SEABIRD HOCR Hyperspectral Ocean Color Radiometer User Manual

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SEA-BIRD SCIENTIFIC

User manual

HOCR

Hyperspectral Ocean Color Radiometer

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Contents

Section 1 Safety information

Please read this entire manual before this equipment is unpacked, set up, or operated.
Pay attention to all danger, warning, and caution statements. Failure to do so could result in serious injury to the operator or damage to the equipment.

⚠DANGER

Indicates a potentially or imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠WARNING

Indicates a potentially or imminently hazardous situation which, if not avoided, could result in death or serious injury.

⚠CAUTION

Indicates a potentially hazardous situation that may result in minor or moderate injury.

NOTICE

Indicates a situation which, if not avoided, may cause damage to equipment. Information that requires special emphasis.

1.1 Hazard information

⚠WARNING

This product can expose the user to chemicals with silica, crystalline (airborne particles of respirable size), which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information, go to www.P65Warnings.ca.gov.

⚠WARNING

Sensors that use ultraviolet light sources (< 400 nm): Do not look directly at a UV light source when it is on. It can cause damage to the eyes. Keep products that have UV light sources away from children, pets, and other living organisms. Wear polycarbonate UV-resistant safety glasses to protect the eyes when a UV light is on.

NOTICE

The manufacturer is not responsible for any damages due to misapplication of misuse of this product including, without limitation, direct, incidental and consequential damages, and disclaims such damages to the full extent permitted under applicable law. The user is solely responsible to identify critical application risks and install appropriate mechanisms to protect process during a possible equipment malfunction.

1.2 Equipment labels

Read all labels and tags attached to the equipment. Personal injury or damage to the equipment could occur if not observed. A symbol on the equipment is referenced in the manual with a precautionary statement.

Electrical equipment marked with this symbol may not be disposed of in European domestic or public disposal systems. Return old or end-of-life equipment to the manufacturer at no charge to the user.

Safety information

EFUP: Hazardous material exists over the threshold of GB/T 26572.2011. The number in the center of the symbol is the Environmentally Friendly Use Period as specified by SJ/T 11364-2014, China's marking for the Restriction of the Use of Hazardous Substances in Electrical and Electronic Products.
This product should be recycled after its environmentally friendly use period.

Section 2 OCR quick start guide

⚠WARNING

Sensors that use ultraviolet light sources (< 400 nm): Do not look directly at a UV light source when it is on. It can cause damage to the eyes. Keep products that have UV light sources away from children, pets, and other living organisms. Wear polycarbonate UV-resistant safety glasses to protect the eyes when a UV light is on.

This quick start guide and user manual applies to the Ocean Color Radiometers.
What's in the box:

- the sensor
- a dummy connector and lock collar
- a plastic protective cover attached to the optical face
- a CD with calibration files, software, and user manuals
- optional: Bio-shutter, attached to the sensor. The protective cap for the optics is not attached.

Table 1 Manufacturer-supplied software

Software	Function
SatView	Collects, saves, and shows data in real-time
SatCon	Converts binary data to ASCII data
ProSoft	Processes data from multiple sensors

Use the .sip file on the CD to use the SatView and SatCon software.

1. Install the software on a PC, connect the OCR, and start SatView.
2. Supply power to the sensor.
3. Move the .sip, .cal, or .tdf file to the main window of SatView and enter configuration settings for the sensor. Refer to Verify sensor functionality on page 11 for details.
4. Make sure that the sensor collects data.
5. Deploy the sensor.
6. Immediately after the sensor is recovered from a deployment:
   a. Turn off the sensor.
   b. Flush the sensor with fresh water.
   c. Keep the sensor out of direct sunlight between deployments.
7. Store the sensor. Refer to General maintenance on page 15 for details.

Section 3 Overview and specifications

The Hyperspectral Ocean Color Radiometer, or HOCR, measures apparent optical properties in the ocean. The sensor collects up to 255 channels of optical data in wavelengths from 350 to 800 nm. The HOCR can be set up to operate in a network or as a network controller for other sensors. The sensor operates via an RS232 or RS422 interface or an RS485 if the user operates the sensor in a SatNet network environment.

Type	Description	Parameters measured	Calibration file types
ICSW	Irradiance Cosine in Water	Ed: Downwelling irradiance (in water pointing up) Eu: Upwelling irradiance (in water pointing down)	HPE: light counts PED: dark counts
ICSA	Irradiance Cosine in Air	Es: Total solar irradiance (in air pointing up)	HSE: light counts HED: dark counts
R08W	Radiance 08 degrees, half-angle in Water	Lu: Upwelling radiance (in water pointing down)	HPL: light counts PLD: dark counts
R03A	Radiance 03 degrees, half-angle in Air	Li: Indirect radiance (in air, sky-pointing) Lt: Total radiance (in air)	HSL: light counts HLD: dark counts

3.1 Mechanical

	Irradiance	**Radiance**
Length	39.3 cm	35.4 cm
Diameter	6 cm	
Weight in air	1.05 kg	0.95 kg
Depth rating	250 m	

