

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
- 4inch 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 RMX10 module incorporates a receiver mixer with input band pass filters and switchable low gain high dynamic range rf pre-amplifier.

Signals are routed from the RX ANT pin to the diode switch D1 and D3/4. The pre-amp is switched from TR5/6. When D11 is grounded D3/4 are back biased closing the bypass and TR6 is on to supply Vcc to TR1-4. Signal amplification is provided by TR1,2,3 and 4, these fets are run in common source mode and coupled to the filter by C2-5. The amplifier output is transformed to 50Ω by T1.

The amp bypass or the out put is routed to one of 6 bandpass filters. The filter is selected by applying 12v from the bandchange switch to the relevant select pin A-F. The select line biases ON the input output switching diodes D5,6. The amount of bias is determined by R9,10,11 and 12. The 3 pole bandpass filters are formed by C11-16 suffix a-j, and L5-7 suffix a-j. The input and output impedance of the filters are 50Ω. T2 is a trifilar wound transformer and matches the filter to the mixer input.

The VFO is coupled to the mixer by C19. T3 another trifilar transformer couples the mixer to the output. The mixer transformers T2/3 are broad band and will accommodate both 9 and 10.7 mhz IF frequencies.

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 :- RX IN[2off], VFO [2off], IF[2off], 12VR, AS.
- ✓ ○ Fit wire links using the single strand pvc covered wire :- select lines A,B,C,D,G,H,I,J (WHITE LINE ADJ TO C8), ANT LINE (WHITE LINE ABOVE C8E)
- ✓ ○ Fit and solder R1-R17. 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 L1A-J (adjcent to R10A-F), using tinned wire links from the resistor off cuts.
- ✓ ○ Fit and solder diodes D1-4,7,8,9,10,11, and ZD1. Make sure that the cathode band on the diode agrees with the band on the board component outline.

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/S18 inductors[2 pin types] L1,2,3 a-j install so that the coil is between the DIAGONAL lines.

- 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-j all have provision for two parallel capacitors. The 2nd capacitor is installed when the filter table 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 [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 200ma. If the current greatly exceeds this check that IC1,TR1-4 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.
- Check pre-amp switching by grounding D11 and checking for increased gain.
- This completes the alignment and the module may now be installed.

- ✓ ○ Fit and solder the ceramic disc capacitors.
- ✓ ○ Fit and solder the electrolytic capacitor C24. 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 T2,3. These are wound on the 43MIX self coloured cores. . The transformers are a trifilar winding formed from three strands twisted together. Cut the 28swg wire into 3 equal lengths. Lay the strands side by side [parallel] and grip together at one end in the chuck of a handdrill or in pin chuck. Anchor the other end of the three wires [pin to a table or trap in a vice] and wind the drill to twist the stands together. Wind untill you have 6-7 turns per 25mm [1inch]. Next wind 8 turns of the stranded cable onto a core , cut leaving 15mm [3/4 inch] tails. Unwind the tails to form three strands on each side of the core . 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 .
- ✓ ○ Repeat for T1 using the large self colour core.
- ✓ ○ Fit and solder L1,2,3.
- ✓ ○ 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 TR1-4. These are static sensitive devices, but in practice are quite robust. However its wise to adopt the standard precautions. Dont wear nylon clothing. Discharge any body static electricity by touching a water or a central heating pipe. Use an insulated soldering iron or fit a ground wire back to the pcb ground track. Dont wave the device about or handle the leads directly. Use insulated pliers to spread the leads. When fitting make sure the transistor outline matches the board ledgend.
- ✓ ○ Fit and solder TR5,6. The wide line on the board ledgend/ pcb layout diagram indicates the metal insert on the transistor.
- Install the bandpass filter packs as detailed below. Each band pack is assigned a posistion using a suffix A-J . Once you assign a posistion 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 POSISTIONS . 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

