PTZ
INTEGRATED PAN & TILT CAMERA

OPERATION AND MAINTENANCE MANUAL

SERIAL NUMBER: _____

SALES ORDER: _____

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75-00952 REV F

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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.

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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

REV	DESCRIPTION	INITIAL	DATE
A	Initial release	TBB	06JUL10
B	SEE EC-00873	BAL	13SEP11
C	SEE EC-00909	NH	07NOV11
D	SEE EC-01033	MLC	03APR12
E	SEE EC-03048	SW	03SEP19
F	SEE EC-03080	SW	03OCT19

1 DESCRIPTION

This manual describes the installation and operation of the PTZ Integrated Pan & Tilt Camera System designed by Remote Ocean Systems (ROS). The PTZ is a high-performance color high definition camera system which incorporates pan and tilt control mechanisms with analog speed control and left/right dimmable, high-intensity LED lights.

The PTZ camera is illustrated by the installation drawings in the appendix. The camera housing is constructed of anodized aluminum. It is designed to be operated in radioactive environments up to 1000 R/hr (5000 R/hr manual focus only) and in underwater applications to 70 meters water depth. The front window is made of impact-resistant, optical-grade acrylic. The standard external connector is an IMPULSE MHDL-24-BCR stainless-steel connector.

The PTZ utilizes a CMOS image sensor coupled with a 10:1 optical zoom lens (12x digital zoom) for video capture. Auto-Focus and Auto-Exposure are enabled upon power-up, but can be overridden with manual control at any time.

The PTZ offer 360 degrees continuous rotation on the pan axis by means of an internal slip ring. Both axes offer variable speed control for precise camera orientation.

2 PTZ SYSTEM SPECIFICATIONS

2.1 ELECTRICAL

SYSTEM

Input Power	100-250 VAC, 48-62Hz (40W)

2.2 MECHANICAL

CONTROLLER

Controller (W x H x D)	19” x 3.46” x 14.8”
Weight	*11.6 lbs*

CAMERA ASSEMBLY

Dimensions (W x H x D)	13.0” x 4.8” x 3.4”
Weight in Water	5.6 lbs [2.5 kg]
Weight in Air	11.6 lbs [5.3 kg]

CABLE

Dimension (Length)	Up to 300 ft. [91 m]
Weight	280 lbs/mft
Jacket Material	Nuclear Grade High Abrasion Resistant
Minimum Bend Radius	10"
Number of Conductors	Triple Coax w/ 18 conductors
Controller-side Connector	Amphenol - PT02A-20-24S
Camera-side Connector	Impulse - MHDL-24-FCR

2.3 CAMERA ASSEMBLY

CAMERA

Power	10 VDC, 3.8 W
Image sensor	1/3-type CMOS
Video Format	HD : Y/Pb/Pr 1080i (NTSC Format)
Aspect Ratio	16:9
Zoom Range	10:1 Optical (12x Digital)
Focus Range	Front port of camera to infinity
FOV in Water	35° Horizontal Full Wide
Picture Effects	Black & White, Negative Image

PAN & TILT

Pan Range	360° continuous rotation
Tilt Range	+/- 160° (146° without image clipping)
Pan Speed Range	Variable 0-15°/sec
Tilt Speed Range	Variable 0-15°/sec
Motor/Camera Protection	Slip clutch protection, both axes

LED LIGHTS

Intensity	≥ 500 Lux @ 1m, viewing up to 15ft
Controls	Left & Right independent dimming

2.4 CAMERA CONTROLS

- Zoom: Manual
- Digital Zoom: Allows for further reduced viewing angles
- Focus: Automatic or manual
- Exposure: Automatic or manual
- Negative Image: Manual
- Black & White Image Manual

2.5 CONTROLLER OUTPUTS

Video outputs	HDMI
Aspect Ratio	16:9

2.6 MATERIALS

Housing Material:	Anodized Aluminum (6061-T6)
Viewing Port:	Optical grade acrylic
LED Ports:	Lexan Polycarbonate

