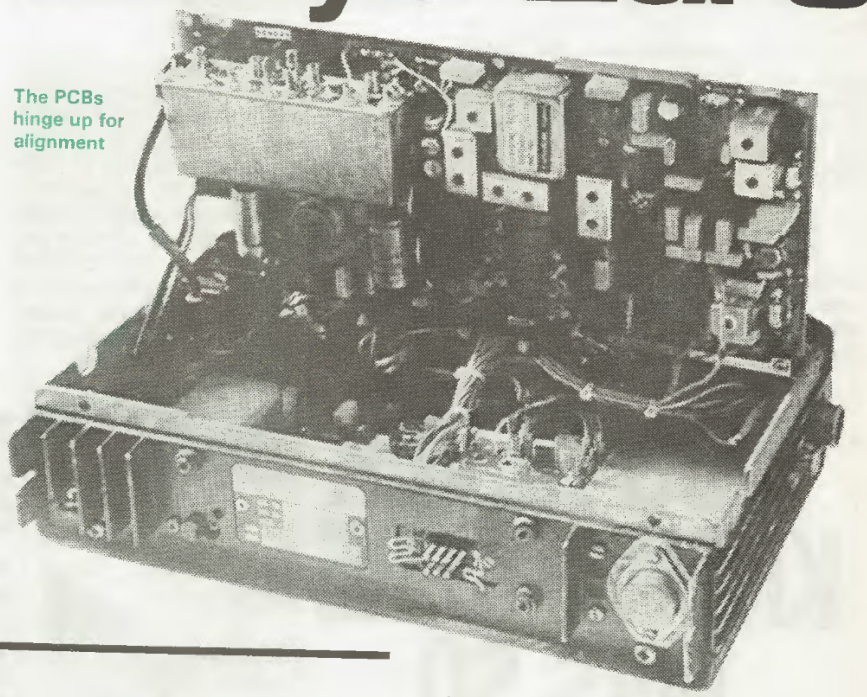
P-Band Pye Europ

Our resident conversion expert G4HCL transforms a low cost P-Band Pye Europa on 4m FM.

Veteran readers of HRT or owners of the 'Surplus Two-Way Radio Conversion Handbook' by Argus Books, will know the VHF Pye Europa is a neat, self-contained 8W or 25W FM transceiver capable of operation on up to 3 or 6 crystal controlled channels. Just the thing for packet radio use, or for a low cost rig for club net use and the like. The recent growth of DX PacketClusters on 4m has significantly prompted the need for a low cost 4m FM rig by users wishing to be 'in on the action', with **no** commercial transceivers currently available for the band.



The PCBs hinge up for alignment

P Band

There have recently been a very large number of 'P' band Pye Europas placed onto the surplus market. Although capable of transmission on 4m without circuit modification and only a re-alignment being required, at first glance these may not be deemed suitable for use as a transceiver due to their receive frequency coverage range of 79-101MHz, this often being too high to 'tune down'. It has certainly **not** in the past been worthwhile paying a high price for sets such as these, when 'E' band (68-88MHz TX/RX) Europas have been commonly available. However, with typical rally prices now of £5 each complete with microphone, power lead and mounting bracket for P band sets (the rally stand we bought several at still having a large pile left at the end of the day) we at HRT weren't blinkered, and the conversion team went into action!

Identification

First of all, make sure you know what you're buying! The accompanying photograph will show what the Europa looks like, but be warned, as besides the rear panel label there is **no** obvious outer difference between Europas made for P Band RX (79-101MHz), E band (4m), B or A band (2m) and T or U band (70cm). Avoid the 'M' band equipments, for the present at least unless of course you fancy designing your own modification details (but watch this space!).

Inspect the rear serial number plate, this being riveted onto every set. Beware the set with **no** identification plate on the rear, don't touch it with a bargepole, as the seller may well have forcibly removed this to 'con' unsuspecting purchasers — we've warned you of this before and we know it still happens!

Next to the 'Cat. No.' on the rear label will be the type designation, either MF5FM (8W VHF), MF25FM (25W VHF), or MF5U (5W UHF). This will often be followed by the channel spacing, 'S' signifying 12.5kHz and 'V' signifying 25kHz, then a digit of either 3 or 6 to signify the number of available channels that may be switched from the front panel.

