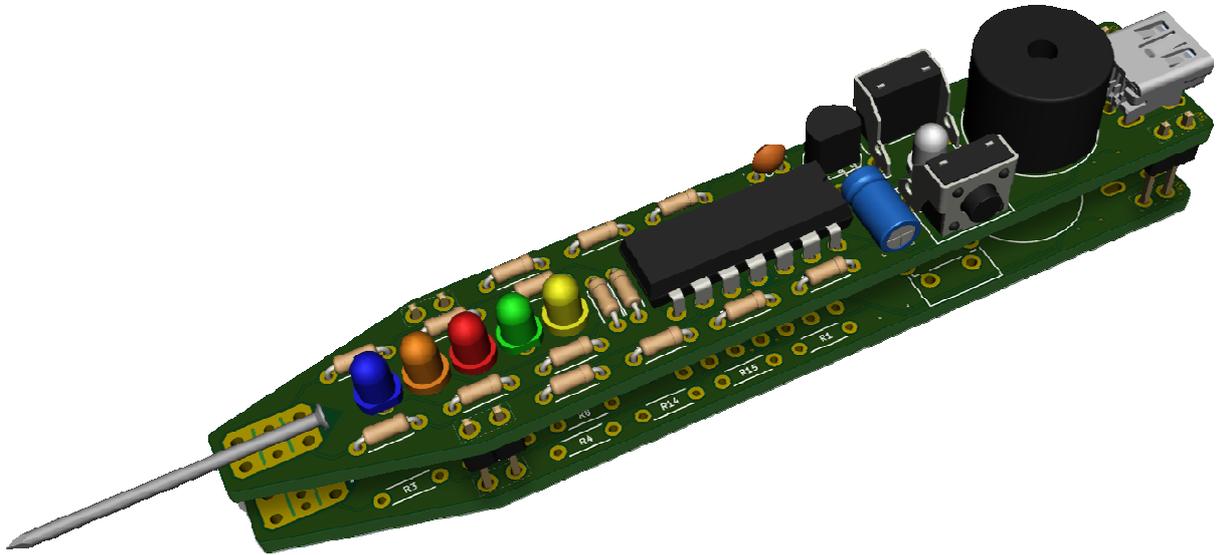


# The Logic and Level Probe



A versatile measuring device

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## OVERVIEW

The Level Probe is fundamentally an enhanced logic probe. It has the following useful features:

- High/Low signal detection (standard logic probe function).
- Approximate voltage measurement.
- Detection of oscillating signals.
- Audible multi-tone buzzer (configurable).
- Wide input voltage range (0V to 30V).
- Wide supply voltage range (4.5V to 12V).
- Suitable for left- or right-handed use.
- USB power connector.
- JST power connector.

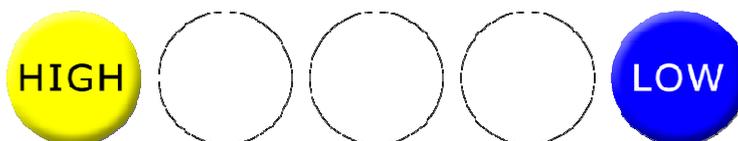
## USAGE

When initially powered on, the LEDs will illuminate in sequence to indicate correct operation; after which a single beep will sound, and the current configuration will be displayed. *See the “Configuration” section.*

To measure a voltage or signal, touch it with the probe. When a signal is detected, coloured lights will show to indicate the type of signal, and (if enabled) a buzzer will sound.<sup>1</sup>

### LOGIC MODE

In **Logic Mode**, the yellow and blue lights will illuminate to indicate a high or low signal, respectively:



If sounds are enabled, a tone will also be emitted. This tone will change in pitch to indicate high or low.

A signal of 1.8V or greater is considered “high”, whilst a signal of 1.5V or lower is deemed “low”. Signals between 1.5V and 1.8V are not valid logic signals, and no colours are shown.

If an oscillating signal (greater than about 40Hz) is detected,<sup>2</sup> the red light will also illuminate; and a different tone will sound.

<sup>1</sup> A common ground is required. The probe cannot detect voltages or signals that are “floating”.

<sup>2</sup> Only when “Oscillation Detection” is enabled. *See the “Configuration” section.*

## LEVEL MODE

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In **Level Mode**, the approximate voltage of the signal will be displayed using lights:



If the measured voltage is between two values, both lights will illuminate.

Voltages in excess of around 12.5V will show all five lights.

Voltages greater than 14V are considered “out of range”, and all five lights will flash.

When sounds are enabled, a tone will be emitted. This tone will vary in pitch to reflect the sensed voltage.

