

# ROS RS-485 CEX-HD 30:1 COLOR ZOOM CAMERA

## OPERATION AND MAINTENANCE MANUAL

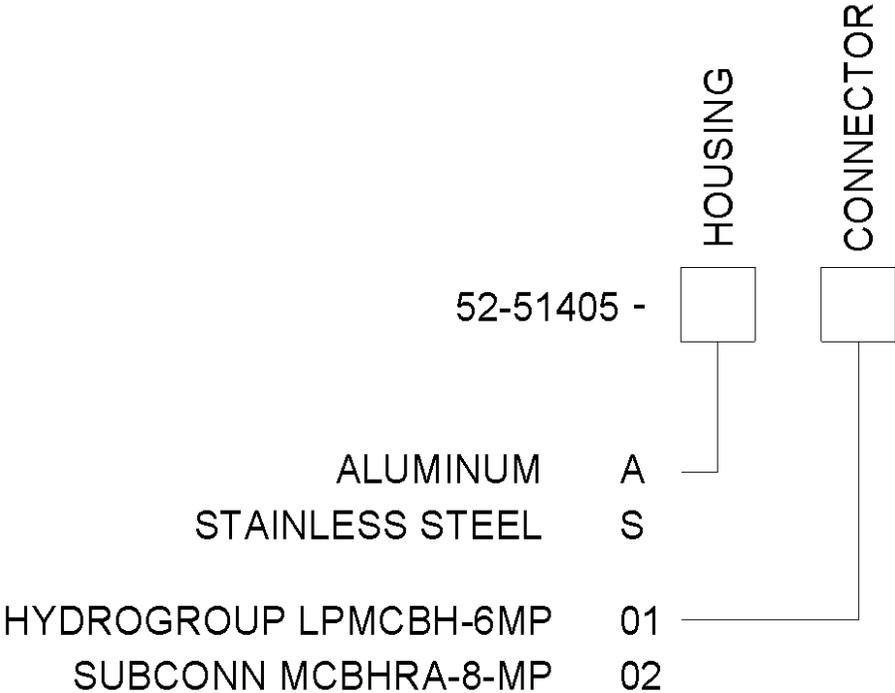
SERIAL NUMBER: \_\_\_\_\_

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5618 Copley Drive  
San Diego, CA 92111-7902  
TEL: (858) 565-8500  
FAX: (858) 565-8808  
[www.rosys.com](http://www.rosys.com)

STANDARD ORDERING FORMAT FOR THE RS-485 CEX-HD CAMERAS



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## WARRANTY

Remote Ocean Systems, Inc. (hereinafter called "**ROS**") warrants its products as stated below subject to the conditions specified.

**ROS** warrants its products, when operated under normal conditions, to be free from defects in material or workmanship for a period of one year from the date of purchase provided that inspection by **ROS** discloses that such defects developed under normal and proper use. **ROS** products repaired or replaced pursuant to this warranty shall be warranted for the unexpired portion of the warranty applying to the original product. The liability of **ROS** under this warranty shall exist subject to the following conditions:

(a) **ROS** is properly notified of such defects by Purchaser, and the defective product is returned to **ROS**, transportation charges paid by Purchaser.

(b) **ROS** shall be released from all obligations under its warranty in the event repairs or modifications are made by persons not authorized by **ROS**.

(c) Representations and warranties made by any person, including distributors and representatives of **ROS**, which are inconsistent or conflict with the terms of this warranty, shall not be binding upon **ROS** unless reduced to writing and approved by an officer of **ROS**. **ROS** shall in no event be liable for other direct, special, incidental, consequential, indirect or penal damages.

(d) This warranty shall be governed by the laws of the State of California.

In the event the defect is determined to be within the terms of this warranty, then **ROS** agrees to repair and/or replace (at **ROS**' discretion) the product or defective portion at no charge to the Purchaser. This warranty does not apply to expendable items or to normal wear and tear and is conditional upon performance of normal preventative maintenance procedures.

Our commitment to quality and customer service directs us to constantly strive to improve our products. The materials and specifications presented in our manuals and data sheets are correct and accurate to the best of our knowledge, and are presented in good faith. However, the information is not guaranteed and is subject to change without notice.