Below this, next to the 'Code' panel will be the channel spacing (S or V), followed by the TX frequency band code letter as detailed above, then the receive frequency band, then again the number of channels.

The 'P' band Europa is thus typically identified by a code of 'SEP6', signifying 12.5kHz channel spacing, E band TX, P band RX, 6 channel.

Tuning details for the A, B, T and U band sets are given in the Argus 'Surplus Two Way Radio Conversion Handbook', which we'll even give you free if you subscribe to HRT using the coupon in last month's issue. Much of the following alignment information is indeed based on information from that source.

Conversion

The transmit section of the set is identical to an E band set, hence for 4m there is no conversion required at all, just a retune as I'll describe later. On receive, the set covers 79–101MHz, and if you

attempt to simply re-tune the receiver multiplier section using positive side oscillator injection as used for P band, you'll probably be able to achieve a tune-up as I did on several sets, although the receiver will not be as sensitive as a correctly modified set, with also the possibility of instability. Better to spend a few pence on six capacitors....

Through a degree of detective work, I have found the receiver multiplier coils are physically identical between the P and E band equipments, therefore by simply replacing a few capacitor values you'll have an E band multiplier circuit. By unsoldering and removing the double screening cans from L10/11, L12/13, and L16/17, you'll see a capacitor soldered in parallel with the windings of each coil. Simply replace each of the six capacitors with a capacitor value as I've shown in Table 1. Keep the capacitor leads as short as possible, then after trimming the leads carefully replace the screening cans, making sure no leads become shorted.

size used for the six channel set. If you need to order them specially cut, you may find it useful to quote the original specification type T25 (3 Chan) or T80 (6 Chan), although to save money it may be worthwhile to request an 'amateur spec' version of these.

4m frequencies commonly used are 70.450MHz for general FM calling, with 'working' channels (if needed in busy areas) of 70.425MHz and 70.475MHz, a traditional 'mobile channel' used in some areas is 70.260MHz. Packet nodes and DX Clusters use 70.325MHz, other nodes use 70.4875MHz. Therefore just one or two crystalled channels are all you should need on 4m FM for either packet or voice.

Crystals

You'll find that some crystal suppliers may keep popular 4m frequencies in stock for the E band Europa, these will work fine in the P band set modified as described, otherwise you can obtain specially made crystals providing you don't mind waiting. The crystal frequencies required are;

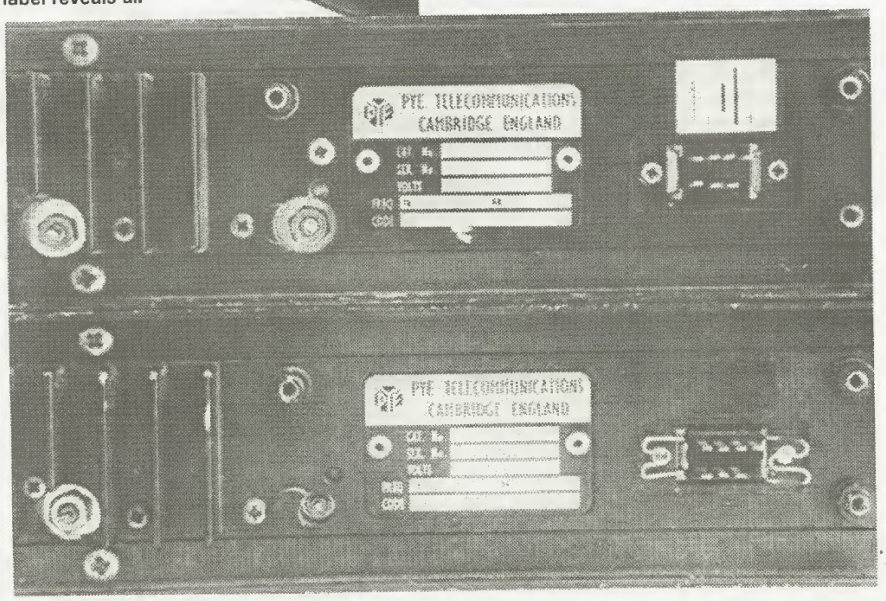
$$\text{TX Xtal Freq (MHz)} = \frac{\text{Tx Freq (MHz)}}{16}$$

