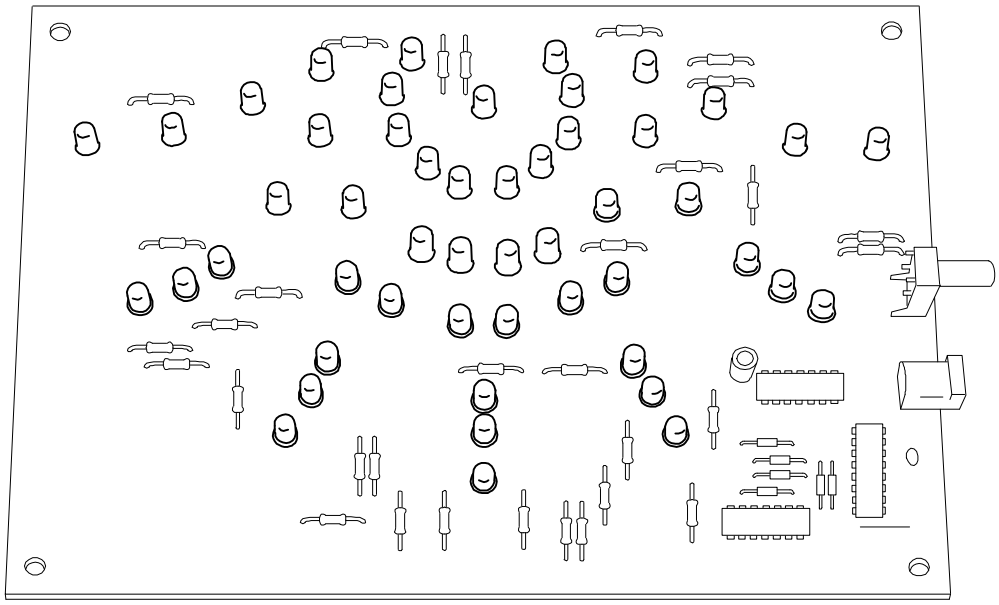
ApogeeKits™



Thank You for your purchase of this ***ApogeeKits*** product. It is our mission to provide you, the kit builder, with a satisfying and enjoyable experience. Every effort has been made during the design and documentation of this quality kit, to ensure your ability to assemble it successfully, and to enjoy the finished product long after the assembly work is completed.

Suggested skill level*:*

4 *advanced*
3 *intermediate*
2 ***a little experience*** ☜ **this kit *Animated Bell***
1 *beginner*

Even if this is the first kit you have ever attempted to assemble, you should be able to accomplish satisfactory results provided that you have the proper tools and pay close attention to the following suggestions and kit building tips. It is suggested that you read through these, *especially* if you have never assembled an electronic kit before.

Tools and materials needed*:*

- One pair of small wire cutters.
- One pair of small "needle nose" pliers or tweezers.
- Low wattage "pencil type" soldering iron with a fine pointed tip. (About 25 to 35 watts.)
- Tin/Lead alloy "rosin core" or "organic core" solder wire. (Organic core flux *must* be removed from the assembly and this can be done with hot running water.)
- Safety glasses (**Always** wear these when soldering. Boiling flux and gasses can surprise you by propelling small hot solder droplets into your eyes!)
- Small damp sponge for cleaning the hot solder iron tip. (Keep one handy.)
- A clean and well lighted work area.

Highly recommended tools, but not absolutely necessary:

- Vacuum operated solder extraction tool. (Known as a "solder sucker", this spring loaded vacuum piston hand tool will extract molten solder from your assembly to aid in removing improperly installed or broken components.)
- Solder Wick. (Braided wire "wick" is an alternative for the removal of molten solder. Both of these solder removing tools work well with some practice.)
- Grounded "static mat" and wrist strap. (Provides a static free work surface to protect components that are sensitive to damage by static electricity. This kit has a few of these.)

