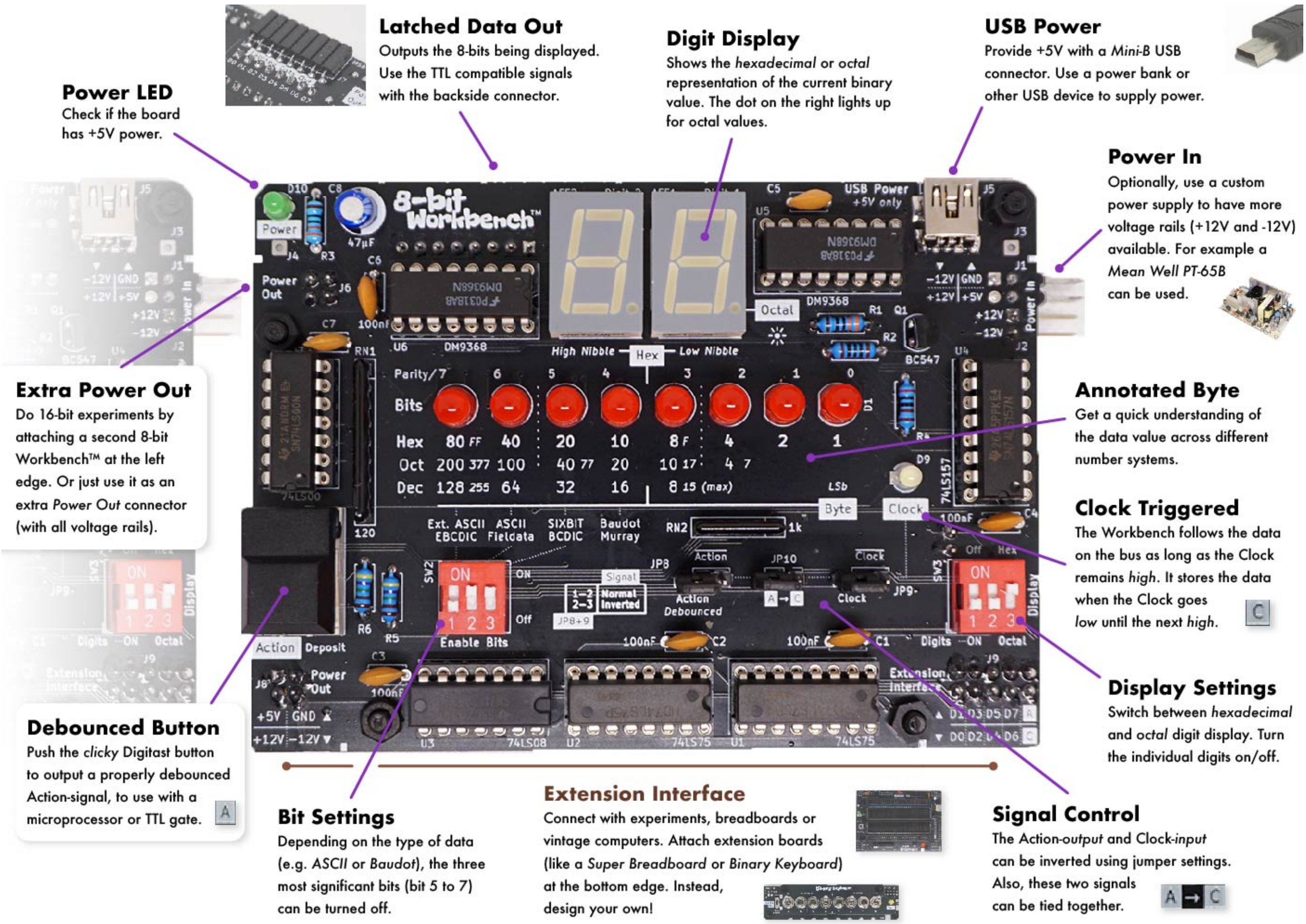
8-bit Workbench™
Preliminary Manual

Your companion for vintage computer experiments. Display 8 bits using blinkenlights. Learn about logic and see how number systems work. Extend and combine.

Feature Overview



Assembly

Make sure you have all the parts, see the *Bill of Materials*. Always solder by vertical height of the components, from low to high:

- Start with the six **resistors** (R1-R6). For best results use a plastic lead bend tool, or bend the leads by hand, before inserting the resistor into the board. Cut the leads after soldering, then reheat again to reflow the solder.

