

Spectator 36:1

OPERATION AND MAINTENANCE MANUAL



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WARRANTY

ROS, 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) Purchaser properly notifies ROS of such defects 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) The laws of the State of California shall govern this warranty.

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.

LIMITATIONS 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 projects, 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 e-mail.

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CHANGE RECORD

<u>REV</u>	<u>DESCRIPTION</u>	<u>DATE</u>
A	INITIAL RELEASE	01FEB12

1 REFERENCE DOCUMENTS

DOC NUMBER	ROS DOCUMENT DESCRIPTION
52-51134	INSTALLATION DRAWING SPECTATOR 36:1
CP52-26900	QUALITY CONTROL PLAN SPECTATOR 36:1
CP52-26907	QUALITY CONTROL PLAN SPECTATOR 36:1
52-26900	SPECTATOR 36:1 BIPOLAR
52-26907	SPECTATOR 36:1 RS485
52-51142	WIRING DIAGRAM SPECTATOR BIPOLAR
52-51136	WIRING DIAGRAM SPECTATOR RS485
10-00234	APPLICATION NOTE, INTERCONNECTING RS-485 COMPONENTS
21-30031	FACTORY SETTINGS PROCEDURE
52-24946	CAMERA ASSEMBLY PURGE PROCEDURE
98-10103	ESD CONTROL
98-10026	LOCKING COMPOUND
98-10025	TORQUING FASTENERS
98-10027	SEAL LUBRICATION
98-10217	ROS LABEL PROCEDURE

2 DESCRIPTION

1. The SPECTATOR is a high performance standard definition color zoom camera controlled via half duplex RS-485 protocol, or Bipolar/tristate voltage inputs.
2. The camera housing is constructed of titanium and is designed to be operated in hostile environments. The SPECTATOR is intended for use in deep water applications and rated to 4000 meters water depth. The front window is made of optical-grade glass. The standard external connector is the SEACON 5506-1508.
3. The SPECTATOR utilizes a CMOS image sensor coupled with a 36:1 optical zoom lens plus 10X digital zoom to provide video under widely varying and adverse viewing conditions. Auto-Focus and Auto-Exposure are enabled upon power-up, but can be overridden at any time. White Balance is always automatic.
4. The electronics circuit interface board includes circuits that condition the input power, protecting the camera electronics from overload voltage and or accidental application of power with reversed polarity. Note: Do not apply power to the video line (coax center) or the RS485 lines. Application of voltage to the RS-485 line will damage the communication boards. In addition, circuits on this board generate the camera control commands sent to lens in order to achieve control of Focus position, Zoom position, Exposure and other special settings. See RS-485 communication protocol 21-30022.

3 Part Number Configuration

Parent Number	Video Format	Connector
52-26900 = BiPolar	A = NTSC	01 = LPMBH-6-MP
52-26907 = RS485	B = PAL	02 = MCBH-8-MP-SS
		03 = LPMBH-8-MP
		04 = FAWM-8P-BCRA
		06 = 5507-1506
		07 = 5507-1508
		08 = BH-6-MP
		09 = BH-8-MP
		11 = 5507-2008
		13 = XSL-5-BCR-1/2"
		14 = 5506-1508
		15 = 5506-2006
		16 = 5506-2008
		CS = Customer Specified

Example: 52-26907-A14 = Spectator with RS485 communications, NTSC video format & 5506-1508 connector.