2.7 ENVIRONMENTAL

Operating Depth	70 m (230 ft) standard
Operating Temperature	0°C to 50°C (32°F to 122°F), tested to 50°C
Storage Temperature	-20°C to 60°C (-4°F to 140 °F)
Radiation Tolerance (Dose Rate)	1,000 R/hr (5,000 R/hr manual focus only)
Radiation Tolerance (TID)	60,000 R

2.8 STANDARD PTZ CONNECTORS

Main Connector	IMPULSE MHDL-24-BCR
Inline Mating Connector	IMPULSE MHDL-24-CCP

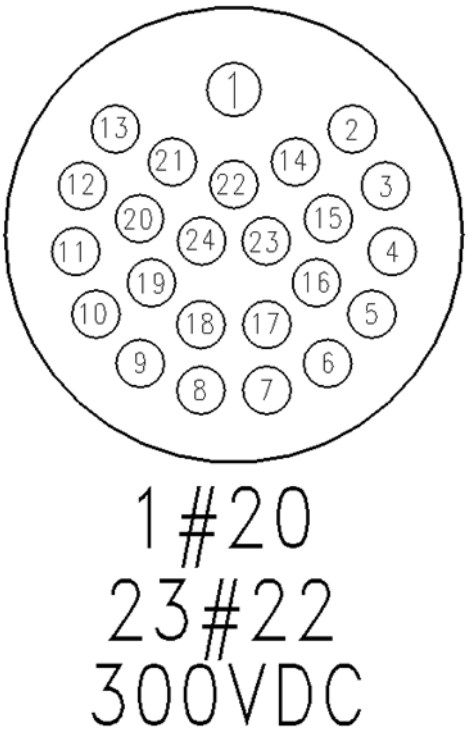

Figure 1: IMPULSE MHDL-24-BCR Pin-out (Face View)

2.9 OPTIONAL ACCESSORIES

Figure 2: PCI Adapter (75-00989-01)

Figure 3: Cable Deployment Clamp Assembly (75-00990-01) W/ Captive Hardware (Included)

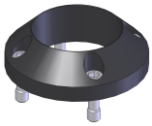

Figure 4: Streamlined Screw Protector Assembly (75-00991-01) W/ Captive Hardware (Included)

3 CAMERA OPERATION

NOTE: BEFORE CONNECTING THE CABLE TO THE CAMERA, CHECK THE INSIDE OF THE CAMERA'S CONNECTOR AND MAKE SURE THAT THE O-RING IS PRESENT (SEE Figure 17 ON PAGE 17). IF THIS O-RING HAS FALLEN OUT AND IS MISSING, WATER MAY LEAK INTO THE CONNECTION CAUSING SHORTS.

3.1 INTERCONNECTION

Electrical connection from the controller to the PTZ camera must be made with the underwater cable for the system to work.

NOTE: PRIOR TO INTERCONNECTING YOUR CABLE, MAKE SURE THE CONTROLLER IS NOT POWERED OR IN THE OFF POSITION. CONNECTING A PTZ WHILE THE POWER IS ON MAY CAUSE DAMAGE TO THE PTZ DUE TO INTERMITTENT VOLTAGE SPIKES.

NOTE: WHEN CONNECTING THE UNDERWATER CABLE TO THE CAMERA, MAKE SURE THE ALIGNMENT FEATURES ON BOTH CONNECTORS ARE CORRECTLY POSITIONED, THE CONNECTOR IS FULLY SEATED AND THE LOCKING SLEEVE IS HAND TIGHT.

3.2 INSTALLATION

The PTZ camera is designed to be adaptable for several different deployment methods.

The camera can be directly mounted using the 4 1/4-20 threaded holes on its mounting plate. Maximum screw depth is .30" from the top of the mounting plate. Clearance for the connector is required in any mounting surface. See Figure 5 for mounting dimensions.

