# Wave Glider® SV2 Integrated Sensor User Guide

## Sea-Bird Electronics Glider Payload CTD

**Revision A**
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# Wave Glider® SV2 Integrated Sensor User Guide: Sea-Bird Electronics Glider Payload CTD





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|---|---|---|---|
| 05574 | A | October 2013 | This is the initial release of this document. |
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# Preface

This guide provides information on operating the Liquid Robotics Wave Glider SV2 with the Sea-Bird Electronics Glider Payload CTD (GPCTD) integration option. It provides an overview of the mechanical, electronic, and software aspects of the Wave Glider SV2/GPCTD integration. It includes descriptions of the command structure, data formats, and data retrieval methods supported by the Wave Glider SV2 when operating the GPCTD. This guide also includes specific considerations for the GPCTD during operational planning, launch, recovery, storage, troubleshooting, and maintenance.

This guide assumes a working familiarity with the Liquid Robotics Wave Glider SV2 and the Sea-Bird GPCTD. It focuses primarily on information that is unique to the GPCTD integration with the Wave Glider SV2. Make sure you have the most recent versions of the following documents available when operating the Wave Glider SV2 with an integrated GPCTD:

- *Glider Payload CTD (GPCTD) and Optional DO Sensor User's Manual* (Sea-Bird Electronics)
- *Glider Payload CTD (GPCTD) Configuration Details* (Sea-Bird Electronics)
- *Glider Payload CTD Brochure* (Sea-Bird Electronics)
- *Wave Glider SV2 Interface Control Description* (Liquid Robotics)
- *Wave Glider User Manual* (Liquid Robotics)

**Sea-Bird Electronics GPCTD manuals are available at:**

- http://www.seabird.com/products/ModelList.htm#GPCTD

**Liquid Robotics manuals are available on the documentation CD included with each Wave Glider and by contacting the Liquid Robotics Support Organization.**

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**Before You Contact Us:**

Before contacting LRI support, please have available the serial number of the vehicle(s) or part(s) that you are contacting LRI Customer Support about.

# Chapter 1. Introduction

The Liquid Robotics integration of the Sea-Bird Electronics Glider Payload CTD (GPCTD) into the Wave Glider SV2 provides a mobile, long endurance platform for collecting conductivity, temperature, and pressure data (and optionally dissolved oxygen data). This chapter provides an overview of the Wave Glider SV2 integrated GPCTD.

## System Overview

The Sea-Bird Electronics family of GPCTD sensors can be mounted on the Wave Glider SV2 Float, the submerged Glider, or a towfish towed by the Glider. More than one GPCTD can be installed in the Wave Glider SV2 system. If the GPCTD has an optional dissolved oxygen sensor, an optional pump must also be integrated into the Wave Glider SV2. This manual is focused on operation of the GPCTD without a pump.

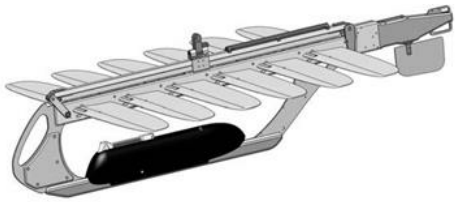
The GPCTD is powered by the Wave Glider's electrical system, which uses photovoltaic solar cells. The GPCTD is controlled by the Liquid Robotics Wave Glider Management System (WGMS). Data generated by the GPCTD can be sent to WGMS using standard Wave Glider SV2 communications channels. A key feature of the data generated by the Sea-Bird Electronics-Liquid Robotics combination is that it can be extended with Wave Glider GPS tags for the latitude, longitude, date, and time for each sample

## Mechanical Design

The Sea-Bird Electronics GPCTD can be mounted under a Wave Glider SV2 Float, attached to the Glider, or attached to a Towfish. Typical Float hull and Glider installations are shown below. Contact Liquid Robotics for more information about the GPCTD integrated into a Towfish.

**Figure 1.1. GPCTD Mounted Under Float Hull**

**Figure 1.2. GPCTD Attached To Glider**

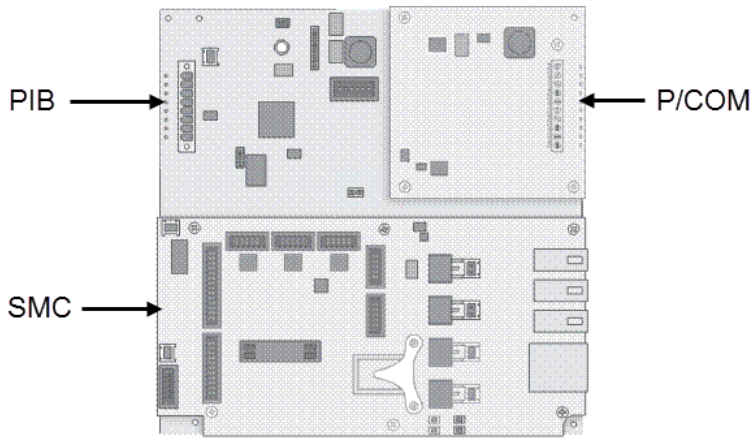


# Electronics

The electronics associated with the GPCTD integration are mounted in a payload dry box. A Payload Interface Board (PIB) is included along with a specialized Personality Module (PM) referred to as a P/COM. The P/COM plugs into one of the personality slots on the PIB providing power to the GPCTD and communications connectivity between the GPCTD and the Wave Glider C&C. Depending on when the GPCTD was integrated into the Wave Glider SV2, the payload dry box may also contain a System Management Computer (SMC) mounted in a PIB personality slot (the SMC covers two slots, but is only connected to one of them). For more information on PIBs, PMs and the SMC, see the LRI *Wave Glider SV2 Interface Control Description*.

The illustration below is an example of how the P/COM and SMC are typically arranged on the PIB, which is mounted on the inside of the payload dry box cover.

**Figure 1.3. PIB with P-Comm and SMC**




# Software Components

The LRI Wave Glider/GPCTD integration uses the following software systems and applications:

- **Sea-Bird Electronics SEASOFT Software Package**

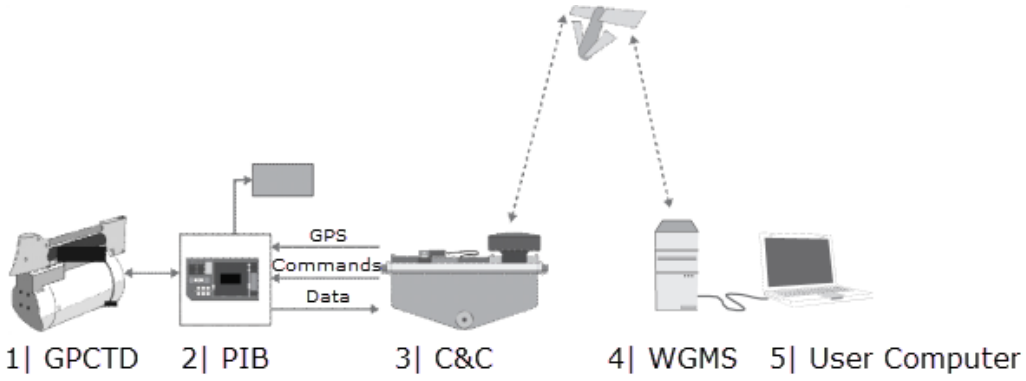
  The Sea-Bird Electronics SEASOFT Software Package can be used to configure the GPCTD prior to integration into the Wave Glider, and for post-processing data.

- **Wave Glider Management System (WGMS)**

  The Liquid Robotics WGMS is a shore-based service used to pilot the Wave Glider. It communicates to the Wave Glider via an Iridium modem and other standard Wave Glider communications channels. Commands are sent to the GPCTD using the WGMS **Write Console Script** command.

# Software System Overview

**Figure 1.4. GPCTD Control and Data Flow**




Plan your use of the GPCTD using appropriate resources including Sea-Bird Electronics documentation, Wave Glider documentation, and the information provided in this manual.

The GPCTD must be configured prior to integration into a Wave Glider. Baud rate and output format are among the parameters that are determined in the GPCTD configuration.

During deployment, WGMS is used to send commands to the GPCTD using standard Wave Glider communications channels.

The GPCTD streams data through the PIB to the C&C, and the C&C transmits the data to WGMS. GPCTD data is returned with tags for latitude, longitude, datestamp, and timestamp for each sample.

# Chapter 2. Collecting Data

This chapter describes how you configure GPCTD data collection parameters using LRI and Sea-Bird Electronics tools. The flexibility of the Sea-Bird and LRI systems allows for a variety data collection formats with equally successful results.

## Data Collection Process Overview

Collecting data from a GPCTD and returning that data to shore involves four operations. This section provides an overview of the process. Each step is described in more detail in the following sections of this chapter.

**Step 1: Plan for Data Collection**

The GPCTD can be configured to take samples at specific intervals and report blocks of samples. The principal constraints on your choices are environmental (primarily communications bandwidth and power consumption) and post-processing requirements.

**Step 2: Configure the GPCTD**

You must configure the GPCTD prior to integration into the Wave Glider.

**Step 4: Collect data**

The GPCTD starts streaming data to the PIB when it receives the **CTD --run** command according to the default configuration parameters, or the parameters sent with commands through WGMS.

**Step 5: Store and Retrieve Data**

The PIB returns data to WGMS. If the GPCTD includes a datalogger option, data can be retrieved directly from the GPCTD on-shore.

## Plan for Data Collection

The Wave Glider SV2 sensor management system combined with the Sea-Bird Electronics GPCTD supports a large number of possible applications. You must balance collection objectives relative to environmental constraints when you develop detailed data collection plans.

One of the key advantages of the Wave Glider/GPCTD integration is that you can easily change the GPCTD data collection plan at any time, including after launch.

## Considerations for the GPCTD

**Communications Bandwidth**

It is possible to configure the GPCTD to generate more raw data than the Iridium communications channel can transport to shore. If the GPCTD samples less than once every 30 seconds, it is recommended that the duty cycle option be used to reduce the required communications bandwidth.

**Power Budget**

The GPCTD subsystem is a relatively low-power sensor. However, its power consumption must be included when assessing the total power budget for the Wave Glider. Using the duty cycle option can reduce the power consumption of the GPCTD. Communications requirements for the GPCTD must also be included when assessing the total power budget for the Wave Glider.

## Configure the GPCTD

The GPCTD must be configured before integration in the Wave Glider using Sea-Bird Electronics tools or a PC with a serial terminal program. See the *Glider Payload CTD (GPCTD) and Optional DO Sensor User's Manual* for more information.

When configuring the GPCTD for use in a Wave Glider, the following parameters must be set.

### Warning

If the configuration parameters are not set correctly, the GPCTD may not return data.

**serial port**: 9600 baud, 8 data bits, 1 stop bit, no parity

**OutputExecuted Tag**: NO

**OutputFormat**: 0

**AutoRun**: OFF

### Note

This is the Autorun feature implemented in the GPCTD, not the Autorun feature implemented in the PIB and controlled by the **CTD --autorun** command.

**Clock**: Correct time (UTC recommended)

# Collect Data

The **CTD --run** command causes the GPCTD to begin collecting data and return it to the PIB. The GPCTD returns samples in Sea Bird Electronics-native format. The PIB appends GPS date, time, latitude, and longitude before sending data to the C&C where it is transmitted over standard Wave Glider communications channels to WGMS.

# Retrieve Data for Further Analysis

GPCTD data is returned to WGMS using standard Wave Glider communications channels. If the GPCTD includes a datalogger option, data can be retrieved directly from the GPCTD on-shore using Sea-Bird Electronics tools or a PC with a serial terminal program.

Commands for the PIB C3 program are sent from WGMS to the Wave Glider C&C using a Vehicle Command Form. All commands are sent to a combined Board ID and Task ID, referred to as a Board Address. The Board Address identifies a specific PIB and the Task ID is used to direct the command to a PM slot on that PIB that is connected to a GPCTD sensor.

# Chapter 3. Commands

## GPCTD Commands

The GPCTD is controlled by the commands described in this chapter. Commands are sent to the GPCTD through an LRI Payload Interface Board (PIB) using the WGMS **Write Console Script** command. Responses are returned with an Acknowledgement (ACK) or Not Acknowledged (NAK).

## Sending Commands to the PIB from WGMS

To send GPCTD commands to the PIB:

1. Select the Wave Glider vehicle you want to issue a command to from the drop-down menu in the upper left-hand corner of the WGMS dashboard.
2. Click on **More Commands...** located just below the command buttons on the left side of the WGMS dashboard - a **Simple Command Form** will appear with the **Vehicle Command Info** tab open.
3. Confirm that the correct vehicle name appears in the **Vehicle** field.
4. Enter a reason for issuing the command in the **Command Reason** field.
5. Select **Write Console Script** in the **Command Type** drop-down menu.
6. Enter 0 in the **Function** field.
7. Enter the decimal version of the combined Board ID and Task ID for the PIB that the GPCTD is connected to into the **Board Address** field.

   The combined Board ID and Task ID consists of two hexidecimal values:

   - The first value is the Board ID for the PIB you want to issue a command to. The Board ID will be between0x00 and 0xFF -exclusive.
   - The second value is the Task ID. The Task ID for a PIB is 00. The Task IDs for each of the PM slots on a PIB are 01, 02, and 03.

   ### Note

   If you do not know the Board ID for the PIB, see “Obtaining the Board ID” (page 7).

   **Examples:**

   The combined Board ID/Task ID for a PIB with a Board ID of 0x01 would be 0x0100. To determine the decimal version, multiply the Board ID value by 256 and add the Task ID {(01)(256) + 00}. The result is 256. This is the number you would enter into the Board Address field on the Vehicle Command tab.

   If the Board ID for the PIB is 0x02, and the command is directed to PM slot 03, the combined hexidecimal values would be 0x0203. To determine the decimal version,

multiply the Board ID value by 256 and add the Task ID {(02)(256) + 03}. The result is 515. This is the number you would enter into the **Board Address** field on the **Vehicle Command** tab.

8. Select the communication channel WGMS will use to send the command to the Wave Glider in the **Com Channel** drop-down menu. The default communications channel will be displayed. If any other communications channels available to the vehicle will be listed in the **Com Channel** drop-down menu.

9. Enter the command you want to issue in the **Script Buffer** field of the **Simple Command Form**.

10. Click **Send** at the bottom of the **Simple Command Form** to issue the command.

## Obtaining the Board ID

The Board ID for the PIB that the GPCTD is associated with should be included in the Mission Plan (the Task ID for a PIB is 00).

