4.   **OPTIONS**

Options available for the KL transceiver are as follows:

1.	Jumper programming (standard) and external connector functions.	Refer to 4.1
2.	Coax Relay.	Refer to 4.2
3.	Fist Microphone.	Refer to 4.3
4.	Low power EPROMs.	Refer to 4.4
5.	CTCSS.	Refer to 4.5
6.	Rear Disable Display Switch.	Refer to 4.6
7.	KL Software Options.	Refer to 4.7
8.	'E' and 'M' Voting with self test, FSK Modem and RS-232 port.	Refer to Section 16
9.	Reserved	
10.	Reserved	
11.	Reserved	
12.	Reserved	
13.	Reserved	
14.	Reserved	
15.	Reserved	
16.	Reserved	
17.	Increased Tx Bandwidth.	
18.	Fast Tx Rise Time of 5mS. Continuous VCO.	
19.	1600 Hz Voting Tone.	
20.	Handset with PTT Switch.	
21.	High Speed Modem Interface (includes OPT 18).	
22.	Dual Channel Interface.	
23.	Dual Tone CTCSS Encode (Option 5 must be fitted)	
24.	Dual CTCSS Decoder (Option 5 must be fitted)	
25.	12.5 KHz Channel Spacing	

4.1   KL JUMPER PROGRAMMING

4.1.1   Mother Board Jumper Description

	IN (A)	OUT (B)
JMP 1	Selects internal PTT	Selects PTT from options socket
JMP 2	Unbalances mic input	Used balanced mic
JMP 3	Connects internal speaker	Use external speaker socket
JMP 4	Connects VF to line	To disable or when options PCB is installed.
JMP 5	Connects Discriminator VF	When options PCB is installed
JMP 6	Disables Rx for Simplex	For duplex, except if CTCSS installed
JMP 7	Line compressor in CCT	Bypass line compressor
JMP 8	Connects line in VF	When options PCB is installed
JMP 9	Selects CTCSS or 5 tone	Disables tones from external connector
JMP 10	Enables display	Disables display
JMP 11	Selects PTT and tail to rear	Isolates PTT tail to rear
JMP 12	For fist microphone	For handset
JMP 13	For handset	For fist microphone

4.1.2   Receiver Unit Jumper Description

	IN (A)	OUT (B)
JMP 101	For Simplex	For Duplex
JMP 102	Special	Normally not fitted

Note: A standard KL or KL Micro simplex radio has jumpers 1 to 11 and 13 fitted and 12 is not fitted. Spare or unused jumpers are located on the spare header on the KL mother board.

Jumpers for other various options PCB's are described within the technical description of the relevant options.

Jumpers 12 and onwards are only found on Revision E mother boards and onwards.

KL OPTIONS AND USER CONNECTOR PINOUTS

4.1.3   CNOP1

Pin No.	Description
1	AUX 2 (spare)
2	+12 volts
3	0 volts
4	Tx alarm output from P.A.
5	5 tone modulation to Tx
6	VF MUTED from Rx
,7	VF output which goes to line
8	AUX 3 (spare)
9	FSK data tones to line output
10	Discriminator VF return to Rx
11	AF lock from Rx
12	S meter voltage from Rx
13	PTT delayed
14	Pin 29 of IC1
15	Tx modulation off
16	Discriminator VF from Rx
17	PTT and tail in
18	AUX 1 (spare)
19	PTT direct input
20	Line out VF from IC17
21	CALL button from mic
22	FSK tones from line
23	PTT output from opt to micro
24	SWR meter
25	Monitor
26	CTCSS LED drive

Note: PCB pin numbers count in an anti-clockwise direction.

4.1.4 CNOP2

Pin No.	Description
1	Line VF
2	A7
3	A6
4	A4
5	A2
6	I/O pin 21 of IC1
7	I/O pin 22 of IC1
8	I/O pin 24 of IC1
9	I/O pin 20 of IC1
10	MUTE from Rx via IC9
11	VF to Tx
12	PTT
13	I/O pin 19 of IC1
14	I/O pin 23 of IC1
15	CTCSS modulation
16	A1
17	A3
18	A5
19	Reset from mic
20	Line VF to IC12

Pin No.	Description	Pin No.	Comments
1	VF input from line	24	600 ohm line levels
2	VF output to line	23	600 ohm line levels
3	D1	22	Bi-directional channel data
4	D3	21	Bi-directional channel data
5	D5	20	Bi-directional channel data
6	D7	19	Bi-directional channel data
7	+12 volts	18	300mA max
8	LF/5 tone mod in	17	Select JMP9
9	Rx discriminator	16	Low Level V.F.
10	Remote channel enable	15	Must be selected first
11	AUX 3	14	Spare/used in options
12	FSK tone OUT	13	Spare/used in options
13	AUX 1	1	Spare/used in options
14	PTT IN	2	PTT with no tail
15	FSK tone IN	3	Spare/used in options
16	MUTE	4	Open collector
17	Earth 0 volts	5	Earth
18	+12 volts	6	300mA max
19	PTT and tail	7	PTT with tail
20	D6	8	Bi-directional channel data
21	D4	9	Bi-directional channel data
22	D2	10	Bi-directional channel data
23	VF output to line	11	600 ohm line levels
24	VF input from line	12	600 ohm line levels

