

## **BULLARD THERMAL IMAGER**

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## **I. INTRODUCTION:**

The Bullard Thermal Imager combines the most advanced thermal imaging technology in high heat, impact resistant thermoplastic case to provide for imager durability and dependability. The benefits of using thermal imaging technology as a firefighting tool encompass just about every aspect of the firefighter's job. Thermal imaging is not, however, a technology designed to completely replace current firefighting tactics. Rather, it is a tool that allows the firefighter to be more effective and make better decisions. Some of the many uses for the thermal imager include:

- **Search and Rescue**
- **Scene Assessment**
- **Locating Seat of Fire**
- **Determining Spread of Fire**
- **Locating Hot Spots**
- **Identifying Potential Flashover**
- **Determining Ventilation Points**
- **Determining Entry Points**
- **Determining Charged Electrical Wires**
- **Overhaul**
- **Hazmat**
- **Wildland Firefighting**
- **Training**



## **II. ABOUT THERMAL IMAGING:**

Thermal imaging is the detection of infrared radiation in the infrared band of the electromagnetic spectrum. The translation of these detected energy levels into viewable images is a way to look at the "Heat Signature" of an object or person. Infrared Detectors (thermal imaging) view infrared radiation sources regardless of the visible light conditions. This detector or imager receives and interprets electromagnetic waves in the infrared spectrum. It is a form of energy that we perceive as heat. All forms of electromagnetic radiation travel in waves. The length of the waves determines the properties of the electromagnetic radiation and what it can and cannot penetrate. The portion of the electromagnetic spectrum that the human eye can detect and process is visible light. This wavelength is very susceptible to interference from outside sources or influences.

A wavelength not so susceptible to outside interference and influences is the infrared band of the electromagnetic spectrum. The infrared portion (band) of the spectrum is just outside of the visible light band. It is a longer wavelength that is less susceptible to interference. Infrared radiation comes from or is emitted by anything with molecular activity. It is important to remember that infrared radiation can be emitted, absorbed, emitted again and reflected. Energy/Heat (infrared radiation) can travel by conduction, convection or by radiation. When viewing infrared radiation on a thermal imaging device, the hottest objects will appear white or lighter shades while the cooler objects will appear black or as darker shades.

**Thermal Imagers cannot see through solid objects**, they can only pick up heat that has been transferred to the surface of the material. The display on the imager is relative to the area being viewed. The shades displayed are relative to each other and the conditions within the displayed area. In a very hot environment, actual visible flames may appear as white. Other items such as a steel pole that is extremely hot to the touch will be displayed as a darker shade, maybe even black.

### III. SET UP AND OPERATION:

**POWER:** To turn the Bullard Thermal Imager on, simply depress the large green “On/Off” button on the left side of the unit (Item 1, Figure 1). Upon depressing

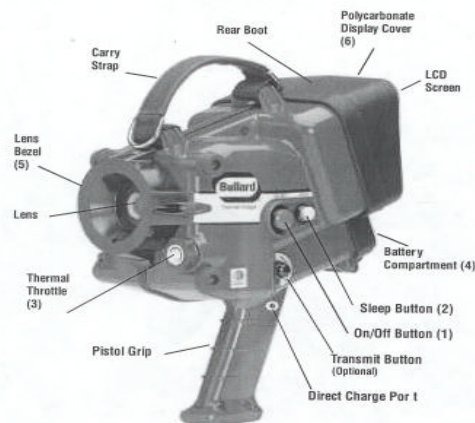


Figure 1

the “On/Off” button, the “Sleep” indicator light will appear on the viewing screen. However, the thermal image will not appear immediately as the unit requires a few moments to warm up and complete the self-calibration process. After approximately 20 seconds, the thermal image will appear accompanied by a

calibrating gray scale at the bottom of the screen. After about 45 seconds, the gray scale is reduced to a small white rectangle in the lower left hand corner of the screen indicating that the unit is fully operational. The white-hot reference rectangle remains on the screen during operation.

**SLEEP MODE:** To conserve battery life, the Bullard Thermal Imager includes a unique "Sleep" mode. To put the unit into sleep mode, simply press the yellow sleep button on the left side of the unit (Item 2, Figure 1). When in the sleep mode, the sleep indicator light will appear on the viewing screen. To bring the unit out of the sleep mode, push the yellow button again. The thermal image will immediately reappear on the screen.



**THERMAL THROTTLE:** The thermal imager features a fully adjustable aperture (thermal throttle), which allows you to always get the clearest picture. The Thermal Throttle controls the amount of energy that reaches the thermal detector. The process is similar to that of the pupil in the eye. When there is bright light, the pupil shrinks to protect it. When there is low light, the pupil expands. The Thermal Throttle works the same way. In high heat situations, the Thermal Throttle may be reduced down to obtain the best contrast and the clearest image. In low heat situations, the Thermal Throttle should be wide open. Since the Thermal Throttle is manually adjusted, the operation can always get the clearest image. The Thermal Throttle is manually adjusted by turning the Thermal Throttle dial on the front left of the unit (Item 3, Figure 1). Turning the dial clockwise closes the Thermal Throttle, and turning the dial counter-clockwise opens it. For increased durability, the Thermal Throttle is equipped with a safety slip mechanism, which engages when the Thermal Throttle reaches fully open or fully closed positions. This mechanism prevents over-adjusting or over-tightening the dial.

