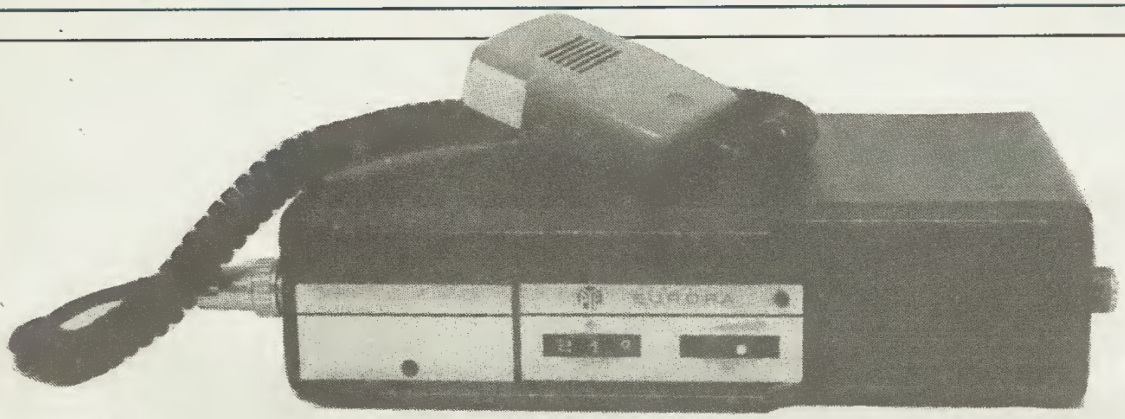
Conversion
PYE EUROPA



Chris Lorek G4HCL retrains a PMR surplus Europa to mind the shop for him, and other tricks

With the latest upsurge in packet radio activity, many amateurs active on this mode are feeling the need for a single-channel FM transceiver for dedicated use, permanently coupled to their Packet Radio TNC and freeing their expensive do-everything rig for voice communication! Alternatively, you may like to have a dedicated rig for use on your local repeater and natter channels without the expense of using a costly synthesised mobile rig. Getting going on the bands certainly doesn't need to be a second mortgage affair, as HRT have shown from the very popular series of surplus professional radio conversion articles. We continue here with the Pye Europa transceiver, now in plentiful sale on the surplus market at around £25 a time.

Identification

The Europa is a reasonably compact dashmount transceiver, with a built-in speaker on the right hand side of the facia, two side-mounted rotary controls, and a black padded surround. It is easily distinguished from the similar Pye 'Motafone' by the Europa's elongated front panel housing a plug-in module at the left hand side of the facia. You may find this has a blank unit installed, or it may be fitted with a tone facility unit housing various buttons and indicators. If you find yours has the latter then don't worry as it may easily be linked out of circuit as will be shown later.

Note that the Europa is a *range* of equipment, and to find out exactly which model you have, take a look at the metal serial number label fitted to the rear of the set.

Following the 'Equipment Type' you will see:

MF5FM 8W VHF set, 3 or 6 channel
MF25FM 25W VHF set, 6 channel
MF50 5W UHF set, 3 channel

This will normally be followed by the frequency band code:

VHF
A 146-174 MHz
B 132-156 MHz
P 79-101 MHz
E 68-88 MHz

UHF
T 380-440 MHz
U 440-470 MHz

Also, for VHF equipment, the channel spacing will be indicated by the 'S' for 12.5kHz, or a 'V' for 25kHz (20kHz channel spacing models being made for export only), possibly followed also by a '3' or '6' to indicate 3 or 6 channel facility.

You will find the A and B band versions suitable for 2m, the A band being the more commonly available of the two, and either the U or T band versions suitable for 70cm with the U band model being the more common. The E band model is perfect for 4m. Details of the 4m Europa were given in the '4m special' in the September 87 issue of HRT so I will not repeat them here. The 'P' band Europa is a bit of a rarity, but it simply is not worthwhile attempting to 'convert' this due to the abundance of cheap A and U band sets on the market.

