HD Multi SeaCam®

Operator's Manual

DeepSea Power & Light
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WARNING!
Read this Operator's Manual carefully before using this product. Failure to understand and follow the contents of this manual may result in electrical shock, fire, and/or serious personal injury.

For support and additional information about using your DeepSea product, go to www.deepsea.com/support or scan this QR code.

DeepSea Power & Light reserves the right to make changes to the design and/or the specifications of this product at any time and without prior notice. Changes made in this way come without obligation to update units already in operation. This Operator's Manual may also be changed without prior notice. The latest documentation for your product can be downloaded from www.deepsea.com/support.

Table of Contents

Read This First!

Users and operators of the HD Multi SeaCam should read and understand the information in this section of the manual in order to be familiar with important warnings, hazards, and maintenance requirements.

Safety Symbols

In this manual, safety symbols and signal words are used to communicate important safety information. This section is provided to improve understanding of these signal words and symbols.

DANGER

DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.

WARNING

WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION

CAUTION indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE

NOTICE indicates information that relates to the protection of property or proper function of the device.

This symbol means read the operator's manual carefully before using the equipment. The manual contains important information on the safe and proper operation of the equipment

This symbol means always wear safety glasses with side shields or goggles when handling or using this equipment to reduce the risk of eye injury

This symbol indicates the risk of electrical shock.

This symbol indicates the risk of explosion.

General Safety Rules

Read all safety warnings and instructions. Failure to follow the warnings and instructions may result in electrical shock, fire, explosion, and/or serious injury.

SAVE THESE INSTRUCTIONS!

DANGER

High Voltage Equipment

Do not operate any high voltage equipment in or around water without using a Ground Fault Circuit Interrupter (GFCI) and an isolation transformer, especially when divers are in the water.

WARNING

Improper Use and Handling

- Whenever possible, subsea electronic systems should be connected to either an active or passive cathodic protection system such as a network of anodes to prevent corrosion of critical components when deployed.
- This product can be configured with a variety of standard pinouts and will be shipped with a pinout label identifying the connector type and the internal connections of power and control signals. Always check the pinout of the unit against the system specifications prior to installation.
- This product operates on low voltage DC power anywhere from 10V DC up to 36V DC. Connecting the unit to a power source outside this range may result in malfunction or damage to the item.
- Never place the pressure housing in a vice or other hard clamping tool unless explicitly instructed to do so in this manual. Should it become necessary to hold onto the unit tighter than can be managed by hand, use a clean and good quality strap wrench.

DANGER

Flooded Housing

A flooded or partially flooded housing presents a significant hazard of both electrical shock and explosion. Water in contact with internal electronics may short to the housing, exposing users to potentially dangerous voltages. It is also possible that water in contact with internal electrical circuits may electrolyze, producing an explosive mixture of hydrogen and oxygen gasses trapped inside the pressure vessel.

For safety reasons, always assume the camera has flooded and take necessary precautions if it stops working underwater. When working with a potentially flooded camera, it is important to use appropriate personal protective equipment (PPE) to include, at a minimum, eye and hand protection and protective clothing.

Follow these steps if the pressure housing becomes flooded or is suspected of flooding:

1. Immediately power off the unit.
2. Put on appropriate PPE, including protective clothing, eye protection, and protective gloves.
3. Relieve any internal pressure by venting the pressure relief valve (PRV) or loosening the bulkhead connector from the unit.
4. Remove the rear endcap retaining ring and then lever the endcap off with a flat blade screwdriver using the groove just forward of the connector mating surface. The endcap should separate in a smooth linear motion. No twisting is necessary.
5. Pour out any water trapped inside the housing.
6. If the unit is completely flooded, rinse the internal components with clean, fresh water in order to minimize contamination and corrosion damage.

7. Allow parts to dry in air or in an oven set to 60°C (140°F).

NOTICE

Proper Cables and Interconnects

This product transmits data over high-speed serial interfaces using controlled impedance transmission lines such as 75Ω coax and 100Ω differential pairs. Use of controlled impedance connectors and cables designed for subsea applications is critical to the proper operation of the unit.

WARNING

Field Service and Modification

Except when specifically instructed, this product does not require the user to open the pressure volume or break the factory-validated high pressure seals to operate. Opening the pressure volume invites the risk of contamination of the high-pressure seal surfaces which may result in water intrusion and failure.

This product is configured for optimal function at the factory. Opening and modifying any of the factory configured hardware, such as the lens assembly, can affect focus and imaging performance. Access to or modification of the internal components should not be attempted without the guidance of a qualified service representative.

NOTICE

Changing Factory Settings

This product is configured for optimal function at the factory. Changing the device settings through either the On Screen Display (OSD) menu for the SDI camera configurations or the online user interface for the IP camera configuration can result in loss of functionality. Carefully read through the sections of this manual describing the OSD menu and online user interface before making changes to the unit and heed warnings about settings that should not be modified.

Pre and Post Dive Inspection

Before deployment, always check to make sure the bulkhead connector assembly is secure.

Prior to and following each deployment, perform a visual inspection of the following areas for damage, wear, or corrosion:

- Bulkhead connector assembly
- Interconnect cable
- Optical port
- Port retainer and pressure housing

Rinse the unit with fresh water after use, especially in saltwater environments.

Customer Service

DeepSea Power & Light provides service to our global customers through our Service and Repair department. Contact DeepSea Support with comments, suggestions, feedback or to request service or support for your product.

To learn more about this product, along with the other products and services provided by DeepSea Power & Light, please visit www.deepsea.com or reach out to us at support@deepsea.com.

Configuration

The HD Multi SeaCam delivers high-quality HD 1080p/30 video in a compact housing. This subsea camera is offered with multiple different lens and port options to maximize the versatility of the product. All configurations have been designed to minimize optical distortion to the degree possible and provide high quality HD imagery at any depth.

Lens and Port Options

The field of view of a particular configuration is determined by the focal length of the lens and the type of optical port fitted to the unit. Flat ports have a reduced field of view in water compared to operation in air, but the optimal focus is the same in either condition. Dome ports maintain the same field of view in air and water, but are not able to focus in air and appear near sighted until underwater where they are optimally focused. For more information on this topic, see our knowledgebase article here: https://www.deepsea.com/dome-view-ports-best-performance-under-pressure/

NOTICE

Operation Without Crash Guard

Due to the extreme wide angle field of view of the widest lens option, the camera cannot be fitted with a crash guard without overlapping with the image. The optical dome is made from chemically toughened borosilicate glass and is very resistant to scratching and superficial damage. Steps should be taken to mount the camera away from abrasives or sharp objects in order to avoid damage.

Horizontal Field of View and Model Number

The table below shows the compatible lens and housing options and provides the model number reference corresponding to that lens and port combination.

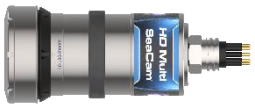
	HOUSING		
			
LENS	*Sapphire Flat Port*	*Glass Dome + Crash Guard*	*Glass Dome*
6 mm, *f*/4.0	40°, **HDMSC-4040**		
2.7 mm, *f*/2.9	72°, **HDMSC-4070**	105°, **HDMSC-4105**	
2.33 mm, *f*/2.9	85°, **HDMSC-4085**	125°, **HDMSC-4125**	
1.97 mm, *f*/3.0			150°, **HDMSC-4150**

Table 1 - HD Multi SeaCam Housing and Lens Options

Housing Options

The HD Multi SeaCam is available in both flat and dome port housing options, each offering different lens and field of view configurations (see Table 1).

Housing selection also affects the depth limit options of the camera. Flat port options are limited to 6000 m, and dome port housings are available in both 6000 m and 11,000 m configurations. While a 6000 m and an 11,000 m housing look the same externally, there are internal differences between the dome seat and support geometry in either housing to achieve the higher pressure rating.

NOTICE

Bulkhead Connector Selection

Regardless of the housing configuration, bulkhead connectors should be chosen that meet or exceed the housing's operating depth limits. **If a customer-specified connector does not meet the housing's pressure rating, the connector will limit the camera's factory certified depth rating.**

Power Input Options

The HD Multi SeaCam configured for both Coax and FleXlink provides a wide range, 10-36 VDC discrete voltage input drawing a maximum 3 W of power. The control interface signals are internally referenced to the DC reference voltage of the power supply.

With the IP streaming configuration, the camera can be powered with either a discrete 10-36 VDC input voltage or by utilizing a Power over Ethernet (PoE) connection, which superimposes a DC voltage (usually 48 VDC) onto the wire pairs carrying data signals to the camera.

Signal Format Options

All configurations of the HD Multi SeaCam feature the latest generation Sony Starvis™[1] CMOS sensors with two types of output video signal options available: HD-SDI digital video or IP streaming.

