

# SPLASH10 (-F, -BF, -FL, -X, -L, -LX, -FX TDR10 (-DD, -F, -BF, -X, -L, FL, -FX, -LX, -BX with host version 1.26.3002 User Guide

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This user guide will give you all the essential information needed for interacting with, configuring, and deploying a Wildlife Computers SPLASH10 and TDR10.

## Table of Contents

Introduction.....	3
Definitions .....	3
Overview of Functionality .....	4
Communication .....	6
Communications Troubleshooting.....	8
Programming and Testing .....	10
Menu Items .....	47
Deployment.....	52
Verifying Function Prior to Deployment .....	52
Sealing the Communications Port.....	53
Additional Deployment Information.....	53
Data Recovery .....	53
Storing Tags.....	54
Testing After Storage .....	54
Technical Specifications.....	71
Contacting Wildlife Computers.....	72



## Introduction

Mk10Host is used to communicate with a variety of Wildlife Computers tags, including all versions of SPLASH10s and TDR10s. Mk10Host is used to set parameters, test sensors and other hardware components, and download data archived on the tag to your PC.

As might be expected, Mk10Host has to be quite complex to support all the possible permutations of modules. In order to simplify the user-interface, Mk10Host will only display the parameters appropriate to the modules present on the connected tag. Therefore, there may be many places where you cannot access features described in this manual because the necessary module is not present.

## Definitions

- **Host:** The software running on a PC which displays information from the tag, downloads data from the tag, and programs the tag.
- **Tagware:** The firmware, or software, running on a tag.
- **Pressure:** The unit force per square inch. Can be converted to a depth in sea water.
- **Depth:** Distance below the surface.
- **Argos:** A satellite-based tracking and data collection system ([www.argos-system.org](http://www.argos-system.org)).
- **Sample:** A single reading from a sensor.
- **Sample rate:** Samples measured per unit time. For example, 0.5 samples per second.
- **Sample interval:** The time between samples, also the inverse of sample rate. For example a 2 second sample interval is equivalent to sample rate 0.5 samples per second.
- **Duty cycle:** Enabling and disabling functionality of the tag during a deployment. This is typically done to save power or conserve data memory, and thus extend the total duration of a deployment.
- **Wildlife Computers USB Communications Cable:** The Wildlife Computers cable for communicating with a tag. It provides power and communications.
- **Mk10Host:** The name of the host for communicating with the tags covered in this user guide.
- **Wet/Dry sensor:** Sensor on a tag which can determine if the tag is in or out of sea water. Unique settings are required for brackish or freshwater.
- **.wch:** File extension for data and setup files used by Wildlife Computers software.
- **GMT:** Greenwich Mean Time. Global time standard that is based on the mean position of the sun at noon at 0 degrees longitude. On Wildlife Computers tags, this is functionally equivalent to UTC and UT1.



# Overview of Functionality

## Operational Modes

Four main operational modes (Appendix F):

<b>Communicating</b>	For configuring tags. The tag is connected via a Wildlife Computers USB communications cable interface to a PC which is running Mk10Host. In this mode the tag draws power from the PC through the USB communications cable.
<b>Standby</b>	For temporary suspension of tag activities. The tag runs in a very low power mode, and does not archive samples or transmit. It can stay in this mode for a very long time without consuming significant battery power. While in this mode the tag will automatically deploy if it detects a high pressure reading* or a wet sensor reading. It can also be manually deployed by appropriate application of a magnet.
<b>Deploy</b>	In this mode, the tag actively collects data and transmits information to Argos, if configured to do so. The tag should be in this mode when attached to a study animal or other platform for an experiment. The tag can be returned to Standby mode by appropriate application of a magnet.
<b>Shut Down</b>	This mode is used for long-term storage of a tag. The tag runs at the lowest-possible power and does not monitor the environment. It can only come out of this state if it is connected to a USB communications cable and a magnet is passed over the reset location on the tag while Mk10Host is running.



***If you use high-power VHF radios near a tag with a depth sensor, it can generate depth spikes which may cause the tag to deploy. You can choose the "Don't Deploy from Standby on Depth Change" option to avoid this situation.***

## Sensors

Tags are configured with the following sensors as standard:

- Depth
- Internal (tag body) temperature
- External (environmental) temperature
- Depth sensor temperature
  - To internally correct drifts in the depth sensor due to temperature changes
  - No need to be set to sample for field deployments
- Light level
- Battery voltage
  - To internally monitor performance of the battery
  - No need to be set to sample for field deployments
- Wet/dry
  - Used by the tag to correct drift in depth zero offset
  - Determines when the tag is out of water
  - No need to be set to sample for field deployments

## Memory

Tags store data in flash memory. This data includes sensor readings, processed data, and satellite messages. Contents of this memory are maintained even if the battery becomes discharged.

## Data Collection Intervals

Data collection intervals can be set independently for each sensor. Intervals can range from 1/128<sup>th</sup> second to 18 hours. Available range may vary between different tag types.

## Decoding the Data

Wildlife Computers provides an analysis program, WC-DAP, to decode and display the data downloaded from a recovered tag. WC-DAP will also export the data in other formats such as .csv, Excel spreadsheet and Google Earth.

## A Word on Version Numbers

The on-board software can be upgraded in our lab. Mk10Host code is upgraded in parallel, and is generally distributed via email or our website. In order to keep the version of on-board software and Mk10Host working seamlessly together, please note the following:

- The Mk10Ware version numbers are in this format: **x.yy**
- Mk10Host has version numbers in this format **a.bb.cccc**
- When attempting to communicate with a tag use the following rules:
  - **a** must be the same as **x**
  - **bb** must be greater than or equal to **yy**
- It is best to use highest **cccc** available – see our website [wildlifecomputers.com](http://wildlifecomputers.com) for the most up-to-date Mk10Host

## Communication

User parameters are programmed into the tag via a Windows-based program provided by Wildlife Computers called Mk10Host. Mk10Host must be installed on your PC. Mk10Host has been tested under Windows 2000 or later versions. Earlier versions of Windows may or may not work, depending on the configuration of your PC. We do not support other operating systems (e.g., UNIX) or Windows emulators.

Mk10Host works by:

- downloading a copy of the set-up parameters from the tag to the PC
- allowing you to edit these parameters in a standard Windows environment
- uploading the changed parameters back to the tag

Mk10Host can be installed from our website [wildlifecomputers.com](http://wildlifecomputers.com). Follow the prompts provided.

Next install the USB Driver from our website. This allows you to use the USB communications cable available only from Wildlife Computers. Install the driver before connecting the USB cable to the PC.

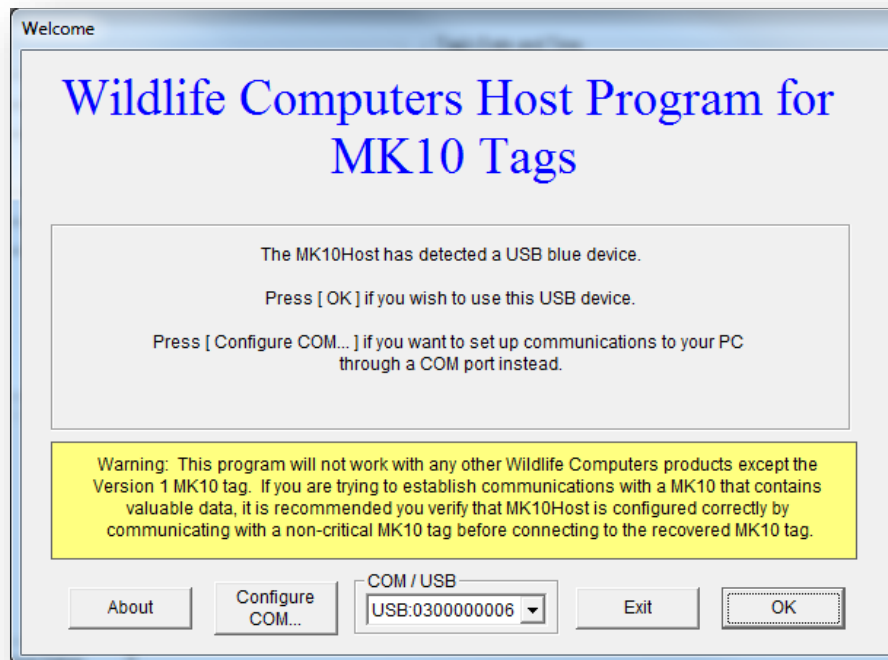
You should verify your communications with your tag before heading out to the field. Trying to debug communications issues remotely with users who are “in the field” can be difficult.

### Communications Connections Between the Tag and your PC

The communications port is a rectangular hole with chamfered edges in the epoxy casting of your tag. It contains 4 gold-plated pins. Note the orientation of the pins in the communications port. There are three pins in sequence, a “missing pin,” and a single pin. Note the orientation of the sockets in the flat plug. One of the sockets is blocked. It is important that the flat plug is correctly oriented to the pins in the communications port before inserting the plug. At the appropriate time, carefully insert the flat plug from the USB communications cable into the communications port. **IMPORTANT: Do not force the plug.**

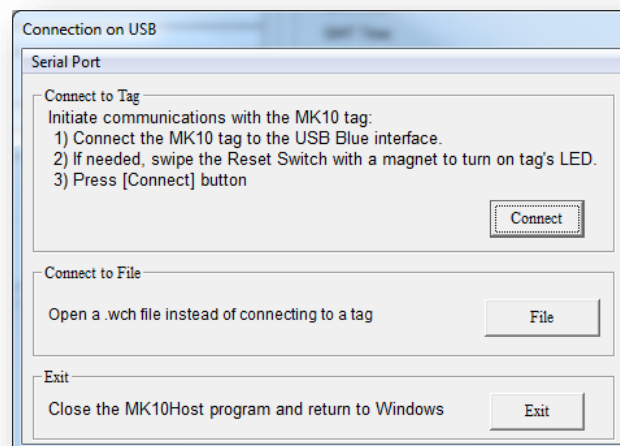
### Configuration with USB Communications Cable

Each time you start Mk10Host, you will be greeted with a Welcome screen. The first time you use the Host, you will use this screen to configure your computer for communication with the tag. If you are using a USB communications cable, continue on with the instructions in this section. If using a Cable Comm or Blue Box, see Appendix E.



If you are using a USB communications cable, click on OK.

You will see the Connection on the USB screen. Follow the instructions displayed.



**Note: The Reset Switch is located near the communications port, so passing a magnet in the vicinity of the communications port should activate the tag causing the LED to glow.**

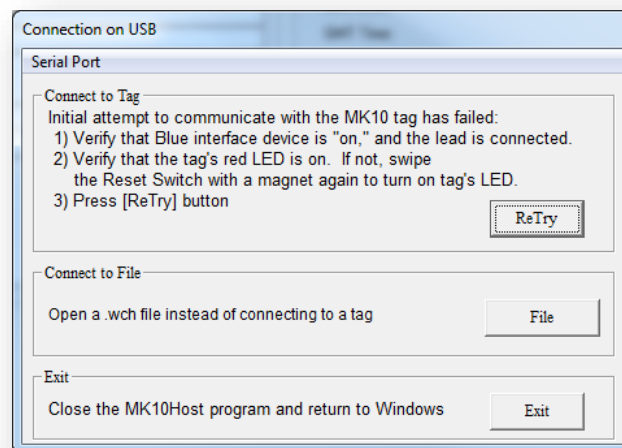
If the connections between the PC, USB communications cable and the tag are seated correctly, an LED on the Mk10 will glow once the tag is ready for communication. *The LED must be glowing before clicking the Connect button.*

### Support for the USB Communications Cable

If you have previously installed the driver for another tag, and that device is connected, the connection will default to that device. Optionally, the drop-down box in the COM /USB frame lets you select the USB device you wish to use (if you have more than one connected) or to revert to a previously defined COM port.

## Communications Troubleshooting

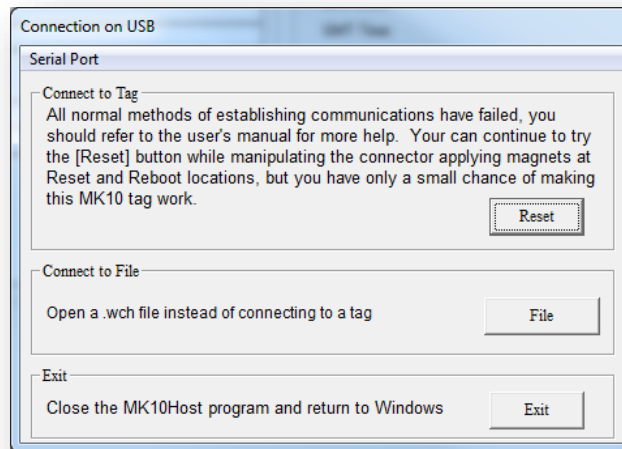
Mk10Host may display additional prompts, such as the next screens illustrate, if there are difficulties in establishing communications.



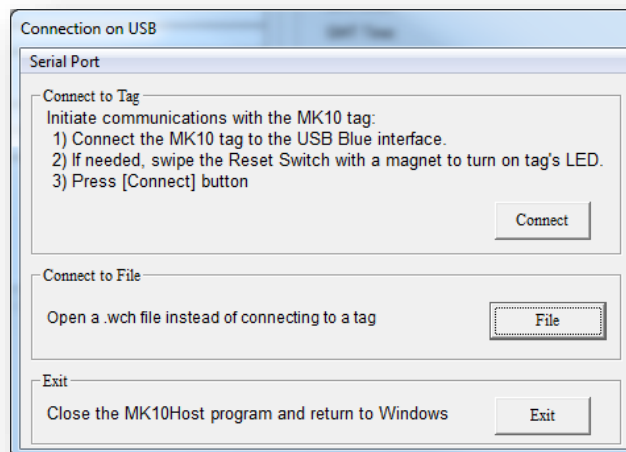
The reset switch location is at the opposite end of the main tag board from the communications connector. Refer to the appendices for more information on locating the reset location.

If you continue to have difficulty, you will eventually reach the following screen. At this point you probably need to contact Wildlife Computers for technical support. Contact information is listed on the last page of this manual.



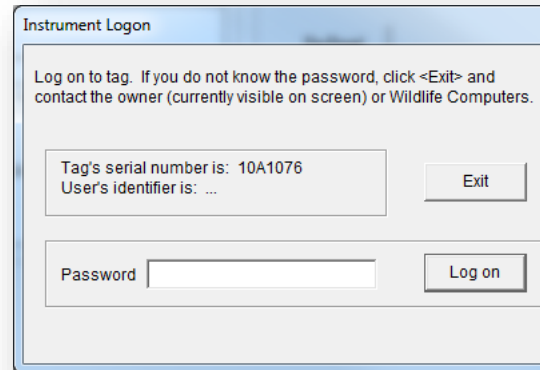


## Connecting to a File



If you click on the **File** button in any the above dialogs, you can connect to a .wch file instead of a tag. This feature provides you with a simple way to examine the set-up of a previous deployment, or to try out the Mk10Host program.

## Log On



After initial communications are established, you need to log on to your tag. You must correctly enter your password and log on as Owner in order to read and update information from the tag. **The default password for all Mk10 tags is mk10.** The password is not case-sensitive.

You can change your password any time after you have logged on as a user, by selecting the **Password** menu item at top left of the Host screen. Acceptable passwords include entries up to 7 characters. If you forget your password, you will have to return the tag to Wildlife Computers so we can reset it.



**Note: The password entered will be remembered for each subsequent logon to successive tags for the duration of the same session with Mk10Host.**

If you do not know the password, you will only be able to see general information. You cannot change any data or access any of the tag's functions. Your only option after viewing the general information is to click on **Exit**.

### Disconnected Batteries and Dangerous Goods

Once you have successfully logged on to the tag, you may receive a warning about disconnected batteries. This occurs when your tag is considered "Dangerous Goods" for shipping purposes due to the number of lithium batteries used in the tag. See Appendix G for important information about Dangerous Goods and disconnected batteries.

## Programming and Testing

Mk10Host will display several sub-screens, identified by "tabs." These tabs appear along the top of the screen. Some of these tabs may be blank (and their captions enclosed in square braces), depending upon the modules installed on the tag.

## General Tab

Identification Information

Tag's serial number	10A1076
User's identifier	...
Argos PTT	5760 (5A03F Hex)
Repetition intervals	60s (at-sea); 60s (haulout)
Versions	Tagware: 1.24t; Hardware: 10.2
Owner	Wildlife Computers 8345 154th Ave NE Redmond, WA 98052 USA +1-425-881-3048

Tag's Date and Time

GMT Date: 7 Jan 2011  
GMT Time: 18:01:53

Re-Read Change...

Last Deployment Information

Bytes of Archived data:	0
Bytes of Histogram and Profile messages:	0
Bytes of Location messages:	0
Number of messages transmitted:	24
Total Memory Available	67,108,864

Read Setup Save Setup Create Report

This screen provides the main interface with the Tag. It is divided into several areas:

1. **Identification Information:** Configuration of the Tag, including the user's identifier, which you can change to identify each tag.
2. **Tag's Date and Time:** Current state of the tag's clock.
3. **Last Deployment Info:** Bytes of collected data.
4. **Dangerous Goods information:** See Appendix G.
5. **Set-up and Report buttons:** Explained below.

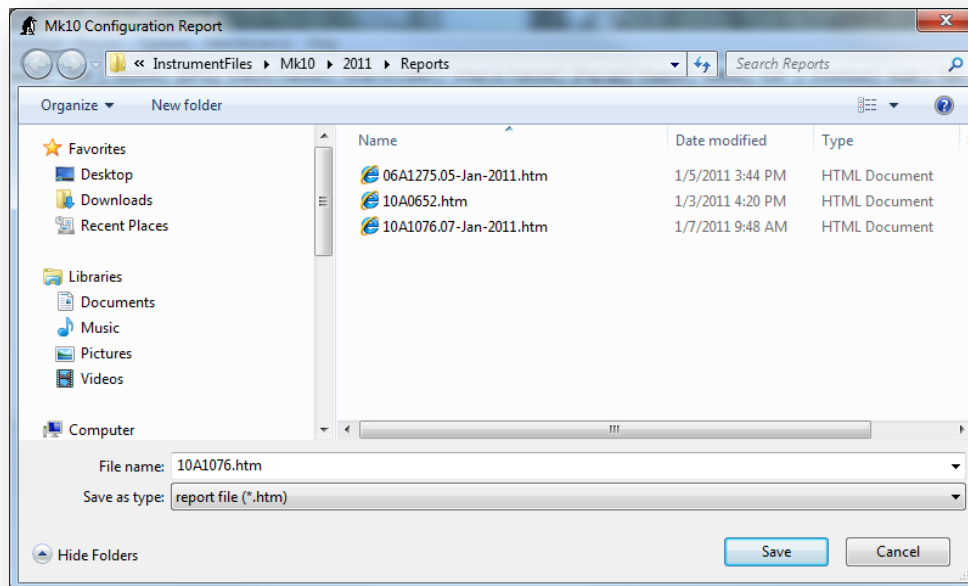
### Copying Set-Up Information from One Tag to Another

The **Save Setup** button is useful if you are setting up a series of tags and wish them all to have the same (or very similar) set-up. Set up the first tag, update, and then click **Save Setup**. You will be prompted for a filename to save this set-up. You can use **Read Setup** on subsequent tags to load previously saved set-up files. The format of these set-up files is compatible with the format used when saving data. Thus you can restore a tag to the configuration used to gather a dataset by reading the set-up from that archive record. These files use a .wch extension.

