DEEPSEA Power & Light®

HD Multi SeaCam®

Operator's Manual

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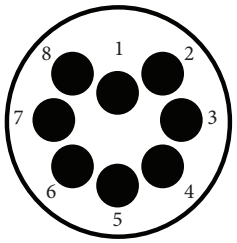
Specification Overview

	HDMSC-3085 Flat Port	HDMSC-3145 Dome Port
Optical Specifications		
Lens	2.5 mm, F/2.8 Low Distortion	2.0 mm, F/3.0 Low Distortion
Focus	Fixed focus	
Depth of Field	50 mm [2 in] to Infinity	10 mm [0.4 in] to Infinity
FOV in Air	130° H x 70° V x 150° D	145° H x 85° V x 165° D
FOV in Water	85° H x 50° V x 95° D	145° H x 85° V x 165° D
Video Specifications		
Image Sensor	1/3-in. 2.2MP CMOS, 16:9 @ 0.1 Lux	
Resolution	1920 H x 1080 V	
Scene Illumination	0.2 Lux [50 IRE] 3.0 Lux (Color)	
Signal to Noise	>50 dB	
HD Video Output[1]	HD-SDI 1.5 Gb/s, 1080p/30	
Analog Video Output[2]	CVBS, NTSC/PAL Selectable	
Environmental Specifications		
Depth Rating[3]	Aluminum: 4,000 m [13,123 ft] Titanium: 6,000 m [19,685 ft]	
Operating Temp. (Air and Water)	-30° C to 40°C [-22° F to 104°F]	
Electrical Specifications		
Power	10~36 VDC, 2W max	
Current	200mA max	
Mechanical Specifications		
Housing	Aluminum Titanium	
Port	Sapphire	Optically polished glass hemisphere
Outer Diameter	56.4 mm [2.22 in]	69.1 mm [2.72 in]
Overall Length (w/o connector)	102.8 mm [4.05 in]	124 mm [4.88 in]
Weight in Air	Titanium: 0.65 kg [1.4 lbs]	Titanium: 0.65 kg [1.4 lbs]
Weight in Water	Titanium: 0.44 kg [1.0 lbs]	Titanium: 0.37 kg [0.84 lbs]
Default Connectors		
FleXlink	SEACON MCBH8-NET	
Coax	SubConn HF75CXBH6M-SS	

[1] Configurable to 1080p/25, 720p/60, 720p/50.
[2] Format contains 16:9 image stretched to 4:3.
[3] 6,000 m depth rating is limited by connector, housing crush depth exceeds 10,000 m.

Standard Connectors

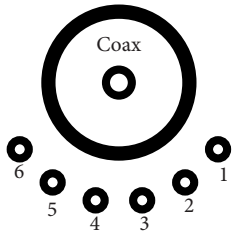
FleXlink®



SEACON MCBH8

Pin 1 – DC +
Pin 2 – DC -
Pin 3 – CVBS - RET
Pin 4 – CVBS
Pin 5 – SDI +
Pin 6 – SDI -
Pin 7 - Control (A)
Pin 8 - Control (B)

Coax



SubConn HF75CXBH6-SS Coax Hybrid
Glass to Metal Version

COAX – HD-SDI video
Pin 1 – Ground
Pin 2 – Power
Pin 3 – Analog Video (CVBS)
Pin 4 – CVBS_RET
Pin 5 – Control (A)
Pin 6 – Control (B)

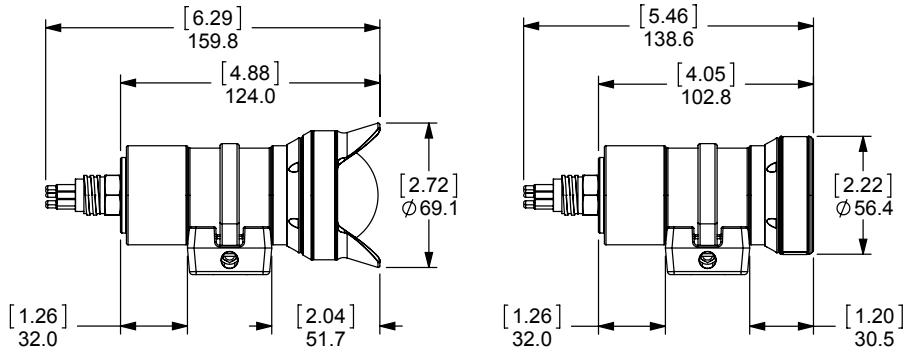
*Pinout diagrams represent the orientation of the pins on the male bulkhead.

