

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

We recommend the following tools to make your HANDS kit

15/25w soldering iron
small electrical screwdriver
4 1/4 inch phillips screwdriver
small side cutters
electricians pliers
snipe nosed pliers
small half round file
multimeter

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 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 clean 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 track or component through prolonged application of the iron. When you are ready to make the joint, apply the iron and the solder 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 joint on scrap wire, you will find it inspires confidence! When the board is complete check for solder bridges and dry joints, an Ohmmeter can be used for checks.

Most large parts in the kit are readily identifiable, but value identification systems are varied and may pose a problem. For wire ended resistors (ie not SMD) 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 increasingly receive resistors with a 4 band code this then becomes 1st fig, 2nd fig, 3rd fig, 4th multiplier e.g 1k5 = brown, green, black, brown = 1 5 0 0 .

Capacitor identification for electrolytics is straight forward but ceramic caps may pose a problem. Where n values are used n10 = 100pf and 1n = 1000pf, 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 = 1000pf. For those with a 3 digit number followed by letters treat as a 3 digit number, where only 2 digits and a letter are used this indicates the value is less than 100pf i.e. 82J = 82pf and 4.7C = 4.7pf.

Inductor value systems are as varied as capacitors but generally there are two common types. The first uses coloured bands with the same colour values as resistors, the inductors are the same length as a 0.25w resistor but much thicker with flat ends where the lead exits the body.

If checked with an ohmmeter they will show very low resistance values. The second type have the value marked on them with an alpha-numeric code in uh e.g. 2R2K = 2.2uh and 220J = 22uh.

Circuit Description

The 6TMX6 board contains a double balanced tree-mixer, 6 diode selected band pass filters, a fixed gain fet amplifier and a further variable gain fet amplifier which may controlled from a front panel potentiometer.

A transmit signal at the IF frequency is routed to the SL6440 mixer IC1 via T1. The VFO signal is coupled to the mixer by C1. Power for the IC is feed via R1 decoupled by C4/5. D1,2,3 program the IC for the correct IMD performance. T2 a trifilar transformer couples the mixer to the output. The mixer transformers T1/2 are broad band and will accommodate both 9 or 10.7 mhz as IF frequencies.

Signals are routed from the mixer to one of 6 bandpass filters. The filter is selected by applying 12v from the bandchange switch to the relevant select pin BSA-F. The select line biases ON the input output switching diodes D4,5. The bias current is determined by R2,3,4 and 5 with C7/15 providing dc isolation. The 2 pole bandpass filters are formed by C8-12 suffix a-f, and L1-2 suffix a-f. The input and output impedance of the filters are 50Ω. The EXT IN/OUT pins allow extra bandpass filter sets to be added and routed to the amplifiers to extend the coverage.

T3 couples the selected band pass filter to TR1 a fixed gain amplifier whose stage gain is determined by the G2 voltage at the divider R7/6. The output is transformer coupled by T4 to TR2 a variable gain amplifier. VR1 varies the gate 2 voltage and thus the output drive level, this control may be front panel mounted as a power control or linked to a PA ALC system. T5 provides a good match for the RTX-AMP but the turns ratio may be adjusted for other applications.

Construction.

- 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 -: TX IN, VFO ,TX OUT, 12VT, BSA-F, RV1 (3 OFF).
- Fit and solder R1,R2,R3,R4A-F,R5A-F,and R6,8,9,10,11and 12 . 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 grounplane side of the board for L1A-F adjacent to R5A-F and R4A-F, using the tinned wire links.
- Fit and solder diodes D4,5 suffix A-F make sure that the cathode band on the diode agrees with the band on the board component outline.