### **LIMITATION OF REMEDIES**

Purchaser assumes all risk and liability for results obtained in any installation, operation, or use of the product. Purchaser's sole remedy for any breach of warranty by vendor shall be limited to the "express remedies" set forth above. Otherwise, in no event shall vendor, its agents, or employees be liable to the original purchaser or any third party for any consequential or incidental damages or expenses of any nature arising directly out of or in connection with the use of vendor products. Even if vendor has been advised of the possibility of such damages or expenses. In any event, unless otherwise contrary to state law, vendor liability under this limited warranty shall not exceed the purchase price of the product.

## CUSTOMER ASSISTANCE

ROS, Inc. uses a worldwide network of stocking distributors and representatives who are familiar with our products and are able to provide assistance during installation and/or operation of these products.

If you have any questions or problems with this product that are not covered by this manual or instruction, please contact our agent in your area, or contact us directly by phone or fax or email.

TEL: +1-858-565-8500

FAX: +1-858-565-8808

Sales: [sales@rosys.com](mailto:sales@rosys.com)

Web Site: [www.rosys.com](http://www.rosys.com)

Technical Support: [support@rosys.com](mailto:support@rosys.com)

## CHANGE RECORD

<u>REV</u>	<u>DESCRIPTION</u>	<u>DATE</u>
A	PRODUCTION RELEASE (EC-03235)	24AUG20
B	SEE EC-03310	19JAN21

# 1 DESCRIPTION

The RS-485 CEX-HD, is a high-performance miniature Color Zoom camera intended for use in shallow water applications. It is rated to 70 meters water depth. The camera has been designed from the outset with an eye towards simple, straightforward operation and maintenance. All major subassemblies: Rear Endcap, Camera Electronics Interface Board and Camera Module have been designed such that any part may be replaced in minutes utilizing only minimal hand tools. Soldering skills are required only for major repairs or modifications to the camera electronics.

The ROS RS-485 CEX-HD camera is illustrated by the installation drawings in the appendix. The camera housing is constructed of hard-anodized aluminum or electro-polished stainless steel and is designed to be operated in natural but hostile environments. The front window is made of impact resistant optical grade acrylic and utilizes a single O-ring seal.

The RS-485 CEX-HD camera utilizes a high resolution, Exmor R CMOS image sensor coupled to a miniature 30:1 zoom lens in order to provide high-resolution video under widely varying and adverse viewing conditions. Scene illumination and White Balance correction is completely automatic. Auto-Focus and Auto-Exposure operation is enabled upon power-up, but these may be overridden at any time with manual inputs if operating conditions warrant.

The basic RS-485 CEX-HD camera is capable of providing video outputs in HD-TVI. In addition, circuits on this board generate the camera control commands sent to the zoom camera module in order to achieve control of Focus position, Zoom position, Exposure Settings and other special settings.

A wiring diagram (Drawing No. 52-51412) outlining the basic interconnections within the RS-485 CEX-HD Camera is included in the Appendix of this manual.

## 2 RS-485 CEX-HD CAMERA SPECIFICATIONS

### 2.1 POWER

Operating voltage:	11 - 26 VDC, Current varies with input voltage
Typical Power consumption:	~ 5 Watts 420 mA @ 12 VDC 200 mA @ 24 VDC

### 2.2 CAMERA PERFORMANCE DATA

Sensor:	1/2.8" Exmor R CMOS (STARVIS)
Pixels:	2.13M
Resolution:	800 TVL minimum
Scene illumination:	0.1 lux @ F1.6
Signal to Noise Ratio:	>52 Db
Video Output	HD-TVI
Zoom Range:	30:1 optical (4.3 to 129.0 mm focal length)
OR	
Digital Zoom:	12x (360x with optical zoom combined)
Field of View In Air:	71.3° Diagonal (full wide angle) 58.9°H x 45.3°V @ full wide angle 2.1°H x 1.6°V @ full telephoto
Field of View In Water:	51.3° Diagonal (full wide angle) 43.4°H x 34.1°V @ full wide angle 1.6°H x 1.2°V @ full telephoto
Minimum Object Distance:	
In air	.01m @ full wide angle 1.0m @ full optical telephoto
In water	.01m @ full wide angle 1.5m @ full optical telephoto
Iris Range	Automatic, f/1.6 - f/5.0

## 2.3 CONTROL SYSTEM

RS-485 camera controls:	RS-485, 2 wire half duplex, 8-bit data, 1 stop bit, no parity, and no hardware flow control.
Supported baud rates:	9.6k baud
Networkability:	Must be used with ROS IC-LINK.