### Create configuration report (.htm file)

It is important to archive the configuration of the tag (versions, parameters) prior to deployment so that they can be used to correctly analyze the data. An abbreviated report is automatically generated whenever deploying from Mk10Host. However, this full report also tests the integrity of the tag's

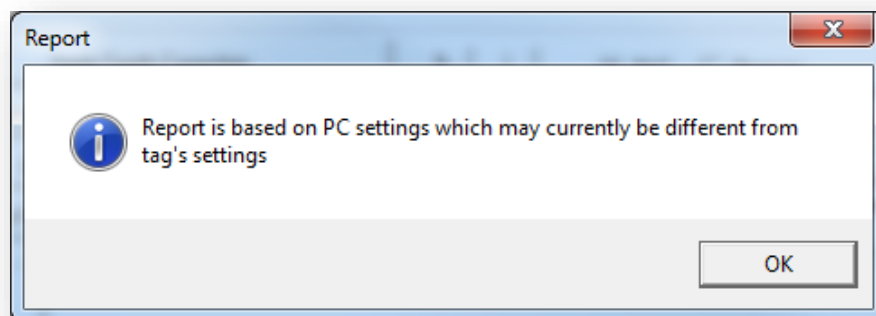
internal table structure. Click **Create Report** and the following screen will appear, offering you a choice on where to save the report prior to displaying it on the monitor or printing it out.



If you want to save the configuration to disk (as a .htm file which can be viewed with any web browser) click **Save**, otherwise click **Cancel**.



**Note:** This configuration report only displays the tag parameters as stored by the Mk10Host on the PC, not necessarily those on the tag. It does not perform any upload function. Mk10Host will indicate (as shown below) if the report shows a change from what is on the tag. If so, be sure to save the changes when you exit or deploy.



Mk10 Configuration Report

File Options

[PRINT](#)

Host Settings	
Mk10Host version	1.24.2000
User Name	Heather

Time And Date Settings	
PC Date (UTC)	07 Jan 2011 at 18:02:10
Tag Date	07 Jan 2011 at 18:02:15
PC UTC offset	8 hours
Last deployment date	29 Nov 2010 at 19:01:00

General Settings	
Tag's Serial Number	10A1076
Password	MK10
User's Identifier	...
Argos Ptt number	5760 (5A03F Hex)
Repetition Intervals	60s (at-sea); 60s (haulout)
Tagware version	1.24t
Hardware version	10.2
Battery Configuration	1 x 2/3AA
Battery Capacity (from manufacturer's datasheet)	1300mAh
Owner	Wildlife Computers 8345 154th Ave NE Redmond, WA 98052 USA +1-425-881-3048

The File menu item at the top of the Hardware Configuration Report screen allows you to save or exit this report. If you choose to save the report, the same Mk10 Configuration Report dialog box you saw earlier will appear.

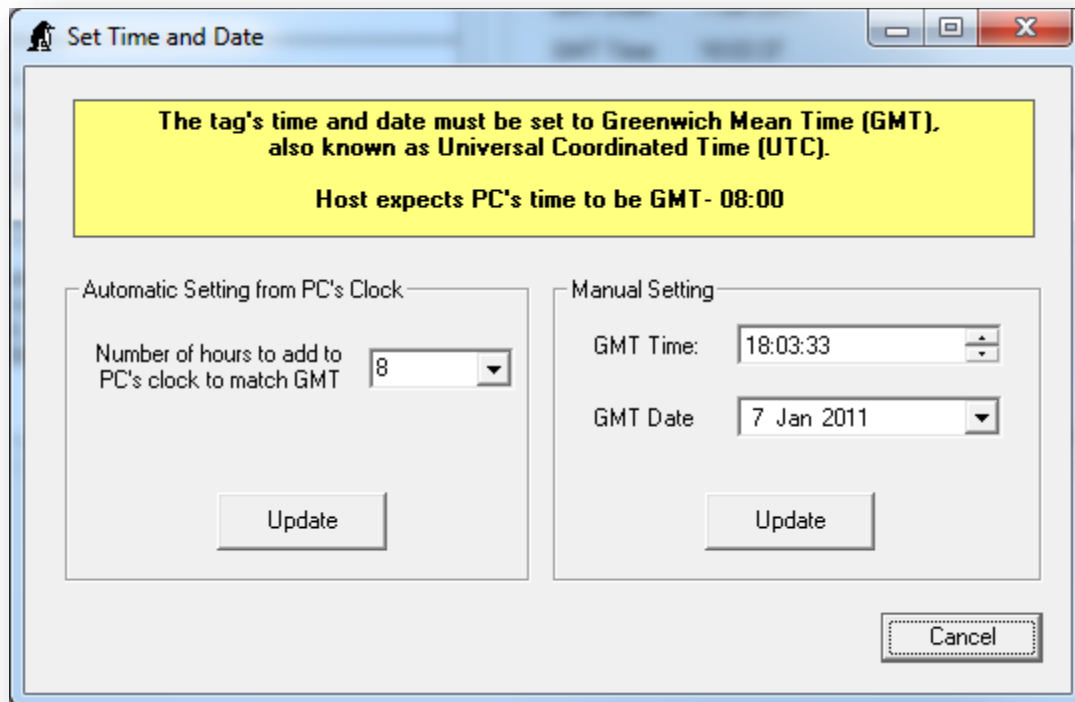
You must select **PRINT** at the top of the Hardware Configuration Report to get a hardcopy of your report.

### Set Tag's Time and Date

It is important the tag's time be accurately set to GMT. The date and time are used to label when the data were collected.

There are two ways to set the tag's clock. The best and most accurate way is to use the clock on your PC. First ensure the clock on your PC is accurate. There are several websites that allow you to do this. Alternatively, in Windows, select "Date and Time" in Control Panel, then select the "Internet Time" tab, and follow the instructions.

Click the **Change** button on the Tag's Date and Time frame to bring up the window to set the tag's clock:



#### Automatic Settings from PC's Clock

Mk10Host will read the local settings of your computer and fill in the GMT offset. If you need to override this, select the number of hours that need to be **added** to the time on your PC's clock to match GMT. For example, if your PC is set to GMT -7, select "7" in the drop-down box.

Click **Update** in the Automatic setting frame.

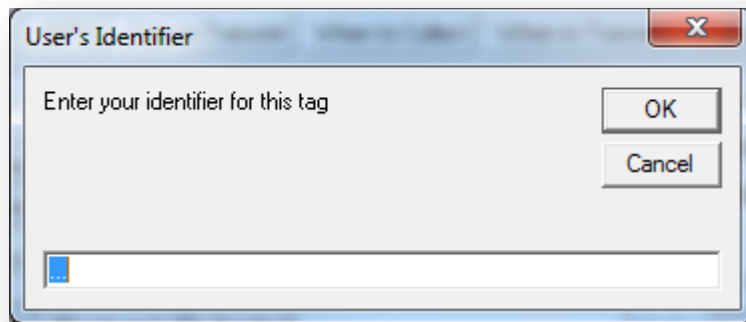
#### Manual Setting of Time and Date

Alternately, enter the appropriate GMT date and time using an accurate time source, clicking **Update** (in the Manual setting frame) to set the tag's time and date to these values.

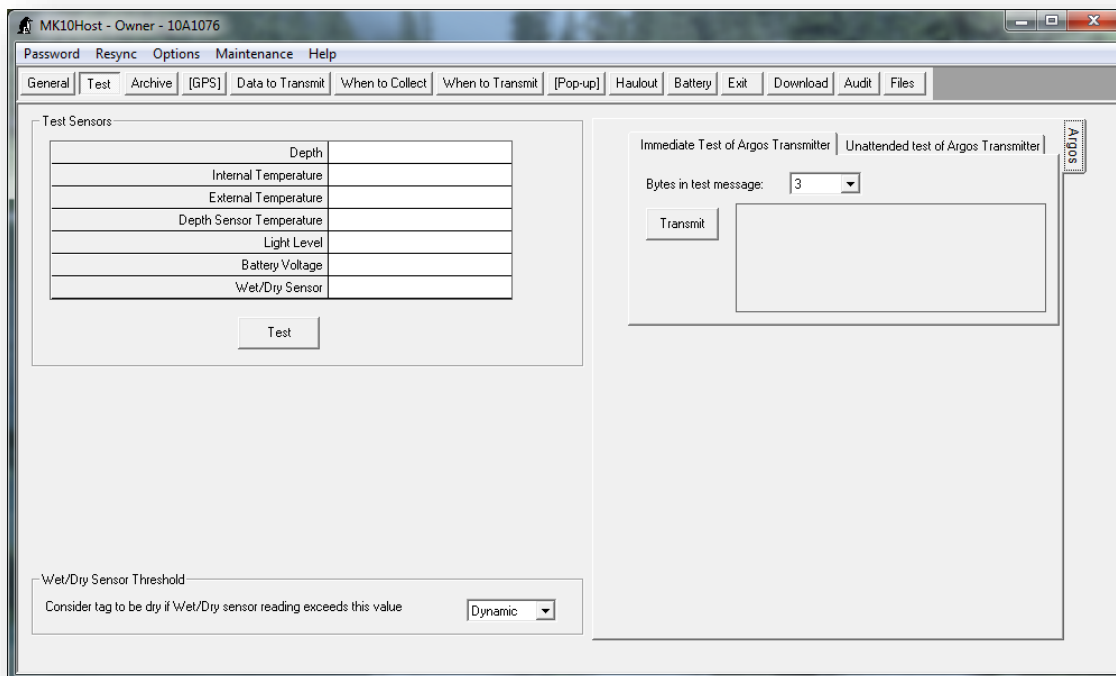
#### Identify Instrument

The User-Defined Identifier is an optional parameter. It can be used to identify the deployment. This identifier will be displayed along with the data downloaded from the tag upon recovery.

Click the box next to the User Identifier label to enter a new identifier. The default value is as shown, "...". The maximum number of characters allowed is 15. Any additional characters will be truncated.

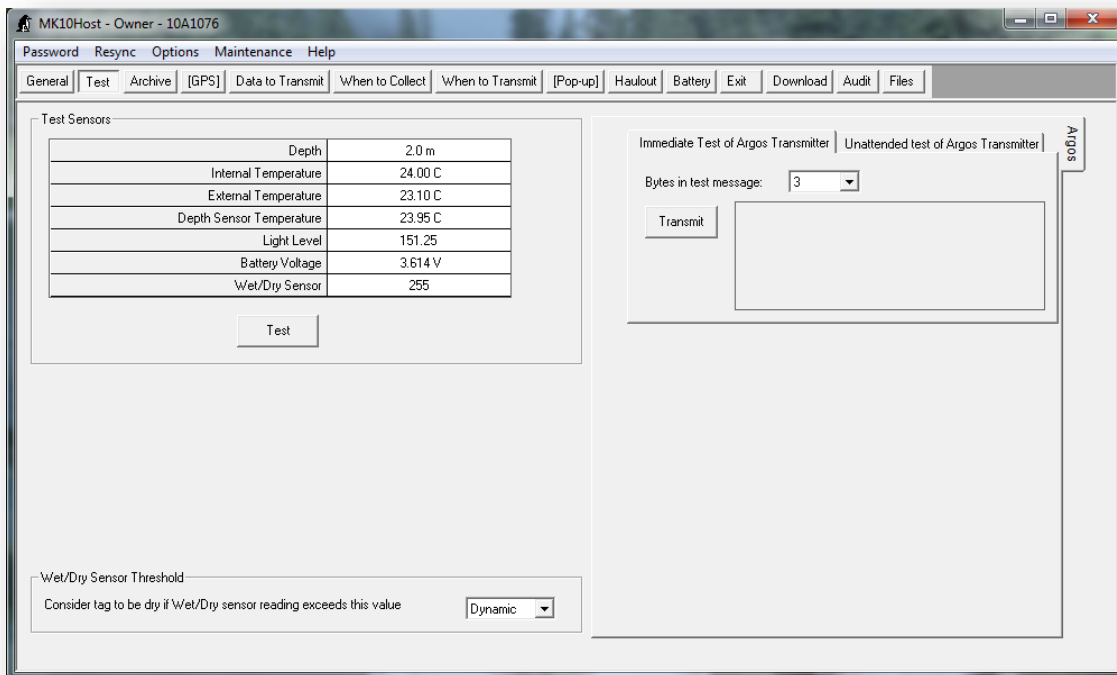


## Test Tab



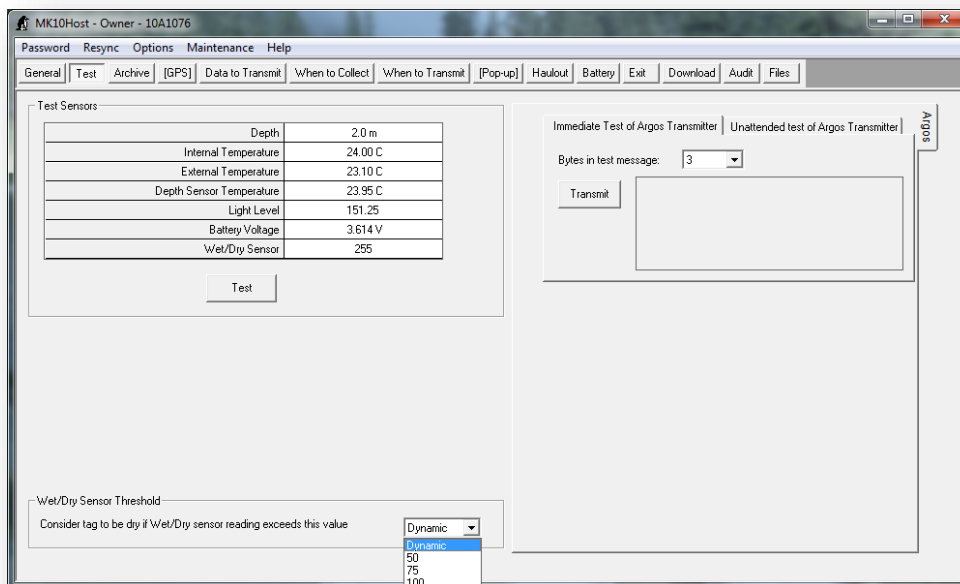
## Test Sensors Frame

Click the **Test** button. The current values of each installed channel will be displayed:



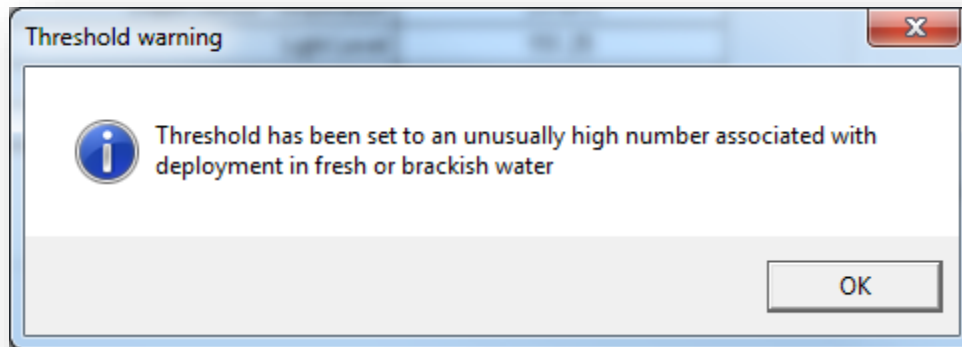
### Wet/Dry Sensor Threshold Frame

The tag can dynamically determine the appropriate threshold value for wet/dry determinations in sea and brackish water. Leave this setting to Dynamic unless you are attempting deployment in unusual water conditions. In such instances, contact Wildlife Computers for advice regarding this setting.





If you change the Wet/Dry Sensor Threshold to either 150 or 200, you will get a warning message. Be sure you have this value set to what you need for the type of water in which the tag will be deployed.

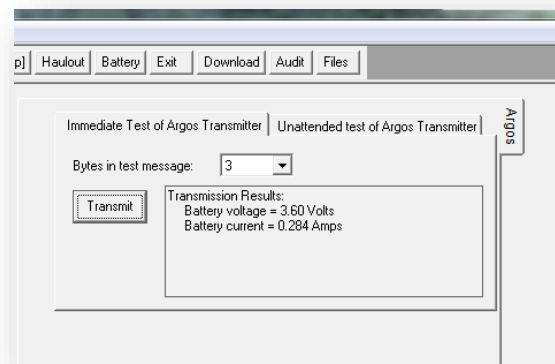


### Argos Side-Tab

This side-tab is visible from the testing tab for tags configured with an Argos transmitter.

### Immediate Test of Argos Transmitter

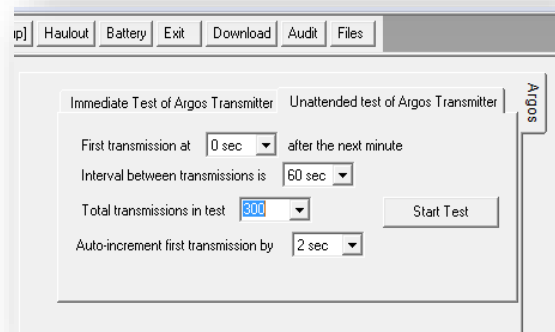
This function allows you to quickly verify the Argos transmitter is functioning and the battery voltage is at least 3.0 V. Click **Transmit** and the battery voltage and current drawn from the battery are reported.



### Unattended Test of Argos Transmitter

This function allows you to retest the tags through the Argos system. This would be most applicable for tags that have been stored for a long period of time (several months).

When testing multiple tags concurrently, it is important that tags do not transmit simultaneously. The "Auto-increment first transmission by" field causes subsequent tags within the Mk10Host session to have their "First transmission at" field automatically incremented to stop the tag's transmissions from being simultaneous.



## Fast-GPS Side-Tab

This function allows you to test the functionality of the Fast-GPS module. Click on **Test Fast-GPS** and wait about 40 seconds, then click **Refresh**. If results are ready, the table will be updated and Fast-GPS data displayed. If Status is still "processing," wait a few seconds and click **Refresh** again. You will probably not receive satellite signals if you are running this test inside a building.

Register	Value
Status	Idle
Mode	7
Offset	176
Span	104
Autotune	0 (off), Target = 6
Threshold	20
Hardware	3.3
Software	2.0d
Serial Number	10F0206
Data	no data
Locations Processed	208 (197 successful)
Energy used	none

## Stomach Temperature Side-Tab

This function allows you to test the functionality of the Stomach Temperature pill. When you start up a pill, it may take an extended time before the tag recognizes it. Or, as shown in the first pane, the receiver may be disabled. In either case, clicking **Search for pill** will force the tag to restart the search, as shown in the second pane. After the pill has transmitted, clicking **Refresh** will display the new reading from the pill. This is generally a more reliable method of interrogating the pill than using the Test button (not shown here). Once a pill has been acquired by the tag (it knows the pill's repetition rate), then status will show "Acquired" and the Test button will work more reliably.

