

# VIDEO SURVEILLANCE GUIDE

Basic elements of video surveillance system are:

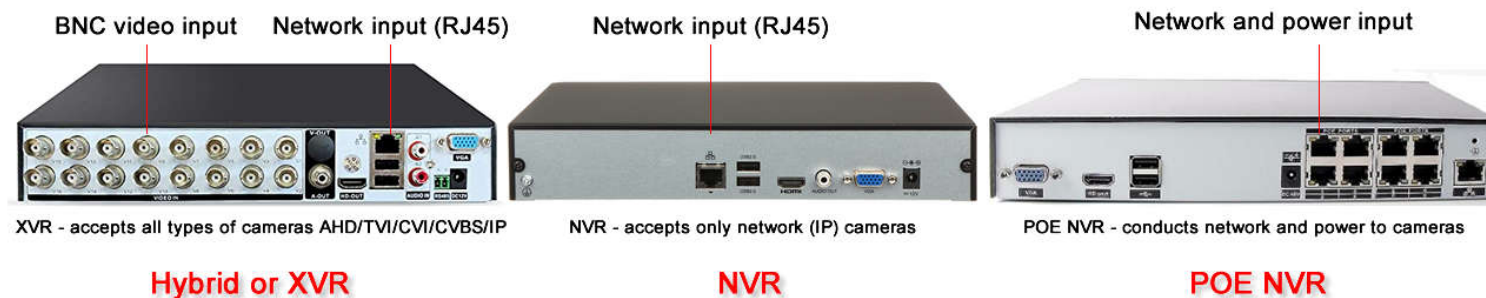
- recorder
- camera
- memory - storage medium
- power supply for camera
- cable
- connectors
- accessories

## ➤ **RECORDER:**

- Hybrid or XVR: accepts all types of cameras: analog AHD/TVI/CVI/CVB and IP (digital)
- Network or NVR - accepts network (IP) cameras (only)

# VIDEO SURVEILLANCE GUIDE

## Surveillance Video Recorders



Recorder comparison	XVR - RECORDERS FOR ALL TYPES OF CAMERAS	NVR recorders for network (IP) cameras
Acceptance of camera technologies	AHD/TVI/CVI/CVBS/IP	IP
Number of channels / cameras input	4,8,16, 32	4,8,16, 32, 64, 128, 256
The resolution by which it is recorded	2-8MP	2-12MP
Built-in network card / network access or internet / smartphone app	Yes	Yes
Bandwidth	lower	bigger
CMS / central monitoring software to control multiple recorders	Yes	Yes
Video analytics (AI)	Yes, partial	Yes, full and advanced
Audio recording	Yes	Yes
Cable installation	separate cable required for each camera	possible use of one cable for several cameras (network)

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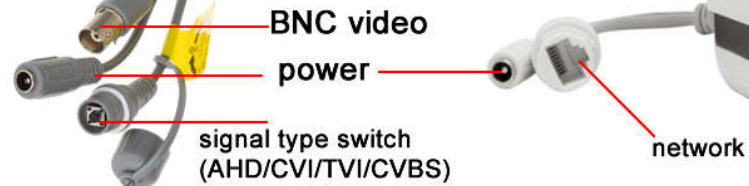
## ➤ CAMERA

- Analog - IP or network camera ( wired or wireless )

## Surveillance camera



**Analog camera**  
2-8MP



**IP(digital) camera**  
2-12MP



**IP wireless camera**

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## Analog camera

Analog CCTV cameras send an analog video signal to a digital video recorder (Hybrid/XVR), which converts analog video to digital format. The XVR connects to a router to broadcast a video signal over a local network (LAN) or the Internet. A monitor is also connected to the recorder as needed. Hybrid/XVR: accepts analog and digital (IP) cameras simultaneously

## Network (IP) camera

Digital CCTV cameras or IP cameras send a digital video signal (do not need conversion) through a network / optical cable or wirelessly (wi-fi) to a network recorder (NVR) or via a router to the Internet. Video can also be stored on the camera itself using SD memory cards. A monitor is connected to the network recorder (NVR or XVR) as needed.

**Wired IP** camera: almost all cameras on the market are POE - the network and power supply for the camera are carried out simultaneously by twisted pair cable (UTP)

**Wireless IP** cameras: they need to be connected to the power supply (12V) and digital signal is sent wirelessly to the recorder or paired with an existing wi-fi network.

**Wireless battery IP camera** - they use a battery for power and digital signal is sent wirelessly to the recorder or paired with an existing wi-fi network

**IMPORATNT!** Ultimately, all recorders (XVR or NVR) have a network / digital component that allows the recorder connect to the Internet and remotely monitor via a smartphone app.

