

## btechnotes.in Originals

### Continuous and Discrete Signals:

Understanding signals is fundamental in fields like engineering, telecommunications, and data processing. Signals carry information and can be categorized mainly into continuous and discrete types. Below are detailed notes to help you grasp these concepts easily.

### What is a Signal?

A signal is a function that conveys information about the behavior or attributes of something. In simpler terms, it's a way to communicate data from one place to another.

### Examples of Signals: Continuous and Discrete Signals

Audio signals (sound)

Video signals (images)

Electrical signals (voltage)

levels)

Continuous Signals -

Definition:

A continuous signal is defined for every instant of time. It has an infinite number of possible values in a given time interval.

Characteristics:

Time Continuity: Exists at every moment in time.

Amplitude Continuity: Can take any value within a range.

Represented by Analog Waveforms: Such as sine waves, square waves, etc.

Mathematical Representation:

Usually represented as  $x(t)$ , where  $t$  is a continuous variable

## btechnotes.in Originals

(time).

### Examples:

**Human Voice:** The sound waves produced are continuous.

**Analog Clocks:** The movement of the hands is smooth and uninterrupted.

**Electrical Signals in Analog Circuits:** Voltage varies smoothly over time.

### Advantages:

**High Resolution:** Can represent more detailed information.

**Natural Representation:** Closely mimics real-world phenomena like sound and light.

### Disadvantages:

**Susceptible to Noise:** More prone to degradation over distances.

**Requires More Bandwidth:** Needs a broader range of frequencies for

transmission.

Discrete Signals --

Definition:

A discrete signal is defined only at discrete points in time. It consists of distinct and separate values.

Characteristics:

Time Discreteness: Exists only at specific intervals.

Amplitude Discreteness: Can take only certain values, often integers.

Represented by Sequences: Such as lists of numbers.

Mathematical Representation:

Usually represented as  $x[n]$ , where  $n$  is an integer representing time

## btechnotes.in Originals

steps.

Examples:

Digital Clocks: Display time in discrete steps (seconds, minutes).

Computer Data: Stored and processed in binary (0s and 1s).

Samples in Digital Audio: Music stored as a series of samples at specific intervals.

Advantages:

Noise Resistance: Less affected by noise and interference.

Easier to Process: Compatible with digital systems like computers.

Efficient Storage: Requires less storage space compared to continuous signals.

Disadvantages:

Aliasing Issues: Can lose information if not sampled correctly.

Lower Resolution: May not capture all

btechnotes.in Originals

details of the original signal.

Key Differences Between Continuous and Discrete Signals

Visit Table For Differences at <https://btechnotes.in/continuous-and-discrete-signals/>

Visualisation

(Visit [btechnotes.in](https://btechnotes.in) for visualisation)

Applications

Continuous Signals:

Analog Broadcasting: Radio and television signals.

Control Systems: Industrial machinery control.

Instrumentation: Measuring physical quantities like temperature, pressure.

Discrete

Signals:

Digital Communications: Internet data transmission.

Computer Systems: Data processing and storage.

Digital Audio and Video: MP3s, digital cameras.

Converting Between Continuous and Discrete Signals

Sampling:

The process of converting a continuous signal into a discrete one by taking samples at regular intervals.

Nyquist Theorem: To avoid loss of information, the sampling rate should be at least twice the highest frequency present in the signal.

Quantization:

Assigning discrete amplitude values to the sampled

points.

**Analog-to-Digital Conversion (ADC):**  
Combines sampling and quantization to convert continuous signals into digital form.

**Digital-to-Analog Conversion (DAC):**  
Converts discrete signals back into continuous form for real-world applications.

## Summary

Continuous Signals are smooth and defined at every moment, ideal for representing natural phenomena but sensitive to noise.

Discrete Signals consist of distinct values at specific intervals, suitable for digital processing and resistant to noise.

Follow us on Instagram  
@btechnotesdotin