1 WHAT IS A THERMAL IMAGING CAMERA?

The thermal imaging camera (TIC) is a tool which:

- detects infrared radiation from thermal energy emitted by a body, an object, a surface, or an area (heat waves invisible to the naked eye)
- records infrared radiation
- and transcribes this infrared radiation by displaying it on a screen so that the user can view this infrared radiation, analyze it and interpret it.

Thermal imaging cameras (TIC's) for firefighters produce an image of the intensity of the thermal radiation detected. Each colorization mode has its own color palette.

Example:

- Colors used in Fire mode = black, white, yellow, orange and red.
- Colors used in Cold mode = black, white and blue.

Thus, the same observed scene can produce a different image depending on the colorization mode used.

2 WHAT IS THE PURPOSE OF A THERMAL IMAGING CAMERA FOR FIREFIGHTING / SEARCH AND RESCUE?

2.1 For Firefighting: Secure the firefighters in action and avoid traps

The firefighting thermal imaging camera is useful for firefighters in the following situations:

- Easier recognition and movement in a room invaded by smoke where it is impossible to see with the naked eye
- The rapid search / detection of the fire source or a smoldering fire
- Identification of dangerous elements that could threaten the safety of firefighters / rescuers:
    - Presence of gas cylinders
    - Monitoring an overheating electrical circuit
    - Identification at distance of the liquid level in a tank (fuel tanks, unloading of wagons or tanks, transport of hazardous materials, etc.) to collect the information necessary for the intervention
    - Locate a hydrocarbon stain on the roadway following a road accident in the middle of the night
- Location of ventilation points

- Identification of residual hot spots after a fire has been extinguished (chimney fire, etc.) that could cause a new start of fire!
- Search for emergency fallback routes in a smoky environment

2.2 For Search and Rescue: Identify / locate victims ...

2.2.1 …in a smoky atmosphere, in the dark

The thermal imaging camera for firefighters allows the rapid identification of unconscious victims who are difficult to spot with the naked eye due to the opaque smokes.

2.2.2 … during road accidents

They provide the ability to assess the number of passengers in a vehicle involved in an accident by visualizing the heated seats by the person (s) and more quickly identify road accident victims who have been thrown from a vehicle in the middle of the night by looking for the victim in fields for example.

2.2.3 ….during earthquakes, landslides, collapses

The portable thermal imaging cameras also allow the ability to easily spot unconscious victims in the dark, where a standard search camera will show nothing on the screen.

2.2.4 ….in the sea, in the mountains and in the desert

Widely used by coast guards and rescuers, in particular for looking for people overboard, LEADER TIC Long Range thermal imaging cameras (which can detect a victim up to 1000 m) are also used for looking for victims (skiers / hikers) in high mountains.

3 HOW TO CHOOSE A THERMAL IMAGING CAMERA / WHAT ARE THE MOST IMPORTANT SELECTION CRITERIA FOR A THERMAL IMAGING CAMERA FOR FIREFIGHTERS / RESCUERS AND WHY?

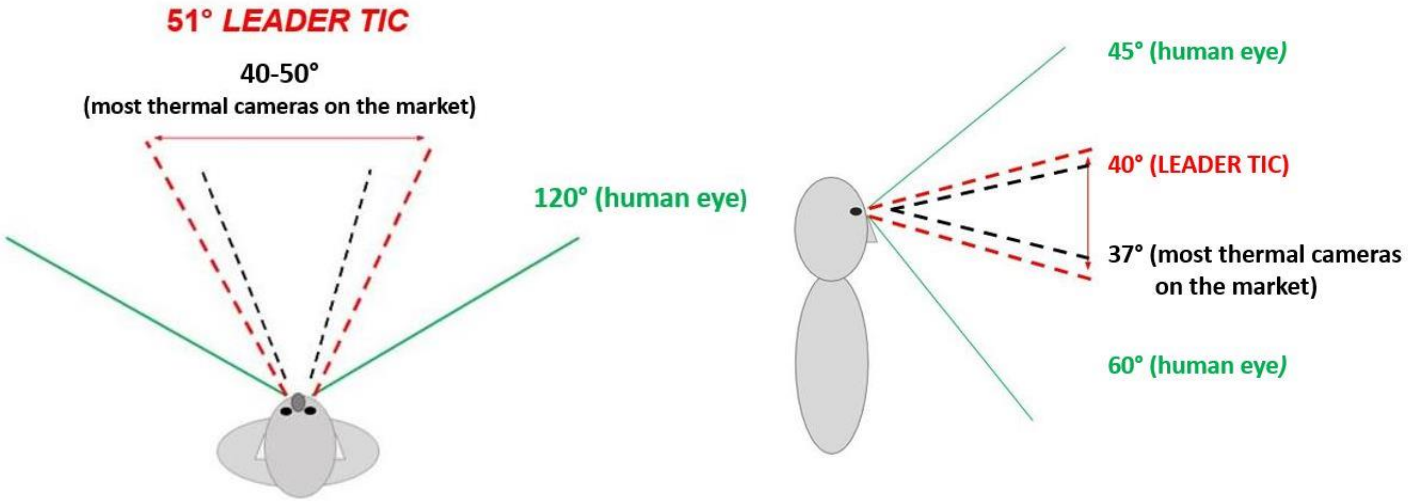
Thermal imaging cameras are now used in many fields such as industry (e.g. monitoring of engine overheating of machines), military, surveillance and security (detection of intruders), buildings (e.g. energy diagnostics), etc...

