

## Hands Electronics

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*Thank you for purchasing one of our kits. We hope it will give you many hours of service once built. Our aim is to provide satisfaction and service. If you have any problems with the construction or use of the equipment, please ring, or write to us. We will do all we can to help. If you are new to construction we suggest you read carefully the about part identity and soldering contained in the tools and construction section.*

*Sheldon Hands*

## Tools and Construction Practice

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We recommend the following tools to make your HANDS kit:

15/25w soldering iron  
small electrical screwdriver  
4 inch Phillips    ----"-----  
small side cutters  
electricians pliers

Below are some notes on construction practice with a heavy emphasis on soldering.

You must use solder with a non-corrosive flux. Acid cored solder **MUST NOT** be used. A 60/40 solder type will be ideal. The secret of good soldering is to have the correct temperature at the joint. Make sure the tip of the iron is clean, if necessary wipe it on a damp sponge. Do not carry solder on the iron to the joint, by the time you get it there the flux will have burnt or vaporised. Although it seems to contradict the above do lightly tin the iron before making a joint. This will aid the heat transfer and lessen the chance of damage to the pcb track or component.

When you are ready to make the joint apply the solder and the iron at the same time. Do not apply too much solder, a thin gauge helps in this respect. Humps of solder on a joint either means you did not leave the iron on the joint long enough or you used too much solder.

Try to get a medium coating over the track and the component lead. If you use too much heat you may damage the track or the component. We suggest you try some test joints on scrap wire, you will find it inspires confidence! When the board is complete check for solder bridges and dry joints.

All parts in the kit are readily identifiable, but value codes may need some explanation. For wire ended resistors a colour code chart is included at the back of the manual. Most supplies of resistors are coded with 3 bands for the value, i.e. 1st fig, 2nd fig, 3rd multiplier. But we do sometimes receive resistors with a 4 band code this then becomes 1st fig, 2nd fig, 3rd fig, 4th multiplier. Capacitor identification for electrolytics is straight forward but ceramic caps may pose a problem. Where n values are used  $n10 = 100\text{pf}$  and  $1n = 1000\text{pf}$ , those with just a 3 digit number use the first 2 numbers as figures and the 3rd indicating the number of zeros, i.e.  $102 = 1000\text{pf}$ . For those with a 3 digit number followed by letters treat as 3 digit number type. Check the parts list for possible codes which are shown in square brackets.

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## Circuit Description

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The PRA6 is a low gain, high dynamic range receiver pre- amplifier. The module uses 4 parallel VHF J fets run in grounded gate to give a low noise figure with good signal handling capability.

The board contains five 2 pole input band pass filters. The on line filter is selected by diode switching, D1 and D2 are the isolation diodes and are biased on by the application of 12v to the band pass filter select pins BS1-5. R1/2 and R3/4 adjust the bias current through the diodes.

The 2 pole filters comprise C1,2/L1 and C4,5/L2 top coupled by C3. C1,2 and C3,4 are capacitive dividers to enable the characteristic impedance of the filter to match 50Ω.

Signal amplification is provided by TR1,2,3 and 4, these fets are run in common source mode and coupled to the filter by C8-11. The amplifier output is transformed to 50Ω by T1. C12 provides dc isolation.