- Then the **USB connector** (J5). First solder the bigger pads at the top side of the board with a regular size soldering tip. Make sure the connector is hold down gently (watch out it gets hot, or use a tool) while doing this to make sure it is fully seated. Proceed with soldering the two bigger pads at the backside of the board using the same size tip. Use a smaller (SMD) tip with the five small legs of the connector. Make sure that they are not being shorted together.

- Continue with the **resistor nets** (RN1, RN2). Make sure the side with the ‘dot’ matches the hole on the PCB indicated by a square. Solder one pin first, align the resistor net and finish off soldering all pins.
- At the back side of the PCB, insert the **jumper header** (JP6) and the **data out connector** (J7). Both parts have to be soldered on the front side. Apply the jumper to the jumper header. Solder one pin first, then melt it again while aligning the part correctly. After that (re)solder all pins. <u>Watch out to not touch the same pin that is being soldered, it gets hot!</u>

  To leave out the disable-function of the *Clock*-LED, header (JP6) can be left out and solder jumper JP7 can be *shorted* instead.
- Keep working on the backside with the three **female buses** (J6, J8, J9) and the **male headers** (J1, J2). Male header J2 is *optional* and can be put in depending the used female power supply connector (*see* the next chapter). Solder one pin first, same procedure as the previous step. Make sure the parts are aligned perfectly with the board layout.
- Seven **IC sockets** (U1-U7) have to be done. Make sure they are oriented correctly, check if the notch of the socket matches the outline on the board. Start with soldering two opposite pins, then melt the soldered pins again while pushing the socket all the way down on the top side. When the socket sits nicely, then (re)solder all pins. Insert the IC’s later.
- Insert the *smaller* 3mm **LEDs** (D9, D10). The power-LED is the green one. The long leg is the anode (+) and the short leg the cathode (-). The short leg should go through the square pad and the long leg through the round pad.
- Put in the **transistor** (Q1) and check its orientation. The flat side of the housing should follow the outline on the PCB. Solder the three contact and then cut the leads. Reheat again to reflow the solder for best results.
- The seven **ceramic capacitors** (C1-C7) follow, one close to each IC. Insert them in the board (orientation does not matter) and solder them.
- **Capacitor** (C8) goes next, make sure the cathode (-, short leg) side of the capacitor is in the shaded, ‘filled’ half of the circle on the board. The anode (+, long leg) should be in the ‘empty’ half of the circle.
- Solder the **DIP switches** (SW2, SW3). Let the ‘ON’-position point to the top edge of the PCB for both switches. Note that the markings on the PCB for SW3 are the other way around, this is correct and reflects function.
- Insert the *bigger* 5mm **LEDs** (D1-D8). The base of the LED is not a full circle, but has a flat edge. This edge (cathode side, short leg) should match the outline on the board.
- Three **pin headers** (JP8-JP10) next. Solder one pin first. Then melt the solder of this pin again while moving the header on the other side in the right angle. <u>Use the jumper with the pull-tab to hold it without burning fingers.</u> Finish by soldering the rest of the pins.
- Put in the two **displays** (AFF1, AFF2) in, make sure the ‘dot’ is in the bottom right corner. Follow the same soldering procedure like for the IC sockets.
- Final part: the Digitast **button** (SW1), press it gently, but firm, until it snaps in place.
- <u>Using a multimeter in continuity mode</u>, **test for shorts** between all side to side pins of connectors J1, J2, J6-J9. Also check for shorts between all combinations of the GND, +5V, -12V and +12V rails.
- Install the **standoffs** and insert the seven **IC**’s (U1-U7), make sure the notch of the IC (first-pin side) matches the notch-side of the socket (and the outline of the board). It is handy to use an IC straightener tool to bend the legs of the IC correctly before inserting them.

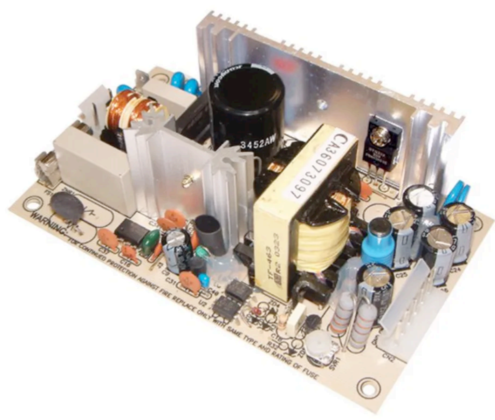
Supplying Power

The easiest way to power the Workbench is through the *Mini-B USB* connector (J5 on the board). This provides **+5V** only, which is the only voltage rail used by the board itself. Use a power bank or a USB port with a (laptop) computer. The green Power LED should light up.

