1. Analog vs Digital Signal

1.1 Analog Signals

Analog signals are signals that are **continuous** — meaning their values can change smoothly without jumps, representing physical quantities from the real world such as temperature, light, sound, and pressure.

Characteristics of analog signals:

- Values can be **any real value** within a range.
- Sensitive to **noise** (electromagnetic interference, heat, etc.).
- Interact directly with the real world (sensors, microphones, photodiodes).

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1.2 Digital Signals

Digital signals are signals that are **discrete** — their values can only be in two conditions: HIGH (1) or LOW (0), usually in the form of a *square wave*.

Characteristics of digital signals:

- Only have **two values**: 0 and 1 (LOW and HIGH).
- Nearly **immune to noise**.
- Used in data transmission and processing within electronic devices.
- Use less energy.

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1.3 Comparison of Analog and Digital

Aspect	Analog Signal	Digital Signal
Nature	Continuous	Discrete
Values	All real values	0 or 1
Noise Resistance	Low	Very high
Primary Use	Sensors, real-world actuators	Data processing, computing
Examples	Microphone sound, LDR output, sensor temperature	Serial data, clock signals, PWM

Aspect	Analog Signal	Digital Signal
Energy Consumption	Relatively larger	More efficient

Both complement each other: analog signals capture real-world phenomena accurately, then are converted to digital so they can be processed by computers/microcontrollers.

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