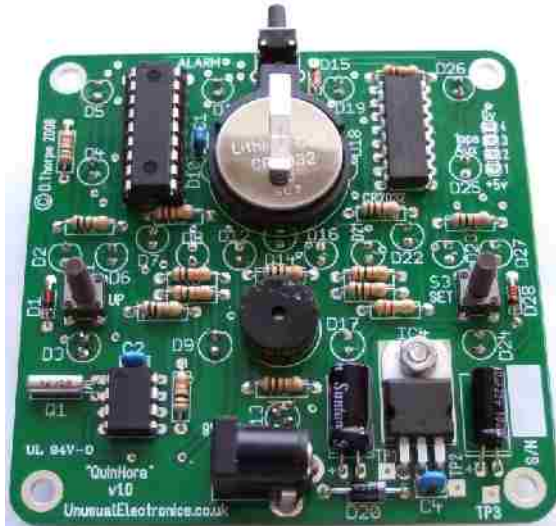


## QuinHora LED Clock Kit Assembly Manual (V1.00)

# Unusual Electronics



Thank you for purchasing this "UnusualElectronics.co.uk" Kit.

Please use this manual – even if you are an experienced electronics engineer.

**The sequence of assembly is very important because components are fitted to both sides of the board!**

\*\*\*\*\* This kit is fairly complex and is not recommended for an absolute beginner \*\*\*\*\*

If you are unsure of being able to complete the kit successfully – seek assistance from someone with good electronic assembly skills.  
Or email us for help and advise.

UnusualElectronics.co.uk will not be held liable to replace components or refund money as a result of damage occurring during assembly or failure to complete the kit successfully.

If you damage any parts or you cannot get it working, please email with a description of the problem. We will endeavour to offer a reasonable amount of free technical support by email and we can also send replacement parts or arrange for you to return the kit to us to be repaired at your expense if you wish.

### **WARNING**

The LEDs used in this kit are **BRIGHT!**










Do not stare closely at them.





We recommend you use a diffuser such as a piece of thin opaque plastic or paper in front of them or use the dimming function. (see user manual section 6).

## Things you need during assembly

	Safety Glasses - (Especially needed when trimming leads) (Always hold the end of leads when trimming them!)
	ESD protection - Anti-static Wrist band and ideally an Antistatic Mat to avoid damage to static sensitive parts.
	A good quality, Miniature type, low wattage Soldering iron with a small tip (e.g. An 18 Watt model with a 1mm tip). Use a solder sponge to keep the iron tip clean.
	A quality, thin (18 or 22SWG), electrical grade of cored solder Lead-free solder can be used (you may need some practice using it first if you have not previously used it.)
	Small, good quality side-cutters for trimming wires etc.
	Small, needle nose pliers to hold components etc.
	A basic Multimeter may be useful for checking resistance, voltages etc.
	A "Wall-Wart" 9 volt unregulated or regulated DC power adaptor (0.25 Amp output rated (or better))
 	<u>Needed if you make any soldering mistakes</u> A cheap de-soldering pump (solder sucker)  Or de-soldering copper wick.
	A ruler for checking the alignment and spacing of the LEDs

## Parts List

CAPACITORS	Qty	VALUE	DESCRIPTION
C1,C2,C4	3	0,1 $\mu$ F	50v Ceramic 
C3	1	100 $\mu$ F	25v Low ESR Electrolytic 
C5	1	10 $\mu$ F	25v Electrolytic 
RESISTORS	Qty	VALUE	DESCRIPTION (All 250mW carbon film 5% tolerance)
R1,R4,R6,R7, R8,R11,R12,R15	8	10K $\Omega$	Brown-Black-Orange-Gold 
R2,R3,R5,R9, R10,R13,R16	7	100R	Brown-Black-Brown-Gold 
R14	1	2R2	Red-Red-Gold-Gold 
LEDS	Qty	VALUE	DESCRIPTION (5mm (approx) tinted oval wide-angle high-brightness)
D5,D11,D19,D26 D2,D6,D8,D12 D16,D21,D23,D27	12		Red for top row (HoursX5) and for 3rd row (MinutesX5)
D4,D10,D18,D25	4		Green for 2nd row (HoursX1)
D7,D14,D22	3		Yellow for 3rd row (15,30,45 Mins)
D3,D9,D17,D24	4		Blue for Bottom row (MinutesX1)
D13	1		RGB (Common Anode) LED for seconds indicator
DIODES	Qty	VALUE	DESCRIPTION
D20	1	1N4003	 1 Amp rectifier diode
D1,D15,D28	3	1N4148	Small, general purpose diode 
ICs	Qty	VALUE	DESCRIPTION
IC1	1	DS1307	Dallas/Maxim RTC (Real Time Clock)
IC2	1	PIC18F1330	Microchip PIC Microcontroller
IC3	1	ULN2003	Seven transistor driver array chip
IC4	1	MC7805CT	Voltage Regulator 5v 1Amp 

