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SPECTRUM 120™

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About This Manual

This manual has been prepared to assist you in the operation and maintenance of your Eddyfi Technologies' Inuktun equipment. Correct and prudent operation rests with the operator who must thoroughly understand the operation, maintenance, service and job requirements. The specifications and information in this manual are current at the time of printing.

This product is continually being updated and improved. Therefore, this manual is meant to explain and define the functionality of the product. Furthermore, schematics or pictorials and detailed functionality may differ slightly from what is described in this manual.

Eddyfi Technologies reserves the right to change and/or amend these specifications at any time without notice. Customers will be notified of any changes to their equipment.

Information in this manual does not necessarily replace specific regulations, codes, standards, or requirements of others such as government regulations.

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Description

The Inuktun Spectrum 120™ (SP120) is an industrial video camera system for use in pipe inspection systems, harsh industrial environments and underwater. Standard features include 360 ° continuous pan, 280 ° tilt, zoom and a 60 m (200 ft) or 300 m (1,000 ft) depth rating. It is designed to fit into a 120 mm (4.75 in) ID space and still be able to tilt and pan throughout its full range. The camera is made from either anodized marine-grade aluminum or 316 stainless steel. Optional video formats are HD 1080p /1080i and SD NTSC or PAL. Installation options include integration with a larger inspection system (such as the Versatrax 150™ pipe inspection system) or independent use as a drop camera or static system. Typical applications include:

- Toxic environment, confined space or underwater inspections
- Small diameter pipe inspection
- Dam and lock inspection
- Reactor vessel inspection
- Foreign object search and retrieval
- Robotics and remote tooling
- ROV integration
- Corrosion evaluation
- Remote and/or continuous monitoring
- Drop camera use.

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| Specifications | | | |
|----------------------|------------|---------------------------------|--------------------------------------|
| Operating Voltage | | 36 – 70 VDC | |
| Operating Power | | 75 W Peak | |
| Operating Current | | 2.1 A Peak | |
| Depth Rating | Standard | 60 m (200 ft) | |
| | Deep Water | 300 m (1,000 ft) | |
| Speed | Pan | 0 – 26 °/s | |
| | Tilt | 0 – 9 °/s | |
| Range | Pan | 360 ° Continuous | |
| | Tilt | 280 ° (+/- 140 °) | |
| Dimensions | Standard | Ø121 x 333 mm (Ø4.75 x 13.1 in) | |
| | Deep Water | Ø121 x 356 mm (Ø4.75 x 14.0 in) | |
| Weight | Standard | Aluminum | 3.4 kg (7.5 lb) |
| | | Stainless Steel | 9.0 kg (20 lb) |
| | Deep Water | Aluminum | 4.8 kg (10.5 lb) |
| | | Stainless Steel | 12.7 kg (28 lb) |
| Imager | Sensor | | 1/2.8in Exmor R CMOS |
| | Lens | Standard | f = 3.8 to 38 mm |
| | | | 120x Zoom (10x Optical, 12x Digital) |
| | | | 67 ° HFOV (air) |
| | | Option | f = 4.3 to 129 mm |
| | | | 360x Zoom (30x Optical, 12x Digital) |
| | | | 64 ° HFOV (air) |
| | Focus | | Manual or Auto |
| | Resolution | | 1920 x 1080 |
| | Format | | 1080p (30 fps) / 1080i (60 fps) |
| Minimum Illumination | | 1.4 lux | |
| Depth of Field | | 10 mm (0.4 in) to infinity | |
| Lights | | 4 x High intensity LEDs | |

| | |
|-----------------------|--|
| Lasers (optional) | 2 x Laser Lines, 635 nm, 77 mm (3.03 in) Spacing |
| Controls | Pan, tilt, zoom, focus, lights, lasers, exposure |
| Maximum Tether Length | 300 m (1,000 ft) |
| Operating Temperature | 0 – 50 °C (32 – 122 °F) |
| Storage Temperature | -20° – 60 °C (-4 – 140 °F) |

Certification

The Spectrum 120™ Camera system is built in accordance with the Machinery Directive 2006/42/EC and Electromagnetic Compatibility Directive 2004/108/EC and Directive 2014/30/EU.



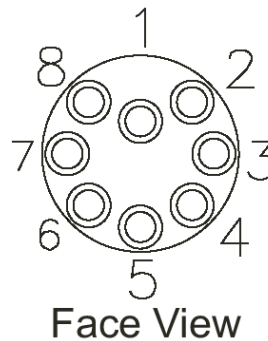
Connector Pin-Out

NTSC / PAL

The Spectrum 120™ Standard Definition (SD) camera connects to power and communications through a Subconn MCBH8M connector.

