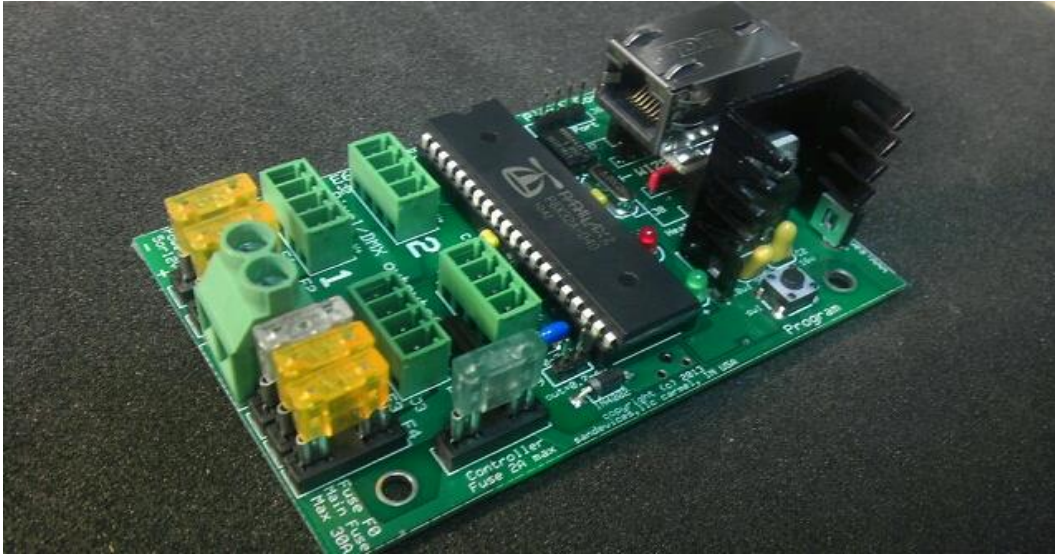# SanDevices

SanDevices E6804 Pixel Controller Kit Assembly Manual

See page 2 for Important revisions as of 01/30/2014

The SanDevices E6804 is an evolution of the E68X product line, and is very similar to its predecessors, the E680, E681, and E682. The E6804 is a controller intended to be used as part of a system to operate a lighting display that consists of many individual RGB LED pixels. To form a complete system, one or more E6804s are used together with one or more pixel power supplies, one or more strings or strips of pixels, and a PC equipped with lighting display software that supports RGB pixels and is compatible with industry-standard SACN, also known as E1.31 or "DMX over Ethernet" lighting protocol, or with Art-Net.

The E6804 is usually installed near the pixels it controls and their power supply, and acts as the "bridge" between the pixels and the PC. The E6804 receives the lighting intensity signals from the computer via a network (LAN) connection, and converts them into a form suitable for operating the actual pixels.

The lighting control software determines what DMX (intensity) values need to be sent to each color of each pixel. The PC software then forms this data into "packets", each packet consisting of the current intensity value for each of up to 510 channels (3 channels for each pixel), and sends these packets out over its Ethernet port. The packets travel through your local network and eventually to the E6804 via its Ethernet connection. The E6804 then converts the DMX intensity values into multiple streams of data that are sent on to the various strings of pixels. The controller uses its configuration data, which you define via the controller's web interface, to know how to reformat each piece of DMX data to route it to the proper pixel in the form that pixel will understand. So the path is:

Lighting Software(PC-Based) -> Network -> E6804 -> Pixels

Updates as of Jan 30, 2014
********** I M P O R T A N T **********

An additional .1uf capacitor is now shipped with each E6804 kit (C6). It is to be mounted to the bottom side of the circuit board as described in the assembly instructions.

It is now recommended that the jumper at J9 be left IN PLACE during normal operation. If your pixels require more than the +3.3V drive level that is provided with the jumper in place, then you should remove the jumper to achieve +4.0V data signals. Flickering or erratic operation may be symptoms of pixels that require the full 4.0V data signal. With the jumper removed, the E6804 is more susceptible to being damaged if there is a short circuit on a pixel data lead, so if your pixels work properly with the +3.3V data signals, it is suggested that you operate with the jumper in place.

Warning: "Hot Plugging" (plugging or unplugging pixel strings with the power on), particularly with 12V pixels, should be avoided.

Warning: Check pixel wiring carefully before connecting pixels to the E6804. A short circuit from the DATA wire to +V, even if very brief, could damage the E6804, particularly if you are using 12V pixels.