The Board ID for the PIB can also be obtained by issuing the **FCC -s** command to Board Address **0** provided:

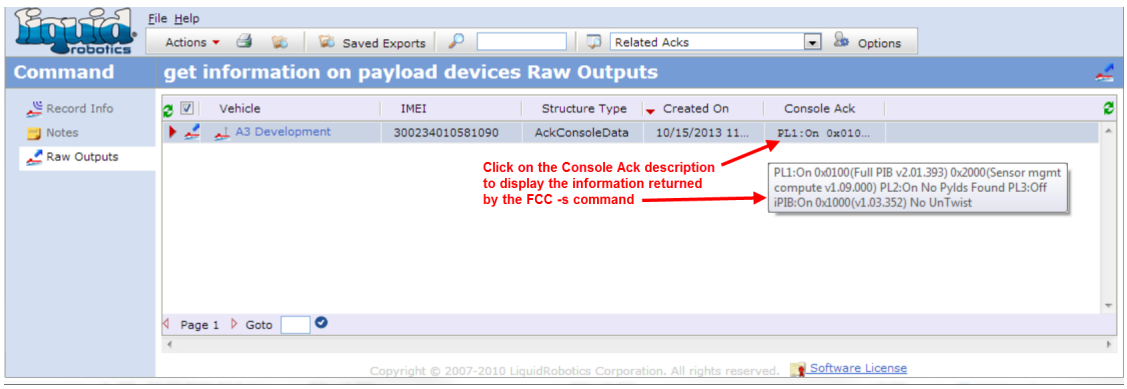
- The payload is turned on (if the payload is not turned on, see “Turning a Payload On or Off” (page 8).
- Float C&C Firmware version 2.0.995 (LRI Part Number 00655-09) or later is installed on the C&C.

The **FCC -s** command will return the power status of each payload port, and the Board ID and Task ID for each enumerated device on each payload port.

When the **FCC -s** command is "ACKed", double click on the **Command Reason** in the **Commands** list at the bottom of the WGMS dashboard - a **Simple Command Form** will appear.

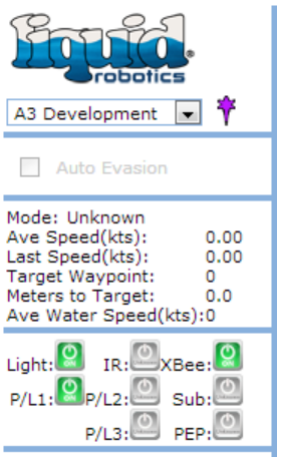
Select **Command Form** in the drop-down menu at the top of the **Simple Command Form** to display the **Command Form**, then click on **Raw Ouputs** and wait for the vehicle to respond.

Click on the information displayed in the **Console Ack** column of the raw output to display the power on/off status of each payload port, and the Board ID and Task ID for each enumerated device on each payload port.



## Turning a Payload On or Off

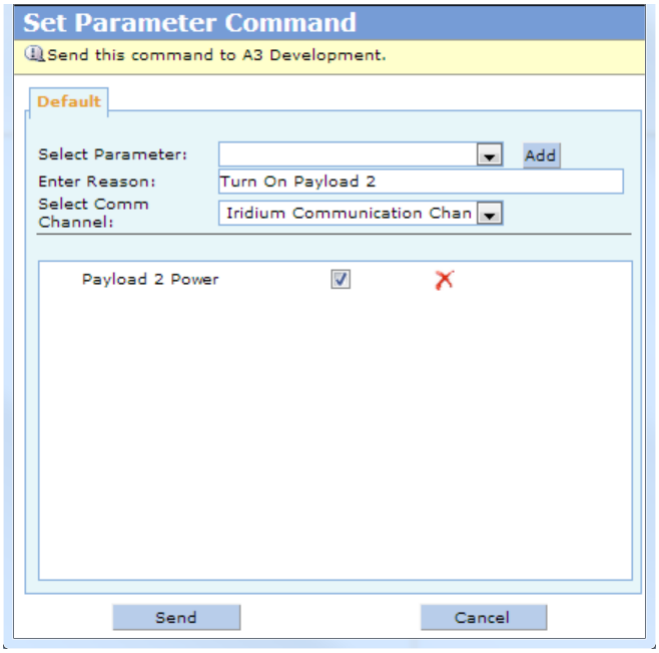
The P/L1, P/L2, and P/L3 payload buttons on the WGMS dashboard turn green when a payload power on command is issued, and they turn gray when a payload power off command is issued. In the following screen capture, Payload 1 is turned on and Payloads 2 and 3 are turned off.




Until telemetry is returned from the Wave Glider indicating that a payload actually is On or Off, the color of these buttons alone is not a reliable indicator of payload power status. See “Payload On Command Sequence” (page 10) for information on circumstances where the payload buttons on the WGMS dashboard may not accurately reflect the On/Off status of a payload.

To turn a payload on, click the gray button associated with that payload and a **Set Parameter Command** dialog box will appear with the parameter field pre-populated.

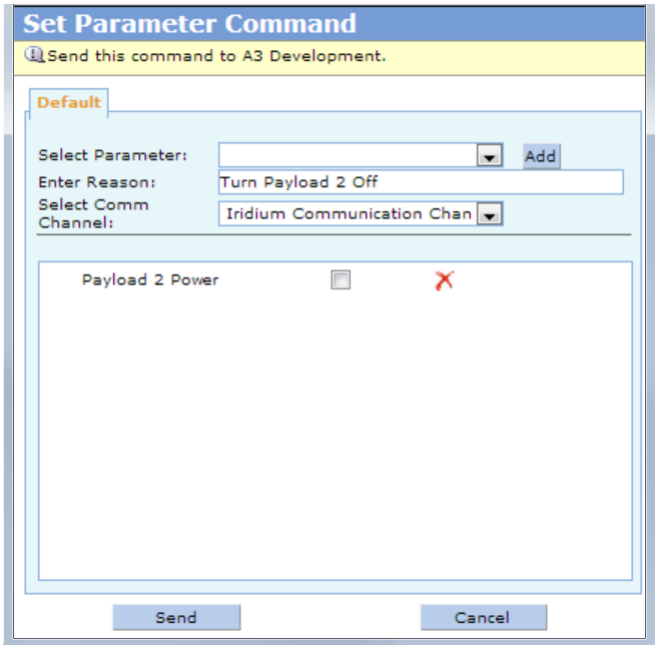
Enter a reason in the **Enter Reason:** field, and select a different communications channel in the **Select Comm Channel:** field (if you are not using Iridium), then click the cursor in an unpopulated area of the parameter field to activate the **Send** button.




Click **Send** to turn the payload on - the button associated with that payload should turn green.

To turn a payload off, click the green payload button associated with that payload and a **Set Parameter Command** dialog box will appear with the parameter field pre-populated.


Enter a reason in the **Enter Reason:** field, and select a different communications channel in the **Select Comm Channel:** field (if you are not using Iridium), then click the cursor in an unpopulated area of the parameter field to activate the **Send** button.




Click **Send** to turn the payload off - the button associated with that payload should turn gray.

## Payload On Command Sequence

When turning a payload on you must allow time for Iridium communications latency (telemetry intervals), and for the payload to boot, before issuing any other commands to the payload. Figure 3.1 shows the sequence of events from the time that you click a **P/L** button on the WGMS dashboard to issue a payload power on command, to the time when telemetry is returned from the Wave Glider C&C indicating that the payload is actually powered on.

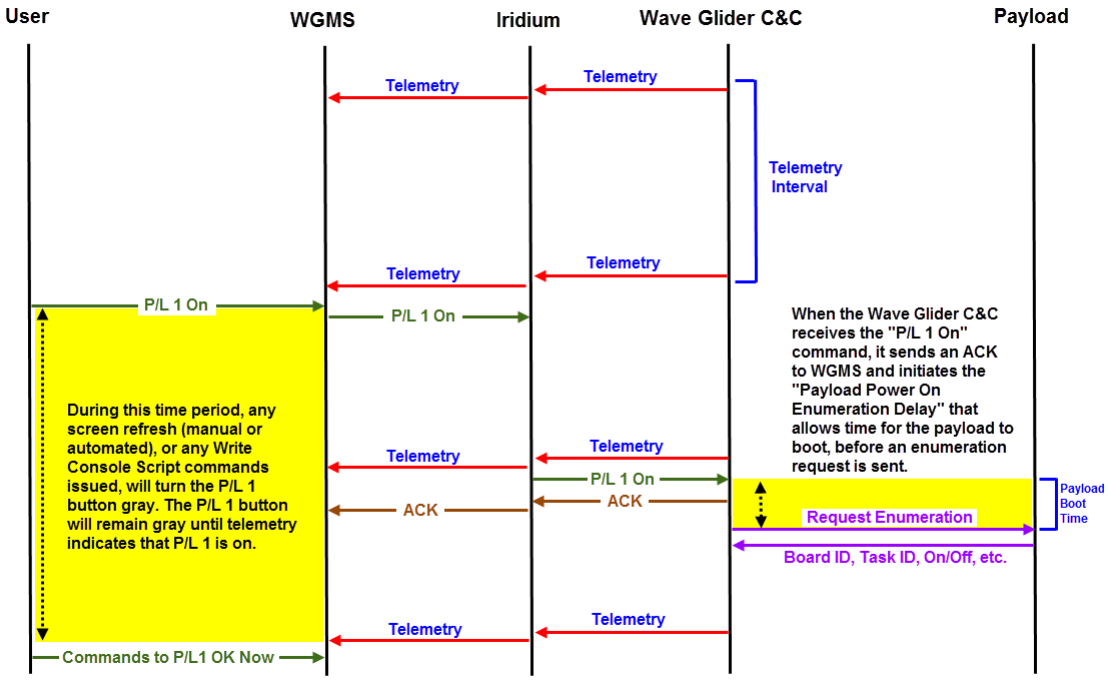
The time between when a payload on command is issued, and when a payload actually is on, depends on the length of the telemetry interval and on the WGMS "Payload Power On Enumeration Delay" setting.

- Telemetry Interval - The time between each telemetry broadcast from the Wave Glider C&C. The telemetry interval is determined by the WGMS **Set Status** command - it can range from 1 minute to 1440 minutes in 1 minute increments. When the Iridium communications channel is used, the telemetry interval is typically set to 5 minutes.
- Payload Power On Enumeration Delay - The time between when a payload is powered on and when the Wave Glider C&C issues an enumeration request to the payload. The purpose of this setting is to allow enough time for payloads to boot so they are able to respond to an enumeration request. The Payload Power On Enumeration Delay is determined by the WGMS **Set Parameters** command. The default setting is 15 seconds, but it can range from 1 to 32767 seconds. This setting applies to all of the payloads on a Wave Glider and should allow enough time for the payload with the longest boot sequence.

When a **P/L** button is clicked to turn a payload on, the **P/L** button instantly turns green. Until telemetry is returned indicating that the payload is actually powered on, a screen refresh will cause the **P/L** button color to revert to gray. Once the payload is actually powered on and the telemetry indicating the payload power on status has been received by WGMS, a green **P/L** button is a reliable indicator that the payload is powered on. Note, an ACK for the payload power on command confirms that the Wave Glider C&C received the command and issued it to the payload - it does not confirm that the payload has been powered on.

It is important to wait until telemetry confirms that a payload is powered on, before you attempt to issue any commands to that payload.

### Figure 3.1. Payload Power On Command Sequence




# Command Syntax

## Note

The Wave Glider SV2 does not support the full command set of the Sea Bird Electronics Glider Payload CTD. Unsupported commands can be implemented using the **CTD -c** command, but some GPCTD commands can make the GPCTD inoperable.

## Note

**All GPCTD commands are case-insensitive. Upper case characters are used in command syntax and examples for emphasis only.**

### Table 3.1. Command Syntax

| | |
|---|---|
| **Bold** | Bold items in the command syntax must entered. |
| *Italic* | Italic items in the syntax are place holders for information that you must include when you enter the command. Italic items are not to be taken literally - do not include them when you enter a command. |
| Vertical Bar “\|” | Vertical bars (also known as “pipes”) are used to separate the short form and the long form of |

| | |
|---|---|
| | commands, or to separate various command options. Vertical bars are not to be taken literally - do not include them when you enter a command. |
| [Text inside Brackets] | Any items insided brackets are optional. Brackets are not to be taken literally - do not include them when you enter a command. |
| Nested Brackets [x [y [z]]] | Bracketed items within brackets are optional, but cannot be executed unless the optional items in the outer sets of brackets are also executed. |
| S p a c e s | All spaces should be taken literally. If a command's syntax has a space, use that space when entering the command. |
| EXAMPLES: | |
| The syntax for the CTD off command is: **CTD -f \| --off**<br><br>The long form of the command is: **CTD --off** The short form is: **CTD -f** | |
| The syntax for the CTD run command is: **CTD -r \| --run [*period* [*report block size* [*destination*]]]**<br><br>Entering values for *period*, **report block size**, and **destination** are optional. You can enter a value for *period* only. You can enter a value for *report block size*, only if you also enter a value for *period*. You can enter a value for *destination*, only if you also enter values for *period* and *report block size*. | |
| The syntax for the CTD period command is: **CTD -p \| --period *period***<br><br>You must replace *period* with a value between 1 and 3600 when you enter this command. | |

**Synopsis**

**CTD -o | --on**

**CTD -f | --off**

**CTD -a | --autorun *mode***

**CTD -r | --run [*period* [*report block size* [*destination*]]]**

**CTD -x | -stop**

**CTD -p | --period *period***

**CTD -z | --size *report block size***

**CTD -d | --dest *destination***

**CTD –y | --cycle *sensor off time***

**CTD -s | --status**

**CTD -i |--id**

**CTD -c | --command *command***

# CTD ON

**Syntax**

**CTD -o | --on**

**Summary**

Directs the PIB to power on the GPCTD.

**Semantics**

Applies power to the GPCTD. The return data will include the serial number of the GPCTD and the default sampling parameters (sample interval, report block size, and destination address).

## Note

This command will not start the GPCTD sampling.

# CTD OFF

**Syntax**

**CTD -f | --off**

**Summary**

Directs the PIB to power off the GPCTD.

**Semantics**

Powers off the GPCTD.

## Note

If the GPCTD was currently sampling data, the last packet will be sent with whatever data has been collected to this point, regardless of whether or not the number of samples specified in the report block size has been reached.

# CTD AUTORUN

**Syntax**

**CTD -a | --autorun *mode***

**Summary**

This command sets the PIB-based Autorun mode.

**Semantics**

Turns the PIB-based Autorun feature on or off. When Autorun is on, the personality module, and therefore the GPCTD, will be powered on when the PIB starts up. When Autorun is off, the personality module and the GPCTD will not be powered on when the PIB starts. After the PIB

is running, the power state can always be changed by sending a **CTD -o** or **CTD -f** command. Valid parameters for the **CTD -a** command *mode* are `On/Yes/1` or `Off/No/0`.

