Conversion PYE SSB130

Chris Lorek G4HCL brings a surplus HF-bander up to date.

Our series of Pye ex-mobile radio conversion projects featured in HRT has been very popular with readers, a tremendous amount of feedback having been received asking 'when's the next one?' Already thousands of amateurs have successfully gained a second rig at very low cost either for use when mobile or portable, or for use as a stand-alone packet radio station for club natter channel use. Others coming into the hobby for the first time have found that getting started in amateur radio need not cost a fortune! As a result, our resident conversion expert has been shaken into activity again, so here we go with what you've been asking us for. We're starting with what many newly-licensed amateurs ask us for, getting onto HF without breaking the bank. We show you how by using the Pye SSB130 HF transceiver.

100W SSB on HF?

Many amateurs consider ex-two way professional gear to be VHF and UHF only, operating solely on AM or FM. Not so, if you know where to look you'll find a blue box with the label SSB130 on it, at the 1988 Elvaston Castle Rally for instance a number of these were being sold from £50 upwards by one trader. 'What's the catch?' you may ask. Well, in common with most other ex-PMR gear it operates on several crystal controlled channels, great for net use but I'll also be showing how to incorporate a VFO or synthesizer add-on to give greater flexibility. It also operates on pre-set bands, and readers of my previous conversion articles will know I'll be showing you precisely what to look for when buying to make sure you come away with exactly what you need. Yours truly has now used an SSB 130 for over 5 years, as well as providing many pleasant SSB contacts on 80m and 40m it is also used for the HF port of my HF/VHF packet radio node, allowing the main transceiver to be freed for other use.

Features

The set covers 2MHz to 15MHz in three pre-set ranges, and was built to operate on six crystal-controlled channels each operating on USB, LSB, CW, or SSB with inserted carrier to provide AM. Plug-in power supplies allow operation either from the AC mains, or from 12V or 24V DC supplies for mobile or remote use. A pair of 6883B power tetrodes are used in the final transmitter amplifier to provide an output of 100W peak envelope power, the remainder of the set being solid-state. Six SO-239 coax aerial connectors on the rear of the set allow you to connect separate aerials for each frequency range if needed, you can of course common any or all of these up as required for multi-band use.

There are two versions of the set, the most common being the SSB130M, designed primarily for mobile operation. This features a built-in speaker, volume and squelch controls, mode switch, a large six-channel knob, and a 'trim' control acting as a receiver clarifier (RIT). A small control box may be connected if required to enable the relatively large set to be mounted remotely in the vehicle. The SSB130F is similar to the 130M apart from having an elongated facia housing a metering panel and VOX facilities.

The DC power supply fits into an opening at the rear of the set, note that *different* plug-in units are used for 12V and 24V although these appear physically similar — look at the attached metal label riveted onto the unit to check. The AC supply comes in a black case fitted with a thick multi-way lead plugging into the rear PSU opening in the SSB130. Make sure when purchasing your SSB130 that you also obtain a power supply, these sometimes being sold separately.

Frequency Ranges

As you will see, the set may be

used to cover the 80m, 40m, 30m and 20m amateur bands, and with a bit of 'stretching' the top section of 160m if required. It is important to note that each batch of sets were individually made to order, and that you will find each switched channel position corresponds to a given built-in frequency range. These are divided into three bands:
Low: 2MHz — 4 MHZ
Mid: 4MHz — 8MHz
High: 8MHz — 15MHz
Any particular channel fitted and aligned in the equipment within a given range may be changed at will with a crystal change and re-tune but only to another frequency within that range.

You may find that many sets will come fitted with at lest one channel in each range, to allow the original user the maximum versatility in choice of operating frequency dependant upon the prevailing propagation conditions from time to time. This of course will also give you the best flexiblity, **but I have seen the odd one or two sets with only the 'Low' and 'Mid' ranges fitted, so beware.** The operating frequencies are often marked on the front or rear of the set, if not I would advise a quick look inside to see which frequency ranges are provided.

