

Wave Glider® SV3 Integrated Sensor User Guide

Leopard Camera Interface

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**LIQUID
ROBOTICS**

Wave Glider® SV3 Integrated Sensor User Guide: Leopard Camera Interface

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The Wave Glider mechanism is patented under US Patent Number 7,371,136 and other patents pending. All aspects of the Wave Glider product have been developed at private expense by Liquid Robotics, Inc.

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Acknowledgements

The Leopard Camera Kit option on the Wave Glider SV3 is a Liquid Robotics implementation of the Leopard Imaging, Inc. Li-M38-IMX136 camera.

Revision History

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06116	A	June 2014	This is the initial release of this document.

Table of Contents

Preface	v
1. Overview	1
2. Leopard Camera Commands	3
Leopard Camera Command Reference	3
Cancel All Periodic Pictures	3
Get Scheduled Pictures Info	3
Manage thumbnail for one periodic picture	4
Schedule Periodic Pictures	4
Set the thumbnail scaling factor	5
Take Photo Now	5
Take Photo of	6
Turn to Heading and Take a Photo	6
Turn Camera On (Expert Command)	7
Turn Camera Off (Expert Command)	7
SV3 WGMS Leopard Camera User Interface	8
3. Pre-Launch Checklist	10

List of Figures

1.1. Leopard Camera Mount (Attaches to Wave Glider SV3 Float Deck)	1
2.1. WGMS SV3 Commands Window - Camera UI	8
2.2. WGMS Camera UI Extended	9

Preface

This guide provides information on operating the Leopard camera included in the forward facing Leopard Camera Kit, LRI part number LR-1036. The Leopard Camera Kit includes a Leopard Imaging, Inc. Li-M38-IMX136 camera, a Regulus software plug-in to facilitate the camera UI, and a custom camera mount for the Wave Glider SV3. In this guide, the Leopard Imaging, Inc. Li-M38-IMX136 camera is referred to simply as the "Leopard camera", or "the camera."

This guide assumes a working familiarity with the Liquid Robotics Wave Glider SV3. The focus is primarily on information specific to the Leopard camera user interface (UI).

The specifications for the Leopard Imaging, Inc. Li-M38-IMX136 camera are available on the Leopard Imaging, Inc. Web site at: <https://www.leopardimaging.com/LI-M38-IMX136.html>

Liquid Robotics manuals are available on the documentation CD included with each Wave Glider vehicle and by contacting the Liquid Robotics Support Organization at:

- Telephone:

(US) 888-574-4574

(International) 1-408-636-4205

- Email: support@liquidr.com

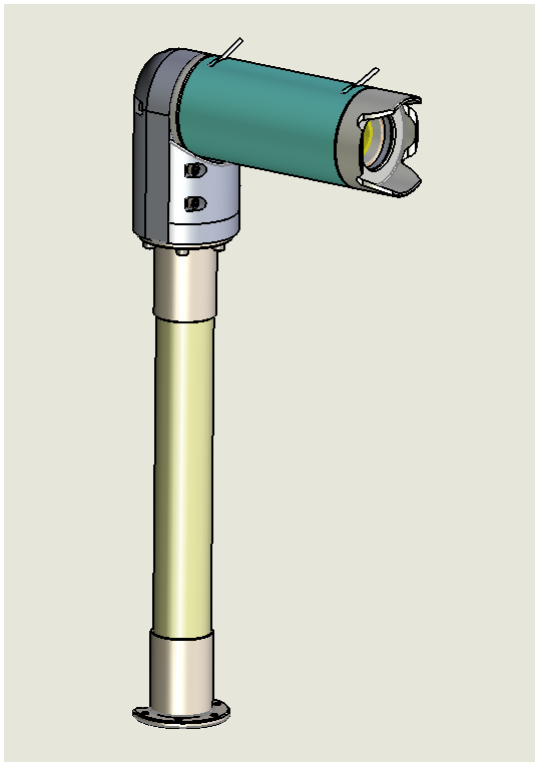
Before contacting LRI support, please have available the serial number of the vehicle(s) or part(s) that you are contacting LRI Customer Support about.