- Fit and solder diodes D1,2,3. Make sure that the cathode band on the diode agrees with the band on the board component outline.
- Fit and solder diodes D4A-F,D5A-F. Make sure that the cathode band on the diode agrees with the band on the board component outline.
- Fit and solder the ceramic disc capacitors C1,3,4,6,7,15,16,17,18,19,20,21,22.
- Fit and solder the electrolytic capacitor C5. The negative lead is made off to the groundplane, bend the lead at a right angle immediately under the body
- Make up the broadband mixer transformers T1,2. These are wound on the small 6.3mm diam self coloured cores. Before commencing look at the pictorial winding guide at the rear of the manual. The transformers are 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 8 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.
- Make up T3 on a small 6.3 mm selfcolour core.
- Make up T4 on a small 6.3 mm selfcolour core.
- Make up T5 on a small 6.3 mm selfcolour core. Cut 350mm of the 32swg wire and wind on 25 turns. Trim the excess and remove the enamel from the remaining tails. Tin the the tails with solder. Next wind 4 turns over the last winding spreading thhe turns. Again remove the enamel from the tails but do not tin yet to aid identification.
- Install the completed transformer with the 25 turn winding between TR2 and R12/C22.

- Fit and solder IC1, be careful to observe the correct orientation of the device. The cut out in the component legend indicates the pin 1 end, also pin 1 is further identified by a square pad on the track side. Note that pins 1,2,6,7,8,9,10,15,16 are also soldered to the groundplane side of the board.
- Fit and solder TR1,2. The tab on the transistor can must agree with the board legend outline.
- 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 C8 is C8A, 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. 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.
- 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. C8 9,10,11,12 a-f all have provision for two parallel capacitors. The 2nd capacitor is installed when the filter table gives VALUE + VALUE

Test And Alignment

The method of test and alignment will depend upon the equipment available. In the absence of a suitable IF strip and pre-mix vfo [RTX1F/RTX6BMX], a 9 mhz oscillator, signal generator and a receiver tuned to mixer output frequency will allow suitable tests to be carried out.

- 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 12VT line and ground connection to suitable supply via a multimeter on its current range . Check that the current drawn is less than 110ma. If the current greatly exceeds this check that IC1 and D1-3 are correctly installed.
- Connect the pre mix vfo or a signal generator to the vfo input pin and the TX input to a 9 mhz oscillator or ssb IF generator.
- Lightly couple the receiver to T5. Switch on the 14mhz BPF by making a temporary 12v connection to the relevant BS* pin.

- Make up the broadband mixer transformers T1,2. These are wound on the small 6.3mm diam self coloured cores. Before commencing look at the pictorial winding guide at the rear of the manual. The transformers are 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 8 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.
- Fit and solder IC1, be careful to observe the correct orientation of the device. The cut out in the component legend indicates the pin 1 end, also pin 1 is further identified by a square pad on the track side. Note that pins 1,2,6,7,8,9,10,15,16 are also soldered to the groundplane side of the board.
- 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 L1-3 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 inductors L1,2,3 a-e install so that the ground pin is at the bottom left of the legend box, bend the pin at 90 degrees and solder to the groundplane. For L1,2f install gnd at bottom right and for L3f top right.
- Fit and solder the 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. C1,2,4,6,7 a-f all have provision for two parallel capacitors. The 2nd capacitor is installed when the filter table VALUE + VALUE

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- 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.
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Test And Alignment