Note: The pin-out is shown for the Bulkhead Connector on the camera.

| Pin | Function |
|-----|----------------|
| 1 | 70 VDC GND (-) |
| 2 | 70 VDC (+) |
| 3 | RS485 (+) |
| 4 | RS485 (-) |
| 5 | SpareA |
| 6 | SpareB |
| 7 | Video1 (+) |
| 8 | Video1 (-) |



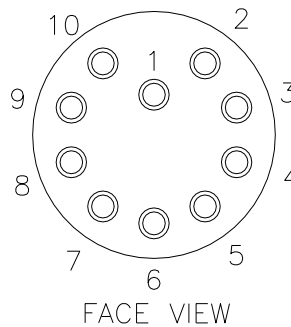
High-Definition (HD)

The Spectrum 120HD High Definition (HD) camera connects to power and communications through a Subconn MCBH10M connector.

Note: The pin-out is shown for the Bulkhead Connector on the camera

Note: The HD Receiver PCB is tuned to specific length of tether. Do not change length of tether. Contact factory for assistance.

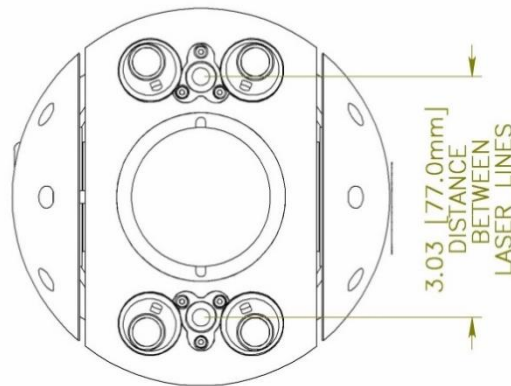
| Pin | Function |
|-----|----------------|
| 1 | 70 VDC GND (-) |
| 2 | 70 VDC (+) |
| 3 | RS485A (+) |
| 4 | RS485B (-) |
| 5 | Pb Out (+) |
| 6 | Pb Out (-) |
| 7 | Y Out (+) |
| 8 | Y Out (-) |
| 9 | Pr Out (+) |
| 10 | Pr Out (-) |



Laser Lines

The Spectrum 120™ camera may be optionally equipped with horizontal laser lines (red Class 2 lasers at 635 nm, 1.5 mW). Laser line separation is 77 mm (3.03 in).

- CAUTION:** Class II Laser: Do not intentionally stare into the beam. Typically, Class II relies on the blink reflex to limit exposure to no more than ¼-second. Intentionally staring into the beam can cause eye injury.



Safety

In order to be able to use this product properly and safely, every user must first read these operating instructions and observe the safety instructions contained therein. Take care of these operating instructions and keep them in a place where they can be accessed by everyone.



CAUTION: Failure to follow these safety instructions may result in injury or equipment damage.



WARNING: High Voltage 36-70 VDC. If the equipment is powered from a source other than an Eddyfi Technologies provided controller, the power supplied to the product must have reinforced isolation from the mains with no reference to earth ground.



WARNING: Spark Hazard - Under no circumstances should this equipment be used in a potentially explosive atmosphere.



WARNING: Intense Optical Radiation – The Spectrum 120™ camera lights are extremely bright. Never look directly at the lights. Use a welding filter (shade #8 or higher) if inspecting the LEDs.

- **CAUTION: Class II Laser:** Do not intentionally stare into the beam. Typically, Class II relies on the blink reflex to limit exposure to no more than ¼-second. Intentionally staring into the beam will cause eye injury.
- When performing maintenance or functional checks of the lasers and camera lights, take precautions to protect nearby personnel from unintended exposure which could be temporarily blinding.
- The Spectrum 120™ is an industrial product. All personnel operating or maintaining this equipment must be competently trained.
- There are no user serviceable parts inside. This product may be serviced only by qualified technicians or trained personnel.
- Our equipment is used in many varied environments from hot/dry to confined spaces to deep underwater. Such diverse environment risks must be addressed by the operators who are trained to work in such surroundings. As such, the operator is responsible to determine safe site setup and appropriate personal protective equipment (PPE) for operation and maintenance of the equipment.
- Do not use the product or any component exposed to pressures higher than the rated working pressure.



