



Thermal imaging cameras: a cost-effective solution for perimeter protection

Today, the challenge for CCTV professionals is to make sure that video footage is effective on a 24/7 basis, 365 days a year. Securing an area during the daytime is one thing. But what happens during the night? And in weather conditions like fog, rain and snow? What can be detected if CCTV cameras are blinded by the sun?

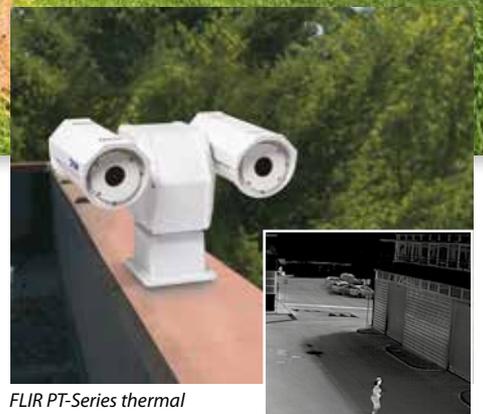
As CCTV systems become more advanced, the security industry will increasingly focus on CCTV installations for 24 hour surveillance, not just day-time operation. To be truly secure, a site must be protected day and night.

A number of tools are available to help detect potential intruders in the dark. Often different technologies are being combined to create a secure perimeter. Fences can be complemented with Closed-Circuit Television (CCTV) systems with or without active infrared illumination or old fashioned light bulbs, Radio Frequency Intruder Detection (RFID) systems, thermal imaging cameras and/or walking patrols.

Whatever solution or technology is chosen for securing an area, they all have their advantages and disadvantages and some technologies are more expensive than others. To get a full picture of the Total Cost of Ownership (TCO) for a

certain solution, not only the initial purchase cost, but also the installation and maintenance costs need to be considered. Some solutions consume a lot of power and need a lot of spare parts. Environmental and energy consumption issues are high on the global agenda today. Given that €1 from every €5 spent globally is used on lighting, and much of this is spent on inefficient and unnecessary lighting, particular attention should be paid to this area. Saving energy by looking at running costs will become increasingly important. Local authorities and private industries are all looking at methods to save energy costs and lighting is one area that will receive due attention.

Quite a number of technologies are available to help detect potential intruders in the dark before they become a real hazard. Let's compare some of them:



FLIR PT-Series thermal imaging camera



FLIR FC-Series S



FLIR SR-series



The total cost of seeing at night



Closed-circuit television (CCTV) combined with traditional lighting

CCTV systems have been an effective tool for security and surveillance applications. However, just like the human eye, CCTV cameras do not see too much in total darkness. So in order to detect intruders at night they are often complemented with traditional lights by mains driven bulbs. Although some bulbs (fluorescent lamps, HID lamps) are more efficient than others, the operational cost remains very high. Light can only penetrate a certain distance and completely illuminating an area, so that it can be kept under surveillance of CCTV cameras, is not always possible. Powering and maintaining the lights can even be more costly.

CCTVs with traditional lamp lighting require lamp replacement every 2,000 to 4,000 hours or about every 8 months. Significant labour and material costs are associated with lamp replacement.

Light pollution is a global problem caused by inefficient, intrusive and unnecessary use of artificial light. Symptoms include glare, clutter over-illumination and sky glow. Light pollution is an increasingly hot political topic given recent government legislation to control and punish light pollution. In some locations light is also considered to be too intrusive.

Furthermore, lighting essentially lays out a route of attack for intruders, creating shadows in which they can hide and access undetected.



Closed-circuit television (CCTV) combined with LEDs

Compared to any bulb, LEDs provide significant savings on electrical consumption. LEDs also provide long life performance with little ongoing maintenance costs.

Infrared illumination with LEDs, sometimes also called active infrared, beams infrared radiation into the area in front of a camera. The LEDs are often placed around the lens of the camera.

LED illumination is compromised by limited range performance. Also, providing lighting for domes has long been a challenge for CCTV professionals as the lighting cannot be fitted to move with the camera.



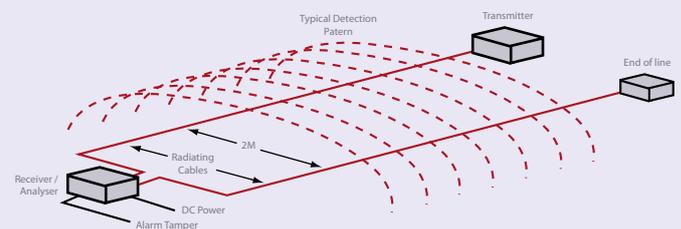
Electrified fences

In order to keep intruders out of certain areas, fences can be constructed. To further increase security, fences can be equipped with sensors that generate an automatic alarm when someone touches the fence. Or they can be electrified, to keep intruders away.

In all cases, fences need to be complemented, for example by CCTV cameras or walking patrols in order to see what is happening around the fence.

Radio Frequency Intruder detection (RAFID)

The simplest description of RAFID is to consider a system using two specially designed cables – one transmitting a radio wave, while the other receives that wave.



Changes in the amount of signal passing between the transmitter cable and receiver cable are analyzed by a signal processor. These changes indicate that someone or something is between the two cables, which will make an alarm go off. Due to the difference in signal strength, the system can detect whether these changes are due to the presence of a human, a small animal, ...

Note that in a lot of cases CCTV cameras still need to be installed in order to see what is generating a real, or false, alarm.



