12 LED circle

Assembly Instructions

Written by Dale Wheat

Version 1.0 · August 2016
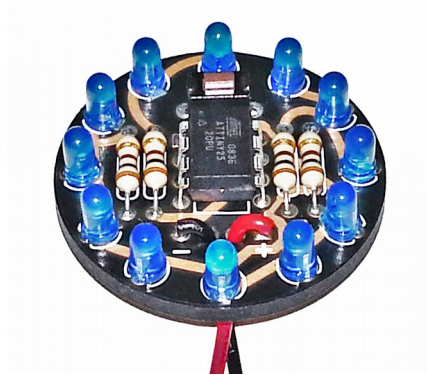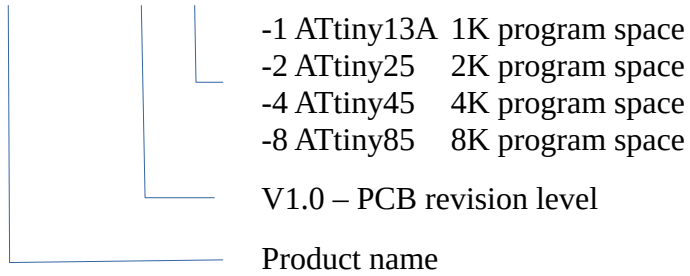
Table of Contents

Part Numbering Guide

The 12LEDcircle uses the following part numbering method to describe available kit options:

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12 LED circle V1.0-2
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-1 ATtiny13A 1K program space
-2 ATtiny25   2K program space
-4 ATtiny45   4K program space
-8 ATtiny85   8K program space

V1.0 – PCB revision level

Product name

Revision History

1.0   20 August 2016   Initial version, largely lifted from the tinyCylon assembly instructions.

Credits

- Written by Dale Wheat
- Photographs by Dale Wheat
- Illustrations by Sophie McNutt
- Technical illustrations by Dale Wheat

Introduction

Thank you for your interest in the 12LEDcircle kit! These instructions will show you one method of assembling the 12LEDcircle. While there are many possible building pathways, these instructions focus on the simplest and most straight-forward steps to get your kit built.
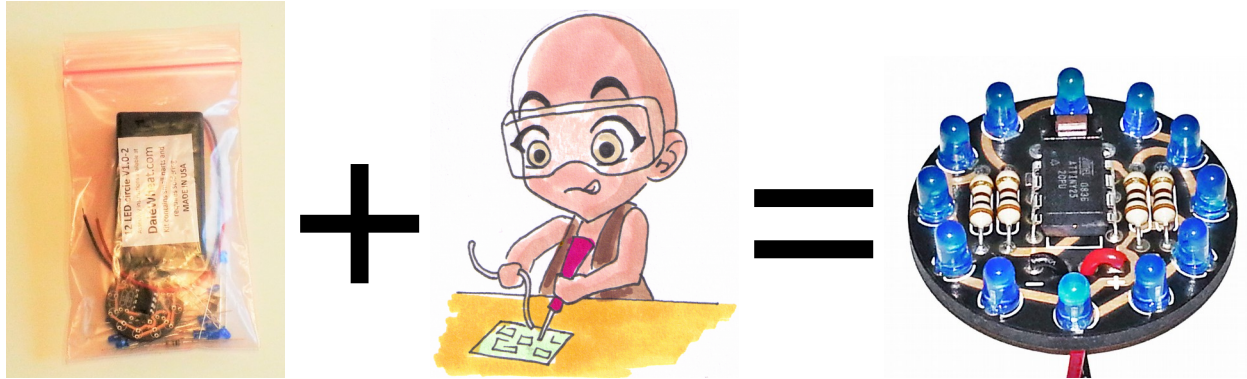
Let's get started building your very own 12LEDcircle! I strongly suggest reading these instructions all the way through at least once before actually starting the build. It will probably take longer to read these instructions than it will to finish building the 12LEDcircle.

The 12LEDcircle was designed to be easy and fun to assemble. If you run into any difficulty, take another look at these instructions or ask someone for help. Building the 12LEDcircle should be a fun and rewarding activity.

Please read these instructions all the way through at least once. Please. These instructions took much longer than you would imagine to write.

Quick Start Guide

Impatient? In a hurry? If you are an experienced kit builder, here's all I need to tell you:

1. Dump parts on table; make sure everything is there (see Photo 1).
2. Install parts according to height, shortest first.
3. Observe polarity: Square pad is pin 1 or positive.
4. Use extra holes near battery connection as wire strain relief.