In addition, observe the following precautions when cleaning or servicing the Spectrum 120™ :

- Do not operate the camera with a damaged connector or cable. Inspect connectors and cables regularly for damage.
- Call the Eddyfi Technologies Service department for assistance or service if needed.



CAUTION: The Schrader cap installed on your camera is a proprietary cap rated to 300 m (1,000 ft) depth. **Do not install any other Schrader cap.** Doing so may result in flooding and destruction of the camera or in personal injuries from electrical shorts. Standard automotive style Schrader valve components will be forced open below 40 m (130 ft) depth by the water pressure.



CAUTION: Disconnecting the camera while the power is on can cause damage to the camera. Disconnect the power source before servicing the product.



CAUTION: Do not over-pressure the camera through the Schrader valve. Applying pressure beyond 15 psi through the Schrader valve may cause the camera to burst resulting in injury and equipment damage. When re-purging, use a regulated, gauged supply and apply no more than **10 psi** pressure.

System Setup

Unpacking Components

The Spectrum 120™ camera is shipped in a rugged case or is installed on an integrated system. Packaging is selected to protect the camera from damage during shipping or storage. Upon receiving your system, check the case and contents for any damage that may have occurred during transport. Should any of these components be missing or damaged, please notify your vendor. We suggest that when the system is re-shipped or stored for any length of time, it should be re-packaged in its original case or be put in a cardboard box encased in high-density foam. It is also strongly advised that the case be placed in a cardboard box again for shipping purposes. This measure greatly reduces rough handling and subsequent shipping damage.

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Mounting the Camera

There are two distinct versions of the Spectrum 120™ camera with different mounting requirements. These are:

- Standard definition camera with M6 mounting holes (8-pin connector)
- High Definition camera with M6 mounting holes (10-pin connector).

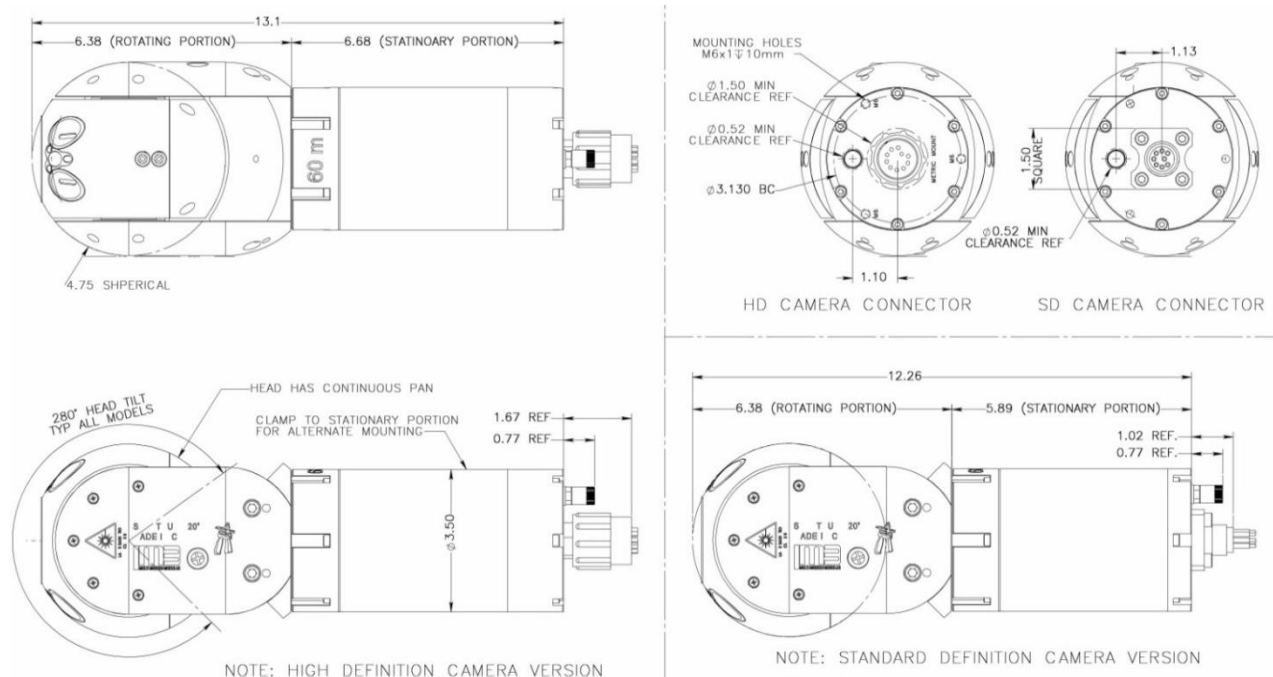
Both of these are illustrated below. In addition to the mounting pattern, the standard (60 m / 200 ft) and deep water (300 m / 1,000 ft) cameras are different lengths as illustrated.

