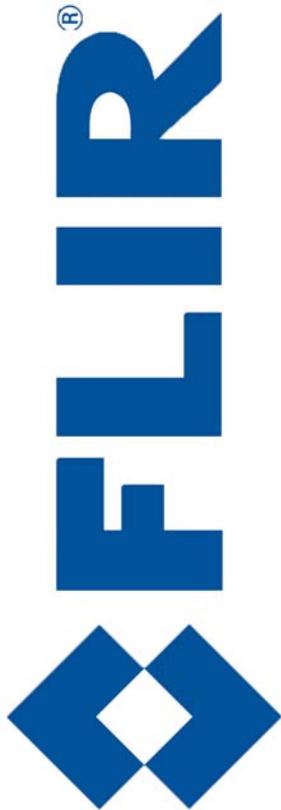

MD-Series



432-0010-00-12
Revision 100
Apr 2013

Installation Guide

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This product is covered by one or more of US Patent Nos: 7470904; 7034301; 6812465; 7470902; 6929410 and other patents pending or design patents pending.

The MD-Series thermal imaging system is controlled by US export laws. There are special versions of this system that are approved for international distribution and travel. Please contact FLIR Systems if you have any questions.

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Document History

Revision	Date	Comment
100	Apr 2013	Initial release



Proper Disposal of Electrical and Electronic Equipment (EEE): The European Union (EU) has enacted Waste Electrical and Electronic Equipment Directive 2002/96/EC (WEEE), which aims to prevent EEE waste from arising, to encourage reuse, recycling, and recovery of EEE waste, and to promote environmental responsibility.

■ In accordance with these regulations, all EEE products labeled with the “crossed out wheeled bin” either on the product itself or in the product literature must not be disposed of in regular rubbish bins, mixed with regular household or other commercial waste, or by other regular municipal waste collection means. Instead, and in order to prevent possible harm to the environment or human health, all EEE products (including any cables that came with the product) should be responsibly discarded or recycled.

To identify a responsible disposal method, please contact the local waste collection or recycling service, the original place of purchase or product supplier, or the responsible government authority in the local area. Business users should contact their supplier or refer to their purchase contract.

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Installing MD-Series Systems



This manual describes the installation of the MD-Series camera. If you need help or have additional questions, please call to speak with our support experts; see the phone numbers on the back cover of this manual.



This manual includes information about the following topics:

- System overview
- Installation overview and planning
- Detailed installation instructions including mounting the camera, routing the cables, connecting power, and adjusting the camera position
- Installing optional components for controlling the camera
- Maintaining the camera
- Camera specifications and other reference information

Additional References

The MD-Series camera comes with a complete documentation set on a CD (FLIR Doc. # 432-0010-50) that includes this manual as well as others. All documents are in PDF format and can be viewed with Adobe Acrobat Reader:

- *MD-Series Operator's Manual* (FLIR Doc. # 432-0010-00-10) contains information about how to configure, use, and operate the camera
- *MD-Series Quick Start Guide* (FLIR Doc. # 432-0010-00-QS) shows the on-screen icons and their meaning
- *MD-Series Interface Control Document (ICD)* (FLIR Doc. # 432-0010-00-19) is an extensive set of CAD drawings with detailed component dimensions, wiring schemes, mounting dimensions, and several possible connectivity options

This manual frequently refers to the ICD drawings for details during the installation steps. Ensure these drawings are available before beginning the installation.

The ICD drawings are also available from the FLIR Web site:

<http://www.flir.com/cvs/americas/en/maritime/ae/>

Refer to the Resources Web page for up-to-date documentation:

<http://www.flir.com/cvs/americas/en/maritime/resources/>

Documentation Conventions

For safety, and to achieve the highest levels of performance from the MD-Series system, always follow the warnings and cautions in this manual when handling and operating the MD-Series camera system.



Warning: Warning notices are used to emphasize that hazardous voltages, currents, temperatures, or other conditions that could cause personal injury or death exist with this equipment, or may be associated with its use.



Caution: Caution notices are used where equipment might be damaged if care is not taken or an operation might have an unexpected outcome.



Note: Notes call attention to information that is especially significant to understanding and operating the equipment.

Warnings and Cautions



Warning: Do not use the MD-Series imaging system as the primary navigation system. Use it in conjunction with other navigation aids and a primary manual navigation system.



Warning: Use extreme caution when installing the product in elevated locations, such as on top of a boat or on a mast. Do not perform the installation in wet conditions when surfaces could be slippery. Follow local codes and observe standard maritime electronic installation best practices.



Warning: Use of insufficient wire gauge can result in fire. Follow local codes and observe standard maritime electronic practices for wiring electronic systems.



Caution: Do not open the camera ball assembly for any reason. The outer enclosure (dome) can be removed during installation but should remain in place during normal use. Disassembly of the camera ball assembly can cause permanent damage and will void the warranty.



Caution: Be careful not to leave fingerprints on the camera optics. Also, if the camera dome is removed, do not touch the gore vent on the back of the camera. Oil and other debris will clog the vent and prevent it from functioning properly.



Caution: The MD-Series requires a Power over Ethernet (PoE) power source compliant to IEEE802.3af. The PoE injector (PN 4113746) supplied with the unit can accept 12 – 24 VDC nominal, and has an absolute range 10 – 32 VDC (–10%/+30% per IEC60945). The camera system comprising the PoE injector connected to the MD-Series camera requires less than 2.5 A. Operating the system outside of the specified input voltage range to the injector or the specified operating temperature range can cause permanent damage.



Caution: During installation, ensure the cables exiting the bottom of the camera are not in contact with sharp edges, do not bend at sharp angles, and are not pinched between the bottom of the camera and the mounting surface. Do not pull on the cables with excessive force.

System Overview

MD-Series is a maritime thermal imaging system for use on most types of vessels. The system has a single thermal imaging camera and is available in two models:

- Model MD-324 has a standard resolution camera that supports 2X zoom.
- Model MD-625 has a higher resolution camera that supports either 2X or 4X zoom.

Details for each model are listed in “Feature Comparison of MD-Series Models” on page 38.

The infrared (IR) thermal camera provides night-time imagery, even in total darkness, based on temperature differences. It provides a clear video image even under completely dark conditions because it is sensitive to thermal infrared energy.

The MD-Series consists of a fixed dome assembly, also known as the camera unit. The camera supplies an analog video output through a standard F-type connection and receives power from its Power over Ethernet (PoE) interface.

The MD-Series dome camera is an IP network device. In some installations, additional cameras, joystick control units (JCU), video equipment, personal computers, or wireless devices can optionally be used, and networking equipment such as switches and routers can be used to interconnect these components.

The MD-Series camera provides an analog video output, which can be connected to a video monitor, a multi-function display, or a 3rd-party IP video encoder. The camera does not provide IP video streaming natively, but the video stream from certain 3rd-party encoders can be integrated with the camera, and viewed through the camera's web interface, the FLIR Mobile app, or with FLIR Sensors Manager (FSM) software. Refer to the *MD-Series Operator's Manual* for details on configuring the camera.



Dome Assembly

MD-Series Dome Assembly

The MD-Series thermal camera is contained in the ball of the dome assembly, which has a removable cover to protect the camera assembly inside. The outer dome is not intended to provide camera sealing.

When the cover is removed at the time of installation, the camera assembly can be mechanically positioned to allow the camera to point in the optimal direction. The assembly can be rotated up to 30° to either side, and can be tilted -27° to +34° (see “Adjust Camera Position” on page 24 for details). The entire camera can also be mounted upside down, known as ball-down installation.

The sealed camera within the dome is rated IPX6 per IEC 60529. The outer enclosure dome is not a sealed volume; it provides enhanced water-jet protection. With the outer enclosure dome attached, the camera as a whole is rated IPX6 per IEC 60945.

Configuring and Controlling the Camera

Typically, the camera is installed using default settings and operated with those defaults without making any changes. The camera generates a video image to a monitor so long as it has power. In this scenario, it is not necessary to make any changes to the camera settings and no camera control is needed.

