EXAMPLE REPORT

Customer: Aptoil AS Norge AS

Location and time: Barents Sea, Q3-Q4 2018

Field: Rogar
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Abbreviations

IR – Infrared
CTO – Clean to Operate
OSD – Oil Spill Detection
ICE – Ice Detection
IFW – Ice Free Waters
NEA – Norwegian Environmental Agency
OBM – Oil-based Mud
OIM – Offshore Installation Manager
1 Introduction

This manual describes how the personnel on standby vessel Tora Merker (or in its place), on behalf of Aptoil, shall work to cover license requirements in regards to monitoring and documentation of clean operation, unintended oil spills and floating sea ice using a handheld BHM-XR infrared camera from FLIR.

![Figure 1](image1.png)

**Figure 1.** Monitoring and reporting on clean operation, unintended oil spills and floating sea ice using handheld thermal camera from STB vessel.

1.1 Clean-to-Operate (CTO), Oil Spill Detection (OSD) and ice (ICE) monitoring

The CTO, OSD and ICE monitoring and reporting is an integrated part of the BlueDeal environmental monitoring solution from NORBIT Aptomar. This manual describes how personnel on the vessel shall work to cover license requirements in regards to monitoring and documentation of clean operation, unintended oil spills and floating sea ice during the Rogar drilling campaign on behalf of Aptoil Norge AS.

The license requirements for Rogar are defined in Table 1.
Table 1.

<table>
<thead>
<tr>
<th>MONITORING TASK</th>
<th>DURING WHAT PART OF THE OPERATION</th>
<th>FREQUENCY</th>
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<tbody>
<tr>
<td>Oil Spill Detection</td>
<td>• During the entire operation</td>
<td>3 hours</td>
</tr>
<tr>
<td>Floating sea ice</td>
<td>• During the entire operation</td>
<td>3 hours</td>
</tr>
</tbody>
</table>

In order to comply with the requirements in Table 1, the following BlueDeal solution will be implemented during the Rogar drilling operation (Table 2):

Table 2.

<table>
<thead>
<tr>
<th>BlueDeal monitoring solution for Rogar drilling campaign</th>
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<tr>
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<td>Reporting and documentation system</td>
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| Manuals and work procedures from Aptomar                 | • BlueDeal Oil Spill and Ice detection Manual for handheld thermal camera FLIR BHM-XR  
|                                                           | • Communication Plan |
| Training of personnel on the rig                         | Aptomar |
| Responsible for the follow-up of the monitoring and reporting | Aptomarin 24/7 Maritime Control Centre |
2 The BlueAptoil I handheld IR-camera package

2.1 Contents of the camera case

The camera case contains one piece of handheld FLIR BHM-6XR infrared camera with a manual focus QD35 and QD65 mm lens for thermal monitoring of potential oil spills.

Installing the lens

1. To install the lens, remove the lens-cover assembly by rotating it clockwise (approximately 45°) and pulling straight off.

2. Install the lens by inserting and rotating it counter-clockwise.

3. Remove lens by releasing latch and rotating lens clockwise (approximately 45°) and pulling straight off.

Caution!
Always keep the camera window covered. A lens or the lens cover should always be installed on the camera to protect the window.
In addition to the camera the case includes the following items:

2.2 General information about the camera

The FLIR BHM-6XR infrared camera makes pictures based on heat emission, not light. It therefore allows you to see vessels, obstructions, people in the water, land, buoys, oil spills, seabirds, gas emissions, fire, heat development in structures, and floating debris in total darkness, as well as through haze, smoke, and light fog.

The camera is handheld and battery-powered with a high-resolution 640 × 480 thermal sensor that gives you four times the resolution of other FLIR handhelds, so you can scan large areas of the sea. As opposed to most other handheld thermal cameras, the FLIR BHM-XR has a dual eyepiece. This makes it is less tiring to use over time and easier to hold steady on rough waters. To download your recordings, the Video Out connection connects it to an onboard monitor or DVR.

The camera is easy to operate, and that, in addition to its broad operational utility, makes it perfect for drill rigs, oil platforms and vessels of any size.

The detection range of the BHM-6XR is the best of the handheld infrared cameras from FLIR, and the 35 mm and 65mm lens options
that comes with your camera package gives the best combination of resolution (upper detection limit) and field-of-view.

### 2.3 Camera features and controls

The following features and controls are available on the camera:
2.4 Using the camera

See Chapter 4 for full user description of the FLIR BHM-XR camera:

4.1 General cautions (s. 28)
4.2 Camera software (s. 28)
4.3 Installing/re-installing the SD card (s. 28)
4.4 Batteries (s. 29)
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4.9 SD card (s. 36)
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4.13 Technical data sheet (s. 41)

2.4.1 Practical use of the camera based on experience

Based on experience from earlier drilling campaigns, the 35 mm lens is most suitable for overview monitoring, because 1) a significantly larger area of the sea surface can be covered at one time (Figure 2 and 3), and 2) it does not require a completely still hand. Even the slightest movement of the hands caused by rough wind or shaking of the hands due to freezing, give blurry images with the 65 mm lens. So although theory states that the range of the 65mm lens is approximately 800 m longer than the 35mm lens, the monitoring crews on earlier campaigns have reported that this was not the case in practice (at least not at sea). The final conclusion is therefore that the 35 mm lens option is the optimal choice for maritime infrared oil spill monitoring:

1. It allows sweeping over larger areas of the sea
2. It provides sharper images (also in moist weather)
3. It gives a much better situation overview (which is crucial during an oil spill incident/accident)

The 35 mm lens gives a range of a minimum 1.3 nautical miles (2.4 km; the distance from the observer to the vessel in Figure 3).
Figure 2. Difference in field of view between the 65 mm lens (left) and the 35 mm lens (right). Both images are taken from the exact same spot.