### Note

This is the Autorun feature implemented in the PIB, not the Autorun feature implemented in the GPCTD and controlled by setting Autorun during configuration.

# CTD RUN [period][report block size][destination]

**Syntax**

**CTD -r | --run [*`period`* [*`report block size`* [*`destination`*]]]**

**Summary**

Directs the PIB to start the GPCTD sampling with either default settings or the given parameters.

**Semantics**

Sends the start command to the GPCTD in order to begin autonomous sampling of the GPCTD. The return data will include serial number and the parameters used for the sampling. The optional parameters are as follows:

*`Period`*: This is the time between successive samples in seconds. The value must be between 1 and 3600 (1 second up to 1 hour). If a sample rate faster than 30 seconds is required, it is recommended to implement the duty cycle option to avoid saturating the Iridium SBD bandwidth. The default value is 1 minute. The value is stored in the PIB EEPROM and will be maintained through power cycles/reboots of the system and/or the PIB.

*`Report Block Size`*: This is the number of samples that are packed into a single data report. The value must be between 1 and 10. The default value is 1. The value is stored in the PIB EEPROM and will be maintained through power cycles/reboots of the system and/or the PIB. You can enter a value for *`Report Block Size`*, only if you also enter a value for *`Period`*.

*`Destination`*: This is a 2-byte Hex address indicating where the data should be sent (shore, another payload, payload resident modem, and so forth.) The standard BoardID-TaskID nomenclature is used, where the address 0x0000 is sent to shore on the default communication channel. The value is stored in the PIB EEPROM and will be maintained through power cycles/reboots of the system and/or the PIB. You can enter a value for *`destination`*, only if you also enter a value for *`Period`* and *`Report Block Size`*.

### Note

Destination is not currently supported. Including a destination in the command will have no impact on the GPCTD.

### Note

All parameters are optional, but if they are entered, they must be entered in the order specified. If the GPCTD is currently off when this command is sent, it will power on the GPCTD and then start sampling. If the GPCTD is currently sampling data when this message is received and the parameters are different from the

current sampling mode, the data collected up to this point will be transmitted and the GPCTD will be reset to use the new parameters for sampling. Otherwise, a “Sampling in progress” message will be returned in the WGMS **Command Status** column.

# CTD STOP

**Syntax**

**CTD -x | --stop**

**Summary**

Directs the PIB to stop the GPCTD sampling but leave the GPCTD powered on.

**Semantics**

Sends the stop command to the GPCTD in order to end autonomous sampling on the GPCTD. The data collected since the last report will be transmitted back to the desired destination at this point, regardless of whether the report block size has been reached.

# CTD PERIOD

**Syntax**

**CTD -p | --period *`period`***

**Summary**

Directs the PIB to set the default sample period (in seconds) for use when the next **CTD -r** command is received.

**Semantics**

Sets the default sample period of time between successive samples in seconds. The value must be between 1 and 3600 (1 second up to 1 hour). If a sample rate faster than 30 seconds is required, it is recommended to implement the duty cycle option to avoid saturating the Iridium SBD bandwidth. The default value is 1 minute. The value is stored in the PIB EEPROM and will be maintained through power cycles/ reboots of the system and/or PIB.

## Note

This will not change the current sample interval if sampling is already in progress when the command is received, but will set the new default for the next time sampling is started. This value is stored in the PIB EEPROM and will be maintained through power cycles/reboots of the system.

# CTD REPORT BLOCK SIZE

**Syntax**

**CTD -z | --size *`report block size`***

**Summary**

Sets the default report block size (the number of samples that are sent in a single data report packet).

**Semantics**

Sets the default report block size. Valid values range from 1 to 10. The default value is 10.

### Note

This will not change the current block size if sampling is already in progress when the command is received, but will set the new default for the next time sampling is started. This value is stored in the PIB EEPROM and will be maintained through power cycles/reboots of the system.

# CTD DESTINATION

**Syntax**

**CTD -d | --dest *`destination`***

**Summary**

Sets the default destination where the data reports are sent.

**Semantics**

Sets the default destination where the data reports are sent. The destination is specified in the standard 2 byte BoardID-TaskID nomenclature where address 0x0000 is the default communication channel to shore. Values must be specified as a Hex value. The default value is 0x0000 (that is, send data to shore via default communication channel).

### Note

Destination is not currently supported. Sending a **CTD -d** command will have no impact on the GPCTD.

# CTD DUTY CYCLE

**Syntax**

**CTD –y | --cycle *`sensor off time`***

**Summary**

Sets up a duty cycle for the GPCTD. When told to start sampling, the firmware will collect one full packet of samples (as specified by the sample period and report block size parameters). Once a full packet of data has been collected, the sensor will stop sampling for the amount of time specified by this command. After the wait period has elapsed, the sequence will repeat.

**Example**

If you want the CTD to sample at a 10-second interval, put 10 samples into a packet, and get one packet every 10 minutes (600 seconds), the sample period would be set to 10 seconds, the report block size would be set to 10 samples per packet (10 samples * 10 seconds per sample = 100 seconds to get one packet's worth of data) and this parameter would need to be

set at 500 seconds (100 seconds for the sampling time and 500 seconds off = 600 seconds or 10 minutes) for the whole duty cycle.

**Semantics**

Sets the amount of time the sensor will wait between blocks of samples (1 block of samples is specified by the report block size parameter). Valid values range from 0 seconds to 43200 seconds (12 hours).

### Note

This will not change the current duty cycle time if sampling is already in progress when the command is received, but will set a new duty cycle for the next time sampling is started. This value is stored in the PIB EEPROM and will be maintained through power cycles/reboots of the system.

The GPCTD enters a low-power mode between sample cycles and the pump is powered off. This can reduce the total power requirement of the GPCTD.

## CTD STATUS

**Syntax**

**CTD -s | --status**

**Summary**

Directs the PIB to return the current state of the GPCTD.

**Semantics**

Generates a response from the PIB indicating the current state of the GPCTD. This will include power on/off, sampling in progress or not, and the parameters that are used for sampling (period, report block size, and destination).

## CTD ID

**Syntax**

**CTD -i | --id**

**Summary**

Directs the PIB to return serial number and version information for the GPCTD.

## CTD COMMAND

**Syntax**

**CTD -c | --command *command***

**Summary**

Sends a user-generated command string replicating a **Sea-Bird Electronics GPCTD command**.

**Semantics**

This command will send a user-generated command to the GPCTD. Commands must be formatted appropriately for the GPCTD as specified in the Sea-Bird Electronics GPCTD documentation. Data will be returned as best as possible from the GPCTD, truncated to 256 bytes. WGMS will not process the data; the user must process the data returned by these commands.

### Warning

Some configuration commands may put the GPCTD in a state where it will stop returning data or the PIB will not be able to communicate with the GPCTD. Examples are changing the baud rate or setting the Autorun to “yes.” The GPCTD cannot be reconfigured while deployed. If the GPCTD becomes inoperable, it cannot be restored until the Wave Glider is recovered and the GPCTD is reconfigured.

# GPCTD Command Acknowledgements

All acknowledgements to commands are sent as a text block in the ACK to the Write Console Script command and can be viewed in WGMS. If the destination is unable to process the command, it will send a NAK back instead of the ACK with text.

## Command Acknowledgement for All Commands Except CTD -id and CTS -cmd

All commands except **CTD -id** and **CTD -cmd** return the following status string as an acknowledgement:

```
OK/FAIL Pwr=On/Off Smpl=On/Off Intrvl=#### sec Size=## smpl/pkt
Off-T=#### Slp=On/Off Dest=0x####/SHORE Oxygen=Yes/No Autorun=Yes/No
```

Where `OK/FAIL` indicates the success or failure of the command and the remainder of the string returns the current status information of the GPCTD.

## Command Acknowledgement for CTD -id

**CTD -id** returns the one of the following acknowledgements:

`SBE Glider Payload CTD 1.0A SERIAL NO. 0024` (serial number and firmware version will vary)

or

`CTD Version and Serial Number is not available`

## Command Acknowledgement for CTD -cmd

The PIB returns up to the first 256 characters returned from the GPTCD as a response to the **CTD -cmd** command.

# Chapter 4. Data Formats

The Wave Glider SV2 returns GPCTD data in Sea-Bird Electronics-native formats with GPS date, time, latitude, and longitude appended. This chapter provides details on the available GPCTD data formats.

## Data Format Overview

Data returned by the GPCTD is a compact ASCII string. The data can be reported back by the GPCTD in three different formats. See the Sea-Bird Electronics Glider Payload CTD User's Manual for more information about the data formats.

### Note

The Wave Glider SV2 currently supports only Format 0. Output must be set to "0" during configuration of the GPCTD prior to integration in the Wave Glider SV2.

Format 0 is Engineering Units in Hex. This format returns the data for each measurement as a 5 byte Hex value (00000 → FFFFF). The data can then be converted to real values with a simple algorithm. When using this format, the sensor will return either a 15-byte or 20-byte string that the PIB will parse and pack as three 4-byte integer values, or as four 4-byte integer values if the oxygen sensor is installed (the 20-byte string is used when the oxygen sensor is installed). Data conversions are as follows:

Pressure in decibars = (Value/100) – 10

Temperature in degrees Celsius = (Value/10,000) – 5

Conductivity in Siemens/meter = (Value/100,000) – 0.05

Oxygen in Hertz = (Value/10)

Format 1 is Engineering Units returned in Decimal (no end user conversion necessary, but more difficult to parse and pack up efficiently for transmission).

### Note

Format 1 is not currently supported by the Wave Glider SV2. If the GPCTD is configured for Format 1, the PIB will not return any data

Format 2 is raw data returned in Decimal format (requires the calibration information in order to convert to engineering units).

### Note

Format 2 is not currently supported by the Wave Glider SV2. If the GPCTD is configured for Format 2, the PIB will not return any data.

## Payload Telemetry Message Format

The GPCTD data is returned to WGMS as a type 0x91 structure as shown in Table 1. See the Sea-Bird Electronics documentation for definitions of the sensor-specific values. Where appropriate, the text strings are converted to binary to save space.

### Table 4.1. Payload Telemetry Message Format 0.91

| Field Name | Bytes Used | Byte # | Format |
|---|---|---|---|
| PayloadType | 4 | 0-3 | Unsigned 32-bit integer: 0x00000070 |
| Board ID | 1 | 4 | Unsigned 8-bit integer |
| Task ID | 1 | 5 | Unsigned 8-bit integer |
| Sensor Data Format * | 1 | 6 (bits 0-3) | Unsigned 4-bit integer |
| Default Parser | 1 | 6 (bit 4) | 0=binary/1=ASCII |
| Delivery Priority | 1 | 6 (bits 5-7) | Signed 3-bit integer |
| Repeat Count | 1 | 7 | Unsigned 8-bit integer |

*Sensor Data Format

0 -Sensor Identification - serial number and version (ASCII) (not currently supported)

1 -Sensor Status/Configuration - on/off/sampling/parameters (ASCII) (not currently supported)

8 -GPCTD Data without Oxygen Sensor

9 -GPCTD with Oxygen Sensor

### Table 4.2. GPCTD Sensor Data Format 8

| Field Name | Bytes Used | Byte # | Format |
|---|---|---|---|
| GPS Latitude | 4 | 0-3 | Signed 32-bit integer |
| GPS Longitude | 4 | 4-7 | Signed 32-bit integer |
| GPS Date and Time | 4 | 8-11 | Unix time_t as read on the SMC |
| Pressure | 4 | 12-15 | Unsigned 32-bit integer |
| Temperature | 4 | 16-19 | Unsigned 32-bit integer |
| Conductivity | 4 | 20-23 | Unsigned 32-bit integer |

Latitude and longitude are 1/10,000 of a minute.

Pressure P (in decibars) = (Value/100) - 10

Temperature T (in deg C) = (Value/10,000) - 5

Conductivity C (in S/m) = (Value/100,000) - 0.05

### Table 4.3. GPCTD Sensor Data Format 9

| Field Name | Bytes Used | Byte # | Format |
|---|---|---|---|
| GPS Latitude | 4 | 0-3 | Signed 32-bit integer |
| GPS Longitude | 4 | 4-7 | Signed 32-bit integer |
| GPS Date and Time | 4 | 8-11 | Unix time_t as read on the SMC |

| Field Name | Bytes Used | Byte # | Format |
|---|---|---|---|
| Pressure | 4 | 12-15 | Unsigned 32-bit integer |
| Temperature | 4 | 16-19 | Unsigned 32-bit integer |
| Conductivity | 4 | 20-23 | Unsigned 32-bit integer |
| Oxygen | 4 | 24-27 | Unsigned 32-bit integer |

Latitude and longitude are 1/10,000 of a minute.

Pressure P (in decibars) = (Value/100) - 10

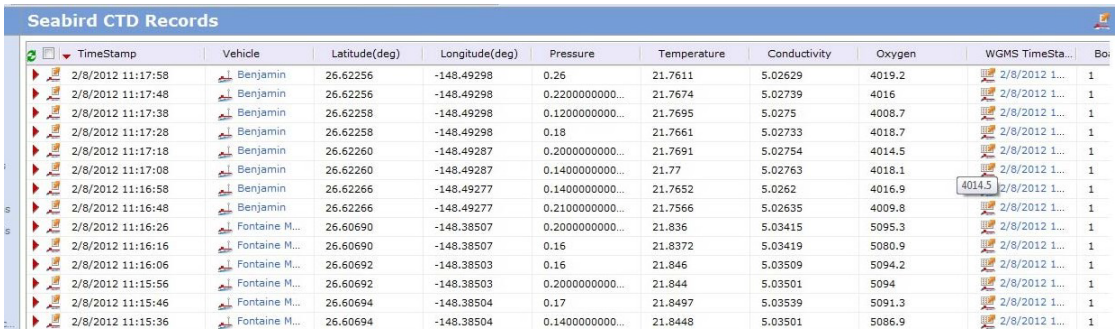
Temperature T (in deg C) = (Value/10,000) - 5

Conductivity C (in S/m) = (Value/100,000) - 0.05

Oxygen O (in Hz) = (Value/10)

Below is the GPCTD data as returned in WGMS.

## Figure 4.1. GPCTD Data in WGMS



# Chapter 5. GPCTD Custom Reports

GPCTD custom data reports can be generated and viewed from the Wave Glider Management System (WGMS) dashboard. WGMS Custom Reports are available for a wide range of Wave Glider integrated sensors.

## Viewing Custom Reports

Use the **Custom Reports** screen to, view data from vehicle operations. A Custom Report displays data from a specific payload on a specific vehicle.

