Oberheim Echoplex Digital Pro Troubleshooting Guide v1.0

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1. Power Up Problems

1.1 Nothing happens When power switched to “on”

Problem:

Power switch turned on, no LED’s flash or light up, no response from unit.

Possible Causes:

- AC power cable not connected.
- AC power outlet not functioning
- Fuse blown. Turn power off and unplug unit. Check fuse with ohm meter. If it is blown, there may be a reason. Check for power-ground shorts. Check that transformer is connected properly (not installed backwards).
- Check system power voltages. There may be a problem with power-ground shorts, a bad component, or a faulty regulator. Good test points:

```
U40/p16:    5V    (digital power 1)
U18/p20:    5V    (digital power 2)
U1/p4:      +12V  (analog positive)
U1/p11:     -12V  (analog negative)
R89/p3:     +5V   (analog 5 volt)
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- Check rectifier output. Failure could be the rectifier diodes or the transformer:

```
U31/p1:     +14V to +20V      (analog positive)
U32/p2:     -14V to -20V      (analog negative)
U40/p1:     +7V to +12V       (5V power)
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- Check that power switch functions correctly. (Use ohmmeter)
- Check that voltage selector switch is set correctly. Use ohmmeter to check that it works properly.

1.2 Random LED's come on at power-up, never change

Problem: Unit never boots, random LED's on display, unresponsive to switches

Most likely causes:

- EPROMs (U34, U35)not installed, backwards, inserted wrong, or misprogrammed
- Pals (U29, U33) not installed, inserted wrong, misprogrammed
- 74LS138 (U41, chip select decoder) bad, missing, or inserted wrong. This part controls the chip selects to the front panel latches. Check that the processor is active and asserting address and enable inputs to U41. If those are valid, check for chip select pulses on pins 10, 12, and 13.

Other possible problems:

- Audio codec missing or malfunctioning. (That part is responsible for generating the system clock)
- No system clock. Check U16/p2 for 16Mhz clock. Clock is generated by U8 (audio codec), check that U8 and crystals Y1, Y2 are present. These parts may be bad, try replacing them. Otherwise BrotherSync clock circuit may have a problem, try disabling it by removing CR12 and CR13.
- Processor not coming out of reset. Check to see if the processor is active by checking the address lines on the EPROMs. Check that U19/3 is going high (reset). If not, check the power on reset circuit. (R80, C92, U15, U19)
- Check for bad solder joints on processor socket, etc.
- Try replacing processor.
- Front panel latches not functioning, (U18, U30, U45, U26)
- Bad solder joints on ribbon cable connectors to front panel.

1.3 Startup Screen comes on and constantly repeats (rebooting)

Problem:

When power is turned on, the start up screen displays, and then constantly repeats. The unit keeps rebooting, never getting to the play mode.

Most likely causes:

- This problem is caused by something basically wrong with the memory system.
- SIMMs installed improperly or missing. Check that simms are firmly in their sockets and no debris is in the way.
- SIMMs malfunctioning. Check one pair at a time in Bank0 to see if one of the simms is bad. Try replacing them with new ones.
- Pal U33 (DRAMLOOP) is programmed wrong or inserted improperly. Replace it with a known good pal. This pal controls memory access and refresh.

Other possibilities:

- U29 (DECLOOP pal) is bad, misprogrammed, or has poor connections.
- U24, U23 might be malfunctioning. These make up part of an important timing circuit for the memory system. Also check R81, R82, C98, C99.

2. Basic Functional Problems

2.1 Switch Test Failure, front panel switches not working

Problem: Switch Test producing incorrect values or not working at all.

Operation: The switches are just momentaries in series with a resistor. When a switch contacts it sets a voltage by creating a voltage divider with it's resistor and R65. This voltage is read by U12, the ADC0804. The switch voltage is multiplexed to the ADC through U6, a 74HC4053 analog switch.