However, the choice of a thermal imager depends on the application for which it is intended.

In addition to ergonomics, compactness, size, resolution and sensitivity of the sensor, the resistance of the camera and its battery to high temperatures... the most important criteria for the selection of a firefighting thermal imaging camera are as follows:

3.1 The field of vision must be as wide as possible

Typically, human binocular vision is in the range of 120° horizontally and 105° vertically (45° up and 80° down). This vision will be reduced by wearing a breathing apparatus mask and will be further reduced with a thermal imaging camera.



As the use of the camera is most often done while wearing a breathing apparatus, the attack team will therefore have to use "scanning" techniques in order to collect as much information as possible during this recognition phase.

The scan technique, whether done in strip, Z, X or 6-sided, must be done with rigor and repeated during the recognition phase, to allow the construction of a mental image of the progress. The combination of repeated scans and progressions without a camera will allow to identify dangers.

The LEADER TIC cameras have a viewing angle that is among the highest on the market, 51° horizontally and 40° vertically, thus making it possible to scan an intervention area more quickly.

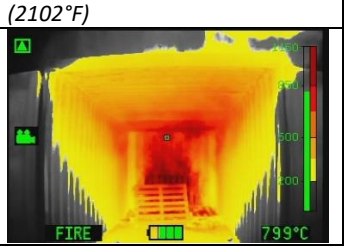
3.2 The temperature range should be as wide as possible

In the case of a “Firefighting” thermal imaging camera, it is important to choose a camera with a wide temperature range in order to guarantee the reliability of the device and especially the safety of firefighters.

- ***To avoid image saturation:***

A camera equipped with a wide temperature range going beyond 1000°C *(1832°F)* allow to analyze all the situations encountered without risk of saturation (inability to discern the observed scene).

Indeed, when the maximum detection temperature of the camera is exceeded, the image is saturated and it is no longer possible to

Saturated image = situation impossible to analyze Max T°C threshold: 650°C *(1202°F)*	*Unsaturated image = understandable situation* Max T°C threshold: 1150 ° C *(2102°F)*
	

clearly see the contrasts on the camera screen, thus making it impossible to read / understand the situation.

- ***<u>To avoid bad reading / misunderstood / misinterpretation of the intervention scene and thus endanger the rescue teams:</u>***

