

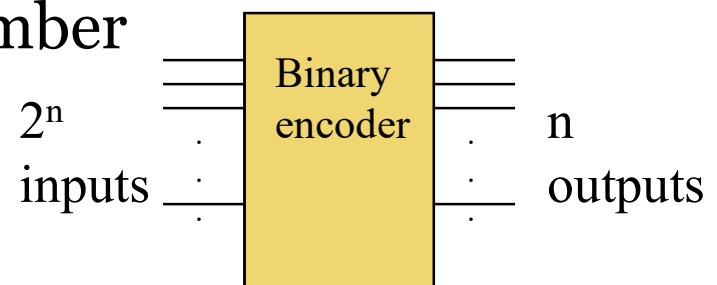
Combinational Circuit(Encoder)

Encoders

- If the a decoder's output code has fewer bits than the input code, the device is usually called an encoder.

e.g. 2^n -to- n

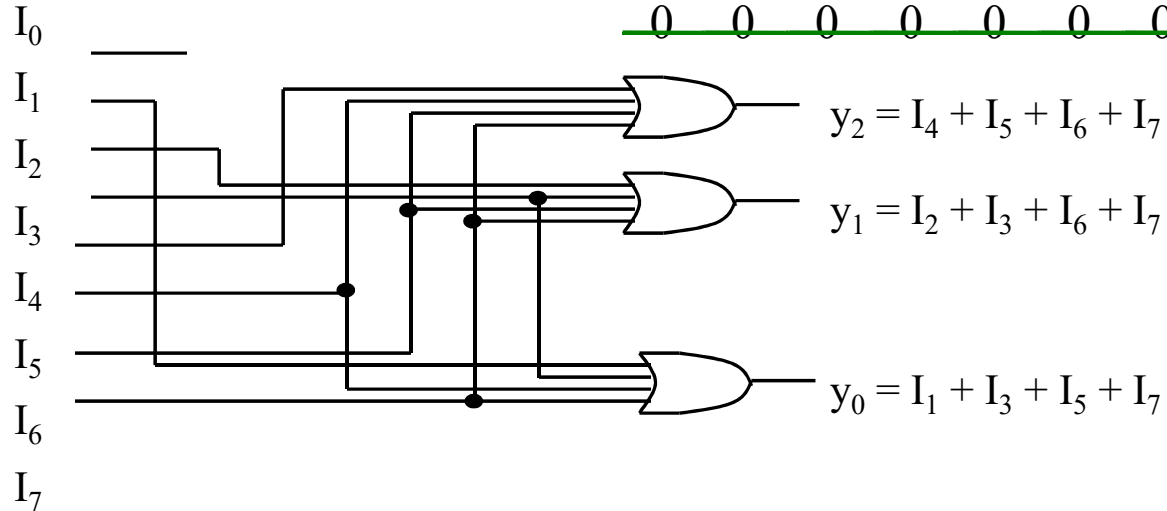
- The simplest encoder is a 2^n -to- n binary encoder
 - One of 2^n inputs = 1
 - Output is an n -bit binary number



8-to-3 Binary Encoder

At any one time, only one input line has a value of 1.

Inputs								Outputs		
I_0	I_1	I_2	I_3	I_4	I_5	I_6	I_7	y_2	y_1	y_0
1	0	0	0	0	0	0	0	0	0	0
0	1	0	0	0	0	0	0	0	0	1
0	0	1	0	0	0	0	0	0	1	0
0	0	0	1	0	0	0	0	0	1	1
0	0	0	0	1	0	0	0	1	0	0
0	0	0	0	0	1	0	0	1	0	1
0	0	0	0	0	0	1	0	1	1	0
0	0	0	0	0	0	0	1	1	1	1



8-to-3 Priority Encoder

- What if more than one input line has a value of 1?
- Ignore “lower priority” inputs.
- **Idle** indicates that no input is a 1.
- Note that polarity of **Idle** is opposite from Table 4-8 in Mano

Inputs								Outputs			Idle
I ₀	I ₁	I ₂	I ₃	I ₄	I ₅	I ₆	I ₇	y ₂	y ₁	y ₀	
0	0	0	0	0	0	0	0	x	x	x	1
1	0	0	0	0	0	0	0	0	0	0	0
X	1	0	0	0	0	0	0	0	0	1	0
X	X	1	0	0	0	0	0	0	1	0	0
X	X	X	1	0	0	0	0	0	1	1	0
X	X	X	X	1	0	0	0	1	0	0	0
X	X	X	X	X	1	0	0	1	0	1	0
X	X	X	X	X	X	1	0	1	1	0	0
X	X	X	X	X	X	X	1	1	1	1	0

Priority Encoder (8 to 3 encoder)

- Assign priorities to the inputs
- When more than one input are asserted, the output generates the code of the input with the highest priority
- Priority Encoder :

$$H_7 = I_7 \quad (\text{Highest Priority})$$

$$H_6 = I_6 \cdot I_7'$$

$$H_5 = I_5 \cdot I_6' \cdot I_7'$$

$$H_4 = I_4 \cdot I_5' \cdot I_6' \cdot I_7'$$

$$H_3 = I_3 \cdot I_4' \cdot I_5' \cdot I_6' \cdot I_7'$$

$$H_2 = I_2 \cdot I_3' \cdot I_4' \cdot I_5' \cdot I_6' \cdot I_7'$$

$$H_1 = I_1 \cdot I_2' \cdot I_3' \cdot I_4' \cdot I_5' \cdot I_6' \cdot I_7'$$

$$H_0 = I_0 \cdot I_1' \cdot I_2' \cdot I_3' \cdot I_4' \cdot I_5' \cdot I_6' \cdot I_7'$$

