

# h-l logic tester

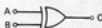
This is a TTL logic probe which, instead of the usual LED to indicate the logic states, uses a seven-segment Minitron or LED display to indicate 'H' for a high or '1' state and 'L' for a low or '0' state. The circuit also detects when the probe input is open-circuit and the readout is suppressed, thus indicating that contact with the desired test point has not been made. This avoids the false readings that may occur with some types of probe when the input is not connected.

The circuit makes use of a 7447 decoder driver. The input circuitry to this IC is designed so that when the input to the probe is high a '1' is applied to the 'C' or 4 input of the IC. When the input to the probe is low a '1' is applied to the 'A', 'B' and 'D' or 1, 2 and 8 inputs of the IC. This results in the display of the number 4 and the symbol  $\square$  respectively in accordance with the truth table for the 7447. However, the connections from the outputs of the IC to the segments of the display are rearranged so that the display is actually H and L. When the input to the probe is open-circuit all four inputs to the 7447 are high ( $A = B =$

7447 output	pin No.	connected to display segment
a	13	not connected
b	12	c.g
c	11	e
d	10	d
e	9	not connected
f	15	b
g	14	f

Truth Table for exclusive-OR gate

A	B	C
0	0	0
0	1	1
1	0	1
1	1	0



$C = D = 1$ , i.e. '15') and the display is completely suppressed.

The input circuitry operates as follows:  $N_1$  and  $N_2$  are exclusive-OR gates. When a '0' is applied to the probe input both inputs of  $N_1$  are '0' so the output is also '0'. One input of  $N_2$  is held at '0' via  $R_1$  and the other is held at '1', by  $R_2$ , so the output is '1'. This output is connected to the A, B and D inputs of the 7447. When the probe input is '1' one input of  $N_1$  is '0' and the other is '1', so the output is '1'. This output is connected to the C input of the 7447. Both inputs of  $N_2$  are '1', so the output is '0'. When the probe input is open-circuit the input of  $N_1$  is not connected to ground floats at just above the '1' threshold level, so the output is '1'. The forward voltage drop of  $D_1$  and  $D_2$  prevents this from holding the input of  $N_2$  high, so the input is held low by  $R_1$ . The other input is, of course, held high so the output is '1'.

2

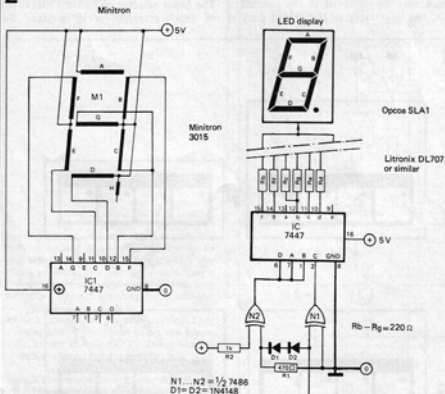


Figure 1. Connections from outputs of 7447 to display segments.

Figure 2. Complete Circuit of the H-L tester, showing the alternative connections for Minitron and LED display.