

# Installation of the FINAL TZ-CLOCK BOARD

## 1.0 Material List

- Clock Board PCB with LEDs
- Separately packaged minute optos (shipped loose to prevent damage in transit)
- Replacement LEDs\*
- Instructions

\*depending on the specifics of your order you may receive LEDs of varying colors

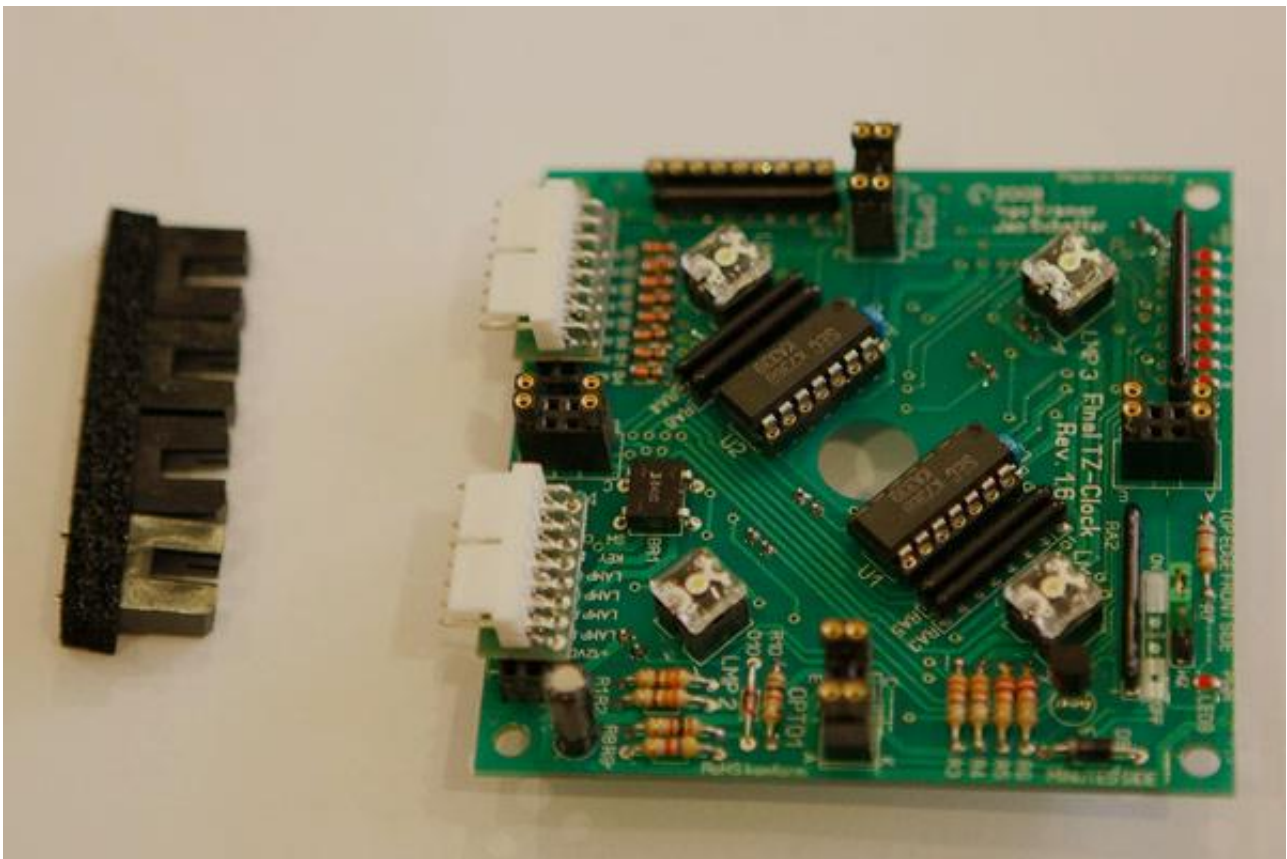


Image 1: Ingo Clock Board and optos

## 2.0 Tools needed

- #2 phillips head screw driver
- Small needle nose pliers (only needed depending on your dexterity)
- Small container to hold parts (small tupperware container or ziplock bag works well)

## 3.0 Before You Start

This set of instruction assumes that your clock's electric motor and motor control board

are in working condition. The Ingo clock board will not fix problems with those two components and it is recommended that you repair any issues you have with those before continuing with this installation. It is also assumed that the installer has a basic understanding on the use of the menu and diagnostic system contained within the WPC operating system. This system is accessed with the four buttons located on the inside of the coin door.

#### 4.0 Clock Disassembly

It will be necessary to partially disassemble to clock to gain access to the original circuit boards for removal. This can be accomplished by removing the clock from it's playfield attachment bracket, yet still leaving the motor wiring harness plugged in. This means that no lifting of the playfield is required. This job is made significantly easier if the clock is at the 12:00 position prior to disassembly.

**Step 1:** Enter the **test** menu through the WPC diagnostic software. Select the **clock diagnostic menu**. Within this menu you can advance or reverse the clock by pressing the enter button. Use these features to line up the clock to noon. This may take several tries going back and forth to get the minute hand to be at exactly noon. Keep in mind that there is a small amount of play in the minute hand and when it is directly at noon it may fall slightly in the clockwise direction. This is ok. **\*\* Do not try to use mechanical force to get the hands to line up \*\*** Consult your user manual for more information on the menu system.



Image2: Lining up the clock at 12:00

**Step 2:** Remove and store the phillips screw holding the clock bracket to the piano scoop. Be careful not to loose the lock washer that should be on this screw. This washer helps keep the clock from coming loose due to vibration. Slide the clock and bracket rearward to free it.

**Step 3:** Once free you will have a limited range of motion since the wiring harnesses are still plugged in. This next step will be to remove the clock hands. It is easy to accidentally drop and lose parts from this step. Putting a hand towel down on top of your work surface will help protect everything and also serve to catch any small items accidentally dropped, preventing them from falling down into the playfield's crevices. Remove and store the plastic front of the clock housing. This requires removing the four phillips screws located in each corner. Now that the hands are accessible, gently remove the "E" clip that prevents the minute hand from sliding off of the end of the shaft. This is where you may need the needle nose pliers. Again, do not use excessive force. If you have sufficient dexterity in your hands, use the tips of your thumbs to gently wiggle off the clip. Retain the clip for later installation.