Video Format Type	HD-SDI Digital Video		IP Streaming
Transmission Method	FleXlink® UTP	75Ω Coax	Ethernet
Video Data Format	SMPTE 292M compliant HD-SDI		h.264, JPEG
Date Rate	1.485 Gbps		10/100 BaseT
Connector Type	Select Subsea Ethernet[2]	Subsea Coax Hybrid	Subsea Ethernet
Onboard Memory	None	None	Yes | 256 GB to 1TB
Internal Recording	None	None	Yes | Video & timelapse
Input Voltage Range	10 to 36 VDC		10 to 36 VDC
Power over Ethernet	N/A		Yes | IEEE 802.3af
Max Power Draw	2 Watts		

Table 2 - HD Multi SeaCam Video Format Options

IP Video Streaming

Our IP video streaming option uses a high quality h.264 video encoder to compress and transmit the HD video signal via an RTSP connection on an Ethernet network. This video option works much like conventional security and surveillance cameras while providing additional features such as onboard recording, multiple video feeds, timelapse image capture, scheduling, and onboard memory up to 1 TB.

For best performance and the highest reliability, subsea cables and connectors rated for CAT5e or better network applications should be used to connect the camera to a network for streaming. In non-streaming applications, the camera can be configured to start recording video and/or timelapse images as soon as power is applied. Stored video files are segmented in 5-minute chunks per file. Therefore, successful video capture requires the camera to be recording for at least 5 minutes.

SDI Video

HD-SDI is the preferred video signal option for uncompressed high-definition digital video. The 1.5Gbps HD-SDI output signal is compliant with the SMPTE 292M and will work with almost any broadcast video equipment. DeepSea offers both conventional coax and our proprietary FleXlink® transmission method, which leverages balanced twisted pairs in standard subsea Ethernet cables to transmit the uncompressed HD-SDI video.

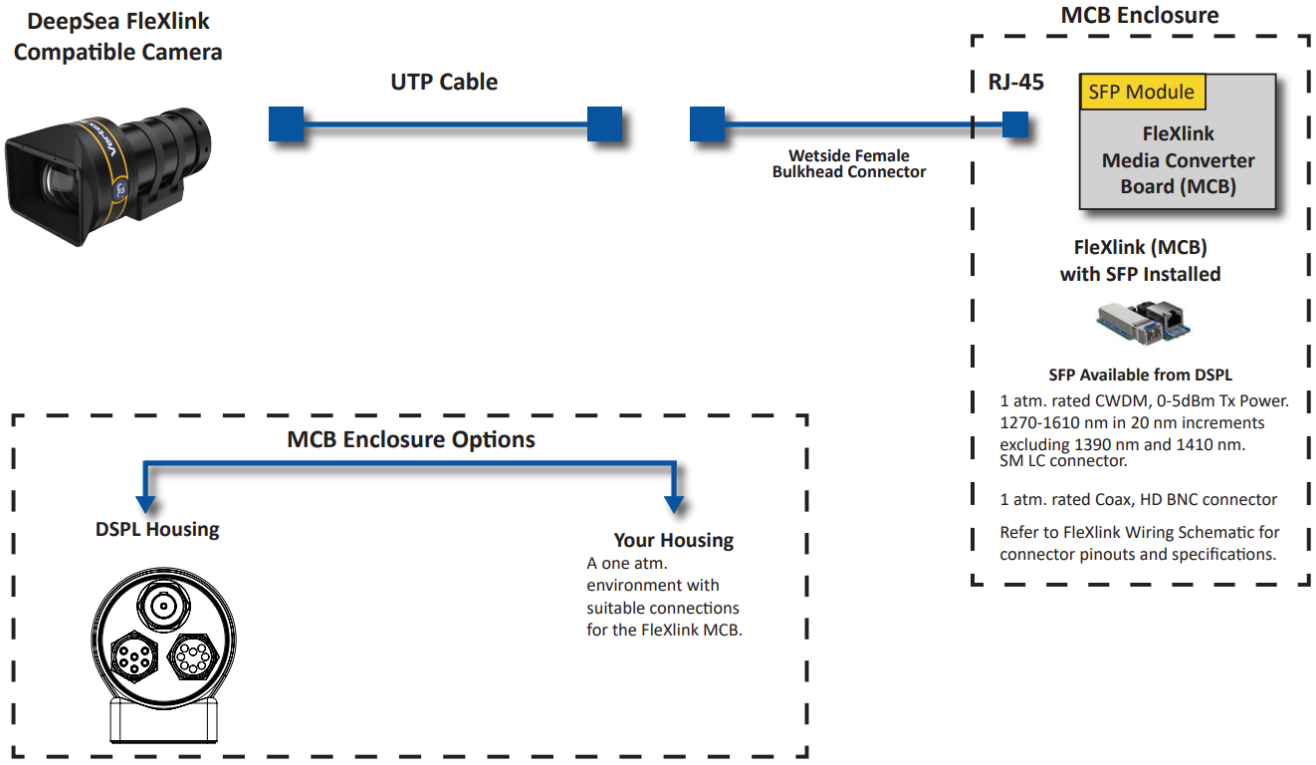
Coax

An HD Multi SeaCam fitted with a coax HD-SDI output leverages the 75Ω impedance of the coaxial transmission line to send the high-speed digital data over distances extending up to 20-30 m with good subsea hybrid coax connectors. The video signal must be connected through a coax conductor all the way from source to destination for proper operation. For longer distances, a SMPTE 292M compliant fiber optic media converter can be used to extend the signal reach to several kilometers.

[1] STARVIS is a trademark of the Sony Group Corporation of Japan
[2] See our web site for a comprehensive list of FleXlink compatible subsea connectors: dspl.com/flexlink-technology/

FleXlink

DeepSea's exclusive FleXlink technology offers an alternative connectivity option for SDI video signal transmission through subsea interconnects. FleXlink uses a proprietary cable driver and media converter to transmit the uncompressed HD-SDI or 3G-SDI video signal over a balanced 100Ω unshielded twisted pair (UTP), such as those typically found in subsea Ethernet cables. The 8-conductors in a typical subsea Ethernet connector provide enough connections to power the camera, transmit SDI video, and connect serial or tristate controls to operate the camera. A FleXlink media converter is required to convert the SDI video into coax or fiber optic signals. See graphic below.



Catalog Configuration Options

HD-SDI COAX and FleXlink Models

	Example Configuration:	**HDMSC**	**-4105**	**-CX**	**-TI**	**-RS2**	**-M**	**-SUDBH8M/S**	**-08C016**

MODEL

HDMSC = HD Multi SeaCam

OPTICAL FORMAT

Flat Port, Sapphire	Dome Port, Glass
4040 = 6 mm, F/4.0, 40° HFoV	**4105** = 2.7 mm, F/2.9, 105° HFoV
4070 = 2.7 mm, F/2.9, 72° HFoV	**4125** = 2.33 mm, F/2.9, 125° HFoV
4085 = 2.33 mm, F/2.9, 85° HFoV	**4150** = 1.97 mm, F/3.0, 150° HVoF

VIDEO SIGNAL

FX = HD-SDI over FleXlink
CX = HD-SDI over Coax

HOUSING

TI = Titanium
11 = 11 km^3 Titanium

CONTROL

TRI = Dual Tristate On-Screen Display (OSD) control
RS2 = RS-232, OSD via SeaSense protocol
RS4 = RS-485, OSD via SeaSense protocol

BRACKET

M = Metric M6, Saddle
I = Imperial 1/4-20, Saddle

BULKHEAD

FleXlink: SUDBH8M/S	Coax: SUHF75CXBH6M/S
SubConn DBH8M	SubConn HF75CXBH6M
Stainless Steel, 7 km	Stainless Steel, 7 km
↓ 8-Pin, Ethernet ↓	↓ 6-Pin + Coax ↓

PINOUT

08C016 (example)		06X023 (example)	
1: SDI+	5: DC+	1: DC-	5: OSD UP/DOWN
2: SDI-	6: DC-	2: DC+	6: OSD LEFT/RIGHT
3: N/C	7: TxD/A-	3: N/C	COAX CENTER: SDI VIDEO
4: N/C	8: RxD/B+	4: N/C	COAX SHIELD: VIDEO RTN

Other connector and pinout options are available. Contact DeepSea Sales for information.

