# I/O BOARD USER MANUAL

## 1. OVERVIEW

The I/O board contains various input and output devices, for the purpose of experimenting with simple digital circuits. It is designed to fit directly onto a breadboard (prototyping board) and features a logic probe that can aid in debugging and a UART serial interface for communication with other devices.

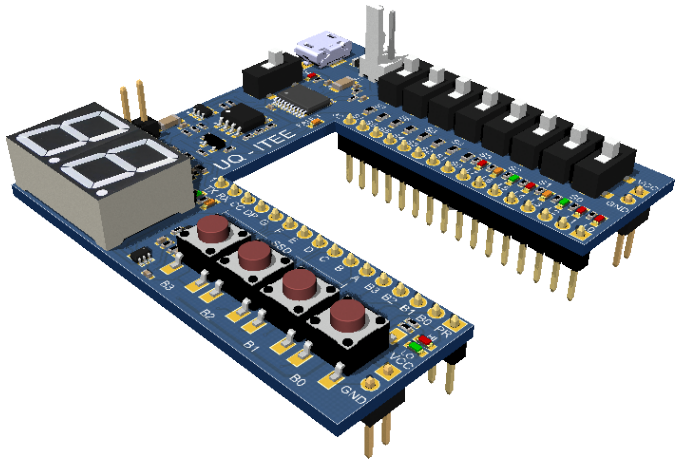

**FIGURE 1 - I/O BOARD**

The board is powered from a single USB connection and features current-sense circuitry that detects short circuits and protects your designs.

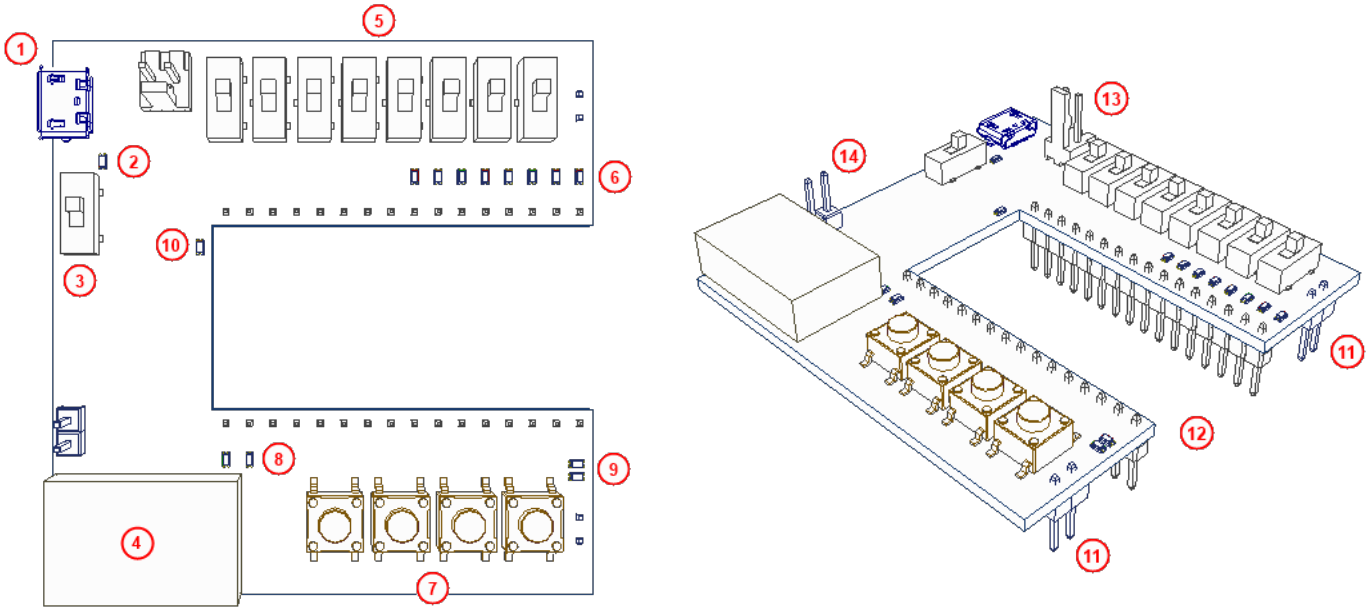


**FIGURE 2 - BOARD OVERVIEW**

1. USB Connector
2. Power LED
3. Power Switch
4. 7-Segment Display
5. Switches
6. LEDs
7. Buttons
8. UART Transmit/Receive LEDs
9. Logic Probe Indicator LEDs
10. Fault LED
11. VCC / GND Headers
12. I/O Device Headers
13. Auxiliary Power Connector
14. High Current Mode Jumper

# 2. SETUP

To begin using the I/O board, first insert it into a breadboard as shown in Figure 3. Take care to align the downward facing headers with the appropriate holes in the breadboard.