The board uses around **400 mA** and could be more depending on experiments that are being added (e.g. extra parts used on a connected Super Breadboard). Please note that the *Super Breadboard* extension board can provide **+3.3V** as well using USB power, as it is regulated from the +5V source.

To be versatile in the support of vintage computing experiments, two more voltage rails can be put to use: **+12V** and **-12V**.

For this, a custom power supply (like a Mean Well PT-65B [1]) is needed. It can be connected to the 2x2-pin *Power In* male header connector (J1). Optionally, add a 2x1-pin male header (J2) to create a 1x4-pin (combined with J1) male header as power input (also for backwards compatibility).



A Mean Well PT-65B [1] power supply, capable of supplying all three voltages: +5V, +12V and -12V.

The +12V and -12V rails are disconnected by default, by means of extra protection. Solder blobs have to be put on the jumpers JP1 and JP2 (backside of the PCB) to activate them. Connect 1-2 of both jumpers to enable the J1 connector. Add a blob to 2-3 of both jumpers to enable J2. Also *see* the Schematics for details.

All three voltage rails (4 pins with ground) are available via two female 2x2-pin connectors:

- At the left board edge (J6). A second 8-bit Workbench™ can be plugged-in here (mates with J1) or use it to supply power to other (breadboard) experiments.
- At the bottom edge (J8), being part of the *Extension Interface*.

Examples of Use

The board can be put to use with a regular breadboard, a vintage computer and/or extension boards that provide extra functionality. It is meant to be very customizable with all its inputs and outputs, whatever the experiment is. The workbench can be seen as an '8-bit (one byte) memory cell' with a versatile display. Added to this, it can provide a microprocessor-safe Action-signal triggered by a push button.

Signal Control

For all experiments, it is handy to familiarize yourself with the **Action** (A) and **Clock** (C) signals of the Workbench. Both are indicated with their respective symbols, also on extension boards, when they are applicable. Disregard the red LEDs and the 7-segment displays for the moment, those will be explained later on.

The Action-signal is a **debounced signal** that is generated when the Action-button is pressed and can used as an *output*. The Clock-signal is an *input* to the board and indicated by the white LED (D9). Both signals are available at the Extension Interface connector (J9) and can be inverted on the Workbench itself, as demonstrated below.

I. Make sure jumper JP8 and JP9 are both set in their default ‘**normal**’-signal position: pin 1-2 is bridged (left hand side). Tie the Action to the Clock signal by bridging jumper JP10, being between the other two jumpers in the middle.

II. Power up the Workbench, no extension boards are needed.

III. When the Action-button is pressed, the Clock LED will light up. Notice that while the button is hold down, the LED will stay on. Logical, the button is tied to the clock with JP10 being set.

> <u>Do not attach another output to the Clock input</u> (using J9) when JP10 is bridged, meaning the Action is tied to the Clock signal. This could damage the Workbench.

IV. If jumper JP10 is removed, notice the Clock signal will float high (a logic 1), as indicated by the LED being lit. Also notice that pressing the button does not change the Clock, as they are disconnected now.

V. Inverse the Clock signal by setting jumper JP9 into the ‘**inverted**’-signal position 2-3 (right hand side). Notice the LED turning off. Remember the Clock signal was floating, so a logic 1. Inverting this 1 will result in a logic 0, meaning the Clock LED is off.

VI. Now put back on jumper JP10, tying the Action to the Clock again. This will cancel the ‘floating’ of the Clock-signal, as it gets a proper 0 as an input while the button is *not* pressed. This input is inverted because of the JP9 setting, so the LED is being lit. Press the Action button and discover that the behavior is inverse to point *III* above.

VII. Last step, put jumper JP8 also into position 2-3 (right hand side). This creates a *double negation* of the signals, so they behave the same as point *III*, but flow through more logic gates. *See* the Schematics for more details.

DISCLAIMER

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REFERENCE LIST

1. Mean Well (2025). *PT-65B AC-DC Triple output Open frame power supply*. Retrieved October 6, 2025, from https://www.meanwell.com/webapp/product/search.aspx?prod=PT-65