Assembly Part No.	Bands Covered
AT27112/1	LOW/LOW
AT27112/2	MID/MID
AT27112/3	LOW/MID
AT27112/4	MID/HIGH
AT27112/5	HIGH/MID
AT27112/6	HIGH/HIGH
AT27112/7	LOW/HIGH

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AT27111/4	MID/HIGH
AT27111/5	HIGH/MID
AT27111/6	HIGH/HIGH
AT27111/7	LOW/HIGH

Assembly part numbers for the tuned circuits.

Identification

To check which ranges are fitted, first look for any frequency label, even if this is out of date due to re-crystalling from change of use it would still have been correct at one time, giving a reliable indication unless the equipment was internally re-built — a rare occurrence. Of course not all six channels may have been used, so referring to **Fig. 1** take the lid off the set and look at the identification partnumbers of PCB No. 85 (three of them, side by side), these are the TX/RX common tuned circuits with each PCB covering two channels.

As the set operates as a single conversion TX/RX, with an intermediate frequency of 1.4MHz, you will need a crystal exactly 1.4MHz higher than each of your intended operating frequencies, conversely if the original crystals are fitted these will show you the operating frequencies of the equipment as supplied. So while at the rally, equipment sale or dealer's premises where you bargain for your SSB130, keep a lookout also for boxes of surplus crystals on sale. At least one crystal on each band will certainly act as a starting point to help you get the transceiver tuned up as well as providing many QSOs following your CQ call if the crystals operate in a suitable portion of the amateur band.

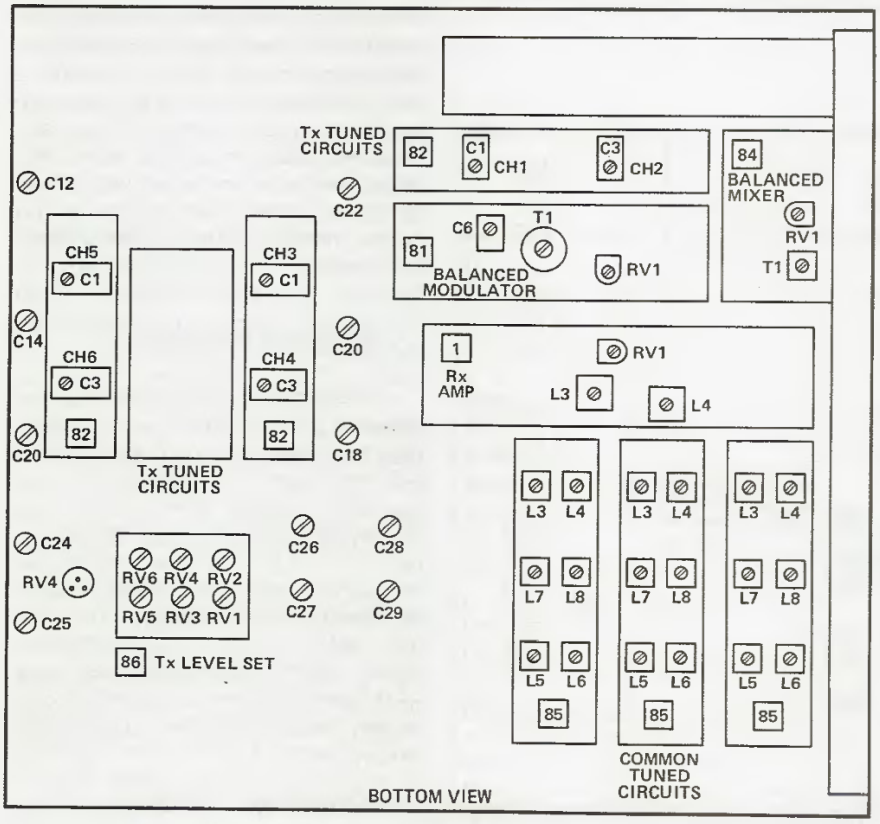


Fig. 1. Alignment diagram: the bottom view.