IP Models

Example Configuration:	HDMSC	-4105	-IP	-TI	-C	-S	-1TB	-M	-SUDBH8M/S	-08E021

MODEL	HDMSC = HD Multi SeaCam	
OPTICAL FORMAT	**Flat Port, Sapphire**	**Dome Port, Glass**
	4040 = 6 mm, F/4.0, 40° HFoV	4105 = 2.7 mm, F/2.9, 105° HFoV
	4070 = 2.7 mm, F/2.9, 72° HFoV	4125 = 2.33 mm, F/2.9, 125° HFoV
	4085 = 2.33 mm, F/2.9, 85° HFoV	4150 = 1.97 mm, F/3.0, 150° HVoF
VIDEO SIGNAL	IP = TPC/IP Network Video	
HOUSING	TI = Titanium 11 = 11 km[3] Titanium	
SENSOR TYPE	C = Color, 2.2MP, 1080p/30 N = Monochromatic, 2.2MP, 1080p/30	
STREAM SETUP	S = Streaming, h.264 Main, 10Mbps R = Recording, h.264 Main, 20Mbps	
MEMORY	NON = No Onboard Memory	512 = 512 GB Flash Memory
	256 = 256 GB Flash Memory	1TB = 1 TB Flash Memory
BRACKET	M = Metric M6, Saddle I = Imperial 1/4-20, Saddle	
BULKHEAD	**SUDBH8M/S** SubConn DBH8M Stainless Steel, 7km ↓ 8-Pin, Ethernet ↓	**SUBH4M/S** SubConn BH4M Stainless Steel, 11 km ↓ 4-Pin ↓
PINOUT	**08E021 (example)** 1: DC- 2: DC- 3: DC+ 4: DC+ 5: TD- 6: TD+ 7: RD- 8: RD+	**04P007 (example)** 1: DC- 2: DC+ 3: N/C 4: N/C

Other connector and pinout options are available.
Contact DeepSea Sales for information.

[3] 11km depth rating only available in dome port Optical Format options. Requires suitable connector selection.

Specifications

Optical Specifications						
HDMSC-	**4040**	**4070**	**4085**	**4105**	**4125**	**4150**
Port Type	Flat			Dome		
Lens	6 mm, *f*/4.0	2.7 mm, *f*/2.9	2.33 mm, *f*/2.9	2.7 mm, *f*/2.9	2.33 mm, *f*/2.9	1.97 mm, *f*/3.0
Focus	100 mm-∞					
Horizontal Field of View (Water)	40°	72°	85°	105°	125°	150°
Min. Faceplate Illumination Color [Mono[4]]		0.095 [0.002] Lux		0.095 [0.002] Lux		

Sensor and Video Format Specifications				
HDMSC-	**40XX-CX/FX**	**41XX-CX/FX**	**40XX-IP**	**41XX-IP**
Image Sensor	Sony 1/2.8 inch class Back Side Illuminated CMOS Sensor			
Resolution	1920x1080			
Sensor Chroma	RGB Color		RGB Color, Monochrome Option	
Video Format	1.5 Gbps HD-SDI 1080/30/25p, 720/60/50/30/25p		h.264 1080/30/25p, 720/60/50/30/25p	
Transmit Type	Coax or FleXlink		Ethernet	
Recording Type	N/A		Video, time-lapse	
Memory	N/A		256 GB microSD, up to 1 TB	

Environmental Specifications				
HDMSC-	**40XX-CX/FX**	**41XX-CX/FX**	**40XX-IP**	**41XX-IP**
Max Depth Rating	6000 m	6000 m 11,000 m Option	6000 m	6000 m 11,000 m Option
Operating Temp	-30° C to 50° C [-22° F to 122° F]		0° C to 40° C [32° F to 104° F]	
Storage Temp	-30° C to 70° C [-22° F to 158° F]		-30° C to 70° C [-22° F to 158° F]	

Mechanical Specifications				
HDMSC-	**40XX-CX/FX**	**41XX-CX/FX**	**40XX-IP**	**41XX-IP**
Housing	Titanium	6km Titanium 11km: Titanium, Stainless Steel[5]	Titanium	6km Titanium 11km: Titanium, Stainless Steel[5]
Optical Port	Sapphire	Borosilicate Glass	Sapphire	Borosilicate Glass
Mounting Bracket	Saddle bracket with 4x M6 or 1/4-20 titanium inserts on 25.4mm centers			
Weight in Air	0.65 kg [1.4 lbs.]	0.65 kg [1.4 lbs.]	0.56 kg [1.23 lbs.]	0.56 kg [1.23 lbs.]
Weight in Water	0.44 kg [1.0 lbs.]	0.37 kg [0.84 lbs.]	0.34 kg [0.75 lbs.]	0.32 kg [0.71 lbs.]

Electrical Specifications				
HDMSC-	**40XX-CX/FX**	**41XX-CX/FX**	**40XX-IP**	**41XX-IP**
Power	10 to 36 VDC		10 to 36 VDC, Power over Ethernet (IEEE802.3af)	
Voltage	3 W Max		2 W Max	
Control	RS-485, RS-232, Tristate (OSD only)		Webpage Operator Interface	
Standard Connector	**Coax**: SubConn HF75CXBH6M Stainless Steel **FleXlink**: SubConn DBH8M, Stainless Steel		**Ethernet:** SubConn DBH8M, Stainless Steel **Power Only:** SubConn BH4M, Stainless Steel	
	Contact Sales for additional options			

[4] Higher sensitivity mono sensor chroma sensor option only available with IP video format options.
[5] All surfaces in contact with sea water are Titanium. Stainless Steel is used internally as a part of the dome support only.

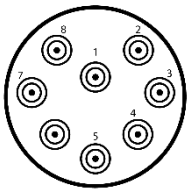
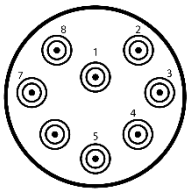
WARNING

Standard Pinout

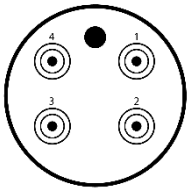
Always verify the pinout of your product against the printed pinout label or documentation supplied with your product before connecting with other systems or powering the device. If you are unsure of how your item is pinned out, contact us at support@deepsea.com and provide the model number, purchase order, and serial number of your item and we will provide a pinout drawing for your product.

The following pinouts are considered "standard" conventions by DeepSea. We strongly urge all of our customers to adhere to these conventions to avoid accident and potential injury. DeepSea is not responsible for damage caused by improper wiring, incorrect power applied to the product, or by using a non-standard pinout.

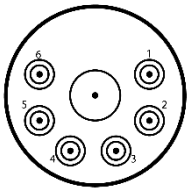
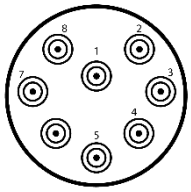
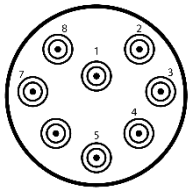
Ethernet IP Pinouts

	SubConn DBH8		**SEA-CON MCBH8M-NET**		**Schilling Robotics SEANET**
	 *MALE PIN VIEW*		 *MALE PIN VIEW*		
PIN	**Ethernet Camera Discrete Power 10/100Mbps**	**Ethernet Camera PoE 10/100Mbps**	**Ethernet Camera Discrete Power 10/100Mbps**	**Ethernet Camera PoE 10/100Mbps**	**IP Camera NIM**
1	DC-	0V PoE	TD-	TD-	DC+
2	DC-	0V PoE	TD+	TD+	DC-
3	DC+	48V PoE	RD-	RD-	CHASSIS
4	DC+	48V PoE	RD+	RD+	RD-
5	TD-	TD-	DC-	0V PoE	RD+
6	TD+	TD+	DC-	0V PoE	TD-
7	RD-	RD-	DC+	48V PoE	TD+
8	RD+	RD+	DC+	48V PoE	
ID	**08E021**	**08E025**	**08E022**	**08E023**	**07E004**

Power-Only Recording IP Pinouts

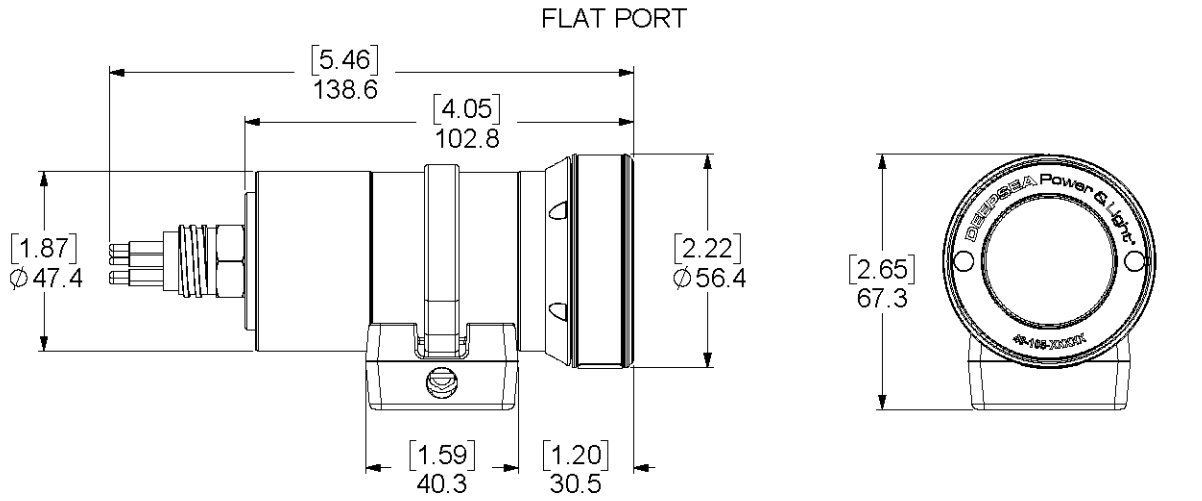
	BH4M, MCBH4M
	 *MALE PIN VIEW*
PIN	
1	DC-
2	DC+
3	N/C
4	N/C
ID	**04P007**

