PoE switch and cabling basics for IP cameras

Most IP camera problems that look like a bad camera are really power or cable problems: an exhausted PoE budget, a run over 100 meters, or cheap copper-clad cable. The rules are simple once you know them.

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Power over Ethernet (PoE) carries power and data on one network cable, so a camera needs a single run back to a PoE switch or an NVR with PoE ports. It is defined by IEEE 802.3 standards, and the standard your switch supports decides how much power each camera can draw.

PoE standards and power levels

Standard	Common name	Max at switch port	Guaranteed at device	Typical camera use
IEEE 802.3af (Type 1)	PoE	15.4 W	12.95 W	Most fixed bullet, dome and turret cameras
IEEE 802.3at (Type 2)	PoE+	30 W	25.5 W	Cameras with heaters, strong IR or built-in speakers; small PTZs
IEEE 802.3bt (Type 3)	PoE++ / 4PPoE	60 W	51 W	Larger PTZs, multi-sensor cameras
IEEE 802.3bt (Type 4)	PoE++ / 4PPoE	90 W	71.3 W	High-power PTZs with heaters and illuminators

Power sourced at the switch port vs power guaranteed at the camera. The difference is lost in the cable.

Passive PoE is not the same thing

Some radios and older devices use 'passive' PoE (for example 24 V) that pushes power without negotiation. It can damage standard cameras. Use standards-based 802.3af/at/bt switches and injectors for IP cameras unless the camera's datasheet says otherwise.

Sizing the switch: per-port and total budget

A PoE switch has two limits: the standard each port supports, and a **total PoE budget** shared by all ports. A 16-port switch with a 150 W budget cannot run sixteen 25 W cameras. When the budget runs out, the switch either refuses power to some ports or drops them, often at night when IR illuminators and heaters switch on and cameras draw the most.

Work out the budget you need

1. **Use each camera's maximum power draw**
   Take the maximum figure from the datasheet (with IR, heater and any speaker active), not the typical figure.
2. **Check the PoE class each camera needs**
   If a camera needs PoE+ (802.3at), the port must support it, even if the total budget is fine.

3 **Add them up and add headroom**
Example: 8 cameras at 7 W max plus 2 PTZs at 25 W max is 106 W. Leave margin for growth and cold-weather heater draw; a switch with a 150 W budget is a sensible fit for that example, a 120 W one is tight.

4 **Check the NVR's built-in PoE too**
NVRs with PoE ports also have a total budget, usually listed in the datasheet. It is often lower than people assume.

The 100 meter rule

Standard Ethernet over twisted-pair copper is specified for a **100 m (328 ft) channel**, normally made up of up to 90 m of fixed cable plus up to 10 m of patch cords in total. Beyond that, data errors and voltage drop start to cause dropouts, especially at higher PoE loads. For longer runs, use a PoE extender (which needs to be in a weatherproof box mid-run), a switch closer to the cameras, fiber with media converters, or a point-to-point wireless link.

Cable grades

Category	Data rating at 100 m	Notes for cameras
Cat5e	Up to 1 Gbps	Adequate for nearly all single cameras, which use far less than 100 Mbps
Cat6	Up to 1 Gbps (10 Gbps on shorter runs, up to about 55 m)	Thicker conductors usually mean less voltage drop and heat at higher PoE loads; a good default
Cat6a	Up to 10 Gbps	Use for switch-to-switch uplinks or future-proofing; bulkier and harder to terminate

- **Buy solid bare-copper cable.** Copper-clad aluminum (CCA) is cheaper, does not meet TIA category standards, has higher resistance, and runs hotter under PoE. It is a common cause of intermittent camera reboots.
- **Use outdoor-rated (UV-resistant) jacket outdoors and direct-burial or gel-filled cable underground**, or run it in conduit. Indoor cable in an outdoor conduit absorbs water over time.
- **Follow local code for in-wall and plenum runs** (CMR, CMP ratings).
- **Terminate properly and test each run** with at least a continuity tester; a cable certifier is better for long or marginal runs.
- **Add surge protection** on long outdoor runs or cameras on tall poles, and bond it to a proper ground.

> **Camera rebooting at night?**
> That pattern almost always means power: the IR or heater turns on, draw rises, and either the switch budget or a long, thin or CCA cable cannot keep up. Check the switch's per-port power readout before replacing the camera.

Frequently asked questions

Can I run a PoE+ camera on an 802.3af switch?

Sometimes it powers up with features disabled (IR, heater or PTZ motion), sometimes not at all. Use a PoE+ port or a PoE+ injector for any camera the datasheet lists as 802.3at.

Does Cat6 let me go beyond 100 m?

No. The 100 m channel limit is the same for Cat5e, Cat6 and Cat6a. Use an extender, fiber or a switch closer to the cameras.

Related guides

- How to put cameras on their own network (VLAN) — vuepointsecure.com/support/how-to-put-cameras-on-their-own-network-vlan
- How much upload bandwidth do security cameras need? — vuepointsecure.com/support/how-much-upload-bandwidth-do-security-cameras-need
- How to find a camera or recorder's IP address — vuepointsecure.com/support/how-to-find-a-camera-or-recorders-ip-address
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