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Design of Return to Zero (RZ) Bipolar Digital to Digital Encoding Data Transmission

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Abstract: **-** Line encoding is the method used to represent the digital information on the media. A pattern, that uses either voltage or current, is used to represent the 1s and 0s of the digital signal on the transmission link. Common types of line encoding methods used in data communications are: Unipolar line encoding, Polar line encoding, Bipolar line encoding and Manchester line encoding. This paper deals with the design of bipolar digital to digital encoding (RZ) data transmission using latch SN 74373, darlington amplifier ULN 2003-500 m A, solid state relay, personnel computer and Turbo C++ programming language).

Keywords: *- Bipolar, Encoding, Digital to Digital, Latch SN 74373, Darlington Amplifier ULN 2003-500 m A, Solid State Relay (SSR) ,Turbo C++ , Computer.*

I. INTRODUCTION

A computer network is used for communication of data from one station to another station in the network [1]. Data and signals are two of the basic building blocks of any computer network. Data must be encoded into signals before it can be transported across communication media [2]. Encoding means conversion of data into bit stream [3]. There are different encoding schemes available:

- Analog-to-Digital
- Digital-to-Analog
- Analog-to-Analog
- Digital-to-Digital

Digital-to-Digital

Digital-to-Digital encoding is the representation of digital information by a digital signal . There are basically the following types of digital to-digital encoding schemes available in Digital-to-Digital encoding **.**

- **Unipolar**

Unipolar encoding uses only one level of value. 1's are encoded as positive value and 0's are encoded as zero value.

- **Polar**

Polar encoding uses two levels positive and negative of amplitude. Types of polar encoding are :

Return to Zero(RZ) Return to Zero use three value(positive, negative, zero) : 1 = positive-to-zero, 0 = negative-to-zero. Fig.(1) shows Return to Zero digital to digital encoding.

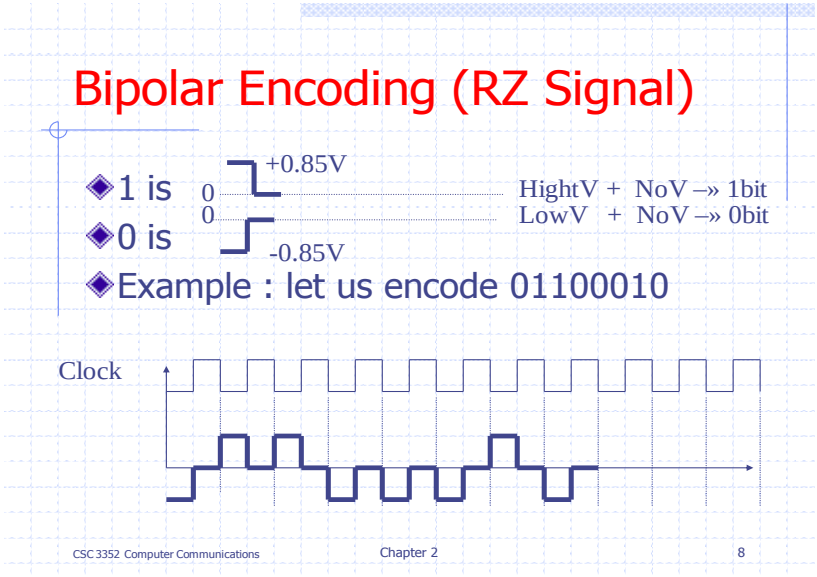

Figure (1) Return to Zero (RZ) digital to digital encoding

Non Return to Zero (NRZ)
Types of Non Return to Zero are:
Non return to Zero-Level (NRZ-L) : the level of the signal is dependent upon the state of the bit.
Non return to Zero-Inverted (NRZ-I): the signal is inverted if a 1 is encountered.

Biphase
Biphase is implemented in two different ways :

Manchester
In Manchester encoding "1" is transmitted as 0 in the first half of the clock and 1 in the second half of the clock. And "0" is transmitted as 1 in the first half of the clock and 0 in the second half of the clock [6]..

Differential Manchester
In differential Manchester encoding, a 1-bit is indicated by making the first half of the signal equal to the last half of the previous bit's signal and a 0-bit is indicated by making the first half of the signal opposite to the last half of the previous bit's signal. That is, a zero bit is indicated by a transition at the beginning of the bit [7].**:**

Bipolar.
Bipolar used three voltage levels(positive, negative, zero). zero level : binary 0, positive and negative voltage : 1(alternate). Types of bipolar encoding :

Alternate Mark Inversion (AMI)
In this code, a binary 0 is encoded as zero volts, whereas a binary 1 is encoded alternately as a positive voltage or a negative voltage [8].

Bipolar 8-Zero Substitution (B8ZS)
Is the convention adopted in North America to provide synchronization of long strings of 0s.

High-Density Bipolar 3 (HDB3)
Is the convention adopted in Europe and Japan.

