

## I. Warranty

The manufacturer shall make standard a warranty for the thermal imager, all features and accessories installed in the thermal imager to be free of defects in material and workmanship, under normal use and service, for a period of **five** years. As part of this warranty, the manufacturer must provide free inbound and outbound shipping for transport within the continental United States for all repair service. The manufacturer must make available a five-year warranty on the thermal imager batteries, providing free battery replacements during this period under the specified program. In addition, the imager's housing shall carry a limited lifetime warranty.

## II. Service

The manufacturer must be located in the U.S.A. and provide a full-service repair center in the U.S.A. to ensure timely and efficient processing of any service related issues concerning the imager. Warranty repairs must carry a guaranteed 48-hour turnaround (2 full business days from the time of receipt at the service center to the time that the manufacturer ships the imager).

Non-warranty repairs must carry a guaranteed 48-hour (2 full business days) turnaround from the time the manufacturer receives purchase order authorization to complete the repairs to the time the manufacturer ships the imager. Upon request, the manufacturer must provide the names and contact information for three (3) fire departments that can serve as references, verifying that the manufacturer complies with this requirement.

## III. Quality

The manufacturer must ensure quality, design and manufacturing methods through third-party certification to ISO 9001, or its equivalent. To ensure that the product is of the highest quality, documentation must be presented upon request illustrating a battery of tests that have been conducted to verify water resistance, heat resistance and shock/impact resistance.

## IV. Physical Configuration

The imager shall be a hand-held design, having a 3.5-inch LCD display screen and two side straps (one on each side of the imager). A combination wrist/gear strap shall accompany the imager. Total weight of the imager shall not exceed 3 lbs. (1.36 kg) with the standard battery installed. The imager shall ship in a padded, re-usable delivery case. The imager shall ship standard with two rechargeable batteries, a battery charger and AC adapter. The imager's physical dimensions shall be no more than 6" (152 mm) tall, 4" (102 mm) wide and 7.5" (190 mm) long. The imager must contain an integral threaded connector to mount on a standard tripod.

## V. Durability

The imager shall remain operational after being submerged under 3 feet of water for 30 minutes. The imager shall withstand a 6-foot drop in any orientation and sustain no operational damage. The manufacturer must perform these tests in front of designated department representatives at a mutually determined time and location. Failure to perform these tests in front of designated department representatives shall constitute non-compliance with this portion of the specification.

## VI. Technology

The imaging technology shall utilize a 240x180 pixel uncooled vanadium oxide (VOx) focal plane array. The Noise Equivalent Temperature Difference (NETD) shall be less than 50 mK. The imager shall exhibit an ability to evade whiteout when pointed directly at flames. The detector shall operate with core temperature ranges of -40°F to 175°F (-40°C to 79°C). The dynamic range of the detector and associated electronics shall be nominally 1100°F (592°C). The detector spectral response shall be 7 to 14 microns. Mid-wave or short-wave infrared products that operate below this portion of the infrared spectrum (below 7.5 microns) are not acceptable due to unreliable performance in smoky conditions. The frame rate of the infrared engine shall be no less than 60 hertz. The infrared engine shall utilize a proprietary Image Contrast Enhancement (ICE™) technology that provides superior infrared imagery utilizing three state-of-the-art image processing techniques: (1) Edge Enhancement algorithms that sharpen distinctions between objects and regions; (2) Dynamic Contrast Thresholding which isolates the most significant image content and then applies further image processing; and (3) Adaptive Rescaling, which decomposes the image into three spatial frequencies and then optimizes the imagery.

## VII. Image Colorization

In order to provide a greater degree of safety, the imager shall utilize a tri-color automatic colorization mode available as an option or upgrade. This colorization mode shall utilize a yellow/orange/red color scheme. The display will show yellow colorization at temperatures of 500°F (260°C) to 799°F (426°C), orange colorization at temperatures of 800°F (427°C) to 999°F (537°C), and red colorization at temperatures of 1000 °F (538°C) or hotter. Such colorization shall be gradient in nature so as to be able to discern scene details though the color (this requirement does not apply to manually engaged colorization).

Manual Colorization Mode – see XIII. Switches

## VIII. Outer Housing

The imager shall be ergonomically designed and the outer shell or housing must be manufactured from heat resistant Ultem<sup>®</sup> thermoplastic given its superior heat performance and chemical resistance. Due to the likelihood of rigorous use, the Ultem must be molded with color pigment throughout to mask small surface scratches. Outer shells or housings that are painted or otherwise lack consistent color through their entire thickness are not acceptable. The interior surfaces of the outer shell or housing shall be coated with a conductive electromagnetic interference (EMI) shielding material.

## IX. Colors

The imager should be available in no less than eight scratch-resistant colors to allow for color-coding as needed by the department. Colors shall include, at a minimum: Metallic Blue, Red, Yellow, Black, White, Orange, Blue, and Lime-Yellow.

## X. Monitor/Screen

The imager shall have a 3.5" diagonal backlit Liquid Crystal Display (LCD) screen. It shall have a minimum of 76, 800 pixels for high quality resolution. The screen must utilize a 6 LED backlight technology so it is visible in thick smoke to both the operator and nearby firefighters from a variety of distances from the face, including arms length. In addition, a clear polycarbonate cover must protect the display screen. This cover must be field replaceable and watertight.

## XI. Lens

The imager shall possess an f/1.3 lens fabricated of germanium and have no less than a 31° (V) x 40° (H) field of view. The lens shall be protected with a watertight, sealed 2 mm thick germanium cover window.