** Specifications subject to change without notice.*

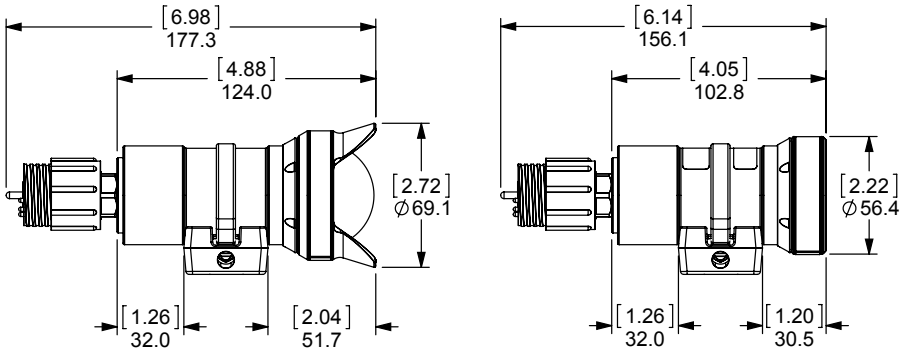
Specification Overview

Dimensions

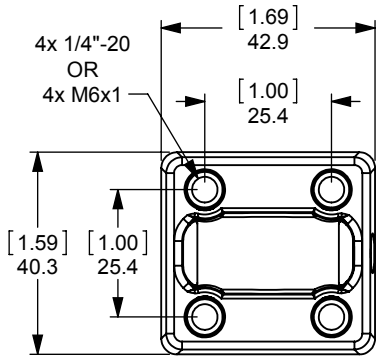
FleXlink®



Coax



Bracket



[inch]
mm

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Safety Symbols

In this operator's manual and on the product, safety symbols are used to communicate important safety information. This section is provided to improve understanding of these symbols.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

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

WARNING **WARNING** indicates a hazardous situation which, if not avoided, could result in damage to the product or bodily harm.

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.

This symbol means read the operator's manual carefully before using the equipment. The operator's 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.

General Notes and Warnings

The HD Multi SeaCam supports a variety of connectors. Be sure to verify pin-out orientation before use.

It is very important when preparing the system for deployment that the cable, at both the camera and topside ends, be carefully dressed to provide complete strain relief to the connectors. Failure of the strain relief provisions will almost certainly damage the connectors and possibly other elements of the system.

DANGER

Do not operate any high voltage electrical 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

Never place the camera in a vice or other hard clamping tool. Should it become necessary to hold the camera more tightly than can be managed by hand, use a clean, good quality strap wrench.

Pre and Post Dive Inspection

Rinse your HD Multi SeaCam in fresh water after use in saltwater.

Always check to make sure that the rear bulkhead connector assembly is secure before deployment.

Before and after each deployment, check the following areas for damage, wear or corrosion:

- Rear bulkhead connector assembly
- Video cable
- Front window
- Retaining cowl

WARNING

After each deployment, carefully check to make sure the camera has not flooded. It is possible for the camera to partially flood and then reseal itself while underwater. Upon surfacing, the camera can become internally pressurized, which may be potentially dangerous. Additionally, if the power remains on when the camera has partially flooded, it is possible for electrolytic generation of an explosive mixture of hydrogen and oxygen gases. If a camera appears flooded upon removal from the water, it should be treated as potentially dangerous.

Point the camera away from persons and valuable equipment and make sure that the power is disconnected. See the Flooding Repair Procedure for more information.

Integration Procedure

Integrating Instruction

1. Prepare a power supply with 10~36 V DC 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 (hand tight-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 2W during operation and will work when supplied with 10~36 VDC.

Video Output

The HD Multi SeaCam is capable of producing an incredible wide field of view both in and out of water. However, depending on the camera model, there will be slight barrel distortion to the image. The optics of the HD Multi SeaCam are optimized for use in water and models with a dome port may not achieve full sharpness in air.

