



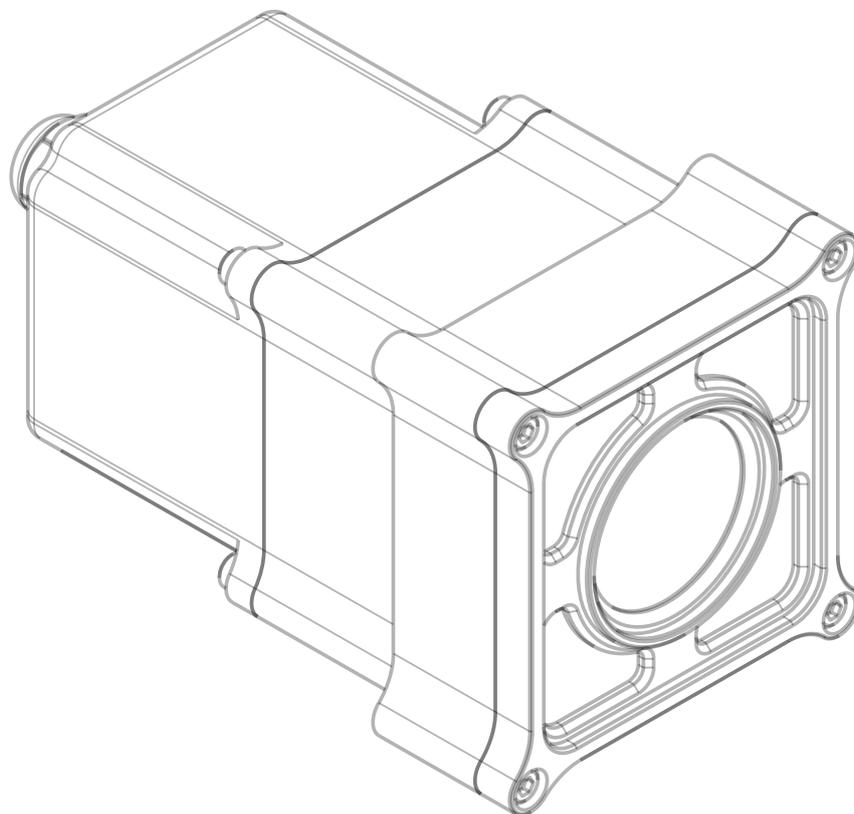
HydroCam Camera

Camera for Remote Visual

Site Inspection

User Manual

v1.2.0



Starting Point

Thank you for purchasing the Geolux HydroCam camera for remote visual site inspection! We have put together the experience of our engineers, the domain knowledge of our customers, the enthusiasm of our team, and the manufacturing excellence to deliver this product to you.

You may freely rely on our field-proven radar technology. The use of top-quality components and advanced signal processing algorithms ensures that Geolux level meter can be used in various applications and environments.

We have created this User Manual to assist you in setting up and using the Geolux instrument.

Should there be any questions left unanswered, please feel free to contact us directly:

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1 Introduction

The Geolux HydroCam camera is a 5-megapixel camera specifically designed for environmental monitoring and for working with a variety of dataloggers via a simple RS-232 communication protocol. The camera has a controllable zoom and focus lens, and automatic day/night mode operation, with IR illuminators used in night mode. The camera compresses the images using JPEG algorithm with a configurable quality parameter.

2 Electrical Characteristics

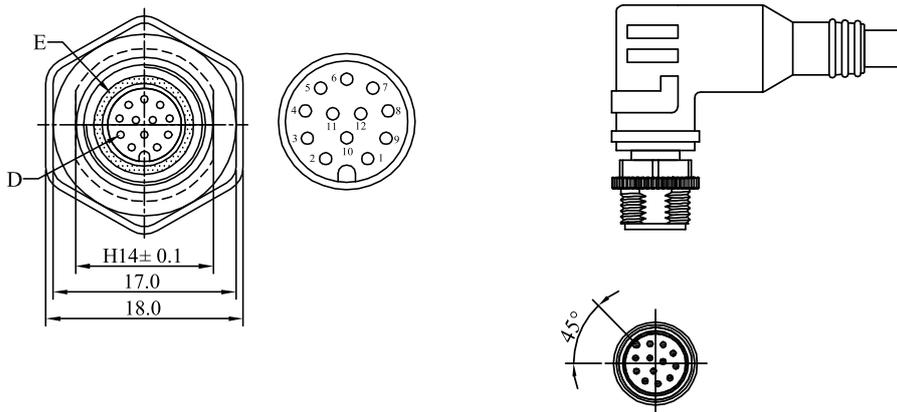
The electrical characteristics of the Geolux HydroCam camera are given in Table 1.