3.1.1 Dimensions

Figure 1 HOCR (ICSW) Ed

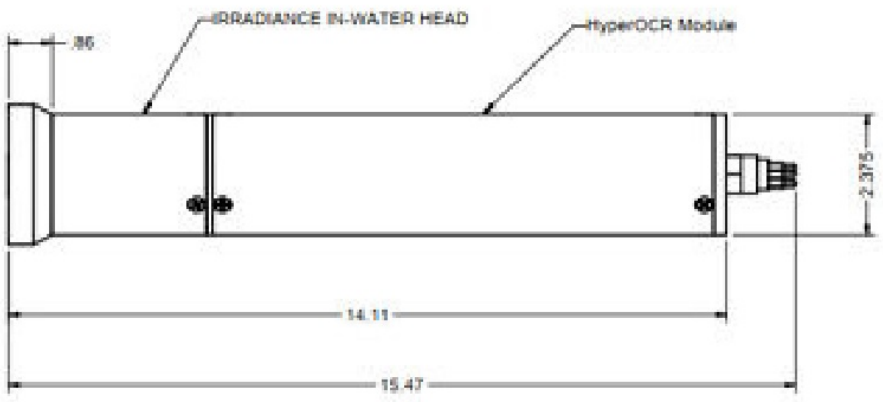
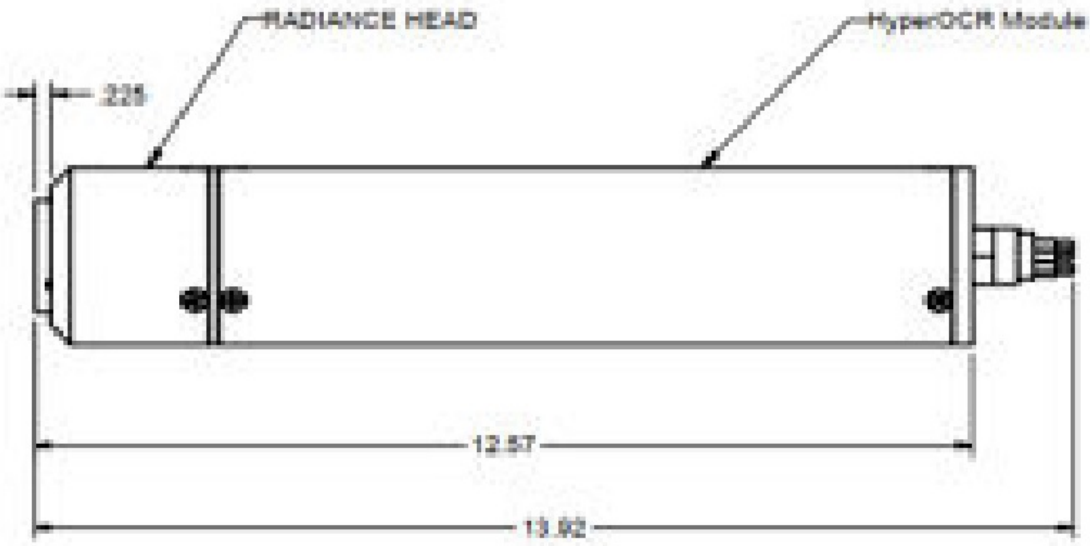
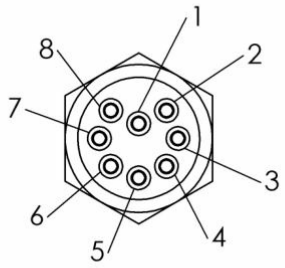


Figure 2 HOCR (R08W) Lu



3.1.2 Standard bulkhead connector functions

Contact	Function	Description	MCBH-8-MP
1	Voltage in	Voltage Direct Current	
2	V-/SG, power supply return, Signal Ground	Power supply return/signal ground	
3	RS422 TXA	Serial communication from sensor to PC	
4	RS422 TXB	Serial communication from sensor to PC	
5	RS232 TX	Serial communication from sensor to PC	
6	RS232 RX	Serial communication from PC to sensor	
7	NA RS485 SatNet™ A	SatNet interface A	
8	NB RS485 SatNet™ B	SatNet interface B	

3.2 Electrical

Input	9–18 VDC
Communications	RS232 (RS422 and RS485 available)
Data rate	9600–115200 baud (default: 57600)
Data resolution	16 bit

3.3 Analytical

3.3.1 Radiance

Spatial properties	
Field of view	3° half-angle, half-radiance, in air; 8° half-angle, half-radiance, in water
Detectors	256 channel silicon photodiode array
Bandwidth range	350–800 nm
Spectral bandwidth	10 nm
Spectral data collection	3.3 nm/pixel
Spectral accuracy	0.3 nm

3.3.2 Irradiance

Field of view	cosine response within 3% at 0–60°; within 10% at 60–85°
Detectors	256 channel silicon photodiode array
Entrance slit	70 x 2500 µm
Pixel size	25 x 2500 µm
Bandwidth range	350–800 nm
Spectral bandwidth	10 nm
Spectral data collection	3.3 nm/pixel
Spectral accuracy	0.3 nm

Section 4 Operation

4.1 Verify sensor functionality

⚠WARNING

Sensors that use ultraviolet light sources (< 400 nm): Do not look directly at a UV light source when it is on. It can cause damage to the eyes. Keep products that have UV light sources away from children, pets, and other living organisms. Wear polycarbonate UV-resistant safety glasses to protect the eyes when a UV light is on.

Make sure that the sensor operates correctly before further setup and deployment.

1. Install the software on the PC. The software is available from the CD that ships with the sensor or from the manufacturer's web site.
2. Start the software.
3. Supply power to the sensor.
4. Move ("drag") the .sip, .cal, or .tdf file to the main window of the SatView software from the supplied CD or from PC if it has been copied there.
5. In the new window that shows, enter configurations for the sensor:
   a. Enter a name for the sensor at "Instrument Package Name". (This is auto-filled if a .sip file was moved in step 4.)
   b. Put a check in the box next to "Auto Read From:" and select the applicable COM port.
   c. Select the "Baud Rate." The default is 57600.
   d. Push **OK**.
   A green border shows around the sensor icon in the software. The sensor collects data.
6. Select (highlight) the sensor with the green border, then right-click and select Control Panel. The "Frames Read" value increments.
7. Double-click on any or all of the views in the "View List" area. Move each window as desired to see real-time data.
8. Go to the Log menu, then Options.
   a. In the "File Naming Mode" select AUTO CAST. The software automatically names data files with AA, AB, AC, etc.
   b. Select the … at "Log Directory" to find or make a folder for saved data.
   c. Put a check in "Log Duration" and select the amount of time for the PC to save data.
   d. Push OK.
9. Push Start Logging in the main window.
   The "Ready" and "Active" status indicators are green and the "Log Time" counter increases. Note that the data is saved in binary format. Use the manufacturer's SatCon software to convert and process this data.
10. To save the settings from the session, select the File menu, then Save As… and find or make a file name and location.
    The software saves the settings from this session so it is not necessary to go through the setup steps again. The software will start when the user double-clicks the saved xxx.sat file.
11. Turn off the power supply to stop the sensor.

