Experiment Number: 01

Name of the Experiment: To write a program for Unipolar Non-Return-to-Zero (NRZ) line coding.

Objectives: To know the basics of line coding technique and how it works and what are the advantages and disadvantages of Unipolar (NRZ) line coding technique.

Theory: Line coding is the process of converting digital data into digital signal suitable for transmission over a communication channel, typically by encoding each bit or symbol with specific voltage levels, frequencies or phases.

Unipolar Non-Return-to-zero is a line coding technique used in digital communication where one voltage level represents a binary '1' and another voltage level represents a binary '0'. Unlike Return-to-Zero encoding, in Unipolar NRZ the signal does not return to zero between the bit intervals. This means that the voltage level is maintained during the entire duration of the bit period, representing either a high or low state of each bit.

In unipolar NRZ the signal is only in the positive side. That is shown as follows.

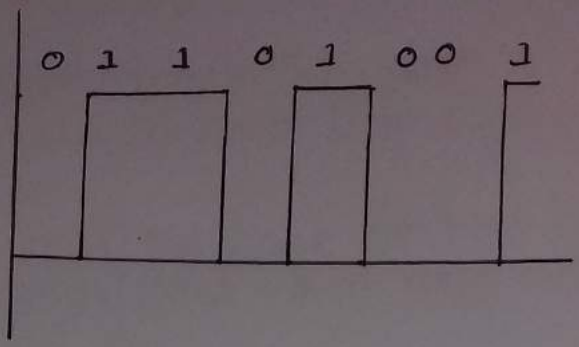

Figure: Unipolan Non-Return-to-zero

Advantages Unipolan NRZ

1. It is simple in implementation.
2. It has a better bandwidth efficiency.
3. It supports higher data rates.

Disadvantages of Unipolan NRZ

1. Presence of DC components leading to signal distortion.
2. Lack of inherent clock synchronization.
3. Vulnerable to base line wandering.
4. Susceptible to transmission errors, especially in noisy environments.
5. Limited error detection, particularly for long sequences of consecutive bits.

Apparatus Required

1. Laptop/ Desktop Computer.
2. Application software.

Experiment Number: 02

Name of the Experiment: To write a program for Polar Non-return to zero Line coding.

Objectives: To know the basic of line coding technique and how it works and what are advantages and disadvantages of it.

Theory:

Line coding is the process of converting digital data into digital signal suitable for transmission over a communication channel, typically by encoding each bit or symbol with specific voltage levels, frequencies or phases.

Polar nonreturn-to-zero is a line coding scheme used in digital communication where each bit represented by a specific voltage level. In polar NRZ one voltage level represents a binary zero, while a different voltage level represents a binary '1'. Unlike return to zero encoding the signal does not return to zero between each bit interval. Instead the voltage level is maintained for the duration of the bit period, making polar NRZ more efficient in terms of bandwidth usage but potentially susceptible wanden and clock recovery issues.

In Polar ~~Retu~~ NRZ the negative side is acceptible the diagram of Polar NRZ is given follows.

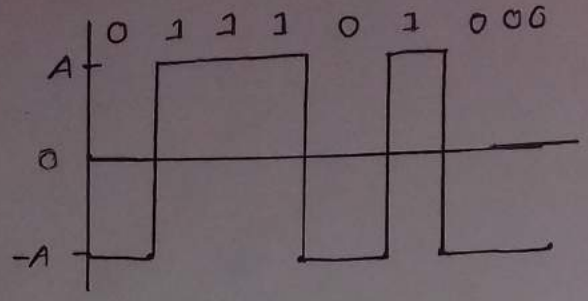

Figure: Polar Rzlon Return to Zero

Advantages of Polar NRZ

1. It is simple in implementation.
2. No low-frequency component are present.

Disadvantages of Polar NRZ

1. No error connection is possible here.
2. No clock is present.
3.

Apparatus Required

1. Desktop/Laptop Computer.
2. Application software.

Experiment Number: 03

Name of the Experiment: To write a program for Uni Polar Return to zero line coding.

Objectives: To know the concept of line coding technique specially the Uni-Polar (RZ) and how it works and what are advantages and disadvantages of it.

Theory: Uni-Polar return to zero encoding is a line coding technique used in digital communication system In Unipolar RZ encoding, each bit of digital data is represented by a signal that returns to zero voltage level within the bit duration, regardless of whether the bit is a logical '0' or '1'. Here is more detailed explanation

1. Encoding
   - Binary '1' is represented by a higher voltage level
   - Binary '0' is represented by a neutral or zero voltage level.

2. Signal Representation
- During each bit period, if the data bit is 1, the signal maintains a high voltage level for the entire half time and then that returns to zero and stays in zero for the remaining half time.

3. Synchronization

Unipolar RZ encoding provides better synchronization capabilities compared to some other line coding schemes such as Unipolar NRZ
The zero voltage level between each bit interval helps in clock recovery and synchronization at the receiver end.

