

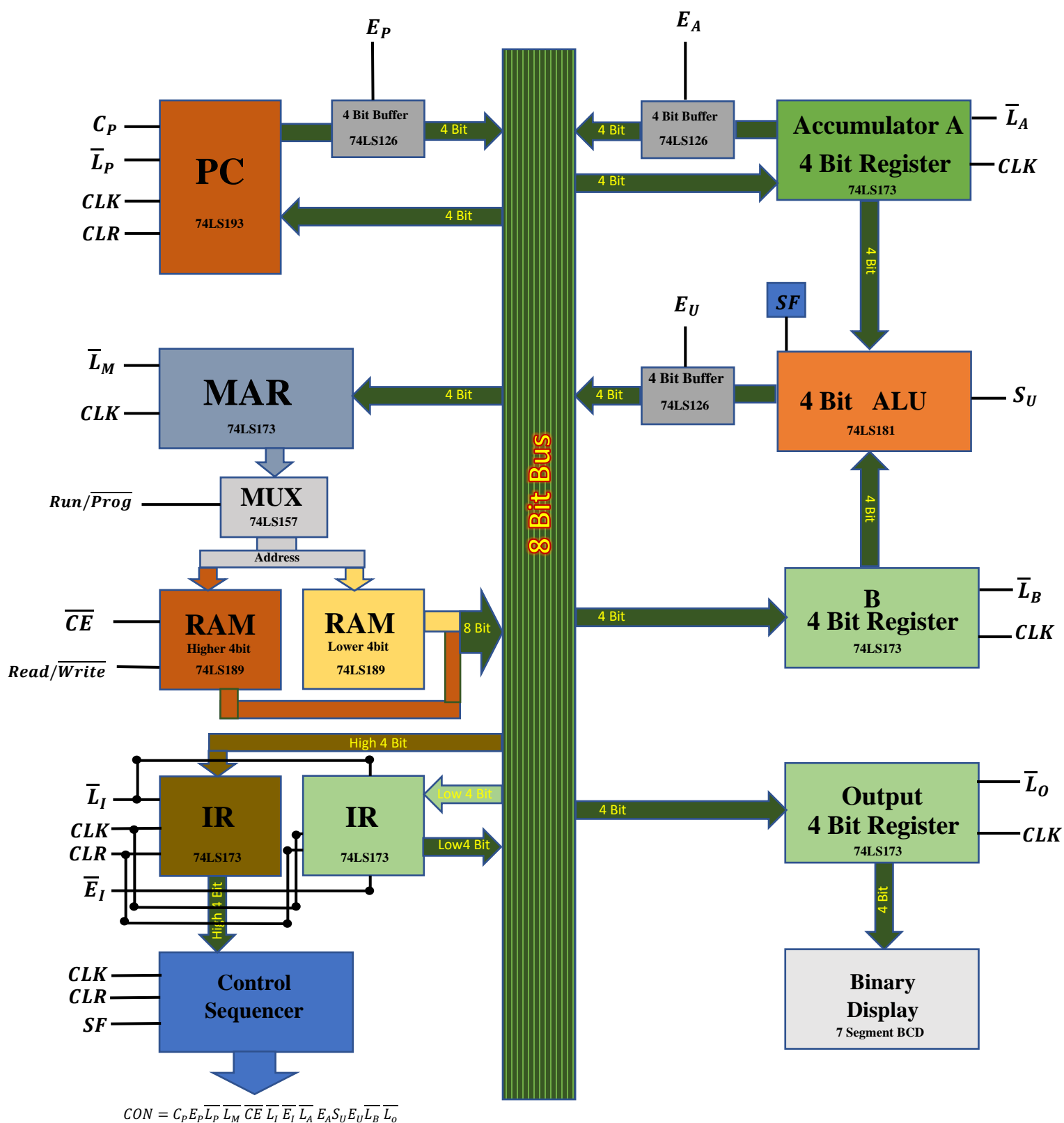


4-BIT MICROPROCESSOR

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Control word format:

$$CON = C_P E_P \overline{L_P} \overline{L_M} \overline{CE} \overline{L_I} \overline{E_I} \overline{L_A} E_A S_U E_U \overline{L_B} \overline{L_O}$$

Macro	State	CON(HEX)	Active
Fetch	T_1	DE3	$E_P, \overline{L_M}$
	T_2	1663	$C_P, \overline{CE}, \overline{L_I}$
LDA	T_3	05A3	$\overline{E_I}, \overline{L_M}$
	T_4	06C3	$\overline{CE}, \overline{L_A}$
MOV	T_3	07F1	$E_A, \overline{L_B}$
	T_4	07E3	NOP
INR	T_3	07C7	$E_U, \overline{L_A}$
	T_4	07E3	NOP
AND	T_3	07CF	$S_U, E_U, \overline{L_A}$
	T_4	07E3	NOP
JM When SF=1	T_3	03A3	$\overline{E_I}, \overline{L_P}$
	T_4	07E3	NOP
OUT	T_3	07F2	$E_A, \overline{L_O}$
	T_4	07E3	NOP
HALT	T_3	07E3	NOP
	T_4	07E3	NOP

Control matrix design:

$$LDA = \overline{I_6} \overline{I_5} \overline{I_4}$$

$$MOV = \overline{I_6} \overline{I_5} I_4$$

$$INR = \overline{I_6} I_5 \overline{I_4}$$

$$AND = \overline{I_6} I_5 I_4$$

$$JM = I_6 \overline{I_5} \overline{I_4}$$

$$OUT = I_6 \overline{I_5} I_4$$

$$HALT = I_6 I_5 \overline{I_4}$$

$$C_P = T_2$$

$$E_P = T_1$$

$$\overline{L_P} = \overline{T_3 \cdot JM \cdot SF}$$

$$\overline{L_M} = \overline{T_1 + T_3 \cdot LDA}$$

$$\overline{CE} = \overline{T_2 + T_4 \cdot LDA}$$

$$\overline{L_I} = \overline{T_2}$$

$$\overline{E_I} = \overline{T_3 \cdot LDA + T_3 \cdot JM \cdot SF}$$

$$\overline{L_A} = \overline{T_4 \cdot LDA + T_3 \cdot INR + T_3 \cdot AND}$$

$$E_A = T_3 \cdot MOV + T_3 \cdot OUT$$

$$S_U = T_3 \cdot AND$$

$$E_U = T_3 \cdot INR + T_3 \cdot AND$$

$$\overline{L_B} = \overline{T_3 \cdot MOV}$$

$$\overline{L_O} = \overline{T_3 \cdot OUT}$$