## CONFIGURATION

When initially powered on, the LEDs will illuminate in sequence to indicate correct operation; after which a single beep will sound, and the current configuration will be displayed.

The configuration can be changed using the button. It is located either on the left or the right of the tool.

A brief press of the button will show the current configuration without changing it; and a single beep will sound.

- Blue represents Level Mode, in which approximate voltages are displayed. If it is not illuminated, you are in Logic Mode, where only yellow (high) and blue (low) measurements are to be shown.<sup>3</sup>
- Orange represents sound. If it is illuminated, sound is enabled.<sup>4</sup>
- Red is for Oscillation Detection.<sup>5</sup>

Holding the button down will flash each configuration light in sequence. This allows you to change the configuration. Keep the button pressed until the desired setting flashes, then release. The setting will toggle on or off.

Settings are automatically preserved in non-volatile memory between uses of the tool.

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<sup>3</sup> Logic Mode is much more responsive than Level Mode. It can also detect and display oscillating signals correctly; whereas Level Mode may simply average them out into a constant voltage.

<sup>4</sup> The sound setting applies only to measurements. The probe will always beep on power-up, and when viewing or changing configuration.

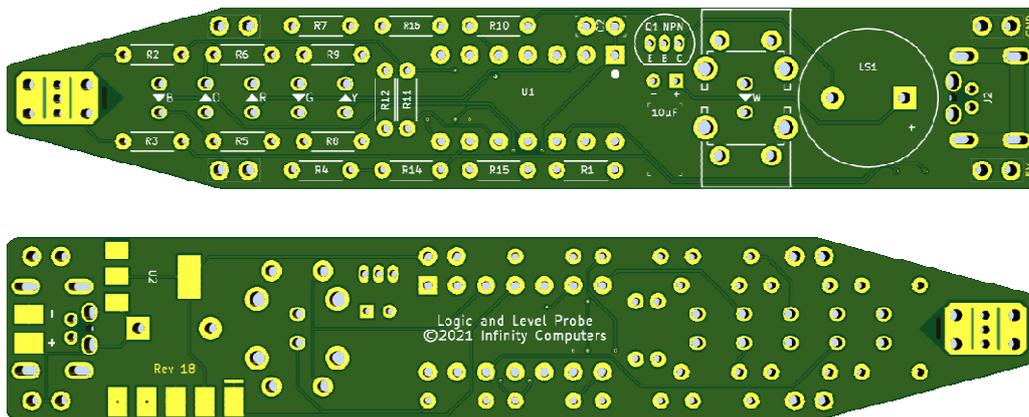
<sup>5</sup> Applicable to Logic Mode only.

# ASSEMBLY INSTRUCTIONS

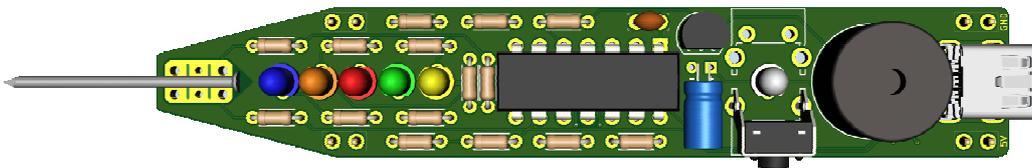
## BOARD LAYOUT

The Level Probe consists of two identical boards joined by headers. All components, with the exception of the JST connector and the rear 2.54mm header, should be mounted on the top board.

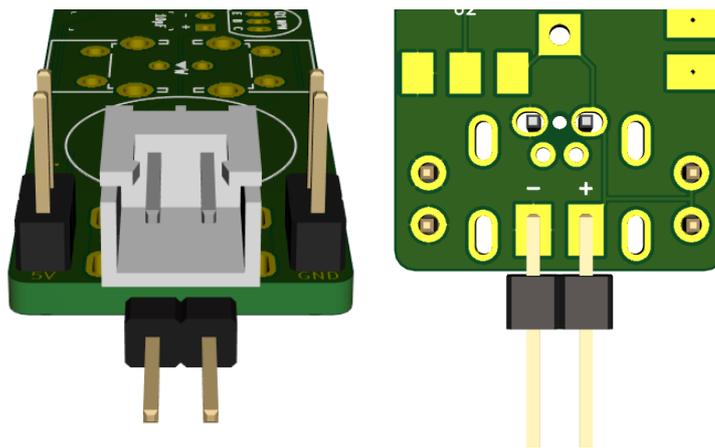
Here are both boards before assembly:



The top board again, after assembly:



The rear of the lower board, after assembly:



Note that there is only one button. However, it may be mounted on whichever side the user finds most comfortable. In this way, the tool is equally suitable for left- and right-handed people.