**NOTE:** If aligned correctly, the I/O board should not require excessive force to insert it into the breadboard.

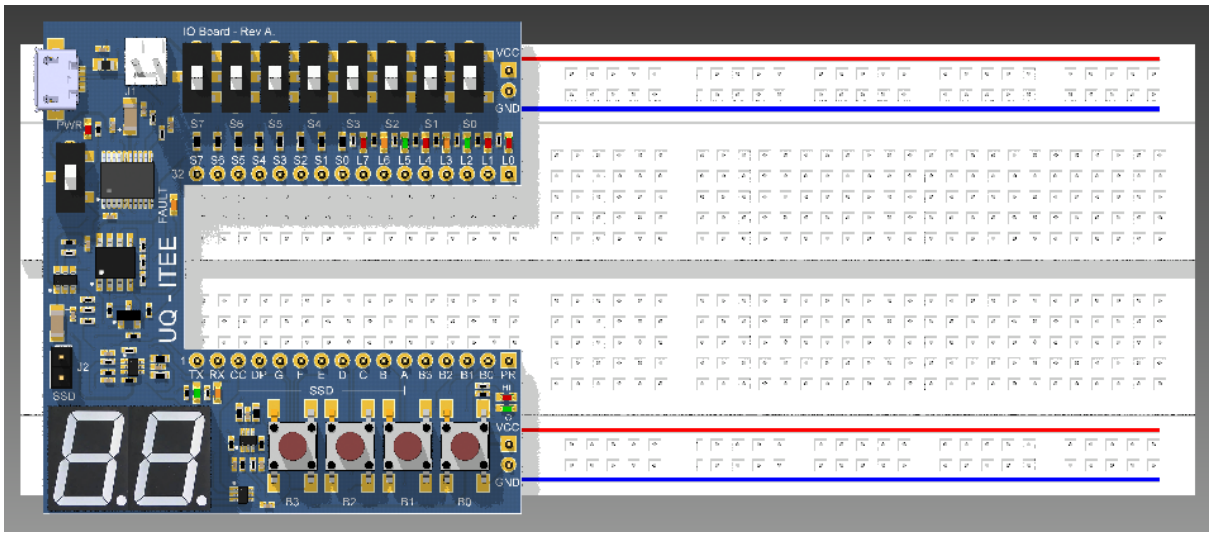


**FIGURE 3 - I/O BOARD INSERTED IN BREADBOARD**

Connect a micro-USB cable to the connector on the top-left corner of the board.

