BlinkenLEDs Plus Colour – Construction Kit

Contents:

2	Printed Circuit Boards	18	n-Ch. MOSFETs IRLU024N	1	Crystal, 14.7456 MHz
1	Controller ATmega162	150	RGB LEDs, 5mm, com. C.	1	SD Card Slot 104G-TAA0-R
1	RS232 Transceiver MAX232	42	Resistors, 33 Ω	1	D-Sub Conn., female, 9-pin
3	Shift Registers 74HC164	18	Resistors, 270 Ω	1	Terminal Block, 2-pin
1	V. Regulator MCP1702-3302	28	Resistors, 1.2 kΩ	2	1x36 Pin Header, SMD
3	14-pin IC Sockets	4	Resistors, 2.2 kΩ	1	2x3 Pin Header
1	16-pin IC Socket	2	Ceramic Capacitors, 33 pF	1	Female Header, ≥ 9 pins
1	40-pin IC Socket	4	Ceramic Capacitors, 100 nF	2	Female Header, 20 pins
24	PNP Transistors BC557C,	7	Tantalum Capacitors, 1 µF	8	M3 Screws, 8 mm
	BC558C or BC560C	2	Electrolytic Capacitors,	4	M3 Threaded Bolts, 10 mm
			470 µF, Low ESR	8	M3 Spacers, 3 mm

General Soldering Advice

Insert the components one at a time and bend the leads outward slightly to prevent the component from falling out. Heat up the solder joint for a second before feeding some solder wire between the soldering iron's tip, the board and the component's lead. Wait for a few more seconds before removing the tip from the solder joint. Don't move the board before the solder has solidified. After soldering, trim the leads with a wire cutter to about 1-2 mm length. See http://mightyohm.com/files/soldercomic/FullSolderComic_EN.pdf for more detailed instructions. **I recommend soldering the components in the order listed below.**

Controller Board

Step 1: Resistors (R1~R92)

Bend the leads as close to the resistor's body as possible before inserting them into the board. The value is indicated by coloured rings on the resistor body. Four-ring resistors use two mantissa rings followed by one exponent ring (power of 10) and one tolerance ring. Five-ring resistors have an additional mantissa ring.
Example: orange, orange, black, gold, brown: **330**·10^{-1} Ω = 33 Ω, ±**1**%.

Resistor	Value	Color Code
R1~R18, R69~R92	33 Ω	orange, orange, black, gold *or* orange, orange, black, gold, brown
R19~R36	270 Ω	red, violet, brown, gold *or* red, violet, black, black, brown
R41~R68	1.2 kΩ	brown, red, red, gold *or* brown, red, black, brown, brown
R37~R40	2.2 kΩ	red, red, red, gold *or* red, red, black, brown, brown

Step 2: Quartz Crystal (Q1)

Make sure the crystal lies flat against the board before soldering. Orientation doesn't matter.

Step 3: IC Sockets (IC1~IC5)

Insert the IC sockets into the board, making sure the orientation of the small notch matches the silkscreen outline on the board.
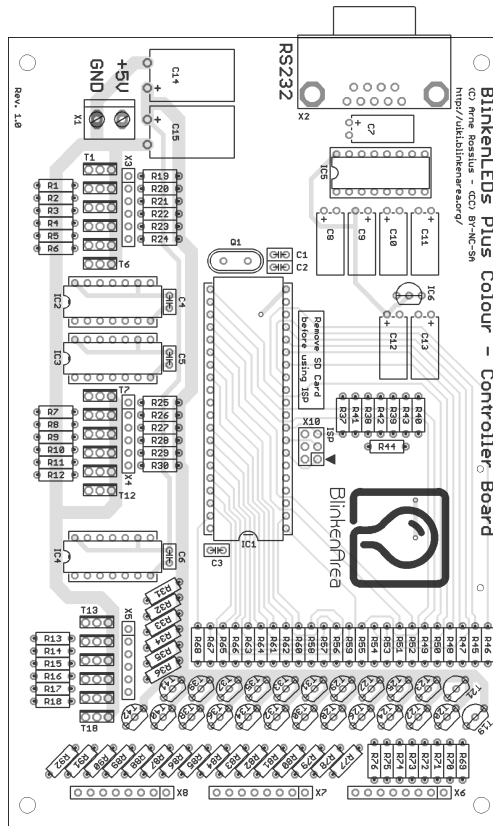
Step 4: Small Capacitors (C1~C13)

Insert the capacitors in a way that they don't touch the board, but have 1-2 mm of space below them. Orientation doesn't matter for the ceramic capacitors. For the 1 µF tantalum capacitors, the correct orientation is indicated by a small "+" sign on the capacitor and on the PCB silkscreen. The marking uses a 3-digit code, consisting of two mantissa digits and one exponent digit, giving the value in pF.

Capacitor	C1, C2	C3~C6	C7~C13
Value	33 pF	100 nF	1 µF
Marking	33 *or* 330	104	105
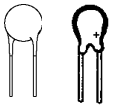
Step 5: Voltage Regulator (IC6)

The voltage regulator looks like a transistor, check the marking ("1702" and "3302" in two lines) to ensure you have the right component. Make sure the orientation matches the silkscreen outline.