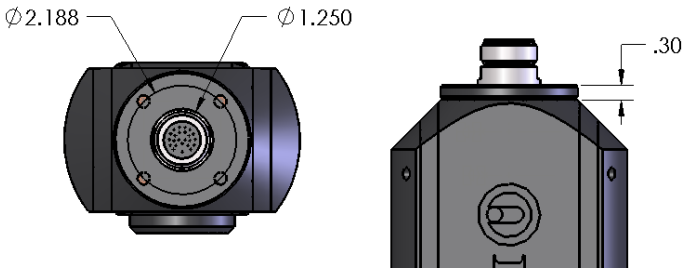

Figure 5: 1/4-20 Mounting and Connector Clearance Dimensions

The camera may also be cable deployed using the optional Cable Deployment Clamp (Figure 3). When used with the Streamlined Screw Protector (Figure 4), the Cable Deployment Clamp will maintain a streamlined profile at the top of the camera, preventing snags when the camera is removed from tight spaces.

To use the Clamp, first slide the Screw Protector onto the cable and connect the cable to the camera. Place the two halves of the Clamp around the cable so that it rests on the camera's mounting plate and slide the Screw Protector down over it so that the hardware in the Screw Protector is aligned with the clearance holes in the Clamp. Fasten the Screw Protector to the camera's mounting plate, then tighten the two screws in the Clamp so that it grips onto the cable. When properly installed, the Cable Deployment Clamp will provide strain relief for the molded connector.

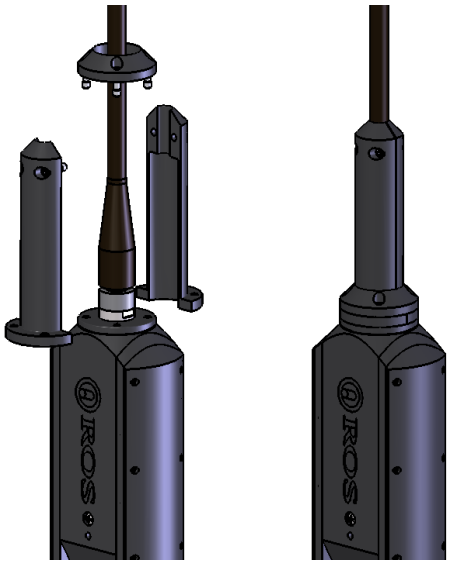

Figure 6: Cable Deployment Clamp Installation

An optional PCI Pole Adapter (Figure 2) is available as well. The cable is routed through the side of the Pole Adapter, which is fastened to the mounting plate using the Streamlined Screw Protector.

Figure 7: PCI Adapter Installed

3.3 EXPOSURE CONTROL

The PTZ 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 optimum viewing results, turn led lights on full and stop down the manual iris until the best picture is achieved. Exposure control works in steps, the exposure button needs to be pushed and depressed in the appropriate direction in order to increment or decrement one step.

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. When the manual exposure control is actuated, the function changes from automatic to manual mode giving the operator full control of this function. If the operator wishes to return the camera to automatic exposure mode, **EXP DEC and ZOOM WIDE** are to be simultaneously actuated as indicated on the front panel of the control unit.

3.4 ZOOM CONTROL

The zoom lens operates when the zoom control switch is actuated in the Zoom Tele or Zoom Wide direction. The zoom function continues until the switch is released by the user 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.

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.

When using the zoom functions of the PTZ Camera system, the operator should be aware of the change in the minimum object distance (MOD) as the viewing angle changes. As zoom increases, the MOD increases as well.

3.5 DIGITAL ZOOM CONTROL

The Digital Zoom feature allows the user to decrease the viewing angles and magnify the scene beyond normal optical zoom. When zooming tele from the wide end of the zoom range, the camera will use optical zoom until the optical zoom limit is reached. At this limit the digital zoom will seamlessly take over and further magnify the scene. Note that as you zoom further into the digital zoom range the picture becomes grainier. For optimal picture quality, the digital zoom range should not be used.

3.6 FOCUS CONTROL

The PTZ camera defaults to the auto-focus mode. The auto-focus provides nearly ideal focusing when the camera is aimed at a scene. However, there may be instances when there is a need for focusing on specific features of an object. Operation in a manual focus mode will be required for such viewing. When the focus control switch is actuated, the function changes from automatic to manual mode giving the operator full control of this function. The auto-focus relies on edges to focus. One set of conditions which may force the operator to switch into manual mode occurs when viewing a relatively close object that has minimal 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 auto-focus process, the camera 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 or thermal currents in the water. If the camera is unable to properly sharpen edges auto-focus

operation will be less than optimal. Switching to manual focus is the best option. To return to the automatic mode, **ZOOM WIDE and FOCUS FAR** are to be simultaneously actuated as indicated on the front panel of the control unit.

