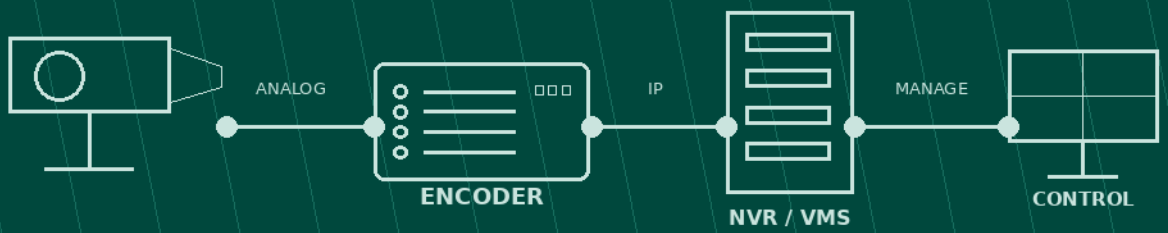
ACTi

Physical Security End-to-End Solution Provider

White Paper | Encoders

VIDEO ENCODERS



A practical white paper for modernizing analog surveillance with secure IP video, centralized recording, and phased migration.

Contents

Document purpose

This white paper explains how video encoders convert signals from existing analog surveillance cameras into digital streams for IP networks, and how project teams can use encoders to modernize recording, remote monitoring, control, audio, alarms, and evidence workflows without immediately replacing every field camera.

It is written for system integrators, consultants, and end users planning phased migration projects in transportation, utilities, government, education, healthcare, retail, banking, industrial, commercial, and critical-infrastructure environments.

The document references ACTi public product information and official ONVIF information. It intentionally uses product categories, form factors, interfaces, and system functions rather than specific model names so it remains useful as product generations change.

Reading guide

Use Sections 3 and 4 to define encoder functions and technical requirements, Section 5 to map high-value applications, Section 6 to review architecture, Section 7 to align ACTi product categories with project needs, and Section 8 to collect terminology for specifications, proposals, and stakeholder alignment.

1. Executive Summary

A video encoder converts the signal from an analog camera into a digital video stream that can travel across an IP network. In practical surveillance projects, the encoder acts as a migration bridge: it preserves usable cameras and existing field cabling while enabling centralized NVR or VMS recording, CMS monitoring, web or mobile access, secure network transport, and modern event workflows. [1]

ACTi public information describes commercial and industrial encoder categories with capabilities such as motion detection, PTZ control through serial interfaces, edge storage, audio transmission, digital inputs and outputs, secure transmission, ONVIF support, and API or SDK integration. ACTi also provides standard and rackmount form factors, with single-channel and multi-channel options. [1]

The business value is strongest when the encoder is designed as part of the whole system. Camera condition, analog signal quality, channel density, image requirements, bandwidth, cybersecurity, time synchronization, recording retention, operator workflow, acceptance testing, and replacement policy must be planned together.

Core message

Encoders reduce modernization risk when they are used to connect proven analog assets to a secure, testable, and maintainable IP surveillance architecture.

Key takeaways

- Use encoders for phased migration when existing analog cameras, specialty optics, cabling, or field installations still have operational value.
- Select channel density and chassis type according to camera count, rack space, power, environmental conditions, maintenance access, and future expansion.
- Confirm analog input compatibility, video quality, frame rate, image enhancement, serial PTZ behavior, audio, digital I/O, edge storage, and network security before procurement.
- Treat ONVIF, API, or SDK support as an integration starting point; verify the required functions with the target NVR, VMS, CMS, or third-party platform. [3][4][5]
- Test live view, recording, playback, export, time accuracy, event actions, link interruption, restart recovery, and configuration backup during acceptance.
- Document firmware, network settings, channel mapping, camera identity, serial control parameters, and replacement rules for lifecycle maintenance.

Procurement principle

Do not specify an encoder only by channel count. Specify the analog source, signal path, image objective, integration functions, environmental limits, network controls, recording outcome, acceptance test, and lifecycle documentation 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 experience in the security industry 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 covers video surveillance, access control, control center operation, system management, system health management, AI-enabled video technologies, mobile applications, and third-party integration. [2]

This broader ecosystem matters for encoder projects because an analog-to-IP migration succeeds only when the converted video remains usable throughout live viewing, recording, playback, event handling, evidence export, health monitoring, remote operation, and maintenance.

