# D1 - INPUT AND OUTPUT POWER

## D1.1 - Input Power Range

The X-PoE lighting controls system is powered by 48V - 57V DC power. This allows it to be compatible with many standard DC power supplies and systems. To determine the maximum current draw, multiply the number of ports on the X-PoE controllers by 2.23 (maximum current output per port).

## D1.2 - Output Power Range

The X-PoE lighting controller includes integrated constant-current LED drivers per channel. Output current per channel is limited by the driver; it will not exceed 1.115A per channel (2.23A per port). As a result, power at the fixture will not exceed the channel limit: for an LED load, max power at the fixture = fixture forward voltage (Vf) × channel current (up to 1.115A). The output voltage per port supports a range from 24V up to the input voltage (D1.1 - Input Power Range). Nominal wattage at 57V is ~54W–65W per channel or ~108W–130W per port; actual power depends on Vf and input voltage. For constant-power loads (e.g. POE-DCO-65, XPOE-DCB-100), the constant-current limit does not apply in the same way. If an LED fixture is specified for more current than the channel can deliver, the fixture will run below its nominal brightness (roughly linear lumen drop at the top end); the driver does not supply more than 1.115A per channel.

## D1.3 - Power Budgeting

1. **Light engine details matter for fixture selection.** The controller is a constant-current driver; per-channel current will not exceed 1.115A, so power at the fixture will not exceed Vf × that current. Many LED engines operate in the 36–48V forward voltage range; higher Vf within the supported range (24–54V) yields more usable power per channel at the same current. If a fixture is rated for more current than the channel can deliver, it will run below nominal brightness (roughly linear lumen drop at the top end). For full brightness, specify fixtures that operate at or below the channel current limit, and document fixture forward voltage and current when specifying loads.

| Vf (typical) | Max power per channel (at 1.115A) |
|---|---|
| 24V | ~27W |
| 36V | ~40W |
| 40V | ~45W |
| 48V | ~54W |
| 54V | ~60W |

1. Once fixtures are selected and Voltage/Current values are established, **Budget by watts per channel.** For sizing, count fixture wattage per channel; nominal max is ~65W per channel at 57V (~130W per port). Sum the load on each channel and on each switch. Total power consumption per X-PoE switch MUST NOT exceed 1,000W with all channels fully loaded. Size the external power supply for the actual total lighting load. For more information, see Recommended DC Power Supplies.
2. Multiple X-PoE switches may share a single power supply; size the supply for the combined load of all switches it powers (e.g. one switch at 200W and another at 400W requires a 600W supply).

# D2 - X-POE LIGHTING CONTROLLERS

## D2.1 - System Design

When planning the design of an X-PoE lighting system, careful consideration must be given to determining the required number of lighting controllers. It is crucial to note that X-PoE lighting controllers offer a range of port types, including one or two channel control, and not all of them may support network connectivity. To accurately assess the quantity of X-PoE lighting controllers, refer to the specific lighting controller's specifications, which outline the available X-PoE and network enabled ports.

## D2.2 - Networking

1. X-PoE lighting controllers must be connected to the same network in order to communicate. This ensures seamless data exchange and enables centralized management of the xpoe lighting system.
2. Router must be capable of and have MDNS support enabled
3. For large sites (>255 devices) the router (or specific DHCP server) must be capable of acting as a DHCP server for a single subnet large enough to fit all of the associated devices (capable of opening up the LAN subnet mask further than 255.255.255.0, which is the default and locked on a lot of non-commercial routers).
4. Ideally, though not required, the router should be capable of providing mac-based DHCP leases across the full subnet
5. For cloud connectivity, network and firewall requirements must be met. See also the AMBR install guide.

## D2.3 - Layout

X-PoE lighting controllers are typically arranged in either a centralized or distributed layout. Large AC/DC power supplies are used to power a cluster of centralized X-PoE controllers. Smaller AC/DC power supplies and high voltage DC distribution systems are used to power distributed X-PoE lighting installations.

