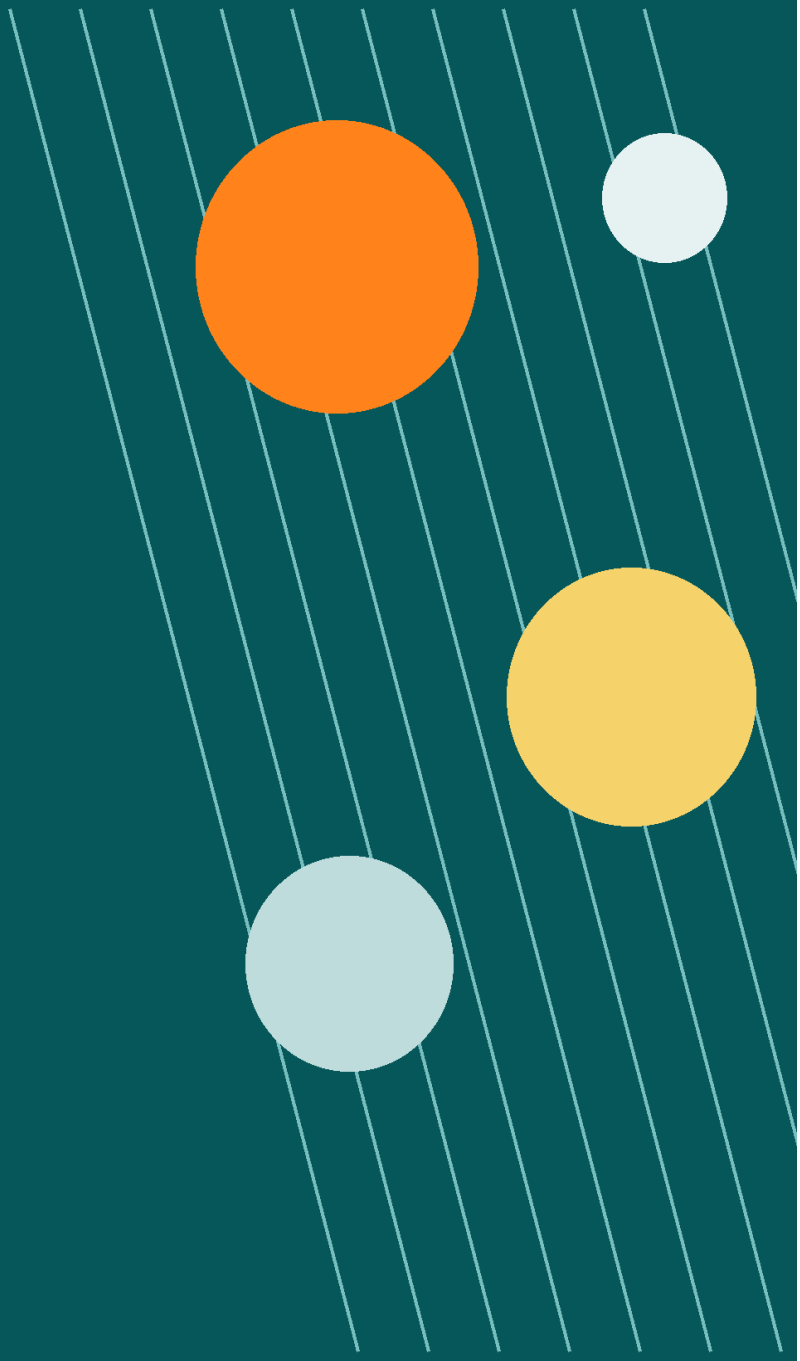
ACTi

Physical Security End-to-End Solution Provider

White Paper | Thermal Cameras

THERMAL CAMERAS

A practical white paper for heat-signature detection, fire prevention, perimeter security, and thermal-video system design



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Document purpose

This white paper explains what thermal cameras mean in professional video surveillance and how they should be specified, deployed, and evaluated. It is written for system integrators, consultants, security managers, facility managers, and procurement teams that need heat-signature detection, early fire-risk warning, equipment overheating monitoring, perimeter protection, and usable recorded evidence in challenging lighting conditions.

