MiniPAT User Guide

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

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About the MiniPAT

The MiniPAT is a pop-up satellite archival tag used to track behavior and migration of marine animals. It is an archival tag equipped with an Argos transmitter and a corrodible attachment link. The MiniPAT 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 MiniPAT determines it is no longer attached to an animal. Depth, temperature, and light-level 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 MiniPAT. Transmitted data products are also explained.

Figure 1—MiniPAT tag rigged with a stainless-steel heat shrink-covered tether and a Wilton anchor.

Before you Begin

The list below shows what is required to configure and deploy the MiniPAT:

- A Wildlife Computers online portal account
- A Windows computer with Tag Agent Software and USB driver installed
- A Wildlife Computers communications cable
- A magnet

Visit wildlifecomputers.com to download the required software (Tag Agent and the USB Communications Cable driver) and setup an account. At the end of this document, there is a list of key terms and concepts for reference. We recommend new users review this list.

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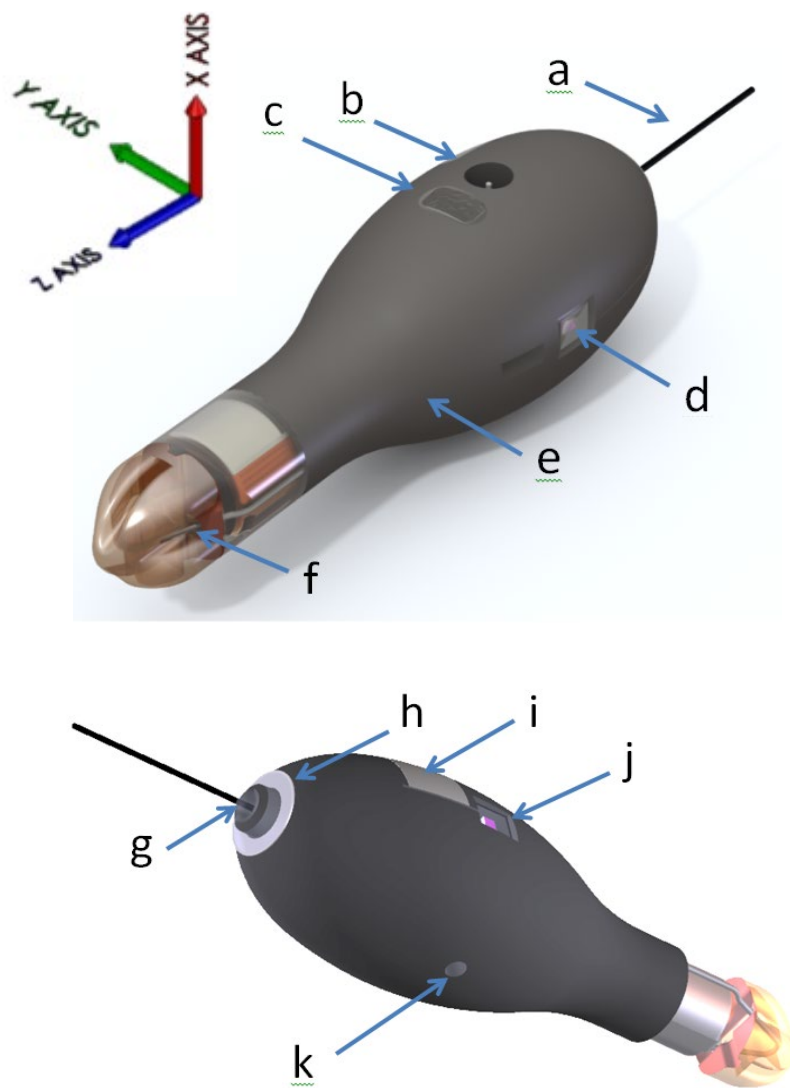
Anatomy of a Tag

Figure 2—MiniPAT tag showing: (a) Argos antenna, (b) temperature sensor, (c) communications port with plug, (d) light sensor (1 of 2), (e) float, (f) release pin, (g) LED light, (h) wet/dry sensor, (i) ground plate, (j) light sensor (2 of 2), (k) pressure sensor.

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.

The wet/dry sensor, ground plate, pressure sensor, thermistor, and electronic release pin should not be covered. Covering these sensors will interfere with the normal function of the tag. This includes antifouling coatings, 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 MiniPAT. 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.

Use the USB communications cable to plug the tag into your PC. Take care to ensure that the pins are aligned. 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).
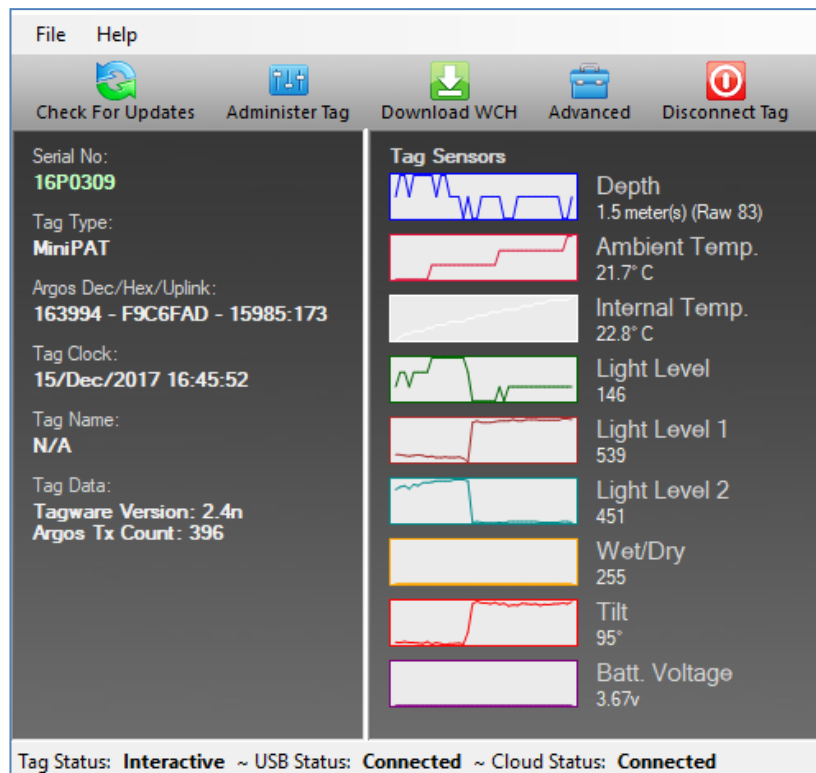