Some of the default settings can be modified at the time of installation and the new settings can be used whenever the camera is powered on. In this scenario, it is necessary to have camera control during installation, but no camera control is needed while it is operating.

If a PC or laptop or iOS device (iPhone or iPad) is on the network, the camera settings can be controlled while it is operating, in order to zoom in/out or to modify the image settings in response to changing conditions or personal preferences.

Since the MD-Series is a fixed camera, it is not possible to move (pan/tilt) the camera remotely while the camera is operating. Control of the camera is limited to making adjustments to the image and to accessing an on-screen configuration menu. The possible control functions or image adjustments are described in *MD-Series Operator's Manual*.

Depending on how much control is needed and what devices are available, there are several options for controlling the camera, including the following:

- Use a web browser running on a PC, laptop, smartphone or PDA through a wireless connection or an Ethernet cable. Refer to the *MD-Series Operator's Manual* for details on the web interface.
- Use the FLIR Mobile app available free through the iTunes store on an Apple iOS device such as an iPad or iPhone. The app supports basic camera functions but not all configuration options.
- Use a Multi-Function Display (MFD) from Raymarine or other vendor. Refer to the MFD manufacturer to determine if control of the FLIR device is supported.
- Use a FLIR Maritime Joystick Control Unit (JCU), available as a separately-purchased accessory. The JCU can be used to control the camera and/or access the on-screen menus and configuration choices.



If the MD-Series system is installed on a network with other FLIR cameras (such as M-Series or Voyager III) that are operated with the Maritime JCU, the existing JCU can be used to control the MD-Series as well. Installing a JCU is described in "Installing Optional Components" on page 26.

Installation Overview

The MD-Series includes these standard components:

- Camera unit
- O-ring for base (Part Number AS568-251)
- 7.7 meter (25-foot) double-shielded low smoke zero halogen (LSZH) Ethernet cable
- 7.7 meter (25-foot) coaxial cable for video output
- FLIR PoE injector (Part Number 4113746)
- RJ45 weatherproof coupler (Part Number 4115028) and various other video adapters
- Female-to-female F-type video connectors (Part Number 4115330)
- Mounting hardware kit that includes six M6 x 60 stainless steel-threaded studs with washers, nylock nuts, and acorn nuts, for attaching the MD-Series camera body
- Zip ties for use during installation



Camera Unit

- MD-Series documentation package



Note: Only four studs are required to mount the camera; two are extra. For installations with special requirements, substitute other mounting hardware as needed since the length required depends on the mounting platform thickness.

It may be necessary to supply the following items:

- Camera grounding strap. The required length varies depending on the boat's configuration. A ring terminal may be needed for attaching the strap to the camera's dedicated stud. This is typically made for 16-14 gauge wire and #6 or M3 stud.

- Tools including the following:

Wrenches. 13-mm socket wrench, 10-mm wrench, 7/16 inch wrench, large adjustable wrench.

Cutters. Two types of cutters may be needed: one to remove the rubber boot from the Ethernet cable and one for stripping and terminating the wires for the PoE injector.

Drill. The drill size depends on how the camera is mounted. When mounted from below using the M6 studs, a 6.4-mm diameter drill is required. When mounting from above by drilling through the base, drill diameter depends on the choice of fastener size and type.

- If drilling holes in the mounting plate for a top-down installation, 4 bolts of the appropriate size and marine grade sealant (3M 4200 or equivalent).
- Loctite 242 or equivalent thread locker.
- Maritime grade sealing tape.

If one of the optional methods for controlling the camera will be used, additional components and steps may be required. See "Installing Optional Components" on page 26 for more details.

If an optional JCU was purchased with the camera, it includes:

- JCU (Part Number 500-0385-00)
- A second FLIR PoE injector (Part Number 4113746)
- 1 foot Ethernet cable
- 5 foot Ethernet cable
- Clamshell ferrite (Part Number 4134175)

Contact FLIR (phone numbers listed on the back cover of this manual) for more information regarding available accessories including JCUs, PoE equipment, video distribution amplifiers, cables, connections, and mounting hardware.

Installation Planning



Caution: The installation requires some familiarity with electrical connections, cabling, sealing, and proper mounting practices. If you do not have this background, consider having the MD-Series camera installed professionally. In addition, there are several choices in how the camera is mounted and cabled. If the more complex installation options are used, such as mounting from the top and creating cable connections within the camera dome, it is especially important to have professional assistance.

Installation Options

There are several options for installing and using the MD-Series camera that affect the complexity of the installation and the steps required.

- One set of options relates to the position of the cable connections: inside or outside the camera dome.
- The other has to do with how the camera is mounted: with mounting bolts coming up from beneath or down from the top of the mounting plate.

The most straightforward approach, and the one that is recommended, is to install the camera with bolts from below and the cables connected outside the dome. This configuration is ideal if the vessel has a simple cover such as a T-top. The cables can be tied back as needed. Alternatively it is possible to install the camera from above on the superstructure or hardtop of a vessel. In either location, it is also possible to configure the cable connections within the camera dome. Doing this requires a number of additional steps.



External Connections

External or Internal Connections

As delivered, the cables on the MD-Series camera extend through the base (shown on left). It is a simple, straightforward process to connect these cables to the supplied longer cables.

Optionally, as shown in the right-hand picture, the connections can be made within the camera dome by bringing the longer cables up through the base and making the required interior cable connections.



Internal Connections

Mounting Bolt Direction

Generally the MD-Series camera is secured directly to a surface using threaded studs that extend from the base through the mounting platform and that are secured from below. If it is not possible to access the space below the mounting platform, the camera can also be mounted in a similar top-down fashion by drilling through the base in four predetermined locations, mounting it directly to the surface. When using this method, it is necessary to seal around the fasteners using a marine grade sealant (3M 4200 or equivalent) to prevent leakage into the mounting structure.



Upside Down
(Ball Down)

Ball-Up and Ball-Down Installation

In most installations, the MD-Series camera unit is mounted upright (ball up) on top of a mounting surface, with the base below the camera. Optionally, the unit can be hung upside down or ball down and configured to invert and revert the video output by selecting Enable Ball-Down Installation under System Settings of the camera on-screen menu system. See the *MD-Series Operator's Manual* for details.

Unless otherwise noted, this manual assumes an upright installation.

Location Considerations

It is important to determine a good location for mounting the MD-Series camera unit. The camera requires two connections:

- One for power and camera control
- One for the video display

When determining the location, consider how the system may be expanded in the future. Optionally, either a JCU or wireless device can be used to control the camera and more than one display can be used to view the video.

These are important points to consider when determining the camera location:

- Make sure the mounting location is level and is at least as large as the footprint of the camera. To ensure a proper seal between the camera unit and the vessel, an O-ring is installed in the camera base, which will seal properly with a surface that is flat to within 0.25 mm (0.010 in) over the diameter of the base of the camera. Use a short straight edge such as a six-inch ruler to confirm the surface is flat and the edge makes contact along the entire surface.



Note: If it is necessary to install on a surface that does not meet that criteria, a marine-grade sealant (3M 4200 or equivalent) must be used rather than the O-ring.

- Make sure the camera is placed close enough to the mounting edge that the camera field of view is not obstructed by the platform. This is especially important if the camera will be tilted downward.
- Mount the MD-Series camera body as high as practical, but without interfering with any radar, navigational, or communications electronics and minimizing the degree to which vessel structures block the camera's view. It is good practice to test the unit at the planned installation location with typical vessel electronics active prior to mounting the camera.
- Ensure a clearance of at least double the overall height of the camera in order to allow for dome removal.
- To maintain situational awareness, a good general practice is to mount the camera so that a small portion of the vessel is visible at the bottom of the video image as a reference point and that no more than 30% sky is visible in the video image.