Warning: When power to the pixels is NOT routed through the E6804, you should insure that the E6804 and pixels are powered up at the same time. Connecting unpowered pixels to a powered E6804 output could damage the pixels and/or the E6804. While properly designed pixels should have a built-in series resistor to prevent this type of damage, some pixels don't have this feature.

Current Firmware version is 4.240.

Kit Packaging:

You will receive your E6804 kit components in a plastic bag. Within the main bag there will be the mechanical components bag, the circuit board (PCB), a small anti-static bag containing the small electronic components, and a block of anti-static foam containing the integrated circuits and Ethernet module.

Before you Begin:

Prior electronic assembly experience is assumed. This is probably not a good 'first' soldering project because many components are located quite close together. If you don't have prior PC board assembly experience, please seek the assistance of someone who has.

Tools required:

A good-quality temperature-controlled soldering station is important. There are several large component leads/pins that will require quite a bit of heat to be soldered properly. Please use a good quality soldering tool.

The use of high-quality solder is critical. Please use a good 63/37 tin/lead solder such as Kester 44. I recommend .031" diameter.   **Protective glasses are recommended when soldering due to the possibility of splashing liquid solder.**

A good pair of **flush-cutting** diagonal pliers. This is an indispensable tool for PC assembly work as it allows you to trim component leads very close to the board after soldering.

Note: Many components must be installed with the proper orientation, these are known as POLARIZED components and will be identified as such in the instructions and in the component illustrations. Please take the time to insure that all POLARIZED components are installed with the proper orientation, as these parts will most likely be destroyed if installed incorrectly. Examples of POLARIZED components include (most) connectors and sockets, all ICs, all diodes, all LEDs, and some capacitors.

Please use reasonable static precautions when handling ICs. Static electricity can destroy them. Before touching an IC, make sure to ground your body by touching your hand briefly to a grounded metal object. Try to work in an area that isn't subject to generation of static electricity.

The order of parts installation isn't critical but in general proceeds from shortest to tallest, to allow the board to be turned over without parts dropping out. If you're fairly new to this I would suggest sticking to the order specified, if you're experienced feel free to do it in whatever order you choose.

When soldering 2-lead components I recommend soldering one lead and letting it cool, rather than immediately soldering the 2nd lead. Otherwise the part may shift slightly when you touch the soldering iron to the 2nd lead, and if the 1st joint hasn't solidified completely you could get a 'cold' solder joint.

For example, if soldering a group of capacitors, I will solder one lead of every cap first, then go back and solder the 2nd lead of every cap.

Components are typically installed singly or in small groups, then soldered, and where necessary the leads are then trimmed with the flush-cutting pliers. When installing components such as sockets and connectors, I recommend first soldering just one pin for connectors, or 2 diagonally opposite pins for ICs and IC sockets. Then double-check to make

sure that the parts are fully seated against the PC board (**and double-check orientation where applicable**), before soldering the remaining pins. If you completely solder an IC socket and then discover it's not fully seated, or it's been installed facing the wrong way, it will be time-consuming and difficult to correct. When only 1 or 2 pins are soldered it's easy to 'seat' an out-of-position socket by applying finger pressure to the part while heating one soldered pin at a time, and it will just "pop" into place.

Certain solder joints will require considerable additional time to solder. This is particularly true when component leads are large, such as the large diodes, the heat sink, or when the lead is being soldered to a large copper area. Make sure to allow sufficient time with these joints to allow solder to flow properly.

Much as carpenter's use the rule of "measure twice and cut once", it's wise to remember that it's far better to take some extra time to insure proper location and orientation of parts before soldering. Removing an improperly installed part is difficult, time consuming, and risks damage to the part and the board.

The reference photo at the beginning of this document is a good guide to parts placement if you are unsure about the mounting location of any part.

Parts Identification:

C1   Quan 1   10uf 35V Tantalum Capacitor:

Will be marked with "35" or "35V".   POLARIZED. **The longer lead is positive (+). If the**

Leads are the same length look for the + mark on the body to identify positive.

C2   Quan 1   10uf 16V Tantalum capacitor

          C2 is very similar in appearance to C1, just slightly smaller. It is POLARIZED, the **+ lead is the long lead. If the lead lengths are the same, look for the "+" mark on the body to identify the positive lead.**. It will be marked "16"

C3, C4, C6 (C6 is new as of 01/30/2014) Quan 3   .1uf capacitor:

Appearance is similar to the tantalum capacitors (but smaller).   These capacitors are <u>Not polarized and **will not have a "+" marking**</u>. Lead lengths are the same.   These capacitors will have leads spaced 0.2" apart.

C5   Quan 1   10uf MLCC Capacitor

(2 illustrated, only 1 supplied), not polarized.

