# Objective

To study various encoding schemes of line coding techniques in digital communication.

## Aim of the Experiment

To study generation of Unipolar NRZ, Polar NRZ, Unipolar RZ and Polar RZ line code.

## Equipment Required

Data encoding Trainer Kit
Digital storage oscilloscope (100MHz, 1GSa/S)
Power supply
Probes
Patch cord
Connecting wires

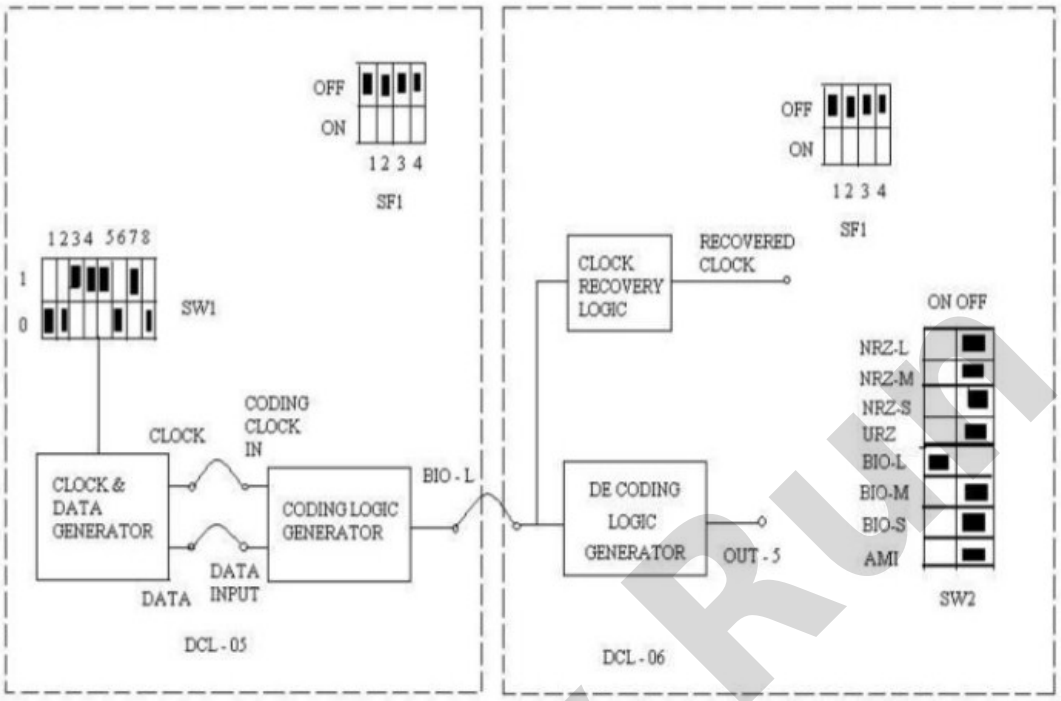
## Theory

1 and 0 can be represented in various formats in different levels and waveforms. The selection of coding technique depends on system band width, system ability to pass dc level information, error checking facility.
**Non return to Zero (level):** The NRZ(L) waveform simply goes low for one bit time to represent a data 0 and high to represent data 1. For lengthy data the clock is lost in asynchronous mode. The maximum rate at which NRZ can change is half the data clock, when alternate 0s and 1s are there.
**DC Level:** A length data will have only a dc level as its waveform, a dc voltage cannot be used in circuits which involve transformers like telephone, AC coupled amplifiers, capacitors, filter etc.
**Manchester Bi-phase:** 0 is encoded low during first half of bit time & high for other half of bit & vice versa for 1.There is no synchronization problem in the receiver. It is independent of DC levels, since there is a transition occurring in each bit. Its max frequency is equal to data clock rate. There is at least one transition per bit. Since there is midway transition, it makes clock regeneration difficult so we use special bi phase clock recovery circuit.
**Return to Bias:** It is a 3 level code, consists of positive, negative and zero. Easy clock synchronization is possible. 1 for positive, 0 for negative in first half and zero bias for second half. Maximum frequency is equal to data clock frequency. A DC level of waveforms depends on strings of 1s and 0s. Hence we cannot use AC coupled communication link. Timing information is easily obtained. The system is referred to as self-clocking system, as magnitude of waveform is original data signal. It requires complex transmitters.

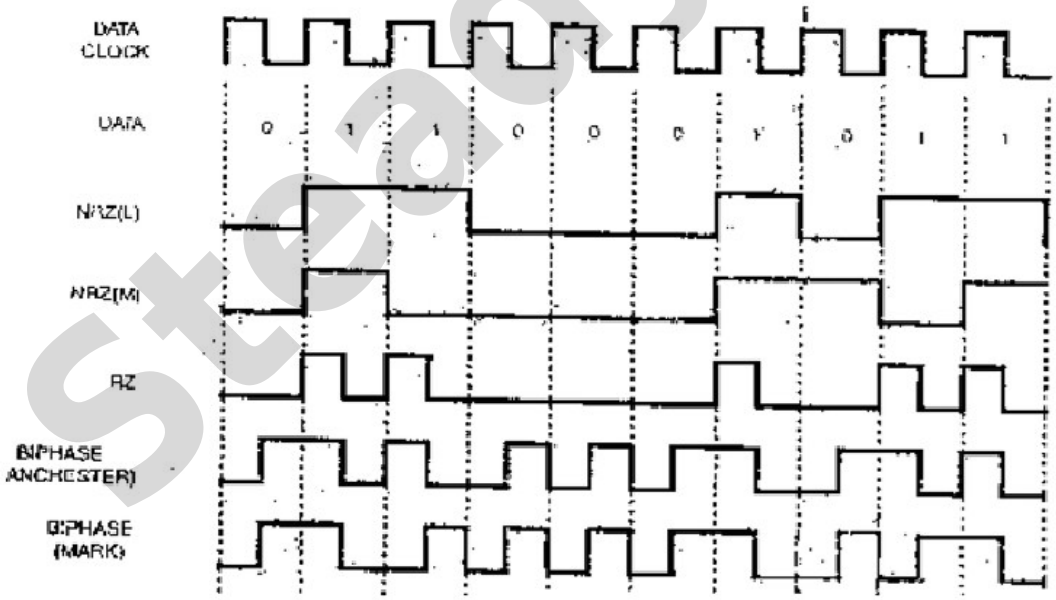
## Procedure

1. Connect the data generator output to code generator kit. This gives the random binary sequence to the kit.
2. Connect the clock signal to the trainer kit.
3. Connect the output to the DSO channel along with the clock signal.
4. Observe the waveforms with respect to clock on a dual channel CRO, and compare with the model graph.
5. Plot the waveforms for different codes.

## Block Diagram / Circuit Diagram




## Graph




## Observation Table

| Signal | Amplitude | Time period |
|---|---|---|
| Input | | |
| Output | | |

## Result

Thus the different coding techniques were studied and observed for a given binary data, and their corresponding waveforms plotted.

## Conclusion

From the above experiment, we conclude that by using these techniques we can encode our data easily which helps to secure our data.

## Precautions

1) Do not use open ended wires to connect 230V, 50Hz power supply.
2) Check the connection before giving the power supply.
3) Observations should be done carefully.
4) Disconnect the circuit after switched off the power supply