HD-SDI COAX and FleXlink Pinouts

BULKHEAD	**SUDBH8M/S**			**SUDBH8M/S**		**SEMCBH8M/S**	
COAX	**SubConn HF75CX6BHM**  *MALE PIN VIEW*		**FLEXLINK**	**SubConn DBH8**  *MALE PIN VIEW*		**SEA-CON MCBH8M-NET**  *MALE PIN VIEW*	
PIN	**HD Camera Hybrid Coax Tristate**	**HD Camera Hybrid Coax Serial**	**PIN**	**HD Camera FleXlink Tristate**	**HD Camera FleXlink Serial**	**HD Camera FleXlink Tristate**	**HD Camera FleXlink Serial**
1	DC-	DC-	**1**	SDI+	SDI+	DC+	DC+
2	DC+	DC+	**2**	SDI-	SDI-	DC-	DC-
3	N/C	N/C	**3**	N/C	N/C	OSD ↑/↓	↓TxD/A-
4	N/C	N/C	**4**	N/C	N/C	OSD →/←	↑RxD/B+
5	OSD ↑/↓	↑RxD/B+	**5**	DC+	DC+	SDI+	SDI+
6	OSD →/←	↓TxD/A-	**6**	DC-	DC-	SDI-	SDI-
COAX	SDI	SDI	**7**	OSD ↑/↓	↓TxD/A-	N/C	N/C
SHIELD	SDI REF	SDI REF	**8**	OSD →/←	↑RxD/B+	N/C	N/C
PINOUT	**08E021**	**06X020**		**08C042**	**08C016**	**08C020**	**08C003**

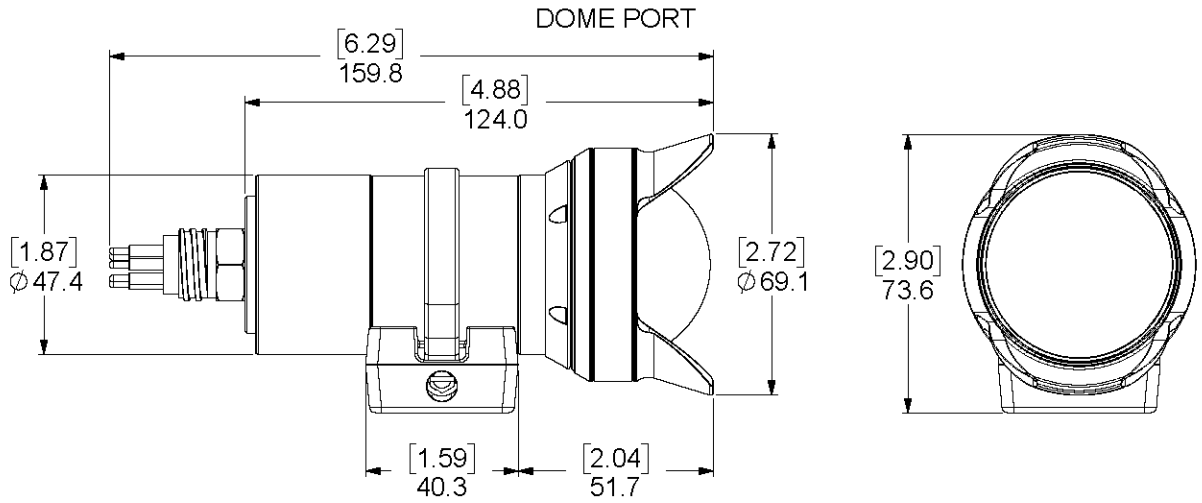
Dimensions

HDMSC-40XX



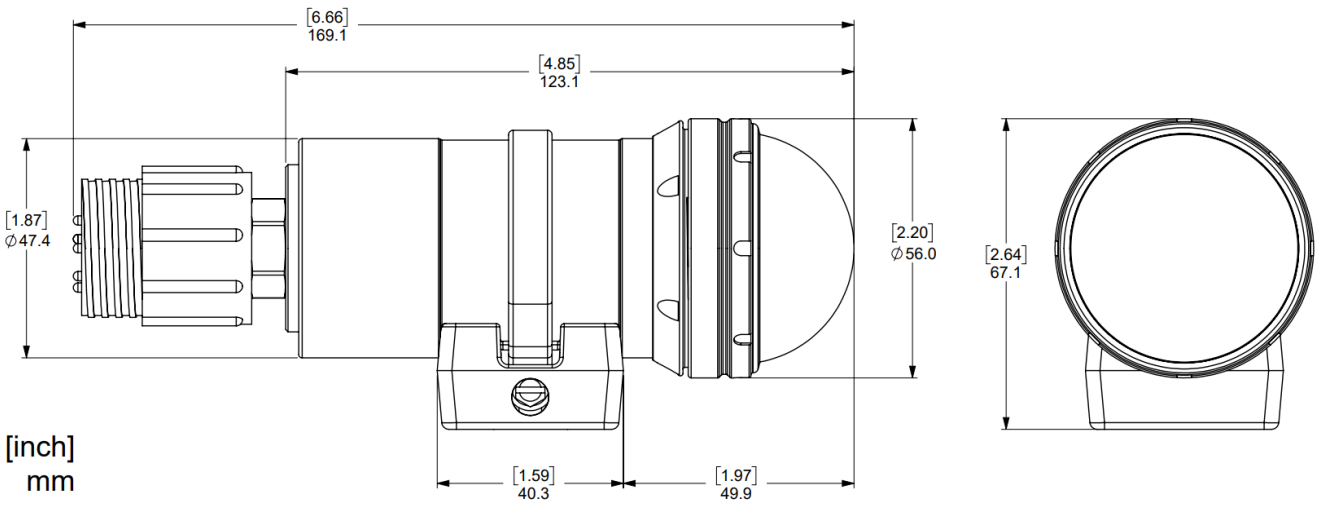
mm
[inch]

HDMSC-41XX – With Cowl

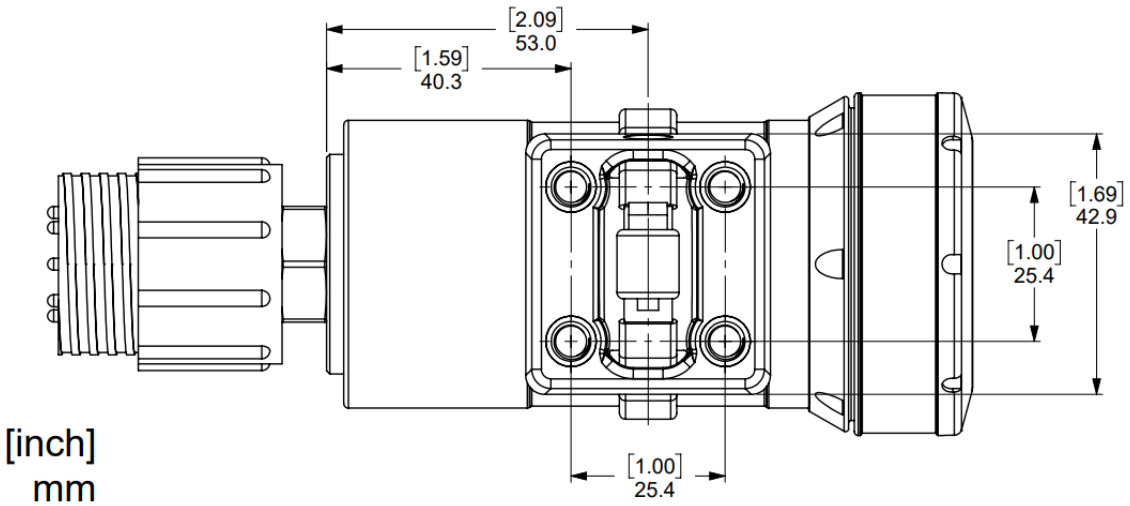


mm
[inch]

