A **line code** is the code used for data transmission of a digital signal over a transmission line. This process of coding is chosen so as to avoid overlap and distortion of signal such as inter-symbol interference.

Properties of Line Coding

Following are the properties of line coding −

As the coding is done to make more bits transmit on a single signal, the bandwidth used is much reduced.

For a given bandwidth, the power is efficiently used.

The probability of error is much reduced.

Error detection is done and the bipolar too has a correction capability.

Power density is much favorable.

The timing content is adequate.

Long strings of **1s** and **0s** is avoided to maintain transparency.

Types of Line Coding

There are 3 types of Line Coding

Unipolar
Polar
Bi-polar

Unipolar Signaling

Unipolar signaling is also called as **On-Off Keying** or simply **OOK**.

The presence of pulse represents a **1** and the absence of pulse represents a **0**.

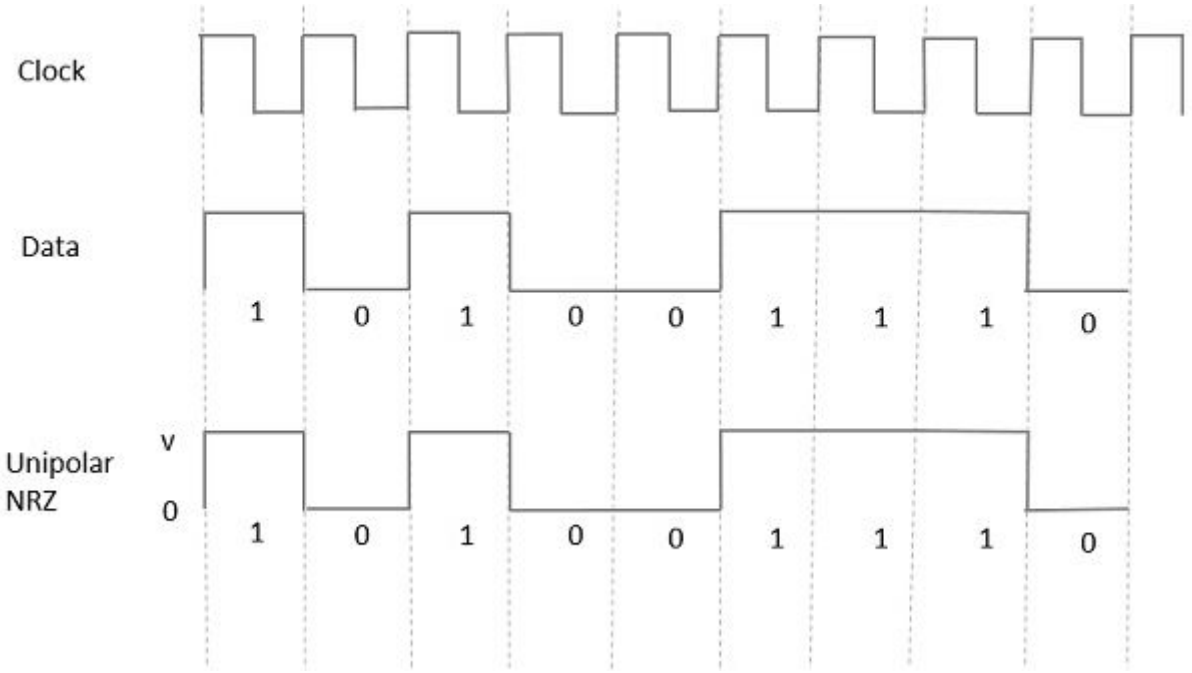
There are two variations in Unipolar signaling −

Non Return to Zero (NRZ)
Return to Zero (RZ)

Unipolar Non-Return to Zero (NRZ)

In this type of unipolar signaling, a High in data is represented by a positive pulse called as **Mark**, which has a duration $\mathbf{T_0}$ equal to the symbol bit duration. A Low in data input has no pulse.

The following figure clearly depicts this.



Advantages

The advantages of Unipolar NRZ are −

It is simple.
A lesser bandwidth is required.

Disadvantages

The disadvantages of Unipolar NRZ are −

No error correction done.

Presence of low frequency components may cause the signal droop.

