

ACTi

Physical Security End-to-End Solution Provider

A decorative graphic on the right side of the page. It features several overlapping circles in shades of orange, teal, and light blue. A series of thin, white diagonal lines runs from the top right towards the bottom left, passing through the circles.

THERMAL SURVEILLANCE

A practical white paper for perimeter protection, fire prevention, equipment monitoring, and AI-enabled security operations

Prepared by ACTi Corporation
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Document purpose

This white paper explains the value of thermal surveillance for professional security projects and positions ACTi thermal cameras as part of an integrated video surveillance ecosystem. It is written for system integrators, consultants, security managers, facility managers, and procurement teams.

1. Executive Summary

Thermal surveillance expands traditional video security by detecting heat signatures rather than relying only on visible light. This makes it valuable in environments where normal cameras struggle: total darkness, glare, smoke, fog, long-distance perimeter monitoring, and early-stage overheating events. Instead of waiting until an incident becomes visually obvious, a thermal camera can identify abnormal temperature patterns and trigger alarms for faster intervention.

For end users, the strategic value is straightforward: detect security and safety risks earlier, reduce dependence on manual observation, and preserve visual evidence for incident verification. For system integrators, the value is a broader solution portfolio: thermal surveillance can be sold not only as perimeter protection, but also as fire prevention, equipment protection, restricted-area enforcement, and operational risk control.

ACTi's thermal surveillance positioning combines thermal imaging, visible-light verification, event transmission to NVR/CMS platforms, and multiple camera form factors. ACTi's product information highlights dual-sensor designs, thermal sensors operating in the 8-14 μm range, NETD performance down to less than 35 mK, visible imaging up to 4 MP, AI analytics, and long-range detection for wide-area applications. These capabilities make thermal surveillance suitable for industrial, commercial, infrastructure, government, logistics, energy, and public-area projects. [1][2]

Core message

Thermal surveillance should not be evaluated only as a camera specification. It should be evaluated as an event-driven risk-reduction system: detect heat, classify risk, notify operators, verify visually, record evidence, and trigger a response workflow.

Key takeaways

- Thermal surveillance is strongest when visible-light cameras are limited by darkness, smoke, fog, glare, distance, or visual clutter.
- The most important technical factors are thermal sensitivity, thermal resolution, lens/field of view, detection range, temperature measurement method, event rules, and VMS/NVR integration.
- Bi-spectrum cameras combine thermal detection with visible image verification, helping operators understand what triggered an alarm.
- Thermal analytics can support fire detection, overheating detection, intrusion detection, smoke detection, body-temperature screening, and smoking detection depending on camera type, firmware, and configuration.
- Deployment quality matters: camera placement, target size, lens choice, calibration, alarm thresholds, environmental conditions, and response SOPs can be as important as the camera form factor.

2. About ACTi Corporation

ACTi Corporation is the writer and publisher of this document. ACTi is a Taiwan-based international company founded in 2003 and serving customers in more than 100 countries. ACTi positions itself as a physical security end-to-end solution provider with a portfolio that includes IP cameras, analog cameras, network video recorders, hybrid DVR, VMS software, workstation applications, web clients, access control, central management, system health management, and integration with third-party systems. [3]

In video surveillance, ACTi provides cameras, recording platforms, standalone and software-based VMS options, and integration paths for real-time video verification. In access control, ACTi supports management of people and vehicle access through readers, door stations, and integration with video systems. In control center deployments, ACTi's Central Management System is designed for multi-site monitoring, TV wall operation, and large project scalability. [3]

ACTi also emphasizes AI-enabled security. Its AI portfolio includes deep-learning cameras and analytics functions that support detection, tracking, counting, classification, recognition, and identification of people, faces, vehicles, license plates, and other object types. For thermal surveillance, this broader ecosystem matters because temperature-based alerts become more useful when they can be recorded, verified, searched, escalated, and integrated into the operator workflow. [3]

Why ACTi is relevant to thermal surveillance projects

ACTi strength	Project relevance
End-to-end system scope	Thermal cameras can be planned together with VMS, NVR, CMS, access control, alarms, and third-party systems instead of being treated as isolated devices.
Security-industry experience	ACTi's corporate materials state more than 20 years of security-industry experience and adoption across vertical markets. [3]
AI and metadata direction	Thermal events become more actionable when combined with AI analytics, event metadata, and central monitoring workflows.
Integrator-friendly portfolio	Multiple camera form factors allow system integrators to match thermal surveillance to different installation sites and budget levels.