Chapter 1. Overview

When you purchase a Wave Glider SV3 with the integrated Leopard camera option:

- The Leopard camera is pre-installed in a specially designed mount and plugged into the G1 Expansion Port on the CCU. The Leopard camera mount is fixed in a single orientation facing forward on the Wave Glider SV3 Float.
- The Leopard camera is registered with Regulus.
- The Leopard camera software plug-in is installed on Regulus.
- The Leopard camera commands appear in the WGMS **SV3 Commands Window** on the **leopardCamera_camera** tab in the **Services** menu. For more information see [“SV3 WGMS Leopard Camera User Interface”](#) (page 8).

Figure 1.1. Leopard Camera Mount (Attaches to Wave Glider SV3 Float Deck)



The Liquid Robotics UI for the Wave Glider SV3 integrated Leopard camera enables you to:

- Schedule pictures to be taken automatically at regular intervals. For more information, see the [“Schedule Periodic Pictures”](#) (page 4) command. You can use the [“Cancel All Periodic Pictures”](#) (page 3) command to stop periodic picture taking.
- Take a picture at any time. For more information, see the following commands:
 - [“Take Photo Now”](#) (page 5)

- “**Take Photo of**” (page 6)
- “**Turn to Heading and Take a Photo**” (page 6)



Note

Using these commands to take a picture will not interrupt any scheduled picture taking that has been configured using the **Schedule Periodic Pictures** command.

- Send picture thumbnails over Iridium to WGMS. You can send a thumbnail for any photo, or for all photos. For more information see the “**Manage thumbnail for one periodic picture**” (page 4) command.
- Set the scaling factor for picture thumbnails. For more information see the “**Set the thumbnail scaling factor**” (page 5) command.
- Query the Leopard camera software to determine if scheduled picture taking is enabled and if any thumbnail transmission settings have been made. For more information see the “**Get Scheduled Pictures Info**” (page 3) command.



Note

To conserve energy, the Leopard camera software manages the ON/OFF status of the camera. The camera automatically turned ON to take photos, and otherwise remains in the OFF state. This is why “**Turn Camera On (Expert Command)**” (page 7) and “**Turn Camera Off (Expert Command)**” (page 7) are considered Expert level commands.

Chapter 2. Leopard Camera Commands

This chapter is a reference for all of the Leopard camera commands. For information on how these commands appear in the WGMS SV3 Commands Window see [“SV3 WGMS Leopard Camera User Interface” \(page 8\)](#).

The Leopard camera commands will not appear in the remote application UI (for example the WGMS UI) unless the Leopard camera is properly connected to the CCU and has been registered with Regulus. If you receive an Unable to find leopardCamera_camera console command NACK, the camera may not be properly registered with Regulus. If you believe the camera is installed correctly and properly registered, try rebooting Regulus. If that doesn't work, contact LRI customer support.



Note

For all commands accepting the (HHmm) UTC format, entries must be between "0000" and "2400". If "100" is entered for 1 AM, it will be rejected; you must enter "0100". Console command entries must include quotation marks around the "HHmm". **Do not include quotation marks when entering HHmm values in the SV3 Commands Window fields..**

Leopard Camera Command Reference

Cancel All Periodic Pictures

Cancels periodic pictures that have been scheduled (but not yet taken) using the **Schedule Periodic Pictures** command. To resume a periodic picture schedule, a **Schedule Periodic Pictures** command must be issued.

Console Command	<code>%leopardCamera_camera.cancelPeriodicPictures()</code>
Example	<code>%leopardCamera_camera.cancelPeriodicPictures()</code>
Expected Output	ACK: • Canceled all periodic pictures • Periodic pictures already cleared
Reports	None

Get Scheduled Pictures Info

Returns information on scheduled tasks.

Console Command	<code>%leopardCamera_camera.getScheduledInfo()</code>
Example	<code>%leopardCamera_camera.getScheduledInfo()</code>
Expected Output	ACK: • EXAMPLE: Take pictures between 2014-06-10T13:20Z and 2014-06-11T03:20Z. Thumbnail setting is first. The period in minutes is 60. Thumbnails sent at 2014-06-10T13:20Z

	• There are no scheduled periodic pictures
Reports	None

Manage thumbnail for one periodic picture

Scheduled pictures are specified in UTC times by `schedulePeriodicPictures`. Once scheduled, individual photos can be set up to send a thumbnail to WGMS with this function. The time format is "HHmm" "HH" hours and "mm" minutes in UTC, e.g. "1300". Include quotation marks when typing "HHmm".