**THERMAL THROTTLE ADJUSTING PROCEDURE:** Once the unit has been turned on and the thermal calibration is completed, turn the Thermal Throttle clockwise until the image on the screen disappears. This is the fully closed reference position. Then turn the Thermal Throttle knob in the opposite direction until the picture contrast is to your liking. It will take less than one full revolution of the Thermal Throttle to completely open the aperture. Once the aperture is

fully open, the safety slip engages to ensure the Thermal Throttle is not over-tightened. Continuing to turn the dial beyond the first full revolution will not improve the contrast.

**NOTE:** Most of the needed adjustment will be accomplished within about a ¼ of one revolution of the Thermal Throttle.

#### **IV. CARE AND MAINTENANCE:**

The design of the Bullard Thermal Imager requires very little maintenance. For best results, after each use:

- Clean the outside of the unit with a mild soap or detergent.
- Wipe the lens with a soft cloth.
- Clean the display with a soft cloth.
- Check screw tightness on rubber bumpers and side strap.
- When not in use, always store the Thermal Imager in the case provided.

**CAUTION: Do not use solvents or paint thinners to clean your Thermal Imager, as they could permanently mar the surface or degrade the protective properties of the casing.**

**CLEANING THE LENS:** The Thermal Imager lens is protected by both a silicone gasket and a plastic lens *bezel*. The bezel (Item 5, Figure 1) contains a drain hole so that any water that may get into or behind the bezel will be effectively drained away. Normally, the lens can be cleaned with a soft cloth and soapy water. However, if the bezel drain becomes clogged it may be necessary to remove the bezel in order to clean out the passageway. The bezel can be easily removed by unscrewing the two retaining screws. Once clean, re-attach the bezel ensuring that the drain is positioned on the bottom of the assembly.

**WARNING: Do not attempt to disassemble the sealed case of the Bullard Thermal Imager. If the unit is not functioning properly, return it to the Supply & Maintenance Division for an evaluation. Disassembling the unit voids the warranties.**

**WARNING: The Bullard Thermal Imager is not certified as intrinsically safe.**

**WARNING: Do not attempt to remove the lens or the rear boot. These parts are sealed and removal will cause leakage.**

## V. BATTERIES:

**CHARGING OF NICKEL METAL HYDRIDE BATTERY:** Before using a battery for the first time, it should be charged and discharged at least three times. This will enable the battery to achieve maximum life. This can be accomplished by fully charging the battery, inserting it into the imager and then turning the imager on. Leave the imager on until the battery is fully depleted and the unit shuts down. Now, recharge the battery as described below.

**USING THE BATTERY CHARGER:** The battery should be charged in the battery charger, using either the AC or DC adapter provided. To charge a battery, insert it into the charger so that the metal connectors on the battery are aligned with the metal connectors in the charger. A red light will illuminate on the charger to indicate that the battery is charging. When the light on the charger turns green, your battery will be fully charged. You may leave the battery in the charger indefinitely. You cannot overcharge the battery.

**USING THE DIRECT CHARGE SYSTEM:** The direct charge system will allow the battery of the Thermal Imager to be charged inside the camera. The standard battery charger should be connected to a power source using either the AC or DC adapter provided. Connect the charger to the camera by using the gray connector cord provided. Insert one end of the cord into the charger using the outlet on the front of the charger. Insert the other end into the direct charge plug located on the handle of the Thermal Imager. A red light will illuminate on the charger to indicate that the battery is charging. When the light on the charger turns to green, your battery will be fully charged. You may leave the direct charge system in place indefinitely. You cannot overcharge the battery.

**USING DIRECT CHARGE SYSTEM/ BATTERY CHARGER:** A battery can be charged in the charger at the same time as the battery in the camera is being charged by using the directions previously mentioned. Charging both batteries at the same time will not lengthen the charge time or cause any damage to the batteries or the charging unit.

**WARNING: Do not attempt to use any other charger to charge the Bullard Thermal Imager Battery. Irreparable damage will occur. The batteries ARE NOT interchangeable with the Motorola radio batteries.**

**NOTE:** The battery charger can only be used to charge the imager batteries. The output of the charger unit is not sufficient to run the imager.