OTHER PARTS	Qty	VALUE	DESCRIPTION
LS1	1	HCM1205F	 Electromagnetic Buzzer, 5v, 45Ω.
PWR1	1	9V DC	2.1mm Power Socket (Centre pin positive)
Q1	1	32,768KHz 	Watch Crystal (Tolerance within +/-20ppm)
S1,S3	2	“UP” & “SET”	Tactile, vertical 6mm Push-button 
S2	1	“Alarm/Snooze”	Tactile, R/A 6mm Push-button 
18 pin IC socket	1		Socket for IC2 (PIC Microcontroller)
CR2032 battery	1		3 Volt long life Lithium battery
Battery holder	1		Holder for CR2032 battery
K1	0		Optional 4 pin external device connector (not supplied)
M3 screw, nut & washer	3		To mount voltage regulator to the pcb
PCB	1		Double-sided board, Plated Holes (ROHS Lead-free)

## Board Layout

NOT INCLUDED IN THIS SPECIAL WEB VERSION OF THE DOCUMENT  
PLEASE USE THE MANUAL ON THE CD THAT CAME WITH YOUR KIT

## Assembly

**Many components are static-sensitive – Always use ESD anti-static protection to avoid damaging them!**

**The lifetime of the LEDs and ICs can be severely shortened by static electricity, or too much heat during soldering!**

### Step 1

Start by fitting the eight **10K $\Omega$**  resistors (Brown Black Orange Gold).

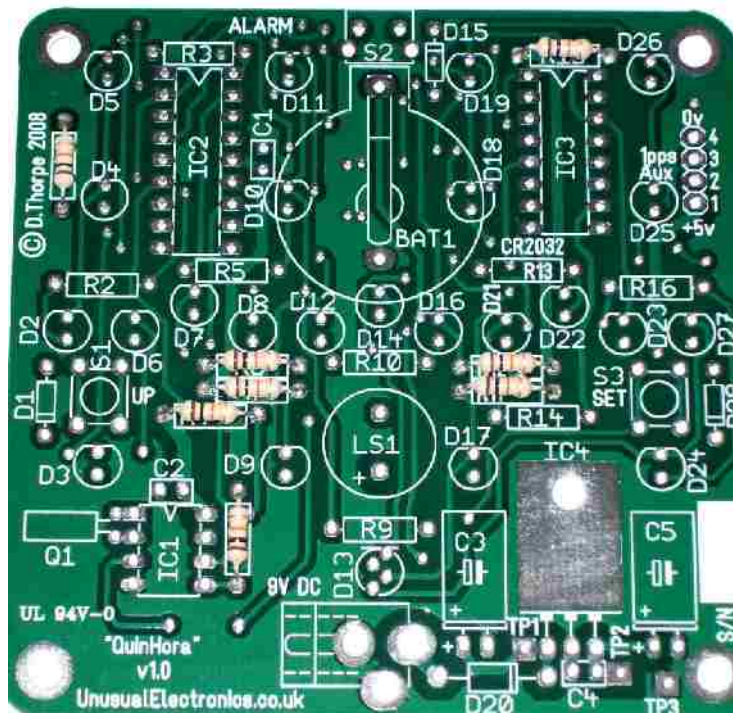


Bend each lead by hand, near to the resistor body as shown.

Insert each resistor fully then spread the leads just enough to stop it falling out.  
(The resistors can go either way round but look neater with all the gold markings on the same side)

Carefully turn-over the board, ensuring the resistors stay in place.