Figure 4—Tag Agent home screen.

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

MiniPAT tags have three states: Start, Auto-start, and Stop. When in Start mode, a tag is running and will begin its deployment. Auto Start allows the tag to Start by submersion in seawater (for use in brackish or freshwater contact Wildlife Computers). In Stop mode, 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.

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 Stopped

A magnet can be used to toggle the MiniPAT out of 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. The second

swipe needs to happen in the window when the light is on. MiniPAT cannot be toggled from Auto Start to Start with a magnet.

If you Start a MiniPAT but do not deploy it on an animal, the tag will initiate a premature release according to your settings (see page 10). Once premature conditions are met, the tag will then begin to transmit and deplete the battery. Best practice is to not leave MiniPATs Started while off animals.

For the first five days of deployment, toggling with the magnet will switch the tag from Start state into Auto-start state. This allows a tag to be redeployed without having to be plugged into Tag Agent. After five days, the magnet toggle will put the MiniPAT in Shut-down mode. This is to avoid unintentional data erasure. If a new deployment is started, the MiniPAT will write over data previously collected.

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

- Erasing the archive—many rapid blinks with the LED mostly on indicate that the tag is clearing the archive in preparation for a new deployment.
- Sample rate—
  - MiniPATs with tagware 2.4p or older for the first two hours of a deployment (or until the tag depth exceeds five meters) the tag will briefly blink at the sampling interval.
  - MiniPATs with tagware 2.4q or newer will NOT blink at the sampling interval after deployment.

Configuring Tag Settings

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

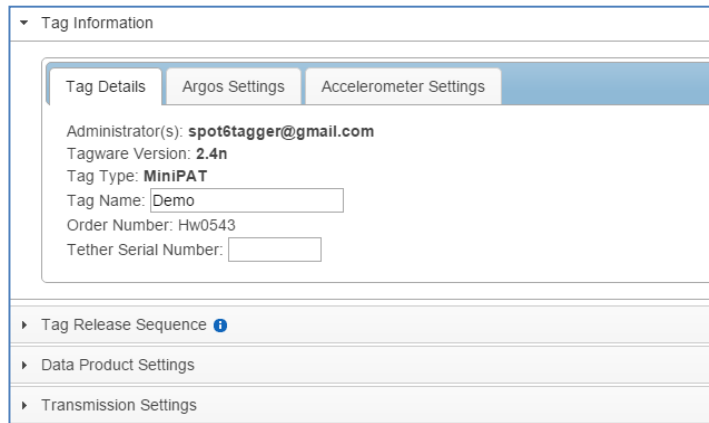*Figure 5—Tag Agent menu bar. Select Administer Tag to edit tag settings.*

A new window will open revealing four sections: Tag Information, Tag Release Sequence, 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 6). 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 Argos Settings tab displays the tag PTT ID details. The Accelerometer Settings show if the accelerometer channels are being archived.

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

Figure 6—Expanded view of Tag Details tab.

Tag Release Sequence

These settings define when the tag will activate its release mechanism.

Either an interval release or scheduled date release can be set. The release will begin at 20:00 UTC after the number of days specified or on the chosen date.

The tag automatically sets its archival sample interval based on the deployment length specified.

Conditional Release

The MiniPAT 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.

Auto-detect Tag Detachment

This parameter automatically initiates release if the tag detects itself floating at the surface.

- Select a depth threshold that the tag must exceed before monitoring for detachment. This helps prevent triggering a conditional release before the tag is attached to its host animal. For example, if you program a MiniPAT tag and put it in Start mode using Tag Agent (while tag is attached to your PC) it will detect constant depth while it's sitting on your desk.
- Select how long the tag must be at the surface before a release will occur. The pin burn will occur after the specified time has elapsed, not at 20:00 UTC like the scheduled release.

Auto-detect Mortality

This parameter monitors for three mortality conditions:

- Floater—the tag is floating at the surface (more than 50% of the wet/dry readings for every hour of the interval is dry, OR if the maximum depth during the premature release interval was <= 1 meter
- Sitter—the tag is sitting at a constant depth)
- Sinker—the tag remains below a certain depth

Upon satisfying any one of these conditions, the tag automatically initiates release. To monitor for mortality, configure the following:

- Select a depth threshold that the tag must exceed before monitoring for detachment.
- Optionally, select the depth that the tag must remain below to be considered a sinker.
- Select the duration—this sets how long each of the depth criteria must be maintained before a release will occur. The pin burn will occur after the specified time has elapsed, not at 20:00 UTC like the scheduled release.
- 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.

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Figure 7—Tag release settings.