The document references ACTi public product information for the Thermal Cameras category and ACTi corporate information. It avoids model-specific naming so the content remains useful even as individual part numbers or product generations change.

Reading guide

Use Sections 3 and 4 to define thermal-camera requirements, Section 5 to map use cases, Section 6 to check architecture, and Section 7 to align ACTi thermal form factors with project needs.

1. Executive Summary

Thermal cameras help surveillance teams detect heat signatures that are difficult or impossible for standard visible-light cameras to capture. Instead of relying only on reflected light, thermal imaging detects infrared radiation and visualizes temperature differences across a scene. This makes thermal cameras valuable for early fire-risk warning, abnormal equipment-temperature monitoring, perimeter protection, low-visibility observation, and event verification.

ACTi describes thermal cameras as cameras that detect and visualize infrared radiation for capturing heat signatures in various environments. ACTi also highlights dual-sensor technology that integrates thermal imaging with visible-light sensors, allowing heat-based detection to be combined with higher-resolution visual verification. [1]

For system integrators, thermal cameras create differentiation when proposals are built around prevention, safety, and evidence workflow rather than only conventional video coverage. For consultants and end users, the correct specification should define detection objective, target size, target distance, field of view, temperature-measurement requirement, alarm thresholds, verification method, VMS/NVR integration, recording profile, and response procedure.

Core message

Core message: Thermal cameras should be specified as a complete detection and verification system. Thermal sensitivity, spectral range, spatial resolution, field of view, temperature rules, visible-light verification, analytics, alarm handling, storage, search, export, and operator workflow all affect whether the system can support prevention, response, and investigation.

Key takeaways

- Thermal value comes from detecting heat anomalies before they become visible incidents.
- Dual-sensor designs combine thermal detection with visible-light context for faster verification.
- Temperature monitoring should be specified by target, distance, accuracy, rule type, alarm logic, and environment.
- Thermal cameras are especially useful where darkness, glare, smoke, distance, or background clutter limits visible cameras.
- VMS/NVR integration, event recording, alarm notification, and evidence export are essential parts of a thermal-camera project.

Procurement principle: Do not specify thermal only as a camera type. Specify detection objective, thermal coverage, target distance, thermal sensitivity, visual verification, alarm output, recording, retention, review, export, and operator response together.

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 states that it has more than 20 years of security-industry experience and has been a pioneer in video-based security technology development and innovation. [2]

ACTi positions itself as a physical security end-to-end solution provider. Its ecosystem includes IP cameras, recording platforms, VMS, access control, central management, system health management, AI-enabled video technologies, and third-party system integration. [2]

This broader ecosystem matters for thermal-camera projects. A camera may detect abnormal heat, but the project succeeds only when operators can receive alarms, verify the visible scene, record the right stream, search events, export evidence, and maintain system health.

Why ACTi is relevant to thermal projects

ACTi strength	Project relevance
End-to-end system scope	Thermal cameras can be planned together with NVR, VMS, CMS, access control, alarms, third-party systems, and health management instead of being treated as isolated devices.
Clear video as a foundation	ACTi states that clear video is the basis of its solution evolution because smart technology depends on high-quality source video. [2]
AI-enabled platform	Thermal projects can combine heat-signature detection, visible-light verification, event metadata, detection, classification, tracking, and response workflow.
Compliance and project fit	ACTi public pages reference compliance considerations such as NDAA, TAICS, vertical-market requirements, and adaptable project needs. [2]

3. Definition of "Thermal Cameras"

A thermal camera is a video surveillance camera that detects infrared radiation and converts heat differences into a visual image. In practical security design, thermal imaging is used to detect heat signatures, abnormal temperature conditions, and objects or people that may not be clearly visible to standard cameras.

