B1500 RF amplifier Backpanel Unit kit

I designed, built and tested this in my spare time with little expectations, a lot of curiosity and a hope to make my small contribution to the Amateur Radio world. I trust you will enjoy putting this together and using it in the spirit of Amateur Radio.

If you have any issues, I'm just an email away.

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The B1500 RF amplifier Backpanel Unit is designed to sit between a LDMOS RF amplifier and the rest of your shack. It handles RX/TX switching, antenna selection and transceiver interfacing. It also has a clean, high-efficiency DC-DC converter that supplies 12V at a maximum of 3A for all the amplifier additional circuitry, display, relays and fans. It will run on any voltage from 15V to 55V. This is an Advanced level kit and assumes you have a good understanding of electronics.

To assemble this kit you will need the following tools & materials:

- soldering kit
- multimeter
- utility knife
- Phillips head screwdriver

You will also need connecting wires & cables.

Specifications

- 0.2dB total insertion loss up to 72Mhz, less than 0.6dB at 150Mhz
- RF power handing: 100W input max., 1500W output max.
- 2 selectable antenna ports
- DC-DC converter: 15V to 55V input, 12V @ 3Aoutput, 90% efficiency, low noise
- AUX port compatible with Elecraft KPA1500 standard & wiring
- Control Port compatible with 5V logic
- Size: 120x100mm

Control Port

The Control Port (J6) is designed to interface with a separate unit that provides control and handles specific transceiver interfacing signals. It is highly recommended to use a ferrite choke on the cable that connects to J6 and decouple each signal with a 10nF ceramic capacitor to ground at the other end.

Pin	Name	Description
1, 9, 11, 13, 19	GND	Reference ground.
2	RX_relay (input)	Logic signal that switches the input side relay. No signal = RX mode, apply +5V to switch to TX mode.
3	TX_relay (input)	Logic signal that switches the output side relay. No signal = RX mode, apply +5V to switch to TX mode.
4	Ant_sel (input)	Logic signal that switches the antenna port. No signal = ANT1 (J5) selected, apply +5V to select ANT2 (J4).
5, 6	12Vdc (output)	12V supply, max 500mA combined
7	Key	PTT signal. Stays around +5V during RX, external source (transceiver) pulls this down for TX.
8	Inhibit (output)	Voltage proportional to the amplifier output reflected power square root. Around 3.20V for 600W.
10	Band_V (output)	Analog band data from transceiver. 0-8V for Icom, 0-5V for Yaesu, 0-2.5V for Xiegu; refer to transceiver specs for details.
12	ALC (input)	ALC voltage for transceiver. From 0V to -11V depending of transceiver and settings. Please note this is a negative voltage.
14	Alarm (input)	Drives low for fault input.
15	Band0_In (output)	BCD Band Input – Bit 0 (Yaesu & Elecraft standard)
16	Band1_In (output)	BCD Band Input – Bit 1 (Yaesu & Elecraft standard)
17	Band2_In (output)	BCD Band Input – Bit 2 (Yaesu & Elecraft standard)
18	Band3_In (output)	BCD Band Input – Bit 3 (Yaesu & Elecraft standard)
20	Power_OnOff (output)	Pulse low to turn amplifier on or off – do not hold low!

AUX Port

Pin	Signal name	Direction	Notes
1	NC (Band Vref Icom)	In	Reference for Icom input – connect to 8V
2	NC (AuxBus I/O)		K3/K3S
3	Band1 In	In	BCD Band Input – Bit 1*
4	NC		
5	GND		
6	Band V (Icom)	In	Analog band data
7	Alarm Out	Out	Drives low for fault input
8	Power On/Off	In	Pulse low to turn amplifier on or off – do not hold low!
9	Band2 In	In	BCD Band Input – Bit 2*
10	Key	In	Low enables amplification. Internally pulled up to +5V.
11	Inhibit#	In	Low inhibits amplifier operation
12	GND		
13	Band0 In	In	BCD Band Input – Bit 0*
14	Band3 In	In	BCD Band Input – Bit 3*
15	ALC	Out	ALC output to transceiver

The AUX Port is used for interfacing with transceivers and/or other peripherals. It is designed to be compatible with the Elecraft KPA1500 standard most signals will be passed along via the Control Port to a separate unit.
Transceiver wiring is not included, as there are so many models on the market; you will have to build your own. For the AUX port you will need a DB15HD female connector, where HD stands for High-Density; do not use the standard DB15 as they're not compatible. These are available with most electronics suppliers.

Stand-alone operation

To enable this, connect JP1 jumper. In this mode, the external signal source (TRX) directly controls the amplifier RX/TX switching via the PTT line. You can use this when there is no unit that controls B1500 via the Control Port.

Control Unit operation

To enable this remove the JP1 jumper. In this case, RX/TX switching is handled via the Control Port. A separate board connected to the Control Port can perform sequencing, disable TX if alarms have been triggered, etc.