Alternatively, the cameras may be mounted by a clamp around the 90 mm (3.5 in) diameter stationary portion of the barrel. The camera may be mounted in any orientation.

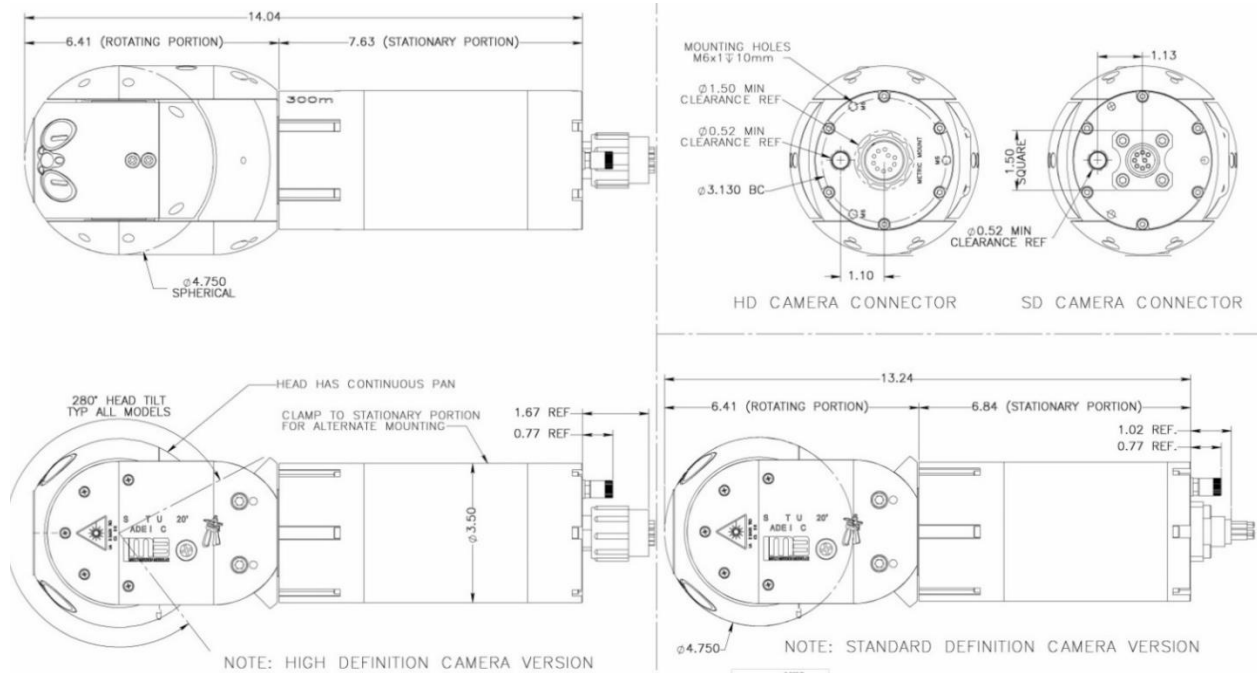


CAUTION: Avoid forcing the PAN mechanisms by hand. It will wear the clutch discs and could cause premature failure.