Register	Value
Status	Disabled
Hardware	1.3
Software	1.0p
Sensitivity	9
Sense Coils	Coil 1 enabled, Coil 2 enabled, Coil 3 enabled
Interval	15
Quality	0
Serial Number	07M1009
Data	No pill detected

Register	Value
Status	Actively Listening
Hardware	1.3
Software	1.0p
Sensitivity	1
Sense Coils	Coil 1 enabled, Coil 2 enabled, Coil 3 enabled
Interval	15
Quality	0
Serial Number	07M1009
Data	No pill detected

Register	Value
Status	Acquired
Hardware	1.3
Software	1.0p
Sensitivity	5
Sense Coils	Coil 1 enabled, Coil 2 enabled, Coil 3 enabled
Interval	10
Quality	200
Serial Number	07M1009
Data	2345 = 14.8C, Thermistor 2

### Corrosion Release Side-Tab

This function allows you to test the corrosion release on towed SPLASH10 tags. To start the test, connect a multi-meter between the release wire and the ground ring (next to the float), and click **Start Test**. The corrosion release wire is now activated. The multi-meter should be set to measure current, and about 50mA of current should be flowing. Click on **Stop Test** and the current should drop to zero. The Pin state field should always read "Intact" but Pin 1 conversion and Pin 2 conversion values may vary from the examples below.

With nothing between pin and ground ring:

The screenshot shows a software window titled "Release Pin State" with a menu bar (up, [Haulout], Battery, Exit, Download, Audit, Files) and a sidebar with "Argos" and "Release" tabs. The main area contains a table with the following data:

Parameter	Value
Pin state	Intact
Detection value	1
Pin 1 conversion	1023
Pin 2 conversion	1023
Pin control	Corrode off

Below the table is a "Start Test" button.

With a 60-ohm resistor between pin and ground ring:

The screenshot shows the same "Release Pin State" window, but with different test results:

Parameter	Value
Pin state	Intact
Detection value	0
Pin 1 conversion	70
Pin 2 conversion	70
Pin control	Corrode off

The "Start Test" button is still present below the table.

## Archive Tab

Set shortest interval first		
Depth	5	Sec
Internal Temperature	5	
External Temperature	5	
Depth Sensor Temperature	5	
Light Level	5	
Battery Voltage	5	
Wet/Dry Sensor	never	

**Sampling Mode**

☒ Archive samples when tag is wet or dry  
☐ Archive samples only when tag is wet

**Sampling Duration**  
Time till 63.921875 MByte memory is filled is 430 days  
Tag will "wake-up" to check if it is time to take an archival sample every 5 seconds

**Automatic Correction of Depth Transducer Drift**

☐ by most common shallow depth  
☐ by first dry depth reading



**Warning:** If the tag has important data from a deployment that have not been downloaded, follow instructions in the section: [Download the Data](#) before changing any parameters.

### Setting the Data Collection Intervals

The tag processes sampling intervals as a 2-fold process:

- Set the granularity of the sensor sampling to 1/128<sup>th</sup> (ultrafine), 1/64<sup>th</sup> (fine), or 1 second (normal). 1/128<sup>th</sup> and 1/64<sup>th</sup> should only be used with Daily Diary tags (-DD). Click on the right column to change the granularity of the sensor sampling.
- Set the sensor with shortest sampling interval first, then the second shortest, and so on. This way the available options will be the most obvious.

Having set the sampling intervals as desired, check the Sampling Duration frame to see how long it will take to fill memory. If this value is longer than your anticipated deployment, you could sample data faster. If this value is shorter than your anticipated deployment, you should probably sample data slower or check the "Archive samples only when tag is wet" checkbox (see below).

### Sampling Mode Frame

Use of memory can be optimized by programming the tag to **Archive samples only when tag is wet**.

This option should only be used if:

- There is not enough memory to store the samplings at the desired sampling rate and anticipated deployment duration
- You are not interested in samples while the tag is dry
- The tag has wet/dry sensors (this option will not be available if the tag does not have wet/dry sensors)
- Use caution when choosing to **Archive samples only when tag is wet**. If the wet/dry sensor is damaged or obstructed, or the water conductivity is not as expected, you may not gather any useful data.

### Sampling Duration Frame

Mk10Host will calculate and display:

- How long data can be stored at the programmed sampling rate
- How often the tag will “wake up” to take a sample

### Automatic Correction of Depth Transducer Frame

Pressure transducers have a tendency to drift over a deployment. The tag offers two strategies to monitor this drift so that it can automatically correct for it:

- **By most common shallow depth.** This is appropriate if tag may not break the surface of the water, (e.g. on a non-air-breathing animal) but you know that it will occasionally come to the surface. This is your only choice if there isn't a wet/dry sensor on your tag.
- **By first dry depth reading.** This is appropriate when the tag is deployed on an air-breathing animal and the tag is positioned such that the tag will be above the surface of the water when the animal breathes.

The automatic correction of the depth transducer only affects data that will be processed into Argos messages; corrections are *not* applied to the archive. Entries are made in the archive to indicate when an automatic correction was made, and its value. These values are only used by analysis programs.

### Fast-GPS Tab

The Fast-GPS module incorporates Fastloc® technology. When appropriate conditions are met, a sub-second “snapshot” of the GPS constellation is taken. Following the snapshot, the Fast-GPS module processes the snapshot to determine the identity and range of the GPS satellites that were present. This processing takes 12 seconds and continues after the animal has submerged.

A Fast-GPS acquisition is considered “successful” if 4 or more satellites are identified in the Fast-GPS snapshot. If 4 or more satellites are identified, these data will still be saved to the archive and an Argos message will be created. When 3 or fewer satellites are identified, no data is stored in the archive.

There is a lot of control regarding when a Fast-GPS acquisition is attempted, how many acquisitions should be attempted, and how many successful acquisitions are targeted:

## Parameters

### Time between Fast-GPS measurements

This parameter controls how frequently the tag should attempt a Fast-GPS measurement. Selecting “Disabled” means do not attempt any Fast-GPS measurements. When a snapshot fails because 3 or fewer satellites are identified, a new snapshot will be attempted after 15 minutes or the **Time Between Fast-GPS measurements**, whichever is shorter, and when the tag is next dry.

### Time Between Fast-GPS Measurements After Release

This parameter controls how frequently the tag should attempt a Fast-GPS measurement after releasing from an animal. This option only appears for a tag fitted with a release.

### Fast-GPS Days Frame

Select the days of the month for which Fast-GPS measurements should be attempted.

### Fast-GPS Hours Frame

Select the hours of the day for which Fast-GPS measurements should be attempted.

### Maximum Number of Fast-GPSs per Hour

The tag will target this number of *successful* Fast-GPS measurements per hour.

### Maximum Number of Fast-GPSs per Day

The tag will target this number of *successful* Fast-GPS measurements within a GMT day.

### Maximum Number of Failed Fast-GPSs per Hour

The tag will *stop attempting* Fast-GPS measurements for an hour once this limit is reached. Remember that a failed Fast-GPS measurement causes a new measurement to be made after 15 minutes have elapsed or the **Time between Fast-GPS measurements**, whichever is smaller. This value includes additional Fast-GPS attempts such as the default 15 minute retry or if “Retry a failed Fast-GPS immediately” is enabled.

### Maximum Number of Fast-GPS Attempts per Day

The tag will *attempt* this number of Fast-GPS measurements within a GMT day. This value includes failed attempts and must also include all the retry settings outlined above.

### Suppress Fast-GPS Measurements Once a Good Location has been Collected ...

Check this box to avoid wasting power attempting Fast-GPS measurements when they are not going to be useful because you are not interested in on-land locations after the initial haulout.

### Deployment Information Frame

Fill in the starting location so that the Fast-GPS solver can generate good locations from the archive seamlessly. Use decimal latitude and longitude with up to 2 decimal places and negative values for South and West start locations, for example -39.66 ° is 39.66 ° south.

### Advanced Features Frame

#### Take Extra Fast-GPS Measurements After Surfacing from a Qualifying Dive

The first parameters are used when a researcher is primarily interested in the heading and speed of the study animal following a “qualifying” dive. Qualifying dives must have a minimum dive depth and dive duration, and are set on the Data to Transmit tab. These snapshots count against the daily and hourly GPS snapshot limits. **This parameter will cause many Fast-GPS measurements to be attempted and will exhaust your battery quite quickly. Do not enable this feature unless you really need these extra measurements.**

#### Haulout Location and Duration, and Post-Haulout Movement

This feature is used when the researcher is interested in haulout behavior and is especially relevant for disturbance studies. When this feature is enabled, GPS messages will contain the location and duration of haulouts and one or more post-haulout locations. The haulout is specified by the haulout definition (see Haulout Control Tab on page 37) and the duration is reported from the first dry minute. By setting **Number of additional Fast-GPS measurements** to one or more, the feature is enabled. At least one post-haulout location must be taken to enable this tool. A GPS snapshot is taken as soon as the criteria for the haulout are met. When the haulout ends, GPS snapshots are attempted with the settings specified here. They override the normal GPS settings. By setting the **Time between Fast-GPS measurements** to **Fast**, the tag will take snapshots as fast as possible at a minimum interval of approximately 30 seconds. Haulout snapshots count against the Fast-GPS budgets for hourly and daily limits. If this feature is enabled, DAP will generate a Haulout.csv file that lists the haul out start time, end time, and location. Post-haulout locations will be included in the FastGPS.csv file.

## Retry a Failed Fast-GPS Immediately

By default, a failed Fast-GPS fix will instigate a new snapshot attempt after 15 minutes or the **Time Between Fast-GPS Measurements**, whichever is shorter. If this box is ticked, the tag will attempt a GPS fix immediately upon the next surfacing. It will continue to attempt fixes until a successful fix is obtained or the maximum number of failed Fast-GPS fixes per hour or day is reached.

## Only Transmit Latest Location

When this feature is selected the tag will only transmit the last location. This is useful when decoding Argos messages in real-time to track a deployed tag; however, this will likely reduce the total number of locations because the tag will not buffer transmissions. For tags with both a release pin and a GPS, this setting applies to locations that occur before *and* after release.

## Data to Transmit Tab

Data are summarized into histograms, timelines, light-based location curves, and/or Fast-GPS acquisitions. Newer tags also include behavior messages. This tab allows you to select the types of messages to transmit, the sampling interval for histograms and timelines (which is independent of the data archiving sampling interval), dive definitions, number of days of data to keep in the buffer for transmission, and the relative priority of location messages over other types of messages.

Mk10Host - Owner -12A1695

Password Resync Options Maintenance Help

General Test Archive GPS Data to Transmit When to Collect When to Transmit [Pop-up] Haulout Battery Exit Download Audit Files

Histogram and Behavior Data Sampling Interval 1 sec

Message Type	# Bins	Upper (deeper/longer/hotter) Limits of Bins													
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
Dive Maximum Depth (m)	14	5	10	15	20	25	30	35	40	45	50	55	60	65	>65
Dive Duration (min sec)	14	15s	30s	1m	2m	3m	4m	8m	16m	24m	32m	64m	128m	256m	>256m
Time-at-Temperature (C)	14	10	12	14	16	18	20	22	24	26	28	30	32	34	>34
Time-at-Depth (m)	14	0	5	10	15	20	25	30	35	40	45	50	55	60	>60

Histogram Collection

Hours of data summarized in each histogram 6

Histograms start at GMT 0

☐ Suspend generating new Histogram-style messages while a tag is continuously dry

Dive Definition

Ignore Dives shallower than 2m

Ignore Dives shorter than 5s

Dive's duration is determined from the first wet reading to the last wet reading

Change Dive Definition

Standard Time-Series DDN Timeline

Additional Messages Generated at Histogram Sampling Interval

☒ PAT-style Depth-Temperature Profiles (PDT) ☐ Lo-Res ☐ Hi-Res

☐ Deepest Dive Depth-Temperature Profiles with temperature range: -4C to 8.75C

Other Messages

☒ Hourly % Timelines (1 per 24 hours) ☐ Lo-Res ☐ Hi-Res

☐ 20-minute Timelines (1 per 24 hours)

Depth threshold for timelines Wet/Dry

☐ Light-Level Locations (1 per 24 hours)

Behavior Collection

☐ Enable Behavior message generation

Transmission Control

Transmit data collected from these last 2 days

Histogram & ST transmission priority ☐ low ☒ med ☐ high

Location transmission priority ☐ low ☐ med ☒ high

Behavior & TS transmission priority ☐ low ☒ med ☐ high



## Histogram Data Sampling Interval

This is the main on/off switch for generating messages. Generally 1-sec intervals are recommended in order to generate the most accurate histograms, but 10-sec intervals may be needed to maintain compatibility with data collected from our previous satellite tags (SDR-T16, etc).

### Histogram table

This table contains and controls many parameters. First set the number of bins required for each histogram message type that you want to be generated by clicking on a cell in the **# bins** column. This will define the number of editable squares in the table. Next fill in the upper (deeper/longer/hotter) limits for the bins by clicking on non-grey bin-limit cells. When focus leaves a row, the bins will automatically sort into ascending order. The last bin is never editable, and consists of the counts not contained in any other bin. If histograms are not required then set **# bins** to **off**.

**Dive Maximum Depth** and **Dive Duration** bins hold the count of dives at that duration or depth. The maximum valid value in any bin is 254. A bin reading of 255 indicates a count of 255 or more dives. In other words, all bins get capped at 255 dives.

**Time-at-Temperature** (TAT) and **Time-at-Depth** (TAD) histograms are the % of time spent at the specified temperature and depth. (in Celsius and meters). Note that each bin value is the upper limit of the bin. E.g. With bin settings of 0, 5, 10 & 20 meters, a reading of 5.1 would appear in the 10 meter bin. Also note that if any data occurs in a bin, that bin will indicate a '1' even though scaling would have rounded the bin down to '0'. This applies to **Dive Maximum Depth**, **Dive Duration**, **TAT**, and **TAD** histograms.



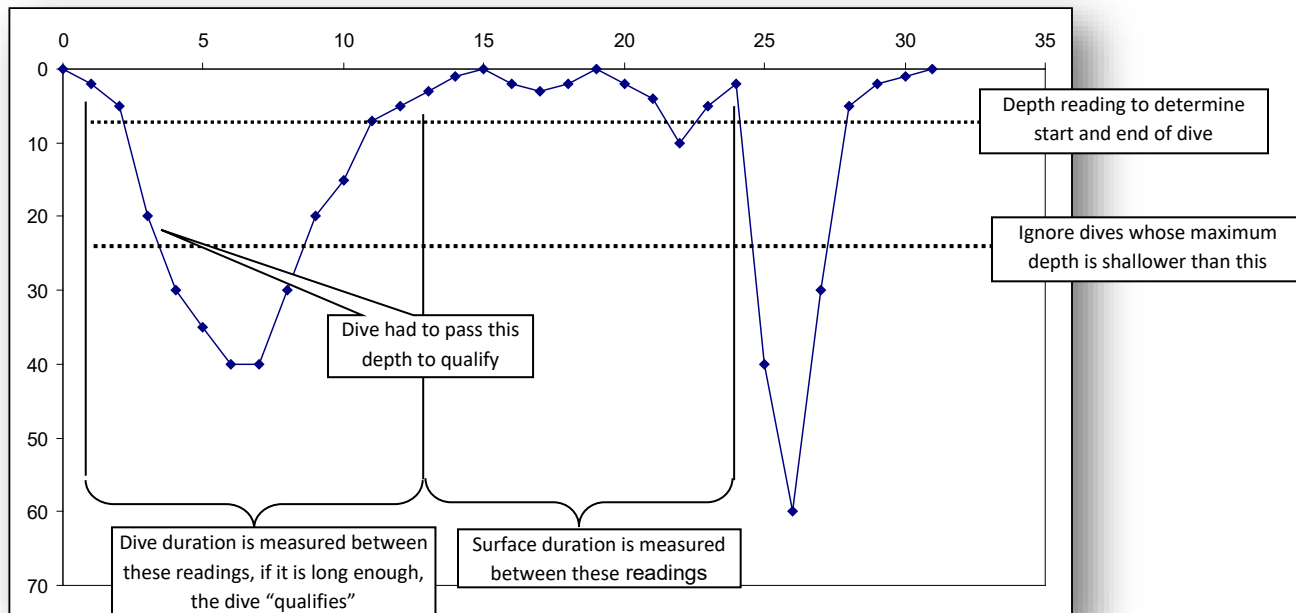
**Tip: It is easiest to enter values starting at bin #1, and then press Enter to move to the next field. When you reach the last bin the row will then sort into ascending order**

**Note: The inherent units of Dive Duration are seconds. Minutes can be entered by following the number with either m or ' (e.g. 2m30 or 2'30 is 2 minutes 30 seconds).**

### Histogram Collection

You can collect between 1 and 24 of each kind of histogram (and **Additional Messages Generated at Histogram Sampling Interval**) per day. This frame allows you to select this number, and at what time (GMT) they should start. You can also restrict the generation of new histograms when the tag is continuously dry throughout the collection period.

## Histogram & Timeline & Behavior Definition



Start/end depth and shallowest maximum dive depth are shown above. They, in combination with the "Ignore dives whose overall duration is shorter than" drop-down list, define "Qualifying Dives." Qualifying dives are used in processing:

- Maximum dive depth histograms
- Dive duration Histograms
- Behavior messages
- Advanced features of Fastloc® control

Timeline messages (messages that record time spent shallower and deeper than a specified depth) use their own depth threshold.

### Depth-Temperature Profiles

These messages are generated from data sampled at the Histogram Data Sampling Interval:

- PAT-style Depth-Temperature Profiles (PDTs)
  - Low Resolution: The minimum and maximum temperatures observed at 8 depths are recorded and transmitted in one message. The depths are chosen dynamically to include the minimum and maximum depths detected, and 6 other depths arranged equally between them.
  - High Resolution: The minimum and maximum temperatures observed at 16 depths are recorded and transmitted in two separate messages. Every other depth (with corresponding temps) is in the first message, and the remaining depths are in the second message. This allows you to see the entire range even if you only receive one of the two messages.

- PDT summary messages are oceanographic profiles. As the time and order of the values are not transmitted it is not possible to “join the dots” and determine dive behavior using PDT data.
- Deepest Dive Depth-Temperature Profiles
  - Deepest Dive Depth-Temperature Profiles create many messages containing paired depth and temperature readings. The number of messages created will depend on the Histogram Data Sampling Interval and the duration of the deepest dive recorded in the Histogram period. You also need to define the temperature range for the profiles from the drop-down list. The tag does not transmit the base temperature (lower value of the temperature range) and therefore must be obtained from the report file for decoding purposes.
  - Since the tag is working to capture the deepest dive and since the tag does real-time processing, it only knows a dive's maximum depth AFTER the animal starts its ascent. For each histogram summary period the tag will select a single deepest dive. So, if the current dive is deeper than the previous deepest dive, data collected from the current dive overwrites the data in the DivePDT buffer. At the end of the histogram summary period, the data in the DivePDT buffer by definition will be from the deepest dive. The buffer reserved for the DivePDT contains 2000 bins. Each bin can only hold the LATEST temperature reading at each depth during an ascent. Data are continuously sampled at the histogram sample interval but only added to the buffer during the ascent of the deepest dive.
  - At the end of the histogram summary period the buffer is processed into Argos messages. The number of messages created is a function of the depth-temp pairs and which can range from a couple of pairs to 2000! In other words, **selecting this option may create hundreds of messages which may swamp other collected data. It is not generally recommended to use this option.**

### Other Messages

- Hourly % Timelines record the percentage of time spent above a threshold depth within 24 1-hour blocks per day. These percentages are rounded to the nearest 10% (low resolution) or 1% (high resolution), but all-deep and all-shallow are identified independently.
- 20-minute timelines record whether the tag was on average deeper or shallower than a threshold depth within 72 20-minute blocks per day. Alternately wet/dry can be used as the threshold instead of a specific depth. In the transmitted data, deeper/wet is indicated with a “1” and shallower/dry with a “0.”
- Light-Level Locations create messages that can be used to locate your study animal using the times of dawn and dusk.