The release settings shown in Figure 7 will result in the following:

- The tag will release 150 days after deployment.
- The tag will release if it exceeds 10 meters in depth and then meets any of the following criteria:
  - Stays within 6m (+/- 3 meters) of a constant depth for more than 3 days.
  - Stays deeper than 400m for more than 3 days.
- The tag will release if it reaches a depth of 1700 meters. This ensures that if the tag is sinking, it will not reach its crush depth and become inoperable.

If your animal naturally remains at a constant depth for long durations consider disabling the Auto-detect Mortality feature.

Adaptive Transmission Schedule on Conditional Release

In the case of early release, the MiniPAT transmits time-series data messages in addition to its scheduled data products. This can help when investigating the cause of the conditional release event. The time-series interval depends on deployment duration.

If the conditional release is:

- Less than 15 days the MiniPAT will transmit 300 second time-series for depth and temperature (unless the originally programmed interval was faster).
- Between 15 and 30 days, the MiniPAT will transmit 600 second time-series for depth and temperature.
- Greater than 30 days AND no temperature or depth time-series were initially enabled, the MiniPAT will create 600 second Time-Series messages for the two days leading up to release.

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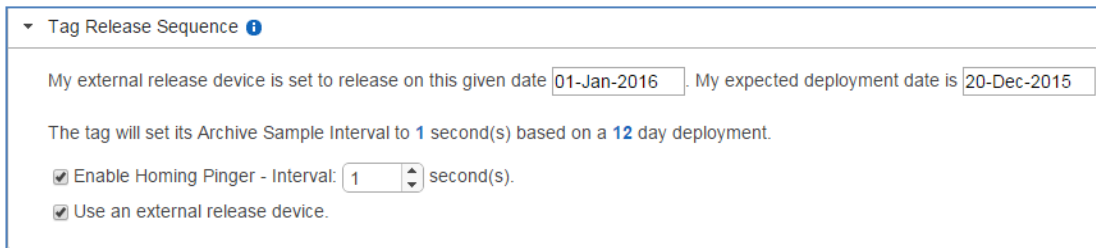
Ignore Wet/Dry After 45 Days

You can optionally choose to have the tag ignore its wet/dry condition 45 days after release. The tag will then attempt transmissions at its scheduled repetition interval until the battery expires. This setting can be useful if a tag is fouled or hung up on debris, in which case the wet/dry sensor may indicate wet, even when the tag is at the surface. The longer a tag is at the surface the more susceptible it is to damage and predation.

Pinger

The pinger is used for tag recovery. When enabled, the MiniPAT sends out low power "pings" after release, while at the surface. The tag can be located with an appropriate receiver and directional antenna. A one or two-second ping interval is the most appropriate setting for tracking, and mimics a typical VHF tracking transmitter. Excess power draw from the pinger is negligible. The transmissions sent by the pinger are very short and do not carry any data.

External Release Device

If using an external release device, such as Wildlife Computers Programmable Timed- Release (PRD-TI), the MiniPAT will not burn its release pin. With the burn pin still intact, the MiniPAT can be redeployed. Set the date the external release device is programmed to release and expected deployment date. Based on this range, the tag will calculate the archival sample interval. The pinger feature can be enabled to assist with recovery.

Figure 8—Release settings for a 12-day deployment using an external release device. The pinger is enabled.

Data Product Settings

Data products are the various types of data available from Wildlife Computers tags.

To take full advantage of the capability of the tag, great care should be taken in considering which data products to enable and the frequency of message generation. If too many messages are generated not all of them will be received. In this case, the result will be random gaps of time during the deployment for which data are missing.

Many settings on the tag affect the total number of Argos messages generated. These include:
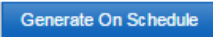
- Enabled data products
- Duty-cycling of enabled products
- Sampling Interval
- Summary Period

The combined effect of the chosen settings is shown at the bottom of the Data Products Settings section. The number of messages generated per day and the total number of messages generated during the entire mission are displayed. In the case of duty-cycling, two values are shown to account for the different number of messages generated during on and off duty-cycle days. A warning is displayed when the message total exceeds the maximum likely to be successfully received. The total number of messages received varies depending on sea-surface.
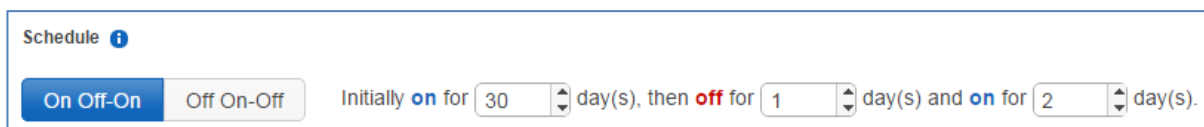
The rule of thumb is, the fewer number of messages that the tag generates, the greater the probability that ALL generated messages will be received. Some study objectives require finer temporal resolution, contiguous temporal coverage, and/or longer deployment durations such that a large number of messages are generated. In these instances, one can use duty-cycling to help control when the "holes" in the data occur.

Duty-cycling

Duty-cycling is the generation of Argos messages on an intermittent schedule, rather than daily. Duty-cycling can be used to reduce the total number of messages generated and to extend deployment duration.

- Duty cycle a data product by selecting: **Generate On Schedule**
- The scheduler will appear at the base of the section (Figure 9).
- Select your preferred pattern, either On-Off-On or Off-On-Off, and fill in the number of days for each step.

The same schedule is used for all duty-cycled data products.

