

## SWITCHING BOX FOR LOUD SPEAKERS MARCH 2018

This was built following a request from someone who wanted to switch one pair of loudspeakers between two amplifiers, one being valve, the other solid state. A commercial unit to do this task was available but at a cost of over £200.

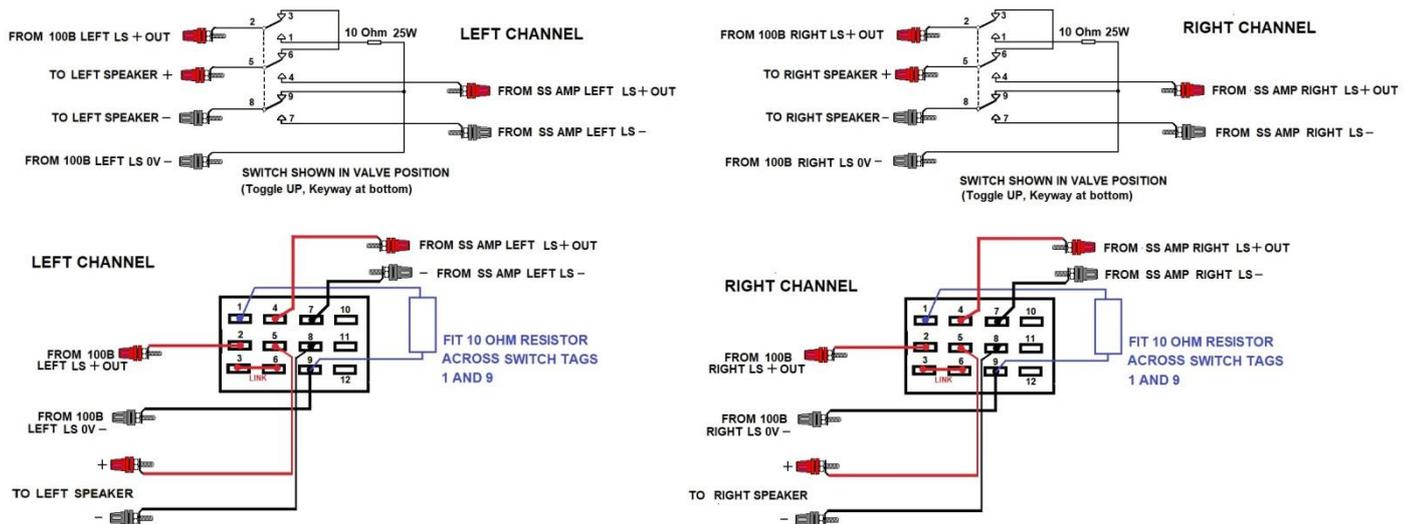
So it was decided to try building the equivalent but with some refinements.

- 1) It should be low loss, all switching to be no greater than 20mΩ.
- 2) High power handling, this is limited by the 4mm terminal posts being rated at 10 Amps (800 Watts) though the internal switches are rated at 20 Amps to reduce contact resistance.
- 3) The Valve Amplifier speaker lines to be loaded if not selected, to avoid damage to the amplifier.
- 4) The Valve and Solid State Amplifiers to have isolated Ground lines to avoid problems with Bridge connected Solid State Amplifiers.
- 5) Final requirement was for the switch box to be a cheaper than the commercial one, with a built for purpose metal case rather than a flimsy plastic one. The quality finished die cast box was sitting in the spares cupboard so was put to use; it is a CAMDENBOSS RTM5006/16-PAT and sold in the UK by RS Components as part number 508-7456. The other parts cost less than £50 so target cost was well met.



**It is most important that the Valve Amplifier is always connected to its allocated terminals else the protection for its output stage under no load conditions will be circumnavigated. It is also inadvisable to switch sources whilst there is a signal going through the valve amplifier.**

## The Circuit.



The Left and Right circuits are identical so only the operation of one channel is required.