Problem Causes:

- If incorrect values are being displayed for switches, the switch resistors (R90-R95) are probably the wrong values.
- A switch may be stuck pressed, that would cause all the other switches to misread because switch resistors would be in parallel in the circuit. This may be the case if something other than 7F is displayed when no switches are pressed.
- Since Record (SW3) is required to start the test software, a total failure of the switch test would actually mean the test software would never start. If the processor is otherwise running, there is a likely problem with the switches or in the path from the switches to the ADC. Check that SW3 is working.
- Check the path from the switches to the 4053 analog switch U6. While pressing and releasing switches, check that voltage changes are occuring at the resistor next to the switch. Than check the input to the buffer amp U5 p12. Check that the voltage changes are occuring at the input to the analog switch, U6/p2.
- Check the operation of the 74HC4053 analog switch U6. During normal operation the switch voltage is multiplexed with the feedback pot voltage in U6. You should be able to see the control line pulses with a scope, U6/p10. Looking at the output of U6/p15 with the scope you should see a square wave consisting partly of the feedback pot voltage and partly of the switch voltage. (You will only see the switch voltage as dc during the switch test) Check that the voltage changes are getting to the ADC0804, U12/p6. If it gets that far than the problem is likely with U12, the ADC0804. Check it's connections or replace it.
- If voltage changes are being read incorrectly, but the resistors are correct, it could be that the regulator voltages are way out of tolerance. That would cause the ADC's supply to be significantly different from the switch supply. This would cause misreads of the switch voltage.

2.2 Footpedal Switch Test Failure, Footpedal switches not working

Operation: The pedal switches are in parallel with the front panel and work in the same way.

Problem Causes:

- Check that the footpedal is ok and that the switches are functioning correctly. Replace switches or resistors in the pedal as necessary.
- Check that the connection cable is ok, replace if necessary.
- Check that the pedal jack J5 is ok.
- Check that switch closures on the pedal result in voltage changes at the buffer amp input, U5/p12. From that point on it is the same as the front panel switches. (They operate in parallel)

2.3 Display Test Failure

Operation: Display data for the LED's and 7-segment LED's is latched off the data bus into several 74HC374 registers. The clock inputs of the registers is controlled by the 74HC138 decoder. The 7-segments are strobed, so only one is on at a time. The data for a given digit is latched in U22, and U18 controls which driver is on.

Problem causes:

- If one of the LED's does not light or displays the wrong colors during the display test, it is probably either bad or backwards. Replace or correct as necessary.
- If replacing does not fix it, check the output of the LED register for that LED. (U30, U45, U26). It should switch at some point during the test when that LED is supposed to light. If it does switch, then the problem is in the path to the front panel. Check the resistor pack and the flat cable connections.
- If one secgment of a 7-segment LED fails to light, and that segment lights on the others, that 7-segment LED is bad.
- If the same segment fails to light on all of them, the path to the components has the problem. Check the flat cable, RP3, RP4, and the outputs of U22.
- If one 7-segment totally fails to light, check that the drive control on U18 is going low. Check that the driver transistor for that LED is ok. (Q7-Q12). Check the flat cable. If those are ok, replace the 7-segment LED.

2.4 Memory Test Failure

Operation: The simple memory test writes the address as data to the DRAM simms, lets it sit for a short while for refresh, and then checks to see if it is all still there. The separate memory tests work the same way. If it reads an incorrect value it will turn the LED red. I think it then loops reading that address so it can be checked with a scope if necessary. The current test needs some memory to run, so if memory is totally failing

the test won't start, and you will see the system reboot itself after the startup screen. Future test versions will change that.

Problem causes/troubleshooting:

- Check that simms are installed, and the pairs in a bank are the same size.
- Check that simms are inserted correctly in the sockets
- Check that the sockets are ok, no contacts are broken or bent, no debris in the socket.
- Try replaceing the simms, it is not uncommon to find bad simms. This is usually the problem.
- If known good simms still fail, check the sockets and their solder joints.
- Make sure the DRAMLOOP pal U33 is installed and programmed correctly. Check the DECLOOP pal U29 as well.
- Check that U42, U43, U44 (74HC157 2:1 mux) are operating correctly.
- Check that the refresh timing circuit (U23, U24, R81, C98, R82, C99) are the correct values and have pulses going through.

