Wire & Cable Calculator

User Guide

Size wire runs, check voltage drop, and verify conduit fill right from the field — no charts or tables required.

Quick Reference

Command: /wire
Calculations: Gauge selection, voltage drop, conduit fill
Standards: NEC Chapter 3 & Article 725
Access: Available to all active subscribers

Contents

1. Getting Started

Send /wire to open the wire calculator. You will be asked a series of questions about your run: voltage, current draw, distance, and cable type. The bot calculates the recommended gauge and checks for compliance.

This tool is designed for low-voltage runs typical in access control and security: 12 VDC, 24 VDC, and PoE installations. For line-voltage work, consult a licensed electrician.

> Tip: Have the device spec sheet handy — you will need the current draw (amps or mA) and operating voltage to get an accurate recommendation.

2. Wire Gauge Selection

The calculator recommends a wire gauge based on three factors: the current your device draws, the length of the run, and acceptable voltage drop. Common scenarios for access control:

- Short runs (under 50 ft): 22 AWG or 18 AWG is typical for readers and contacts drawing under 200 mA.
- Medium runs (50–150 ft): Step up to 18 AWG or 16 AWG to stay within voltage drop limits, especially for 12 VDC locks.
- Long runs (150+ ft): 16 AWG or 14 AWG may be needed. Consider PoE devices or a local power supply to avoid excessive drop.
- Lock power: Electric strikes and mag-locks can draw 300–600 mA at 12/24 VDC. Size wire for peak inrush, not just steady-state.

> Note: Always round up to the next larger gauge when the calculation falls near a boundary. A slightly heavier wire costs little but prevents field problems.

3. Voltage Drop Analysis

Voltage drop is the single most common cause of intermittent lock failures and reader resets in the field. The calculator uses the standard formula:

$V_{drop} = 2 \times L \times I \times R$ where L = length in feet, I = current in amps, R = resistance per foot for the gauge.

- For 12 VDC circuits, keep drop under 5% (0.6 V) for reliable operation.
- For 24 VDC circuits, 5% is 1.2 V — more forgiving on longer runs.
- PoE (48 V) tolerates longer runs but check the PSE wattage budget.

> Tip: If voltage drop is too high, the cheapest fix is often adding a local power supply near the device instead of upsizing the entire cable run.

4. Conduit Fill

NEC Chapter 3 limits how many cables you can pull through a conduit. The calculator checks your cable count and sizes against NEC fill tables:

- 1 cable: 53% fill allowed
- 2 cables: 31% fill allowed
- 3+ cables: 40% fill allowed
- Use the outer diameter of the cable jacket, not just the conductor size

Overfilling conduit makes pulling difficult and can damage cable jackets, leading to shorts and ground faults. The calculator warns you when you approach or exceed the fill limit.

5. NEC Compliance

The calculator cross-references your inputs against NEC requirements and flags potential issues:

- Class 2 circuit limits (100 VA max per NEC 725.121)
- Plenum-rated cable required above drop ceilings with HVAC returns
- Riser-rated cable required for vertical runs between floors
- Separation from Class 1 and power circuits per NEC 725.136

> Note: The calculator flags common violations. It does not replace a full NEC review for complex installations.

6. Quick Reference

22 AWG	Readers, contacts — short runs under 50 ft
18 AWG	General purpose — readers, REX, locks under 100 ft
16 AWG	Lock power, longer reader runs
14 AWG	Long high-current runs, mag-lock feeders
Cat5e/6	PoE devices, IP readers, network cameras