The digital HD video output from the camera is a SMPTE 292M compliant uncompressed HD-SDI data stream at 1.485 Gb/s. This camera is available with field selectable 1080p/30, 1080p/25, 720p/60, and 720p/50 image formats.

As an auxiliary output this camera also has a 1Vp-p 75 ohm CVBS analog video signal available in either NTSC or PAL formats. This can be used for diagnostic purposes or as a redundant, backup standard definition video feed.

Flooding Repair Procedure

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

1. Immediately turn off the power to the unit.
2. Open the housing by first removing the connector for the device.
3. Remove the rear end cap-retaining ring. Do so by separating the two components using a linear motion. If required gently twist components while separating.
4. Pour out any water trapped in the housing.
5. If the camera is completely flooded, rinse the internal components with clean fresh water in order to minimize contamination and corrosion.
6. Allow parts to dry in air or a convection oven set to 60° C (140° F).

Troubleshooting

1. If the camera stops working while underwater, always assume that it has been flooded. See Flooding Repair procedure.
2. Once it has been determined that the camera is not flooded, or if it does not turn on during pre-deployment checks, troubleshoot 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 camera being used. See page 2 of this manual for electrical specs and standard connector pin-outs.
    b. Remove the endcap to access the bulkhead connector. Inspect the assembly for visual signs of wear. Use a multi-meter check for continuity or shorts in the connector. Try a spare connector, if available.
    c. If the camera still does not work, return it to DeepSea Power & Light using the RMA Procedure.

RMA Procedure for Repair

Should it be necessary to return your camera to the factory, follow the procedure for the Flooded Camera Repair above, and by leaving the connector partially unscrewed. For warranty and non-warranty repairs please contact DeepSea Power & Light for a RMA number prior to returning your item. Please have your light model number, serial number and any other pertinent information along with a description of the problem, on hand when you call, or include them in a fax or e-mail. 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
e-mail: 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