4 PRODUCT SPECIFICATIONS

Mechanical	
Housing Material	6AL4V Titanium
Window Material	Optical Grade Glass
Mounting Options	Mounting collar
Length (w/o connector)	257 mm (10.1 in)
Diameter Main Body	88.4 mm (3.5 in)
Diameter Forward End	155 mm (6.1 in)
Weight in Air	3.0 kg (6.6 lbs)
Weight in Salt Water	1.2 kg (2.6 lbs)
Implodable Volume	1592 cm ³ (97 in ³)
Environmental	
Depth Rating	4000 MSW (13,320 FSW)
Test Pressure	6500 Psi
Operating Temperature	-5° to 60°C (23° to 140°F) in water
Storage Temperature	-20 to 60°C (-4° to 140°F) in air
Operating Shock 3 Axis	30g peak, 6ms half-sine pulse
Operating Vibration 3 Axis	10g, 20-150 Hz
Optical	
Optical Zoom	36X
Digital Zoom	12X (432X with optical zoom)
Iris control	Automatic or manual, f1.6 – f4.5
Focus control	Automatic or manual
Minimum focus distance	Wide angle: forward port 36X optical zoom: 406 mm (16 in)
Field of view in air	80° diagonal
Field of view in water	88° diagonal
Electrical	
Horizontal Resolution	550 TV Lines – NTSC (Camera Module) 550 TV Lines – PAL (Camera Module)
Minimum Illumination	1.4 Lux Typical
Sensor Type	¼" EXview HAD CCD
Signal to Noise	> 50 db
Power Input	11 – 30 VDC, 400mA (max)
Video Output	Standard Video
Control Options	Bipolar +/-12 VDC input Differential 12 VDC input Unipolar 12 VDC RS485 input RS232 input
Long Line compensation	Externally selectable by toggling control levels or RS485/RS232 communication
Electromagnetic Compatibility	EN50081-1 / ENs50082-1 Immunity

5 INSTALLATION / GENERAL FUNCTIONALITY

5.1 Mounting

To mount the SPECTATOR, you can purchase an optional mounting bracket (Contact your sales representative for a list of options). The camera must be mounted in a position that will protect against impacts with obstacles passing close to the camera.

The pins on the camera connector should be clean and dry. Grease should not be used on enclosed connectors. These connectors are not open face pressure rated.

For the electrical installation, use a cable designed according to the communications protocol and connector configuration. This can be designed or purchased from Remote Ocean Systems. Refer to the Wiring Diagram (52-51142 Bipolar or 52-51136 RS485) and Application Note (10-00234) for more details about networking multiple components sharing the same power and communication lines.

5.2 Camera Start-up Sequence

When the camera is energized, the video signal does not become viewable for about 14 seconds. Then the video as seen by the camera is displayed, but system is still continuing its boot up sequence for another 5 seconds.

NOTE: While the camera is booting up, all RS-485 commands will be ignored. Only after a delay of about 19 seconds RS-485 or tristate bipolar commands will be accepted. Character echo, if enabled, is only available once the boot up sequence is terminated

5.3 Exposure Control

The SPECTATOR Camera provides operation over a wide range of scene illuminations. To achieve this wide range the camera automatically adjusts Exposure Control through composite operation of the iris, video gain and shutter modes. 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.

The camera's iris, gain, and shutter functions are all controlled by an internal microprocessor. This automatic mode is normally selected when the camera is turned on. As illumination is increased from complete darkness, the AGC (automatic gain control) is the first function to operate from maximum to minimum gain. At the point of minimum gain the iris begins to function, closing as the illumination continues to increase. If the illumination continues to increase with the lens fully closed, the camera goes into a shutter mode where the CMOS sensor is allowed to capture light over decreasing time intervals as the illumination increases.

In the event that manual Exposure Control is desired, due to abnormal viewing conditions such as severe reflections or flashing lights, the remote control unit must send Exposure INC or DEC commands. This will place the camera in the manual mode

and each command will result in a step change of the exposure. The operator normally continues to send the same command until an optimum display is seen on the video monitor.

To restore automatic Exposure Control: the remote control unit must send EXP AUTO command.

5.4 Optical Zoom Control

The zoom lens operates whenever the remote control unit sends Zoom Tele or Zoom Wide commands. The zoom function continues until the Zoom Stop command is received by the camera or the lens zoom limit is reached. Tele operates towards increasing focal length settings providing reduced viewing angles with increased magnification of objects in the scene. The SPECTATOR has a 36x optical zoom and a 12x digital zoom. This means with digital zoom enabled, the total zoom is 432x. 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. Once the optical zoom limit is reached, the digital zoom will seamlessly take over, if enabled.

When selecting different zoom 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, the MOD is approximately 16 inches in water, while at the full Wide Angle position the MOD reduces to the front of the camera window in air or water.

