Ozone Generator and Ozone PCB Tests and Fault Troubleshooting

For specific details of the BioTector analyzer model you are working on, please see the relevant BioTector analyzer manual.

Precautionary Labels Attached to the Instrument

The labels and tags attached to the instrument are summarized below. Please read all labels and tags attached to the instrument. If not observed, personal injury or damage to the instrument could occur.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td><img src="image" alt="Electric Shock Symbol" /></td>
<td>This symbol, when attached on an enclosure, indicates an existing risk of electrical shock and/or electrocution. Only qualified personnel should open such enclosures and work with hazardous voltages.</td>
</tr>
<tr>
<td><img src="image" alt="Hot Component Symbol" /></td>
<td>This symbol, when displayed on a component, identifies that the component surface can be hot. When it is necessary to work with this component, it should be handled with care.</td>
</tr>
<tr>
<td><img src="image" alt="Chemical Hazard Symbol" /></td>
<td>This symbol, when noted on a product, illustrates the risk of chemical harm due to its corrosive, acidic, caustic or solvent nature. Only qualified and trained staff should handle such chemicals.</td>
</tr>
<tr>
<td><img src="image" alt="Eye Protection Symbol" /></td>
<td>This symbol, when displayed on the product, indicates that protective eye wear must be used during the maintenance or service of the equipment.</td>
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</table>
Please ensure that all internal tubes are connected before carrying out the ozone tests to ensure the system is gas tight.

When the ozone test is complete, go to the Simulate menu, set the MFC flow to 40 l/hr and purge the lines with oxygen gas for at least 2 minutes. This will ensure than any traces of ozone are completely purged through the ozone destructor.

Electrocution Hazard.

When connecting a multi-meter to the ozone PCB to measure the current taken, or adjust the settings on the PCB, please use the following procedure:
- All electrical work should be carried out by qualified electrical personnel only.
- Isolate the system power before connecting the meter to measure current on the ozone PCB.
- The system power can be restored when the meter is connected. When taking current readings or making adjustments, contact should not be made with the meter leads, ozone PCB or any other PCB.
- Isolate system power before disconnecting meter leads from the PCB, and re-connecting the PCB wiring.

Note:
BioTectors are typically built with two types of Ozone PCBs. These are Ozone PCB “OZB 2000.1” or “81204325-02”. Please refer to figures 1.2 & 1.2 and 3.1 & 3.2 below to identify the type of the PCB installed in BioTector and follow the corresponding procedures.

Ozone Generator Operation Test

In BioTector, the ozone is generated by the corona-discharge method using oxygen gas. The oxygen gas passes through an electrical field. The electrical current causes the oxygen molecules to split into atomic oxygen. The resulting oxygen atoms, which seek stability, attach to other oxygen molecules and form ozone. The concentration of generated ozone plays an important role in the correct operation of the BioTector Two Stage Advanced Oxidation process.

To test the operation of the ozone generator, follow below procedures:

- Go to Simulate menu and select ‘Ozone Generator’ and activate the generator by selecting ‘On’.

- A pressure test cycle, which is a system safety function, will be automatically carried out before the ozone generator is switched on. Depending on BioTector software version, the pressure test cycle may not take place.

- If the pressure test is successful, which takes approximately 30 seconds, the Mass Flow Controller will automatically set to a flow rate of 10 L/h and the Ozone Generator will turn on.

- Observe and confirm that 3 green LED’s (LD8, LD1 and LD5 on Ozone PCB “OZB 2000.1” or L8, L1 and L5 on Ozone PCB “81204325-02”) are illuminated on the Ozone PCB in the electronics enclosure. See figures 1.1 and 1.2 below, which shows the Ozone PCB with the illuminated LEDs below.

- When the Ozone Generator is not activated, only the green Ozone PCB power LED (LD8 in Ozone PCB “OZB 2000.1” or L8 on Ozone PCB “81204325-02”) should be on.

- If the red LED 2, (LD2 in Ozone PCB “OZB 2000.1” or L2 on Ozone PCB “81204325-02”) is on, the lockout circuit has been activated. Reset the Ozone PCB by pressing once on the RESET switch (the white push button switch on the Ozone PCB). Note that some reset switches have a small black protection cap fitted. This cap should be removed before pressing the reset switch. See Figures 1.2 & 1.2 and 3.1 & 3.2 below for details.
When Ozone Generator is on, a high pitched buzzing may be audible from the ozone generator in the lower analysis enclosure.

After this test has been completed, turn the Ozone Generator ‘Off’.