With the exception of haul-out data in status messages, wet/dry sensor values are not transmitted and are only available if the tag is recovered.

## Behavior Collection

If behavior collection is enabled, then messages will be created describing the diving behavior of the study animal. Diving behavior is subdivided into 2 modes:

- In a qualified **dive** as defined above in the **Histogram & Timeline & Behavior Definition** section, the following are reported:
  - Dive Duration
  - Maximum dive depth
  - The shape of the dive (see Dive Shape Classification below)
    - Square
    - "V"
    - "U"
    - Unclassified
- At the **surface**, the following are reported:
  - Time spent at the surface. Surface is defined as the time between qualifying dives as described above in the **Histogram & Timeline & Behavior Definition** section.
  - Time spent shallow. This is the time spent at or above the defined start/end depth of a dive, or time dry if using the wet/dry sensor to start/end dives, while in a surface interval.
  - Time spent deep. This is the time spent below the defined start/end depth of a dive, or time wet, while in a surface interval.

You can expect about 5 dives with associated surface periods to be encoded into a single Argos message. If your dive definition is inaccurate, you could end up with no messages (qualifying dive definition is too broad, so no dives qualify), or too many messages (qualifying dive definition is too narrow, so every vertical movement the animal makes is a "dive"). This could result in a holey dataset.

## Dive Shape Classification

Dives are classified into one of three simple dive shapes (square, V, U) by assuming the bottom of a dive is any depth reading  $\geq 80\%$  of the maximum reading observed for the dive. If the total duration for the dive is **T**, the total time between the first bottom reading and the last bottom reading is **B**:

Classification	Bottom Time
Square	$B > 50\% T$
U	$20\% T < B \leq 50\% T$
V	$B \leq 20\% T$

## Stomach Temperature

This section will be disabled unless you have the -L module installed to link data from a stomach temperature pill. There are three types of messages that can be generated; they can be selected in any combination. The processing will recognize "ingestion events" from a rapid drop in stomach temperature (ST). You set this threshold. An ingestion event ends when the ST returns to within 0.5°C

of pre-ingestion temperatures or when the event exceeds a maximum duration (that you also set). The message types are:

- **Ingestion event records.** These records are created as an ingestion event finishes and contains the following parameters:
  - The time and date of the ingestion event
  - The ST immediately before the ingestion event started
  - The first ST of the ingestion event
  - The depth immediately before the ingestion event started
  - Whether the tag was ascending or descending when the ingestion event started
  - The deepest depth measured during the ingestion event
  - The seawater temperature at this deepest depth
  - The time of this deepest depth
  - The overall duration of the feeding event
  - The last ST of the feeding event
  - The lowest ST recorded
  - The time of the lowest ST recorded
- **Fine-scale ST samples during an ingestion event.** During a recognized ingestion event, the ST readings will be saved as a time-series at 1-min intervals. Temperature resolution is 0.1°C.
- **Course-scale ST messages when not fine-scale.** This is the default method of encoding ST readings as a time-series. Data are stored at 2-min intervals, but small changes in temperature ( $< \pm 0.5^{\circ}\text{C}$ ) will be reported as “no change.” This allows much greater compression of data.

The message types can be selected independently. Selecting or deselecting the “Ingestion events records” just affects the generation of such messages, not the recognition of ingestion events. You can deselect “Ingestion events records” and select “fine-scale ST...” The fine-scale messages will still be generated during an ingestion event. The table below shows how the fine- and coarse-scale messages interact.

	Fine-scale disabled	Fine-scale enabled
Coarse-scale disabled	No time-series data are generated. Ingestion events can still be generated if enabled.	No time-series data will be generated unless an ingestion event is underway.
Coarse-scale enabled	Coarse-scale data will be generated throughout the deployment. No special action will take place during an ingestion event.	Coarse-scale data will be generated between ingestion events, and fine-scale data will be generated during ingestion events.

## Time-Series Data

Time-series data is available on some tags. If this option is available to you, you will see the following Data to Transmit screen, with a Time-Series tab.

Message Type

Message Type	# Bins	Upper (deeper/longer/hotter) Limits of Bins													
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
Dive Maximum Depth (m)	12	10	20	50	100	150	200	300	400	500	600	700	>700		
Dive Duration (min sec)	14	3m	6m	9m	12m	15m	30m	45m	60m	75m	90m	120m	150m	180m	>180m
Time-at-Temperature (C)	14	-2	0	3	6	9	12	15	18	21	24	27	30	33	>33
Time-at-Depth (m)	14	0	2	10	20	50	100	150	200	300	400	500	600	700	>700

Histogram Collection

Hours of data summarized in each histogram: 6

Histograms start at GMT: 0

☐ Suspend generating new Histogram-style messages while a tag is continuously dry

Dive Definition

Ignore Dives shallower than 2m

Ignore Dives shorter than 2min

Dive's duration is determined from the first wet reading to the last wet reading

Change Dive Definition

Standard messages: Time-Series (TS) | Stomach Temperature (ST)

☒ Enable Time-Series message generation

Channels to report: Depth ☒ External Temperature ☒

Duty-Cycling

Initially on for: 90 days

Then start duty cycling: off for: 255 days and on for: 255 days

Time series data interval: 10 min

These settings will generate: 6 Argos messages per day for the first 90 days and an average of 3 Argos messages per day thereafter

Transmission Control

Transmit data collected from these last: 7 days

Histogram & ST transmission priority: ☐ low ☒ med ☐ high

Location transmission priority: ☒ low ☐ med ☐ high

Behavior & TS transmission priority: ☐ low ☒ med ☐ high

On the Time-Series tab, you will choose

- whether or not to enable Time-Series message generation
- what duty-cycling settings to use
- the time-series sampling interval

Time-Series Data is not generally recommended on Fastloc tags as the volume of both Time-Series Data and Fastloc data is too high for the limited Argos bandwidth.

Detailed information on Time-Series data options and what the parameters mean is available in Appendix D.

## Dry-Deep-Neither Timeline

The Dry-Deep-Neither Timeline (or DDN Timeline) categorizes each hour of the day as Dry, Deep, or Neither. The statistics are based on data collected at the histogram sampling interval.

On the DDN Timeline tab you will define:

- Dry hour – the percentage of the hour that must be dry in order for the hour to be considered “Dry.”
- Depth threshold– the depth used to determine “Deep”.
- Deep hour – the percentage of the hour that must be below the depth threshold in order for the hour to be considered “Deep.”

Any hours that do not qualify as Dry or Deep will be considered Neither.

At the end of each day, each hour is marked as Dry, Deep, or Neither. This message is generated once per day and contains data from the previous 5 days.

In the example below, the tag will tally each 10 second sample in an hour. If more than 90% of those 600 samples are “dry” the hour will be marked as “Dry.” Or if more than 50% of those 600 samples are deeper than 10 meters, the hour will be marked as “Deep.”

Mk10Host - Manufacturer - 12A1805

General | Test | Archive | GPS | Data to Transmit | When to Collect | When to Transmit | [Pop-up] | Haulout | Battery | Exit | Download | Audit | Files

Histogram Data Sampling Interval: 10 sec

Message Type	# Bins	Upper (deeper/longer/hotter) Limits of Bins													
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
Dive Maximum Depth (m)	off														
Dive Duration (min sec)	off														
Time-at-Temperature (C)	off														
Time-at-Depth (m)	off														

**Histogram Collection**

Hours of data summarized in each histogram: 1

Histograms start at GMT: 00h

☐ Suspend generating new Histogram-style messages while a tag is continuously dry

**Dive Definition**

☐ Ignore Dives shallower than 84m

☐ Ignore Dives shorter than 2min

Dive's duration is determined from the first wet reading to the last wet reading

Change Dive Definition

**Standard | Time-Series | DDN Timeline**

DDN Timelines are messages that categorize each hour as: "Dry" "Deep" or "Neither"

☒ Enable DryDeepNeither (DDN) Timeline message generation (1 per day, which covers previous 5 days)

Hour is "Dry" if it is dry at least 90% of the time

Hour is "Deep" if it is deeper than 10m at least 50% of the time

Otherwise hour is classified as "Neither"

**Transmission Control**

Transmit data collected from these last 7 days

Histogram & ST transmission priority: ☐ low ☒ med ☐ high

Location transmission priority: ☐ low ☐ med ☒ high

Behavior & TS transmission priority: ☐ low ☐ med ☒ high

## Transmission Control

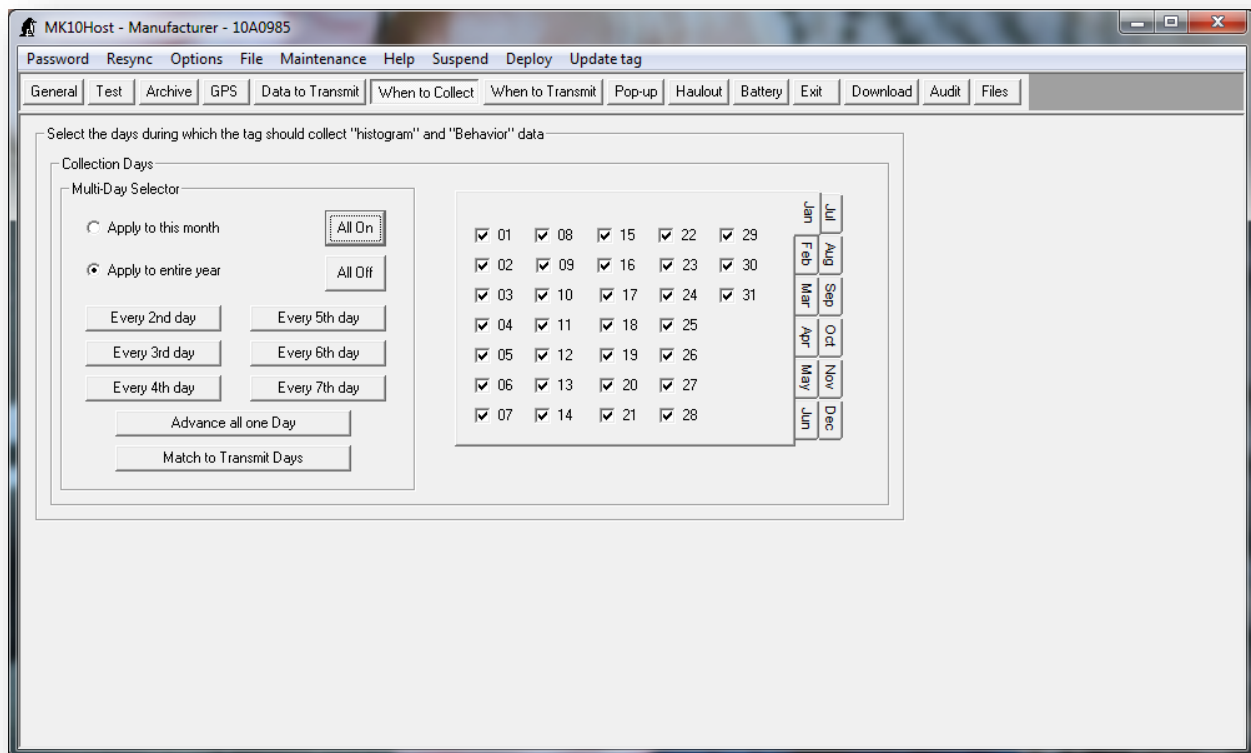
- Sets the number of days of data to hold in the transmission buffer
- Sets the priorities for the different kinds of messages

Together, these parameters determine the likelihood that a given message type will be sent from a given period of the deployment.

The current version of the control uses relative priorities where high = 3x, medium = 2x, and low = 1x. Thus if the behavior priority is set to high, and location priority is set to low, the transmission of data will be adjusted so that all the behavior messages (in the transmit buffer) will be transmitted three times for every time the entire set of location messages (in the transmit buffer) are transmitted. Note that setting all priorities to high, will have no impact. Priorities must be set to different values to create a difference in the likelihood that a message type will be received by an Argos satellite. You can also set the number of days of Argos data to hold in the transmit buffer.

### When to Collect Tab

Mk10Host allows you to control which day of each month to collect and process Argos messages for later transmission.

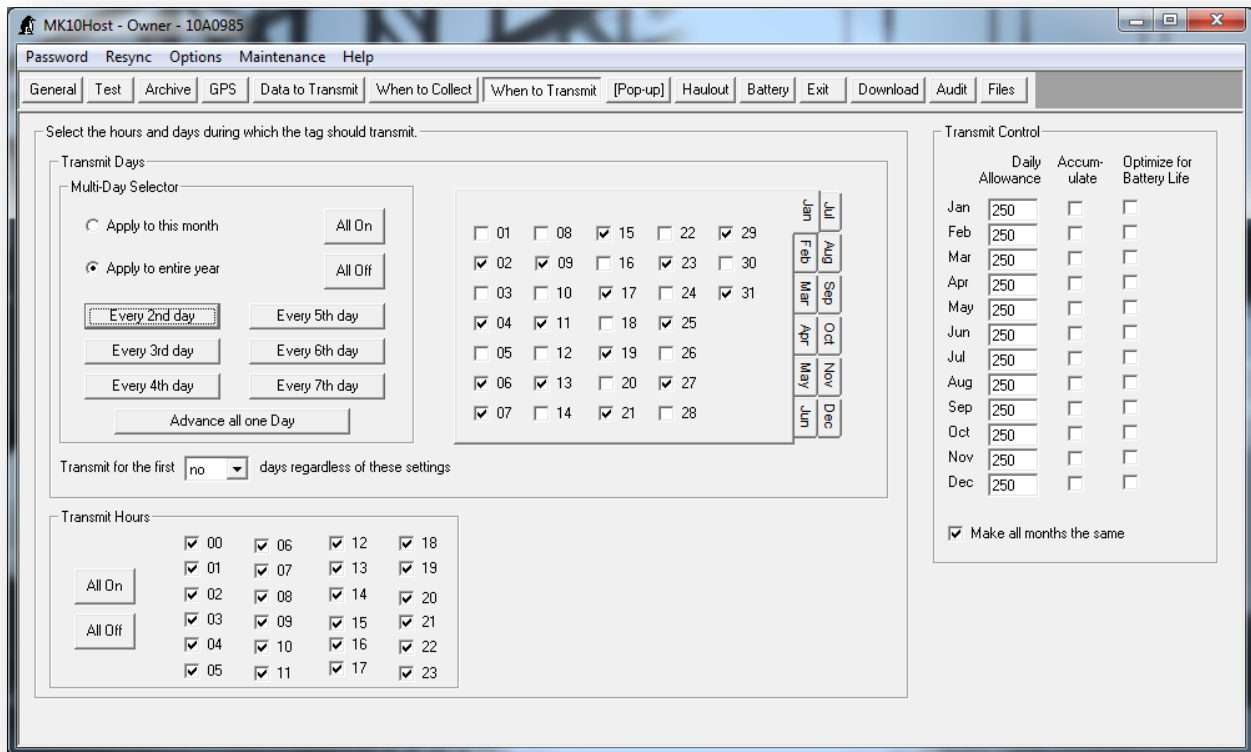


The default setting is to collect on all days. Only use other set-ups if you are sure that you only want to sub-sample the overall Argos message creation (to extend battery life, for instance).

### When to Transmit Tab

This tab controls when Argos messages should be transmitted, how many should be transmitted, and how they should be constructed.





Use the controls in the **Transmit Days** and **Transmit Hours** to control the dates and times of transmissions.

You can ignore the specified transmit days and hours at the beginning of the deployment. This allows for intense telemetry effort to track an animal immediately following tag deployment. Adjust **Transmit for the first...** drop down to do this.

The **Daily Allowance** field allows you to limit the number of transmissions per day on a month-by-month basis.



**Note: Set the Daily Allowance for each month to 0 to disable all Argos transmissions.**

The **Accumulate** check boxes determine whether unused daily allowances of transmissions should roll-over to the next transmission day (checked), or whether just the specified allowance should be used each day (unchecked). Regardless of this state, the daily transmission allowance is accumulated at 00h (tag time) only on days that are checked in the **Transmit Days** frame. Additionally one day's transmission allowance is allocated when the tag is deployed (assuming the deployment day is enabled, or the number of days to transmit regardless of other settings is not set to "no").

The **Optimize for Battery Life** check boxes determine how the tag builds Argos Messages. If unchecked, the tag will attempt to pack as many different message types into a single Argos message as it can, using a complex packing scheme. This will generally result in Argos messages close to the

maximum of 31 bytes long. If the **optimize** boxes are checked, then the tag will stop packing in additional message types once the Argos message is 15 bytes long. Longer messages are more efficient for retrieving data through the Argos system, but discharge the battery faster. These boxes should only be checked when your deployment is only going to generate comparatively little data, and you need the tag to continue to provide locations for as long as possible.

The control for the towed SPLASH tags is a little different:

The **Transmit Days** setting and the **Transmit Control** are for pre-release only, only the **Transmit Hours** affect both the pre- and post-release phases. In post-release mode the tag will transmit every day as often as possible until the battery is flattened, regardless of these settings.

This allows the towed SPLASH10 tag to be set up for “opportunistic transmissions” by setting the Daily Allowance to a small (non-zero) number, like 10 or 20, for the months you are interested in getting occasional messages through the Argos system.



**Note: Because the Transmit Hours controls both post-and pre-release, we recommend that these are set to All On.**

## Pop-Up Tab

The towed SPLASH10 tag can be instructed to pop-up (or release from the study animal) either on a specific date:

The screenshot shows the MK10Host software window with the 'Pop-up' tab selected. The window title is 'MK10Host - Owner - 10A0985'. The menu bar includes Password, Resync, Options, Maintenance, and Help. The toolbar contains buttons for General, Test, Archive, GPS, Data to Transmit, When to Collect, When to Transmit, Pop-up, Haulout, Battery, Exit, Download, Audit, and Files.

**Scheduled Release Setup**

☒ Release on specified date ☐ Release Specified days after tag is deployed or activated

Calendar for April 2011:

Sun	Mon	Tue	Wed	Thu	Fri	Sat
27	28	29	30	31	1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
1	2	3	4	5	6	7

Hour: 12

Release on: 17-Apr-2011 at 12:00

**Premature Release Setup**

The Mk10-PAT tag thinks it has released prematurely or the fish has died if it stays at a constant depth (either the surface or the seafloor) for a long time. It will then corrode off its tether and start transmitting.

Hours permissible at a constant depth before MK10-PAT starts to corrode off its tether: 48

Minimum depth to start premature release detection: immediate

Mk10-PAT thinks it is at a constant depth even if depth varies within this range: 5m (+/- 2.5m)

Release even if there are a few outliers (4 for PRHours = 48): ☒

Must be at surface to be a premature release: ☐

When released and trying to transmit, ignore wet/dry sensor after 45 days: ☐

Start release when this percentage of the battery capacity has been used: Disabled

If Mk10-PAT releases prematurely: Initially transmit the Histogram and PDT messages collected immediately preceding the premature release event with doubled priority.

