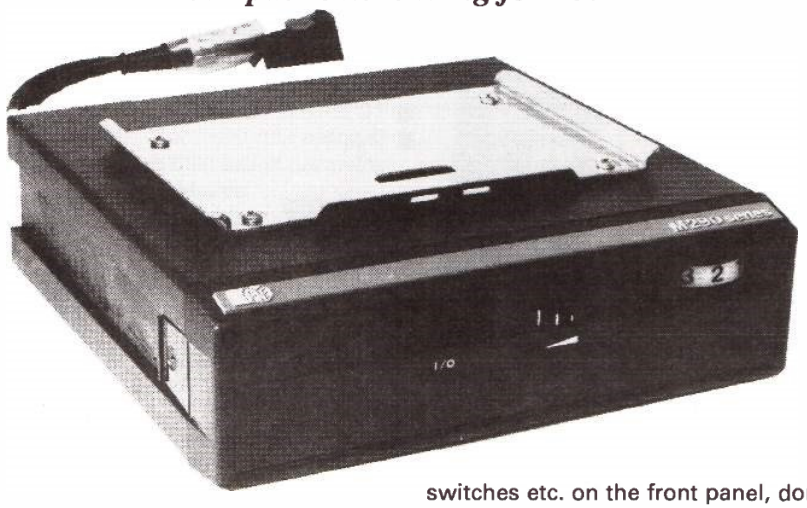
Pye M296 Conversion to 70cm FM

G4HCL continues with the M290 series by featuring a compact 6W/25W rig for 70cm



The M290 Series, they all look the same!

I gave an introduction to M290 series in the January 1993 issue of HRT, this series covering a range of VHF AM/FM and UHF FM car radio-sized transceivers, and giving details for the M294 A, B, and E band models for 2m and 4m use. This time I'm covering the M296, suitable for use on 70cm, and there's also a HRT article 'lined up' by Pete G7DXV on converting the M band M294 to 2m, which you'll see in these pages shortly.

Part of a Series

From the Jan 93 article (if you missed it, back issues *are* available!) you'll see this set is part of a *series*, which all look identical from the outside. So take a look at the bolted-on serial number plate on the rear panel, if you see 'M296' on this then you're in business for 70cm! The set comes in either single or six channel versions, if it has a mechanical 6-way channel switch on the front it's multichannel, if it has a blanking plate instead it's single channel, simple as that. You may also see various selective calling indicators, switches etc. on the front panel, don't worry about these, (see the earlier article for details), we'll get your M296 operating 'normally' without these.

The set's transmitter comes in either a 6W or 25W power output versions, the difference being an additional power amplifier PCB which is bolted to the inside rear panel of the set. Take a look inside by undoing the four screws on the rear panel and sliding the set out, if you see such a board with its prominent CD4442 transistor fitted, you've got a 25W model, if there's an empty space it's the more common 6W version.

The transceiver was originally manufactured to cover either the 405-440MHz range (T band) or the 440-470MHz range (U band), either will operate on 70cm, but ensure you obtain the correct crystals using the formula shown here. Don't be 'fobbed off' by the supplier saying "Yours is a U band set so you need receive crystals to the U band formula", as this uses negative side carrier injection and you may end up with lower receive sensitivity when you try to tune the multiplier stages down to operate on 70cm. If he wants to argue the point, say 'goodbye' and purchase them from someone else instead!

Crystals

The formula you need is;

$$\text{TX Crystal Freq.} = \frac{\text{TX Freq}}{32}$$

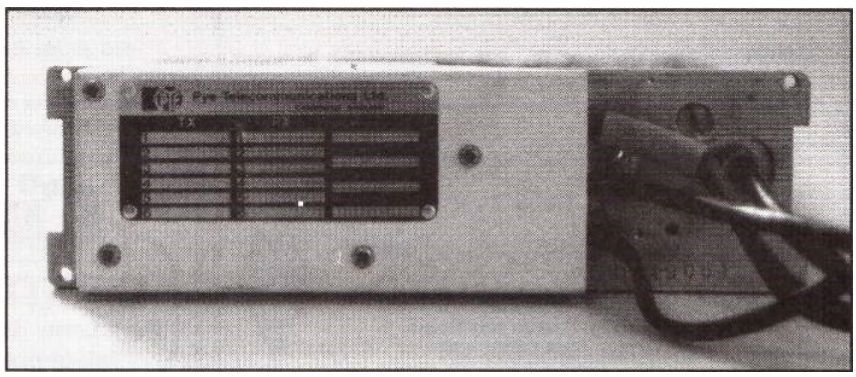
$$\text{RX Crystal Freq.} = \frac{\text{RX Freq} + 21.4\text{MHz}}{8}$$