Why ACTi is relevant to encoder migration projects

ACTi strength	Project relevance
Taiwan-based security manufacturer	Product planning and documentation can support commercial, government, transportation, and industrial project workflows that require clear product categories and integration evidence.
End-to-end security system scope	Encoders can be planned together with network video recording, VMS, CMS, mobile operation, access control video verification, and system health management.
Legacy-to-IP migration focus	Encoder categories provide a practical path to preserve usable analog cameras while moving recording and management onto IP networks.
Integration and project fit	System integrators can align encoder form factor, channel mapping, PTZ control, audio, I/O, storage, cybersecurity, software integration, and acceptance documentation.

3. Definition of Encoders

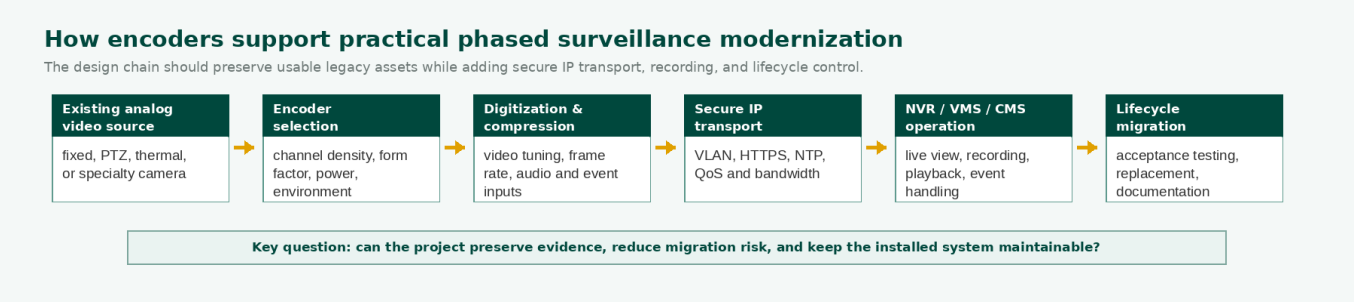
In professional video surveillance, a video encoder is a network device that receives one or more analog camera signals and converts them into digital video streams for transmission across a LAN or WAN. The encoder allows existing analog cameras to participate in an IP-based system that can include NVR or VMS recording, CMS monitoring, mobile viewing, event management, and third-party integration. [1]

An encoder is most useful when the field camera remains fit for purpose but the project needs centralized management, secure remote access, network recording, phased replacement, or integration with modern security platforms.

Encoders vs. related system components

Term	Meaning	Common misunderstanding
Video encoder	Converts analog camera video into IP streams and may also carry audio, PTZ control, alarms, and local storage.	It is not a camera and does not improve a poor field of view or defective analog signal by itself.
IP camera	Captures and encodes video inside the camera, then sends it directly to the network.	Replacing every analog camera with an IP camera may be unnecessary during a phased migration.
DVR / hybrid recorder	Records analog inputs locally and may provide network viewing; a hybrid recorder can also manage some IP sources.	A recorder-centered migration is different from distributing encoders near the field or rack.
NVR / VMS	Receives network streams for recording, playback, search, export, user management, and event workflows.	The recorder or VMS still needs tested compatibility with the encoder and required functions.
Video decoder	Converts network video back into display output for monitors or video walls.	A decoder performs the opposite direction of an encoder.
Transcoder	Changes an already-digital stream into another codec, resolution, or bitrate.	Transcoding is not the same as digitizing an analog camera signal.

Visual Concept



Design note

Encoder projects create the most value when the complete migration chain is planned: analog camera condition, signal quality, cabling, encoder location, channel density, power, serial PTZ control, audio, digital I/O, edge storage, network path, cybersecurity, recording platform, operator access, evidence export, firmware maintenance, asset inventory, and replacement control.

Practical deployment interpretation

In a traffic cabinet, transportation depot, utility facility, industrial plant, campus, hospital, retail chain, bank branch, warehouse, public building, or critical-infrastructure site, the project may need to preserve specialty analog cameras, avoid disruptive recabling, maintain continuous recording, support remote operations, and replace cameras gradually. The encoder should protect both migration flexibility and evidence value.

4. Core Technical Concepts

Encoder projects should begin with the required operational outcome and the condition of the installed analog system. The goal is not only to produce an IP stream; it is to deliver predictable video quality, control, recording, event handling, secure transport, and maintainable evidence workflows.

