

SPOT5 User Guide

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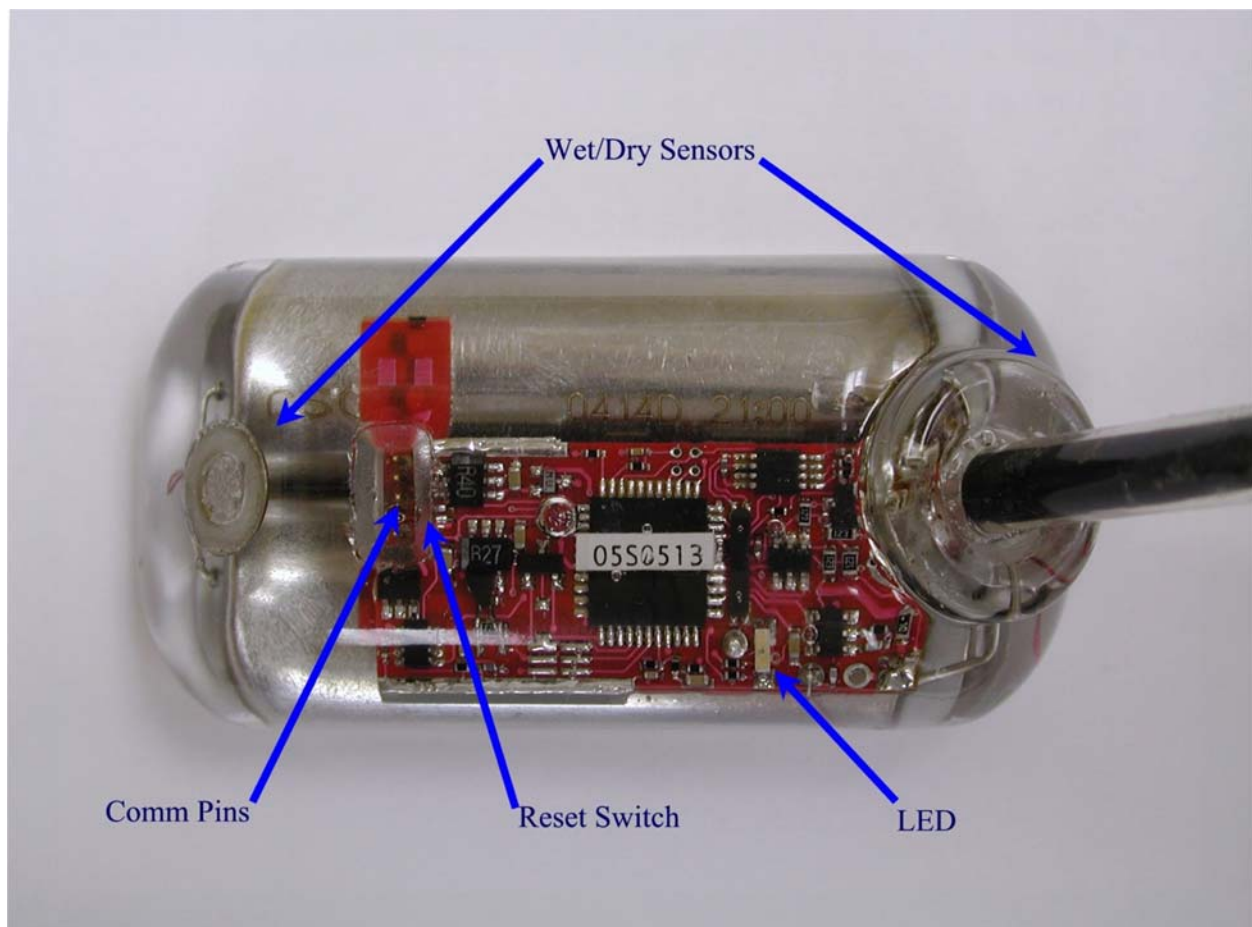
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Overview of SPOT5 functionality

The Wildlife Computers SPOT5 tag is the natural successor to the SPOT4. It remains a small-sized, real-time Argos transmitter that includes a temperature and a wet/dry (conductivity) sensor. The overall functionality of the SPOT5 is the same as the SPOT4; however it uses a more powerful processor which allows for future upgrades.

Note that you must use the SPOT5Host program to communicate with the SPOT5 tag.

Tag Diagram



What it does

The SPOT5 transmits to the Argos satellite system. These transmissions are relayed to the Argos ground systems, where they are used to calculate the location of the tag. Data can be encoded in the transmissions. See www.argos-system.org for more information on the Argos system.

The SPOT5 has an on-board clock that helps it keep track of when a transmission should be made. When it is time to make a transmission, the SPOT5 monitors the wet/dry sensor. As soon as the sensor indicates a dry condition, the transmission is initiated.

What data are collected

In addition to Argos locations, the SPOT5 can optionally transmit the time an animal spends within user-defined temperature ranges in the form of “time-at-temperature” histograms. The SPOT5 can also be set to transmit “Percentage Haulout Timelines.” These timelines show the percentage of each hour the animal is “dry.”

Histogram messages.

The time-at-temperature histograms are built by counting the number of temperature readings (taken at 10 second intervals) which fall inside 12 user-specified temperature ranges. The user sets these temperature ranges, and also the time over which these histograms are built (from 1 per hour to 1 per 24 hours).

Percentage Haulout Timelines.

The percentage haulout timelines show what percentage of the hour the tag’s conductivity sensor indicated “dry.” The percentages are as follows:

0% (every sample was wet)
 0% < dry < 5%
 5% <= dry < 15%
 15% <= dry < 25%
 25% <= dry < 35%
 35% <= dry < 45%
 45% <= dry < 55%
 55% <= dry < 65%
 65% <= dry < 75%
 75% <= dry < 85%
 85% <= dry < 95%
 95% <= dry < 100%
 100% (every sample was dry)

Status messages.