Number of days of messages to transmit with doubled priority: none

Or after a specified number of days following deployment:

The screenshot shows the MK10Host software interface with the 'When to Collect' tab selected. The 'Scheduled Release Setup' section on the left has two radio buttons: 'Release on specified date' (unselected) and 'Release Specified days after tag is deployed or activated' (selected). Below the selected option is a 'Release Days' field with a value of 100. A 'Hour' dropdown menu is set to 12. A summary box at the bottom of this section states 'Release 100 days after deployment at 12:00'. The 'Premature Release Setup' section on the right contains several settings: 'Hours permissible at a constant depth before MK10-PAT starts to corrode off its tether' is set to 48; 'Minimum depth to start premature release detection' is set to 'immediate'; 'Mk10-PAT thinks it is at a constant depth even if depth varies within this range' is set to '5m (+/- 2.5m)'; 'Release even if there are a few outliers (4 for PRHours = 48)' is checked; 'Must be at surface to be a premature release' is unchecked; 'When released and trying to transmit, ignore wet/dry sensor after 45 days' is unchecked; 'Start release when this percentage of the battery capacity has been used' is set to 'Disabled'; and 'Number of days of messages to transmit with doubled priority' is set to 'none'. A note at the bottom of the right section states: 'If Mk10-PAT releases prematurely: Initially transmit the Histogram and PDT messages collected immediately preceding the premature release event with doubled priority.'

### Premature Release Set-Up

If your SPLASH10 has a depth sensor, the tag can detect when it comes off the animal before the scheduled release. Tags without a depth sensor will not have premature release detection.

Having premature release set up appropriately is important for a successful deployment. A premature release is determined to have happened when the depth reading hasn't been variable enough. This indicates that the tagged animal is not moving in the water column (dead) or that the towed SPLASH10 has become detached from the animal. After premature release is detected, the towed SPLASH10 corrodes off its tether and starts to transmit immediately. The depth measurement for premature release detection is taken every minute (for detection periods up to, and including, 96 hours) and every two minutes (for detection periods over 96 hours). This happens regardless of the other settings on the tag.

The **Hours permissible at a constant depth before towed SPLASH10 starts to corrode off its tether** field sets the sensitivity of the premature release. A short number of hours will cause a premature release to be detected sooner, but may be subject to false detection.



**Note: If you do not wish to enable premature release detection, set the Hours permissible at a constant depth before towed SPLASH10 starts to corrode off its tether to forever**

Use the **Minimum depth to start premature release** detection control to disable premature release detection before the tag is actually deployed on a study animal. Be careful if you have a very shallow diving animal to make sure this threshold will be passed. **DO NOT press on the pressure sensors to test the release.**

If the animal is dead and resting on the seafloor, then depth will still continue to change due to tidal variation. Use the towed **SPLASH10 thinks it is at a constant depth even if depth varies within this range** control to allow for this tidal variation, and set it to a number larger than expected tides.

We generally recommend enabling the **Release even if there are a few outliers**. This allows a few readings to be outside the prescribed range without stopping the premature release. This can be useful where a tag is washed up on a beach and is tumbling among rocks, and occasional waves cause high pressure readings. Do not enable this if you have an animal that stays at the surface almost constantly, with very rare dives.

Depths deeper than a specified value can be treated as if the tag remained at this value using the **Treat all depths deeper than this value as if they are this value** field. This can be useful where a study animal is known never to go deeper than some value, and that premature release detection should start detection immediately this threshold is passed. This will not cause an immediate release. It will still have to stay the specified hours, above, deeper than this value. However, variations in depth that might have postponed a premature release detection are effectively masked out.

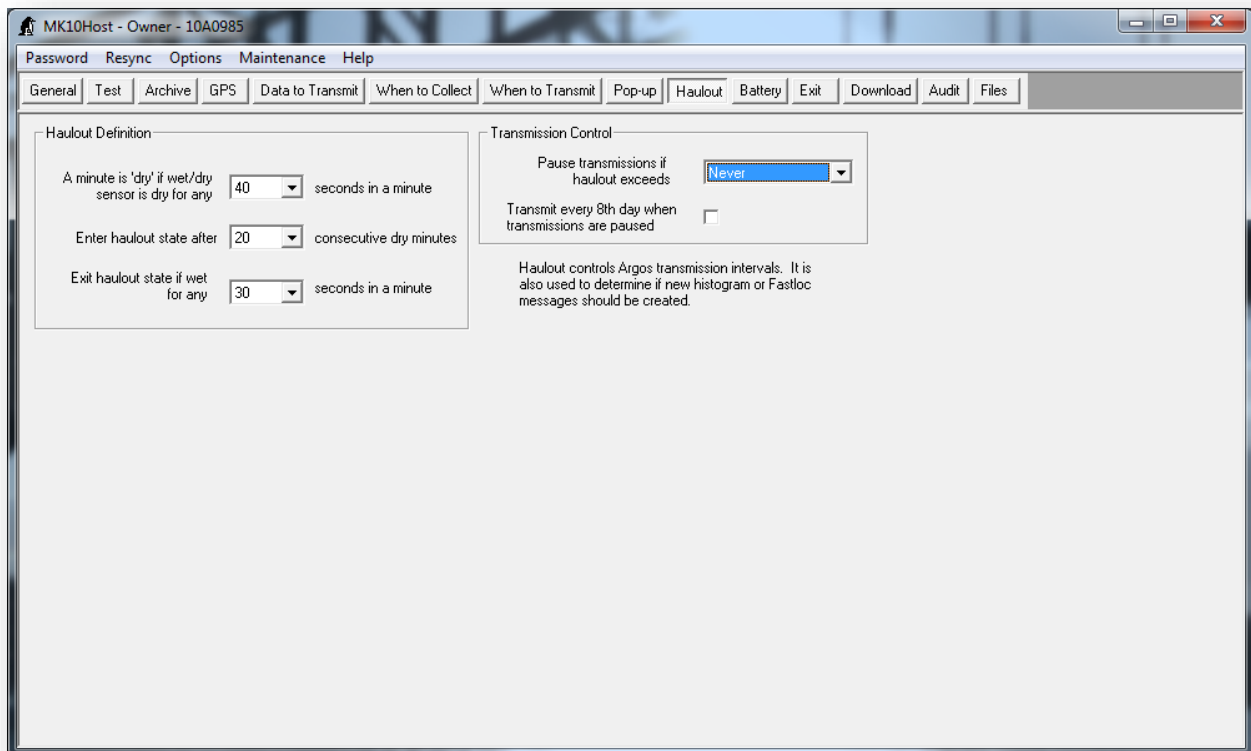
Newer versions of Mk10Ware (v1.22 on) allow the user to initiate a premature release based on an internal calculation of the amount of battery power consumed. This is only relevant for experiments which include opportunistic transmissions, as otherwise no appreciable current is consumed by the tag during data sampling.

You may be very interested in what took place immediately preceding a premature release detection, e.g., in a mortality study. The **Number of days to transmit with doubled priority** allows you to specify this history window.

### Haulout Control Tab

The tag can have different regimes when the animal is “hailed out.” This includes the transmission repetition rate and the creation of new histograms and Fast-GPS messages.

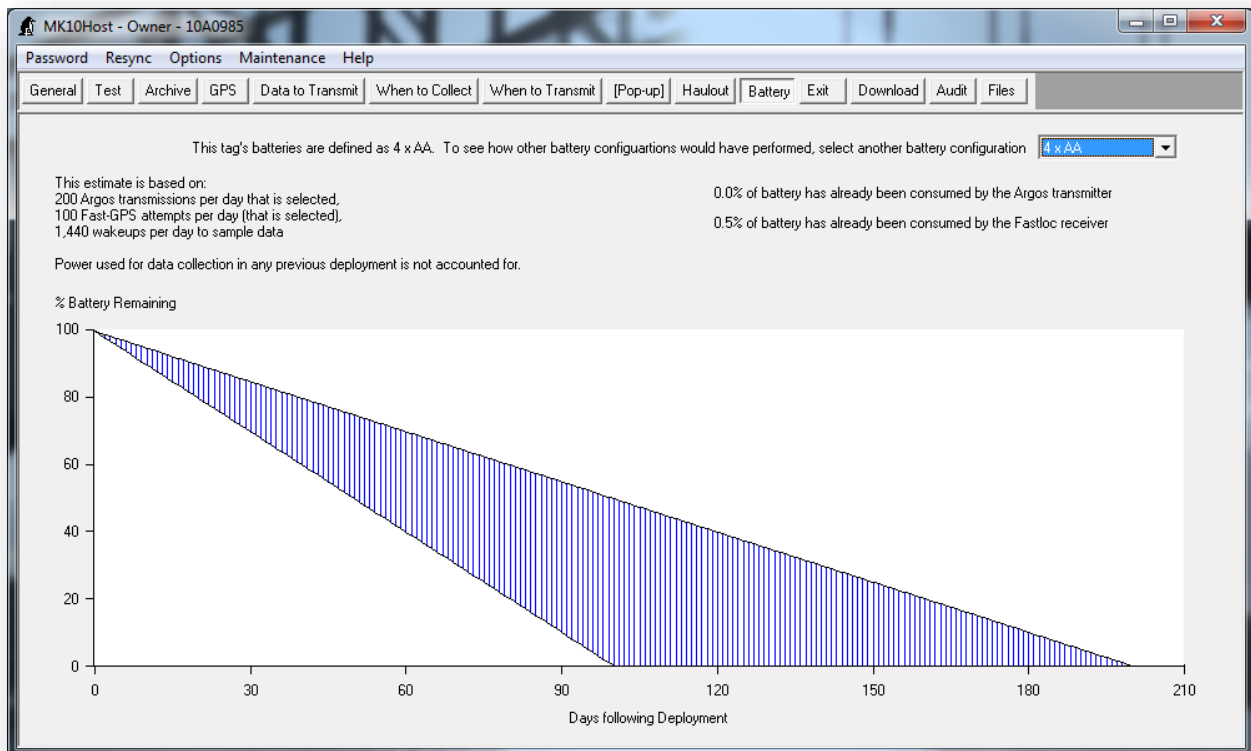
The parameters on this tab define when the tag switches to haulout mode, whether Argos transmissions should be paused after a certain number of hours in haulout mode, and whether informative Argos transmissions should be made on every 8<sup>th</sup> day of haulout (to indicate the tag is still functioning). Set the ‘Pause transmissions’ parameter to ‘Never’ to transmit for entire haul out.



Haulout is defined to start when a predefined number of consecutive minutes pass in which the tag is “sufficiently dry.” “Sufficiently dry” is in turn defined as having enough dry readings, measured once per second, in a minute. These dry readings do not have to be consecutive. Haulout ends in a similar manner, when enough wet readings occur in a minute.

### Battery Tab

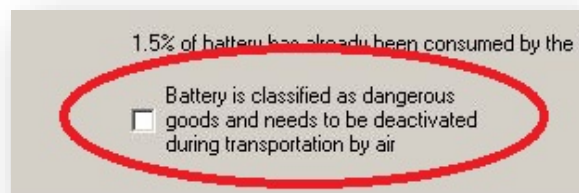
This tab is designed to let you forecast how long the tag batteries will last. As this is a new addition to the feature set, early tags may not have their battery configuration pre-encoded. In this case, manually select the battery installed on your tag from the drop-down list.



You may also use the battery selector to see how long your tag would have lasted, had it been configured with different batteries.

The area shaded represents the expected performance of the tag. The upper limit is the optimistic view. The lower limit is a pessimistic view of the battery capacity. Actual life is usually somewhere between these extremes.

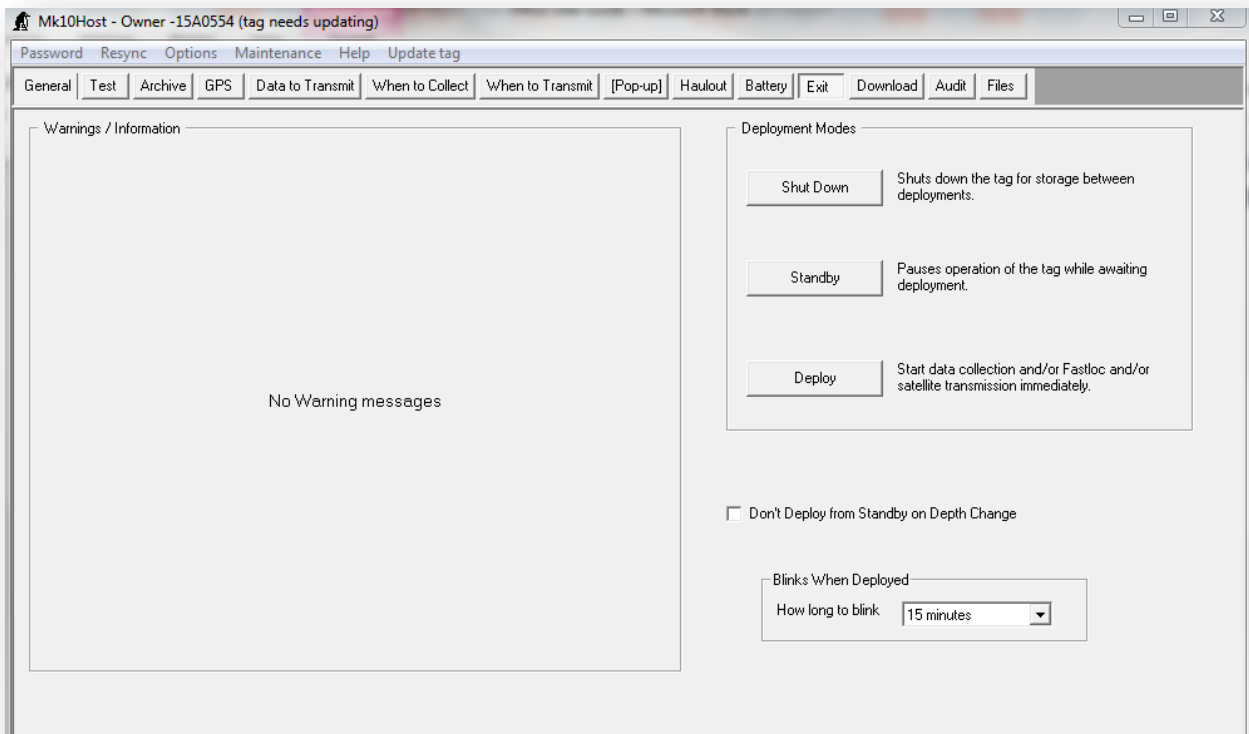
If your tag is considered dangerous goods for shipping, you will have the ability to indicate if the dangerous-goods screw is placed. See Appendix G for details.



## Exit Tab

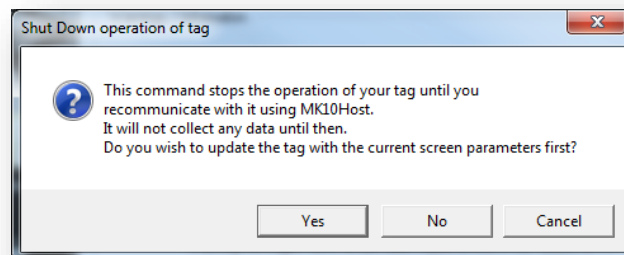
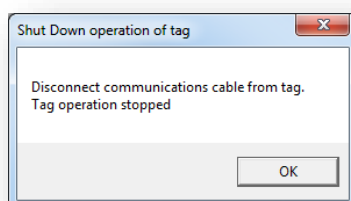
You will always use this tab when disconnecting the tag. Future versions of the software may include warnings about parameters that seem to be poorly set. *Absence of a warning does not necessarily indicate that the tag has been set up optimally!*

There are three options for deployment modes: Shutdown, Standby and Deploy.



## Shutdown Mode

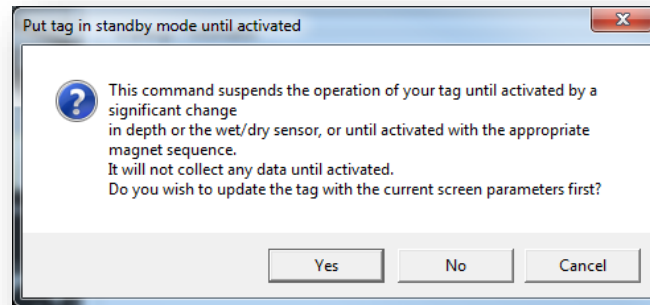
Use this mode for storage between deployments. You must re-establish communications to deploy the tag or put it into Standby mode. The clock is maintained. The data in memory are maintained. Depending on whether or not you have changed any parameters during your Host session with the tag, you will see one or the other of these messages.



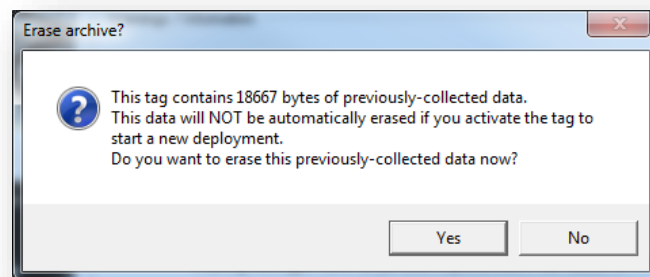


## Standby Mode

In this mode the tag is not entirely “turned off,” but monitors for a signal to activate it into Deployed mode. The signals are described below. Depending on whether or not you have changed any parameters during your Host session with the tag, you will see one or the other of these messages.

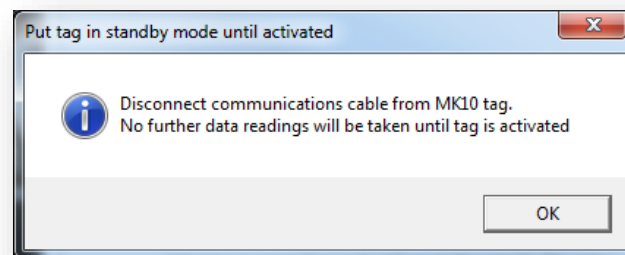


If you have any previously collected data in memory, you will receive the following prompt:



If you do not erase previously-collected data, the new data will be appended. The new data will be marked as a new deployment.

Finally, you will receive this confirmation:



An abbreviated report file and a set-up file will be automatically created. They have filenames of serialnumber.date.htm and serialnumber.date.wch respectively. The report is saved into the Report directory, the set-up file into the Backup Directory, see page 46

### Activating the Tag from Standby Mode

The tag can now be activated into deploy mode without re-establishing communications. There are three ways to do this:

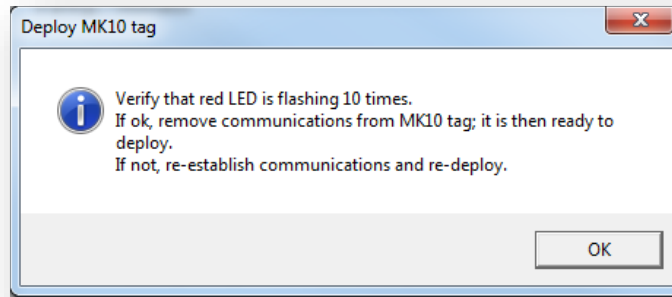
- Applying a magnet in a specific way:
  - Pass a magnet near the communications port. The LED will quickly double-flash three times, followed by one long flash, indicating it is in Standby mode.
  - If you pass a magnet over the same location during the long LED flash, the tag will go into Deploy mode. The LED will flash quickly 10 times, followed by one long flash. It will then glow dimly until the next full minute, indicating it is deployed.
  - If you do not time the magnet passes correctly, the tag remains in Standby mode.
- Depth sensor reads a 20m change in depth
  - If you use high-power VHF radios near a tag with a depth sensor, it can generate depth spikes which may cause the tag to deploy. You can choose the "Don't Deploy from Standby on Depth Change" option to avoid this situation.
- Wet/dry sensor senses a pre-set minimum change in conductivity.