Step 6: PNP Transistors (T19~T42)

These transistors are marked with "557", "558" or "560", depending on which type is included in the kit. All types perform equally well in this circuit. Orientation must match the silkscreen outline.

Step 7: Female Headers (X3~X8)

The kit contains three female header strips that need to be cut to the correct number of pins first. **Don't try to cut between two pins,** always cut right in the middle of a pin (which will be destroyed in the process) using wire cutters or similar. Use one 20-pin strip to make three 6-pin strips and the other to make two 8-pin strips. Cut the short (9- or 10-pin) strip into the remaining 8-pin strip. Make sure the headers are straight before soldering.
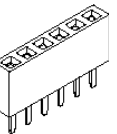
Step 8: ISP Pin Header (X10)

The 2x3 header can be used to connect an AVR ISP programmer using the standard Atmel pinout. Insert the short side of the header into the board, orientation is not important.

Step 9: MOSFETs (T1~T18)

The thick line on the silkscreen indicates the metal side of the MOSFETs. Don't force them into the board, or they will slide in too far. There should be a 1-2 mm gap between the board and the MOSFETs.
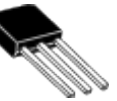
Step 10: Electrolytic Capacitors (C14, C15)

The big electrolytic capacitors need to be mounted lying flat against the board, so bend the leads by 90° about 1 mm away from the capacitor. Electrolytic capacitors are polarised, the polarity is indicated by a printed bar containing "–" signs on the *negative* side of the capacitor. On the board, the *positive* side is indicated by a little "+" sign next to the corresponding pad. Make sure that the capacitor lies flat against the board before soldering.

Step 11: Connectors (X1, X2)

Orientation is not important for the terminal block, but it is recommended that the openings face toward the edge of the board to make it easier to insert wires. The D-Sub connector only fits in one orientation.
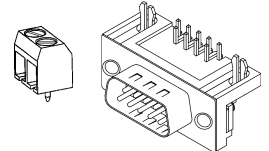
Step 12: SD Card Slot

Remove the SD card dummy before solering! Place the SD card connector on the solder side of the board, it will lock into the two holes in the board. Solder the two large pins first.
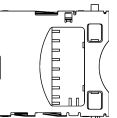
Step 13: Insert ICs (IC1~IC5)

Insert the ICs into the corresponding sockets observing the orientation of the notch. It might be necessary to slightly bend the pin rows inward before the pins will fit into the socket. This can be done by placing the IC with one pin row against a hard surface and then gently pushing the IC against the surface. Repeat for the other row of pins.
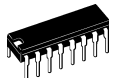
LED Board
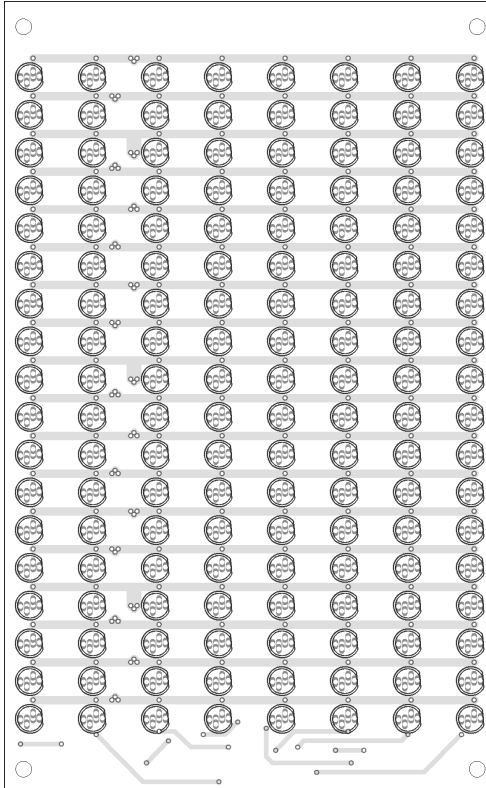
LED Board: top side (blank on PCB)
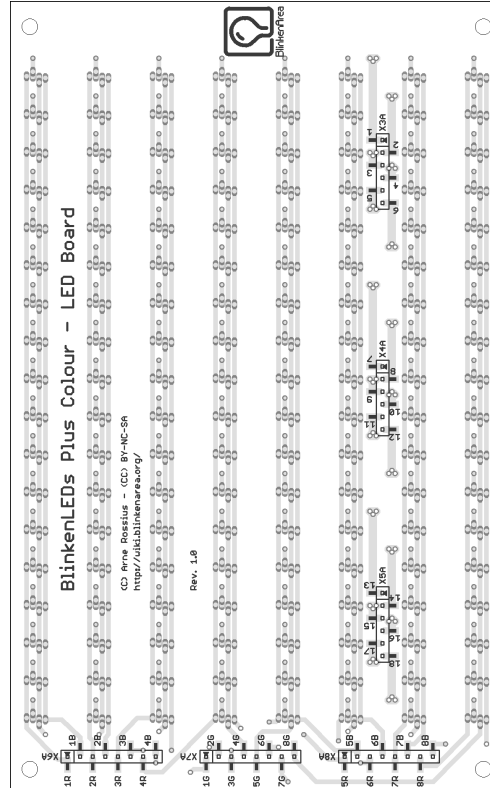
LED Board: bottom side (solder side)

