# EMERGENCY RESPONDER

# THERMAL IMAGING

WINTER 2005 Volume 1 Number 1

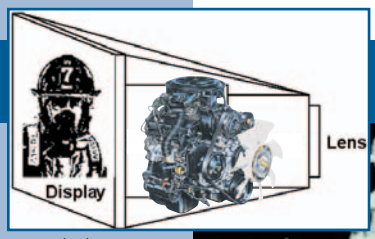
FIRE SERVICE
HAZMAT
EMS
LAW ENFORCEMENT
HOMELAND SECURITY

'TIC EVALUATION AND OPERATION CHECKLIST' PULLOUT SECTION

The Latest On:

- ☑ Thermal Imaging Technology (Explained for all)
- ☑ Imaging Evaluation & Testing Techniques (Easy and inexpensive)
- ☑ Operations and Use (Achieving Maximum Utility)

# TIC Sensors




**The IR sensor is the "engine" of the TIC.**

- There are several TIC sensor engines available to the TIC Manufacturers
- Each has its own specifications and operating characteristics
- They are tuned for performance at the different sensitivity and temperature ranges
- Sensor engines use either BST or Microbolometer sensor technology:

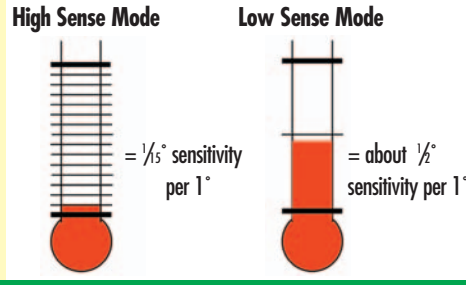
**BST**: Barium, Strontium and Titanate materials in the sensor are sensitive to thermal energy. BST sensors produce a more black and white image, showing contrast and with limited shades of grey to differentiate temperatures.

**Microbolometer:** Produce more grey shading than BST sensors do, showing more defined detail of the temperature differences. The materials in the sensor are either ASi (Amorphous Silicon) or VOx (Vanadium Oxide). When comparing a VOx-based to ASi-based TICs, there are image quality differences, especially over a broad range of temperature in not only fire service and emergency response applications, but also in industrial, medical and scientific applications.



# High Sensitivity vs. Low Sensitivity

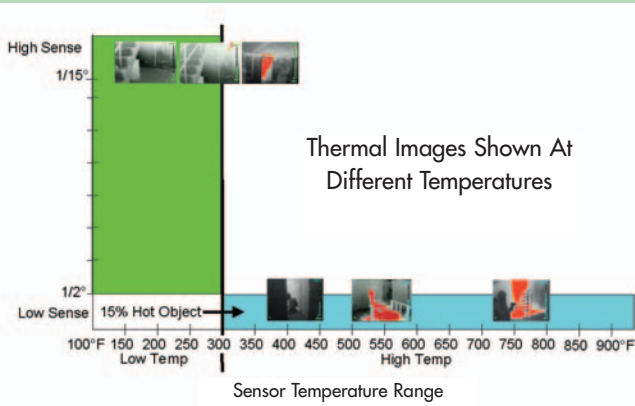
- Sensitivity is measured in the smallest temperature difference a sensor reacts to
- Sensor engines at 1/15° or better sensitivity are considered high performance
- TIC Sensors operating at 1/15° are in **High Sense** mode with best clarity and detail
- **Low Sense** mode drops down to about 1/2° sensitivity limiting clarity and detail




# Sensor Temperature Range – It's Dynamic!

A TIC sensor engine constantly monitors two temperature sources:

1. Ambient Temperature:
   - 80% of structural firefighting is at ambient temperatures between 150° to 300°F
   - For the best image quality, some TIC sensors have a **High Sense** temperature range up to 300°F; others only up to about 175°F
   - The broader the range, the better – to stay in **High Sense** mode.
2. Hot Objects in the Scene:
   - Hot Objects can force a TIC down into **Low Sense** Mode to prevent over-exposing the sensor.
   - Some TICs can only handle a hot object up to about 1% of the total scene before dropping down into **Low Sense**; other TICs can fill up to 15% of the total scene and stay in the **High Sense** longer
   - When exceeding 15%, by moving the TIC slightly to reduce object size, you can stay in **High Sense** mode.



