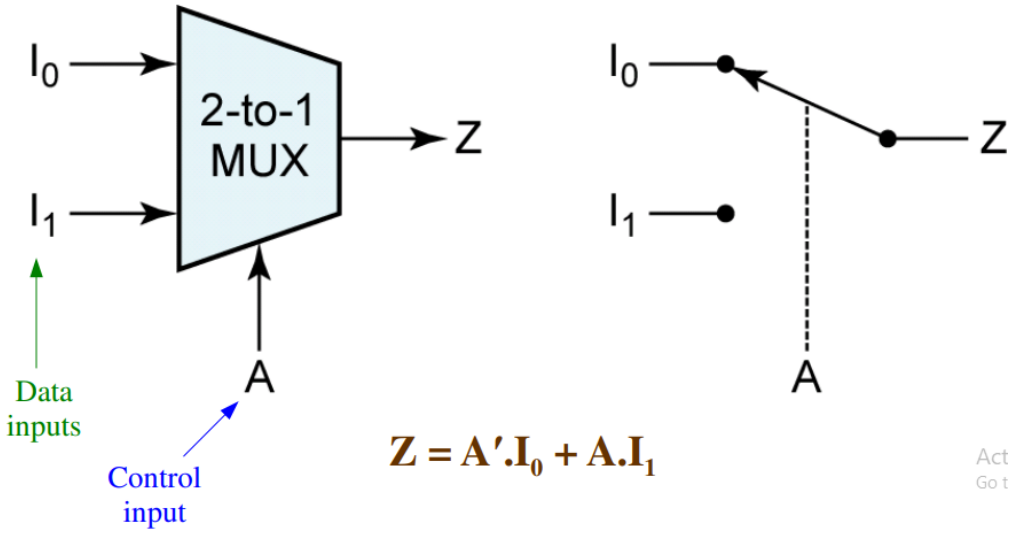
Decoder, Encoder and Multiplexer

Multiplexer

A multiplexer has

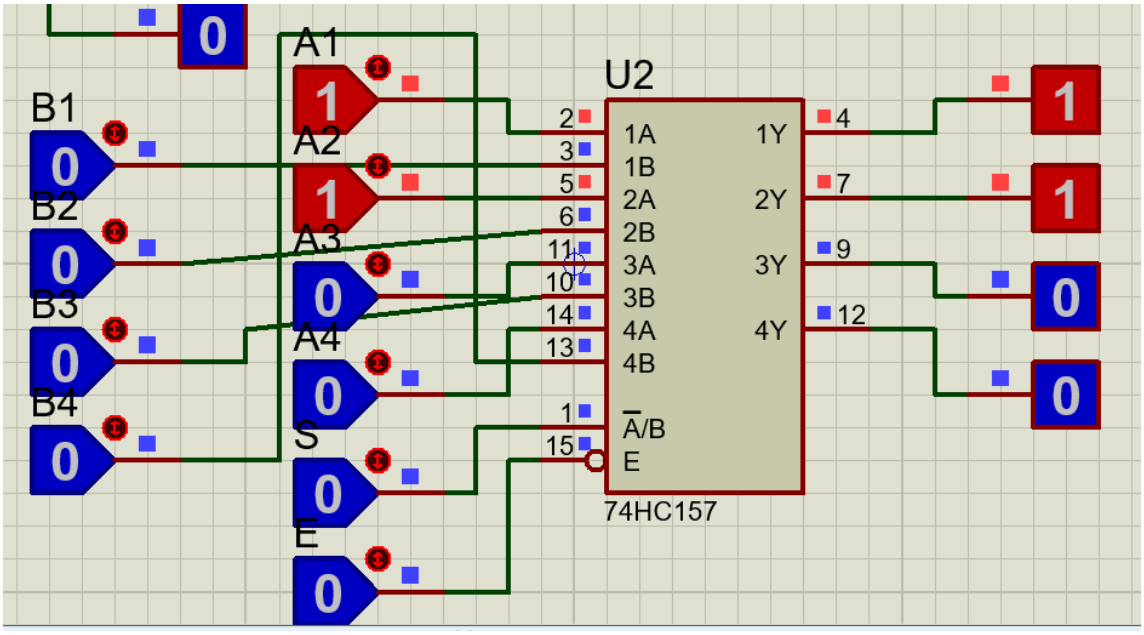
- 2^n data inputs
- n control inputs
- 1 output

A multiplexer routes (or connects) the selected data input to the output. The value of the control inputs determines the data input that is selected.



$$Z = A'.I_0 + A.I_1$$

Multiplexer in Proteus(74HC157)