**Note: Daily Diary tags use a laser rather than magnet to switch modes because they contain a magnetometer. Other tags with magnetometers will also use a laser. See Appendix C for more details and additional options.**

### Deployed Mode

The tag initializes and immediately begins to sample. *This mode automatically updates the tag (if parameters have changed) and erases memory.* A report file and a set-up file will also be automatically created. They have filenames of serialnumber.date.htm and serialnumber.date.wch respectively. The report is saved into the Report directory and the set-up file into the Backup Directory, see page 46.



**WARNING:** You should never turn off the Blue Box or disconnect a tag from a USB communications cable, Cable Comm, or Blue Box without clicking on either the Deploy, Standby or Shutdown buttons. Doing so may leave your tag in a mode that will rapidly deplete its internal battery.

### Don't Deploy From Standby on Depth Change

Checking this box prevents a depth change from triggering deployment. A change in the wet/dry sensor readings or magnet swipe will still active the tag.

### Blinks When Deployed

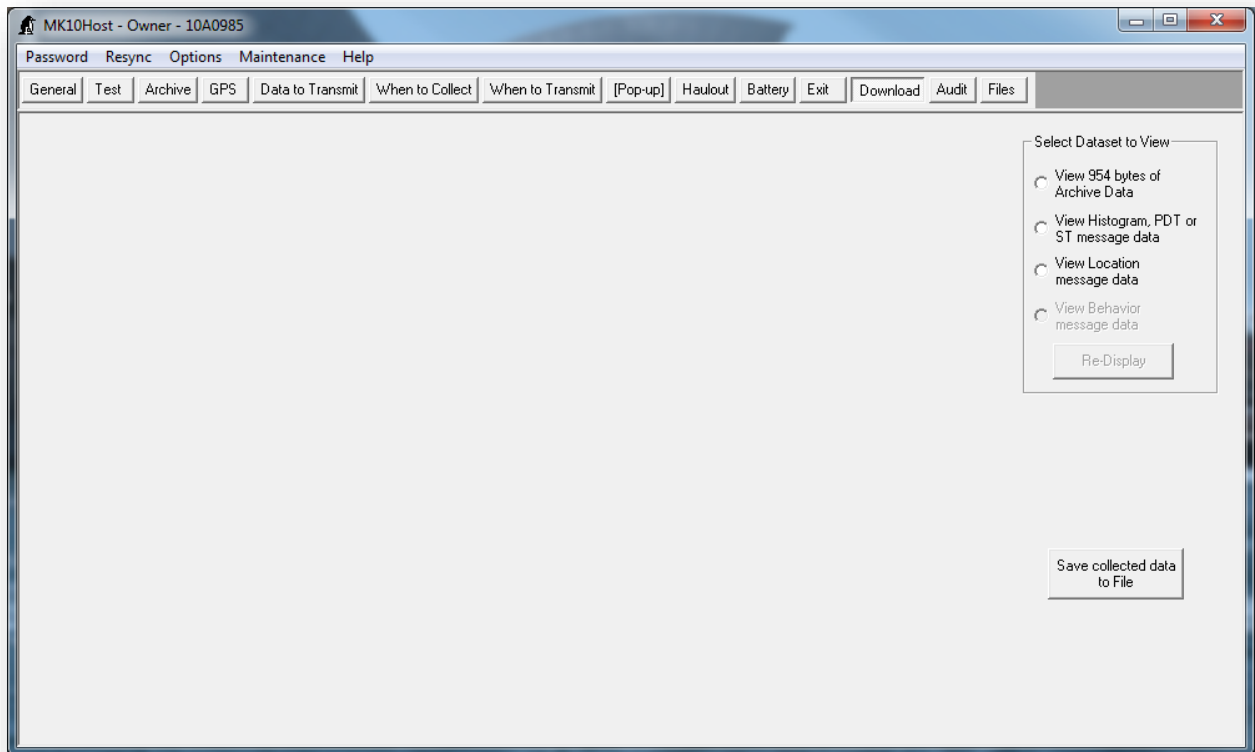
Once deployed, the tag begins data collection and flashes whenever it wakes up to take a sample. How long the blinks run for is customizable. Selections are in increments of 10 minutes, from never up to 3 days. Once the tag reaches depth, the LED will stop flashing after 31 hours regardless of the set blink duration.

### Download Tab

There are two ways you can examine your collected data.

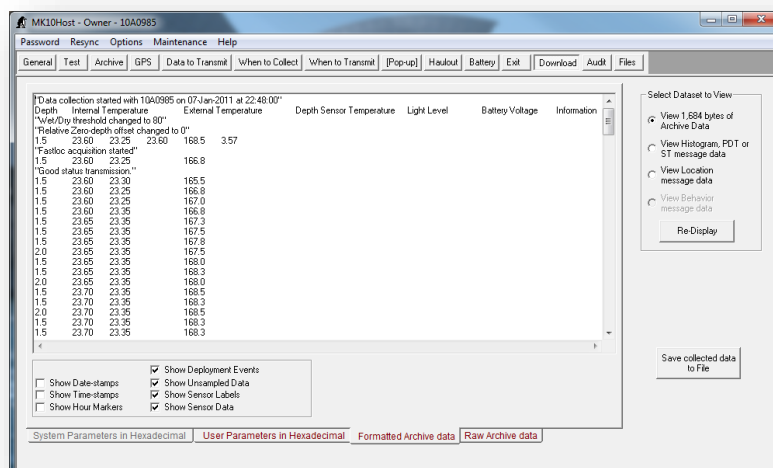
1. Use the built-in data viewer (only recommended for small data sets, such as for verification of the sensors).
2. Download the collected data to a file and use other utilities (such as WC-DAP) to decode/view the data for analysis.

## Viewing the Data



To view at least some of your data, click on a radio button in the **Select Dataset to View** frame. If you have more than 50,000 bytes of data in your archive, you will be limited to viewing only those initial data.

Viewing Archive data will generate a view that looks similar to this:



You can change the fields displayed using the checkboxes. The column separator can be changed in the Options menu. You can cut-and-paste data from the data display textbox into Excel, or other programs. If you press Ctrl-A after clicking somewhere inside the data display textbox, all data are copied to the clipboard (even data that were not displayed due to constraints of the textbox control).

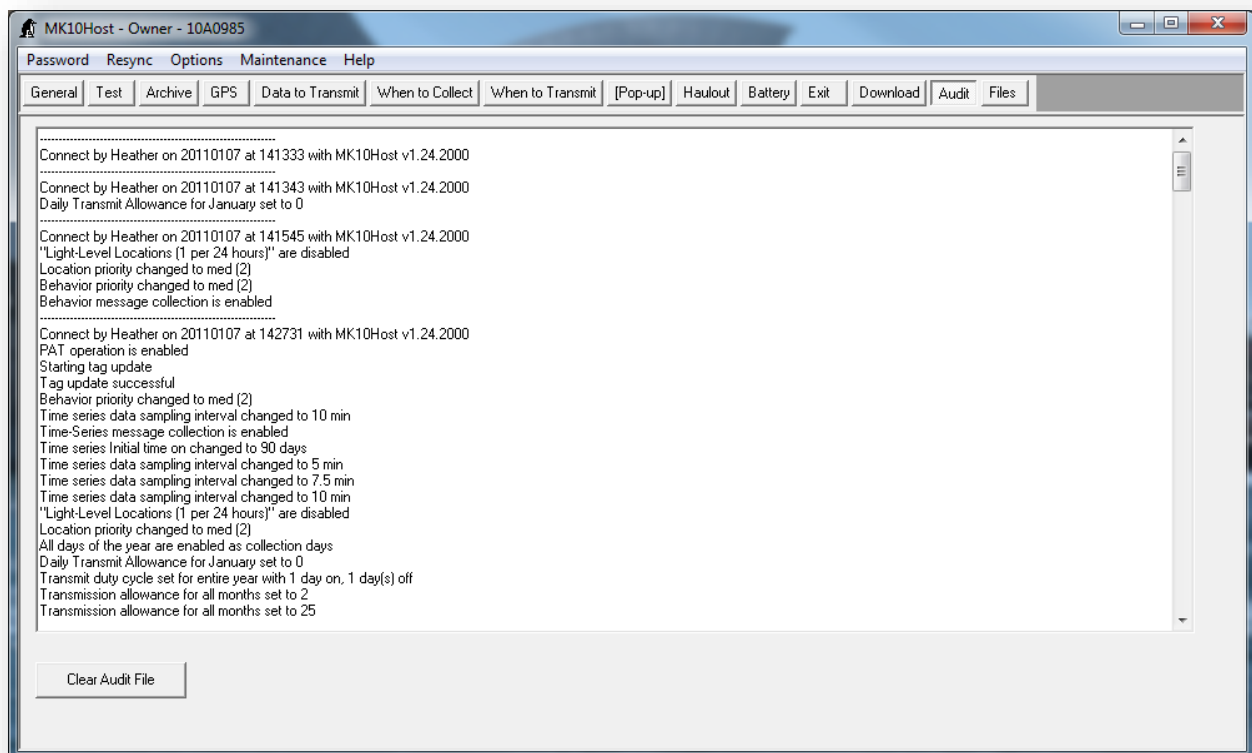
You may also view Histogram, PDT, Location or Behavior records in a similar manner.

### Download the Data

Use the **Save collected data to File** button to Download your data. This will save the data in our standard .wch format. These data can then be viewed graphically using WC-DAP.

### Audit Tab

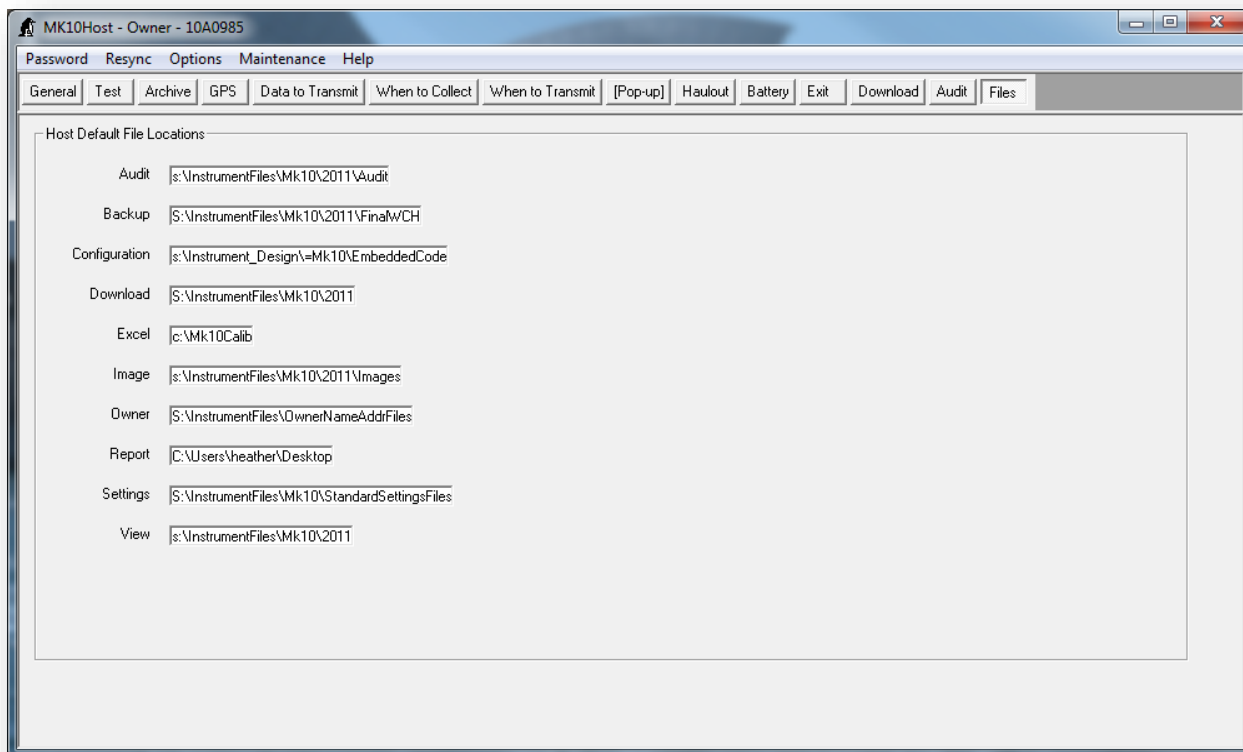
This shows the history of commands and responses that occurred during communications.



New information is appended. This can be a useful diagnostic tool when trying to figure out how or when a parameter was changed.

## File Tab

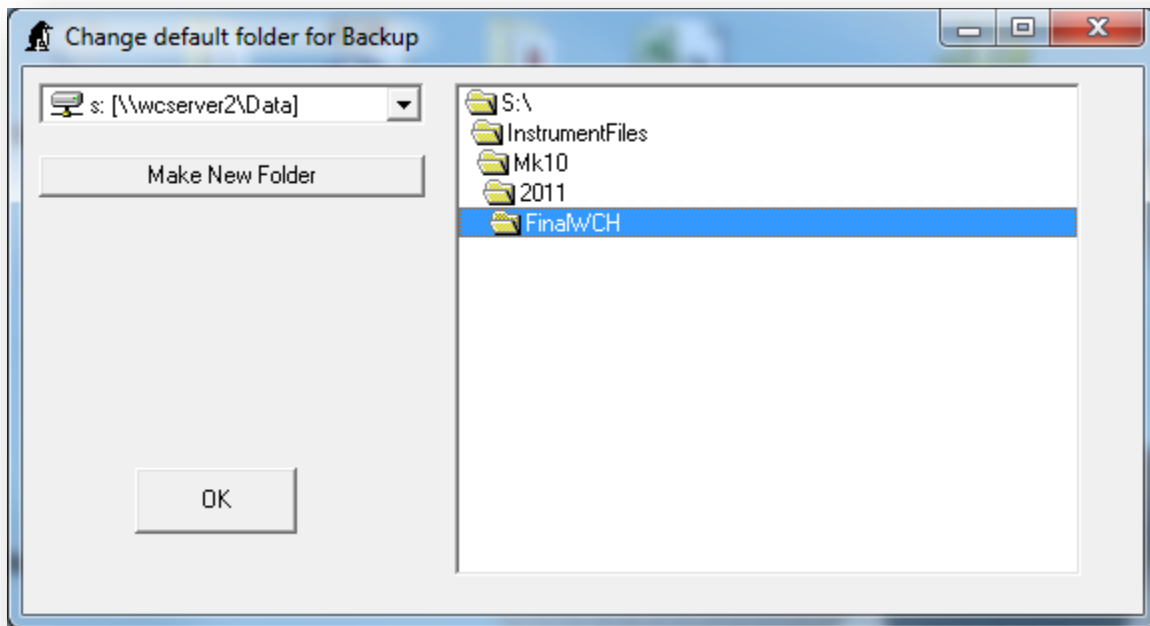
This tab allows you to see (and change) the default location to which Mk10Host saves data. Half of the options shown will not affect you, and are only used during initial testing by Wildlife Computers.



The files affected by these settings that are pertinent to your use of Mk10Host are:

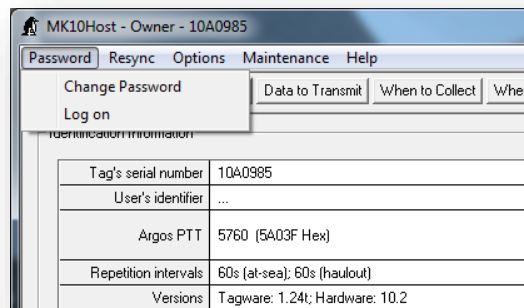
Audit	Audit files. Naming convention is <b>AuditOfxxAxxxx.tag</b>
Backup	Automatically generated set-up files when you Standby or Deploy a tag. Naming convention is <b>xxAxxxx.dd-mmm-yyyy.wch</b>
Configuration	Manually generated set-up files from the <b>General</b> tab. Naming convention is <b>xxAxxxxconfig.wch</b>
Download	Downloaded data files. Naming convention is <b>xxAxxxx.wch</b>
Report	Manually and automatically created report files. Naming convention is <b>xxAxxxx.htm</b> for manually created reports, <b>xxAxxxx.dd-mmm-yyyy.htm</b> for automatic (where <b>xxAxxxx</b> is serial number, and <b>dd-mmm-yyyy</b> is today's date).

To change a default folder, click on its name and the following dialog will appear. Browse to choose the desired location.



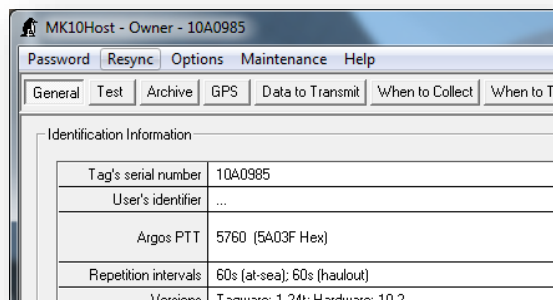
## Menu Items

### Password

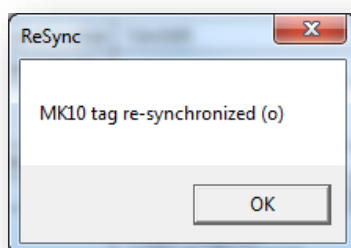


You may change your password anytime you are logged on as a user, by selecting the **Password** menu item at top left of the Host screen. Acceptable passwords include entries up to 7 characters. If you forget your password, you will have to return the tag to Wildlife Computers so we can reset it. Passwords are not case sensitive. The default password is **mk10**.

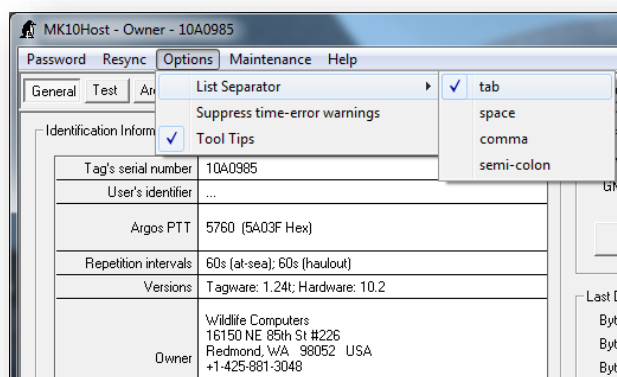
## Resync



On occasion, your tag may get out of sync with the Host program. You will get a message warning you about this. Clicking on the **ReSync** menu item should resynchronize communications. When you have successfully re-synchronized your tag, you will get the following notice.



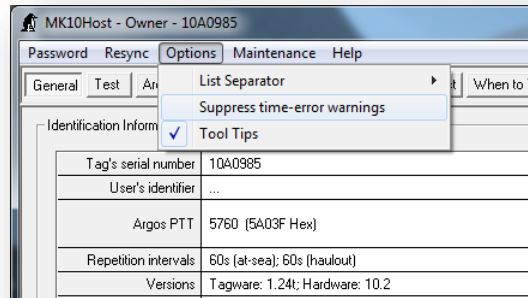
## Options – List Separator



You may choose your preferred separator for displaying viewed data on the Download tab.