Concept	Practical meaning
Analog input compatibility	Identify signal type, connector, video standard, termination, cable length, grounding, interference, and camera power arrangement.
Channel density and form factor	Choose compact, desktop multi-channel, rackmount, or industrial categories according to camera count, rack space, maintenance access, and spare capacity.
Image quality and encoding	Define expected resolution, frame rate, compression, stream count, low-light or contrast enhancement, bitrate, and latency.
PTZ and serial control	Confirm RS-485 or RS-422 wiring, protocol, address, baud rate, command response, presets, and control ownership.
Audio and digital I/O	Define microphone or line input, speaker output, two-way audio, sensor inputs, relay outputs, and event-action logic.
Network and cybersecurity	Plan addressing, VLANs, firewall rules, HTTPS where supported, password policy, time synchronization, bandwidth, QoS, remote access, and firmware control.
Recording and resilience	Plan NVR or VMS recording, edge storage, retention, interruption behavior, reconnection, playback, search, snapshots, and export.
Interoperability and lifecycle	Verify ONVIF or vendor integration, software compatibility, configuration backup, logs, firmware versions, acceptance evidence, spares, and replacement rules.

Specification interpretation

An encoder can appear to work because live video is visible, yet still fail the project if image quality is unstable, PTZ control is unreliable, audio or alarms are unmapped, time is incorrect, bandwidth is excessive, edge storage is untested, or exported evidence cannot be reproduced. A well-specified encoder deployment improves continuity, migration flexibility, operator efficiency, and lifecycle control at the same time.

Capability Matrix

Project requirement	What can go wrong	Capabilities to specify	Operational output
Preserve usable legacy cameras	Cameras are replaced unnecessarily, or degraded signals are accepted without testing.	Camera condition survey, signal test, channel map, field-of-view review, image acceptance criteria.	Lower migration disruption and a defensible reuse decision.
Centralize recording and viewing	Live view works but recording, playback, search, export, or time accuracy is unreliable.	NVR/VMS compatibility, stream settings, NTP, retention, playback/export checklist, user permissions.	Consistent evidence workflow across analog and IP sources.
Migrate PTZ cameras	Video is available but serial control, presets, or addressing fails.	Serial interface, wiring, protocol, baud rate, address, preset test, operator control policy.	Continued remote operation of existing PTZ assets.
Integrate audio and alarms	Audio is distorted or event inputs and relay actions do not reach the management platform.	Audio level and codec test, DI/DO mapping, event rules, notification actions, relay safety review.	More complete incident verification and response.
Operate in traffic or industrial sites	Temperature, power variation, vibration, cabinet space, or grounding causes instability.	Industrial form factor, extended-temperature option, power range, surge protection, grounding, ventilation, cabinet layout.	Stable conversion in demanding field environments.
Support phased replacement	Channel identities and documentation are lost as cameras are upgraded over time.	Asset register, spare channels, labeling, configuration backup, firmware records, replacement and decommissioning procedure.	Maintainable migration without losing evidence continuity.

How to use this matrix

Use the matrix during site survey and proposal design. Each retained analog camera should have a documented condition, signal path, encoder channel, PTZ or I/O requirement, network destination, recording policy, cybersecurity setting, and acceptance test.

For tender writing, define the migration objective first. Then specify encoder category, channel capacity, analog interfaces, image performance, environmental conditions, security controls, recording integration, evidence workflow, documentation package, and replacement rules.

5. High-Value Applications

Encoders are most valuable where organizations need to modernize surveillance management while preserving usable analog cameras, specialized installations, or existing field cabling. ACTi positions encoders for commercial and industrial use and highlights remote management through NVR, CMS, or mobile clients. [1]

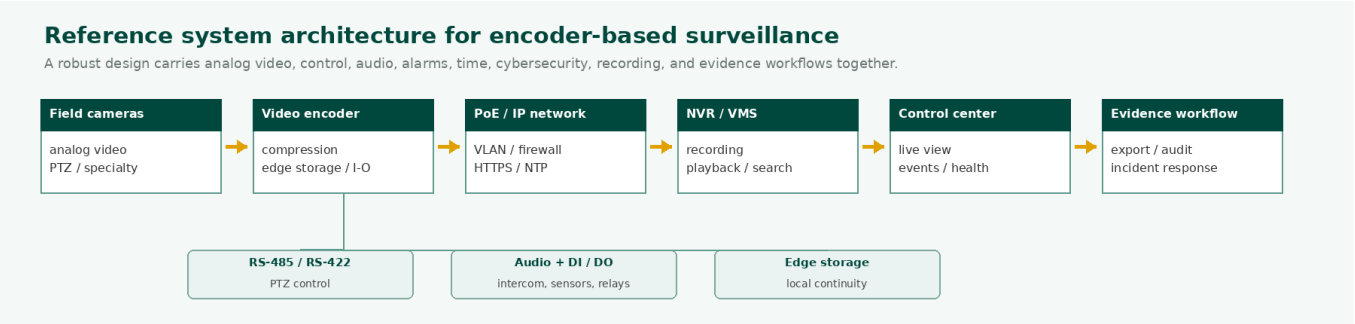
Application	Operational value	Typical locations
Transportation and traffic	Modernize roadside, station, depot, tunnel, or cabinet-based analog cameras while preserving PTZ control and centralized monitoring.	Road intersections, rail stations, bus depots, tunnels, parking, traffic cabinets.
Utilities and industrial facilities	Connect specialty or rugged analog cameras to IP recording and control systems without immediate field replacement.	Power, water, oil and gas, factories, process areas, control rooms.
Government and public facilities	Support phased procurement, centralized evidence management, and gradual replacement across existing sites.	City halls, courthouses, public buildings, detention or service facilities.
Campuses and healthcare	Extend the life of installed analog cameras while introducing centralized access, permissions, retention, and remote support.	Schools, universities, hospitals, laboratories, care facilities.
Retail, banking, and branches	Migrate many distributed sites in stages while keeping local cameras operational and centralizing investigation.	Stores, bank branches, ATMs, warehouses, offices, service counters.
Perimeter and specialty systems	Preserve long-range optics, thermal or low-light analog sources, legacy PTZ units, or hard-to-reach installations.	Perimeters, ports, yards, substations, remote facilities, high-mounted positions.