These messages contain diagnostics regarding the SPOT5’s performance (e.g., number of messages transmitted and battery voltage).

Decoding the messages.

Wildlife Computers provides an analysis program, WC-DAP, that decodes and displays the messages relayed by Argos.

A word on version numbers

The SPOT5's on-board software can be upgraded. The SPOT5 needs to be returned to Wildlife Computers to perform the upgrade. SPOT5Host will be upgraded in parallel. In order to keep the version of on-board software (SPOT5Ware) and SPOT5Host working seamlessly together, please note the following:

- The SPOT5Ware version numbers are in this format: ***x.yy***
- SPOT5Host has version numbers in this format ***a.bb.cccc***
- When attempting to communicate with a SPOT5 tag use the following rules:
 - ***a*** must be the same as ***x***
 - ***bb*** must be greater than or equal to ***yy***
- It is best to use highest ***cccc*** available – see our web site www.wildlifecomputers.com for the most up-to-date SPOT5Host

Special care must be taken when communicating with SPOTs with different versions of SPOTWare. If you have some SPOT4s and some SPOT5s, you will need to use two versions of SPOTHost. All versions of SPOTHost will refuse to communicate with an inappropriate SPOT tag, and tell you why.

Communication with the SPOT5

User parameters are programmed into the SPOT5 via a Windows-based program provided by Wildlife Computers called SPOT5Host. SPOT5Host must be installed on your PC. SPOT5Host has been tested on Windows 2000 and Windows XP. Earlier versions of Windows may or may not work, depending on the configuration of your PC. We do not support other operating systems (e.g., UNIX) or Windows emulators.

Install SPOT5Host on your PC from the distribution disk (or from our web site), following the prompts.

SPOT5Host synchronizes communications with the SPOT5's on-board software. It sends and receives commands to the SPOT5. Parameters are downloaded from the SPOT5 to your PC. SPOT5Host allows you to modify those parameters. Once the parameters are set, they can be uploaded to the SPOT5.

The SPOT5 is connected to your PC via a USB-Blue, available from Wildlife Computers only. The USB-Blue connects to a USB port on your PC.

Word of note: make sure you install the USB-Blue driver, available on our website, before plugging in the USB-Blue.

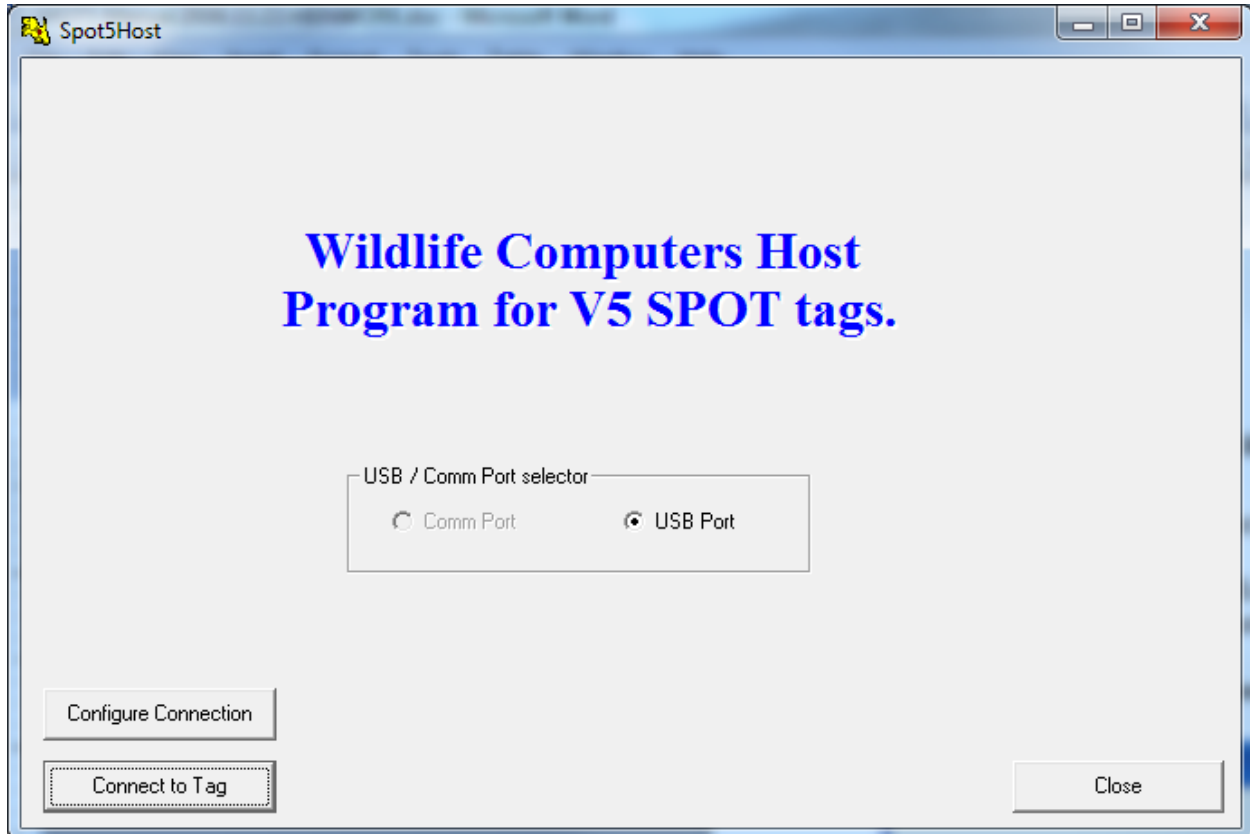
For laptop users, we suggest you set everything up on your new laptop before heading out to the field.

Note: If you have inherited a Blue Box or a Cable Comm see Appendix A for instructions on how to configure SPOT5Host.

Configuring SPOT5Host to Your PC

Each time you start SPOT5Host, you will be greeted with a Welcome screen.