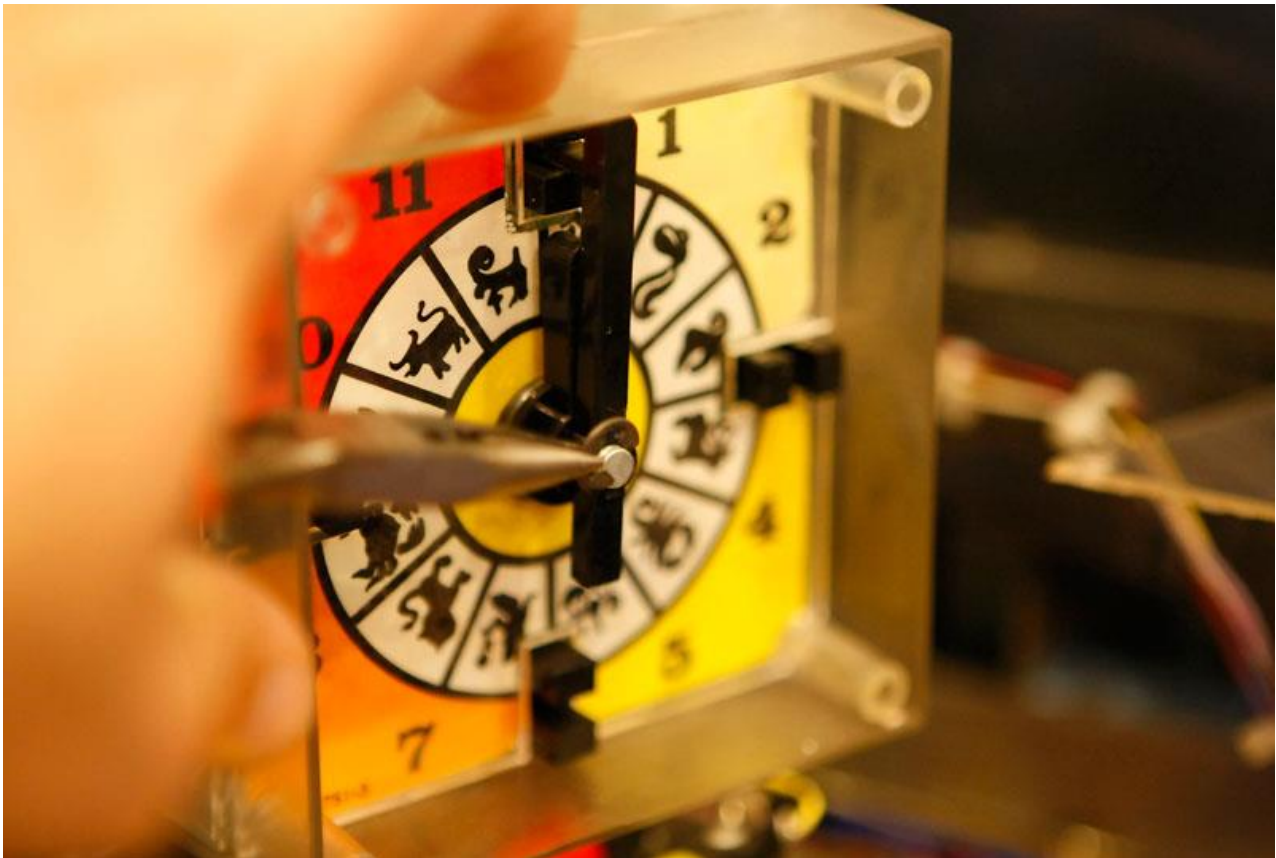


Image3: Removing the E clip; do not use excessive lateral force

Next you will be removing the second hand. Be aware that there is a small metal pin behind the second hand that serves to keep it lined up. This pin will have a propensity to fall out as soon as you begin to slide the minute hand off the shaft. Keep one hand below the shaft, ready to catch this pin as it falls out. Once the minute hand is removed,

remove the hour hand. There is no pin to worry about on the hour hand.

**Step 4:** Move the clock such that you can access the back. Remove and store the four screws that are now accessible. This will release the metal bracket and the metal airball preventer in the process. Three of the four screws are shown in the image below:



Image 4: 3 of the 4 back screws (the 4th is behind the bracket in this photo)

**Step 5:** Take precautions not to disturb the gearing in the clock assembly from this point forward. You want to keep everything lined up at noon. Turn the clock back to the front and remove the clock face.

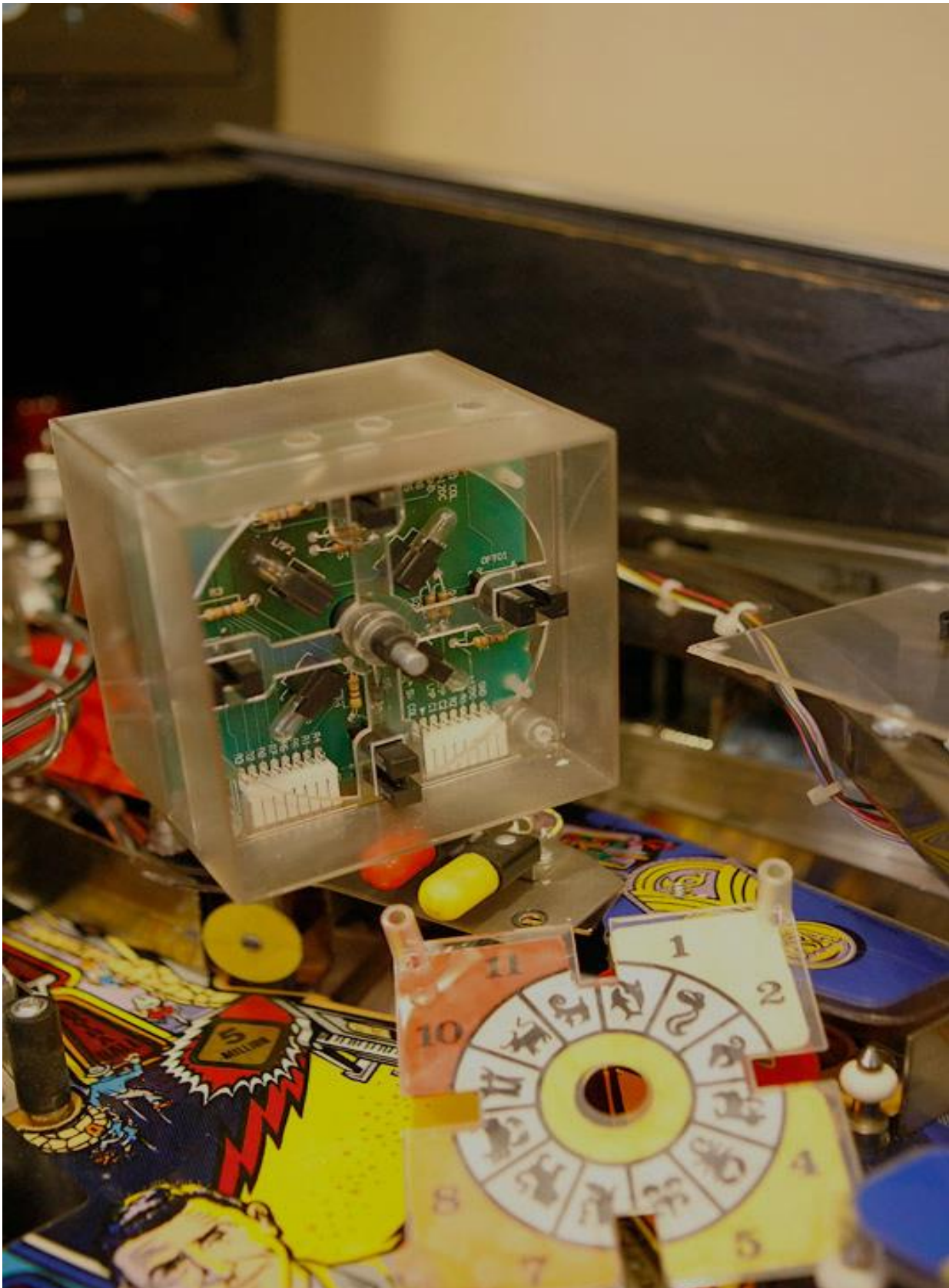
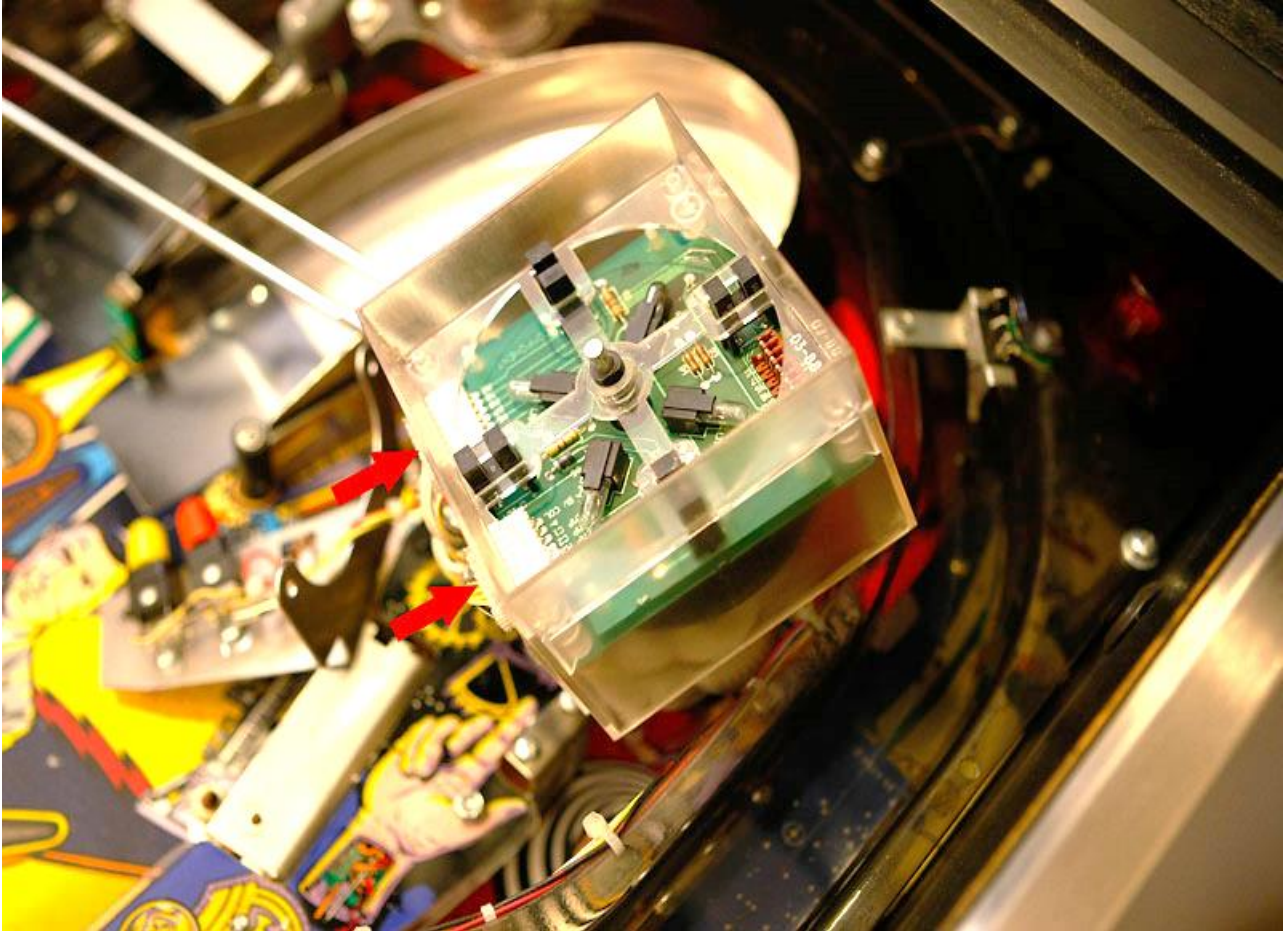