Parts List all bands

R1,7,14,15,17	470R	ZD1	5V6 BZY88
R2,8,9,10A-F,11A-F,12,	1k	TR1-4	J310
✓R3,4,5,6	220R	TR5/6	BD140
✓R13,16	330R	IC1	SL6440
C1,7,8A-F,9A-F,17,18,19,20,21,22	10N	T1	59-61001101
✓C2,3,4,5	100P	T2,3	37 /43MIX
✓C6,23	100N	✓L1,2,4	100uH [101J]7BS
C25	4.7MFD	✓L3	2u2 [2R2] 7BS
D1,2,3,4,5,6	BA243		
D7,8,9,10,11	1N4148		

Coil Winding Data

T1	59-61001101	9 turns trifilar 32swg
T2,3	43MIX	8 turns trifilar 28swg

Resistor Colour Code

	Band 1	Band 2	Band3
Colour	1st fig	2nd fig	multiplier
Black		0	X 1
Brown	1	1	X 10
Red	2	2	X 100
Orange	3	3	X 1000
Yellow	4	4	X 10,000
Green	5	5	X 100,000
Blue	6	6	X 1,000,000
Violet	7	7	X 10,000,000
Grey	8	8	
White	9	9	

FILTER TABLE

BAND MHZ	C10,16 Pf	C11,15 Pf	C12,14 Pf	C13 Pf	L5,6,7 type
A 1.8	1000 + 1000	1000 + 680	180	1000	KANK3334 [YEL]
✓B 3.5	1000 + 100	390	33	390	KANK3334 [YEL]
✓C 7.0	1000	100	3P9	100	KANK3334 [YEL]
✓D 10.0	470	47	1P8	39	KANK3334 [YEL]
✓E 14.0	1000	100 + 12	6P8	82 + 12	KANK3335 [PINK]
✓F 18.0	680	100 + 68	5P6	100 + 33	MC120 E526HN-10010 WHITE
G 21.0	470	120	6P8	82	MC120 E526HN-100109 [WHITE]
✓H 24.0	330	82	4P7	68	MC120 E526HN-100109 [WHITE]
✓I 28.0	270	68	3P9	56	MC120 E526HN-100109 [WHITE]
✓J "					

Coil Winding Data

Resistor Colour Code

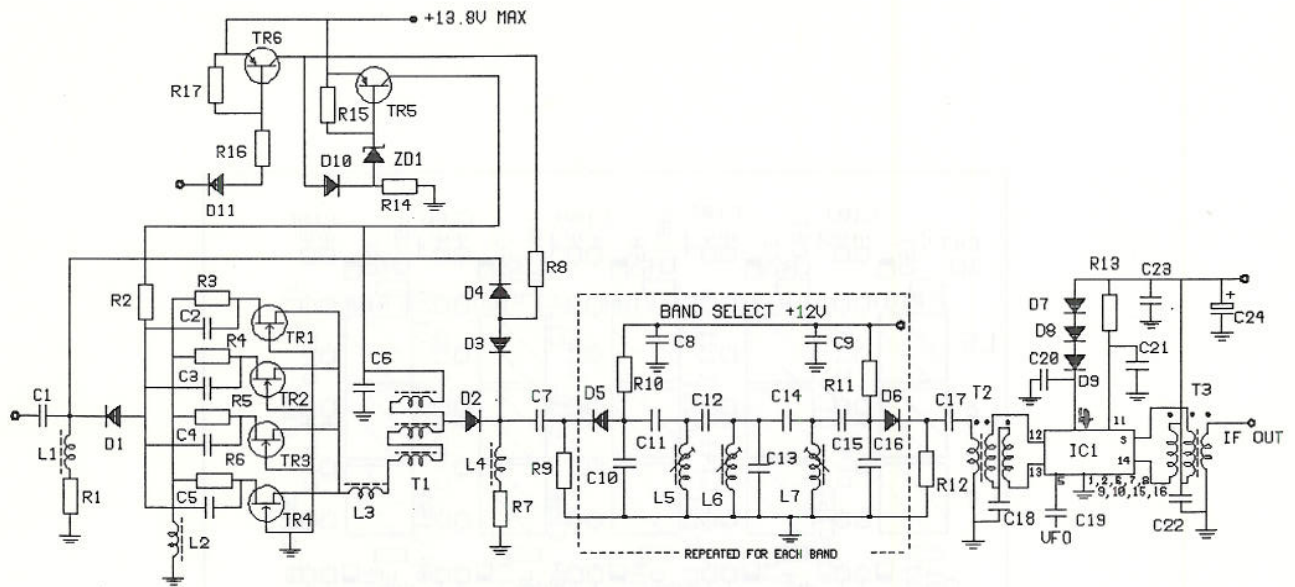
Colour	Band 1	Band 2	Band 3	Band 4
Black	0	0	0	0
Brown	1	1	1	1
Red	2	2	2	2
Yellow	3	3	3	3
Green	4	4	4	4
Blue	5	5	5	5
Violet	6	6	6	6
Grey	7	7	7	7
White	8	8	8	8