Value by stakeholder

Stakeholder	Main benefit
System integrator	More migration options, fewer disruptive replacements, stronger proposals, and clearer acceptance evidence.
Consultant	Better specification language for reuse criteria, channel mapping, integration functions, cybersecurity, and lifecycle controls.
Security manager / operator	Unified live view, playback, events, and export across retained analog cameras and newer IP devices.
Procurement team	A defensible phased investment based on asset condition, operational value, project risk, and total lifecycle cost.

6. System Architecture

Encoder-based projects should be designed as complete system architecture. The analog camera provides the field image, but the full solution must preserve operational value through signal conversion, control wiring, network security, recording, live viewing, playback, event handling, evidence export, health monitoring, documentation, and maintenance.



Architecture layers

Layer	Role in encoder-based surveillance
Field source layer	Analog camera location, lens, field of view, lighting, camera power, enclosure, mounting, cable route, grounding, and signal condition.
Conversion layer	Encoder channel, analog input, video settings, serial PTZ, audio, DI/DO, edge storage, local power, labeling, and configuration backup.
Network and security layer	Switching, addressing, VLANs, bandwidth, HTTPS where supported, firewall rules, NTP, remote access, surge protection, and cyber controls.
Recording layer	NVR or VMS recording, codec, bitrate, frame rate, retention, playback, search, snapshots, bookmarks, export, and evidence handling.
Management and response layer	CMS or workstation operation, mobile access, permissions, event review, health monitoring, incident escalation, maintenance, and decommissioning.

Architecture warning

A migration can underperform if the analog signal is weak, the camera field of view is unsuitable, PTZ protocol is unknown, time is not synchronized, bandwidth is underestimated, cybersecurity controls are weak, edge recording is not tested, or channel documentation is incomplete.

7. ACTi Product Portfolio Overview

ACTi positions its encoder portfolio around analog-to-IP conversion for commercial and industrial surveillance. Public product information describes standard and rackmount encoder categories, single-channel and multi-channel options, motion detection, PTZ control, edge storage, audio transmission, secure transmission, digital I/O, ONVIF support, and API or SDK integration. [1]

This section intentionally describes product categories and form factors rather than specific model names so the white paper remains usable as individual product generations and part numbers change.

Portfolio categories

Category	Where it fits	Use-case fit
Compact single-channel encoders	Small installations or distributed field points where one analog source must be added to an IP network.	Single retained camera, remote cabinet, specialty analog source, localized migration.
Desktop multi-channel encoders	Small to medium groups of cameras where several analog inputs can be converted near an equipment room or cabinet.	Branch sites, retail, schools, offices, small transport or utility locations.
High-density rackmount encoders	Central equipment rooms with many analog channels, structured cabling, rack power, and centralized maintenance.	Control rooms, campuses, transportation hubs, government and industrial facilities.
Industrial and extended-temperature options	Demanding power and temperature conditions where stable operation is required in field cabinets or industrial environments.	Traffic, utilities, outdoor cabinets, factories, infrastructure and remote sites.
NVR / VMS / CMS and integration ecosystem	Recording, live view, playback, search, event review, mobile operation, system health, and third-party integration.	Security operations centers, distributed facilities, phased mixed analog/IP systems.