2.5 MIDI test failure

Operation: The midi test sends data out the MIDI OUT jack and reads it back in the MIDI IN jack. If it doesn't get the correct data back, the LED turns red and it will continue sending data for debugging with the scope.

Problem causes:

- Make sure a good midi cable is connecting MIDI OUT to MIDI IN.
- With the midi test running, check that data is being transmitted from U17/p6, the MC6850 uart. If not, check that the control signals to U17 are being asserted by the processor. Check that the data bus is active. If those are fine, replace the 6850.
- Check that data is being transmitted through the buffer U16 properly, replace as necessary.
- Check that the data is getting to pin 5 of the MIDI OUT jack, J7. Make sure J7/pin 4 is pulled up to +5V through R70. Make sure data is transmitting through the jack ok, and it is not damaged or the solder joints are not broken.
- Check that data is arriving at J8/pin4, and that the solder joints for the connector are ok. Data should arrive across pins 1 and 2 of the optoisolator U13. Replace or resolder jack if necessary.
- Check that the data is transmitting through the optoisolator, U13/pin 4. Replace or resolder if necessary.
- Check that data arrives at the uart, U17/pin 2. Replace if necessary.
- Check that midi in data is transmitted back out the midi thru jack J6. If first travels through buffer U16 pins 5/6 and pins 9/8. Make sure the jack J6 is not damaged and the solder joints are ok. Make sure pin 4 of J6 is indeed pulled up to +5V.

2.6 EEPROM test failure, problems saving Parameters

Operation: Data is sent to the eeprom U21 from latch U18/p9,p12. Data out of the eeprom goes to U9/p8. Chip select is asserted by U26/p2. The eeprom test writes the default parameters to the serial eeprom and reads them back to check. The eeprom can also be checked in normal operation by changing some parameters, doing a powercycle, and checking that the changes were stored.

Problem causes:

- LoopIII v5.0 has one known bug, which is that the eeprom test in the built-in tester does not work. When the test software is updated, this will be fixed. Until then, test the eeprom by storing parameters in normal mode.
- If the the eeprom U21 is not storing properly, check it's solder connections. Check that pulses are at the register and go to the pins on the eeprom.
- If those are fine, try replacing the eeprom U21. If the unit is very old, there is some small chance that the eeprom is worn out. Those parts can only endure a finite number of write cycles, about 100,000. It should take a while to do that many, but you never know.

2.7 Problems with feedback knob test

Operation: The feedback knob R89 sets a voltage as a voltage divider. The analog switch U6 routes it to the ADC0804 by first selecting between the feedback knob and the footpedal jack, and then selecting between the feedback and switch voltages. This voltage is read by U12, the ADC0804. The feedback test displays the hex value, between 0x00 and 0xFF.

Problem causes:

- On old software (v3.2 and previous), the feedback test would sometimes crash if the analog +5V regulator had a significantly lower voltage than the digital +5V. These problems have been corrected in LoopIII v5.0. Either use the new software or change the regulators. The new software is tolerant of max deviations in the regulator voltages for all it's functions.
- Check that there is no cable inserted in J3. The processor will detect this and try to read from the pedal instead of the knob.
- Check that the pot has 5V on one end and ground on the other, and that the wiper is indeed settiing a voltage between these.
- Check that this voltage is getting to U6/p13.
- Check that the switch is selecting the R89 pot instead of the pedal, and that the voltage is on U6/p14. If it is not switching, check that there is no jack in J3. Also check that the PEDCONN signal coming from J3 is at ground. PEDCONN can be easily checked at U9/p14. If PEDCONN is high, the processor will decide that a jack is in J3 and select that voltage. If there is no

jack inserted in J3, clean the connector, check that the contacts are not bent, and check it's solder joints

- Check that the switch U6 is selecting between the feedback pot and the panel switch voltage and that the feedback voltage is present at U6/p15. In normal operation, this switching will occur constantly, so the voltage will appear as part of a square wave at U6/p15. (The switch voltage will be the other part.)
- Check that the voltage gets to the U12/p6, the ADC0804.
- Check that the display shows the feedback covering the full range. It should travel between 0x00 and 0xFF. The software will tolerate some deviation from this in normal operation. Probably 0x02 to 0xFD is acceptable. If it is significantly different from that, check the regulator voltages and the supply inputs to the ADC0804 and the feedback pot.