Figure 3. Minimum oil spill detection range of the infrared camera with 35 mm lens. The vessel in the image is 1.3 nm from the position where the image is taken, which corresponds to 2.4km.

Based on experience, the operational recommendation for oil spill monitoring at sea with handheld infrared camera is the 35 mm lens. The 65mm lens should only be deployed if/when there is need for closer inspection of something specific, and/or to secure image documentation.
2.5 Connecting the camera to PC and transfer of files

All image (and/or video files in AVI format) are stored on the integrated SD card in the camera (see section 4.9). They must be transferred to a computer for viewing. This is done by connecting the camera to the computer via the USB cable (see section 2.5), or, alternatively, temporarily removing the SD card from the camera (see section 4.9) and inserting it into the card reader slot if available on the computer. The process of connecting the camera to the computer has been a bit unstable, so there are some user tips related to this in the user tips section of this BlueDeal manual. All stored files include:

- Thermal image
- Time (filename)
- Date (filename)
- FLIR logo

Other icons seen in the display are not stored on the saved images. Download the images/video files to a computer. A dedicated folder named with date and hour for each monitoring round (see section 3) is recommended, and the images in the folder should be named 1-3(4) for each picture taken from each position (see section 3.4).

2.6 Uploading the files to the Aptomar BlueDeal online portal

Once the images from the complete monitoring round are downloaded from the camera to the PC, follow the procedure on reporting on the BlueDeal online portal:

1. Log onto the BlueDeal portal in any browser with the following address:
   
   http://rogar.tcms.aptomar.com

   - Username: tora_merker
   - Password: Cdn92wle

2. Go to “Manual OSD, ICE and BaM report” on the main menu

3. Enter the result of your observation in the Title and Text field of the form;

   - For no observation of oil or ice, enter: Title: CTO (clean to operate) IFW (ice-free waters) + Date + Time + “your initials” (CTO, IFW, 10.Aug 15.00 JPG). Whole hours
should be used for the 3 hour intervals CTO/OSD/ICE reporting (0900, 1200, 1500 etc.), and 0900, 1500, 0900 and 0300 for the BaM.

- For other oil related events (or ICE), enter: OSD (or ICE) + Date + Time + “your initials” and use the Text field for description (location, wind, size estimate etc.).
- Upload the thermal images from the monitoring round using the “Add Media” button, make sure they are numbered correctly.

4. Press “Publish”. The files will reach Aptomarin if/as soon as the system is online and have sufficient bandwidth to shore.

**Note!**

Once the images from one monitoring round (see section 3) are uploaded to the BlueDeal online portal, the images should be deleted from the camera to avoid the SD card from getting full and to avoid confusion with a high number of images from different rounds. The folders with all the image files on the PC should however be kept during the entire campaign, to ensure backup.

If/when required, Aptomarin 24/7 Surveillance Centre has the following contact information:

Phone: +47 73 52 48 84

E-mail: aptomarin@aptomar.com
3 The monitoring procedure

3.1 IR-imaging in general

As presented in section 2, infrared imaging is based on heat emission rather than light. The camera detects even the smallest differences in heat between matters and objects, which allows you to image vessels (Figure 4m), obstructions, people in the water (Figure 4g), floating sea ice (Figure 4n), buoys, petrochemicals (crude oil, diesel, produced water, water from jetting, OBM etc.; Figure 4a,b), seabirds (Figure 4i-l), gas emissions, fire (Figure 4e,f), heat development in structures, and floating debris independent of darkness, haze, smoke and light fog. When it comes to thick fog, heavy snow or rainfall on the other hand, the performance of the camera is severely reduced.

In the following you find a selection of examples on what to look for and expect when monitoring the sea surface with IR camera. Individual settings might be required for imaging of different objects/phenomena during different weather conditions (see sections 4.7 and 4.12).
Fire on a rooftop/balcony.

The same picture as e), with color filter applied to visualize better the highest temperature.

Man over board.

Polar bear on floating sea ice taken from aircraft.

Close-up of seabird showing the areas of highest heat emission around the chest (heart-case) and around the eye.

Flock of migratory bird flying low over the seasurface. Image taken from aircraft.

Seabirds on the water.

Close-up of seabirds on the water.
3 The monitoring procedure

Vessel leaving an area in the dark night.
Floating ice in Arctic waters.

Figure 4. a-n: Example images of different operational utilities taken with handheld IR camera.