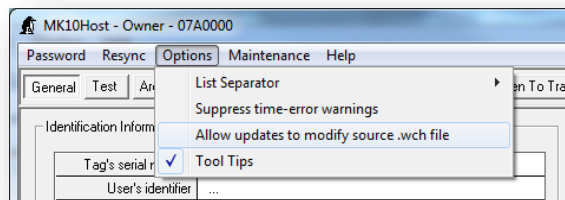


## Options – Suppress Time-Error Warnings



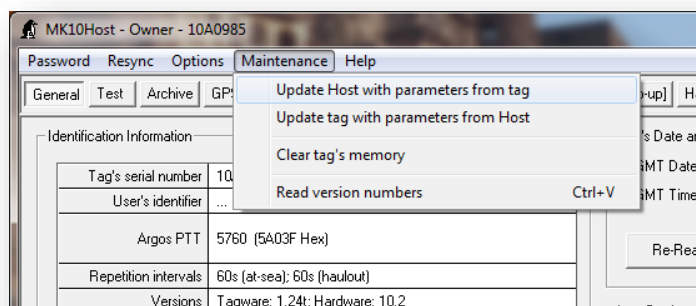
If you have a tag whose clock has failed, you may be plagued with error messages warning you that the clock is not advancing correctly. Clicking this menu item will suppress these messages so you can continue to work with the tag.

## Options – Allow Updates to Modify Source .wch File



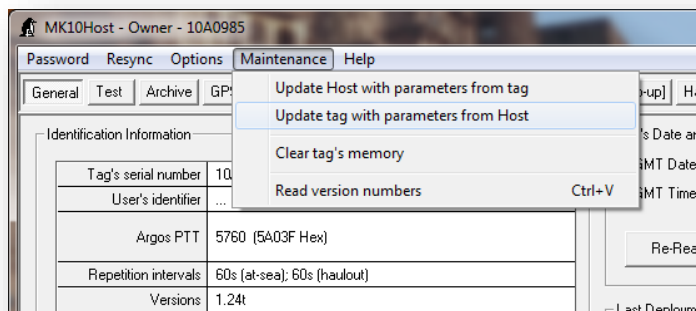
This menu item only appears if you are connected to a file rather than a real tag. Normally you are prevented from modifying the .wch file to which you are connected in order to protect the integrity of the data in that file. Checking this menu item overrides this restriction. Use with extreme caution.

## Maintenance - Update Host...



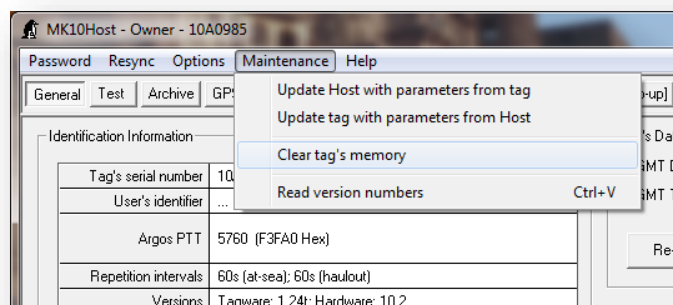
This provides a route for re-downloading parameters from the tag to the PC. Use this if you make mistakes while setting your parameters and want to start over.

## Maintenance - Update Tag...



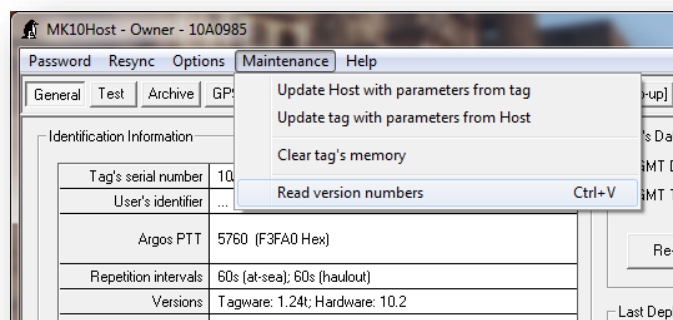
This provides a manual route for forcing an immediate update of the tag with any changed parameters on your PC.

## Maintenance - Clear Tag's Memory

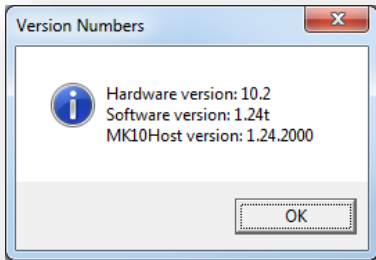


This menu item may be used to clear collected data from a tag. It is not generally necessary to do this, as data is automatically erased when a tag is re-deployed and you are prompted to erase when putting a tag into Standby mode.

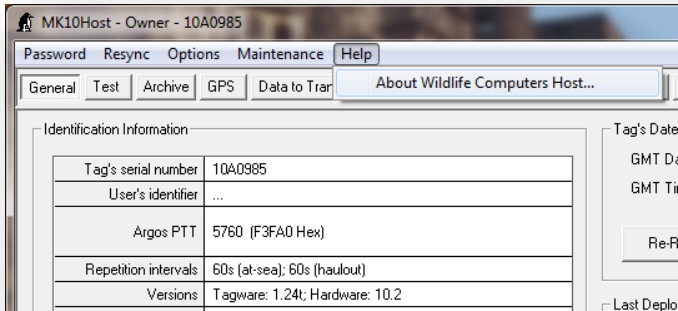
## Maintenance - Read Version Numbers



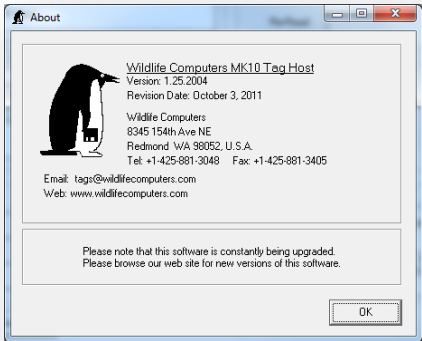
This allows you to view all the version number information for the tag and Mk10Host



Help



The Help item will display the following Host version and contact information:



## Deployment

### Setting up Communications

Follow the instructions in the detailed description of the Mk10Host program.

### Setting Up the Tag

Follow the instructions in the detailed description of the Mk10Host program.

### Changing Modes with a Magnet

Pass a magnet once across the tag near the communications port. The LED will flash in a sequence that displays the mode of the tag:

- Shutdown mode LED pattern: The LED will illuminate constantly as long as the magnet is present.\*
- Standby mode LED pattern: **2 blinks, a 1 second pause, 2 blinks, a 1 second pause, and 2 more blinks** (You may not see all three sets, as this occurs quite rapidly.)
- Deployed mode LED pattern: **10 blinks**

Once the Standby or Deployed mode has been displayed, the **LED will pause for another second and then stay on for 2 seconds.**

- If you keep the magnet away from the tag during the 2 seconds that the LED is on, the tag will stay in its current mode.
- If you pass a magnet across the board during the 2 seconds that the LED is on, you will toggle the mode between Standby and Deploy. The mode identification blink sequence of the new mode will be displayed.

In summary, a single pass of the magnet over the tag displays the mode of the tag. It takes two specifically timed passes of the magnet to change the mode.

## Verifying Function Prior to Deployment

You should always confirm the tag is sampling before deployment.

Pass a magnet once across the tag near the communications port. The LED will flash, showing its current state, as described above. After the next minute has rolled-over, the tag begins data collection and flashes whenever it wakes up to take a sample. How long the LED flashes is user customizable. Selections are in increments of 10 minutes, from never up to 3 days. Once the tag reaches depth, the LED will stop flashing after 31 hours regardless of the set blink duration. **DO NOT press on the pressure sensors to test.**

---

\* If the magnet is present for an extended period of time, the LED will turn off to save power. When this happens, the LED no longer responds to the presence of a magnet and you will have to use 2 magnets (in Reset locations) to get a response from the tag.

## Sealing the Communications Port

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.

## Additional Deployment Information

Wildlife Computers recommends that all tags initially be set up in the lab, when there is plenty of time and conditions are at their best. Once the tags are set up, they can be placed in Standby until ready to use. Just prior to deployment, the user can deploy them using a magnet.



**Note:** *Be sure that all previous data are erased prior to redeploying if you want the entire memory available for data collection.*

Alternatively, since tag batteries have plenty of capacity, if the tags will be deployed within a month, they can be set up and deployed at the same time. The user should then use a magnet to verify the tag is sampling before deploying it on the study animal or gear.



**WARNING:** *If you are programming towed SPLASH10 tags, and have set the tags with premature release parameters, it is STRONGLY recommended to leave the tags in Standby mode and not in Deploy mode to prevent accidental premature release detection, which may burn the corrodible pin and/or start transmissions, which will drain the battery.*

## Data Recovery

### Basic Recovery Information

If the tag has been out for a long deployment (months to years), 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 tag 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 tag full of valuable deployment data, there are several steps to perform before attempting to connect it to the USB communications 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 tag with a paper towel.
  2. Remove the 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. Note that communicating with a tag 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. Send the tag 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 tag back to Wildlife Computers for downloading.
  6. If all four pins look clean and golden, you can continue and attempt to establish communications.
  7. You may wish to spray some contact cleaner into the communications port as a precaution.

### Download Your Data

Follow the instructions in the detailed description of the Mk10Host program.



***It is very important to save the collected deployment data in the .wch format. This is the only format that can be processed by Wildlife Computers analysis programs.***

Put your tag into Shutdown or Standby mode after downloading the data.

## Storing Tags

Tags that will not be deployed for an extended period of time (more than one month) should be Shut down and stored in a refrigerator or freezer (5° C to -20° C). This minimizes the battery passivation and extends the life of the tag.

If you tag has a battery isolator screw (see Appendix G), place the screw before storing your tags.

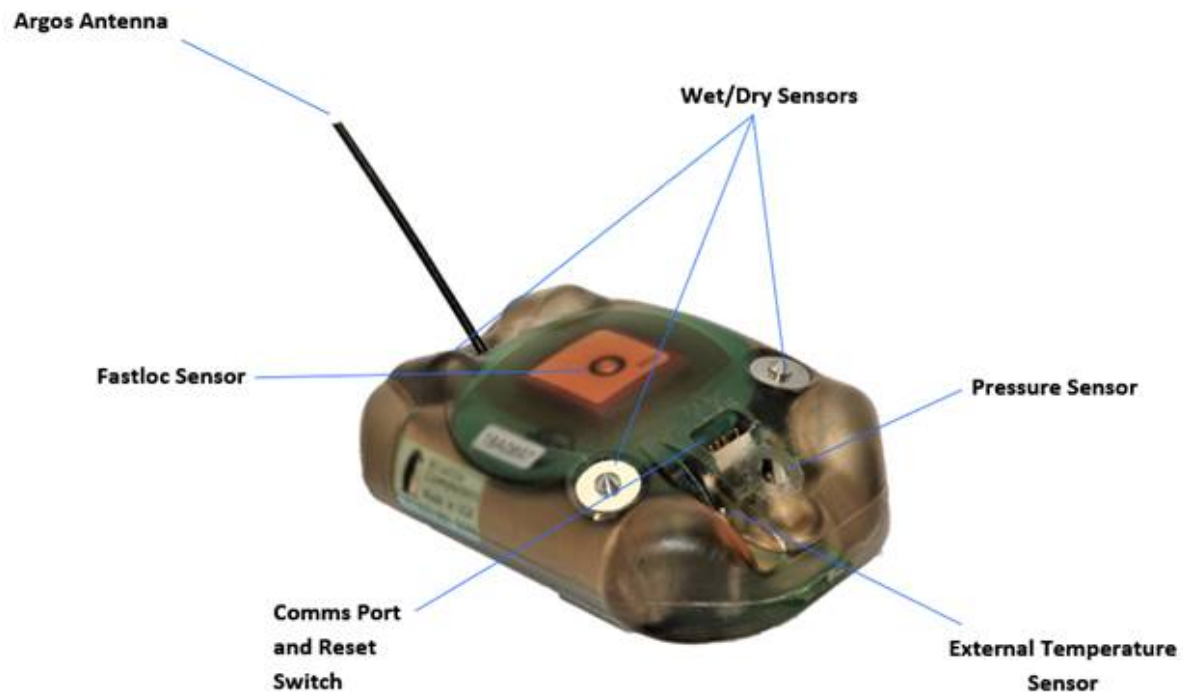
## Testing After Storage

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

Establish communications with the tag. If the tag has an Argos transmitter, test the Argos transmitter (page 17) and check the battery voltage reported. It should read 3.0V or greater. The battery voltage may be a little low initially, but should increase after testing the transmitter several times. If the tag has a Fast-GPS module, initiate a Fast-GPS test (page 18). Then test the sensors to read the battery voltage while the Fast-GPS processing is taking place. Again the battery voltage should stay above 3.0V throughout the test. Repeat as necessary.

## Appendix A. SPLASH10-F: Argos Transmitter & Fast-GPS

The SPLASH10-F includes the Wildlife Computers Cricket Argos transmitter plus the Fastloc® fast-acquisition GPS module. In addition to the standard archival functions, the SPLASH10-F takes snapshots of the GPS constellation. These GPS snapshots, along with summarized depth and temperature data, can be transmitted to the Argos satellite system.



### Notes:

- Do not put anything over any of the sensors or the GPS antenna
- Ensure the wet/dry sensors are free of oils and epoxy
- Place magnet on the side of the tag by the communications port to trigger the reset switch
- LED is best visible from the side of the tag

## Appendix B: RD1800 Release Device for towed SPLASH10

Wildlife Computers has developed a mechanical release device, called the RD1800, which prevents the towed SPLASH10 from being towed to depths that could crush it. The RD1800 acts as a guillotine, severing an internal shear pin when it is exposed to a depth of 1800-2000 meters. At these depths, water pressure overcomes an internal support within the RD1800, the center section of the RD1800 snaps down and cuts the pin, separating the RD1800. This releases the towed SPLASH10 so that it can float to the surface. The Premature Release feature eventually recognizes a “constant depth” situation and initiates transmission.

### RD1800 Installation Instructions

The RD1800 release devices are supplied pre-assembled, but not connected to the SPLASH tags.

This device has been designed to work with both monofilament and stainless steel leadering materials. We recommend:

- .046 inch stainless steel cable so that it can be pulled tightly around the RD1800 thimbles.
- Monofilament should be no greater than .070 inches in diameter so that it will fit through the holes in the RD1800. This includes some 300 lb. test monofilament, depending on the manufacturer.

When leadering your tags, it is important to be sure to pull whichever leader material you use tight around all three thimbles, one on the tag and two on the RD1800, prior to crimping the crimps.

Stainless Steel Cable



Monofilament leader



## Appendix C. TDR10-DD (Daily Diary) and TDR10-X

### Daily Diary and TDR10-X Tags

Daily Diary and TDR10-X tags form the range of Wildlife Computers accelerometer datalogging tags. In addition to the 3-axis accelerometer, these tags may contain 3-axis magnetometers, depth, temperature, velocity, wet/dry, battery voltage and light-level sensors.



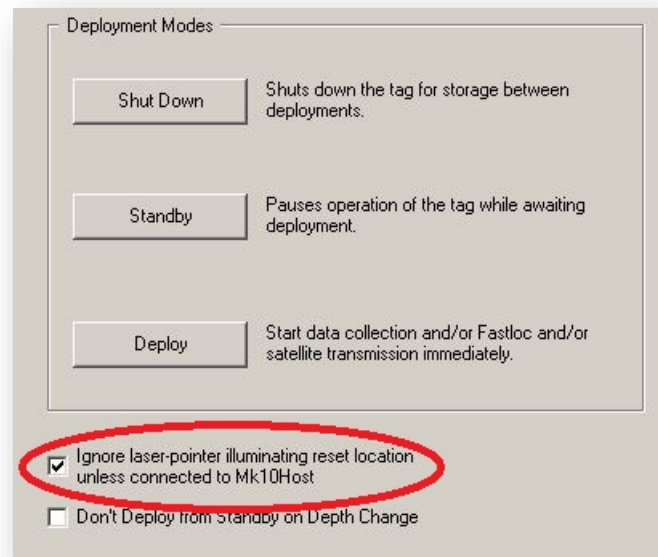
## Daily Diary Setup

Daily Diary tags contain a magnetometer and use a laser rather than a magnet to switch modes or initiate a reset. The laser reset location is just to the right and above of the communication port.



Use the laser when Mk10 Host, or this manual, mention a magnet swipe. Running the laser beam over the reset location will perform the same function. These tags will not respond to magnets and using a magnet near the tag may have an effect on the performance of the magnetometers.

We recommend disabling the laser reset when the tag is not connected to host. Refracted sunlight, such as found 1-2 meters below the sea surface, is intense enough to activate the reset switch. Disabling the laser can be done by checking the "Ignore laser-pointer..." box on the Exit Tab. With this feature enabled, the tag can only be deployed when connected to host, when the tag exceeds 20 m in depth, or the tag senses sea water with the wet/dry sensor. A magnet will not deploy the tag or put the tag into standby mode.

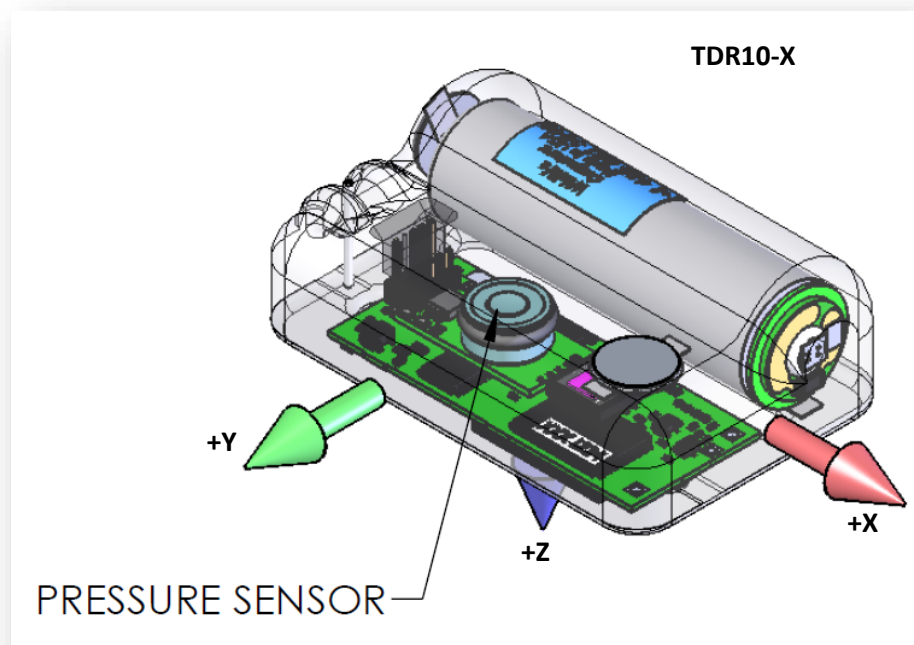


## Sensor Configuration

Daily Diary is a name given to our MK10 based TDR tag implying additional motion and attitude sensors. The additional sensors measure 3 axes of accelerations, 3 axes of magnetic field strength, and paddle wheel speed. These 7 data channels are archived onboard the tag in addition to the standard Light Level, External Temperature, and Depth measurements and can be exported in various formats using the WC-DAP Processor.