## 2.4 FEATURES

All features below are controlled via the IC-LINK:

- Zoom: Direct zoom position
- Focus: Automatic or manual. Manual uses direct focus position
- Exposure: Automatic or manual. Manual uses direct iris position
- Video Negative Art: Negates the video signal, can help with contrast in some applications
- Video B&W: Transform the color video into black & white video
- Image Flip: Puts the image right side up when the camera is mounted upside down
- Display: On or Off, displays icons with the camera status, zoom progress bar, focus, exposure, etc.

## 2.5 DIMENSIONS

Length: (less connector)	5.70 inches (145 mm)
Diameter (max):	2.96 inches (75 mm)

## 2.6 WEIGHT (less connector)

Aluminum	In Air	1.8 pounds (0.82 kg)
	In Water	0.4 pounds (0.18 kg)
Stainless	In Air	3.2 pounds (1.45 kg)
	In Water	1.8 pounds (0.82 kg)

## 2.7 MATERIALS

Housing:	Hard-Anodized Aluminum or Electropolished Stainless Steel
Viewing Port:	Polished Acrylic

## 2.8 ENVIRONMENTAL

Operating Temperature:	0°C to +50°C (32°F to 122°F)
Storage Temperature:	-20°C to +60°C
Depth Rating:	70 m (230 ft)

## 2.9 RS-485 CEX-HD CONNECTORS

Hydrogroup LPMBH-6-MP (-01 configuration)

Endbell Connector: Hydrogroup LPMCBH-6-MP

Inline Mating Connector: Hydrogroup LPMCIL-6-FS

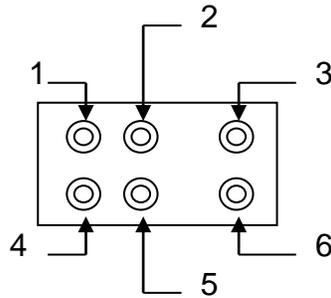


Figure 1: LPMCBH-6-MP Face View

SUBCONN MCBHRA-8-MP (-02 configuration)

Endbell Connector:

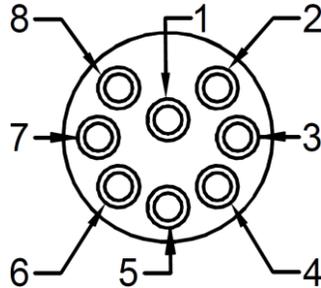
Subconn

MCBHRA-8-MP

Inline Mating Connector:

Subconn

MCIL-8-F



**Figure 2: MCBHRA-8-MP Face View**

## **2.10 CAMERA INTERCONNECTIONS**

<u>CONNECTOR PIN</u>	<u>FUNCTION</u>
1	Camera Power Input (+11 to +26 VDC)
2	VDC Return
3	RS-485 A
4	RS-485 B
5	TVI Out
6	Ground
7	Spare (MCBHRA -02 only)
8	Spare (MCBHRA -02 only)

### 3 CAMERA OPERATION

#### 3.1 GENERAL

Operation of the RS-485 CEX-HD Camera is straightforward, but there are some differences, which may not be familiar to personnel accustomed to operating closed-circuit TV systems. The RS-485 CEX-HD is designed to be used with only the ROS IC-LINK controller.

#### 3.2 INSTALLATION

### STOP – WARNING! READ BEFORE DEPLOYING

The connector pins on this cable assembly are keyed to ensure proper alignment when mated.

Forcing the connectors to mate with the pins misaligned will cause equipment damage not covered under warranty.

For LPMBH-6-MP (configuration -01) the logos will be aligned as shown in Figure 3 when the pins are aligned correctly.



**Figure 3: Correct alignment of LPMBH-6-MP cable connector (-01 configuration)**

For ease of mounting, the RS-485 CEX-HD camera has a mounting saddle, integral to its housing, with two 1/4-20 UNC tapped holes on 2.00-inch mounting centers. The camera must be mounted in a position that will protect against impacts with obstacles passing close to the camera. The camera housing should be electrically isolated from the mount with a thin piece of rubber, electrical tape, or other non-conductive material in order to reduce effects of galvanic corrosion from metal-to-metal contact in water.

