

# SPOT User Guide

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This user guide will give you all the essential information needed for interacting with, configuring, and deploying a Wildlife Computers SPOT tag.

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## Before you Begin



The information contained in this guide is designed to help you get the most from your deployment. In the guide, you will see the yellow icon highlighting information where special attention should be paid.

The list below shows what is required to interact with a SPOT tag:

- A Windows® computer with Tag Agent and our USB driver installed
- A Wildlife Computers Portal Account
- A Wildlife Computers Communications Cable
- A magnet

Visit [www.wildlifecomputers.com](http://www.wildlifecomputers.com) to create a Portal account and download the required software. At the end of this document there is a list of key concepts to reference. We recommend new users review this list.

## About the SPOT

The Wildlife Computers SPOT tag is an Argos transmitter that includes temperature and wet/dry sensors.

SPOT tags transmit to the Argos satellite system. Consecutive transmissions received in a single satellite pass are used to calculate the location of the tag and its host animal. See <http://www.argos-system.org> for more information on Doppler locations.

SPOT tags have an on-board clock that keeps track of when a transmission should be made. When it is time to make a transmission, the SPOT monitors its wet/dry sensors. As soon as the sensors indicate a dry condition, transmission is initiated.

## Anatomy of a Tag

Wildlife Computers offers SPOT tags in many different shapes to suit a variety of applications. While the shapes may differ, all SPOT tags have several elements in common (Figure 1).

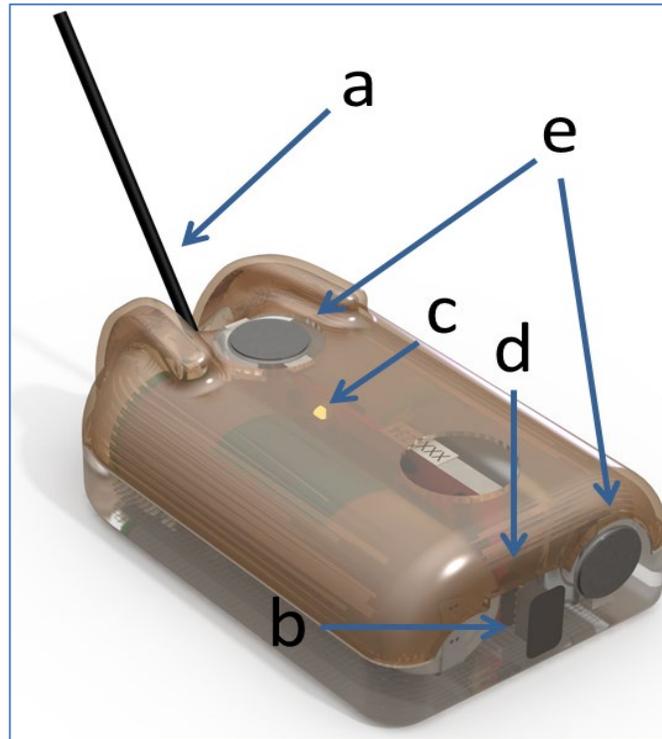


Figure 1—typical backmount SPOT showing: (a) Argos antenna, (b) communications port with plug, (c) LED indicator light, (d) magnetic switch, and (e) wet/dry sensors.

**Note: the magnetic switch is not visible. It is located near the base of the communication port. Swiping a magnet across the communication port will activate the switch.**



The wet/dry sensor is composed of two or more metal discs on the surface of the tag. **Do not cover any of the metal discs** with anything including antifouling substances and/or attachment adhesives (e.g. epoxy). Sea water contact is essential for normal function of the tag.

The communications port is where the Wildlife Computers Communications Cable connects to the tag. Prior to a deployment, this port should be sealed with the plug provided. Smear a small amount of the silicone grease supplied onto the sides and bottom of the plug, align the plug and pins, and carefully push the plug into the port. If it does not align easily with the pins, rotate it 180° and try again. The plug prevents corrosion of the pins during the deployment; however, the plug is not required for the tag to function normally.

## Tag States

SPOT tags have three states—Auto-start, Start and Stop.

**Auto-start**—when in Auto-start mode, the SPOT tag will automatically deploy when submerged in seawater.

**Start**—when in Start mode, a SPOT tag is running and will transmit to Argos satellites. When first deployed, the tag’s LED will blink every second. This “heartbeat” blink provides visual confirmation that a tag switched from Auto Start to Start and is meant to prevent deployment of deactivated tags. Additionally, the LED will blink brightly whenever the SPOT tag transmits to the satellite. The duration of both the heartbeat blinks and transmission blinks is user-programmable (see [Miscellaneous Settings](#) section). For some applications, it may be best to disable the blinks as they can draw unwanted attention to the tagged animal.

**Stop**—Stop mode is used for storing and shipping tags. In Stop mode, the tag will remain unresponsive until the tag is communicated with via Tag Agent. If storing tags, keep them in a cold place such as a refrigerator or freezer. [See Tag Storage and Battery Maintenance.](#)

### Display a Tag’s State Using a Magnet

Passing a magnet near the communications port will cause the tag to reveal its current state using the LED.

- Two blinks and a pause repeated three times means the tag is in Auto-start mode.
- Ten rapid blinks indicate the tag is Started.
- No blinks indicate the tag is Stopped.

### Change a Tag’s State Using a Magnet

A timed magnet swipe can be used to change the state of a SPOT between Auto-start and Start modes.

First, swipe the magnet and wait for the tag to indicate its current state. At the end of the blinking pattern, the indicator light will remain on for several seconds. If the magnet is swiped a second time during the extended light-on stretch, the state will toggle. The second swipe needs to happen in the window when the light is on (Figure 2).



Figure 2—sample of the indicating light pattern

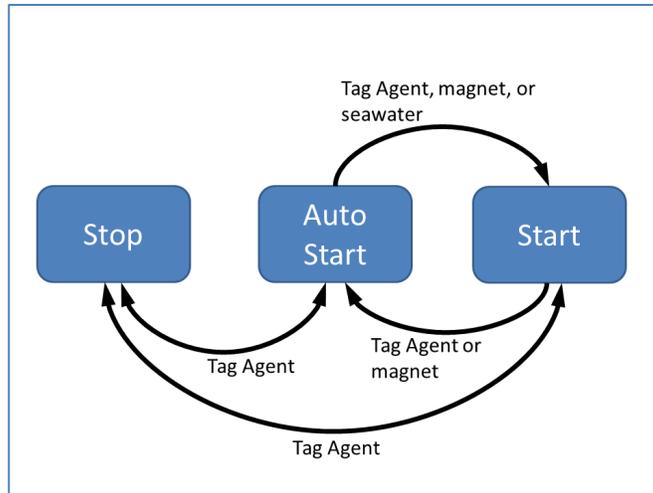


Figure 3—methods for changing a SPOT states. Tag Agent can be used to put a SPOT in any state.

## Interacting with a Tag

### Tag Agent

Tag Agent is used to communicate with SPOT tags. A local copy of Tag Agent must be downloaded the first time you use it. Once installed, all updates to the tag’s setup are done directly through the local copy on your machine. More information on using Tag Agent can be found in the [Wildlife Computers Data Portal & Tag Agent User Guide](#).



**The USB driver must be installed and a Wildlife Computers Data Portal account must be created prior to opening and using Tag Agent.**

Each time Tag Agent is launched, you’ll be greeted by a welcome screen (Figure 4). Along the bottom the Tag Status, USB Status, and Cloud Status are displayed.