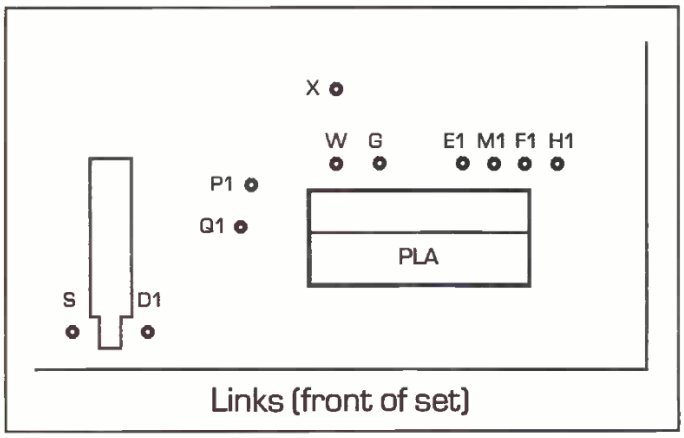
You'll need a pair of crystals for each channel, i.e., one for transmit and one for receive. The crystals are plug-in HC25u types, remember to quote the crystal frequency rather than the transceiver operating frequency when you order these, stating they're for the M296 transceiver. Although I'd advise ordering just 'amateur spec' crystals to save money, the commercial specification reference for these are T92RX for both the TX and RX crystals, which may be useful to give to your supplier for information.

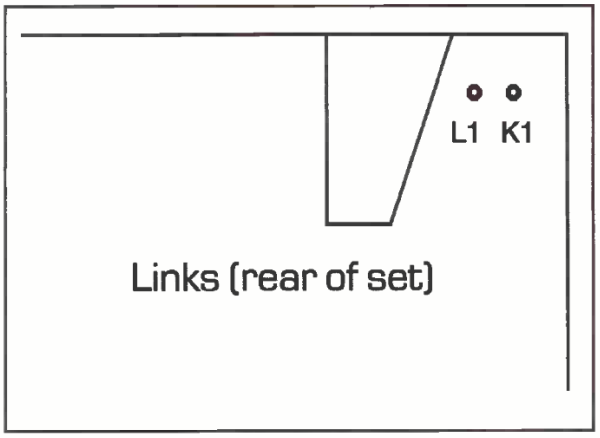
Getting it Going

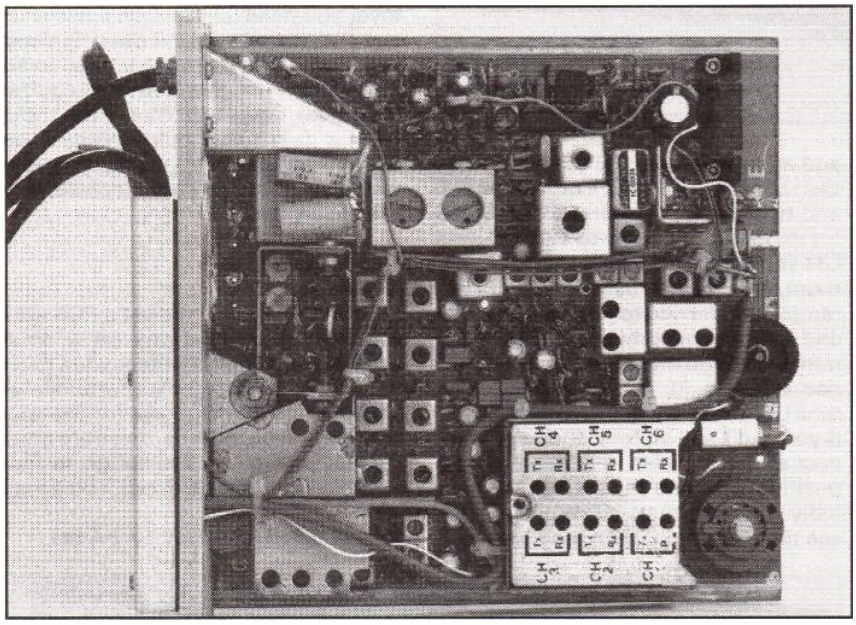
The first thing to do is to slide the set out from its case (just remove the four rear screws, you don't need to remove the front panel), lift the crystal compartment lid and plug your crystals into their respective positions. Now take a look inside the case you've just removed the set from, and see if any 'electronics' remain in the shape of selective calling units. These slide into the set in the same way as the RF board you've just removed, but out of the front of the set rather than the rear. This circuitry may cause your set to either keep its receive audio muted until it

