Digital Logic Design
(EL-227)
LABORATORY MANUAL
Fall – 2021

LAB 08 & 09
Binary Encoder

Lab Session 08 & 09: Binary Encoder

OBJECTIVES:

After completing this lab, you would be able to know

- To study the basic operation and design of the Encoder circuits
- Explain the working principle of 3-8 line Octal to Binary Encoding
- Understand the usage of Priority Encoder

APPARATUS:

- Logics Trainer, Logics works

Introduction:

An encoder is a combinational circuit that performs the inverse operation of a decoder. An encoder has a maximum of 2^n input lines and n output lines. The encoder generates binary code at its output lines that represents which input line is active at a given time. In encoder, it is assumed that only one input is active high at a time, if more than one inputs are high simultaneously then ambiguous output is generated. In order to resolve this ambiguity, there must be some input priority function to ensure that only one input is encoded at a time.

A priority encoder is a combinational circuit that encodes the input using priority function i.e. if more than one inputs are high simultaneously than the input having the highest priority will take precedence. Each input line is assigned priority. The most significant input line may be given highest priority and least significant input line the lowest or vice versa. The priority encoder has an additional output to ensure that at least one input line is active high and the binary code at the output lines is valid. Figure 7-2 shows the block diagram of $2^n xn$ priority encoder.

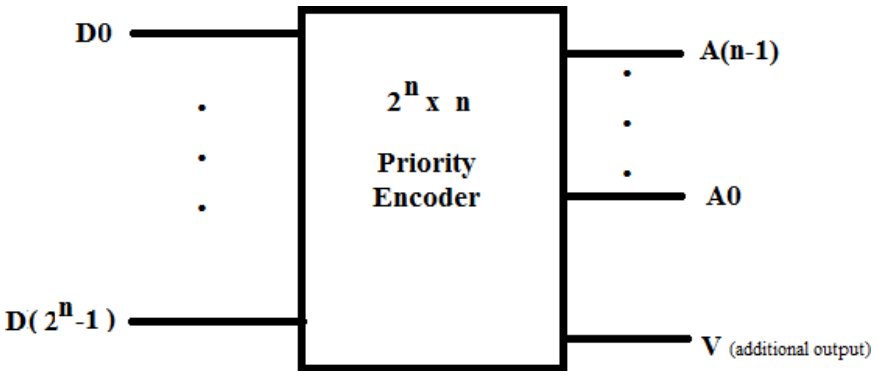
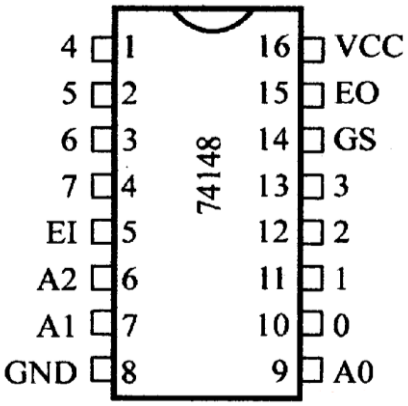


Figure:1 2x4 Encoder Block Diagram

74148 (8 x 3) Octal to Binary Priority Encoder

The 74LS148 is a Priority Encoder. It provides priority decoding of the inputs to ensure that only the highest-order data line is encoded. The 74LS148 encode eight data lines to three-line (4-2-1) binary (octal). Cascading circuitry (enable input E1 and enable output E0) has been provided to allow octal expansion without the need for external circuitry. For all types, data inputs and outputs are active at the low logic level.

Figure: 2 8*3 Priority Encoding



Function of various pins of this IC is described below:

- 0 through 7: Active low data inputs representing the octal digits
- A2, A1, A0: Active low output lines representing the binary code
- E1: Active low enable Input
- E0: Active low output indicating none of the inputs is high
- GS: Active low output indicating any of the inputs is high
- VCC and GND: Supply connections lines.
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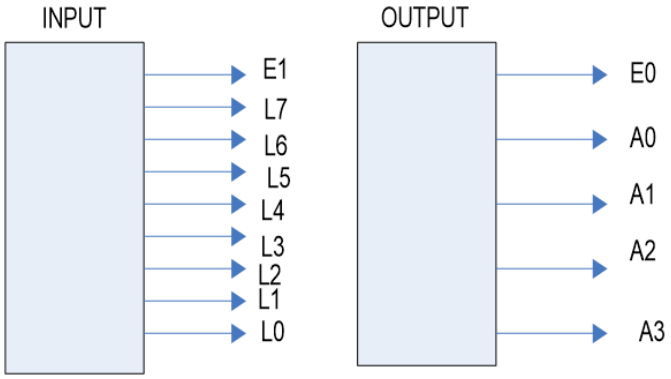