The loudspeaker selector switch is a 4 pole switch but only 3 poles are used.

In the VALVE position, (toggle UP), the + speaker wire from the valve amplifier is routed from its Red Terminal Post, through the loudspeaker switch to the Red SPEAKER Terminal Post via switch tags 2,3,6 and 5.

The - speaker wire from the valve amplifier is routed from its Black Terminal Post, through the loudspeaker switch to the Black SPEAKER Terminal Post via switch tags 9 and 8. A permanent connection is also made to a 10 Ohm resistor but its other end is presently isolated by the speaker switch at tag 1.

The speaker is thus being fed from the Valve amplifier, the solid state amplifier being fully isolated.

In the SS position, (toggle DOWN), the + speaker wire from the valve amplifier is routed from its Red Terminal Post, through the loudspeaker switch to the 10 Ohm resistor via switch tags 2 and 1.

The - speaker wire from the valve amplifier is now fully isolated except for its connection to the other end of the 10 Ohm resistor previously mentioned, thus protecting the valve amplifier by applying a dummy load to its output.

The Solid State Amplifier is now connected to the Red SPEAKER Terminal Post via switch tags 4 and 5.

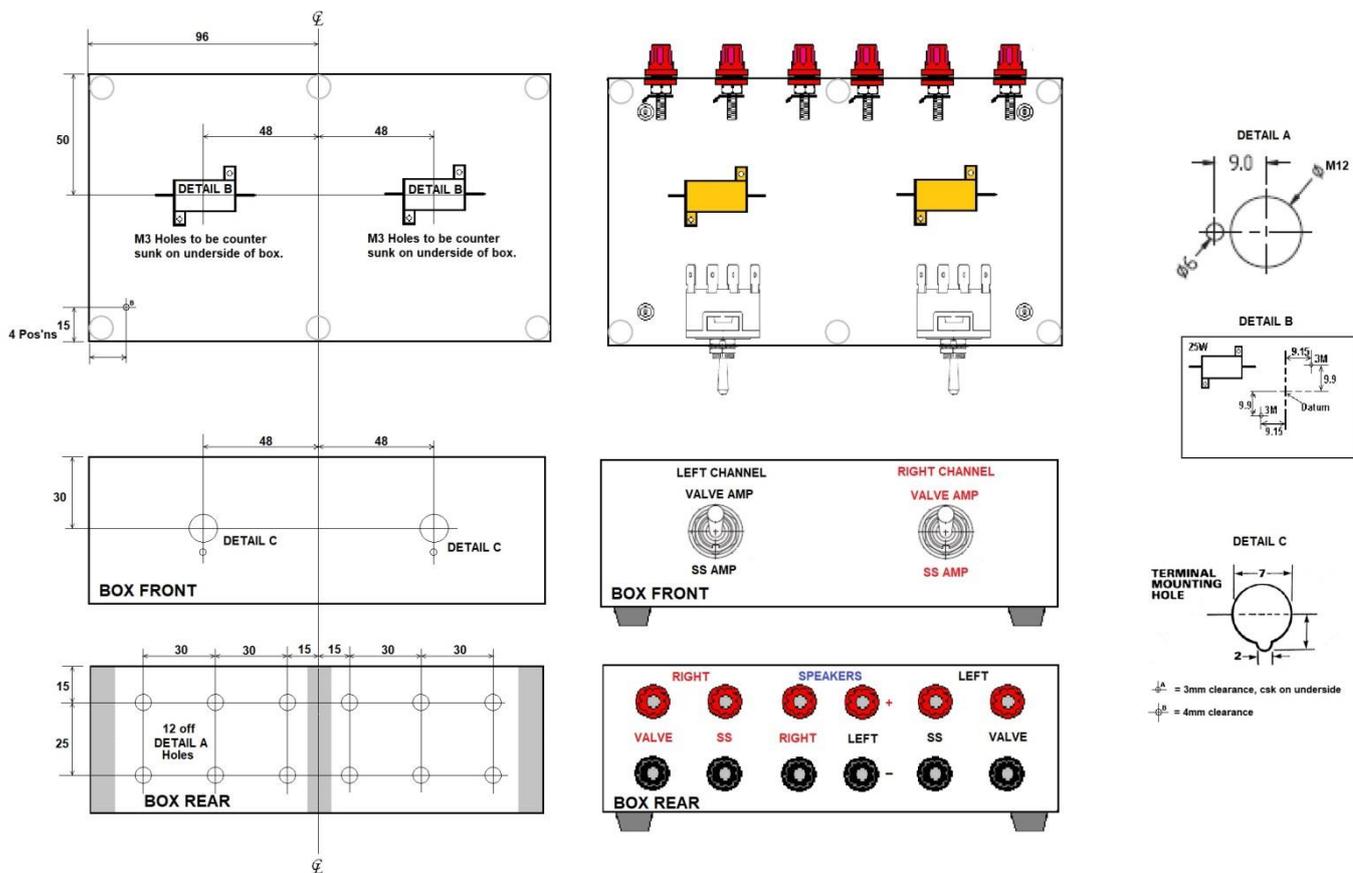
The - speaker wire from the Solid State Amplifier is routed from its Black Terminal Post, through the loudspeaker switch to the Black SPEAKER Terminal Post via switch tags 7 and 8.