Table 1. Electrical Characteristics

Parameter	MIN	TYP	MAX	Unit
Communication interface RS-232 interface speed	1200		115200	bps
Power supply voltage	9.0	12.0	27.0	V
Image resolution	160x120		2592x1944	
Focal length	6		22	mm
Field of view	16.3		46.4	deg.
Minimum illumination		0.1		lux
IR-cut filter		650		nm
Current consumption		75	150	mA
Operational temperature range	-20		+85	°C
Mechanical		110x90x50		mm
Weight		600		g

3 Connector Pin-Out

The camera uses robust IP68 circular M12 connector with 12 positions and the mating cable is also delivered with the camera. The connector and cable details are shown in Picture 1 while Table 2 gives a detailed description of each pin.



Picture 1. Surface Velocity Radar Connectors

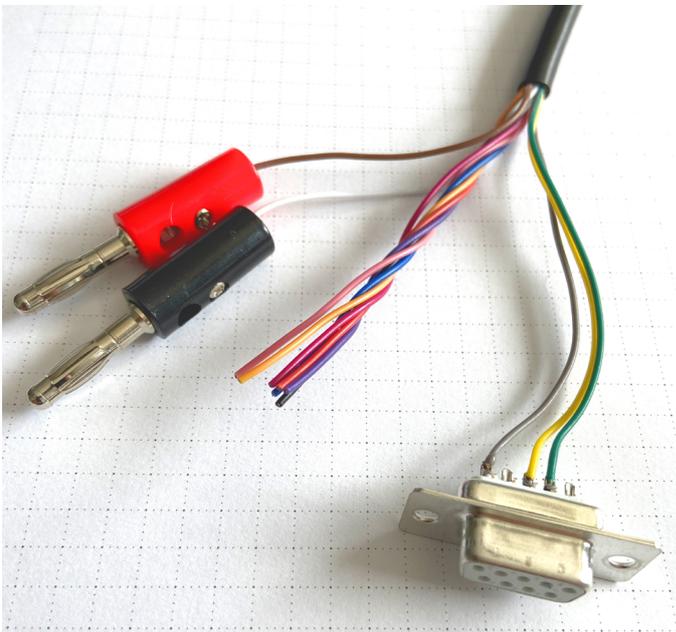
Table 2. Cable Pin-Out

Pin No.	Wire Color	Pin Name	Pin Description
1	White	GND	This pin should be connected to the ground (negative) pole of the power supply.
2	Brown	+Vin	The power supply for the HydroCam camera is provided on this pin. The HydroCam camera power supply voltage must be in the range of 9 VDC to 27 VDC, and the power supply must be able to provide at last 0.65W
3	Green	RS232 – TxD	RS-232 data transmit signal.
4	Yellow	RS232 – RxD	RS-232 data receive signal.
5	Grey	GND	Signal ground.
6	Pink	CAN – H	CAN2.0B high signal. (optional)
7	Blue	CAN – L	CAN2.0B low signal. (optional)
8	Red	SDI12 DATA	SDI12 data line
9	Orange	RS485 – D-	RS-485 data transmitter/receiver low signal.
10	Dark Red	RS485 – D+	RS-485 data transmitter/receiver high signal.
11	Black	Service RS232 - TxD	Do not connect
12	Purple	Service RS232 - RxD	Do not connect

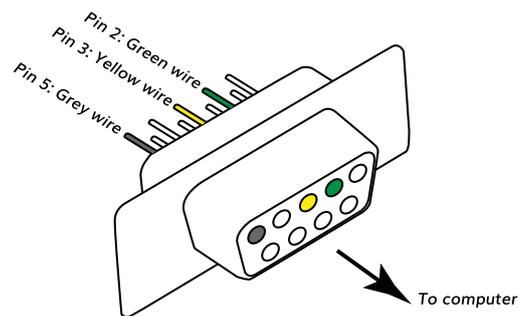
3.1. Serial RS-232 Interface

Serial RS-232 interface is implemented as standard PC full-duplex serial interface with voltage levels adequate for direct connection to PC computer or other embedded devices used for serial RS-232 communication.