Detailed Assembly Guide

If you'd like more hints on how to successfully build the 12LEDcircle, follow these steps:

1. Parts check: Make sure you have all the parts that come with the kit (see Photo 1).
2. Tool check: Collect the tools you will need to build the 12LEDcircle.
3. Install the resistors, solder, trim the leads.
4. Install the push button, solder, trim.
5. Install the computer chip, if needed, solder, trim excess leads (see notes on orientation).
6. Install the LEDs, observing the correct polarity.
7. Connect the battery holder.
8. Install batteries into battery holder.

These steps are described in more detail on the following pages.

That's all there is to it. Good luck!

Let me know if you have any questions, suggestions or comments about these instructions. I believe that they can always be improved, and I need your help to do it.
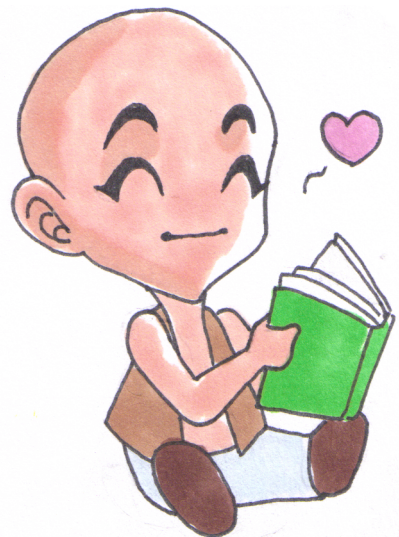
Step 1 – Parts Check

Open the 12LEDcircle kit carefully. There are many small parts that would like to play hide & seek with you if you're not careful. Make sure you have all the parts you see in Photo 1.
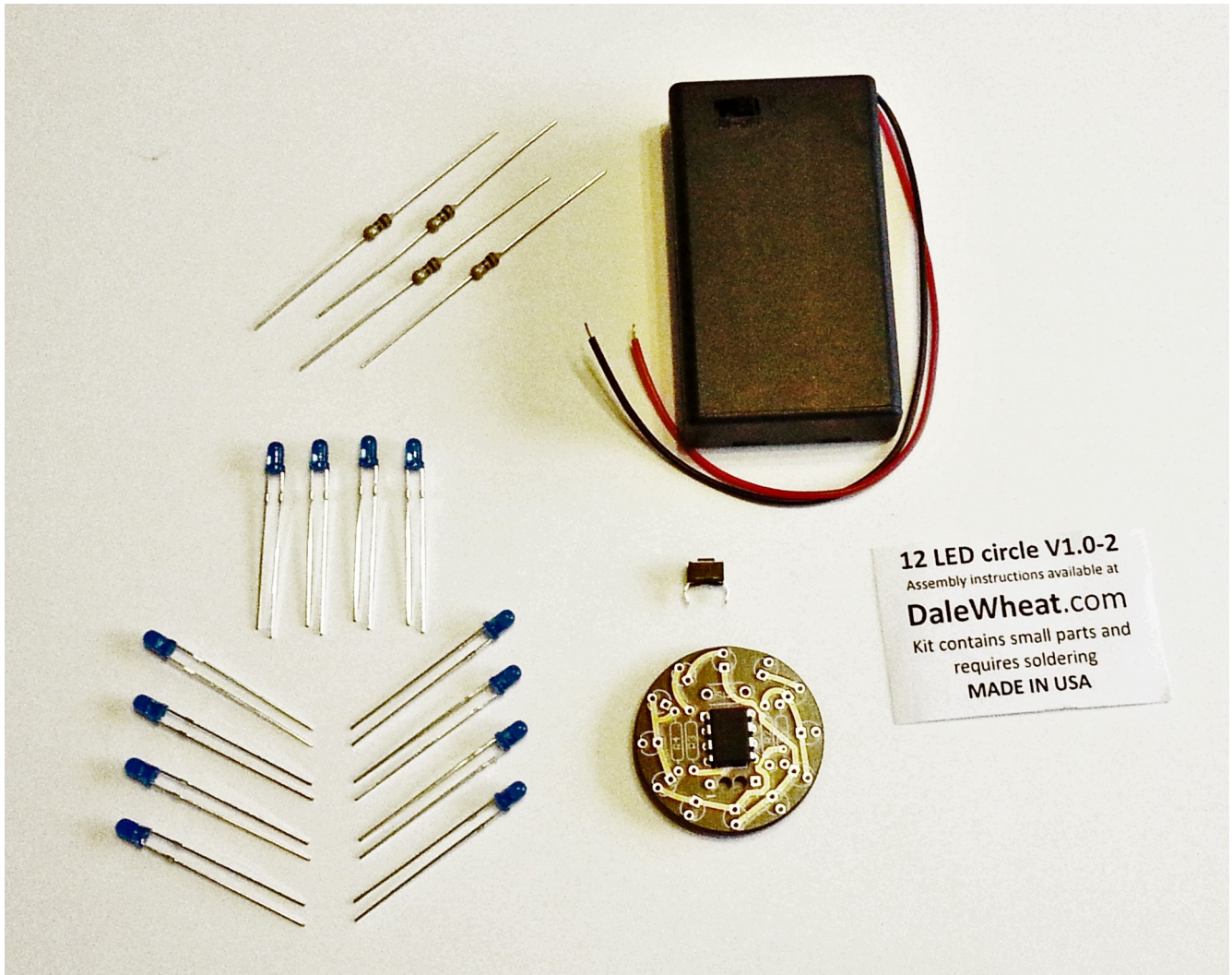