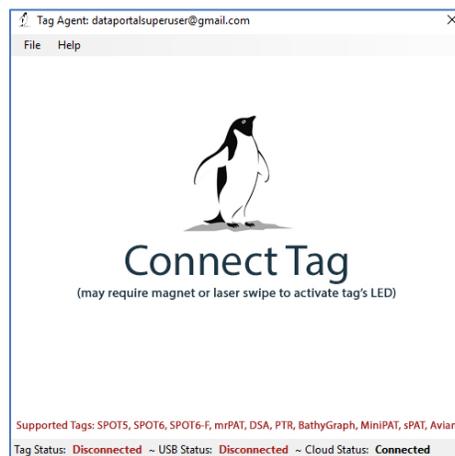


Figure 4—Tag Agent welcome screen.

## Connecting a Tag to Your PC



To communicate with a tag, open Tag Agent and use the USB communication cable to plug the tag into your PC. **Make sure to align the pins properly.** Once plugged in, swipe a magnet near the tag's communication port to establish a connection. The Tag Agent home screen will appear with tag information on the left and sensor readings on the right (Figure 5).

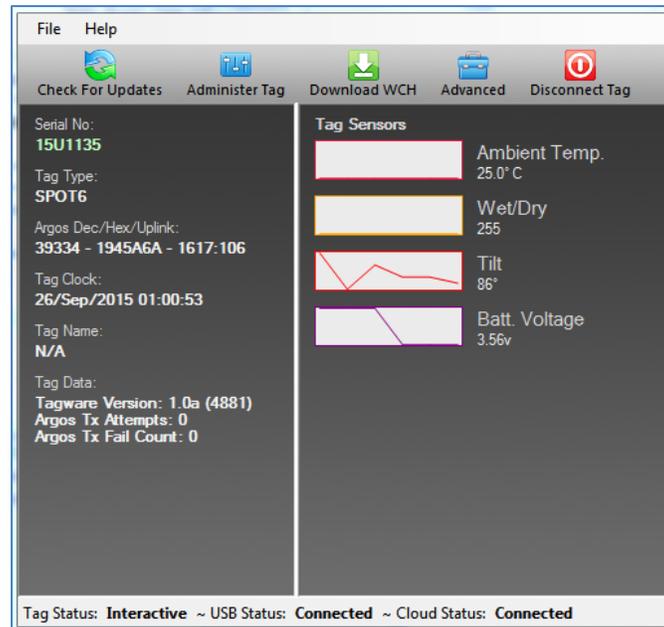


Figure 5—Tag Agent home screen.

If this is the first time you are communicating with a tag, a pop-up box will ask if you'd like to become the tag administrator. Selecting 'yes' will allow you to select and publish tag settings.

## Configuring Tag Settings

Use the Administer Tag button in the upper menu of Tag Agent to configure tag settings.



Figure 6—Tag Agent menu bar. Select Administer Tag to edit tag settings.

A new window will open revealing three categories—Tag Information, Data Product Settings, and Transmission Settings.

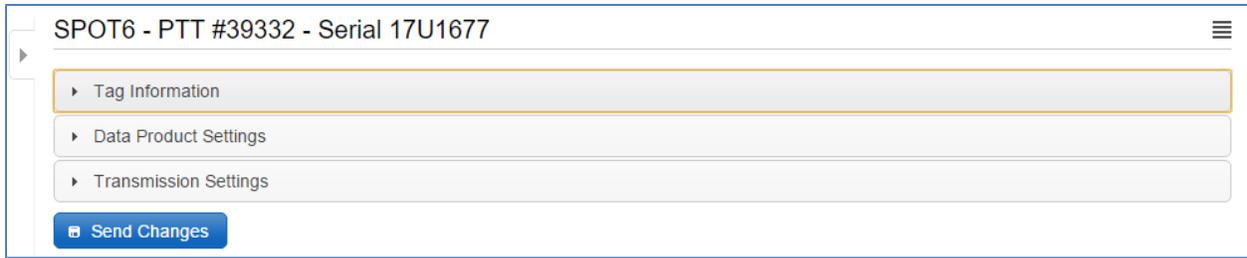


Figure 7—collapsed version of SPOT tag programming categories.

## Tag Information

### Tag Details

This tab includes information on tag administrators and the Tagware version. A friendly name can be assigned to the tag if desired. This can make it easier to search and filter for the tag within the portal.

### Argos Settings

The PTT decimal and hexadecimal numbers as well as the Argos uplink ID are listed here. PTT numbers are a manufacturer’s setting. Contact Wildlife Computers if a change is needed.

### Miscellaneous Setting

SPOT tags include an LED that blinks for a set amount of time after deployment starts. The blinks are a way to visually confirm a tag has switched from Auto-start to Start mode. Consider disabling the blinks if your animal may be compromised by the flashing LED.

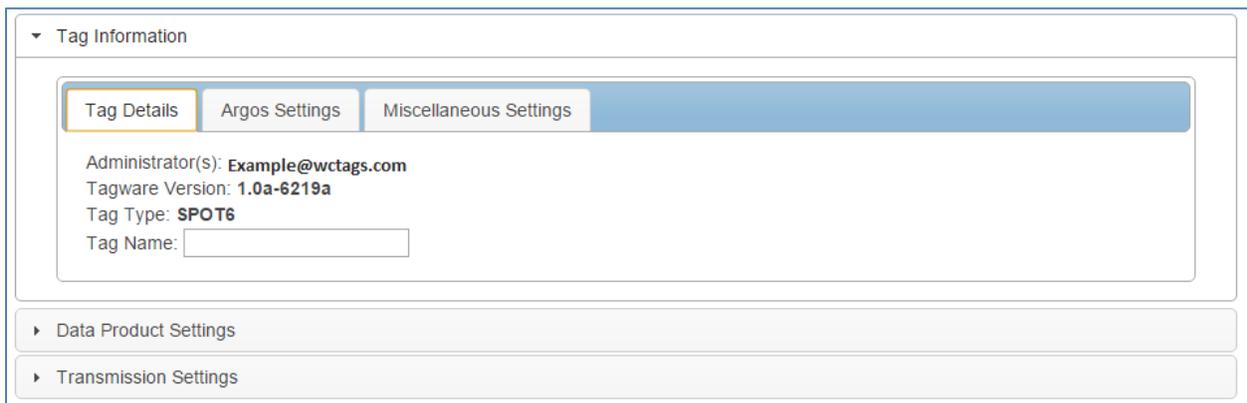


Figure 8—expanded view of Tag Details tab.

## Data Product Settings

In addition to providing locations, the SPOT tag can optionally transmit two data products. These are Time-at-Temperature histograms and Percent Dry Timelines.



**Enabling SPOT data products will generate larger messages which require more power to transmit. The more data product messages created, the greater the impact on battery life.**

## Summary Period Data

### Time-at-Temperature Histograms (TAT)

The Time-at-Temperature histogram reports the amount of time that an animal spent within each temperature bin. The amount of time is reported as a percentage of the histogram summary period.

Select the high temperature limit for each bin. Next choose the summary period. The summary period can range from one hour to 24 hours but the chosen period must divide the day evenly. The summary period begins immediately after midnight UTC by default and runs to the end of the UTC day.