$$\text{RX Xtal Freq (MHz)} = \frac{\text{RX Freq (MHz)} - 10.7}{8}$$

The crystal case size for the 3 channel set is HC6/u, the smaller HC25/u

a Conversion

A facility unit is sometimes fitted to the front panel



The rear panels label reveals all

Preliminaries

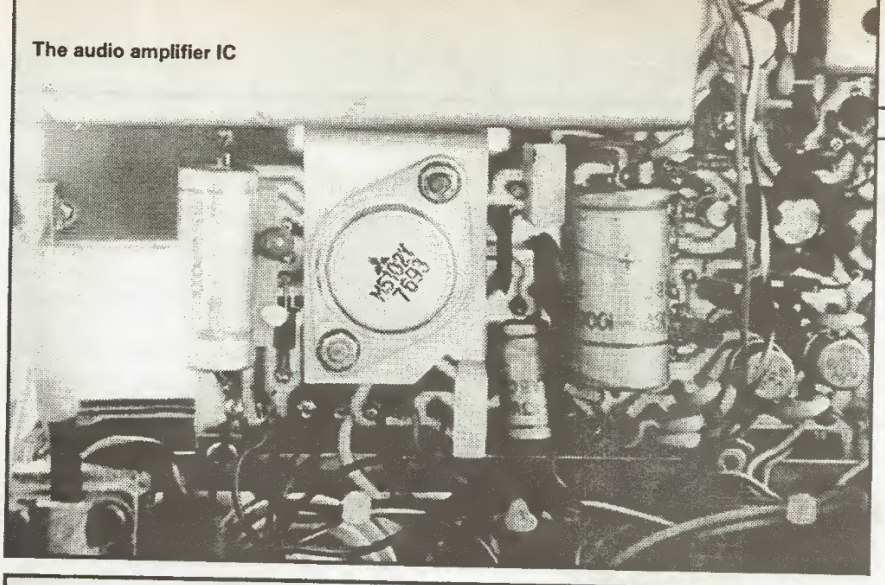
Remove the top lid of the equipment by removing the two screws at the rear of the case, then remove the three screws securing the RX PCB and hinge this upwards. Plug your crystals into their respective sockets on the TX and RX PCBs. Check that Pins 8 and 12 are linked on the facility socket on the lower TX board (pin 1 is at the left looking from the front of the set), either by a PCB link on a blanking board or by a wire link at the rear of the socket. If a tone option board is fitted here, I would recommend removing the board and fitting the appropriate link in its place.

If you don't have a couple of suitable non-metallic alignment tools, you'll have to either buy, borrow, or fabricate some to suit the slots in ferrite cores, and the trimmer capacitors in the TX PA. A filed-down plastic knitting needle or similar object works very well here. **Do not** under any circumstances be tempted to use metallic items such as jeweller's screwdrivers, you will not be successful due to their de-tuning effect and you could easily destroy the ferrite cores in the set.

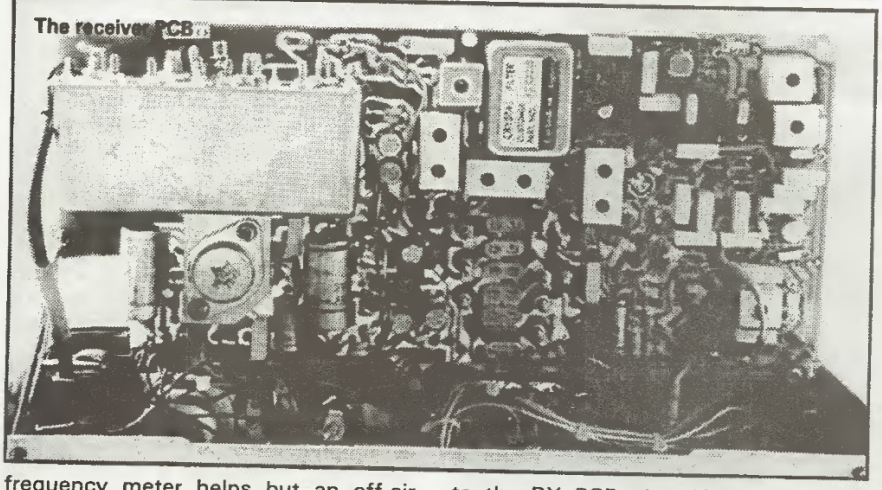
For the receiver tune-up, you'll need a multimeter and also a variable level of signal at the receive frequency, if you have access to a signal generator then all well and good, otherwise a friendly local amateur transmitting a signal to you may be useful, combined with variation of transmit and receive aerials, or of course for a linked packet node you can 'connect' to it via a different band, then get it to send a signal out for you with a TheNet 'CQ' command.