Console Command	%leopardCamera_camera.managePeriodicPictureThumbnail(Periodic Picture Time "HHmm", Send Thumbnail) • Periodic Picture Time (HHmm) UTC, for example, "1300". The time range must be between "0000" and "2400". If "100" is entered for 1 AM, it will be rejected; you must enter "0100". Entries must include quotation marks around the "HHmm". • Send thumbnail to the remote application (WGMS). Enter 0 for NO, or 1 for YES.
Example	%leopardCamera_camera.managePeriodicPictureThumbnail ("1520", 1)
Expected Output	ACK: • EXAMPLE: Able to change thumbnail to true at 1520 • EXAMPLE: Unable to modify thumbnail setting at 1520
Reports	None

Schedule Periodic Pictures

Schedules pictures to be taken periodically between the start time (UTC) and the end time (UTC) at equal intervals (in minutes). The time format is "HHmm" ("HH" hours and "mm" minutes in UTC), for example, 1300 would be 1 PM. By default, no thumbnails are sent to WGMS. Periods (intervals) of less than one minute will be rejected. If the period is between one minute and four minutes, the Wave Glider will keep the camera on while taking periodic pictures. Otherwise, the camera will be turned off after each photo is taken to conserve energy.

Console Command	%leopardCamera_camera.schedulePeriodicPictures(Start Time "HHmm", End Time "HHmm", Period (Minutes), Thumbnail Setting) • Daily Start Time (HHmm) UTC – Must be four characters inside of quotes, for example: "1300" and not "100" or 100. • Daily End Time (HHmm) UTC • Period in Minutes • Thumbnail Setting: – all - All periodic pictures send a thumbnail over Iridium to WGMS.
------------------------	---

	WARNING: Sending thumbnails over the Iridium communications channel is EXPENSIVE. Transmitting one thumbnail could cost \$20.00 at \$1.00 per 1KB for Iridium. – first - Send the first thumbnail of the day to WGMS – none - Do not send thumbnails
Example	<code>%leopardCamera_camera.schedulePeriodicPictures("1320", "0320", 60, "first")</code>
Expected Output	ACK: • Success - Returns the output from the Get Scheduled Pictures Info command. • Unable to take pictures at a frequency less than 60 seconds - Returns: The period setting is too short. • Unable to take pictures at a frequency more than 24 hours - Returns: The period is too long. • Schedule Periodic Pictures unable to parse the given times - Start "100" and end "0". Expected format of "HHmm". Returns: Start and/or end time is not formatted correctly.
Reports	• Alarm: Failed to schedule periodic pictures - Check the parameters of the command you issued. If the command syntax is correct, report as a software bug.

Set the thumbnail scaling factor

Sets the scaling factor applied to thumbnails sent to WGMS. A factor of 5 will be 1/5th original image size. The supported range for this setting is whole numbers between 4 and 20.

Console Command	<code>%leopardCamera_camera.setThumbnailScalingFactor(Scaling Factor)</code> • Scaling Factor: A number between 4 and 20
Example	<code>%leopardCamera_camera.setThumbnailScalingFactor(6)</code>
Expected Output	ACK: • EXAMPLE: Set scaling factor to 6 • Did not set scaling factor. Must be between 4 and 20.
Reports	None

Take Photo Now

The Wave Glider will turn the camera on, take a photo, store the photo on the CCU, and turn the camera off. Optionally, a thumbnail will be sent to the remote application (WGMS). If the camera is already turned on when the **Take Photo Now** command was issued, it will not be turned off.

Console Command	%leopardCamera_camera.takePhotoNow(Send Thumbnail) • Send thumbnail to the remote application (WGMS). Enter 0 for NO, or 1 for YES.
Example	%leopardCamera_camera.takePhotoNow(1)
Expected Output	ACK: • Took a Photo • "Photo failure: " + java exception – It couldn't connect to the camera. – Is it plugged in? Are the settings correct? • "Failed to generate thumbnail." – Contact customer support.
Reports	• Alarm: Failed to generate thumbnail - Report as a software bug. • Alarm: Photo failure + java exception - Report as a software bug.

Take Photo of

The Wave Glider will turn toward the specified coordinates, turn the camera on, and call **Take Photo Now**. After a photo is taken, the Wave Glider will turn the camera off and resume the course it was on before the **Take Photo of** command was issued.