Y1   Quan 1   5mhz   crystal:

Not polarized.

D1   Quan 2   SB5100 Diode:

POLARIZED. Must be installed with banded end down matching
 the circuit board silkscreen. Do not confuse D1 and D2. D2 is   similar in appearance but much
smaller.

D2   Quan 1   1N4001 or 1N4002 Diode:

POLARIZED. Must be installed with banded end down
 matching the circuit board silkscreen.

RLed   Quan 1   Red LED, size T1:

POLARIZED. Longer lead is + and is
nearest bottom edge of the PCB.

GLed   Quan 1   Green LED, size T1:

POLARIZED. Longer lead is + and is
nearest bottom edge of the PCB.

Resistor Networks RN1 and RN2:

There are 2 resistor networks. They are identical in
 appearance except for their Identification number. RN1 will contain "271" as
part of the part number. RN2 will contain "472" as part of the part number.
THEY ARE NOT INTERCHANGEABLE. **Although some resistor
networks are polarized, these parts are NOT polarized and may be installed in
either direction.**

SW1   Quan 1   Pushbutton switch:

(When mounting, please note that the lead
arrangement is rectangular, not square.)

IC3   Quan 1   3.3V regulator (usually LF33CV):

Please read detailed instructions later re mounting this part. To avoid damaging this part, **The leads MUST be soldered AFTER the part is bolted to the heat sink.**

IC1   Quan 1   Propeller CPU, Parallax   P8X32A-D40

As with ALL ICs, it's **POLARIZED**. Insert into the PC board   with the Pin 1 end
(indicated by a notch on the short side, to the left as   shown in this
illustration) facing to the **TOP** of the PCB. **This IC is not**   **soldered directly**
to the PCB, it is installed in a socket.

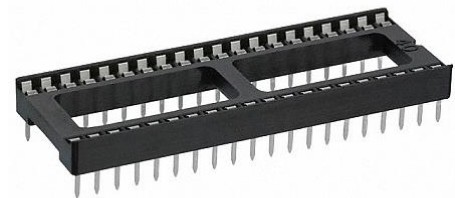IC2   Quan 1   EEPROM: Atmel   AT24C1024BPU
"ATML" or ON Semiconductor part# CAT24M01LI. The ON Semi part is most   common.

POLARIZED. The notched end, pin 1, faces to the bottom when installed.

IC Socket   Quan 1   This is soldered to the PCB at the IC1
location. The side with the notch should face the top edge of the
PCB.

Fuseholders   Quan 6   These fuseholders are not polarized
and may be installed in either direction. For neatness, it's a good idea to have them oriented
the same way. These mount at the locations designated as F0 through F5.

Fuses: Quan 6   A 5A fuse is illustrated. The E6804 uses four 5 Amp fuses (F1, F2, F3, and F4), a 2A fuse at F5, and a 25A fuse at F0. **The 2A and 25A fuses are Similar in appearance, their values are printed on the top edge.**

J1-J4   Quan 4   4-pin Eurostyle Pluggable Connectors :

These POLARIZED SOCKETS must mount in the orientation that matches the image on the silkscreen. The upper edge as illustrated in the photo will be toward the top of the board for J1-J16 and towards the left for J19.

These PLUGS are the supplied mating connectors that will be wired to the pixel strings.

J5   Quan 1   6.35mm Euro-Style

Pluggable Terminal Block- **Polarized**

J6, J9   '1" Pin Headers. J6 is 4 pins, J9 is 2 pins. These are often supplied a single length of pins that Must be 'snapped' to create a 2-pin and a 4-pin piece. Not polarized. The short side pins are inserted into the PC board and soldered.

J7 and J8   Quan 2   6-pin SIP male socket

Sockets supplied are similer but not Identical to illustration, not polarized.

A single Shunt is supplied for J9:

Heat Sink: Quan 1

Printed Circuit Board (PCB):

Specific Items to watch for during assembly:

Be very sure to identify the 2 resistor networks correctly. **They are identical in appearance and you MUST go by the part number.**

Follow the recommended procedure when installing the voltage regulator and heat sink. Solder the heat sink in place first, insert the voltage regulator leads through the PC board (DO NOT SOLDER!) then install and tighten the regulator mounting hardware. Finally, solder the regulator leads. **IT IS VERY EASY TO DAMAGE THE VOLTAGE REGULATOR IF YOU SOLDER THE LEADS AND THEN TIGHTEN THE MOUNTING BOLT.**

The Ethernet module must be installed with the Ethernet jack facing toward the center of the board. It is important to secure the Ethernet module with 2 small beads of glue where the plastic part of the Ethernet module connectors meet the two 6-pin sockets. Do this BEFORE installing the heat sink.