Photo 1. Contents of the 12LEDcircle kit

Here are the parts that come with the 12LEDcircle kit:

1. Twelve (12) blue 3mm LEDs
2. Battery holder for 3 x AAA cells
3. Push button for selecting display modes
4. Four (4) resistors
5. 12LEDcircle label
6. 12LEDcircle printed circuit board (PCB) with computer chip inserted

It's entirely possible that your kit may have different parts, depending on where you got your kit. This list describes the standard parts in the kit available from the online store at dalewheat.com.
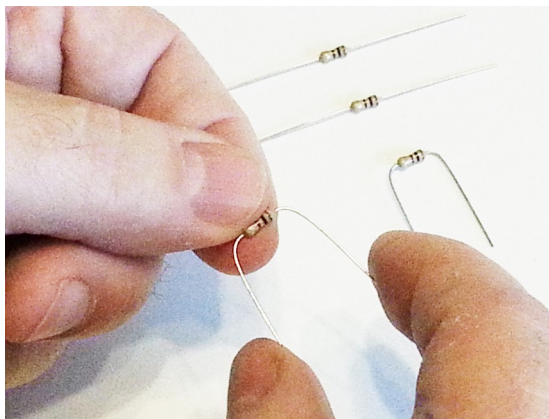
Step 2 – Tool Check

Collect the tools needed to assemble the 12LEDcircle:

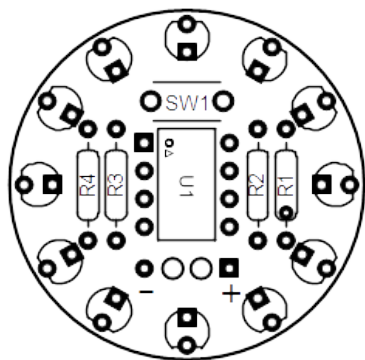- Soldering iron and some solder
- Wire cutters

Step 3 – Install the resistors
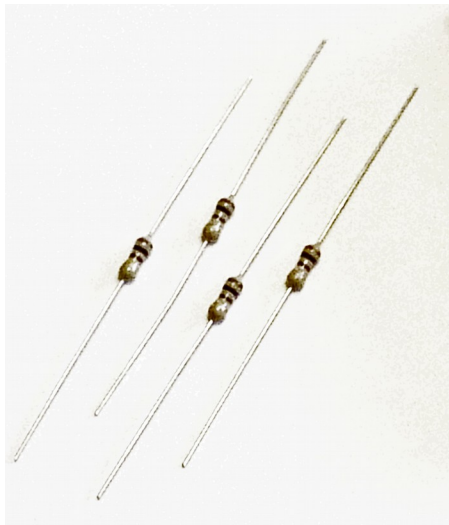
Find the four (4) resistors. They are one of the smaller parts included in the kit.