Selecting a six-hour summary period will cause the tag to generate four histograms. One from 00:00 hrs. to 06:00 hrs.; one from 06:00 hrs. to 12:00 hrs.; one from 12:00 hrs. to 18:00 hrs.; and one from 18:00 hrs. to 24:00 hrs. This pattern repeats on the next UTC day.

To measure behavior associated with local time, you can delay the start of each summary period by setting a summary period offset. Choosing an offset of three hours will shift the example summary periods as follows: 03:00 hrs. to 09:00 hrs.; 09:00 hrs. to 15:00 hrs.; 15:00 hrs. to 21:00 hrs.; and one from 21:00 hrs. to 03:00 hrs.



**Choosing a one-hour summary period will cause 24 times more data to be generated than choosing a 24-hour summary period.**

Be aware that the temperature sensor is buried in the tag and has a response time of approximately 30 minutes.

▼ Data Product Settings

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Summary Period Data
Daily Data

**Classic Histograms: Time-at-Temperature** ⓘ ON

Temperature is sampled at a rate of (seconds): 3

Set the high temperature limit for each histogram bin. The tag can measure temperatures from -40°C to 60°C.

Bin #	1	2	3	4	5	6	7	8	9	10	11	12
High °C	3 °C	12 °C	16 °C	20 °C	25 °C	27 °C	30 °C	33 °C	35 °C	37 °C	40 °C	60.0 °C
Low °C	-40.0 °C	3.1 °C	12.1 °C	16.1 °C	20.1 °C	25.1 °C	27.1 °C	30.1 °C	33.1 °C	35.1 °C	37.1 °C	40.1 °C

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Choose the histogram summary period (hours): 6 ▼

Choose the summary period start delay (hours): 3 ▼ UTC

Figure 9—example of Time-at-Temperature histogram with six-hour summary periods and a three-hour start delay.

## Daily Data

### Percent-Dry Timelines

This timeline reports the amount of time the tag is dry. The amount of time is reported as a percentage of each hour in the day. Choosing the Low-Resolution option will cause the tag to report to the nearest 10%. The Low-Resolution timeline will also indicate when the tag was wet for the entire hour and when the tag was completely dry for the entire hour. The High-Resolution option reports to the nearest 1%.

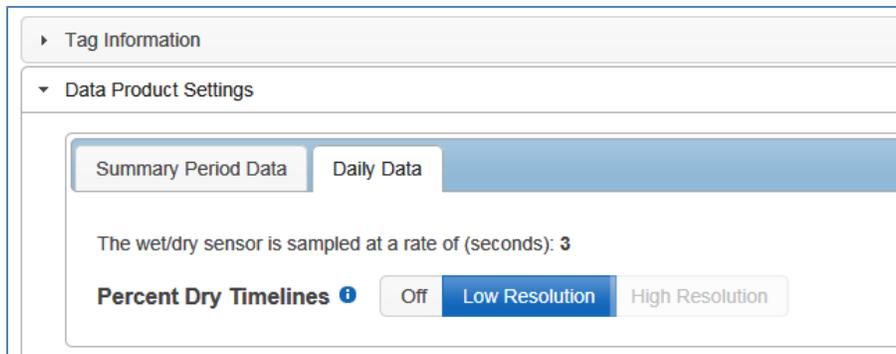


Figure 10—low resolution percent dry timeline enabled.

The percentages are as follows:

<b>% reported in DAP spreadsheet</b>	<b>Amount of time during hour</b>
0	0% (no readings were dry)
3	0% < dry < 5%
10	5% <= dry < 15%
20	15% <= dry < 25%
30	25% <= dry < 35%
40	35% <= dry < 45%
50	45% <= dry < 55%
60	55% <= dry < 65%
70	65% <= dry < 75%
80	75% <= dry < 85%
90	85% <= dry < 95%
98	95% <= dry < 100%
100	100% (every sample was dry)

## Transmission Settings

### Data Uplinks

Argos uplinks serve two purposes—generation of Argos locations and data transmission.

**Location Messages**—SPOT tags send short, three-byte messages for the purpose of generating locations. The location uplink scheduler is used to set hourly or daily transmission limits. The scheduler is highly flexible. See [At-Sea Mode versus Haul-Out Mode](#) section for more information.

**Data Messages**—the tag uses a separate itinerary to transmit data messages. Data throughput is optimized by sending each data message multiple times (approximately 10). Resent messages are separated in time by at least 40 minutes to maximize the odds of reception. Data messages are only combined with location messages when timing coincides.



In summary, SPOT tags transmit two types of messages—short, location-only messages which transmit at a user determined uplink schedule and longer, data-filled messages which transmit according to a preset agenda. Data messages are independent of the location transmit count. A tag programmed to send 250-location transmissions per day and generate 10-data messages could attempt 350 uplinks (assuming each data message is sent 10 times). This is important to keep in mind for power budgeting.

## Transmission Modes

### At-Sea Mode versus Haul-Out Mode

Independent transmission regimes can be set for when an animal is At-Sea versus Haul-Out.

The Haul-Out mode entry and exit conditions are user defined. When haul out is achieved the tag switches to its slower repetition rate (usually 90 seconds).

If tagging an animal that never hauls out, set Haul-Out mode to DISABLED to ensure transmissions always occur at the faster repetition rate.

### Transmission Patterns

Both transmission modes have a schedule that can have one or more patterns.

Patterns can start on a specific calendar date or a fixed number of days after the preceding step. This allows the tag to modify its schedule to accommodate changing requirements during a deployment.

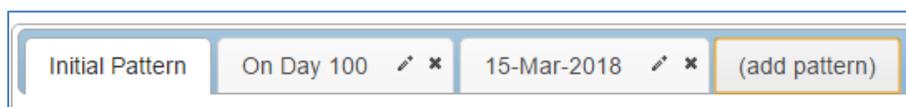


Figure 11—example of a deployment with 3 transmission patterns.

## Transmission Steps

Each pattern is made up of sequential steps and a loop. The pattern will run to the last step, then revert to the step designated by the loop and repeat. This can be any step in the pattern. The loop allows steps in a schedule to be used only once or all the steps to be repeated.

The screenshot shows the 'Transmission Parameters' tab in 'At Sea Mode'. It features an 'Initial Pattern' dropdown set to 'On Day 100' and an '(add pattern)' button. Below is a table with the following data:

Duration	Location Uplink Limit	Limit Type	Pinger	Prevent Data Uplink	Step Lock	Stay Until Midnight	Actions
24 Hours (1 Day)	∞	Total	×	×	×	×	[edit] [lock] [refresh]
24 Hours (1 Day)	250	Total	×	×	×	×	[edit] [lock] [refresh]

An 'Add Step' button is located below the table. A green arrow in the original image points from the 'Actions' column of the second row to the 'Add Step' button.

Figure 12—transmission schedule example with an initial pattern made up of two looping steps. Step one lasts for one day with an unlimited number of transmissions allowed. Step two lasts for 24 hours with a limit of 250 uplinks per day. On day 100, the next pattern is scheduled to begin.