Switching isolated speaker Ground wires will avoid problems with Bridge connected Solid State Amplifiers.

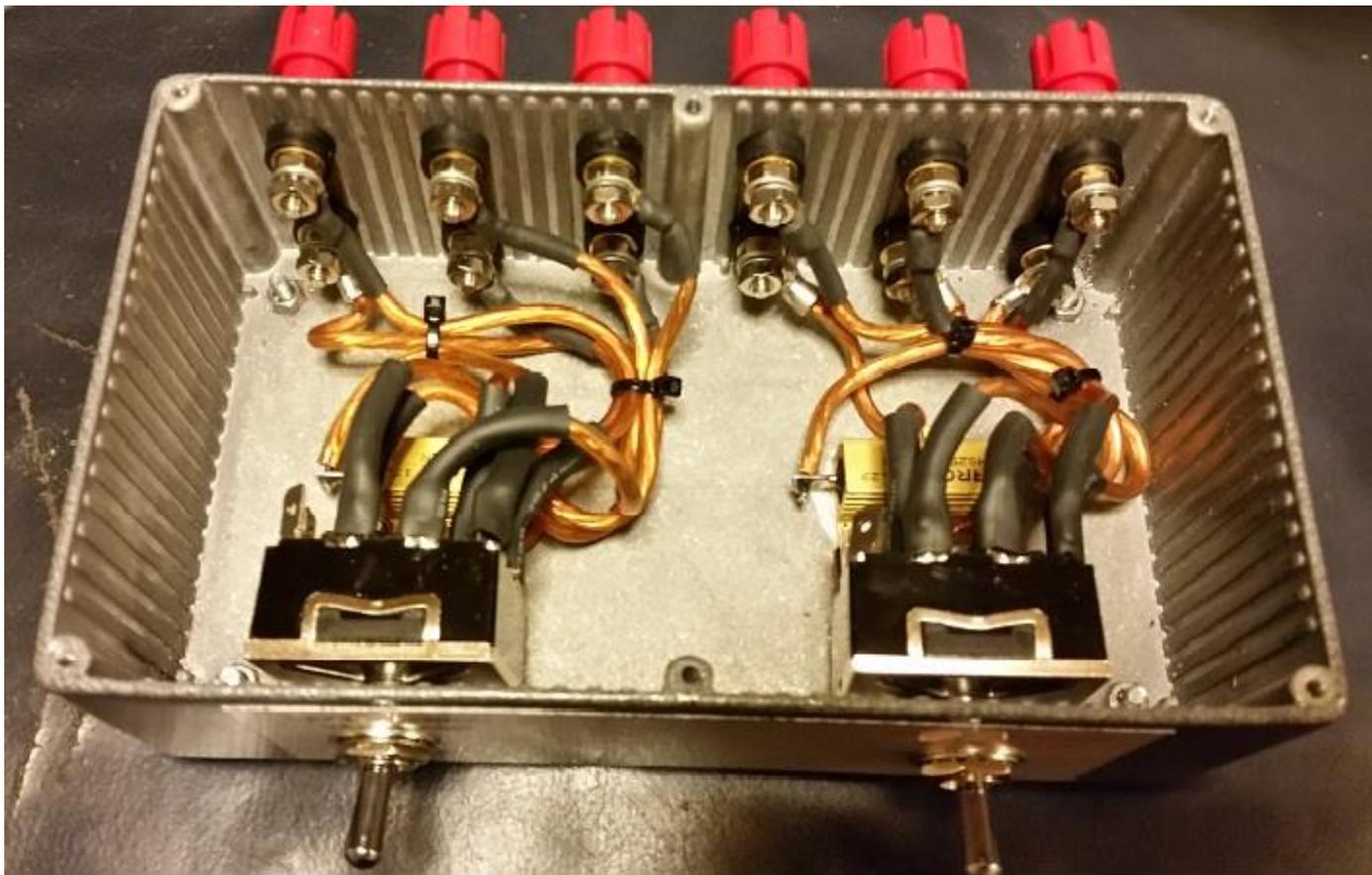
Parts Used

ITEM	DESCRIPTION	UK SUPPLIER	PART No.	Cost (£)
1	CAMDENBOSS RTM5006/16-PAT 192x112x61mm	RS	508-7456	21.53
2	Rubber Foot (4 off)	FARNELL	320237	n/a
3	3M5 x 12 Pan Head Screw (4 off) - For Item 2	RS	528-788	n/a
4	3M5 Nut (4 Off) - For Item 2	RS	560-300	n/a
5	3M5 Shakeproof washer (4 off) - For Item 2	RS	825-247	n/a
6	M3 x 10 C/sk Head (4 off) - for item 15	RS		n/a
7	M3 Nut (4 off) for Item 15	RS	527-230	n/a
8	M3 Crinkle Washer (4 off) for Items 15	RS	428-638	n/a
9	20 Amp, 4 Pole, ON-ON Switch (4PCO) (2 off)	RS	734-6814	18.22
10	Wire (As required)			n/a
11	10 Ohm 25W metal clad power resistor (2 off)	RS	157-550	7.7
12	4mm Insulated Binding Post, Black (6 off)	RS	677-8740	14.28
13	4mm Insulated Binding Post, Red (6 off)	RS	677-8746	14.28
14	Loctite 22 Thread lock or similar ( As required)	RS	908-2795	n/a
15	Thermal Paste			n/a
			Total	76.01

Box drilling and assembly



Internal View



Front Panel View



## Rear Panel View



### Commissioning Tests:-

Both switches set to SS (Down).

Verify 10 Ohms present across the RIGHT VALVE Red and Black terminals.

Verify 10 Ohms present across the LEFT VALVE Red and Black terminals.

Check continuity between the RIGHT Red SS terminal and the RIGHT Red SPEAKER terminal.

Check continuity between the RIGHT Black SS terminal and the RIGHT Black SPEAKER terminal.

Check continuity between the LEFT Red SS terminal and the LEFT Red SPEAKER terminal.

Check continuity between the LEFT Black SS terminal and the LEFT Black SPEAKER terminal.

Check for infinity resistance between any of the VALVE terminals and the SS or SPEAKER terminals.

Check for infinity resistance between the Red SS terminals and their associated Black SS terminals.

