

microPAT User Guide

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

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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 configure and deploy the microPAT:

- A Wildlife Computers Portal Account—visit wildlifecomputers.com to set up.
- A Windows® computer with Tag Agent and our USB driver installed—[download the required software](#).
- A Wildlife Computers communications cable.
- A magnet.
- [Deployment Checklist](#).

At the end of this document, there is a list of [key terms and concepts](#) for reference. We recommend unpracticed users review this list.

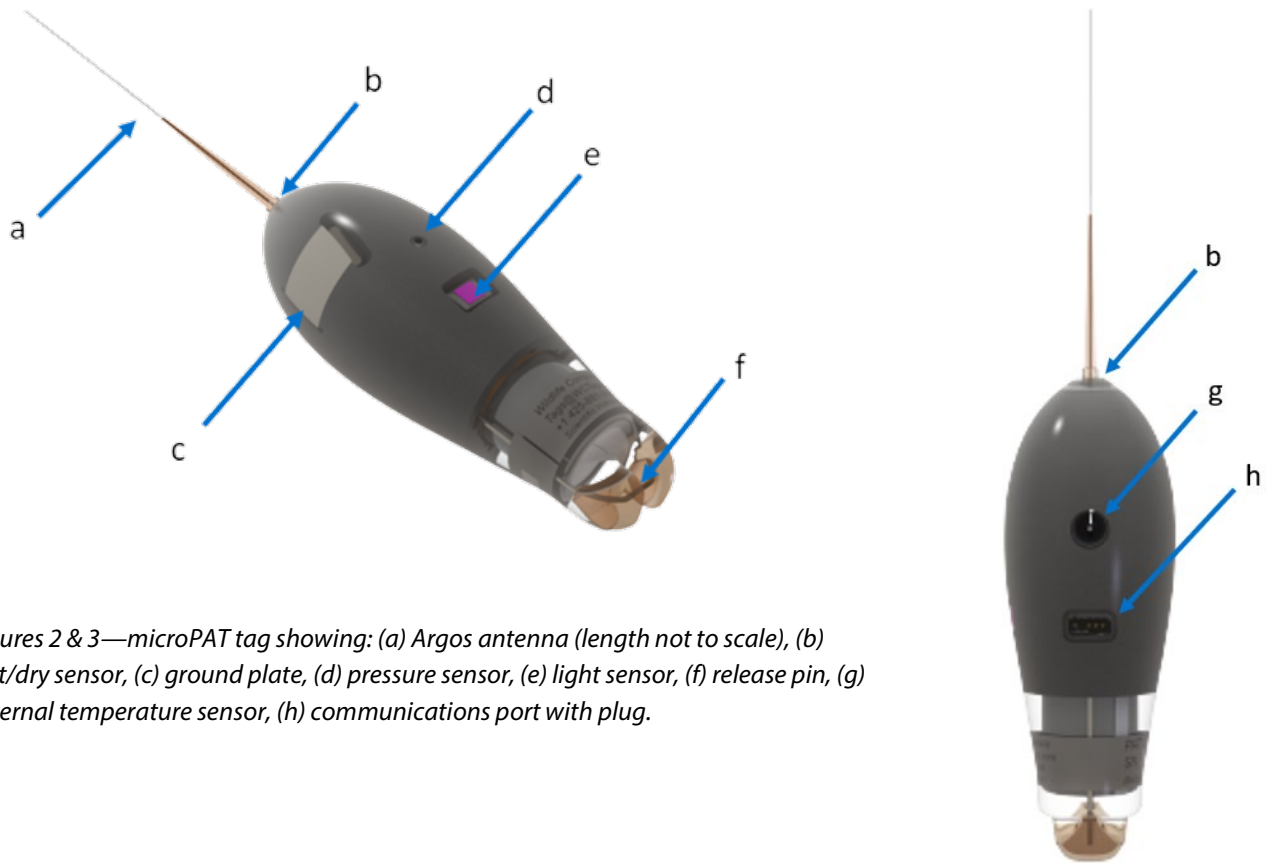
About the microPAT

The microPAT is the smallest geolocating satellite pop-up tag on the market. It is used to track the behavior and migration of marine animals. It is an archival tag equipped with an Argos transmitter and a corrodible attachment link. The microPAT is designed to be attached to an animal by a tether. The corrodible burn pin releases the tag from the tether on a pre-programmed date, or optionally when the microPAT determines it is no longer attached to an animal. Light, depth, temperature, and wet/dry data are collected and summarized for transmission through Argos. Transmission occurs after the release of the tag from the tether, while the tag is floating on the ocean surface. This guide describes how to set up and deploy the microPAT. Transmitted data products are also explained.



Figure 1—microPAT tag

Anatomy of a Tag



Figures 2 & 3—microPAT tag showing: (a) Argos antenna (length not to scale), (b) wet/dry sensor, (c) ground plate, (d) pressure sensor, (e) light sensor, (f) release pin, (g) external temperature sensor, (h) communications port with plug.

The communications port is where the Wildlife Computers Communications Cable connects to the tag. Prior to 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.



The wet/dry sensor, ground plate, pressure sensor, thermistor, light sensor, and electronic release pin should not be covered. Covering these sensors will interfere with the normal function of the tag. This includes antifouling coatings—[read about the importance of antifouling](#)—brightly colored paints for recovery purposes, and attachment adhesives (e.g., epoxy).

Interacting with a Tag

Tag Agent software is used to communicate with the microPAT. Tag Agent and the USB Communication Cable driver can be downloaded from our website: wildlifecomputers.com. Once installed, Tag Agent can be used to:

- Change tag states.
- Configure the tag settings.
- Upload remotely-selected settings into a tag.
- Check sensor readings and conduct test transmissions.

To communicate with a tag, open Tag Agent Software (Figure 3).



Figure 3—Tag Agent screen prior to tag connection.

Plug the USB communications into your Window's PC and then the communications port of the microPAT. Take care to ensure that the pins of the tag are aligned with the USB adapter. Once plugged in, swipe a

magnet near the tag communication port to establish connection. The tag LED at the base of the antenna will turn orange, and the Tag Agent home screen will appear with tag information on the left, and sensor readings on the right (Figure 4).