Portfolio-level capabilities to confirm

- Analog input type, channel capacity, chassis, local storage, power, serial ports, audio, digital inputs and outputs, and operating environment.
- Video resolution, frame rate, compression, stream settings, image enhancement, latency, bandwidth, and expected evidence quality.
- NVR, VMS, CMS, mobile, ONVIF, API, SDK, PTZ protocol, event mapping, search, playback, export, and health monitoring.
- Cybersecurity requirements such as secure transmission, account control, password policy, network segmentation, firmware workflow, and remote access.
- Accessories, rack space, cabling, labeling, grounding, surge protection, cooling, maintenance access, spare channels, and regional availability.

Project note

Product availability, detailed specifications, conformance status, integration scope, accessory compatibility, recorder compatibility, environmental limits, and regional part numbers should be confirmed from the latest ACTi product pages, datasheets, release notes, installation guides, and quotation documents before project submission.

8. Related Keywords and Terminology

The following reference groups collect common terms related to video encoders, analog-to-IP migration, surveillance architecture, network security, recording, control interfaces, and project planning.

Core topic keywords

video encoder, CCTV encoder, surveillance encoder, analog to IP converter, analog camera to IP, network video encoder, IP video conversion, legacy CCTV modernization, phased surveillance migration, hybrid analog IP system

Analog video and interface keywords

analog camera, CVBS, composite video, BNC connector, coaxial cable, video termination, signal loss, ground loop, interference, analog video input, loop-through output, camera power, PAL, NTSC

Encoding and streaming keywords

video compression, H.264, H.265, frame rate, bitrate, resolution, low-light enhancement, contrast enhancement, video stream, substream, RTSP, multicast, latency, bandwidth planning, image tuning

Network and cybersecurity keywords

LAN, WAN, Ethernet, PoE, VLAN, HTTPS, TLS, firewall, IP address, subnet, NTP, QoS, network segmentation, secure transmission, password policy, account management, remote access, firmware management

Control, audio, and I/O keywords

PTZ control, RS-485, RS-422, serial protocol, baud rate, camera address, preset control, two-way audio, audio input, audio output, digital input, relay output, alarm integration, sensor integration

Recording and management keywords

NVR recording, VMS integration, CMS monitoring, edge storage, microSD recording, live view, playback, event search, evidence export, retention, snapshots, bookmarks, health monitoring, mobile client, failover behavior

Form factor and deployment keywords

single-channel encoder, multi-channel encoder, desktop encoder, rackmount encoder, high-density encoder, industrial encoder, extended-temperature encoder, traffic cabinet, equipment rack, control room, field cabinet, surge protection

Application and project keywords

traffic surveillance modernization, utility site monitoring, industrial CCTV migration, campus security upgrade, hospital surveillance migration, retail branch migration, bank video modernization, perimeter surveillance, tender specification, site survey, acceptance test, asset register, lifecycle replacement

Common Question Phrases

what is a video encoder, how does an analog to IP encoder work, when should analog cameras be retained, how to migrate CCTV to IP, how to choose a single-channel or multi-channel encoder, how to size a rackmount encoder, how to connect PTZ control through an encoder, how to use RS-485 with a video encoder, how to integrate encoder audio and alarms, how to record encoder streams on an NVR, how to integrate encoders with VMS, how to secure encoder traffic, how to test encoder bandwidth, how to use edge storage, how to plan phased camera replacement, how to prepare an encoder acceptance test

Source notes

Ref.	Source
[1]	ACTi Corporation, "Encoders," official product category page. URL: https://www.acti.com/products/encoders. Accessed: July 16, 2026.
[2]	ACTi Corporation, "About ACTi," official corporate page. URL: https://www.acti.com/corporate. Accessed: July 16, 2026.
[3]	ONVIF, "Profile S," official profile page for basic video streaming and video encoder devices. URL: https://www.onvif.org/profiles/profile-s/. Accessed: July 16, 2026.
[4]	ONVIF, "Profile T," official profile page for advanced video streaming, events, metadata, secure streaming, PTZ, I/O, and audio. URL: https://www.onvif.org/profiles/profile-t/. Accessed: July 16, 2026.
[5]	ONVIF, "Conformant Products," official database and conformance guidance. URL: https://www.onvif.org/conformant-products/. Accessed: July 16, 2026.

Revision note

Revision note

This document is a marketing and technical education white paper. It is not a final site design, cybersecurity audit, interoperability certification, electrical design, or legal opinion. Always validate current product specifications, analog signal condition, camera field of view, cabling, grounding, serial control, power, network security, recording settings, storage, software compatibility, environmental conditions, and operator workflow in the target scene before deployment.

Prepared by ACTi Corporation

For encoder projects, confirm product category selection, channel capacity, analog interfaces, recording platform, cybersecurity policy, accessories, environmental requirements, and regional availability with your ACTi sales contact or authorized system integrator.

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