3.7 NEGATIVE COLOR VIDEO or BLACK & WHITE CONTROL

Another built in function is the negative color or black & white video effect. This function is useful when an immediate change in contrast is needed. In negative color video mode, dark colors will be turned white and light colors, as well as white illumination, will turn dark. This can allow the user to see details in a shadowed area, like a crack. From a color picture, to activate the negative color function, **ZOOM TELE and FOCUS NEAR** must be toggled simultaneously. From a negative art picture, to activate black & white function **ZOOM TELE and FOCUS NEAR** must be toggled simultaneously again. Toggle **ZOOM TELE and FOCUS NEAR** simultaneously once again from black & white picture mode to return to standard color.

4 SERVICE AND REPAIR

NOTE: IT IS RECOMMENDED THAT LOCTITE 222, VIBRA-TITE OR AN EQUIVALENT THREAD LOCKING COMPOUND BE APPLIED TO ALL FASTENERS BEFORE THEY ARE INSTALLED.

4.1 CAMERA MODULE REPLACEMENT

Replacement of the PTZ camera module requires the following:

- Module Replacement Assembly (75-00958-01, see drawing in Appendix)
- #3 Phillips Screw Driver
- 7/64" Allen Wrench
- Silicone O-Ring Grease (included in PTZ Maintenance Kit, 75-00997-01)

To replace the module, follow these steps:

1. Loosen the 4 screws on the back of the camera module housing. The module is attached to this back piece and will slide out along with it. You will only be able to pull out the module a few inches while the wire harnesses are still attached to it.