If you are using a USB-Blue, be sure that the driver is installed prior to opening SPOT5Host. If the driver is installed and the USB-Blue is plugged in, the USB Port button should be selected on your Welcome screen.



Connecting the SPOT5 to your PC

Carefully insert the flat plug from the USB-Blue into the SPOT5's communications port. Note the orientation of the pins in the communications port. There are three pins in sequence, a "missing pin," and a single pin. Note the orientation of the sockets in the flat plug. One of the sockets is blocked. *It is critically important to ensure the flat plug is correctly oriented to the pins in the communications port before inserting the plug.*

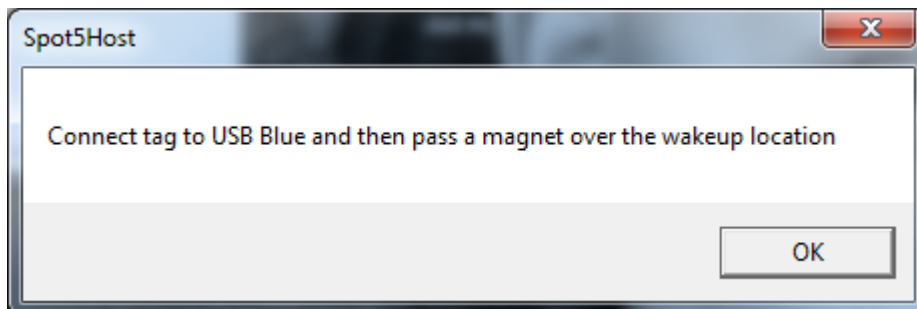
Initiate Communications with the SPOT5

Click "Connect to SPOT Tag."

Follow the instructions displayed on the Connection screen.

An LED on the SPOT5 will glow when the cables between the PC, USB-Blue, and SPOT5 are connected correctly and the magnet was passed over the reset location of the SPOT5. SPOT5Host may display additional prompts if there are difficulties in establishing communications.

CAUTION: Do not leave the SPOT5 tag hooked up to the communications hardware any longer than necessary to set up or download the tag. Leaving the tag hooked up to the communications hardware for extended periods of time will eventually drain the battery.



Please note that the SPOT5 does not require a password to login.

Navigating through the Tabs

General Tab - Parameters and Functions

This screen displays and allows the update of basic parameters and the testing of the sensors and transmitter.

The screenshot shows the Spot5Host software window with the following configuration details:

- Serial number:** 1051614
- Total Transmits since 29-Oct-2010 =** 259
- Tagware:** 5.03d
- Extended Argos PTT number:** 39345 or 01D27013 Hex. **Uplink/LUT number:** 1865/19
- Maximum number of transmissions per day:** 250
- Add any unused transmissions to next day's allowance:**
- Wet / Dry threshold:** 100 (default)
- Owner:** Last Deployment Information
- Last Deployment Information:** Tag started on 02-Nov-2010 at 15:22, Tag stopped on 02-Nov-2010 at 19:15
- Buttons:** Set Tag's Time, Generate Test Transmission, Test Sensors
- Tag's Time & Date:** Date is 01/12/2010, Time is 16:06:57
- Results:** (Two empty result boxes)
- Bottom Buttons:** Standby, Save this Setup, Generate Report, Reload from Tag, Deploy, Update Tag, Recall previous Setup

Maximum number of transmissions per day.

Generally 250 transmissions per day is sufficient for one location calculation a day in mid-latitudes.

Add any unused transmissions to the next day's allowance.

Select this option if your study animal does not surface frequently, and you wish to maximize the probability of a location when it does surface. Do not select this option if you are limiting the number of transmissions per day in order to extend the deployment duration.

Wet/Dry threshold.

This is the threshold value that the SPOT5 uses to determine “wet” vs. “dry.” The default value is appropriate for most marine applications. This threshold may need to be changed if the SPOT5 is being deployed in an area of low salinity (e.g., an estuary, the Baltic Sea). In such instances

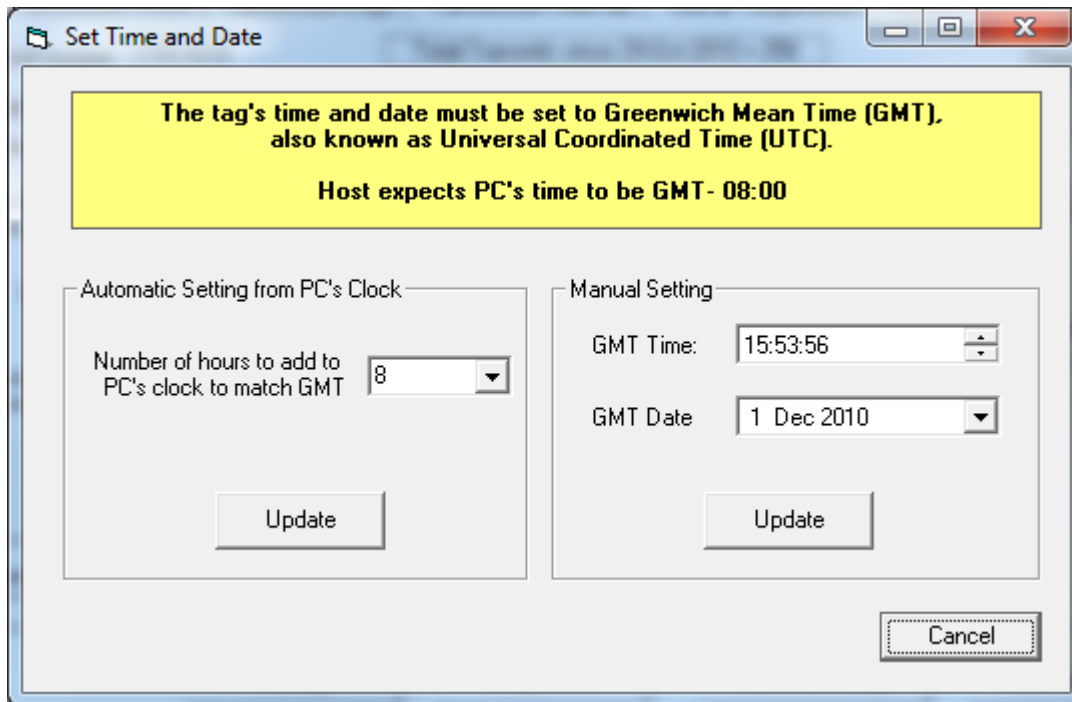
you will need to check what the SPOT5's conductivity sensor reads when immersed in that water. Click the **Test Sensors** (see below) and *carefully* dip the SPOT5 in a bucket of water from the study area, taking care not to allow water to reach the communications port. Note the conductivity sensor reading. The threshold should be set to double the value, but to no less than 40. The SPOT5Host program limits the minimum and maximum values you may set.