In case the RS-232 interface is connected to standard DB-9 PC connector, TxD line (green wire) is connected to pin 2 and RxD (yellow wire) is connected to pin 3. For proper operation of the serial interface, additional connection of signal GND (grey wire) is required on pin 5 of the DB-9 connector.



Picture 2. Serial RS232 DB-9 Cable



Optionally Geolux can supply a cable with DB-9 connector connected to the cable but this must be specified as option when ordering the sensors.

4 Communication Protocol Description

The camera uses a standard RS-232 connection to communicate with the datalogger unit or any other device. The default RS-232 port parameters are 115200 baud rate, 8 data bits, 1 stop bit and no parity.

Immediately after the camera is powered up, it will report the current firmware version over the serial port. After that, the camera will not send any data over the serial port automatically. It will wait until a valid command is sent to the camera, and then the camera will return the response to the received command.

Each command starts with the hash character (#), and ends with carriage-return line-feed pair (denoted as <CR><LF> below).

The camera recognizes the following commands:

Command: **#take_snapshot<CR><LF>**
 Response: **#take_snapshot:STATUS<CR><LF>**

This command requests that the camera starts taking the next snapshot. Immediately after the command is received, the camera will return the response with the current status, which can be **OK**, **ERR** or **BUSY**. If the response is **OK**, this means that the camera is now in the process of taking the snapshot and compressing it to JPEG. If the response is **BUSY**, this means that a previous **#take_snapshot**, **#move_zoom**, or **#move_focus** command has not yet been completed, or the camera is waiting for auto exposure process to determine the best possible exposure for current environment conditions. The **ERR** response indicates a general error, and the **#take_snapshot** command should be sent again to retry the operation. After sending the **#take_snapshot** command, the **#get_status** command should be periodically sent to check when the snapshot is ready for download.

Command: **#get_status<CR><LF>**
 Response: **#get_status:STATUS,SIZE<CR><LF>**

This command checks the current snapshot status. The reported status can be any of the following: **NONE**, **BUSY** or **READY**. The returned status will be **NONE** if no previous **#take_snapshot** command was issued, and in that case the reported size will be zero. The returned status will be **BUSY** (and the reported size will be zero) after the **#take_snapshot** command is issued, but before the compressed JPEG image is ready for retrieval. The status will be **READY** after the snapshot is completed, and the compressed JPEG image can be retrieved by sending the **#get_image** command. When the status is **READY**, the size will be set to the JPEG image size in bytes.

Command: **#get_image=OFFSET,LENGTH,FORMAT<CR><LF>**
 Response: **IMAGE_DATA**

This command requests the camera to send the image data chunk. The image is sent in JPEG format, and can be sent only after the **#get_status** command returns the status **READY**. Three parameters need to be supplied to the camera. The **OFFSET** parameter is the starting offset of the chunk in JPEG image data. The **LENGTH** parameter is the requested length in bytes of the data chunk to be sent while the **FORMAT** parameter specifies which format the camera should use to transmit the data chunk, and is set to **RAW**. If **OFFSET** and **LENGTH** parameters are set so that a part of the chunk (or the whole chunk) is beyond the end of the image data, the camera will return the requested number of bytes, but bytes beyond the end of image will be sent as zeros.

Command: **#reset<CR><LF>**
 Response: **#reset:OK<CR><LF>**

This command requests the camera to perform a software reset.

Command: **#get_info<CR><LF>**
 Response: **#firmware:2.1.7<CR><LF>**
#serial_id:000073<CR><LF>
#resolution:1600x1200<CR><LF>
#quality:83<CR><LF>
#night_mode:auto|on|off<CR><LF>
#ir_filter:day|night<CR><LF>
#exposure:723<CR><LF>
#device_type:2

This command requests the camera to send the current status. The following information is reported by the camera:

- Current firmware version, as three numbers spaced by a dot character
- Unique serial camera number, as a zero-padded 6 digit number
- Currently configured image resolution
- Currently configured JPEG quality which can be in the range between 1 and 100
- Night mode setting, which can either be **always on**, **always off**, or **automatic** based on the background illumination level (automatic is preferred)
- IR filter status (this parameter cannot be changed), whether the IR filter is in **day** or **night** mode; if night mode parameter is set to **on**, then the IR filter will always be in night mode; if night mode parameter is set to **off**, then IR filter will always be in day mode, and if night mode parameter is set to **auto**, then the IR filter status will change depending on the background illumination level
- Exposure is the current, read-only, camera exposure level which is automatically determined by the camera, in the range between 0 and 4000
- Device type - always 2

