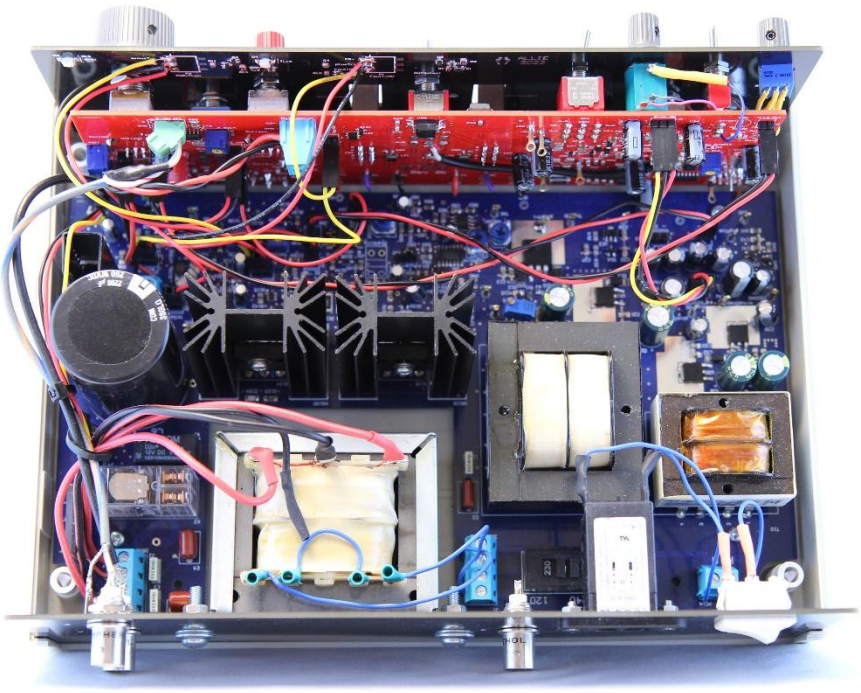
Main Board
Construction & Installation Instructions



1. Solder all the SMD components to the Main on both sides.
2. Add the trimmers. Put them in the mid position.
3. Add all the terminal blocks.
4. Add the transformer filter capacitors, C1 and C2, C3, C4, C5 and C8.
5. Add all the test point, although you could leave out a few marked GND on the edge of the board.
6. Add all the .1 connector strips.
7. Add a jumper to P1-En
8. Add a jumper to J50, the Z-pulse direction. Set it to the left position.
9. Add the main voltage selector switch. With the switch showing the 230V marker, the 230 indicator should be on the side pointing to the J1 connector block. The new pn in the BOM has not markings on it anymore. This avoids a wrong placement and or confusion.
10. **Select the right main switch voltage.**
11. Check with a DMM in the Ohms position if there are no shorts between ISO and plusStep, ISO and minStep, GND and plusTri, GND and minTri, GND and xyPlus and GND and 7.5V.
12. Add T10, the supply rail transformer.
    Note: the leg numbers are flipped from the silkscreen:

Pins 1234 on the xfrmr are actually pins 4321 on the board. The secondary pins 5678 are actually 8765 on the board.

13. On the back plate, install the C8 receptacle with the filter. Install the main switch and add the three BNC connectors with the ground lugs.
14. Connect the main switch to the C8 receptacle with a wire and isolate the connections with shrink wrap tubing.
15. Put the Back plate in the bottom of the enclosure. This is the side with the low flanks.
16. Position the Main board in the enclosure but don't screw it down yet.
17. Connect one side of the switch and one side of the filter with wires to J3, the mains input connector on the Main board.
18. Connect a DMM between an ISO test point and minusStep.
19. Add a mains power cable and connect it to mains. **Be careful not to touch the mains related parts from now on.**
20. Before you turn on the instrument and verify that you have -15V, make sure all the THT electrolyte capacitors for the rails are installed.
21. Connect the DMM between ISO and plusStep and verify that you have +15V.
22. Connect the DMM between GND and plusTri and verify that you have about 10V.
23. Connect the DMM between GND and minusTri and verify that you have -5V.
24. Connect the DMM between GND and xyPlus and verify that you have at least 24V.
25. Connect the DMM between GND and 7.5V and verify that you have 7.5V.
26. Turn off the power.
27. Use a scope and connect one channel with the GND lead to a GND test point and the probe tip to the Tri test point.
28. Turn on power and verify that you have a triangle waveform.
29. Turn trimmer Pot52, marked Freq and verify that you can change the frequency of the triangle. Set it to about 160Hz.
30. Turn trimmer Pot51, marked 0V Adjust and verify that you can adjust the bottom of the triangle waveform a little above and below the GND level. Adjust it at about the GND level.
31. Connect the probe tip to the Rect test point and verify that you have a rectangular waveform.
32. Switch off the main power and remove the power lead.
33. Disconnect the Scope probe and disconnect the mains wires going to J3 so we can remove the Main board.
34. Add the two relays, K1 and K2.
35. Add the bridge D4.
36. Add C6, the main capacitor.
37. Prepare the main transformer.

    Refer to the Above_from_Back.jpg picture for details for my 230V version and the J1, J2 and J3 connections.

    The transformer can be mounted to the bottom of the enclosure, but you'll have to be very careful that the nuts and bolts don't touch the bottom of the Main board. You can also mount the transformer to the Back plate, by putting it on its back, lying on the bottom of the enclosure. This is what I did and the pictures show. If you do that, make sure that the Back plate can be

fully inserted into the bottom of the enclosure. Drill holes that are a little larger than the bolts you will use. I used 4mm bolts and drilled 5mm holes. Because the iron of the transformer is not aligned with the frame, I used two rings on each bolt to create some space between the transformer and the back plate. I used anti-slippage rings to secure the nuts.