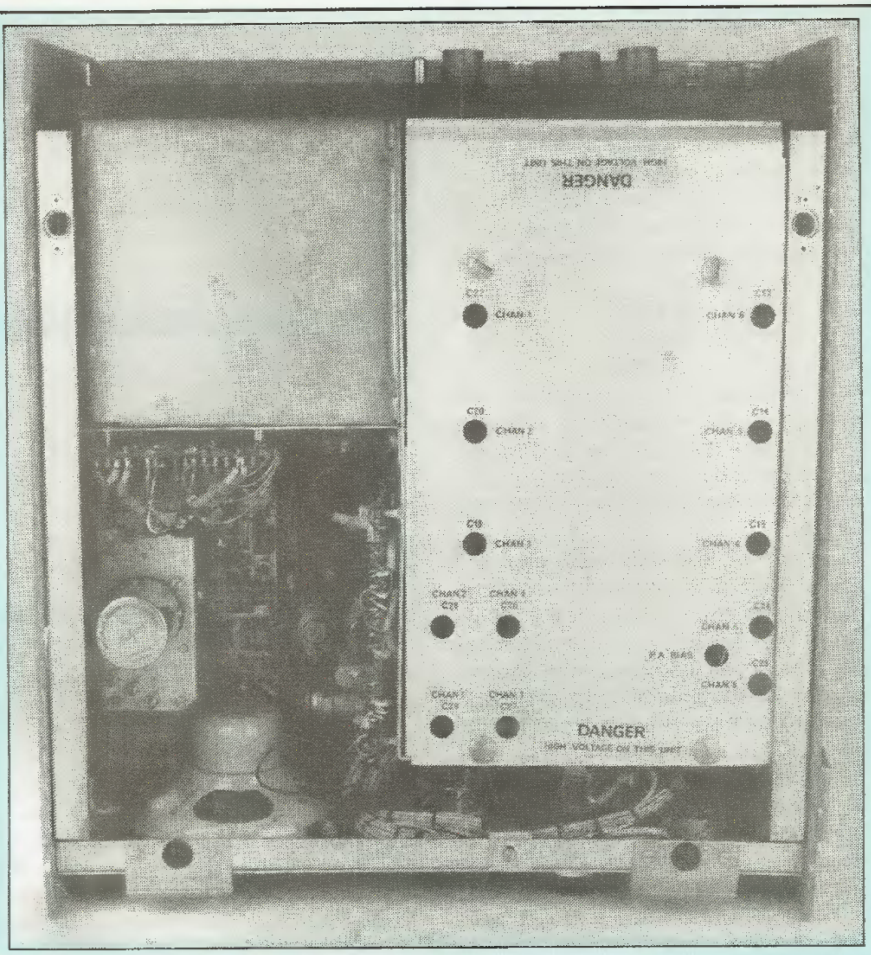
Tuning Up

First of all, fit your crystals, remembering to place these in the correct channel positions for the fequency ranges fitted in your particular set. If the plug-in crystal housing has been removed, or your crystals are of a different holder size, you may find it convenient to mount

suitable sockets onto a piece of Veroboard or similar, wiring these to the underside of the original crystal socket as shown in **Fig. 3**. Each aerial socket is numerically marked corresponding to the channel number, if you wish to use a single aerial for all bands simply link all the socket centre pins together inside the set with a soldered length of wire.

Switch the set onto receive, with the volume control mid-way and the squelch control to the fully 'off' position. You'll need some form of HF signal source to align the receiver, and you'll need to reduce the level of this as tuning progresses. A purpose-designed signal generator is ideal of course if you own or can borrow one, alternatively a strong off-air signal from a local amateur could be used, combined with reduction of transmitter power or variation of your receive aerial length or attenuation. I have even had complete success in the past simply by using a small handheld 1kHz signal injector into the aerial socket to align an SSB130 onto 80m, the generated square wave of this being rich in harmonics right up to HF.

Now take a look at the small ferrite cores in the tuned circuit PCBs, and fabricate yourself a small non-metallic tool to adjust these with, filed-down matchstick or small knitting needle is ideal. Do not under *any* circumstances be tempted to use a jeweller's screwdriver for this, apart from the metal having a de-tuning effect on the coils the use of this can so easily crack the brittle ferrite cores, making further adjustment impossible.