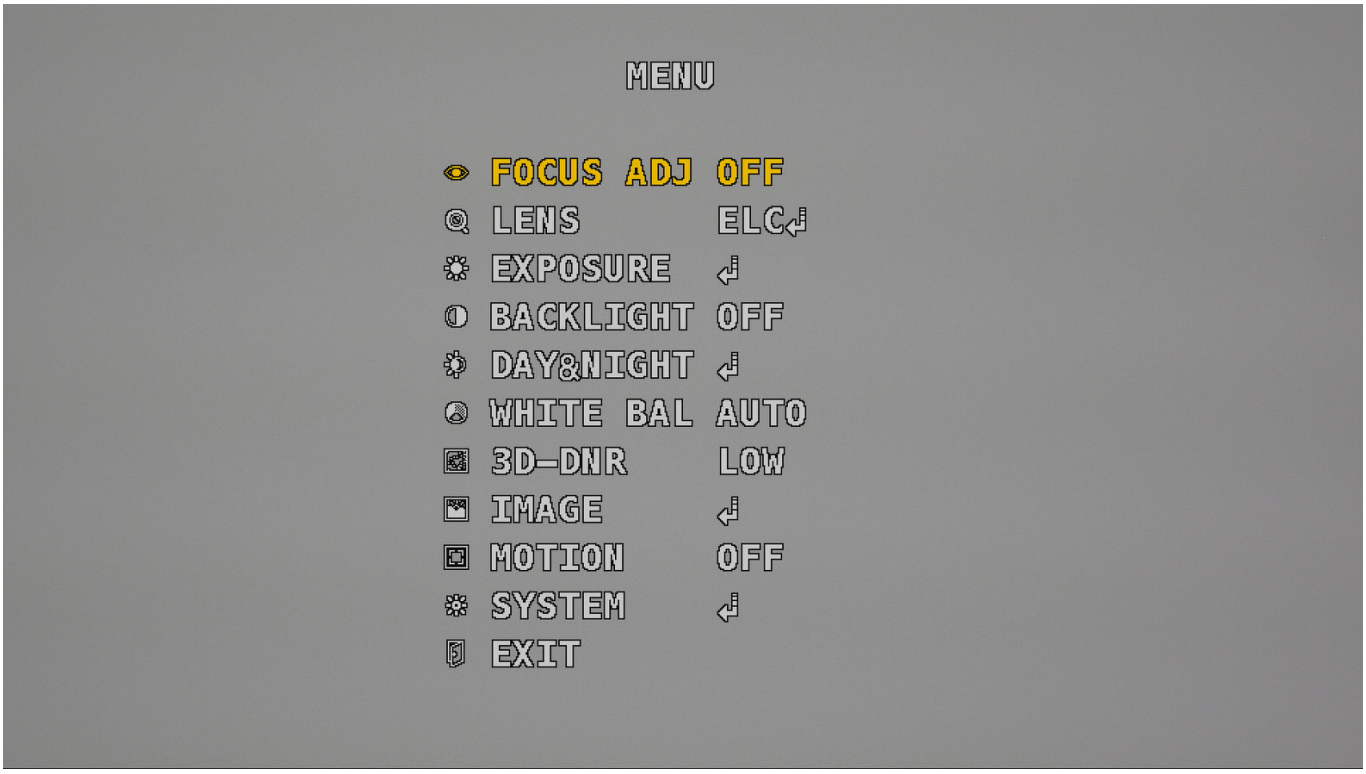
Tristate Input Camera Control

1. HD Multi SeaCam On Screen Display Control

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

1.1 Tristate Controls

The HD Multi SeaCam can be configured with dual tristate input control pins which are mapped to control the on screen display 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: pulled high "HI", pulled low "LO", or undriven/open "OPEN". These states are mapped to a menu navigation direction with Tristate A controlling "UP" and "DOWN" and Tristate B controlling "LEFT" and "RIGHT". Simultaneously pulling both tristate pins low is mapped to a "SELECT" function as summarized in the table below. Pulling both pins high can be used to return the camera to its factory reset 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

See Section 1.5 for a detailed walkthrough of the OSD configuration menus.

1.5 OSD Menu Structure

MAIN MENU	SUB MENU1	SUB MENU2	SUB MENU3	VALUE	FACTORY DEFAULT
FOCUS ADJ	RETURN	-	-	-	OFF
LENS	ELC	MODE	-	NORMAL / DEBLUR	ELC - NORMAL
	ALC	MODE	-	INDOOR / OUTDOOR / DEBLUR	
EXPOSURE	BRIGHTNESS	-	-	0 - 20	9
	SHUTTER	AUTO	-	-	AUTO
		MANUAL	SPEED	1/30(1/25) - 1/60000	
		FLICKER	-	-	
	SENS-UP	-	-	OFF / X2~X8	OFF
	AGC	-	-	0 - 20	10
BACKLIGHT	OFF	-	-	-	OFF
	HLC	LEVEL	-	0 - 20	
	BLC	H-POS	-	0 - 20	
		V-POS	-	0 - 20	
		H-SIZE	-	0 - 20	
		V-SIZE	-	0 - 20	
	WDR	WEIGHT	-	LOW / MIDDLE / HIGH	
DAY&NIGHT	MODE	-	-	AUTO / COLOR / B&W / EXTERN	COLOR
	SMART IR	-	-	OFF / ON	OFF
	AGC THRES	-	-	0 - 20	10
	AGC MARGIN	-	-	0 - 20	10
	DELAY	-	-	LOW / MIDDLE / HIGH	LOW
	N->D LEVEL	-	-	0-20	7
	D->N LEVEL	-	-	0-20	5
WHITE BALANCE	AUTO	-	-	-	AUTO
	AUTO ext	-	-	-	
	PRESET	-	-	*[NOT AVAILABLE]*	
	MANUAL	KELVIN	-	LOW / MIDDLE / HIGH	
		R-GAIN	-	0 - 20	
		B-GAIN	-	0 - 20	
3D-DNR	-	-	-	LOW / MIDDLE / HIGH	LOW