Set SPOT5 Time and Date.

It is important to accurately set the SPOT5's time to GMT. The date and time are used to control when the SPOT5 makes transmissions, as well as controls how data are collected. The time displayed on the General Tab screen is from the SPOT5's clock at the time communications was established.

There are two ways to set the SPOT5's clock. The best and most accurate way is to use the clock on your PC. First ensure the clock on your PC is accurate.

Click the **Set Tag's Time** button on the General Tab screen to bring up the window to set the SPOT5's clock.



Automatic Settings from PC's Clock.

If your PC clock is not set to GMT, select the number of hours that need to be ***added*** to the time on your PC's clock to match GMT. For example, if your PC is set to GMT -8, select "8" in the drop-down box.

Click the ***Update*** button.

Manual Setting

Alternately, enter the appropriate GMT date and time using an accurate time source, clicking the ***Update*** button to send the values to the SPOT5 tag.

Generate Test Transmission.

The voltage draw on a battery is greatest during transmissions. Generating a test transmission allows you to confirm the transmitter is functioning and the voltage is within limit. Clicking this button immediately initiates a transmission. You can detect the transmission with an Argos uplink receiver, or any receiver that is sensitive to 401.65 MHz. The battery voltage during the transmission will be displayed. This should be 3.0V or greater.

Test Sensors.

This displays the temperature and the battery voltage under a low voltage draw. Verify that they are reasonable values.

Volts: greater than 3.0V

Temp: current temperature

Cond (conductivity from wet/dry sensor): At least 200 in air

Transmission Hours tab: Set the hours to transmit

The Transmission Hours tab allows you to set the hours the SPOT5 should transmit. Utilities exist that will calculate the hours an Argos satellite will likely be in view. If you know the general location of your study animal, you can maximize the battery life by limiting transmissions to when an Argos satellite is likely to be in view.

Select the hours (UTC time) during which the tag should transmit. Remember to clear hour 00 and 23 if you are not transmitting every day to avoid unintentional Argos charges.

00 12
 01 13
 02 14
 03 15
 04 16
 05 17
 06 18
 07 19
 08 20
 09 21
 10 22
 11 23

Transmit during all of the hours before midnight on the first day of deployment before resuming those on the right

All On All Off

Standby Save this Setup Generate Report

Reload from Tag Deploy Update Tag Recall previous Setup

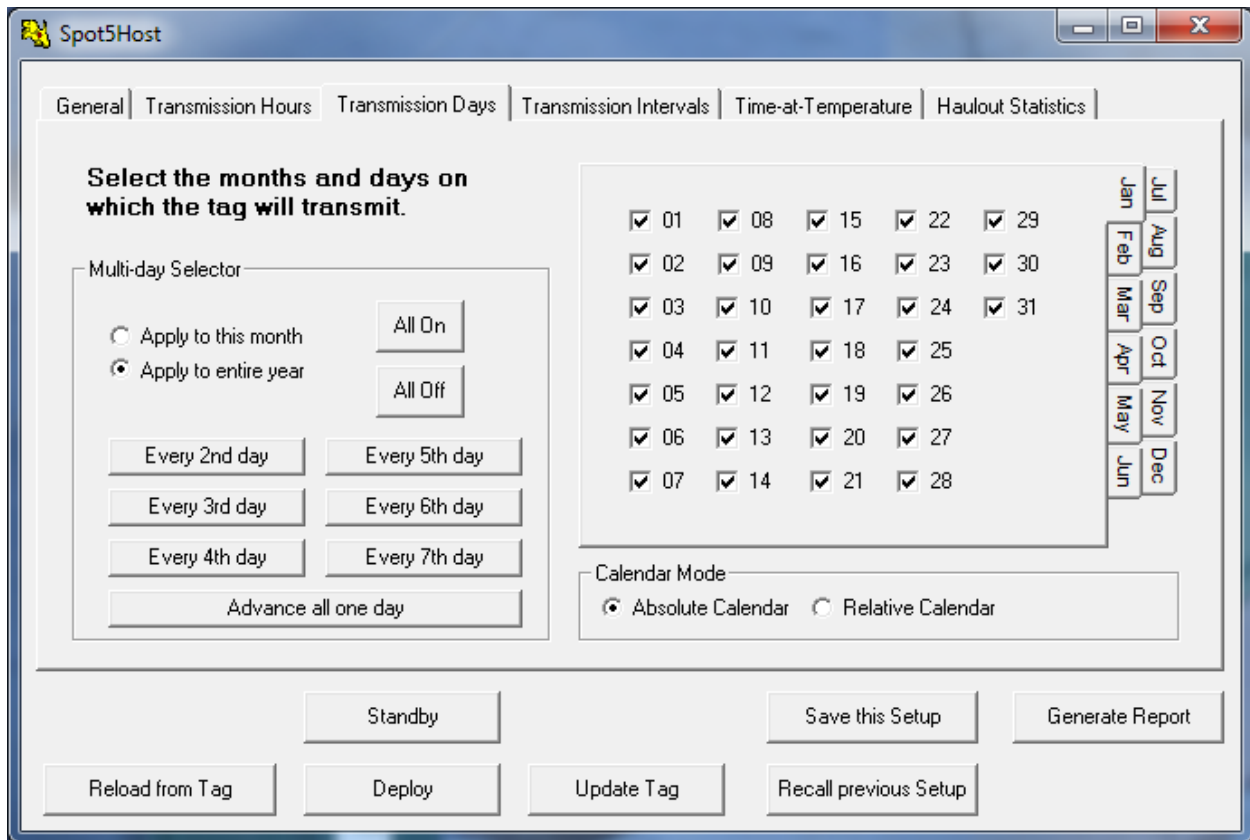
How to determine when a satellite is in view

To determine when the satellites will pass overhead, Argos offers a Satellite Prediction tool.