Standard Camera Mounting



Deep Water Camera Mounting



Galvanic Corrosion Control

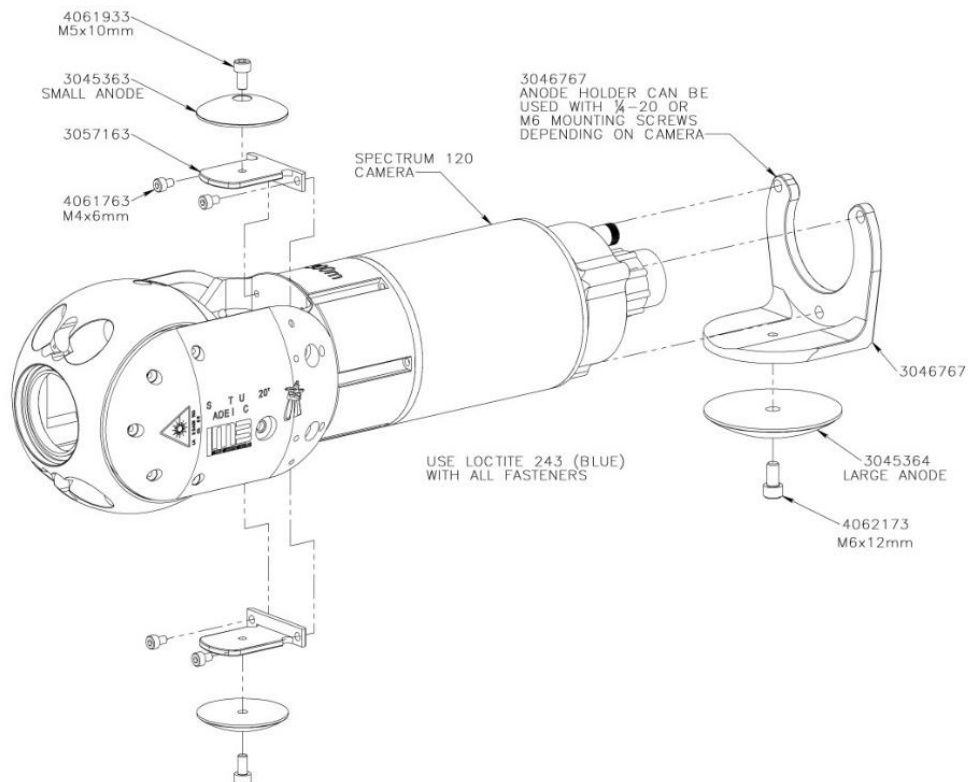
We strongly recommend stainless steel cameras for salt water environments or other corrosive environments. The camera warranty is conditional when aluminum body cameras are chosen these kinds of applications.

Cathodic protection is required whenever the camera is being deployed in a salt water environment, either submerged or in salt spray, regardless of camera material.

Our cameras use **aluminum** marine anodes for both stainless and aluminum cameras. Aluminum anodes are common in the marine industry and are replacing zinc anodes in many areas. For cameras systems that are often pulled in and out of the water, aluminum anodes are especially important, as zinc anodes tend to scale over when exposed to air and may not reactivate when submerged again. An aluminum anode will always reactivate.

It is required that the structure to which the camera is mounted also be protected by **aluminum** anodes. If the structure is of a dissimilar metal, the camera mount must be isolated from the structure. Do not mix anode types (zinc and aluminum) on the assembly. There must be only one anode type throughout the structure. Magnesium anodes must never be used with Spectrum™ camera installations.

Anodes are installed onto the camera as illustrated below. The small anode is installed onto the mounting bracket using an M5 x 10 mm 316 SS SHCS. A large disk anode is attached to a mounting bracket for the base using an M6 x 12 mm 316 SS SHCS. Contact your sales representative for replacements.



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Connector Handling

Connectors are an essential part of system reliability. They should be properly maintained and cared for to ensure long life and reliability. It is recommended to follow these steps to help prevent damage and increase the life of connectors.

- Always put the cap back on the tether bulkhead when the tether is disconnected
- Always inspect the end of the connector prior to engaging
- Never plug in a dirty or damaged connector
- Visually align key-ways or locating pins prior to engaging the connector
- Always fully engage or tighten the connector
- Secure locking collars finger tight
- Install dummy plugs on unused connectors
- Disconnect by pulling straight, not on an angle
- Do not pull on the cable to disengage the connector



IMPORTANT: Never “Hot Plug” any connector, this will result in internal damage to the electronics. Power down the system prior to connecting the inspection system tether.

Note: Never use WD-40 or similar solvent-based fluids on connectors or crawlers. These will cause the rubber parts of the connector or crawler to soften and swell rendering them inoperable.

SubConn Connector: Lubrication and Cleaning

- Periodically apply Molykote 111 silicone grease or equivalent before mating connectors
- For dry mate connections, a layer of grease corresponding to 1/10 the socket depth should be applied to the female connector
- After greasing, fully mate the male and female connector and remove excess grease from the connector joint
- General cleaning and removal of sand or mud on a connector should be performed using a spray-based contact cleaner like isopropyl alcohol