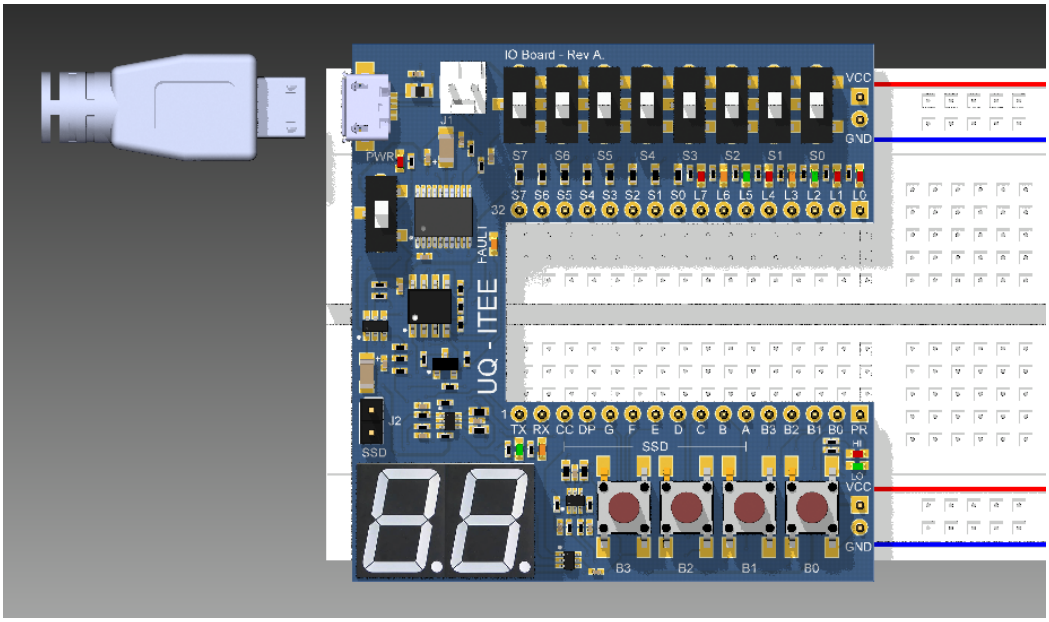


**FIGURE 4 - USB CONNECTION**

**DO NOT STORE THE BOARD WITH THE USB CABLE ATTACHED - THIS MAY CAUSE THE USB CONNECTOR TO BREAK OFF!!**

Turn on the I/O board by sliding the **PWR** switch *up* into the ON position – the red power LED should illuminate.

Check to see that the orange **FAULT** LED does not light up. If it does, turn the power off immediately by sliding the **PWR** switch *down* into the OFF position – see Section 3: Fault LED.

# 3. FAULT LED

The I/O board uses a current-limited power switch to protect itself and any circuits that it powers from harm due to short-circuits. In the case of a short circuit, the orange FAULT LED will be illuminated.

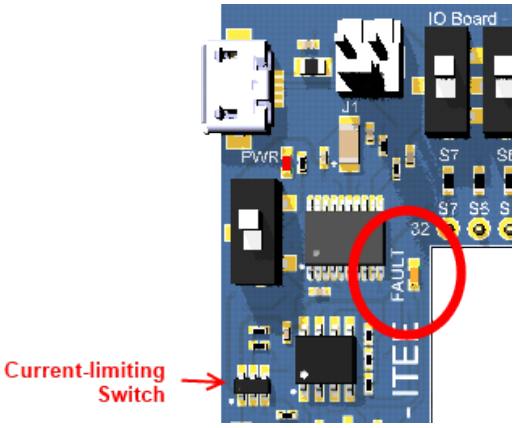


**FIGURE 5 - FAULT LED**

If the FAULT LED is on, **immediately turn the power off to the board by sliding the PWR switch *down* into the OFF position.** Check your design for short circuits before returning power to the board.

**WARNING! In the case of a short circuit, the current-limiting switch may become extremely hot!**

# 4. SWITCHES, LEDS, BUTTONS

The I/O devices are all accessible via the breadboard holes directly above/below the relevant labels printed on the I/O board (see Figure 6 - I/O Device Labels). The switches are labelled **S0 … S7**; the LEDs **L0 … L7**; and the buttons **B0 … B3**.

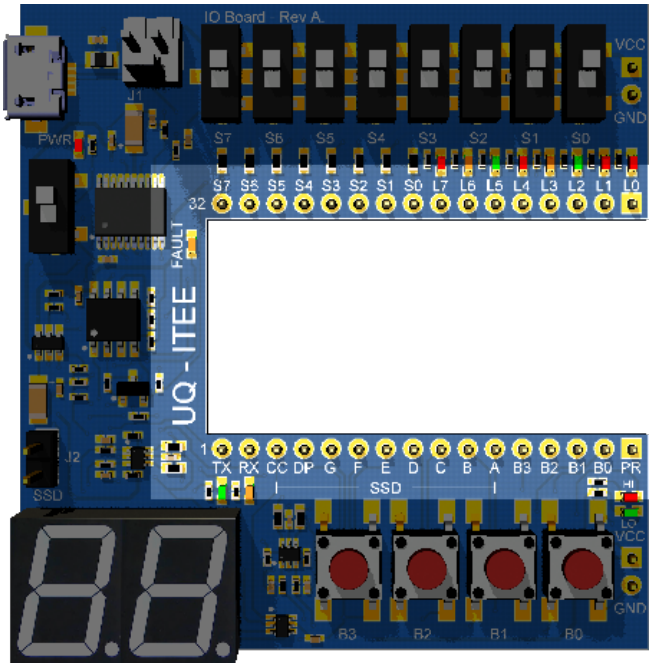


**FIGURE 6 - I/O DEVICE LABELS**

These I/O devices can be connected to other circuit elements by connecting a wire from the column of terminals in the breadboard above/below the relevant label. An example of this is shown in Figure 7 - Example Connection, where the switch **S0** is connected to pin 13 of an external device and the LED **L0** is connected to pin 11.