- Go to: <https://argos-system.clsamerica.com/cwi/Prediction.do>
- Enter your Argos Username and Password, and select your Time Zone and Language preference and click *Enter*.
- Select *Satellite Pass Predictions* from the left side bar.
- Enter Simulation period and Location data.
- Leave all satellites selected and click *Simulate* to get a list of satellite passes.

Transmission Days tab: Set which days to transmit

You can extend the battery life by controlling which days of the year the SPOT5 will transmit.



Note each day of the year can be set as “on” or “off.” This can be useful if you are more interested in locations during certain times of the year. For example, if you know your animal will be hauled out during March and April and begins its migration in May, you may want to set the SPOT5 to transmit every third day for March and April, and then transmit daily for the months following while the animal is at sea.

Absolute vs. Relative Calendar

The *Absolute Calendar* uses the standard calendar year, starting with the present day's date.

If you choose to use the *Relative Calendar*, the SPOT5 will automatically change the date of the tag to 1 January upon deployment, keeping the year and time unchanged. Example: You want the SPOT5 to transmit every day for the first month of deployment, and then switch to every other day for the remainder of the year, but you do not know exactly what day you will deploy the tag.

Transmission Intervals tab: set up how often to transmit

Spot5Host

General | Transmission Hours | Transmission Days | **Transmission Intervals** | Time-at-Temperature | Haulout Statistics

Fast repetition rate seconds

Slow repetition rate seconds

If it is time for the tag to transmit but it is underwater, read the wet/dry sensor to check for a dry state every 0.25 seconds and transmit after extra consecutive dry reading(s)

Change from Fast to Slow repetition rate after being dry for successive transmissions

Pause transmissions after being dry for hours

Restart transmissions after being continuously wet for seconds

Standby Save this Setup Generate Report

Reload from Tag Deploy Update Tag Recall previous Setup

Fast and slow repetition rates.

These rates are set by the manufacturer. It is easier for transmissions to reach the satellite when the animal is hauled-out, thus the rate of transmissions is slowed to extend battery life. The rate is increased when the animal is at sea to increase the probability of a good transmission reaching the satellite. The maximum (fastest) rate is imposed by Service Argos.

Delaying transmission upon surfacing.

The recommended setting is to transmit after 0 successive dry readings. That ensures the tag will attempt to transmit as soon as possible after the animal surfaces. However, some users may want to delay slightly the initial attempt to transmit to allow water to sheet away from the tag. This is recommended only if you know that your study animal is a longer surfacing species. Note that the dry readings are attempted at 0.25 second intervals, so a setting of 4 equals a 1-second delay.

Change from Fast to Slow repetition rate after being dry for N successive transmissions.

Determine how long in seconds the tag should be dry to indicate the animal has hauled-out. Divide that number by the fast transmission rate for this value.

Pause transmissions after being dry for N hours.

You may wish the tag to suspend transmissions after the animal has been hauled-out for N hours to conserve battery life.

Restart transmissions after being continuously wet for N seconds.

Ensure N is less than a typical dive duration, or else transmissions will never resume.

Time-at-Temperature tab:

Time-at-Temperature Histogram Bin Limits

The tag measures temperature from -40C to 60C in approximate 0.1C steps. Enter the high limits for the first 11 time-at-temperature bins, the low bins will be updated automatically. The 12th bin limit is always 60C - the limit of the sensor. Numbers entered may be slightly modified to match the actual ability of the tag to measure temperature.

Low	High
-40	-20.0
-19.9	-10.0
-9.9	-5.0
-4.9	0.0
0.1	5.0
5.1	10.0
10.1	15.0
15.1	25.0
25.1	35.0
35.1	45.1
45.2	55.0
55.1	60.0

Save to File Read from File

Hours at which to start new Histograms

Check the start hours for creating a new time-at-temperature histogram. Only the last 12 collected histograms will be transmitted at any time. The start hours are measured in GMT. We do not generally recommend more than 6 histograms per day.

none 2 per day 3 per day 4 per day 6 per day Advance all one Hour

<input checked="" type="checkbox"/>	00	<input checked="" type="checkbox"/>	12
<input type="checkbox"/>	01	<input type="checkbox"/>	13
<input type="checkbox"/>	02	<input type="checkbox"/>	14
<input type="checkbox"/>	03	<input type="checkbox"/>	15
<input checked="" type="checkbox"/>	04	<input checked="" type="checkbox"/>	16
<input type="checkbox"/>	05	<input type="checkbox"/>	17
<input type="checkbox"/>	06	<input type="checkbox"/>	18
<input type="checkbox"/>	07	<input type="checkbox"/>	19
<input checked="" type="checkbox"/>	08	<input checked="" type="checkbox"/>	20
<input type="checkbox"/>	09	<input type="checkbox"/>	21
<input type="checkbox"/>	10	<input type="checkbox"/>	22
<input type="checkbox"/>	11	<input type="checkbox"/>	23