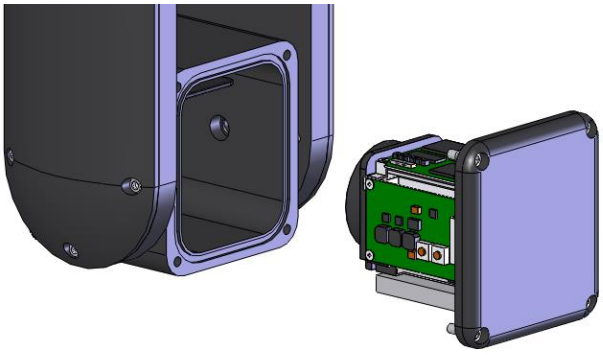

Figure 8: Camera Module Removed from Housing

2. Detach the two connectors from the camera module.

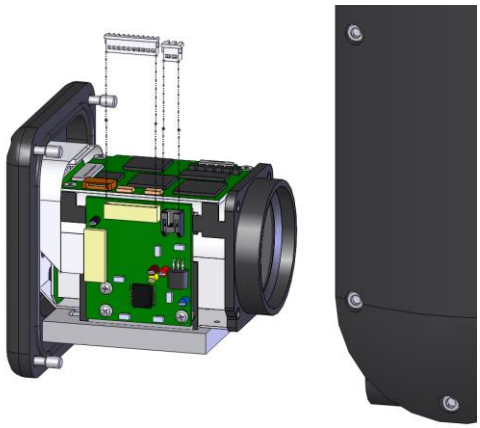

Figure 9: Camera Module Connections

3. Remove the 1/4-20 screw at the bottom of the module, then remove the module.

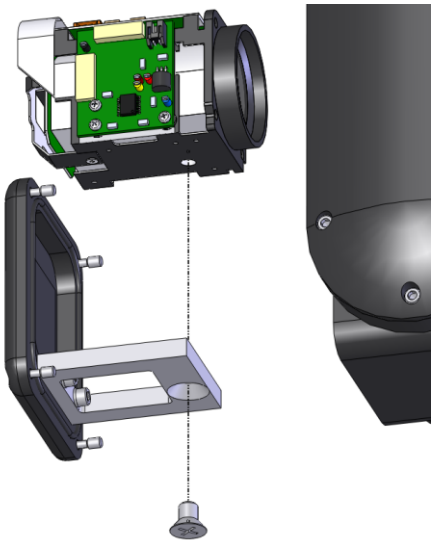

Figure 10: Module Removal

4. Set the replacement module on the plastic mounting plate and push it backward against the tacky gap-pad until the threaded hole in the module lines up with the screw hole in the mounting plate. This ensures good thermal contact with the housing.
5. Apply Vibra-tite, or an equivalent thread locking compound, to the 1/4-20 flat head screw included with the module and screw the module to the mounting plate.
6. A replacement for the -039 size O-ring shown in Figure 11 is included with the replacement module. Replacing this O-ring at this time is recommended. Make sure the O-ring groove is free of dirt and debris. Lubricate the new O-ring with silicone lubricant and insert into the groove as shown.

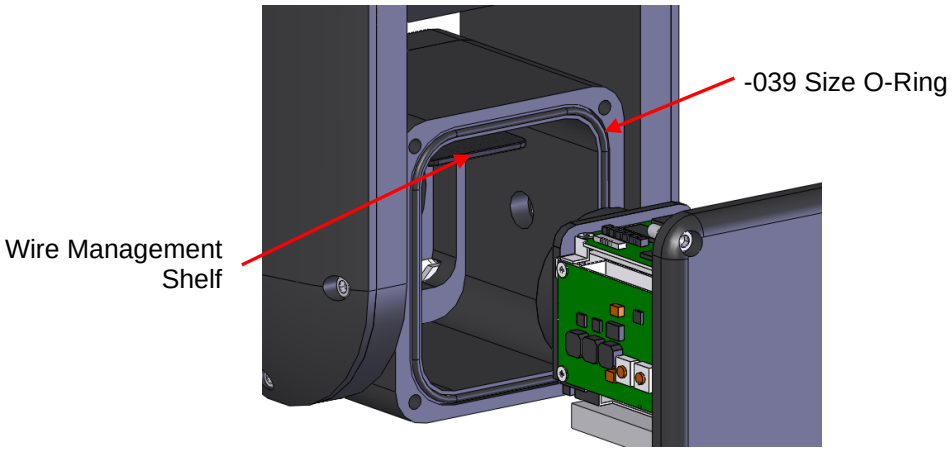

Figure 11: Module Housing O-Ring Replacement

7. Make sure there are no fingerprints or foreign matter on the lens of the camera module before reinserting it into the housing. If necessary, clean it with lens cleaner and a lint free cloth.
8. Reconnect the two connectors to the camera module and re-insert the module into the housing. As you insert the module, guide the wires so they sit on top of the wire management shelf inside the module housing. This will prevent snagging the next time the module is removed.
9. Make sure that the O-ring is still seated correctly in the groove and that no wires have been pinched, then re-tighten the 4 screws on the back cover of the module housing.
10. Connect the PTZ to a controller and test operation of the camera and LEDs prior to redeploying the camera.
11. Purge the camera. Refer to Section 4.5.2 for the Camera Purge Procedure.

4.2 PTZ CONTROLLER "IN AIR" VS. "IN WATER" OPERATION (FOR 45-03175-04 ONLY)

4.2.1 CONFIGURATION CHANGE

45-03175-04 can be configured to operate in air or in water use. To configure, make sure power is disconnected from the controller. Remove top panel from PTZ controller as shown in image below.