2.8 Problems with feedback pedal test

Operation: The feedback pedal works by having a variable resistance plugged into the tip and sleeve of the feedback pedal jack, J3. The variable resistance creates a voltage divider with R39. This voltage is read by the ADC0804 U12, and used to set the feedback level in the processor. The processor determines if the a connector is present in the jack by looking at the contact point on the ring of the jack. This is the PEDCONN signal, and is low when no connector is present, high when a connector is inserted in J3. This signal is regularly latched to the data bus by U9. If a connector is there, the processor sets the analog switch U6 so the voltage generated by the pedal is routed to the ADC0804. The processor reads this regularly to set the feedback value.

Problem causes:

- Make sure the pedal used in the feedback jack J3 is the correct type. It must be a passive type that connects the output directly to the wiper of a potentiometer. With a passive volume pedal, this means plugging a 1/4" cable into the "output" jack of the pedal, then to the feedback jack of the Echoplex.
- The potentiometer should used in the jack should be 20k ohms or greater. If it is less it won't go to full scale.
- Make sure the feedback pedal jack J3 is not damaged, the connector tabs are not bent, and the solder joints are ok.
- Check that PEDCONN is going high when a plug is inserted, and low when it is removed. This can be seen at U9/pin 14.
- Check that the pedal in the feedback jack is able to swing the voltage between 0V and something close to +5. This can be checked at the buffer amp, U5/pin 10.
- Check that the amp is outputing the dc voltage at u5/pin8.
- Check that the voltage is present at U6/pin 12, the analog switch.
- Check that the voltage is being routed through the switch correctly, looking at U6/pin 14 and U6/pin 15.
- Beyond that it should be just like the frontpanel feedback pot operation, going to the ADC0804, U12, and being read by the processor.

2.9 Jack input tests fail

Operation: The jack test checks if three of the rear jacks are receiving inputs properly. These are J4, J9, and the ring of J10. The line is normally pulled hight. A switch closure at the jack is routed through a buffer to a register, where it is latched to the data bus when the processor checks for the input. The test turns an LED red when the switch is pressed.

Problem causes:

- Check that a 1/4" cable is used with a momentary switch. For J10 in the test, the plug should only be connected part way to get the ring instead of the tip.
- Check that the jack is clean, not damaged, and the solder joints are ok.
- Check that the level change gets to the buffer. U15, U24, or Q6 depending on the jack.
- Check that the buffer output gets to the register U9 properly.
- Check that components are correct value, that U19 is an open-collector 74HC03.

2.10 Sync pulse output tests fail

Operation: Jacks J9 and J10 are bidirectional. The sync test sends our a pulse to check the output. The pulse is transmitted by a 74HC03 open-collector gate to achieve wire-OR between units and allow for bidirectionality.

Problem causes:

- With the sync pulse output test running, check for a pulse with the scope on J9 tip and J10 ring. J10 tip will have the BrotherSync pulse, which is always going.
- Check that the jack is not damaged or dirty, solder joints are ok.
- Check that the pulse appears at U19/p8 for J10 and U19/p11 for J9.
- Check that the pulse is present at the register output. U10/p9 for J9, U10/p12 for J10 ring.

2.11 BrotherSync failure

Operation: The BrotherSync circuit is a little difficult to understand. It is basically an open loop sort of pll-like circuit. The circuit compares the internal clock to the external clock from another unit. If the internal clock is faster, it the circuit slows it down a little by applying a voltage to varactor diodes across the clock crystal. The other units on the brother line will be doing the same, and they should lock into the same frequency within a second or so.

Problem causes:

- Check that a TRS or stereo cable is being used to connect the units together.