On transmit, as well as a multimeter you'll need some form of RF power meter, and a dummy load if available. A

The audio amplifier IC



The receiver PCB



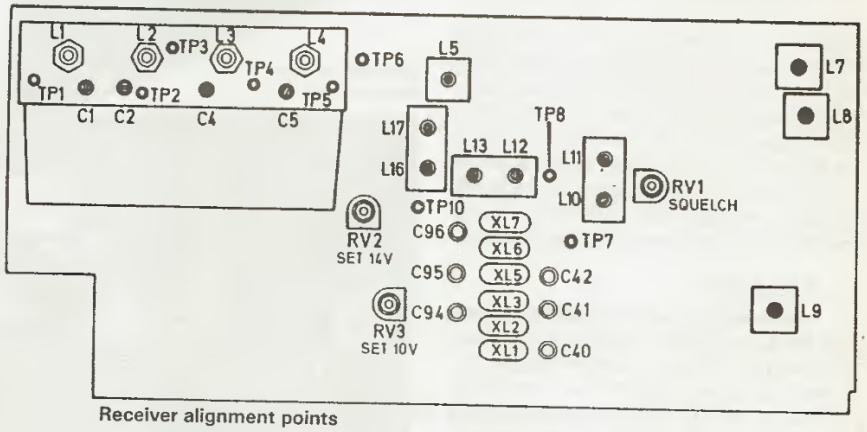
frequency meter helps but an off-air report from a helpful amateur with a centre-zero meter on his transceiver is usually quite sufficient. Correct setting of the deviation may be done by a listener comparing the peak level of your audio with that of another source such as a packet node or an alternative station.

Connections

The microphone connections are shown in Table 2, a 5-pin 270 deg. DIN type plug is used for this although note that the pins are numbered logically as 1 to 5 around the socket, not to the 'DIN' numbering convention. TX PTT control is performed by switching the +10V line between pin 3 and pin 5, if you are connecting a packet radio TNC to this then bear the polarity in mind. If you want to use a 'ground to transmit' line from your TNC then connect this via. a 2k2 series resistor to the base of a PNP switching transistor, the collector to pin 3 and the emitter to pin 5.

Note that the receiver audio output is available on the two-pin socket on the rear of the set, but this is a floating line, so **do not** connect one of these to earth, you could easily destroy the audio IC which is rather expensive to replace, this incidentally is the most common cause of a faulty set. To connect received audio to your packet radio TNC, link its audio input to the RX PCB pins 12 (live) and 11 (Screen) at the rear of the plug-in facility PCB, this is the squelched audio feed to the volume control. If you need a 'busy' squelch line output, the collector of TR14 on the RX PCB switches between 0.9V (busy) and 8.4V (no signal).

The rear panel 13.8V DC power connection needs a special 7 pin socket, so try and obtain one with the set if possible, but otherwise you'll have to wire up your own socket or flying leads. In this case you will need to link pin 2 to 3, and pin 4 to 5, connecting positive DC to pin 1 and negative DC to pin 7, all these are identified on the inner rear panel of the set. Use a 5A fuse in the DC power lead with an MF5 set, and a 10A fuse in line with an MF25 set.



