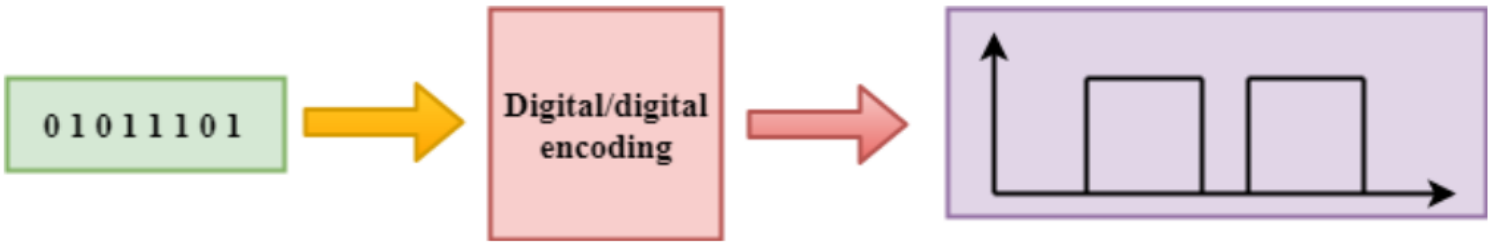
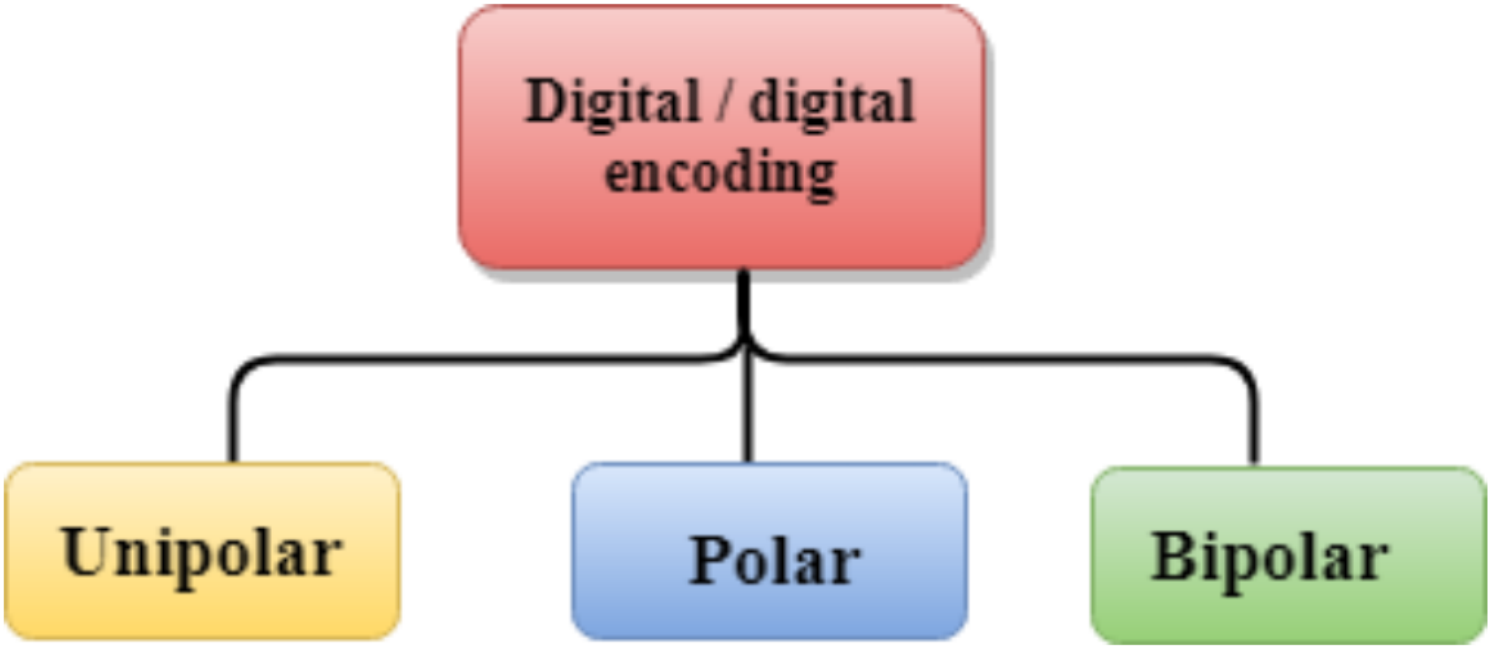
DIGITAL-TO-DIGITAL CONVERSION

Digital-to-digital encoding is the representation of digital information by a digital signal. When binary 1s and 0s generated by the computer are translated into a sequence of voltage pulses that can be propagated over a wire, this process is known as digital-to-digital encoding.