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## Construction

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- Fit the PCB pins listed below by pressing the pins home from the TRACK side with a hot iron and then soldering to the track. Always support the board around the circumference of the pin with an old cotton or solder reel.
- PCB PINS -: PA IN, OUT, +12V, BS1-5.
- Fit and solder R1,2, R3,4 A-E and R5-8 . Check the appendix for the correct way to fit components. Where you see a ground legend on a resistor this end is soldered to the top foil of the pcb termed GROUNDPLANE. The groundplane acts as a large heat sink so always tin the pcb with solder around the area of the connection first. Cut the ground side resistor lead back to about 3mm before fitting. If the connections are too long and obstruct another pad angle the component or its lead to a free area of groundplane.
- Install the ground links between the track and groundplane side of the board for L1,2A-E adjacent to R2A-E and R3A-E, using the tinned wire links.
- Fit and solder diodes D1,2 suffix A-E make sure that the cathode band on the diode agrees with the band on the board component outline.
- Fit and solder capacitors C8-11. Install in the same manner as the resistors.
- Install the bandpass filter packs as detailed below. Each band pack is assigned a position using a suffix A-F . Once you assign a position then all the parts in THAT pack are fitted at the suffix position. EG if 3.5 mhz uses the A position then C1 is C1A, L1 is L1A etc. DO NOT MIX SUFFIX POSITIONS . Install one pack at a time to insure correct placement.
- Fit L1-2 to the board. For KANK inductors bend the CAN tabs to a right angle. Align the coil can to the board [cans will only fit one way round] . With the PCB orientated as shown in the PCB LAYOUT in the appendix remove the RIGHT hand

tab where it fouls a capacitor. Trim the left hand tabs to 4mm in length. Install by soldering the left hand tabs to the ground plane and the pins to the track. If your soldering iron allows access to the right hand tabs these may also be soldered.

For MC120 or S18 style 2 lead inductors fit diagonally so that the first lead is located at the top right of the box [pad connected to junction of C3/C2 for L1 and C3/4 for L2] and the second at the bottom left [ pad connected to ground via ground links]

- Fit and solder the Band pack ceramic disc capacitors . Many of these capacitors are connected to the ground plane, use the same technique for installation as you did for the resistors. C1,2,4,5 a-e all have provision for two parallel capacitors. The 2nd capacitor is installed when the filter table shows VALUE + VALUE
- Make up the broadband output transformer T1. This is wound on the self colour core. Before commencing look at the pictorial winding guide at the rear of the manual. The transformer is a trifilar winding formed from a twisted pair, twisted again with a single strand . Cut 300mm of the 32 swg enamelled copper wire and bend it in half. Hold the loop or hairpin end between your thumb and forefinger and twist the wires together once or twice. Now splay the two wires to a 45 degree V as shown on the coil diagram, now with your other hand lightly grip the wires with thumb and forefinger in the centre of the V and twist them together. Continue twisting together, checking as you twist that the splay remains at 45 deg, you should get 6 to 8 twists per cm. When the wire is finished cut another length of 32swg of 150 mm length. Now take both the twisted pair and the single strand and grip one loop end and one cut end together between the thumb and fore finger of one hand and twist together as before. You should now have a twisted bunch of 3 wires . Now pass one end of the bunch through the centre of a core and wind on 9 turns, be careful not to damage the enamel on the last few turns as there will not be much room in the core centre. Now make three tails from the wire on each side of the core by unwinding the bunch. Clean the enamel off each tail and tin the wires.
- Using a multimeter on its ohm or continuity range identify the start and finish of each of the three strands. Check that there is no damage to the enamel or shorts between the windings. Install the completed transformer by soldering one winding between each hole pair .

## Test and alignment

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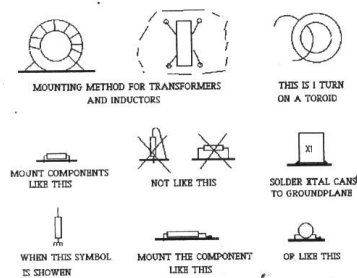
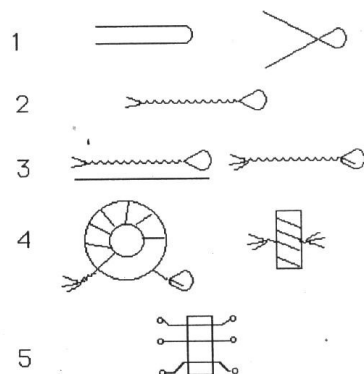
- Check the completed PCB for solder splashes, bridged tracks or pads and dry joints. If you suspect a dry joint use a multimeter to carry out a resistance check between the track and the component lead on the ground plane side.
- Connect the 12V line and ground connection to suitable supply via a multimeter on its current range . Check that the current drawn is less than 20ma. If the current greatly exceeds this check that TR1-4 are correctly installed.
- Connect a signal generator or ant to the PA IN pin and the OUT pin to the a receiver tuned to one of the pre-amp frequencies. Use miniature coax for the connections.