HDMSC-41XX – Without Cowl



HDMSC Saddle Bracket Dimensions



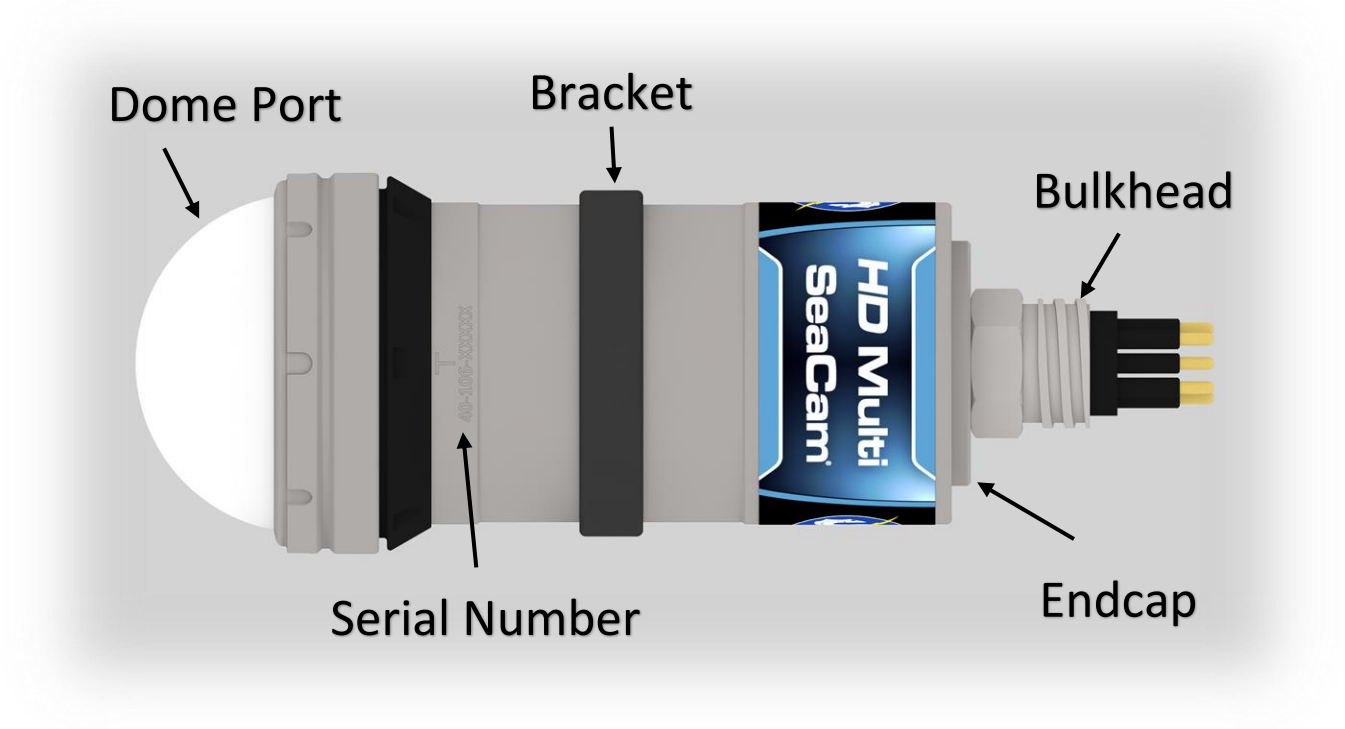
Bracket available with either 6x1 mm or 1/4-20 threaded inserts.

Introduction

The HD Multi SeaCam is a family of fixed focus cameras designed for high-definition imaging at depth. As the “Multi” part of the name implies, there are multiple options built into the platform, allowing this camera to be configured for a wide range of subsea imaging needs—including options that can achieve full ocean depth. This camera is compact yet feature-rich, and brings full digital high definition video to tooling and operator-context applications to the deep ocean.

There are two video standards available within the HD Multi SeaCam family: real-time uncompressed HD-SDI broadcast video and low-latency streaming over Ethernet. Flat port and dome port options along with different lens options provide seven different field of view configurations, from a narrow 40° horizontal view for up-close imaging to an ultra-wide 150° horizontal field of view.

External Description



Integration Procedure

Unpacking

NOTICE

HDMSC IP Quick Start Guide

IP configurations of the HD Multi SeaCam are shipped with a quick start guide. The quick start guide includes important information about logging into the camera, including the default IP address and username and password for the web-based user interface. The password information is unique to each camera, so it is important to retain and archive this information where it can be referenced in the future.

Connecting to Your HD Multi SeaCam for the First Time

SDI Video Interface

1. Prepare a power supply with 10~36 VDC output.
2. Connect the camera power, HD-SDI video, analog video, and control signals to their respective interfaces per the pin-out specified for the camera.
3. Prepare the camera bulkhead connector as required, verifying proper lubrication of all O-rings and seal surfaces with a silicone lubricant (spray recommended).
4. Mate the female underwater connector to the male bulkhead using a smooth linear motion, making sure the connectors are fully seated and seals are engaged.
5. Screw the locking sleeves together firmly by hand. Do not use tools.
6. The camera is now ready for operation. Switch the power supply ON to power the camera. The camera draws a max of 3 W during operation and will work when supplied with 10~36 VDC.
7. Verify proper operation of the camera by viewing the HD-SDI video feed on an appropriate monitor.

IP Video Interface – Discrete Power

1. Prepare a power supply with 10~36 VDC output.
2. Connect the camera power and Ethernet connection to their respective interfaces per the pin-out specified for the camera.
3. Prepare the camera bulkhead connector as required, verifying proper lubrication of all O-rings and seal surfaces with a silicone lubricant (spray recommended).
4. Mate the female underwater connector to the male bulkhead using a smooth linear motion, making sure the connectors are fully seated and seals are engaged.
5. Screw the locking sleeves together firmly by hand. Do not use tools.
6. The camera is now ready for operation. Switch the power supply ON to power the camera. The camera draws a max of 2 W during operation and will work when supplied with 10~36 VDC.
7. The HDMSC IP address defaults to 192.168.1.250. Navigate to the camera web interface in a browser window at http://192.168.1.250.
8. Use the username and password listed on the quick start guide to log in. See Appendix B on page **30** for details on configuring the camera over the web interface.

IP Video Interface – Power over Ethernet

1. Connect the Ethernet interface of the camera to a PoE-capable Ethernet switch following the pin-out specified for the camera.
2. Prepare the camera bulkhead connector as required, verifying proper lubrication of all O-rings and seal surfaces with a silicone lubricant (spray recommended).

3. Mate the female underwater connector to the male bulkhead using a smooth linear motion, making sure the connectors are fully seated and seals are engaged.
4. Screw the locking sleeves together firmly by hand. Do not use tools. The camera is now ready for operation. Switch the power supply ON to power the camera. The camera draws a max of 2 W during operation and draws power from the PoE network switch.
5. The HDMSC IP address defaults to 192.168.1.250. Navigate to the camera web interface in a browser window at http://192.168.1.250.
6. Use the username and password listed on the quick start guide to log in. See **Appendix B on page 30** for details on configuring the camera over the web interface.

Controlling Your HD Multi SeaCam

SDI Video Versions

Customization of the camera settings is possible through an on-screen display (OSD) menu. Accessing and navigating this menu is done either using a pair of tristate inputs which map to left-right and up-down menu and select menu actions. Alternatively, these functions can be access through either an RS-232 or RS-485 serial interface using the appropriate SeaSense OSD commands. See **Appendix A on page 23** for complete details on accessing and navigating the OSD menu options.

IP Video Versions

All IP versions of the HD Multi SeaCam are compliant with the ONVIF Profile S standard, which provides network identification and limited access to the camera settings and features. Full access to the camera setup and controls is through the integrated web-based user interface. See **Appendix B on page 30** for complete details on the web-based user interface and the full features of the IP camera variants.

Additional guides for advanced features, troubleshooting, and instructions for recovering the onboard microSD card recording media can be found on our support website at: https://help.deepsea.com/support/home.

Care and Maintenance

The HD Multi SeaCam is designed to require minimal maintenance for proper operation and a long service life. Maintaining your HD Multi SeaCam according to the below timeline will help prolong the life of your equipment.

After every dive…

- Rinse the camera with fresh water to prevent buildup of salt and mineral deposits outside seals.

Every year…

- Disconnect the inline connector from the camera and visually inspect for any signs of corrosion, water intrusion, wear, or damage to the pins and shell of the mating connector and bulkhead.
- Clean all pin and bulkhead seals and apply fresh lubrication to O-rings and rubber molded pins as necessary.
- Look over the housing for any indications of mechanical damage sustained during subsea operations.
- Visually inspect the optical port for any signs of moisture, cracks, or water intrusion.

Every five years…

- In addition to the normal annual maintenance, remove the camera from operation and return to DeepSea for a high-pressure seal replacement service. You may also contact our support team for instructions on performing this maintenance in the field **(support@deepsea.com)**.