Thermal imaging

A new tool for seeing in total darkness, and in extreme weather conditions, is thermal imaging. Thermal imaging is the use of a thermal imaging camera to "see" thermal energy emitted from an object. Thermal imaging cameras produce images of invisible infrared or "heat" radiation. Based on temperature differences between objects, thermal imaging produces a crisp image on which the smallest of details can be seen. They work both during daytime and nighttime.

Most FLIR Systems thermal imaging cameras contain an uncooled Vanadium Oxide detector. Not only does this produce excellent quality thermal images, since it is not containing any moving parts, it needs virtually no maintenance. Thermal imaging technology requires no additional lighting or illumination and has no regular maintenance costs.



FLIR PT-Series thermal imaging camera

FLIR F-Series thermal imaging camera



Deciding which technology to use

Before making a final decision about which technology will be implemented to secure a perimeter at night, security managers should have a look at the advantages and disadvantages of each technology.

This is outlined in the table below.

	Advantages	Disadvantages
CCTV with traditional lighting or LED	<ul style="list-style-type: none"> - Good visibility during daytime - Relatively low initial cost 	<ul style="list-style-type: none"> - A lot of cameras need to be installed to cover a large perimeter - Limited detection at night. Light illuminates only certain small area. - Limited capabilities in fog, rain, ... - Civil works need to be carried out to install light poles - High power consumption - High maintenance cost for replacing the lights: material and manpower
Electrified Fence	<ul style="list-style-type: none"> - Creates a physical barrier - Allows to stop intruders - Works during the night as well 	<ul style="list-style-type: none"> - High installation cost - Full civil works needed - Power consumption - Needs to be complemented with CCTV to see if alarm is false or not. Light or infrared illumination needed during the night to do this.
RFID or Sensor Cable	<ul style="list-style-type: none"> - Fully automated system - Works in total darkness 	<ul style="list-style-type: none"> - High installation cost - Full civil works needed - Troubleshooting and maintenance after installation - Many unwanted alarms - Needs to be complemented with CCTV to see if alarm is false or not. Light or infrared illumination needed during the night to do this.
Thermal imaging	<ul style="list-style-type: none"> - Full awareness - Can be used day and night - Works in practically all weather conditions. Can see through light fog, rain, smoke, ... - No downtime, low maintenance - Low power consumption - Extremely difficult to hide from since thermal contrast in practically impossible to mask 	<ul style="list-style-type: none"> - No physical barrier - Potential intruders are easily spotted but not identified

Case study : lower investment for thermal imaging

As is shown in the advantages and disadvantages table on the previous page, thermal imaging cameras have many advantages for perimeter protection. To make a final decision, however, the purchase cost of the system needs to be considered.

Below you'll find a comparison between the required number of units for perimeter protection systems based on CCTV cameras versus systems based on thermal imaging cameras. In this simplified example, the cost of personnel and equipment during the installation and the cost in maintenance and power bills are not included, as they might vary strongly depending on available infrastructure,

local power rates and local wages. In all cases these costs will be directly proportional to the amount of equipment and on the usage of lighting.

Assumptions:

- An industrial perimeter of 700 meters needs to be protected with the perimeter protection system.
- The perimeter needs to be secured day and night, in all weather conditions. This means that CCTV cameras are limited in terms of distance that can be covered by the infrared illuminators.

Even though the price of one single thermal imaging camera might be higher than the price of a CCTV camera, the overall investment costs for a thermal imaging camera perimeter protection system is actually lower, in this case 28% lower. The larger the perimeter, the bigger this difference will become. Since thermal imaging cameras require no lighting to function and given the fact that fewer cameras are needed with the thermal imaging perimeter protection solution, this system will also consume less electricity than the CCTV solution, making the thermal solution less expensive in its upkeep than the CCTV solution.

CCTV cameras	units
D/N Camera with outdoor housing and 19 mm lenses	12
Pole and pole basement	12
IR Lamp	12
Video Analytics License	12
Input on DVR or nDVR	12

Thermal imaging cameras	units
FLIR FC-324 S camera	5
Pole and pole basement	5
IR Lamp	0
Video Analytics License	5
Input on DVR or nDVR	5

Monitoring this 700 m perimeter would require either 12 CCTV cameras or only 5 thermal imaging cameras.



Even though the price of one single thermal imaging camera is higher than the price of a CCTV camera, in this example the total investment costs for a thermal imaging camera perimeter protection system is 28% lower.

Conclusion

Although all technologies have advantages and disadvantages a small calculation makes it clear that thermal imaging is a very good and a very cost effective solution for protecting a perimeter, especially if this perimeter, like in practically all cases, also needs to be protected during the night.

In this technical note, we have demonstrated that for thermal imaging systems, not only maintenance costs are lower (power, spare parts, etc.), but already the initial purchase cost of a thermal system is lower than a CCTV system.

Although a single thermal imaging camera is more expensive than a CCTV camera, fewer

cameras need to be deployed to cover the same area. The civil works that need to be carried out are minimal. In some cases, the cameras can even be mounted on existing structures. Furthermore, since thermal imaging cameras produce a clear image in the darkest of nights, no complementary technologies like lighting or infrared illuminators need to be installed. Not only does this limit the amount of civil works that needs to be carried out, it also reduces the maintenance cost.

Thermal imaging cameras also generate fewer false alarms which is a common problem with CCTV cameras combined with Video Motion Detection or Video Content Analysis software.



For more information about thermal imaging cameras or about this application, please contact:

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