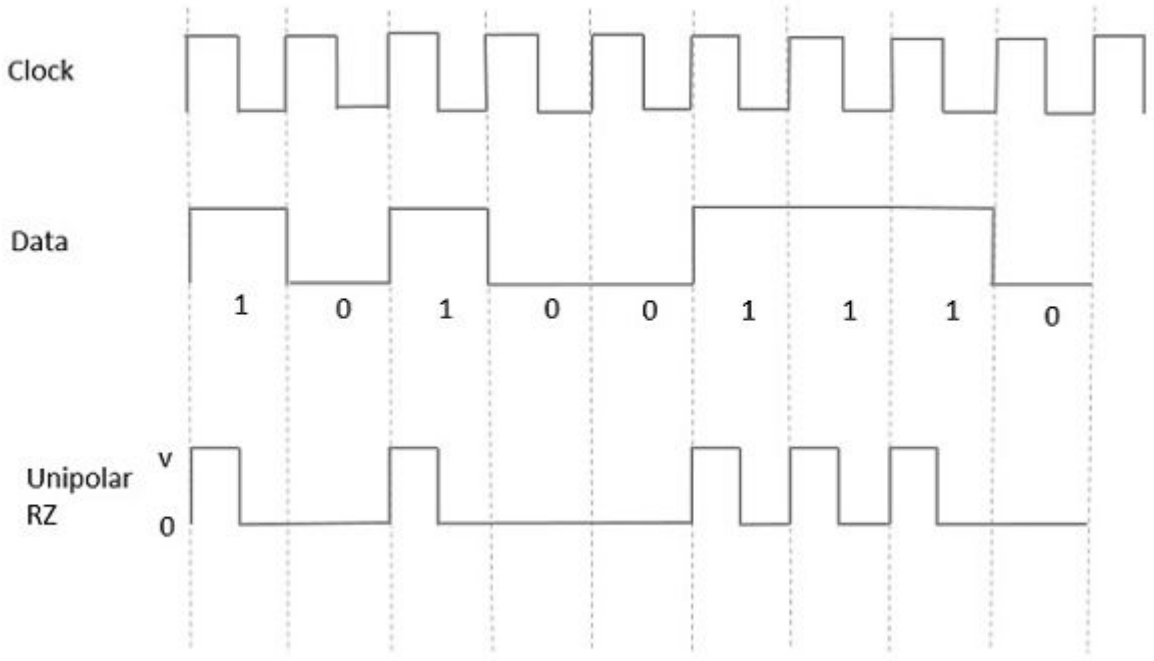
No clock is present.

Loss of synchronization is likely to occur (especially for long strings of **1s** and **0s**).

Unipolar Return to Zero (RZ)

In this type of unipolar signaling, a High in data, though represented by a **Mark pulse**, its duration $\mathbf{T_0}$ is less than the symbol bit duration. Half of the bit duration remains high but it immediately returns to zero and shows the absence of pulse during the remaining half of the bit duration.

It is clearly understood with the help of the following figure.



Advantages

The advantages of Unipolar RZ are −

- It is simple.
- The spectral line present at the symbol rate can be used as a clock.

Disadvantages

The disadvantages of Unipolar RZ are −

- No error correction.
- Occupies twice the bandwidth as unipolar NRZ.
- The signal droop is caused at the places where signal is non-zero at 0 Hz.