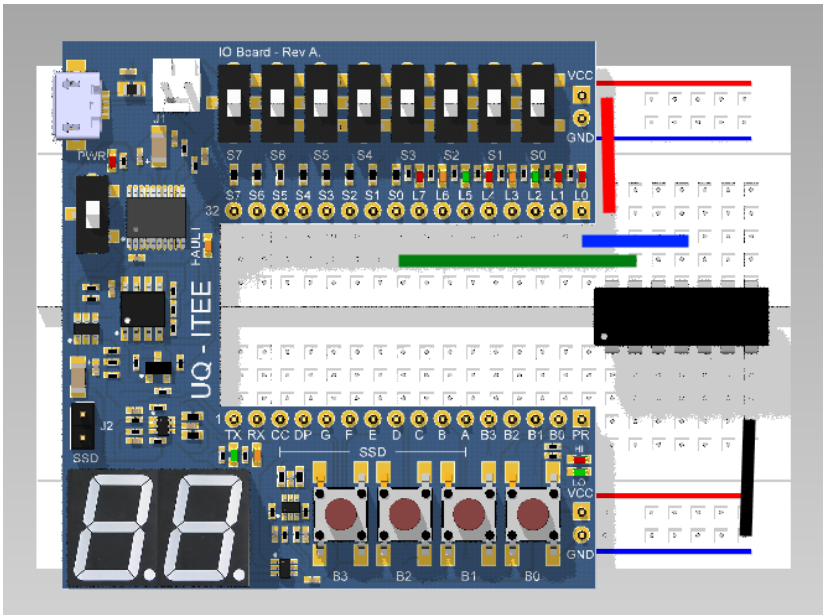


**FIGURE 7 - EXAMPLE CONNECTION**

## 5. LOGIC PROBE

The Logic Probe can be used to analyse the logic state of points within a digital circuit. It is used by attaching a wire to the column of terminals above the **PR** label (see Figure 8 - Logic Probe). The other end of this wire can then be touched to other points around a circuit and the HI / LO LEDs will indicate the logical state at that point in the circuit.

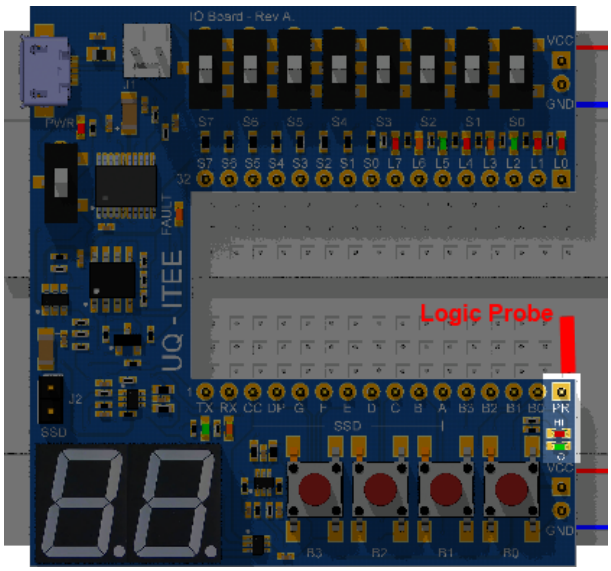


**FIGURE 8 - LOGIC PROBE**

A logic probe is a simple, yet useful tool for troubleshooting digital circuits. When used as part of a well thought-out debugging strategy it can greatly speed up the process of finding and fixing errors. As circuits increase in complexity, so does the necessity to have a clear strategy in mind when debugging them, as probing random points in a large circuit rarely reveals the location of errors.

**Suggested Troubleshooting Strategy**

1. Check that the FAULT light is not on, indicating a short-circuit
2. Probe the VCC and GND connections at every device in your circuit to ensure each is powered correctly
3. Start at the inputs to your circuit, probe the inputs to verify their logical state; move logically through the circuit from input to output – a pen and paper will help here (write down the expected state at each point and then verify this state using the logic probe – a schematic and a truth table are great for this!)

This strategy is not a fool-proof guide to solving any problems within a circuit, but it is a useful starting point to begin developing your own approach. The key to any successful debugging strategy is to assume nothing, know what to expect before you actually begin testing and have a plan!

**Electrical Characteristics**

| | |
|---|---|
| VCC | 5V |
| GND | 0V |
| Logic High | > 3.5V |
| Logic Low | < 1.5V |