Channel Spacing

All UHF Europas employ 25kHz channel spacing, making them suitable for current use on 70cm. However the VHF sets may either be 12.5kHz *or* 25kHz sets, so do ensure you obtain a set to suit your needs. At the time of writing, the majority of use is based on 25kHz spacing, but proposals are afoot to go to formal 12.5kHz spacing in the UK with corresponding changes in equipment parameters such as receiver bandwidth and transmitter deviation.

If you are in any doubt as to the spacing of your Europa, take a look inside at the metal crystal filter, which will be marked with FCO3233

(12.5kHz) or FCO3234 (25kHz). It is however reasonably easy to replace this filter with the alternative type to suit your requirements. Surplus dealers such as Garex Electronics may be able to supply spares. Apart from this filter, only slight re-alignment is required in practice to change between the two for most amateur needs.

Crystals

The required crystal frequencies are:

$$2m = \frac{\text{RX Xtal Freq (MHz)}}{\text{RX Freq (MHz) + 10.7}}{12}$$

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

$$70cm = \frac{\text{RX Xtal Freq (MHz)}}{\text{RX Freq (MHz) + 10.7}}{36}$$

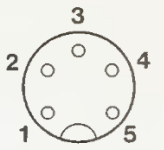
$$\text{TX Xtal Freq (MHz)} = \frac{\text{Tx Freq (MHz)}}{32}$$

The crystal case size for the 3 channel set is HC6/u, and the smaller HC25/u for the six channel set. You may find crystals are available ex-stock on popular channels for the Europa from the usual suppliers, but if you need to order them specially you may find it useful to quote their specification type T25 (3 Chan. VHF.) or T80 (6 Chan. VHF), with T40 for UHF. Note these are commercial specifications with accompanying prices, but it will give the supplier the correct crystal loading etc. if you give this but requesting 'amateur spec'. Note also the UHF crystals are identical to those used in the earlier Pye W15U UHF Westminster.

Take heed that I have specified additive mixing in both cases for the receiver, this is correct for when using the set on the UK amateur band. If a crystal supplier attempts to sell you incorrect crystals of a frequency only suitable for subtractive mixing, ie −10.7MHz rather than +10.7MHz, as I have experienced from one supplier in the past, be warned that you may run into problems when you try to align the receiver multiplier stages, hence possibly suffering poor receive sensitivity as well as experiencing difficulties in alignment. This crystal supplier once had the cheek to tell me the manufacturers of the set had made the equipment incorrectly because they did not match their crystals!

Preliminaries

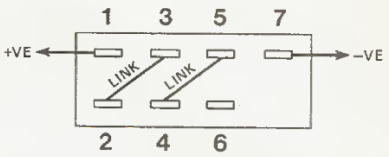
For the receiver tune-up, you'll need a multimeter, and also a variable level of signal at the receive frequency. If you have access to a signal generator then fine, otherwise a friendly local amateur transmitting a signal to you may be useful, combined with variation of transmit and receive aerials. For UHF, the third harmonic of a 2m transmitter can often provide a reasonable degree of help. On transmit, as well as a multimeter you'll need some form of RF power meter, and a dummy load if available. A frequency meter helps but off-air reports from a helpful amateur with a centre-zero meter on the transceiver are usually quite sufficient. Correct setting of the deviation may be done by a listener comparing the peak level of your audio with that of an accurate source such as a repeater, or if your set is crystalled up for the repeater itself then quickly switching between input and output frequencies will give a useful comparison.