Then solder and trim all the leads on the underside of the PCB.  
(*Tip.* Hold the end of each lead as you trim it)



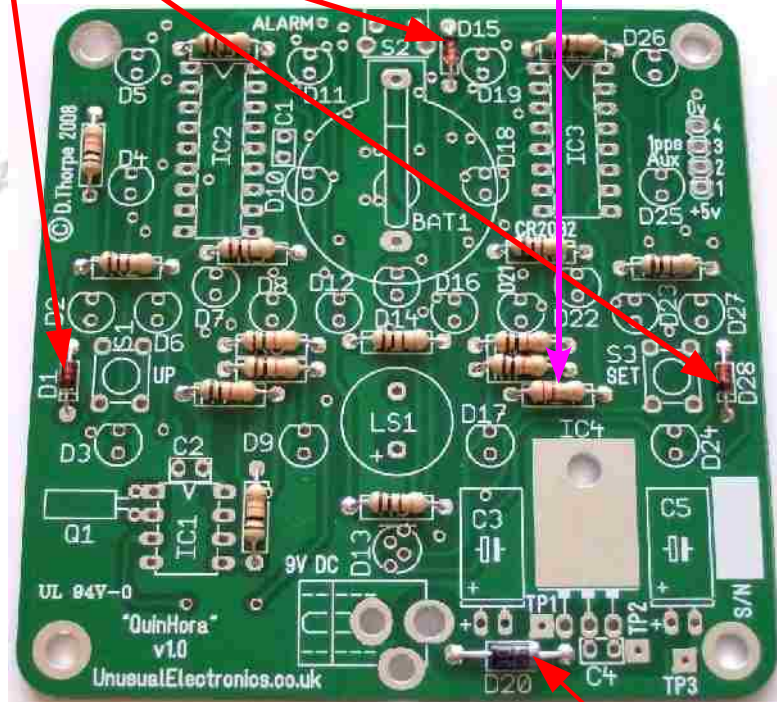
## Step 2

Fit the remaining resistors.

### **Note**

**R14** (nearest the voltage regulator) is **2.2Ω** (Red-Red-Gold-Gold)

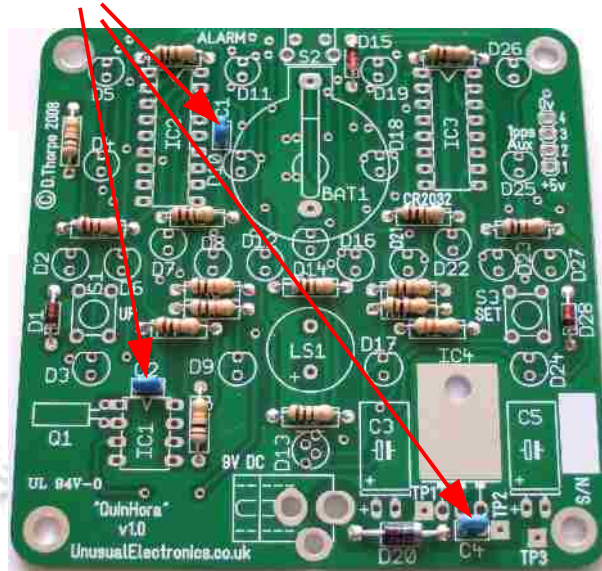
Then fit the three small glass 1N4148 diodes (D1, D15, D28) ensuring the black polarity mark matches the pcb.



Bend the leads of the 1N4003 rectifier diode (D20) to match the hole spacing width on the pcb, then fit it with the silver polarity band matching the mark on the pcb as shown.

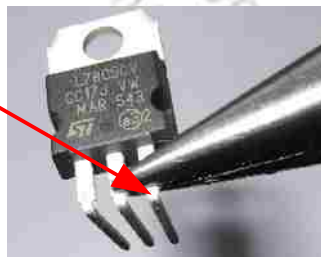
### Step 3

Fit the three 0.1uF Ceramic Capacitors ( C1,C2,C4)



### Step 4

Bend each lead of the voltage regulator (IC4) at a right angle whilst holding the thick part of the lead in pliers to avoid bending it where it enters the chip.



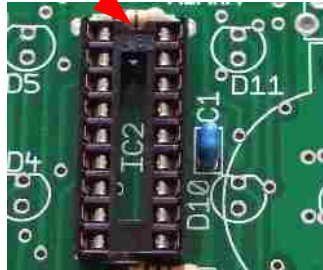
Bolt the regulator to the pcb using the supplied M3 screw, washer and nut. You can apply a small amount of heatsink compound to the mating surfaces if you wish, although it is not essential as the regulator runs quite cool in this design.