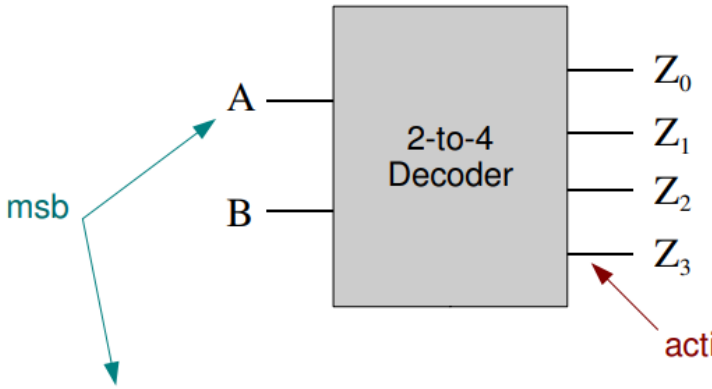
Decoder

A decoder has

- n inputs
- 2^n outputs

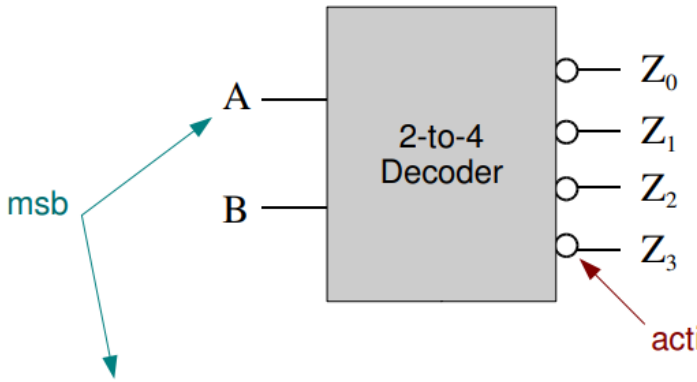
A decoder selects one of 2^n outputs by decoding the binary value on the n inputs.

The decoder generates all the minterms of the n input variables. Exactly one output will be active for each combination of the inputs.



$$Z_i = m_i$$

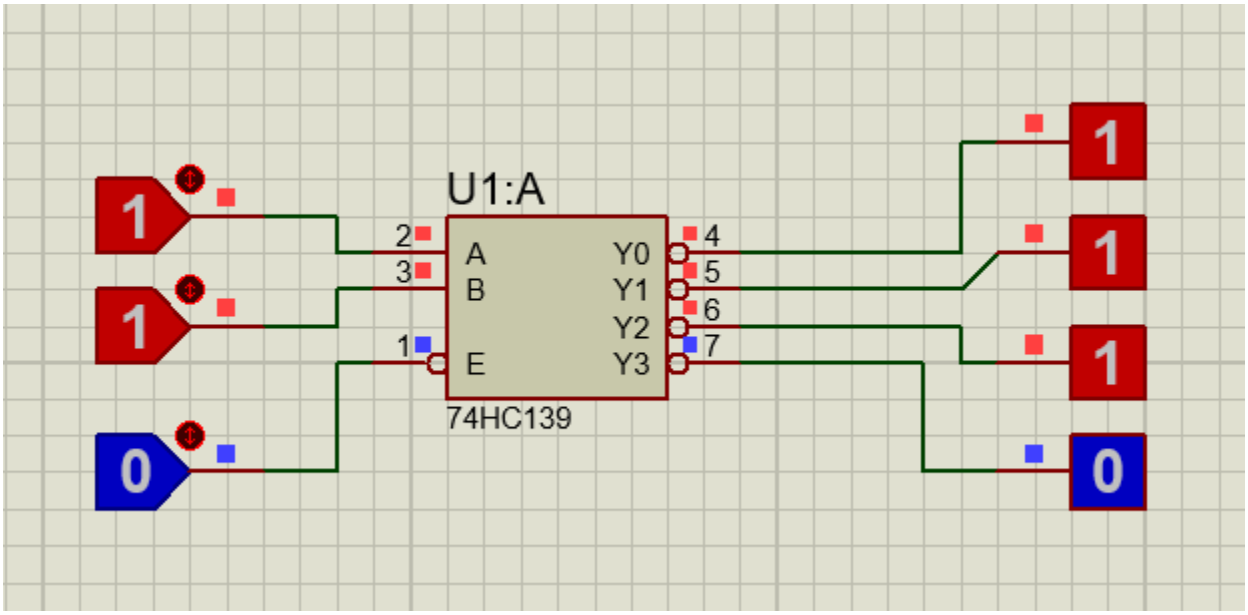
A	B	Z_0	Z_1	Z_2	Z_3	
0	0	1	0	0	0	m_0
0	1	0	1	0	0	m_1
1	0	0	0	1	0	m_2
1	1	0	0	0	1	m_3



$$Z_i = (m_i)' = M_i$$

A	B	Z_0	Z_1	Z_2	Z_3	
0	0	0	1	1	1	M_0
0	1	1	0	1	1	M_1
1	0	1	1	0	1	M_2
1	1	1	1	1	0	M_3

Decoder in Proteus (74HC139)

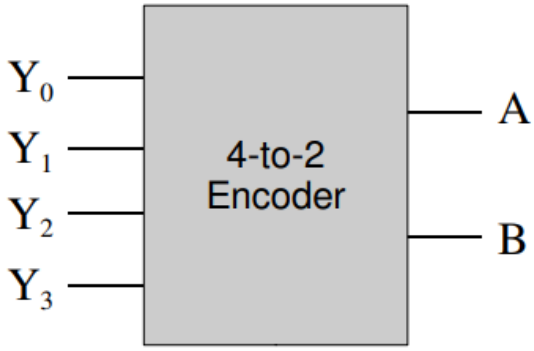


Encoder

An encoder has

- 2^n inputs
- n outputs

Outputs the binary value of the selected (or active) input. Performs the inverse operation of a decoder.



Y_0	Y_1	Y_2	Y_3	A	B
1	0	0	0	0	0
0	1	0	0	0	1
0	0	1	0	1	0
0	0	0	1	1	1

Encoder in proteus (4532)