Receiver alignment points

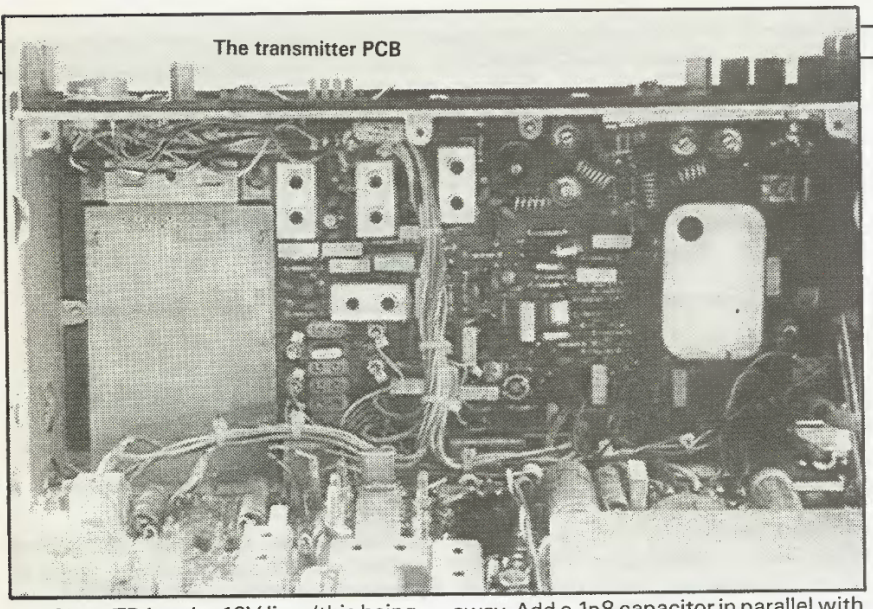
Receiver Alignment

Start by switching to the appropriate channel for your installed crystal, and connect your multimeter negative lead to the DC supply negative line. Switch the multimeter to its 10V DC range, and connect the positive lead to TP7. Tune the core of L10 very carefully, looking for a tiny 'dip' in the meter reading, re-adjusting carefully for minimum voltage reading. I found this very hard to detect on the sets I tried, so take care. Now transfer the positive lead to TP8, and tune L11 and then L10 for maximum reading, re-tune again for absolute maximum and then tune L12 for a 'dip', e.g. minimum voltage. Transfer the positive lead to TP10, and tune first L13 and then L12 for maximum, then tune L16 for a dip. Transfer to TP6, and tune L17, then L16 for maximum, re-tuning again as required for absolute maximum. This completes the crystal multiplier alignment, now we go on to the RX front end.

Start off by screwing the four threaded metal trimmer rotors (the ones with small screwdriver-type slots in them) in towards the die-cast metal case, until they protrude only around 3-4mm from being flush with the case. Now you need to receive a signal at the aerial connection, and start by adjusting the relevant multi-turn crystal trimmer to ensure your crystal is on frequency, until you are sure you are receiving the right frequency, it could save a lot of fruitless front end tuning! Open the receiver squelch by adjusting RV1 which is the squelch preset control.

If you are already receiving a controllable signal, simply tune the four adjusters on the front end metal block for best signal, peaking finally for absolute best reception on a weak signal, you don't need to use a non-metallic tool for this. Otherwise continue with the following.

The transmitter PCB



Short TP4 to the 10V line, (this being the adjacent pin 1 on the PCB linking to the feedthrough capacitor on the front end block). Tune the C5 adjuster, for best quieting of the received signal. Once you have done this, remove this DC link and instead link TP5 to chassis, then tune C4 for best quieting. Transfer the link now to connect TP1 to chassis, and tune C2 for best quieting. Transfer the link again now connecting TP2 to chassis and tune C1 for best quieting, and then carefully re-tune L17 and L16 for best quieting using your ferrite adjuster for the latter two. Now remove the link, and give all four capacitors on the front end a final adjustment for absolute best sensitivity, i.e. maximum quieting of a weak received signal.

Although I did not have any problems, if you find that the front end capacitor adjusters are 'right in' the die-cast assembly hence preventing a peak tuning point being obtained, you'll need to add extra capacitance in parallel with them. To do this, first undo the four retaining screws holding the block to the PCB, then undo the six small screws securing the case to the top of the assembly. Hinge the assembly up at the rear, then carefully side the metal casting away. Add a 1p8 capacitor in parallel with each of the variable capacitors, note you'll need a high-wattage soldering iron for this. Again checking for shorted leads re-assemble the front end and re-tune the four variable capacitors.