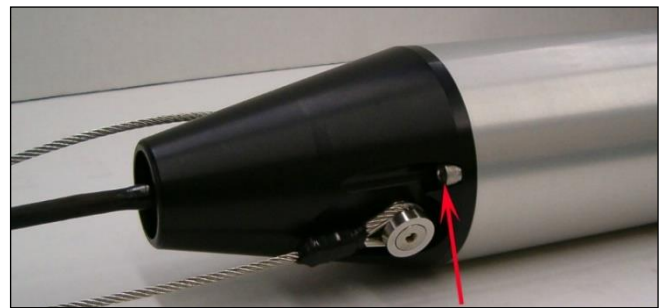
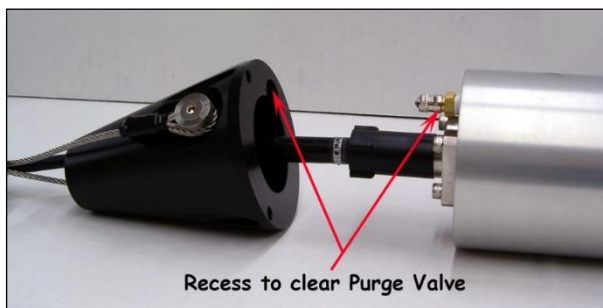
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Drop Cone Assembly

A drop cone assembly should be attached to the rear of the camera for drop camera configurations. Always use the drop cone as the connector is not strong enough by itself for lifting applications.

To install the drop cone do the following:

1. Insert the tether cable through the cone and connect to the camera.
2. Align the recess with the purge valve as shown above.
3. Secure the drop cone with 3x M6 x 16 mm SHCS.
4. Attach the Kellem's grip to the tow cable on the drop cone.



Flow Thru Cooling (Continuous Purge)

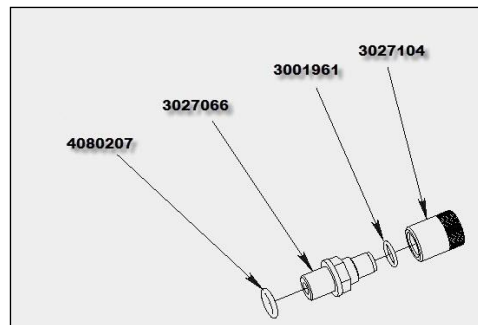
The Spectrum 120™ camera may be continuously purged for cooling purposes. Contact Eddyfi Technologies for more details.

Schrader Valve

All versions of the Spectrum 120™ camera use a proprietary Schrader valve rated up to 300m (1000ft) depth. The factory Schrader cap and O-ring must always be installed.



CAUTION: The Schrader cap installed on your camera is a proprietary cap rated to 300 m (1,000 ft) depth. **Do not install any other Schrader cap.** Doing so may result in flooding and destruction of the camera or in personal injuries from electrical shorts. Standard automotive style Schrader valve components will be forced open below 40 m (130 ft) depth by the water pressure.



DEPTH RATED SCHRADER VALVE ASSEMBLY

Nitrogen Purge and Pressurization

The Spectrum 120™ camera has been nitrogen purged and pressurized at the factory as part of the production process. This will ensure that no moisture is present inside the camera housing and camera body.

The Spectrum 120 camera has the capability to be re-purged and pressurized by the user. All necessary hardware for purging is installed on the camera, all that is needed is a supply of bottled nitrogen with a pressure regulator and gauge suited for 5 – 10 psi control, and a locking rubber air chuck.

1. Remove the seal screw from the camera's left side plate as illustrated below.
2. After removing the depth rated protective cap, hook up the nitrogen supply to the Schrader valve at the bottom end of the camera using an air chuck at the end of the hose.
3. Turn on the nitrogen. Pressure must be no more than 10 psi. Internal passages are routed to ensure nitrogen flows throughout the entire camera.
4. Let the nitrogen flow for minimum one minute, and then re-install the seal screw again while the nitrogen is still flowing to create a small internal pressure.
5. When the nitrogen source is removed, the Schrader valve will keep the pressure inside. Cap the valve again when done. Fasten the depth rated cap securely.

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CAUTION: Do not over-pressure the camera through the Schrader valve. Applying pressure beyond 15 psi through the Schrader valve may cause the camera to burst resulting in injury and equipment damage. When re-purging, use a regulated, gauged supply and apply no more than **10 psi** pressure.



SEAL SCREW LOCATION ON LEFT SIDE PLATE



NITROGEN PURGE SCHRADER VALVE

Operation

Pre-Operations Check

A Pre-Operations check should to be carried out prior to every camera mission.