Step 1: LEDs
Start with one LED in each corner, then add the other ones gradually after soldering those. Observe the orientation of the LEDs, the flat side of the LED must have the same orientation as shown in the image.
The LED leads go into the four holes in a straight line. Note that the PCB silkscreen shows the LED outlines on the bottom side, but **the LEDs have to be on the blank side of the board!**
The LED lead pitch is rather small, so here are some tips to make it easier to solder them:
- Use thin solder wire (0.5 mm diameter works well).
- Solder only one of the middle leads first, then trim all leads before soldering the rest.
- To improve LED alignment, gently push the LED against the board while re-heating the already soldered pad. Don't solder the other leads before the LED sits perfectly flush against the board.
- To remove a solder bridge between two LED pads, drag it towards the long end of one pad.

Step 2: Pin Headers
The pin headers go onto the solder side (bottom side) of the LED board. Cut the pin header strips to make three 6-pin headers and three 8-pin headers. **Make sure the pins line up with the pads on the board!** It might be necessary to discard the first pin of the strip to get the pins to line up, depending on which type of pin header strip is included in your kit.
Align the pin headers very carefully before soldering, they must be in exactly the right position and straight or they might not fit into their counterparts on the controller board. Solder only one of the middle pins first and check the alignment before soldering the other pins.

Connecting a Power Adapter
You need a power adapter capable of supplying at least 1.5 A at 5 V. If the power adapter has a plug at the end of its cable, cut it off. Remove about 5mm of insulation, thoroughly tin the ends and insert them into the terminal block before tightening the screws. If you are unsure about the power adapter's voltage or polarity, use a multimeter to check it first.
The polarity of the power adapter is critical, your kit might be destroyed if you get it wrong, so please be extra careful!

Connecting the Boards
Slide one spacer each on four screws, then insert the screws into the four corner holes in the controller board from the solder side (these will be the BlinkenLEDs Plus Colour's "feet"). Screw the bolts onto the screws. Place the LED board on top of the controller board and gently push the pin headers into their counterparts on the controller board. Place the remaining spacers between the bolts and the LED board and finally screw in the remaining screws from the top. If this was confusing, have a look at the picture on the right ;-).

Using the BlinkenLEDs Plus Colour
Plug in the power adapter and the LEDs should show the BlinkenPlus logo ("B+") followed by a "Chaosknoten". You can now send an MCUF stream via RS232 (115200 Baud) or insert an SD card. If the LEDs remain dark, turn off the power immediately.
The MCUF streaming format is described at
http://wiki.blinkenarea.org/index.php/MicroControllerUnitFrameEnglish

MMC, SD and SDHC cards are supported with a FAT16 or FAT32 filesystem. Very small MMC and SD cards (up to 32 MB) use FAT12 and must be reformatted to FAT16 before they can be used with this kit. If there are several partitions on the card, the first primary partition with a FAT16 or FAT32 partition ID (0x04, 0x06, 0x0B, 0x0C) will be used. Some SD cards come with no partition at all, in which case a partition must be created and formatted. If your SD card isn't compatible with the BlinkenLEDs Plus Colour, an error message will scroll across the LEDs.
Files on the SD card must be stored in a directory with the name `BP18X8.RGB`. The files in that directory will be played in the order listed in the FAT (usually the order in which they were copied onto the SD card, or use 'fatsort' from http://fatsort.sourceforge.net/). If there is no `BP18X8.RGB` directory, an error message will scroll across the LEDs. All files must be 18x8 pixels, 3 channels. The supported file formats are:

Filename extension	Format
BIN	Modified BlinkströmAdvanced file (binary, 8 grayscales per colour = 512 colours)
BLM	BlinkenLights Movie (simple ASCII format, no grayscale support, i.e. each colour can be either on or off, resulting in a total of 8 possible colours)
BML	Blinkenlights Markup Language (XML-based, 2 to 256 grayscales per colour, but only 8 grayscales per colour displayed, i.e. 512 colours)
BBM	Blinken Binary Movie (binary format with up to 256 grayscales per colour, but only 8 grayscales per colour displayed, i.e. 512 colours)

More information about the file formats is available at http://wiki.blinkenarea.org/index.php/FileFormats

Questions? Problems? Comments? Ideas? Please contact me:
E-Mail: arne@blinkenarea.org   XMPP: ArneRossius@jabber.ccc.de

Project Webpage
Hardware: http://wiki.blinkenarea.org/index.php/BlinkenLEDsPlusColourEnglish
Software: http://wiki.blinkenarea.org/index.php/BlinkenPlusEnglish