**Engineering Dept Manager**

**(Responsibilities/Suggestions)**

**To design an 8-bit computer from 74LS—series Integrated Circuits (IC)**

**Priorities**

**I) To assign and re-assign duties for each worker throughout the Project. (The Hardware Architecture would be a guide.)**

**A) Many Possibilities: one example would be to assign according to Modules: [Program Counter, ALU, Input/Output, Clock, Memory, Control, BUS]**

**B) Input and RAM(Memory) make a good combination**

**C) Some Considerations:**

**1) The abilities of each worker and the levels of difficulty for each assignment will vary.**

**2) Remember Quality Control Testing should be done before sending anything to the Drafting Dept.**

**3) The Drafting Dept cannot do anything until you are finished with any module/project etc.**

**4) While some projects (eg Program Counter, Memory-Registers etc.) are very straight forward and can be done quickly, projects like Control, Clock, Output and error detection in the ALU, are more difficult requiring more time.**

**II) Cooperation between Departments**

**A) Technicians can’t build without the draftsman's schematics who, in turn, can’t draw schematics without the engineer’s designs.**

**Problems and alterations occurring at the Technician or Drafting level will transverse in the opposite direction. Communication between the three is imperative.**

**B) Engineering, Drafting, & Technician Departments should all agree on naming of Components, Data, Signals etc. to avoid confusion as best as possible.**

**1) For example: to the Program Counter, data going from the Program Counter to the BUS is an “output” (DataOut)) but to the BUS that data is an “input” (DataIn).**

**2) Control Signals can be “active LOW” or “active HIGH”. Eg some elements can be cleared(reset to 0) by a LOW signal while others by a HIGH signal.**

**An “active LOW” signal can be represented by placing a BAR over the name of the signal or by placing an ! or ~ before the name. In “Digital”(engr) those representations are possible; however, in “Fritzing”(Drafting), placing a bar above the name may be challenging if not impossible. Regardless, all personnel should be familiar with all three representations.**

1. **IMPORTANT! Naming 4-bit or 8-bit data can present significant challenges.**
2. **Some IC’s will number Data starting with “0” while others will start with “1”. This definitely presents confusion that cannot be eliminated. NOTE: it’s possible that Data0 = Data1.**
3. **Sometimes subscripts are used and at other times not so. Eg Data0 versus Data0.**

1. **For some Data, the order is of utmost importance. Eg the number 6 in binary is 1010 with the “least significant bit” is usually placed on the “right”. If you wish to put it of the “left” you can do so but must add “LSB” or “MSB” to indicate where the “Least Significant Bit” and “Most Significant Bit” is located. (Eg 0101 = 1010MSB = 5). On the ALU IC you will find the inputs labeled A0, A1, A2, A3. A0 will ALWAYS be the LSB and A3 the MSB. You may want to require that the bit on the right will always be the LSB.**

**Your ALU, however, will be 8-bits! (eg 10010110) OR (A7, A6, A5, A4, A3, A2, A1, A0). So A0 will be connected to A0 on the first IC and A4 will be connected to A on the second IC, etc.**

1. **For some Data, however, order does not matter. Eg Control Signals do not depend on each other. The Control Signal “HALT” does not depend on the Control Signal “JUMP” and vice versa.**

**Control Signals can be assigned arbitrarily to the outputs of an EEPROM (I/00, I/01, I/02, I/03, I/04, I/05, I/06, I/07).**

**NOTE: The person responsible for programming the EEPROMs must know the order you assign the Control Signals! (eg Good Communication between the Engineering and Computer Departments!)**