Form the leads by holding one resistor at a time between two fingers and bending the leads 90º with your other hand.
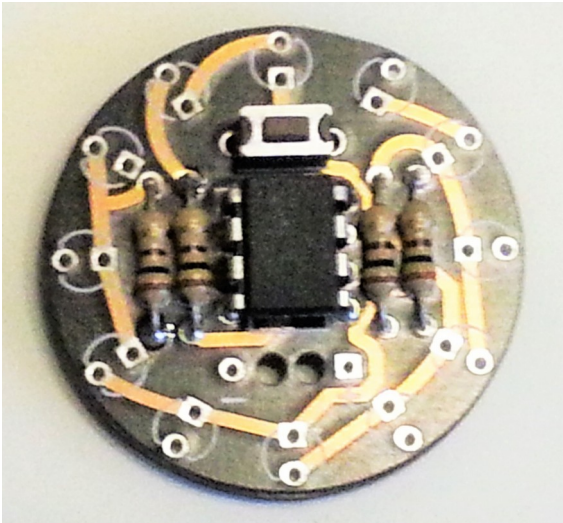

Look at the PCB and find the places where the resistors are supposed to go. They are marked with an outline and labeled "R1", "R2", "R3" and "R4". Install the leads into the holes in the PCB and push the resistor all the way down until it is lying right on top of the PCB. There is no right or wrong way to install them. They will work either way. In fact, since these parts are symmetrical, you can even install them from the other side of the PCB and they will still work correctly.

Once the resistors are installed flat on the PCB, bend their leads outward a bit so that the resistors

do not accidentally fall out when the PCB is flipped over, because that's what we do next. Turn the PCB over and solder one lead of one resistor. Now look back at the resistor body on the other side of the PCB and make sure it is still lying flat against the PCB. Solder the other lead of the resistor to the PCB. Repeat for all four resistors.

After the solder connections cool, use the wire cutters to clip the extra leads sticking out into the air. Do not cut into the actual solder connection.
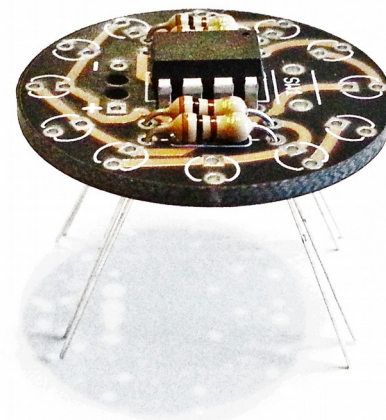
Step 4 – Install the push button

Look at the PCB again and find the spot where the push button wants to live. The button's location is marked "SW1". Align the push button legs with the holes in the PCB. The push button should snap into the PCB and hold itself there because it has slightly curved pins. It can be a very snug fit so you may have to press hard to get it to snap in place.

Note: Don't let your thumb be a pin-cushion for the pins as they pop through the PCB! Hold the PCB by the edges when pushing the button into the holes.

The push button, like the resistors, is a symmetrical device and has no polarity. This means that you can install it on either side of the PCB and it will work just fine.

Make sure both the legs of the push button are properly installed through their holes and that the bottom of the push button is lying flat against the PCB. Turn the PCB upside down again and solder the two pins of the push button to the PCB. Once the solder connections have cooled, clip the extra part of the pins that stick out of the PCB. Do not cut into the actual solder connections.
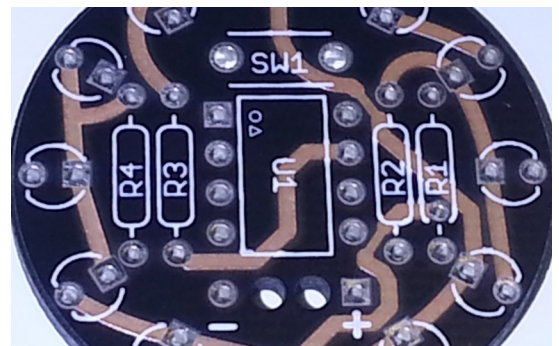
Step 5 – Install the computer chip

If your 12LEDcircle kit came with the IC already inserted into the PCB, you can skip this section and just go ahead and solder it to the PCB. It's already installed the right way (most probably). If not…

Important Note: Do not handle the computer chip until you are ready to assemble your 12LEDcircle. It can be damaged by static electricity.
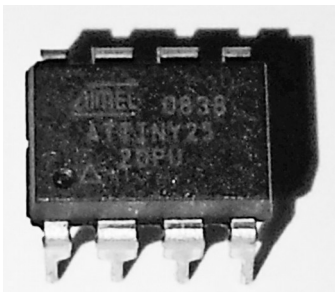
The computer brain of the 12LEDcircle comes in a small package called an integrated circuit (IC). The IC is **mostly** symmetrical and it is possible to install it backwards. It will not work at all if it is installed backwards, so there are extra clues printed on the PCB to show you the right way to install the IC.