Suggestions and tips:

- Be aware before you begin soldering, that some of the components in this kit are "polarized". Meaning, they must be installed with one or more of its leads oriented in a particular direction. The detailed assembly instructions will warn you of these.
- Don't get in a big hurry. Paying close attention and "building it right the first time" will prevent the frustration of having to troubleshoot to find and repair assembly errors later.
- Use good soldering techniques. *Don't overheat the pads and landings on the circuit board as this could cause them to "lift" off of the board*. Solder joint connections are best completed within 2 to 4 seconds after the iron heat is applied. If your solder iron has an adjustable temperature range, use the *lowest effective* temperature setting. Once a solder joint is made, *avoid re-heating* the connection unless it is absolutely necessary.

Suggestions and tips: (continued)

- A good quality solder joint will appear smooth and shiny. Not grainy and dull or chunky. Solder should feather smoothly between the pad and the lead of the component, indicating good "wetting". Excessive solder will ball up around the component lead and the pad. This should be avoided.
- When soldering, first touch the iron tip to the pad and component lead. Then apply the solder to the pad and the lead, not directly to the iron tip. After applying the solder, keep it heated for a second, then gently pull the solder iron away.
- Clean the hot iron tip on a moist sponge as frequently as needed. Keep only enough solder on the tip of your iron to keep it "tinned" and shiny.
- "Rosin core" flux does not need to be removed from your circuit board. If you use an "organic core" solder wire, the flux must be removed under running hot water within a couple of hours. After the board is rinsed with hot water, make sure it is *thoroughly dry* before applying electrical power to the completed assembly. (A hair dryer can speed this process). If you do not finish building the circuit board in a few hours, and need to complete it another day, then wash the organic flux off of the board anyway, and finish the board at another time.
- One advantage of organic flux is a cleaner appearing circuit board when you're done.
- Clip excess component lead length from the back of the board after it is soldered in place to minimize interference while working around the board.
- Always wear eye protection when soldering and when clipping leads.
- Place a check mark in the box next to each assembly instruction step. If you don't finish in one sitting, you'll find it easier to pick up right where you left off when you return to it later.
- Relax, take your time, do a great job! Enjoy yourself!

Assembly Instructions Follow:

All components in this kit are installed on the silk screened ink side of the circuit board.

Before beginning assembly, examine the parts list included with this kit. Use it to count, identify and organize all of the components into separate piles. (Gather all components of the same value together)

Resistors:

Begin by installing all of the resistors first. Since all of the values are now already separated, it is logical to install them in ascending order of their *value*. **Not** R1, R2, R3…and so on, but rather, all the 47 ohm, all the 150 ohm, all the 270 ohm, and so on. This should also reduce the amount of instruction required.

First, bend all 32 resistors, (still keeping them in their separate piles) so that their leads make 90° bends ½of an inch (500 mils) apart. See fig. 1.

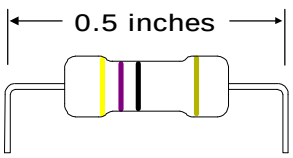


Fig.1

Note: Resistors are *not* polarized components. They can be inserted in either direction. For a more professional look, consider mounting your resistors so that the color code bands read from top to bottom, or from left to right.

Take the three 47Ω (ohm) resistors (color code: yellow, violet, black) and insert them onto the circuit board at the locations marked R5, R13, and R18. Bend the leads *slightly* on the bottom (solder side) of the board, to aid holding the components in place while you solder them to the board. Solder the three components to the board and clip off the excess lead length.

Insert the 150Ω resistor (color code: brown, green, brown) into your board at the location marked R10.

Insert the 270Ω resistor (color code: red, violet, brown) into your board at the location marked R11.

Now, solder the two resistors (R10 and R11) to the circuit board. Be sure you solder all the leads to their circuit pads, and clip off the excess lead length.

The next value is 470Ω. You should have 16 of these resistors (color code: yellow, violet, brown). Install the first 5 of these into your circuit board at the locations marked R1, R2, R3, R4, and R6. Solder these into place and clip off the excess lead length.