The pins on the camera connector should be cleaned and dried then sprayed with a silicone-based lubricant. Grease should not be used on enclosed connectors such as the standard LPMBH series. Grease will eventually become impacted in the mating connector, forcing the contacts apart and causing intermittent operation.

### **3.3 CAMERA BOOT-UP SEQUENCE**

When the camera is energized, the video signal consists of a blue screen for 5 to 7 seconds. Then the video as seen by the camera is displayed.

**NOTE:** While the camera is booting up, all RS-485 commands will be ignored. Only after video is displayed on the screen will RS-485 commands be accepted.

### **3.4 EXPOSURE CONTROL**

The RS-485 CEX-HD Camera provides operation over a wide range of scene illuminations. For most operations, it is recommended to simply leave the camera in automatic exposure mode, as it generally does very well at optimizing itself for the ambient illumination conditions.

In the event that manual Exposure Control is desired due to unusual viewing conditions such as severe reflections or flashing lights, the IC-LINK must send a manual Exposure command followed by direct Iris position commands. The operator normally adjusts the joystick slider to send a direct Iris position command until an optimum display is seen on the television monitor.

To restore automatic Exposure Control: the IC-LINK must send EXP AUTO command.

### **3.5 ZOOM CONTROL**

The zoom lens operates whenever the IC-LINK sends direct Zoom position commands. The zoom function continues until the Zoom position reaches its commanded position or the lens zoom limit is reached. The zoom position is relative to the position of the joystick slider, moving the slider forward corresponds to Tele and moving the slider backwards corresponds to Wide. Tele operates towards increasing focal length settings providing reduced viewing angles with increased magnification of objects in the scene. Wide operation reduces focal length settings increasing viewing angles and allows viewing of greater areas of a scene.

When zooming towards the tele end from the full wide end, the optical zoom is activated until the optical zoom limit is reached.

When selecting different zoom lens settings, the operator should be aware of the change in the Minimum Object Distance (MOD) as the viewing angle changes. At the full telephoto position in air and water, the MOD is approximately 1.5m, while at the full Wide-Angle position it decreases to the front of the window.

### **3.6 FOCUS CONTROL**

The RS-485 CEX-HD camera is normally operated in Auto-Focus mode. This provides nearly ideal focusing when the camera is aimed at different scenes and tracks while the zoom control is actuated. In some instances where there are objects in a scene at different distances and there is a need for focusing on specific objects, operation in a Manual Focus Mode may be required. This is achieved by sending the manual Focus command followed by the direct Focus position command to the IC-LINK. The focus function continues until the camera reaches its commanded direct Focus position or the lens focus limit is reached.

To restore Automatic Focus Control: the IC-LINK must send the Auto Focus command.

Generally, most in-air users are able to stay in Auto-Focus mode all the time. The one set of conditions which may force the operator to switch into Manual mode, is when viewing a relatively close object that does not have much sharp detail. This occurs because the Auto-Focus system relies on increasing the sharpness of edges in the viewed image in order to optimize the focus.

If there are no edges to utilize for this process, the Auto-Focus will not be able to properly compensate and may even tend to "hunt" around the optimum focus point. Focus hunting may also be caused by low illumination. Again, if the camera is unable to properly sharpen edges due to insufficient video level, Auto-Focus operation will be less than optimal. Switching over to Manual mode by sending direct Focus commands is the best option.

Underwater users have a special set of considerations which may make Auto-Focus operation more difficult. Some underwater environments contain particles in suspension and un-dissolved solids that tend to reduce the detail of a viewed image. If the image does not have sharp detail, the Auto-Focus system will have a difficult time obtaining correct focus. In those cases, manual operation may be a better choice.

### **3.7 COMPUTER CONTROL**

All camera features are controlled using half duplex 2-wire RS-485. The ROS IC-LINK must be used to operate the CEX-HD.

## **4 THEORY OF OPERATION**

### **4.1 ELECTRONICS INTERFACE BOARD**

The electronics interface board assembly contains the following circuits: Power Conditioning, circuits required to decode Focus, Zoom, Exposure and other special commands and RS-485 circuits.