1. Visually inspect the camera to ensure that there is nothing jamming the movement.
2. Check the camera cable for cuts, tears, etc.
3. Check that the camera connector is fully engaged and that the locking collar is finger tight.
4. Ensure that all other cables are properly connected including the monitor.
5. Clean the camera port (window).
6. Power up and test all camera functions. This includes adjustability of the lights and **full** pan and tilt movements.
7. Verify the functionality of your monitor and video recording equipment. At this time verify the functionality of the video overlay, zoom and manual focus settings.

Post-Operations Check

A Post-Ops inspection should be carried out after every camera mission.

1. The system should be visually inspected for mechanical damage.
2. If the system has been used in salt water, thoroughly rinse the camera and pole with fresh water right away. Accelerated corrosion will result if the camera is not rinsed properly. Pay close attention to rinsing and cleaning the spaces between moving parts.



CAUTION: Do not use a pressure washer to clean the camera. Very high-pressure water can push past seals and flood the camera resulting in electrical damage or personal injuries.

3. Clean off the camera and remove objects or debris from between its moving parts.
4. Visually check through the camera port to ensure that no water has entered the camera.
5. Inspect the camera cable for cuts, nicks or kinks. Store the camera in its rugged case with the connector sufficiently protected.

ICON™ & ICON™ RPT

Camera control and video recording are accomplished using ICON graphical interface controller software. Video playback and reporting are conducted through ICON RPT. **Manuals for these two software packages are included separately.** Controls for recording and snapshot functions are kept on-screen with the camera controls.

- ICON Manual – (Control Interface and Recording)
- ICON RPT Manual - (Reporting, Playback and Video Export)

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Troubleshooting

Camera Control Problems

1. Not all the auxiliary lights are on.
 - The ICON™ software allows the lights to be controlled independently. Ensure all lights are enabled. Refer to the ICON interface manual.
 - Inspect for blown LEDs.



CAUTION: High Intensity. Do not look directly into the lights or lasers. Use a welding filter (shade #8) to observe the light elements.

2. Camera tilt does not function in one or both directions.
 - Check that the camera is not jammed.
 - If you can hear a motor running but see no movement, there is a mechanical or clutch problem inside the camera. Contact us.
3. Camera is moving very slowly.
 - Check the tilt speed in the camera control window. Refer to the ICON™ user interface manual.

Video Problems

1. No video (black or blue background).
 - Interface box is not turned on.
 - Video cables are not hooked up between interface box and computer.
 - Camera connector on vehicle is loose (turn power off first before plugging in camera).
 - Check monitor input settings.
 - Vehicle power is not on.
 - Check for problems with other video components between the computer and monitor.
 - Try a different monitor. Whole days have been spent on field maintenance trips only to discover a faulty monitor.
2. Picture is very dark or very bright.
 - Check the light levels of both the camera and main lights.
3. Intermittent picture.
 - Check and replace the video cables.
 - Check the monitor is working properly.
 - Check that the camera harness whip is fully plugged in.
 - Check for intermittent breaks in the camera harness cable.
 - Check the tether connectors at both controller and vehicle.
 - Check for tether or slip ring damage by testing tether continuity.
4. Picture is blurry, will not focus, or has poor color.
 - This may be a dirty camera view port, or a narrow object lying in front of the view port.
 - Object may be too close to the camera.

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Maintenance

Tether Re-termination

Tether termination is a specialized service beyond the scope of this manual. Contact Eddyfi Technologies if the tether is damaged or requires re-termination.

Rinsing and Cleaning

After every mission check to see if the camera needs cleaning.

1. If the system has been used in salt water, thoroughly rinse the camera with fresh water prior to being stored away. Accelerated corrosion will result if the inspection system is not rinsed properly. Pay close attention to rinsing and cleaning the camera window, LED lights dome and the spaces between moving parts.
2. Use an open hose or tap at regular water line pressure for rinsing. Do not pressure wash the equipment – water will be forced into the camera at these high pressures.
3. Avoid scratching the camera port. Use glass cleaner and a soft cloth to clean the port.



CAUTION: Do not use a pressure washer to clean the camera. Very high-pressure water can push past seals and flood the components resulting in electrical damage or personal injuries.

Periodically:

1. Use a damp cloth or spray cleaner for the power supply / controller box. The box must never be sprayed down or immersed in water. Unplug the controller before cleaning.
2. For general cleaning of the camera, use a mild detergent.

Inclinometer Calibration

Contact your local representative for calibration instructions.