**LOADING THE BATTERY:** To open the battery compartment, turn the two thumb knobs outward and pull the door open. Remove the battery. Now insert a fully charged battery making sure the Bullard decal is facing away from the camera, and the type is right side up. If the battery has not been inserted correctly, the door will not shut and the thumb knobs cannot be secured. If the door will not shut, remove the battery and review the instructions above. The battery can easily be replaced in the dark. To do so, locate the notched bottom of the battery. Make sure the notch is pointing away from you and is on the left-hand side. If the door will not shut, remove the battery, check its orientation and try again. Additionally, as with all batteries, the rechargeable battery will experience a slow drain of its charge during storage. The amount of drain varies widely based on storage conditions. For best performance, charge each of the batteries every two weeks at a minimum.



**WEEKLY CHECK:** Monday morning checks replace the battery with a fully charged battery. Turn the imager on and let it warm up, about twenty seconds, or until a picture shows up on the display. Push the "Sleep" button and check the display screen to make sure the sleep indicator light is on and the imager is in the battery conservation mode. Turn the imager off and before replacing it in the protective case go through the "Care and Maintenance" procedures to ensure it is clean and ready to use.

## **VI. THERMAL IMAGER USE:**

### **SIZE UP:**

- Can quickly identify the seat of the fire from outside the structure.
- Can identify fire spread and changing fire conditions.
- Can be used to identify the hottest areas and/or ventilation points.

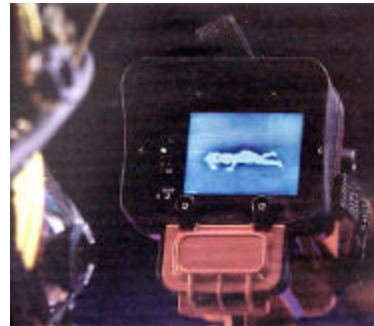
### **RAPID INTERVENTION COMPANY (RIC TEAM):**

- After considering existing conditions for rescue, a Rapid Intervention Company should collect the proper equipment required for any potential search and rescue operation encountered.

- Company Commanders shall ensure that the equipment is in a state of readiness and is appropriate for the potential rescue situation.
- If the building requires an in-depth search and rescue operation, consider using the search and rescue methods described in the “Rapid Intervention Manual” Book 101, in conjunction with using the thermal imager.
- DO NOT neglect to maintain reference points, using ropes, handlines, or staying on an exterior wall.
- NEVER rely 100% on the imager to identify your way out.

### SEARCH AND RESCUE:

- Can greatly reduce the time required to find and remove the victim.
- Identify victim by the shape, not the shade.
- Scan areas to include ceilings, walls and floors.
- Identify potential exit points such as windows and doors.
- DO NOT neglect to maintain reference points, using ropes, hand lines, or staying on an exterior wall.
- NEVER rely 100% on imager to identify your way out.
- ALWAYS scan all areas.



### FIRE ATTACK:



- Can quickly identify the seat of the fire, even through heavy smoke conditions.
- Quickly identify hidden and spreading fire conditions.
- Observe impact of extinguishing agent an application. If white areas do not darken with application then application rate is inadequate or improperly applied.

### VENTILATION:

- Identify areas of greatest heat accumulation, remembering that imager cannot see through material; only identify heat transferred through the materials.



- Identify construction features such as roof rafters. Heavy solid objects will transfer heat slower and appear darker than the surrounding materials.
- Heat levels can appear differently, based on the type of window assembly being viewed.

#### **OVERHAUL:**



- Thermal Imager can identify hot spots without causing unnecessary damage.
- Can reduce the possibility of rekindle.
- Remember that the imager cannot see through solid surfaces, it only picks up heat that has been transferred to the material's surface.

#### **WILD LAND:**

- Can identify fire lines from the air, through blinding smoke conditions.
- Can save time in identifying and cooling hot spots.
- Keep track of or locate fire personnel on the fireground, using the imager.
- Use to direct vehicle movement safely and efficiently.

#### **HAZ-MAT:**

- Can be used to identify hazardous material movement.
- Will identify materials on the surface of the water when the material has a temperature different than the water. Remember that the imager cannot see through the water.



- Can identify gaseous cloud when there is a temperature difference.
- Solid and liquid product levels inside a container can be determined when the material inside the container has affected the external surface temperature of the container.

## VII. LIMITATIONS:

Infrared technology does have limitations, as listed below. These limitations, if not understood and taken into consideration, not only pose an operational challenge, but also may create undue risk to the user.

- Glass - Infrared radiation will not penetrate glass, however heated glass will show up lighter in color.
- Reflections – Infrared radiation can be reflected by a number of surfaces. These include glass, water, mirrors and shiny surfaces.
- Water - Infrared radiation will not penetrate water although some penetration may occur in a fog or mist. It can, however, distinguish objects floating on the surface of the water such as a person or a chemical.
- Thermal Inversion – Occurs when an object changes shade, even though its temperature has not. This can happen when there is an environmental change.
- Haloing – Occurs around the hottest objects. Can be used as a visual queue or can be eliminated by adjusting the Thermal Throttle.
- Heat from an object can leave an image after the object is gone.



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