

# Data Communication Basics

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The fundamental role of data communications is to transfer information from one location to another.

## Definitions:

- **Data** - An entity that conveys meaning or information.
- **Signal** - An representation of data that can more through a particular medium.
- **Signaling** - The physical propagation of a signal across a medium.

Practically speaking, a signal is energy moving in a medium and the data is produced by **modulation**.

# Modulation

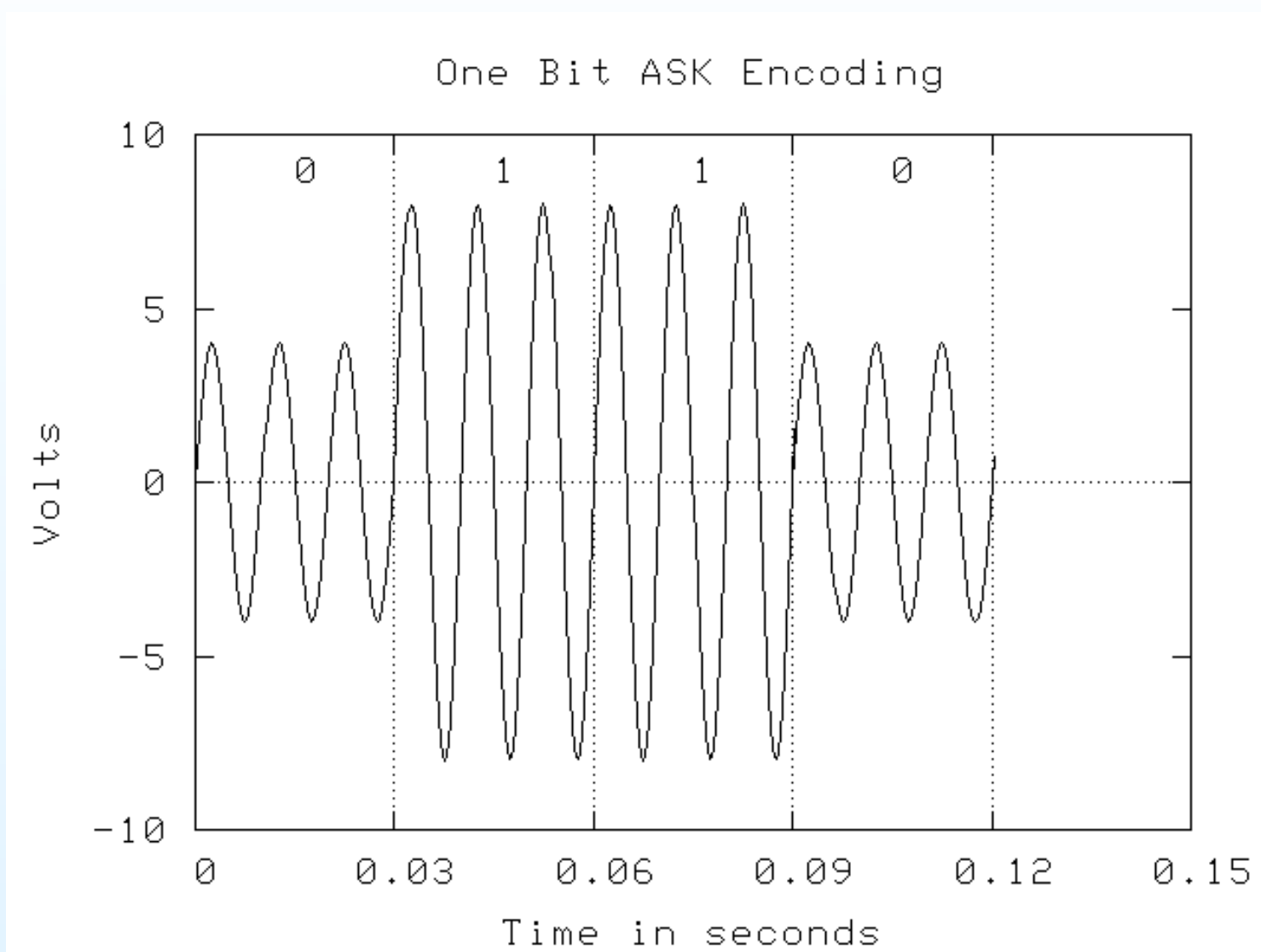
- An example is the human voice/hearing transmitter/receiver.
- Consider the null data signal as a:
  - voltage on a wire,
  - light in a fiber optic cable,
  - potential in the AM radio band or
  - temperature differential in the infrared spectrum.
- In order to encode data in the signal, it has to have changes over time. This is modulation.
- The changes could have any form, but they must be decipherable on the other end.
- An example is a sinusoid:  $x(t) = A \sin(2\pi ft + \phi)$  where  $A$  is the amplitude,  $f$  is the frequency in Hz,  $\phi$  is the phase angle and  $t$  is the time ( $2\pi ft$  is the time converted to radians).