Capacitor value = 2.2µF 50V

A B C D E F G H I J

Bottom Right

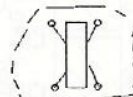
CIRCUIT DIAGRAM



COMPONENT MOUNTING



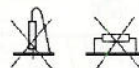
MOUNTING METHOD FOR TRANSFORMERS AND INDUCTORS



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

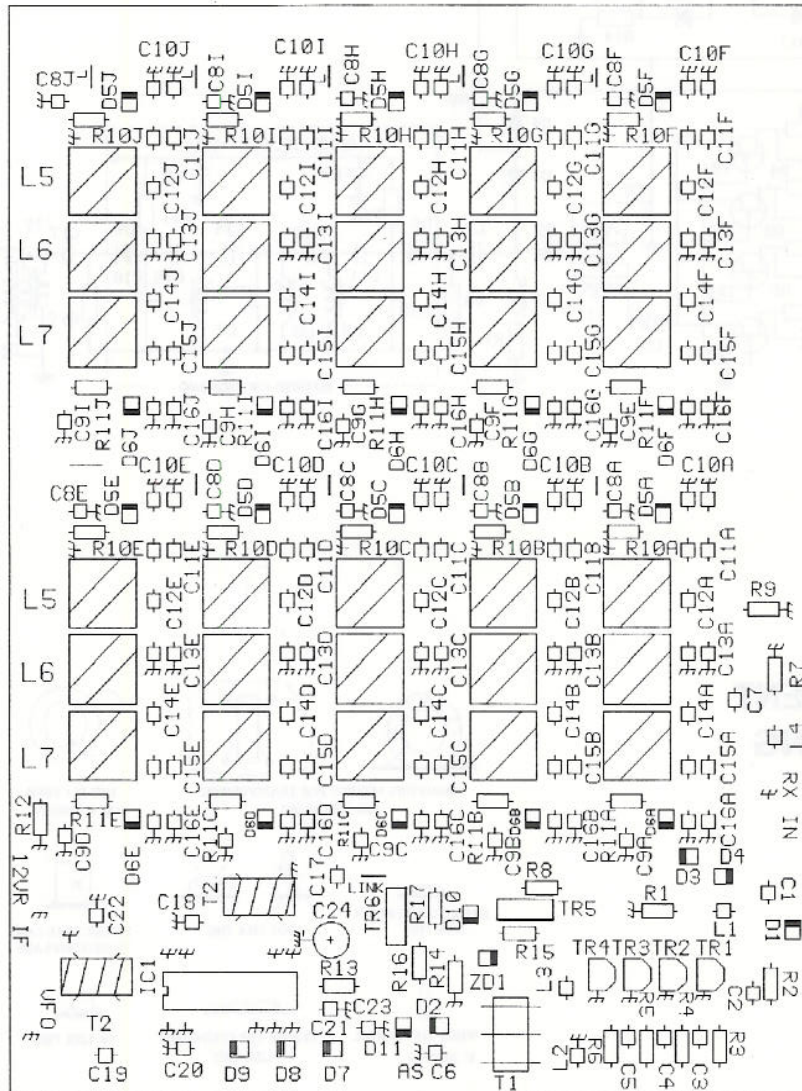


OR LIKE THIS

2 PINK
1 YELLOW
H BLACK

26 ORANGE
E LIGHT BLUE
D GREY
C WHITE
B WHITE/RED
A GREEN

PCB LAYOUT



A BLACK
 B YELLOW
 C WHITE
 D GREY
 E LIGHT BLUE
 F LIGHT GREEN
 G ORANGE