The JST connector and the rear 2.54mm header are optional.

## BILL OF MATERIALS

References	Description	References	Description
C1	Capacitor, 10 $\mu$ F, electrolytic	R2	$\frac{1}{8}$ W resistor, 47K, 1%
C2	Capacitor, 100nF	R3	$\frac{1}{8}$ W resistor, 39K, 1%
D1	LED, 3mm, white	R4	$\frac{1}{8}$ W resistor, 10K, 1%
D3	LED, 3mm, blue	R5, R10	$\frac{1}{8}$ W resistor, 15K
D4	LED, 3mm, orange	R6, R7	$\frac{1}{8}$ W resistor, 5.1K
D5	LED, 3mm, red	R8, R9	$\frac{1}{8}$ W resistor, 1.5K
D6	LED, 3mm, green	R11	$\frac{1}{8}$ W resistor, 30K, 1%
D7	LED, 3mm, yellow	R12	$\frac{1}{8}$ W resistor, 4.7K, 1%
J1	Metal probe	R14	$\frac{1}{8}$ W resistor, 1K, 1%
J2	USB port <sup>6</sup> or JST or 1x02 header	R15	$\frac{1}{8}$ W resistor, 27K, 1%
J4, J5, J6, J7	2.54mm male headers, 1x02 <sup>7</sup>	R16	$\frac{1}{8}$ W resistor, 3K, 1%
LS1	Passive buzzer	SW1 or SW2	Angled tactile button
Q1	S8050 or similar NPN Transistor	U1	PIC16F1503
R1	$\frac{1}{8}$ W resistor, 51K	U2	3.3V regulator

## REQUIRED TOOLS

You will need the following equipment:

- Soldering iron
- Solder
- Pliers

The following equipment is also recommended:

- Multimeter

You may also want some way to hold the board in place during soldering. A clamp or vise is ideal; but in a pinch you can secure it to your work surface with sticky tape.

## ASSEMBLY

Anyone with a basic modicum of soldering experience should have no difficulty in assembling this board. It is quite straightforward.

We advise the following sequence of construction:

1. Solder all the resistors.
2. Solder all the LEDs.
3. Solder everything else except the sandwich headers.<sup>8</sup>
4. Test that the probe works.
5. Solder the sandwich headers.

The coloured bands on metal-film resistors (the blue ones) are difficult to read with the human eye. Instead of squinting, you may simply measure them with a multimeter.<sup>9</sup>

<sup>6</sup> On the upper board, fit the USB. On the lower board, fit the 2-pin JST and/or the included rear 2.54mm header, as desired. Note that the header is to be mounted horizontally on the square pads.

<sup>7</sup> These are referred to as “sandwich headers”, and are used to join the upper board to the lower board.

<sup>8</sup> You should hold the probe with your pliers whilst soldering it, as it will get very hot along its entire length.

## ABSOLUTE MAXIMUM RATINGS

	Minimum	Maximum
Power supply voltage relative to ground	4.5V*	14V
Input voltage relative to ground	-30V	30V
Input current	<i>(internally limited)</i>	

\* Lower values may result in the unit failing to operate correctly.

## TROUBLESHOOTING

- **The probe does not power up**
  - **Is the probe correctly assembled?**
  - **Is power being supplied?**
  - **Is the supply polarity correct?**
  - **Have any of the maximum ratings been exceeded?**
  
- **The probe doesn't detect my signal**
  - **Does the probe share a ground with the device being measured?**

Like other electrical measuring devices (such as multimeters) the Level Probe requires two connections. One connection is the probe tip and the other is a ground connection. You cannot measure an isolated device.

The Level Probe comes with a JST connector and a 2.54mm header that can be used to power the probe and/or to establish a ground connection. Alternatively, one of the rear sets of "sandwich pins" is labelled "GND" and can be connected – e.g. with a small crocodile clip – to the ground level of your target device.
  - **Is the target voltage between 1.5V and 1.8V?**

Such voltages are officially designated as "indeterminate" logic levels and are neither high nor low. The probe will ignore these.
  - **Is the probe correctly assembled?**

Try measuring a known 5V or 0V signal.
  
- **No sound**
  - **Enable the sound.**

See the "Configuration" section.
  
- **Probe is only showing yellow or blue lights**
  - **Switch to Level Mode.**

See the "Configuration" section.

<sup>9</sup> Don't have a multimeter? Get one. It's the single most useful tool you could possibly have for electronics work.