4.2 Set up for autonomous operation

The standard mode of operation for OCR sensors is autonomous operation and continuous data collection. It is typical to use the SatView software to set up and monitor data collection.

1. If necessary, start the software.
2. Make sure that the sensor is connected to a power source and the PC.
3. Open the xxx.sat session file that was saved in the previous section, Verify sensor functionality on page 11.
4. Go to the Log menu, then Options:
   a. Select an option in the "File Naming Mode" dropdown.
   • USER DEFINED—the user names the data file.

• AUTO CAST—the software names files that increment “AA,” “AB,” “AC,” etc.

• TIME STAMP—the software names files with YYYY-DDD-HHMMSS.raw, which is year, day of the year, hours, minutes, seconds.

• SQM—SeaWiFS-specific name options.

b. Determine the location to which the data file is saved on the PC in the “Log Directory” area.

c. Put a check in the box at “Log Duration” and enter the period of time the sensor will collect data.

d. Put a check in the box at “Log Interval” and enter the period of time the sensor will stop between data collection cycles.

Note that the sensor will repeat the cycle of data collection and low power until the user pushes Stop Logging. Each data collection cycle will be in a separate file.

e. Put a check in the box at “Write PCZDA Time Stamps…” so that the software will write a time stamp to the file every second. It has the format $PCZDA,132430.00,03,08,1999,, which is 1:24:30 pm, 03 August 1999.

f. Put a check in the box at “Use GPS Data…” so that the software will use GPS data if such a sensor is attached.

5. Push **OK**.
6. Optional: Go to the Log menu then Station Setup. Enter information as needed. It will show in the header of the data file.
7. Optional: Select the sensor and right-click to see the Ancillary, Optical, and Spectral views.

4.3 Verify or change sensor settings

Use a terminal program such as Tera Term to look at and, if necessary, change the settings in the sensor prior to a deployment. The manufacturer has set up the sensor with default values listed in Configuration commands below.

1. Make sure that the sensor is connected to the PC that has a terminal program installed.
2. Start the terminal program.
3. Select “Serial” then push OK.
4. Select Setup, then Serial Port.
5. Change the “Baud rate” to 57600. Other settings do not need to be changed:
   • Data: 8 bit
   • Parity: none
   • Stop: 1 bit
   • Flow control: none
6. Push OK.
7. Supply power to the sensor.
   Data shows in the terminal window.
8. To stop the data collection, enter Ctrl C.
   • If the sensor is in autonomous mode, the [Auto]$ prompt shows.
   • If the sensor is in a network, the [Remote: 050]$ prompt shows. The three characters are the network address of the remote sensor.The sensor is ready to accept commands.

```
[Auto]$ help

The following console commands are available for this instrument:

reset         Resets the command console.
id            Displays the instrument identification banner.
power         Turns operational power off and on.
set           Sets the instrument's configuration parameters.
show          Shows the instrument's configuration parameters.
save          Saves the instrument's configuration parameters.
sample        Samples the instrument's sensors and displays.
exit          Exits the command console.
exit!         Exits the command console and resets the instrument.

For more information in individual commands, type '-?' after the command.

[Auto]$
```

9. The settings stored in the sensor by the manufacturer should not need to be changed. Look at the value of a specific setting, for example, baud rate: At the [Auto] $ prompt, type show tel baud then push Enter to see the baud rate that is stored in the sensor.
10. To save data on the PC:
    a. Select File, then Log…
    b. Select the directory in which to save the file, and a file name.
    c. Push Save.
11. To start data collection again, type exit.
12. To stop data collection, select File, then Disconnect.
    The terminal session ends.

4.4 HOCR data format

The standard data from the sensor is in binary format, and is defined by the Technical Definition File (.tdf) from the manufacturer and whether the sensor measures radiance or irradiance.

Format description	
AF = ASCII floating point number	BS = Binary signed
AI = ASCII integer number	BU = Binary unsigned
AS = ASCII string, test	

Field Name	**Field size, bytes**	**Description**
Instrument	6 (1–10 permitted)	AS-formatted string that usually starts "SAT" followed by the type of sensor.
Serial number SN	4 (1–10 permitted)	AS- or AI-formatted string. The Instrument and Serial number are the frame header.

Operation

Integration time INTTIME	2	BU-formatted value that shows the integration time in milliseconds that are used for to collect data. Refer to Maximum Integration Time for more information.
Sample delay	2	BS-formatted value that shows the number of milliseconds to offset the timer value.
Channel (lambda$_1$)	2	BU-formatted value that shows the A/D counts of the start channel from the spectrometer.
. . .	. . .	. . .
Channel (lambda$_n$)	2	BU-formatted value that shows the A/D counts of the end channel from the spectrometer.
Dark sample DARK_SAMPLE	1	BU-formatted value that shows the number of dark channels used for the DARK_AVE field.
Dark average DARK_AVE	2	BU-formatted value that shows the average of the dark channel values. The dark channels are optical sensors with low sensitivity that may be used for baseline measurements.
Spectrometer temperature SPECTEMP	6	AF-formatted value that shows the temperature of the photodiode array. Format is ±CC.CC. Used for temperature dependent corrections.
Frame counter	1	BU-formatted value that keeps count of each transmitted frame from 0–255, at which point it starts over at 0.
Timer	10	AF-formatted string that shows how many seconds have passed since the initialization sequence was completed. This field is left-padded with zeros and is accurate to two decimal places.
Check sum	1	BU-formatted value that puts a check sum on a frame of data.
Terminator	2	This field is the end of the frame, <CR-LF>.

