

UNDERSTANDING VOLTAGE DROP IN X-POE LIGHTING SYSTEMS

When designing X-PoE lighting systems, one of the most critical factors to consider is voltage drop—the reduction in voltage that occurs as power travels over the length of a cable. While wattage is often the go-to metric for estimating power requirements, it's the voltage at the end of the cable run—specifically, the fixture's forward voltage—that ultimately determines whether your fixture will operate correctly.

CONSTANT CURRENT FIXTURES AND VOLTAGE REQUIREMENTS

Most lighting fixtures powered by X-PoE are constant current loads, meaning they draw a fixed current (e.g., 2.23A) regardless of the input voltage, within a supported range. This leads to a few key design rules:

1. **Current First:** Ensure the fixture's required current does not exceed the maximum output current of the X-PoE port. If a fixture demands more current than the port can supply, it will not function properly, even if the voltage is sufficient.

2. **Voltage Next:** If the current is within spec, the next consideration is the voltage at the fixture. After accounting for voltage drop along the cable, the remaining voltage must still meet the fixture's forward voltage requirements.

For this reason, a 57V power supply is typically used. Most constant current LED fixtures operate below 48V, so starting at 57V allows for significant voltage drop while still ensuring proper operation.

RECOMMENDED CABLE LENGTHS BY FIXTURE VOLTAGE

To simplify planning, the following cable length guidelines are recommended based on fixture voltage:

- **Fixtures requiring 40V or less:**
  - ✅ Cable runs up to 100 meters (328 feet) are acceptable. No additional voltage drop calculations or special wire gauge considerations are needed within this range.
- **Fixtures requiring more than 40V:**
  - ⚠️ Limit cable runs to 200 feet or less. Within this range, standard Cat6 cabling is sufficient and voltage drop will not affect operation.
- **PoE Distance Limits:**
  - In accordance with Ethernet and PoE standards, PoE cable runs should not exceed 100 meters (328 feet).

By staying within these limits, system designers can avoid the need for voltage drop calculations, heavier-gauge cable, or additional power regulation.

EXAMPLE VOLTAGE DROP TABLES

The tables below show calculated voltage drop and power delivery to a constant current fixture drawing 2.23A, using 23 AWG and 22 AWG Cat6 cable, powered from a 57V supply.

23 AWG Cat6

Distance (ft)	Voltage Drop (V)	Power Loss (W)	Voltage at End (V)	Current (A)	Power at End (W)
328	12.68	28.28	44.32	2.23	98.83
200	7.74	17.26	49.26	2.23	109.85
100	3.87	8.63	53.13	2.23	118.48
40	1.55	3.46	55.45	2.23	123.65

22 AWG Cat6

Distance (ft)	Voltage Drop (V)	Power Loss (W)	Voltage at End (V)	Current (A)	Power at End (W)
328	10.11	22.55	46.89	2.23	104.56

Distance (ft)	Voltage Drop (V)	Power Loss (W)	Voltage at End (V)	Current (A)	Power at End (W)
200	6.17	13.75	50.83	2.23	113.36
100	3.08	6.87	53.92	2.23	120.24
40	1.23	2.74	55.77	2.23	124.37

Because the current is fixed, power delivered is directly proportional to voltage at the load. This makes voltage drop the primary design constraint, rather than wattage.

For example, using standard 23 AWG Cat6 with a 40 ft run, you could deliver almost 124W to the fixture, but it would be delivered at 55V. To deliver 128W at 48V would require almost 2.7A, which exceeds the current capacity of an X-PoE port. This is why system design should focus on the voltage at the fixture, not just the nominal wattage.

SPECIAL NOTES ON OTHER LOAD TYPES

The voltage drop behavior and system response outlined above apply most directly to constant current loads, which are common in LED lighting applications. However, other types of devices such as constant voltage and regulated output loads respond differently to voltage drop.

Constant Voltage Loads Constant voltage devices (e.g., 12V, 24V, or 48V LED strips and fixtures) expect a specific input voltage and allow current to vary with the load.

- If voltage drops below the rated value, the device may dim, flicker, or fail to power on.
- Over-voltage conditions can result in permanent damage.

Regulated Output Devices (e.g., DCOs) Regulated output devices—such as DC-DC converters or smart drivers—are designed to maintain a constant output voltage or power regardless of fluctuations on the input.

- When input voltage drops, these devices increase their input current to compensate and maintain the desired output.
- This can overload the X-PoE port, triggering current protection or port shutdown.

RELATED INFORMATION

Technical Support

Questions about voltage drop on an X-PoE cable run can be sent to support@luum.io.

Document Feedback

While we have taken great care to ensure the accuracy and completeness of this document, we welcome your feedback and suggestions. If you notice any errors or omissions, or feel a topic could benefit from further explanation, please email your feedback to support@luum.io.

Revision History

Date	Revision	Notes
11/3/2026	A	Converted to the current guide format.

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