

HANDS-ON LAB INSTRUCTION SHEET – MODULE 6

NOTES:

1) To conserve the life of the Multimeter's 9 volt battery, be sure to turn the meter off if not in use for over 5 minutes. Always double check the unit is off when finishing your work, or leaving the classroom. All work is to be done individually and submitted before you leave

Always keep the Instruction sheets.

2) Be sure you still have power properly wired on your Radio Shack Learning Lab console. Plug in the '9V AC Adapter' and see if the Power Switch controls the Green LED (up=Lit). **Keep the 5 volt Voltage Regulator (7805 with capacitor, resistor and LED) wired till end of course!**

BASIC DIGITAL LOGIC

SERIES SWITCH "AND" GATES

1. Wire the switch and LED circuit of Figure 6.1 (similar to Workbook #2 pg. 14 but using a regulated +5 volt source).

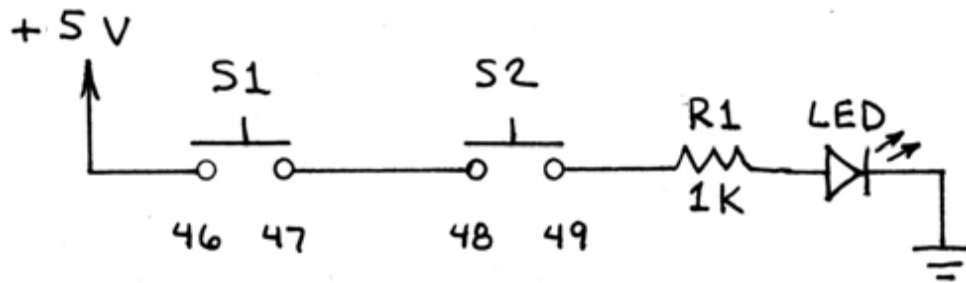


Figure 6.1. Series Switch AND Logic

Wire directly from the schematic placing resistor R1 and the LED anywhere convenient.

Demonstrate that switch S1 **AND** switch S2 must be depressed to get a high output and light the LED by filling in Table 6.1, the AND logic 'Truth Table' noting the switch being **ON** or **OFF** and the resulting **ON/OFF** state of the LED.

AND Logic Truth Table		
S1	S2	LED
OFF	OFF	
OFF	ON	
ON	OFF	
ON	ON	

Table 6.1. AND Logic Truth Table

PARALLEL SWITCH “OR” GATES

2. Wire the circuit of Figure 6.2 (similar to Workbook pg. 15 but using regulated +5 volts.) Wire directly from the schematic:

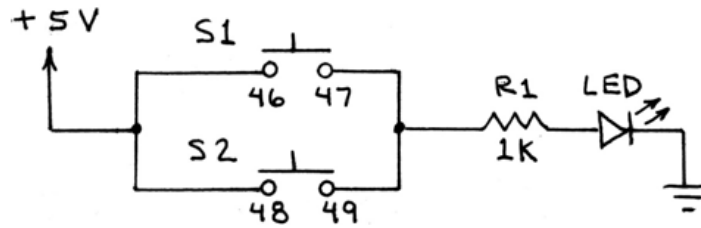


Figure 6.2. Parallel Switch OR Logic

Demonstrate that switch S1 **OR** switch S2 must be depressed to get a high output and light the LED by filling in Table 6.2’s OR logic truth table noting the switch being **ON** or **OFF** and the resulting **ON/OFF** state of the LED.

OR Logic Truth Table		
S1	S2	LED
OFF	OFF	
OFF	ON	
ON	OFF	
ON	ON	

Table 6.2. OR Logic Truth Table

This is Instructor **Checkpoint 7A**.

CD4011 QUAD 2-INPUT NAND GATE IC

3. Wire the circuit of Figure 6.3 (similar to Workbook 2 pg. 34 but using +5 volts.). Insert the **CD4011** 16-pin DIP (dual in-line package) integrated circuit across Slot 2 with its pin 1 at **H10**. It is best (for fastest learning) to wire directly from the schematic rather than using the Workbook suggested wiring. Pins are as shown in Figure 6.4.