- Switch on the correct BPF by making a temporary 12v connection to the BPF\* pin.
- Tune the receiver until a signal is resolved. Using a trim tool adjust L1/2 for best signal strength. The cores of the inductors are very brittle, a metallic screwdriver **MUST NOT** be used for adjustment. In the absence of the proper tool an old plastic knitting needle with its end filed may be used. This completes the alignment and the module may now be installed

**C5-1 FILTER TABLE**

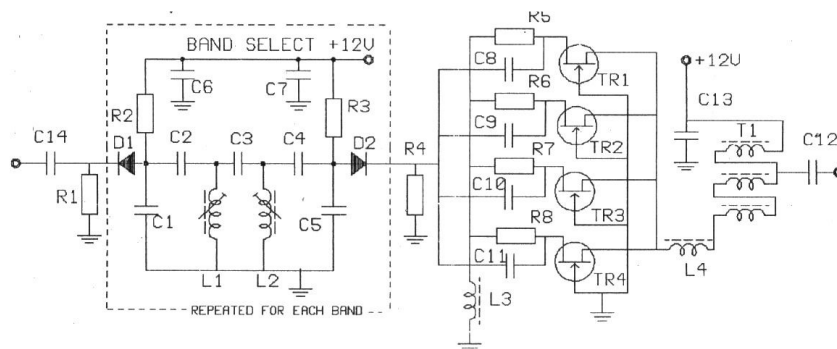
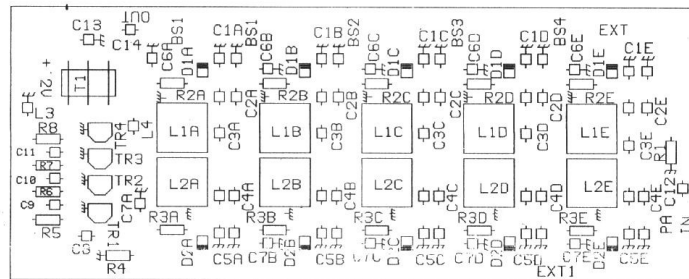
Band Mhz	C8,12 pf	C9,11 pf	C10 pf	L1,2 type
3.5	1000 + 560	270 + 100	33	KANK3334
7.0	680 + 220	100	4P7	KANK3334
10.0	1000 + 220	220 + 10	10	KANK3335
14.0	390 + 560	270 + 82	18p	S18
18.0	820 + 39	100 + 68	5P6	MC120 0.53uH
21.0	680 + 82	120	3P9	MC120 0.53uH
24.0	680 + 82	100 + 68	6P8	MC120 0.53uH
28.0-30	220 + 18	68	4P7	MC120 0.53uH

## T1 WINDING



## PARTS LIST

R1,2A-E,3A-E,4	1K	L3	100UH [101J]
R5,6,7,8	220R	L4	2.2UH [2R2K]
C8,9,10,11,13	100N	T1	59-61001101 [SELF COLC
C12,14,6A-E,7A-E	10N		9T TRIFILAR 32SWG
TR1,2,3,4	J310		
D1,2 A-E	BA243		



PR176

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**FILTER TABLE**

Band Mhz	C1,5 pf	C2,4 pf	C3 pf	L1,2 type
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14.0	390 + 560	270 + 82	18p	S18
18.0	820 + 39	100 + 68	5P6	MC120 0.53uH
21.0	680 + 82	120	3P9	MC120 0.53uH

26.0

28.0

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