II. METHODOLOGY

The circuit diagram for the method of bipolar digital to digital encoding data transmission consists of two elements :

A . Hardware components:
Latch SN 74373 : used as a buffer to store data.
Amplifier ULN 2003-500 m A : used to increase the current of the signal.
Solid state Relay : used as an ON-OFF control device.
Lab link : used to connect latch SN 74373 to the computer.
Computer : used to install Turbo C++ programming language.

B. Software:
Turbo C++ programming language: is used to send data bits to the designed circuit.

The circuit diagram for the paper consists of latch SN 74373, Darlington amplifiers ULN 2003-500 m A, solid state relay (SSR), computer and Turbo C++ programming language. The block diagram for the design is shown in Figure (2). The method is based on creating an input digital data by the computer. One bit to pass each time. The output depends upon the input bit value. This process will be repeated until the end of data. The interface circuit contains three steps as follows;

- Step one : A latch which serves for buffering and storage of data.
- Step two : A darlington amplifier which serves as a current amplifier in order to drive the solid state relay.
- Step three : A solid state relay which changes the logic state.

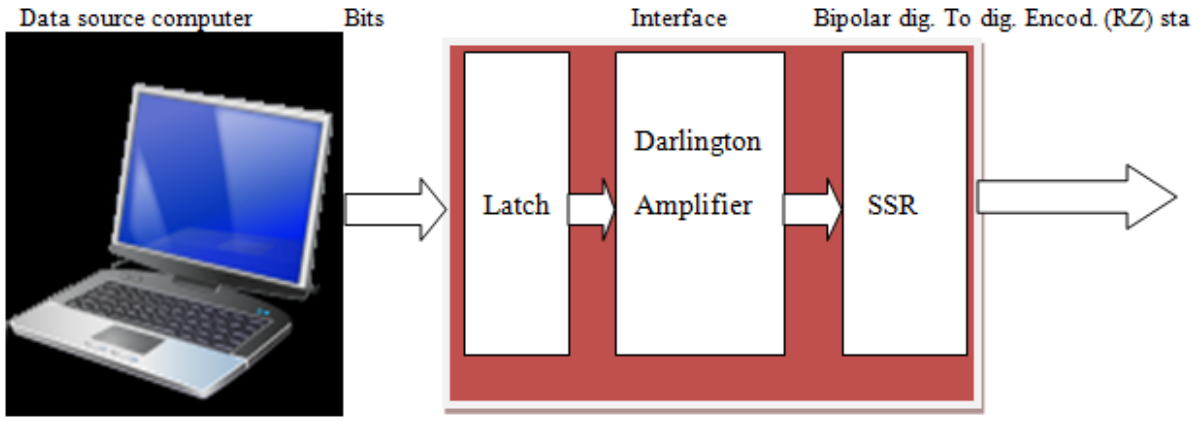

Figure (2) Block diagram of the return to zero bipolar digital to digital encoding circuit.

III. ALGORITHM

The computer algorithm includes a sequence of steps for the performance of bipolar digital to digital encoding (RZ) . Each byte will be send serially bit by bit to the interface circuit .A star (*) is assumed as the end of data. The algorithm is:

START
Initialization:
--- Clear the output to start the encoding.
---- Generate clock frequency.
End of data:
--- If the byte is star (*) go to end...
--- Call encoding subroutine.
END

Encoding: (Subroutine)
Next bit:
--- If bit value equals zero ,then put the solid state relay to negative voltage position.
Check the clock:
--- If a clock is present ,then put the solid state relay to zero voltage position.

--- If bit value equals one ,then put the solid state relay to positive voltage position.
Check the clock:
--- If a clock is present ,then put the solid state relay to zero voltage position.

--- If the byte is finished ,then go to return .
--- go to next bit.
Return

IV. RESULTS

The circuit for bipolar digital to digital encoding consists of an interface circuit which contains ;latch SN 74373, amplifier ULN 2003-500 m A, solid state relay, computer and Turbo C++ programming language .The task of the interface circuit is to transform the solid state relay (SSR) from one state to another .The change over position of the SSR depends upon the value of the incoming bit .The final output from the interface circuit will be a signal voltage that varies according to the bit value. Table (1) shows the result of bipolar digital to digital encoding (RZ).

Table (1) Bbipolar digital to digital encoding (RZ)

Bit value	Latch output	SSR position	SSR pos. (with CK.)	Final output
0	0	Negative		
0	0		Zero	Negat. → Zero
1	1	Positive		
1	1		Zero	Posit. → Zero

V. CONCLUSION

The bipolar digital to digital encoding scheme offers synchronization between the transmission and reception entities. This

Advantage is of great importance during the process if data communication .The disadvantage of this scheme is that for encoding each bit we need two clocks. The design of the electronic circuit is made simple and easy to connect to the computer. A lab link is used to connect the computer to the interface circuit. The circuit can be easily modified to accommodate other digital to digital encoding schemes .

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