Figure 9—Argos message generation duty-cycle pattern. Messages are initially generated for 30 days then off for one day and on for two. The off one, on two pattern repeats for the duration of the deployment.

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. Two light-level curves are created for each day of the deployment containing the following information:

- Whether or not the curve contains a dawn or dusk transition.
- Nine light-level and depth samples taken during each transition.
- A sea-surface temperature for each transition. This is compiled from the samples taken up to seven hours on the dark side and one hour on the light side of the transition.

Light Attenuation Constants

The tag calculates daily light attenuation constants, correcting the light measurements for depth. For most applications, having light attenuation constants turned on is appropriate. If this feature is disabled, the tag uses predetermined values for the light attenuation constant. Disabling this feature can be useful for animals that follow isolumes (e.g., swordfish).

Daily Data

Daily data messages contain the minimum and maximum temperature and depth readings from the fast-sampled archive data set, as well as the change in light-level for each UTC day. Each message contains four days of data.

Orientation Data

This data product characterizes the vertical orientation over time of a single-point mount MiniPAT. Orientation data uses the onboard accelerometer and is designed to detect activity. It is only available on shorter deployments with the archive sample interval is 1 second.

For each UTC day, one message is generated that contains two-hour summary periods with:
1. Time upright
2. Number of times the tag was *knocked down*
3. Wet/dry summarization

There are adjustable parameters for this data product:
1. The knockdown detector identifies changes in tag orientation. Select the threshold that qualifies a change in acceleration as a knockdown event.
2. To determine the amount of time a tag spends upright versus tilted, a threshold definition of upright is needed.

Daily Data cannot be duty-cycled.

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Figure 10—Daily Message data products. Screen capture shows Light-level messages generated daily, Light Attenuation calculations turned on, Daily Data messages turned off, and Orientation Data turned on.

Activity Time Series Messages

MiniPAT tags have the ability to send time-series depth, temperature, and activity data through Argos. Depth and temperature time-series provides low frequency reporting of sensor data for instruments which may never be recovered. Activity time series counts outliers in activity above an average activity level. This data is derived from 10Hz acceleration data.

Activity Time Series is only available on deployments of 30 days or less.

Sampling Interval

Time-series messages can be generated using one of five sample intervals (75, 150, 300, 450, 600 seconds). This determines the number of Argos messages generated per day. **The time-series sample interval is entirely independent of, and unrelated to, the archive sample rate.** 48 summarized samples, covering one message period, will fit into one Argos message. Messages are transmitted in sequential order to maximize the probability of receiving continuous runs of data.

Possible Time Series combinations:

- Depth
- Temperature
- Depth and temperature
- Depth and activity
- Temperature and activity
- Depth, temperature, and activity

Sampling Interval (seconds)	Argos Messages Per Day			Message Period (hours)
	Depth or Temp (One channel)	Depth and Temp (Two channels)	Depth, Temp and Activity (Three channels)	
75	24	48	72	1
150	12	24	36	2
300	6	12	18	4
450	4	8	12	6
600	3	6	9	8

Figure 11—The number of Argos messages created per day and the corresponding message sample period for the five time-series sample intervals.

The sample interval determines the number of messages generated per day. Selecting a short (75-second) time-series sampling interval will rapidly generate many messages. This may be appropriate for a short deployment. However, if too many messages are generated, they may not all be received. The result will be random gaps of time during the deployment for which there is no time-series data. Selecting a longer sampling interval will improve the odds that there will be no gaps; however, the temporal resolution of each datum will be reduced. Different study objectives will warrant different trade-offs between coverage and temporal resolution.

Each depth and temperature time-series message contains:

- The time-series data sampled at the specified interval.
- The minimum and maximum values encountered during the period of time covered by the time-series message period as measured at the fast 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.

Each activity time-series message contains:

- The number of active events occurring in each time series interval (ex: 75 sec or 600 sec).
- The overall level of activity for the period of the message (ex: 1 hour or 8 hours).

Duty-cycling can be used to reduce the number of time-series messages generated. Duty-cycle settings do not affect the tags archive sample rates.

Example Time-Series Sampling Settings

For the MiniPAT tag, on average approximately 2,000 Argos messages are received following release. With this number in mind, one can work backwards to determine how quickly time-series can be sampled given a preferred deployment length. Following are some typical set-ups:

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- 20-day deployment = 75-second sampling interval for depth, temperature and activity time-series. 72 messages per day x 20 days = 1500 messages.
- Three-month deployment = 300 second sampling interval for depth and temperature time-series. 12 messages per day x 90 days = 1080 messages.
- Eight-month deployment = 600 second sampling interval for depth and temperature time-series. 6 messages per day x 240 days = 1440 messages.

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.

Summary Messages

In order to maximize information throughput, the MiniPAT condenses sensor observations into summarized messages.

Mixed-Layer Temperature

Mixed-layer temperature messages describe the amount of time the animal spends in the mixed layer, the depth of the thermocline, and temperature of the mixed layer. When enabled, one message is created for each summary period and includes:

- Time in the mixed layer (percent)
- Depth of mixed layer (max)
- Temperature of mixed layer (min, max, avg)
- Temperature of the sea surface (min, max, avg)
- Overall depth (min, max)
- Overall temperature (min)

Profile of Depth and Temperature

PDTs record the minimum and maximum temperatures observed at different depths.

- Low-resolution profiles use eight different depths and fit into one message per summary period. When all dives during a summary period are less than 400 m the tag will default to low-resolution profiles.
- High-resolution profiles use 16 different depths and generate two messages per summary period. For summary periods when the tag ventures below 400 m the tag defaults to high-resolution profiles.