Troubleshooting

1. If the HD Camera stops working while underwater, always assume that it has been flooded. See Flooding Repair procedure on **page 5**.
2. If it has been determined that the unit is not flooded, or if it does not turn on during pre-deployment checks, troubleshoot the camera in the following sequence:
    a. Check the cable/inline connector to make sure that correct voltage and current are being supplied, and that the pin-out matches the HD Camera being used. See **pages 11 and 12** of this manual for electrical specifications and standard connector pin-outs.
    b. Remove the endcap to access the bulkhead connector. Inspect the assembly for visual signs of wear. Use a multimeter check for continuity or shorts in the connector. Try a spare connector, if available.
    c. If the HD Camera still does not work, return it to DeepSea Power & Light using the RMA Procedure on page 22.

Resources

Additional information and troubleshooting guides for your product may be available on our Customer Help site at https://help.deepsea.com/support/home. Create an account there to access the broadest range of content on our products.

RMA Procedure for Repair

Should it be necessary to return your camera to the factory, follow the procedure for the Flooded Camera Repair on **page 5**. Leave the connector partially unscrewed before shipping the camera to DeepSea Power & Light.

For warranty and non-warranty repairs, please contact DeepSea Power & Light for an RMA number prior to returning your item. Provide your product's model number, serial number, and any other pertinent information along with a description of the problem when you request the RMA. You may request an RMA via:

- **Phone**: + 1 (858) 576-1261
- **Email**: RMA@deepsea.com
- **RMA form on our website**: www.deepsea.com/rma

When shipping your item, be sure that the freight is pre-paid (CODs will not be accepted) and that the RMA number is clearly printed on the outside of the box. All shipments should be sent to the address below:

DeepSea Power & Light
Attn: RMA ####
4033 Ruffin Road
San Diego, CA 92123-1817
U.S.A
Tel: (858) 576-1261
Fax: 858-576-0219
Email: RMA@deepsea.com

Warranty Information

Limited Warranty

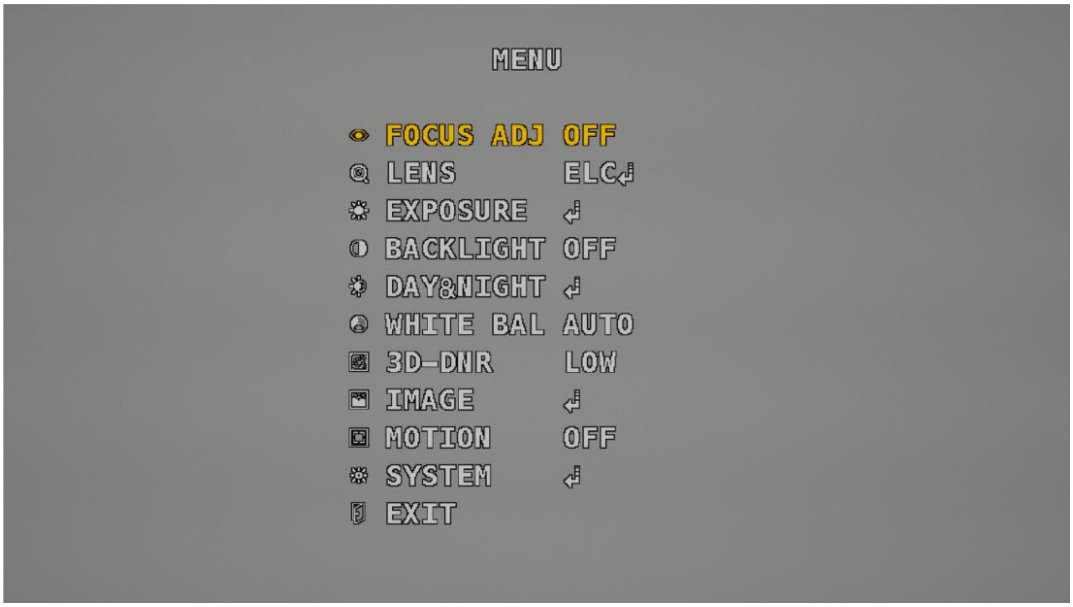
Seller warrants that the goods (except internal electronic components) sold under this contract will be free from defect in material and workmanship for a period of one year from the date of shipment from the factory, if they have been properly used. Internal electronic components are warranted for 90 days from the date of shipment from the factory, if they have been properly used. This warranty will be limited to the repair or replacement of parts and the necessary labor and services required to repair the goods. IT IS EXPRESSLY AGREED THAT THIS WARRANTY WILL BE IN LIEU OF ALL WARRANTIES OF FITNESS AND IN LIEU OF THE WARRANTY OF MERCHANTABILITY. This warranty is the exclusive and only warranty to pass with the goods under this contract. No agent, employee, or representative of the Seller has any authority to bind Seller to any information, representation, or warranty concerning the goods sold under this contract, and unless an affirmation, representation, or warranty made by an agent, employee, or representative is specifically included within this contract, it will not be enforceable by Buyer. If notice of defect is given to DeepSea Power & Light LLC within such 90 day or one-year warranty period, the sole obligation of DeepSea Power & Light LLC shall be to furnish new or repaired parts free of charge in exchange for parts which have been proved defective and does not include any other costs such as the cost of removal of the defective part, installation, labor, or consequential damages of any kind, the exclusive remedy being to require DeepSea Power & Light LLC to furnish such new parts. Under no circumstances shall the Buyer be entitled to recover any incidental damages as that term is defined in Commercial Code §2715.

Appendix A – Tristate OSD Controls

The HD Multi SeaCam is equipped with an on-screen display (OSD) interface, which allows you to configure various parameters of the camera module. The OSD interface is only accessible in the CVBS analog video output and is not visible in HD-SDI.

Tristate Controls

The HD Multi SeaCam can be configured with dual tristate input control pins, which are mapped to control the OSD menu of the internal HD camera module. The two control pins are referred to as Tristate A and Tristate B.



Each control pin has three valid states protected up to ±40 V:

- Pulled high “HI” from 1~40 V
- Pulled low “LO” from 0~0.4 V
- Undriven or open “OPEN” state in greater than 100KΩ source impedance

The ideal drive should operate within the input supply rails. Tristate A controls “UP” and “DOWN” and Tristate B controls “LEFT” and “RIGHT”. Simultaneously pulling both tristate pins low is mapped to the “SELECT” function. Pulling both pins high can be used to return the camera to its factory state. See section 1.4 for more information on the factory reset feature.

Tristate A	Tristate B	OSD Action
OPEN	OPEN	N/A
OPEN	HI	RIGHT
OPEN	LO	LEFT
HI	OPEN	UP
HI	HI	RESET
HI	LO	N/A
LO	OPEN	DOWN
LO	HI	N/A
LO	LO	SELECT/OPEN

Table 1 - OSD Tristate Control Signal Mapping

OSD Menu Structure

MAIN MENU	SUB MENU1	SUB MENU2	SUB MENU3	SUB MENU4	VALUE	FACTORY DEFAULT
IRIS	-	-	-	-	ELC	ELC
EXPOSURE	BRIGHTNESS	-	-	-	0 - 20	10
	SHUTTER	AUTO	-	-	NORMAL / DEBLUR	NORMAL
		MANUAL	SPEED	-	1/30 - 1/30000	1/30
		FLICKER	-	-	-	-
	SENS-UP	-	-	-	OFF, X2 - x32	X2
	AGC	-	-	-	0 - 10	6
BACKLIGHT	-	-	-	-	OFF / HLC / BLC / WDR	OFF
	HLC	LEVEL	-	-	-	0 – 20
		COLOR	-	-	BLK/CUSTOMIZE, WHT/YEL/CYN, GRN/MAG/RED/BLU	BLK
	BLC	H-POS	-	-	0 - 20	8
		V-POS	-	-	0 - 20	7
		H-SIZE	-	-	0 - 20	3
		V-SIZE	-	-	0 - 20	3
	WDR	MODE	-	-	NORMAL / ROI	NORMAL
		NORMAL	-	-	-	-
		ROI	WINDOW ZONE	-	0 – 3	3
			WINDOW USE	-	OFF / ON	ON
			H-POS	-	0 - 1920	920
			V-POS	-	0 - 1080	630
			H-SIZE	-	0 - 1920	512
			V-SIZE		0 - 1080	452
		WEIGHT	-	-	LOW / MIDDLE / HIGH	MIDDLE
DAY & NIGHT	-	-	-	-	COLOR / B&W / AUTO	COLOR
	COLOR	-	-	-	-	-
	B&W	IR LED	-	-	OFF / ON	ON
		ANTI – SAT.	-	-	0 - 20	0
	AUTO	IR LED	-	-	OFF / ON	ON
		ANTI – SAT.	-	-	0 - 20	0
		AGC THRES.	-	-	0 - 20	10
		AGC MARGIN	-	-	0 - 20	10
		DELAY	-	-	LOW / MIDDLE / HIGH	LOW