- Check that two units lock together and create a square wave on J10 tip. If they don't you will probably see a strange sort of waveform that looks like two square waves moving against each other. The most likely problem is that the crystals in the two units are too far away from each other in frequency. The cirucuit can only pull the clock frequency a small amount, and if one clock is very slow or very fast they won't lock. Cheap crystals from different manufacturers can have widely varying frequency tolerances. If the crystals are from different manufacturers, try replacing one so they are the same. Try using better tolerance crystals, at least +/-50ppm. +/-30ppm is better.
- With the cable unplugged, check that a pulse is being generated on J10/tip. If not, check the output of U19/6 for the pulse. Check that the clock divider circuit of U25, U20, and U14 is working and generating the pulse.
- With the cable connected to both units, check the output of U20/pin12. You should see a funny pulse modulated wave. This is the signal trying to slow down the clock. If it is not there, check that U15, U23, U14, and U20 are functioning. Also check that Q13 is inserted correctly.
- Check that varactors CR12 and CR13 are not inserted backwards.

3. Audio Path

3.1 Direct Audio path problems

Operation: Audio at the input passes through a preamp with gain controlled by the input volume knob. The direct audio path goes to a mix circuit controlled by the mix knob, setting the mix of direct and wet audio. This passes through an output amp, with level control from the output volume knob. This goes to the output jack.

Problem causes:

- Check that the volume pots R86 and R87 are set reasonably, and that the mix knob R88 is set to direct (counter-clockwise). Check that the audio source is on. Check that the amplifier for the output is on.
- Check that the +12 and -12 supplies are at the correct volage and present at the opamp power pins. If not, check the regulators and look for shorts.
- Use the scope to check that the audio is present at the input jack J1 tip. Check that the jack is not dirty or damaged, and that the solder joints are ok.
- Check that audio appears at the output of the first amp, U1/p14.
- Check that audio gets to the output of the volume control circuit, U1/p1. If not, check the flat cable connections to the front panel and the input volume pot R86. Check that the solder connections are good, especially on the pot.
- Check that audio is present at the buffer in to the mix control, U2/p1.
- Check that the audio is present after the mix control, at U1/p8. If not, check the flat cable connection to the front panel and the and the mix pot R88. Check solder connections on the pot.
- Check that audio is present after the output level control, at the output amp U2/p7. If not, check connections to the front panel and the pot R87.
- Check that audio is present at the output jack J2 tip. Check that the jack is not damaged or dirty, and the solder joints are ok.
- Check that the power down mute circuit does not have any diodes or transistors inserted backwards. The voltage at the base of Q1 should be low and the transistor should not be on.

3.2 Audio Passthrough Test Failure / digital audio problems

Operation: The audio passthrough test turns the input and output VCAs fully on. Audio from the input passes through the input VCA to the audio codec. The audio is sampled to digital and immediately converted back to analog at the codec output. The output audio passes through the output VCA to the mix circuit, and to the output path.

Problem causes:

- Check that the direct audio path is ok. That will take care of the input preamp, the input volume, mix control, output volume, and output amp.
- Check that the audio source is working and that the mix circuit is set fully wet for the passthrough test. (Clockwise)
- Check that audio is making it through the input VCA and it's buffer amp by checking U5/pin 1. If not, replace the VCA U3. Quality on these parts can sometimes be poor. Use the premium grade of the PA 381 from OnChip systems to replace it. The premium grade is tested more thoroughly, to higher standards. If that isn't it, check that the control input of the VCA U3/pin2 is high. Check the power supplies to the opamp U5.
- Check that audio is making it through the codec U8, by checking R45 on the side towards the codec. If not, try replacing the codec. (Make sure the audio test is actually running)
- Check that the ouput half of the VCA is working by checking it's output buffer amp, U1/pin 7. If not, try replacing the VCA U3. If that isn't it, check the control line to the VCA and the power supplies on the opamp U1.
- Check that audio is present at the mix pot R88. It should be on both sides. If not, check the solder connections for the flat cable and the pot.