The following browsers are supported for viewing WGMS Custom Reports:

| Browser | Version | Platform | Display |
|---|---|---|---|
| Internet Explorer | 9, 10 | Windows | Desktop |
| Firefox | 20.0.1 (or later) | Windows | Desktop |
| Safari | 6.0.4 (or later) | Mac | Desktop |
| Safari | (latest) | iPad (iOS 6.1 or later) | Mobile |
| Chrome | 26.0.1410.64 m (or later) | Windows | Desktop |
| Chrome | (latest) | Android (4.0 or later) | Mobile |

There are Custom Reports available for the following Wave Glider integrated payloads:

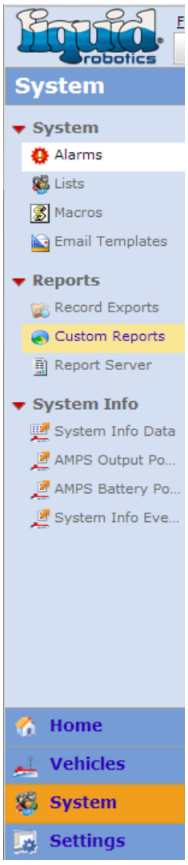
- **ADCP C2**
- **ADCP C4**
- **ADCP Bathymetry**
- **ADCP Header**
- **Aquatracka**
- **Benthos Modem**
- **C-Star**
- **Datawell MOSE**
- **Eco-Puck**
- **Fluorometer**
- **Fluorometer Header**
- **LISST Sensor**
- **pCO2 Sensor**
- **Seabird CTD**

- **VEMCO VR2C**
- **WHOI Micro Modem**

To view Custom Reports:

1. Click on **Show System Menus** to open the WGMS system menus.
2. Click on the **System** button to open the **System** screen.
3. Click on the **Custom Reports** side tab in the **Reports** menu on the side-bar.

### Figure 5.1. Opening the Custom Reports Screen



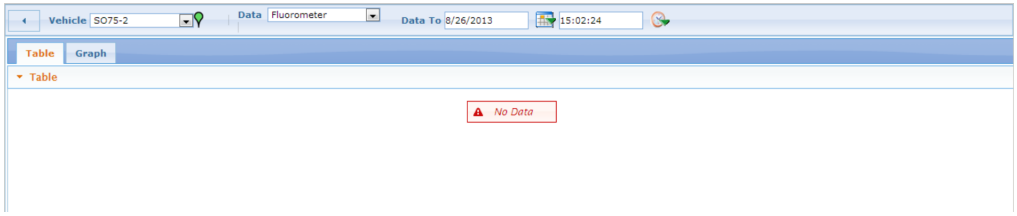

The Custom Reports screen for the selected vehicle will appear.

The toolbar at the top of the Custom Reports screen includes a drop down menu that displays the name of the vehicle that the data in the custom report comes from. If you want to view data from a different vehicle, you can select one from the drop down menu.

Data can be viewed in either of two formats, depending on which tab is selected:

- **Table** - This data format appears when the **Table** tab is selected. By default, the Custom Reports screen opens with the **Table** tab selected displaying data in a tabular format.
- **Graph** - This data format appears when the **Graph** tab is selected displaying data in a a variety of graphs depending on the variables you select.

### Figure 5.2. Custom Reports Screen - No Data Available



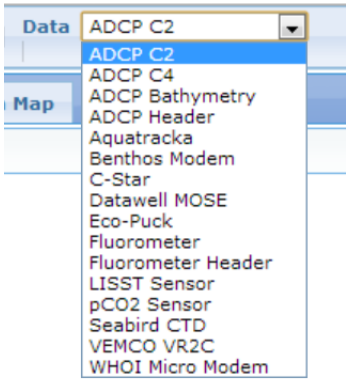

The data type in the **Data** drop-down menu will vary depending on what data type was last viewed in the Custom Reports screen. In Figure 5.2, the Custom Reports screen opened with **Fluorometer** selected in the **Data** drop-down menu, but the No Data icon indicates that the selected vehicle in the **Vehicle** drop-down menu (**SO75-2**) is not generating Fluorometer data. This is the expected behavior for the Custom Reports screen. If the selected vehicle does not have a payload that generates the selected data type, the **No Data** icon will appear, instead of data.

## Note

The Custom Reports screens for all of the supported data types have a similar format, except for the ADCP C2 and ADCP C4 data types. For information on viewing the ADCP C2 and C4 data types, see the *Wave Glider® SV2 Integrated Sensor User Guide* for the Teledyne RD Instruments Workhorse Monitor ADCP.

If you know the type of data that you want to view, and you know the selected vehicle is capable of generating that data type, select it from the **Data** drop down menu.

### Figure 5.3. Data Drop-Down Menu




If you do not know which data types the selected vehicle is capable of generating, you will need to work your way through the list in the **Data** drop-down menu to determine what data types are available from the selected vehicle.

## Note

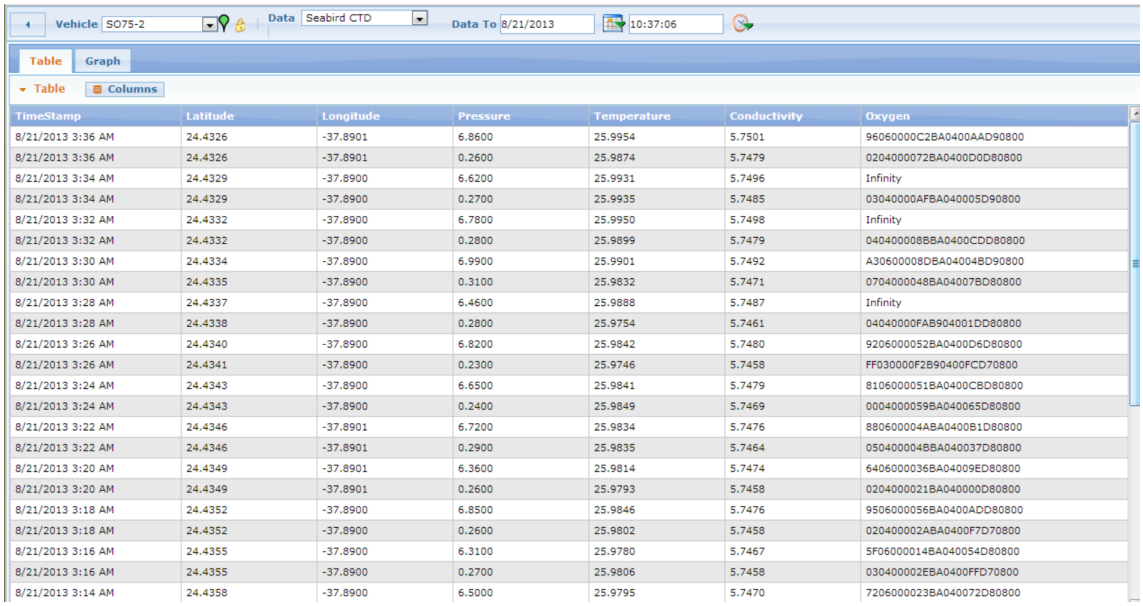
A future WGMS release will automatically populate the **Data** drop-down menu with only the data types that are available from the selected vehicle.

If a data type selected in the **Data** drop-down menu is available for the selected vehicle, an animated loading icon will appear temporarily while the data loads, then the Custom Report screen will display data.

# Custom Reports Table Format

By default, the Custom Reports screen opens to the **Table** tab and displays all of the columns available for a selected data type.

### Figure 5.4. Custom Reports Screen With Data - Table Format

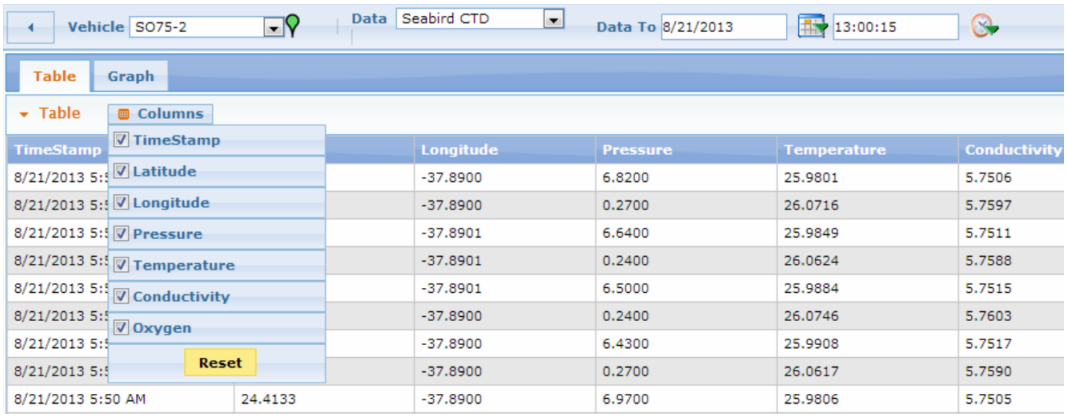



| TimeStamp | Latitude | Longitude | Pressure | Temperature | Conductivity | Oxygen |
|---|---|---|---|---|---|---|
| 8/21/2013 3:36 AM | 24.4326 | -37.8901 | 6.8600 | 25.9954 | 5.7501 | 96060000C2BA0400AAD90800 |
| 8/21/2013 3:36 AM | 24.4326 | -37.8901 | 0.2600 | 25.9874 | 5.7479 | 0204000072BA0400D0D80800 |
| 8/21/2013 3:34 AM | 24.4329 | -37.8900 | 6.6200 | 25.9931 | 5.7496 | Infinity |
| 8/21/2013 3:34 AM | 24.4329 | -37.8900 | 0.2700 | 25.9935 | 5.7485 | 03040000AFBA040005D90800 |
| 8/21/2013 3:32 AM | 24.4332 | -37.8900 | 6.7800 | 25.9950 | 5.7498 | Infinity |
| 8/21/2013 3:32 AM | 24.4332 | -37.8900 | 0.2800 | 25.9899 | 5.7479 | 040400008BBA0400CDD80800 |
| 8/21/2013 3:30 AM | 24.4334 | -37.8900 | 6.9900 | 25.9901 | 5.7492 | A30600008DBA04004BD90800 |
| 8/21/2013 3:30 AM | 24.4335 | -37.8900 | 0.3100 | 25.9832 | 5.7471 | 0704000048BA04007BD80800 |
| 8/21/2013 3:28 AM | 24.4337 | -37.8900 | 6.4600 | 25.9888 | 5.7487 | Infinity |
| 8/21/2013 3:28 AM | 24.4338 | -37.8900 | 0.2800 | 25.9754 | 5.7461 | 04040000FAB904001DD80800 |
| 8/21/2013 3:26 AM | 24.4340 | -37.8900 | 6.8200 | 25.9842 | 5.7480 | 9206000052BA0400D6D80800 |
| 8/21/2013 3:26 AM | 24.4341 | -37.8900 | 0.2300 | 25.9746 | 5.7458 | FF030000F2B90400FCD70800 |
| 8/21/2013 3:24 AM | 24.4343 | -37.8900 | 6.6500 | 25.9841 | 5.7479 | 8106000051BA0400CBD80800 |
| 8/21/2013 3:24 AM | 24.4343 | -37.8900 | 0.2400 | 25.9849 | 5.7469 | 0004000059BA040065D80800 |
| 8/21/2013 3:22 AM | 24.4346 | -37.8901 | 6.7200 | 25.9834 | 5.7476 | 880600004ABA0400B1D80800 |
| 8/21/2013 3:22 AM | 24.4346 | -37.8901 | 0.2900 | 25.9835 | 5.7464 | 050400004BBA040037D80800 |
| 8/21/2013 3:20 AM | 24.4349 | -37.8901 | 6.3600 | 25.9814 | 5.7474 | 6406000036BA04009ED80800 |
| 8/21/2013 3:20 AM | 24.4349 | -37.8901 | 0.2600 | 25.9793 | 5.7458 | 0204000021BA040000D80800 |
| 8/21/2013 3:18 AM | 24.4352 | -37.8900 | 6.8500 | 25.9846 | 5.7476 | 9506000056BA0400ADD80800 |
| 8/21/2013 3:18 AM | 24.4352 | -37.8900 | 0.2600 | 25.9802 | 5.7458 | 020400002ABA0400F7D70800 |
| 8/21/2013 3:16 AM | 24.4355 | -37.8900 | 6.3100 | 25.9780 | 5.7467 | 5F06000014BA040054D80800 |
| 8/21/2013 3:16 AM | 24.4355 | -37.8900 | 0.2700 | 25.9806 | 5.7458 | 030400002EBA0400FFD70800 |
| 8/21/2013 3:14 AM | 24.4358 | -37.8900 | 6.5000 | 25.9795 | 5.7470 | 7206000023BA040072D80800 |

For some data types you will need to scroll to the right to see all of the columns. To limit the number of columns displayed:

1. Click on **Columns** button. A drop-down menu listing the column names will appear.
2. Un-check the check box next to each column name that you do not want displayed and that column will instantly be removed from the Custom Report.
3. To restore all columns, click the **Reset** button.

### Figure 5.5. Changing the Columns that are Displayed




## Note

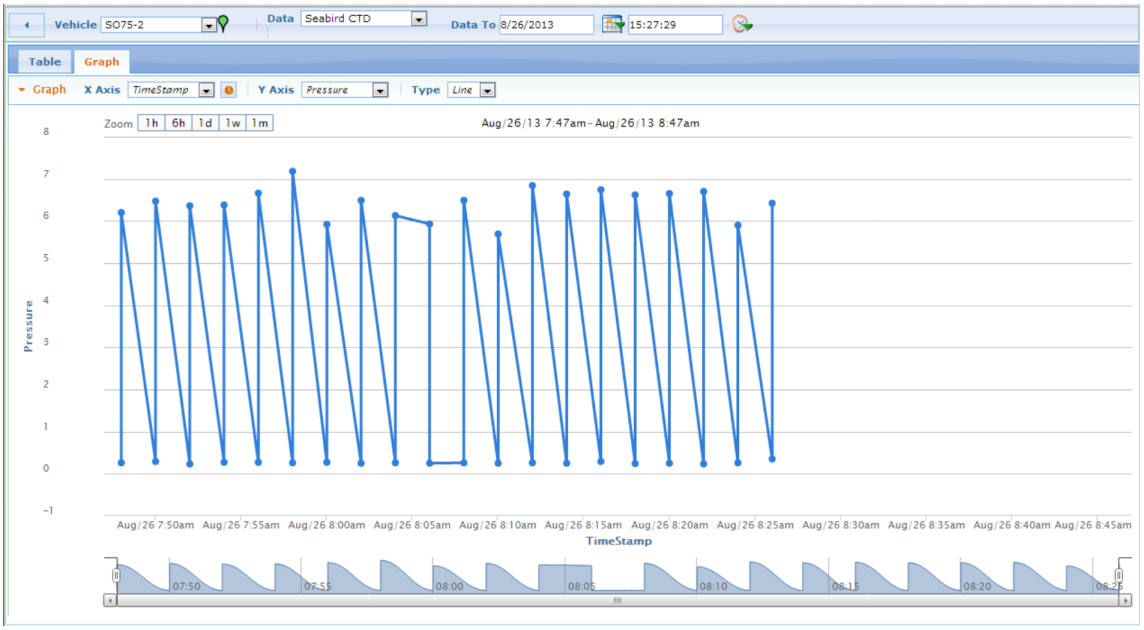
The Custom Report screen provides similar functionality on a tablet, but the navigation is slightly different. When using a tablet, allow extra time for Custom Report screens to generate.

