

BASIC ELECTRICITY

QUICK REFERENCE

VOLTAGE
CURRENT
RESISTANCE

OHM'S LAW

$$V = I \times R$$

$$24 \text{ V} / 2,000 \text{ } \Omega = 0.012 \text{ A}$$

12 mA example supervision current

BEGINNER TRAINING | FREE LEARNING RESOURCE

Companion to Episode 2: Basic Electricity for Fire Alarm Technicians.
Conceptual learning only; not a field wiring or compliance manual.

THE FOUR ESSENTIAL CONCEPTS

VOLTAGE (V) — ELECTRICAL POTENTIAL DIFFERENCE

Voltage is measured between two points. A meter used to measure DC voltage is connected across the measurement points (in parallel). A displayed voltage only describes a valid measurement when the probes and meter are correctly connected.

CURRENT (A) — RATE OF CHARGE FLOW

Current flows through a complete conducting path. One ampere is 1,000 milliamperes (mA). A current meter ordinarily becomes part of the measured path (in series); its input jacks and protection ratings matter. Do not place a meter set to amps directly across a power source.

RESISTANCE (Ω) — OPPOSITION TO CURRENT

Resistance affects how much current flows for a given voltage. Resistance is measured in ohms (Ω), kilohms (k Ω), or megohms (M Ω). Measure resistance only with the circuit de-energized and, as appropriate, isolate the component to avoid parallel circuit paths affecting the result.

OHM'S LAW — CONNECTING THE CONCEPTS

$$V = I \times R \quad I = V \div R \quad R = V \div I$$

At a fixed voltage, increasing resistance reduces current. A simplified 24 VDC source across a 2,000 Ω resistor yields 0.012 A, or 12 mA.

COMMON CONVERSIONS

$$1 \text{ k}\Omega = 1,000 \Omega \quad 1 \text{ A} = 1,000 \text{ mA}$$

$$0.012 \text{ A} = 12 \text{ mA} \quad 24 \text{ mA} = 0.024 \text{ A}$$

A meter can display an unstable or stray reading when a probe is disconnected. Do not treat an open-lead reading as a valid measurement across a supply.

WORKED ELECTRICAL EXAMPLES

EXAMPLE 1 | CALCULATE CURRENT

Known: $V = 24 \text{ V}$, $R = 2 \text{ k}\Omega = 2,000 \text{ }\Omega$

$$I = 24 \div 2,000 = 0.012 \text{ A} = 12 \text{ mA}$$

EXAMPLE 2 | DOUBLE THE RESISTANCE

Known: $V = 24 \text{ V}$, $R = 4 \text{ k}\Omega = 4,000 \text{ }\Omega$

$$I = 24 \div 4,000 = 0.006 \text{ A} = 6 \text{ mA}$$

EXAMPLE 3 | CALCULATE RESISTANCE

Known: $V = 24 \text{ V}$, $I = 0.024 \text{ A}$

$$R = 24 \div 0.024 = 1,000 \text{ }\Omega = 1 \text{ k}\Omega$$

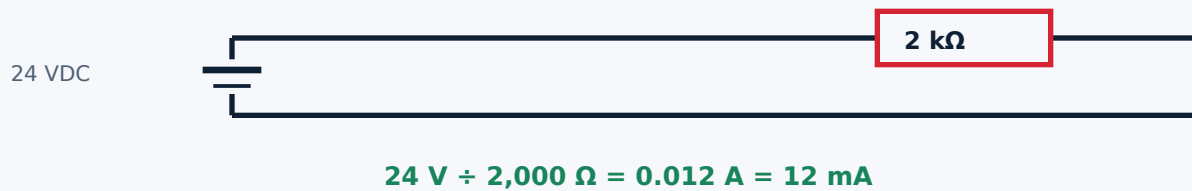
KEY TAKEAWAY

With voltage held constant, a larger resistance results in less current. The actual voltages and thresholds in listed fire alarm equipment depend on its design, wiring, and operating conditions.