In both modes, all the other signals are transparently being passed to/from the AUX Port and Control Port.

Kit contents

Reference	Description	Value	Code
PCB		120*100mm	
L1	DC-DC	300uH, 3A	1430430C
L2	DC choke, 16t	20uH, 3A	5961001801
K1	Input relay		G5V-1-DC12
K2	Output relay		G2RL-1-E-DC12
K3	Antenna switch relay		G2RL-1-E-DC12
J1	SMA PCB mount		
J2	SMA PCB mount		
J3	SO-239 PCB mount		
J4	SO-239 PCB mount		
J5	SO-239 PCB mount		
J6	20-pin IDC header		302-S201
J7	2-pin power connector		282837-2
J8	2-pin power connector		282837-2
J9	DB-15 data connector		A-HDF 15 PP/Z
JP1	Jumper		
WIRE	For L2		
STANDOFFS	16pcs. M3 4mm		
NUTS & BOLTS	16pcs. M3		
WASHERS	18pcs. M3		

Assemble parts

Some of the parts supplied in this kit require assembly before they can be installed.

L1, K1, K2, K3, J1, J2, J6 - install in their designated positions.

J7, J8 - install in their designated positions. Make sure the holes are facing outside the board.

L2 - 16 turns on toroid. Wind the supplied wire on the toroid; it should be enough for 16 turns, with a bit to spare. With the utility knife scrape the insulation from the wire ends. Make sure you apply a clean layer of solder coating, install L2 as in the picture and solder in place.

Board now should look like this:
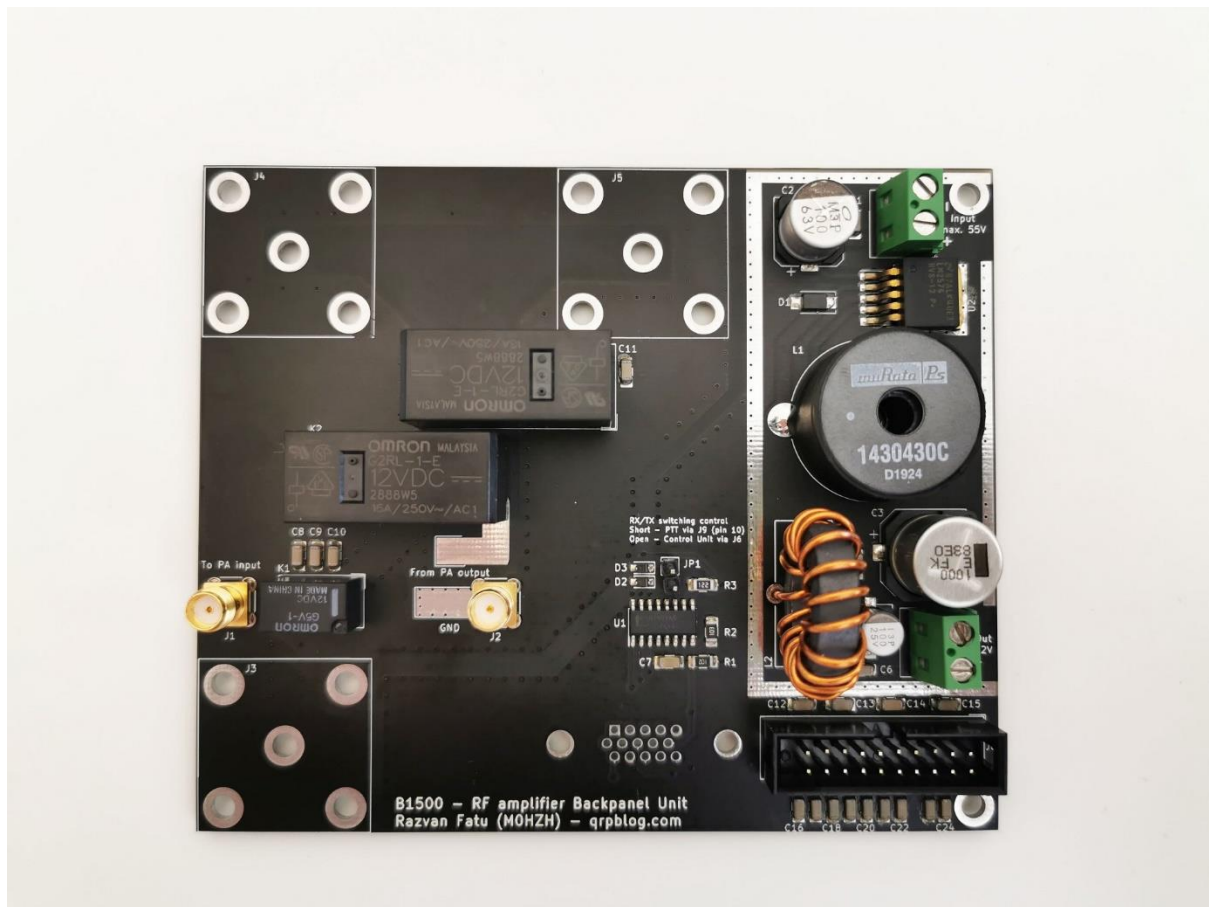
J3, J4, J5, J9 - use standoffs, bolts, nuts and washers to install, as pictured.
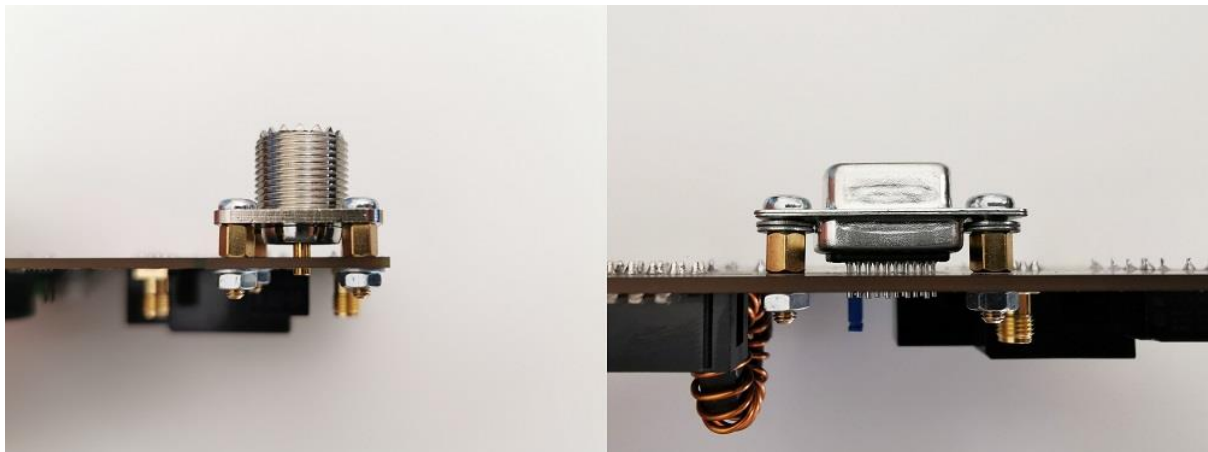
Install & adjustment