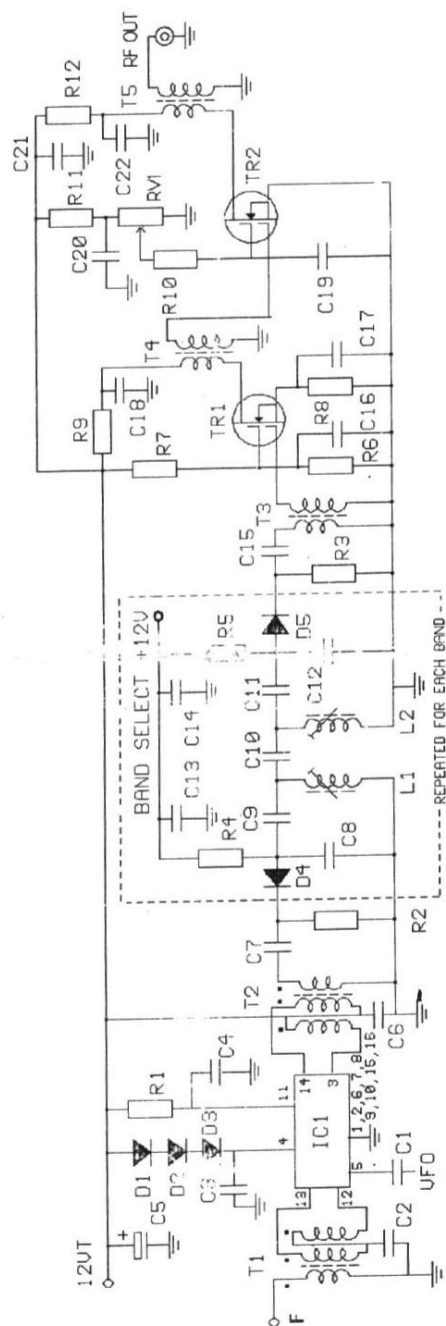
The method of test and alignment will depend upon the equipment available. In the absence of a suitable IF strip and pre-mix vfo [RTXIF/RTX6BMX], a general coverage receiver at 9 mhz and a signal generator will allow suitable tests to be carried out.

- 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 12VR line and ground connection to suitable supply via a multimeter on its current range. Check that the current drawn is less than 110ma. If the current greatly exceeds this check that IC1 and D3-5 are correctly installed.
- Connect the pre mix vfo or a signal generator to the vfo input pin and the IF output to an IF strip or a receiver tuned to 9 mhz.
- Connect an aerial or signal source to the RX IN pin. Switch on the correct BPF by making a temporary 12v connection to the BPF* pin.
- Tune the vfo at (SIGNAL + IF)mhz, until a signal is resolved. Using a trim tool adjust L3,4,5 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.

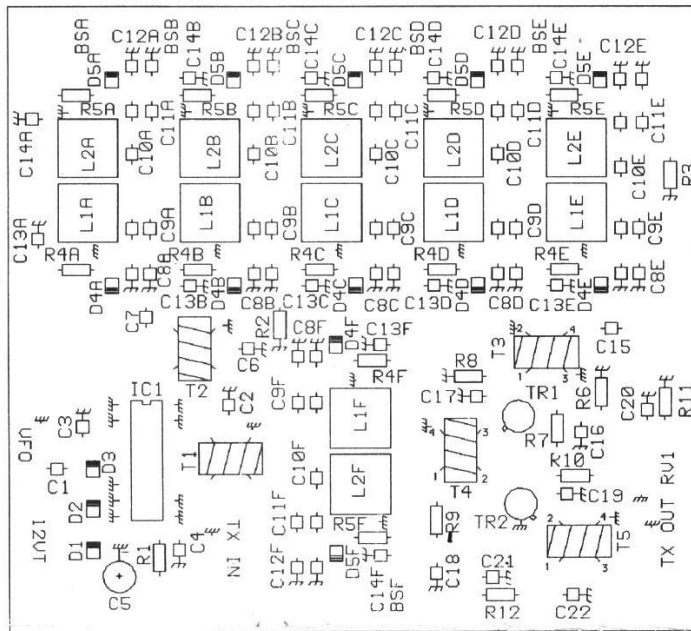
FILTER TABLE

BAND MHZ	C1,7 Pf	C2,6 Pf	C3,5 Pf	C4 Pf	L1,2,3 type
3.5	1000 + 100	390	33	390	KANK3334 [YEL]
7.0	1000	100	3P9	10u	KANK3334 [YEL]
10.0					
14.0	1000	100 + 12	6P8	82 + 12	KANK3335 [PINK]
18.0					
21.0	470	120	6P8	82	MC120 E526HN-100109 [WHITE]
24.0					
28.0	270	68	3P9	56	MC120 E526HN-100109 [WHITE]