Image 5: Removal of the clock face

**Step 6:** Unplug the two moxex connectors found at the bottom of the housing. Do not pull from the wires; the insulation displacement fittings are tempermental and it is easy to accidentally pull a wire out. Gently rocking the plastic male fitting side to side will work it connectors loose safely.



**Image 6:** Horizontally placed clock makes it easier to work on the assembly without fear of disrupting the gearset

**Step 7:** Orient the clock horizontally, as shown in the previous picture, above. Lift the plastic housing off of the clock circuit boards. Remove the circuit boards as well. Don't mess with the gears, you want them to stay in the same orientation.

## 5.0 Ingo Board Installation

**Step 8:** Get the new Ingo Clock Board and **install the minute optos that were shipped uninstalled**. Look at the optos and identify the **notched edge**. **CAREFULLY** take each minute opto and insert the legs into the sockets on the board; **the notched edge should be oriented to the outside of the board** as shown in images 8 and 9. The board is designed so that when the legs are inserted all the way, the opto will be at the correct height.

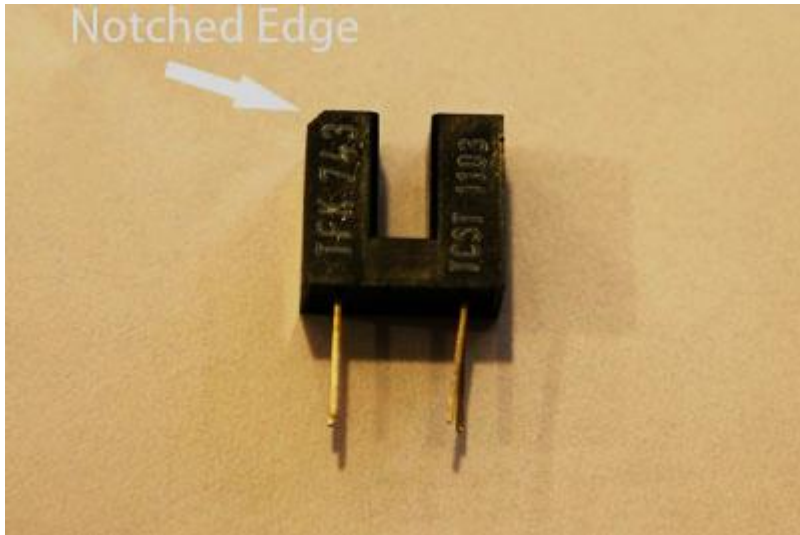


Image 7: Take note of the notched edge in the supplied optos

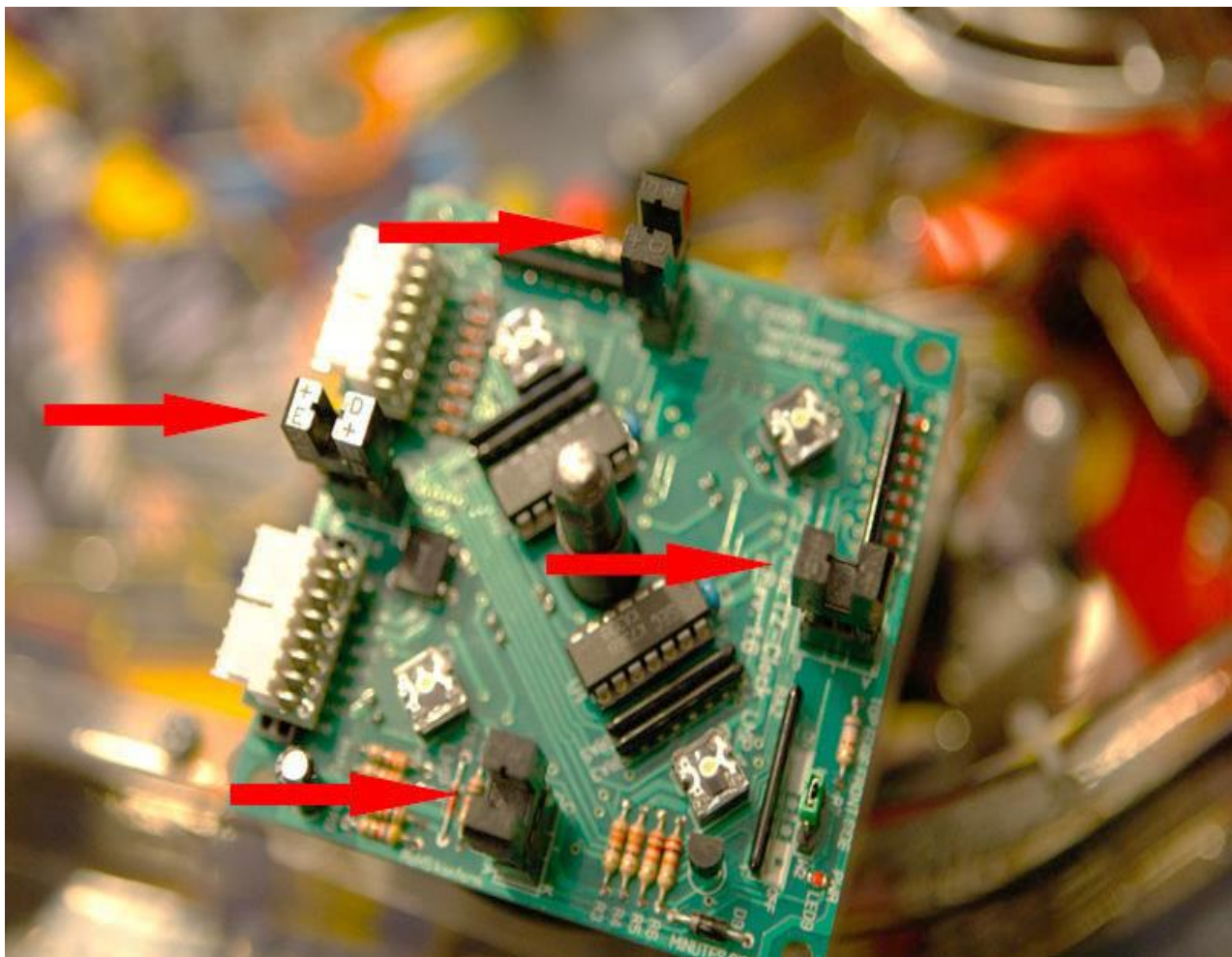


Image 8: The 4 optos should be installed as shown with the notch facing out

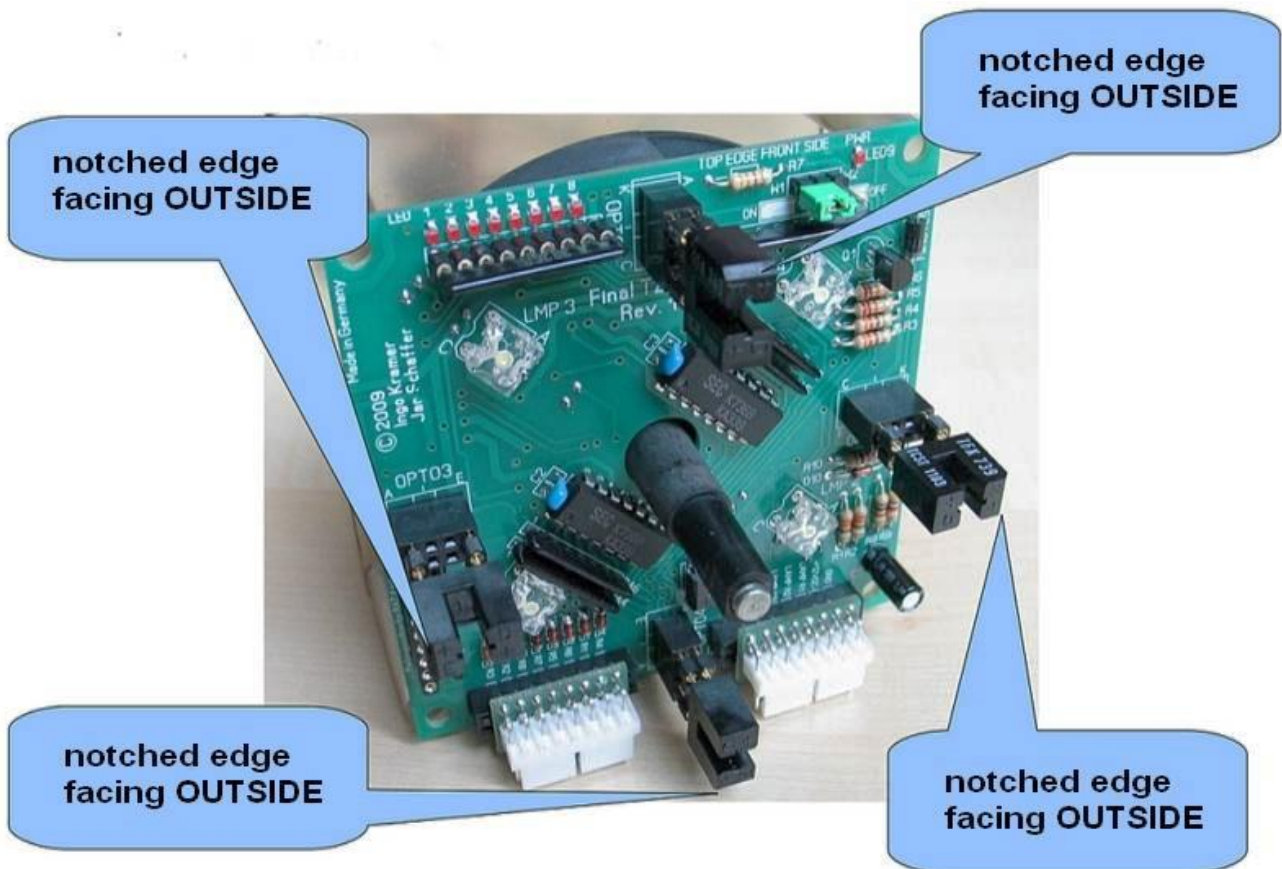


Image 9: The 4 optos should be installed as shown with the notch facing out (NOTE: the board is a prototype board, in the final version, the ICs and LEDs are socketed)

**Step 9:** Place the new board down over the big black gear with the text "TOP EDGE FRONT SIDE" on the front, facing you. The electric motor is on the bottom so the text should be on the opposite side of the electric motor. Make sure that the ridges on the black gear are inside of the hour optos, on the back side of the board. It may be a tight fit.