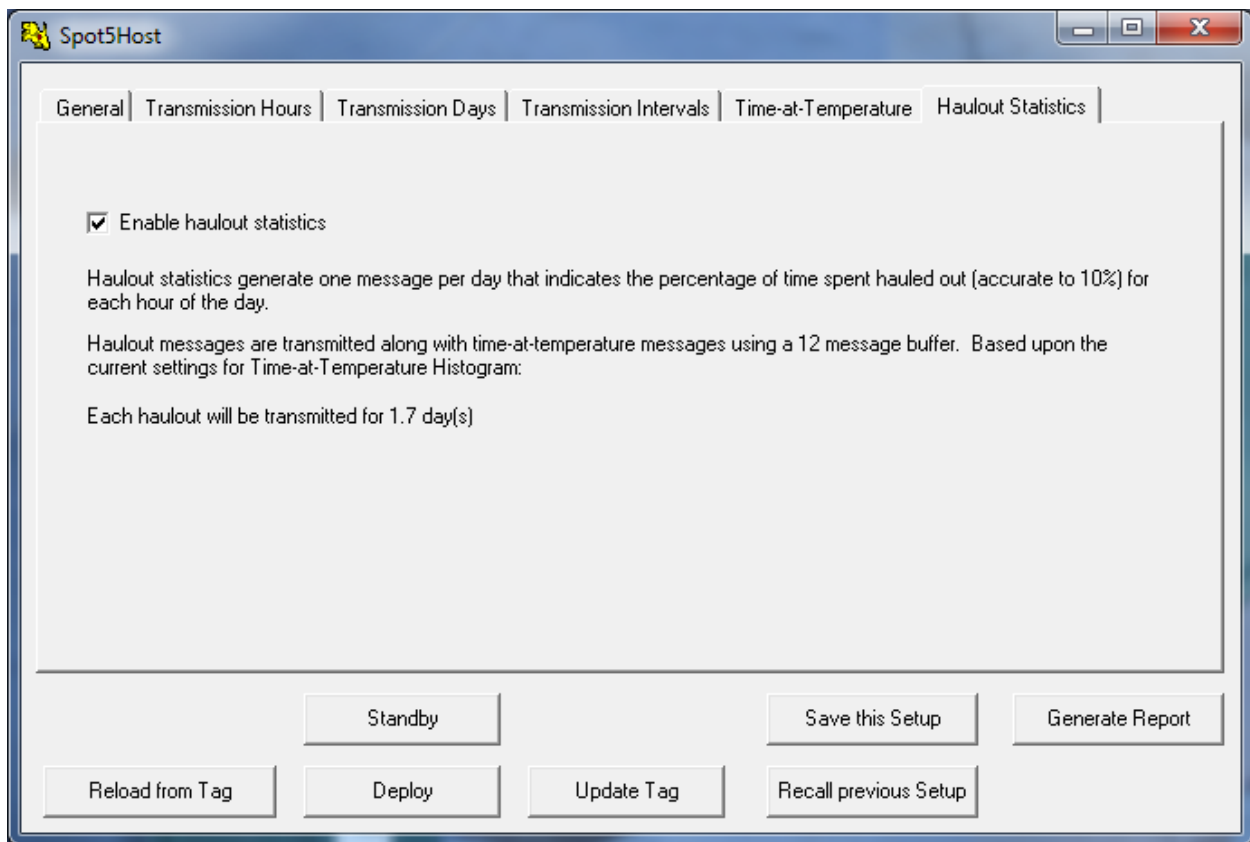
Standby Save this Setup Generate Report

Reload from Tag Deploy Update Tag Recall previous Setup

Each bin will contain the fraction of the histogram period the animal spent within that bin's temperature range.

The number of histograms per day can be selected. This defines the histogram duration (12, 8, 6, or 4 hours). Select "none" if you do not want the SPOT5 to collect and transmit histograms. Be aware that it takes approximately 1/3 more battery capacity to transmit Temperature Histograms and/or Haulout Statistics.

The hour each histogram starts is in GMT. The start hour of the histograms can be changed to reflect diurnal behavior.

Haulout Statistics tab:

This screen allows you to enable Haulout Statistics timelines.

Be aware that it takes approximately 1/3 more battery capacity to transmit Temperature Histograms and/or Haulout Statistics.

Control buttons common on all screens.

Reload from Tag.

The parameters displayed on the screen reside on the PC. This button reloads the parameters on the PC with the ones that are in the SPOT.

Standby.

This button puts the SPOT in “Monitor” mode (see below) and exits communications. This should be used if the SPOT is not going to be immediately deployed on an animal.

Deploy.

This button puts the SPOT in “Deploy” mode (see below) and exits communications.

Update Tag.

This button uploads the parameters from the PC to the SPOT.

Save This Setup.