Question: If I am planning video surveillance with IP cameras, should I choose XVR or NVR? XVR has lower bandwidth than NVR. What exactly does that mean? This means that video images from IP cameras on the XVR will have fewer frames per second than on the NVR, so it is better to have NVR.

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CAMERA comparison	ANALOG CAMERA	IP CAMERA
Lens	Fixed Vari focal Motor zoom	Fixed Vari focal Motor zoom
IR range	20-100m	20-800m
Connectivity	wired	Wired, wireless ( wi fi)
Resolution	2-8mp	2-12mp
SD card slot	No	Yes
Audio	Yes, microphone	Yes, microphone and speaker
Access to each camera via network / internet	No	yes
Video analytics (AI)	no	yes
POE	Yes (POC)	Yes
Cable	Coax / Twisted pair ( special adapter needed- baluns)	Twisted pair / coax ( special adapter needed)
Full color camera	Yes	Yes
Price	lower	higher



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➤ **Memory :** Hard disc and memory card

**Hard disc:** for video surveillance, disks that can withstand "greater effort" are used - continuous 24-hour operation. Two series are dominant in the market: the Western Digital Purple series and the Seagate Skyhawk series.

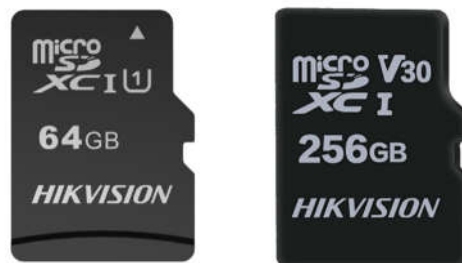


Disk capacities are from 1-12TB.

**IMPORTANT:** in the recorder specifications it is important to always check how many hard drives the recorder we intend to buy accepts, the problem is if in the future we want to have longer video storage and the recorder has space for only one hard drive

**Memory cards:** used as a medium for storing video / audio in IP cameras, capacity 32-512GB, there are several models on the market,

**IMPORATNT!** you should pay attention to the amount of "overwrite" cycle - how many times they can be completely overwrite from start to finish, a typical model has 300 cycles, while models intended for video surveillance have up to 3000 cycles



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➤ **Power supply:** for camera: power adapter 220 / 12v, 110/12V , POE switch

\*



**Power adapter 220 or 110/12V**

used for analog&IP cameras



**POE switch**

used for IP cameras

Analog cameras usually use 12V operating voltage, and network POE cameras 12V or 48V via POE connection.

## a) 220 / 12V **power adapter**

When choosing an adapter, two pieces of information are important: voltage or operating voltage and amperage. At this moment, the operating voltage of 12v is most often used on the market.

Amperage is, in simple terms, the amount of energy used by a camera / recorder. The adapter must be able to deliver at least the same amount of power consumed by the camera. Example: if the camera is marked with 350mA, it means that the voltage adapter cannot be less than 350mA, higher amperage will not cause any damage. Example 2: if the system has 4 cameras and each is marked with 1A, we need voltage adapters individually 1.5A or one adapter of 5A.

# VIDEO SURVEILLANCE GUIDE

b) **POE** (power over ethernet) switches are used for simultaneous network and power supply of IP POE cameras, operating voltage is 48V.

One UTP cable is used for each camera, which means that if we have a set of 8 network cameras and we want to use POE, it is necessary to run a separate cable for each camera.

NVR recorders also come with a built-in POE switch, 4, 8, 16 and 24 port NVRs are the most common on the market.

c) **POE - injectors** connect a network device (camera) that supports PoE to a non-PoE LAN switch port.

Eg: If we need to install only one POE camera, instead of getting a 4 port POE switch, we get one POE injector that we connect on one side to a power outlet and a regular switch or internet router and on the other side to a POE camera



# VIDEO SURVEILLANCE GUIDE

- **Cable:** UTP- twisted pair, coaxial and power cable

a) **Network or twisted pair cable (UTP)** is today the most commonly used cable in all types of video surveillance systems.

Solid (solid cable, 8 wires) and stranded (twisted cable, 56 wires, 7 strands twisted into one wire, 8 wires) are used. Solid cables are best for cabling (walls, ducts) and stranded cable types are better for connecting networks (patch cabinets, etc.).

UTP cable has several categories, the most common are 5, 5e and 6.

The main difference between CAT5 and CAT6 cables lies within the data transmission bandwidth. CAT6 cables are designed for operating frequencies up to 250 MHz, compared to 100 Mhz for CAT5. This means that a CAT6 cable can process multiple data at the same time. Think of it as the difference between a 2- and 4-lane highway. You can drive at the same speed on both, but a 4-lane highway can handle a lot more traffic at the same time.