Collect 5 more of the 470Ω resistors and insert them into your circuit board at the locations marked R7, R8, R9, R12, and R14. Solder these into place and clip off the excess lead length.

Now collect the final 6 of the 470Ω resistors and insert them into your board at the locations marked R15, R16, R17, R19, R20, and R21. Solder these into place and clip off the excess lead length.

Insert the only 560Ω resistor (color code: green, blue, brown) into your board at the location marked R22. Solder it into place and clip off the excess lead length.

You're making good progress! Now, the next value to install is 1.5K. (1,500Ω.) (color code: brown, green, red) You should have 8 of these in your kit. Insert the first 5 of these, into your board at the locations marked R23, R24, R25, R26 and R27. Solder these into place and clip off the excess lead length.

Now, insert the final 3 of the 1.5K resistors into your board at the locations marked R28, R29, and R30. Solder these into place and clip off the excess lead length.

Insert the 10K (10,000Ω) resistor (color code: brown, black, orange) onto your board at the location marked R33.

Insert the 220K (220,000Ω) resistor (color code: red, red, yellow) onto your board at the location marked R31.

Solder these last 2 resistors into place and clip off the excess lead length.

Now, you need to make a "jumper wire". Bend one of the clipped off resistor leads into a "jumper wire" with 90° bends ½of an inch (500 mils) apart just like you did with the resistors as shown in (Fig. 1).

Insert this new "jumper wire" into the board at the location marked JMPR 1 (found at the lower right corner of the board), solder the jumper into place and clip off any excess lead length.

Good job! You've completed the installation of all of the resistor values. Now would be a good time to re-examine your work. Look for unsoldered leads, solder "bridges" (shorts) between adjacent pads and traces, cold (grainy) solder joints, component values in the wrong locations, etc. If you're now satisfied of the quality of your work, then continue on!

Potentiometer:

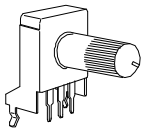


Fig. 2 The "pot" you find in your kit should look similar to this.

You have 1 potentiometer (variable resistor) included in your kit. Install it into the location marked R32. Although a potentiometer (pot) is *not* considered a polarized device, you'll find that there is only one way it will fit into your circuit board.

Solder the pot into the R32 location. There should be no need to trim the leads on this device.

Capacitors:

Locate the .001µF capacitor, (labeled: 102) and install it into your board at the location marked C2. (This cap is *not* polarized) See Fig. 3.

Locate the 4.7µF capacitor (labeled 4.7µ) and install it into your board at the location marked C1. (This cap *is polarized*) Observe proper polarity (+/-) when installing this cap. See Fig. 3.

If the polarity marking band on this cap says negative (-) instead of positive (+), then the *unmarked lead* is the positive one. In this case, insert the *negative lead* into the hole located *opposite* the (+) positive indication of the silk screen outline on the board.

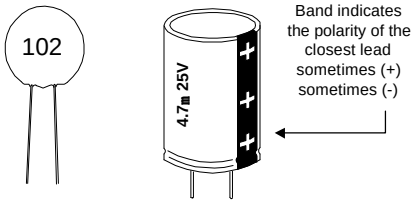


Fig. 3

Solder C1 and C2 to the circuit board and clip off the excess lead length.

DC Input Jack:

Install the DC input Jack onto your circuit board at the location marked J1. There is only one way it will fit into your circuit board. The mounting holes are quite large, and it is not necessary to try to completely cover or fill in the holes with solder. Just use enough solder to mount it securely.

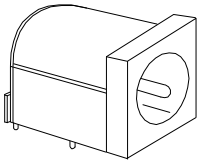


Fig. 4 The DC input jack in your kit should look similar to this.

Solder the DC input jack to your circuit board. There should be no need to trim the leads.