ACTi describes thermal cameras as devices that detect and visualize infrared radiation for capturing heat signatures. ACTi also states that its thermal cameras can combine thermal imaging and visible-light sensors to support both heat-based detection and incident verification. [1]

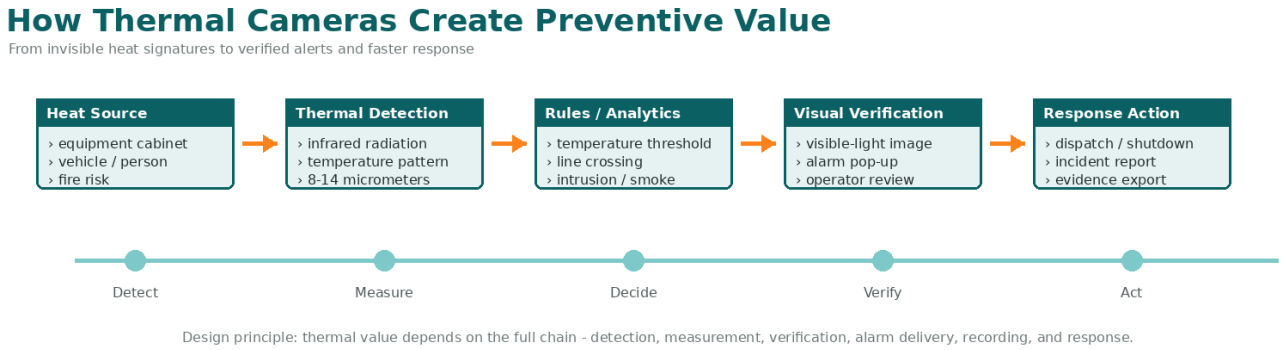
Project teams should treat thermal imaging as both a sensing method and an operational workflow: what heat signature matters, what temperature threshold triggers an alert, what visible image confirms the incident, who receives the alarm, and whether the recorded evidence is sufficient after the event.

Thermal cameras vs. related concepts

Term	Meaning	Common misunderstanding
Thermal camera	Camera that visualizes heat signatures by detecting infrared radiation rather than depending only on visible light.	It is not simply a night camera; thermal imaging is a different sensing method with different design rules.
Bi-spectrum camera	Camera type that combines thermal imaging and visible-light imaging for detection plus verification.	The thermal and visible channels should be specified together; one does not replace the other.
Temperature detection	Alarm or measurement function based on temperature changes, thresholds, or monitored zones.	A detection alarm is not automatically the same as a calibrated industrial measurement system.
Fire / overheating detection	Use of thermal patterns and temperature thresholds to warn about equipment overheating, smoke, or possible fire risk.	It supports early warning, but it does not replace fire-code systems, engineering controls, or safety procedures.
Thermal PTZ	Thermal-enabled PTZ form factor for moving observation across larger areas.	Movement capability still needs presets, coverage design, and operator response procedures.

Visual concept

Thermal detection is most useful when the system converts invisible temperature conditions into verified, actionable events. The diagram below summarizes the operational chain from heat source to response.



Design note

A thermal camera creates value when it can detect a relevant heat signature early enough for the organization to respond. The complete chain must be planned: scene coverage, temperature rules, thermal sensitivity, visible-light verification, alarm delivery, recording, playback, export, and response.

4. Core Technical Concepts

Camera selection should begin with the operational problem. The goal is to preserve usable thermal and visual information at the distance, angle, lighting condition, temperature condition, and response workflow that matter to the project. The following concepts help teams avoid under-designed specifications.

Concept	Practical meaning
Infrared radiation and spectral range	Thermal cameras detect infrared energy emitted by objects. ACTi references a thermal spectral range of 8-14 micrometers for its thermal sensor category. [1]
NETD and sensitivity	Noise Equivalent Temperature Difference indicates how small a temperature difference the sensor can distinguish. Lower NETD supports finer heat-pattern detection.
Thermal resolution and spatial resolution	Thermal resolution and spatial resolution affect how much thermal detail can be captured from the target at distance.
Field of view and target distance	A wide field of view covers more area, while narrower views can improve target detail. Specify distance, target size, and required detection outcome together.
Temperature rules and alarm thresholds	Rules may be based on points, areas, lines, thresholds, rate of change, or abnormal patterns. Alarm logic should match the operational risk.
Visible-light verification	Visible imaging supports object confirmation, scene context, incident review, and operator confidence after a thermal alarm.
Analytics and event metadata	People, vehicle, line-crossing, intrusion, smoke, and other analytics can improve alarm handling when scene design and target size are suitable.
Recording and evidence workflow	The system must record the intended thermal and/or visible streams, event metadata, timestamp, alarm result, and evidence export quality.