3. What Thermal Surveillance Means

Thermal surveillance uses infrared radiation emitted by objects to form an image or trigger an alarm. Because it is based on heat rather than visible light, thermal imaging can detect people, vehicles, equipment, smoke/fire conditions, or abnormal heat patterns even when conventional cameras cannot capture a reliable image. ACTi describes thermal surveillance as useful for night vision, zero-light operation, and operation through smoke, fog, and adverse weather. [1]

For security operations, this changes the camera's role. A standard visible-light camera is often evidence-first: it helps operators see what happened. A thermal camera is often event-first: it detects a risk condition, generates an alarm, and then enables the operator or VMS to verify and respond. In many deployments, the best design is to use both: thermal detection for reliable event initiation and visible imaging for recognition, identification, and color evidence.

Thermal vs. visible-light surveillance

Dimension	Thermal surveillance	Visible-light surveillance
Primary signal	Infrared radiation / heat signature	Reflected visible light
Strength	Detection in darkness, low visibility, smoke/fog, glare, and some long-range environments	Human-readable detail, color evidence, facial/object appearance, signage, license plates under suitable lighting
Common weakness	May not provide facial identity or color evidence; performance depends on thermal contrast, lens, distance, and calibration	Reduced performance in darkness, backlight, smoke, fog, heavy rain, and visual clutter
Best role	Early detection and risk alerting	Visual verification and forensic evidence
Best combined use	Thermal detects; visible camera verifies; VMS records and escalates	Visible camera provides evidence and operator context

In bi-spectrum designs, one sensor captures thermal information while another captures standard visible video. ACTi identifies this combination as a way to pair thermal event accuracy with visual proof. [1]

4. Core Technical Concepts

Thermal surveillance decisions should be made from both a security perspective and an imaging-performance perspective. The following concepts help procurement teams compare products accurately and avoid under-designed deployments.

Concept	Practical meaning
NETD	Noise Equivalent Temperature Difference. It indicates the smallest temperature difference a thermal camera can distinguish. Lower NETD usually means higher thermal sensitivity. ACTi's technology page gives an example of distinguishing 36.04°C from 36.00°C with a 40 mK camera. [1]
Thermal resolution	The number of thermal pixels available for detecting heat patterns. Higher thermal resolution helps when targets are smaller, farther away, or require more thermal detail.
Spatial resolution / IFOV	A measure of how much physical scene area each detector pixel covers. Smaller IFOV generally supports better detail at distance. ACTi explains spatial resolution as related to pixel pitch and optics. [1]
Wavelength range	Thermal cameras commonly operate in LWIR 8-14 μm or MWIR 3-5 μm. ACTi states LWIR is well suited to passive human detection, while MWIR fits high-temperature industrial use cases. [1]
Temperature rules	Point, area, and line-based rules can be used to monitor thermal conditions. ACTi's product data lists temperature measurement by point, area, and line for selected camera types. [2]
Thermal event types	Events may include fire alarm, smoke alarm, overheating alarm, high body temperature alarm, intrusion, or smoking behavior depending on the camera type and analytics configuration. [1][2]
Bi-spectrum verification	Thermal and visible sensors together provide thermal alerting plus visual context for incident verification and evidence.

Specification interpretation

A single specification rarely determines real-world performance. For example, a camera with good thermal sensitivity but an unsuitable lens may still miss small targets at distance. A high-resolution visible channel does not automatically improve thermal detection. A long stated detection range may apply only to specific target sizes, environmental conditions, and detection criteria. Thermal projects should therefore validate target size, distance, angle, background, expected temperature contrast, and required alarm confidence during site design.