- Ensure the camera mount is suitable for the camera mass and that potential vibration and mechanical shock is minimized. The camera is tested to hold position for mechanical shock up to 9g transverse and 15g vertical. Improper mounts that are loose and/or resonate can magnify vessel impacts causing the camera to be unable to maintain pointing direction.
- Consider the camera's location relative to other navigation devices. If a magnetic compass is used for navigation and direction, establish a "compass safe distance" for any object placed in its vicinity, especially any electronic equipment. The magnetic compass safe distance for the camera is 7 cm (2.75 in) and for the PoE injector is 11 cm (4.33 in).
- Verify that both sides of the mounting surface are accessible.
- Consider the thickness of the mounting platform. With the supplied hardware, the camera can be mounted to a platform that is up to 41 mm (1.6") thick. Depending on the thickness of the mounting platform, it may be necessary to provide other mounting hardware, rather than using the supplied threaded studs and nylock nuts and acorn nuts.
- Ensure the supplied coaxial and Ethernet cables are long enough, given the proposed mounting locations and cable routing requirements. It is a good idea to route the cables before beginning the physical installation to verify correct length.

Camera Settings

The MD-Series has a number of settings that can be tailored using on-screen menus. These settings are fully described in the *MD-Series Operator's Manual*. To change the system settings requires the use of a wireless device, a direct connection with a PC, or the installation of an optional JCU. If one of these is not available on the vessel when the camera will be used, consider setting up the camera at the time of installation.

For example, connect a PC or laptop to the camera's Ethernet connection¹. Then it will be possible to make any setup changes from the PC a web browser.

Proper Grounding

As part of the installation, ensure the camera is properly grounded. Following best grounding practices, the camera chassis ground should use the lowest resistance path possible.

A dedicated stud located on the bottom of the MD-Series near the cable egress points provides chassis ground for a high conductivity path to vessel ground (maximum 0.25 Ohm). The installer must provide the grounding strap and ring terminal for the connection. A nylock nut is provided to secure the strap. The ring terminal is typically sized for #6 or M3 stud and 14 to 16 gauge wire. If using a

¹ Connect the camera to the end of the PoE injector with the warning and then connect an Ethernet cable from the other end of the PoE injector to a PC or laptop. Connect DC power to the PoE injector's terminal block.

different ring terminal, make sure that its size does not interfere with the camera mounting.



Dedicated grounding stud with nut

Failure to provide this connection may result in electrical interference between the camera and other shipboard electronic systems. Furthermore, it is recommended that a bonded grounding scheme is used with a common ground between the chassis ground and electrical return, with the connection made as close as possible to the negative terminal of the battery.



Physical Installation

When shipped from the factory, the MD-Series camera has two cables that extend through the base.

- The teal cable is to be connected to the supplied 25-foot Ethernet cable using the supplied RJ45 waterproof coupler.
- The black cable is to be connected to the 25-foot coaxial cable using the supplied F-type female-to-female connector.



Caution: During installation, ensure the cables exiting the bottom of the camera are not in contact with sharp edges, do not bend at sharp angles, and are not pinched between the bottom of the camera and the mounting surface. Do not pull on the cables with excessive force.

The complete installation of the MD-Series camera follows a series of steps:

1. Remove the camera dome so that the camera is accessible
2. Attach the grounding strap and mount the camera in the chosen location
3. Route the camera cables without tightening the cable glands in the base. This can be done with the connections outside the camera dome (simpler approach) or inside the dome. The MD-Series ICD contains a drawing representing the two approaches
4. Complete the electrical connections using the supplied PoE injector and observe the video on a monitor

5. Adjust the pan/tilt position of the camera if needed and tighten the cable glands in the base
6. Replace the camera dome

Important: Use a thread-locking compound such as Loctite 242 or equivalent with all metal-to-metal threaded connections.



Remove the Camera Unit Dome

1. Place both thumbs on the ball front near the top of the opening and grip firmly around the dome
2. Push down on the ball front with both thumbs while pulling up on the dome
3. Once the dome is detached, gently slide it up and off the camera

Mount the Camera Unit

The camera unit can be mounted from the bottom, which is the recommended approach because it is the most straightforward. If necessary, it is possible to mount it from above by drilling holes in the base plate. Both approaches are described in this section.

Prior to cutting or drilling holes, determine if any interior trim panels must be removed in order to gain access to the mounting hardware, and remove them ahead of time.



Caution: Please be aware of these cautions:

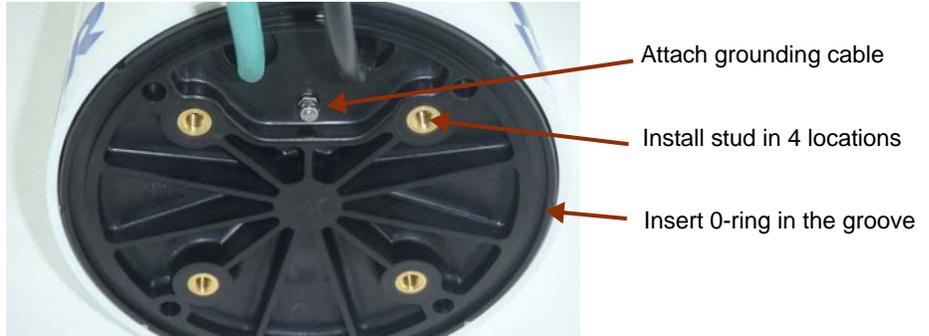
- When installing the camera, do not tighten fasteners in the threaded holes so far that they contact the bottom of the threaded hole. Maximum insertion should not exceed 6 mm (0.24 in), and torque should not exceed 9.5 N·m (7 lbf·ft).
- The F-type connector terminating the video cable on the camera is not a sealed connection; therefore, appropriate sealing steps are needed to protect the connection and the camera.
- Before drilling holes, ensure the steps outlined in the planning section (starting on page 10) have been followed. For example, it is important to test the unit at the planned installation location, with the typical vessel electronics active, prior to mounting the camera.

Mounting the Camera from the Bottom

1. Using the mounting template supplied with the camera (and part of the MD-Series ICD) as a guide, mark the location of the holes for mounting the camera. Also mark the location for the cable port holes.

Make sure the template is oriented properly relative to the bow of the vessel. If the template is printed, be sure it is printed to scale so the dimensions are correct.

2. Drill the 4 holes for the mounting studs using a 6.4-mm diameter drill. Also drill the appropriate cable port holes.
3. After the holes are drilled in the mounting surface, install the four threaded studs into the base of the camera with thread-locking compound.



4. Install the rubber O-ring in the groove in the base of the camera.
5. Pull the supplied grounding cable up through the cable access port and attach it to the grounding stud on the base of the camera using a user-supplied ring terminal.
6. The next step depends on whether the cables are connected externally or internally:

External Connection: Thread the video and Ethernet cables from the camera through the cable port.

Internal Connection: Loosen the light grey capture nuts on both of the cable glands in the base. Use a wrench if they are tight. Pull the rubber glands and clamping claws out of the threaded counter bores. Pull both cables completely up through the base. Slip the rubber gland, clamping claw and capture nut off each cable and set them aside.



7. Place the camera on the mounting surface so the threaded studs extend through the drilled holes.
8. Secure the camera body to the mounting surface with the supplied nuts and washers.



Note: As needed, the threaded studs can be replaced with studs of a different length or cut to a shorter length.

Continue with “Route Camera Cables” on page 16.

Mounting the Camera from the Top

1. Loosen the light grey capture nuts on both of the cable glands in the base, using a wrench to loosen them if necessary. Pull the rubber glands and clamping claws out of the threaded counter bores, leaving them on the cable. Pull both cables completely up through the base. (See the picture for step 6. in the previous section.)
2. Using a 10-mm wrench, completely loosen the self-locking M6 bolt in the center of the camera bracket in order to detach the base from the rest of the camera assembly.



Loosen this bolt to remove camera from base

Make sure to place the bolt, washer, and thrust washer in a safe place for reuse once the base is properly mounted.



Caution: Do not detach the grounding cable since doing so will adversely affect its seal.

3. Use the pilot locations in the base to drill clearance holes for the 4 required mounting fasteners. The exact fasteners to use will vary depending on the mounting surface. Maximum major diameter is 6.5 mm. Maximum head diameter is 13 mm.



Drill holes using the 4 pilot locations in the top of the base

Ensure that the size of the clearance holes accommodates the tolerance associated with hand drilling, bolt patterns, and fastener tolerances.