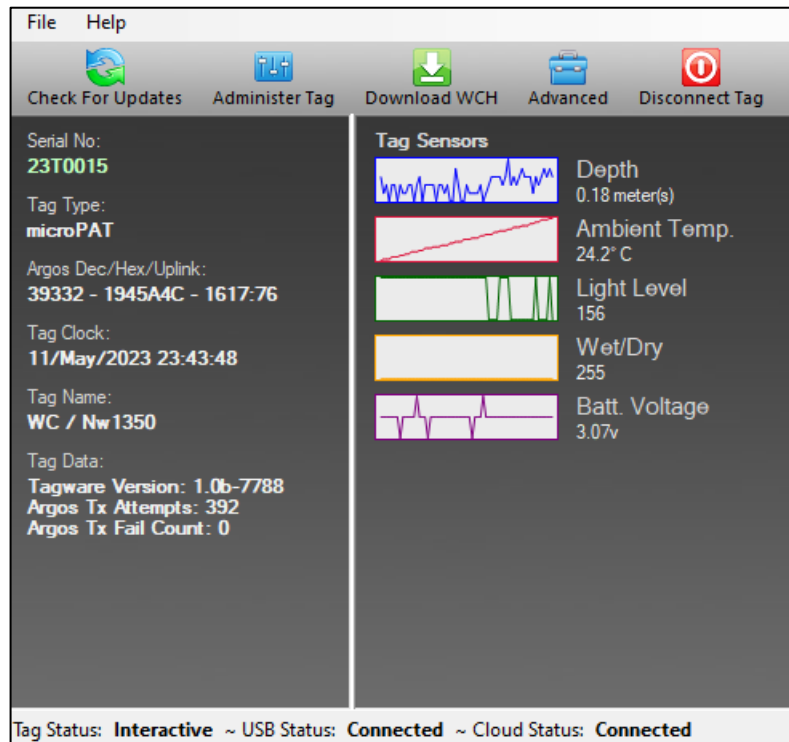


Figure 4—Tag Agent home screen.

Tag States: Auto-Start, Start, and Stop Modes

microPAT tags have three modes or states: Auto-Start, Start, and Stop.

- Auto-Start—allows the tag to start either in Tag Agent or by submersion in seawater.
- Start—a tag is running and will begin its deployment.
- Stop—the tag will remain unresponsive unless connected to Tag Agent. [Stop mode is used for storage of tags for periods longer than a month.](#)

Changing Tag States with a Magnet

Within Tag Agent, the Disconnect Tag tab on the top-right navigation bar can be used to put a tag in any state.

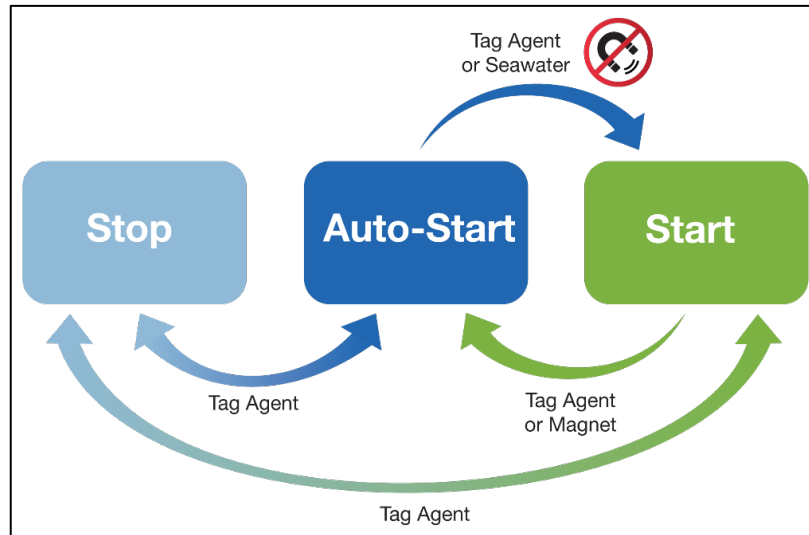


Figure 5—Tag states.

Once disconnected, a single pass of a magnet near the communication port will cause the tag to blink the indicator light, revealing its current state.

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

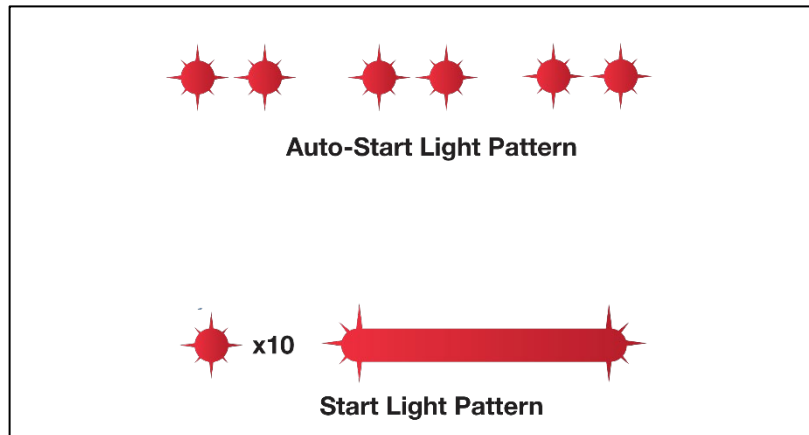


Figure 6—LED sequence

A magnet can be used to toggle the microPAT from Start to Auto-Start mode. This requires two specifically timed passes of the magnet. First, swipe the magnet and wait for the tag to indicate its current state. At the end of the blinking pattern (10 rapid blinks in a row if started) 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 to Auto-Start. The second swipe needs to happen in the window when the light is on.



microPAT cannot be toggled from Auto-Start to Start with a magnet.