3.2 Oil spill detection

3.2.1 Challenges with visual imaging techniques in oil spill detection

Oil spills (or any other discharge of petrochemicals of any sort) in water is especially challenging for imaging-based detection methods. In the visible-light, ocean water often appears dark when looking straight down. At high angles on the other hand, ocean water reflects the sun, horizon or sky and can appear very bright. Against this highly variable surface brightness, any thin film of liquid floating on the surface can be hard to see with the naked eye or with a color video camera.

Crude oil or diesel spills typically rise to the surface and float there for a while because of their lower density. Although spills can form well-defined films, especially in still waters, there is often a low visual contrast between the film and the water surface. Particularly at low incidence angles, both the water and the oil film tend to look dark. Detecting the oil becomes even more difficult in choppy or wavy water since the undulating water surface alternately appears dark or light depending on how it reflects the sky or the sun above it, masking the low contrast oil-film areas to an even greater extent.
3.2.2 IR imaging in oil spill detection

By using a long wavelength infrared camera for oil spill monitoring and detection, the contrast between petrochemicals and water can be significantly increased in a variety of different sea states and lighting conditions:

Variability of different light levels
The infrared images are very uniform with changing light levels. The infrared images are always lit by heat emission from the scene itself, do not require illumination at night, and have an appearance that changes very little between day and night.

Variability created by reflection in the Visible light spectrum
Since most of the thermal infrared radiation one sees with the infrared camera is emitted by the water surface itself rather than being reflected, the surface looks much more uniform. This brightness uniformity found in the infrared images makes visual detection of oil spills much easier.

Ability to render a clear, high contrast image
Oil or diesel film on the surface of water tends to look quite different from the water itself in the infrared images, giving floating films of petrochemicals a distinct appearance. In the visible band, oil films can be very hard to see unless the lighting and viewing angles are just right, or the film is dirty, thick crude oil. In the infrared videos/images of oil films are much less sensitive to these factors.

Different oil types
There is a difference in appearance between different oil types on different sea-states under different atmospheric conditions. It is therefore very difficult to say something general about what an oil spill or other spilt petrochemicals will look like at sea. The only thing that can be said in general, is that if the atmospheric conditions and the sea-state is such that an oil spill can be detected, the contrast between the oil film and the water will be enough to differentiate between them. But if there is a thick fog, heavy rainfall or snow, or high, breaking waves as mentioned earlier, the IR camera will not be able to detect oil. Figure 5a and b shows two examples of how an oil spill of two different oil types might appear on the water surface. In a), a crude oil film (thick) in thermal equilibrium (at the same temperature) with the water surface, emit less IR light than the water, and hence
always appear darker than the water with a long wavelength IR camera like the BHM XR (BOTTOM image). In b), a thin diesel film tends to look even darker than water that a thick oil film (like the one in a).

Figure 5. a) Crude oil spill on calm sea. TOP: Visible light, BOTTOM: long wavelength camera (like the one you have; BHM XR) b) Dielsel fuel spill on water, imaged at dusk. TOP: Visible light, BOTTOM: long wavelength camera (like the one you have; BHM XR)

3.3 Ice detection

3.3.1 Background for using thermal imaging to detect ice

Arctic waters like the Barents Sea can be tough. The combination of long nights, harsh weather and potentially floating ice makes vessel navigation and oil and gas activity challenging. Vessels, installations and, consequently, also personnel, can be seriously damaged in case of collision with floating ice. Such activities in Arctic waters can be made much safer by using a thermal imaging camera. Ice is difficult to track by marine radar as the radar signal is scattered by air bubbles
and other imperfections in the ice. Many experienced seafarers can attest to the difficulty of detecting ice with radar. Even the radar signal returns from large icebergs are much lower than from ship targets because of the lower radar reflectivity of ice (and especially snow) if compared with steel. Detection of ice targets is therefore rather difficult, especially if they have low or smooth profiles.

Smaller pieces of ice are even harder to detect by radar. This is particularly true in heavy sea conditions where the radar returns from ice floes may be lost in the so-called ‘sea clutter’, which means that the waves show up on the radar image, making it difficult to distinguish between ice and the waves.

During the daylight hours the inability of radar to detect ice in certain conditions can be compensated by visual inspection. This requires good visibility, however. In the long polar nights this task becomes very difficult due to the lack of light and even during those scarce hours of daylight the visibility might be restricted by fog or snow. Fog is common in the Arctic during the open water period and during the winter snowstorms regularly occur. In the nighttime the combination of darkness and fog or snow can limit the capability of regular eyesight to detect ice hazards even further.

3.3.2 Detection of ice with thermal camera

By using a thermal imaging camera to detect ice, the intensity of all electromagnetic radiation in the infrared spectrum can be recorded. All matter emits infrared radiation. Even objects we think of as cold, such as ice, emit infrared radiation. The difference in temperature between the very cold ice and the warmer water, allows detection of floating ice. And even if the ice and the seawater are the same temperature sometimes, there will still be a contrast between the two in the thermal image due to differences in emissivity (the ability of a matter to emit thermal radiation). The reason for this is that glaciers (and ice in general) mostly consists of fresh water. Fresh water has a higher emissivity than salty sea water. Yet another factor, is the movement of the surface. The surface of the seawater is ever moving, rippling and churning, while the surface of the ice is solid, still. So even when the amount of thermal radiation emitted to the thermal imaging camera is more or less the same, which means that the ice and the water have more or less the same color in the thermal image, the ice will stand out in the thermal image due to this difference. Thermal imaging is therefore one of the best technologies to utilize when monitoring for floating sea ice.