Procurement warning
 Do not compare thermal cameras only by megapixels. Thermal resolution, NETD, lens, IFOV, analytics, alarm rules, environmental rating, and VMS integration are often more relevant to the success of a thermal surveillance project.

5. High-Value Applications

ACTi identifies several thermal surveillance applications, including fire detection, overheating detection, smoke detection, enhanced intrusion detection, human body temperature detection, and smoking detection. [1][2] These applications can be grouped into three operational categories: life safety, asset protection, and security enforcement.

Application	Operational value	Typical locations
Fire detection alert	Detect temperature conditions that exceed configured fire thresholds and send early alarms before visible flames may be obvious.	Warehouses, logistics centers, recycling sites, factories, power facilities, parking structures, public infrastructure
Overheating detection	Monitor equipment, cabinets, electrical panels, motors, storage areas, or process zones for abnormal heat buildup.	Factories, data rooms, electrical rooms, substations, production lines, battery storage areas
Smoke detection	Support early fire warning when smoke or abnormal thermal/visual cues appear, depending on camera capability and scene setup.	Warehouses, schools, public buildings, transportation sites, parking lots
Enhanced intrusion detection	Detect people or vehicles in total darkness or visually difficult perimeter areas.	Fences, yards, borders, ports, military sites, solar farms, utilities, construction sites
Human body temperature detection	Screen for elevated body temperature using dedicated thermal camera configurations tuned for small variances.	Entrances, checkpoints, lobbies, schools, government facilities, hospitals, factories
Smoking detection	Identify smoking behavior in restricted or high-risk areas where policy enforcement or fire prevention is important.	Factories, chemical storage, campuses, public transportation areas, hospitals, warehouses

Value by stakeholder

Stakeholder	Main benefit
Security manager	Fewer blind spots, earlier alerts, improved perimeter response, better night operations.
Facility / EHS manager	Early warning for overheating, fire, smoke, or unsafe behavior in critical areas.
Control room operator	Event-based monitoring reduces dependence on continuously watching many live feeds.
System integrator	Thermal surveillance creates higher-value solution opportunities beyond standard camera replacement.
Procurement team	A well-scoped thermal system can reduce risk, reduce false dispatch, and improve asset protection.

6. System Architecture and Event Flow

From an NVR or VMS perspective, thermal cameras can behave like standard IP surveillance cameras because thermal video is digitized in the camera and delivered using standard streaming protocols. ACTi notes that bi-spectrum thermal cameras can send both thermal video and visual video streams, while NVR systems can receive events such as fire alarms, smoke alarms, and high body temperature alarms. [1]

Typical event-driven workflow

- 1 Detect - The thermal sensor monitors heat signatures in the scene.
- 2 Analyze - The camera applies configured rules, thresholds, or analytics to identify abnormal conditions.
- 3 Trigger - When conditions are met, the camera sends an event to the NVR/VMS/CMS.
- 4 Verify - Operators use visible video, thermal video, maps, event clips, or adjacent cameras to verify the incident.
- 5 Respond - The organization follows SOPs such as dispatching guards, notifying EHS, activating access control, or escalating to emergency services.
- 6 Record - Video, event metadata, snapshots, temperature values, and operator actions are retained for investigation and audit.

Reference architecture

Layer	Role in thermal surveillance
Field layer	Thermal cameras, bi-spectrum cameras, PTZ thermal cameras, visible cameras, access control readers, alarms, sensors, intercoms.
Network layer	PoE switches, fiber/uplink infrastructure, VLAN segmentation, cybersecurity controls, and bandwidth planning.
Recording layer	NVR/VMS receives thermal and visible streams, events, snapshots, and metadata; stores video evidence.
Management layer	CMS/control center aggregates events across sites, displays maps/TV wall views, and supports centralized response.
Response layer	Operator SOPs, guard dispatch, notifications, alarm outputs, third-party integration, and reporting.

Integration principle

Thermal surveillance creates value when the alarm is connected to a response workflow. A camera that detects overheating is useful; a camera that detects overheating, records evidence, alerts the right people, and guides action is a solution.