- CONTINUED ON NEXT PAGE -

MAIN MENU	SUB MENU1	SUB MENU2	SUB MENU3	SUB MENU4	VALUE	FACTORY DEFAULT
COLOR	AWB	-	-	-	AUTO / AUTOext / MANUAL	AUTO
		AUTO	-	-	-	-
		AUTOext	-	-	-	-
		MANUAL	C-TEMP	-	3000K / 5000K / 8000K	5000K
			R-GAIN	-	0 - 20	10
			B-GAIN	-	0 - 20	10
	COLOR GAIN	-	-	-	0 - 20	13
DNR	-	-	-	-	OFF / LOW / MIDDLE / HIGH	MIDDLE
IMAGE	SHARPNESS	-	-	-	0 - 10	5
	GAMMA	-	-	-	0.45 / 0.55 / 0.65 / 0.75	0.55
	MIRROR	-	-	-	OFF / ON	OFF
	FLIP	-	-	-	OFF / ON	OFF
	ACE	-	-	-	OFF / LOW / MIDDLE / HIGH	OFF
	DEFOG	-	-	-	OFF / ON	OFF
		ON	MODE	-	AUTO / MANUAL	AUTO
			LEVEL	-	LOW / MIDDLE / HIGH	MIDDLE
	PRIVACY	MASKING	-	-	OFF / MODE 1 / MODE 2	OFF
		PRIVACY BOX	-	-	OFF / ON	OFF
			ON	ZONE NUM	0 - 15	0
				ZONE DISP	OFF / ON	OFF
				H-POS	0 - 60	12
				V-POS	0 - 34	2
				H-SIZE	0 - 60	3
				V-SIZE	0 - 34	3
				Y-LEVEL	0 - 20	10
				CB-LEVEL	0 - 20	10
				CR-LEVEL	0 - 20	10
				TRANS	0 - 3	0

- CONTINUED ON NEXT PAGE -

MAIN MENU	SUB MENU1	SUB MENU2	SUB MENU3	SUB MENU4	VALUE	FACTORY DEFAULT
MOTION	-	-	-	-	OFF / ON	OFF
	ON	DET WINDOW	WINDOW ZONE	-	0 - 3	0
			WINDOW USE	-	OFF / ON	ON
			DET H-POS	-	0 - 60	1
			DET V-POS	-	0 - 34	1
			DET H-SIZE	-	0 - 60	58
			DET V-SIZE	-	0 - 34	32
		DET TONE	-	-	0 - 4	2
		MDRECT FILL	-	-	OFF / ON	ON
		SENSITIVITY	-	-	0 - 10	5
		MOTION OSD	-	-	OFF / ON	ON
		TEXT ALARM	-	-	OFF / ON	ON
SYSTEM	COM.	-	-	-	-	-
	FRAME RATE	-	-	-	720p 30 / 720p 60 / 1080p 30	1080p 30
	FREQ	-	-	-	50Hz / 60Hz	60Hz
	EX - SDI	-	-	-	OFF / ON	OFF
	IMAGE RANGE	-	-	-	FULL / COMP / USER	FULL
		FULL	-	-	-	-
		COMP	-	-	-	-
		USER	OFFSET	-	0 - 30	16
	LANGUAGE	-	-	-	ENG / CHN / CHN(S) / JPN / KOR	ENG
	RESET	ON	-	-	ON (PUSHING)	ON

OSD Configuration Options Summary

FOCUS ADJUST - Focus Adjustment Aid

The FOCUS ADJUST menu option provides an on-screen tool for feedback in positioning and focusing the lens at the factory. It has no use for field operations with the assembled HD Multi SeaCam.

LENS – Lens Light Level Control

There are two available level compensation modes:

ALC – Automatic Level Control: primarily used with lenses equipped with an auto iris mechanism
ELC – Electronic Level Control: uses sensor exposure correction to substitute the functionality of an auto iris lens in some applications

The HD Multi SeaCam is equipped with a fixed aperture lens, meaning the ALC function cannot adjust the camera's aperture. However, laboratory testing has shown that the ALC mode is preferable as the default setting due to the small sensing area used in the ELC algorithms.

EXPOSURE - Exposure Settings

The EXPOSURE menu allows you to configure sensor exposure settings such as the electronic shutter speed, pixel Automatic Gain Control (AGC), and multiple frame integration modes for higher low-light sensitivity (SENS-UP).

For most conditions, Auto exposure mode will work best.

Enabling and increasing the SENS-UP value will allow the sensor to perform exposure integration periods longer than the video frame rate to increase the amount of light collected on the imager. This will slow the effective refresh rate of the video, increase latency, and add artifacts to dynamic scenes such as motion blur and increased pixel noise. Enabling SENS-UP is generally not useful for subsea applications.

BACKLIGHT - Backlit Image Compensation

The BACKLIGHT menu offers mechanisms to compensate for back-lit scenes and is not often useful in subsea imaging applications.

DAY&NIGHT – Low Light Image and Color Compensation Tools

The day/night mode of the camera module is primarily for security applications and is generally not useful in subsea applications. This settings is fixed to provide a color image full-time in the factory default settings.

WHITE BALANCE – Image White Balance and Color Correction

Auto white balance mode will work in most situations where color accuracy is not critical. If a fixed white point is needed, use the Manual settings menu to configure the camera for the specific application and lighting system. The AUTO ext and PRESET modes are not supported.

3D-DNR – 3D Digital Noise Reduction

The 3D digital noise reduction engine in the image signal processor can help reduce the amount of pixel noise present in low-light environments and is enabled by the factory default settings at the LOW level. There is little performance difference observed with increasing the noise reduction level.

IMAGE – Video Image Tuning Options

The IMAGE menu offers access to a variety of tools for tuning the video color, image orientation, and other digital imaging effects.

SHARPNESS

Applies a digital sharpening algorithm to the video data to enhance edges in high contrast scenes, bringing out finer details in the image.

GAMMA
Shifts the color gamma curve to change color saturation within a limited range.

COLOR GAIN
Changes the saturation level of the color information in the image to heighten or suppress color information. This can be used to enhance contrasting color areas of an image to help different colors stand out more against a background. Note that color gain affects color accuracy. The default factory settings prioritize color accuracy over color contrast.

MIRROR
A digital effect that mirrors the image vertically.

FLIP
A digital effect that flips the image approximately 180°.

D-ZOOM
A digital effect that scales the image's pixels to effectively zoom in on the center of the image. This is a digital effect only and does not produce full resolution images when in use.

D-WDR
The D-WDR feature applies a digital wide dynamic range filter to compress the dynamic range of an image into the displayable picture by selectively brightening dark areas and darkening light areas. This effect can enhance visibility in high-contrast lit scenes but is disabled by default in the factory settings.

DEFOG
The DEFOG filter is a digital effect that employs contrast stretching to improve visibility of objects in cloudy scenes with high amounts of particulates and diffuse lighting. The effect is usually subtle and disabled in the default factory settings.

SHADING
The SHADING filter is used to remove fixed intensity gradients introduced by lenses and lighting. It is not useful for most subsea applications and is disabled in the factory default settings.

PRIVACY
The PRIVACY effect applies a privacy mask to the video image blocking part of the scene from being viewed and is not typically useful for subsea applications.

MOTION DETECT – In-Frame Motion Detection Image Processor
The Motion Detection engine can be used to highlight parts of the image that change from one video frame to the next. It will draw red outline boxes around those areas that meet the change threshold set by the user. The hardware alarm feature is not supported by the HD Multi SeaCam.

SYSTEM – Video Format Settings and Camera System Options

COM
The COM menu is used by some of the internal functions of the HD Multi SeaCam. Access to these settings through the OSD menu is restricted.

IMAGE RANGE
The IMAGE RANGE options change the apparent brightness of the video image.

OUTPUT MODE
The OUTPUT MODE option selects between full resolution HD 1080 (1920x1080) progressive scan video frames and a scaled 720 (1280x720) progressive scan video frame. Since the 720P output mode is scaled, the effective field of view of the video image is unchanged from the full HD 1080P mode.

COLOR SPACE

Select between HD-CbCr, YUV, and SD-CbCr color spaces. It is not recommeded to change these settings from their default values.

FRAME RATE

Users can select the video frame rate for a given Output Mode: either 30 or 25 frames per second. 60 and 50 frames per second rates are not currently supported for either OUTPUT MODE.

CVBS

The CVBS analog video output can be configured for either NTSC or PAL formats and frame rates.

LANGUAGE

Select between English, Simplified Chinese, Traditional Chinese, Japanese, and Korean for the OSD menu.