Look at the rear panel to find the model number

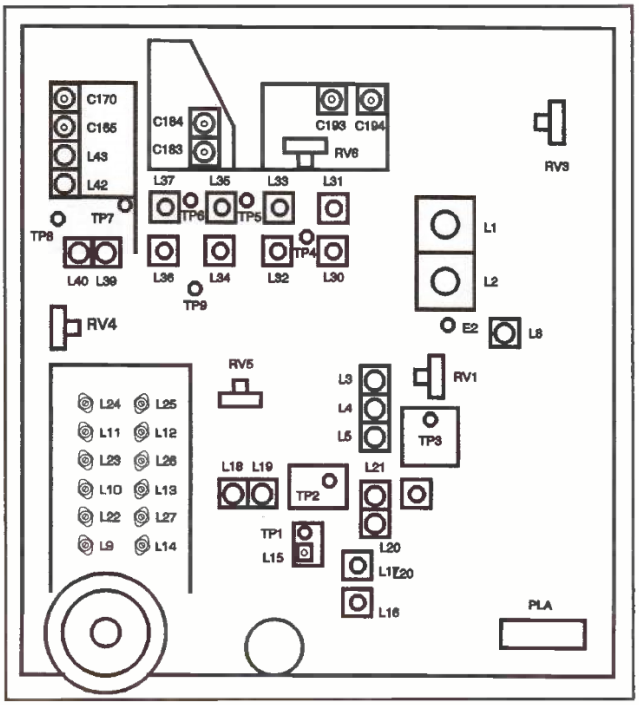








Here's what's inside the M296



receives the correct off-air tone(s), or transmit various 'funnies' you possibly might not wish it to! If you find a selective call module present, I'd recommend you entirely remove the electronics of this from the set, just retaining the plastic front panel for use with the set. If so, then check the linking details on the radio section PCB, you need to have pin F1 linked to pin S, rather than G1 linked to S as may be fitted if the option provides RX audio switching. Likewise on transmit, the lead from pin 3 of the mic socket should go to pin L1, rather than to pin K1 if automatic selective call signalling is used on transmit.

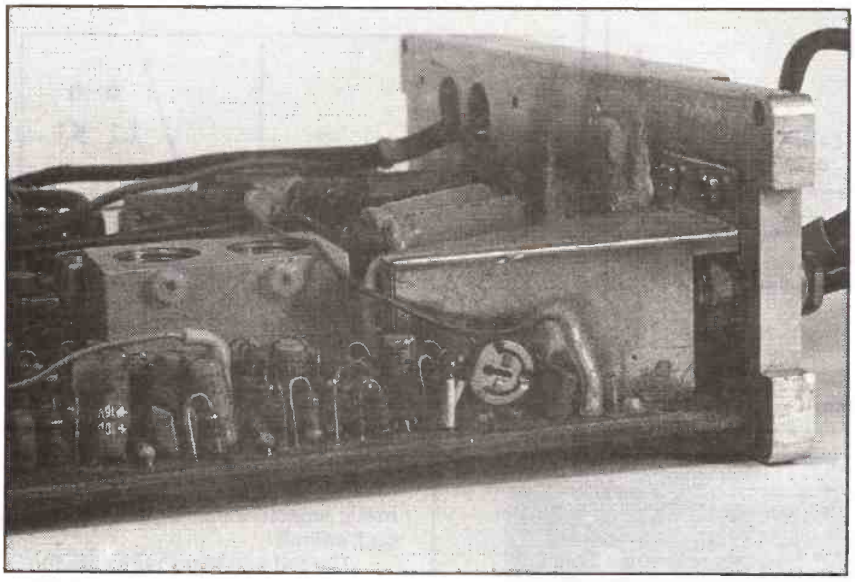
The red and black wires are the DC 12V positive and negative, and the remaining pair are for the external loudspeaker connection, you should use a 3-8Ω impedance speaker here. The TX PTT needs +10V for switching, this is provided on pin 5, see the previous article for details of packet TNC interfacing.