**Step 10:** Assembly of the parts will be the reverse of disassembly above. \*NOTE\* when assembling the minute hand back on the shaft you will need to reinstall the metal pin in the hole in the shaft. The pin should be inserted such that when the minute hand goes onto the shaft the pin fits neatly inside the groove on the back of the hand.

## 6.0 Diagnostic LEDs

The Ingo Board features diagnostic LEDs to help you troubleshoot and/or verify proper operation of the clock.

**PWR LED:** This LED illuminates when the board is receiving supply power. This LED can be disabled by the use of Jumper W2.



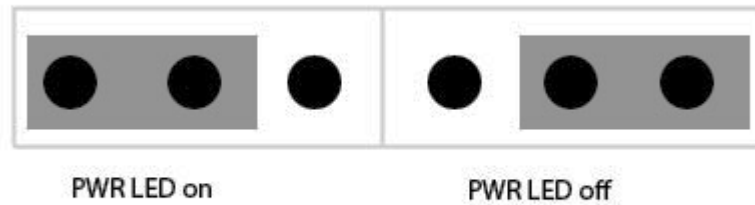


Image 10: The two possible positions of Jumper W2: to the left and the LED is on, jumper to the right and the LED is off

**OPTO STATUS LEDs:** These LEDs will illuminate when the opto is OPEN. When the opto is interrupted then LED will go dark. This helps you determine if a switch problem is with the opto itself or with the wiring or on the expansion board in the pinball back box. To disable the LEDs remove the resistor network RA7 and place it in the "PARKPOSITION" slot for storage.

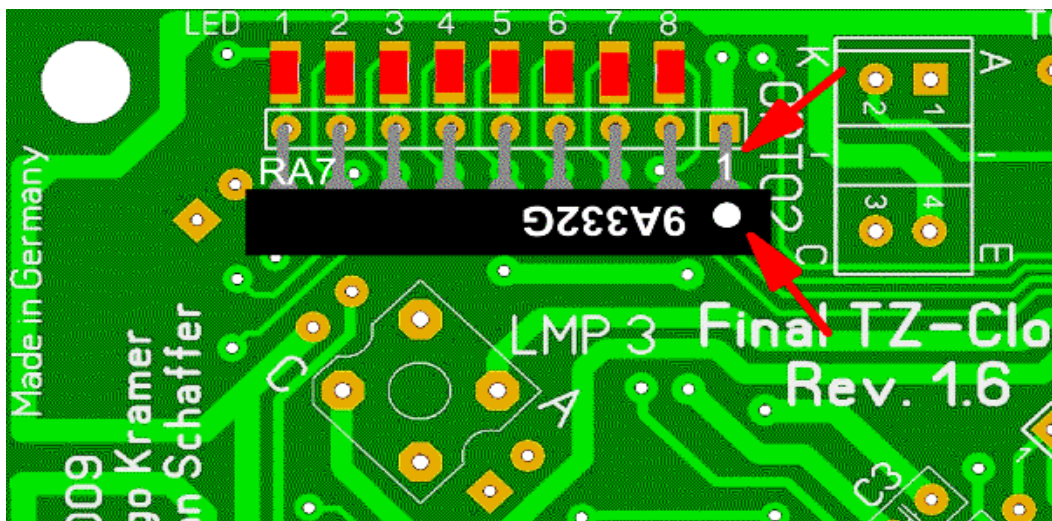


Image 11: Diagnostic LEDs



Image 12: Diagnostic LEDs

If you want to enable the diagnostic LEDs again, simply put the resistor network RA7 back to the resistor socket below the 8 diagnostic LEDs.

**CAUTION:** Please be very careful, when you put the resistor network back into its socket. It must be put in the correct way.

- On the resistor network is a **white dot, that marks PIN 1** of the resistor network
- On the board, PIN 1 is as well clearly marked with "1"

The resistor network now needs to be put back that way, that the white dot (marking PIN 1) of the resistor network and the imprinted "1" on the board match/correspond. See the following images 13 and 14:

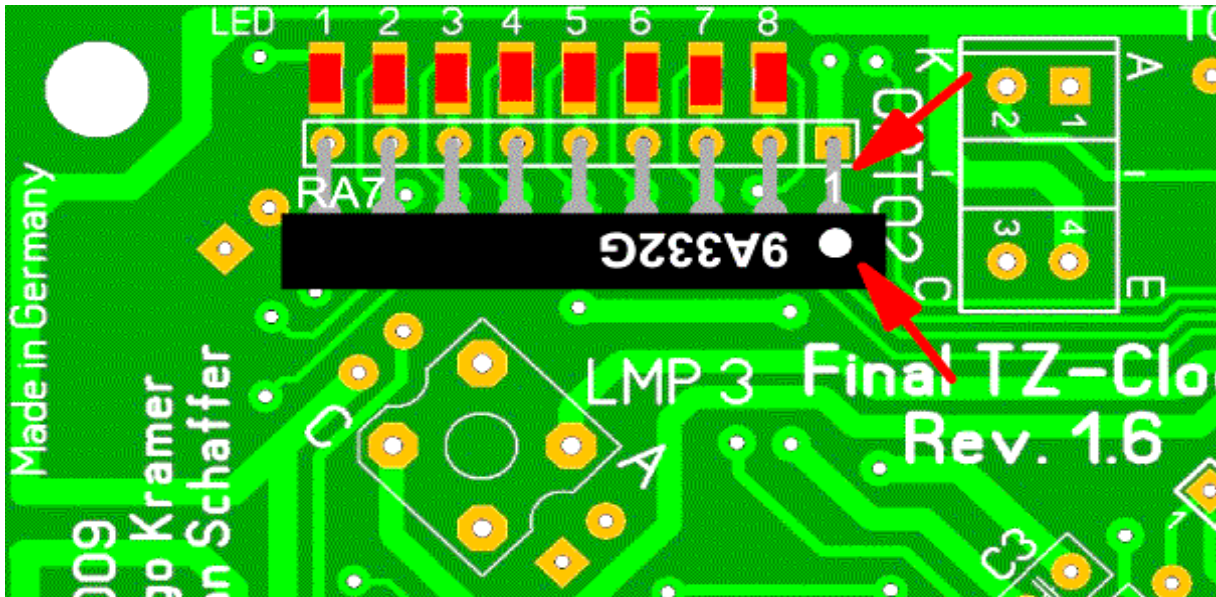


Image 13: CORRECT installation of RA7 (White dot and imprinted "1" match/correspond)

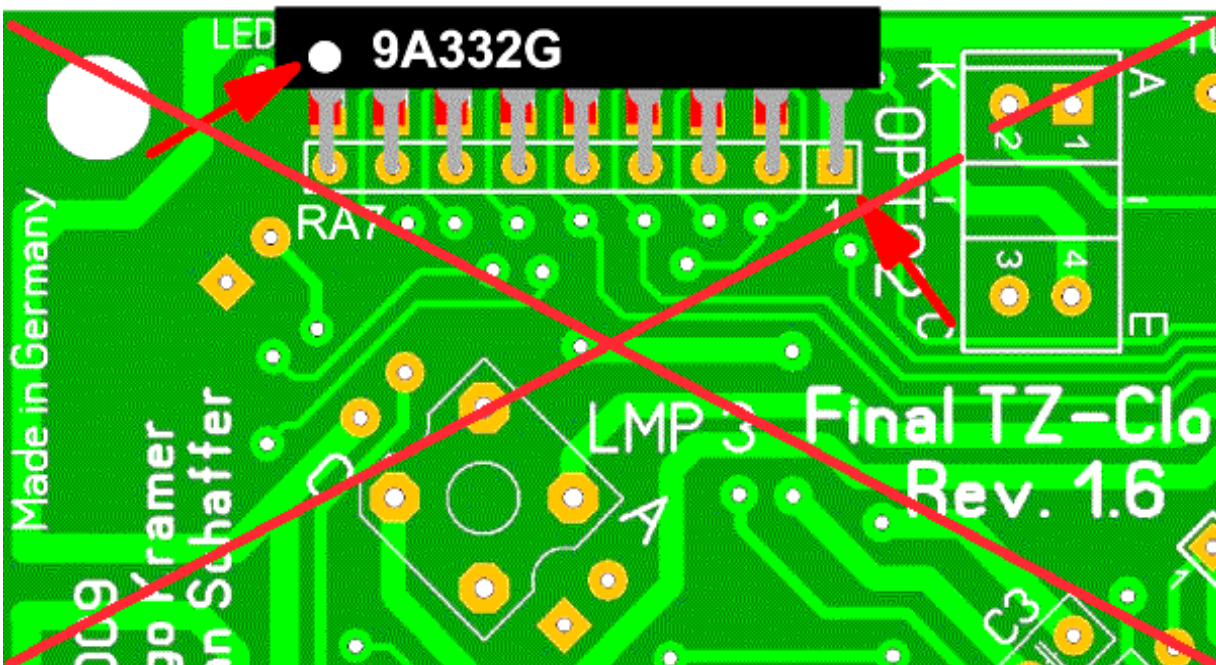


Image 14: NOT THIS WAY - WRONG installation of RA7 (white dot and imprinted "1" do not match/correspond)

## 7.0 General Illumination LED Replacement

The LEDs on the board are 1-chip SUPERFLUXX-LEDs.

If you ordered a board with the option to have socketed General Illumination (note: since 2010 sockets are standard and no longer an option), then you can easily replace the LEDs. To remove the LED gently pry the existing led from the socket. The best method is to use a chip puller, but a small, flat head screw driver works well too as long as you pry in small increments working your way around each edge. The idea being not to pry up too far on any single edge so that the legs bend on the LED. When inserting the new LED line up the notched on the LED with the notched on the silkscreen, as indicated in Image 15.

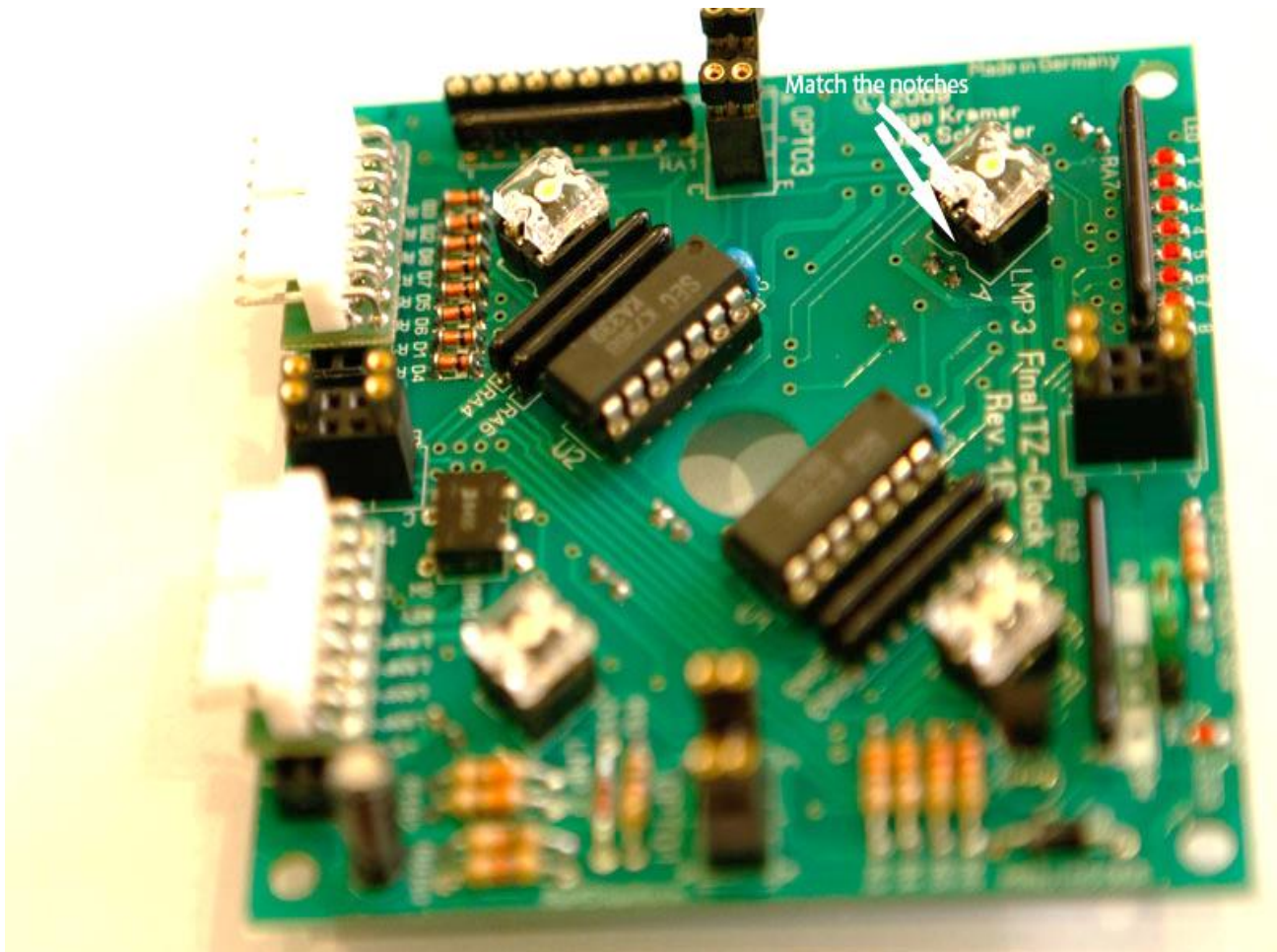


Image 15: Line up the notch in the LED as shown

Also line up the **notched edge of the LEDs** (the notched edge is the Cathode-side of the LEDs) with the notched edge on the silkscreen (also marked with "C" on the board), when inserting the new LED. See image 16:

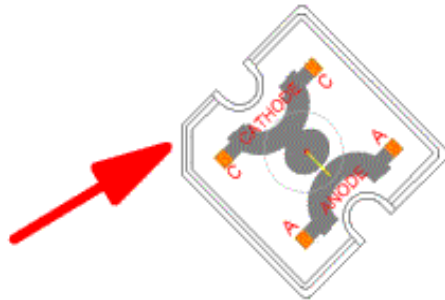
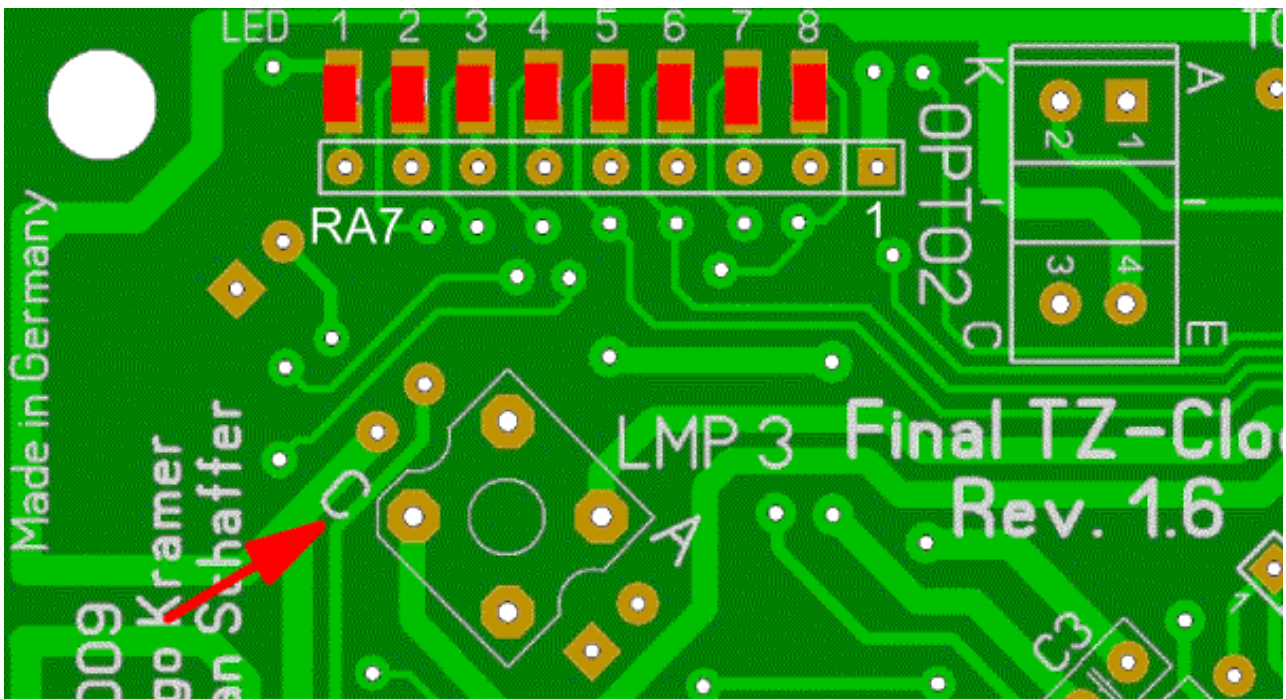


Image 16: Notched edge of the LED and the imprinted "C" must match/correspond

Depending on what options you ordered, your board may have come with LEDs, that illuminate with different colors. The following colors are available:

- warm-white (standard)
- cold-white
- yellow
- red
- green
- blue
- rainbow (color changing)

Use the included anti static foam to store your LEDs and protect them when not in use.

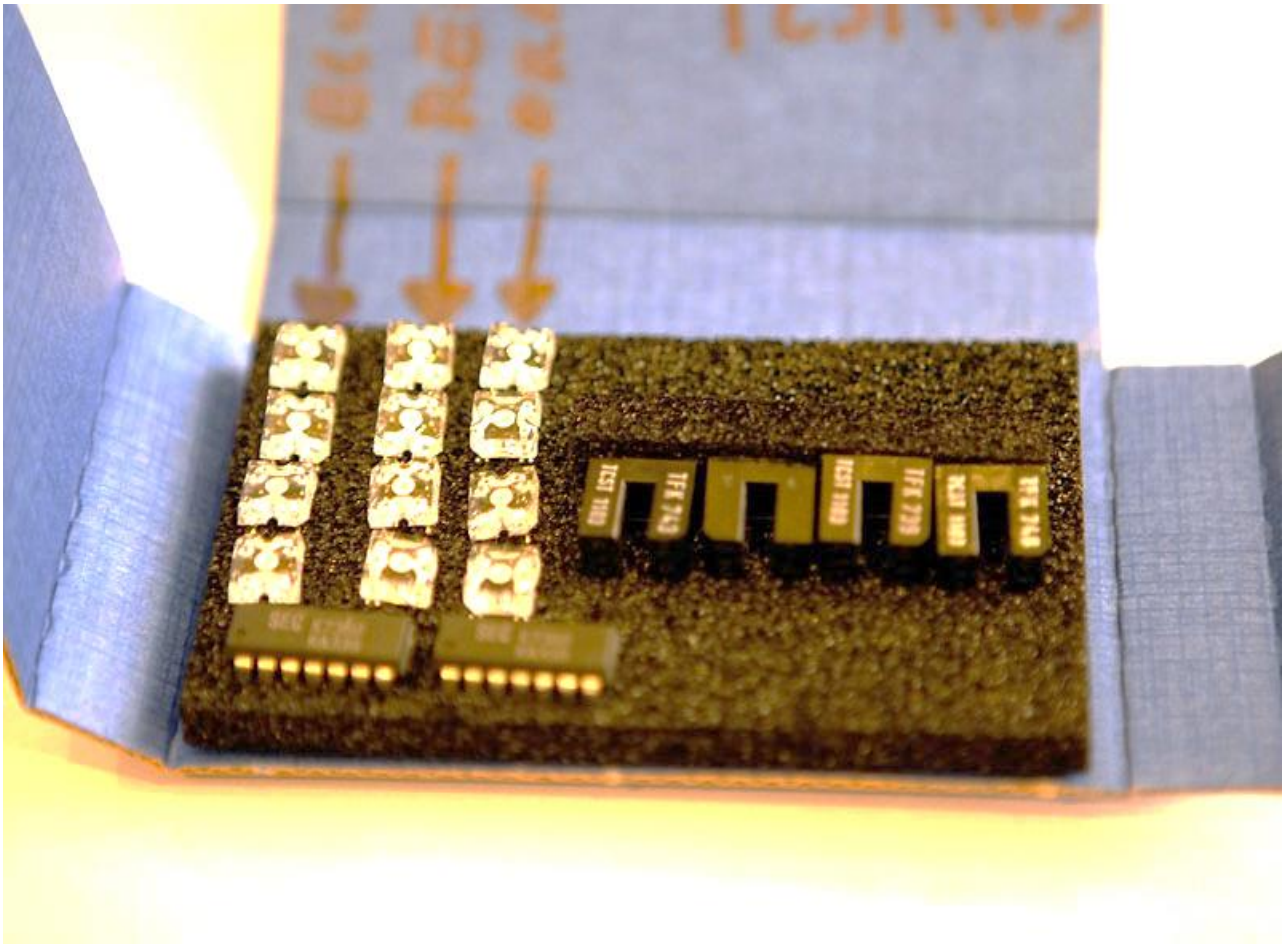


Image 17: Extra LEDs should be stored in the included anti static foam

Since October 2010 rainbow LEDs are available. These have an integrated microchip for nice colorfading effects and they cycle slowly through seven different colors.

From Board Revision 1.0 – 1.8 each rainbow LEDs was mounted together with a  $47\mu\text{F}$  smd-capacitor on an extra PCB.