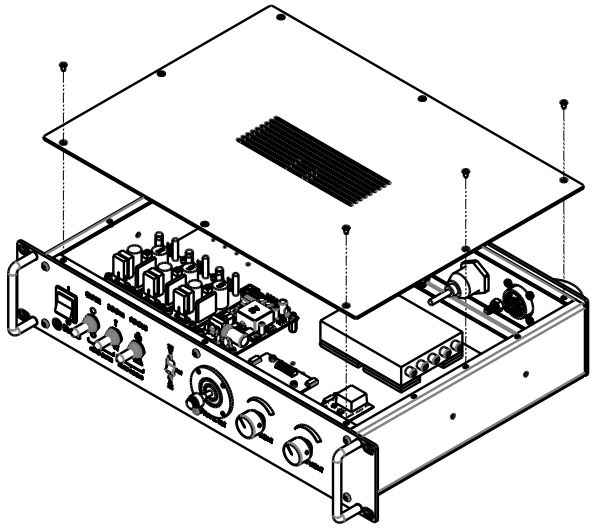

Figure 12: Removal of Top Panel

Look behind the front panel where light control knobs are located, user should see a wire harness labeled “IN AIR” and another labeled “IN WATER”, an example is shown below.

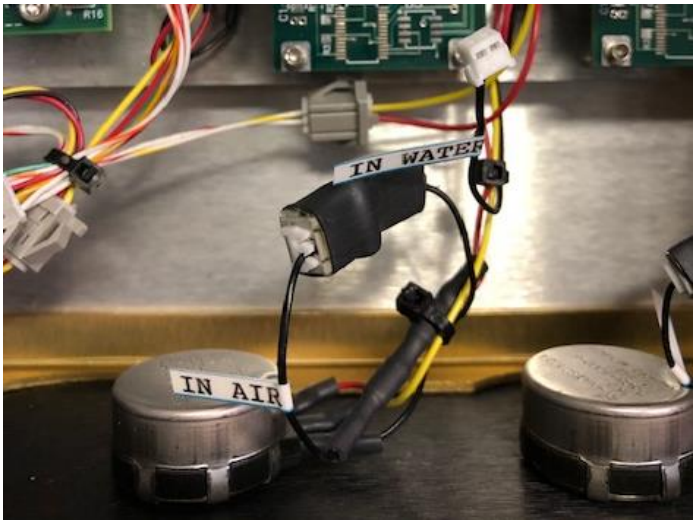

Figure 13: “IN AIR” and “IN WATER” Wire Harness

Plug in the appropriate connector to the socket for desired operational use, make sure change is performed for both left and right LED drivers. Replace top panel onto controller, use Loctite on screws if necessary.

4.3 LED PLATE & CAMERA PORT REPLACEMENT

4.3.1 LED PLATE REPLACEMENT

The integrated LED lights should not need to be replaced often. However, over time the

light from the LEDs will become increasingly blue and light output will be diminished, which will signal that the LED Plate will need to be replaced.

Replacement of the PTZ LED Plate requires the following:

- LED Face Plate Replacement Assembly (75-00959-01, see drawing in Appendix)
- 3/32" Allen Wrench
- Silicone O-Ring Grease (included in PTZ Maintenance Kit, 75-00997-01)

To replace the LED Plate, follow these steps:

1. Loosen the 4 screws and pull off the LED Plate to expose the connector. Disconnect the inline connector and the LED Plate can be removed.