The RS-485 communication protocol allows adjusting the zoom speed. This will accommodate user preferences and application-dependent requirements. There are 8 discrete settings from 0 to 7, with 0 being the slowest and 7 the fastest. The default zoom speed for Tristate bipolar controls is set to 3 and cannot be changed.

5.5 Digital Zoom Control

The Digital Zoom feature allows the user to further decrease the viewing angles and magnify the scene beyond normal optical zoom. This feature can be enabled/disabled using the Digital Zoom ON and Digital Zoom OFF commands. Once enabled, the camera will have an increased zoom range. When zooming tele from the wide end of the zoom range, the camera will use optical zoom until the zoom limit is reached. At this limit the digital zoom will seamlessly take over and further magnify the scene.

The digital zoom is always enabled for tristate/bipolar controls. (Digital zoom will affect picture quality)

5.6 Focus Control

The SPECTATOR 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 Focus Near and Focus Far commands from the remote control unit. The focus function continues until the Focus Stop command is received by the camera or the lens focus limit is reached.

To restore Automatic Focus Control: the remote control unit 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 optimum. Switching over to Manual mode by sending Focus Far or Near commands is the best option.

Underwater users have a special set of considerations which may make Auto-Focus operation more difficult. Seawater normally contains particles in suspension and undissolved solids (animal, plant life, etc.) 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.

To capture images faster, the user may switch to manual focus. This reduces the processing time before an image capture.

The RS-485 communication protocol allows adjusting the focus speed. This will accommodate user preferences and application-dependent requirements. There are 8 discrete settings from 0 to 7, with 0 being the slowest and 7 the fastest. The default focus speed for Tristate bipolar controls is set to 3 and cannot be changed.

5.7 Power Standby

The SPECTATOR camera module automatically turns on upon application of power to the main connector. To disable the camera without removing power from the connector, the user can place the camera in standby mode using the Camera Sleep Mode command. In this state, all commands are read, but none are executed except the Camera Wake command. Character Echo is still available. Sending the Camera Wake command will restore power to the camera, making all commands accessible again. Power to the camera can then be restored by sending the Camera Power ON command. Certain functions such as camera negative mode, and camera black and white mode are reset to their default settings upon entering sleep mode. This function is not available in tristate/bipolar control mode.

5.8 Backlight Compensation

The Backlight Compensation feature gives the user a quick option to illuminate a scene when there is light coming towards the camera. This feature can be enabled/disabled using the Backlight Compensation ON and Backlight Compensation OFF commands. When the user switches to Manual Exposure, backlight compensation is automatically disabled.

This function is not available in tristate/bipolar control mode.

5.9 Video Freeze

Upon activation; this function continuously outputs the last saved video field or frame in memory.

This function is not available in tristate/bipolar control mode.

5.10 IR Filter Control

The IR Filter feature allows the user to view scenes in low visible light. This feature is enabled/disabled using the IR Filter ON and IR Filter OFF commands. The Video will be displayed in Black and White as a side effect. This function is not available in tristate/bipolar control mode.

6 ROUTINE 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 glass 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.

Routine visual inspections should be performed to verify that the camera bumpers are clean from debris that may obstruct the camera field of view when deployed.

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 very important if the camera was opened 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.

7 Troubleshooting

7.1 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 (or all) camera functions are lost, many times the best course is to disconnect the cable connector from the back of the camera and check to see if the power and control voltages are present at the connector.

Complete camera isolation from the system will help reduce troubleshooting time. A test cable that connects the camera, power supply, monitor and a computer (preferred) is recommended to complete a series of tests. Checking baud rate, computer port settings, RS-232 to RS-485 converters (if used) are not reversed, custom software (if used) often times has errors, etc. It is unlikely that the electronics responsible for RS-485 communication are the cause of malfunction, unless power was applied to the RS-485 A or B channels.

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.