Digital-to-digital encoding is divided into three categories:

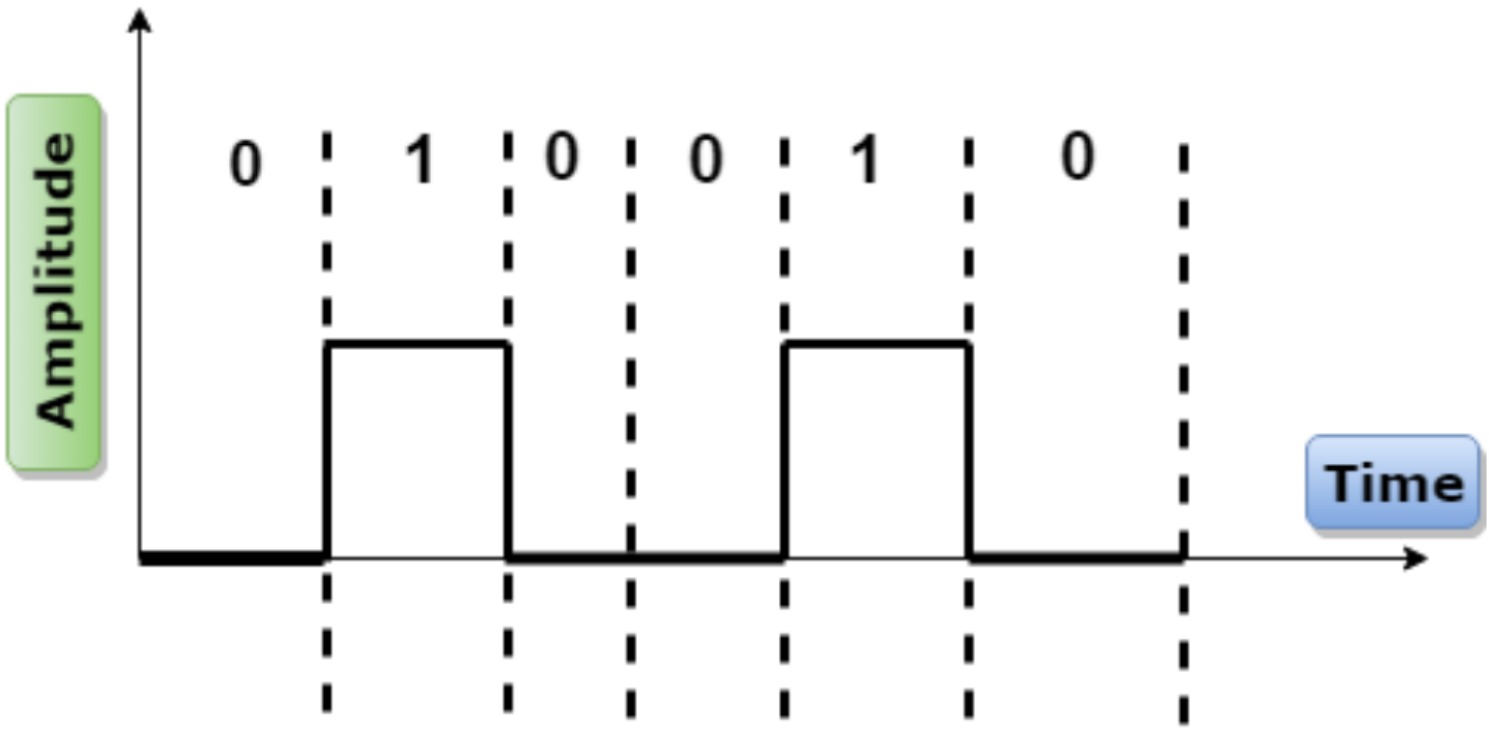
- Unipolar Encoding
- Polar Encoding
- Bipolar Encoding



Unipolar

- Digital transmission system sends the voltage pulses over the medium link such as wire or cable.
- In most types of encoding, one voltage level represents 0, and another voltage level represents 1.
- The polarity of each pulse determines whether it is positive or negative.
- This type of encoding is known as Unipolar encoding as it uses only one polarity.
- In Unipolar encoding, the polarity is assigned to the 1 binary state.

- In this, 1s are represented as a positive value and 0s are represented as a zero value.
- In Unipolar Encoding, '1' is considered as a high voltage and '0' is considered as a zero voltage.
- Unipolar encoding is simpler and inexpensive to implement.



Unipolar:

- It uses only one polarity
- One of the two binary states is encoded, usually the 1. The other state, usually 0, is represented by zero voltage
- Unipolar encoding uses only one level of value

Diagram of unipolar encoding:

Polar Encoding:

- Polar encoding uses two voltage levels
- One positive and one negative

Non-Return-to-Zero (NRZ) Encoding

- In NRZ encoding, the level of the signal is always either positive or negative.
- If the line is idle or zero it means no transmission is occurring at all