In addition to revealing the tag state, the LED also indicates the following conditions:

If you Start a microPAT but do not deploy it on an animal, the tag will initiate a premature release according to your settings. Once premature conditions are met, the tag will then begin to transmit and deplete the battery. *The best practice is to leave a microPAT in Auto-Start mode while OFF an animal. Alternatively, store the tag in Stop mode for longer term storage.*

Be aware that your microPAT tag will begin transmitting and depleting the battery if left in Start mode and not deployed on an animal. If the tag is left in Start mode, the tag will initiate its premature release sequence based on your settings. We DO NOT recommend keeping the tag in Start mode while OFF an animal.



Tag sensors may be impacted by strong radio signals and cause erroneous readings. Do not leave deployed tags near radio antennas, such as a VHF antenna on a boat or a handheld radio.

Configuring Tag Settings

To configure tag settings within Tag Agent, select the Administer Tag button in the upper menu.

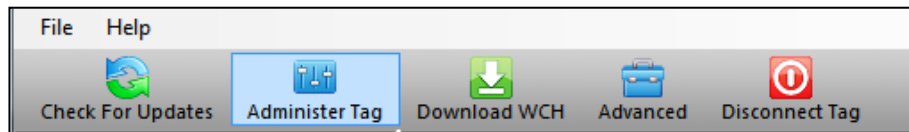


Figure 7—Tag Agent menu bar.

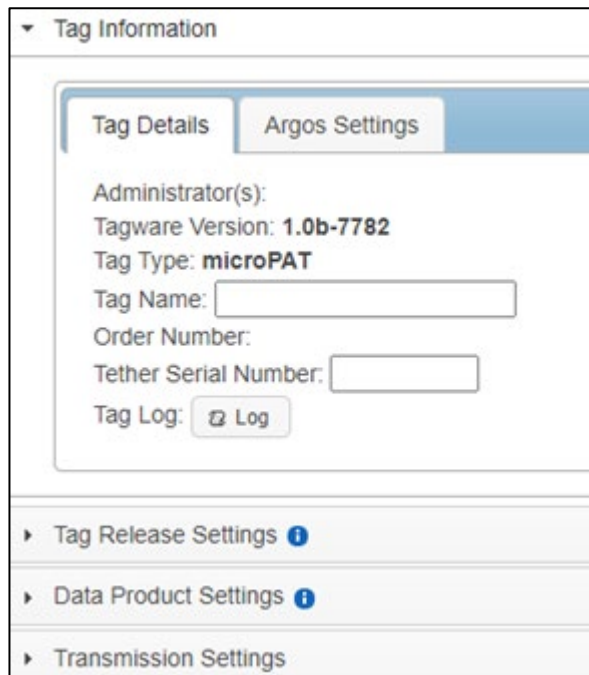
A new window will open revealing four sections: Tag Information, Tag Release Settings, Data Product Settings, and Transmission Settings.

Tag Information

Tag Details & Argos Settings

Tag Administrators, tagware version, and tag type are displayed on the Tag Details tab (Figure 8). Tag Name is an optional user-definable field which makes a tag, or tags, easy to find in the Tag Portal using the filter. The Tag Log tracks interactions with the tag. The Argos Settings tab displays the tag's Argos PTT ID details.

For more information on these terms, reference the Glossary of Terms section at the end of this document.



The screenshot shows a web interface titled "Tag Information". It has two tabs: "Tag Details" (selected) and "Argos Settings". Under the "Tag Details" tab, the following information is displayed:

- Administrator(s):
- Tagware Version: **1.0b-7782**
- Tag Type: **microPAT**
- Tag Name:
- Order Number:
- Tether Serial Number:
- Tag Log:

Below the main content area, there are three expandable sections:

- ▶ Tag Release Settings ⓘ
- ▶ Data Product Settings ⓘ
- ▶ Transmission Settings

Figure 8—Expanded view of Tag Details tab.

Tag Release Settings

Tag release settings define when the tag will activate its release mechanism. Either an interval release (xxx days) or scheduled date release (dd-mmm-yyyy) can be set.

- For an interval release, the release will begin within minutes of "x" days after the deployment time. For example, if deployed at 13:14 UTC, microPAT programmed for a 10-day deployment begins release at approximately 13:14 UTC ten days later.
- If configured for a specific date, microPAT begins the release at UTC midnight of specified date.

▼ Tag Release Settings ⓘ

Release my tag days after deployment start, or on this given date .

Activate Premature Release – Tag Detachment ⓘ ON

Activate Premature Release – Mortality ⓘ ON

Activate auto-detection after all of the selected conditions are met:

- The first dive below meter(s).
- Tag has been deployed for more than day(s).

Start tag release sequence when any of the following conditions are met:

- Tag is more than **25%** dry or is shallower than 1 meter(s)
- Tag is at a constant depth +/- meter(s) ⓘ

for longer than hour(s). ⓘ

Figure 9—Expanded view of the Tag Release Setting section

Activate Premature Release

The microPAT uses sensor measurements to make reasonable assumptions about the state of the deployment. Depending on your study design and the behavior of your study animal, you can program the tag to release and begin transmitting if certain conditions are met.

The following parameters monitors for these conditions:

- **Tag Detachment (Floater)**—the tag is floating at the surface (more than 25% dry or shallower than 1 meter) for the duration of the premature release interval. For fish and non-surface breathing animals, a tag that is dry is likely at the surface and detached from the animal.
- **Mortality (Premature Release at a constant depth)**—the tag is sitting at a constant depth for the premature release interval. A tag which remains at a constant depth is a good indicator of mortality or a tag that has detached from the animal.
 - Select the variance—variance is used here in a statistical sense (see example below). Be mindful of the tidal activity in your study area. A tag stuck on the bottom will detect some minor depth changes as tides change the water depth. If you choose a range that is too small for local tidal conditions, the tag will not initiate a conditional release when it is stuck or sitting on the bottom.



Consider disabling Mortality feature if your animal typically remains at a constant depth. microPAT tags do not have a fast-pin burn feature. If the animal experiences a mortality at depth, or tag sinks to depths $\geq 2000\text{m}$, the tag will crush and will not report in.