1. MICROPHONE LIVE
2. MICROPHONE SCREEN
3. PTT COMMON
5. PTT MAKE

PYE EUROPA MICROPHONE CONNECTIONS

Fig. 1. Pye Europa microphone connections

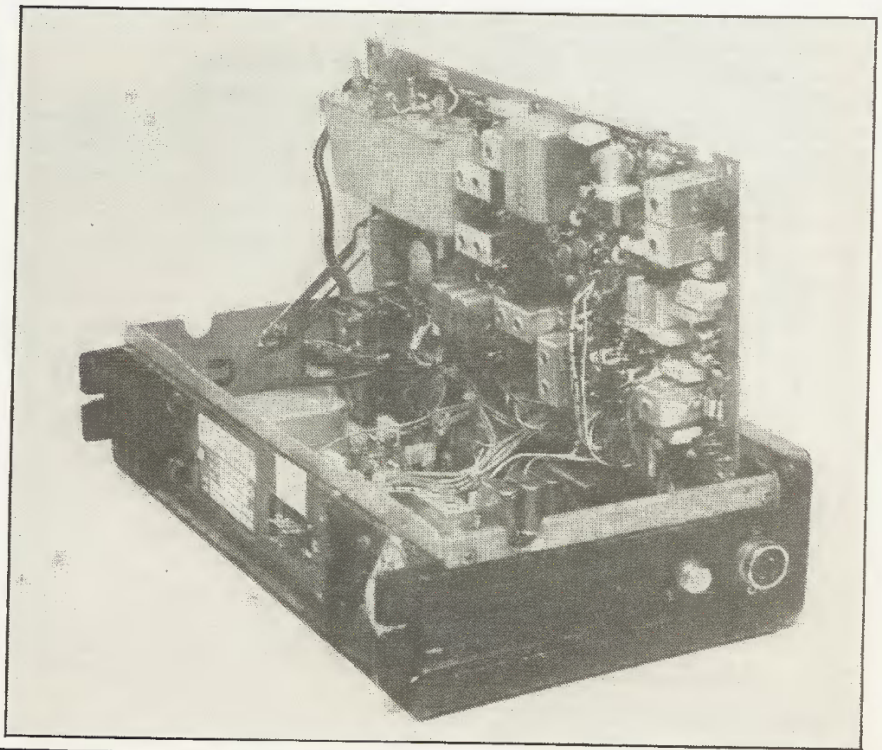


PYE EUROPA DC POWER PLUG WIRING (NEG. EARTH)

Fig. 2. Pye Europa DC power plug wiring (negative earth).

Connections

The microphone connections are shown in the accompanying diagram, a 5-pin 270 deg. DIN plug is used for this. 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.



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. If you wish to connect an external speaker, make sure it has a impedance of greater than 6 ohms. If you need to connect received audio to your packet radio TNC, link its audio input to the RX PCB pins 12 (live) and 11 (Screen), which is the squelched audio feed to the volume control. If you require a 'busy' squelch line output, the collector of TR14 on the RX PCB of both VHF and UHF sets switches between 0.9V (busy) and 8.4V (no signal).

The 13.8V DC power connection requires a 7 pin Plessey type free socket, the connection details for this being shown. You may wish to replace this with your own socket or with flying leads, in which case you can wire the required links on the inside of the rear socket. I would recommend using a 5A fuse in the DC power lead with the MF5 sets, and a 10A fuse in line with the MF25 set.

Opening Up

Remove the top lid of the equipment by removing the three screws at the rear of the case, then remove the three screws securing the RX PCB and hinge this upwards. Insert your crystals in their respective positions. 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 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.

VHF 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 for 'dip' in the meter reading, re-adjusting carefully for minimum voltage reading. 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 minimum voltage. Transfer the positive lead to TP10, and tune first L13 and then L12 for maximum, then tune L16 for minimum. 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.

Here we need to receive a signal at the aerial connection, so start by adjusting the relevant multi-turn crystal trimmer to ensure your crystal is on frequency, continuing until you are sure you are receiving the least distortion possible on a modulated signal. Throughout the front end alignment, you'll need to gradually reduce the level of the signal as your receiver becomes more and more sensitive. You may find it useful to open the receiver squelch while tuning, by adjusting RV1 which is the squelch preset control.