7. ACTi Thermal Camera Portfolio Overview

ACTi's thermal camera page positions the portfolio as dual-sensor thermal imaging plus visible light monitoring for complete situational awareness. ACTi states that its thermal camera portfolio includes visible imaging up to 4 MP, thermal sensors in the 8-14 μm range, NETD performance below 35 mK, spatial resolution from 2.74 to 5.71 mrad, detection range up to 2 km, built-in AI analytics, and camera choices including bullet, turret, PTZ, positioning systems, cube cameras, and specialized bi-spectrum form factors. [2]

Portfolio categories

Category	Where it fits
Thermal cube	Compact thermal/visual monitoring for indoor or focused-area applications such as equipment monitoring or temperature detection.
Thermal bullet	Outdoor fixed-view monitoring for perimeters, yards, industrial areas, entry zones, and line/area temperature rules.
Thermal turret	Outdoor fixed-view form factor suitable where compact appearance and flexible installation are required.
Thermal PTZ / speed dome	Movable long-range monitoring for wide areas, patrol paths, perimeter scanning, and operator-controlled investigation.
PTZ positioning system	Long-range positioning platform for large outdoor sites where high optical zoom and rugged aiming are important.

Thermal product types and form factors

Product type	Form factor / role	Use-case fit
Bi-spectrum bullet cameras	Fixed outdoor thermal + visible monitoring	Fire detection, overheating detection, intrusion detection, and general perimeter thermal surveillance.
Outdoor thermal turret cameras	Compact fixed-view outdoor installation	Sites where a low-profile form factor and flexible mounting angle are preferred.
Thermal PTZ / speed dome cameras	Movable thermal surveillance with visual channel and optical zoom	Wide-area monitoring, patrol routes, perimeter scanning, and operator-controlled investigation.
PTZ thermal positioning systems	Long-range rugged positioning platform	Large outdoor sites, critical infrastructure, and wide-area perimeter applications.
Thermal cube cameras	Focused-area thermal monitoring	Equipment monitoring, indoor checkpoints, and temperature detection applications.

Product availability, detailed specifications, analytics support, and regional part numbers should be confirmed from the latest ACTi product pages, datasheets, and quotation documents before project submission.

8. Deployment and Procurement Guidance

Thermal surveillance projects are most successful when site design begins with the event to be detected rather than a specific camera name. A fire-prevention project, a fence-intrusion project, and an equipment-overheating project may all use thermal cameras, but their lens, mounting, rules, alarm thresholds, and validation criteria can be very different.

Design questions before selecting a camera

- What is the target event: human intrusion, vehicle intrusion, fire, smoke, overheating, elevated body temperature, smoking behavior, or general observation?
- What target size must be detected, and at what maximum distance?
- Will the target be stationary, moving, partially hidden, or mixed with hot/cold background objects?
- What environmental conditions must be handled: darkness, rain, fog, dust, smoke, sunlight, heat sources, reflections, vibration, or seasonal temperature change?
- Is thermal-only detection sufficient, or is visual image verification required?
- What response action should occur after an alarm: guard dispatch, siren, door lockdown, email, VMS popup, CMS event, or emergency escalation?
- What evidence retention period, metadata retention, privacy rules, and cybersecurity controls are required?

Procurement specification checklist

Procurement item	What to define
Detection objective	Specify what the system must detect, not only the camera type.
Thermal performance	Require NETD, thermal resolution, wavelength range, lens/FOV, IFOV/spatial resolution, and range assumptions.
Temperature measurement	Define point/area/line needs, temperature range, accuracy, thresholds, rules, and reporting format.
Verification	Require visual channel, adjacent visible cameras, snapshots, or event clips if operators need clear evidence.
Integration	Confirm event transmission to ACTi NVR/CMS or third-party VMS, including event names and metadata.
Cybersecurity	Define account management, firmware update process, network segmentation, secure protocols, and access control.
Environmental durability	Specify IP/IK rating, operating temperature, mounting accessories, cabling, surge protection, and maintenance access.
Acceptance testing	Define test target, test distance, pass/fail criteria, alarm latency, false alarm tolerance, and documentation.