Command: **#set_resolution=RESOLUTION<CR><LF>**
 Response: **#set_resolution:STATUS<CR><LF>**

This command changes the image resolution. The **RESOLUTION** parameter can be any of the following:

160x120
320x240
640x480
800x600
1024x768
1280x960
1600x1200
1920x1080
2048x1536
2592x1944

The **STATUS** parameter can be either **OK** or **ERR**, in case the given parameter is invalid.

Command: **#set_quality=QUALITY<CR><LF>**
 Response: **#set_quality:STATUS<CR><LF>**

This command changes the JPEG quality parameter, which can be in the range between 1 and 100. 100 corresponds to the best image quality with the biggest file size, and lower numbers will give stronger compression. The recommended setting is in the range of 70-80. The returned **STATUS** can be **OK** or **ERR**, if the given parameter is invalid.

Command: **#set_night_mode=MODE<CR><LF>**
 Response: **#set_night_mode:STATUS<CR><LF>**

Changes the camera mode according to the given **MODE** parameter which can be either **off**, **on** or **auto**. In **off** mode, the IR filter in the camera is always active. In **on** mode, the IR filter is disabled and the camera gives a black and white image. In **auto** mode, the camera measures the current level of environmental illumination and automatically selects the optimal mode for the IR filter. The returned **STATUS** can be **OK** or **ERR**, if the given parameter is invalid.

Command: **#set_ir_led_mode=MODE<CR><LF>**
 Response: **#set_ir_led_mode:STATUS<CR><LF>**

Changes the camera's IR LED mode according to the given **MODE** parameter which can be either **off**, **on** or **auto**. In **off** mode, the IR LEDs are always off. In **on** mode, the IR LEDs are on during the night, and off during the day. In **auto** mode, the IR LEDs are active only during image acquisition, autofocus or manual zoom or focus operations. The returned **STATUS** can be **OK** or **ERR**, if the given parameter is invalid.

Command: **#move_focus=OFFSET<CR><LF>**
Response: **#move_focus:STATUS<CR><LF>**

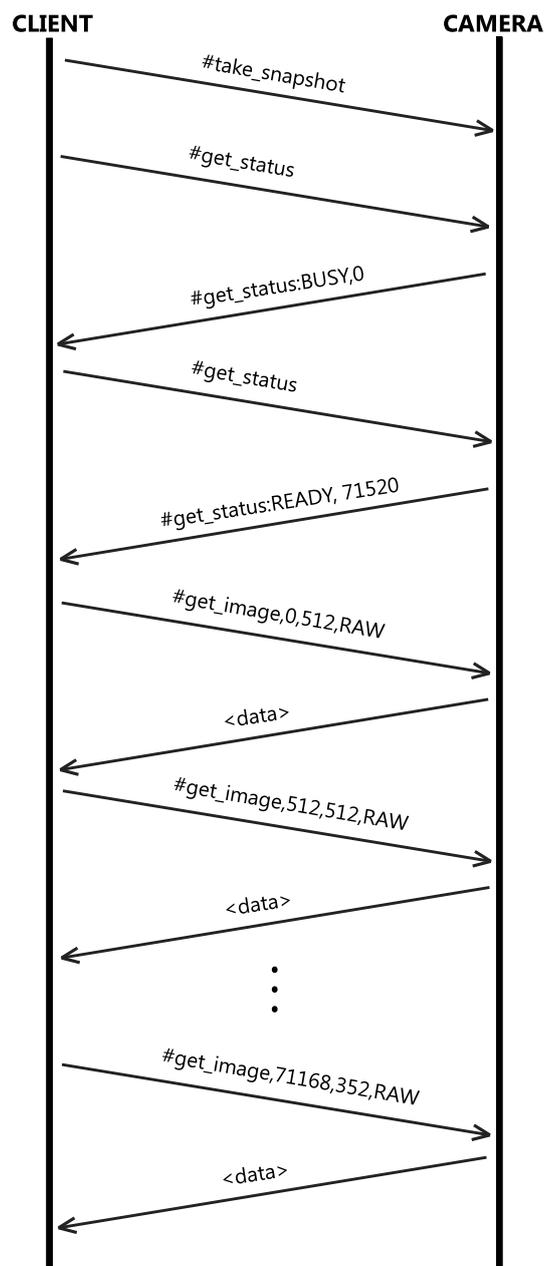
This command forces the camera to move the focus of the lens for a given number of steps. The **OFFSET** parameter can be either a positive or a negative integer number. The focus movement is relative to the starting focus position. The returned **STATUS** can be either **OK** or **ERR**, if the **OFFSET** is outside of the allowed range (-100 to +100).