On the large metal block front end assembly, 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, not necessarily with a non-metallic tool (you may need to use a pair of fine nosed pliers for instance), for best quieting of the received signal. Once you have done

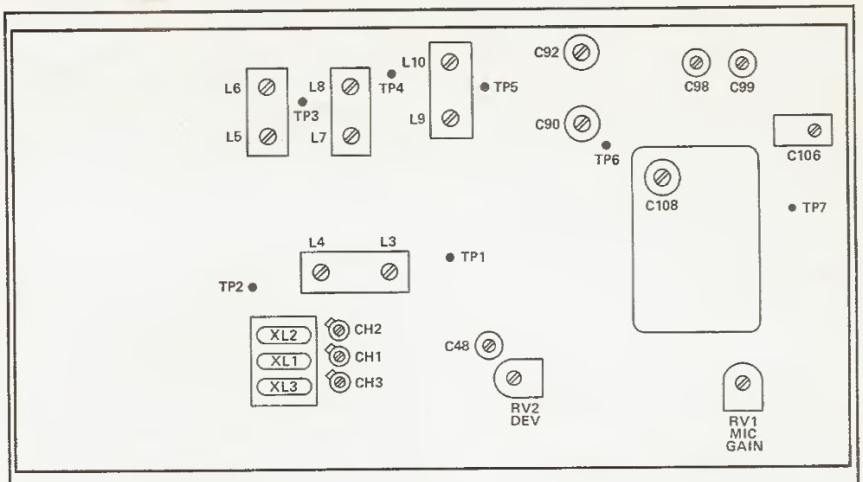


Fig. 4. VHF MF5 Tx alignment diagram

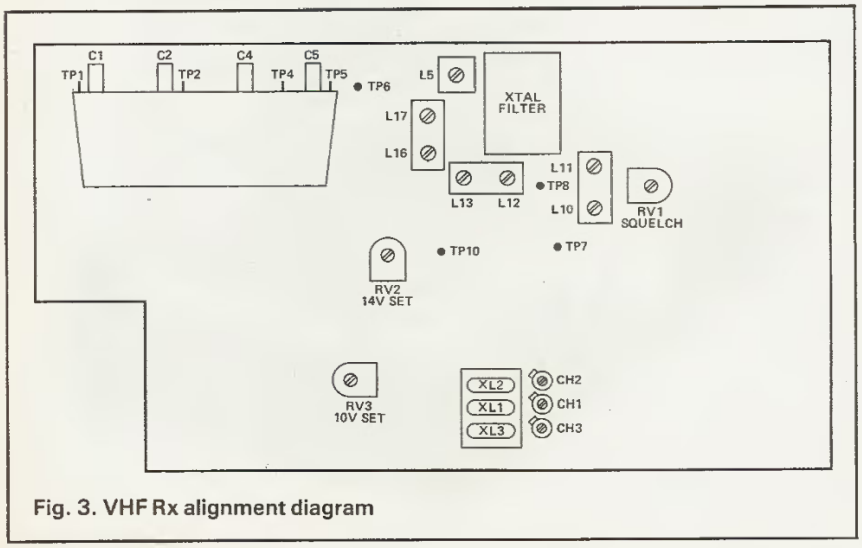


Fig. 3. VHF Rx alignment diagram

this, remove the 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, ie maximum quieting of a weak received signal. Carefully re-tune the crystal trimmer if required for spot-on reception, and at this stage if you have replaced the crystal filter you may find that you'll need to slightly re-adjust L5 for minimum distortion of a modulated signal, otherwise leave it and the successive IF coil adjustments well alone as they will have been aligned correctly in manufacture.

Now onto the transmitter. Connect your power meter to the aerial connection, and key the TX on your crystalled channel, 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 and L3 both for maximum, then L5 for minimum 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 beneath the PCB, for maximum power, re-tuning the PA capacitors as required for absolute maximum, repeating several times as required.

