**Power output failure and how to deal with it.**

The most common fault a transistor amplifier can have is blown or shorted power transistors. The reason for the fault is often unknown. This document explains the reasons for their failure, the indications of a fault and how to change the transistors and re-test the Destiny amp.

**<u>These are some of the reasons why a fault may have occurred:</u>**

1. The loudspeaker terminals or cable have been shorted together by the user, while a signal is being passed, causing an overload. Even though there is protection circuitry involved it may not always protect the amp.
2. The amplifier has become unstable, due to an unacceptable load condition, or general fault in the power amp circuitry, causing the transistors to overheat.
3. The power transistors were not correctly fitted with sufficient thermal grease, causing one or all of them to overheat. A compensation component or other device may have failed.
4. The power transistors were not correctly screwed or clamped to the heatsink, causing them to overheat.
5. The wrong bias (idle) current was applied, causing thermal runaway and overheating.
6. The thermal sensing transistor is not in proper contact with the heatsink, causing the idle current to rise to an unacceptable level.
7. The gate of one or two P channel driver transistors (Q12, Q112, or Q0 and Q100) is leaking, (due to static damage) which causes the bias current to be unstable and incorrect, leading to thermal runaway.

**<u>These are a number of indicators that some or all the power transistors are broken:</u>**

1. The channel that is broken will normally blow the (10Amp) AC power supply fuses. The Destiny amp has separate pairs of fuses for each channel, so one channel can continue to work even if the other has failed and its fuses are blown.
2. If one or two cascode transistors (Q17, Q18, or Q117 and Q118) are broken (open circuit), the conditions may not cause the AC power supply fuses to blow. The amp will simply not pass a signal and not draw excessive current. It will be like a switch that has turned off the output stage.
3. It is more normal for the 2 amplifying transistors (Q15, Q16, or Q115 and Q116) in the output to fail short circuit. Creek Audio recommends changing all 4 transistors in the output with the same transistors (Fairchild - HUF76639P3, 100V, 50A, N-Channel), even if they don't all measure as dead.

4. Measurement between the Source and Gate pins, 1 and 3, will normally show a short, if the transistors are broken. Otherwise they will show the same resistance as the fixed resistor (R22, R24, or R122 and R124) soldered across them = 240 Ohms.

**What to do when changing the power transistors:**

1. Remove the heatsink carefully by first un-screwing the metal blocks from the front of the transistors and unplug the temperature sensor that enters from the input PCB side first, leaving the wires and plug hanging out from the fins during the repair. Remove the plastic clamp that holds the sensing transistor to the face of the heatsink carefully.
2. Carefully save the mica-washers that isolate the transistors from the heatsink. Remove any surplus silicon grease. Check to see if there is a hole in the mica-washer. If there is, it must be at the top, not underneath the body of the transistor. Check them for cracks and replace if broken. They are brittle so take extra care when handling. It is best to use a rectangular TO-220 mica with no hole, or a triangular TO-3P mica-washer turned sideways with its hole and extra material cut off with scissors, to turn it from a triangle into a rectangle without a hole.
3. Remove broken transistors, which are soldered to the top and bottom of the double sided PCB. It is easier to cut the pins close to the body of the transistor and then use tweezers or pliers to pull each pin out separately, while heating the joint with a soldering iron. It is not necessary to remove the PCB as the transistors can be completely replaced from above.
4. Replace the transistors with new ones, being careful not to break them with a static-discharge when handling them. Set them all to the same height as before so they can be pressed to the heatsink by the metal blocks.
5. Grease the back of the transistors and then place the mica-washers onto them. Spread a small amount of grease to the mica-washer, so that it fully covers it when bolted back to the heatsink and doesn't spill-out too much from the sides afterwards.
6. Reassemble the heatsink over all four transistors with the metal clamps resting on the front of them both. Level the blocks and tighten the 4mm hex-head bolts to clamp the transistors to the heatsink tightly.
7. Screw the heatsink to the bottom of the case with 2 screws previously removed.
8. Tighten the bolts holding the metal clamps down hard with an Allen Key, but not so hard they damage the transistors. Check to see that the mica-washers are fully covering the face of the transistors and not allowing any part of them to touch the heatsink directly.
9. Apply more grease under the flat face of the small transistor first, if necessary, to give a good thermal connection between the transistor and the heatsink. Screw the plastic clamp back so that the small sensing transistor (Q13 or Q113) is touching the heatsink.
10. Reconnect the temperature sensor (LM19), from between the fins of the heatsink to the input PCB (Connector JP704 or JP705).

**Testing the reworked amplifier:**

1. Since the characteristics of the replacement transistors will be a little different to those you have replaced, it is necessary to adjust the bias (idle) current before returning the amplifier to normal use. Provided the correct transistors are used the adjustment should not be difficult.
2. It would be ideal if the engineer repairing the amplifier could us a bench power supply to limit the current to the circuit during the delicate first few milliseconds of its new life. However, few if any service technicians own adjustable regulated power supplies and even if they do, they rarely provide enough power to run the amp exclusively at full power. Anyway, it would be our wish to see the amp switched-on slowly, with a current limit of about 100mA maximum used to begin with. Voltage should be increased from 0 to +/-50V. Note that adding external DC is best done by removing the mains transformer AC secondary wires from the PCB plug-in terminal (PL201) and using this port to input DC. It doesn't matter which way round the -/+Vs are added, since it is followed by a rectifier, which sorts out the polarity automatically.
3. Be aware that the power supply storage capacitors will sink a lot of current to charge them initially. Therefore, if you are checking the initial current, be prepared to see it jump briefly and then drop until the capacitors are charged.
4. Do not connect any form of load to the output of the amplifier until the initial (idle) current has been adjusted, as any instability will cause a heavy current to be drawn and possible further damage to the output transistors.
5. Use a milli-volt meter to measure the voltage across the test pins JP3 or JP103 and adjust pre-set VR2 or VR102 for 600mV +/- 10mV (0.6V +/-10mV).
6. Use a milli-volt meter to measure the voltage drop across the IDLE measurement terminals (JP4 and JP104). Initially, the voltage drop, which is across the top-half (0.33 Ohm) source resistors (R26 and R126), should be less than 50mV. If it is 50mV or higher, turn the IDLE adjustment pre-set (VR1 or VR101) anti-clockwise to reduce the current a little.
7. Setting the IDLE current takes about 10 minutes, since it is important to o so only after the heatsink temperature has reached room temperature (25 – 35 degrees C) (77 – 95 degrees F).
8. When the optimum temperature has been reached, use a small trim tool to adjust the IDLE preset (VR1 or VR101) to measure 21.5mV (+/- 0.5mV), across the 0.33 Ohm resistor. Preferably use a tool that is not a screwdriver, which could short out the amp circuit if accidently dropped inside. The measurement 21.5mV (+/- 0.5mV), is equivalent to an IDLE current of 70 – 72.5mA's.
9. The adjustment is very fine and requires a bit of patience to get right, as once you have made an adjustment, the measurement may drift a little afterwards.
10. Once you are satisfied with the IDLE current setting, it should be safe to apply a load (resistor or speaker) to check if the current consumption rises.
11. If all is well, it is safe to re-assemble the rest of the amplifier and try it with a music signal source.