## TIC Evaluation Point #1: *Comparing **High Sense** and **Low Sense** mode*

**Materials:** TICs, Electric Hot Plate, Extension Cord, Heat Mitt or Firefighter's Glove

*Place electric hot plate on table. Turn up to high heat. Stand 15 feet away with TIC looking away from the hot plate; then slowly scan the room over to the hot plate. Then slowly scan away from – and than back to the hot plate several times noting how the quality of the image is affected by the heat from the hot plate.*

**Result:** When the hot plate comes into the scene, is the TIC in **High Sense** (sharp, clear, high detail) or does it drop down into **Low Sense** looking fuzzy with lost detail?

## TIC Evaluation Point #2: High Sense *with Hot Objects in the scene*

**Materials:** TICs, Electric Hot Plate, Extension Cord, Heat Mitt or Firefighter's Glove

*Place electric hot plate on table. Turn it on to high heat. Stand 25 feet (or further) away making sure that the TIC is in **High Sense** when initially looking at the hot plate. (If the TIC goes into **Low Sense** mode initially when looking at the hot plate, simply move farther away from it for it to go into **High Sense** mode.) Then, slowly walk toward the hot plate until the TIC drops down into **Low Sense** mode. Note the distance from the hot plate and the size of the hot object filling the scene.*

**Result:** If conducting this evaluation with several different TICs, compare the distances from the hot plate for each. The closer you can move to the hot plate while staying in **High Sense** mode the better. Also, as a **SAFETY** feature, some TICs colorize hot objects (usually red) while in **High Sense** mode for easier identification.

## TIC Evaluation Point #3: *Sensitivity Mode Switching Time*

**Materials:** TICs, Electric Hot Plate, Extension Cord, Heat Mitt or Firefighter's Glove

*With a **SAFETY** heat mitt or firefighter's glove, cautiously hold the electric hot plate, set on high heat, in front of a TIC forcing it into **Low Sense** mode. Then point the TIC away from the hot plate and count the seconds before the TIC returns to **High Sense** mode.*

**Result:** Some TICs take up to 5 seconds to switch out of **Low Sense** back up into **High Sense** mode. Other TICs switch in less than 1 second – which keeps things moving.

## TIC Evaluation Point #4: *Moving the Hot Plate to show Scene Dynamics*

**Materials:** TICs, Electric Hot Plate, Extension Cord, Heat Mitt or Firefighter's Glove

*With a **SAFETY** heat mitt or firefighter's glove, cautiously hold the electric hot plate set on high heat, walking around the room as the extension cord allows. Have someone using a TIC stand about 15 feet from the hot plate, first scanning toward and then away from the hot plate several times while observing the clarity and definition of objects in the room.*

**Result:** Some TICs will change in and out of **High** and **Low Sense** mode in this evaluation. With both scene changes (from moving around) and temperature changes (including or excluding the hot plate in the scene) compare the changing dynamics of the imagery.

## TIC Evaluation Point #5: *Heat-Seeking Color in **High Sense** mode*

**Materials:** TICs, Electric Hot Plate, Extension Cord, Heat Mitt or Firefighter's Glove

*Place electric hot plate on table. Turn it on to high heat. Stand far enough away from the hot plate (sometimes up to 25 feet) so that the TIC starts out in **High Sense** mode. In **High Sense** mode, check for Heat-Seeking Color on the display. Then move closer to the hot plate to force the TIC into **Low Sense** mode. Check for heat-seeking color.*

**Result:** In the TICs that offer it, Heat-Seeking Color in **High Sense** mode is easily seen and used. Some TICs "flash" some color in **High Sense** mode, other just do not offer it.

## TIC Evaluation Point #6: *Measuring Temperature and Temperature Differences*

**Materials:** TICs, objects in the room that generate moderate heat (lights, equipment, etc.)

*With the TIC, find heated objects in the room using the Temperature Measurement feature. Stand at several different distances from the objects, starting at 5 feet, then 10, then 20. Note the temp readings either on the temp bar graph or the digital temp of each object.*

**Result:** With TICs that offer it, having both the temp bar graph and digital temp measurement provides more useful information for more applications. Notice that some temp bars, due to their size on the display, show temperature increments that are difficult to read.

# TIC Operational and Personal SAFETY

As also examined in this edition of *EMERGENCY RESPONDER* **THERMAL IMAGING**, the operational and personal SAFETY features and functions provided by the sensor play and important part in TIC SAFETY. These include:

☐ 1. **High Sense** mode: Provides the best image quality–and should be used whenever possible

☐ 2. **Low Sense** mode: A "warning sign" with limited image quality. Prevents sensor over-exposure

☐ 3. **Low Sense** to **High Sense** switching time: Quick switching keeps things moving.