Ice of all of all different sizes and shapes can be detected. From icebergs, to bergy bits (Figure 6 a, b and c), growlers and ice slush (Figure 6 c). Icebergs are floating chunks of high, density heavy ice
3 The monitoring procedure

with more than 5 meters of its height exposed above sea level. Bergy bits are pieces of icebergs showing 1 to 5 meters above sea level. Growlers are pieces of icebergs showing less than 1 meter above sea level.

![Small growler detected with IR camera at 800 meters.](image1)

![Floating bergy bits on a few hundred meters distance.](image2)

![Floating bergy bits near the vessel.](image3)

![Ice slush on the sea surface.](image4)

**Figure 6.** Different classes of floating sea ice detected with thermal camera. a) Small growler, b) Floating bergy bits, c) Floating bergy bit near the vessel, d) Ice slush on the sea surface.

3.4 So what to look for?

The things to look for during the Rogar monitoring campaign are:

1. **Unintended oil spills or other discharges of petrochemicals to the sea**

   Unintended oil spills to the sea surrounding the rig will, depending on the oil type, sea-state and the prevailing atmospheric conditions, generally appear as white or lighter areas on a dark sea surface (Figure 7a and d), or darker areas on a light sea-surface (Figure 7b and c). Switching between hot white (HW; Figure 7a) and hot black (HB; figure 7b) modes will invert this. **The most important thing to look for is an area**
of different contrast (greytone) than the surrounding sea surface, such as demonstrated in Figures 5 and 7.

The thicker portions of a spill will drift in the direction of the predominant sea current. Over time, this creates a “sausage” like shape. The thinner parts of the film will drift in the direction of the dominant direction of the surface wind. The thinner the oil is, and gets, the quicker its infrared signature will vanish, and it will look more and more like the surrounding sea.

![Figure 7. Thermal image of oil spill on the sea surface in a: hot white mode, b: hot black mode, c: hot black mode and d: hot white mode.](image)

2. Floating/drifting sea ice

Floating sea ice will, depending on the ice type, sea-state and the prevailing atmospheric conditions, generally appear as white or lighter areas on a dark sea surface (Figure 6a-c). Switching between hot white and hot black will invert this. The most important thing to look for are defined areas (chunks) of different (and high) contrast (greytone) than the surrounding sea surface, such as demonstrated in Figure 6.
3.5 Oil spill and ice monitoring from the STB vessel

The operational procedure of the Clean-to-Operate, Oil Spill Detection and ice monitoring from the vessel are described in the following chapters.

3.5.1 The monitoring position

The infrared oil spill and ice detection monitoring of the Rogar drilling operation is going to be performed by personnel on the STB vessel Tora Merker (or in its place) downwind from the drilling rig as shown in Figure 8a. The monitoring has been planned according to the following requirements and recommendations:

- Coverage of the area downwind of the drilling rig, with a slight overlap to avoid that certain areas are missed
- The location of the imaging from the vessel has to give free sight without physical obstacles to ensure the safety of the personnel performing the monitoring
- The location of the imaging should be without strong heat profile from nearby structures or components, meaning avoid having own or other vessels in the video / picture

![Figure 8. a: The monitoring position of the STB vessel downwind of the drilling rig. b: The potential four imaging views (1-4, depending on how many that are required for the overview) or video sweep to be photographed during each OSD / ICE monitoring procedure every hour.](image-url)
Start the monitoring procedure from a position facing the drilling rig as indicated with the dashed red arrow in Figure 9. Lift the camera and take one, two, three or four images (section 4.7.2) to cover the green field of view, alternatively make a video sweep by slowly and steadily moving the recording camera (section 4.7.2) from left to right at the same height.

![Figure 9. The imaging procedure during the monitoring.](image)

**Caution!**
Be sure to overlap the images to cover the entire OSD and ice monitoring area. Avoid having other vessels or the drilling rig in the video / picture.

3.5.2 The monitoring procedure

According to the Rogar license requirements, oil spill and ice monitoring shall be performed every 3 hours.

To start the monitoring, plug out the fully charged camera from the battery charger (note that it should always be left charging between rounds) and press the Power button for 1 second. This will put the camera in power-on boot-up for about 90 seconds before going to On (only the first time of use). The camera can be put in Standby between monitoring rounds by momentarily pressing the Power button. To start it from Standby on the following round, momentarily press the Power button again. Take the powered On camera out on the deck to start the Clean-to-Operate (CTO), Oil Spill Detection and Ice monitoring according to the process in the following.

**Caution!**
Remember to keep the lens covered to-, between imaging and back inside upon completed round, to avoid scratches and damage.
### 3.5.3 Clean-to-Operate (CTO), Oil Spill and Ice Detection process

The four steps of the Clean-to-Operate (CTO), Oil Spill and Ice Detection process is described in the following, and should be performed in this exact manner on every monitoring round:

1. Go to position as indicated in Figure 8.

2. Check that the camera is in Power On mode. If not, press the button for 1 second. This will put the camera in Power On bootup for about 90 seconds before going to On. If in Standby, momentarily press the Power On button to get in On mode.

