown" button present on the initial screen.

The system will take few seconds to perform the shutdown process. When the blue LED in the right side turns OFF it means that the system can be powered off. Internal circuits will still be working as they never power off completly. The switch in the front keypad can be used to wake up the device when it was turned off through the software. For safety reasons the front keypad switch will not switch off the device. The procedure must be done through the software.