4.1.6 <u>CN14D</u>   <u>Remote I/O #2</u>

Pin No.	Description	Pin No.	Comments
1	VF to and from line disable	14	Isolate 600 ohm lines
2	AUX2 to OPT1 PCB	13	Spare/used in options
3	Tx Alarm	12	VSWR and low power alarm
4	CTCSS received	11	CTCSS active
5	+12 volts	10	300mA max
6	Earth 0 volts	9	Earth
7	PTT delayed out	8	Tx PTT monitor
8	Low power	1	Active low selected
9	Earth 0 volts	2	Earth
10	+12 volts	3	300mA max
11	S meter	4	Rx S-meter voltage
12	Power meter output from P.A.	5	Reads Tx power
13	+5 volts *	6	300mA max
14	Standby (power down)	7	Active low for power down

*   Only on mother boards Revision E and onwards.

4.1.7 STANDARD COLOUR CODE FOR REMOTE I/O CABLES

Pin No	Colour of Cores	Pin No	Colour of Cores
1	White	32	Yellow/Blue
2	Brown	33	Green/Red
3	Green	34	Yellow/Red
4	Yellow	35	Green/Black
5	Grey	36	Yellow/Black
6	Pink	37	Grey/Blue
7	Blue	38	Pink/Blue
8	Red	39	Grey/Red
9	Black	40	Pink/Red
10	Violet	41	Grey/Black
11	Grey/Pink	42	Pink/Black
12	Red/Blue	43	Blue/Black
13	White/Green	44	Red/Black
14	Brown/Green	45	White/Brown/Black
15	White/Yellow	46	Yellow/Green/Black
16	Yellow/Brown	47	Grey/Pink/Black
17	White/Grey	48	Red/Blue/Black
18	Grey/Brown	49	White/Green/Black
19	White/Pink	50	Brown/Green/Black
20	Pink/Brown	51	White/Yellow/Black
21	White/Blue	52	Yellow/Brown/Black
22	Brown/Blue	53	White/Grey/Black
23	White/Red	54	Grey/Brown/Black
24	Brown/Red	55	White/Pink/Black
25	White/Black	56	Pink/Brown/Black
26	Brown/Black	57	White/Blue/Black
27	Grey/Green	58	Brown/Blue/Black
28	Yellow/Grey	59	White/Red/Black
29	Pink/Green	60	Brown/Red/Black
30	Yellow/Pink	61	Black/White
31	Green/Blue		

4.1.8 CNRL

Pin No.	Description
1	Simplex changeover relay drive
2	Simplex changeover relay drive

4.1.9 CNAF

Pin No.	Description
1	Earth 0 volts
2	Speaker audio

4.1.10 CN106

Pin No.	Description
1	A1
2	A2
3	A3
4	A4
5	A5
6	A6
7	A7
8	Monitor
9	Reset
10	CTCSS Received

4.1.11 CN108

Pin No.	Description
1	CTCSS mod
2	5 tone mod
3	CTCSS Repeater

4.1.12 DIP Switch 1

	ON	OFF
#1	Continuous channel scan	Front panel scan only
#2	Talk through repeater	Duplex or Simplex
#6	100mS PTT delay	No PTT delay

Note: When using a CTC-1 Module and as a talk through repeater, #2 should be off.

4.1.13 Transmit Limit Timer Setup

#3	#4	#5	Time Out
OFF	OFF	OFF	Timer Disabled
ON	OFF	OFF	1 minute
OFF	ON	OFF	2 minutes
ON	ON	OFF	3 minutes
OFF	OFF	ON	4 minutes
ON	OFF	ON	5 minutes
OFF	ON	ON	6 minutes
ON	ON	ON	7 minutes

4.1.14 DIP Switch 2

Channel programming information.

Channel selection	= Binary Data.
"-"	= Switch OFF.
"x"	= Don't care.
#8 in "OFF" position	= Internal channel selected.
*	= Channel is selected from front panel or REMOTE I/O #1 connector.