These additional sensors allow for an expanding field of applications. For example, under acceptable conditions and with the appropriate data post processing, the attitude (tilt and roll) of the tag and animal can be derived from the static acceleration data. The accelerometers could also be used in a dynamic sense to detect head strike events (lunges). Attitudinal information (tilt and roll) can be used to rotate magnetometer measurements made in the sensor frame into the Earth's coordinate frame to determine magnetic heading and other magnetic field strength components used for navigation (magnetic dip angle). Change-in-Depth readings can be treated with the paddle wheel speed measurements to derive the horizontal and vertical components of the animal's swimming speed.

Typical sense and assignment of the tag axes are illustrated in the following picture. Note that positive X axis indicates the direction of travel for optimal paddle wheel performance.



## Measured Data (Sensors)

### External Temperature

Range: -40°C to +60°C  
Resolution: 0.05°C  
Accuracy:  $\pm 0.1^\circ\text{C}$   
Sample Rate: 32/second maximum, 1/second typical

### Depth

Range: 0 to 2000 meters  
Resolution: 0.5 meters  
Accuracy:  $\pm 1\%$  of Reading  
Sample Rate: 32/second maximum, 1/second typical

### Light Level

Range:  $5 \times 10^{-10} \text{ W.cm}^{-2}$  to  $5 \times 10^{-2} \text{ W.cm}^{-2}$  (8 decades)  
Resolution: 20 units/decade  
Passband: 430 nanometers  
Sample Rate: 32/second maximum, 1/second typical

### 3 Axes Acceleration

Range:  $\pm 2g$  (-20m/s/s to 20 m/s/s)  
Resolution: 0.05 m/s/s  
Sample Rate: 32/second maximum  
Sensor Coordinate Frame: Right-Handed

Note that sitting the tag on a desk (motionless) will produce the following static acceleration values.  
X = 0, Y = 0, Z = -9.8 m/s/s

### 3 Axes Magnetic Field Strength

Range:  $\pm 100$  nanoTesla  
Resolution: 0.2 nanoTesla  
Sample Rate: 8/second maximum  
Sensor Coordinate Frame: Right-Handed

### Paddle Wheel Speed

Range: 0 to 5 m/s  
Resolution: 0.01 m/s  
Sample Rate: 1/second maximum

## Battery/Memory Capacity



The Daily Diary configuration is based on the Mk10 platform employing a 1 gigabyte memory chip used to store the sensor values. Typically the tag is fitted with 2 x AA batteries with a capacity of 5.2Ah. The following details typical battery life and memory fill times which vary with sample rate.

**Note: The expected battery life is impacted dramatically based on the actual speed of the animal. The velocity paddle wheel consumes more power at extremely slow speeds, dictating the "minimum" battery life.**

#### Case1

Accelerometer @ 32 Hz  
Magnetometer @ 4 Hz  
Depth, Temperature, Paddle Wheel @ 1 Hz  
Memory Fill = 70 days  
Battery Life = 21 to 28 days

#### Case2

Accelerometer @ 16 Hz  
Magnetometer @ 4 Hz  
Depth, Temperature, Paddle Wheel @ 1 Hz  
Memory Fill = 122 days  
Battery Life = 35 to 46 days

#### Case 3.

Accelerometer @ 8 Hz  
Magnetometer @ 2 Hz  
Depth, Temperature, Paddle Wheel @ 1 Hz  
Memory Fill = 234 days  
Battery Life = 56 to 75 days

### Derived Data

The WC-DAP Processor will attempt to calculate (post process) several derived values from the archived acceleration and magnetic field strength data. These derived values are only available when the tilt (i.e. pitch and roll) of the tag can be reliably determined. Since the accelerometers are sensitive to both static and dynamic accelerations, DAP will only process data when the total acceleration measures  $9.8 \pm 0.2$  m/s/s. Under this condition DAP assumes that the acceleration reading is mostly static and therefore tilt can be determined.

Once the tilt of the tag is known, its components (i.e. Pitch and Roll) can be reported along with various magnetic readings as follows. Note that in special cases, the static acceleration can be isolated from the total acceleration readings using methods such as low pass filtering. This technique is not employed by the DAP Processor.

#### **Heading**

This is the direction in which the nose of the tag is pointing. The value is expressed in degrees on a scale from 0 to 360. Magnetic North corresponds to a reading of 0 with a clockwise rotation increasing the value (consistent with navigational headings).

#### **Magnetic\_Vertical**

This is the value of the vertical component of earth's magnetic field strength, derived from the total magnetic field strength. The value is given in microteslas.

#### **Magnetic\_Horizontal**

This is the value of the horizontal component of earth's magnetic field strength, derived from the total magnetic field strength. The value is given in microteslas.

### ***Magnetic\_Dip***

This is the angle at which the earth's magnetic flux lines enter the earth's surface. This value is given in degrees, from -90 to +90 with 0 being completely horizontal to the earth's surface. +90 corresponds to the tag resting directly over the magnetic north pole while a -90 reading means the tag is over the magnetic south pole.

### ***Pitch***

This is the counterclockwise rotation of the tag about its Y axis (see Figure 1). This value is given in degrees from -90 to +90 (where a horizontal tag reads 0 degrees).

### ***Roll***

This is the counterclockwise rotation of the tag about its X axis (see Figure 1). This value is given in degrees from -180 to +180 (where a tag flat on its base reads 0 degrees).

### ***Magnetic\_Magnitude***

This is the overall strength of the earth's magnetic field. It is the vector sum of the three magnetometer channels. The value is presented in microteslas.

### **TDR10-X Tags**

TDR10-X tags consist of a 3-axis accelerometer with optional depth sensing and also temperature and light-level sensors. As these tags do not contain a magnetometer they are activated via a magnet.

### **Battery/Memory Capacity**

TDR10-X configuration tags are based on the Mk10 platform employing a 1 gigabyte memory chip used to store the sensor values. These tags are typically powered by a single 2.1Ah AA battery. The following details typical battery life and memory fill times which vary with sample rate.

#### **Case 1**

Accelerometer @ 32 Hz  
Depth, Temperature, light-level @ 1 Hz  
Memory Fill = 79 days  
Battery Life = 9 days.

#### **Case 2**

Accelerometer @ 16 Hz  
Depth, Temperature, light-level @ 1 Hz  
Memory Fill = 154 days  
Battery Life = 17 days.

#### **Case 3**

Accelerometer @ 8 Hz  
Depth, Temperature, light-level @ 1 Hz  
Memory Fill = 297 days  
Battery Life = 32 days

## Appendix D. Time-Series Data in Detail

Some versions of transmitting tags have the ability to send time series depth and/or temperature data through Argos. This feature is designed to provide low-frequency reporting of sensor data for instruments which may never be recovered.

MK10Host - Owner - 10A1076

Password Resync Options Maintenance Help

General Test Archive [GPS] Data to Transmit [When to Collect] [When To Transmit] Pop-up [Haulout] Battery Exit Download Audit Files

Histogram and Behavior Data Sampling Interval 30 sec Greyed-out parameters are not available for MK10-PAT tags

Message Type	# Bins	Upper (deeper/longer/hotter) Limits of Bins													
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
Dive Maximum Depth (m)	off														
Dive Duration (min sec)	off														
Time-at-Temperature (C)	14	-2	0	3	6	9	12	15	18	21	24	27	30	33	>33
Time-at-Depth (m)	14	0	2	10	20	50	100	150	200	300	400	500	600	700	>700

**Histogram Collection**

Hours of data summarized in each histogram 6

Histograms start at GMT 0

☐ Suspend generating new Histogram-style messages while a tag is continuously dry

**Dive Definition**

Ignore Dives shallower than 2m

Ignore Dives shorter than 14368min

Dive's duration is determined from the first wet reading to the last wet reading

Change Dive Definition

**Standard messages: Time-Series (TS) Stomach Temperature (ST)**

☒ Enable Time-Series message generation

**Channels to report**

Depth ☒ External Temperature ☒

**Duty-Cycling**

Initially on for 90 days

Then start duty cycling:

off for 1 day

and on for 1 day

Time series data interval 10 min

These settings will generate:  
12 Argos messages per day for the first 90  
and an average of 6.0 Argos messages per day thereafter

**Transmission Control**

In pre-release, transmit data from these last days

**Histogram & ST transmission priority**

☐ low ☐ med ☐ high

**Location transmission priority**

☒ low ☐ med ☐ high

**Behavior & TS transmission priority**

☐ low ☒ med ☐ high

Total transmits until popoff = 1260

If you collect more than 1250 messages, you are unlikely to receive them all through Argos

You can choose from one of five time series sample rates. A single point sample is taken at the chosen sample rate, for example every 5 minutes. The sample rate determines the number of messages generated per day. The Min/Max values for the message period are determined and used to set the range of values. This range is divided into 16 bins to which each sample point is fitted.

48 summarized samples will fit into 1 Argos message. **This time series sample rate is completely independent of and unrelated to the archive sample rate.**

Sample Rate (minutes)	Argos Messages Per Day		Message Period (hours)
	Depth or Temp (1 channel)	Depth & Temp (2 channels)	
1 ¼	24	48	1
2 ½	12	24	2
5	6	12	4
7 ½	4	8	6
10	3	6	8

For example, 12 time series messages per day are created if both depth and temperature data are sampled every 5 minutes; six messages per day would be transmitted if temperature were omitted. Messages are transmitted in sequential order to maximize the probability of receiving continuous runs of data.

Selecting a short (75-second) Time-Series Sampling Interval rapidly generates a need for lots of messages. This might be acceptable for a short deployment. However if too many messages are generated too quickly, the tag will be unable to transmit all of them. The result will be random gaps of time during the deployment for which there is no time-series data. Selecting a longer Sampling Interval so that fewer than 1250 messages are needed to transmit the Time-Series will improve the odds that there will be no gaps in your Time-Series data set. However, the temporal resolution of each datum will be reduced. Different study objectives will warrant different trade-offs between coverage and temporal resolution.

Each time series message contains:

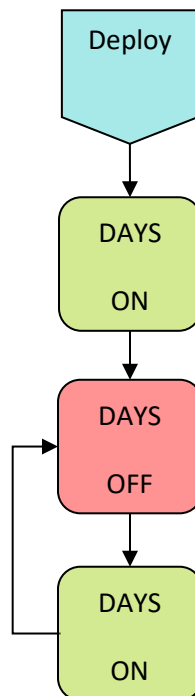
- 48 instantaneous points sampled at the specified sample rate for that message period.
- The minimum and maximum values encountered during the message period for the channel which are determined from all archived values in that message period.



**Note: that the absolute Min/Max values and point sample values may not match as the Min/Max value is determined from all archived data during the message period.**



Three duty cycling parameters are available to control the time series data generation as shown below:

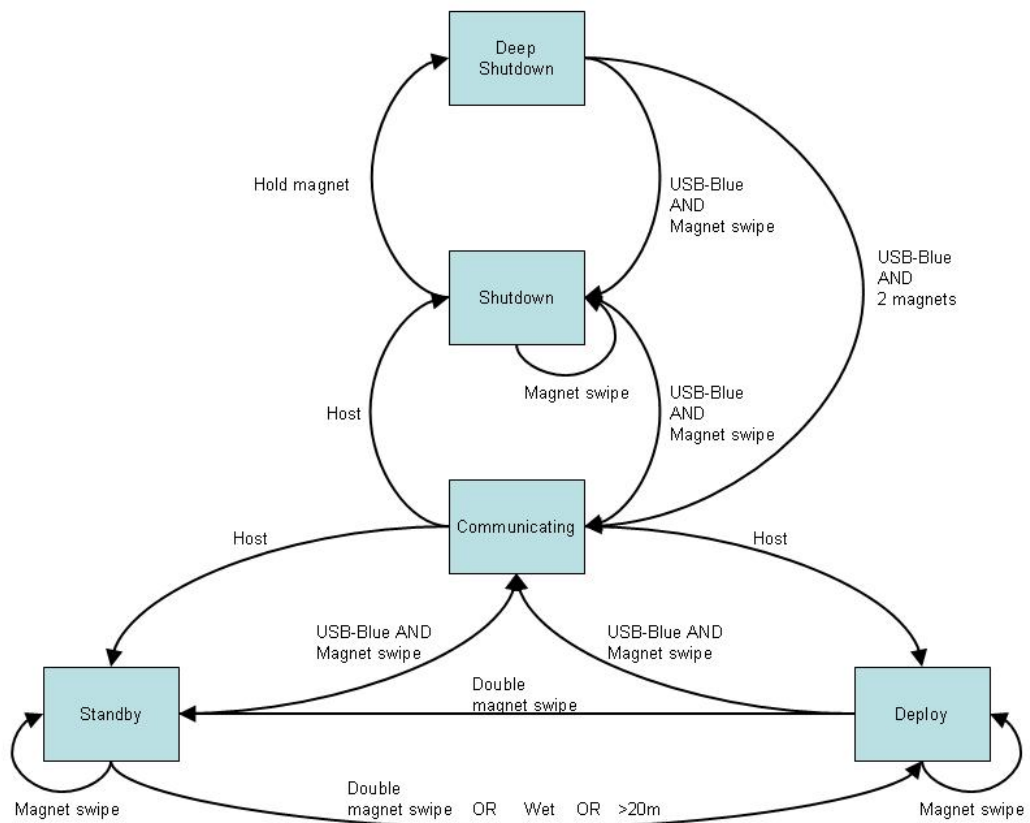


Duty cycling is by days, each day is defined as the passage of 00:00 on the instrument clock. The instrument supports time series generation being turned **ON** for zero or more days immediately after deploy, **OFF** for zero or more days, followed by **ON** for zero or more days. The instrument can be set to sample for only a predetermined time after deploy (and never again) by setting the topmost **ON** block to the desired value and setting the two lower blocks to zero. Alternatively, the instrument can be set to sample during the entire deployment by setting the topmost **ON** block to any value, the **OFF** block to NEVER, and the bottom **ON** block to a value such as 10.



**Note: The duty-cycle settings are for Time-Series Data message creation only and do not affect the tags archive sample rates or Argos transmission settings.**

## Appendix E. Tag Modes



## Appendix F. Disconnected Batteries and Dangerous Goods

### Summary

In order to comply with lithium battery shipping regulations, certain Wildlife Computers tags include a battery isolator screw. Tags with the isolator can be transported with their power cells disconnected. It is critical that you communicate with these tags and connect the batteries before deployment.

A tag with disconnected batteries can only be put into Shutdown mode. This prevents accidental deployment of the tag without first connecting the batteries.

### Connecting to a Tag for the First Time

When you connect to a tag that has disconnected batteries, host will prompt you to place the screw that connects the batteries. By clicking “OK” you acknowledge that the screw is placed. The tag can now be placed in Standby or Deploy mode.



You may also choose to cancel at this point and leave the batteries disconnected (with the screw unplaced). This allows you to change the tag settings but you will only be able to put the tag into deep kill. You might want to do this if you were setting up tags and then shipping them to your field site.

The next time you connect to the tag with host you will be prompted with this message again.

## General Tab

The general tab will display the status of the batteries. A red warning will indicate the batteries are not connected.

**Mk10Host - Owner - 11A0537 (tag needs updating)**

Password Resync Options Maintenance Help Update tag

General Test Archive GPS Data to Transmit When to Collect When to Transmit [Pop-up] Haulout Battery Exit Download Audit Files

**Identification Information**

Tag's serial number	11A0537
User's identifier	...
Argos PTT	109907 (52049F2 Hex) Uplink / LUT id: 5249.242
Repetition intervals	44s (at-sea); 89s (haulout)
Versions	Tagware: 1.26g; Hardware: 10.2
Owner	Christophe Guinet CEBC-CNRS 79360 Villiers en Bois France

**Tag's Date and Time**

GMT Date: 12 Aug 2013  
GMT Time: 21:03:20

Re-Read Change...

**Last Deployment Information**

Bytes of Archived data:	20,714
Bytes of Histogram and Profile messages:	0
Bytes of Location messages:	96
Number of messages transmitted:	11
Total Memory Available	67,108,864

Read Setup Save Setup

Tag has a Disconnected "Dangerous-Goods" Battery

Create Report

1.5% of battery has already been consumed by the I

☒ Battery is classified as dangerous goods and needs to be deactivated during transportation by air

## Exit Tab

If you have not acknowledged placement of screw connecting, only shutdown mode will be available. We do not recommend storing the tags without first connecting the batteries; however, you are able to put the tag into Shutdown. If you attempt to place the tags into Standby or Deploy mode, you will again have the opportunity to place the screw.

### Instructions for Connecting the Batteries

1. You will need the titanium battery isolator screw, titanium lock washer, and 3/32" Allen key, all of which are included in your shipment. **DO NOT USE A POWERED SCREWDRIVER.** This will damage the socket and the screw.





2. For each tag, you will insert a screw and lock washer into the cylindrical metal socket.



3. Hand-tighten the screw until the lock washer compresses and the screw is firmly seated. The screw will be flush or slightly recessed.



4. The battery isolator bolt is intended to be inserted up to 10 times. Once inserted, take care not to unnecessarily remove and reinsert the screw.
5. Before deployment, communicate with the tag to confirm that the batteries are connected.

Tags Programmed with Host (SPLASH and TDR)	Tags Programmed with Tag Agent (SPOT)
 <p>Host prohibits tags from entering Deploy mode until battery connection is confirmed. Once 'OK' is selected, the tag can be put in any mode.</p>	<p>Tag Agent displays tag battery status on the lower left. Ensure the battery status is listed as 'Connected' before deployment.</p> 

For more information on the battery isolator screw and Dangerous Goods shipping regulations, visit our website: <https://wildlifecomputers.com/wp-content/uploads/misc/IATA-Battery-Shipping-Compliance.pdf>.

## Technical Specifications

The TDR10 is configurable with a wide variety of sensors. Fastloc® GPS is available on several configurations. Below are the general physical specifications. \*\*\* indicates the specification is dependent upon the configuration model

Attachment Type	Externally mounted***
Sensors	Depth, Temperature, Light-level, Wet/Dry, 3D Accelerometer, Stomach Temperature, Fastloc GPS***
Depth Sensor Range	0-1700 m, 0-2000 m***
Depth Sensor Resolution	0.5 m, 1 m***
Depth Sensor Accuracy	±1% of reading
Temperature Sensor Range	-40 °C to 60 °C
Temperature Sensor Resolution	0.05 °C
Temperature Sensor Accuracy	± 0.1 °C
Light Sensor (When Installed)	$5 \times 10^{-12} \text{ W cm}^{-2}$ to $5 \times 10^{-2} \text{ W cm}^{-2}$
3D Accelerometer Range	± 2g
3D Accelerometer Resolution	0.05 m <sup>-2</sup>
Stomach Temperature Resolution	± 0.1 °C
Stomach Temperature Accuracy	± 0.3 °C
Maximum Sampling Rate	32 Hz
Pressure Rating (m)	Up to 2000 m
Operating Temperature Rating (°C)	-20 °C to 50 °C
Recommended Storage Temperature Range (°C)	-20 °C to 5 °C
Conductivity Operational Limits	0.1 S m <sup>-1</sup> to 5 S m <sup>-1</sup>
Memory	1 GB
Length, Width, Height, Weight, Wet/Dry Sensor, Maximum Deployment Length	***

## 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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