

Experiment No. (6)

Decoder Circuit

Objective:

Understanding the construction and operating principles of decoder circuits.

Introduction:

A decoder is a logic circuit that will detect the presence of a specific binary number. The input to the decoder is a parallel binary number and the output is a binary signal that indicates the presence or absence of that specific number.

The AND gate can be used as a basic decoder circuit, since the AND gate's output will be a binary 1 only when all inputs are binary 1. Proper connections of AND gate's inputs to the data will ensure detection of any binary number.

Binary-to-Octal Decoder:

A binary-to-octal decoder is shown in Fig.(6-1). There are 3 binary inputs **A,B,C** and octal outputs Q_0 - Q_7 . If $CBA="010"$ output $Q_2=1$. When $CBA="111"$ output $Q_7=1$

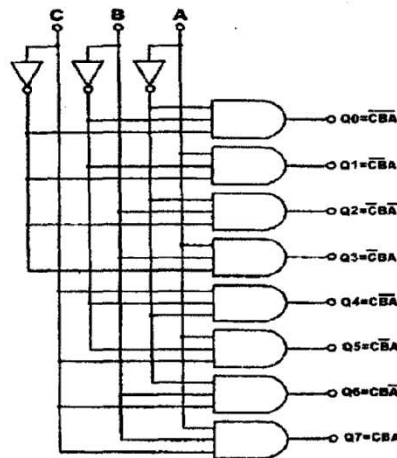


Fig. (6 - 1)

Equipments Required:KL-31001 Digital Logic Lab; Module KL-33004/KL-33005.

Procedures:

(a) Constructing a 2-to-4 Decoder with Basic Gates.

1. Block C of module KL-33005 will be used in this section of the experiment.

Connect V_{cc} to +5V.

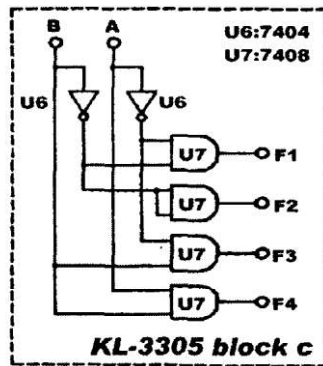


Fig. (6-2)

2. Connect inputs B, A to Data Switches SW1 and SW0. Connect outputs F1 & F4 to Logic Indicators L₃-L₀ respectively.
3. Follow the input sequences for A and B in Table (6-1) and record output states .

B	A	F1	F2	F3	F4
0	0				
0	1				
1	0				
1	1				

Table (6-1)

(b) Constructing a BCD to Decimal Decoder with TTL IC.

1. U₁₀ (7442) on block c of module KL-33004 will be used in this section of the experiment. 7442 is a BCD-to-Decimal decoder IC.

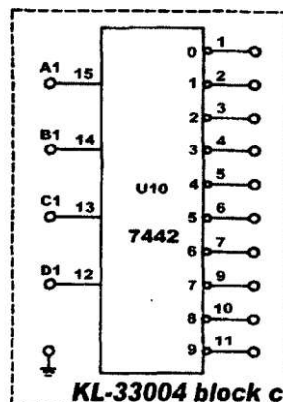


Fig. (6-3)

2. Connect inputs(A_1 , B_1 , C_1 , D_1), to the BCD outputs “1”, “2”, “4”, “8” of one of the Thumb wheel Switches respectively. Connect outputs (0-9) to Logic Indicator (L_9 - L_0).

The thumb wheel switch is a mechanical device that converts numbers to BCD codes.

3. Adjust the Thumb wheel Switches according to Table (6-2), Presence of voltage at the inputs indicates high logic state or “1”, absence of voltage indicates low logic state or “0”, Observe the output states at(L_0 - L_9). Record input and output logic states in table (8-2)

	D	C	B	A	0	1	2	3	4	5	6	7	8	9
0														
1														
2														
3														
4														
5														
6														
7														
8														
9														

Table (6-2)

(c) BCD - to -7-Segment Decoder.

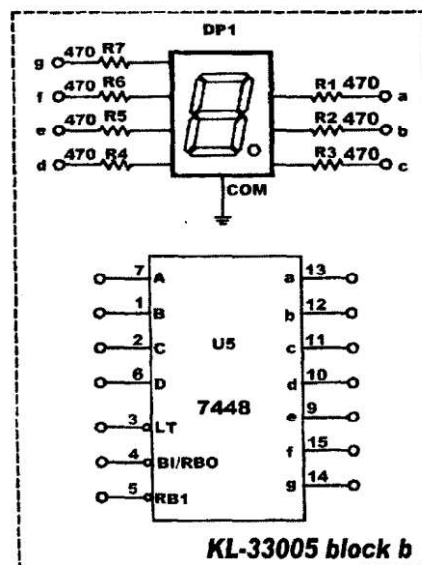


Fig. (6-4)

1. Connect inputs D, C, B, A of U_5 (7448) on block b of module KL-33005 to Data Switches SW_3 , SW_2 , SW_1 , SW_0 respectively. The 7448 is a BCD-to-7 segment

decoder/driver with internal pull-up outputs.

2. Connect LT to DIP Switch 1.0, BI to DIP 1.1 and RBI to DIP 1.2.
3. Follow the input sequences for D, C, B, A in table (6-3) and record outputs of the 7- segment display.

Decimal Or Function	Inputs						Outputs
	LT	RBI	D A ₃	C A ₂	B A ₁	A A ₀	Display
0	H	H	L	L	L	L	
1	H	X	L	L	L	H	
2	H	X	L	L	H	L	
3	H	X	L	L	H	H	
4	H	X	L	H	L	L	
5	H	X	L	H	L	H	
6	H	X	L	H	H	L	
7	H	X	L	H	H	H	
8	H	X	H	L	L	L	
9	H	X	H	L	L	H	
10	H	X	H	L	H	L	
11	H	X	H	L	H	H	
12	H	X	H	H	L	L	
13	H	X	H	H	L	H	
14	H	X	H	H	H	L	
15	H	X	H	H	H	H	

Table(6-3)

4. Set BI to Low while LT & RBI remains High. Repeat step 3. Are the outputs any different from step 3.
5. Set LT to Low and RBI & BI to High. Repeat step 3. Are the outputs any different from step 3.

DISCUSSIONS:

1. What is the function of decoder?
2. Which of the following has 4 input lines and 16 output lines ?
1. Decoder 2. Encoder 3. 16-Segment display.
3. What converts binary numbers to decimal numbers?
1. BCD to 7-segment Decoder 2. Encoder 3. Decoder
4. What purpose does the series of resistors in front of a display serve?
1. Matching. 2. To limit the current. 3. To increase the brightness.
5. What purpose does the pull up resistors at the output of each pin?
6. What is the difference between common anode and common cathode displays?