L.S.B.   **M.S.B.**

#1	#2	#3	#4	#5	#6	#7	#8	Channel #
X	X	X	X	X	X	X	OFF	*
-	-	-	-	-	-	-	ON	01
ON	-	-	-	-	-	-	ON	02
-	ON	-	-	-	-	-	ON	03
ON	ON	-	-	-	-	-	ON	04
-	-	ON	-	-	-	-	ON	05
-	-	-	ON	-	-	-	ON	09
-	-	-	-	ON	-	-	ON	17
-	-	-	-	-	ON	-	ON	33
-	-	-	-	-	-	ON	ON	65
ON	-	-	-	-	ON	ON	ON	98
-	ON	-	-	-	ON	ON	ON	99

Note: Channel #0 may be selected, however it is not normally used. KL software versions "KL V1.B" and "KL BIN V1.0" use binary +1 for channel programming.

Also see Option 7 "KL SOFTWARE OPTIONS" (4.7).

4.2   SIMPLEX CHANGEOVER RELAY

4.2.1   General Description

The optional antenna change over relay is used for simplex operation when an antenna is required to be switched between the receiving and transmitting ports.

Mechanical

The unit is housed in an enclosed steel box which is directly mounted on the rear panel of the transceiver.

The Transmit/Receive connection to the antenna is made via an 'N' type femaleë coaxial connector.

Electrical

Changes over transmit and receive R.F. paths.

4.2.2   Specifications

Mechanical Size

100.0mm x 40.8mm x 41.6mm Steel Box.

116.7mm x 40.8mm x 41.6mm with 'N' type female connector to the antenna.

Features

Two flexible semi-rigid (conformal) coax inputs terminated with one (1) BNC male connector for receiving and one (1) 'N' type male connector for transmitting.

Electrical Characteristics

Supply Voltage	:	DC 11-16V (DC 13.8V nominal)
Circuit Impedance	:	50 ohms
Contact Resistance	:	Less than 15 milli ohms at DC 1 Amp
Insulation	:	More than 250M ohms at DC 500 Volts
Current Consumption	:	120mA at DC 13.8 Volts
Maximum Input Power	:	200W
Insertion Loss	:	0.2 dB
Standing Wave Ratio	:	Less than 1.2 to 1
Maximum Frequency	:	520 MHz

4.2.3 Technical Description

Operating Principle

It is recommended that the transmitter Tx PTT delay be turned on when the KL transceiver is to be configured for simplex operation.

This will enable the coax relay to switch over 100 milliseconds before the transmitter (Tx) is turned on, thereby ensuring a correct load to the transmitter at all times.

Note: The PTT delay may be turned on by selecting switch six (6) of DIP one (1) to the on position.

OPTION 3

4.3 FIST MICROPHONE

The fist microphone has a built in audio amplifier for low noise operation. In addition the microphone also contains:

a) Microphone clip for automatic 'quite base' mode of operation when used in conjunction with "CTCSS" Option 5. Refer to 4.5.

b) Monitor switch ON-OFF for manual control of CTCSS.

c) Call button for selective calling.

d) Reset button for selective calling

OPTION 4

4.4 LOW POWER EPROMS

Low current consumption CMOS EPROMs are available to replace standard NMOS/HMOS EPROMs. The KL receive current will drop approximately 100mA with this option.

Refer specifications to 2.1.2.

4.5. CONTINUOUS TONE CODED SQUELCH SYSTEM

4.5.1 Description - PCB 148 Rev D

The KL CTCSS option 5 module is capable of providing full duplex operation on any tone frequency between 67 and 165.5 Hz. Eleven dip switches and one jumper provide for very flexible configuration. Please refer to the configuration procedure.

Dip switch descriptions:

JMP1:   located in the 'normal' position when used with a handset. CTCSS functions are operational when the handset is removed. The handset is installed when the KL is required to be in the monitor mode.

JMP1:   located in the 'reversed' position when used with a fist microphone. CTCSS functions are operational when the fist microphone is on the microphone hang up clip. The KL is set to the monitor mode when the fist microphone is picked up, or the monitor switch on the rear of the fist microphone is left in the ON position.

SW1 DIP1:   switched to ON when a repeater is required to be accessed only by the presence of a CTCSS tone on the mobile units.

SW1 DIP2:   not used.

SW1 DIP3:   switched to ON to bypass the high pass filter in the C1116 encoder/decoder.

SW1 DIP4:   switched to ON to connect the high pass filter in the C1116 to the receiver audio.

SW1 DIP5:   switched to ON to lock out any received audio to the speaker or interfaces.

SW1 DIP6:   switched to OFF to allow the CTCSS decoder to operate while the KL is transmitting. When ON it allows the C1116 to change to encoder mode.

SW1 DIP7:   switched to ON when it is required that the local PTT has to override the disable function of the reset line from the Option 8.

SW1 DIP8:   switched to OFF to disconnect the CTCSS simplex encoder from the C1116.

SW2 DIP1:   switched to ON to allow the reset line from the Option 8 to disable the C1116 decoder, i.e. in permanent decode state.