Solder and trim the regulator leads AFTER bolting it to the pcb.

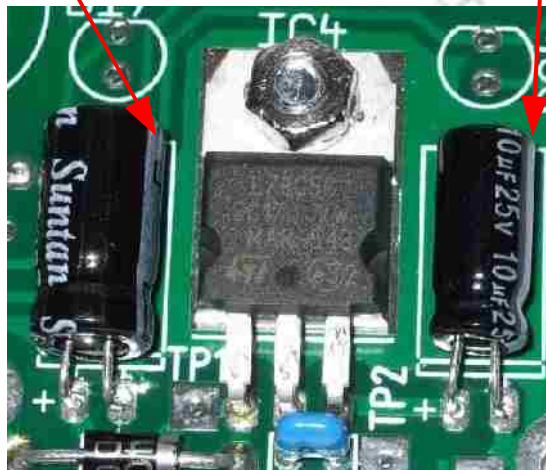
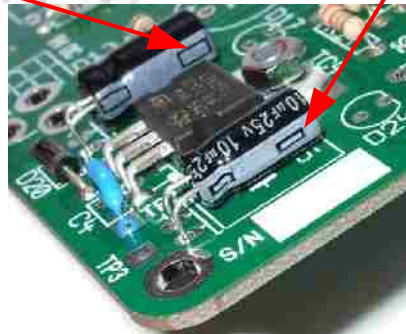
## Step 5

Fit the 18 pin socket for IC2 with the Pin1 cut-out marking at the top.



Carefully bend the leads at a right angle on the two electrolytic capacitors C3 (100 $\mu$ F) and C5 (10 $\mu$ F)

Fit them lying down on the board ensuring the correct polarity, the “plus” lead is marked on the pcb and circuit diagram but the capacitor body actually has the “minus” side marked on it. (White stripe)

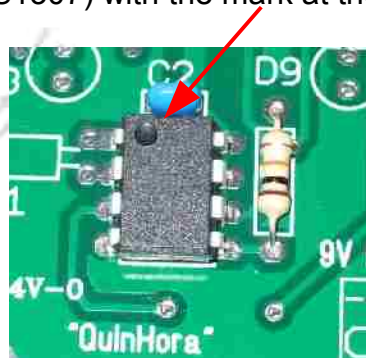


## Step 6 – Fit the Display driver and RTC chip

Solder-in the 16pin chip, IC3 (ULN2003A) with the pin1 mark matching the pcb mark at the top.



Repeat for the 8pin chip, IC1 (DS1307) with the mark at the top as before.



Fit the beeper with the “plus” matching the mark on the pcb. Leave the seal on it until the clock is finished.



### Note

You could alternatively fit the beeper on the other side of board if you want the sound to be directed to the front of the clock for extra loudness.

## Step 7 – Fitting the LEDs

Now is the time to install the LEDs, the rest of the parts can be fitted later.

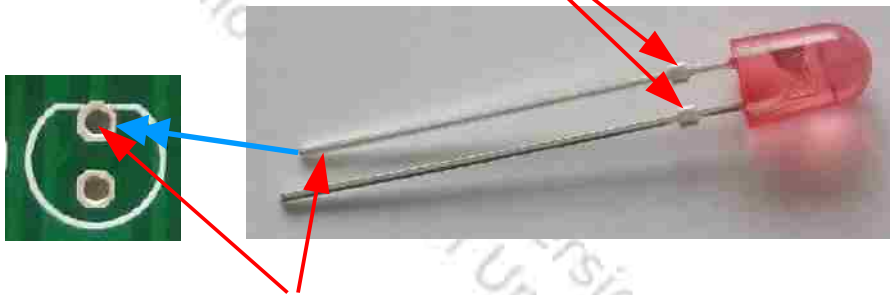
**Don't forget the LEDs are going to be fitted to the underside of the board!**

Use a slim, low power soldering iron with a small tip (about 1mm). If using an adjustable temperature type, set the temperature to about 260°C.

Do not solder a lead for more than about 3 seconds at a time and do not apply any force to the LED body whilst a lead is still hot.