7.2 Problem/Cause Outline

Problem	Typical Causes
Camera doesn't turn on	Check cables, connector and power supply
Have power, no video	Check cable and monitor
Communications not working	Check converter, comm. port

8 BILL OF MATERIAL

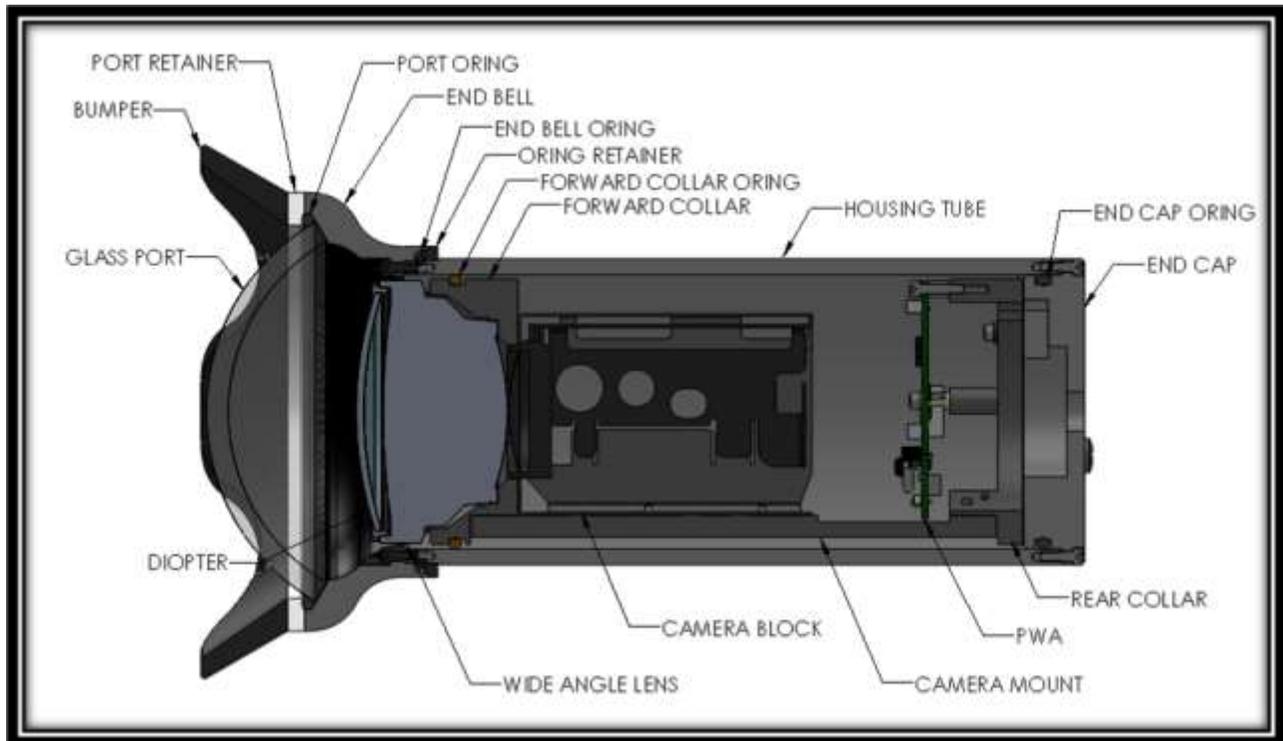


Figure 1

PART DESCRIPTION	ROS PART NUMBER
HOUSING TUBE	52-26912-01
END CAP	(RELATIVE TO CONNECTOR SELECTION)
END BELL	52-29117-01
GLASS PORT	52-29118-01
ORING RETAINER	52-29127-01
PORT RETAINER	52-29119-01
REAR COLLAR	52-26910-01
FORWARD COLLAR	52-26908-01
CAMERA MOUNT	52-26909-01
CAMERA BLOCK	50-010058-4 (NTSC) OR 50-01059-4 (PAL)
PWA	21-06065-01 (RS485) OR 51-11108-03 (BIPOLAR)
WIDE ANGLE LENS	50-01057-4
DIOPTER	50-01203-01
END CAP ORING	60-20233-4
FORWARD COLLAR ORING	60-22233-4
END BELL ORING	60-20007-4
PORT ORING	60-20244-4

9 APPENDIX

DOC NUMBER	ROS DOCUMENT DESCRIPTION
10-00234	APPLICATION NOTE, INTERCONNECTING RS-485 COMPONENTS