3.3 Excessive codec offsets

Operation: The audio codec can generate a dc offset in the digital audio stream due to imperfection in the chip and thermal variations. The codecs can recalibrate themselves to fix this problem, which is done regularly by the software during actual operation. In some rare cases the offsets can be extreme and the recal routine will not fix it. Most codecs don't have this problem, and it only appeared for the first time after 3 years of production. When this is happening the feedback LED will come on during normal operation showing a digital level when there is no input. There is a test function to show the dc offset generated by the codec. It works by adding a few thousand samples at a time and displaying it. If there is no offset it will be zero. Positive offset will count up to a max of 0x7F. Negative will count down from 0xFF to a minimum of 0x80. Normally the offset read is between 0x00 and 0x30 or 0xFF and 0xD0. If it is outside of this range there may be a problem, but that doesn't appear to be a good indicator that the huge offset problem will occur. Future tests will check this better.

Problem causes:

- The codec U48 is not functioning properly. This appears to be very rare and may just be a bad batch of parts. Replace U48 with another CS4248.

3.4 VCA Problems - Trimmer adjust/VCA test fails

Problem:

VCA test waveform does not appear at output when the trimmer is being set, digital audio path not functioning or producing severely distorted signals, DC pops at audio ouput whenever digital audio path turned on.

Most likely cause:

VCA (U3) is bad. The audio pass through test should also fail. Replace U3 (PA381). The manufacturer of this part doesn't seem to screen them very carefully and bad lots sometimes get into manufacturing.

What should be happening:

For the VCA test, the processor generates a square wave pulse on the SIN signal. This signal originates on U10/p19, passes through the analog switch U11 (from pin 12 to pin 14), and terminates at the control input of the VCA, U3/pin2. The VCA is pulsed on and off, and any offset will be amplified through the audio path as a low frequency audio waveform. Adjusting the trimmer R5 will change the amplitude of this offset.

Other possible causes:

- Malfunctioning VCA's can often be detected by the DC voltages on the pins. Pin 3 and pin 5 will often have -12V on a bad part. You should see:

```
pin 1:   0V
pin 2:   0V
pin 3:   -1V to -2V
pin 4:   -12V
pin 5:   -1V to -2V
pin 6:   0V
pin 7:   0V
pin 8:   +12V
```

- Make sure output volume (R87) is turned up
- Make sure Mix (R88) is set to Loop (clockwise)
- Make sure the processor isn't crashing. If you can't exit the VCA test it has crashed. Go to the section on processor problems.
- Control signal not reaching U3. With the VCA test running, check for low frequency squarewave at U11/14 and R22 (the pin away from U3, it will be more of a triangle wave here). You won't see pulses at U3/2 because it is a current control input. If you see the pulse on U11 and R22, the control path is fine. If there is nothing at U11/p14, check pin 12 for the pulse, and check that U11/p11 is high to set the switch correctly. If those are correct, U11 may be the problem. If not, check U10/19. If there is no pulse there is a processor problem.
- VCA output buffer problem. With the VCA test running, Check U5/p1 for the test waveform. If it appears here, the VCA and it's control are working

fine, the problem is in the audio path. Go to the sections on audio path problems. If the test waveform doesn't appear here, but the VCA and control path appear fine, the buffer U5 may have a problem, try replacing it.

- Trimpot problem. If the VCA test waveform appears but won't adjust, check the trimpot R5. The DC voltage on the wiper should change as the pot is adjusted. It should vary between -1.2V and +1.2V.
- Limiter circuit problem. If the control signal is getting to R22, the VCA pin voltages appear ok or a known good VCA doesn't work, the buffer U5 is ok, the trimmer is ok, etc, but the VCA test still fails, there may be a problem with the limiter circuit. Disable the circuit by removing Q3, check if the VCA test works now.

3.5 Input LED not changing green-orange-red

Operation: Input audio is rectified by U4/pins 12,13,14 and diodes CR3, CR4. The other three opamps in U4 are comparators to turn the input LED on green at lower levels, then orange at higher levels by turning on green and red, and then only red at the highest levels.

Problem causes:

- If the LED is not coming on in the right sequence, it is probably backwards.
- If it doesn't come on at all, it is probably bad, or there is a problem with the solder connections on the flat panel connection.