COLORBAR

The HD Multi SeaCam can generate a color bar test pattern for signal diagnostic purposes and to troubleshoot the HD-SDI video data link.

RESET

The camera module reset function is not available through the OSD menu. Use the Factory Reset procedure found in section 1.4 instead.

EXIT – OSD Menu Exit

Selecting EXIT will exit the OSD menu and apply all settings. Changes will be preserved through power cycles only after exiting the OSD menu using this EXIT prompt.

Factory Reset

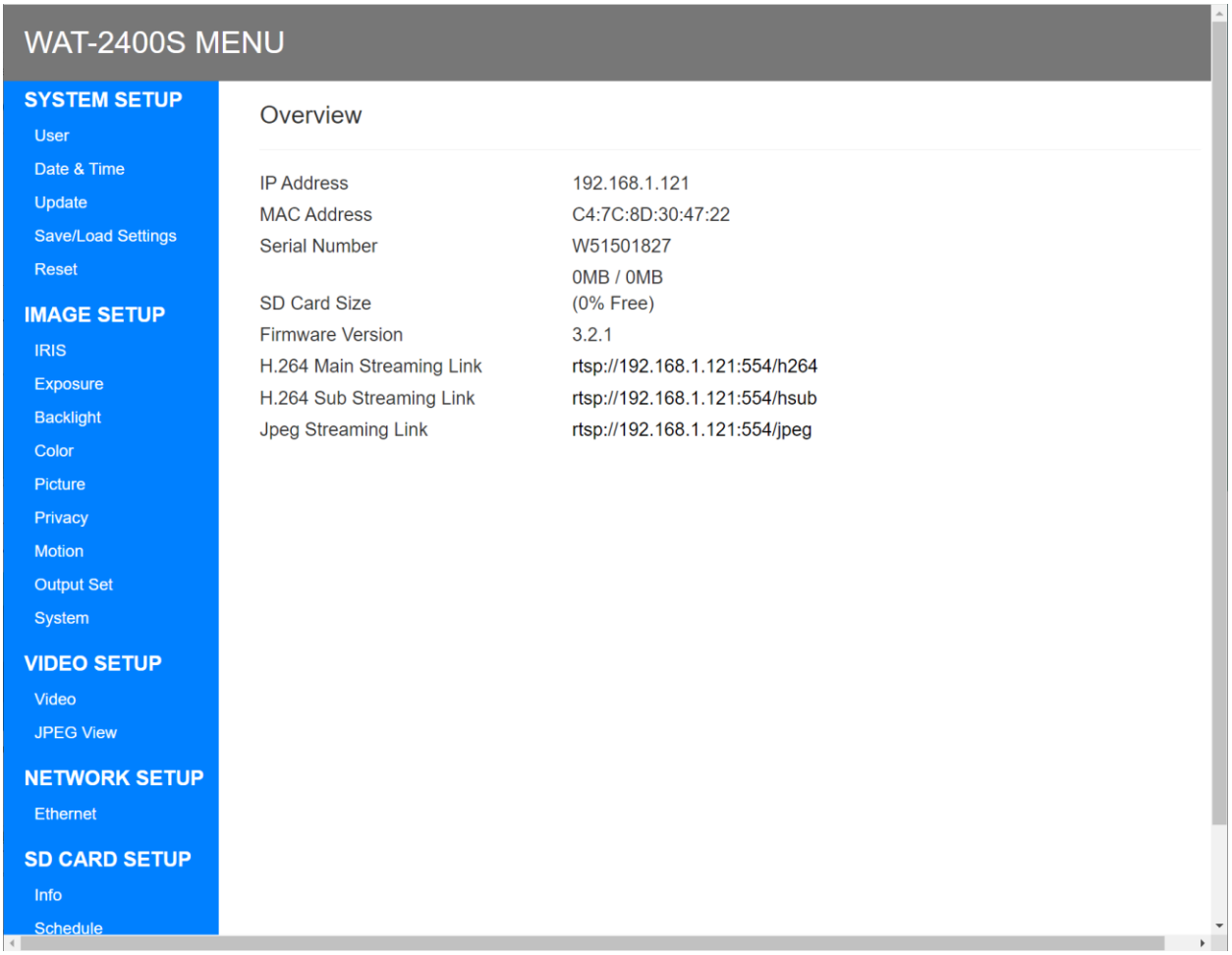
Returning the HD Multi SeaCam camera to the factory supplied settings can be done through the Tristate input control pins.

Tristate Input Factory Reset Method

To reset the camera using the two Tristate inputs, hold Tristate A and Tristate B high for 5 seconds. After 5 seconds the camera will undergo a brief reset sequence, during which the camera video outputs will be disabled and there will be no image available. After the successful factory reset the output video drivers will be re-enabled and the camera will be reset to the factory default settings. This process takes approximately 20-30 seconds.

Appendix B – IP Web User Interface

The IP version of the HD Multi SeaCam includes a web-based user interface (UI) for accessing the camera settings. From this menu, users can change everything from the network and streaming settings to the exposure and color settings. The UI is broken up into several sub-menus:

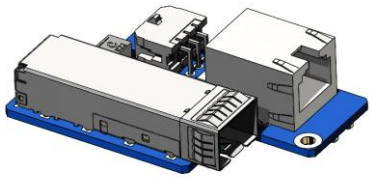


The Web UI requires a username and password. This information is provided in the quick start guide included in the HDMSC packaging. Contact support@deepsea.com with any issues accessing the camera web UI or missing log-in credentials.

OVERVIEW	This is the landing page users are taken to when logging into the camera UI. It can be accessed by clicking on the camera model title at the top of the web UI. It displays the camera IP and MAC address along with the module serial number, current firmware version, and active streaming links.
SYSTEM SETUP	
User	Change the username and password for the module.
Date & Time	Set up a SNTP server connection and set the time zone the camera will use for its local time.
Update	Upload firmware updates.
Save/Load Settings	Save the current camera settings or load previously saved settings file.
Reset	Reset the camera settings.
IMAGE SETUP	
IRIS	This setting does not impact operation of the HD Multi SeaCam.
Exposure	Configure exposure settings and automatic gain control for adapting to different lighting conditions.
Backlight	Set up color overlays to highlight where the pixel data is saturated. Generally not used in subsea applications.
Color	White balance and tint settings.
Picture	Gamma settings and image effects such as mirror and flip.
Privacy	Settings for privacy masks that overlay on the camera image to hide areas from view on the live stream and recordings.
Motion	Motion detection settings. Can trigger a text overlay when motion is detected in the video.
Output Set	Sets the frame rate of the video.
System	Set a text overlay title on the video image and enable a color bar pattern output.
VIDEO SETUP	
Video	Configuration settings for the video streams.
JPEG View	Low frame rate live image preview.
NETWORK SETUP	
Ethernet	Camera IP address, gateway, DNS, DHCP, and FTP settings.
SD CARD SETUP	
Info	Onboard storage summary and settings for enabling continuous recording and browse stored video and snapshot files.
Schedule	Event scheduling feature. Allows users to schedule video capture windows based on a 24 hour, 7-day week.
Timelapse	Setup timelapse image capture at a fixed interval.

Appendix C – SDI Media Converters

With HD-SDI video signals, it is necessary to use a compatible media converter to adapt one transmission method to another, e.g. FleXlink to fiber optic, or fiber optic to coax. DeepSea offers options for coax, fiber, and FleXlink media converters, available in both OEM board level and housed configurations.

	 **3G-SDI FleXlink Media Converter**	 **12G-SDI Media Converter**
Converter Direction	FleXlink → coax/fiber	coax → fiber, fiber → coax
Upstream Connector	RJ45 Ethernet Jack	HD-BNC
Downstream Connector	SFP cage	SFP cage
Power Connector	Molex MicroFit 3.0	2.1 mm DC Barrel
Optical SFP Support	YES	YES
Coax SFP Support	YES	YES | up to 3G-SDI
SMPTE Compliant	YES | up to 3G-SDI	YES | up to 12-SDI
CWDM Capable	YES | through supported SFPs	YES | through supported SFPs
MSA/NON-MSA SFPs	YES | via user select switch	YES | via auto detection
Input Voltage	10 to 36 VDC	10 to 36 VDC
Pass-thru power	YES	NO
Pass-thru control	YES	NO

NOTICE

SMPTE Compliant Fiber Converters

The HD-SDI video signal uses non-return to zero (NRZ) encoding, which may contain long strings of bits in the same logic state. This causes drift in the average voltage of the video signal in an unbalanced transmission line, such as coax, which can interfere with the optical transmit and receive channels of many off-the-shelf SFPs and similar fiber optic data transmission hardware. It is critical to use SMPTE-rated video SFPs to transmit HD-SDI and other SDI video formats for proper operation.