3. Once powered on, place yourself in imaging position according to Figure 9.

4. Lift the camera to cover the area of the sea-surface as described in Figure 9. Ensure that ONLY the sea surface, and not parts of the vessel or other closeby vessels, are visible in the image.

---

**1. Getting in position**

1. Inspect the sea-surface to visually evaluate if there are any potential oil spills or floating ice (see Figures 6 and 7). Keep the camera in white hot (WH) mode as default setting.

2. If the camera shows ANY indications of white/lighter areas than the sea (or the opposite depending on the camera settings), go to nr. 3. If the camera shows NO indications of white/lighter areas than the sea, go to nr. 4.

---

**2. Evaluating presence of oil or ice on the water**

1. Take one or several pictures and videos to document the potential oil spill or the ice. Try to capture as much of the situation as possible, including surrounding vessels and the drilling rig.

2. Use standard procedures for reporting unintended oil spills or ice as defined by Aptoil Rogar Communication Plan.
1. Take a picture of the inspected area from each defined position as described in 8 and 9, pressing the Capture Button momentarily. The time is shown on the image files, so this is the way to keep track of both the monitoring time, and the position that the pictures are taken from.

2. When round is completed, set the camera in Standby, go inside and plug it into the computer with the USB cable or by temporary removing the SD card from the camera (see section 4.3) and inserting it into the computer (if the computer has an SD slot). Transfer the images from the round to the computer (see section 2.5), a dedicated folder for each round/day/month is recommended to keep track of the images.

3. Log on to the BlueDeal web portal and follow the CTO and ICE reporting procedure described in section 2.6.

3.6 Charging the camera

As soon as a monitoring round is completed, set the camera in Standby and leave both cameras to charge. In this way you are always sure that you have an operating camera, also if something should happen to one of them.

3.7 Cleaning the lens

If the lens requires light cleaning, utilize the white lens cloth with the FLIR logo that came with the camera in the case. If further cleaning is required (greasy fingerprints, salt crystals etc.), use lukewarm tap water and rinse carefully with the lens cloth.

3.8 Aptomarin

At Aptomarin 24/7 maritime control center the thermal images, CTO, OSD and ICE reports from the rig are received every day. All images are double-checked for oil spills for optimal environmental safety, and the CTO and OSD reports are analyzed, statistically visualized live on the portal, and reported to the operator on a weekly basis unless otherwise agreed.

A thorough report from the entire monitoring campaign will be handed over to the operator at the end of the drilling campaign.
4 Camera user description

4.1 General cautions

Do not disassemble the camera enclosure. Disassembly can cause permanent damage. Keep the compartment covers closed to avoid exposing the cameras electronics to water or debris. Do not point the camera directly at extremely high-intensity radiation sources, such as the sun, lasers, arc welders, etc. Use only the supplied adapters to power or recharge the camera. Be careful not to leave fingerprints on the camera’s optics as this will impair the image quality.

Caution!
Always keep the camera window covered. A lens or the lens cover should always be installed on the camera to protect the window.

4.2 Camera software

The BH-Series Configurator software of the camera (also known as the Badger GUI) allows a user to obtain information from the camera, or make minor configuration changes. For example, the user can obtain and display the camera serial number and firmware version numbers. This information may be useful if it is necessary to contact FLIR for support. If the camera model is one that has a real time clock display, a user can set the system date and time. In some cases a user can enable or disable certain features on the camera.

4.3 Installing/re-installing the SD card

Install/re-install the SD card as follows:

1. Remove the small SD card door. No tools are required.

2. Install the SD card into card slot with label facing the front of the camera.

3. Snap the SD card door back into place, ensuring that the rubber lanyard retracts into the camera.
4.4 Installing the batteries

The batteries must be installed and charged before using your camera:

1. Pull off the battery cover by lifting the latch as shown at the right.

2. Install the batteries paying attention to the positive and negative markings, as shown at the right.

3. Re-install the battery cover by engaging the hinge and snapping the latch back in place.

Note!
If you have installed rechargeable batteries, they must be charged before using the camera. Regular AA batteries may be used but will only provide about one and a half hours of camera use.

4.5 Charging the camera

The batteries in the camera must be fully charged prior to use. If not fully charged, or if the recommended batteries are not installed, the battery status indicator may not accurately reflect the remaining battery life.

1. Connect the Hot Shoe to your camera.

2. Plug the power adapter provided with the camera into its power source and also into the Hot Shoe.

3. Ensure that the plug is fully seated in the Hot Shoe. When charging correctly, the charging indicator will be lit yellow and will blink green for one second within about 35 seconds. The charging indicator will continue to blink at decreasing intervals until the batteries are fully charged. When fully charged, the charging indicator will be lit solid green. The initial charge time is approximately 4 hours.
4 Camera user description

**Note!** The charging indicator will be lit solid green when the Hot Shoe is not connected to the camera or the recommended batteries are not installed. Ensure the batteries are charging by verifying the green blinking indicator described above.