By default, the custom report for a selected data type will display all available data. You can limit the amount of historical data that is displayed by changing the **Data To:** date and time settings. Changing the date and time settings will update the custom report screen that you are viewing.

# Custom Reports Graph Format

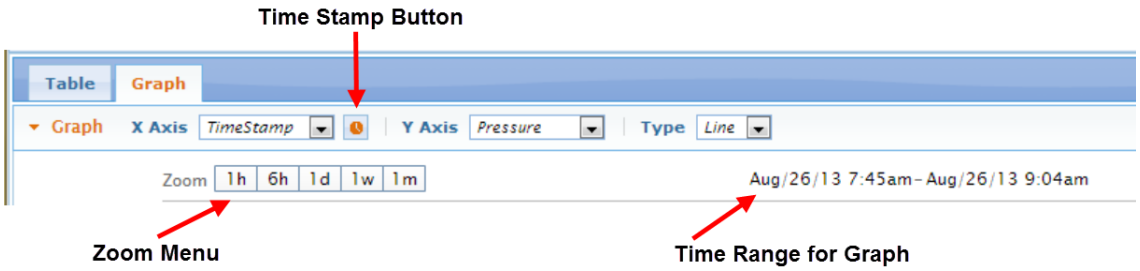
Click on the **Graph** tab to view the graphical data display for the selected vehicle and data type.

### Figure 5.6. Custom Reports Screen - Graph Format



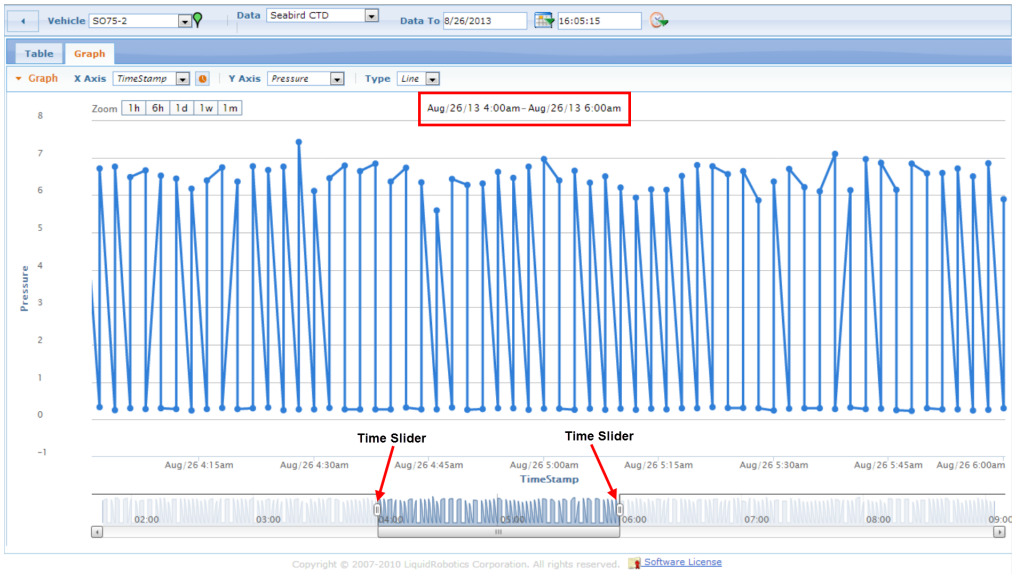
The selections made in the **X Axis** and **Y Axis** drop-down menus determine how the data is displayed. Displaying the **Time Stamp** on the X Axis with one of the other variables displayed on the Y Axis graphs the Y Axis data over time. This is the most widely used combination of X and Y Axis variables. The **Time Stamp** button adjacent to the **X Axis** drop-down menu can also be used to set the X Axis to **Time Stamp**. The **Type** drop-down menu is used to add or remove the line that connects the data points on the graph. Click on one of the selections in the **Zoom** menu to display data for the last hour, 6 hours, 1 day, 1 week, or 1 month. The Time Range indicates when the data display begins and ends.

## Figure 5.7. Custom Reports Screen - Graph Format Time Settings




The **Time Slider** buttons in the time line at the bottom of the **Graph** display can also be used to adjust the time range for the data display.

## Figure 5.8. Custom Reports Screen - Graph Format Time Slider




## Note

The options available in the **X Axis** and **Y Axis** drop-down menus may not always result in a useful or meaningful graph. Knowledge of the data being measured is necessary to choose X and Y Axis variables that make sense.

# Chapter 6. Launch, Recovery, and Storage

This chapter provides specific instructions and considerations for Wave Glider SV2 launch, recovery, and storage, when the Glider Payload GPCTD is installed.

# Launch, Recovery, and Storage Overview

## GPCTD Accessories Kit

A Wave Glider SV2 with integrated GPCTD ships with a GPTCD accessory kit. You should keep the kit on hand, as some items may be needed for troubleshooting or to return the GPCTD. The GPCTD Accessories Kit includes:

- Sea-Bird Electronics manuals and software
- Custom cut packing foam (save for reshipping)

## Glider Payload GPCTD Precautions

In order to minimize contamination of the conductivity cell or the optional oxygen sensor membrane with surface oils as the GPCTD enters/exits the water, it is critical that proper deployment and recovery techniques be used. See the Sea-Bird Electronics Glider Payload GPCTD User's Manual for detailed information.

Pressure housings in the GPCTD may flood under pressure due to dirty or damaged o-rings or other failed seals. When a sealed pressure housing floods at great depths and is subsequently raised to the surface, water may be trapped at the pressure at which it entered the housing, presenting a danger if the housing is opened before relieving the internal pressure.

If you suspect the GPCTD is flooded during recovery, point it in a safe direction away from people and loosen the four screws on the sensor end cap about ½ turn. If there is internal pressure, the end cap will follow the screws out, and the screws will not become easier to turn. In this event, loosen the bulkhead connector (on the other end cap) very slowly, at least 1 turn. This opens an o-ring seal under the connector. Look for signs of internal pressure (hissing or water leak). If internal pressure is detected, let it bleed off slowly past the connector o-ring. Then,you can safely remove the sensor end cap.

When a GPCTD includes a pump, the pump begins running when the GPCTD is turned on. The pump must not be operated unless the GPCTD is fully submerged to ensure that water flows through the GPCTD into the pump, preventing the pump from running dry. The pump will be damaged if it runs dry. If there is no water in the GPCTD, a sensor inside the GPCTD will prevent the pump from running, but if there is sufficient moisture in the GPCTD the sensor may allow the pump to run. For these reasons, a GPCTD with an attached pump should not be operated unless the GPCTD is fully submerged or totally dry.

## Pre-Launch Checkout

The Wave Glider integrated GPCTD should undergo a final pre-launch test, as part of the overall test of the Wave Glider. Add the following to the checklist to confirm GPCTD functionality:

## Status Checks

Calibrate and characterize the Glider Payload GPCTD, if necessary. See the Sea-Bird Electronics Glider Payload CTD User's Guide

## Functionality Checks

### Warning

If the GPCTD includes a pump, the GPCTD should only be operated if it is fully submerged or totally dry.

Confirm that the GPCTD is powered on by issuing the **ctd -o** command using the WGMS Write Console Script command. The GPCTD should return the following acknowledgement:

```
OK/FAIL Pwr=On/Off Smpl=On/Off Intrvl=#### sec Size=## smpl/pkt Off-T=#### Slp=On/Off
     Dest=0x####/SHORE Oxygen=Yes/No Autorun=Yes/ No
```

where `OK/FAIL` indicates the success or failure of the command and the remainder of the string returns the current status information of the GPCTD.

Confirm the status of the GPCTD by issuing the **ctd -i** command. The GPCTD should return the following acknowledgement:

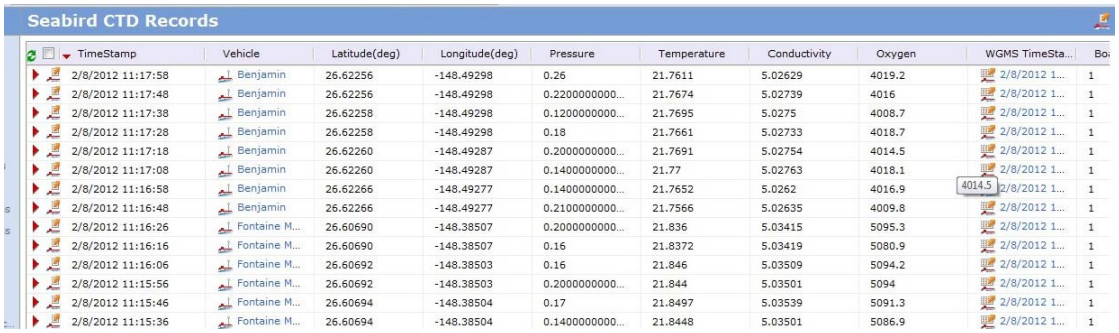
```
SBE Glider Payload CTD 1.0A SERIAL NO. 0024 (serial number and firmware version will vary)
```

Confirm that the GPCTD is returning data by issuing the **ctd - r** command. The GPCTD should return the following acknowledgement:

```
OK/FAIL Pwr=On/Off Smpl=On/Off Intrvl=#### sec Size=## smpl/pkt Off-T=#### Slp=On/Off Dest=0x####/SHORE
Oxygen=Yes/No Autorun=Yes/ No
```

Data should be visible in WGMS as shown below. If the data is older than the sample rate/ block report size period, the GPCTD may not be returning data correctly.

### Figure 6.1. GPCTD Data in WGMS




Stop the GPCTD by issuing the **ctd -x** command. If needed, power the GPCTD off by issuing the **ctd -f** command. For each command, the GPCTD should return the following acknowledgement:

```
OK/FAIL Pwr=On/Off Smpl=On/Off Intrvl=#### sec Size=## smpl/pkt Off-T=#### Slp=On/Off Dest=0x####/SHORE
Oxygen=Yes/No Autorun=Yes/ No
```

If the GPCTD does not return acknowledgements or data as expected, go to "Chapter 6, Troubleshooting."

# Chapter 7. Troubleshooting

Testing and troubleshooting of the standalone GPCTD must be completed according to the Sea-Bird Electronics Glider Payload GPCTD User's Guide prior to its integration into the Wave Glider. This chapter provides instructions for troubleshooting when the GPCTD is integrated with the Wave Glider SV2.

## Troubleshooting Overview

There are three situations in which you may become aware that the GPCTD is not operating properly:

- During on-shore checkout
- During pre-launch checkout
- During normal operations at sea

If you become aware of a possible problem with the GPCTD, follow the steps below to isolate the problem.

### Note

The Wave Glider SV2 with the GPCTD installed shipped with an GPCTD accessory kit. The kit contains items needed for troubleshooting. See "Chapter 5, GPCTD Accessories Kit."

1. Confirm that the GPCTD is working by performing the functionality checks. See "Chapter 5, Pre-Launch Checkout."
2. If the GPCTD does not return acknowledgements or data as expected, consult the Troubleshooting chapter of the Wave Glider User Manual to ensure that there are no problems with the Wave Glider power or communications systems.
3. If the GPCTD continues to fail, see the following "Liquid Robotics Customer Support" (page 31) section for instructions on contacting LRI.

## Liquid Robotics Customer Support

Customer support is available during regular business hours: Monday - Friday, 8:00 AM to 5:00 PM (PST). Outside of regular business hours, support will be provided within 2 (two) business days.

**Telephone**

(888) 574-4574

or

(408) 636-4200

**Email**

support@liquidr.com

### Before You Contact Us

Before contacting Liquid Robotics support, please have the following information ready:

- Your support contract number
- Serial number of the vehicle(s) or part(s) affected

# Chapter 8. Maintenance

There are no special maintenance procedures for the GPCTD integrated into the Wave Glider SV2. See the Sea-Bird Electronics GPCTD User's Guide for standard GPCTD maintenance procedures.

If the GPCTD needs to be removed from the Wave Glider to perform maintenance, see Chapter 9: *Replacement*. If the GPCTD is re-installed following maintenance, be sure to complete a checkout of the GPCTD before installation. Follow the testing and troubleshooting instructions in the Sea-Bird Electronics GPCTD User's Guide.

## Warning

The GPCTD includes an anti-foulant device that contains bis(tributyltin) oxide, which is a corrosive agent. Wear rubber or latex gloves and eye protection when handling the devices. See the Material Safety Data Sheet (MSDS) for more information.

# Chapter 9. Replacement

This chapter provides detailed instructions for disconnecting, removing, and installing the GPCTD in the Wave Glider SV2 Float hull and in a Glider payload. Contact Liquid Robotics for replacement information for a GPCTD installed in a towfish.

## Replacement Overview

The GPCTD needs to be disconnected or removed from the Wave Glider for troubleshooting.

### Note

The GPCTD includes an anti-foulant device that contains bis(tributyltin) oxide, which is a corrosive agent. Wear rubber or latex gloves and eye protection when handling the devices. See the MSDS for more information.

Before installing the GPCTD, be sure to first do a complete checkout of the GPCTD. Follow the testing and troubleshooting instructions in the Sea-Bird Electronics GPCTD User's Manual.

When a GPCTD includes a pump, the pump begins running when the GPCTD is turned on. The pump must not be operated unless the GPCTD is fully submerged to ensure that water flows through the GPCTD into the pump, preventing the pump from running dry. The pump will be damaged if it runs dry. If there is no water in the GPCTD, a sensor inside the GPCTD will prevent the pump from running, but if there is sufficient moisture in the GPCTD the sensor may allow the pump to run. For these reasons, a GPCTD with an attached pump should not be operated unless the GPCTD is fully submerged or totally dry.