Above test will only confirm that the ozone generator is operating. Above test does not confirm that the correct concentration of ozone is generated. In order to measure the concentration of generated ozone, using an Ozone Tester kit, follow the procedures described in information sheet “T006. Procedure to Check the Ozone Level”.

IC1, UC3824
Adjust current using P1.
Press once to reset the PCB.
Check ozone current by looping a multi-meter to wire 41 on Z9+.
Check 24 Volt DC Power supply on Z7– and Z9+

Current adjustment is typically not required.
Press once to reset the PCB.
Check ozone current by looping a multi-meter to wire 41 on Z9+.
Check 24 Volt DC Power supply on Z7– and Z9+
Ozone Current Test

In order to confirm that the ozone current is set at the correct level, follow the procedures below:
- In BioTectors built with Ozone PCB “OZB 2000.1”, confirm that BioTector has been running at least 10 reactions before the ozone current test.
- Stop the BioTector. Disconnect wire number 41 from terminal Z9 or Z10 on Ozone PCB. Using a loose terminal (flying lead), connect a multi-meter (Amp meter set at 10 Amp DC scale) in series to Z9. See figures 1.1 and 1.2 above.
- If more than one wire is connected to terminals Z9 and Z10, both must be removed and connected together using a loose terminal. Amp meter should then be connected from this lose terminal to Z9.
- Go to Simulate menu select ‘Ozone Generator’, and turn it ‘On’.
- Measure the current taken by the ozone generator. It should be 0.9 Amp. In BioTectors built with Ozone PCB “OZB 2000.1”, it should be 0.9 Amp if the system was cold, and not greater than 1.2 Amps if the system was warm and running at least 10 reactions before this test.
- In BioTectors built with Ozone PCB “OZB 2000.1”, if the current is below 0.9 Amp, use P1 and adjust the current accordingly. See figure 1.1 above. BioTectors built with Ozone PCB “81204325-02” typically does not require any current adjustment.

Again above tests does not confirm that the correct concentration of ozone is generated. In order to measure the concentration of generated ozone, please follow the procedures described in information sheet “T006. Procedure to Check the Ozone Level” using an Ozone Tester kit.

**Electrocution Hazard.**
The Ozone Generator Coil produces very high voltages. System power must be isolated during this test. Do not turn the Ozone Generator on when the generator cover is removed.

**WARNING**

High Voltage Coil Resistance Test

As very high voltages are present, please do not turn the Ozone Generator on when the generator cover is removed.

Referring to figure 2 below, follow below procedures to measure the resistances of the High Voltage (HV) coil:
- Power down the BioTector. Remove the cover of the ozone Generator.
- Measure the resistance between the low voltage + (15) terminal and low voltage - (1) terminal. The resistance should be between 2.5 and 3 ohms.
- Measure the resistance between the low voltage + (15) terminal “or alternatively low voltage – (1) terminal” and high voltage terminal. In figure 2 below, the high voltage terminal is shown at the centre of the coil, where the cable running from the coil to the Ozone Tube is displayed with a darker and thicker high voltage cable. The resistance should be between 7k and 14k ohms.
- Measure the resistance between the low voltage + (15) terminal “or alternatively low voltage – (1) terminal” and earth (see figure 2 below). The resistance to earth should be > 1M ohms.
Running voltage test across IC1, UC3824 on Ozone PCB “OZB 2000.1”

1. When the IC1 (see figure 1.1 above and figure 3.1 below) is removed from Ozone PCB “OZB 2000.1”, and when the ozone generator is turned on, the voltage from pin 7 of the IC socket to ground should be 23V DC.
2. When the IC1 is in its socket, and the ozone generator is turned on, the voltage from pin 7 of the IC1 to ground should be 14.5V DC.
3. If these voltages are not correct, check diode D3, type SA30 or SA28 and confirm that it is operating correctly.

Confirmation to signal to FET’s on Ozone PCB “OZB 2000.1”

1. When measured with a Fluke 77 meter, the DC voltage from R3 or R4 (located next to IC1, see figure 3.1 below) to ground is 11.2 V DC.
2. The voltage when measured in AC mode is 2.9 V.
3. The current taken by the Ozone PCB is 0.95A during above measurements.
Ozone PCB Fault and Ozone Current Troubleshooting

Depending on software version, the “OZONE PCB FUSE” or “09_OZONE PCB FAULT” faults occur in BioTector if the ozone generator does not initiate when it is supposed to or if its initiation is prevented by a lockout (system interlock). The possible causes for the OZONE PCB FUSE are as follows:

- The Lockout Circuit (an interlock on Ozone PCB) is activated. LED 2 (LD2 or L2) on Ozone PCB is on.
- Fuse 3 (F3 on Ozone PCB “OZB 2000.1”) or Fuse 2 (F2 on Ozone PCB “81204325-02”) is blown. LED 7 (LD7 or L7) on Ozone PCB is on.
- Sticking Ozone Relay (24V plug-in replaceable relay ‘REL1’) on Ozone PCB “OZB 2000.1”. Relay type Schrack RP3SL024 “see item Q in service kit”.
- Faulty Ozone PCB or faulty components on Ozone PCB.