Depth points are distributed between the minimum and maximum depths observed during each summary period.

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Histogram Messages

Two types of histograms are available:

- Time-at-Depth (TAD) histograms bundle the depth sensor measurements collected into bins based on how much time the tag was at the user-defined depth ranges.
- Time-at-Temperature (TAT) histograms bundle the temperature sensor measurements into bins based on how much time the tag was at user-defined temperatures.

Histograms are generated starting at 00:00 UTC.

Histogram Bin Limits

There are twelve bin limits for each of the two histograms. These numbers are the upper inclusive limit for each bin. The limits in first eleven boxes can be edited. The twelfth bin limit shows the highest valid sensor measurement and cannot be adjusted.

Summary Period

The summary period is the collection duration of the summary messages. The summary period can range from one hour to 24 hours, but the chosen period must divide the day evenly. The summary periods begin immediately after midnight UTC by default and run to the end of the UTC day. Selecting a six-hour summary period will cause the tag to split the day into four periods from 00:00 hrs. to 06:00 hrs.; 06:00 hrs. to 12:00 hrs.; 12:00 hrs. to 18:00 hrs.; and 18:00 hrs. to 24:00 hrs. This pattern will repeat on the next UTC day.

Figure 12—The Data Product settings.

The Data Product settings shown in Figure 12 are for a 180-day deployment. 11 messages are generated each day. These include:

- 1 x Light-level message
- 6 x Time-series messages
- 2 Mixed-layer temperature messages
- 2 Histogram messages

Transmission Settings

This category displays the Argos interval how often the tag will test for dry conditions and try to transmit after pop-off. The transmission interval for pop-up tags is 60 seconds. This parameter is set by Wildlife Computers.

Loading Settings into a Tag

Once settings have been chosen use the blue Send Changes button (or Propose Changes button if working in Tag Portal) to load settings into tag. Tag Agent will confirm receipt of settings via dialog box. The Check for Updates tab on the top left navigation bar of Tag Agent home screen can be used at any time to see if setting updates are available.
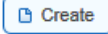
Save Settings to PDF

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.
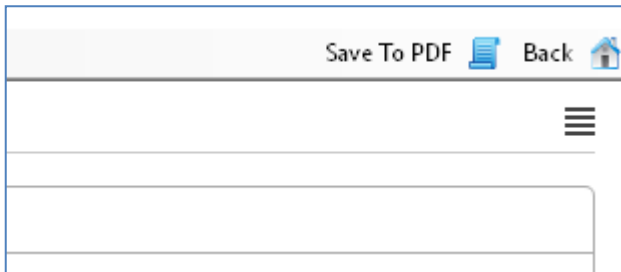
Creating Templates

Once tag settings have been configured a template can be saved. Templates allow configure 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 temple, select [🗋 Create] and give the template a name.

Viewing Configuration History

A tag's configuration history can be viewed using the arrowhead icon on the left sidebar menu. Clicking the arrowhead will expose the tag history and once viewed, clicking on the arrowhead again will hide the History. Previous tag settings can be viewed by clicking on each date listed.

Figure 13—Tag configuration history can be viewed using arrowhead icon.

Disconnecting from MiniPAT

Use the Disconnect tab on the upper left of the Tag Agent Menu to select the tag state before unplugging. If you are planning to deploy in the near future, select Auto Start mode. Tag will then auto deploy upon saltwater submersion.

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 MiniPAT Memory
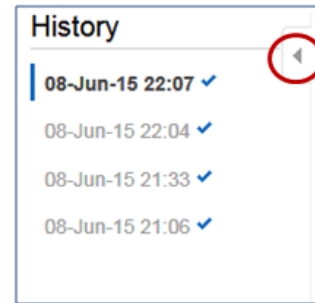
The memory archive is cleared automatically when a new deployment is Started (Tag set to Start, then put into Standby or Stop, and then Started once again). The LED will indicate that the tag is clearing the archive with many rapid blinks.

Be mindful of this when selecting the tag state. If a tag is recovered, be sure to download the data prior to putting back in Start mode.

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:

- Ambient Temperature—responds quickly to warm air blown onto the thermistor located immediately above the communications port.
- 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 from the large rectangular ground plate strap above the communication port to the metal ring around the base of the antenna (letters i and h respectively in Figure 2) should change the value from over 200 to less than 20.
- Light-level—under typical office lighting, covering both light sensors (shiny squares on opposite sides of tag, letters d and j in Figure 2) with your fingers should drop the value by 20 to 40 counts.

Testing 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.
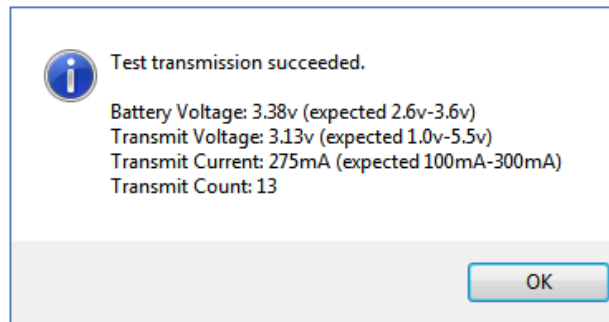
Figure 14—Test transmission results.

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. The Transmit Current will vary depending on the presence of conductive objects near the tag. It has been optimized for a tag that is floating in seawater. Transmit Count is the number of transmissions the tag has made since it was manufactured.