38. The next step is to separate the two secondary windings so we can switch them in parallel or in series. Both windings on the transformer are connected to a single post in the middle of the transformer (solder lug 8). We need to pry them loose and separate them. By heating that connection with a solder iron, you can carefully! separate the two wires. Use an Ohm meter to make sure you have the correct two windings identified and solder the wire that connects to solder lug 6 back to solder lug 8. Solder a wire from the now free winding end (that is the winding connected to solder lug 10) and insulate that with shrink tubing. In the picture, that is the black end pointing to the half circle blue wire of the primary.

    The connections from the 4 windings of the transformer need to go to the proper binding post pins of J2 on the Main board, in order to put the now separate windings in series or parallel. The J2 silkscreen indicates the two windings, but unfortunately there is no silkscreen for the pin numbers.
    Proceed as follows. Solder lug 6 of the transformer goes to the J2 pin closest to the relays (K2). Solder lug 8 of the transformer (same winding) goes to the next J2 pin. The “free” wire from the next winding goes to the third pin of J2 and solder lug 10 goes to the fourth pin (closest to the Back panel).
39. Connect the primary windings to the Main board through J2. If you only use the 230V mains supply, you can solder a short wire between the two primary windings by bridging the two middle soldering posts and don’t need to go all the way to J2. The outside solder lugs of the transformer, 1 and 5 now go to the outside pins of J2. Make sure that all 4 connections on the transformer are well insulated with shrink tubing.
40. Once everything is mounted and the connections are verified, add the mains leads from J3 to the Back panel Fuse and the mains receptable.
41. Perform a quick test to make sure this is all working.

    Connect a DMM in DC mode between TransP and TransM, they are the raw DC voltage test points.
42. Add a jumper lead between J4-2 and J4-3, the 3-way switch connector. This will set the supply voltage to the 35V range, switching the two secondary windings in parallel.
43. Turn on the main power and verify that you have about 40V DC.
44. Switch the power off.
45. Connect J4-1 with J4-3, which is the 70V range, by switching the secondary windings in series.
46. Turn on the main power and verify that you have about 80V DC.
47. Switch off the power and remove the mains lead.
48. Install T1, the high voltage transformer. You may have to disconnect the wire connections to the Main board to get access to the bottom of the Main board.
49. Re-connect all wires again, and add the main power lead.

50. Reconnect the DMM in DC mode between TransP and TransM again.
51. Connect J4-4 with J4-3, to activate K1 which is the 200V range relays. Both transformers are now in series.
52. Turn on power and verify that you have more than 230V DC.
53. Turn off the power and remove the mains lead.
54. Disconnect all wires going to the Main board so we can mount the MOSFET's and the Current Source.
55. Use nuts and bolts and some heat paste to loosely mount the MOSFET's to the heatsinks. Use the second hole from the top such that the leads are in line with the heatsink mounting pins. Do not tighten the nuts and bolts yet.
56. Solder both MOSFET's/Heatsinks to the Main board. When they are in place, you can tighten the nuts and bolts.
57. Watch out that test point Vcur is not touching the heatsink of Q105. You can bend it a little to create a few mm spacing.
58. Mount the Current Source transistor Q91 to the heatsink HS90 and solder them to the Main board.
59. Install the Main board back into the enclosure and re-connect all leads again.
60. In order to make the DUT supply functional without the Front board, you need to add a jumper between the two pins of J54, which connects the Triangle waveform to the DUT supply.
61. We also need to connect the 100K Volt potmeter between one of the J102 pins called Vset (CCW) and DUTSupplyM/TransM (Tap+CW) so we have an output, and we can set the level. Set the potmeter to about mid-range. Note that after the latest revision, J102 has two interconnected pins. You can use either of them.
62. Connect the jumper lead between J4-2 and J4-3 to select the 35V range. Do not select the other ranges with all these flying leads to prevent you from touching dangerous voltages.
63. Add a scope probe with the GND clip to a GND test pin, and the probe tip to pin 1 of J6, which is indicated with CS-.
64. Verify that you have made all connections and they are correct before we do the final and acid test.
65. Add the main power lead.
66. Turn on the power and verify that you have a negative going triangle waveform and that you can change the amplitude with the 100K volt setting potmeter. If you do, we have a working Main board.
67. If not, quickly remove power and you need to trouble shoot the DUT supply.
68. If you did, congratulations!
69. Now we need to verify that we can calibrate the output to 200V. This depends on the toleration of the 100K voltage setting potmeter, which has a +/-10% tolerance.
70. Change the jumper from J4-2 for the 35V selection in step 62, to the 200V selection, J4-4.
71. Make sure that the trimmer Pot101 is in the mid position and measure the output again, using the same instruction as in point 63.
72. Set the output with the 100K volt setting potmeter to the maximum. It should be around 200V +/- 10V. Now check if you can trim the value with Pot101 to a precise 200V with the trimmer

about in the middle of the range with at least some +/- 5V room. If you cannot do this, you have to change the value of R112 until you can, which is easier to do at this point.

73. If this is successful, you're done with this part of the installation & verification.

WARNING:

Before making any measurements yourself, make sure you are limiting the current to the DUT when powering them. It is very easy to blow them up if you are not careful. This is especially true for MOSFET's and their low RDSON.