Follow below procedures to identify and fix the Ozone PCB fault:

- Check the LEDs on the Ozone PCB. If the red LED 2 (LD 2 or L2) on the Ozone PCB is on, this means that the Lockout Circuit could be activated on the Ozone PCB. Replace the plug-in relay (REL1) on the Ozone PCB “OZB 2000.1”. There are no replaceable relays on Ozone PCB “81204325-02”.
- Reset the PCB by pressing once on the RESET switch (the white push button switch on the Ozone PCB). Note that some reset switches have a small black protection cap fitted. This cap should be removed before pressing the reset switch. When the PCB has been reset, LED 2 (LD 2 or L2) on Ozone PCB and LED 7 (L7) on the Signal PCB should be off. The fault can then be acknowledged in the Fault Archive menu.
- Operation of the Lockout Circuit (an interlock) on Ozone PCB: When the BioTector is operating normally, the ozone generator switches off during approximately middle of the TOC phase. Any ozone remaining in this phase is purged through the ozone destructor, which converts ozone into oxygen, out through the exhaust port. Therefore, when the sample out valve activates to discharge the oxidized liquid at the end of the TOC phase (which is the start of the Reactor Purge phase), the Ozone PCB should be off. However, if the Ozone PCB remains on in the event of the ozone on/off relay sticks on, the signal from the sample out valve is also sent to the Ozone PCB to operate an interlock, which is a lockout circuit. This lockout circuit activates a second relay, which is connected in series with the first relay, providing the lockout of the Ozone PCB with an emergency shutdown of BioTector operation. The second relay latches to prevent further activations of the Ozone PCB generating a fault condition. This fault condition shuts down the BioTector operation. Thus, a manual re-start of the system is required once the problem with the Ozone PCB has been resolved.

- If the red LED 7 (LD7) on the Ozone PCB “OZB 2000.1” is on, check and if necessary replace the fuse 3 (F3) on the PCB (see figure 1.1 above and figure 3.1 below). Check the fuse holder and confirm that the fuse holder has a tight and good grip on the fuse. Acknowledge the fault in Operation, Fault Archive menu. When the fault is acknowledged, the red LED 7 (LD7) on the Ozone PCB and the red LED 7 (L7) on the Signal PCB should be off.

- If the red LED 7 (L7) on the Ozone PCB “81204325-02” is on, this indicates that there is an overcurrent on the PCB (see figure 1.2 above and figure 3.2 below). To reset the resettable fuse 2 (F2) on the PCB, power off the BioTector, wait 30 seconds and power up. LED 7 on the Signal PCB should be off when the fault is cleared. Acknowledge the fault in Operation, Fault Archive menu. When the fault is acknowledged, the red LED 7 (L7) on the Ozone PCB and the red LED 7 (L7) on the Signal PCB should be off.

- Check all wires on the Ozone PCB and confirm that none of them are loose and all are tight. Replace the plug-in Ozone Relay (REL1) on Ozone PCB “OZB 2000.1”. Measure the ozone current referring to “Ozone Current Test” above. If the procedures above do not rectify the problem, the Ozone PCB may be faulty and it may need to be replaced.

- If there is a problem with the ozone current, for instance, if it is not possible to adjust the current to 1.0 Amp, there could be a problem with the Ozone Coil, Ozone Tube or high voltage cable located inside the Ozone Generator box (see Figure 2 above). There could be a short in the wiring to the coil or a short in the coil itself. Follow the procedures “High Voltage Coil Resistance Test” and “Output Voltage Test” described above. Depending on the findings, one or more of the components inside the Ozone Generator may need to be replaced.
Figure 3.1: Ozone PCB “OZB 2000.1” Layout

Figure 3.2: Ozone PCB “81204325-02” Layout
Compatibility between OZB 2000.1 and 81204325_02 ozone PCB’s.

Note that ozone PCB’s OZB 2000.1 and 81204325_02 are interchangeable.

Figure 4.1: Ozone PCB OZB 2000.1

Figure 4.2: Ozone PCB 81204325_02