Activate auto-detection

- Select a depth threshold that the tag must exceed before monitoring for detachment. This helps prevent triggering a conditional release. For example:
 - If you program a microPAT and put it in Start mode using Tag Agent (while the tag is attached to your PC) it will detect 'constant depth' while it's sitting on your desk.
 - If the animal inhabits shallow waters before migrating to deeper depths, and you don't want the tag prematurely releasing before the animal goes to sea.
- Select the number of days that the tag must be deployed before it begins monitoring for detachment. This will help if you are deploying in a shallow water area and you want to ensure the animal gets out to deeper waters before monitoring for a constant depth.
- If you disable both features above, the tag will start monitoring for release immediately.

Premature Release Interval

This is the length of time that the tag must meet one of the three criteria above to initiate release. Choose a duration that is significantly longer than what you would expect from normal animal behavior.

The release settings shown in [Figure 9](#) will result in the following:

- The tag will release 120 days after deployment.
- The tag will start monitoring for release only after it 1) exceeds 10 meters in depth and 2) has been deployed longer than 3 days.
- Once it starts monitoring for release, the tag will initiate release if it meets one of the following criteria:
 - The tag is dry or shallow for longer than 48 hours.
 - Stays within an 8-meter depth range (± 4 meters) for more than 48 hours. For example, all the depths are between 122 and 130 meters for 2 days.

Data Product Settings

Data products are the distinct types of data available from Wildlife Computers tags. The microPAT sends the following data messages to Argos upon release:

- Daily light curves and sea surface temperature (SST) for Geolocation.
- Empirical Cumulative Distributions (ECD) of depth, with temperature readings for each ECD depth.
- Time Series depth and temperature data for either
 - 2 days prior to release for deployments ≥ 10 days.
 - For an early release, this will include the premature release detection period. For example, if the programmed premature release period is 24 hours, you would get 3 days of time series data at the end of the deployment, or
 - For the entire deployment if the deployment is < 10 days.

Summary Period Data

Light-level and SST Geolocation

Light-level and sea-surface temperature messages are always generated daily. The dawn and dusk transitions are used to calculate geolocation. Provided the animal is not too deep or within dark murky water, two light-level curves are created for each day of the deployment and contain the following information:

- Whether the curve represents a dawn or dusk transition.
- Twelve depth-corrected light-level samples for each transition.
- A sea-surface temperature for each dawn. This is derived from the temperatures for the shallowest samples in the ECD and Time Series messages closest in time to the dawn transition.

ECDs

Empirical Cumulative Distribution (ECD) of depths including the minimum and maximum depths encountered, as well as the depth above which (i.e., shallower than) the animal spends 25, 50, 75, and 100% of its time during fixed 6-hour summary periods.

For each ECD depth, the tag will also provide the maximum temperature encountered at the ECD depths during the summary period, providing a temperature profile of the water column. These are behaviorally-driven temperature profiles.

Note: Due to limited bandwidth, the tag will attempt to send three out of the four 6-hour summary periods per day at random.

Summary Period Offset

The 6-hour summary period is fixed, but you can set an offset. The offset is the number of hours after UTC 00:00 that you want your summary periods to begin. This can be used to choose summary periods based on the local time of day.

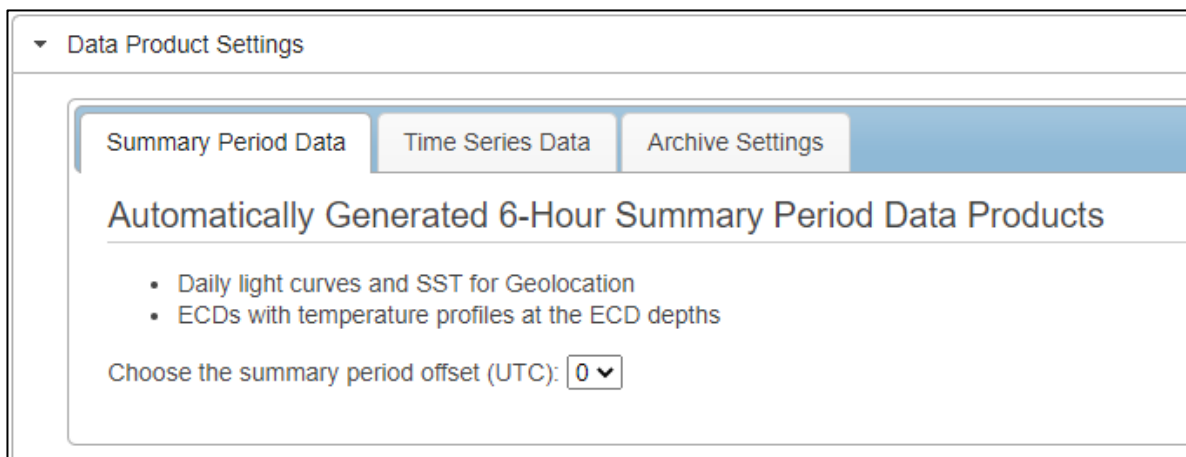


Figure 10—Summary Period Data tab

Time Series Data

microPAT tags send time series depth and temperature data messages through Argos to assess animal condition post-tagging or pre-release. Depth and temperature time series provides low frequency reporting of sensor data for instruments which may never be recovered.

Each depth and temperature time series message contains:

- The time series data sampled at a fixed 600 seconds.
- The minimum and maximum values encountered during the period covered by each time series message as measured at the 30 second archive sampling rate.



The absolute Min/Max values and point sample values may not match as the absolute values are determined from all archived data collected during the message period. This can give insight to the amount of aliasing that has occurred when generating the time series message.

Time Series Sensor Resolution

Time series sensor resolution will vary for each measurement. All time-series sensor readings have an associated resolution which is reported in the decoded data. The resolution is dynamically adjusted to compress the data for transmission.