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.
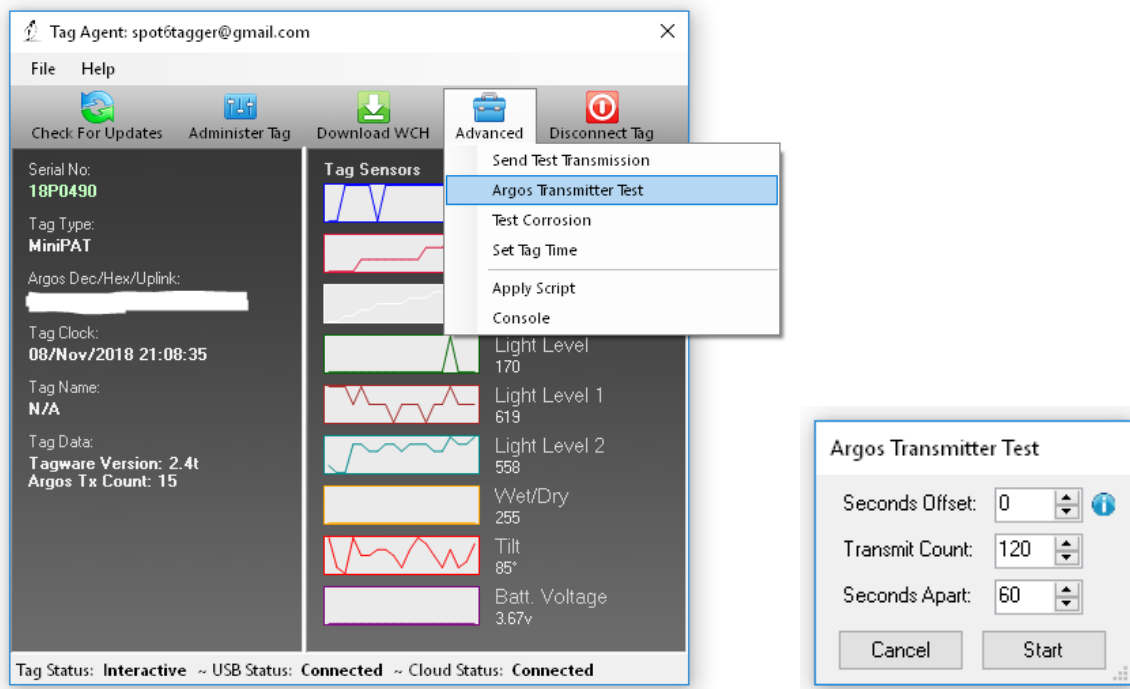
- Seconds Offset: If you will be testing multiple tags at one time, you can use this parameter to offset transmissions so the tags will not transmit at the same time.
- Transmit Count: How many times you want the tag to transmit. 120 transmissions at a 60 second interval will provide a 2-hour test, which 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. The usual repetition rate for a MiniPAT is 60 seconds.

When all of the tags are setup and deployed, take them outside where they have a full view of the sky. For best results, float the MiniPATs in a bucket of saltwater.

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.

Figure 15—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 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 programed 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 feasible. 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 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.

Technical Specifications

Dimensions	124 mm (length) X 38 mm (diameter)
Weight in Air	60 g
Pressure Rating	2000 m
Memory	64 MB
Operating Frequency	401.678 MHz
Operating Life	Up to two years
Sensors	Light, Pressure, Temperature, Wet/Dry
Light	$5 \times 10\text{-}12 W.cm^{-2}$ to $5 \times 10^{-2} W.cm^{-2}$
Temperature	Range: -20° C to 50° C/Resolution: 0.05° C
Conductivity Operational Limits	0.1 to 5 S/m
Storage Temperature	5° C Optimal
Communication	Via USB port using Wildlife Computers communications cable

Additional Information

Glossary of Terms

- Administrator—someone who has authority to publish and change tag settings
- 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 Subprogram—subdivision of a primary Argos account. Each subprogram has separate login credentials.
- 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 Uplink—a radio transmission intended for the Argos satellite system
- 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 Computers tags
- Deployment—the period when a tag is attached to an animal and started
- 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
- Repetition Interval (repetition rate)—how often a tag will test for dry conditions and try to transmit. This value is programmed by Wildlife Computers
- Start/Auto Start/Stop—tag states. When started, will initiate a scheduled release. 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 program Wildlife Computers tags
- Tagware—the software running on a tag
- Wildlife Computers communications cable—the cable required by Tag Agent
- Tag Portal—the cloud-based service offered by Wildlife Computers for data viewing and remote tag setup
- Wildlife Computers Spark Cable—the Wildlife Computers communications cable which is required by Tag Agent to interface with a Wildlife Computers tag
- Wet and Dry—the state of the tag as determined by the wet/dry sensor which measures conductivity.

Tag Storage and Battery Maintenance

Store tags in a dry, cool environment (ideally around +5° C) to help minimize passivation and keep the batteries charged. When stored correctly, the amount of battery life lost per year is only 1-2 percent. It is recommended to exercise the batteries every few months by sending a test transmission. This can be done in Tag Agent. Select "Advanced" and then "Send Test Transmission." The transmission voltage should read approximately 3.2 v and the battery voltage displayed on the main sensor screen should be around 3.5 v. If you receive a low voltage reading, it may be due to passivation forming during storage.

MiniPAT Recovery Instructions

If the MiniPAT 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 MiniPAT 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 MiniPAT 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 MiniPAT with a paper towel.
2. Remove the rubber communications port protection plug.
3. 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 MiniPAT which has saltwater in the communications port will cause the pins to corrode very fast!***

4. 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 MiniPAT to Wildlife Computers, and we will download your data.
5. Examine the pins in the communications port. If they are rusty or corroded, send the MiniPAT back to Wildlife Computers for downloading.
6. If all four pins look clean and golden in color, you can continue and attempt to establish communications.
7. You may wish to spray some contact cleaner into the communications port as a precaution.