Details of interconnections between the electronics Interface board, the camera module and the main connector are shown on Wiring Diagram 52-51412.

### **4.2 VIDEO SIGNAL**

The camera module within the camera assembly generates a HD-TVI signal.

## **5 TROUBLESHOOTING**

### **5.1 GENERAL**

In the case of any sort of malfunction of the camera system, it is wise to resist the temptation to completely tear down the system and start replacing components indiscriminately. Many times, a quick call to the ROS Technical Support Department will help with restoring operation with minimum effort. Most failures in the field generally tend to be cabling problems, and the camera is typically the least likely cause.

If any camera functionality is lost, you may not be getting power to the camera. Turn off the power and disconnect your cable from the camera. Then, turn on the power and measure the voltage at the camera end of the cable according to your camera's pinout. If there is no voltage or low voltage, then you have cabling issues. Normally, all voltage levels present at this connector are referenced to Signal Common (normally Pin 2.) Camera power should be between +11 and +26VDC.

It is a common mistake to reverse RS-485 channels on the controller side. In other words: Controller RS-485 channel (A) is connected to camera channel (B) and vice-versa, which can lead the user to think that the camera is not responding to commands. Swapping communication channels while power is applied to the camera will not cause damage to any of the RS-485 transceiver electronics.

If all video has been lost, use a standard DVM on the ohm scale to check the center conductor of the coax for continuity. This is normally Pin 5 on the standard connector, and exits the user controller on the middle pin of the BNC connector for example. Normal resistance should only be a few ohms unless the system cable is extremely long. If all appears well at this point, the next step is to open up the camera housing and check the electronics Interface board and internal wiring for proper operation.

## **5.2 CAMERA DISASSEMBLY**

The RS-485 CEX-HD Camera Assembly is fairly easy to disassemble.

- 1) Remove the stainless-steel snap ring retaining the rear end bell to the camera housing.
- 2) Remove the seal screw in the rear endbell.

Next Very Carefully:

- 3) Use a standard air chuck (preferably with a rubber tip) to slowly pressurize the housing until the camera slides out the back. Do not pressurize too quickly or the camera may tend to become airborne as it exits the housing.
- 4) Once the camera electronics assembly is out of the housing it should be placed on a non-conductive surface and secured to prevent accidental damage.

## **5.3 CAMERA OPERATIONAL CHECKS**

Fuse F1 on the electronics interface board assembly should be checked for continuity. F1 is a 1.25A 32VDC fuse element that protects the camera module from excessive loads and in the event of accidental shorts to camera power or control lines. If F1 is open or has an impedance greater than 10ohms, it can be removed and replaced by soldering the component off the board. Naturally, before powering up the camera again, the cause of the output overload should be identified and corrected.

## **5.4 CAMERA TROUBLESHOOTING**

Check if the indicator LED (D3) on the 54-00446 is turned on. If the indicator LED is not turned on and F1 has an impedance of less than 3 ohms the 54-0046 circuit board may have to be replaced, ROS' Technical Services Department should be contacted for assistance.

## 6 MAINTENANCE

Maintenance of the camera is typically limited to cleaning, and maintenance of the O-ring seals on the window and rear end plate. The acrylic window should only be cleaned with a commercial lens cleaner or with a mild soap and water. Use only a soft cloth or lens tissue to avoid scratching the surfaces.

Anytime the housing is removed the O-rings should be carefully inspected for cuts, tears, or any other damage and replaced if necessary. The new O-ring should be given a light coating of silicone grease or other O-ring lubricant before re-assembly.

On the internal camera assembly, ensure that all electrical connectors are correctly fitted and all cabling is secured.

As the camera is being re-assembled just before the camera is sealed in the housing, blowing dry air or nitrogen into the housing is highly recommended, to avoid condensation on the inside surfaces, especially the front port. This is especially important if the camera is being sealed in a humid environment. Excess humidity in the housing will normally result in fogging of the window and may cause eventual damage to the camera electronics through corrosion.

## APPENDIX

### RS-485 CEX-HD CAMERA DRAWINGS

52-51405	Top Assembly, RS-485 CEX-HD
52-51411	Installation, RS-485 CEX-HD
52-51412	Wiring Diagram, RS-485 CEX-HD