### 4.6 BHM-series bi-ocular power management

Your BHM-Series Bi-Ocular camera is equipped with a power management system that provides up to five hours of continuous operation and up to five days of standby time between battery charges. To make the best use of the camera and to assure it is always ready when you need it, it is important to understand the basic power states of the camera. The BHM-Series Bi-Ocular camera is designed to operate much like your cell phone:

- It is rarely turned off unless you do not plan to use it for several days.
- When near a power source (AC power or a car cigarette lighter) or when not in use, it is recommended that you keep a charger plugged into the camera.
- When the camera is turned on from the Off state, it takes about 90 seconds to become operational.
- In Standby, it is always ready to go. Press the Power button and the camera will come on in about two seconds.
- It will automatically put itself in Standby to conserve the battery. A red state LED located under the right-eye display, as shown in the photograph below, indicates the current power state.
4.6.1 Power states

- There are three power states: Off, On, and Standby.

- The initial power-on Bootup process between the Off state and the On state takes about 90 seconds (fast flashing red state LED). During the Bootup process, pressing the Power button again will turn the camera off. After the camera finishes its power-on Bootup process, it is in the On state (state LED is off). After the camera is On, pressing the Power button will toggle the camera between On and Standby (state LED is flashing slowly).

- When battery powered, if Auto-Standby is enabled (see “Auto-Standby Operation” on page 22), the camera goes to Standby after three minutes if no buttons are pushed. A warning is shown in the display.

- From the Standby state, the camera comes back on within about two seconds when the Power button is pressed.

- The Auto-Standby function is disabled if the camera is powered with auxiliary power. During most use scenarios you will cycle between Standby and On. Only at the end of a shift or when not needed on multi-day field missions might you consider putting the camera into the OFF state.

<table>
<thead>
<tr>
<th>Camera State</th>
<th>Indication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Off</td>
<td>The display and the state LED are off</td>
</tr>
<tr>
<td>On</td>
<td>Power-on Bootup-Color bars on the display and the state LED flashing quickly</td>
</tr>
<tr>
<td></td>
<td>There is a thermal image on the display and the state LED is off</td>
</tr>
<tr>
<td>Standby</td>
<td>The display is off and the state LED is flashing slowly</td>
</tr>
</tbody>
</table>

4.7 Buttons and controls

4.7.1 Power Button

Changing between the Off, On, and Standby power states is controlled by the Power button. The table below describes how the camera moves between states.
### 4 Camera user description

**From state** | **To state** | **Method**
--- | --- | ---
Off | On | Press the Power button for 1 second. (This will put the camera in power-on bootup for about 90 seconds before going to On.)
On | Standby | Momentarily press the Power button
Standby | On | Momentarily press the Power button
On | Off | Press and hold the Power button for 8 seconds
Standby | Off | Press and hold the Power button for 8 seconds

To shut off the camera completely press and hold the Power button for eight seconds.

After holding the Power button for three seconds this message will be shown in the display and the camera will enter the Off state if the countdown finishes:

![Shutdown in 5 Seconds](image)

Release the Power button at any time during this countdown to terminate Shutdown and resume normal operation.

### 4.7.2 Capture Button

Use this button to capture snapshots (in JPEG format) or video clips (in AVI format):

- Momentarily pressing the button captures a single snapshot.
- Pressing and holding the capture button for three seconds puts the camera in video record state. The video record icon should be displayed. The button may now be released and the camera will continue to record until the capture button is pressed again. The video file is then written to the SD card in AVI format.

The files are stored on the integrated SD card. AVI files are viewable via the FLIR Viewer Utility included on the BHM-Series Bi-Ocular resource CD.
Twenty-five seconds of video requires about one megabyte (MB) of storage on the SD card. The image and video files must be transferred to a computer for viewing.

**Note!**
The images must be transferred to a computer via the USB cable, or the SD card can be temporarily removed from the camera and inserted in a card reader.

- If the camera is not licensed for this feature, this message will be shown in the display:
- If an SD card is not installed, this message will be shown in the display and no image will be stored:
- If the SD card is full, a warning will be shown in the display and the image will not be stored.

**Note!**
The stored image will include the thermal image, time and date information, and the FLIR logo. Other icons seen in the display are not stored on the saved image.

### 4.7.3 Still frame capture and store

To capture and store a single still image of what is currently being shown in the display, momentarily press the Capture button. The thermal image will momentarily freeze and the following icons will appear in the display:

- The SD Card Memory Gauge indicates how much memory is left on the SD card. The camera icon with the green lens indicates that a single frame was successfully stored to the SD card. Still images are stored in the JPEG file format at 320 x 240 pixel resolution. Still images are approximately 90Kb in size.