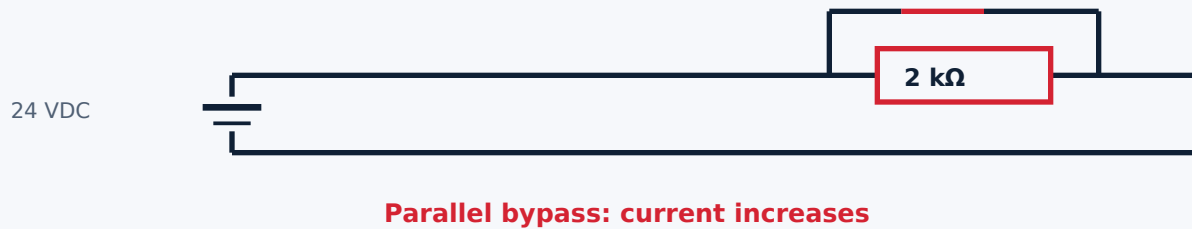
SIMPLIFIED CIRCUIT SUPERVISION

Example: idealized 24 VDC source + 2 kΩ end-of-line resistance.

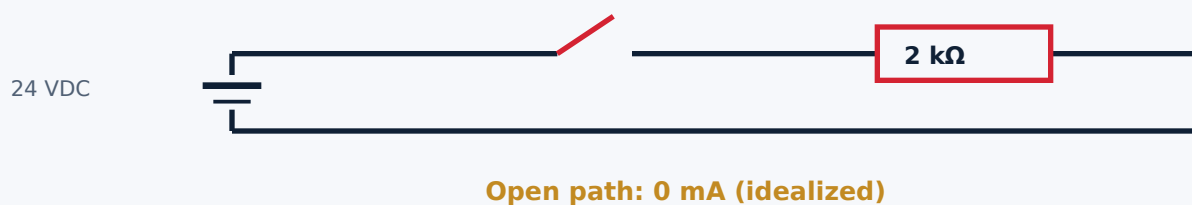
NORMAL — SUPERVISION PATH INTACT



ALARM — LOWER-RESISTANCE PARALLEL PATH



OPEN TROUBLE — BROKEN CONDUCTOR



Important: These are teaching sketches, not a field wiring diagram. A conventional alarm contact may provide a lower-resistance parallel path without removing the EOL resistor. Current in the alarm state depends on the actual circuit and panel design; do not assign a universal alarm current. An ideal open path carries zero current, but real monitoring arrangements may differ.

PRACTICAL TECHNICIAN CONNECTIONS

WHAT THE METER CAN TELL YOU

DC volts: measure across properly selected test points, using the voltage function and corresponding meter jacks.

Resistance: remove power and isolate as necessary before checking an EOL resistor.

Current: use the correct current range, fused jack, and series connection; follow safe test procedures.

WHY END-OF-LINE RESISTORS MATTER

In a common resistor-supervised conventional initiating circuit, the panel observes an expected electrical path under normal conditions. An open may eliminate that path and cause trouble. A closed initiating contact can create a lower-resistance alarm path. Detection thresholds and interpretation are manufacturer- and model-specific.

DON'T CONFUSE THE CONDITIONS

NORMAL: Expected supervision condition.

ALARM: A recognized alarm input or qualifying system condition.

TROUBLE: A system fault such as a broken supervised pathway.

SUPERVISORY: A monitored abnormal condition requiring attention, such as valve tamper; not the same as circuit trouble.

FIELD SAFETY REMINDERS

- Verify the selected meter function and lead jacks before contacting equipment.
- Never measure resistance on an energized circuit.
- Follow manufacturer documentation and applicable site safety procedures.
- Do not infer fire alarm control-unit thresholds from this 24V / 2k Ω example.

KNOWLEDGE CHECK

1. What quantity is measured in volts, and where are the probes placed?
2. How many milliamperes are in 0.012 amperes?
3. What happens to current if resistance doubles while voltage stays fixed?
4. What idealized current flows in an open 24 VDC circuit?
5. Why does a typical resistor-supervised circuit include an EOL resistor?

ANSWER KEY

1. Potential difference; measure between two points in parallel.
2. 12 mA.
3. Current is reduced by half.
4. 0 mA through an ideal open path.
5. To create a recognizable normal supervision path (system-specific).

NEXT LESSON

Build on the fundamentals with electrical measurements, series and parallel circuits, and practical troubleshooting examples.