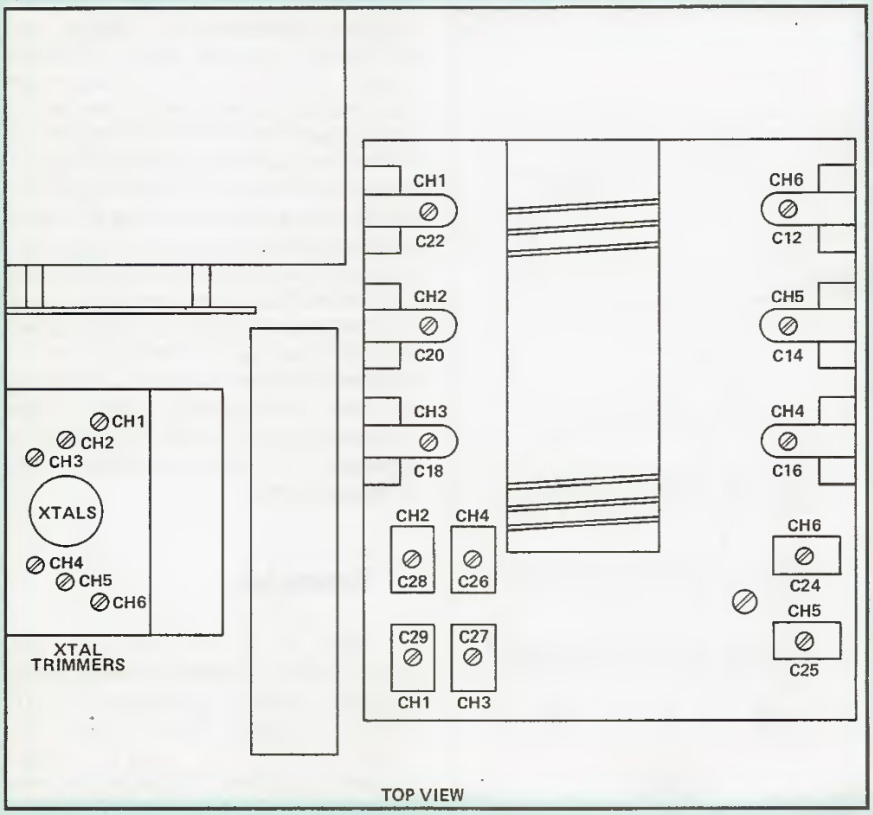


Fig. 2. Alignment diagram: the top view.

Receiver Alignment

By injecting a strong signal at the required receive frequency, remembering to use the correct aerial socket if these have not been linked, you should hear a beat tone coming from the speaker. All you need do now is simply tune the receiver stages for maximum audio level, reducing the RF signal level as required. To do this, refer to **Fig. 1** on the common tuned circuit board (PCB No. 85), and tune L6, L7 and L4 if using channel 1, 3 or 5, alternatively tune L5, L7 and L3 if using channel 2, 4 or 6, remembering to adjust the correct bank of coils appropriate to your selected frequency range.

Retune these again as required for the absolute best sensitivity. Having done that, you may now peak L3, L4, and RV1 on the receiver front end board (PCB No. 1), and T1 on the balanced modulator board (PCB No. 81), all for absolute best sensitivity, these last adjustments however should need little alteration if the set has been in previous use. Alignment of the common tuned circuits, ie L6, L8 and L4, or L5, L7 and L3 must now be reeated for each fitted channel, remembering that each crystal position has its own tuned circuit line-up.

Transmitter Alignment

Initially turn the chassis-mounted capacitors C24, C25, C26, C27, C28 and C29 all fully clockwise, and on the TX level set board (PCB No. 86) turn RV1 RV2, RV3, RV4, RV5 and RV6 all fully clockwise. Then set the TX PA coil tapping points as shown in **Table 1**, ensuring the correct link is used for each crystal position with its respective frequency range. You'll need a power meter and suitable 50ohm load connected to the relevant aerial socket to provide an indication of transmit power, and a simple multimeter for tuning adjustments.