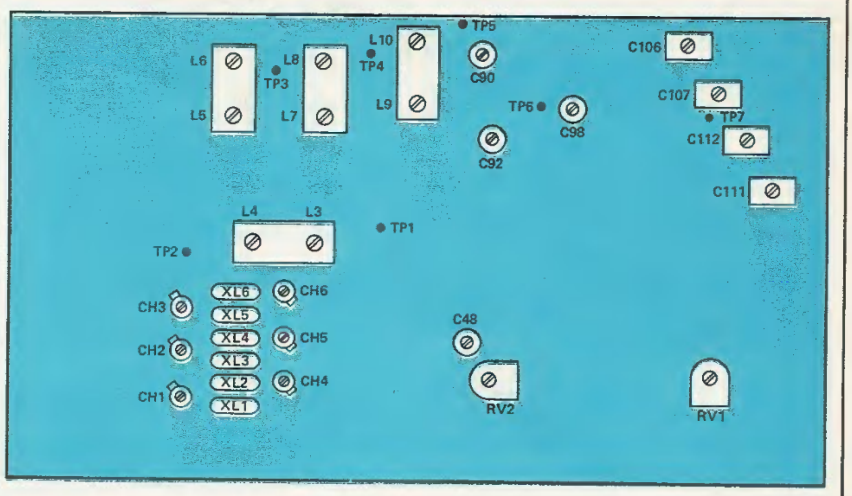


Fig. 5. MF25 Tx alignment diagram

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 as required 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 of 5kHz peak for 25kHz channelling. You may find that hinging the boards down often has a slight effect on the operating frequency of both TX and RX, so check this and re-adjust as necessary before finally screwing the case lids down.

UHF Alignment

As with the VHF set, we start by aligning the receiver multiplier stages. Switch to the appropriate crystal channel position, and connect your multimeter negative lead to the DC supply negative. Switch to the 2.5V