Specification interpretation

A thermal camera can still fail if the field of view is too wide, the monitored object is too small, thermal contrast is insufficient, the wrong alarm threshold is used, or alarms are not integrated into the operator workflow. Conversely, a moderate thermal design can perform well when target distance, field of view, rules, verification, recording, and response are planned together.

Capability matrix

Scene challenge to thermal-camera capability matrix

Match the monitoring problem with the full camera and system settings required for usable detection, verification, and evidence.

Scene challenge	What can go wrong	Capabilities to specify
Electrical cabinet overheating	The system sees the cabinet but does not measure or alarm on the relevant hot spot.	temperature-monitoring zones, point/area/line rules, threshold logic, alarm output, verification image
Early fire-risk detection	Heat, smoke, or abnormal temperature changes are missed until the incident becomes visible.	thermal sensitivity, fire/smoke analytics, alarm rule design, 24/7 recording, operator escalation
Large outdoor perimeter	Visible cameras lose targets in darkness, glare, fog, or background clutter.	long-range thermal detection, proper FOV, intrusion rules, line crossing, target-size validation
Industrial process safety	Hot equipment, pipes, or mechanical parts vary by normal operating cycle.	baseline temperature profile, tolerance band, abnormal-change rules, site-specific validation
Human body temperature screening	Small temperature variance is affected by distance, environment, calibration, and workflow.	proper camera type, controlled installation, measurement SOP, accuracy expectations, privacy policy
Low visibility or no light	Standard cameras cannot provide reliable detection; operators receive unclear visual evidence.	thermal channel for detection, visible channel for verification, event pop-up, recording and playback workflow

How to use this matrix

Use the matrix during site survey and proposal design. Each monitoring problem should be translated into a camera requirement, a network/recording requirement, and an operator-review requirement. This reduces the risk of specifying thermal hardware while leaving the rest of the system unable to preserve or use the captured event.

5. High-Value Applications

Thermal cameras are most valuable where teams need heat-based detection, early warning, low-visibility observation, or verified response. ACTi highlights thermal use cases including fire detection alert, overheating detection, smoke detection, enhanced intrusion detection, human body temperature detection, smoking detection, high-resolution visual imaging, dual image sensors, extended thermal monitoring range, and VMS compatibility. [1]

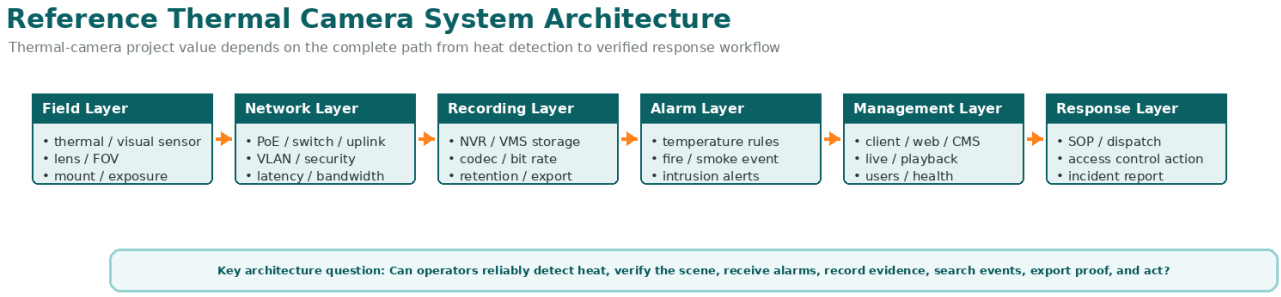
Application	Operational value	Typical locations
Fire-risk and smoke warning	Identify abnormal heat or smoke-related cues before a visible incident escalates.	EV chargers, parking areas, power rooms, industrial sites, warehouses
Equipment overheating monitoring	Monitor cabinets, electrical equipment, machinery, or high-value assets for temperature abnormality.	Utility rooms, substations, server rooms, production lines, plants
Perimeter and intrusion security	Detect people or vehicles in darkness or difficult visibility where visual contrast is weak.	Fence lines, yards, ports, campuses, restricted outdoor zones
Critical infrastructure	Improve early warning and remote verification for restricted, large, or safety-sensitive sites.	Utilities, transport hubs, energy facilities, government sites
Commercial and public safety	Support 24/7 abnormal-event detection and faster response across occupied facilities.	Commercial buildings, healthcare sites, schools, event venues
Smoking or restricted-area behavior	Detect high-risk behavior or thermal cues in locations where smoking or ignition risk must be controlled.	Factories, storage areas, restricted zones, logistics facilities