Check for infinity resistance between any of the terminals and the metal enclosure.

Both switches set to VALVE (Up).

Check continuity between the RIGHT Red VALVE terminal and the RIGHT Red SPEAKER terminal.

Check continuity between the RIGHT Black VALVE terminal and the RIGHT Black SPEAKER terminal.

Check continuity between the LEFT Red VALVE terminal and the LEFT Red SPEAKER terminal.

Check continuity between the LEFT Black VALVE terminal and the LEFT Black SPEAKER terminal.

Check for infinity resistance between any of the SS terminals and the VALVE or SPEAKER terminals.

Check for infinity resistance between the Red VALVE terminals and their associated Black VALVE terminals.

Check for infinity resistance between any of the terminals and the metal enclosure.

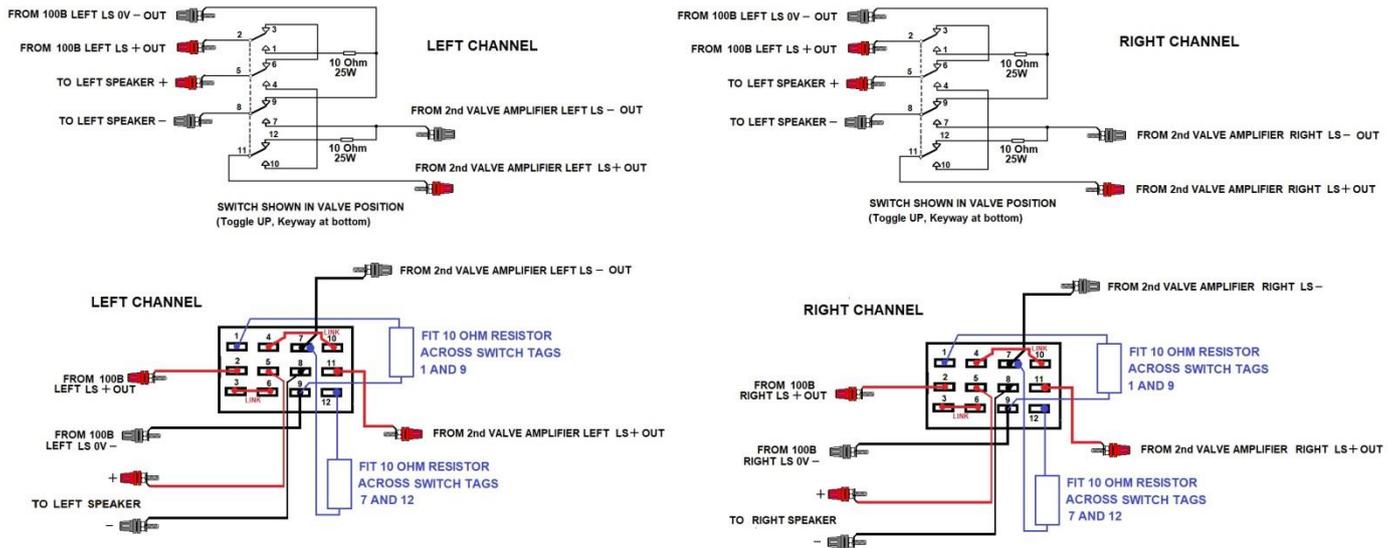
### Use with two separate valve amplifiers?

Could this box be modified to switch speakers to two amplifiers, both being valve so both needing load protection?

Yes it can, thanks to having a spare un-used switch on each channel.

It will be necessary to move the present load resistors slightly to the rear so that another pair of resistors can be fitted.

## Two Valve Amp Circuit



The Left and Right circuits are identical so only the operation of one channel is required.

The loudspeaker selector switch is a 4 pole switch, all 4 poles are used.

It either selects Valve Amplifier 1 in the toggle UP position or a second Valve Amplifier 2 in the DOWN position.