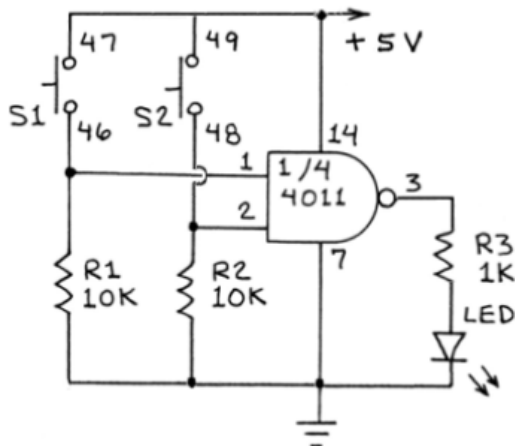


Figure 6.3. IC NAND Gate Logic

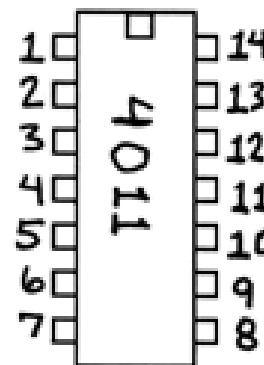
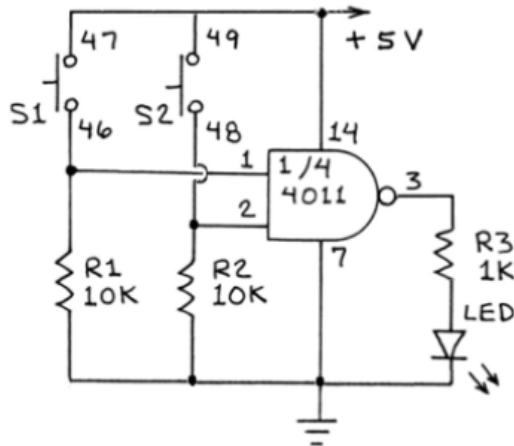


Figure 6.4. 14-pin DIP Package

In any case, follow our color code (red = + supply, black = ground, and yellow for everything else). The **CD4011** is a quad, 2-input NAND gate which means there are four devices with logic outputs of AND followed by NOT (*an inverter*).

Fill in Table 6.3, a truth table with a column for each input and one for the output, using 0's and 1's where **0** = LO (zero volts) and **1** = HI (+5 volts, Output HI = LED lit)



S1	S2	LED
0	0	
0	1	
1	0	
1	1	

Table 6.3. NAND Logic Truth Table

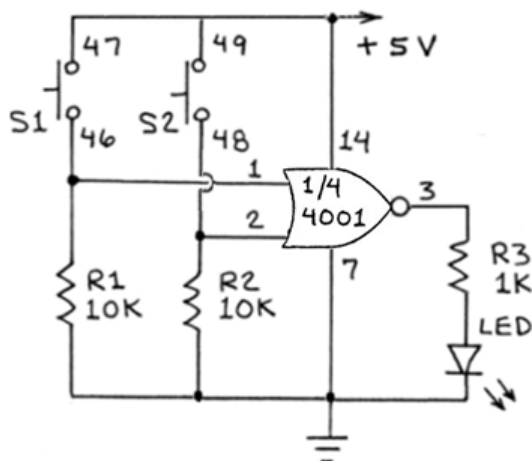
This is Instructor **Checkpoint 7B**.

CD4001 QUAD 2-INPUT NOR GATE IC

4. Leaving the overall circuit of Figure 6.3 in place:

4.1 **TURN OFF THE POWER.** REPLACE the **CD4011** NAND gate IC with a **CD4001** NOR gate IC. Be sure to insert the **CD4001** across Slot 2 with pin 1 at H10.

4.2 Now turn the power back on and repeat all of part 3 for the NOR Gate IC.



S1	S2	LED
0	0	
0	1	
1	0	
1	1	

Table 6.4. NOR Logic Truth Table

Figure 6.5. IC NAND Gate Logic

This is Instructor **Checkpoint 7C**