The installation and removal procedures require the following tools and equipment. Have the necessary tools and equipment ready before beginning the disconnection, removal, or installation procedures.

| Tool/Part | Quantity | Part # |
|---|---|---|
| Glider Support Stand (Launch Stand) | 1 | 00047 |
| Float-Glider Saddle | 1 | 00231 |
| #2 Phillips-head screwdriver | 1 | N/A |
| 6mm hex head wrench | 1 | N/A |
| 4mm hex head wrech | 1 | N/A |
| 3M silicone spray lubricant | 1 | N/A |
| Loctite 242 (blue) | 1 | N/A |
| Cable ties | 4 | N/A |
| Cable cutter (for cable ties) | 1 | N/A |

## Removal and Installation Process - Float Hull

**Removing the GPCTD from the Float hull**

1. "Removing the Turtle Deck" (page 36).

2. “Removing the Aft Solar Panel” (page 37).
3. “Disconnecting and Removing the Payload Drybox” (page 39).
4. “Removing the Payload Drybox Lid Assembly” (page 40).
5. “Removing the GPCTD Assembly” (page 40).

**Installing the GPCTD in the Float hull**

1. “Removing the Turtle Deck” (page 36).
2. “Removing the Aft Solar Panel” (page 37).
3. “Installing the GPCTD Assembly” (page 42).
4. “Installing the Payload DryBox Lid Assembly” (page 43).
5. “Connecting and Installing the Payload dry box” (page 44).
6. “Installing the Solar Panel” (page 45).
7. “Installing the Turtle Deck ” (page 46).

# Placing the Float on the Float-Glider Saddle

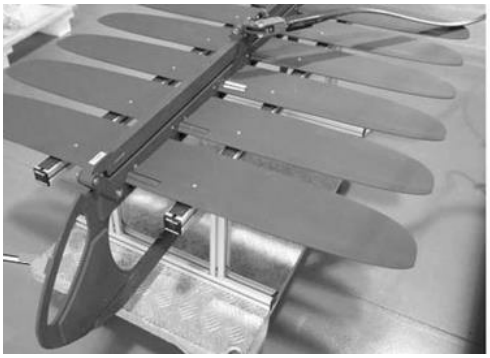
**Before You Begin**

Before removing the GPCTD from the Float hull, the Float must be installed on the Float-Glider saddle that ships with the Wave Glider SV2.

**Description of Work**

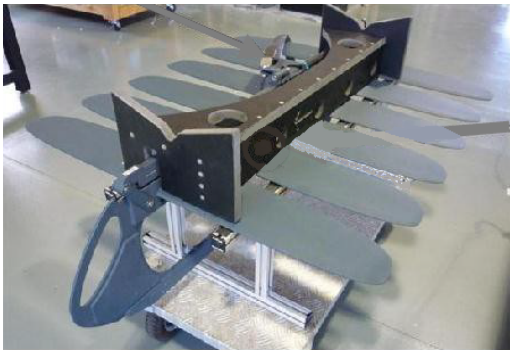
1. Place the Glider on the support stand following the instructions in the *Wave Glider Unpacking and Assembly Guide*.

### Figure 9.1. Glider on Support Stand



2. Following the instructions in the *Wave Glider Unpacking and Assembly Guide*, place the Float-Glider saddle on top of the Glider.

### Figure 9.2. Float-Glider Saddle



3. Following the instructions in the *Wave Glider Unpacking and Assembly Guide*, place the Float on the Float-Glider saddle.

### Figure 9.3. Float on the Float-Glider Saddle

This completes the procedure for using the Float-Glider saddle.

# Removing the Turtle Deck

**Before You Begin**

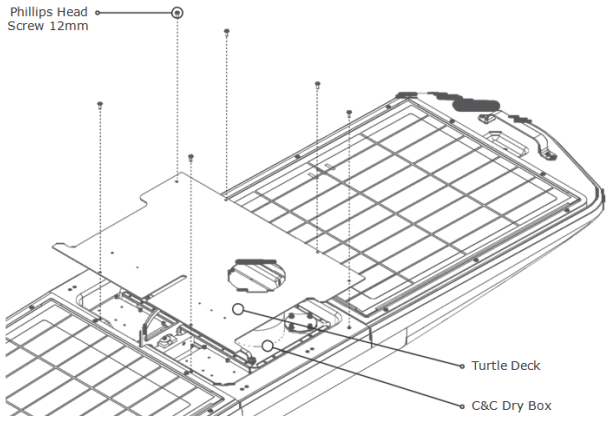
## Warning

Before working on the Wave Glider, make sure that you have powered off the vehicle by disconnecting the shorting plug from the battery switch on the C&C drybox.

**Description of Work**

1. Remove the six (6) screws securing the turtle deck.

### Figure 9.4. Removing the Turtle Deck




2. Remove the turtle deck to expose the C&C drybox.

This completes the procedure for removing the turtle deck.

# Removing the Aft Solar Panel

#### Before You Begin

To remove the aft solar panel, the turtle deck must be removed so that you can access the C&C drybox.

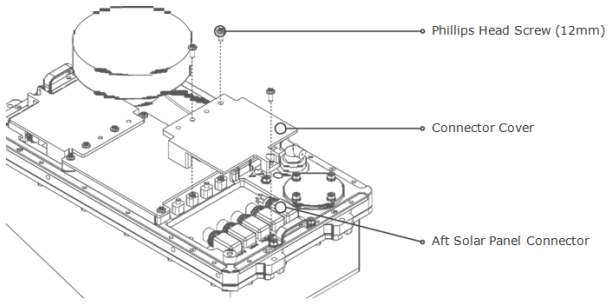
## Note

For detailed instructions see “Removing the Turtle Deck” (page 36).

#### Description of Work

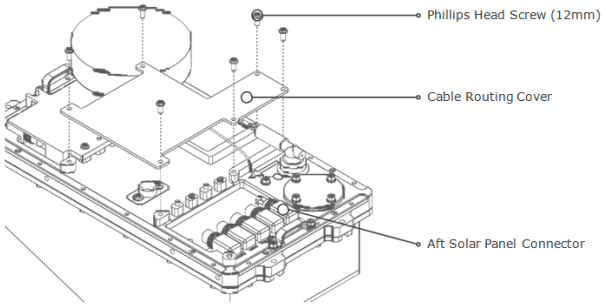
1. Remove the three (3) screws securing the left side connector cover to the C&C drybox, and remove the cover to access the solar panel cable connector.

### Figure 9.5. Removing the Connector Cover from the C&C Drybox



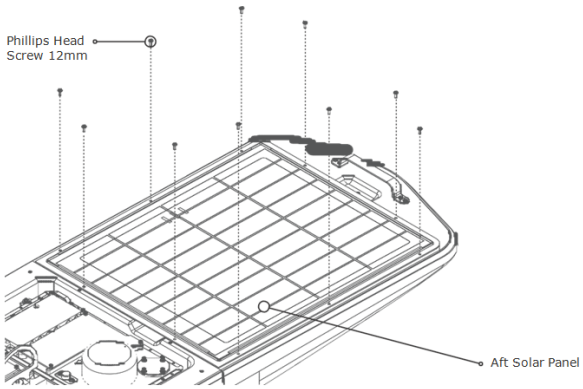

2. Remove the six (6) screws securing the center cable routing cover to the drybox, and remove the cover.

### Figure 9.6. Float on the Float-Glider Saddle




3. Disconnect the aft solar panel cable from the SOLAR 1 AFT connector on the C& drybox.
4. Remove the eight (8) screws securing the aft solar panel.

### Figure 9.7. Removing the Aft Solar Panel Screws




## Warning

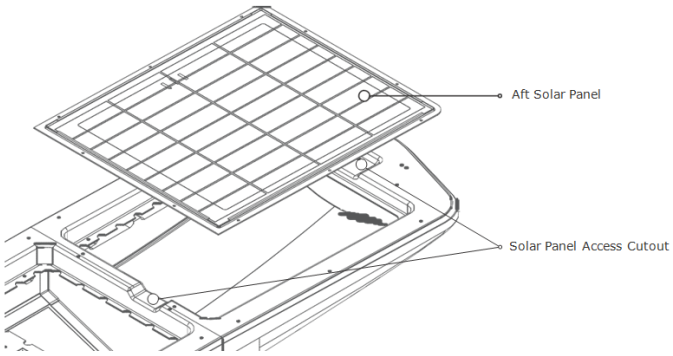
Handle the solar panel with care. Bending a solar panel during removal or installation can cause damage.

5. Grasping the assembly from both ends, gently lift the solar panel out of the Float and place it on a smooth, level surface where it will not get damaged.

## Note

There are cutouts in the Float at the front and back of the solar panel that allow you to access the panel for easy removal.

### Figure 9.8. Removing the Aft Solar Panel




This completes the procedure for removing the aft solar panel.

# Disconnecting and Removing the Payload Drybox

**Before You Begin**

To disconnect and remove the payload drybox, the turtle deck must be removed so that you can access the C&C drybox; the aft solar panel must be removed so you can access the aft payload bay.

## Note

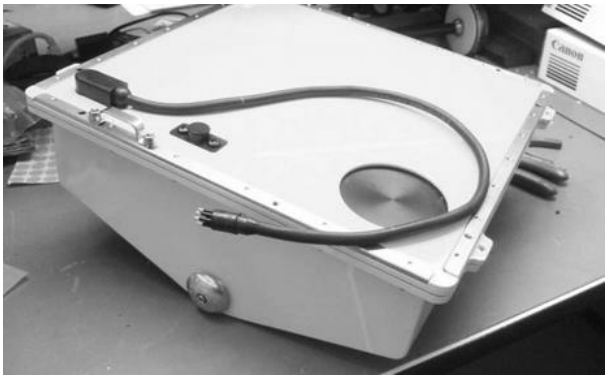
For detailed instructions see “Removing the Turtle Deck” (page 36) and “Removing the Aft Solar Panel” (page 37).

The payload drybox is connected to the C&C via a cable. The cable must be disconnected prior to removing the payload.

**Description of Work**

1. Disconnect the C&C cable.
2. Lift the payload drybox out of the payload bay.

### Figure 9.9. Payload Drybox and C&C Connection Cable



This completes the procedure for disconnecting and removing the payload drybox.

# Removing the Payload Drybox Lid Assembly

**Before You Begin**

To remove the payload drybox lid assembly, the payload must be disconnected.

## Note

For detailed instructions see “Disconnecting and Removing the Payload Drybox” (page 39).

**Description of Work**

1. Lift the payload drybox out of the hull.
2. Place the payload drybox lid side down on a work surface.
3. Remove the 26 screws attaching the lid assembly to the payload drybox.

### Figure 9.10. Removing the Payload Drybox Cover Attachment Screws

4. Lift the payload drybox away from the lid assembly.

The payload drybox lid assembly is now removed.

# Removing the GPCTD Assembly

**Before You Begin**

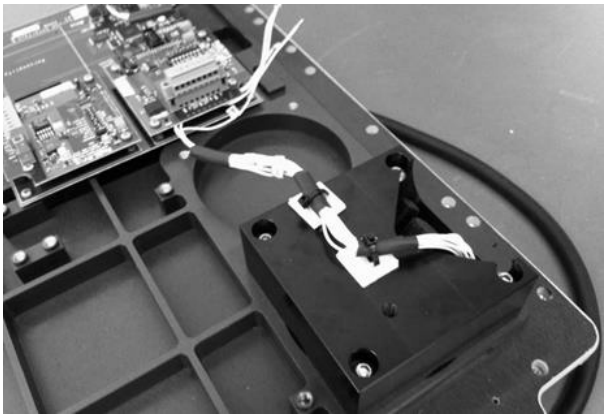
To disconnect the GPCTD assembly, the payload drybox lid assembly must be removed.

For detailed instructions see “Removing the Payload Drybox Lid Assembly” (page 40).

**Description of Work**

1. Place the payload drybox cover lid-side down on a work surface.
2. Disconnect the GPCTD connector from the P-Comm on the PIB.

### Figure 9.11. Disconnecting the GPCTD from the P-Comm

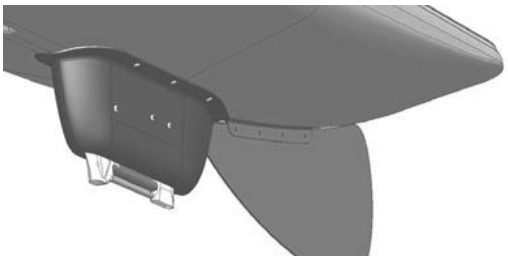


3. Feed the GPCTD connector cable out of the foam and out of the grommet in the hull of the Float.

### Figure 9.12. Removing the GPCTD Cable

4. Remove the attachment screws that hold the GPCTD and housing to the hull of the Float.

### Figure 9.13. Removing the GPCTD Housing Attachment Screws



5. Lift the GPCTD, housing, and cable away from the Float.

This completes the procedure for removing the GPCTD assembly.

# Installing the GPCTD Assembly

**Before You Begin**

To install the GPCTD assembly, the Float must be installed on the Float-Glider saddle that ships with the Wave Glider.

## Note

For detailed instructions see “Placing the Float on the Float-Glider Saddle” (page 35).

## Warning

Before working on the Wave Glider, make sure that you have powered off the vehicle by disconnecting the shorting plug from the battery switch on the C&C drybox.

**Description of Work**

1. Align the GPCTD and housing to the holes in the hull of the Float.
2. Attach the GPCTD housing to the hull using the attachment screws.

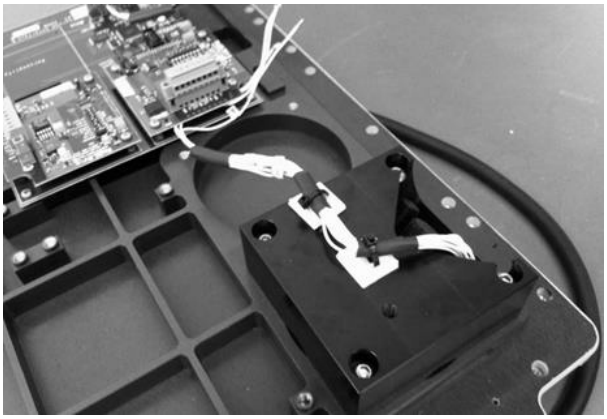
### Figure 9.14. Attaching the GPCTD Housing Screws

3. Feed the GPCTD subconn through the grommet in the hull of the Float and through the foam.

### Figure 9.15. Installing the GPCTD Cable

4. Plug the subconn into the P-Comm on the PIB.

### Figure 9.16. Plugging the GPCTD Subcon into the P-Comm



This completes the procedure for installing the GPCTD assembly.

# Installing the Payload DryBox Lid Assembly

**Before You Begin**

The GPCTD must be properly installed and connected to the payload drybox lid assembly prior to performing this procedure.