If you are able to 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 MiniPAT archival data (Figure 16). You'll be prompted to save the. wch file to your computer. The file can then be uploaded into the Data Portal for decoding, analysis, and storage.

Put tag into Stop mode after downloading the data.

Figure 16—Tag Agent menu bar. Select Download WCH to download archived data.

Biofouling Overview

Biofouling is the attachment of micro-organisms—plants, algae, etc.—to a surface in contact with water. Biofouling can greatly inhibit a tag from transmitting a signal to Argos satellites. A bio-fouled tag will also experience more drag, thereby reducing its hydrodynamic performance.

Researchers should think seriously about antifouling any tag if the study animal is in tropical waters, a shallow-dwelling or slow-moving species or your deployment period lasts a long time.

Wildlife Computers leaves the decision to antifoul tags after manufacturing and before deployment entirely to the researcher's discretion, however we strongly recommend that tags be treated with anti-fouling paint to ensure the best possible chance of a successful deployment.

Wildlife Computers field tested two antifouling paints with good results in different applications — PropSpeed and Micron66.

We also offer an optional service to sand, mask, and paint tags with PropSpeed 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 Micron66 anti-fouling paint due to the hazardous nature of the product. However, it is extremely effective for many applications including sea turtle tags.

Antifouling Overview

Micron66 has been used successfully for over a decade to limit biofouling on sea turtle satellite tracking tags. Wildlife Computers has also seen great success in Micron66 limiting biofouling on our pop-up tags. The following instructions are based on recommendations from the technical department of International Paints, the Micron66 anti-fouling paint manufacturer.

The process involves one coat of Interprotect primer and three coats of Micron66.

Personal Protective Equipment

⚠️ ***The safety guidelines must be followed and the correct personal protective equipment must be worn for the application of both the primer and Micron paints.***

Once painted, tags should only be handled with gloves due to the copper and biocide in the anti-fouling paint.

MSDS

Use the following link to access the safety datasheets for both the Interprotect primer and Micron66 anti-fouling paint: http://www.yachtpaint.com/usa/diy/products/antifouling/micron-66.aspx

Check your paint can for the MSDS version number. For example, E5 for Micron66 Black.

⚠️ ***Micron66 is not suitable for use in fresh water. Other Micron paints are available for fresh water use.***

Application Requirements

Accessories Required
- Four paint mixing cups or bowls
- Two strong mixing sticks for the paint
- Two strong mixing sticks for the primer
- Two disposable 100 ml measuring cups for the primer components
- Four small disposable paint brushes
- One sheet of 80-100 grit sandpaper
- 500 ml of isopropyl alcohol or acetone
- Three clean rags
- 10 pairs of disposable gloves
- One roll of masking tape
- Appropriate respirator, fume cabinet, or well-ventilated area in which to work
- Optional: 3/8" (10 mm) and 1/4" (6 mm) hollow punches, hammer, and wooden or nylon board to punch out masking tape discs

⚠️ ***Allow 48 hours for the application of the primer, three coats of Micron66 and curing time before immersion.***

Tag Preparation

- Cover critical areas—two light sensors, wet/dry metal ring at the base of the antenna, pressure and temperature sensor, LED light, and ground plate—with a non-soluble tape, such as masking tape. Painting over these areas will hinder the tag's operation and greatly impede its performance. As per the critical alert below, do not paint the tag's nose cone!

⚠️ ***Make sure you tape off the nose leaving a 2 cm buffer. This will ensure you don't accidentally "glue" the nose to the tag preventing it from popping off.***

- Sand the tag thoroughly to roughen the surface. Sand all the areas except the critical areas mentioned above. Be careful not to damage any external sensors such as the temperature sensor probe
- Clean with a rag and isopropyl alcohol or acetone
- Insert the communication's connector plug and cover with a rectangle of masking tape
- Cut or punch a 6 mm (1/4") circle of masking tape and place this over the LED area to enable viewing once the tag is painted—swipe a magnet over the communication's connector plug to determine the LED position
- Clean the tag again with isopropyl alcohol or acetone, avoiding the masking tape. Do not handle the tag without gloves once cleaned

Interprotect Primer Application

- Mix thoroughly the 2000E primer base
- Measure three parts by volume of 2000E base and one-part 2001E hardener and mix thoroughly
- Allow to rest for 10 minutes to pre-cure
- Apply to tag with a brush, painting all surfaces evenly, except the critical sensors that have been taped off—avoid drips and wet areas that will dry at a different rate

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Primer Drying Time

It is critically important that the first coat of Micron66 be applied when the primer is still tacky.

This is determined using a "thumb-print test." After the primer has dried for 10 minutes, use a gloved hand to touch the tag's surface to see if it leaves a print on the paint. If paint sticks to the glove, it needs to dry longer. If the primer feels tacky and leaves a mark without getting paint on your finger, then it is ready to overcoat with Micron66.

Drying times vary with temperature and humidity; however, 10 minutes is typical in warmer climates.

If the primer is left too long and has cured hard, then another coat of primer will need to be applied and the process repeated for a tacky base.

Micron66 Application and Drying Time

Mix the can of Micron66 well with a strong stir stick. Shaking the can is not effective as the copper will have settled to the bottom of the can so it must be mixed thoroughly.