Here is the comparison between different UTP cable category:

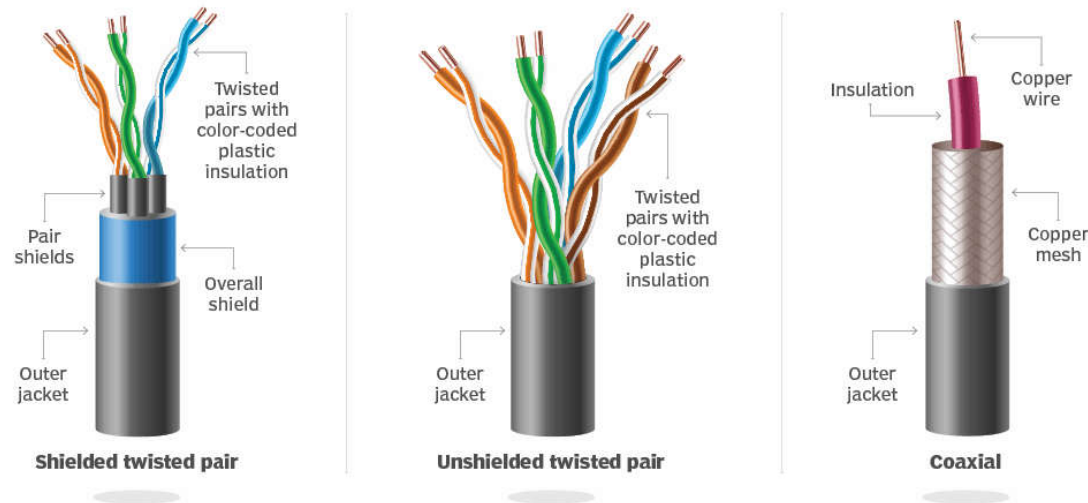
CATEGORY	CAT5	CAT5e	CAT6
Working frequency	100MHz	100MHz	250MHz
Maximum cable lenght	100m	100M	100m
Bandwith	100 mbps	1000 mbps	10Gbbps at a distance of up to 50m
Interference	possible	less possible	low

Capacity occupancy of UTP cable bandwidth when using IP cameras of different resolutions:

CABLE	Camera resolution	Bandwidth used by the camera	Remaining bandwidth
UTP5e & UTP6	2MP	5 mbps	995 mbps
	4MP ( 2K)	10 mbps	990 mbps
	8MP ( 4k)	30 mbps	970 mbps

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The maximum cable length (without the use of amplifiers) for network over twisted pair cable is approximately 100m in line



Connectors: RJ45 for network, BNC for coaxial cable, power connectors

For **analog** cameras today, UTP cable is most often used as a cable, primarily due to the cost of the entire installation and also due to the excellent image and sound transmission properties. If we want to use a UTP cable, we need video balloons.

Video baluns are used to conduct the analog video signal through the UTP cable. The function of a balun is to transform an unbalanced signal into a balanced signal.

They are bought in pairs, one unit is connected to the camera and the other to the video recorder. Video balloons with power are also on the market. The maximum cable length for analog video signal over twisted pair cable is up to 500m, depending on camera resolution.

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**IMPORATNT!** When conducting video signals and powering through a UTP cable at the same time, pay attention to the length of the cable. This is important due to the voltage drop at lengths greater than 40m.



## b) Coaxial and camera power cables

The most commonly used cable is RG59, which is used in combination with the power cable or alone with POC (power over coax) technology when video and power are transmitted by coaxial cable. The maximum cable length (without the use of amplifiers) for video signal over coax is approximately 100m in line.

Coaxial cable is also used to send a network up to 800m away (using IP over coax adapters).

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## ➤ **Base or installation boxes**

Bases are used to accommodate the installation-camera connection. Bases are mounted on a solid surface (wall and ceiling) and cameras are mounted on the base. Today, it is almost impossible to imagine a neat and functional installation of cameras without the use of bases.

The main functions of bases are:

- camera and cable connection protection
- aesthetic function

There are two types of bases:

- simple base - no water resistance, cheaper
- junction box- water resistance, more expensive



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## ➤ Monitor:

They are usually connected to the recorder with an HDMI or VGA cable. For the operation of the recorder (recording, remote access) it does not matter whether they are connected to the recorder or not. The most common sizes in use are 22" or larger.

Important: If the recorder is recording in 4K resolution, to watch live or play back the recording in 4K resolution, it is necessary that the recorder has 4K output resolution and that the HDMI cable is also 4K.