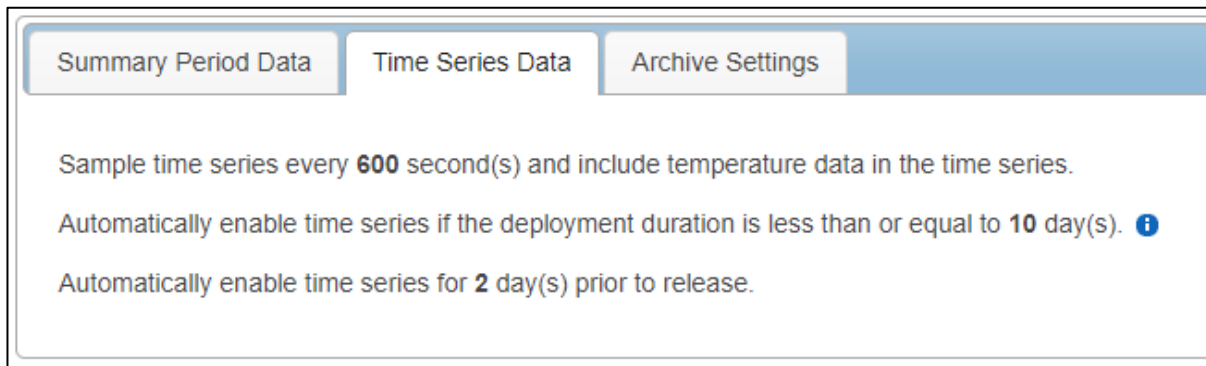


Figure 11—Time Series Data tab

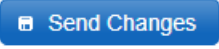
Archive Settings

The microPAT samples and stores Light, Depth and Temperature and wet/dry readings every 30 seconds.

Transmission Settings

This category displays the Argos uplink interval (repetition rate), which is how often the tag will test for dry conditions and try to transmit after pop-off. The transmission interval for the microPAT tag is fixed at 60 seconds. This parameter is set by Wildlife Computers.

Loading Settings into a Tag

Once the tag release settings are chosen, click the blue-colored  button (or 'Propose Changes' button if working in Tag Portal) to load settings into the tag. Tag Agent will confirm receipt of settings via a dialog box.

The 'Check for Updates' tab on the top left navigation bar of the Tag Agent home screen can be used at any time to see if setting updates are available.

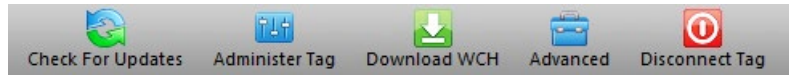


Figure 12—Tag Agent navigation bar

Save Settings to PDF

To save a copy of your settings in a separate file, click on 'Save to PDF' in the top right of the Administer Tag section of Tag Agent. This will save a PDF to the computer. Send changes to the tag prior to saving the settings.

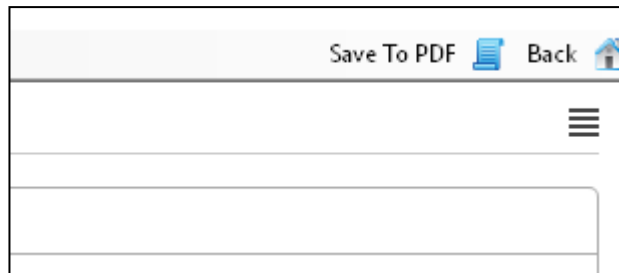



Figure 13—Save settings to PDF.

Creating Templates

Once tag settings have been configured a template can be saved. Templates allow configuring of multiple tags with the same settings. Select the  icon in the upper right corner of the screen to reveal the Template Manager. 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.

To create a template, select  and give the template a name.

Viewing Configuration History

View the tag's configuration history by clicking the arrowhead icon on the left sidebar menu. Clicking the arrowhead exposes the tag history. Clicking again on the arrowhead will hide the History. View previous tag settings by clicking on each grey-colored date listed.

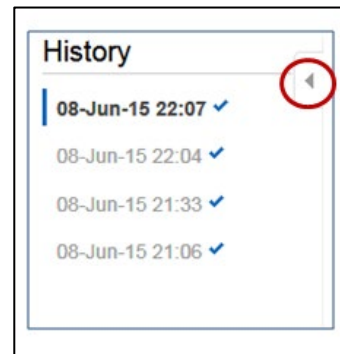


Figure 14—Tag configuration history can be viewed using arrowhead icon.

Disconnecting from microPAT

Use the Disconnect tab on the upper right of the Tag Agent Menu to select the tag state before unplugging. If you are planning to deploy soon, select Auto-Start mode. The tag will then auto deploy upon saltwater submersion. If you are planning to store the tag for longer than one month, select Stop mode and refer to the [Tag Storage and Battery Maintenance](#) section for more details.



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

Clearing the microPAT Memory

The memory archive is cleared automatically when the tag is put into AutoStart or Start in Tag Agent. The LED will indicate that the tag is clearing the archive with many rapid blinks.

If a tag is accidentally deployed be sure to use Tag Agent to put it back into AutoStart or Start so that the memory is clear for the real deployment.

If a tag is recovered post-deployment, be sure to download the archived data as soon as possible.



If the tag is accidentally put into Start or Auto-Start prior to downloading the archive, the archive will be lost. Keep a microPAT tag in Stop mode until the archived data are downloaded. A microPAT kept in Stop mode will maintain its archived data.

Checking Sensor Readings & Transmission Test

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:

- Depth – should be reading ~ 0 meters.
- Ambient Temperature—responds quickly to warm air blown onto the thermistor located immediately above the communications port.
- Light-level—under typical office lighting, covering the light sensor (shiny square on the side of the tag) with your hand should drop the value by 20 to 40 counts.
- Wet/Dry—connecting a wire from the large rectangular ground plate strap above the communication port to the metal ring around the base of the antenna should change the value from over 200 to less than 20.

Test Transmissions

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.

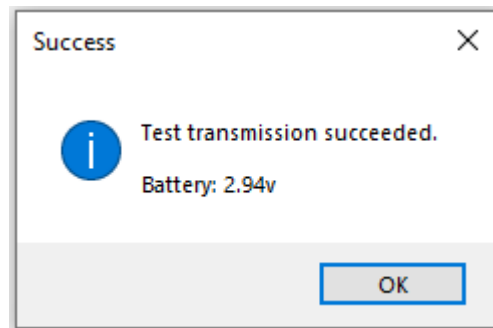


Figure 15—Test transmission results.

The Transmit 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.

The test transmission voltage should read approximately 2.8 to 3.1v and the battery voltage displayed on the main sensor screen should be around 3.0v.