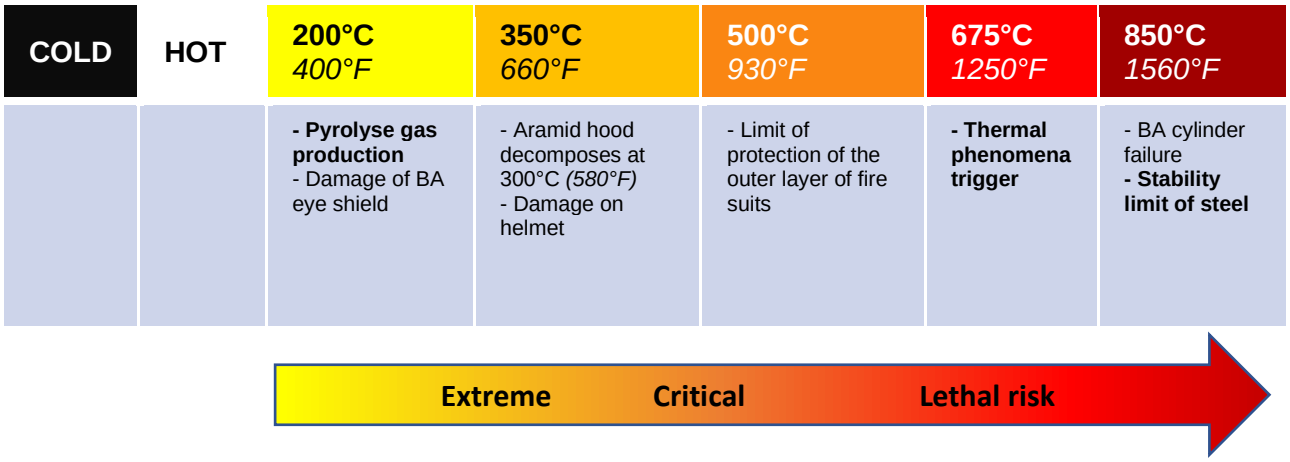
Depending of the temperature range, it will not be possible for the firefighter to analyze all the elements of the observed scene.

A thermal camera with a temperature range of up to 450 or 500°*C (842 to 932°F)* will not be able to:

- Understand perfectly the triggering of a flash-over occurring between 600 and 650°C *(1112 to 1202°F)*
- Analyze the risk of collapse of a metal structure building knowing that steel loses all stability from 850°C *(1562°F)*.

Even for first responders, it is necessary to be equipped with a firefighting equipment that can warn them of a danger!

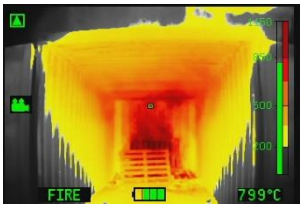
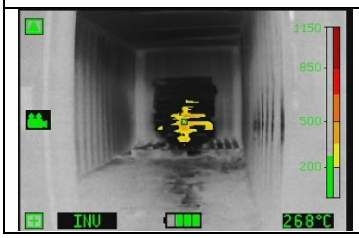
LEADER has chosen to equip its portable thermal imaging cameras for firefighters with the widest temperature range on the market (from -40°C to + 1150°C) *(-40 to + 2102°F)* in order to give firefighters the opportunity to analyze all the situations encountered.



3.3 <u>The color modes must be complementary</u>

The use of several color modes allows the user to analyze the observed scenes with greater precision in order to facilitate understanding (temperature level, smoke propagation, traffic axis, danger, etc.). This is why it is important to have the ability to change the colorization mode, in order to highlight other unseen elements.
LEADER offers up to 5 colorizations modes on its LEADER TIC cameras: Fire, Search, Inverse, Cold and Multicolor. Each colorization mode has its advantages, disadvantages and limitations.

It is therefore essential to know the specificities of each mode in order to choose the most suitable according to the situation encountered. This is why the training of the users is essential for a good understanding of the observed image.

FIRE MODE	SEARCH MODE	MULTICOLOR MODE
		
INVERSE MODE	COLD MODE	
		

FIRE MODE	SEARCH MODE	MULTICOLOR MODE
		
INVERSE MODE	COLD MODE	
		

4 *THE IMPORTANCE OF TRAINING*

As with any firefighting equipment, it is important that the firefighter is trained to properly use their thermal imaging camera. Indeed, this knowledge will allow them to fully understand the situations encountered during interventions by integrating into their analysis the information obtained thanks to the thermal imaging camera.

Since training is too often forgotten, it turns out that many firefighters do not always appreciate the value of their thermal imaging cameras and are unable to use them properly. It is for this reason that thermal cameras are too often left in trucks and are therefore underused.

As you have clearly seen from the few examples given throughout this article, it is very important to be trained in the use of the firefighting thermal imaging camera but it is also just as important to be trained in the interpretation of thermal images.

LEADER, manufacturer of thermal imaging cameras specifically designed for firefighting, assists all its customers in choosing the thermal imaging camera that best suits their needs and also trains them in the use of its firefighting equipment.

Wishing to join the firefighters and rescuers in a process of acquiring knowledge for the use of thermal cameras, LEADER also trains all its customers in the interpretation of thermal images so that they can use all the potential of this powerful equipment!

Find info on LEADER website www.leader-group.company!