### 4.7.4 Video capture and storage

To capture and store a video sequence of what is currently being shown in the display, press and hold the Capture button for 3 seconds. Video capture will begin immediately and continue until the Capture button is pressed again. During the video store process, real-time video will be shown and these icons will appear in the display:

The lens on the camera icon will flash red/green during recording.
4.7.5 Zoom Button and zoom indicator

Use this button to switch the camera between no zoom (full resolution) and 2× zoom:

The central part of the image is magnified twice its normal size when 2× is selected. When zoom has been selected, the icon is continuously shown in the display:

4.7.6 White/Black Hot/Instalert™ Button

Use this button to toggle between the two video and the four Instalert modes:

In the default White Hot mode, hotter objects appear as white or light grey (see Figure 2e-n). In the Black Hot mode, hotter objects appear as black or dark grey (Figure 2a and b). In the Instalert™ modes the hottest objects in the scene are highlighted in red (Figure 2g-inlet) to simplify detection of animals, people, and objects. There are four pre-set levels of Instalert that you can select based on the specific scene being viewed. All of the Instalert modes are based on the white hot video mode.

While white hot is the most commonly used and visually intuitive method of viewing thermal imagery; black hot can often enhance contrast of certain objects or provide better visual perspective in some conditions. This has to be tried in each individual case.

When switching between modes, the appropriate icon is displayed for approximately 3 seconds.
4.7.7 Display brightness button

Use this button:

to cycle through the five levels of display brightness. Each press of the button advances to the next level of brightness.

When the highest brightness level is reached, subsequent button presses advance to the next lower brightness levels. When the lowest brightness level is reached, subsequent button presses advance to the next higher brightness levels. One of the following icons is displayed for approximately 3 seconds after the button is pressed, indicating the current brightness level:

4.7.8 Inter-ocular Adjustment

The inter-ocular adjustment lever allows the distance between the two eyepiece displays to be adjusted for the most comfortable viewing.

4.8 Batteries

Your BHM-Series Bi-Ocular camera is equipped with a sophisticated power system that accommodates a wide variety of AA battery types. This includes rechargeable and non-rechargeable batteries. The camera is optimized for operation with the 2700 mAh rechargeable NiMh batteries that were supplied with your camera. It is recommended that you use these batteries in all but emergency situations.

4.8.1 Battery status indicator

While the camera is On, a battery status indicator is always shown in the corner of the display image. This indicator provides an estimation of the remaining battery charge.

Note!
If non-rechargable batteries are installed the battery indication may not be accurate.
4.8.2 Using non-rechargeable batteries

The BHM-Series Bi-Ocular camera allows Alkaline non-rechargeable batteries to be used. When non-rechargeable batteries are installed, connecting the Hot Shoe to a power source will power the camera from the power source and the battery charging circuitry will be disabled.

**Note!**
Using Alkaline batteries, operating battery life is reduced to approximately 1.5 hours.

4.8.3 Low battery shut-down

The SD Card slot is located on the bottom of the camera in front of the battery compartment. The SD card, the USB connector, and the Auto- Standby Enable switch are located under the cover.

4.9 SD card

![SD Card slot diagram]

The SD Card slot is located on the bottom of the camera in front of the battery compartment. The SD card, the USB connector, and the Auto- Standby Enable switch are located under the cover.

**Note!**
The Hot Shoe must be removed to access the SD Card slot.

To access the SD Card, grasp the two edges of the cover with your thumb and finger and pull straight up.

**Caution!**
Do not stretch or break the rubber lanyard that keeps the door captive to the camera when opened.
To close the SD Card cover, slide the lanyard strap back into the camera, position the cover in place, and then firmly press in the middle until it is fully seated.

4.9.1 SD card capacity and type

The BHM-Series Bi-Ocular camera supports storing images and video on standard 1-Gb and 2-Gb SD cards or up to 32-Gb on SDHC cards.

4.9.2 SD card installation and removal

To install an SD card, insert the card into the slot and press on the SD card until its edge is nearly flush with the surface and release. To remove an SD card, use this same motion.

4.9.3 Downloading stored files via USB

The BHM-Series Bi-Ocular camera also supports downloading stored images and video via the USB port. With the camera on, plug the USB cable into the USB connector on the camera and a USB port on your computer. Allow up to two minutes for the USB connection to be recognized by the computer’s operating system.

4.10 Auto-standby operation

Auto-Standby is a feature of the BHM-Series Bi-Ocular camera that helps to guard against draining the batteries prematurely by inadvertently leaving the camera on. Auto-Standby puts the camera into the Standby state if the following three conditions are met:

- The camera is in the On state.
- The Auto-Standby switch (STBY) is set to ON.
- No buttons have been pressed for three minutes.
Once these conditions are met you will see the following message in the display and the camera will enter the Standby state after the countdown is finished:

Press any button during this countdown to terminate Auto-Standby and resume normal operation.

**Note!**
Pressing any button during an Auto-Standby countdown will only terminate the countdown and abort the Auto-Standby. The normal function of the button will not occur.

### 4.10.1 Auto-Standby switch

Unattended operation of the camera requires disabling Auto-Standby.

- Select OFF to turn off Auto-Standby.
- Select ON to turn on Auto-Standby.

If Auto-Standby is off, a reminder message will appear in the display each time the camera enters the On state:
4.11 The hot shoe

**Note!**
The hot shoe is not waterproof and should not be used in wet environments.

The Hot Shoe provides the connections to power the camera for continuous operation or charging the batteries; and for accessing the analog video output. The Hot Shoe attaches to the bottom of the camera and is secured by two latches:

![Image of Hot Shoe](image)

The following steps are recommended for quick and easy attachment of the Hot Shoe:

1. With the camera positioned bottom-side up, squeeze the two latches on each side of the Hot Shoe with your thumb and finger and push the Hot Shoe into position.