The IC has eight (8) legs or pins. The main clue is the location of "pin 1". There is a small triangle printed on the top of the IC right next to pin 1. This triangle is printed on the PCB part outline as well. There is also a small, circle-shaped dent molded into the plastic body of the IC, and a drawing of a similar small circle on the PCB. Pin 1 on the PCB has a square shape and all the other pins are round.

Double check the orientation of the chip before soldering it to the PCB. If in doubt, ask someone else to double check for you.

Important note: The computer chip **must** be installed on the front side of the PCB, where all the printed part outlines are. It **will not work** if installed on the back side. This is the only part that has to be installed in exactly one correct way.

You might have to bend the legs of the chip together just a little bit to get all the legs to line up with the holes on the PCB. Once you've installed the IC on the PCB, flip it over and verify that all the pins made it all the way through their holes and are sticking out the other side.

At this point the computer chip is correctly installed on the PCB. Solder two opposite corner pins and then go back and look at the other side of the PCB and make sure that the chip is still lying flat on the PCB. Solder all the rest of the pins to the PCB. Once all the solder connections have cooled, clip off the ends of the IC legs that a poking out, but do not cut into the actual solder connections.

Step 6 – Install the LEDs

Find the twelve (12) LEDs and take a closer look at one of them (see Photo 2). Each LED has two long leads but one is a little longer than the other. This is important! The longer lead of each LED, called the "anode", goes into the hole in the PCB with the square shape. The shorted lead, called the "cathode", goes in the hole with the round shape.
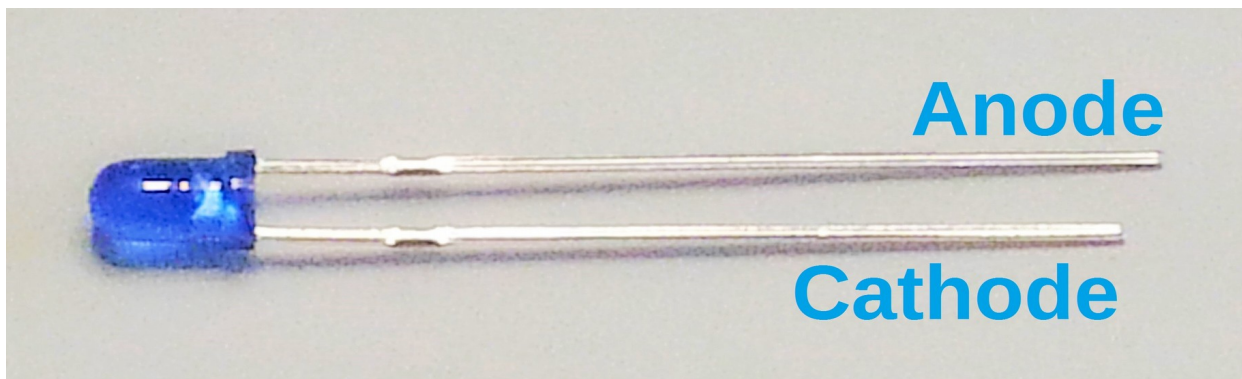

Photo 2. The LEDs are polarized. The longer lead is the anode. The shorter lead is the cathode.

Now find the ring of holes along the edge of the PCB where the LEDs are supposed to be installed. Notice that half of the holes have a round shape (the outer ring). The other half have a square shape (the inner ring). Like the computer chip, they only work right when they are installed the correct way. If you put them in backwards, they won't work right at all; not even a little bit.

As long as the long lead goes in the hole with the square pad, you can install the LEDs from the front or the back of the PCB. You can even have some LEDs on one side and the rest on the other. You don't even have to install all of the LEDs if you don't want to. The 12LEDcircle will work just fine either way.

To build the standard 12LEDcircle, put the long lead in the hole with the square shape and the short lead in the hole with the round shape and push the LED all the way down until it is sitting right on top of the PCB, with most of its leads sticking out the backside. Flip the PCB over and solder just one of

the leads to the PCB. This will hold the LED in the PCB and let you flip the PCB back over and check that the LED is still lined up correctly. If not, you can move the LED around until it is all lined up as you like it. Then go back and solder the other lead. This is a lot easier than trying to solder both leads at once and then trying to go back and unsolder both leads so that you can adjust the position of the LED.