Immediately brush a coat of Micron66 onto the whole tag and antennas once the primer is tacky.

Minimum drying time between coats is four hours at 35° Celsius (95° Fahrenheit), six hours at 23° Celsius (73° Fahrenheit), and eight hours at 10° Celsius (50° Fahrenheit). It is ideal to leave the tag overnight   Apply a second coat of Micron66 and allow to dry as above

- Apply a third coat of Micron66 and allow to dry as above

Masking Tape Removal

After the final coat is dry, put on a pair of disposable gloves and remove the masking tape from the wet/dry sensors, pressure sensor opening, light sensors, and LED.

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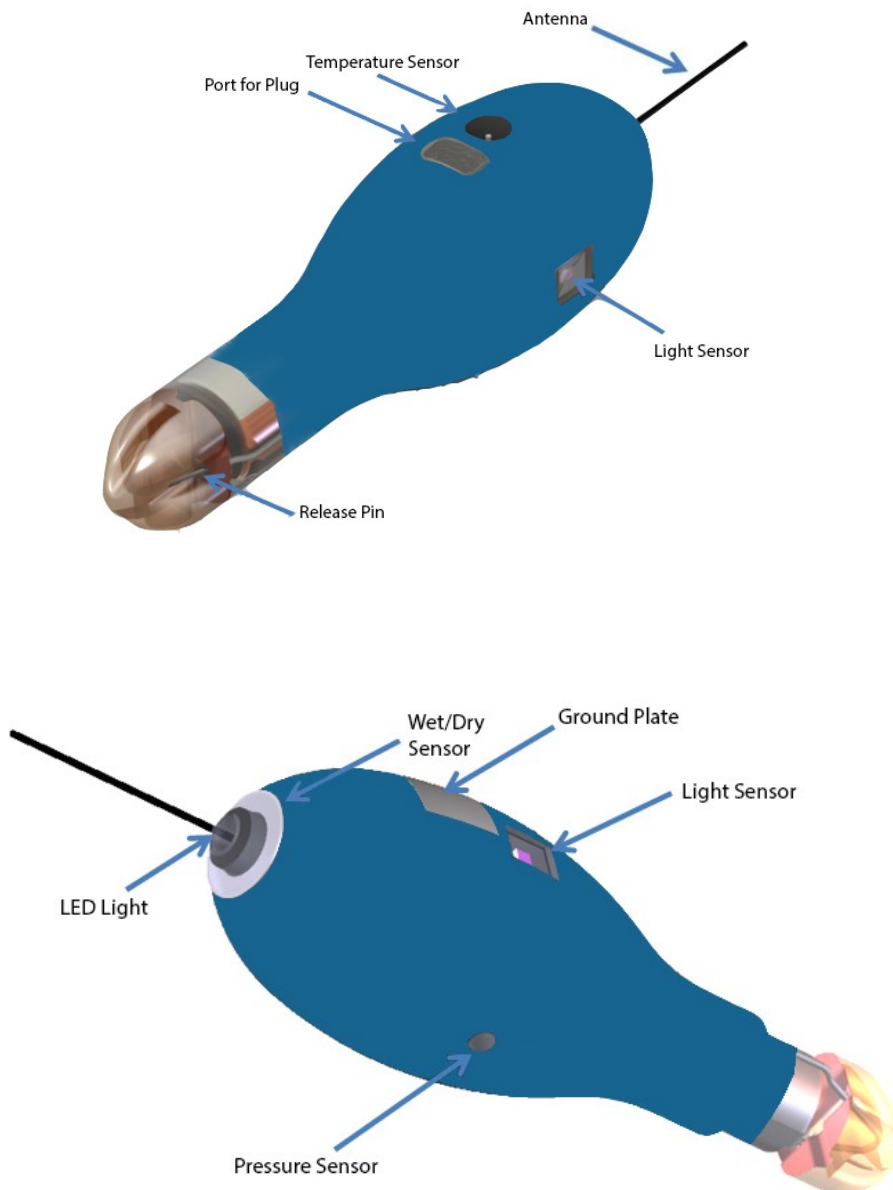
Tag Handling

⚠️ *Note: tags must only be handled with gloves as Micron66 contains copper and biocides.*

Store the tags in a Ziploc® bag as Micron66 gives off a strong odor. Store the tags in a cool place. A refrigerator is good but **NOT** with food.

Tag Deployment
The tag can be attached and deployed immediately; however, if more than 30 days have elapsed since the last coat, use a stiff nylon brush to lightly wash and reactivate the top layer.

Resources
International Paints Micron66 Antifouling Paint

Micron66 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

Micron66 is available in the USA and Asia-Pacific regions from International Paints dealers and ship chandlers. Micron66 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


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Antifouling Tests

Wildlife Computers have 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. Next is a placebo blank area with no protection that has fouled badly. The next strip down had Micron66 and no primer and the Micron66 has nearly worn away completely.
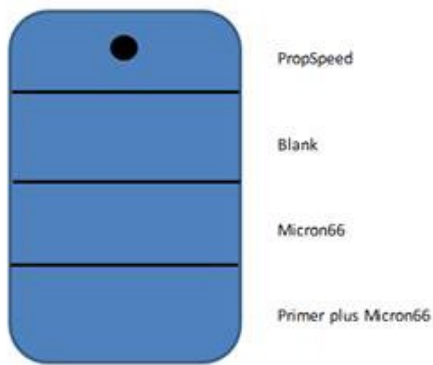
The Micron66 at the bottom has primer and is pristine. One coat of Interprotect primer and three coats of Micron66 are mandatory for a successful project.

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.

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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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