Value by stakeholder

Stakeholder	Main benefit
System integrator	Stronger differentiation when proposals are built around preventive detection, safety workflow, and total solution design.
Consultant	Clearer specification language for thermal sensitivity, target distance, alarm logic, measurement rules, integration, and evidence export.
Security / safety manager	More reliable early warning, heat-event verification, operational response, and incident reconstruction.
Procurement team	A more defensible buying decision based on application fit, compliance readiness, and total evidence workflow.

6. System Architecture

Thermal cameras should be designed as a system architecture. The camera creates heat-based and/or visible views, but the full solution must preserve operational value through control, transmission, recording, storage, live viewing, playback, search, export, alarm handling, and response. If any layer is under-designed, the project may lose preventive or evidential value.



Architecture layers

Layer	Role in thermal surveillance
Field layer	Thermal and visible sensors, lens, field of view, target distance, mounting height, enclosure, temperature environment, weather exposure, and maintenance access.
Network layer	PoE, switching, uplink capacity, fiber or wireless links, VLANs, latency, cybersecurity controls, remote access, and bandwidth headroom.
Recording layer	NVR or VMS storage, codec, bit rate, frame rate, retention period, redundancy, backup, playback performance, and export workflow.
Alarm layer	Temperature rules, fire/smoke events, intrusion alarms, alarm priority, escalation, event metadata, and notification paths.
Management layer	Client software, web access, CMS, user permissions, event review, health management, and multi-site monitoring.
Response layer	Operator SOPs, access-control actions, guard dispatch, shutdown procedures, escalation, incident reporting, evidence export, and audit trail.

Architecture warning: A camera that looks excellent in a datasheet can still underperform if alarm logic, network control, recording profile, display layout, storage retention, event search, or operator response workflow is poorly planned.

7. ACTi Product Portfolio Overview

ACTi positions its Thermal Cameras category as a portfolio for heat-signature detection across multiple installation needs. The public page highlights dual-sensor thermal and visible-light technology, visible images up to 4MP for incident verification, thermal sensors operating in the 8-14 micrometer spectral range, NETD below 35 mK, spatial resolution between 2.74 and 5.71 mrad, detection range up to approximately 2 kilometers, long-range security up to 2100 m, thermal resolution up to 640 x 512, built-in AI analytics for people, vehicles, line crossing and intrusion, and VMS compatibility with ACTi NVR and CMS. [1]

Portfolio categories

Category	Where it fits	Use-case fit
Thermal cube	Compact indoor or controlled-area thermal monitoring where installation simplicity and localized observation are important.	Equipment areas, small rooms, temperature-watch points.
Thermal bullet	Outdoor or indoor directional thermal surveillance with fixed-view coverage and rugged mounting.	Perimeters, gates, cabinets, yards, fire-risk zones.
Bi-spectrum bullet	Fixed thermal plus visible-light verification in one camera type.	Industrial safety, overheating detection, fire-risk warning, perimeter verification.
Thermal turret	Compact form factor for thermal monitoring where lower-profile installation is preferred.	Commercial sites, industrial interiors, short-to-mid-range zones.
Thermal speed dome	Movable thermal observation for wider scene coverage and operator-controlled verification.	Large outdoor spaces, industrial yards, public areas.
PTZ positioning system	Long-range outdoor thermal and/or visible observation for demanding mounting and distant targets.	Critical infrastructure, ports, utilities, large perimeter projects.