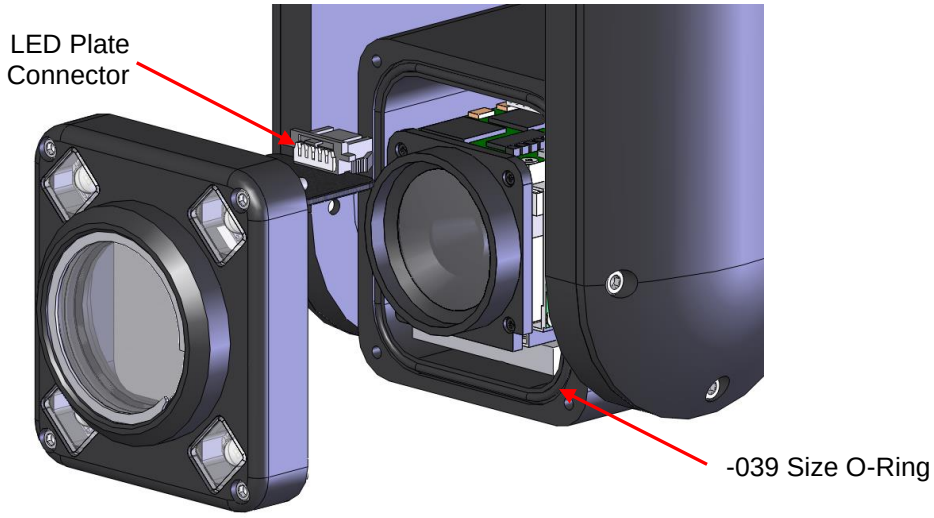

Figure 14: LED Plate Removed

2. The new LED Face Plate Replacement Assembly includes a replacement -039 size O-ring (shown in Figure 14). Replacing the O-ring at this time is recommended. Make sure the O-ring groove is free of dirt and debris. Lubricate the new O-ring with silicone lubricant and insert into the groove as shown.
3. Reconnect the connector to the new LED Plate. When putting the LED Plate back on the camera module housing, make sure to slide in the wire management shelf (see Figure 11) under the wires going to the camera module. Be careful not to damage the wires or pull out the camera's connections.
4. Make sure the O-ring is still correctly seated in the groove and tighten the 4 screws.
5. Connect the PTZ to a controller and test operation of the camera and LEDs prior to redeploying the camera.
6. Purge the camera. Refer to Section 4.5.2 for the Camera Purge Procedure.

4.3.2 CAMERA PORT REPLACEMENT

NOTE: IF CAMERA MODULE AND LED PLATE ARE BEING REPLACED AT THE SAME TIME, MAKE SURE THAT THE LED PLATE IS INSTALLED FIRST IN THE CORRECT ORIENTATION. THE WIRE MANAGEMENT SHELF ON THE INSIDE OF THE LED PLATE MUST BE INSTALLED TOWARD THE TOP OF THE MODULE HOUSING WITH THE PORT FACING FORWARD. REFER TO THE ASSEMBLY DRAWING 75-00953-01 IN THE APPENDIX FOR REFERENCE.

The LED Plate Replacement Assembly comes with a new Camera Port already installed. However, the port can also be replaced independently.

Replacement of the PTZ Camera Port requires the following:

- Camera Port Replacement (75-00962-01)
- O-Ring for Port (60-20128-4)
- 3/32" Allen Wrench
- Small Flat Head Screw Driver
- Silicone O-Ring Grease (included in PTZ Maintenance Kit, 75-00997-01)

To replace the Camera Port, follow these steps:

1. Remove the LED Plate. See Step 1 in Section 4.3.1.
2. With the LED Plate removed, use a flat head screw driver to remove the retaining ring. Push on the back of the port to pop it out of its cavity.

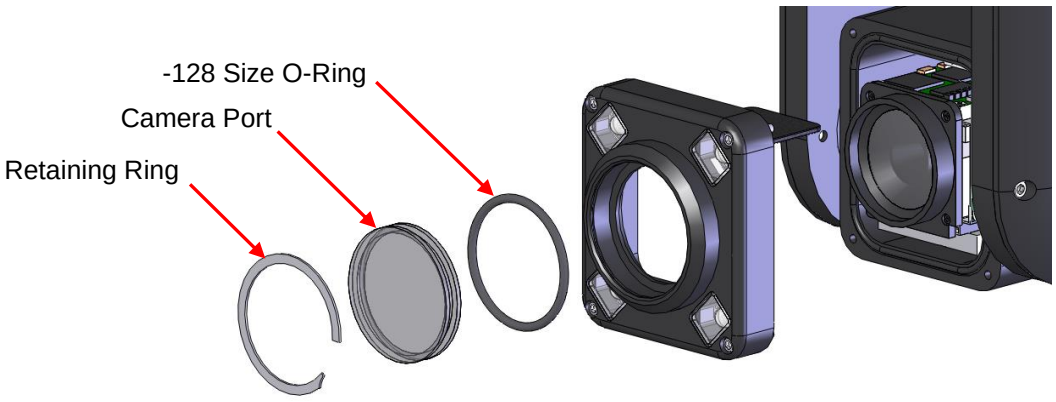

Figure 15: Camera Port Assembly

3. Make sure the o-ring groove is free of dirt and debris. Lubricate the replacement o-ring and stretch it over the port so that it sits in the groove.