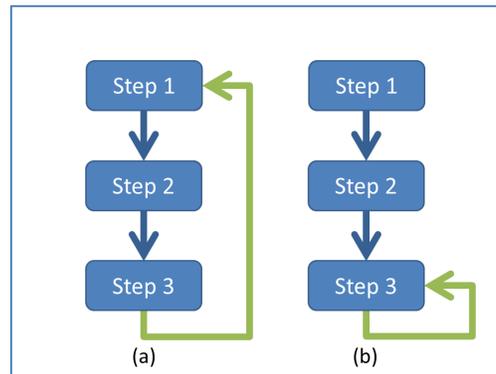


Figure 13—a pattern which repeats all steps (a), and a pattern which uses steps one and two once and then repeats the last step (b).

To configure steps within a pattern, select the pencil icon under the Actions column on the far right.

1. Select the duration of the step.
2. Select the options for the step.
  - Set the Location Uplink Limit—the limit can be either hourly or for the entirety of the step.
  - Enable/Disable the Pinger—the pinger is used for radio tracking recovery.
  - Prevent Data Uplink—this will disable data transmissions for this step. This has significant power savings for some applications.

- Lock the Step—overrides the At-Sea and Haul-Out mode definitions for the duration of the step.
- Stay Until Midnight—locks the step until the UTC midnight after the step was set to expire. It is used as a way to sync subsequent steps to UTC midnight.

The info button next to each option offers additional information.

**Edit Transmission Setting Step**

Select the duration for this step.

Year(s): 0 Day(s): 1 Hour(s): 0

Select the options for the step duration above:

Hourly Location Transmission Limit: 60 (unlimited)

Make Limit(s) Hourly:

Pinger Enabled:

Prevent Data Uplink:  ⓘ

Step Lock:  ⓘ

Stay Until Midnight:  ⓘ

Argos transmissions for this step: 1440.0/day or 60.0/hour

Save Cancel

Figure 14—example of a step lasting one day with an uplink limit of 60 attempts per hour and the pinger enabled.

The daily and hourly transmit settings are displayed at the bottom of the box. A caution symbol appears if fewer than 50 transmits per day are scheduled. Achieving locations from so few uplinks can be a challenge.



**The Location Uplink Limit is the maximum number of transmissions for the duration of that step. It is not a daily transmission limit unless the duration is set to 24 hours.**

If numerous steps have been set, the spiral arrow icon under the Actions column can be used to create loops.

Duration	Location Uplink Limit	Limit Type	Pinger	Actions
24 Hours (1 Day)	25	Hourly	×	ⓘ × ↻
144 Hours (6 Days)	0	Hourly	×	ⓘ × ↻

Figure 15—two looping steps created using the arrow icon.

### Considerations for Setting Location Uplink Limits

1. Hourly limits can be used to distribute transmissions evenly throughout a step. By default, when a step begins, transmissions occur as fast as possible (at the set Argos repetition rate and when a dry environment is detected). Once the uplink limit is achieved, transmissions are suspended

until the next step begins. If a long step duration is set the allowable transmissions may be used before the step is complete. This can result in recurring gaps in location data. For example, in the case of a 24-hour step with a total transmit limit of 400, and a repetition period of 30 seconds, the tag could run through its allowance in the first 4 hours after UTC midnight. Alternatively, a limit of 16 uplinks per hour could be set and locations achieved throughout the day.

2. *Only a fraction of transmissions sent result in locations.* Argos locations require a perfect combination of events.
  - a. A satellite must be overhead (near the equator satellites are overhead roughly 20% of the time)
  - b. The tag and animal must be at the surface
  - c. The tag must be allowed to transmit (the uplink limit must not have been met, and no mask must be on)
  - d. Multiple uplinks must be received during a single satellite pass (ideally 3+)
  - e. When the transmit limit is too conservative it can be difficult to achieve these conditions.
3. *Consider battery capacity and your target mission duration.* SPOT tags can send a finite number of transmissions. Limiting the number of transmissions allowed per step can save battery and extend the deployment. This is especially important for animals that spend ample time at the surface or haul out. For animals that surface infrequently (such as turtles and sharks) animal behavior tends to restrict transmits more than the set limit.

[Contact Wildlife Computers](#) to discuss the battery capacity of your tag, your target deployment length and how frequently locations are required.

## Transmission Parameters

### Argos Uplink Mask

In a given location, there are known, consistent gaps in Argos satellite coverage. The Mask feature can be used to save battery power by preventing a tag from transmitting during hours with few or no satellite passes.



Figure 16—Argos Uplink Mask with UTC hour 10 disabled.

By default, all transmitting hours are enabled (blue). Hours which you choose to disable will turn red and appear with an X.

The best and worst satellite coverage hours can be determined using the Argos Pass Prediction Program. See [Argos Satellite Pass Prediction](#) section for instructions on how to use the program.



If you expect your animal to move more than 500 km East or West, leave all hours enabled as satellite coverage will change drastically enough that masking is not advised. Alternatively, you may run satellite pass predictions for the expected new locations and determine if there are appropriate transmission hours for the animals' entire migration. The Uplink Mask does not impact data collection or the pinger. The schedule only impacts when Argos transmissions are allowed.

### Argos Uplink Settings

The minimum uplink interval (or repetition rate) is displayed for At-Sea and Haul-Out modes.

The typical rate for pinnipeds is 45 and 90 seconds, respectively. Turtles and sharks tend to have faster At-Sea rates (15-30 seconds) to increase the probability of multiple transmissions reaching the satellites.



**The repetition rate is a manufacturer setting. [Contact Wildlife Computers](#) before deployment if you wish to change the interval.**

Argos uplinks can be delayed by fractions of a second once the tag is ready to transmit and becomes dry. This is typically used for large cetaceans to make sure the animal is well clear of the water and not likely to be splashed or re-submerged during an uplink. **Note: the dry readings are attempted at 0.25 second intervals.**



To maximize the probability of receiving data messages, it is recommended that each unique message be sent 10 times. Changing the number of times a message is resent will greatly impact what data is received.

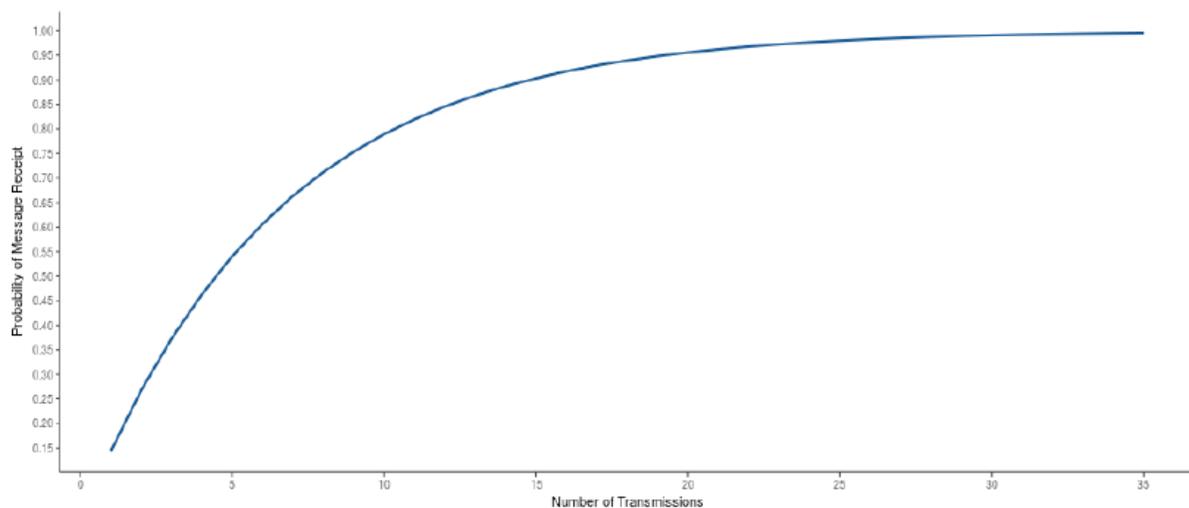


Figure 17—graph showing the probability of successful data transmission with an increasing number of re-transmits for a specific location. A per message corruption rate of 10% is assumed.