NPN Transistors:

By now you are ready for some of the more delicate work. While soldering the semiconductor devices which follow, take care not to overheat the components.

Locate the 8 NPN transistors included in your kit and insert them into your circuit board at the locations marked Q1, Q2, Q3, Q4, Q5, Q6, Q7, and Q8. The orientation of the "flat side" of the transistor should coincide with the silk screen outlines on your circuit board. See Fig. 5.

Note: You may find it necessary to pre-form (make gentle bends) the leads so the transistors will mount closer to the circuit board. Avoid damaging the part. Try not to apply too much stress where the leads attach to the component package.

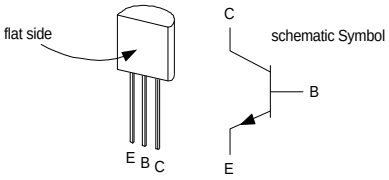


Fig. 5 Transistors *are polarized* devices. The transistors in your kit should be numbered **2N3904** or **2N2222**.

Solder the transistors to your circuit board and trim off the excess lead length.

Switching Diodes:

There are 6 small signal diodes included in your kit. Bend all 6 diodes so that their leads make 90° bends exactly 4/10 of an inch apart. (400 mils) See fig. 6.

Install diodes D1 through D6 onto your circuit board, ensuring that the banded (cathode) end coincides with the silk screened outlines of D1 through D6 on your board.

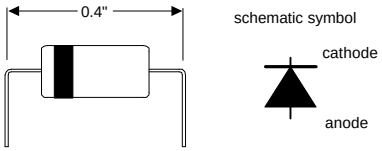
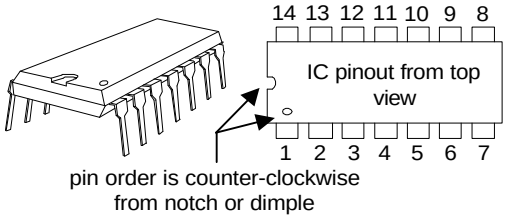


Fig. 6 Diodes *are polarized* devices. The banded end of the component is the cathode.

Solder D1 through D6 to your circuit board and clip off the excess lead length.

Integrated Circuits: (ICs)

There are 3 **D**ual **I**n-line **P**ackage (DIP) c-mos chips included in your kit. Two of these have 14 pins, and one has 16 pins. These *are polarized* semiconductor devices. See Fig. 7.



IC's come in many types and sizes
14 pin DIP shown here

Fig. 7

Install the IC labeled CD4001 onto your board at the location marked IC1. Ensure that the orientation of the chip matches the silk screen outline on your board. (observe the notch or dimple in the case of the chip)

Install the IC labeled CD4017 onto your board at the location marked IC2. Ensure that the orientation of the chip matches the silk screen outline on your board. (observe the notch or dimple in the case of the chip)

Install the IC labeled CD4071 onto your board at the location marked IC3. Ensure that the orientation of the chip matches the silk screen outline on your board. (observe the notch or dimple in the case of the chip)

Solder the three IC chips to the circuit board and clip off the excess lead length.

Light Emitting Diodes: (LED's)

There are 50 LED's included in your kit. See fig. 8.

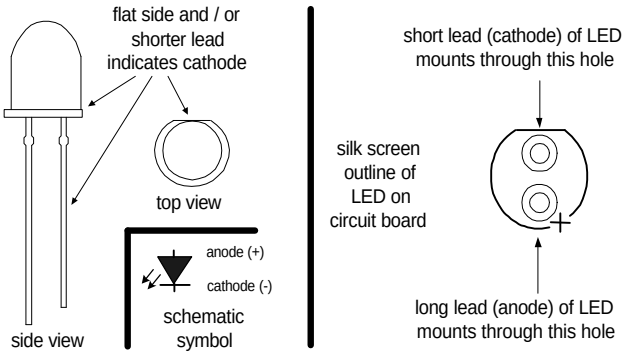


Fig. 8

Note: LEDs *are polarized* devices. The *LONGER* lead is the *ANODE*. Each LED must be installed onto your circuit board so that the *longer* lead mounts through the hole which is *closest* to the silk screened "+" sign.