Place the Mode switch onto LSB or USB, and connect your multimeter set to the 10V DC range between the power supply unit sockets TP1 and TP2. Operate the microphone PTT and adjust RV4, mounted on the chassis, for a multimeter reading of 0.8V. Now place the mode switch onto one of the CW positions, keeping the PTT depressed. On the transmitter tuned circuit board (PCB No. 82), adjust the appropriate C1 or C3 capacitor (C1 for channels 1, 2, 3 and 5, C3 for channels 2, 4 and 6) for a meter reading of 1.5V. Then adjust C22 (Ch.1), C20 (Ch.2), C10 (Ch.3), C16 (Ch.4), C14 (Ch.5), or C12 (Ch.6) as appropriate for a 'dip' indication on the multimeter, repeating these last two adjustments as required for the greatest dip.

By now you should be seeing some RF being indicated on your in-line power meter. Adjust C24-C29 as appropriate for your switched channel to obtain maximum RF power, then adjust C22-C12 again for maximum dip on the multimeter, note that the multimeter reading shouldn't exceed 3V here. On the balanced mixer board (PCB No. 84), adjust T1 for maximum reading, and continue readjusting these two capacitors as required for maximum voltage reading, this should give around 2.6V when using a DC PSU and 2.9V with an AC PSU. Now turn the relevant TX level set potentiometer RV1-6 down until your multimeter reading drops by 0.1V to avoid over-driving in use.

This procedure will again need to be repeated for each crystal position, tuning the appropriate capacitors in each case. You should find your set will now give you around 100W on CW and SSB transmission, and as a final adjustment switch the mode knob to one of the AM positions and adjust RV1 on the balanced modulator board until the indicated RF output is 25W. That completes the transmitter alignment, all that remains to be done is any slight 'tweak' of the appropriate crystal trimmer to place you on the exact frequency you require, you'll find this has a tuning range of anywhere between 0.5kHz and 2.5kHz depending on the frequency in use. Remember when

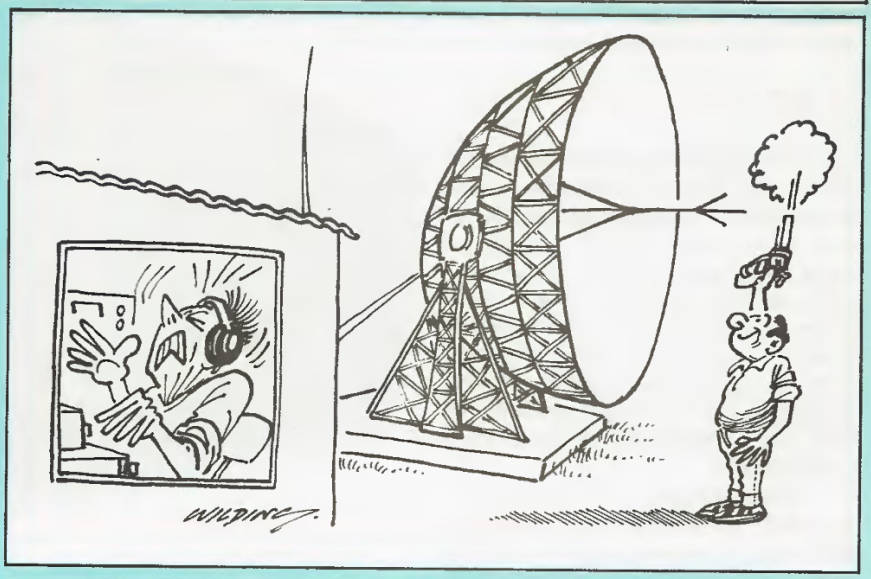
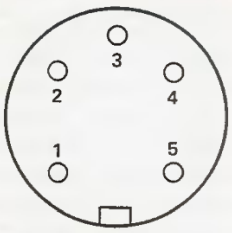


Table 1 TX PA Tapping Points

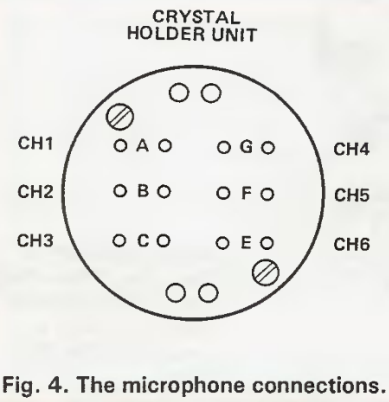
Band	No of Turns
160m	27 (Max)
80m	18
40m	11
39m	9
20m	6



5-PIN 270° DIN PLUG

1 = MIC LIVE
2 = MIC SCREEN
3 = PTT
5 = PTT

Fig. 3. Crystal connections.