## Loading Settings into a Tag

Once settings have been chosen use the blue Send Changes button to load settings into the tag. Tag Agent will confirm receipt of settings with a pop-up box.

## Creating Templates

A template can be saved so the same settings may be applied to multiple tags. To save settings as a template, click the four horizontal lines in the shape of a square ≡ visible in the top right corner of the screen. You have the option of creating an online template or a local template file of the current settings selected. Local templates are used when no Internet connection is available.

## Viewing Configuration History

You can review a tag's programming history using the arrow icon on the left-hand sidebar menu. Clicking the arrow exposes the tag history. Previous tag settings can be viewed by clicking on each date listed. The blue check mark indicates settings were applied. A date without a check mark indicates settings were proposed but not applied to a tag.

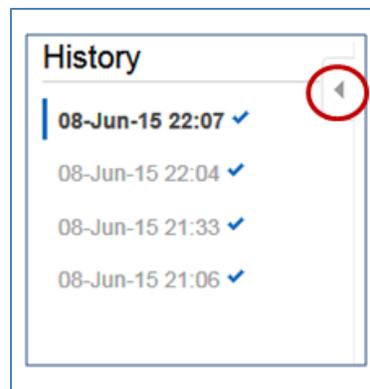


Figure 18—arrow icon exposes tag programming history.

## Check Sensor Readings

The sensor values displayed on the Tag Agent home screen are continuously updated from the tag. Sensor functionality can be validated by manipulating the sensors as follows:

- Internal Temperature—this will change slowly as the entire tag changes temperature. Leaving a tag in a refrigerator for a while will change the value.
- Wet/Dry—connecting a wire between a ground and active wet/dry sensor disc should change the value from 255 to less than 20.

## Test Transmission

Under the Advanced button on the top menu there's an option to Send Test Transmission. When selected, a pop-up box with transmission values will appear.

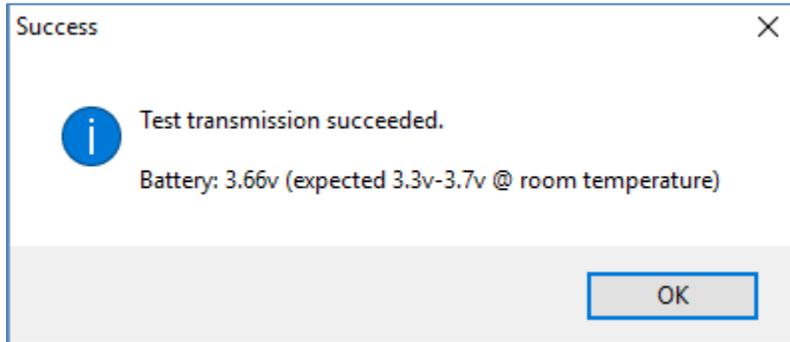
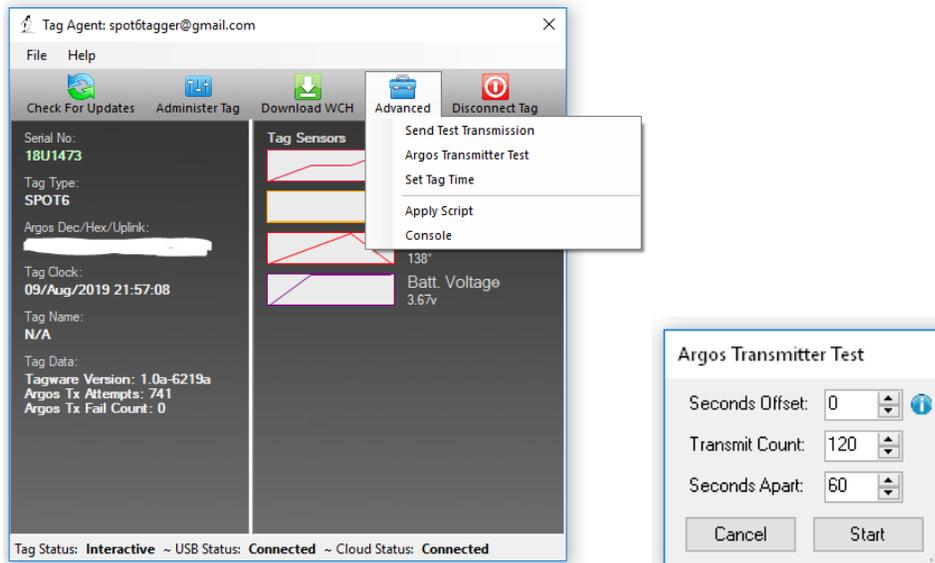


Figure 19—test transmission results.

The battery voltage value will be lower in the pop-up box than on the Tag Agent home screen because it is measured when the battery is driving a transmission.

## Argos Transmitter Test

The Argos Transmitter test allows for a full system test to confirm that the tag is successfully sending messages to the Argos satellites. Click on the Advanced Tab then Argos Transmitter Test.



- Seconds Offset: If you will be testing multiple tags at one time, you can use this parameter to offset transmissions so the tags will not transmit at the same time.
- Transmit Count: How many times you want the tag to transmit. 120 transmissions at a 60 second interval will provide a 2-hour test, which is usually enough to coincide with a couple of satellite passes. Check the satellite passes in your area prior to beginning the test.
- Seconds Apart: The time between each transmission. 60 seconds is standard.

When all of the tags are setup and deployed, take them outside where they have a full view of the sky.



***Upon completion of the Argos Transmitter Test, the tag will be in STOP mode and you will need to communicate with it again prior to deploying it.***

## Disconnect from SPOT

Use the Disconnect button on the upper right of the Tag Agent home screen menu to select the tag state before unplugging. If you are planning to deploy in the near future, select Auto-start. The tag will then auto deploy upon submersion in saltwater.



***Always disconnect the tag using the Disconnect button. Unplugging without setting the tag state could leave the tag in a state that will rapidly deplete the battery.***

## Using Tag Portal to Select Settings Remotely

Tag Portal is the cloud-based service offered by Wildlife Computers for remotely selecting tag settings. Configuring can be done without connecting to your tag. This enables project coordinators to review and select settings for their associates and programming to be done while tags are in transit, before arrival. More information on using Tag Portal can be found in the [Wildlife Computers Data Portal & Tag Agent User Guide](#).

When logged into your portal account, a list of the tags for which you have administration rights can be viewed under the My Tags tab. To select settings, click on the serial number of the tag you wish to configure or use the pencil icon.

This will open a new window with setting selections. The same programming options are available whether settings are configured via Tag Portal or from within Tag Agent.

Once settings have been selected in Tag Portal, click the blue Propose Changes link. This will save the settings into the Cloud. The next time the tag communicates with Tag Agent (no matter who plugs in the tag), a notification will appear stating that new settings are awaiting upload.

Multiple set-ups can be published resulting in a queue of configurations awaiting upload. In this case, a dialog box will reveal a list of the configurations, when they were selected, and which administrator chose the settings.