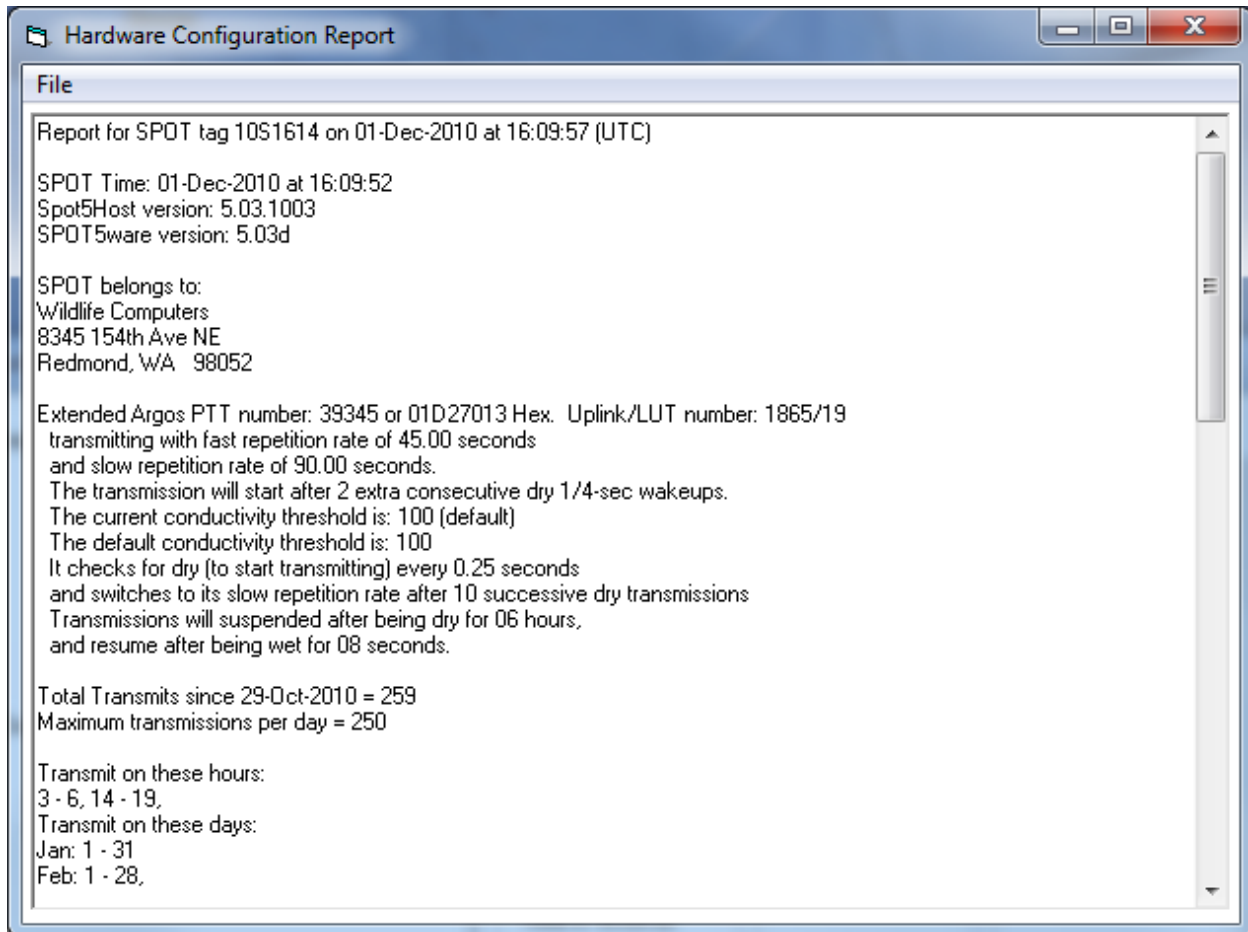
This is useful if you are setting up a series of SPOT5 tags and wish them all to have the same (or very similar) setup. Setup the first SPOT5 tag and then click this button. As long as you don't leave SPOT5Host, you can use the ***Recall Previous Setup*** button on subsequent SPOT5 tags to set all of the user-configurable parameters to be the same.

Recall Previous Setup.

This loads a previously saved setup into the SPOT5 that is currently connected. This is to minimize the data entry. *It is important to always verify the parameters are correct, even when using the Recall Previous Setup.*

Generate Report

It is important to archive the configuration of the SPOT5 (versions, parameters) prior to deployment so that they can be used to correctly analyze the data. Click the ***Generate Report*** Button. The following screen will display the configuration of the SPOT5 that is held by SPOT5Host.



The *File* menu item allows you to save and/or print this report.

You should always save a copy of the report and review all parameters before deployment. The success of your experiment depends upon the correct setup of all parameters.

Note that selecting this configuration report function only displays the SPOT5 parameters stored on the PC, not necessarily on the SPOT5, and does not perform any upload function. When running the report, the SPOT5Host will indicate if the report shows a change from what is on the SPOT5. If so, be sure to save the changes when you exit or deploy.

Deploying the SPOT5

SPOT5 modes.

The SPOT5 is never entirely “turned off.” It is either deployed (transmitting according to schedule) or in Standby mode monitoring for a signal to go into deployed mode. When you exit communications by clicking the ***Standby*** button in SPOT5Host, the tag goes into Standby mode. Clicking the ***Deploy*** button puts the tag into Deployed mode.

Standby mode.

When in Standby mode, the SPOT5 wakes up every ten seconds to check its wet/dry sensor. If SPOT5 finds that the wet/dry readings have significantly changed from the running average of the previous eight readings, it increases its sampling rate to once per second. If the change lasts for five seconds (signified by a blink per second), SPOT5 automatically enters the Deployed mode and displays the LED pattern as described below.

Deployed mode.

When first deployed, SPOT5 dimly lights its LED waiting for the top of the next minute. SPOT5 is not recording data or transmitting messages during this phase.

If collecting Time-at-Temperature histograms or Haulout Statistics, the SPOT5 will blink its LED every 10 seconds when it wakes up and archives data. The LED will stop blinking after 31 hours.

The LED will always blink when the SPOT5 transmits data.

Changing mode with a magnets.

You can display and change the mode of the SPOT5 after exiting communications by using a magnet.

Swipe a magnet once across the center of the SPOT5's controller board. The LED will flash in a sequence that displays the mode of the SPOT5 tag.

- Standby mode LED pattern: ***2 blinks, a 3 second pause, and 2 more blinks***
- Deployed mode LED pattern: ***10 blinks***

Once the mode is displayed, the ***LED will stay on for 2 seconds.***

- If you keep the magnet away from the SPOT5 while the LED is on, the SPOT5 will stay in its current mode.
- *If you swipe a magnet across the board while the LED is on, you will toggle the mode.* If the SPOT5 was toggled to the Standby mode, the LED will blink as described in "Standby mode" above. If the SPOT5 was toggled to the Deployed mode, the LED will blink as described in "Deployed mode" above.

In summary, a single swipe of the magnet displays the mode of the SPOT5. It takes two specifically timed swipes of the magnet to change the mode.