4. Using the mounting template supplied with the camera (and part of the MD-Series ICD) as a guide, mark the location of the holes for mounting the camera. The base itself can also be used as a guide.

Make sure the template is oriented properly relative to the bow of the vessel. If the template is printed, be sure it is printed to scale so the dimensions are correct.

5. In addition to the four mounting holes, drill the appropriate cable port holes using the template as a guide.
6. Install the rubber O-ring in the base of the camera.
7. After the holes are drilled in the mounting surface, secure the base to the mounting surface with the required fasteners. Seal around fastener heads using marine grade sealant (3M 4200 or equivalent).
8. Using the M6 bolt, washer, and thrust washer, reattach the camera to the base.
9. If connecting cables externally, rethread the video and Ethernet cables through the counter bores and through the cable port, making sure the rubber cable gland and clamping claw fit properly.
If connecting cables internally, leave the cables as they are, refer to “Connect Cables Internally” on page 19 and skip the next step.
10. Loosely tighten the light grey capture nuts at the base. Make sure to support the cable so it is perpendicular to the base. The nuts will be tightened completely after any needed mechanical adjustments are made to the camera pan and tilt (see page 24).

Route Camera Cables

There are two options for routing the camera cables:

- The simplest and most straightforward is to route the cables through the two cable glands in the base and connect the camera cables externally to the extended 25-foot cables. In this case the connections are visible.
- Optionally make the connections within the camera by routing the longer cables through the two base cable glands. In this case the connections are hidden inside the dome cover.



Caution: It is recommended that any built-up triboelectric charge on the Ethernet cable be discharged *before* connecting it to the camera. This can be accomplished simply by pressing an ungloved finger across the Ethernet RJ45 coupler of the cable for a few seconds.



Connect Cables Externally

Leave the cables as installed from the factory and make connections outside the camera unit, as shown in this diagram. This is the simplest way to install the camera and is the recommended approach.

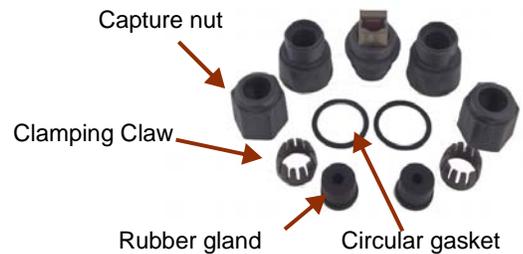
Step 1: Connect the Ethernet Cables (Teal and Grey)

In this step, connect the camera's Ethernet cable to one end of the supplied RJ45 coupler. Then connect the supplied 25-foot Ethernet cable to the other end.

The two ends of the RJ45 coupler are different, but if using the supplied cable, connect either of the cables to either ends. The complete coupler is shown below on the left. On the right, the coupler is fully disassembled showing all components.



Assembled RJ45 Coupler



Caution: The Ethernet clamping claw is delicate; treat it gently so that no prongs are broken

1. Connect the teal Ethernet cable to the RJ45 coupler using these steps:
 - a. Remove the dark grey capture nut, gland, and claw from one end of the RJ45 coupler.
 - b. Thread the teal cable through the dark grey capture nut, followed by the dark grey claw. Then wrap the cable gland around the cable. Seat the clamping claw over the gland.
 - c. Insert the end of the cable into the end receptor in the coupler. This picture shows the sequence of pieces on the cable.



- d. Bring the capture nut up to the coupler and tighten it.
2. Then connect the 25-foot Ethernet cable to the other end of RJ45 coupler:

- a. Remove the rubber boot from the end of the Ethernet cable using a cutter. It will not seal correctly with the rubber boot in place.



Caution: Be careful not to cut any part of the Ethernet cable when removing the rubber boot to ensure the enclosure seal is not compromised.

- b. Remove the dark grey capture nut, clamping claw, and gland from the other end of the RJ45 coupler.
- c. Thread the 25-foot Ethernet cable through dark grey capture nut, followed by the dark grey claw. Then wrap the cable gland around the cable. Seat the clamping claw over the gland.
- d. Insert the end of the 25-foot Ethernet cable into the receptor in the coupler until it snaps into place.



Caution: Be careful to minimize any twisting in the cable to prevent communication failure.

- e. Bring the capture nut up to the coupler and tighten it.
- f. Pull down on the cable at the camera base to reduce slack for dome clearance.
- g. Loosely tighten the light grey capture nut at the base. Make sure to support the cable so it is perpendicular to the base. The nut will be tightened completely after any needed mechanical adjustments are made to the camera pan and tilt (see page 24). If no further adjustments are needed, hand tighten the capture nut and then make an additional 1/4 turn with a wrench.

Step 2: Connect the Video Cables (Black)

Connect the video cable from the camera to the 25-foot video cable using the supplied female-to-female connector. Then seal the connection with marine grade sealing tape and electrical tape.

1. Thread the female-to-female connector into the end of the camera's video cable with a 7/16 inch wrench.



Female-to-Female Connector

Important: Be sure to apply thread locker to the F-type connectors.

2. Attach the 25-foot coaxial cable to the other end of the connector after applying thread locker so that it looks like the picture below.



3. Wrap the connection with maritime grade sealing tape (3M Scotch-Seal 2229 or equivalent). For additional protection, wrap the sealing tape with electrical tape.



4. Pull down on the video cable at the camera base to reduce slack.
5. Loosely tighten the light grey capture nut at the base. Make sure to support the cable so it is perpendicular to the base. The nut will be tightened completely after any needed mechanical adjustments are made to the camera pan and tilt (see page 24). If no adjustments are needed, hand tighten the capture nut and then make an additional 1/4 turn with a wrench.
6. Attach the other end of 25-foot video cable directly to whatever device is used to view video output.

After completing this section, continue with the steps outlined in “Complete Electrical Connections” on page 23.

Connect Cables Internally

If there is limited space or it is preferable to keep the connections hidden, make the cable connections inside the camera unit, as shown in this picture. This approach can be completed by following these instructions.



Step 1: Remove the Capture Nuts on the Camera Base

This step should already have been completed when the camera was mounted (see step 6 on page 14). If not, do so now.

1. Loosen the light grey capture nuts on the cable glands in the base, using a wrench to loosen them if necessary.
2. Pull the rubber gland and clamping claw out of the threaded counter bore.
3. Pull both cables completely up through the base.
4. Remove the three pieces of the two nut assemblies (capture nut, cable gland, and clamping claw) and set them aside.



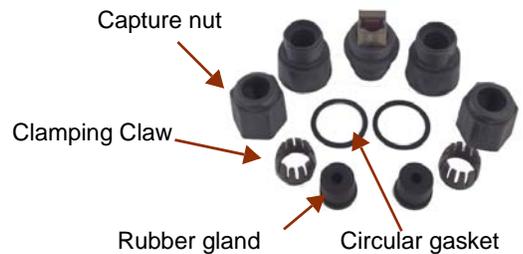
Step 2: Connect the Ethernet Cables (Teal and Grey)

In this step, connect the camera's Ethernet cable to one end of the supplied RJ45 coupler. Then thread the supplied 25-foot cable through the cable gland and connect it to the other end of the coupler. Finally, secure the coupler to the body of the camera with zip ties.

The two ends of the RJ45 coupler are different, but if using the supplied cable, it is possible to connect either of the cables to either end. The complete coupler is shown below on the left. On the right, the coupler is fully disassembled showing all components.



Assembled RJ45 Coupler



Caution: The Ethernet clamping claw is delicate; treat it gently so that no prongs are broken

1. Connect the teal Ethernet cable to the RJ45 coupler using these steps:
 - a. Remove the dark grey capture nut, gland, and claw from one end of the RJ45 coupler.
 - b. Thread the teal cable through the dark grey capture nut, followed by the dark grey claw. Then wrap the cable gland around the cable. Seat the clamping claw over the gland.
 - c. Insert the end of the cable into the end receptor in the coupler.
 - d. Bring the capture nut up to the coupler and tighten it.
2. Then connect the 25-foot Ethernet cable to the other end of RJ45 coupler:
 - a. Thread the end of the 25-foot Ethernet cable through the left counter bore in the base.
 - b. Wrap the larger gland around the cable, cover the gland with the black clamping claw and push down until it is seated in place, then thread the cable through the light grey capture nut. (These are the three pieces that were set aside in step 4 on page 19.) Do not fasten this nut yet.