Tag Portal maintains a historical record of tag settings each time changes are uploaded into a tag. The record is instantly updated so long as an Internet connection is available.

If tags are programmed offline using Tag Agent, the next time an Internet connection is established and Tag Agent software is open, the record automatically updates.

## Offline Mode

Before programming can be done offline, Tag Agent must be downloaded and opened with valid credentials entered while connected to the Internet. Credentials are your Wildlife Computers Data Portal login username and password.

As long as the software has been opened once and credentials entered, programming offline is possible. To program settings, select Administer Tag from Tag Agent's top navigation bar, configure the tag, and click Send Changes. A dialog box will confirm when settings are loaded into the tag.

The next time an Internet connection is established, and Tag Agent software is open, the historical record will be updated in Tag Portal.

Online templates are not accessible when working offline. To program a group of tags with the same settings when working without an Internet connection, you need to create a local template. A file of the selected tag settings will be saved onto your local machine. Local templates can be created and applied in the Template Manager. Expose the Template Manager with the icon in the upper right corner of the screen.

The Internet connection status is displayed at the bottom of the Tag Agent home screen.

## Tag Storage and Battery Maintenance

Proper tag storage is important to minimize passivation and keep the batteries charged. When stored correctly, the amount of battery life lost per year is only 1-2 percent.

### **SPOT Storage—Less Than One Month**

Not much needs to be done as you will be deploying them soon. Wildlife Computers recommends storing tags in a cool, dry environment—ideally around +5° C.

### **SPOT Storage—Longer Than One Month**

If you will be storing SPOT tags longer than one month, you will need to place your tag in "Stop" mode using Tag Agent and exercise the batteries every 3 months.

Connect to each tag and login to Tag Agent. In the menu at the top, you will see the "Disconnect Tag" tab. Scroll down to "Stop." The tags can now be stored. Wildlife Computers recommends storing tags in a cool, dry environment—ideally around +5° C.



Every few months we suggest exercising the tag’s batteries by sending several test transmissions. This can be done in Tag Agent. Select Advanced and then Send Test Transmission. The transmission voltage should read approximately 3.2v and the battery voltage level displayed on the main sensor screen should be around 3.5v. It may take several transmissions for the tag voltage to build up after storage.

If you receive a low voltage reading, it may be due to passivation. Turn the tag on and leave it outside for several hours. Then reconnect to Tag Agent to see if the transmission voltage level has increased.

## Technical Specifications

Below are general physical specifications of SPOT tags.

Pressure rating	2000 m for most shapes
Operating frequency	401.678 MHz
Sensors	Temperature, Wet/Dry
Temperature	Range: -40° C to 60° C / Resolution: 0.05° C
Conductivity operational limits	0.1 to 5 S/m
Communication	Via USB port using Wildlife Computers USB communications cable

## Additional Information

### Glossary of Terms

- Administrator—someone who has the authority to publish tag settings.
- Argos ID—uniquely identifies a transmitter for the Argos system. The ID consists of a decimal number and a hexadecimal (base 16) number.
- Argos Location—a location generated by the Argos system from uplinks received during a satellite pass. Get more information about how the Argos system works here: <http://www.argos-system.org/web/en/391-faq-general-questions.php>
- Argos Uplink—a radio transmission intended for the Argos satellite system.
- At-Sea and Haul-Out—tag states controlled by wet/dry readings.
- Daily Data—generated from sensors over a fixed 24-hour period.
- Data Message—created by the tag to transmit data through the Argos system. Each data message is transmitted as payload in an Argos uplink. In order to increase the likelihood of its reception by the Argos system, each message is sent a fixed number of times.
- Data Products—the various types of data available from Wildlife Computer tags.
- Deployment—the period when a tag is associated with an animal and actively collecting and sending telemetry data.



- Location Uplink—a transmission intended to generate an Argos location. These uplinks can also carry a data message payload. Multiple uplinks are required to generate an Argos location.
- Pinger—a UHF radio tracking beacon.
- Start/Auto Start/Stop—tag states. When Started, will generate locations and/or collect sensor data. Auto Start will allow the tag to Start using a magnet or when reading wet. Stop causes the tag to do nothing until reconnected to Tag Agent.
- Summary Period Data—generated from sensors during a defined number of hours.
- Tag Agent Software—the program used to change tag states and select tag settings and connect a tag to the Wildlife Computers Tag Portal.
- Tagware—the software running on a tag.
- Wildlife Computers Communication Cable—the Wildlife Computers communication cable required by Tag Agent.
- Tag Portal—the cloud-based service offered by Wildlife Computers for remote tag setup. A historic record of tag settings and templates is maintained within the Tag Portal.
- Wet and Dry—the state of the tag as determined by the wet/dry sensor which measures conductivity

### Argos Satellite Pass Prediction

CLS offers a satellite pass prediction program to help forecast satellite coverage at a given location. Additionally, Wildlife Computers offers a tool to graph the results and display the best hours for tags to transmit data for up to six months. The Wildlife Computers tool will display satellite pass histograms in both UTC/GMT for tag programming, and in local time for tag initialization and testing.

The following instructions outline the two-step process:

To determine when satellites will be in view, log onto the CLS website at <http://www.argos-system.org> and select “DATA ACCESS.” Log in with your Argos username and password. Ensure that the time settings next to the login username are set to UTC. If not, then change them using the settings icon.

To run a simulation, select “Satellite Pass Prediction” on the right side of the dashboard.

- To run a simulation, select “Satellite Pass Prediction” on the right side of the dashboard.
- Set your simulation period—select today’s date as the “Start Date.” Then select “End Date.” Use the calendar box on the right-hand side to select an end date that is six months out from today’s date (the calendar will be grayed-out after six months). A shorter period can be selected for initialization testing or shorter deployments.
- Select satellites—ensure all satellites are selected.
- Enter location—select “Latitude/Longitude/Altitude.” Input your deployment location coordinates. The location will display on the world map on the right-hand side. Altitude must also be set to “0” for marine applications.
- Click “Simulate”—the results spreadsheet will now appear.
- Click “Export”—select to save as a .CSV file and to save it in an easy-to-access location on your computer.

- Exit the Argos website.

### Plotting the Results

- Use a web browser to navigate to the following link: <http://bit.ly/argospassprediction>. Adjust the UTC/GMT slider to the UTC/GMT offset of your current location, including possible daylight-saving time.
- Upload the Argos file—browse and import the pass prediction file saved from Argos. The program will display the pass prediction data for the next six months which will assist in selecting the best hours to activate the tag.