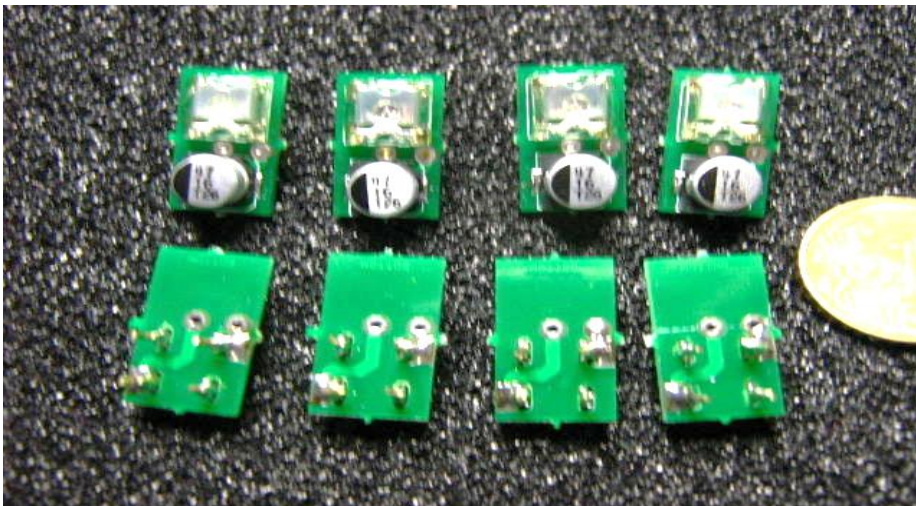


Image 18: Front- and back side of the rainbow LEDs (only Board Revision 1.0 – 1.8)

Since Board Revision 1.9 the extra PCB is no longer needed and the rainbow LEDs

can be installed the same way as the other Fluxx LEDs as easy as described above.



Image 19: rainbow LEDs (since Board Revision 1.9)

If you ordered a set of **rainbow LEDs**, please note the following, when installing:

### Board Revision 1.0 – 1.8:

From Board Revision 1.0 – 1.8 the rainbow LEDs were mounted on a little extra PCB together with a 47 $\mu$ F smd-capacitor.

The rainbow LEDs do not have a notched edge. But there is a notched edge imprinted on the silkscreen of the rainbow-LED-pcb. Line up the notched edge of the rainbow-LED-pcb with the notched edge on the silkscreen of the clock board (also marked with "C" on the board), when inserting the rainbow LEDs. See the correct installation of all 4 rainbow LEDs in the following image 20:

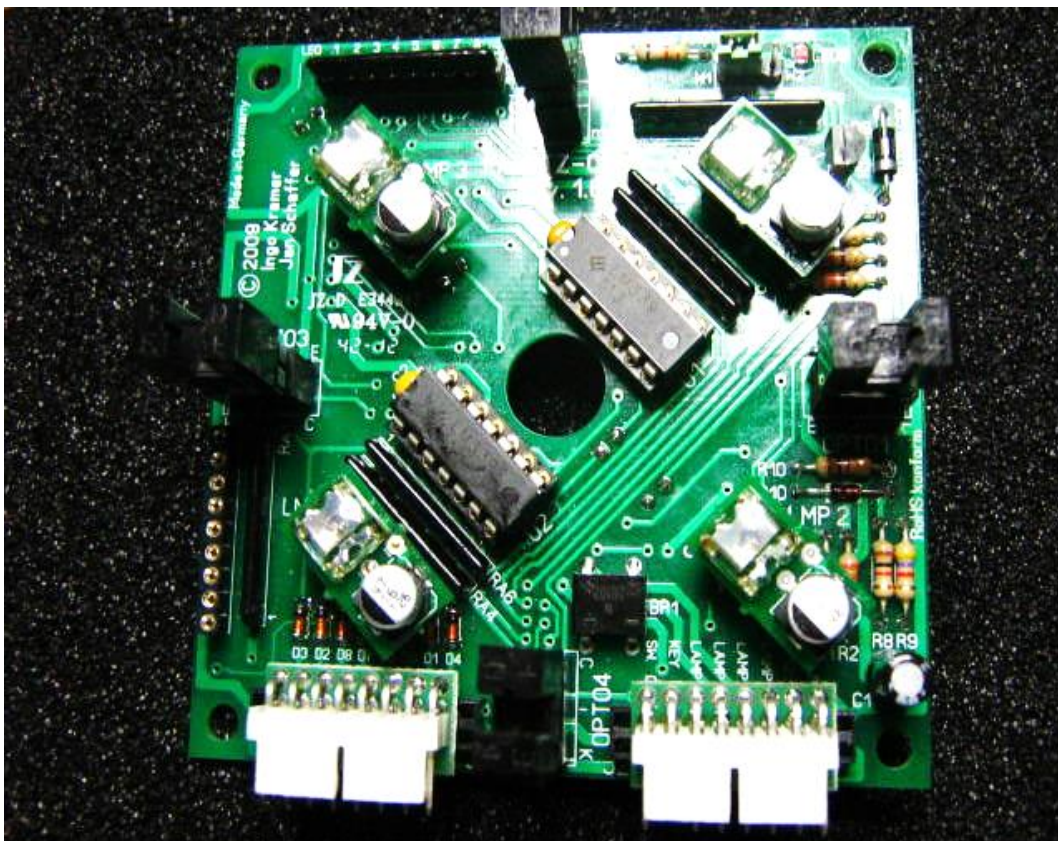


Image 20: CORRECT installation of all 4 rainbow LEDs

**since Board Revision 1.9:**

Since Board Revision 1.9 the rainbow LEDs can simply installed the same way as the other Fluxx

The rainbow LEDs do not have a notched edge. But there is a notched edge imprinted on the silkscreen of the rainbow-LED-pcb. Line up the notched edge of the rainbow-LED-pcb with the notched edge on the silkscreen of the clock board (also marked with "C" on the board), when inserting the rainbow LEDs. See the correct installation of all 4 rainbow LEDs in the following image 19:

Hint: The RAINBOW-FLUXX-LEDs have a bigger area inside; this is the **CATHODE** of the LED. See the following image 21:

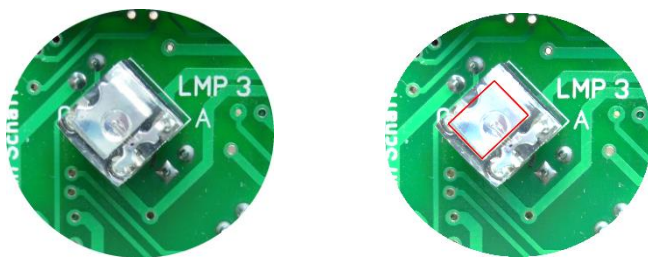


Image 21: rainbow LEDs (since Board Revision 1.9)

The CATHODE-side must show to the **LEFT** for all 4 LEDs!!!!.

Please see image 22 below, there you can see the correct installation of all 4 RAINBOW-FLUXX-LEDs.

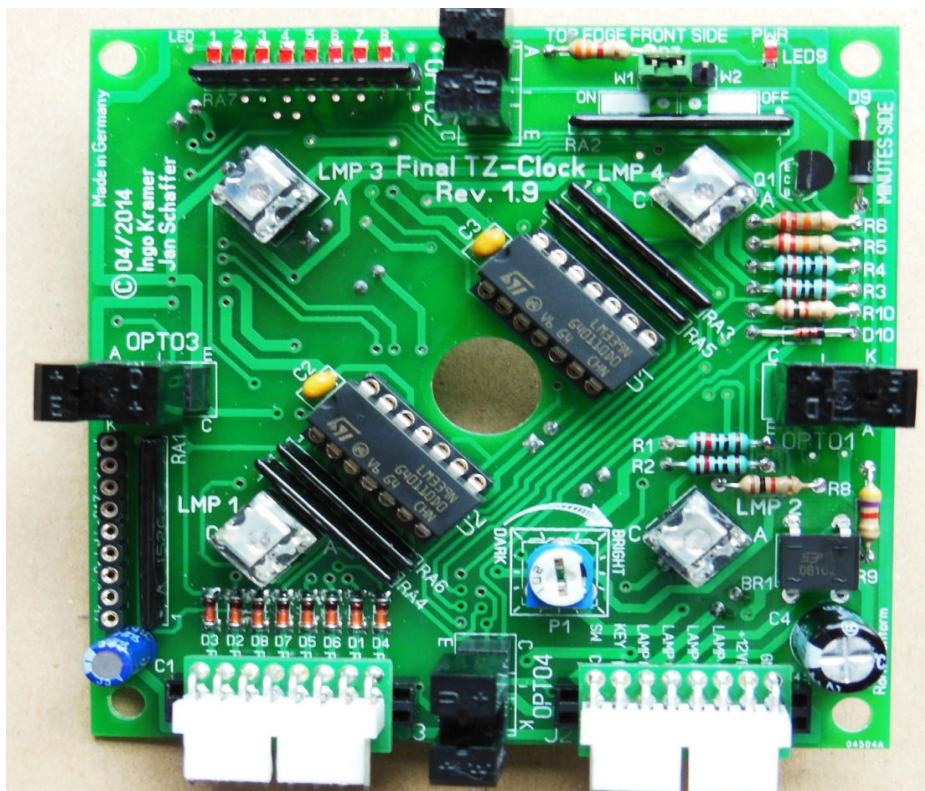


Image 22: CORRECT installation of all 4 rainbow LEDs (since Board Revision 1.9)



Since Board Revision 1.9, you have the possibility, to change the brightness of the Fluxx LEDs. Please use the potentiometer, to find your individual brightness.