9. Operational Best Practices

Thermal surveillance is an operational system, not only a device. The camera must be installed, configured, validated, monitored, and maintained in a way that matches the user's risk profile. The following practices help reduce false alarms and improve incident response.

Configuration and alarm tuning

- Use separate rule profiles for different zones, such as perimeter line crossing, equipment cabinet temperature, roof area, storage area, or smoking-restricted area.
- Set thresholds based on baseline measurements from the real environment, not only generic values.
- Avoid placing rules over reflective surfaces, exhaust vents, direct sunlight hotspots, moving machinery, or uncontrolled heat sources unless specifically intended.
- Use schedule-based rules where risk changes by time of day, work shift, or site operating status.
- Combine thermal alarms with visible verification to reduce unnecessary dispatch.
- Document the alarm meaning and response action in the VMS/CMS operator SOP.

Maintenance and governance

Practice	Reason
Periodic verification	Test alarm rules at defined intervals using approved test conditions and document results.
Lens and housing cleaning	Keep the field of view clear; dirt, water, obstruction, or incorrect housing can degrade performance.
Firmware control	Maintain firmware versions, release notes, update approvals, rollback plans, and cybersecurity review.
Operator training	Train operators to interpret thermal images, distinguish real alarms from environmental patterns, and escalate correctly.
Evidence review	Confirm that event clips, thermal streams, visible streams, snapshots, and metadata are retained as required.
Continuous improvement	Review false alarms, missed alarms, seasonal changes, and response time metrics to refine configuration.

10. Evaluation Checklist

Use the following checklist during site survey, proof-of-concept testing, tender preparation, or project handover. It is intentionally practical and can be adapted into an internal worksheet.

Area	Acceptance question	Done
Business objective	Risk and use case are clearly defined	<input type="checkbox"/>
Site survey	Distances, mounting points, angles, blind spots, and environmental conditions are documented	<input type="checkbox"/>
Target definition	Target type, size, speed, and required detection confidence are defined	<input type="checkbox"/>
Camera selection	Thermal resolution, NETD, lens/FOV, form factor, environmental rating, and visual channel are selected	<input type="checkbox"/>
Analytics	Required event types are confirmed for the chosen camera type, firmware, and configuration	<input type="checkbox"/>
Temperature rules	Point/area/line rules, thresholds, temperature range, and accuracy needs are confirmed	<input type="checkbox"/>
VMS/NVR integration	Video streams, event triggers, metadata, and alarm actions are tested	<input type="checkbox"/>
Cybersecurity	Accounts, passwords, network segmentation, update process, and secure access are reviewed	<input type="checkbox"/>
Acceptance test	Pass/fail criteria, test objects, distances, alarm latency, and reporting are agreed	<input type="checkbox"/>
Operations	SOP, escalation path, training, maintenance, and reporting are completed	<input type="checkbox"/>

Suggested POC success metrics

- Detection accuracy for agreed target types and distances.
- False alarm rate under normal operating conditions.
- Alarm latency from camera event to VMS/CMS operator notification.
- Quality of visible verification image or adjacent camera view.
- Operator response time and action completion rate.
- Evidence completeness: event clip, timestamp, thermal value, visible image, and operator notes.

11. Related Keywords and Terminology

The following keyword reference groups collect common terms related to thermal surveillance, thermal cameras, fire prevention, overheating detection, perimeter protection, and video security operations.