Note: the optical channels lambda1 to n are discrete output channels.

4.5 Temperature correction

The photodiode array is temperature dependent and may show a different value during a deployment than at the time of calibration. Use the SPECTEMP command to see the temperature during a deployment.

Section 5 General maintenance

⚠WARNING

Sensors that use ultraviolet light sources (< 400 nm): Do not look directly at a UV light source when it is on. It can cause damage to the eyes. Keep products that have UV light sources away from children, pets, and other living organisms. Wear polycarbonate UV-resistant safety glasses to protect the eyes when a UV light is on.

NOTICE

Do not use abrasive cleaner on the optical face of the sensor. It will cause scratches on the optical epoxy and glass.

NOTICE

Do not use acetone or other solvents to clean any part of the sensor.

1. After each cast or exposure to natural water, flush the sensor with clean fresh water.

2. Use soapy water to clean any grease or oil on the optical face of the sensor. It is made of plastic and can be damaged if an abrasive cleaner is used.
3. Dry the sensor with a clean soft cloth.
4. Install the dummy plug and lock collar to protect the bulkhead connector.
5. Install the protective cap on the optical face.

5.1 Clean bulkhead connectors

NOTICE

Do not use WD-40® or petroleum-based lubricant on bulkhead connectors. It will cause damage to the rubber.
Damaged connectors can cause a loss of data and additional costs for service.
Damaged connectors can cause damage to the sensor and make it unserviceable.
Use silicone-based lubricants only.

Examine, clean, and lubricate bulkhead connectors at regular intervals. Connectors that are not lubricated increase the damage to the rubber that seals the connector contacts.
The incorrect lubricant will cause the failure of the bulkhead connector.

1. Apply isopropyl alcohol (IPA) as a spray or with a nylon brush or lint-free swab or wipes to clean the contacts.
2. Flush with additional IPA.
3. Shake the socket ends and wipe the pins of the connectors to remove the IPA.
4. Blow air into the sockets and on the pins to make sure they are dry.
5. Use a flashlight and a magnifying glass to look for:

Any corrosion.		
Cracks, scratches, or other damage on the rubber pins or in the sockets.		
Separation of the rubber from the pins.		
Swelled or bulging rubber pins.		

6. Use a silicone-based lubricant on each of the contacts of the bulkhead connector.
   The manufacturer recommends any of the products listed below.
   • 3M™ Spray Silicone Lubricant (3M ID# 62-4678-4930-3). Make sure to let it dry.
   • Dow Corning Molykote® III Compound (DC III)
   • Dow Corning High Vacuum Grease® (DC 976 V)

- Dow Corning 4 Electrical Insulating Compound® (DC 4)
- Dow Corning Molykote 44 High Temperature Grease® (DC 44)Use a finger to put a small quantity (approximately 1 cm in diameter) of silicone grease on the socket end of the connector and push as much of the lubricant as possible into each socket. Do not use too much lubricant, as that will prevent a good seal.

7. Connect the connectors.
8. Use a lint-free wipe to clean any unwanted lubricant from the sides of the connectors.

Section 6 Optional equipment: Bioshutter

The bioshutter works to decrease biofouling on the optical faces of the multispectral (504, 507, and 504 UV) and hyperspectral sensors, which can help to increase deployment time. The bioshutter uses a separate power supply to operate and is typically connected to the optical sensor with a Y-cable (supplied by the manufacturer. The basic operation sequence:

- The shutter opens when power is supplied to the bioshutter, and the device enters a low power mode.
- During the low power mode, the internal backup is charged.
- When power is removed from the bioshutter, the internal power supply closes the shutter.

This mode of operation works well for moored deployments. The bioshutter operates independently of the optical sensor and the controller, as long as there is enough time to charge the internal power supply (approximately 30 seconds).

6.1 Mechanical specifications

	850 m	850 m RA	500 m	300 m
Length	20.3 cm	21.9 cm	19.6 cm	
Diameter	5.1 cm		6.3 cm	5.7 cm
Weight in air	0.9 kg		0.87 kg	0.7 kg
Depth rating	850 m		500 m	300 m
Shutter rotation	180 or 90° clockwise (counterclockwise optional)			