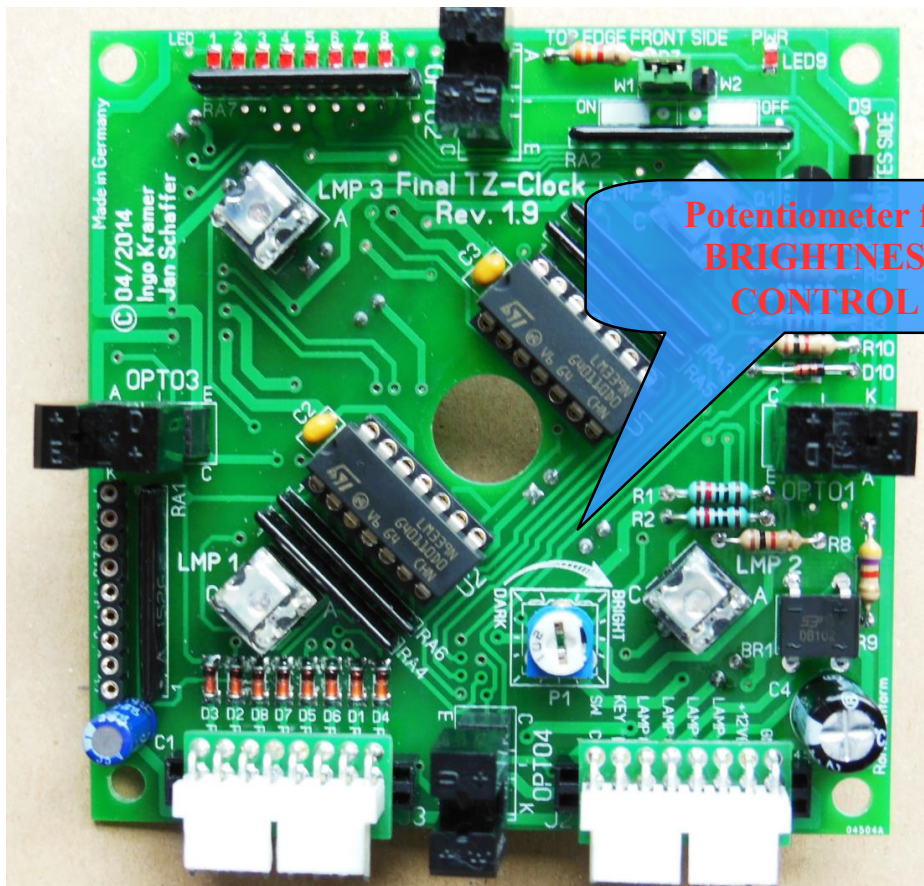


Image 23: Potentiometer for brightness control

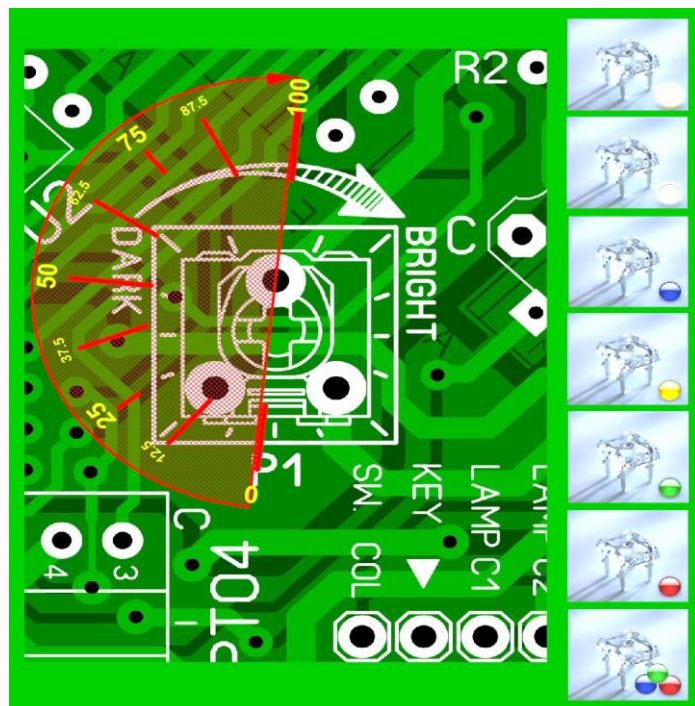


Image 24: Potentiometer setting range

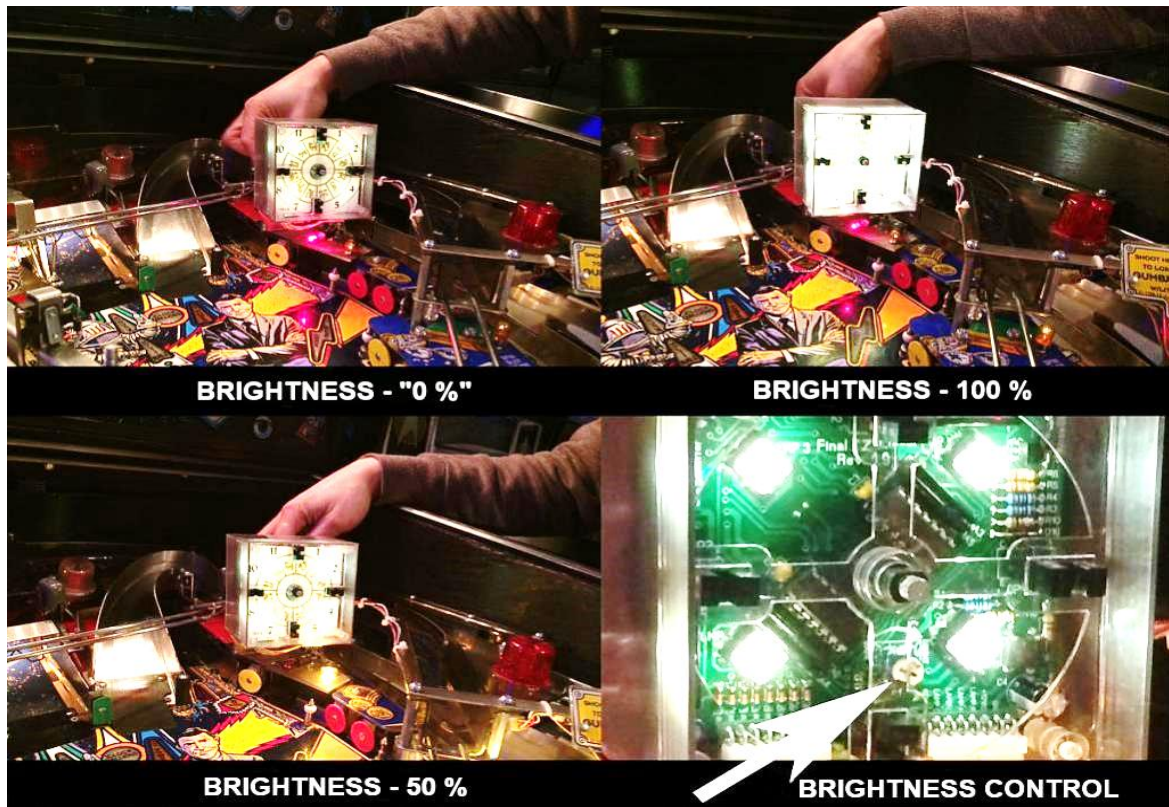


Image 25: Impressions of the brightness control

COPYRIGHT NOVEMBER 2014 by Ingo Kramer

The original version of this installation guide was written by Garrett Word from the US, the first user from the US ever. Many thanks Garrett for your great work.