Command: **#move_zoom=OFFSET<CR><LF>**
Response: **#move_zoom:STATUS<CR><LF>**

This command forces the camera to change the lens zoom. The **OFFSET** is a number between 0 and 100. When the **OFFSET** parameter is set to 0, the camera is fully zoomed out, and when it is set to 100 the camera is fully zoomed in. The returned **STATUS** can be either **OK** or **ERR**, if the **OFFSET** is outside of the allowed range (0 to 100).

5 Communication Flow Diagram

Picture 3. shows a flow diagram of the communication between the client and the HydroCam camera to get the image from the camera.

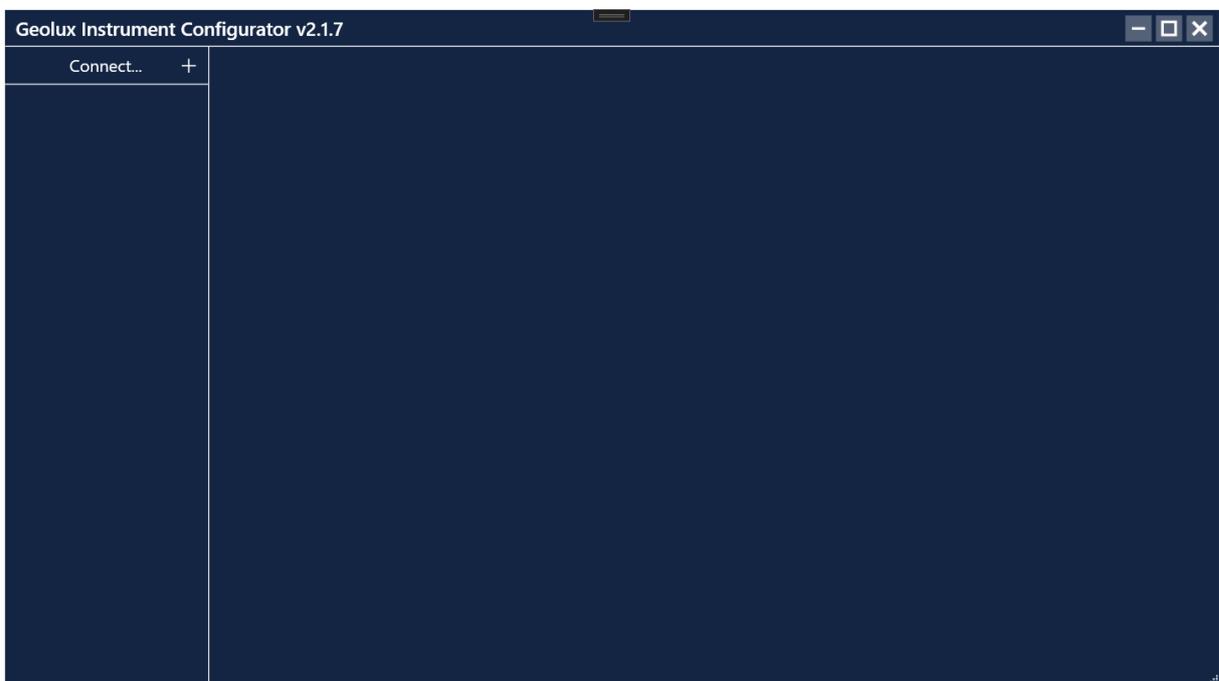


Picture 3. Communication Flow Diagram

6 Camera Configurator Utility

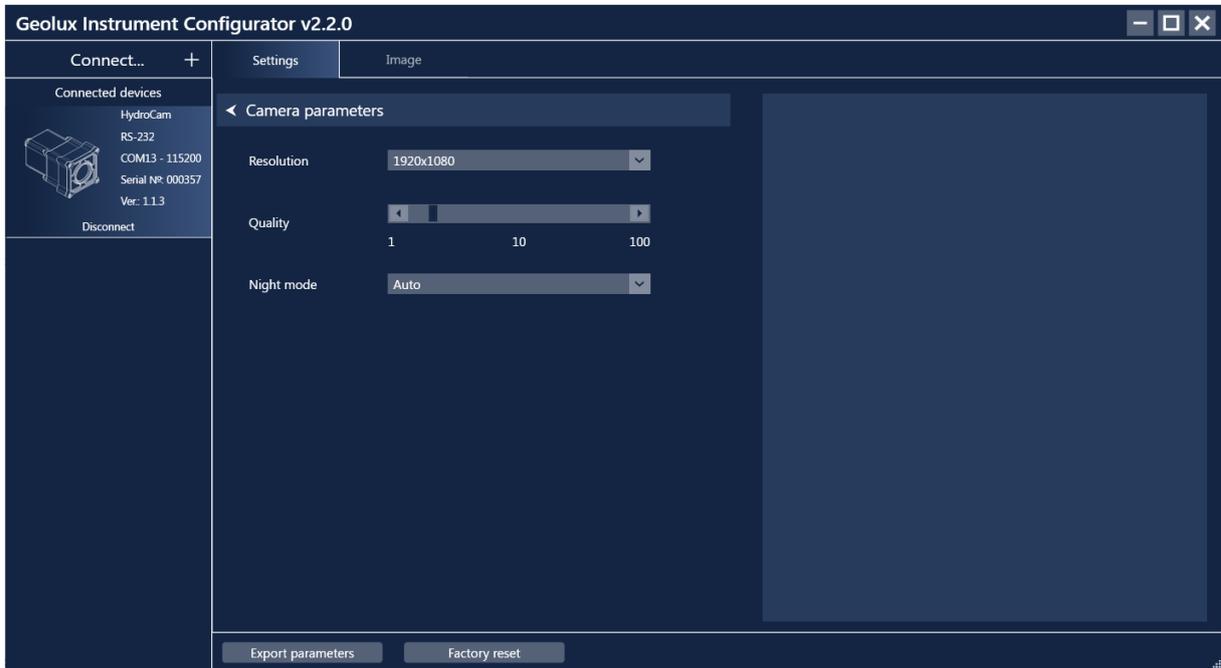
Geolux provides a user-friendly PC application, Geolux Instrument Configurator, for setting up the HydroCam camera's operating parameters as well as displaying the images taken by the camera.

When started, the Geolux Instrument Configurator displays its main window. Picture 4. shows the Geolux Instrument Configurator main window on start-up.



Picture 4. Geolux Instrument Configurator Main Window

To connect the Geolux Instrument Configurator with the instrument, connect your PC to the camera using a serial cable connection. Then, click the *Connect* button in the upper left corner and select HydroCam from the window which appears. In the next window, select the appropriate COM port. When the *Connect* button