The board is designed to be mounted along the rear panel of a case, with the connectors exposed externally via adequate cut-outs. Make sure you use ferrite chokes on all the wires connected to the board.

When first powered, make sure no other wires are connected and measure the +12V output to make sure it is within specifications. Install JP1 (see picture below) and on the AUX port, short pin 10 to ground (pin 12 for example); you should hear RX/TX relays click, a sign that everything works as intended. There is no adjustment needed.
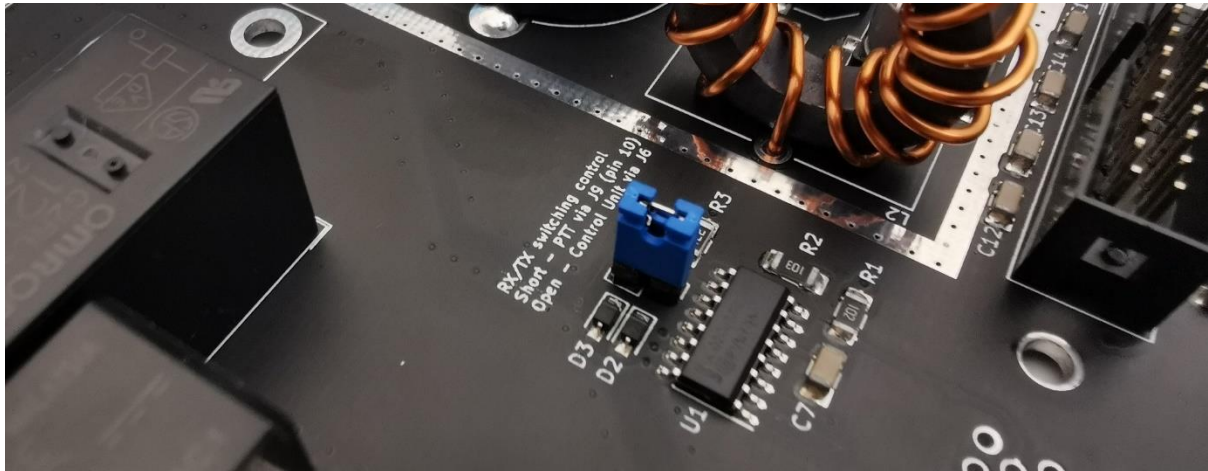
If you intend to use this with RF power over 600W, it is recommended you solder the coaxial cable directly to the PCB instead of using the SMA connector. For this, there are special pads right next to J2:

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