## XII. Visual Indicators

The imager shall have only one LED-indicator system to promote maximum ease-of-use. This indicator shall display battery life via three green, one yellow and one red LEDs. On-screen battery indicators are unacceptable as they block otherwise visible areas of the display.

## XIII. Switches

The imager shall use only one switch to activate the unit. The switch must be recessed and protected to avoid accidental shut-off. The switch shall be a mechanical capture switch which allows for automatic power restoration during a hot battery swap and eliminates the need for a "push and hold" mechanism for powering off that is associated with electronic switches.

The imager shall have a manual colorization mode as an option or upgrade. This imager must utilize a pair of switches for activating this colorization mode, which helps the user identify the hottest objects in a scene. This colorization mode must be manually adjustable by the user and colorize the hottest objects in a scene with a color that is unique to this mode. Thermal imagers that use yellow, orange, or red to identify hot objects for a manual colorization mode are not acceptable as they can easily be confused with the automatic colorizations modes which typically use such colors to designate fire and high heat conditions.



#### **XIV. Strap Systems**

The imager must be equipped with side straps, one on each side of the imager and these straps shall be made primarily of Kevlar. The side straps must be adjustable and must include a metal D-ring for secure lanyard attachment. To improve safety, the side straps must have reflective trim. The combination wrist and gear strap shall be made primarily of Kevlar. This strap shall include two metal carabiners and a quick-release buckle that frees the imager from the strap. An optional self-retracting strap must also be available for the imager. This self retracting gear keeper must hold the unit to the firefighters chest with the full weight of the imager (with battery) hanging unsupported from the gear keeper. All straps must be field replaceable.

#### **XV. Power Supply**

A minimum of 2 rechargeable batteries and 1 battery charger shall accompany each imager. Each battery shall be a 10-volt nickel metal hydride (NiMH) cell, providing more than 3 hours of continuous use with all standard functions and features. Each battery must be capable of a minimum of 1,000 charges. The battery shall have an Ultem outer shell. The battery shall eject from the imager only when two opposing battery release buttons are pressed simultaneously. The battery must be capable of being loaded into the housing only one way and must be easily inserted and removed by a person wearing standard firefighting gloves.

An optional AA alkaline battery case must also be available for the imager. The case must load and secure into the imager in the same manner as the standard NiMH battery. The alkaline case must also be constructed from Ultem.

#### **XVI. Operation**

The imager shall display a useable image no more than 4 seconds after activating the power switch. The imager must not have a standby switch or mode.

#### **XVII. Wireless Transmission**

The manufacturer shall offer an optional wireless remote transmitter compliant with FCC part 90 while operating at a range of 2.4 GHz. The wireless transmitter must come as a two (2) or four (4) channel unit. The transmitter shall be housed inside an attachable handle, protecting the transmitter and antenna from possible damage while giving the department the option to disengage the transmitter. Attaching the transmitter handle must not increase the width of the imager by more than one (1) inch. Each wireless unit must have a receiver and antenna able to receive a signal from at least 600 feet through common Type V construction. The transmitter must carry a one year warranty.

#### **XVIII. Wireless Receivers and Video Recorders**

The manufacturer must offer the following receiver and recorder options:

A handheld, self-contained receiver / monitor system that uses the same batteries as the thermal imager. The handheld receiver / monitor system must operate for a minimum of 2 hours on the standard battery and must utilize a minimum 3.5" diagonal viewable display. The receiver must be equipped with video out capability and have a field replaceable display cover. The receiver must carry a one year warranty.

A digital image and video recorder (DVR), housed in an attachable handle, capable of recording five hours of video and 300 still images. Stored digital video shall download to the user's computer via USB 2.0 connection. Due to video file sizes, USB 1.0 is not acceptable due to its slower transfer speed. Video and image files shall be a minimum 720 x 480 resolution and incorporate time and date stamps on the recorded image. The DVR shall utilize "plug and play" technology so Windows PC operating systems automatically recognize and enable installation and setup of the software without need for an installation CD or other media. If so configured, the DVR shall work seamlessly with the transmission system and allow the user the ability to operate the transmitter and DVR separately or both simultaneously. The DVR must carry a one year warranty.

#### **XIX. Truck Mount**

The manufacturer must offer a truck mounted charging system to mount the imager and internal charging system in a vehicle or fire apparatus or on the wall of a fire station. The charging system shall come standard with all necessary mounting hardware, a direct charge system, and power cords that enable the use of a DC power supply. The system must charge the battery in the imager at the same time it charges a spare battery utilizing separate charging systems. The battery in the imager must be charged through contacts on the imager. No cables or wires connecting the imager to the charging system are acceptable, nor are straps or other connecting devices to hold the imager to the truck mounting system. The system must be compliant to NFPA 1901 when properly mounted in a vehicle or fire apparatus. The truck mount charger system must include a separate storage compartment large enough to hold a spare battery or AA alkaline battery case. The truck mount must carry a one year warranty.

#### **XX. Battery Analysis and Conditioning**

The manufacturer must offer an analyzer / conditioner system for use with the thermal imager's batteries. The hardware unit must utilize a PC software system that enables adding, naming, and removing batteries from a user's inventory. The software must be capable of automatically providing battery analysis and conditioning of up to four separate cycles to ensure optimal battery restoration. The hardware unit must be capable of conditioning up to four separate batteries simultaneously via multiple conditioning units or banks. The software must report analysis conclusions in simple English (i.e. "good" or "bad") for intuitive user understanding. The software must also be capable of notifying the user, via mobile text messaging or email, upon the completion of battery charging and/or analysis / conditioning events. The unit must also be capable of separately charging a battery.

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