Storing SPOT5s

Lithium batteries develop an oxide layer over their anodes to minimize self-discharging. This is called passivation. This process is exacerbated at high (30C+) temperatures. The passivation layer is "burned off" when current is drawn from the battery. Very little current is drawn from the SPOT5 when it is in Monitoring mode, so a passivation layer can form.

If the passivation layer is too thick, the battery voltage drops so low that the SPOT5 cannot function.

SPOT5s that will not be deployed for an extended period of time (more than one month) should be stored in a refrigerator or freezer (5 to -20C). This minimizes the battery passivation.

The SPOT5 should be tested after storage, prior to deployment. It is not necessary to warm up the tag prior to proceeding with the test.

- Establish communications with the tag.
- Go to the General tab in SPOT5Host

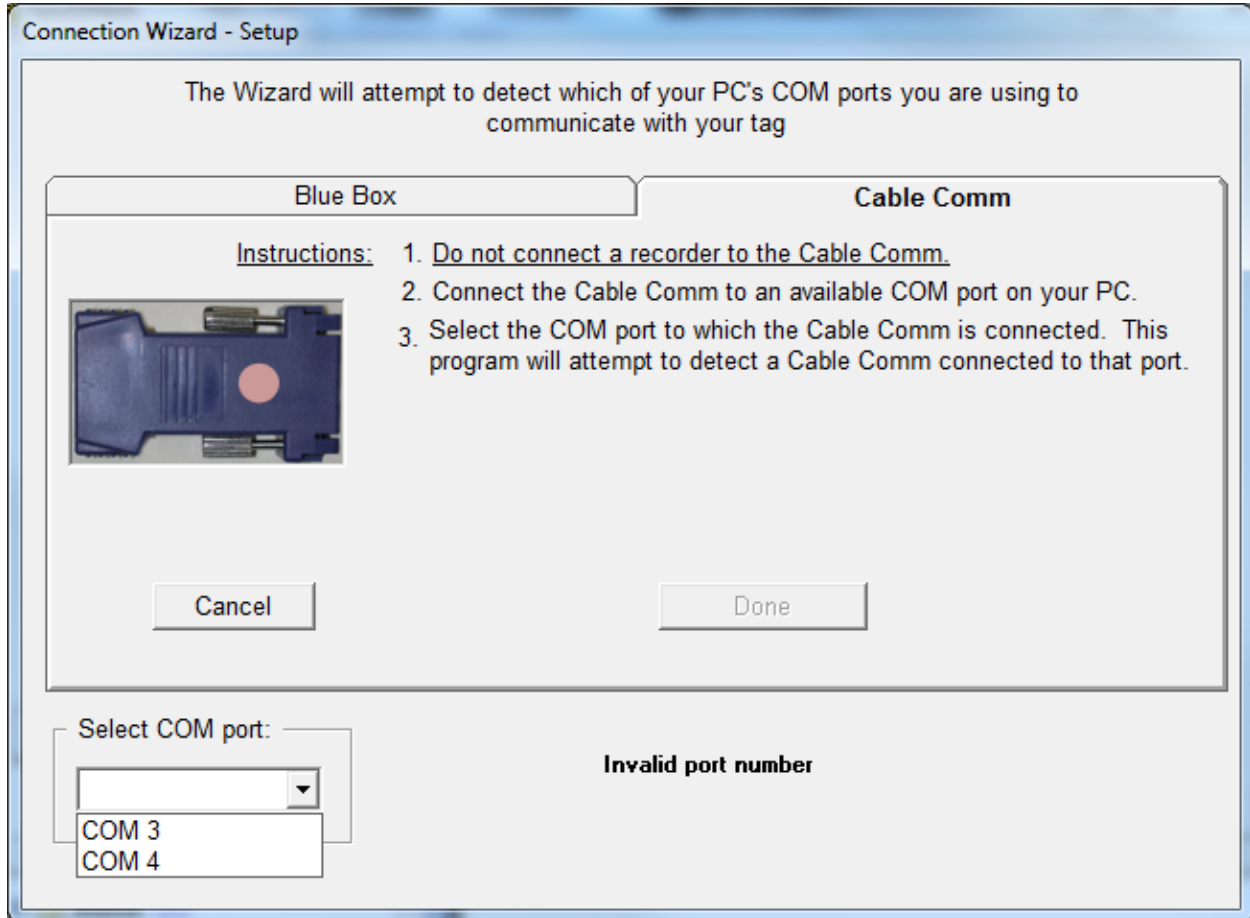
- Click ***Test Sensors*** to verify the sensors read appropriately and the battery voltage is appropriate under a low load (>2.9V).
- Click ***Generate Test Transmission*** to check the battery voltage under load (> 3.0V). The battery voltage may be a little low initially, but should increase after several transmissions.

Other Advice

1. Once a SPOT5 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 still is a good idea to keep magnets away just in case.
2. Do not use any metallic-based anti-fouling paint on the antenna. Metals near the antenna may seriously compromise the transmissions.
3. Use fine-grade sandpaper to ensure the conductivity sensors (metal washers) are clean and free of any residual epoxy or other contaminants. Failure to do so may reduce the SPOT5's ability to determine "wet" and "dry."
4. If you will be traveling on a commercial carrier with your SPOT5 tags
 - a. We recommend that you have them in "Monitoring" mode so they are not transmitting.
 - b. If you hand-carry a tag, you may wish to carry a copy of your invoice or our product literature identifying the tag as a scientific research instrument.
5. We recommend that the user always take a laptop or other computer to the field location, even if the tags have been set up in advance, so that communication with the tag is possible on site if necessary.
6. We strongly recommend that the user ALWAYS re-verify that the tag is still in the proper mode following travel to the field site.

Appendix A. Configuring COM Ports using a Blue Box or a Cable Comm.

When using a Cable Comm, follow the prompts on this tab.



When using a Blue Box, follow the prompts on this tab.