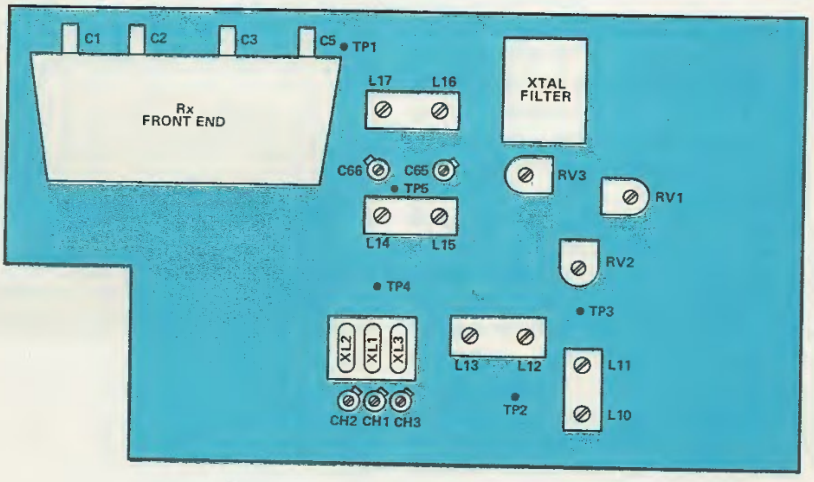


Fig. 6. UHF Rx alignment diagram

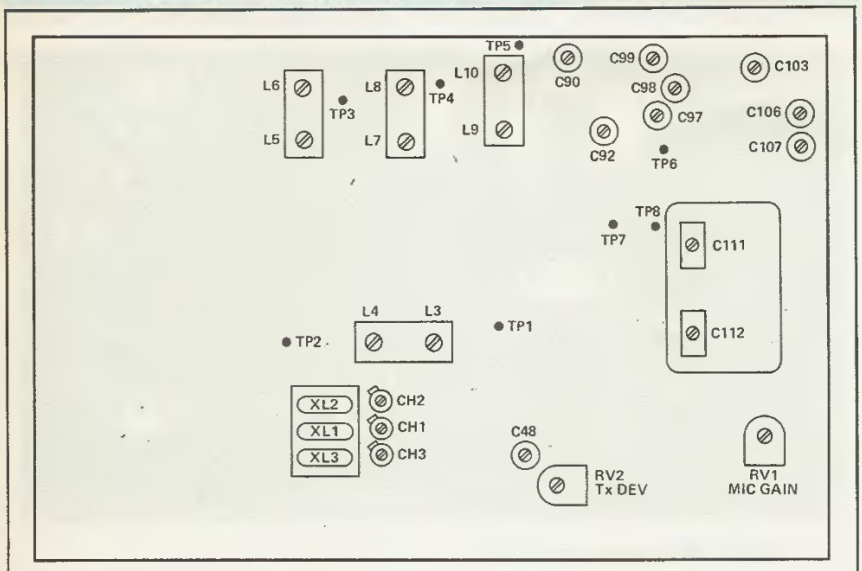


Fig. 7. UHF Tx alignment diagram

DC range and connect the positive multimeter lead to TP2. Using your non-metallic ferrite core adjuster tune L10 for minimum reading. Transfer the multimeter positive lead to TP3, and tune L11 and then L10 for maximum reading, re-adjusting as required for absolute maximum, then tune L12 for a minimum reading.

Switch to the 10V range on your mulitmeter, and transfer the positive lead to TP4. Tune L13, then L12, for maximum reading, again readjusting as required for maximum. Transfer to TP5, switch to the 2.5V range, and tune L14 and L15 for maximum. Now switch back to the 10V range and transfer the lead to TP1. You'll now need to use a flat-bedded non-metallic trimmer to adjust the multi-turn capacitors C65 and C66, tune these for maximum indicated voltage on TP1.

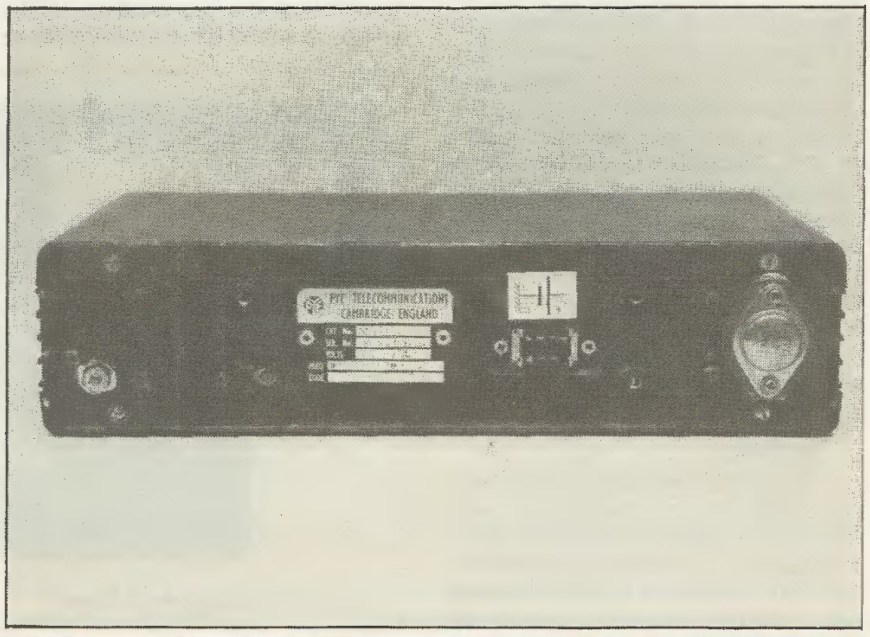
We now need to monitor an RF signal by using the aerial connection. Ensure the relevant crystal trimmer is adjusted so that you correctly receive a strong signal on the required channel, you may find it useful to open the receiver squelch at this point by adjusting RV1, the preset squelch potentiometer. On the metal front end block, adjust C5, C3, C2 and C1 for maximum quieting of a received signal, reducing the RF level of this as required. Again as with the VHF front end, you may find you need to use a pair of small pliers or suchlike for this if you don't have the correct tool. It is not necessary to use a non-metallic tool on these four. Once you have done this, go back to C65 and C66 adjusting these for absolute best quieting of a weak signal, re-adjusting the trimmers on the front end block also for absolute best sensitivity.

