EE 200 DIGITAL LOGIC DESIGN EXPERIMENT #0

INTRODUCTION TO LAB EQUIPMENT

OBJECTIVE:

- To get acquainted with the breadboard and the cathode ray oscilloscope.

APPARATUS:

- Dual –trace oscilloscope
- Digital Proto-Board

THEORY:

See sections 1-2, and 1-6 in the book.

PB-503-C Analog/Digital Proto-Board:

The PB-503-C Analog/Digital Proto-Board is a self-contained digital logic laboratory. It includes a +5 volt power supply that provides operation power to the circuits under test, and also serves a ‘’1’’ logic level for TTL (transistor-transistor logic) integrated circuits. The ‘’0’’ logic level is represented by connection ground. Located on the front panel (see Fig 1) is a Breadboarding Socket that contains over 2500 tie points. These tie points are divided into 384 sets of five electrically interconnected solderless tie points, 8 sets of 25 interconnected solderless tie points along the right and left edges, and 4 sets of 50 interconnected solderless tie points on the top of the board. Tie points are spaced 0.1 inch apart and will accommodate the pins of DIP {dual-in-line package) integrated circuits, as well as a wide variety of other circuit components. The four groups of tie points (50 tie points each) at the top of the breadboarding are connected to +5V, an adjustable (+5, 15V), an adjustable (-5, -15V), and a ground connection, respectively. In the EE200 Lab experiments, we will only use the +5V row and the ground row of tie points. The eight larger groups of tie points (25 tie points each) are handy where large number of connections are to be made to a common circuit point, e.g., extending the ground, +5volt, etc.

Other useful features of the PB-503 include:

- Function Generator: The multi-waveform function generator provides continuously variable frequency signals from 0.1Hz to 100KHz. The frequency is selected in three ranges, with each range covering two-decades. The generator produces, sine, triangle, and square waveforms.

- Logic Indicators: A bank of eight LEDs is provided for use as built-in logic indicators. The LEDs are active high (they light) to indicate a “logic one” condition.

- Debounced Pushbuttons (Pulsers): two manual, bounceless (digitally conditioned) pulser buttons PB1 and PB2.

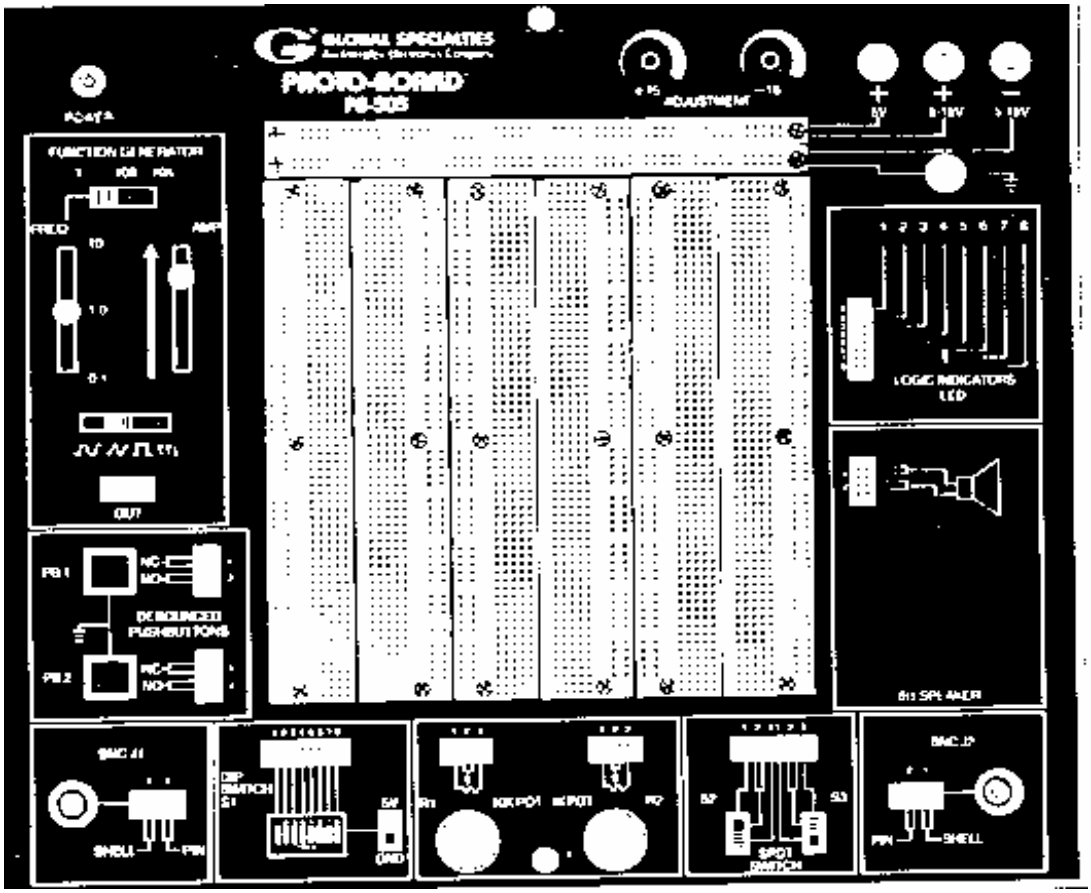
- Switches: An eight-pole DIP switch provides a convenient source of digital outputs. All eight switches have one side connected to a common lead, which may be switched to either +5 volts or ground. The remaining sides of all eight switches are separate, available, and uncommitted. This arrangement makes connecting special digital circuitry such as an eight-bit input port quick and easy. In addition to