## D2.4 - Thermal Management

When installing X-PoE lighting controllers in tight spaces or equipment racks, it is important to consider ventilation and air flow. X-PoE lighting controllers should not be directly stacked in equipment racks. A blank space is recommended for thermal management.

### D2.5 - High Frequency Noise

Depending on the selected dimming mode, the X-PoE lighting controller may emit a high frequency noise. This noise is typically within normal operational parameters and does not indicate a malfunction unless it becomes excessively loud or is accompanied by other issues.

## D3 - LOW VOLTAGE WIRING

### D3.1 - CAT6 Wire Selection

Standard 23AWG Cat6 or thicker is recommended for most applications. Thinner cables are not supported. Use cable with a **75°C or 90°C temperature rating** (minimum 75°C) when the cable carries both power and data; NEC Table 725.144 ampacity limits are based on conductor temperature rating, and 23 AWG at 75°C aligns with X-PoE per-channel current in bundles up to 192 cables. 90°C-rated cable may be used for additional thermal margin in larger bundles or higher ambient conditions. For the relationship between NEC, the common "100 VA per cable" misconception, and X-PoE compliance, see Doesn't NEC limit the amount of power per cable to 100VA when a cable is carrying both power and data?. It is best practice to minimize the length of the wire runs between the X-PoE lighting controller and the lighting loads. X-PoE supports distances up to 100m (328ft), in line with the Ethernet and PoE standards. If many of the X-PoE loads will be far away from the controllers, it is recommended to explore a distributed X-PoE installation or consider using 22AWG Cat6 cabling.

### D3.2 - Power Input Wire Selection

The DC input to an X-PoE switch can carry up to 20A at 48–57 VDC under full load conditions. 10–12 AWG copper conductors are recommended, with 10 AWG preferred for runs longer than 10 ft (3 m). **Final conductor sizing and overcurrent protection must comply with applicable electrical codes.**

## D4 - PDS (POWERED DEVICES)

### D4.1 - Overview

The X-PoE PDs convert the RJ45 from the Cat6 infrastructure to pairs of conductors for connecting to an LED. These are small enough to fit into most places, and most fixture housings can be adapted to fit the panel mount PD model. Most PD models also pass through the X-PoE power so additional fixtures can be daisy chained. For more information, see XPD Overview Data Sheet.

### D4.2 - Multi-Channel PDs

Fixtures and loads greater than 1.115A will need to use a single channel port or a two channel port with a two channel PD. Both channels can be used to power a high wattage fixture, or share a load with several low wattage fixtures. Two channels from a single X-PoE port MUST NOT be used to power two separately controlled loads (circuits) in different rooms; channel split is allowed only for multi-zone control within the same room[1].

### D4.3 - IEEE PDs

The X-Poe ports are compatible with IEEE802.3af/at/bt-type 4, up to 90W per port. Standard IEEE PoE splitters/PDs can be used to provide low voltage power to a variety of devices. All ports support IEEE power, but not all ports support data connectivity.

### D4.4 - PD Verification

Verify and install the appropriate PD for the load type before establishing a connection with an X-PoE lighting controller. PDs can be utilized in generic or customized configurations; confirm the configuration matches the fixture or load.

### D4.5 - Polarity and Lead Colors

Each channel has independent (+) and (−) conductors at the PD output. For panel-mount PDs (e.g. XPD-T2P-G), lead colors are typically: Channel 1 — RED (+), WHITE (−); Channel 2 — YELLOW (+), BLUE (−). Refer to the specific PD data sheet for the product in use.

## D5 - LED LIGHT FIXTURES

### D5.1 - Fixture Selection

The X-PoE lighting controllers contain LED lighting drivers, capable of dimming constant current and constant voltage LED loads. This eliminates the need for an LED driver at each fixture. Each X-PoE port can support up to 2.23A maximum output (1.115A per channel on 2-channel X-PoE ports). In order to connect an LED to an X-PoE channel, an adapter called a “PD” is used (D4 - PDs).