If you receive a low voltage reading, we recommend repeating this test at least 3-10 times. If you continue to receive a low voltage reading, anything less than 2.8v, contact your technical sales consultant.

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, resulting in a deployment seed location. After completing the test, **the tag will be in STOP mode, and you will need to communicate with it again prior to deployment.**

Pop-up tags do not need a deployment seed location (initialization) prior to deployment, like other satellite tags. If you want a reassurance test before deployment that the tags are transmitting to the satellites, click on the Advanced Tab and then Argos Transmitter Test.

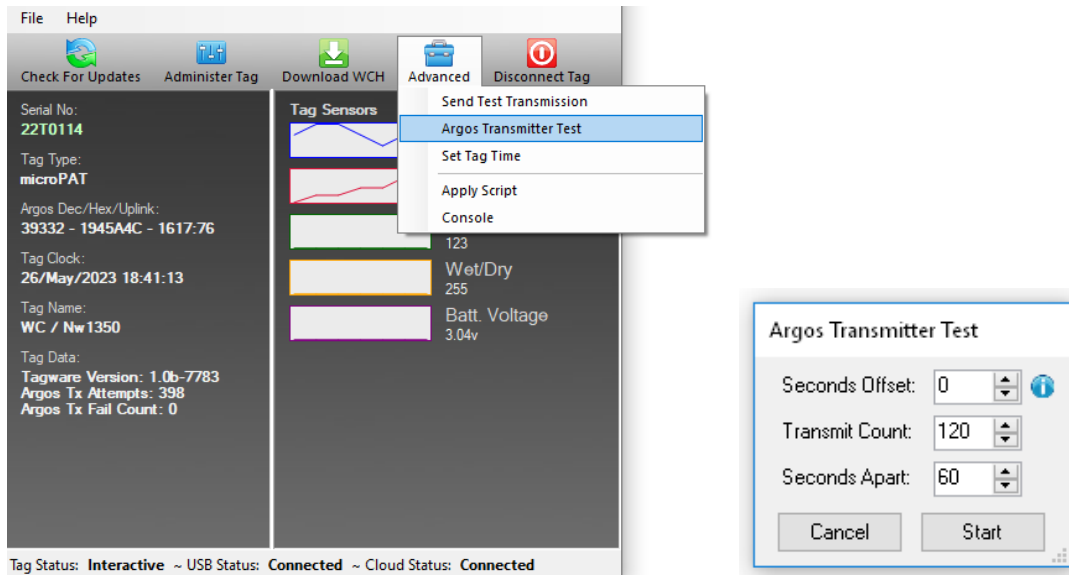


Figure 16—Argos transmitter test.

- 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 using the Argos website prior to beginning the test. [Instructions to obtain Argos Pass Prediction data for up to six months.](#)
- Seconds Apart: The time between each transmission. The usual repetition rate for a microPAT is 60 seconds.

When all tags have started the Argos Transmitter Test, take them outside where they have a full view of the sky. For the best results, float the microPATs in a bucket of saltwater.



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 deployment. When the test is complete, verify that the LED light is not on. If the LED light is on, you MUST communicate with the tag using Tag Agent and manually place the tag in Auto-Start or Stop mode.

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.

When logged into your Portal account, a list of the tags which you have administrator power over 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.

Administrator(s)	Tag Type	Serial Number	PTT Id	Tagware Version	Name
spot6tagger@gmail.com	MiniPAT	13P0569	91966	2.4q	ETP 2014
spot6tagger@gmail.com	sPAT	16P0239	39332	2.4q	Heather sPAT 2.4q
spot6tagger@gmail.com	sPAT	16P2040	39332	2.4q	
spot6tagger@gmail.com	MiniPAT	13P0544	39332	2.4n	

Figure 17—List of tags within Tag Portal. To program select the serial number or 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. This will save the settings in the cloud. The next time that tag communicates with Tag Agent (no matter who plugs the tag in), a dialog box will appear notifying you 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 published, when they were selected, and which administrator chose the settings.

Tag Portal maintains a historic 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.

So long as the software has been opened once and credentials have been entered, programming offline is possible. To program settings, select Administer Tag from Tag Agent’s top navigation bar, choose settings, and click Send Changes. A dialog box will confirm settings have been loaded into 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 internet connection, 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.

microPAT Recovery and Data Download Instructions

If the microPAT is recovered after deployment, it is possible that contamination of the communications port may cause some communication difficulties. The following instructions, in addition to describing how to recover the data, explain possible problems that might occur during the recovery and how to fix them. Even if all attempts to communicate with the microPAT fail, your deployment data are probably still in memory, and can be retrieved by Wildlife Computers.

Preparation for Post-deployment Communication

When you recover your microPAT full of valuable deployment data, there are several steps to perform before attempting to connect it to the USB communication cable.

As a precaution, it is advised to have the following on hand:

- Compressed air in a can
 - Electronic contact cleaner, if available
1. Thoroughly dry the microPAT with a paper towel.
 2. Remove the rubber communications port protection plug.
 3. Gently clean the pins with a small brush—like a toothbrush—and isopropyl alcohol or acetone to remove the silicone grease from the pins.
 4. Blow out any water in the communication port. Make sure the port is clean and dry. Compressed air in a can works well for this.



Communicating with a microPAT which has saltwater in the communications port will cause the pins to corrode very fast!

5. Count the number of pins in the communications port. If there are not four pins, one or more have corroded or broken off. Stop there and send the microPAT to Wildlife Computers, and we will download your data.
6. Examine the pins in the communications port. If they are rusty or corroded, send the microPAT back to Wildlife Computers for downloading.
7. If all four pins look clean and golden in color, you can continue and attempt to establish communications.
8. You may wish to spray some contact cleaner into the communications port as a precaution.

If you can establish a communication connection with the tag, you are now ready to download your data with Tag Agent.

Download Your Data

Use the Download WCH tab on the Tag Agent top navigation bar to download microPAT archival data (Figure 18). You will be prompted to save the .wch file to your computer. The file can then be uploaded into the Wildlife Computers Data Portal for decoding, analysis, and storage. [Reference the Portal and Tag Agent User Guide](#) for more details.