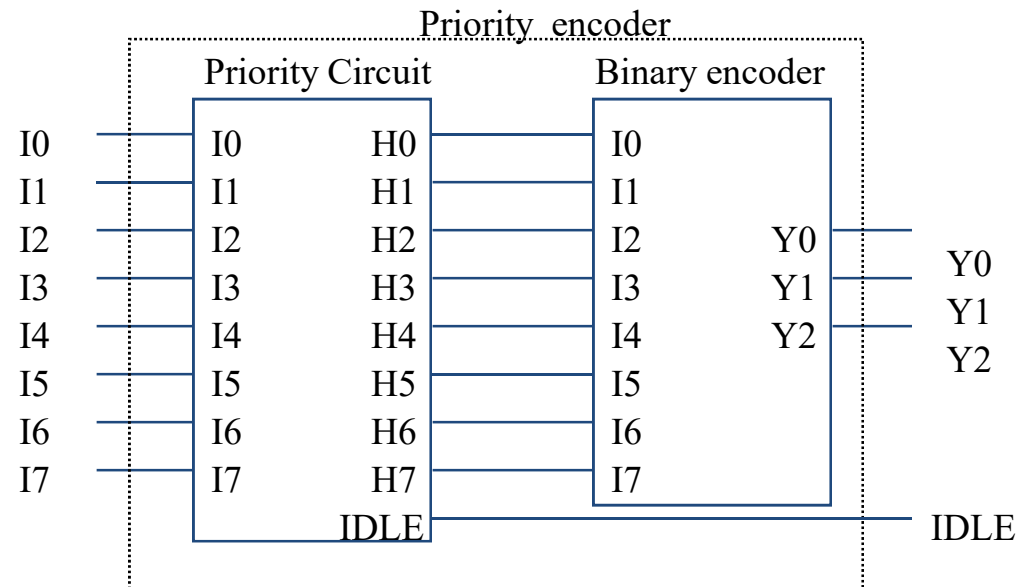
$$IDLE = I_0' \cdot I_1' \cdot I_2' \cdot I_3' \cdot I_4' \cdot I_5' \cdot I_6' \cdot I_7'$$

- Encoder

$$Y_0 = I_1 + I_3 + I_5 + I_7$$

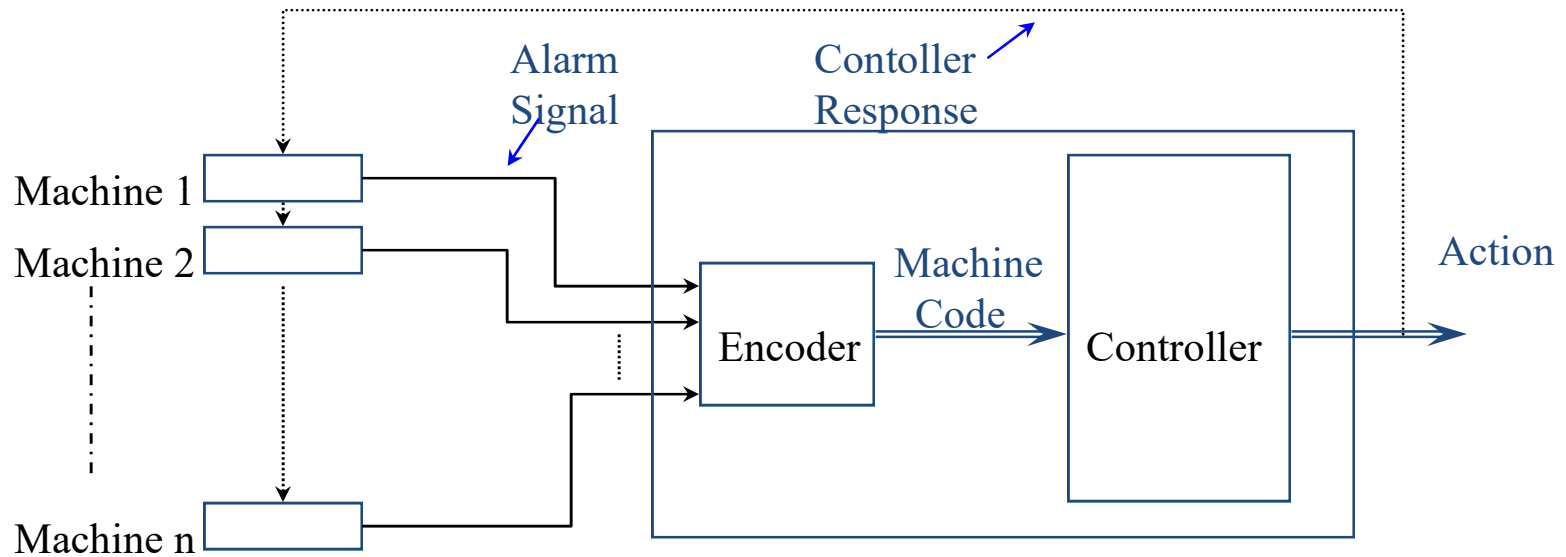
$$Y_1 = I_2 + I_3 + I_6 + I_7$$

$$Y_2 = I_4 + I_5 + I_6 + I_7$$



Encoder Application (Monitoring Unit)

Encoder identifies the requester and encodes the value
Controller accepts digital inputs.



Summary

- Encoders all for data compression
- Priority encoders rank inputs and encode the highest priority input