- c. Remove the rubber boot from the end of the Ethernet cable using a cutter. It will not seal correctly with the rubber boot in place.



Caution: Be careful not to cut any part of the Ethernet cable when removing the rubber boot to ensure the enclosure seal is not compromised.

- d. Remove the dark grey capture nut, clamping claw, and gland from the other end of the RJ45 coupler.
- e. Thread the 25-foot Ethernet cable through dark grey capture nut, followed by the dark grey claw. Then wrap the cable gland around the cable. Seat the clamping claw over the gland.
- f. Bend the end of the 25-foot Ethernet cable and insert into the left end receptor in the coupler until it snaps into place.



Caution: Be careful to minimize any twisting in the cable to prevent communication failure.

- g. Bring the capture nut up to the coupler and tighten it.
 - h. Pull down on the cable at the camera base to reduce slack for dome clearance.
 - i. Loosely tighten the light grey capture nut at the base. Make sure to support the cable so it is perpendicular to the base. The nut will be tightened completely after any needed mechanical adjustments are made to the camera pan and tilt (see page 24). If no adjustments are needed, hand tighten the capture nut and then make an additional 1/4 turn with a wrench.
3. Finally, secure the coupler to the body of the camera with two black plastic zip ties.
- a. Thread a zip tie through the two holes in each of the zip tie anchors on the back of the camera.



Thread zip tie through the two holes in the two anchors

Wrap the tie around the groove in the RJ45 coupler

- b. Wrap the tie around the groove in the corresponding end of the RJ45 coupler and tighten it to hold the coupler snugly against the back of the camera.



Step 3: Connect the Video Cables (Black)

Bring the video cable attached to the camera around to the front; then thread the 25-foot video cable through the gland and bring it around the other side to meet the camera cable, joining them with the supplied female-to-female connector. Seal the connection and then secure the cable to the camera with zip ties.

1. Prepare the video cable attached to the camera:
 - a. Loosen the light grey capture nut on the right cable gland in the base. Pull the rubber gland and clamping claw out of the threaded counter bore. Pull the black cable completely up through the base.
 - b. Remove the three pieces of the nut assembly (capture nut, cable gland, and clamping claw) and set them aside.
 - c. Thread the female-to-female connector into the end of the cable with a 7/16 inch wrench.



Female-to-Female Connector

Important: Be sure to apply thread locker to the F-type connectors.

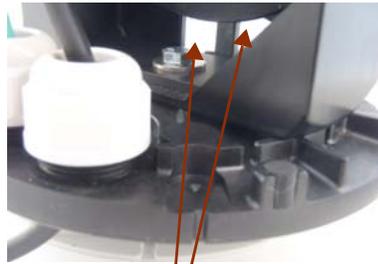
- d. Pull the black video cable to the left around to the front of the camera.
2. Attach the 25-foot coaxial cable.
 - e. Thread the 25-foot coaxial cable up through the right counter bore in the base.
 - f. Wrap the cable gland around the cable. Seat the clamping claw over the gland and thread the video cable through the capture nut. Do not tighten this at the base yet.
 - g. Pull the 25-foot cable to the right and around to the front of the camera under the white part of the bracket so that it meets the cable that was pulled around to the left.



- h. Attach the end of the 25-foot cable to the other end of the female-to-female connector, after applying thread locker.
- i. Wrap the connection with maritime grade sealing tape (3M Scotch-Seal 2229 or equivalent). For additional protection, wrap the sealing tape with electrical tape.



- j. Tie the video cable to the base of the camera by threading a zip tie through the two holes in the bracket and around the cable. Pull on the zip tie, securing it tightly.



Back view: Wrap zip tie through these two holes and around video cable



Front View: Sealed cable tied to camera base

- k. Pull down on the video cable at the camera base to reduce slack.
 - l. Loosely tighten the light grey capture nut at the base. Make sure to support the cable so it is perpendicular to the base. The nut will be tightened completely after any needed mechanical adjustments are made to the camera pan and tilt (see page 24). If no adjustments are needed, hand tighten the capture nut and then make an additional 1/4 turn with a wrench.
3. Attach the other end of 25-foot video cable directly to whatever device is used to view video output.

Complete Electrical Connections

A watertight coupler/enclosure should be used on each electrical connection.

Power to the MD-Series camera is supplied using the PoE injector included with the camera purchase and the supplied Ethernet cable. The injector is not a sealed device and should be installed in a protected location.



Note: The maximum cable length between the camera and the injector is limited to 100m per the PoE IEEE802.3af specification.

To complete the connections, follow these steps:

- 1. Insert the cable from the camera into the end of the injector with the red warning sticker.



Insert Ethernet cable from the camera in this end

Attach vessel power to the green terminal block



2. Attach vessel power to the green terminal block.
3. Optionally insert an additional Ethernet cable to the vessel network in the Data In port.

Connecting Power

The camera does not have an on/off switch. Generally the MD-Series camera is connected to a circuit breaker and the circuit breaker is used to apply or remove power to the camera. The *MD-Series Operator's Manual* has detailed information about powering and operating the camera.

Consider installing a 2.5 amp fuse in line with the power connection to protect the camera from power surge or short circuit.

Power Cable Considerations

The power cabling from the vessel to the injector must be of sufficient size gauge or diameter for the supply voltage and total load (PoE injector connected to MD-Series camera and length of cable run) to ensure proper supply voltage at the camera and adequate current carrying capacity.

Table 1.1 lists recommended wire size for various cable lengths assuming the provided injector is used with the MD-Series camera. If using an injector from another manufacturer or a PoE capable network switch, a higher power draw may require a heavier wire gauge than indicated in the table.

TABLE 1.1 Power Cable Wire Gauge Recommendation

Length in Meters (Feet)	Wire Gauge (AWG) for 12V Supply	Wire Gauge (AWG) for 24V Supply
8 (25)	16	18
16 (50)	14	18
24 (75)	14	16
32 (100)	12	16



Warning: Use of insufficient wire gauge can result in fire. Suggested gauge depends on supply voltage shown. For lower supply voltages, heavier gauge wire must be used.

Adjust Camera Position

The position of the MD-Series camera cannot be controlled through a remote device, but the tilt and the pan positions can be mechanically adjusted at the time of installation if necessary. Due to its adjustable pan design, the camera can be rotated and pointed 30 ° either direction before choosing a static position. The MD-Series can also be adjusted to tilt -27° to +34°.

After viewing sample output on the video device, determine if adjustments are needed and follow these steps to modify pan or tilt.

Adjusting the Camera Tilt

1. If necessary, remove the dome that covers the camera unit. Using an adjustable wrench, loosen the cable gland nuts in the base to provide slack so that the camera can move freely. It may be necessary to push the cable gland and claw completely out of the counter bore.
2. Using a 13-mm wrench, slightly loosen the two self-locking nuts on either side of the camera bracket.

Loosen the self-locking nut on each side to adjust camera tilt



3. Tilt the camera to the desired position.
4. Tighten the self-locking nuts on both sides of the bracket.

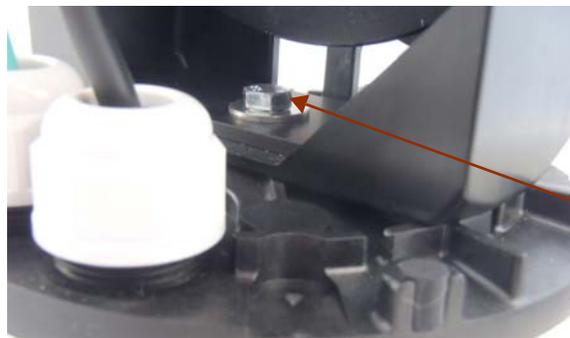


Caution: Do not exceed 10 ft-lbs of torque when retightening the nuts.

5. Readjust the slack in the cables. Make sure to support the cable so that it passes through the gland perpendicular to the base. Then hand tighten the capture nut and then make an additional 1/4 turn with a wrench.