6.1.1 Bulkhead connector

6.1.2 Dimensions

Figure 3 Standard bioshutter dimensions

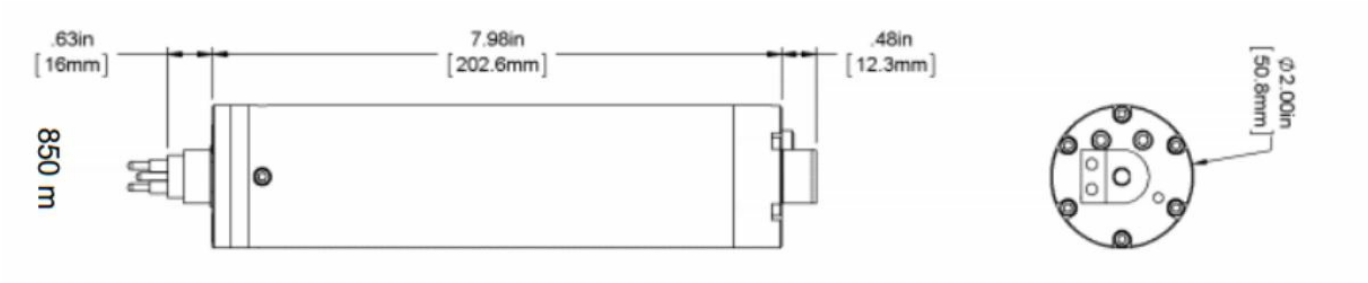
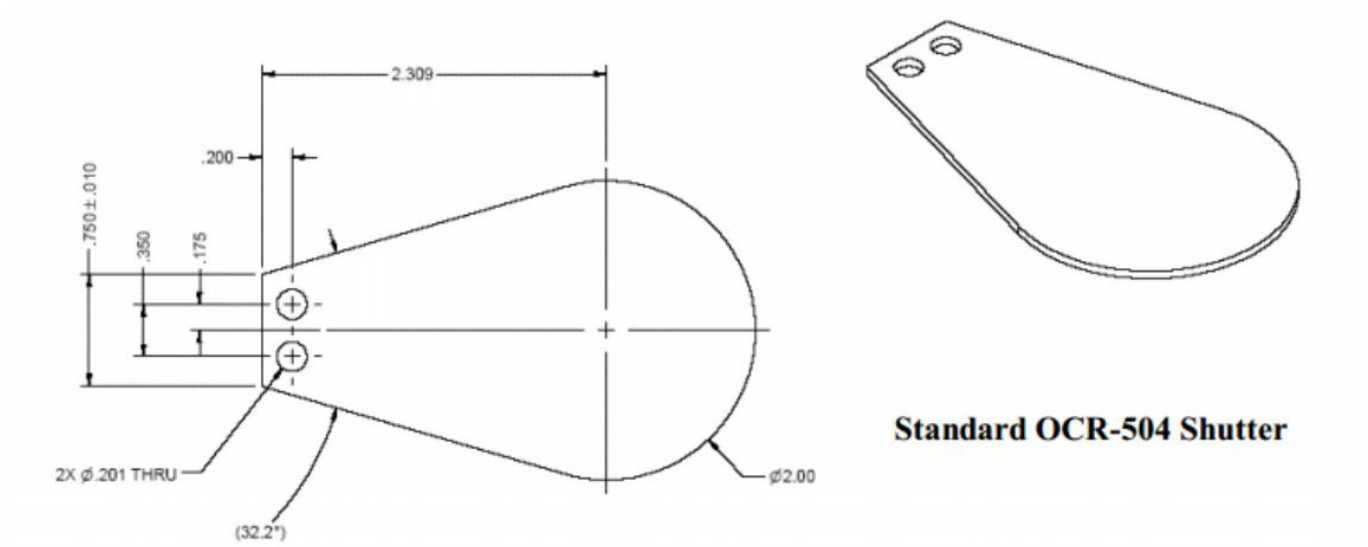
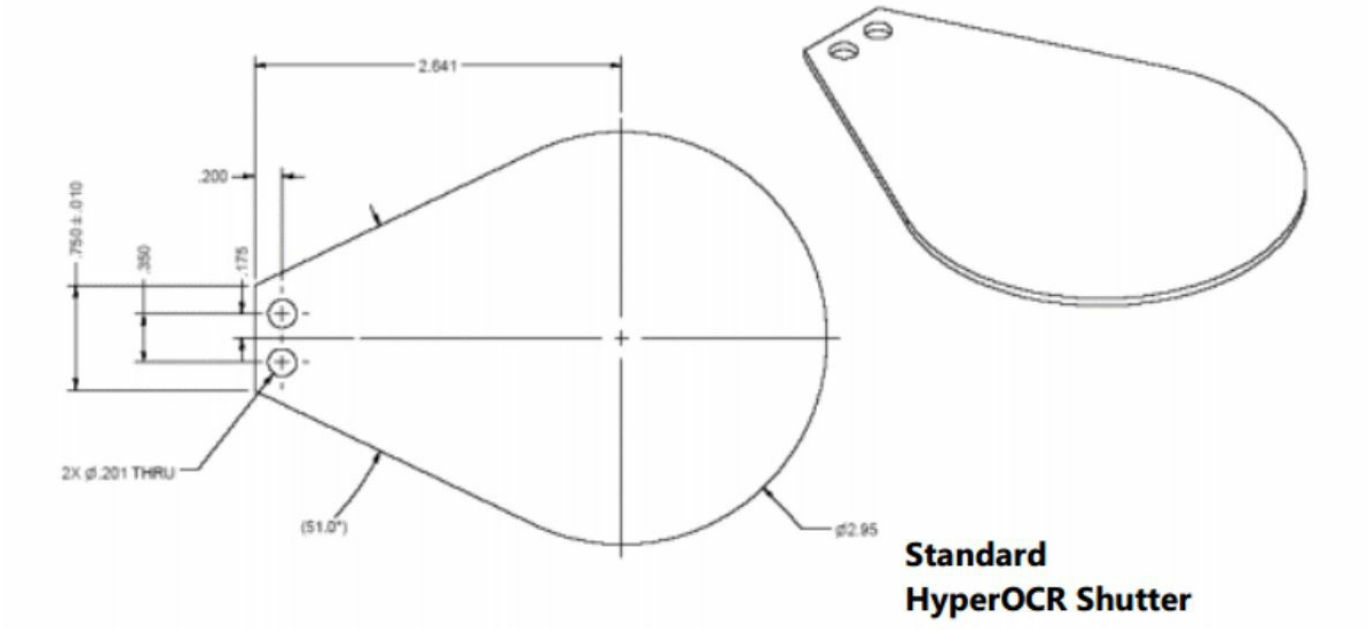


Figure 4 OCR 504 shutter



Shutter weight: 31 g.

Figure 5 HyperOCR shutter



Shutter weight: 100 g.