☐ 4. 300°F Temp Range in **High Sense**: Delivers more time in **High Sense** mode–a SAFETY plus

☐ 5. ISDR (Instantaneous Scene Dynamic Range): Indicator of total SAFETY performance

☐ 6. Hot Objects up to 15%: Allows more time in **High Sense** mode–another SAFETY plus

☐ 7. Heat-Seeking Color: If available in **High Sense** mode, an added level of SAFETY

☐ 8. Temperature Measurement: Temperature bar gives the warnings, digital readout gives the details

**Professional Training on TIC Operation and Use goes a long way in developing a solid understanding of the TIC SAFETY tools and functions listed to the left. TIC Manufacturers can recommend TIC Training Programs from independent and objective training organization to help meet or supplement your TIC training needs.**

Several additional safety features are important with regards to thermal imager operation and use. The following questions highlight key SAFETY issues for the TIC user:

☐ 1. Does the TIC always provide a warning prior to shut down–for any reason?

☐ 2. Can the TIC be accidentally shut off? Is normal shut-off delayed and does the camera issue any warning?

☐ 3. Is there an Over-Temp warning when the TIC is exposed to too much heat?

☐ 4. Is there a Shutter Indicator prior to (microbolometer) sensor shuttering?

☐ 5. Does the Battery Usage Indicator clearly indicate pending shut-down?

☐ 6. Are the TIC batteries reliable and long lasting, with no memory buildup?

☐ 7. Is the TIC resistant to Radio Frequency Interference (RFI), in order to prevent shut-down?

☐ 8. Are the TIC's electronics surrounded with a continuous, grounded RFI shell?

☐ 9. Does the TIC have Instant Start-Up to prompt immediate use?

☐ 10. Is the sensor lens Field of View (FOV) 55°, for wide viewing without panning?

**SAFETY NOTE: The evaluation of Thermal Imaging Camera performance often involves exposure to high heat situations and/or hot objects. Please use extreme caution when performing these evaluations. It's all about SAFETY.**

# TIC Fire Scene Progression

## HIGH SENSE MODE


**Scene 1.** High Sense Mode with advancing heat


**Scene 2.** High Sense with first Heat Seeker color


**Scene 3.** High Sense with 338°F Hot Object at 15%

## LOW SENSE MODE


**Scene 4.** Low Sense Mode at 365°F with no color


**Scene 5.** Low Sense at 500°F and Heat Seeker color


**Scene 6.** Low Sense with Temp Measurement at 740°F

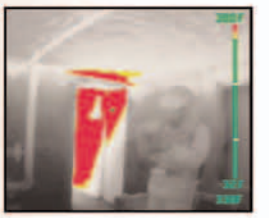
# Decision Time.

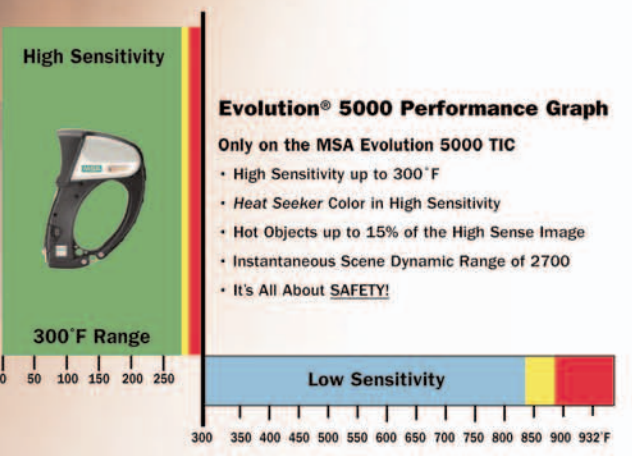
## One of Your Most Critical Command Decisions: Choosing The Right TIC.

**When every second counts,** you need fast, reliable performance from your most critical tools. That's why it's so important to choose the leader in thermal imaging performance – **MSA's Evolution® 5000 Thermal Imaging Camera.**

The Evolution 5000 TIC gives leading-edge professionals the durability and critical performance needed for real-world firefighting.

- Immediate start-up, easy integration and ergonomic design keep the Evolution 5000 TIC available and ready to work when you are.
- High-impact construction and an internally housed battery system protect the camera's crucial components from the harsh firefighting environment.
- A wide field of view and highly functional Heat Seeker and dual-mode Quick-Temp options provide a comprehensive display of fire-scene information in high- and low-temperature environments.






**Evolution® 5000 Performance Graph**

**Only on the MSA Evolution 5000 TIC**

- High Sensitivity up to 300˚F
- *Heat Seeker* Color in High Sensitivity
- Hot Objects up to 15% of the High Sense Image
- Instantaneous Scene Dynamic Range of 2700
- It's All About SAFETY!

MSA Be Sure. Choose MSA.

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