Adjusting the Camera Pan

1. If necessary, remove the dome that covers the camera unit. Using an adjustable wrench, loosen the cable gland nuts in the base to provide slack so that the camera can move freely. It may be necessary to push the cable gland and claw completely out of the counter bore.
2. Using a 10-mm wrench, slightly loosen the self-locking bolt in the center of the bracket.



Loosen this bolt to adjust camera pan

3. Turn the bracket to the desired pan position.

4. Tighten the self-locking bolt in the center of the bracket.
5. Readjust the slack in the cables. Make sure to support the cable so that it passes through the gland perpendicular to the base. Then hand tighten the capture nut and then make an additional 1/4 turn with a wrench.

Replace the Dome Cover



1. Gently slide the dome over the camera so that the front opening is aligned with the camera viewing direction.

Caution: The dome may require additional care to re-engage when the Ethernet and video connections are made inside the enclosure. Be careful not to scratch the surface of the ball front when replacing the dome.

2. Without engaging the dome, carefully align the sides of the opening with the edges of the white area of the bracket.
3. When alignment is complete, push directly down on the top of the dome with a firm pressure to engage the dome with the rest of the camera assembly and lock it in place.

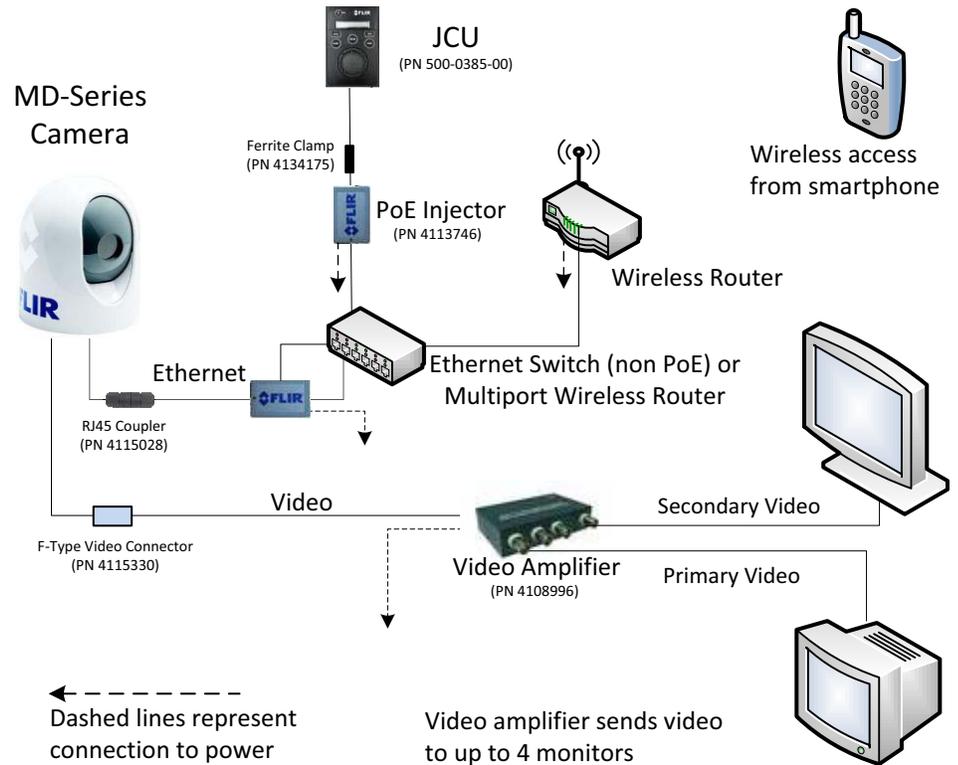
Installing Optional Components

If it is desirable to control camera settings during operation, additional components must be installed and configured such as a JCU or network components to support control by a PC or wireless device. Refer to the MD-Series ICD (FLIR Doc. # 432-0010-00-19) for interconnect diagrams showing several possible system configurations with JCU and wireless control.

Figure 1 on page 27 shows a possible system configuration using:

- A video amplifier (PN 4108996) supplied by FLIR that supports output to four video devices
- PoE injectors (PN 4113746) supplied by FLIR for DC/DC Power over Ethernet
- JCU (PN 500-0385-00) supplied by FLIR for controlling the camera
- Ferrite clamp (PN 4134175) used between the PoE injector and JCU
- Wireless router for wireless access from a smartphone or iOS device

Figure 1. System Integration Diagram



Connecting Optional Components

Video Connections

The video cable from the camera is terminated with an F-type male connector. Video cables of various lengths with F-type male connectors at one end and BNC connectors at the other end are available from FLIR. The video cable used should be rated as RG59/U or better to ensure an adequate quality video signal.

Another alternative is to interconnect the camera video cable to a longer video cable using an optional F-type female-to-female connector (FLIR PN 4115330). For cable runs in excess of 100 feet, a video amplifier should be used.

Ethernet Connections

The Ethernet cable from the camera can be connected to additional Ethernet cables with additional waterproof couplers (FLIR PN 4115028).

If additional Ethernet cables are used, they should be rated for use with PoE devices (IEEE802.3af) and should be 8-conductor T568B, Ethernet, double-shielded for EMI considerations (FLIR PN 308-0163-25 or equivalent). Do not exceed the standard for Ethernet cable length.



Note: The maximum cable length between the camera and the injector is limited to 100m per the PoE IEEE802.3af specification.



Joystick Control Unit

Installing a Joystick Control Unit (JCU)

If an optional JCU is used for controlling camera settings, mount it in a convenient area that is close to the monitor being used to display the MD-Series video output. Make sure there is sufficient clearance for the cable under the JCU (refer to the MD-Series ICD for dimensions). The magnetic compass safe distance for the JCU is 55 cm (21.7 in).

The JCU can be mounted to the dash (or other surface) in any orientation, using four captive mounting screws that hold panel mounting clamps. When the mounting screws are tightened, the panel mounting clamps rotate and extend away from the JCU at a right angle, and come into contact with the mounting surface. The JCU can be mounted to dash thicknesses ranging from 0.16 – 4.45 cm (0.063 – 1.750 in). A trim bezel snaps on top of the JCU to cover the mounting screws.

JCU Connection to Camera

The JCU is a Power over Ethernet (PoE) device and cannot be connected to the camera directly. Installation of a JCU will require an additional PoE injector.

Alternatively, the camera and the JCU can be connected together via an Ethernet switch; this type of configuration allows more than one JCU or camera to be used. The JCU draws its power through the Ethernet connection, so a PoE injector or PoE switch is required. The JCU could also be powered using an additional PoE injector coupled with a non-PoE switch.

Ferrite Clamp

A clamp-on ferrite, consisting of a ferrous ceramic core, is attached to the JCU cable close to the PoE injector to reduce any high-frequency noise that might interfere with communication.

Open the ferrite, lay the cable into the inner groove, and snap the cover shut. The ferrite should fit snugly over the cable, but if sliding is an issue, add a zip tie on either side of the ferrite to limit movement.

Prior to Cutting Hole

To ensure a proper seal around the JCU, the supplied gasket must be applied to the JCU and the cutout opening for the JCU should precisely match the template. If the cutout opening is too large, the gasket around the JCU may not cover the opening adequately.

JCU Installation Steps

The cable gland seal is designed for use with double-shielded category 5 Ethernet cable. To ensure a good seal and to maintain compliance with EMI ratings, a double-shielded cable is required.

The JCU enclosure is rated IP66 above the JCU mounting surface/gasket and rated IP64 behind or below the gasket.



Caution: An installation template is provided in the JCU ICD. If the template is printed from the PDF file, ensure it is printed to the correct scale by checking the dimensions prior to cutting any holes.