the eight-pole switch, there are two single pole, double throw (SPDT) switches provided for general switching functions.

- Potentiometers: Two potentiometers are provided on the PB-503. The resistance values chosen (1 K and 10 K ohms) may be used in common circuit applications.

- BNC Connectors: The PB-503 may be connected to other pieces of equipment via two BNC connectors BNC J1 and BNC J2. These allow the use of shielded cable to minimize noise and interference.

Fig.1 PB-503 Panel layout.



IC PIN CONNECTIONs:

The IC type 7493 is in a 14-pin dual in-line case. The base pins progress in a counter-clockwise direction as seen from the side away from the pins, as shown Fig 2. Pin 1 is located by an identifying symbol, or the location of pins 1 and 14 are identified by an index notch at the end of the case where pins 1 and 14 are located.

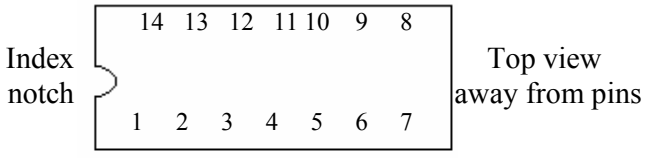


Fig.2 IC pin location, 14 pin dual-in-line (TO-116) case

PROCEDURE:

THE PB-503

1. Connect the PB-503 line cord into the AC power supply and turn on the power switch.

2. Connect the LOGIC INDICATORS (lamp monitor) (1, 2, …,8) to +5 volts. The lamps monitors should light when connected +5 volts and this "ON" lamp condition will represent a "l" logic level in your experiments.

3. Now connect the lamp monitors to ground. They should all be off at this time. This "OFF": lamp condition will represent a "0" logic level in your experiments.

4. Connect one side of a resistor (20 ohms, to 100 K) to ground and the other side to DIP switch S1-1 and switch the 5 V/GND switch to 5 volts position (These steps are already done for you). Connect S1-1 to LED-1. Now, when the S1-1 is pushed up to the closed position LED-1 will light, and when the S1-1 is brought back to the open position the LED will be off. Repeat these steps for S1-2 through S1-8 and observe the resultant condition of the lamp monitors.

Switch position	lamp	logic level
CLOSED	ON	1
OPEN	OFF	0

The switches can, thus, be used to supply logic level inputs to experimental circuits.

5. PULSER BUTTONS. Connect one side of a resistor (20 ohms, to 100 K) to +5 volts and the other side to PB1-1, the NC point. Then connect PB1-1 (the other lead of NC point) to LED-1. The LED should light when PB1 is pressed and extinguish when PB1 is released. Next, move the connections from PB1-1 to PB1-2, the NO point. Now the LED should be lit when PB1 is not pressed and go off when PB1 is pressed. Repeat these steps for PB2. These buttons will be used to enter momentary pulses of "O" and "1" logic levels.
6. Single Pole, Double Throw (SPDT) switches. Connect one side of a resistor (20 ohms, to 100 K) to +5 volts and the other side to lead 1 of S2. Then connect lead 2 to LED-1 and Lead 3 to LED-2. When the switch is brought to the up position then LED-1 and LED-2 will be ON and when the switch is brought down, the two LED's will be off. Repeat these steps on S3. These switches are provided for general switching functions.

7. CLOCK output. Connect the FUNCTION GENERATOR output TTL to LED-1. Set the function generator to "times 1" position and move the frequency control all the way to the top. Set the frequency selector to Hz. LED-1 should flash on and off, alternately at about 1 cycle per second. Move the function generator to "times 10" position (setting the frequency to 10 Hz). The lamp monitors should flash on and off at a faster rate, too high to count. Higher frequency settings "times 100" should cause the lamps to appear to be on continuously, at about half-normal brilliance

8. Connect the FUNCTION GENERATOR output TTL to an oscilloscope. You should observe a square wave having fairly steep sides and a peak-to-peak

amplitude of 4 to 5 volts. Change the selection to Square, triangle, Sine and observe the waves on the oscilloscope.