is clicked, Geolux Instrument Configurator will try to establish a data link between your PC and the camera. If the connection is successful, the device will appear under *Connected devices* and the *Settings* tab will be displayed as shown in Picture 5. Clicking on *Camera Parameters* displays all the parameters which can be changed. A detailed description of the selected parameter appears on the right side of the window when the user clicks on, or begins to change, a specific setting. When a setting is changed, the *Set* button will appear next to the setting. By clicking the *Set* button, the user confirms the change and the new setting is saved. Clicking the *Export parameters* button exports the current camera settings to a .txt file, while clicking the *Factory reset* button restores the default camera settings.



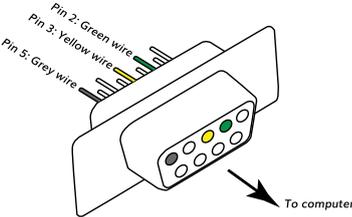
Picture 5. Geolux Instrument Configurator - Settings View

Navigating to the *Image* tab allows the user to change the zoom and focus of the camera in specific steps by sliding the scroll bar and clicking the *Move zoom* or *Move focus* button. To capture an image with the camera, the first step is to click the *Take snapshot* button. After the snapshot has been taken the *Get image* button must be clicked. When the image is ready, it will be displayed in the bottom part of the window shown in Picture 6. The captured image can be saved as a .jpg file by clicking the *Save image* button.