6.2 Electrical specifications

Input	8–20 VDC
Current draw, typical	250–300 mA
Current draw, low power	13 mA or less
Shutter speed, open	5–10 rpm
Shutter speed, close	4–5 rpm

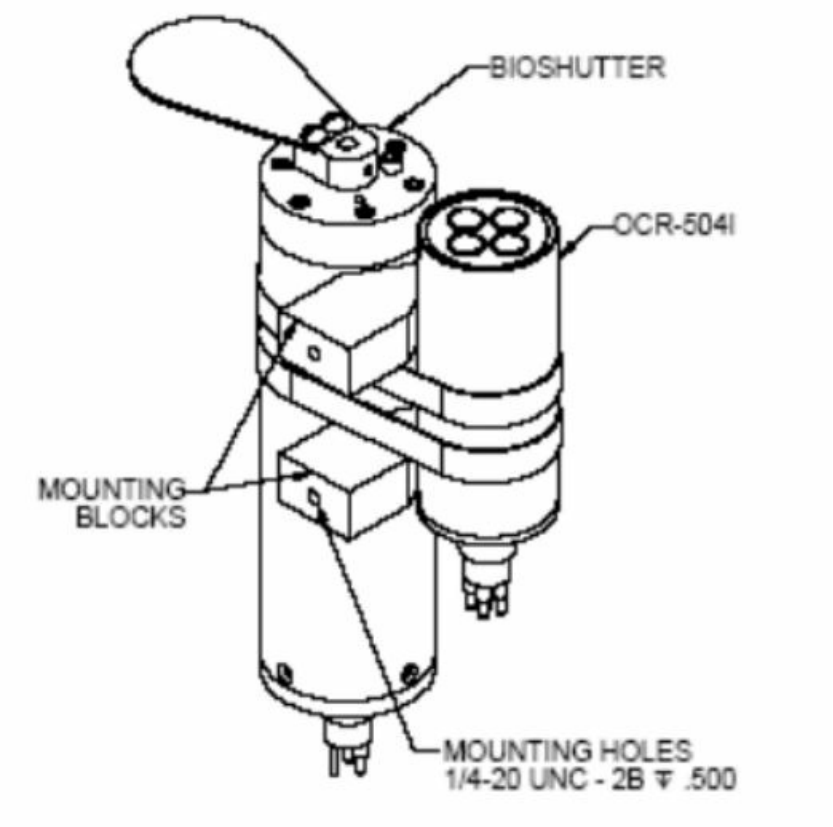
6.3 Operation and maintenance

The manufacturer ships the bioshutter attached to the sensor that was purchased by the user if it was so ordered. The items delivered:

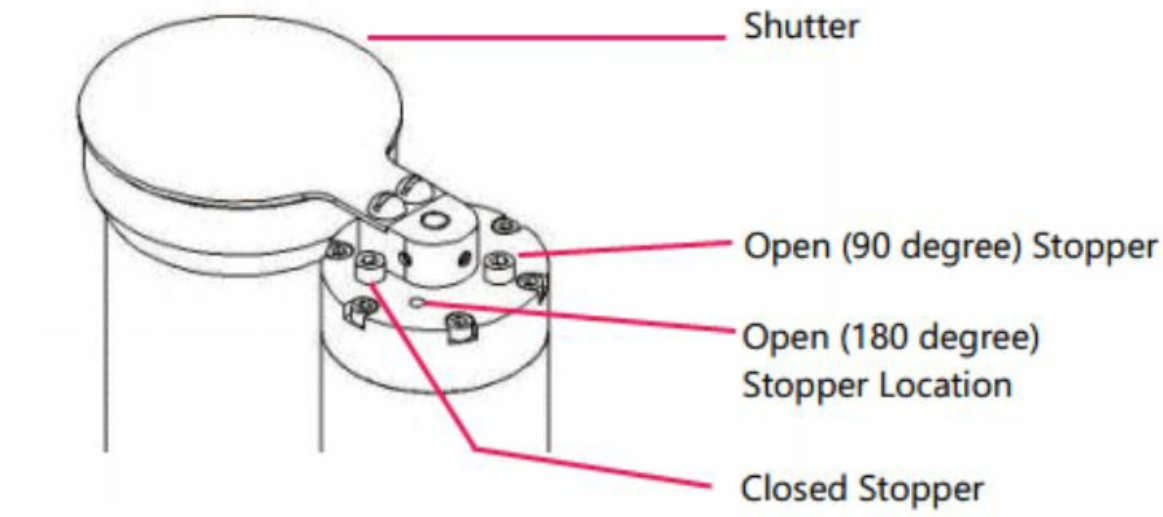
Sensor only	**Sensor with bioshutter**	**Bioshutter only**
8-contact dummy plug and lock collar		
Test cable		
Characterization page		
	Y-cable with 2- and 8-contact (socket) connectors and one 8-contact (pin) connector	
	2 mounting blocks	
	2 #80 316 stainless steel hose clamps	
	2-contact dummy plug and lock collar	

If the bioshutter is purchased by itself, do the steps below to attach it to an optical sensor.

1. Apply a layer of neoprene between the pressure housings and the hose clamps and V-blocks to prevent scratches.
2. Put the bioshutter and the sensor side by side on a flat surface so that the copper shutter is on top of the optical face of the sensor.
3. Note the location of the ¼-20 holes in the V-blocks. These are used for screws to mount to a deployment structure. Make sure that there will be no interference with the rotation of shutter if such a deployment structure is used.
4. Slide the hose clamps onto the pressure housings.
5. Set the V-blocks between the pressure housings. Make sure that the blocks are as close to the top and the bottom of the shorter sensor as practical.



6. Use a flat blade screwdriver to loosely tighten the hose clamps onto the pressure housings.
7. Adjust the distance between shutter and the optical face to 0.5–1 mm.
8. Tighten the hose clamps onto the OCR and bioshutter.
9. The ends of the hose clamps are sharp. Wrap the ends with electrical tape.
10. Use an abrasive pad if necessary to clean the copper shutter before each deployment.
11. Optional: the shutter is set up by the manufacturer to rotate 180 degrees clockwise.
    The user can set up the shutter to rotate 90 degrees if necessary.
    • Move the 10-32 stainless steel screw to the other open hole. The shutter will rotate 90 degrees to the new hard stop position.



6.3.1 Calculate power use

The bioshutter is typically used in battery-powered moored deployments and can use the same power supply as the OCR to which it is attached. The equation below lets the user estimate the power use of the bioshutter.

$$DBCR \approx (N/3600) \times \left(\int_0^{t_{SS}} 0.2427 e^{-0.0971t} dt + \frac{I_{MT}}{R} \times t_{OPEN} + I_{SS} \times t_{ON} \right)$$

Where:

- DBCR = Daily Battery Capacity Requirement
- N = number of events/day
- IMTR = motor current (assume 100 mA)
- tOPEN = time to open the shutter (assume 10 seconds)
- ISS = current necessary in steady state (assume 13 mA)
- tSS = amount of time, in seconds, per event, that the bioshutter has power supplied.

