HF<+>VHF Patch Unit for Bulletins and Relays

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Over many years PARC transmissions from Pretoria on Sunday mornings have been handled by the author. Prior to day one a patch unit was devised to handle the control of two radios in all possible permutations. Since then various tweaks have culminated in what is now considered a final version which appears to satisfy the many callers and listeners on both bands. The solution is not difficult to reproduce and in retrospect uses common sense.

PURPOSE: To patch VHF to HF
To patch HF to VHF
Transmit both simultaneously
Monitor all permutations

FEATURES Only one 3 pos lever switch
Only one microphone reqd
No electromechanical relays
Small size

The master radio is the HF radio on which the front panel multi-pin microphone and head phones-out connectors are the only connectors required. The following should then be available:

MIC CONNECTOR : Chassis (= DC) ground
PTT (DC grounded for TX)
Mic ground
Mic live
DC voltage 5-12V

PHONES: Generally a mono signal to a mono- or stereo socket fed by the speaker amplifier via 100Ω

The VHF radio can be a spare hand-held. The author has one permanently attached to the HF station. The repeater distance is about 12km and the radio was adjusted to 3W. Here the requirements are:

VHF RADIO: Auxiliary speaker output (mutes main speaker)
Microphone input
PTT line accessibility
Private antenna fully floating from other station antennas and earthing
Power supply floating from station earthing (battery is ideal)

Referring to the diagram, it will be seen that all VHF radio cable screens are not DC connected to the HF station DC ground (metal enclosure) in any way. Sockets J4, J5, J6 are so mounted or wired that:
The VHF radio and all its attachments are referenced to the HF microphone ground only.
The opto-coupler and audio transformer are thus also necessary.

Despite running 400W on HF and the VHF antenna being almost directly below the HF antenna, no adverse affects have been experienced. For good measure the VHF cable has 10 (red) ferrite rings over it near the radio antenna socket to choke off possible HF RF coming down the VHF cable screen.

The circuit is pretty logical and the lever switch functions are as annotated. Getting the audio levels right is a matter of a few iterations with the help of other amateurs and monitoring transmissions on both bands. Guidelines are as follows:

1. Initially -Plug in your monitor headphones into J3 and activate MON switch. Mic gain set as usual.
2. VHF>HF -Listen to your local repeater and adjust the VHF volume control so that the HF ALC meter indication is within safe limits. Set the HF AF control for a comfortable listening level.
3. HF+VHF -Set the 22k trimmer for undistorted VHF modulation when speaking into the microphone.
4. HF>VHF -Check that HF receive effects the same audio level on VHF as step 3.

The ideal result for all cases above is equal audio levels to listeners that can monitor both HF and VHF.