The 2A fuse and the 25A fuse are very similar in appearance. Make certain that the 2A fuse in installed at F5.

Suggested component installation order:

5.000 MHz Crystal, Y1

8-pin IC, IC2, AT24C1024BPU, **pin 1 (notched end) faces DOWN**

1N4001 or 1N4002 Diode at D2, **cathode band as marked**.

40-pin IC socket at IC1**, Pin 1 UP**

Quantity 2, .1uf capacitor (yellow) at C3 and C4

10uf MLCC capacitor (blue, non-polarized) at C5

10uf 35V Tantalum cap at C1, polarized, + (long lead) to the right **TANTALUM CAPACITOR POLARITY IS CRITICAL!**

10uf 16V Tantalum cap at C2, polarized, + (long lead) to the right **TANTALUM CAPACITOR POLARITY IS CRITICAL!**

The 2 LEDs at Rled and Gled, polarized, + (long lead) in lower hole**. Be certain that LEDs are installed with the correct polarity. If they are reversed they will not light, and this may lead you to believe there is a problem with the controller. The LONGEST lead goes in the hole nearest the lower edge of the PC board.**

4.7k resistor network (**marked 472**) at RN2, not polarized **RN1 and RN2 are identical in appearance, you must check the part numbers.**

270 ohm resistor network (**marked 271**) at RN1, not polarized

SB5100 Diode (**Large Diode**) at D1, **polarized, cathode band down**

6mm pushbutton switch at SW1 This part snaps into place and is then soldered.

Note: .1" male header pins may be supplied as 1 or 2 pieces, and may have to be snapped to needed size. **These headers install with the short pins inserted through the circuit board, and the longer pins on top.**

You need one 2-pin header, and one 4-pin header.

Install the 2-pin header at J9 and the 4-pin header at J6.

Install the 2 6-pin sockets at J7 and J8.

Install the 6 fuseholders at F0 through F5. **These will require considerable heat (and patience) to solder**.

Install the 4 green 4-pin male pixel connectors at J1 thru J4. **Polarity notches to the right**.

Install the 2-pin power terminal block at J5**, make sure wire connection side faces left**!

Plug the Ethernet module (WIZ820IO) into J7 and J8. **MAKE SURE THE ETHERNET JACK FACES LEFT (toward the CPU)**.

Secure the Ethernet module in place with 2 beads of hot melt glue or silicone along the seams where the sockets meet the module. The glue or silicone should not contact the leads or components of the Ethernet module. **This will be much easier to do if you do it before installing the heat sink.**

Install the heat **heat (and patience) to solder.**

Place the voltage regulator at IC3, **BUT DO NOT SOLDER YET**. Align the mounting hole with the hole in the heat sink and secure the regulator to the heat sink with the supplied **hardware**. It is not necessary to use heat sink compound.

AFTER the regulator is tightly bolted to the heat sink, solder the regulator leads to the PCB. **(Soldering the leads before tightening the bolt risks damage to the regulator.)**

New as of 01/30/2014: Install C6 (.1uf capacitor) on the BOTTOM side of the circuit board. There are no dedicated pads for C6, it must be soldered to two of the existing component pads. As viewed from the bottom side of the board, with the heat sink to the left, one lead of C6 goes to the right-hand lead of the voltage regulator, and the other lead to the right-hand (-) lead of C1. Trim the leads as shown in the photo and then solder this part in place.
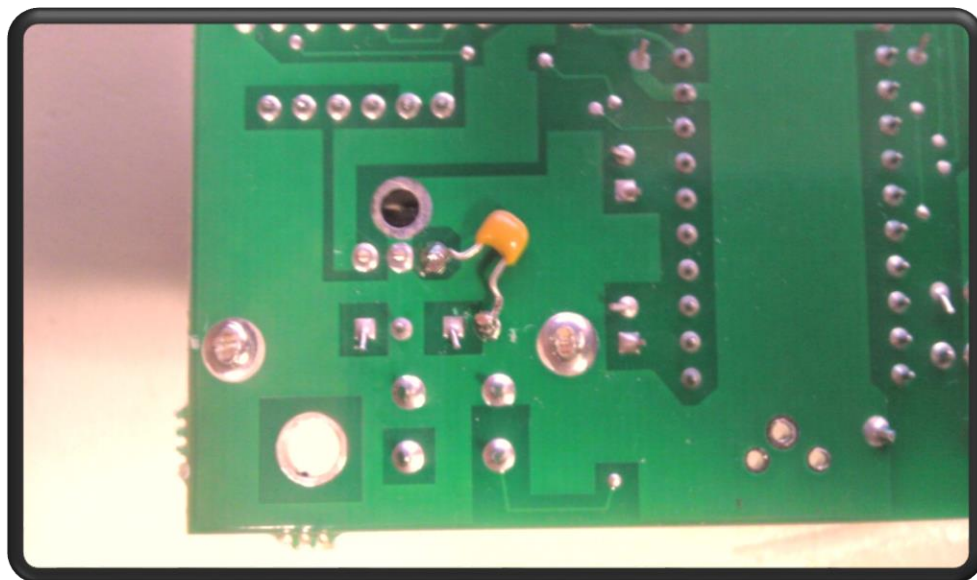
Insert the propeller CPU into the 40-pin socket. Straighten both rows of pins first by 'rolling' each row of pins slightly against a hard flat surface. **Make sure pin 1 (notched end) faces UP.**