Portfolio-level capabilities to confirm

- Required form factor, mounting method, coverage area, target distance, target size, and environmental condition.
- Required thermal resolution, NETD, field of view, spectral range, spatial resolution, temperature rules, and detection range.
- Required visible-light verification, WDR, low-light performance, IR, analytics, alarm rules, and event metadata.
- Recorder/VMS compatibility, bit rate, codec, retention, playback, evidence export, CMS, and remote access requirements.
- Environmental casing, operating temperature, weatherproofing, anti-corrosion needs, vandal resistance, and maintenance access.
- Cybersecurity and compliance requirements such as NDAA, TAICS, firmware policy, secure access, and regional availability.

Project note: Product availability, detailed specifications, compliance status, recorder compatibility, and regional part numbers should be confirmed from the latest ACTi product pages, datasheets, firmware release notes, and quotation documents before project submission.

8. Related Keywords and Terminology

The following keyword reference groups collect common terms related to thermal surveillance, heat-signature detection, fire-risk warning, overheating monitoring, perimeter security, system architecture, and project procurement.

Core topic keywords

thermal camera, thermal security camera, thermal surveillance camera, thermal imaging camera, infrared camera, IP thermal camera, network thermal camera, outdoor thermal camera, industrial thermal camera, thermal camera system

Thermal detection keywords

heat signature detection, infrared radiation detection, temperature detection camera, thermal sensor, 8-14 micrometer thermal imaging, NETD thermal camera, thermal sensitivity, spatial resolution, thermal field of view, temperature threshold alarm

Fire and overheating keywords

fire detection camera, thermal fire detection, overheating detection camera, equipment overheating monitoring, electrical cabinet monitoring, smoke detection camera, early fire warning, abnormal temperature alarm, hot spot detection, thermal safety monitoring

Dual-sensor and image keywords

bi-spectrum camera, dual-sensor thermal camera, thermal and visible camera, visible-light verification, 4MP visual imaging, thermal-visible fusion, visual incident verification, day night thermal surveillance

Analytics and intelligent video keywords

AI thermal camera, thermal intrusion detection, thermal line crossing, people detection thermal camera, vehicle detection thermal camera, smart intrusion protection, alarm verification camera, event metadata, smoking detection camera

Application keywords

perimeter security camera, critical infrastructure surveillance, industrial safety camera, utility security camera, parking lot fire detection, EV charger monitoring, warehouse fire prevention, transportation security, campus perimeter monitoring, energy facility surveillance

Common question phrases

what is a thermal camera, how do thermal cameras work, what is the difference between thermal cameras and night vision cameras, when do I need a thermal camera, how to specify thermal cameras for fire detection, how to monitor equipment overheating with thermal cameras, what is NETD in thermal cameras, what is thermal camera spectral range, how far can thermal cameras detect heat, when to use bi-spectrum thermal cameras, how to integrate thermal cameras with NVR or VMS, how to design thermal surveillance for perimeter security, how to record thermal camera evidence, how to use thermal cameras for industrial safety, what thermal camera is suitable for electrical cabinets

System and architecture keywords

IP camera system, NVR thermal camera system, VMS thermal camera system, CMS surveillance, remote thermal monitoring, multi-site surveillance, system health management, video retention planning, alarm event search, evidence export workflow, thermal bandwidth planning, ACTi thermal camera

Procurement and project keywords

thermal camera specification, thermal camera selection guide, surveillance camera white paper, camera for system integrators, camera for consultants, camera for end users, NDAA security camera, TAICS security camera, thermal camera for fire prevention, thermal camera for industrial safety

Source notes

Ref.	Source
[1]	ACTi Corporation, "Thermal Cameras," official product category page. URL: https://www.acti.com/products/thermal-cameras. Accessed: June 15, 2026.
[2]	ACTi Corporation, "About ACTi," official corporate page. URL: https://www.acti.com/corporate/. Accessed: June 15, 2026.

Revision note: This document is a marketing and technical education white paper. It is not a regulatory certification, life-safety approval, fire-code approval, medical device statement, or final project design. Always validate coverage area, target distance, thermal field of view, temperature range, alarm rules, visible-light verification, recording settings, storage, VMS control, evidence export, and operator workflow in the target scene before deployment.

Prepared by ACTi Corporation

For thermal camera projects, confirm camera type selection, lens, thermal range, alarm rules, recording platform, compliance requirements, mounting accessories, and regional availability with your ACTi sales contact or authorized system integrator.

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