That's the receiver modification and alignment completed, so now on to the easy part.

Transmitter Alignment

Connect your power meter to the aerial connection, switch to your crystalled channel and key the TX, remembering to keep it keyed when taking readings. Connect your multimeter positive lead to TP1 on the transmitter board, keeping the range at 10V DC. Initially tune C48 for maximum, then tune L3 for minimum. Transfer the multimeter positive lead to TP2, and tune L4 then L3 both for maximum, then L5 for minimum. Transfer the positive lead to TP3 and change the multimeter range to 2.5V DC. Tune L6 and then L5 for maximum, then L7 for minimum. Transfer to TP4, tuning L8 and then L7 for maximum, then L9 for minimum. On to TP5 and tune L10 and then L9 both for maximum. Now remove the multimeter leads, and connect the positive lead to the DC positive supply, and the negative lead to TP6. Tune C90 and C92 using a flat-bladed non-metallic adjuster for maximum indicated voltage. Now remove the positive multimeter lead, change the range to 250uA DC, and connect the negative lead to TP7. From now on, keep the TX keyed only for as long as it takes you to make an adjustment, to prevent overheating of the PA.

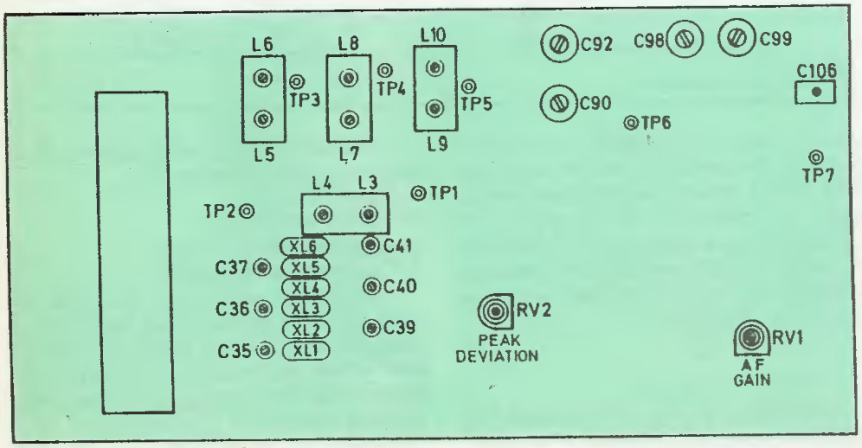
MF5FM; Tune C98 and C99 for maximum indication on your multimeter, you should now have an indication of RF power, so disconnect the multimeter and tune C106 and C108, the latter accessible from a hole in the screening can, for maximum power, re-tuning the PA capacitors as required for absolute maximum, repeating several times to get the absolute maximum.

MF25FM; Tune C98 for maximum current indicated on the multimeter, then watching the RF power meter tune C106, C107, C111 and C112 in that order for maximum RF output. Re-tune all the PA capacitors again for absolute maximum, repeating as required.

You may now find it useful to go through the multiplier and PA alignment stages again to squeeze the last drop of RF power out of the set. Then set the relevant crystal trimmer for the correct transmit frequency, and while modulating the transmitter adjust C48 for maximum deviation as heard on a monitoring receiver. RV1 which sets the mic gain will already be set fairly accurately, but RV2, the TX deviation control, may need adjustment to give the required peak deviation, this being 2.5kHz peak for 12.5kHz channelling as used on 4m.

That's It

So now you have a fully working 4m rig, all ready to use for your club net, for mobile use on 70.450MHz, or for packet use into your local node or DX Cluster. Have fun on the air!



Transmitter alignment points

Table 1 Receiver Modifications

Capacitor	Original Value	New Value
C49 (L10)	39p	82p
C51 (L11)	39p	82p
C53 (L12)	27p	56p
C55 (L13)	27p	56p
C65 (L16)	8p2	22p
C66 (L17)	8p2	18p

Table 2 Microphone Connections

Pin 1 Mic Live
Pin 2 Mic Ground
Pin 3 +10V for TX
Pin 4 Not Used
Pin 5 +10V