

Voltage in Parallel Circuits

- **Voltage is the same across all parallel-connected devices.**
 - In a house outlet (typically 120V or 240V depending on your region), every device plugged in sees the same voltage—120V in the U.S.
 - This is true whether you plug in one device or multiple devices in parallel.

Current in Parallel Circuits

- **The current increases as you add more devices.**
 - Each device draws the current it needs, based on its resistance or power requirements, according to **Ohm's Law**:

$$I = V / R$$

- or for power:

$$I = P / V$$

- For example:
 - A 120W device at 120V will draw $120/120 = 1$ Ampere
 - Two 120W devices will draw $1A + 1A = 2A$, and so on.

Can You Plug in a Device That Draws More Than 120V?

No, you cannot safely plug in a device that **requires more than 120V** into a standard U.S. house outlet. Here's why:

1. **Voltage Compatibility:**
 - The device would expect a higher voltage (e.g., 240V).
 - If plugged into a 120V outlet, it would not function correctly and could be damaged or not operate at all.
2. **Overvoltage Risks:**
 - Conversely, plugging a 120V-rated device into a 240V outlet can cause it to overheat, burn out, or explode, as it is designed to handle a specific voltage range.

The Role of Circuit Breakers

- In your house's electrical system, **circuit breakers** ensure safety by limiting the total current that a circuit can handle (e.g., 15A or 20A).
- If the combined current of all devices plugged into the circuit exceeds this limit, the breaker trips, cutting off power to prevent overheating and potential fire hazards.

Practical Examples

1. **Single Outlet:**
 - Plugging in multiple devices that collectively draw more than the circuit's current limit (e.g., 15A) will trip the breaker, even though the voltage stays constant at 120V.
2. **High-Current Devices:**
 - Devices like air conditioners, ovens, or dryers often require dedicated 240V circuits because they need both higher voltage and higher current.

Key Takeaways

- **Voltage remains constant in parallel connections**, whether it's LEDs connected to a shift register or devices plugged into a house outlet.
- **Current is additive:** The total current is the sum of the currents drawn by all devices.
- **You cannot plug in a device requiring more voltage than the outlet provides**, as it won't work correctly or safely.
- **Current limits depend on the circuit breaker rating**, not just the outlet. Exceeding the current limit trips the breaker for safety.

Let me know if you'd like to dive deeper into any specific aspect!