Receiver Alignment

Let's start with the receiver. Connect your 12V power supply, set the receiver volume control to about a third of its maximum travel, and rotate the squelch potentiometer, RV3, fully anticlockwise to make sure you hear squelch noise from your speaker - if not then check your connections and links. You'll need a non-metallic trimming tool for alignment, and the use of a multimeter, and towards the end an off-air signal to align the front end with.

Starting with the multiplier stages, connect your multimeter negative lead to the DC negative supply, which is also the rear panel chassis, and set your meter to its 2.5V DC range. Connect the meter positive lead to test point TP1, and with your channel switch in the correct position use your non- metallic trimming tool (*don't, ever,* use a jeweller's screwdriver!) tune the cores of L15 and L16 for maximum reading, peaking both for absolute maximum, then adjust L17 for minimum reading. Remove your multimeter positive lead, switch the meter to the 10V DC range, then connect the positive lead to TP2 and tune L18 and L19 both for minimum reading. Transfer the lead to TP3, switch back to the 2.5V DC range, and tune L20, L21, L18 and L19 for maximum, then retune L20 and L21 again for absolute maximum. That's it for the multiplier alignment.

Now for the front end. If you con-



RV3, the RX squelch control

nect an aerial (or a signal generator if you're fortunate enough to have access to one), you may be able to hear any strong off-air signals on your frequency already. You'll need to find some form of signal on your channel frequency to align onto (local amateurs can be useful here), and start by adjusting your receiver crystal trimmer for distortion-free reception. Then, tune L1, L2, L3, L4 and L5 for best quieting, reducing the level of the off-air signal as needed for accurate adjustment, and retune all these until you can't get it any better. Then, a final re-set of the crystal trimmer, followed by your squelch preset, and that's it, you should have a fully operational receiver.

Transmitter Alignment

For this you'll need a 50Ω dummy load connected to your aerial socket, capable of handling 6W or 25W as applicable, with some form of RF power level detection in line such as a power meter or an absorption wavemeter. Remember to keep your PTT (Push-To-Talk) keyed when making adjustments, by shorting pins 3 and 5 on the microphone connector, but keep this keyed for only the length of time it takes for you to adjust each stage, to prevent overheating or damage to the PA.

To begin with, set the RF power preset, RV6, fully anticlockwise, you can get access to this with your trimmer through the small hole in the screen in front of it. Set your multimeter to its 10V DC range, and connect the meter positive lead to TP4. With the PTT keyed, adjust L30 and L31 for maximum reading. Transfer your meter positive lead to TP5, set now to its 2.5V DC range, and adjust L32 and L33 for maximum, then L34 for minimum. Transfer to TP6 and tune L35 for maximum, then L36 for minimum. Transfer to TP7 and tune L37 for maximum, then L39 for minimum. Now switch back to the 10V DC range, transferring to TP8, and tune L39 and L40 for maximum, then L42 for minimum. You may by now see a slight rise on your RF power indicator, so tune L43 and C165 for maximum power. If you can't see an indication yet, connect a DC ammeter in series with the positive supply to the set and tune initially for maximum current until you see the RF appear, then tune for maximum RF output. Carry on by tuning C170 again for maximum, and then tune C183 and C184 as a 'pair' for maximum, then C193 and C194 again as a 'pair' again for maximum - i.e., tune one of the pair slightly, then the other of the pair, then back again and so on, then onto the next pair. If you have a 25W PA unit fitted, you'll need to also peak the trimmer capacitor, C306, on this PCB for maximum output. As a 'final touch', readjust L39 and L40 for absolute maximum power. You can, now, if you wish adjust RV6 to reduce the power output to the level you need, if so you should readjust C193 (and C306 if fitted) for maximum power again, then readjust RV6 again for the level you need.

RV5 is the transmit deviation control, which you'll probably need to adjust slightly to give you the required 5kHz peak deviation. RV4 is the transmit mic gain (this should already be set to appropriate level) which you may wish to adjust after you've correctly set the deviation.

Interfacing

On the front of the set's PCB are a number of connections on a small socket. The details for these were given in the earlier article, but unfortunately a 'gremlin' got in the works for the table of the pin designations, these are given correctly here, my thanks go to Pete G7DXV for pointing this out. You'll need