Bandwidth Utilization

Unipolan RZ encoding typically requires more bandwidth compared to other line coding schemes like NRZ due to the presence of additional transactions

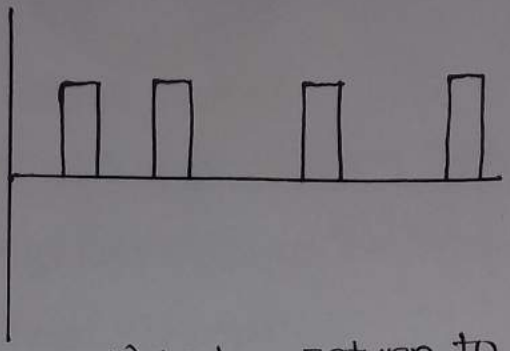

Figure: Unipolan return to zero

Advantages of Unipolan RZ encoding

* Improved synchronization due to transitions between bits.
* Enhanced noise immunity compared to unipolan NRZ
* Easier clock recovery at the receiving End.

Disadvantages of Unipolan RZ encoding

* Requires more bandwidth compared to some other line coding techniques.
* Required efficiency in terms of Bandwidth utilization

Appantus Required

1. Laptop / Desktop Computer.
2. Application Software.

Experiment Number: 04

Name of the Experiment: To write a program for Bi-polar Return-to-zero line coding.

Objectives: To know the fundamentals of Bi-Polar return to zero line coding. How it works and what are the advantages and disadvantages of it.

Theory: Bi-Polar Return-to-zero (Bipolar RZ) is a line encoding technique used in digital communication system. In this encoding technique each bit of digital data is represented by a signal that transitions between multiple voltage levels. Specifically, Bipolar RZ encoding envolves three voltage levels: positive, negative and zero.

Here is how bipolar RZ works

1. VOLTAGE LEVELS
   - (*) Positive level
   - (*) Negative level
   - (*) zero level
2. Representation of Data bits
   - (*) A positive value represents binary 1
   - (*) A negative voltage pluse represents binary 1
   - (*) No voltage pluse represent a binary 0
3. Signal Generation
   - (*) For each bit of digital data a signal is generated
   - (*) For the finst binary 1 the pluse is positive and for the second 1 pluse is negative vice versa
   - (*) If the data bit is zero no pluse is generated

* For each positive and negative pluse it returns to zero.

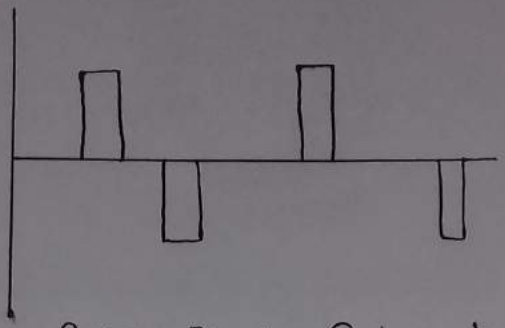

figure: Bipolar Return to Zero

Advantages of BRZ

* It provides a better synchronization capabilities compared to the other encoding schemes
* It helps in minimizing errors during the data transmission due to the clean definition of bit boundaries.

Disadvantages of Bipolar RZ

* It requires more bandwidth compared to the other encoding techniques due to the use of three voltage levels.
* It may less efficient in terms of bandwidth utilization.

Appartus Required

1. Laptop / Desktop
2. Application Software.

Experiment Number: 05

Name of the Experiment: To write a program for Split-Phase or Manchester code.

Objectives: To know the basic properties of manchester code / Gray code and determine that how it works and what are the advantages and disadvantages of it.

Theory: Manchester encoding also known as manchester code, is a line coding technique used in digital communication to encode binary data for transmission over a communication channel. In Manchester coding each bit period is divided into two halves, and a transition occurs in the middle of each bit period. The presence or absence of transition determines the value of the bit being transmitted.

Basic Principle: In Manchester encoding, both logical 0 and 1 is represented by transitions.

Transition Rules: For a logical 0: The signal transitions from a high voltage to a low voltage in the middle of the period.

For a logical 1: The signal transitions from a low voltage to high voltage in the middle of the bit period.

Synchronization: Since transitions occurs at a regular intervals, Manchester encoding facilitates clock recovery and synchronization between the sender and receiver. This makes it suitable for systems requiring precise timing and reliable data transmission.