Re-check the adjustment of each cystal trimmer for correct on-frequency reception, tuning these for minimum distortion of a modulated signal. Re-adjust the squelch as required, and that completes the receiver alignment.

To get the transmitter going, connect your power meter to the aerial connection, and with your multimeter switched to its 10V DC range connect its positive lead to TP1 on the transmitter PCB, with the negative lead again connected to the DC negative supply. Key the transmitter PTT, and remember to keep this keyed when taking readings. Using your ferrite core adjusting tool, tune L3 for a minimum voltage reading. Transfer the multimeter positive lead to TP2, and tune L4 then L3 both for maximum reading, re-adjusting as required for absolute maximum, then tune L5 for minimum. Transfer to TP3 and switch your multimeter to its 2.5V DC range. Tune L6 and then L5 for maximum reading, then tune L7 for minimum. Transfer to TP4 and tune L8 then L7 for maximum, then L8 for minimum. Transfer onto TP5 and tune L10 and then L9 for maximum.

Now remove the multimeter leads, and connect the positive lead to the +10V DC stabilised line present on pins 5 and 6 of the TX PCB, and the negative lead to TP6. Using your flat-bladed non-metallic trimming tool adjust C90 and C92 for maximum reading. Now connect the multimeter positive lead to the 13.8V DC positive supply, and the negative lead to TP7. Tune C97, C98 and C99 for maximum reading, re-adjusting again as required for absolute maximum.

Transfer the multimeter negative lead to TP8, and tune C103 and C104, again for maximum reading. By now you should be getting an indication of RF power output, so try to keep the TX PTT keyed only for as long as you need for individual adjustments, to avoid overheating the PA. Tune C106 and C107 for maximum indicated power



output, then tune C111 and C112 also for maximum output. Go back and re-tune these capacitors again for absolute maximum output; you may also find it useful to go through the DC alignment stages again to make sure you get optimum performance.

Adjust each crystal trimmer as required for the correct transmit frequency, and while monitoring on a receiver adjust C41 for maximum deviation when modulating the transmitter, then adjust RV2 for the correct peak deviation as required. You'll find the TX microphone gain should already be set to a reasonable level, but this may be adjusted with RV1 if required.

Faultfinding

It is beyond the scope of this brief article to give complete PCB layouts and circuit diagrams for faultfinding purposes, however the most common fault you may encounter is that of no receive audio. If so, first check that the audio link is in place between pins 8 and 12 on the facility socket, as a tone board that may have once been in place could have been removed for some purpose. If not fitted, a blank PCB with a connecting track linking these two connections should normally be in place, which of course may also be missing.

If all is correct here, check the squelch potentiometer (a spray of switch cleaner on this often works wonders) and try connecting an external 8 ohm speaker in case the internal one is faulty, remembering to keep the speaker leads isolated from the chassis. If however the large circular audio IC next to the front end block is getting hot it is likely this has been destroyed, a common reason for a set being sold as a 'scrap' bargain. This is of little consequence for packet radio use, but I would advise you to unsolder and remove the IC if it is overheating. If you do require loudspeaker level audio, I recommend adding one of the many low-cost audio ICs. Maplin and Cirkit amongst others supply a variety. This may be built onto a small sub-board inside the set, fed from the wiper of the volume control. This point carries fully squelched receive audio, and the output of the amplifier may of course be connected to the internal speaker as before.

Finale

This series will continue with a look at the Pocketphone 70 range of equipments suitable for 2m use, followed by the 'Olympic' range for 2m, 4m and 70cm together with channel scanning and synthesizer modifications. As the mobile rally season approaches, more and more surplus PMR gear will be on sale, often at very low prices in view of the forthcoming PMR regulations coming into force in 1990 which make these earlier sets redundant. As this series can only give limited details on the range of ex-PMR equipment available, our sister company Argus Books will be publishing the *Surplus Two-Way Radio Conversion Handbook* written by G4HCL. in time for the 1989 rally season. This will give greater details on the many sets already covered in past issues of HRT, as well as several other equipments including repeater modifications and details for packet radio use.