Console Command	%leopardCamera_camera.takePhotoOf(Latitude, Longitude, Send Thumbnail) • Latitude - Enter decimal coordinates • Longitude - Enter decimal coordinates • Send Thumbnail to the remote application (WGMS). Enter 0 for NO, or 1 for YES.
Example	%leopardCamera_camera.takePhotoOf(36.996, -122.034, 1)
Expected Output	ACK: empty - relies on reports
Reports	• When starting, the camera will report a comment: Taking photo @ <latitude>, <longitude> • On completion the camera will report a comment: Took photo of the location

Turn to Heading and Take a Photo

The Wave Glider will turn toward the specified heading, turn the camera on, and call **Take Photo Now**. After a photo is taken, the Wave Glider will turn the camera off and resume the course it was on before the **Turn to Heading and Take a Photo** command was issued.

Console Command	%leopardCamera_camera.takePhotoAtHeading(Heading, Send Thumbnail) - Heading Degrees. Enter a heading from 0 to 360 degrees. - Send thumbnail to the remote application (WGMS). Enter 0 for NO, or 1 for YES.
Example	%leopardCamera_camera.takePhotoAtHeading(270, 1)
Expected Output	ACK: empty - relies on reports
Reports	- When starting the camera will report a comment: Taking photo @ heading <degrees> - On completion the camera will report a comment: Took a photo at the heading

Turn Camera On (Expert Command)

This is an Expert level command. It turns the Leopard camera on and keeps it on, allowing you to take photos in rapid succession.

Console Command	%leopardCamera_camera.on() This command has no parameters.
Example	%leopardCamera_camera.on()
Expected Output	ACK: - True Camera was already ON and is still ON. - False Camera was OFF and is now ON.
Note: The Leopard camera will wait until any photos that have been initiated are completed and the camera cycles OFF, before turning the camera ON and keeping it ON.	

Turn Camera Off (Expert Command)

Exception for "Expert Mode": When the camera is already on, it will take the photo and leave it on. Not necessary to put here I think, but important to note in the Expert Mode notes (will review below)

Console Command	%leopardCamera_camera.off()
Example	%leopardCamera_camera.off()
Expected Output	ACK: - True Camera was already OFF and is still OFF. - False

Camera was ON and is now OFF.

Note: The Leopard camera will wait until any photos that have been initiated are completed, before turning the camera OFF.

SV3 WGMS Leopard Camera User Interface

If you are using WGMS as a remote application, all of the Leopard camera commands listed in “[Leopard Camera Command Reference](#)” (page 3) will appear in the SV3 Commands Window.

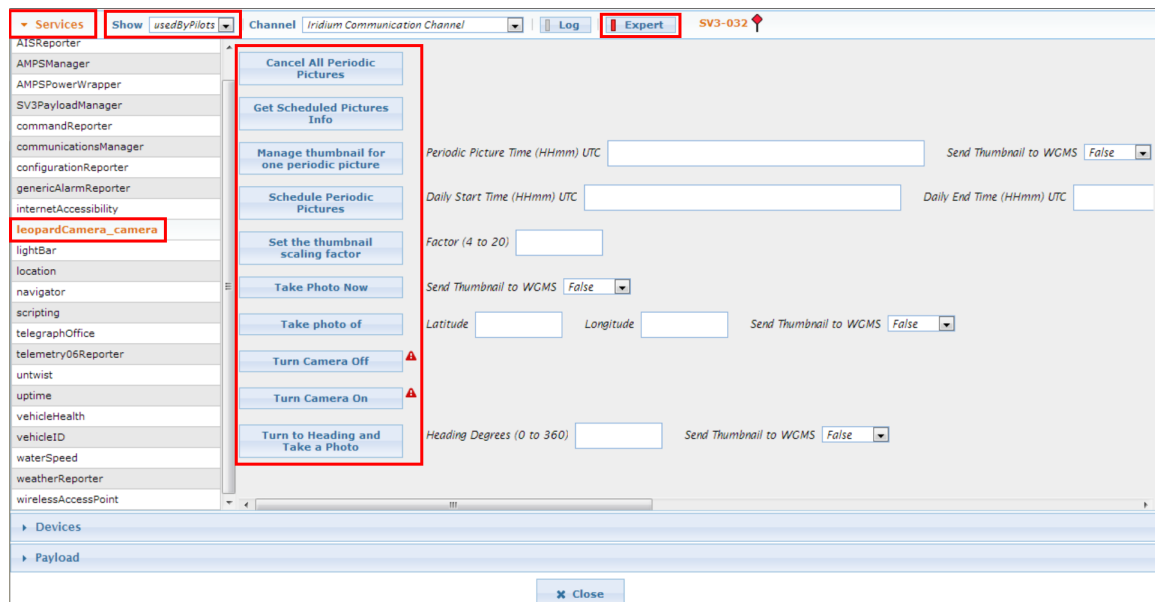
When the Leopard camera is installed on the Wave Glider SV3 and properly registered with Regulus, the **leopardCamera_camera** side tab will appear in the **Services** menu of the SV3 Commands Window as shown in [Figure 2.1](#). Notice that the **Expert** option is selected. Two Leopard camera commands, **Turn Camera Off** and **Turn Camera On** are expert commands. They are identified as expert commands by the red triangle icon, and they are displayed only when the **Expert** option is selected at the top of the SV3 Commands Window. For more information on using the WGMS SV3 Commands window see the *WGMS® User Guide*, Liquid Robotics Part Number 05910.