Core topic keywords

thermal surveillance, thermal surveillance camera, thermal camera, thermal imaging camera, thermal security camera, thermal monitoring camera, infrared surveillance, infrared camera security, heat signature camera, thermal video surveillance, thermal IP camera, thermal imaging security system, thermal detection camera, thermal monitoring system

Fire and safety keywords

fire detection camera, thermal fire detection, early fire detection camera, smoke detection camera, thermal smoke detection, overheating detection camera, equipment overheating detection, temperature monitoring camera, abnormal temperature alarm, thermal alarm camera, fire prevention surveillance, warehouse fire detection, factory fire prevention camera, electrical cabinet temperature monitoring

Security and perimeter keywords

perimeter intrusion detection, thermal perimeter camera, long range thermal camera, night vision thermal camera, zero light surveillance, darkness intrusion detection, outdoor thermal surveillance, fence line detection camera, border security thermal camera, critical infrastructure surveillance, wide area surveillance, thermal PTZ camera, thermal speed dome, thermal positioning system

Bi-spectrum and AI keywords

bi-spectrum thermal camera, dual sensor thermal camera, thermal visible camera, thermal and optical camera, AI thermal camera, AI video analytics thermal camera, people detection thermal camera, vehicle detection thermal camera, line crossing thermal camera, intrusion analytics thermal camera, thermal event detection, thermal metadata, thermal video analytics

Industry and vertical-market keywords

industrial thermal surveillance, factory thermal camera, logistics warehouse thermal monitoring, government thermal surveillance, campus thermal surveillance, transportation thermal camera, power plant thermal monitoring, utility site thermal surveillance, solar farm thermal surveillance, oil and gas thermal camera, parking lot thermal surveillance, rail station thermal camera, port security thermal camera

Specification keywords

NETD thermal camera, NETD less than 35mK, LWIR thermal camera, 8-14 μm thermal sensor, thermal camera spatial resolution, IFOV thermal camera, thermal camera temperature accuracy, thermal camera detection range, 640x512 thermal camera, 256x192 thermal camera, thermal camera point area line measurement, thermal camera visible 4MP, thermal camera VMS integration

Procurement and project keywords

best thermal surveillance camera, thermal camera for fire detection, thermal camera for perimeter security, thermal camera for warehouse, thermal camera for factory, thermal camera for equipment monitoring, thermal camera for security integrators, thermal camera NVR integration, ACTi thermal camera, ACTi thermal surveillance, ACTi thermal bullet camera, ACTi thermal turret camera, ACTi thermal PTZ camera, thermal surveillance white paper

Common question phrases

what is thermal surveillance, how does a thermal camera work, thermal camera vs night vision camera, thermal camera vs visible camera, how to detect fire with thermal cameras, how to monitor equipment overheating, how to choose a thermal camera, what is NETD in thermal cameras, what is LWIR thermal imaging, how far can a thermal camera detect, how to reduce false alarms in thermal surveillance

Additional related terms

thermal safety monitoring, heat detection system, infrared security monitoring, temperature anomaly detection, thermal alert workflow, thermal alarm verification, thermal video recording, thermal camera system integration, thermal surveillance for industrial sites, thermal surveillance for critical infrastructure, thermal surveillance for logistics sites, thermal monitoring for electrical rooms, thermal monitoring for substations, thermal surveillance for parking areas, thermal surveillance for public facilities, thermal camera event management, VMS thermal camera integration, NVR thermal camera integration, thermal camera deployment planning, thermal camera acceptance testing

12. Source Notes

This white paper is based on ACTi public source pages and general thermal surveillance system-design practices. Product details should always be reconfirmed against the latest ACTi datasheets, firmware release notes, regional availability, and quotation documents before formal project commitment.

Ref.	Source
[1]	ACTi Corporation, 'Thermal Surveillance', official technology page. URL: https://www.acti.com/technologies/thermal-surveillance . Accessed: May 5, 2026.
[2]	ACTi Corporation, 'Thermal Cameras', official product category page. URL: https://www.acti.com/products/thermal-cameras . Accessed: May 5, 2026.
[3]	ACTi Corporation, 'About ACTi', official corporate page. URL: https://www.acti.com/corporate . Accessed: May 5, 2026.

Revision note

This document is a marketing and technical education white paper. It is not a regulatory certification, safety standard, or final project design. Always validate detection performance in the target scene before deployment.

Prepared by ACTi Corporation

For thermal surveillance projects, confirm camera type selection, analytics capability, system integration, mounting accessories, and regional availability with your ACTi sales contact or authorized system integrator.

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