This is where the 25W TX PA fits

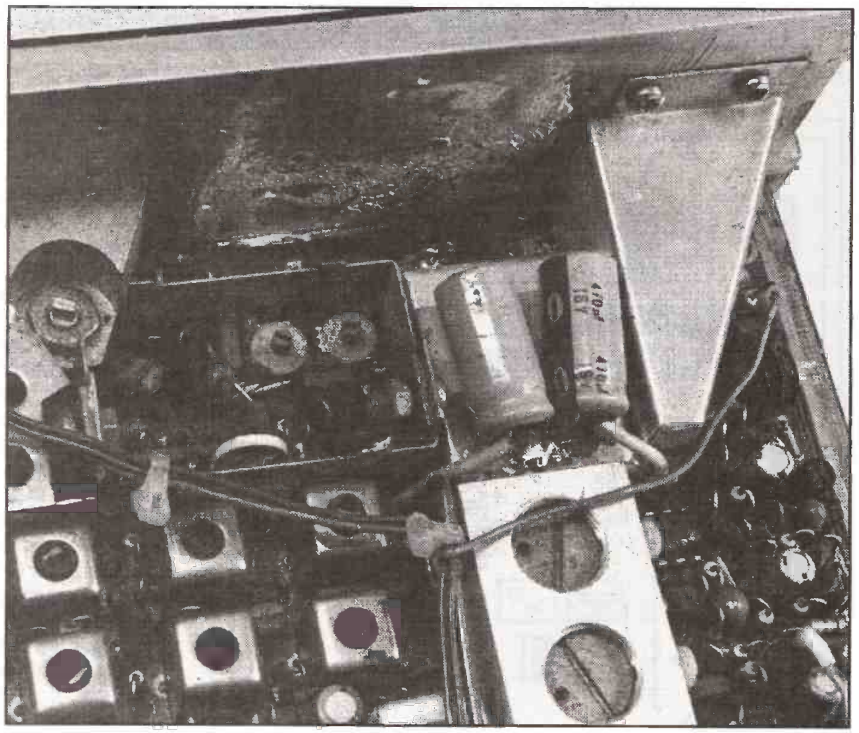
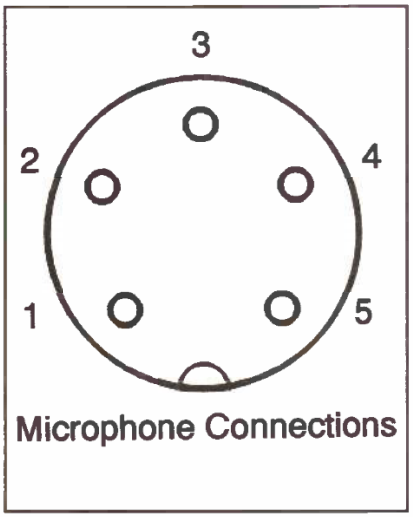
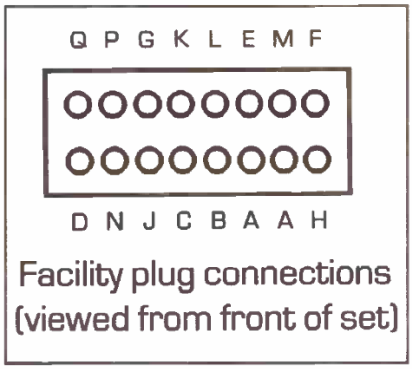


Table 1 - Mic Connections	
1	Mic live
2	Ground
3	10V PTT line
4	RX low level audio
5	10V output



Microphone Connections

Table 2 - Facility Module Connections (correction from Jan 93 article)			
A	-ve	J	TX 10V
B	Mic preamp gating	K	10V via TX PTT
C	In band TX encode	L	TX relay coil
D	Sub audio TX encode	M	Undedicated
E	RX audio for decoders	N	13.2V
F	RX squelched audio	P	Undedicated
G	Undedicated	Q	Undedicated
H	10V		



Facility plug connections (viewed from front of set)

a link between pins D1 and D2 if you want to add TX sub-tone (CTCSS) encode. If you'd like to add a 'busy' indicator, you'll find that pin P2 goes to 0V when the squelch raises (you may sometimes find this is linked to pin M1, which is in turn connected to pin M on the PCB facility connector), so you can add an LED/resistor combination or an indicator lamp here if you wish. You may also find it handy to bring the squelch potentiometer connections out to a front panel mounted control, you'll need to use a 10k linear potentiometer for this.

Final Final

That's it. If you've used a jeweller's screwdriver on the cores and broken them, don't cry to me for help (you were warned!), but if you find you are having problems and need a copy of the circuit diagram of the set, send an SAE, marked 'M296 circuit' in the top left hand corner, to the HRT Editorial Office, P. O. Box 73, Eastleigh, Hants. SO5 5WG, and you'll have one by return of post. Happy 70cm operating!