## Note

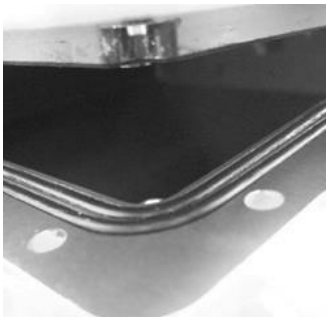
For detailed information see “Installing the GPCTD Assembly” (page 42).

All electronics for other sensors that may be mounted in the payload dry box must be properly installed prior to performing this procedure. See the appropriate sensor guide for detailed information.

**Description of Work**

1. Orient the payload dry box lid assembly over the housing so that the alignment pin on the lid assembly can be mated to the alignment hole on the housing. Place the lid assembly on the payload dry box.

### Figure 9.17. Payload dry box Lid Assembly Alignment Hole



2. Keeping the payload dry box and lid together, flip them over and place them on the work surface.

3. Attach the 26 screws attaching the lid assembly to the payload dry box.

### Figure 9.18. Installing the Payload dry box Lid Assembly Attachment Screws

This completes the procedure for installing the payload dry box lid assembly.

# Connecting and Installing the Payload dry box

**Before You Begin**

To connect and install the payload dry box, the payload dry box lid assembly installation must be completed.

## Note

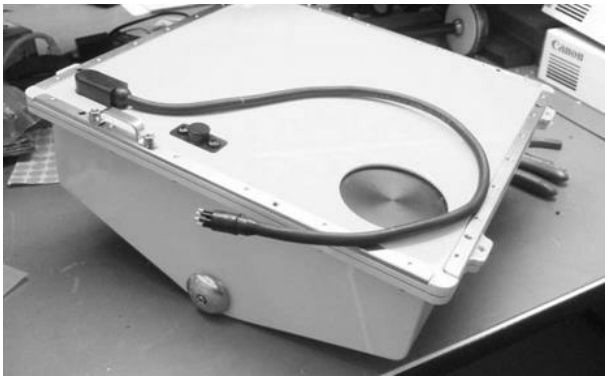
For detailed instructions see “Installing the Payload DryBox Lid Assembly” (page 43).

The payload is connected to the C&C via a cable. The cable must be connected prior to installing the payload dry box.

**Description of Work**

1. Place the payload dry box in the payload bay of the hull.
2. Connect the payload cable to the C&C.

### Figure 9.19. Connecting the Payload Cable to the C&C



This completes the procedure for connecting the payload.

# Installing the Solar Panel

**Before You Begin**

To install the solar panel, the payload dry box must be installed and connected.

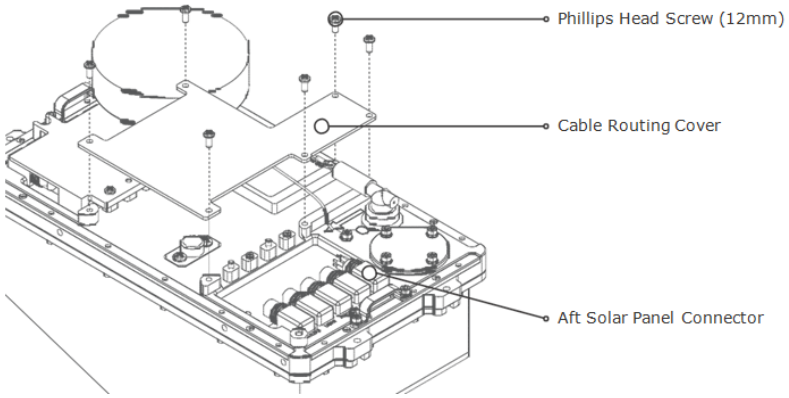
## Note

For detailed instructions see “Connecting and Installing the Payload dry box” (page 44).

**Description of Work**

1. Connect the aft solar panel cable to the SOLAR 1 AFT connector on the C&C dry box.
2. Install the center cable routing cover and secure it with the six 12mm Phillips-head screws.

### Figure 9.20. Installing the Cable Routing Cover on the C&C dry box

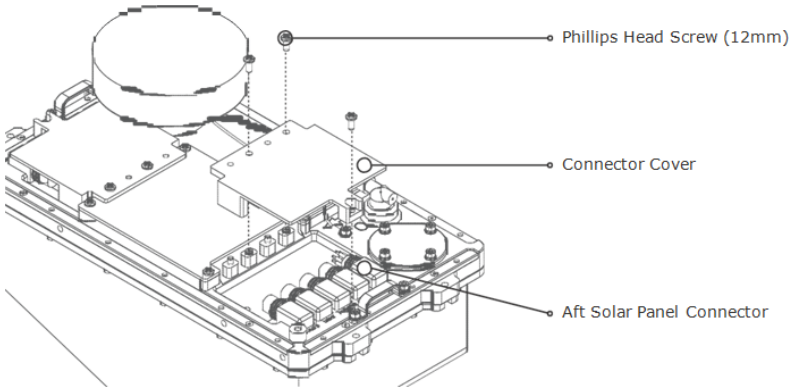



3. Install the left side connector cover on the C&C dry box and secure it with three 12mm Phillips-head screws.

## Warning

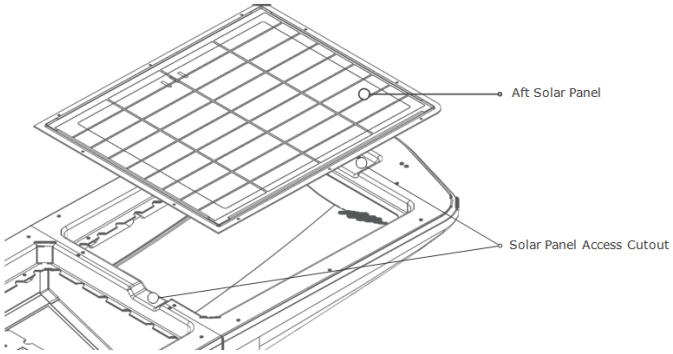
Handle the solar panel with care. Bending a solar panel during removal or installation can cause damage.

### Figure 9.21. Installing the Connector Cover on the C&C dry box




4. Gently lower the solar panel in place, making sure not to pinch the solar panel cable in the process. The cable must be routed through the cutout at the forward end of the aft payload bay.

### Figure 9.22. Installing the Aft Solar Panel




5. Secure the solar panel with eight 12mm Phillips-head screws.

This completes the procedure for installing the solar panel.

# Installing the Turtle Deck

#### Before You Begin

To install the turtle deck, the solar panel must be installed.

## Note

For detailed instructions see “Installing the Solar Panel” (page 45).

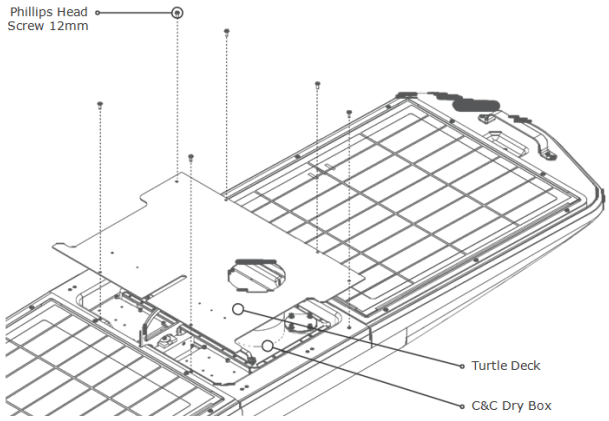
#### Description of Work

1. Install the turtle deck and secure it with six 12 mm Phillips-head screws.

### Note

Depending upon your vehicle configuration, you may have to uninstall antennas or other components in order to install the turtle deck.

**Figure 9.23. Installing the Turtle Deck Screws**




This completes the procedure for installing the turtle deck.

# Removal and Installation Process - Glider

**Removing the GPCTD from the Glider**

1. “Disconnecting the GPCTD Assembly from the Glider” (page 48).
2. “Removing the GPCTD from the Glider Frame” (page 49).

**Installing the GPCTD on the Glider**

1. “Installing the GPCTD on the Glider Frame” (page 50)
2. “Connecting the GPCTD Assembly to the Glider” (page 51).

# Placing the Glider on the Glider Support Stand

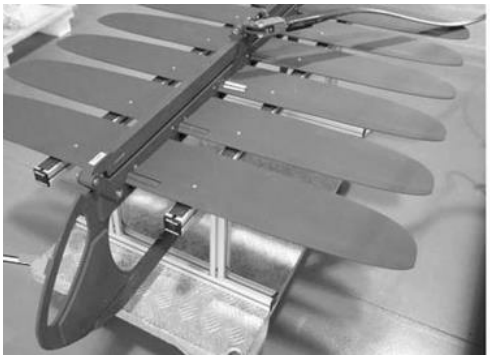
**Before You Begin**

Before removing the GPCTD from the Glider, the Glider must be installed on the Glider support stand that ships with the Wave Glider.

**Description of Work**

1. Place the Glider on the support stand.

### Figure 9.24. Glider on Support Stand



This completes the procedure for placing the Glider on the support stand.

# Disconnecting the GPCTD Assembly from the Glider

**Before You Begin**

To disconnect the GPCTD, the Glider must be placed on the Glider support stand.

## Note

For detailed instructions see “Placing the Glider on the Glider Support Stand” (page 47).

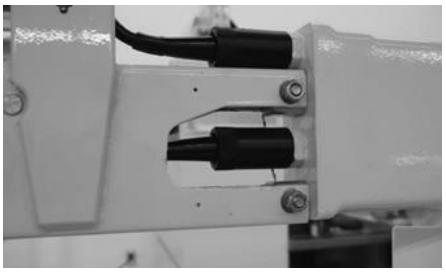
## Warning

Before working on the Wave Glider, make sure that you have powered off the vehicle by disconnecting the shorting plug from the battery switch on the C&C dry box.

**Description of Work**

1. Disconnect the cable clamp and remove the screws.
2. Unscrew the locking sleeve and unplug the GPCTD subconn from the Glider.

### Figure 9.25. GPCTD SubConn Connector to Glider with Cable Clamp



3. Remove the cable from the cable frame.

This completes the procedure for disconnecting the GPCTD assembly.

# Removing the GPCTD from the Glider Frame

**Before You Begin**

To remove the GPCTD from the Glider frame, the GPCTD must be disconnected from the Glider.

## Note

For detailed instructions see “Disconnecting the GPCTD Assembly from the Glider” (page 48)

**Description of Work**

1. Remove the screws attaching the front and rear fairings to the Glider frame.

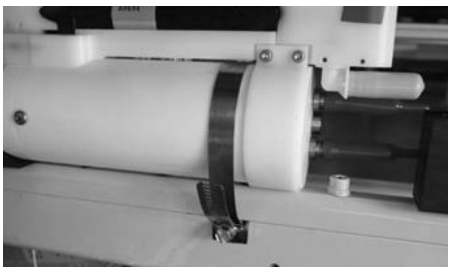
### Figure 9.26. GPCTD Front and Back Fairings

2. If the optional pump is installed, remove the clamp attaching the pump to the pump bracket.

### Figure 9.27. Optional Pump with Clamp

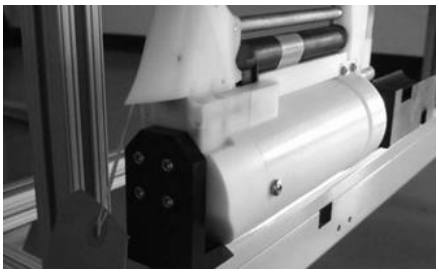
3. Remove the clamp attaching the GPCTD to Glider frame.

### Figure 9.28. GPCTD with Clamp



4. Remove the 4 screws attaching the GPCTD to the GPCTD bracket.

### Figure 9.29. GPCTD Bracket and Attachment Screws



5. Remove the GPCTD from the bracket.

This completes the procedure for removing the GPCTD from the Glider frame.

# Installing the GPCTD on the Glider Frame

**Before You Begin**

To remove the GPCTD from the Glider frame, the Glider must be placed on the Glider support stand.

## Note

For detailed instructions see “Placing the Glider on the Glider Support Stand” (page 47)

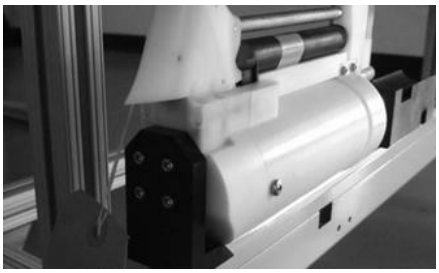
## Warning

Before working on the Wave Glider, make sure that you have powered off the vehicle by disconnecting the shorting plug from the battery switch on the C&C dry box.

**Description of Work**

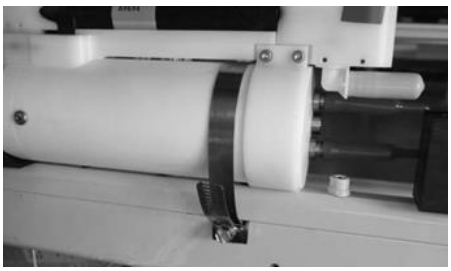
1. Place the GPCTD on the GPCTD bracket.
2. Install the four screws attaching the GPCTD to the bracket. Make sure the GPCTD is aligned with the Glider frame.

### Figure 9.30. GPCTD Bracket and Attachment Screws



3. Install the clamp attaching the GPCTD to Glider frame. Make sure screw head on hose clamp is on the port side of Glider. Tighten firmly.

### Figure 9.31. GPCTD with Clamp



4. If the optional pump is included, place the pump on the pump bracket.
5. Install the clamp attaching the pump to the pump bracket.

### Figure 9.32. Optional Pump with Clamp

6. Place the front and rear fairings over the GPCTD.
7. Adjust pump (using the outlet), such that the pump does not interfere with the back fairing.
8. Install the screws attaching the front and rear fairings to the Glider frame using blue Loctite.

### Figure 9.33. GPCTD Front and Back Fairings

This completes the procedure for installing the GPCTD on the Glider frame.

# Connecting the GPCTD Assembly to the Glider

**Before You Begin**

To connect the GPCTD, the GPCTD must be installed on the Glider frame.

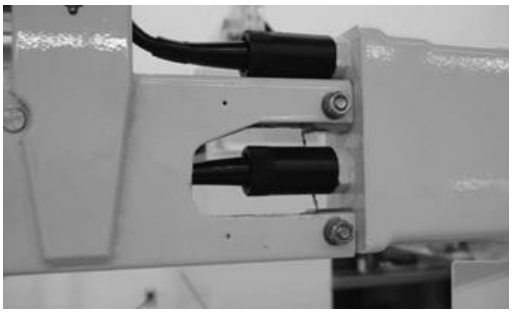
## Note

For detailed instructions see “Installing the GPCTD on the Glider Frame” (page 50)

**Description of Work**

1. Attach the locking sleeve to the subconn cable.
2. Spray the GPCTD subconn cable and the female connector on the Glider with 3M silicone lubricant spray.
3. Feed the cable through the Glider frame.
4. Plug the GPCTD subconn cable into the female connector on the Glider.
5. Secure the locking sleeve.