The integral part of the equation is derived from the charge current of the internal backup supply that exponentially decreases.
If the bioshutter operates for 60 seconds every hour for 24 hours, for example, the DBCR is approximately 0.025 Ah per day.

6.3.2 Maintenance

The only maintenance necessary for the bioshutter is to clean the copper shutter at regular intervals and flush the pressure housing after each deployment.

1. Use a ScotchBrite® pad or steel wool to clean the copper shutter. Clean the shutter in place—do not remove from the pressure housing.
2. Flush the sensor and bioshutter with clean fresh water after each deployment.
3. Use a clean soft cloth to dry the sensor and bioshutter.
4. Refer to Clean bulkhead connectors on page 15 for details on the maintenance of bulkhead connectors.
5. Attach the dummy plug and lock collar

Section 7 Reference

7.1 Configuration commands

The command prompt in the terminal program is the $.
Notes on the use of a terminal program—

- Type -? after a command to get more details.
- Use the backspace key to remove characters in the command before it is sent.
- Commands are case-sensitive: exit is not the same as EXIT or Exit. Most commands are lower case.
- Use the <Esc> key at the $ prompt to repeat the last command that was executed.
- Type help to see the available commands.

Reset	
Command line:	reset
Value:	reset
Description:	Resets the terminal console. The command prompt header shows again. Changes to settings that were not saved are lost.

ID	
Command line:	id
Value:	id
Description:	Shows the initial star-up information for the sensor.

Power	
Command line:	power
Value:	on | off | ?
Example:	power on
Description:	Power on = power to operate the sensor and collect data. Power off = decreases the power consumption of the sensor. Data collection is not possible. Power ? = Shows the status of power, either on or off. The power stays in the state of the last command value set by the user when the terminal program is closed.

Set	
Command line:	set
Value:	set [parameter] [value]
Example:	set telbaud 57600
Description:	Changes the settings in the sensor. To see a list, type **set -?** to see a list. Make sure to **save** to store any changes to the sensor.

Show	
Command:	show
Value:	[parameter] | all
Example:	show telbaud
Description:	Shows a specific setting, or *all* of the current settings that are stored in the sensor.

Reference

Save	
Command line:	save
Value:	save
Description:	Stores a changed setting in the sensor. Refer to the **set** command.

Ping	
Command line:	ping -?
Value:	network address (1-255 | all)
Example:	ping 101 101> Instrument: SATHSL - S/N :0045
Description:	Shows the network address of any or all connected sensors.

Remote (Network controller only)	
Command line:	remote -?
Value:	network address (1-255 | all)
Example:	remote 101 [Remote:101]$
Description:	Lets the user communicate with the specified sensor. To get the network address of connected sensor(s), use the" ping all" command. To go back to the command line for the controller, enter "exit"

Query	
Command line:	query
Value:	query
Example:	query # of pixels: 256 Resolution: 16 bits Frequency: 16 MHz Operational baud rate: 57600 bps
Description:	Shows information about the spectrometer.

Sample	
Command line:	sample
Value:	sample integration time in ms (between 5 and 8192 ms)
Example:	sample 16 Integration time: 16 ms
Description:	Tests the operation of each optical channel, the regulated input voltage, the analog voltage, and the internal temperature of the sensor.

Shutter	
Command line:	shutter
Value:	on | off | * | ?
Example:	shutter * The shutter opens, then closes
Description:	Tests the operation of the shutter. "On" closes the shutter. "Off" opens the shutter. "?" shows the current condition of the shutter.

Spectrometer temperature	
Command line:	spectemp
Example:	spectemp +22.625 °C
Description:	Tests the operation of the spectrometer temperature and shows the current temperature value. If the temperature sensor is not found or has failed. a "DS1820 not found" message will show.

Exit and Exit!	
Command line:	exit or exit!
Value:	exit or exit!
Description:	Exit: the sensor starts to collect data. The terminal session stays open. Exit!: the sensor is reset to previously saved settings, and starts to collect data.

7.1.1 HOCR configuration values

The Set and Show commands let the user change and look at different values that are stored in the sensor.

Network master mode	
Command line:	master
Value:	on | off
Example:	set master on
Description:	"On" enables the network master mode. "Off" disables the network master mode.

Note: *This value does not apply if the connected sensor has a lower rate of data collection than the controller setting.*

Master controlled telemetry	
Command line:	mct
Value:	on | off
Example:	set mct on
Description:	"On" enables the controller to control the data collection rate of the connected sensors. "Off" lets the connected sensors collect and send data at the individual sensor collection rate.

Master network bias	
Command line:	bias
Value:	on | off
Example:	set bias off
Description:	"On" enables the bias circuitry for normal network operation. "Off" disables this setting. The bias must be on for network operation.

Network reset delay	
Command line:	netdelay
Value:	1–3600
Example:	set netdelay 5
Description:	The controller will reset if the connected sensor does not send data before the netdelay time expires.

Reference

Minimum integration time	
Command line:	minint
Value:	Default: 8 ms. Other values: 16, 32, 64, 128, 256, 512, 1024, 2048, 4096, 8192
Example:	set minint 8
Description:	Length of time the spectrometer collects light. In bright light, use a short integration time to prevent saturation of the sensors. In low light, use a longer integration time to get enough light for good data. Minimum integration time is 5 ms with a 1 ms resolution. Maximum and minimum integration times are the range over which the adaptive gain feature sets the integration time.