Once the solder connections have cooled, clip off the extra leads sticking out the back. Do not cut into the actual solder connection.

Install one LED at a time. This is a lot easier than trying to install all twelve (12) LEDs at once.

Remember: Long lead = Square hole!

Step 7 – Connect the battery holder
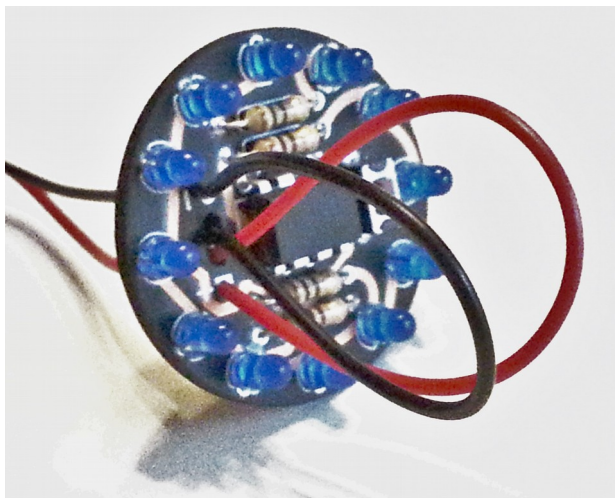
Find the battery holder and locate the red wire and the black wire. Now look at the PCB and find the holes that are labeled "+" and "-". The "+" hole has a square shape. There are two extra holes between the "+" and "-" holes.

Thread the red wire up through the inner hole and then back down into the hole marked "+". Leave about a one or two inch loop in the wire. Solder the red wire to the PCB. Pull the excess wire from the loop through the hole. Repeat with the black wire, attaching it to the "-" hole after being threaded through the other inner hole. Once the solder connections have cooled, clip off the extra leads that are sticking out. Do not cut into the actual solder connection.

The extra loop of wire through the inner holes provides a little bit of strain relief for the battery holder wires. This will extend the life of your 12LEDcircle.

Step 8 – Install batteries into the battery holder

Find 3 AAA batteries and install them in the battery holder. Use rechargeable batteries when possible. Pay attention to the polarity markings on the holder. Replace the battery cover on the battery holder. Turn on the power switch, located on the battery holder. Your 12LEDcircle should begin glowing. Push the button to change the display pattern. Keep pushing the button to cycle through all the available patterns.

The last "pattern" in the cycle is quite boring: all LEDs off. Use this to turn the 12LEDcircle off when you can't get to the normal power switch on the battery holder. Technically, it is still "on", but it is using only a very tiny amount of battery power. Turn the power off with the switch on the battery holder when you are done.

Congratulations! You've successfully built your very own 12LEDcircle. Tell the world!

Troubleshooting Guide

Symptom	Possible Causes	Suggested Remedy
Nothing happens at all	Dead batteries	Try new batteries.
	Batteries installed backwards	Double check battery polarity.
	Wrong size batteries	Use AAA size batteries unless you are using a different battery holder.
	Battery holder springs misbehaving	Roll the batteries around in holder. Verify they are making contact.
	Battery holder wires connected backward	Unsolder the wires and connect them the right way.
	IC installed backwards	This can't happen. You double checked this, remember? Good luck unsoldering all eight (8) pins without destroying the IC. It's possible, but unlikely.
	Every LED installed backwards	Try unsoldering one LED and reinstalling it the right way. Test again. If this LED starts working, you will have to remove and reinstall all the other LEDs in the right way as well. Since the leads have now been trimmed you can't tell the anode from the cathode. Look for a flat side at the base of the LED. This is the cathode.
Some LEDs work, some don't	Some LEDs installed correctly, some not	Try removing one of the misbehaving LEDs and installing it the right way. If that fixes the problem , repeat for the other non-working LEDs.
	LED leads touching each other	Straighten out the leads so that none of them are touching.
One LED is always on when any of the other LEDs are on	This LED is installed backwards	Remove this LED and install it the right way.
Display is very dim	Non-rechargeable batteries	Replace with new batteries.
	Rechargeable batteries	Recharge the batteries.