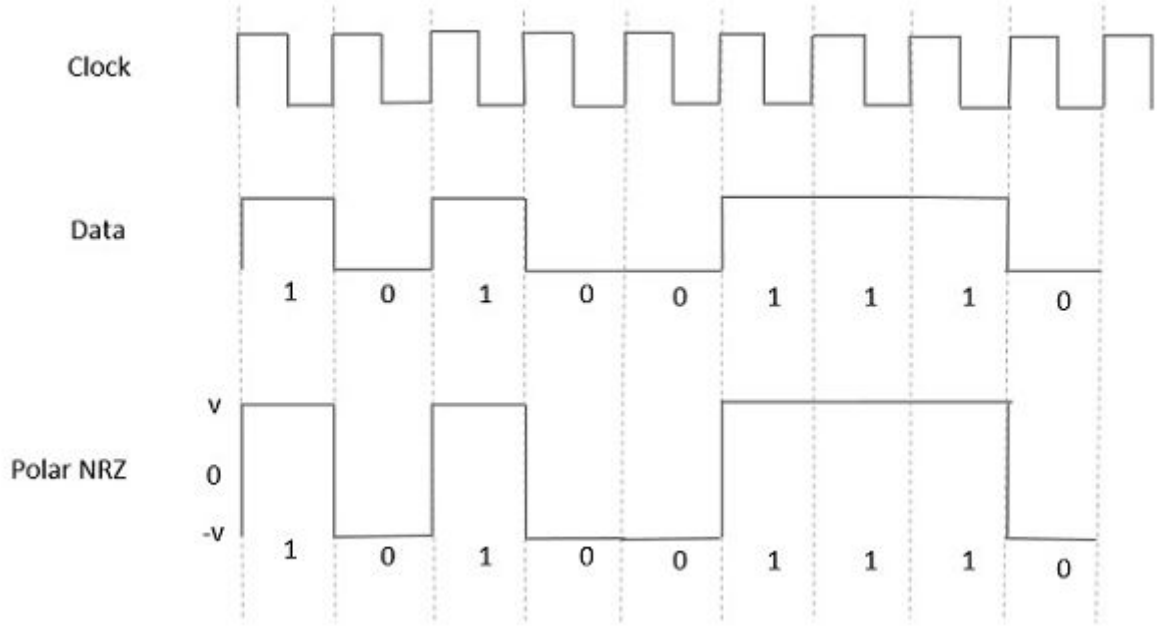
Polar Signaling

There are two methods of Polar Signaling. They are −

- Polar NRZ
- Polar RZ

Polar NRZ

In this type of Polar signaling, a High in data is represented by a positive pulse, while a Low in data is represented by a negative pulse. The following figure depicts this well.



Advantages

The advantages of Polar NRZ are −

It is simple.
No low-frequency components are present.

Disadvantages

The disadvantages of Polar NRZ are −

No error correction.

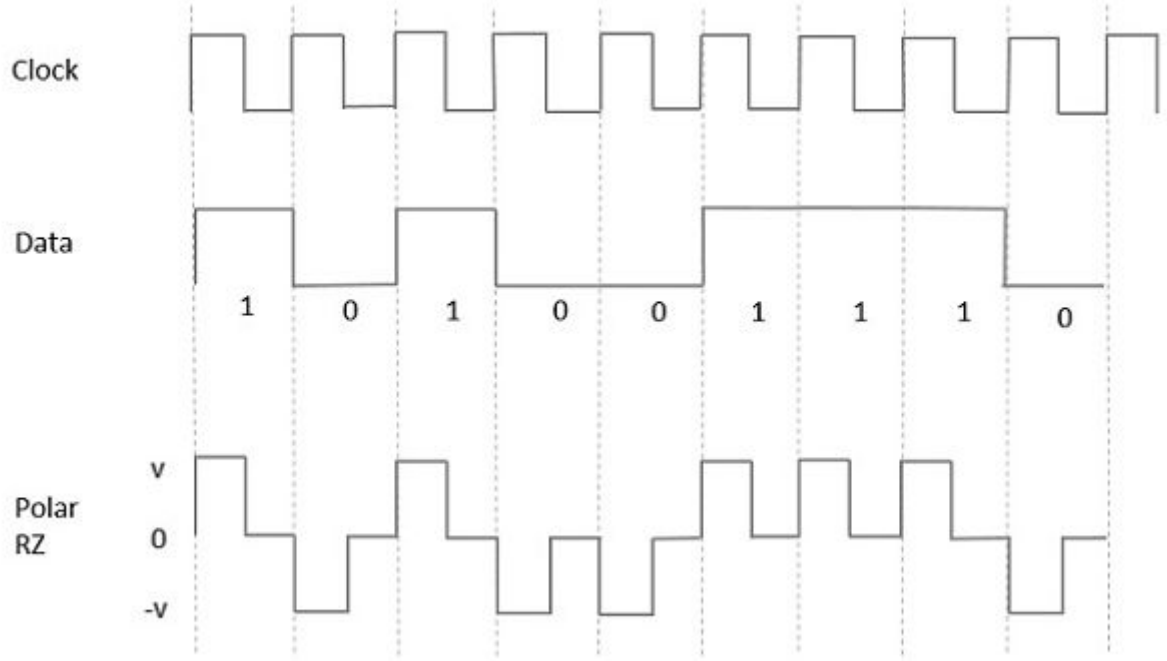
No clock is present.

The signal droop is caused at the places where the signal is non-zero at **0 Hz**.

Polar RZ

In this type of Polar signaling, a High in data, though represented by a **Mark pulse**, its duration $\mathbf{T_0}$ is less than the symbol bit duration. Half of the bit duration remains high but it immediately returns to zero and shows the absence of pulse during the remaining half of the bit duration.

However, for a Low input, a negative pulse represents the data, and the zero level remains same for the other half of the bit duration. The following figure depicts this clearly.



Advantages

The advantages of Polar RZ are −

It is simple.
No low-frequency components are present.

Disadvantages

The disadvantages of Polar RZ are −

No error correction.

No clock is present.

Occupies twice the bandwidth of Polar NRZ.

The signal droop is caused at places where the signal is non-zero at **0 Hz**.