Maximum integration time	
Command line:	maxint
Value:	2048 ms. Other values: 16, 32, 64, 128, 256, 512, 1024, 2048, 4096, 8192
Example:	set maxint 2048
Description:	Length of time the spectrometer collects light. In bright light, use a short integration time to prevent saturation of the sensors. In low light, use a longer integration time to get enough light for good data. Minimum integration time is 5 ms with a 1 ms resolution. Maximum and minimum integration times are the range over which the adaptive gain feature sets the integration time.

Adaptive gain	
Command line:	adgain
Value:	on | off
Example:	set adgain on
Description:	"On" enables the controller to control the integration time of the spectrometer during normal operation based on light levels. Refer to Minimum and Maximum integration time, above. The sensor adjusts the integration time based on the light level of the previous sample. For example, if the highest value of the spectrometer's output is more than the upper threshold (see below), the integration time for the next sample is decreased by a decreased integration time multiplier. If the highest value is less than the lower threshold (see below), the integration time for the next sample in increased by an increased integration time multiplier.

Start integration time	
Command line:	startint
Value:	on | off
Example:	set startint off
Description:	"On" enables the adaptive gain to change the integration time when necessary. "Off" disables the adaptive gain so that the integration time stays constant.

Upper threshold	
Command line:	uthresh
Value:	an integer more than the lower threshold and less than or equal to 65535
Example:	set uthresh 2000
Description:	The upper limit of the range used with the adaptive gain configuration value.

Lower threshold	
Command line:	lthresh
Value:	an integer from 0 to less than the upper threshold

Example:	set Ithresh 0
Description:	The lower limit of the range used with the adaptive gain configuration value.

Increase integration time multiplier	
Command line:	ifactor
Value:	default = 2
Example:	set ifactor 2
Description:	Set the factor by which the integration time increases if the light level of the previous spectrometer sample is above the user-specified threshold range. This setting is only used if the adaptive gain setting is on.

Decrease integration time multiplier	
Command line:	dfactor
Value:	default = 0.5
Example:	set dfactor 0.5
Description:	Set the factor by which the integration time decreases if the light level of the previous spectrometer sample is below the user-specified threshold range. This setting is only used if the adaptive gain setting is on.

Shutter frame output	
Command line:	dframes
Value:	0–255
Example:	set dframes 4
Description:	Set the frequency that a "dark frame" is collected. The shutter will never close when this is set to 0. When this is set to 1, every other data frame will be a "dark" frame. When this is set to 2, two "light" frames (shutter open) and one "dark" frame will be collected.

7.2 Network controller operation

The sensor can operate as the controller sensor of a SatNet™ network in which all communication occurs through this sensor and the SatView software or a terminal program. The network controller sends data to a user-supplied data acquisition system.
While the network is in operation the HOCR controls the connected sensors. Data from each of the sensors is sent to the HOCR, which then sends the data to a user-supplied data acquisition system such as a PC. Communication with sensors in the network must go through the controller.
Data is controlled with one-byte commands to the sensor through a terminal program. All commands are ASCII control characters.

Command	**Hex**	**Description**
<Ctrl+C>	03	Stops free-run operation and starts the Command Console.
<Ctrl+S>	13	Stops continuous data collection and enables "polled" (controller-controlled) data.
<Enter> or <space>	0D or 20	In the controlled mode, the controlled sensors collect data that the HOCR sends as a frame.
<Ctrl+A>	01	Stops the controlled mode and enables free-run operation.
<Ctrl+P>	10	Turn off power to the sensor to reduce power consumption. Communication is still possible. Data collection and output are disabled.

Reference

<Ctrl+U>	15	Supplies power to the sensor. Data collection stars again.
<Ctrl+N>	0E	Network controller only. When controlled operation is enabled, this command followed by a valid network address lets the user poll the device at that address.

Section 8 General information

Revised editions of this user manual are on the manufacturer's website.

8.1 Service and support

The manufacturer recommends that sensors be sent back to the manufacturer annually to be cleaned, calibrated, and for standard maintenance.
Refer to the website for FAQs and technical notes, or contact the manufacturer for support at support@seabird.com. Do the steps below to send a sensor back to the manufacturer.

1. Complete the online Return Merchandise Authorization (RMA) form or contact the manufacturer.
   Note: The manufacturer is not responsible for damage to the sensor during return shipment.
2. Remove all batteries from the sensor, if so equipped.
3. Remove all anti-fouling treatments and devices.
   Note: The manufacturer will not accept sensors that have been treated with anti-fouling compounds for service or repair. This includes AF 24173 devices, tri-butyltin, marine anti- fouling paint, ablative coatings, etc.
4. Use the sensor's original ruggedized shipping case to send the sensor back to the manufacturer.
5. Write the RMA number on the outside of the shipping case and on the packing list.
6. Use 3rd-day air to ship the sensor back to the manufacturer. Do not use ground shipping.
7. The manufacturer will supply all replacement parts and labor and pay to send the sensor back to the user via 3rd-day air shipping.

8.2 Warranty

Refer to the manufacturer's website for warranty information (seabird.com/warranty).

8.3 China RoHS disclosure table

Name of Part	Hazardous substance or element in product					
	Pb	Hg	Cd	Cr(VI)	PBB	PBDE
PCBs	X	O	O	O	O	O
This table is compiled to the SJ/T 11364 standard.						
O: This hazardous substance is below the specified limits as described in GB/T 26572. X: This hazardous substance is above the specified limits as described in GB/T 26572.						

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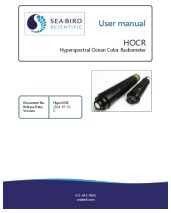
Documents / Resources

	SEABIRD HOCR Hyperspectral Ocean Color Radiometer [pdf] User Manual HOCR Hyperspectral Ocean Color Radiometer, HOCR, Hyperspectral Ocean Color Radiometer, Ocean Color Radiometer, Color Radiometer, Radiometer

References

- Sea-Bird Scientific | Powering Science-Based Decisions for a Better Ocean
- Warranty | Sea-Bird Scientific
- P65Warnings.ca.gov
- User Manual