Put tag into Stop mode after downloading the data.



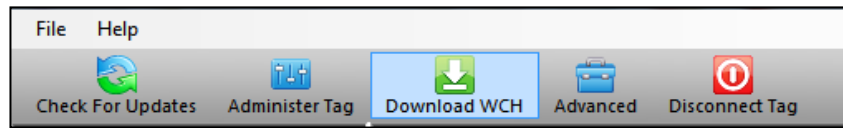


Figure 18—Tag Agent menu bar. Select Download WCH to download archived data.

Tag Storage and Battery Maintenance

Proper tag storage and battery maintenance are important to minimize passivation, maintain optimal battery voltage, and prepare the tags for deployment. As a standard, microPAT tags ship in “Auto-Start” mode for immediate deployment, unless otherwise specified. When stored correctly, tags may experience battery life loss of one to two percent for every year of non-use.

microPAT Storage—Less Than One Month

If your deployment date is in less than one month, simply store the tags in “Auto-Start” mode at the optimal storage temperature. The optimal storage temperature range is 0° to 5° C. Tags must not be stored at temperatures warmer than 5° C or colder than -20° C. Remember to read the [pre- and post-deployment checklists](#) to optimize your deployment.

microPAT Storage—Longer Than One Month

If your deployment date is more than one month away, place the tags in “Stop” mode before storing.

To put tags in “Stop” mode, open Tag Agent. In the top menu, click the “Disconnect Tag” tab. Scroll down to “Stop” and follow the prompts. Tags should be stored at the optimal temperature. The optimal temperature range is 0° to 5° C. For long-term storage, tags must not be stored at temperatures warmer than 5° C or colder than -20° C. Remember to read the [pre- and post-deployment checklists](#) to optimize your deployment.



At least three months prior to your deployment, check the transmit voltage by performing a few test transmissions (see the Test Transmissions section) to confirm the tags are ok to deploy.

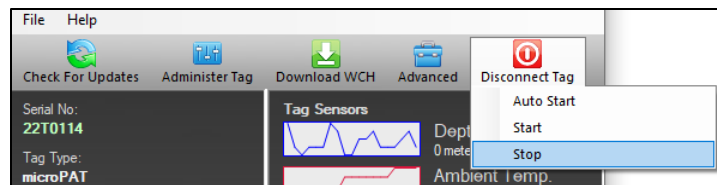


Figure 19—Example of how to put tag in Stop mode in Tag Agent.

Technical Specifications

Attachment type	Towed
Conductivity Operational Limits	0.1 to 5 S/m
Depth Sensor Accuracy	1% of reading (typical), 3% FS (maximum)
Depth Sensor Range	0 to 2000m (dBar)
Depth Sensor Resolution	0.061m (dBar)
Dimensions	96 mm (length) x 33 mm (diameter)
Light Sensor	$5 \times 10^{-12} \text{W.cm}^{-2}$ to $5 \times 10^{-2} \text{W.cm}^{-2}$
Maximum deployment length	365 days
Memory	16 MB
Operating Temperature Rating Range	-20° C to 50° C
Optimal Storage Temperature Range	0° C to 5° C
Pressure Rating	2000 m
Sensors	Depth, Temperature, Wet/Dry, Light
Temperature Sensor Accuracy	0.1° C
Temperature Sensor Range	-40° C to 60° C
Temperature Sensor Resolution	0.05° C
Transmitter Frequency	401.678 MHz
Transmitter Power	0.5W / 3 dBi peak antenna gain
Weight in Air	46 g

Data Product Specifications

TEMPERATURE PROFILE	
Depths (source)	ECD for depth
Depth accuracy	1% of reading (typical), 3% FS (maximum)
Depth resolution	1 – 8 m, varies with maximum depth
Depth range	0 to 2000 m
Depth units	meters of seawater (dBar)
Temperature accuracy	0.1 C
Temperature resolution	0.2 C
Temperature range	-5° C to 46° C
Temperature units	Celsius
Profile points	5
Sample interval	30 s
Summary period	6h
UTC offset?	Yes
CRC check?	Yes
TIME SERIES	
Depth accuracy	1% of reading (typical), 1.25% FS (maximum)
Depth resolution	Varies, proportional to range observed
Depth range	0 to 2000 m
Depth units	meters of seawater (dBar)
Temperature accuracy	0.1° C
Temperature resolution	Varies, proportional to range observed
Temperature range	-2° C to 48° C
Temperature units	Celsius
Sample interval	600 s
Argos messages per day	6 (depth and temperature)
CRC check?	Yes
EMPRICAL CUMMULATIVE DISTRIBUTION FOR DEPTH	
Depth resolution	1 – 8 m, varies with maximum depth
Depth accuracy	1% of reading (typical), 3% FS (maximum)
Depth range	0 to 2000 m
Depth units	meters of seawater (dBar)
Sample interval	30 s
Percentiles	0, 25, 50, 75, and 100%
Summary periods	6h
Argos messages per day	3 (3 out of 4 summary periods are sent)
UTC offset?	Yes
CRC check?	Yes
LIGHT LEVEL	
Time resolution	Minutes

Curve points	12
Argos messages per day	1
CRC check?	Yes
ARCHIVE	
Sample interval	30 s
Depth accuracy	1% of reading (typical), 1.25% FS (maximum)
Depth resolution	0.061 m
Depth range	0 to 2000 m
Depth units	meters of seawater (dBar)
Temperature accuracy	0.1° C
Temperature resolution	0.05° C
Temperature units	Celsius
Light sensor range	$5 \times 10^{-12} \text{W.cm}^{-2}$ to $5 \times 10^{-2} \text{W.cm}^{-2}$
Wet/Dry accuracy	N/A
Wet/Dry resolution	1
Wet/Dry range	0 to 255
Wet/Dry units	Relative conductivity
Dry	Reports tag state based on Wet/Dry
Battery	Reports battery voltage

Additional Information

Glossary of Terms

- Administrator—someone who has authority to publish and change tag settings.
- Archive—Sensor time series sampled by a tag.
- Argos PTT (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 Argos from uplinks received during a satellite pass. Multiple uplinks are required to generate a single location. Get more information about how the Argos system works here: <http://www.argos-system.org/web/en/391-faq-general-questions.php>
- Argos Payload—Argos payload contains a maximum of 31 bytes and carries our data products. Data products are encoded in messages. Many data products are encoded in one payload. Some data products require multiple, partial, or variable payloads (e.g. Temperature profile, Low-res % Dry timelines, and ECD with variable bin values, respectively).
- Argos Uplink—a radio transmission intended for receipt by the Argos satellite system.
- Auto-Start/Start/Stop—tag modes. Auto-Start allows the tag to Start by submersion in seawater or Tag Agent. Start means a tag is running and will begin its deployment according to its programming. Stop means the tag will remain unresponsive unless connected to Tag Agent.