1. Using the JCU template supplied as a guide in MD-Series ICD, mark the location of the rectangular opening that will allow the JCU to be recessed in the vessel's control console. Ensure the corners are marked precisely and cut square.
2. Apply the adhesive side of the rubber gasket to the back of the JCU on the surface that faces the mounting platform. The JCU comes with 4 panel mounting clamps that can be reversed when the thickness of the panel material is less than 0.79 cm (5/16 or 0.31 in); see instructions below. Ensure the mounting clamps are rotated inward and are recessed so the entire JCU fits into the hole
3. Remove boots from both ends of the Ethernet cable, as it may interfere with the coupling gland. The boot may cause the RJ45 coupler tab to depress, which can lead to intermittent connections.
4. Loosen or remove the cable gland nut on the JCU, and insert the Ethernet cable RJ45 coupler through the gland nut. Once the Ethernet cable is connected to the JCU, replace the gland nut and turn the nut 1/4 turn beyond hand tight.
5. Insert the JCU into the hole and secure by turning the 4 corner screws clockwise. Rotate each screw one full turn and ensure the mounting clamps are rotated outward from the JCU housing. Tighten the screws to draw the mounting clamps up against the mounting surface and then tighten another quarter or half turn. Do not over tighten the screws.

Mounting the JCU to a Thin Panel

As shipped from the factory, the JCU can be mounted to dash thicknesses ranging from 0.79 – 4.45 cm (0.31 – 1.75 in). The clamps are set with the small foot on the clamp facing away from the panel and toward the front of the JCU, as shown below.



If the JCU is mounted to a panel of 0.79 cm (0.31 in) thickness or less, remove the clamps from the mounting screws, turn them around and thread them back onto each of the four screws. In this configuration, the clamp foot faces the rear of the mounting surface and allows the clamp to contact thinner panel surfaces while still

allowing for proper compression of the JCU mounting gasket to form a watertight seal.





Introduction

This chapter includes the following reference information:

- A summary of maintenance procedures
- A table of camera specifications
- Information about standards referenced during the installation procedure
- A glossary of acronyms
- A table comparing features of various MD-Series models

MD-Series Maintenance

The MD-Series components are designed for years of rugged, trouble-free use.

Cleaning the Camera Optics

Great care should be used with the camera's optics. They are delicate and can be damaged by improper cleaning. The MD-Series thermal camera lenses are designed for the harsh outdoor environment and have a coating for durability and anti-reflection, but may require cleaning occasionally. FLIR Systems Inc. suggests that you clean the lens when image quality degradation is noticed or excessive contaminant build-up is seen on the lens.

Rinse the camera housing and optics with low pressure fresh water to remove any salt deposits and to keep it clean. If the front window of the camera gets water spots, wipe it with a clean soft cotton cloth dampened with fresh water. If the

window requires further cleaning, use a soft moist cotton-based cloth with isopropyl alcohol or dish soap.

Do not use abrasive materials, such as paper or scrub brushes as this will possibly damage the lens by scratching it. Only wipe the lens clean when you can visually see contamination on the surface.

Cleaning the Camera Body

Do not use a pressure washer to clean the camera, as that could force water through the camera seals. Clean underneath the dome periodically to prevent the accumulation of debris or salt.

If you have a problem with the thermal camera, do not attempt to repair it. The MD-Series camera is a sealed unit and, apart from removing the dome, cannot be opened or serviced in the field. Consult the installation dealer or FLIR Systems Inc. for repair information.



Caution: The MD-Series is designed with a removable dome, but the inner camera is sealed at the factory against liquid water, suspended particulates, and other contaminants. It is important that you not open the camera for any reason, as it will compromise this seal and possibly damage the unit. Opening the MD-Series camera will void the manufacturer's warranty.

Cleaning the JCU

If you have installed an optional JCU, use a soft cloth and clean water to clean it. Mild household cleaner such as Windex can also be used to remove tougher stains or spots. Do not use alcohol based cleaners or any type of solvents as this may discolor or damage the unit.

When the system is not in use, keep the JCU cover in place for additional protection.

MD-Series Specifications

Table 2.1 lists details about physical characteristics, power usage, and environmental features of the MD-Series camera.

Table 2.1 Specifications

Physical Characteristics	
Camera Size	5.2 cm (6 in) diameter, 17.8 cm (7 in) tall
Camera Weight	Under 1.4 kg (3 lb), depending on the camera model
Joystick Size	9.1 X 14.2 X 8.13 cm (3.6 X 5.6 X 3.2 in) 3.17 cm (1.25 in) above platform including joystick
Joystick Weight	.45 kg (1 lb)
Power	
Camera Input Power from PoE	12 – 24 V DC nominal, 2 A Max Absolute range 10 – 32V DC (–10%/+30% per IEC 60945)
JCU Input Power	Power over Ethernet (PoE) per IEEE 802.3af
Consumption (camera and FLIR PoE injector)	<7.5W Nominal without heater <18 W Nominal with heater
Environmental	
Operating temperature range	–25° C to +55° C (–11° F to +131° F)
Storage temperature range	–40° C to +85° C (–38° F to +185° F)
Automatic Window defrost	Standard (automatic at unit power-up)
Sand/dust	Mil-Std-810E
Automatic Window de-icing	Standard (automatic at unit power-up)
Water Ingress	IPX 6
Shock	15 g vertical, 9 g transverse
Vibration	IEC 60945; MIL-STD-810E
Lightening Protection	Standard
Salt Mist	IEC 60945
Wind	100 knot (115.2 mph)
EMI	IEC 60945

External Standards

Table 2.2 lists other sources of information and standards definitions that may be useful during the installation of the MD-Series camera.

Table 2.2 External References

Standard	Description
ANSI/SCTE 01 2006 "F" Port, Female, Outdoor	http://www.scte.org
IEC 60169-24	Radio-frequency coaxial connectors with screw coupling, typically for use in 75 Ohm cable distribution systems (Type F)
IEC 60945	Maritime navigation and radio communication equipment and systems general requirements
IEC 60529	Degrees of Protection Provided by Enclosures (IPX6)
IEC 60068	Basic Environmental Testing Procedures, Part 2: Tests
89/336/EEC	Electromagnetic Compatibility (EMC) directive
Directive 2002/95/EC	Restriction of the use of certain hazardous substances in electrical and electronic equipment (European Union)
Directive 2002/96/EC	Waste Electrical and Electronic Equipment Reg. 2006
TIA/EIA T568B	CAT5/RJ-45 wiring standard
IEEE 802.3 / IEEE 802.3u	10Base-T/100Base-TX Ethernet
IEEE 802.3af	Power over Ethernet (PoE) standard (48V/400mA/15.4W)
ANSI/SMPTE 170M - 1994	Composite Analog Video Signal (Supersedes RS-170A)
Directive 96/98/EC	Marine Electronics Directive (MED)

Acronyms

Table 2.3 lists each acronym that is used in this manual and its meaning.

Table 2.3 Acronyms

Acronym/Term	Definition
AGC	Automatic Gain Control
ANSI	American National Standards Institute
EAR	Export Administration Regulations
EMI	Electromagnetic Interference
FFC	Flat Field Correction
FLIR	Forward Looking Infrared
FoV	Field of View
FPS	Frames per Second (refresh rate)
HFoV	Horizontal Field of View
ICD	Interface Control Document
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IP	Internet Protocol
IR	Infrared or thermal
JCU	Joystick Control Unit
MFD	Multifunction display
NMEA	National Marine Electronics Association
NTSC	National Television System Committee
PAL	Phase Alternating Line
PoE	Power over Ethernet
SCTE	Society of Cable Telecommunications Engineers
VDC	Volts, Direct Current

Feature Comparison of MD-Series Models

Table 2.4 lists the two MD-Series models and supported features. Each model is available in four variations, identified by a unique part number:

- <9 hz thermal frame refresh rate (FPS), NTSC video format
- 30 hz thermal frame refresh rate (FPS), NTSC video format
- <9 hz thermal frame refresh rate (FPS), PAL video format
- 25 hz thermal frame refresh rate (FPS), PAL video format



Note: Different frame formats and rates are used in the US (NTSC, 320 x 240 @ 30 FPS) and other parts of the world, such as Europe and China (PAL, 320 x 256 @ 25 FPS).