INPUTS									OUTPUTS				
EI	0	1	2	3	4	5	6	7	A2	A1	A0	GS	EO
H	X	X	X	X	X	X	X	X	H	H	H	H	H
L	H	H	H	H	H	H	H	H	H	H	H	H	L
L	X	X	X	X	X	X	X	L	L	L	L	L	H
L	X	X	X	X	X	X	L	H	L	L	H	L	H
L	X	X	X	X	X	L	H	H	L	H	L	L	H
L	X	X	X	X	L	H	H	H	L	H	H	L	H
L	X	X	X	L	H	H	H	H	H	L	L	L	H
L	X	X	L	H	H	H	H	H	H	L	H	L	H
L	X	L	H	H	H	H	H	H	H	H	L	L	H
L	L	H	H	H	H	H	H	H	H	H	H	L	H

H = high logic level, L = low logic level, X = irrelevant

Fig 3: Truth Table of Priority Encoders

7447 BCD to Seven Segment Driver

7447 IC is particularly used to drive common-anode Seven Segment displays. Its input is a BCD number and output drives a seven-segment display. Refer to appendix A for IC pin configuration. Function of various pins of these ICs is described below:

1. A, B, C, D: Active high inputs representing BCD digits (D being the MSB).
2. O A through O G: Active low outputs to drive segments although of the display.
3. RBI: Ripple Blanking Input. Turns off all the segments if kept low, provided that LT is kept high and all other inputs(A,B,C,D,BI)are kept low. Should be kept high otherwise.
4. BI/RBO: Wire-AND logic serving as a Blanking Input and/or Ripple Blanking Output.
5. BI: Turns off all the segments if low.
6. RBO: Goes to a low level (response condition) along with other outputs, when RBI and inputs A, B, C, and Dare low with LT input at high level.
7. LT: Lamp Test input. Tests whether all segments are working or not. Illuminates all segments if kept low, provided that high. Should be kept high otherwise.
8. VCC and GND: Supply connections lines.

You are required to display the outputs of a 74148 encoder IC on a seven segment display. The circuit is given in figure,

1. Make connections as shown in figure
2.
3. Select any input from 74148IC and observe the corresponding decimal code being displayed on the seven segments.

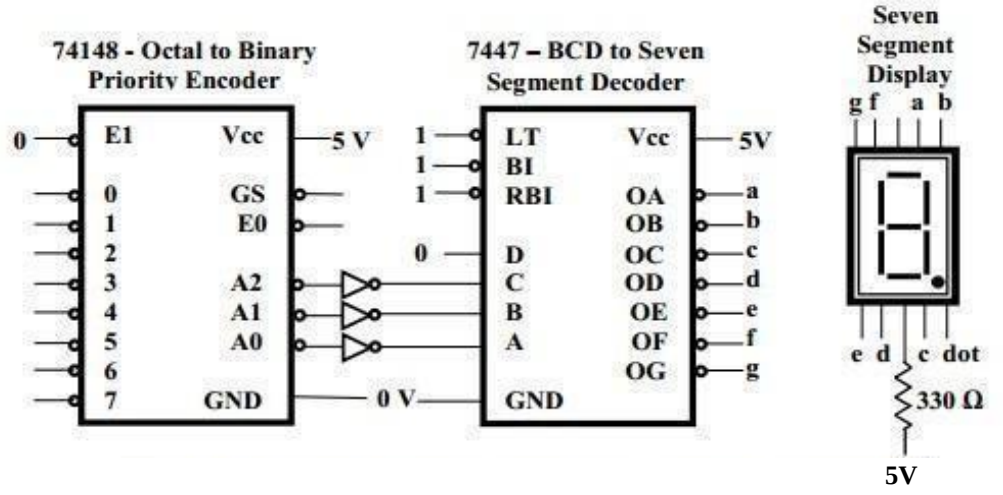

Figure:4 8*3 Circuit of Encoder and Segment display

Lab Tasks

Implement Octal to Binary Priority Encoder on Bread Board by Using 74148 IC.

INPUTS								OUTPUTS		
D7	D6	D5	D4	D3	D2	D1	D0	Z2	Z1	Z0

Lab Task#2

Implement Decimal to BCD Priority Encoder by Using 74147 IC.

	Decimal Inputs									Outputs			
E1'	1'	2'	3'	4'	5'	6'	7'	8'	9'	Q3'	Q2'	Q1'	Q0'