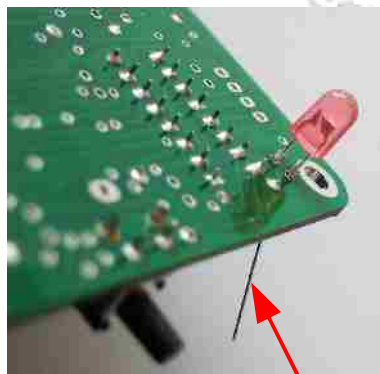
Check the LED position after soldering the first lead as it is easier to correct the error and solder the second lead when positioned OK.

Each lead incorporates a stand-off **stopper** to help achieve the correct spacing height from the pcb.



The Cathode lead is **SHORTER** and goes to the flat side marked on the pcb as shown. (These oval-shaped LEDs **do not** have any Cathode mark on the plastic LED body.)

Start by fitting one of the four Red LEDs (D5,D11,D19, D26) nearest the top of the pcb

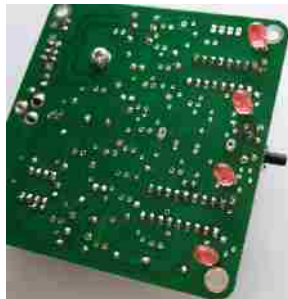


Insert it from the **UNDERSIDE** of the pcb with the shorter lead matching the cathode marking as described above (nearest the top of the pcb).

Spread-out the leads slightly to prevent it falling out, then turn-over the pcb and solder **one lead only**.

Check that there is no gap between the pcb and the stoppers and check alignment.

Re-heat the LED solder pad to adjust the position if needed, then solder the other lead. Repeat the procedure for each LED, check the alignment and height with a ruler as you solder each LED.

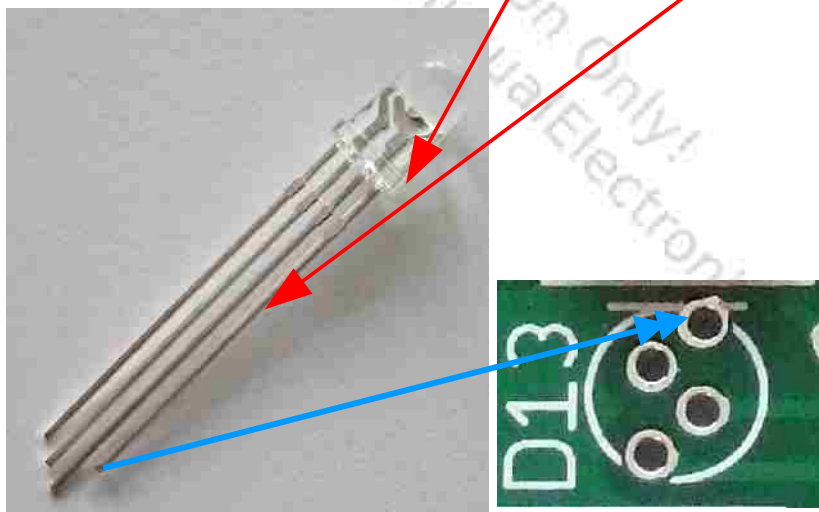


Then repeat for the four Green LEDs in the second row.

For the third row, fit the Eight Red LEDs first. Then fit the three Yellow LEDs (D7,14,22) (These Yellow LEDs are slightly smaller and need to be fitted so that the stoppers are about 1mm above the pcb to match the height of the other LEDs – check with a ruler )

Then fit the remaining row of four Blue LEDs as before.

Finally, fit the RGB LED (D13). This LED has a **flat side** and **shortest lead** that must match the PCB marking as shown.



Carefully insert the LED and push it down until it's height matches the others (use a ruler to check).

(Take extra care with soldering this LED as the leads are very close together)

## Step 8 – Fitting the remaining components.

Insert the three push-button switches (S1,2,3) fully, check alignment then solder them in.

Carefully bend the leads of the crystal (Q1) at 90 degrees and fit it as shown below.



Fit the DC power socket, applying sufficient solder to it's three pins to ensure a good, reliable connection.



Carefully insert the Microcontroller chip (IC2) into it's socket with the pin1 mark matching the mark at the top of the socket. (Make sure all of it's pins are completely aligned with their sockets as you push-in the chip)



**DO NOT** fit the battery holder yet, wait until after the initial testing to do this because it covers some of the LED connections.

Closely inspect the board on both sides, looking for any solder splashes, un-trimmed or un-soldered leads and double-check that all components are fitted the right way round.

## Preliminary Testing

Place the board on an insulated surface.