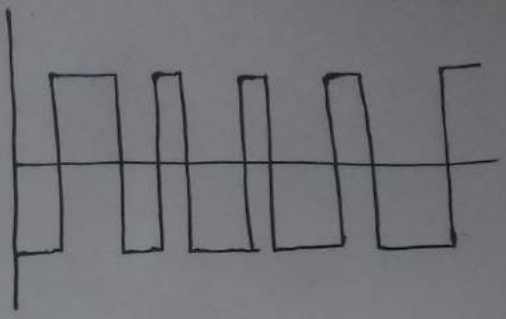

Figure: Manchesten Encoding

Advantages of Manchesten Encoding

Self Clocking: The presence of transitions in the middle of each bit ensures that the receiver can extract the clock signal from the data stream, adding synchronization

DC Balance: The average voltage over a bit period is zero, which helps in maintaining the integrety of the transmission medium, particularly in systems susceptible to signal degradation

Disadvantages of Manchesten Coding

1. It requires a higher bandwidth
2. It has a lower data rate

Appartus Required

1. Laptop/Desktop Computer
2. Application software

Experiment Number : 06

Name of the Experiment: To write a program for binary Amplitude shift keying (ASK) modulation and demodulation.

Objectives: To know the fundamentals of shif keying and know the procen of Amplitude shift keying modulation and demodulation.

Theory: Shift keying is a digital modulation technique used in communication system to transmit digital data over a cannien wave by varying one on mone of its characteristics.
Amplitude shift keying is a digital modulation technique where the amplitude of a cannien signal is varied to nepresent digital data. In ASK, there are typically two discnete amplitude levels used to nepnesent binary states

In ASK technique two types of amplitude are fixed for nepnesenting the binary '0' and '1'. We can determine any amplitude nepnesenting ang of the binary data. Suppose if we nepnesent high amplitude for '1' the low amplitude means binary '0' vice versa.

For Modulation the amplitude of the cannien signal vannies according to the digital bit nepnesentation on the other hand while demodulating nighen amplitude means binary 1 and lowen means 0 and the demodulation is done

Experiment Number: 07

Name of the Experiment: To write a program for frequency shift keying (FSK) modulation and de modulation.

Objective: To know the concept of Frequency shift keying (FSK) modulation and demodulation in digital data communication.

Theory: Frequency Shift keying (FSK) is a digital modulation technique in which the frequency of the carrier signal is varied to represent digital data. In FSK modulation two different frequencies are used to represent the two binary states (0 and 1).

In FSK, a high frequency carrier signal is generated. The carrier signal typically has a mixed amplitude. The frequency of the carrier signal is modulated according to the binary data. One frequency is used to represent one binary and another frequency is used to represent the other binary state. The modulated signal then transmitted through communication channel. At the receiving end, the received signal is demodulated to extract the original binary data.

Experiment Number: 08

Name of the Experiment: To write a program for Phase Shift keying modulation and demodulation.

Objectives: To know the basic concept of phase shift keying technique and how it can be used for digital communication.

Theory: Phase shift keying is a digital modulation technique in which the phase of the cannier signal is varied to nepresent digital data. In PSK modulation the cannien signal's phase is shifted by specific angles to nepresent diffenent binany states.

Fan PSK, A high fnequency cannien signal is generated This cannien signal typically has a fixed fnequency and amplitude. The phase at the cannien signal is modulated according to the binany data. Diffenent phase shifts ane used to nepnesent the diffenent binany states. Fan example a phase shift of 0° degnee might nepnesent binany '0' and a phase shift of 180° might nepnesent binany 1. The modulated cannien signa which now cannies the digital data thnough the comm nication channel. At the neceiving end, the neceived signal is demodulated to extnact the oniginal binany data.

Experiment Number: 09

Name of the Experiment: To write a program for Quadrature Phase Shift keying (QPSK) modulation.

Objective: To know the general format of QPSK and how its works.

Theory: Quadrature Phase Shift keying is a digital modulation scheme that extends the concept of Binary Phase Shift keying (BPSK) to transmit two bits of digital data per symbol. In QPSK modulation, four different phase shifts are used to represent four different combinations of two binary bits. The digital data to be transmitted is encoded into a binary format. Each pair of binary bits is maped to one of four possible phase shifts. Two carrier signals, typically in quadrature (90° degree out of phase) are generated. These carrier signals has fixed frequencies and amplitude. Each pair of the binary digits is maped to one of the four possible phase shifts (0°, 90°, 180° or 270°). These phase shifts are used to modulate in-phase and quardrature (Q) components of the carrier signals.

Experiment Number: 10

Name of the Experiment: To write a program for pulse amplitude modulation.

Objective: To know the basic concept of Pulse Amplitude modulation how it works and how PAM is used for modulation.

Theory: Pulse Amplitude Modulation (PAM) is a digital modulation technique in which the amplitude of a series of rectangular pulses is varied to represent digital data. In PAM, each pulse represents one or more bits of digital information.

The digital data to be transmitted is encoded into a binary format. Each binary digit (bit) or group of bits is mapped to a specific amplitude level. A train of pluses is generated, where each pulse represents one or more bits of digital data. The amplitude of each pulse is modulated according to the binary data. Different amplitude levels are used to represent different binary states.

At the receiver end, the received pulse train is demodulated to extract the original binary data.