## D6 - CONTROLS

### D6.1 - Integration

The X-PoE lighting controls system is controls agnostic, meaning it can work with any IP based controls system. Standard IEEE PoE PDs can be used to power a variety of low voltage sensors, switches, and other controllers. MQTT and a REST API are available and can easily be integrated into many 3rd party control systems. We also offer an in-house controls system if one is not specified for your project.

## D7 - PORT AND CHANNEL MODEL

### D7.1 - Granularity

The port is the power budget envelope; the channel is the smallest controllable unit. Choose port and channel assignment based on control intent before wiring.

### D7.2 - Zoning Within One Room

If one room needs two zones, use both channels of one port for that room.

### D7.3 - Zoning Across Rooms

If loads are in separate rooms, use separate ports (or separate controllers) even if power would allow a single port; one port SHALL NOT serve two different rooms. In some small projects, violating this rule in extreme cases may make sense, but repeatedly breaking this rule on large projects will cause more pain than gain.

### D7.4 - Fixture Packing

Calculate fixture count per channel, not only per port; a fixture using one channel consumes that channel for control purposes. Multiple fixtures on the same channel will all be controlled together.

## D8 - AMATIS CONTROLS

### D8.1 - Typical Office

For typical office designs using Amatis controls, the system should include: one AMBR gateway (XWS-AMBR-KIT) per 100 wireless devices (battery switches excluded), one occupancy or multi-sensor (e.g. XWS-S1 or Luum XWD-SENSOR-3 where documented) per office, and one wall switch (e.g. XWS-SW series or XWS-SW6). See AMBR Install Guide, Sensor1 Install Guide, and Wall Switch Install Guide.

### D8.2 - Placement

The AMBR MUST NOT be installed in a metal enclosure or behind signal-blocking materials (e.g. thick concrete or metal walls). Install the AMBR in a location central to the devices it will communicate with. Sites with more than 100 wireless devices require multiple AMBRs distributed among the devices; do not centrally locate all AMBRs. See AMBR Install Guide - Placement.

### D8.3 - Commissioning

The AMBR assigns programming tasks to devices during commissioning. Ensure the AMBR is updated and the local event bus is enabled when integrating X-PoE controllers with Amatis. See X-PoE Amatis Integration Guide.

### D8.4 - Mesh and Multiple Gateways

When the site has more than 100 devices, multiple AMBRs are required and MUST be distributed (not centrally located). Wall switches have shorter range (e.g. 75') than sensors (e.g. 200'); obstacles reduce range. Do not hide the gateway behind materials that block wireless signal.

## D9 - COMMISSIONING WORKFLOW

1. **Pre-install review**: Confirm fixture specs, forward voltage/current, and channel zoning plan.
2. **Controller and PSU bring-up**: Power up X-PoE controller(s) and verify power supply is sized for load (and for combined load if sharing a PSU). See D1.3 - Power Budgeting.
3. **Network validation**: Ensure controllers and AMBR are on the same network; verify mDNS and DHCP. See D2.2 - Networking.

4. **PD connection and polarity**: Verify correct PD for load; connect with correct polarity per D4.5 - Polarity and Lead Colors.
5. **Channel assignment and zoning**: Confirm channels match room/zoning intent; verify no port spans two rooms.
6. **Sensor and switch pairing**: Commission Amatis sensors and switches per install guides; note device IDs for programming.
7. **Functional test**: Test dimming, scenes, and occupancy (if applicable) per room.
8. **Handoff**: Document as-builts, port map per room, and labeling (patch panel, PD, fixture tail).

## D10 - RECOMMENDATIONS (NOT YET DOCUMENTED)

Items in this section are not yet specified in official data sheets or install guides. Use engineering judgment and confirm with Luum or Amatis as needed.

- Headroom or diversity policy for power budgeting (e.g. derating or spare capacity).
- Room templates and bill-of-materials templates (see Office Example, Classroom Example for reference).
- Installation QA checklist and troubleshooting quick reference (see install guides and FAQs for documented items).

See D4.2 - Multi-Channel PDs and D7.2 - Zoning Within One Room.

## RELATED INFORMATION

### Technical Support

Questions about these design rules 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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