SNS COLLEGE OF ENGINEERING

An Autonomous Institution

Coimbatore-641 107

Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

19EC504-ANALOG AND DIGITAL COMMUNICATION

III YEAR/ V SEMESTER

UNIT - III - DIGITAL COMMUNICATION

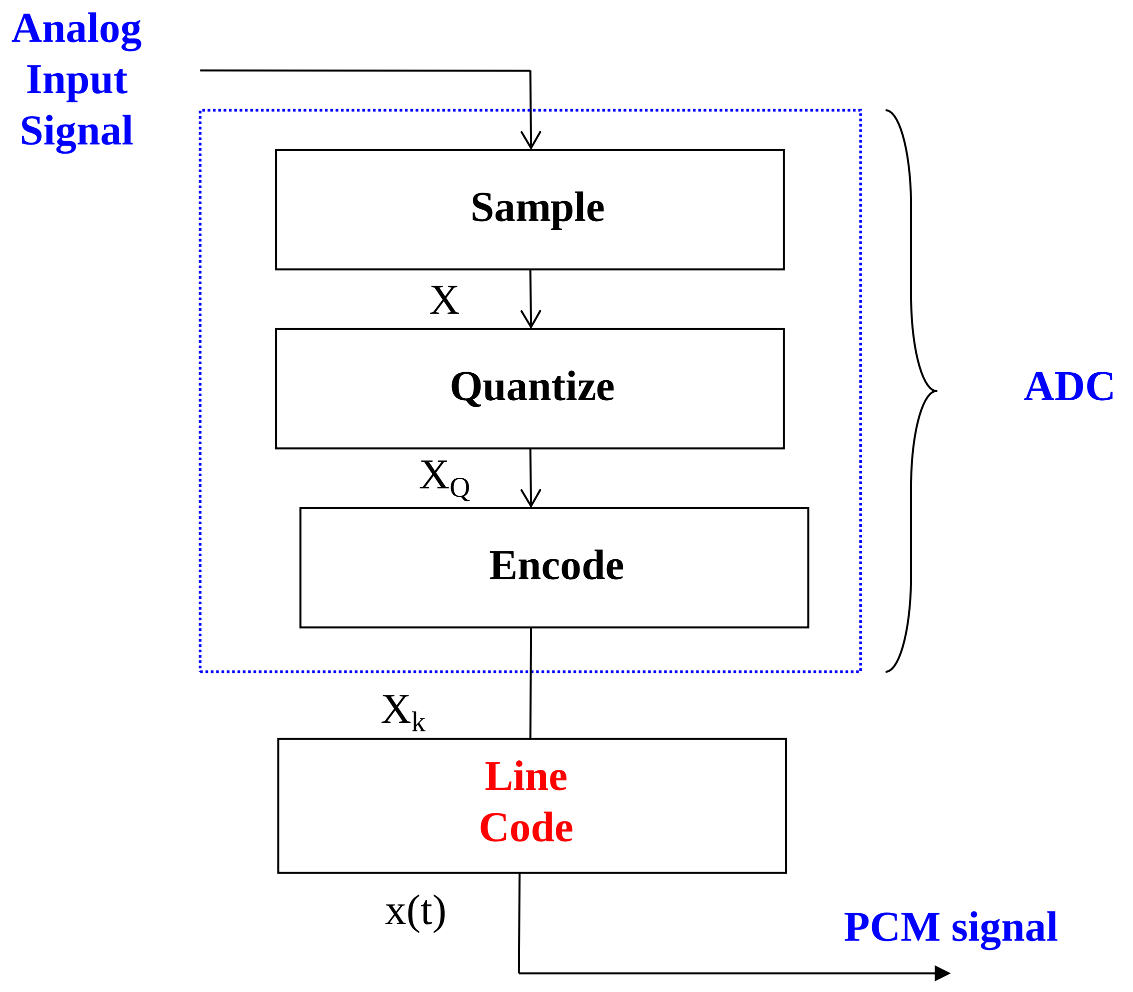
TOPIC - PROPERTIES OF LINE CODING

Line Code

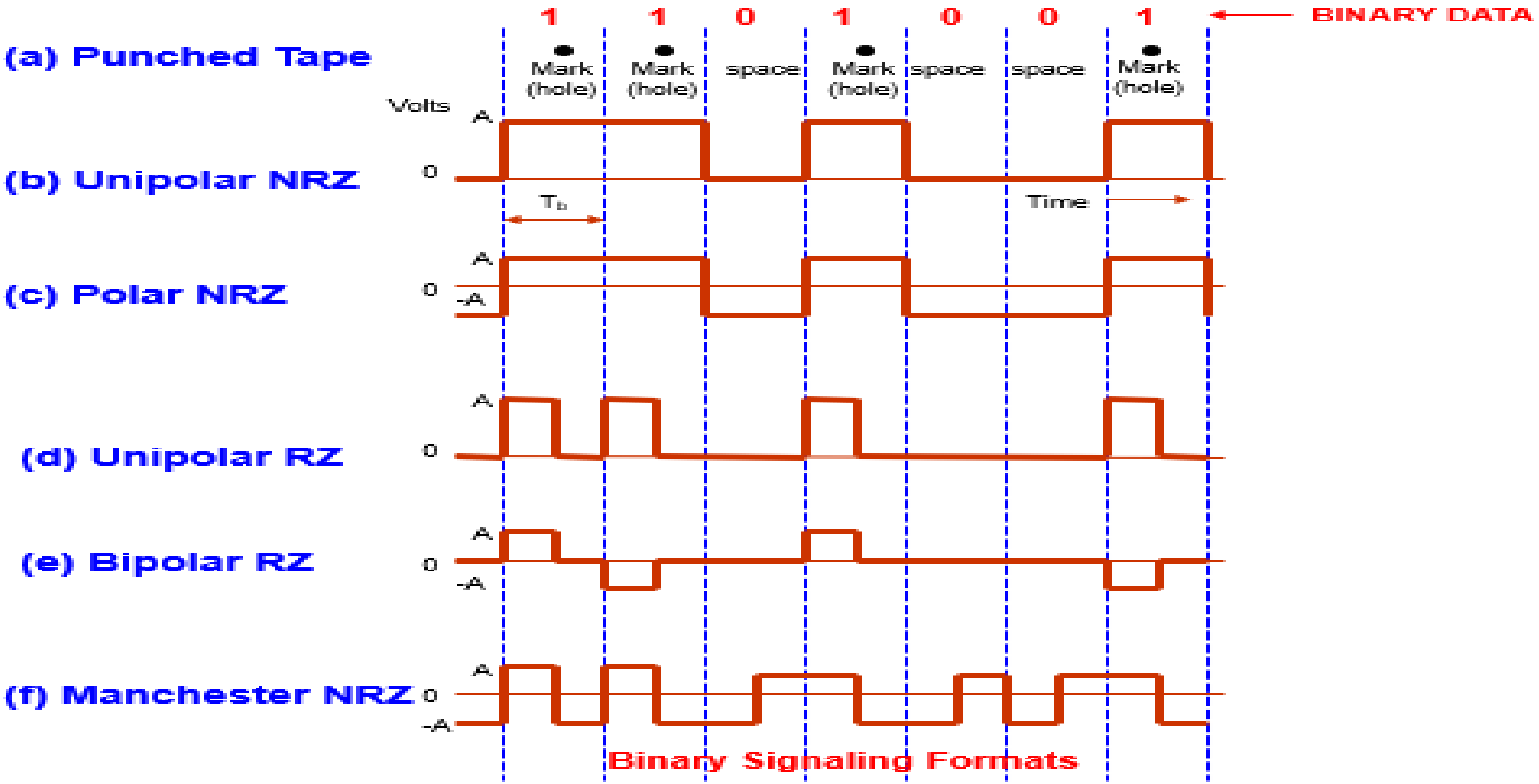
- In telecommunication, a line code (also called digital baseband modulation, also called digital baseband transmission method) is a code chosen for use within a communications system for baseband transmission purposes.
- Line coding is often used for digital data transport.
- Binary 1's and 0's, such as in PCM signaling, may be represented in various serial–bit signaling formats called line codes.

The output of an ADC can be transmitted over a baseband channel.

- The digital information must first be converted into a physical signal.
- The physical signal is called a ***line code***. Line coders use the terminology ***mark*** to mean binary one and ***space*** to mean binary zero.