Table 2.4 Feature Comparison

Model	Part Numbers	Video Format	Thermal Video Resolution	Thermal Frame Refresh Rate	HFoV	Digital Zoom
MD-324	432-0010-01-00S	NTSC	320 x 240	<9 Hz	24°	2x
	432-0010-01-00	NTSC	320 x 240	30 Hz	24°	2x
	432-0010-02-00S	PAL	320 x 256	<9 Hz	24°	2x
	432-0010-02-00	PAL	320 x 256	25 Hz	24°	2x
MD-625	432-0010-03-00S	NTSC	640 x 480	<9 Hz	25°	2x and 4x
	432-00010-03-00	NTSC	640 x 480	30 Hz	25°	2x and 4x
	432-0010-04-00S	PAL	640 x 512	<9 Hz	25°	2x and 4x
	432-0010-04-00	PAL	640 x 512	25 Hz	25°	2x and 4x
MD-324 with JCU kit	432-0010-11-00S	NTSC	320 x 240	<9 Hz	24°	2x
	432-0010-11-00	NTSC	320 x 240	30 Hz	24°	2x
	432-0010-12-00S	PAL	320 x 256	<9 Hz	24°	2x
	432-0010-12-00	PAL	320 x 256	25 Hz	24°	2x
MD-625 with JCU kit	432-0010-13-00S	NTSC	640 x 480	<9 Hz	25°	2x and 4x
	432-0010-13-00	NTSC	640 x 480	30 Hz	25°	2x and 4x
	432-0010-14-00S	PAL	640 x 512	<9 Hz	25°	2x and 4x
	432-0010-14-00	PAL	640 x 512	25 Hz	25°	2x and 4x

Troubleshooting Tips

This section includes information that may help you with common issues that may arise during operation of the MD-Series system.

Video not displayed on monitor

If the camera will not produce an image, check the video connection at the camera and at the display. If the connectors appear to be properly connected but the camera still does not produce an image, ensure that power has been properly applied to the camera and circuit breaker is set properly. If a fuse was used, be sure the fuse is not blown.

Check the wiring at the electrical panel. Ensure that the contacts are clean, dry and free from corrosion. If maintenance on the wiring connection is required, have an authorized service representative make the appropriate repairs.

If the camera still does not produce an image, contact the FLIR dealer or reseller who provided the camera, or contact FLIR directly (contact information is provided on the back cover of this manual).

Cleaning

If the camera lens has become smudged or dirty, clean it with low-pressure fresh water and a soft cloth. Improper care of the camera window can cause damage to its anti-reflective coating, degrade the camera's performance, and void the camera warranty.

The camera housing has a durable marine coating. Rinse the camera housing with very low-pressure fresh water to keep it clean. If the front window of the camera gets water spots, wipe it with a clean lens cloth folded in fourths and dampened with fresh water.

Noisy image

A noisy image is usually attributed to a cable problem—too long or inferior quality—or the cable is picking up electromagnetic interference (EMI) from another device. Although coax cable has built-in losses, the longer the cable is or the smaller the wire gauge/thickness, the more severe the losses become; and the higher the signal frequency, the more pronounced the losses. Unfortunately this is one of the most common and unnecessary problems that plagues video systems in general.

Cable characteristics are determined by a number of factors such as core material, dielectric material and shield construction, among others and must be carefully matched to the specific application. Moreover, the transmission characteristics of the cable will be influenced by the physical environment through which the cable is run and the method of installation. Use only high quality cable and ensure the cable is suitable to the marine environment.

Check cable connector terminations. Inferior quality connections may use multiple adapters that can cause unacceptable noise.

Image too dark or too light

By default, the MD-Series thermal camera uses an automatic gain control (AGC) setting that has proven to be superior for most applications. However, a specific environment may benefit from a different AGC setting. For example, a very cold background (such as the sky) could cause the camera to use a wider temperature range than appropriate. You should keep the ocean, and not the sky or the boat, as the predominant object in the image. Refer to the *MD-Series Operator's Manual* for information about how to make adjustments to the image.

Performance varies with time of day

You may observe differences in the way the camera performs at different times of the day, due to the diurnal cycle of the sun. Recall that the camera produces an image based on temperature differences.

At certain times of the day, such as just before dawn, the objects in the image scene may all be roughly the same temperature, compared to other times of the day. Compare this to imagery right after sunset, when objects in the image may be radiating heat energy that has been absorbed during the day due to solar loading. Greater temperature differences in the scene generally will allow the camera to produce high-contrast imagery.

Performance may also be affected when objects in the scene are wet rather than dry, such as on a foggy day or in the early morning when everything may be coated with dew. Under these conditions, it may be difficult for the camera to show the temperature the object itself, rather than of the water coating.

Eastern or Western exposure

While a boat is under way, the camera may inevitably end up pointing directly east or west, and this may cause the sun to be in the field of view during certain portions of the day. We do not recommend intentionally viewing the sun, but looking at the sun will not permanently damage the sensor. In fact the thermal imaging camera often provides a considerable advantage over a conventional camera in this type of back-lit situation.

However, the sun may introduce image artifacts that will eventually correct out and it may take some time for the camera to recover. The amount of time needed for recovery will depend on how long the camera was exposed to the sun. The longer the exposure, the longer the recovery time needed.

Image freezes momentarily



The camera has a feature that lets you momentarily freeze the image. How you do this depends on the device you are using to control the camera. When an image is frozen, a snowflake image icon appears on the screen. Any other action with the control device will unfreeze the image.

By design, the camera image will freeze momentarily on a periodic basis during the flat field correction (FFC) cycle. A shutter activates inside the camera and provides a target of uniform temperature, allowing the camera to correct for ambient temperature changes and provide the best possible image. Just prior to the FFC, a small green square will appear in the upper left corner of the screen.



Note: If you have a JCU, pressing and holding the COLOR button causes the thermal camera to do an FFC operation.

Multiple Cameras and/or JCUs on a single network

You can configure the system with multiple cameras and multiple JCUs on the same network. More than one JCU can be used to control a given camera. The camera will respond to commands from both JCUs in the order the commands are received across the network. Unpredictable behavior may result from users sending conflicting commands from separate JCUs (for example, one user selects white hot and the other selects black hot). In general, the camera will respond to the last command received and there is no way to set priority, given that IP networks use a “best effort” delivery protocol.



Note: This behavior is true only of JCUs. If you are using the Web interface to control the camera with a browser on a PC or smartphone, a message displays prompting you to release control before the other Web device assumes it.

On Screen Messages

In some circumstances, a status or alert message may appear on the video screen. This section describes the messages and the appropriate actions that may be necessary.

Loading, please wait...

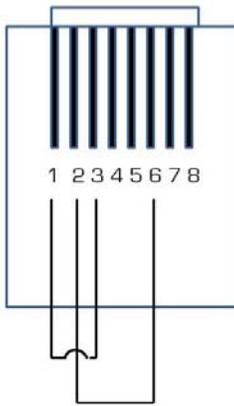
Indicates the camera has power and is booting up. No action is needed; the message will be removed when camera is ready for operation.

Reconnect network, now...

Indicates the camera has detected a loopback termination on the Ethernet RJ45 connector and has reverted to the Factory Default network settings. Remove the Ethernet RJ45 loopback termination adapter. The camera will then continue the startup process under the factory default network configuration (with DHCP dynamic IP addressing).

No Network...

Indicates the camera has lost connection with a previously available network. Normally, when the camera is on a network, the IP address of the camera displays. If the network connection is interrupted, this message displays instead.



Restoring the Factory Network Settings

In some cases, it may be necessary to restore the network settings of the camera to the original factory settings. At each power up, the system transmits a packet and then checks to determine if that same packet has been received. Detection of the received packet indicates the camera has a custom loopback connector installed on its Ethernet interface. The detection of the loopback packet cues the camera to restore factory defaults and to revert to the same configuration and behavior as when the camera left the factory.

The following table describes the loopback connector.

Pin	Signal	Tied to pin
1	Transmit +	3
2	Transmit -	6
3	Receive +	1
4	Unused	N/A
5	Unused	N/A
6	Receive -	2
7	Unused	N/A
8	Unused	N/A

The RJ45 loopback termination ties pin 1 to pin 3, and pin 2 to pin 6. The other pins are not connected.



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