Factory Maintenance

The Spectrum 120™ camera is equipped with a number of rotary surface seals that have to operate with close tolerances to achieve the 60 m (200 ft) or 300 m (1,000 ft) depth rating. It is of the utmost importance that the sealing surfaces are protected from scratches during maintenance work. When seals are removed or replaced the sealing surfaces and seals must be clean and sufficiently lubricated before installation.

To re-certify a camera's depth rating we recommend the camera be serviced at Eddyfi Technologies in-house service centre.

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Parts and Repairs

Ordering Parts/Customer Service

Spare and/or replacement parts are available for your product and can be ordered directly from your local office.

When ordering parts always make sure to quote the sales order acknowledgement (SOA) number and/or the serial number of the system component in question.

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Warranty Repairs

Warranty conditions are specified in the Warranty section. Should any conditions of the manufacturer's warranty be breached, the warranty may be considered void. All returned items must be sent prepaid to Eddyfi Technologies at the above address.

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Factory Returns to Canada

Some sub-assemblies of your Eddyfi Technologies product are not field-serviceable and may need to return to the factory for repair. Warranty claims must return to the factory for evaluation.

To return an item for evaluation or repair, first contact Eddyfi Technologies at our toll-free number or e-mail address. Eddyfi Technologies will supply a Return Merchandise Authorization (RMA) number with detailed shipping and customs instructions. Items shipped without an RMA number will be held at Eddyfi Technologies until the correct paperwork is completed. If cross-border shipments are not labelled as per the instructions, the items may be held by customs and issued additional fees.

All returned items must be sent prepaid unless other specific arrangements have been made.

When the product or system is being shipped anywhere by courier or shipping company, it must be packaged in the original packaging it was received in. This measure greatly reduces the consequences of rough handling and subsequent shipping damage.

Eddyfi Technologies cannot be held responsible for damages due to improper packaging. Shipping damage may have significant impact on repair turnaround times.

Product/System Drawing Package Availability

Mechanical assembly and electrical wiring diagram drawing packages for your equipment are available in PDF format upon request. Printed copies may also be purchased from Eddyfi Technologies. Contact your local sales contact for more information.

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Limited Warranty Policy

Eddyfi Technologies will repair or replace, at its expense and at its option, any system or component, subject to the limitations and / or exclusions specified herein, which in normal use has proven to be defective in workmanship or material provided that, within one (1) year of the purchase date, the original purchaser returns the product prepaid, accompanied by proof of purchase, from a sales agent authorized by Eddyfi Technologies, and provides Eddyfi Technologies with reasonable opportunity to verify the alleged defect by inspection.

Warranty Limitations and/or Exclusions:

1. This warranty does not apply to light bulbs.
2. Batteries, fuses, transistors, integrated circuit modules (IC's), voltage regulating devices and electrical plugs and / or connectors are warranted to be free from defects in material and workmanship for a period of ninety (90) days from the date of shipment to the original purchaser.
3. Any article purchased from, but not manufactured by, Eddyfi Technologies is sold with only such warranties as are made by the manufacturer therein. Eddyfi Technologies only warrants that it has title thereto, free of all liens or encumbrances.
4. This warranty does not apply to units which are damaged by connection to improperly wired AC receptacles.
5. Track belts, tethers, view ports and other components subject to wear through abrasion are warranted to be free from defects in material and workmanship for a period of ninety (90) days from the date of shipment to the original purchaser.
6. Any damage caused by failure to observe proper packing or to observe instructions for operation and maintenance as contained in the Instruction Manual furnished with the equipment, by accident in transit or elsewhere, will not be covered by the warranty.
7. Repairs are warranted for 90 days.

Eddyfi Technologies may require that certain components may be returned, prepaid, to a manufacturer's authorized station for inspection and repair or replacement.

Eddyfi Technologies will not be responsible for any asserted defect which has resulted from Acts of God, normal wear, misuse, abuse, improper configuration, repair, or alteration made, or specifically authorized by, anyone other than a representative of Eddyfi Technologies authorized to do so. The giving of, or failure to give, any advice or recommendation by Eddyfi Technologies shall not constitute any warranty by, or impose any liability on, Eddyfi Technologies.

The foregoing constitutes the sole and exclusive remedy of the purchaser and the exclusive liability of Eddyfi Technologies and is in lieu of any and all other warranties, express, implied or statutory as to merchantability, fitness for purpose sold, description, quality productiveness, or any other matter. Under no circumstances shall Eddyfi Technologies be liable for special, incidental or consequential damages, or for delay in performance of this warranty.

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