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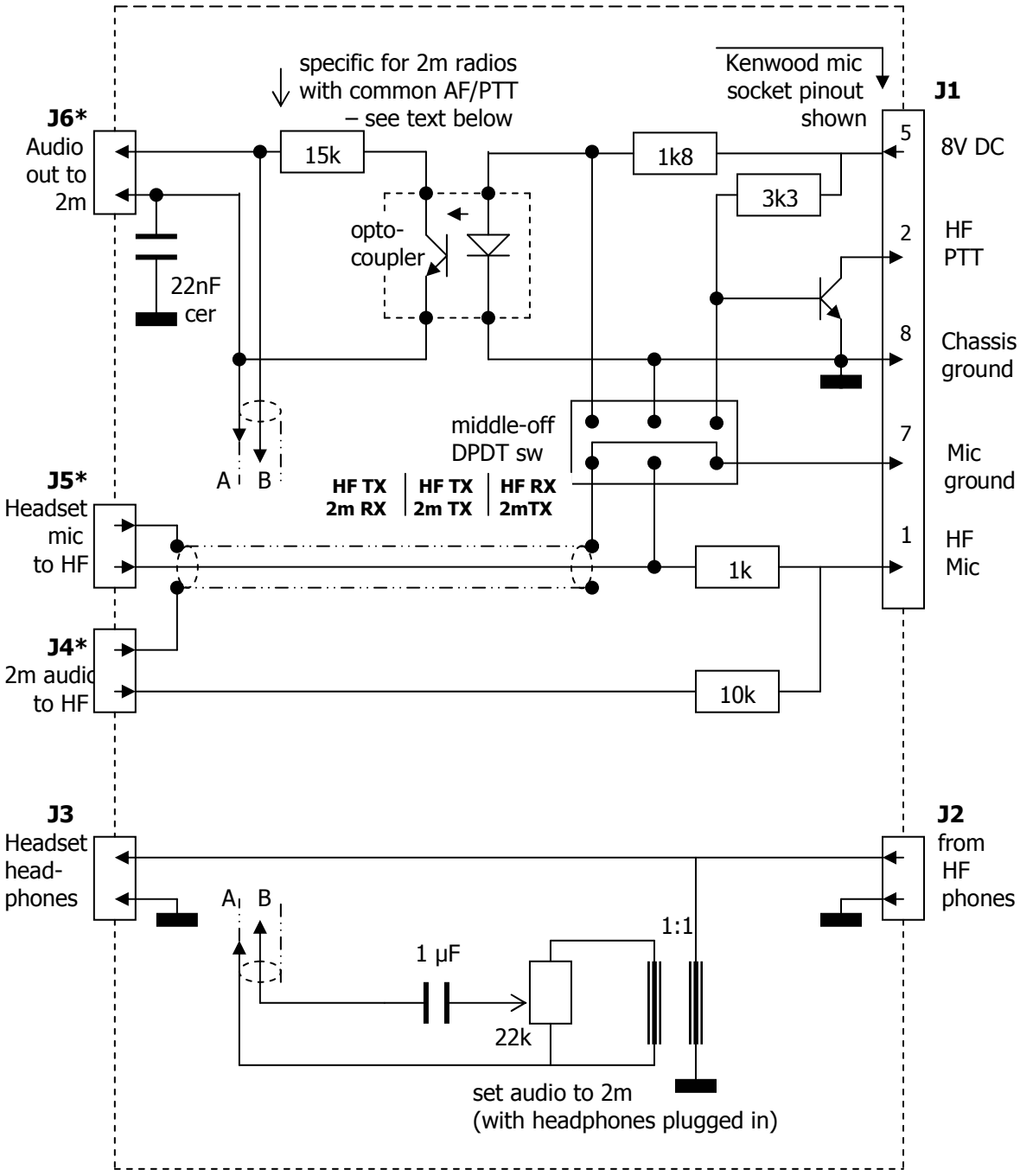