Be careful to install all the LEDs straight and flush against the circuit board. The extra care you take in this step will affect the quality of the final appearance of your display.

You may find it easier to solder one lead, straighten the LED *slightly*, then finish by soldering the other lead.

Install the LEDs onto your circuit board at the locations marked LED 1 through LED 50. Be *very careful to note the correct polarity* as you install and solder each one.

Solder the LEDs to your circuit board and clip off the excess lead length.

Final inspection:

The importance of inspecting your work can't be overstated. Take a few moments to carefully look over your work. Sometimes it is helpful to have someone else inspect your work also. Look for correct placement of components and values. Are all the leads soldered well? There should be no polarized components installed backward.

Congratulations! You are now ready to test your completed circuit board! Just plug in your DC voltage adapter and view the display. If everything seems to be working OK, then you're done. Just don't forget to ***remove the DC power adapter*** and rinse your board under running hot water *if* you assembled it with *organic core* solder. If something on your circuit board does not work properly, then continue on to the following trouble shooting section.

Trouble shooting:

The most likely cause of a circuit malfunction would be a misplaced component(s). You can refer to the schematic drawing to assist in isolating the cause of any problem.

Trouble shooting: (continued)
Do a thorough visual inspection on all the associated components. Are they all the correct value? Are they all soldered properly? Are the polarized components all oriented and installed in the correct position?

If a portion of the animated bells LEDs do not illuminate as the logic circuit drives the bell back and forth, a likely cause could be one or more LEDs installed backwards. (Wrong polarity). Since there are many branches of LEDs that are connected in "series" circuits, even one LED installed backwards could cause as many as three or four LEDs not to light up. First, determine which LEDs are *not* being illuminated by noting the silk screen "reference designator" on the face of the circuit board for the LEDs which do *not* light. Write them down. Now disconnect the power adapter and examine those LEDs carefully. One or more may be installed backwards but *not necessarily* all of them. In most cases, you should be able to determine visually, which one(s) are installed backwards. (Check Fig. 8, the "flat" side of the LED flange should match the silk screen outline of the LEDs on the board. Do the placements match?) Remove any backward installed LEDs by extracting the solder from the connections and turning the LEDs around.

If the above scenario does not lead you to the solution of a problem involving the illumination of several LEDs, you may have to dig a little deeper. Refer to the schematic. Determine which transistor is connected to the branch of LEDs that will not light. Is it correctly installed on your board? Continue to work backward through the circuit from there. There is a resistor connected to the base lead of the transistor. Is it the correct value? Soldered well? Follow the schematic further back to the next component. (An IC gate pin *or* a diode). Is it installed in the correct direction? Are the correct IC part numbers installed where they should be? Follow this path until it leads you to the suspect component(s). If you can not determine the cause of the problem(s), then you may need a few specialized hand tools, such as a volt meter or a logic probe to troubleshoot further. In this case you *may* have a faulty or *damaged* component installed.

You may call or email ApogeeKits' customer support for help and advice. If our technical support assistance does not help you to resolve the problem, you may need to ship the product back to ApogeeKits to have it repaired or replaced at our option. If we determine the problem to be caused by improper assembly or technique, you may be charged for the cost of the repair or replacement and shipping charges. If no such physical damage is evident, we will either: (1) repair the board, or (2) return a new *unassembled* kit to you, at our option, *and* refund your shipping charges. We will do our best to satisfy you.

If you do decide to return the assembly for service, or return an unassembled kit to ApogeeKits, then you *must contact* our customer service (call or email) to receive an RMA (Return Material Authorization) number.

Please visit our web site at http://www.apogeekits.com to find our contact information, policies and forms, or to see more quality ApogeeKit product offerings.