Insert the 6 fuses. **The 2A and 25A fuses look very similar, be sure to check the printed rating on the fuse**. The 25A fuse goes at F0, the 2A fuse at F5, the others are the 5A fuses.

Attach the supplied shunt at J9. This shunt should be installed during normal operation, unless your pixels require the full 4V output signal, in which case you should remove this jumper.

This completes the assembly of the E6804. Check carefully for solder bridges or missed solder joints. **MAKE SURE THE ETHERNET MODULE IS INSTALLED WITH THE ETHERNET JACK FACING LEFT! MAKE SURE ICs, DIODES, and POLARIZED CAPACITORS ARE INSTALLED WITH PROPER ORIENTATION.**

Testing:

Initial testing is without any connections to the output connectors.

Connect a power source of 5V or 12V DC to the power terminal block. **BE SURE TO OBSERVE POLARITY, + is on the RIGHT, as you view the board from the end**. **For initial testing, the use of a small 'wall wart' type transformer is suggested.**   A transformer rated at 5 to 12 VDC at about 300ma to 500 ma is best. This limited current will help to prevent component damage in the event there is a solder bridge or component installation error.

Turn on power. After a few seconds you should see the green and red LEDs come on and stay on. The green LED will flicker, this is normal since the default "as-shipped" setup is to have a test pattern enabled.. **(Note: specific behavior of LEDs may depend on firmware version installed.)**

If the LEDs light as indicated, you can try a test with a string of pixels using the built-in test pattern. **See the cautions in the notes area regarding wiring pixel strings to the E6804**. For this test you will need a power supply capable of providing at least 3A (for up to 50 pixels), at the proper voltage for your pixels. Plug one string of pixels into the pixel connector indicated in this list (only the pixel types listed may be used for this test, if you have a different pixel type you will need to configure your E6804 before running this test):

If type 2801 pixels, use output#1. If type GE pixels, use #2. If type 1804 or 2811 pixels, use #3, and if TLS3001s, use #4.

Turn on power, wait a moment (up to a minute or 2 depending on which socket you are connected to), and you should see a test pattern appear on the pixels.

If these tests are successful you should read the final operating notes in this manual, then refer to **the E6804 Operating Manual** for information on connecting and configuring the E6804**.**

Troubleshooting:

If the LEDs do not light, the first step is to recheck for the proper installation of all components. Also recheck your solder joints looking for inadvertent solder bridges, cold solder joints, or joints that were missed. Also verify that the LEDs are properly installed. If this fails to correct the problem, please contact SanDevices for assistance.

Notes:

When mounting the E6804 be sure that the screw heads do not come into contact with any of the traces on the top side or bottom side of the circuit board. <u>Nylon hardware is STRONGLY recommended.</u>

<u>Caution: When operating with 12V pixel power the heat sink will get quite warm. This is normal and well within the tolerance of the parts.</u>

<u>Caution: When wiring pixels to the E6804 take care to avoid shorting clock and data leads to +V or to ground. Also be 100% sure that you understand which wire is which on your pixel strings before attempting to connect them to the E6804. You CANNOT rely on wire colors. Pixel strings have an IN end and an OUT end, the E6804 must connect to the IN end of the pixel string. Usually the data wire will be marked "DI" for Data In.</u>

Note: If making voltage measurements for testing/troubleshooting, temporarily install the supplied jumper at J9. For normal operation this shunt should be removed. With the shunt in place, the "ground" of the controller electronics, including the heat sink, will be at a potential of about +0.7V with respect to the (-) power input terminal.

PLEASE SEE ADDITIONAL NOTES AND WARNINGS ON PAGE 2