Picture 6. Geolux Instrument Configurator - Image View

7 Troubleshooting

Problem	Possible solutions
<p>The instrument does not connect to the PC application over RS-232 connection.</p>	<ol style="list-style-type: none"> <p>1. Make sure that the cable is properly connected to the instrument</p> <p>Check that the cable M12 circular connector is firmly connected and screwed to the instrument. It is not sufficient to simply attach the cable connector to the instrument connector, the cable connector must be screwed into the instrument connector.</p> <p>2. Check power supply</p> <p>Make sure that the power is being supplied to the instrument. A direct-current voltage, between 9 and 27 Volts must be connected to brown (+) and white (-) wires of the instrument cable. The power supply must be able to deliver at least 500 mA of current.</p> <p>3. Check RS-232 connector</p> <p>The yellow, green and grey wires from the instrument cable must be properly connected to the serial port on the computer. Make sure that the grey wire (signal ground) is connected – the RS-232 connection will not work if the signal ground is not connected. Also, make sure that the yellow (device Rx) and green (device Tx) are properly connected. If you are using a standard DB9 type connector on the PC computer, the wires should be connected like in the following diagram:</p>  <p>4. Make sure that you are using the correct COM port</p> <p>If there are multiple COM ports available on your computer, make sure that you are selecting the correct COM port in the PC application. If you are not certain which COM port number is assigned to the COM port that is being used to establish a connection with the instrument, try setting up the connection with each COM port available in the system, until the connection is established.</p> 

5. Make sure that the COM port is not already open

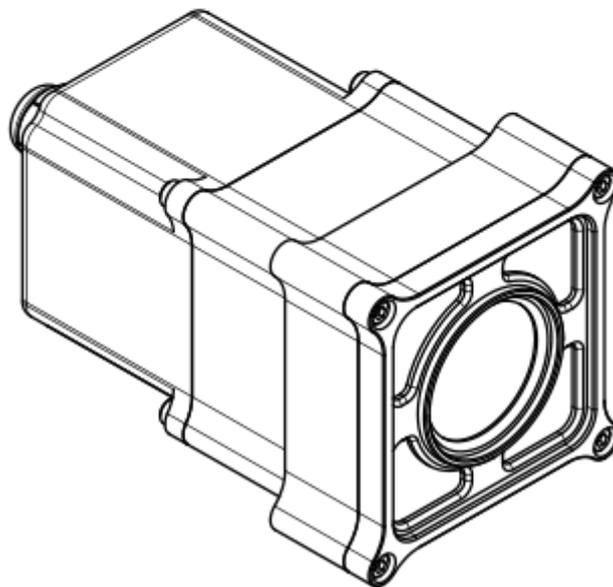
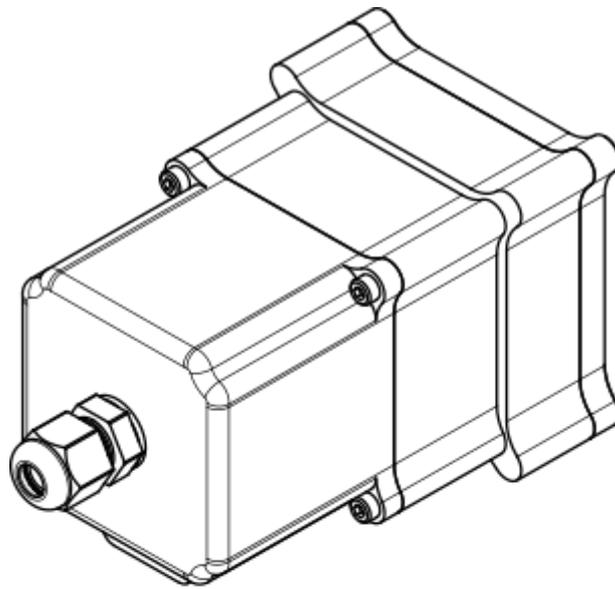
Only one application may use a single COM port in the system. Make sure that no other open application uses the same COM port that you are trying to open.

6. Try restarting the application and/or the computer

Close and reopen the configurator application and try to establish the connection again. Restart your computer and try to establish the connection to the instrument again.

8

Appendix A - Mechanical Assembly





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