2. Release the latches and check that the Hot Shoe is secure.

3. To remove the Hot Shoe, simply squeeze the two latches and pull.

4.12 Image capture and storage

4.12.1 Still frame capture and storage

To capture and store a single still image of what is currently being shown in the display, momentarily press the Capture button. The thermal image will momentarily freeze and the following icons will appear in the display:

![Capture Icon](image)

The SD Card Memory Gauge indicates how much memory is left on the SD card. The camera icon with the green lens indicates that a single frame was successfully stored to the SD card. Still images are stored in the JPEG file format at 320 × 240 pixel resolution. Still images are approximately 90Kb in size.
4.12.2 Video capture and storage

To capture and store a video sequence of what is currently being shown in the display, press and hold the Capture button for 3 seconds. Video capture will begin immediately and continue until the Capture button is pressed again. During the video store process, real-time video will be shown and these icons will appear in the display:

![Camera and Battery Icons]

The lens on the camera icon will flash red/green during recording.

4.12.3 Connecting the camera to PC and transfer of files

All image and video files in AVI format are stored on the integrated SD card (see section 2.5). They must be transferred to a computer for viewing. This is done by connecting the camera to the computer via the USB cable, or, alternatively, temporarily remove the SD card from the camera and insert it in the card reader slot if available on the computer. All stored files include the thermal image, timestamp, date and the FLIR logo:

- Thermal image
- Time
- Date
- FLIR logo

Other icons seen in the display are not stored on the saved image. Download the images and/or video files to a computer.
### 4.13 Technical data sheet

<table>
<thead>
<tr>
<th>The package includes:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Handheld Thermal Camera, Hot Shoe Charging &amp; Video Output Accessory, 4 Rechargeable AA Batteries, AC Power Adapter/Charger, Neck Lanyard, DVD with Operators manual, USB Cable, RCA Video Output Cable, SD Card, Quick Start Guide, Hardshell Case, Tactical Carry Pouch (optional)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>System</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>FOV</td>
<td>10° × 8° NTSC</td>
</tr>
<tr>
<td>Start-up from Standby</td>
<td>&lt; 1.5 seconds</td>
</tr>
<tr>
<td>Waveband</td>
<td>7.5 - 13.5 µm</td>
</tr>
<tr>
<td>Thermal Sensitivity</td>
<td>&lt;50 mK @ f/1.0</td>
</tr>
<tr>
<td>Detector Type</td>
<td>640 × 480 VOx Microbolometer</td>
</tr>
<tr>
<td>Image Processing</td>
<td>FLIR Proprietary Digital Detail Enhancement</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>User Interface</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Button</td>
<td>On/Off/Standby</td>
</tr>
<tr>
<td>Picture Button</td>
<td>Still &amp; Video image capture to SD card</td>
</tr>
<tr>
<td>Zoom Button</td>
<td>2× &amp; 4× E-zoom</td>
</tr>
<tr>
<td>Polarity</td>
<td>Black Hot/White Hot/Marine Red/InstAlert</td>
</tr>
<tr>
<td>Brightness</td>
<td>Adjusts Display Brightness</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Image Presentation</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Built-In Display</td>
<td>LCD Display</td>
</tr>
<tr>
<td>Video Output</td>
<td>NTSC or PAL composite video; RCA jack</td>
</tr>
<tr>
<td>Video Refresh Rate</td>
<td>&lt;9 Hz or 30 Hz (NTSC and PAL)</td>
</tr>
<tr>
<td>Image Polarity</td>
<td>White Hot/Black Hot/Marine Red/InstAlert; Selectable</td>
</tr>
<tr>
<td>On-Screen Symbology</td>
<td>Standard</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Other</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>SD Card</td>
<td>Stores still images and video</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Power</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Battery Type</td>
<td>4 AA Batteries; NiMH, Li-Ion, or Alkaline</td>
</tr>
<tr>
<td>Battery Life (Operating)</td>
<td>&gt;5 Hours On NiMH batteries</td>
</tr>
<tr>
<td>Battery Life (Stand-By)</td>
<td>120 hours on NiMH batteries</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Environmental</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Rating</td>
<td>IP-67, Submersible</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>-4°F to +140°F (-20°C to +50°C)</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>-40°F to +167°F (-40°C to +70°C)</td>
</tr>
<tr>
<td>Drop</td>
<td>1 m drop (camera body only)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Physical</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight (incl. lens)</td>
<td>3.05 lb (1380 g) with batteries</td>
</tr>
<tr>
<td>----------------------------</td>
<td>----------------------------------</td>
</tr>
<tr>
<td>Size (L x W x H)</td>
<td>11.5” × 6.5” × 2.6”</td>
</tr>
<tr>
<td><strong>Range Performance</strong></td>
<td></td>
</tr>
<tr>
<td>Detect Man (1.8 m × 0.5 m)</td>
<td>~2.2 km</td>
</tr>
<tr>
<td>Detect Small Vessel (2.3 m × 2.3 m)</td>
<td>~6.5 km</td>
</tr>
</tbody>
</table>