- CONTINUED ON NEXT PAGE -

MAIN MENU	SUB MENU1	SUB MENU2	SUB MENU3	VALUE	FACTORY DEFAULT
IMAGE	SHARPNESS	-	-	0 - 10	4
	GAMMA	-	-	0.45 - 0.65	0.55
	COLOR GAIN	-	-	0 - 20	10
	MIRROR	-	-	OFF / ON	OFF
	FLIP	-	-	OFF / ON	OFF
	D-ZOOM	-	-	X1.0 – X8.0	1.0X
	D-WDR	-	-	OFF / LOW / MIDDLE / HIGH	OFF
	DEFOG	OFF	-	-	OFF
		MODE	-	AUTO/MANUAL	
		LEVEL	-	LOW/MIDDLE/ HIGH	
	SHADING	OFF	-	OFF / ON	OFF
		WEIGHT	-	0-100	
	PRIVACY	OFF	-	-	OFF
		ON	ZONE NO.	0 – 15	
			ZONE DISP	OFF / ON	
			H-POS	0 - 60	
			V-POS	0 - 40	
			H-SIZE	0 - 60	
			V-SIZE	0 - 40	
			Y LEVEL	0 - 20	
			CR LEVEL	0 - 20	
			CB LEVEL	0 - 20	
MOTION DETECT	OFF	-	-	-	OFF
	ON	SENSITIVITY	-	0 - 20	
		WINDOW TONE			
		WINDOW USE			
		WINDOW ZONE			
		DET H-POS	-	0 - 60	
		DET V-POS	-	0 - 40	
		DET H-SIZE	-	0 - 60	
		DET V-SIZE	-	0 - 40	
		ALARM	-	OFF / ON	

- CONTINUED ON NEXT PAGE -

SYSTEM	IMAGE RANGE	USER	OFFSET	0 - 20	USER – 8
		FULL	-	-	
		COMP	-	-	
	OUTPUT MODE	-	-	1080P / 720P	1080P
	COLOR SPACE	-	-	HD-CbCr / YUV / SD-CbCr	HD-CbCr
	FRAME RATE	-	-	[30FPS / 25FPS] / [60FPS / 50FPS]	30FPS
	CVBS	-	-	NTSC / PAL	NTSC
	LANGUAGE	-	-	English/Chinese/ Chinese(s)/ Japanese/Korean	English
	COLORBAR	-	-	OFF / ON	OFF
	RESET	-	-	*[NOT AVAILABLE]*	-
EXIT	-	-	-	-	-

1.5 OSD Configuration Options Summary

1.5.1 *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 and is not useful for field operations with the assembled HD Multi SeaCam.

1.5.2 *LENS – Lens Light Level Control*

There are two available level compensation modes:

1. ALC – Automatic Level Control: primarily used with lenses equipped with an auto iris mechanism
2. 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 lending the ALC function inert, however laboratory testing has shown that the ALC mode is still preferred as the default setting due to the small sensing area used in the ELC algorithms.

1.5.3 *EXPOSURE - Exposure Settings*

The EXPOSURE menu allows user configured 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, the 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.

1.5.4 *BACKLIGHT - Backlit Image Compensation*

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

1.5.5 *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.

1.5.6 *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.

1.5.7 *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.

1.5.8 *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.

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

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

1.5.8.3 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 but does affect color accuracy. The default factory settings prioritize color accuracy over color contrast.

1.5.8.4 MIRROR
A digital effect that mirrors the image vertically.

1.5.8.5 FLIP
A digital effect that flips the image around 180°.

1.5.8.6 D-ZOOM
A digital effect that scales the image 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.

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

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

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

1.5.8.11 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.

1.5.9 *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.

1.5.10 *SYSTEM – Video Format Settings and Camera System Options*

1.5.10.1 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.

1.5.10.2 IMAGE RANGE

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

1.5.10.3 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.

1.5.10.4 COLOR SPACE

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

1.5.10.5 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.

1.5.10.6 CVBS

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

1.5.10.7 LANGUAGE

Select between English, Chinese, Chinese(s), Japanese, and Korean for the OSD menu.

1.5.10.8 COLORBAR

A color bar test pattern can be generated by the HD Multi SeaCam for signal diagnostic purposes and troubleshooting of the HD-SDI video data link.

1.5.10.9 RESET

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

1.5.11 *EXIT – OSD Menu Exit*

Hitting select on 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.

1.5 Factory Reset

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

1.5.1 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 enabled again and the camera will be reset to the factory default settings. This process takes approximately 20-30 seconds.