If you have a test-meter, set it to measure resistance and check for any short-circuit between the power test points TP1&TP2 and between TP1&TP3.

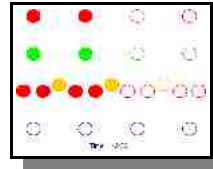
If OK, Plug-in your 9 volt DC power adapter lead and turn-on the power.

The start-up sequence will quickly light each row of LEDs, starting with the top row (Red). When all four rows are lit, the RGB led will flash Green, Red then Blue followed by a beep.

After the beep, every LED should stay lit and the RGB led should stay glowing Blue.

Press the “**Alarm**” or “**UP**” button and it should make a beep.

Press the “**SET**” button and it should go to the time set-up routine, showing the default time of 12:30 (with the Hours LEDs flashing)



**Do not try to set the time at this stage.**

If everything worked OK, you can disconnect the power and fit the battery holder. (When fitting the holder, if one of it's plastic support lugs does not fit completely flush with the pcb, you may need to trim the obstructing LED lead a bit more).

Insert the battery with the + (Positive) mark on the top.

Apply power again then after the beep, press the “**SET**” button. Change the hours time setting by pressing the “**UP**” button.

Then press the “**SET**” button twice and it should start showing your set time (with the RGB LED flashing Red)


Turn off the power for at least 10 seconds then turn on again. After the start-up beep, the time should be shown, proving that the battery and RTC chip are working.

If everything worked OK – **Congratulations!!** You can move on to the user manual or start designing a case for it.

### **Feedback**

We welcome any suggestions or comments:  
email us or use the contact form on our web site.

## Troubleshooting

Symptom	Possible Cause
No display and no beep (dead)	<p>Check D20, IC2, IC3 orientation and solder connections.</p> <p>Apply power, use a test meter to check voltage between TP3 (Ground) and TP1, it should read 9V or more. If zero:</p> <ul style="list-style-type: none"> <li>● Check that your 9 Volt DC power supply has the centre pin as + (positive)</li> <li>● Check solder joints around D20, Power socket and capacitor C3 for shorted connections.</li> </ul> <p>If the TP1 voltage was OK, check voltage on TP2 (5 volts).</p> <ul style="list-style-type: none"> <li>● If it was zero and the regulator is hot, then the voltage regulator has shut-down due to a short somewhere on the 5V power rail, - check solder joints for shorts on every capacitor, inspect the board closely, look for solder splashes.</li> <li>● If it was OK (5V), check that IC2 is correctly inserted in it's socket.</li> </ul>
Some LEDs do not work	<ul style="list-style-type: none"> <li>● Check each LED solder joint, may be either a bad connection or a short caused by a solder splash.</li> <li>● May be wrong orientation of a LED. To check orientation, shine a torch at a row of LEDs – compare their internal connections, you can see if any are different.</li> <li>● Anode  Cathode (should match pcb mark)</li> </ul>
A whole row of LEDs do not work. (or several in the “MinutesX5” row)	<p>Look at the circuit diagram and check the 100Ω resistor that feeds that matrix row of LEDs. Also check the connection from that 100Ω resistor to the pin of IC2 (microcontroller)</p>
A whole matrix column of LEDs do not work. (e.g. D3,7,16,2,4,5)	<p>Look at the circuit diagram and check the pin connection of IC3 (ULN2003) that feeds the matrix column and the corresponding pin of IC2 (microcontroller)</p>
After initially setting-up the time, the RGB LED stays solid RED (and the time does not increment).	<p>Problem with the DS1307 RTC chip (IC1) or it's connections.</p> <ul style="list-style-type: none"> <li>● Check the battery voltage (3 volts) and is inserted correctly</li> <li>● Check all solder joints around the RTC chip (IC1)</li> <li>● Check for a bad joint or short circuit to the crystal</li> <li>● Check resistors R6 and R8</li> <li>● Check joints to IC2 (microcontroller) pins 6 &amp; 7</li> </ul>
One or more push buttons do not work properly	<ul style="list-style-type: none"> <li>● Check diodes D1, D15 D28 orientation and solder joints</li> <li>● Check resistor R1 (10KΩ) connections.</li> <li>● Check pin 4 connection of IC2 (microcontroller)</li> <li>● Check all push button connections for solder splashes</li> </ul>

### For further assistance:

Email us with a description of the problem, include as much detail as possible .