Types of Non-Return-to-Zero (NRZ) Encoding

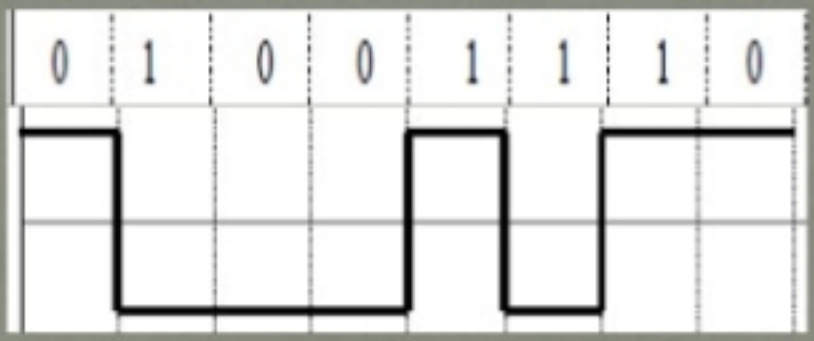
- NRZ-L (Non-return-to-zero, Level)
- NRZ-I (Non-return-to-zero, Invert)

NRZ-L (Non-return-to-zero, Level)

- In NRZ-L the level of the signal is dependant upon the state of the bit.
- A positive voltage usually means the bit is 0, and negative voltage means the bit is a 1

NRZ-I (Non-return-to-zero, Invert)

- In NRZ-I, an inversion of the voltage level represents a 1 bit
- A 0 bit is represented by no change
- It is the transition between a positive and a negative voltage



RZ (Return-to-zero) Encoding

- Uses three Values: positive, negative, and zero.
- The signal state is determined by the voltage during the first half of each data binary digit
- The signal returns to a resting state (called zero) during the second half of each bit
- The resting state is usually zero volts, although it does not have to be

RZ (Return-to-zero) Encoding

Biphase Encoding

- The signal changes at the middle of the bit interval

  but does not return to zero

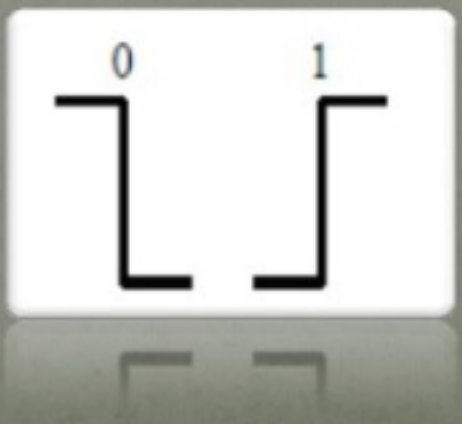
- It continues to the opposite pole

Types of Biphase Encoding

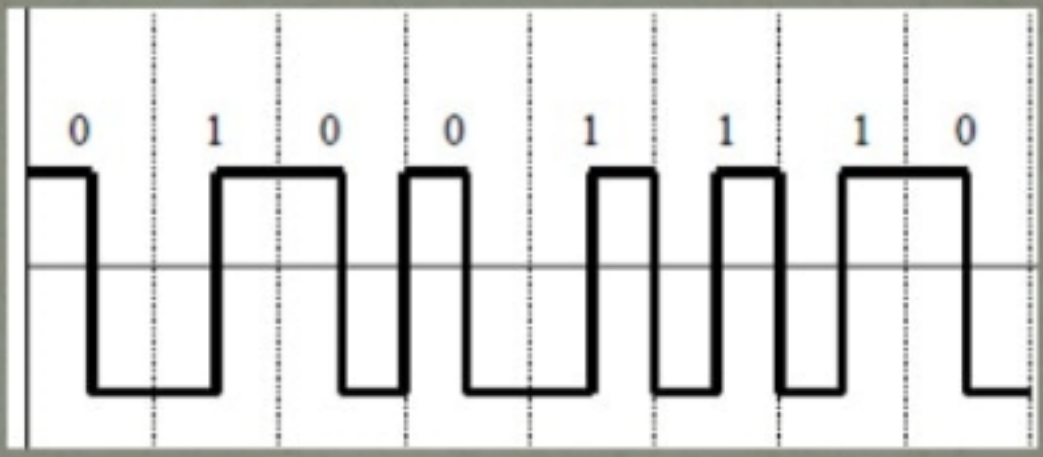
- Biphase encoding is implemented in two different ways
  - Manchester
  - Differential Manchester

Manchester Biphase Encoding

- Uses the inversion at the middle of each bit interval for bit representation
- A negative-to-positive transition represents binary 1 and a positive-to-negative transition represents binary 0.



Manchester Biphase Encoding



Bipolar Encoding

- Bipolar encoding uses three voltage levels: positive, negative and zero. The zero level is used to represent binary 0 positive and negative voltages represent alternating 1s. (If 1st one +ve, 2nd is -ve).
- * Three types of bipolar encoding are popular use by the data communications industry: AMI, B8ZS, and HDB3

Bipolar Alternate Mark Inversion (AMI)

- AMI means alternate 1 inversion. A neutral, zero voltage represents binary 0.
- Binary 1s are represented by alternating positive and negative voltages

Bipolar Alternate Mark Inversion (AMI)