# Sinusoidal Modulation

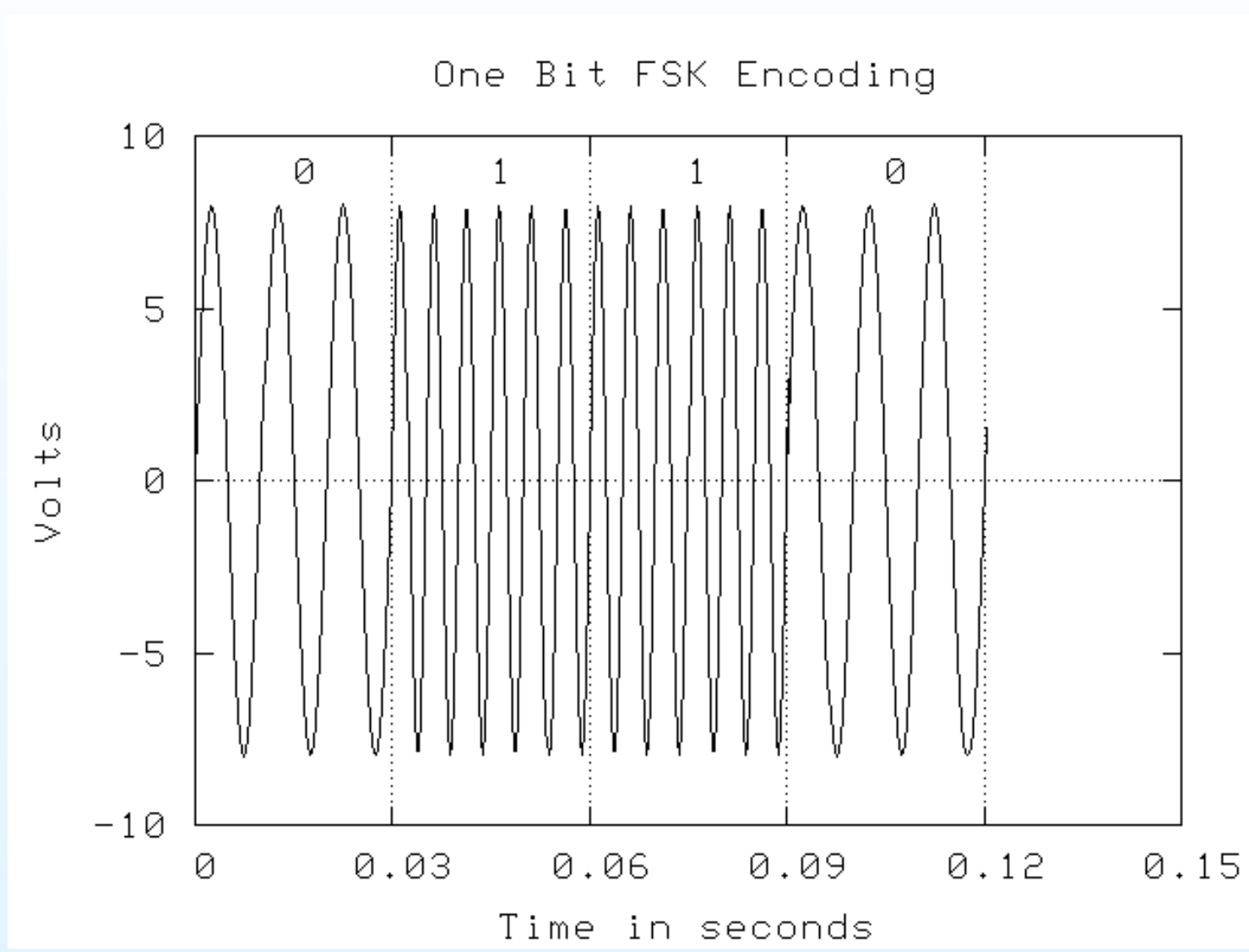
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- A transmitter can change:
  - the amplitude,
  - the frequency,
  - and/or the phase angle,
- The receiver can sample the signal and ferret out the amplitude, frequency and phase angle.
- Modulation of the amplitude is called *Amplitude Shift Keying* or *Amplitude Modulation (AM)*.
- Modulation of the frequency is called *Frequency Shift Keying* or *Frequency Modulation (FM)*.
- Modulation of the phase angle is called *Phase Shift Keying*.

# ASK Modulation Examples



# FSK Modulation Examples



# PSK Modulation Examples