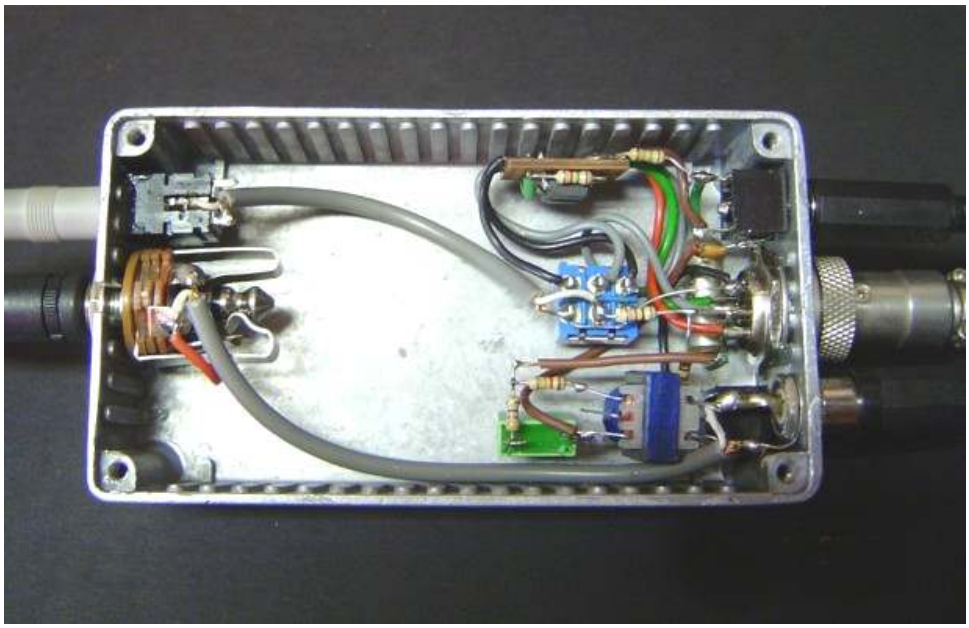
*** Isolated from chassis**

J1 : 8-pin mic socket
J2 : 6.35mm mono jack or RCA socket
J3 : 6,35mm stereo socket (L+R joined)
J4 : 3,5mm stereo socket (gnd not used)
J5 : 3,5mm mono socket (isolated from chassis)
J6 : 3,5mm stereo socket (gnd not used) – suitable for common PTT/Audio line.

Dotted line : Aluminium diecast box

Radios with separate PTT/audio lines will need J6 isolated from chassis allowing its ground bush to be used also. The 15k resistor must be reduced to 1k or less.

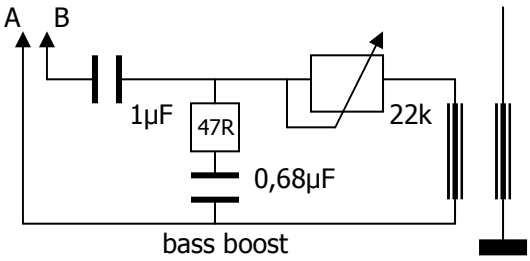
CONSTRUCTION A small die-cast aluminium box was used and, if possible, use one without ribs inside as the author encountered extra work and irritation when fitting the connectors!
As can be seen from the picture, only the headphone and microphone connectors are on the operator end and the rest face the radios when in operational position.
The smaller the box, the more careful the positioning of the sockets has to be, taking into account that tools to fasten them must have access also. The holes for the collars of the 3,5mm fully insulated sockets were made larger than necessary and the sockets epoxied into position. Depending on wall thickness, various schemes can be devised. Make doubly sure that all the mechanical work is sound before any wiring is done.



Wiring can simply be point to point as can be seen in the effort by the author.
The advantage is good accessibility for modifications.

For instance, VHF fidelity was found to be inadequate as bass response was rather lacking.
FM modulation response tests revealed the radio response to be -6dB at 500Hz.
This was inherent in the design of that radio and external compensation had to be devised.

A small modification to the VHF audio feed as illustrated here replaced the lower part of the main diagram and gave a very pleasant improvement for this particular radio.



CONCLUSION Many patch projects have been published elsewhere but they never seem to fully apply to one's own situation. This is an easy-to-use minimal system for two-radio control and will be successful if careful attention is given to avoiding earth loops as set out in the text. If RF feedback is distorting your audio, carefully assess every part of the system and experiment by changing only one thing at the time. Unfortunately working into a dummy load will generally not simulate the real situation to solve problems.

Parts List (one of each unless stated)

Resistors ¼W	1k, 1k8, 3k3, 10k, 15k or 1k (see page 2) and 22k variable
Capacitors	22nF ceramic 50V, 1µF 63V non-polar
Transformer	Miniature audio 1:1 or similar (ratio not critical)
Switch	DPDT middle-off miniature lever type
Transistor	NPN BC547 etc.
Opto-coupler	any 4-leg type
Sockets	As specified on page 2
Coax	Short lengths of audio coax as required
Box	Size and shape as preferred. Diecast aluminium preferably with no internal ribs at envisaged connector locations.