**Tags must always be set and programmed in UTC/GMT time. The “Local Time” histogram is only used for identifying the best hours for tag initialization and testing.**

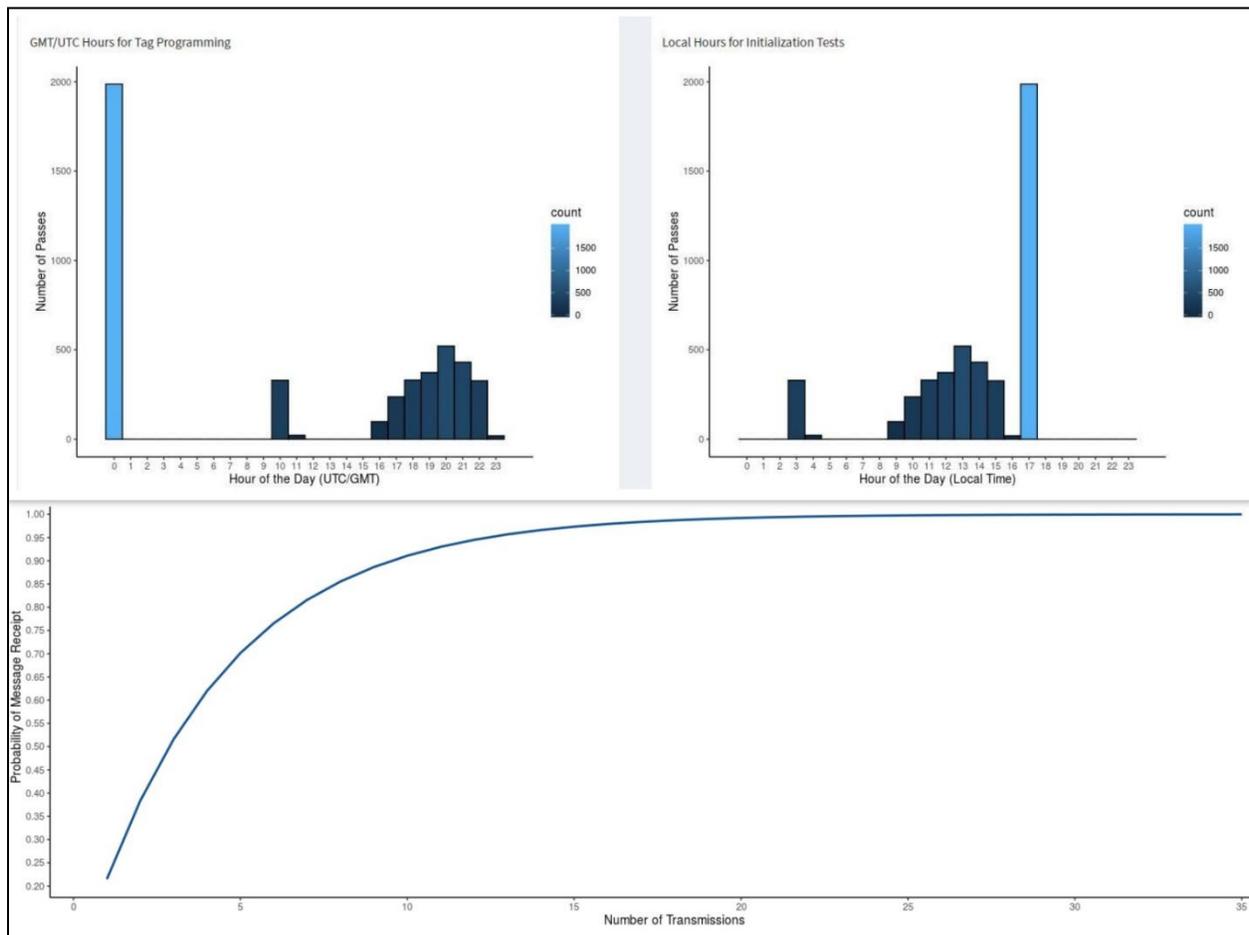


Figure 21—satellite coverage is best in UTC hours 2-4 and worst in hours 7-10 with no passes at all in hours 8 and 9.



**Note: if you expect your animal to move East or West more than 500 km, leave all hours enabled as satellite coverage varies significantly East to West so the mask will not be effective.**

### Initializing Tags Prior to Deployment

Before deploying a SPOT tag, it is recommended to conduct a trial mission. Activating tags prior to deployment has several benefits. It provides exposure to the software and data, it allows you to evaluate the performance of the tag, and, perhaps most importantly, it enables Argos to secure a quality location at your field site prior to the animal being released. This is significant because the Kalman filtering algorithm not only uses measurements from the current satellite pass but also from prior satellite passes to calculate positions from just one or two Argos messages.

Run the trial mission for four to six hours, leaving the tag outside with a clear view of the sky. It can be beneficial to run a pass prediction via the Argos website to ensure multiple satellite passes are scheduled during the mission window.

As long as the primary purpose of the trial is to hit the Argos satellites and generate locations, the recommended settings are one step with a 250-uplink limit and no data products enabled. If data product testing is desired, ensure the summary periods fit within your six-hour testing time frame.

**At Sea Mode** ⓘ

Initial Pattern (add pattern)

Duration	Location Uplink Limit	Limit Type	Pinger	Prevent Data Uplink	Step Lock	Actions
6 Hours (6 Hours)	250	Total	×	✓	×	✎ ✕ ↻

Add Step

**Hauled Out Mode** ⓘ **DISABLED**

Figure 21—settings for priming Argos locations; a single six-hour step with a 250-uplink limit and no data uplinks.

When testing multiple tags, it is important to space out the transmissions so they don't interfere with one another. This is easily accomplished by using a magnet to activate tags ten-seconds apart. Alternatively, it can be accomplished by starting tags using Tag Agent, placing tags in a bucket of salt water and then pulling each tag out of the bucket, ten seconds apart. Wildlife Computers recommends only testing four to five tags at a time to avoid signal collisions. You could alternatively run an [Argos Transmitter Test](#) as described above.

After the trial, review your results in the data portal. Use Tag Agent to change the tag settings and switch the state to Auto-start or Stop.

## The Pinger

The pinger is used for radio tracking recovery. When enabled, a SPOT tag sends out low-power pings every two seconds while at the surface. With an appropriate receiver and directional antenna, the tag can be located. Excess power draw from the pinger is negligible.

## Battery Isolator Screw

Certain SPOT tags with ample battery power (>2g lithium metal) include a battery isolator screw. The isolator keeps batteries disconnected during shipment. Once tags arrive at their destination, the screw must be inserted to connect the batteries.

Tag Agent displays the SPOT tag battery status on the lower left.