Note

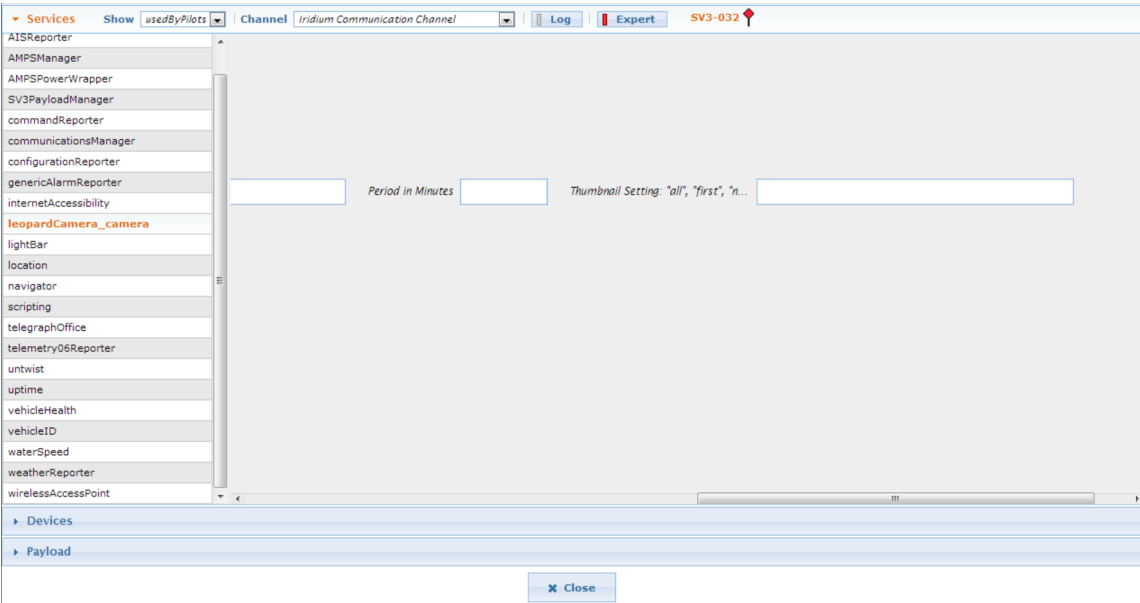
Do not include quotation marks when entering HHmm values in the SV3 Commands Window fields.

Figure 2.1. WGMS SV3 Commands Window - Camera UI



[Figure 2.2](#) is included to display fields associated with the **Manage thumbnail for one periodic picture** command that extend beyond the window frame. You will probably need to use the horizontal scroll bar to view these fields in your browser.

Figure 2.2. WGMS Camera UI Extended



Chapter 3. Pre-Launch Checklist

Before sending the Wave Glider SV3 on a mission, you should verify that the Leopard camera is working properly:

1. Issue a **GetScheduleInfo** command. If it returns an ACK, this confirms that the Leopard camera plug-in is installed.
2. Issue a **Take Photo Now(1)** command. If a thumbnail is received by the remote application (for example, WGMS), the Leopard camera is working.