### Figure 9.34. GPCTD Subconn Connector to Glider with Cable Clamp



6. Clamp the GPCTD subconn cable using cable clamp. Pull any slack out of the cable between the clamp and the connection to the Glider (so that the self-fusing tape and heat shrink are sitting on the edge of the slot the cable passes through).
7. Insert clamp screws using blue Loctite.
8. Push the clamp up, firmly securing the cable.
9. Tighten screws with 14 in-lbs torque.

This completes the procedure for connecting the GPCTD assembly.

# Appendix A. PIB and PM Slot Configuration Commands

## Overview

The LRI payload electronics architecture for Wave Glider SV2 vehicles includes a Payload Interface Board (PIB) with an 8 bit Atmel processor. Each PIB has three slots that can accommodate up to three generic device interface boards known as Personality Modules. A Personality Module (PM) provides a power and communications interface between a sensor (or other payload device) and the PIB. Each PM slot is configured to meet the power and data transmission requirements for the sensor or payload device it is connected to. For more information on PIB and PM electronics see the "Payload Development - Hardware Environment" chapter in the *Wave Glider SV2 Interface Control Description*.

On legacy Wave Glider SV2 vehicles, several LRI sensor-specific applications run on PIBs providing a management and communications interface between WGMS and sensors that LRI has integrated into the Wave Glider platform. On more recent Wave Glider SV2 vehicles, a single board computer known as a System Management Computer (SMC) is connected to a PM on a PIB with LRI sensor-specific applications running on the SMC Linux operating system.

This appendix provides information on the commands used to configure the PIB and its PM slots. This appendix does not provide information on LRI sensor-specific commands for managing LRI integrated sensor payloads.

## Issuing PIB and PM Slot Configuration Commands

PIB and PM slot configuration commands are associated with several small programs that run on each PIB:

- PIBs are managed by the PIB program. The PIB program runs constantly when a PIB is powered on.
- The EMPTY program designates an unused PM slot as "empty." Issuing an EMPTY -i command to this PM slot will return a Console Data ACK containing the string `Dummy Sensor`. For more information see the section called “Empty ID”.
- The COMM program configures a PM slot to allow a connected device to communicate using the LRI payload communications protocol.
- The POWER program turns power to the PM slot on or off.
- The SMC program sets up a PM slot for a System Management Computer.
- The 37SI program is a sensor-specific application for managing the Seabird 37SI CTD sensor.
- The CTD program is a sensor-specific application for managing the Seabird GPCTD sensor.

- The C3 program is a sensor-specific application for managing the Turner C3 sensor.
- The ATM program is a sensor-specific application for managing the Teledyne ATM-88X Modem.
- The CO2 program is a sensor-specific application for managing the MBARI CO2 sensor.

PIB and PM slot configuration commands are sent from WGMS to the Wave Glider C&C using a Vehicle Command Form. All commands are sent to a combined Board Address and Task ID. The Board Address identifies a specific PIB and the Task ID is used to direct the command to the PIB, or to one of the PM slots on that PIB. Sensor-specific or payload device-specific commands must also be addressed to a PIB and the PM slot on that PIB where the sensor or payload device is connected.

To issue a command:

1. Select the **`Write Console Script`** command in the **Command Type** drop-down menu of the **Vehicle Command** tab.
2. Enter some text in the **Command Reason** field. This is a free-form field, but it is also a required field. If you enter nothing, you will not be able to issue the command.
3. Enter the decimal version of the combined Board Address/Task ID for a specific PIB or one of the PMs attached to it into the **Board Address** field.

   The combined Board Address/Task ID consists of two hexidecimal values. The first value is the Board ID for the PIB you want to issue a command to. The Board ID will be between `0x00` and `0xFF` - exclusive.

   The second value is the Task ID. The Task ID for a PIB is `00`. The Task IDs for each of the PM slots on a PIB are `01`, `02`, and `03`.

   For example:

   The combined Board ID/Task ID for a PIB with a Board ID of `0x01` would be `0x0100`. To determine the decimal version, multiply the Board ID value by 256 and add the Task ID {(01)(256) + 00}. The result is 256 . This is the number you would enter into the **Board Address** field on the **Vehicle Command** tab.

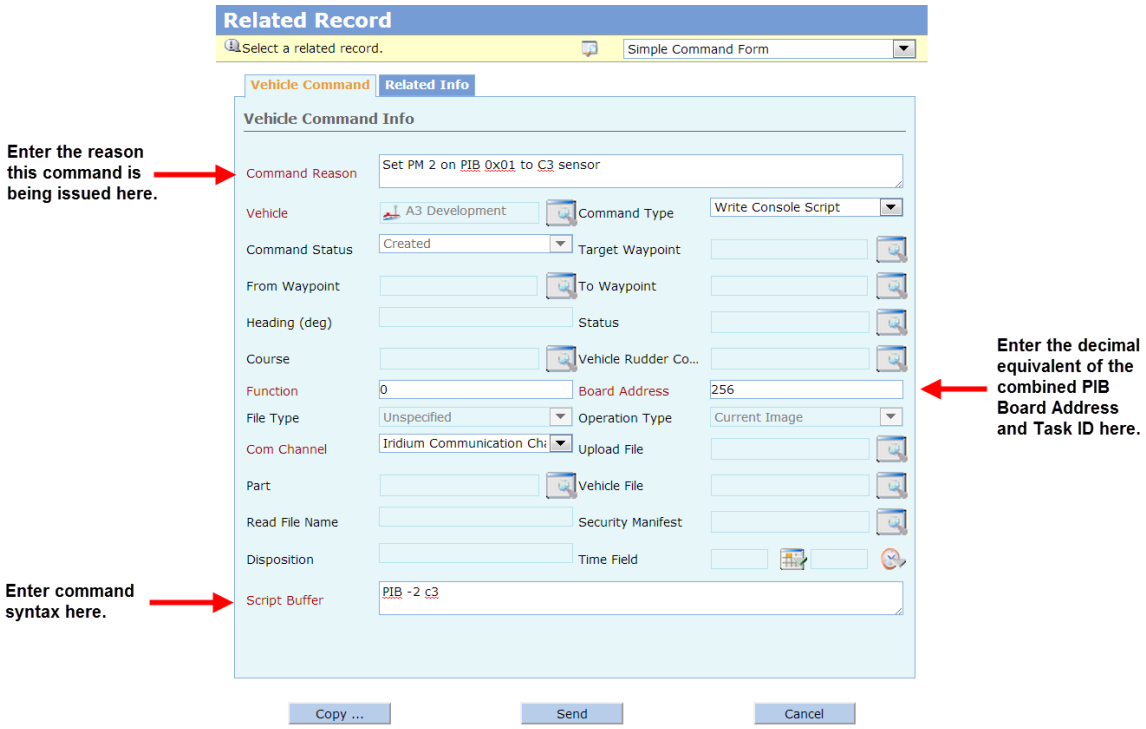
   If the Board ID for the PIB is `0x02`, and the command is directed to PM slot `03`, the combined hexidecimal values would be `0x0203`. To determine the decimal version, multiply the Board ID value by 256 and add the Task ID {(02)(256) + 03}. The result is 515. This is the number you would enter into the **Board Address** field on the **Vehicle Command** tab.
4. Enter the command you want to issue into the Script Buffer field in the Vehicle Command tab.
5. Click **Send** to issue the command.

## Note

PIB commands must be sent one at a time.

**All PIB commands are case-insensitive. Upper case characters are used in command syntax and examples for emphasis only.**

**Figure A.1. Vehical Command Form**




# PIB PM Slot Configuration Commands

There are 3 commands used to configure each of up to 3 PM slots for the PMs that are connected to a PIB.

### Syntax

`PIB -1 | --pm1` [sensor]

`PIB -2 | --pm2` [sensor]

`PIB -3 | --pm3` [sensor]

### Summary

[sensor] assigns one of the PIB programs to the designated PM slot including the EMPTY program, if the PM slot is not being used.

### Semantics

These commands allow you to set the [sensor] configuration for each PM slot. The sensor parameter can be a string (case-insensitive) or a number.

| Program Setting | String | Number |
|---|---|---|
| Empty Sensor | EMPTY | 0 |
| Payload Communications | COMM | 1 |
| System Management Computer | SMC | 2 |

| | | |
|---|---|---|
| Seabird 37SI CTD | 37SI | 3 |
| Seabird GPCTD | CTD | 4 |
| Turner C3 | C3 | 5 |
| Power On/Off | POWER | 6 |
| Teledyne ATM-88X Modem | ATM | 7 |
| MBARI CO2 | CO2 | 8 |

For example, sample commands are:

**PIB -3 ctd** This command tells the PIB to configure PM slot 3 with the Seabird GPCTD sensor-specific program.

**PIB --pm2 SMC** This command tells the PIB to configure PM slot 2 with the SMC program.

**PIB --pm1 0** This command tells the PIB to run the EMPTY program on PM slot 1. Note, the EMPTY program should be used for PMs that are not connected to anything. A PM configured with the Empty Sensor setting can only respond to an Empty ID command. For more information see the section called “Empty ID”.

Upon receiving a command for one of its PM slots, the PIB program will compare the current setting for that PM slot to the command argument (desired setting). If they are the same, no action will be taken. If they are different, the PIB program will clear the EEPROM allotted to that task and end the task. If the command is successful, the PIB program will send a Console Data ACK back to shore with the current PM slot configuration. Note that this configuration does not reflect what is currently running on the PIB, instead it reflects the program that will be loaded the next time the PIB is started. The desired program is stored in the PIB non-volatile memory and will run on the designated PM after a re-boot.

If the command is unsuccessful for any reason, the PIB will return a NAK. The most common cause of a NAK is an attempt to set an invalid sensor.

### Note

The PM configuration commands will NOT start the assigned programs, these commands are only for configuring the PM slots. Configuration setting changes will not take effect until the PIB is re-booted. The Power On/Off command must be used to start or stop the program assigned to a PM slot.

## Reading the PIB Configuration

**Syntax**

```
PIB -c | --cfg
```

**Summary**

Returns the current PM slot configuration.

**Semantics**

The PIB will return a Console Data ACK with the sensor configuration that is stored in the PIB nonvolatile memory. This is not necessarily the current setting - it is the setting that will run the next time the PIB is started. The response syntax is:

PM1=[*Sensor*] PM2=[*Sensor*] PM3=[*Sensor*]

For example, a response could be:

PM1=C3 PM2=SMC PM3=CTD

# PIB boardID

**Syntax**

`PIB -b | --boardID` [*boardID*]

**Summary**

Sets the board ID for the PIB.

**Semantics**

This command will set the board ID for the PIB. This ID must be between 0x00 and 0xFF, exclusive - otherwise the command will NAK. This board ID is stored in the PIB nonvolatile memory. The PIB will respond with a Console Data ACK containing an empty message.

## Note

This command will NOT take effect until the PIB is re-booted (power is cycled on the payload port). Commands sent to the PIB or any of its assigned sensors or functions must be addressed to the previous board ID, until power is cycled and the PIB re-boots at which time the new board ID will be set.

# PIB setDly

**Syntax**

`PIB -d | --setDly` [delayTime]

**Summary**

Sets the power down delay time to gracefully shut down the payloads (sensors or devices) connected to the PMs on the PIB. When the C&C receives a command to turn off the power to a payload port, the longest power down delay associated with a PIB connected to that port will determine the power down delay for the port.

**Semantics**

This command will set the power down delay time from 0 to 255 seconds. The power down delay time will be sent to the C&C the next time the PIB receives a power down notification. It is stored in the PIB nonvolatile memory.

# PIB ID

**Syntax**

`PIB -d | --id`

**Summary**

Returns PIB identification information.

**Semantics**

This command will respond with a Console Data ACK that contains identification information, including the board ID and the power down delay time. For example:

```
PIB ver. 2.0.341. Board ID = 0x01. Power Down Delay = 1 sec.
```

Note that the board ID will not necessarily be the current board ID; it will be the board ID setting that will be used the next time power to the PIB is cycled.

# PM Slot Commands

PM slot commands are a sub-set of PIB commands that designate unused PM slots, or configure power for PM slots connected to payloads that are not managed by an LRI sensor-specific application.

## Empty ID

**Syntax**

```
EMPTY -i | --id
```

**Summary**

Used to determine if there is nothing connected to a PM.

**Semantics**

If the `[sensor]` variable in any of the the section called “PIB PM Slot Configuration Commands” is set to `EMPTY` or `0`, the EMPTY id command will return a Console Data ACK containing the string `Dummy Sensor`. Any other command sent to this PM will return a NAK.

## Power On

**Syntax**

```
POWER -o | --on
```

**Summary**

Powers on the PM.

**Semantics**

This command will turn on the PM and then return a Console Data ACK indicating whether power is on or off.

## Power Off

**Syntax**

```
POWER -f | --off
```

**Summary**

Power off the personality module.

**Semantics**

This command will turn off the personality module. It will then return an Ack Console Data indicating whether power is on or off.

# Power AutoRun (mode)

**Syntax**

```
POWER -a | --autorun [mode]
```

**Summary**

Sets the Autorun mode.

**Semantics**

This command will turn the AutoRun feature On or Off. When AutoRun is On, the PM will be powered on when the PIB starts up. When Autorun is Off, the PM will not be powered on when the PIB starts. After the PIB is running, the power state can always be changed by sending a Power On or Power Off command. Valid parameters for the AutoRun command are `On, Yes, 1,` for Power On, or `Off, No, 0` for Power Off.

# Power Status

**Syntax**

```
POWER -s | --status
```

**Summary**

Sends back whether power is on or off.

**Semantics**

This command will return an Ack Console Data indicating whether power is on or off.

# Power ID

**Syntax**

```
POWER -i | --id
```

**Summary**

Sends back identification.

**Semantics**

This command will return an Ack Console Data containing identification.

# Glossary

This glossary defines Wave Glider and GPCTD terms that are used in this manual.

| | |
|---|---|
| C&C | Command and Control module: The C&C is located in the center dry box, which also houses the primary control electronics. The C&C transfers information between the SMC to WGMS. |
| GPCTD | Sea-Bird Electronics Glider Payload GPCTD that collects conductivity, temperature, and pressure data (and optionally dissolved oxygen data). |
| Iridium modem | Modem communicating with the Iridium satellite constellation. |
| Wave Glider | A marine robot developed by Liquid Robotics. |
| WGMS | Wave Glider Management System. WGMS provides applications and programming interfaces for users to send commands to, and receive data from, the Wave Glider and its payloads. |