- Data Message—created by the tag to transmit data through the Argos system. Each data message is transmitted as payload in an Argos uplink. To increase the likelihood of its reception by the Argos system, each message is sent a fixed number of times.
- Data Portal—the cloud-based data management service offered by Wildlife Computers.
- Data Products—summarized tag data for transmission including (but not limited to) Time Series Data, PDT (Profiles of Depth and Temperature), ECD Histograms. Founded on sensor output. Compressed data are sent over Argos.
- Deployment—the period when a tag is attached to an animal and started.
- ECD—Empirical Cumulative Distribution.
- Summary Period Data—data generated from sensors during a defined number of hours (or interval).
- Tag Agent Software—the program used to program Wildlife Computers tags.
- Tag Portal—the cloud-based service offered by Wildlife Computers for tag setup.
- Tagware—the software running on a tag.
- Transmission—The action or process of sending a radio signal, usually to the Argos Satellite System. Every transmission that is sent from a tag is not necessarily received.
- Tag Release Sequence —The settings that define when a tag will activate its release mechanism. On the user specified time interval or scheduled date, the tag will begin the release sequence, unless a conditional release occurs prior to reaching the intended duration.
- Time Offset—Offset applied to summary periods to synchronize them to local time. An offset can provide better data for the periods of interest.
- Uplink Interval (repetition rate)—how often a tag will test for dry conditions and try to transmit. This value is programmed by Wildlife Computers.
- Wet and Dry—the state of the tag as determined by the wet/dry sensor which measures relative conductivity.
- Wildlife Computers Communications Cable—the cable required by Tag Agent.
- Wildlife Computers Portal—the cloud-based service offered by Wildlife Computers for data viewing and remote tag setup.

What is Antifouling Paint and Why You Should Apply It

Heavily fouled tags can be hugely detrimental to tagging studies as fouling growth over critical sensors impedes the tag's transmitting performance. Especially for deployments in tropical waters, it is imperative that tags be protected against marine growth.

Wildlife Computers leaves the decision to apply antifoul coating after manufacturing and before deployment entirely to the researcher's discretion. Excluding animals that regularly haul-out, ***we strongly recommend that tags be treated with some antifouling coating to ensure the best possible chance of a successful deployment as Wildlife Computers does not provide warranty against biofouling.***

Wildlife Computers endorses two antifouling coatings: Micron and Prospeed.

Micron is a range of copper-based antifouling paints, many with a biocide that repels barnacles. For optimal protection, it is critical to use [International Paints' Interprotect primer](#) in addition to the paint. Micron66* is a great choice for slow movers like sea turtles and whale sharks. Other Micron saltwater paint options are available and should work well. Proven choices are Micron 66, 77, 99, CSC, and Extra SPC. If Micron paint is unavailable in your area, find an alternative copper-based ablative antifouling paint with a suitable primer. Wildlife Computers does not currently apply Micron antifouling paint.

**Micron66 has been discontinued but can still be found in some stores. Wildlife Computers has been testing Micron CSC and Micron Extra SPC as a replacement. microPAT pop-up tags will float with one coat of primer and two coats of Micron CSC. Micron Extra SPC is heavier, restricting its application until further testing can be done on microPAT tags. Once antifouling paints and tethers are applied, Wildlife Computers recommends performing a float test.*



Tags painted with Micron must only be handled with gloves as Micron contains copper and biocides.

Store the tags in a Ziploc® bag as Micron gives off a strong odor. Store the tags in a cool place optimally between 0° C and 5° C.

Prospeed is a foul release silicon coating, not an antifoul, that impedes biofouling adhesion. Prospeed is non-toxic and widely available. Prospeed relies on movement for its effectiveness—the more water moves over its surface, the better it performs, as marine growth cannot get a grip to grow. Prospeed can last up to a year and is relatively non-toxic according to the manufacturer.

Wildlife Computers offers an optional service to sand, mask, and paint tags with Prospeed antifouling and coat the wet/dry sensors with conductive polymer. Wildlife Computers offers Prospeed antifouling painting at a charge of \$100 per tag prior to shipping.

For instructions on how to apply antifouling coatings, videos, and more:

<https://wildlifecomputers.com/our-tags/extras/anti-fouling/>

Antifouling Tests

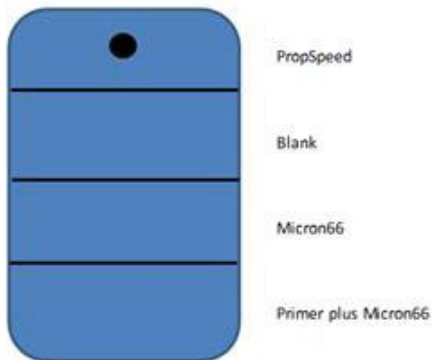
Wildlife Computers has been undertaking tests on antifouling paint in various parts of the world.

Below is an image of submerged polyurethane and epoxy test plates after two months on a wharf pile in New Zealand.

PropSpeed is at the top and has done a reasonable job but has started to fail, likely due to the test being performed on an immobile object and not a moving animal. Next is a placebo blank area with no protection that has fouled badly. The next strip down had Micron without a primer and the Micron has nearly worn away completely.

The Micron at the bottom has one coat of Interprotect® primer and one coat of Micron—it is pristine. We recommend this set up for a successful project.

The plates are as follows:



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

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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.

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