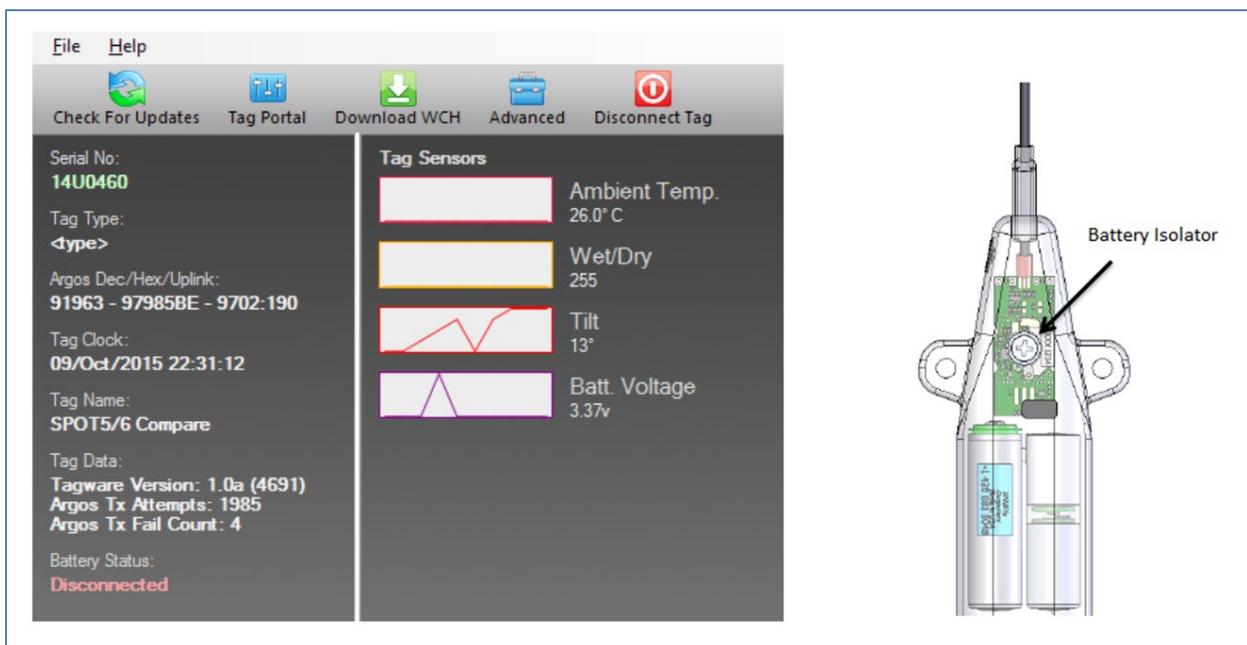


Figure 22—Tag Agent showing the Battery Status as disconnected and the placement of the battery isolator screw on a SPOT-257 tag.

## Antifouling Tags

Heavily fouled tags can be hugely detrimental to tagging studies as fouling growth over critical sensors can impede the tag's transmitting performance. Especially for deployments in tropical waters, it is imperative that tags be protected against marine growth. Wildlife Computers endorses two antifouling paints, Micron and Prospeed. While we prefer Micron66, it is not available in some countries. There are dozens of paint options available, but Micron 66, Micron77 and Micron99 are our favorites from years of testing and client feedback.

Micron66 is a copper-based antifouling paint that has a biocide which repels barnacles. For optimal protection, it is critical to use International Paints' Interprotect primer in addition to several coats of paint. Micron66 is a great choice for slow movers like sea turtles and whale sharks—<http://bit.ly/Micron66>

Propspeed is non-toxic and widely available. Its glossy texture sloughs off marine growth before it has a chance to bond. Constant water flow is key to Prospeed's effectiveness making it most beneficial for active swimmers.

Wildlife Computers offers an optional service to sand, mask, and paint tags with Prospeed antifouling and coat the wet/dry sensors with conductive polymer. This comprehensive antifouling service is offered at a charge of \$100 per tag prior to shipping. We do not apply Micron antifouling paint due to the hazardous nature of the product.



***SPOT tag wet/dry sensors should never be covered or coated with antifouling paint. Seawater contact is essential to these sensors for correct operation. Use masking tape to protect the wet/dry sensors when painting.***

### Tips and Tricks When Antifouling Your Tags

Here are a few critical points to ensure successful tag antifouling:

- Mix the Micron paint with a battery drill and paint mixer tool—this step is imperative to dislodge the copper off the bottom of the can! If you can't use a drill, mix it thoroughly with a wide paddle to ensure all the copper sludge is mixed into the paint.
- After covering the wet/dry sensors, communications port, depth sensor opening, "Battery Isolator" screw, and LED viewing port with tape, ***prime the entire tag including all the antennas when applicable—Fastloc® GPS patch antennas, Fastloc® GPS antenna, and the Argos antenna.***
- Only prime two to three tags at a time and ensure that the first coat of Micron paint goes on when the primer is tacky and not dry (if too late, apply another coat of primer and then paint when tacky).
- Apply three to four coats of Micron, allowing time to dry between coats (it is ablative, so it needs several coats that will wear off over time in the water).
- Remove masking tape!
- Optionally, apply another coat to the Fastloc® GPS and Argos whip antennas after attaching the tag (especially to a turtle). Remember to avoid the wet/dry sensors. Micron will not harm the attachment epoxy.

Check out our [antifouling resources](#) on the Wildlife Computers website including a video that shows you exactly how to do apply antifouling paint.

## Resources

### International Paints Micron Antifouling Paint



Micron is only available in 5-liter (one gallon) cans.

<http://www.yachtpaint.com/LiteratureCentre/micron-66-info-usa-eng.pdf>

USA Store Locator: <http://www.yachtpaint.com/usa/diy/store-locator/search.aspx>

Micron is available in the USA and Asia-Pacific regions from International Paints dealers and ship chandlers. Micron is not available in all countries.

Similar Micron products such as Micron Extra, Micron Extra2, MicronCSC, Micron77 and Micron99 are alternative solutions although Micron66, Micron77 and Micron99 are the most effective. Micron77 may only be available from licensed applicators.

### International Paints Primer



“Interprotect 2000E” or “Interprotect” or “Gelsheild 200” (These are the same product). Interprotect is a two-part epoxy primer and is available in 750ml, (one quart) cans.

If Interprotect primer is not available then “Primocon” primer can be used but it is not as effective.

### Peel Ply Instructions

Backmount SPOT tags are shipped with a sheet of heavy-duty white polyester peel ply. When the peel ply is removed, the tags have a contamination-free, bondable surface that requires no additional preparation.

#### Attachment instructions

- Immediately prior to attachment, peel off the peel ply fabric
- Apply epoxy to the tag bottom
- Attach tag to the animal

## Recommendations

- If your application process includes sterilizing the tag, do so with the peel ply fabric in place
- Do not touch the exposed tag bottom surface with anything other than your epoxy
- Surfaces with peel ply should not be sanded

## Additional Advice

1. Once a SPOT is deployed, keep all magnets away from the reset position. Even though it takes two specifically timed swipes of the magnet to change modes, it is still a good idea to keep magnets away just in case.
2. Fine-grade sandpaper can be used to clean wet/dry sensors. Before deploying, ensure the wet/dry sensors are clean and free of any residual epoxy, tape residue or other contaminants. If the wet/dry sensors are covered, it will reduce the SPOT ability to determine wet and dry.
3. If traveling on a commercial carrier with your SPOT tags:
  - We recommend you place the tags in Stop mode so they are not transmitting.
  - We suggest carrying a copy of your invoice or our product literature identifying the tag as a scientific research instrument.
4. We highly recommend that a laptop with Tag Agent and USB driver installed and a Wildlife Computers USB communications cable are brought to the field location so that communication with the tag is possible onsite if necessary.



## Contacting Wildlife Computers

### U.S. and International

Members of the Wildlife Computers technical sales and support team are located in Redmond, WA, USA, and Havelock North, New Zealand, allowing us to cover promptly a wide range of time zones.

### Mailing and Shipping

Wildlife Computers

8310 154th Avenue NE, Suite 150

Redmond, WA 98052 USA

### Email

Sales, Quotes, and Inquiries: [tags@wildlifecomputers.com](mailto:tags@wildlifecomputers.com)

Technical Support: [support@wildlifecomputers.com](mailto:support@wildlifecomputers.com)

### Phone

+1 (425) 881 3048

### Website

[WildlifeComputers.com](http://WildlifeComputers.com)

### For Asian Clients

While we welcome your direct correspondence, we recommend that you contact our colleague, Yong Huang, for assistance. Mr. Huang understands the special purchase processes for your countries, and will provide you with the best service for the best price. He also is fluent in Japanese, Chinese, and English.

**Mailing Address** — Please ship tags to our main office in Redmond, WA

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