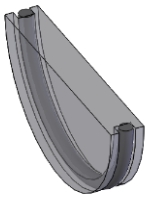

Figure 16: Cross Section of O-Ring in Camera Port Groove

4. Push the Camera Port back into the cavity in the LED Plate and replace the retaining ring.
5. Before replacing the LED Plate, make sure that there are no fingerprints or foreign matter on the inside of the Camera Port. If necessary, clean the inside surface with lens cleaner and a lint free cloth.
6. Purge the camera. Refer to Section 4.5.2 for the Camera Purge Procedure.

4.4 O-RING REPLACEMENT

O-ring locations and part numbers can be found on the PTZ Assembly Drawing in the Appendix. Replacements for all O-rings are included in the PTZ Maintenance Kit (75-00997-01). See Sections **Error! Reference source not found.** and **Error! Reference source not found.** for details on camera disassembly.

3 additional O-rings are included in the Maintenance Kit for replacement of the O-rings included with the connector. See Figure 17 for connector O-ring locations.

The wires exiting the bottom of the connector should not be twisted. To loosen the connector in order to access the O-ring 60-20022-4, first remove the retaining ring inside the connector and pull out the plastic insert. The metal shell of the connector can then spin freely so that it can be unscrewed from the Pan Shaft.

2x 60-20018-4

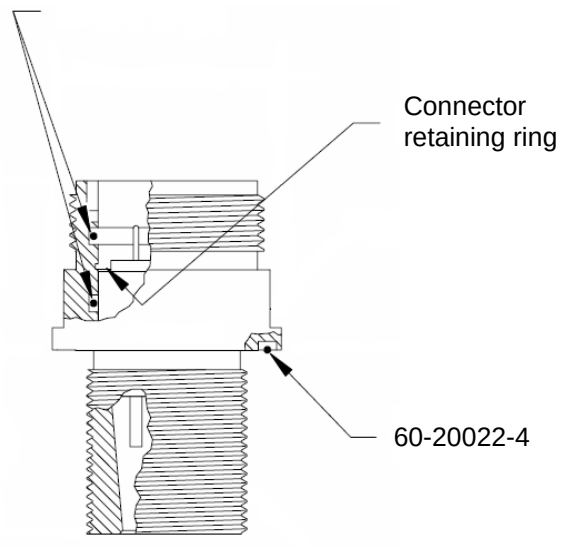

Figure 17: Main Connector O-Ring Locations

4.5 VACUUM TEST AND PURGE

4.5.1 VACUUM TEST

A vacuum test is a non-destructive test to make sure the camera is watertight. Any time the camera is opened, ROS recommends vacuum testing the camera prior to submerging it in water. The PTZ camera has a #10-32 threaded port on the front of the housing for connecting a vacuum or purge gas line. This port is normally sealed with a #10-32 seal screw.

Vacuum testing requires a vacuum pump, a valve, a pressure gauge and a #10-32 male-threaded fitting. To perform the test, hook the vacuum pump to the vacuum port (normally plugged with a seal screw) on the PTZ Camera, with the valve between the pump and the camera, and the gauge between the valve and the camera. Draw vacuum on the unit (ideally about 25 mmHg) and close the valve. Watch the pressure gauge for 5 minutes to ensure that the vacuum pressure stays constant. Any noticeable drop in pressure indicates a leak.

4.5.2 PURGE PROCEDURE

Purging the camera with a dry gas will prevent condensation from forming inside the housing or on the camera port.

It is easiest to purge the camera after a vacuum test. Instead of letting ambient air fill the camera, spray dry nitrogen or clean, dry air into the unit as the vacuum pressure is relieved. Quickly replace the seal screw to limit the amount of ambient air that enters the camera.

If a vacuum pump is not available, dry nitrogen or clean dry air may be sprayed into the camera as it is closed and into the purge port.

4.6 ROUTINE MAINTENANCE AND CLEANING

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

Anytime the camera is serviced, 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 before re-assembly. Ensure that all electrical connectors are correctly fitted and all cabling is secured.