Types of Line Coding

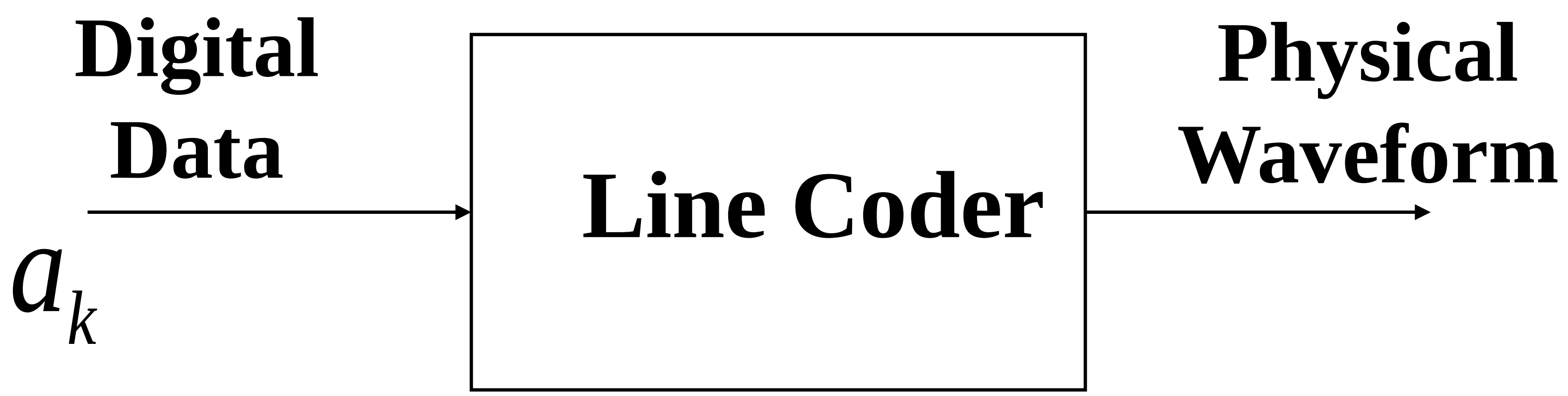


Goals

A line code is designed to meet several goals:

- Self-synchronization.
  - The ability to recover timing from the signal itself.
  - Long series of ones and zeros could cause a problem.
- Low probability of bit error.
  - The receiver needs to be able to distinguish the waveform associated with a mark from the waveform associated with a space, even if there is a considerable amount of noise and distortion in the channel.
- Spectrum that is suitable for the channel.
  - In some cases DC components should be avoided if the channel has a DC blocking capacitance.
  - The transmission bandwidth should be minimized.

Line Coder



$$x(t) = \sum_{k=-\infty}^{\infty} a_k\, p(t - kT_b)$$

- The input to the line encoder is a sequence of values a_k that is a function of a data bit or an ADC output bit.
- The output of the line encoder is a waveform:

$$x(t) = \sum_{k=-\infty}^{\infty} a_k\, p(t - kT_b)$$

- Where $p(t)$ is the ***Pulse Shape*** and T_b is the ***Bit Period***
  - $T_b = T_s/n$ for n bit quantizer (and no parity bits).
  - $\mathbf{R}_b = 1/T_b = nf_s$ for n bit quantizer (and no parity bits).
- The operational details of this function are set by the particular type of ***line code*** that is being used.

Properties of Line Codes

- **Self–Synchronisation**: There is enough timing in formation built into the code so that bit synchronisers can extract the timing or clock signal. A long series of binary 1’s or 0’s should not cause a problem in time recovery.
- **Low Probability of Bit Error**: Receivers can be designed that will recover the binary data with a low probability of bit error when the input data is corrupted by noise or **ISI**.
- **A Spectrum that is Suitable for the Channel**: For example, if the channel is AC coupled, the PSD of the line code signal should be negligible at frequencies near 0. In addition, the signal bandwidth needs to be sufficiently small compared to the channel bandwidth, so that **ISI** will not be a problem.
- **Transmission Bandwidth**: This should be as small as possible.
- **Error Detection Capability**: It should be possible to implement this feature easily by the addition of channel encoders and decoders, or the feature should be incorporated into the line code.

THANK YOU