With toggle UP, the + speaker wire from Valve Amplifier 1 is routed from its Red Terminal Post, through the loudspeaker switch to the Red SPEAKER Terminal Post via switch tags 2,3,6 and 5.

The - speaker wire from Valve Amplifier 1 is routed from its Black Terminal Post, through the loudspeaker switch to the Black SPEAKER Terminal Post via switch tags 9 and 8. A permanent connection is also made to a 10 Ohm 25W resistor but its other end is presently isolated by the speaker switch at tag 1. The speaker is thus being fully driven by Valve amplifier 1.

Valve Amplifier 2 is connected, as a safeguard while not connected to speakers, to a second 10 Ohm 25W resistor.

The + speaker wire from Valve Amplifier 2 is routed from its Red Terminal Post to this resistor via switch contacts 11 and 12.

The - speaker wire from Valve Amplifier 2 is routed from its Black Terminal Post to a permanent connection on this second 10 Ohm resistor and also to switch tag 7 ready for when connection to the loudspeaker is required via tag 8.

In the Valve Amplifier 2 position, (toggle DOWN), the + speaker wire from Valve amplifier 1 is routed from its Red Terminal Post, through the loudspeaker switch to a 10 Ohm 25W resistor via switch tags 2 and 1.

The - speaker wire from Valve amplifier 1 is now fully isolated except for its connection to the other end of the 10 Ohm resistor previously mentioned, thus protecting the valve amplifier by applying a dummy load to its output.

Valve Amplifier 2 is now connected to the Red SPEAKER Terminal Post via switch tags 11, 10, 4 and 5.

The - speaker wire from Valve Amplifier 2 is routed from its Black Terminal Post via switch tags 7 and 8 to the Black SPEAKER Terminal Post.

## Commissioning Tests for two separate valve amplifier version:-

Both switches set to Valve Amplifier 2 (Down).

Verify 10 Ohms present across the RIGHT Valve Amplifier 1 Red and Black terminals.

Verify 10 Ohms present across the LEFT Valve Amplifier 1 Red and Black terminals.

Check continuity between the RIGHT Red Valve Amplifier 2 terminal and the RIGHT Red SPEAKER terminal.

Check continuity between the RIGHT Black Valve Amplifier 2 terminal and the RIGHT Black SPEAKER terminal.

Check continuity between the LEFT Red Valve Amplifier 2 terminal and the LEFT Red SPEAKER terminal.

Check continuity between the LEFT Black Valve Amplifier 2 terminal and the LEFT Black SPEAKER terminal.

Check for infinity resistance between any of the Valve Amplifier 1 terminals and the Valve Amplifier 2 or SPEAKER terminals.

Check for infinity resistance between the Red Valve Amplifier 2 terminals and their associated Black Valve Amplifier 2 terminals.

Check for infinity resistance between any of the terminals and the metal enclosure.

Both switches set to Valve Amplifier 1 (Up).

Verify 10 Ohms present across the RIGHT Valve Amplifier 2 Red and Black terminals.

Verify 10 Ohms present across the LEFT Valve Amplifier 2 Red and Black terminals.

Check continuity between the RIGHT Red Valve Amplifier 1 terminal and the RIGHT Red SPEAKER terminal.

Check continuity between the RIGHT Black Valve Amplifier 1 terminal and the RIGHT Black SPEAKER terminal.

Check continuity between the LEFT Red Valve Amplifier 1 terminal and the LEFT Red SPEAKER terminal.

Check continuity between the LEFT Black Valve Amplifier 1 terminal and the LEFT Black SPEAKER terminal.

Check for infinity resistance between any of the Valve Amplifier 2 terminals and the Valve Amplifier 1 or SPEAKER terminals.

Check for infinity resistance between the Red Valve Amplifier 1 terminals and their associated Black Valve Amplifier 1 terminals.

Check for infinity resistance between any of the terminals and the metal enclosure.