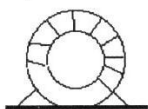
CIRCUIT DIAGRAM



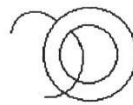
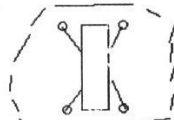
PCB LAYOUT



COMPONENT MOUNTING

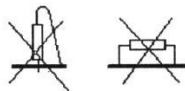


MOUNTING METHOD FOR TRANSFORMERS
AND INDUCTORS



THIS IS 1 TURN
ON A TOROID

MOUNT COMPONENTS
LIKE THIS



NOT LIKE THIS



SOLDER XTAL CANS
TO GROUNDPLANE

WHEN THIS SYMBOL
IS SHOWN



MOUNT THE COMPONENT
LIKE THIS



OR LIKE THIS

PARTS LIST

R1	220R		
R2,3,4A-F			
5A-F,10	1K	IC1	SL6440
R6	47K	TR1,2	MFE201
R7,11	100K	D1,2,3	1N4148
R8,9,12	100R	D4A-F,D5A-F	BA479
RV1	47K LOG	T1,2,3,4,5	K37X830 [BLACK SELF COLOUR]
C5	4.7MFD		
C1,2,3,4,6,7,13A-F,14A-F			
15,16,17,18	10N [103]		
C19,20,21,22	100N [104]		

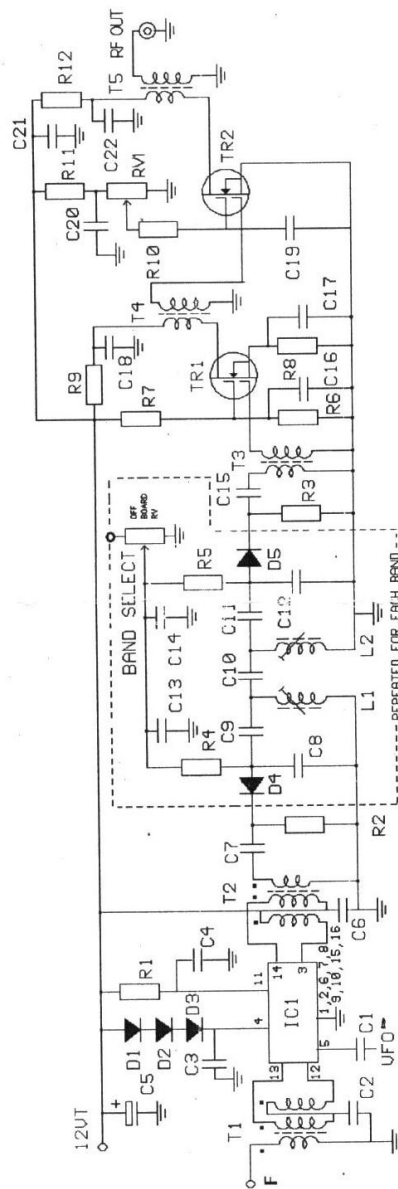
FILTER TABLE

Band Mhz	C8,12 pf	C9,11 pf	C10 pf	L1,2 type
1.8	1000 + 1000	1000 + 680	180	KANK3334
3.5	1000	390	33	KANK3334
7.0	1000	100	3P9	KANK3334
10.0	1000 + 220	220 + 10	10	KANK3335
14.0	1000	100 + 15	2p2	KANK3335
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

COIL WINDING DATA

		SWG	SWG	CORE
T1/2	8turns trifilar	32		K37X830
T3	4T pad3/4	32	15T pad1/2	K37X830
T4	5T pad3/4	32	13T pad1/2	K37X830
T5	25T pad1/4	32	3T pad3/2	K37X830

CIRCUIT DIAGRAM



BAND SWITCH SWITCH LAYOUT TMX6,

