



Decoder Circuit

OBJECTIVE

Understanding the operating principles of decoder circuits.

summary

A decoder is a logic circuit that will detect the presence of a specific binary number or word. 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 gates'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. 2-67. There are 3 binary inputs A, B, C and 8 octal outputs Q0~Q7. If CBA="010" output Q2="1". When CBA="111" output Q7="1".

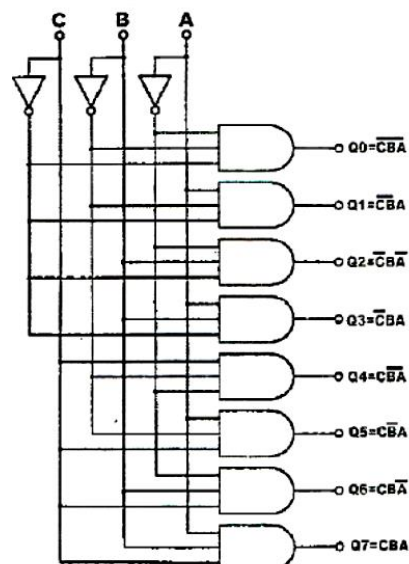


Fig. 2-67



EQUIPMENTS REQUIRED

KL-31001 Digital Logic Lab; Module KL-33004/KL-33005; Multimeter

PROCEDURES

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

- Block c of module KL-33005 will be used in this section of the experiment.
Connect Vcc to +5V.

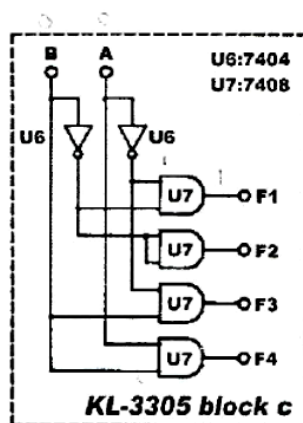


Fig. 2-68

- Connect inputs A, B to Data Switches SW0 and SW1. Connect outputs F1~F4 to Logic Indicators L0~L3 respectively.
- Follow the input sequences for A and B in Table 2-31 and record output states.

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

Table 2-31

(b) Constructing a 4 to 10 Decoder with TTL IC

- 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.

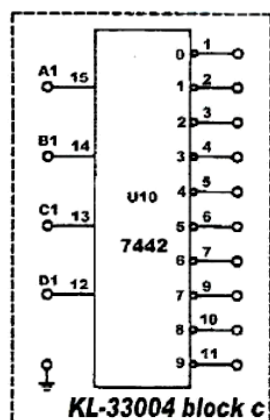


Fig.2-69

2. Connect inputs A1, B1, C1, D1 to the BCD outputs "1", "2", "4", "8" of one of the Thumbwheel Switches respectively. Connect outputs 0~9 to Logic Indicator L0~L9.

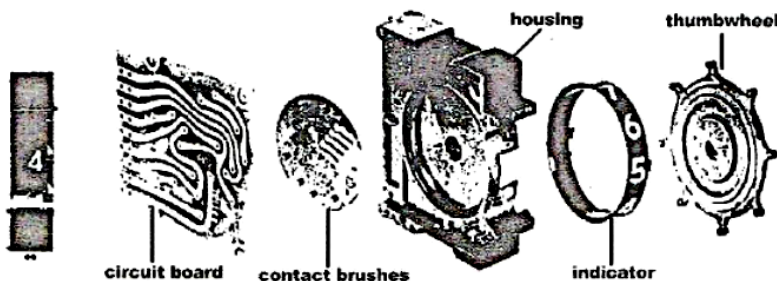
The thumbwheel switch is a mechanical device that converts numbers to BCD codes.

3. Adjust the Thumbwheel Switches according to Table 2-32, measure voltages at A, B, C, D with a multimeter. 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 L0~L9. Record input and output logic states in Table 2-32.

	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 2-32

※Thumbwheel switches consist of the following parts※



(c) BCD-to-7-Segment Decoder

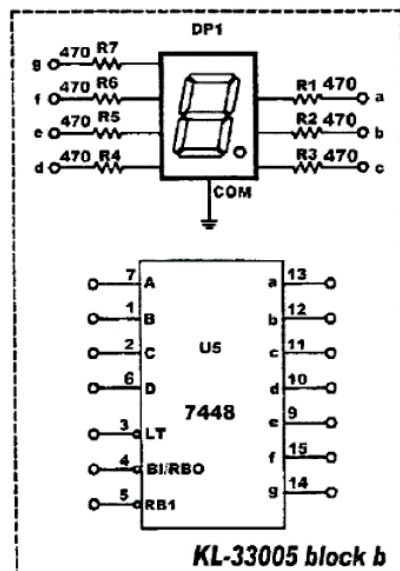


Fig. 2-70

1. Connect inputs A, B, C, D of U5 (7448) on block b of module KL-33005 to Data Switches SW3, SW2, SW1, SW0 respectively. The 7448 is a BCD-to-7-segment decoder/driver with internal pull-up outputs. Connect "RBI" to DIP Switch 1.0; "BI/RBO" to L0; "LT" to DIP1.1. Set DIP 1.0 and 1.1 to "HIGH".
2. Follow the input sequences for D, C, B, A in Table 2-33 and record outputs of the 7-segment display.
3. Set DIP1.1 to "LOW" while DIP1.0 remains "HIGH". Repeat step 2. Are the outputs any different from step 2?



D	C	B	A	Display
0	0	0	0	
0	0	0	1	
0	0	1	0	
0	0	1	1	
0	1	0	0	
0	1	0	1	
0	1	1	0	
0	1	1	1	
1	0	0	0	
1	0	0	1	
1	0	1	0	
1	0	1	1	
1	1	0	0	
1	1	0	1	
1	1	1	0	
1	1	1	1	

Table 2-33

- Set DIP1.0 to "LOW" and DIP1.1 to "HIGH". Repeat step 2. Compare outputs with step 2 between DCBA=0000~1001. Are the outputs different?

DISCUSSION:

- Determine the logic required to decode the binary number 1011_2 by producing a HIGH indication on the output?
- A certain application requires that a four-bit binary number be decoder use 74154 decoders to implement the logic. The binary number is represented as A,B,C and D?
- Design 4x10 decoder which used to convert from BCD code to decimal?
- Design 3x8 decoder at active high using Enable line at active low?
- Design a BCD to 7 segment display decoder cct using NAND gate?

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Experiment no.: 7
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