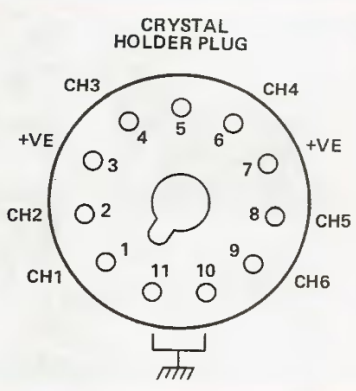


Fig. 4. The microphone connections.

doing this to place the front panel 'trim' control at centre position.

CQ, CQ

That completes the alignment, all you need do now is connect your aerial plus any tuning unit if required, and have some QSOs! The PA is reasonably tolerant of impedance mismatch, certainly far more so than many homebrew solid state PAs of this power level. Any low impedance dynamic microphone giving around 5-10mV output will be suitable for SSB, **Fig. 4** gives the required plug connections.

You may find it useful to extend the crystal socket connections onto the front of the set, together with a front-panel mounted variable capacitor for frequency trimming, to save you repeatedly diving into the set with your screwdriver to net onto the station calling CQ just half a kHz or so off your frequency (yes, I've had my fair share of doing that!). Alternatively, you may consider building a small VFO to allow continuous coverage. Remember the VFO or crystal frequency required is always 1.4Mhz above the final RF frequency, so you'll need to band switch your VFO as well between ranges.

Tunable Additions

A useful addition could be the 'Minisynth PLL VFO' from Cirkit, the basic kit (Stock No. 41-03300) currently selling at under £25. This uses a stable low frequency reference VFO operating at under 1MHz and tunable over the band of interest, controlling a final frequency VCO (Voltage Controlled Oscillator) producing a low noise signal that could possibly be of benefit over a synthesizer approach on our congested HF bands. A variable capacitor and reduction drive is supplied with the basic kit, a further mixing crystal and small number of components are required for each band of interest. Hence by using this approach one can build an accurate multi-band VFO to control your SSB130, using the front-panel crystal switch simply as a band chance as a result. The VFO output is simply fed to the crystal socket connections.

Alternatively, the technical boffins may wish to add a digital synthesiser. Again Cirkit offer the MC1415151 Development Kit, (Stock No. 40-14151) currently selling at just under £20. This covers 4-6MHz as supplied, as such it may be used for the 80m band, alternatively a few component changes will enable it to be used on any or all of the other bands. Simple DIP switch lines are used for frequency control, and tuning methods are limited only by your imagination, such as diode arrays for fixed net channels, or optical couplers for up/down control.

Using the supplied crystal, 10kHz steps are provided, smaller steps down to 625Hz may be used simply by reference link changes and appropriate alteration of the low pass filter component values if required, interpolation between these steps may be made by varying the trimmer capacitor across the reference crystal.

So there we are, a well built professional HF rig at a bargain price. These sets, together with so many other pieces of surplus ex-PMR equipment are so often overlooked by amateurs simply due to lack of available information, I hope this series will fill a few gaps as a result. It is common knowledge amongst the PMR trade that a large number of VHF and UHF sets will be made obsolete under govenment legislation in 1990, so we are due to see a flood of these on the surplus market soon at literally giveaway prices. Watch out for further conversion articles in the forthcoming months!

I receive many postal requests for further information or advice, I'm always happy to help wherever possible but please note that my address is NOT correct in the current call-book, nor is it likely to be in the next one, mail sent to that address is not likely to reach me. As a result please address any queries to myself c/o *Ham Radio Today* at 1 Golden Square, London W1R 3AB. An SAE will guarantee a response!

Better make this a final, Jim. Some chap from alpha centauri come to collect a meteor scatter QSL card.