SW2 DIP2:   switched to ON to allow other circuits to disable the CTCSS encoder amplifier.

SW2 DIP3: switched to ON to allow only the handset to bypass the disable function from the Option 8.

SW2 DIP4: switched to OFF to permanently disconnect all CTCSS encoders from the transmitter.

4.5.2 Programming the CTCSS Operation

Many different configurations are possible with the KL Option 5. Listed below are the most common setups.

a)   'Quiet base' mode CTCSS decoder with duplex or simplex transmitter encoder.

b)   'Quiet base' mode CTCSS decoder only. No Tx encode.

c)   CTCSS decoder output to Option 8 or rear connector, but not in quiet mode. Including Tx encode.

d)   CTCSS operated only repeater. No Tx encode.

e)   CTCSS operated only repeater with Tx encode.

f)   'Quiet base' mode CTCSS decoder with two simultaneous encoders for simplex transmission.

g)   'Quiet base' mode CTCSS decoder with local handset monitor to override any disable function that may be initiated remotely by the Option 8. Option 8 can disable the decoder and encoder. Simplex or duplex operation.

h)   Quiet base CTCSS decoder with local handset monitor decoder override from any control initiated remotely by the Option 8. The Option 8 can control the encoder but not the decoder. Local handset does not transmit a CTCSS tone from the transmitter. Simplex or duplex operation. Receiver high pass filter is not connected.

Switch Settings for Various Configurations

| | DIP Switches located on Option 5 | | | | | | | | | | | |
| | SW1 | | | | | | | | SW2 | | | |
Configuration	1	2	3	4	5	6	7	8	1	2	3	4
a	0	-	0	1	1	0	0	0	0	0	0	1
b	0	-	0	1	1	0	0	0	0	0	0	0
c	0	-	0	1	0	0	0	0	0	0	0	1
d	1	-	0	1	1	0	0	0	0	0	0	0
e	1	-	0	1	1	0	0	0	0	0	0	1
f	0	-	0	1	1	1	0	1	0	0	0	1
g	0	-	0	1	1	0	0	0	1	1	1	1
h	1	-	1	0	1	0	0	0	0	1	0	1

Switch settings '0' = OFF, '1' = ON.

	JMP1 Position
Handset	Normal
Fist Mic	Reversed
Mic not used	Removed

KL Motherboard settings for use with CTCSS Option 5 are:

    JMP5   = OUT
    JMP6   = IN
    JMP101   = IN for simplex, OUT for duplex.

4.5.3 Programming the CTCSS Frequency

The C1116 CTCSS Encoder/Decoder assembly provides continuous subaudible tone decoding (reception) and tone encoding (transmission) for radio squelch control applications.

The C1116 is compatible with any system using standard EIA CTCSS frequencies.

As a second source supply, UNI-LAB uses the Selectone ST146 CTCSS tone decoder. Specifications, alignment procedure and pinout descriptions of this module are given in section 4.5.5 of this manual.

Electrical Specifications

Operating Voltage	6-17 Volts DC -ve common.
Operating Current	6.0mA typical.
Operating Temperature Range	-30 o +70 Degrees C.
Frequency Range	67.0 to 254.1 Hz.
Frequency Accuracy	< +/- 0.08% w.r.t. EIA std.
Frequency Stability	< +/- 0.01%.
Encode Output Level	Adjustable 0-775mVrms(o/c).
Encode Output Impedance	2K ohms (at centre setting).
Encode Output Purity	< 1.5% THD.
Encode Output Turn-on Time	< 2 mS.
PTT Output	Open Collector 50mA SINK.
Audio Input Sensitivity	< 10 mV RMS.
Audio Input Level Range	50 dB typical.
Audio Input Impedance	> 50 K ohms.
Decode Bandwidth	2% Total (+1%, -1%).
Detection TimeFo <100 Hz	< 220 mS typical.
Fo = 100-200 Hz	< 150 mS typical.
Fo = > 200 Hz	< 100 mS typical.
Speech Rejection	> 20 dB (300-3000 Hz).
Dec Output 1 - No Decode	Open Col. 50 mA SINK 0.2V.
Option 2 - No Decode	V Source > 4 V @ 4 mA S.C.
Option 3 - Decode	Open Col. 50 mA SINK 0.2V.
Option 4 - Decode	V Source > 4 V @ 4 mA S.C.
High Pass Filter Insertion Loss	< 1.5 dB @ 1 kHz.
High Pass Filter Attenuation	> 14 dB @ 250 Hz.
High Pass Filter Attenuation	> 40 dB @ 100 Hz.
Interface	10 x 12" (300mm) flying leads.
Size	1.6" (40mm) x 0.9" (23mm) x 0.3" (7.5mm).
Mounting	Double Sided Tape.

Output Level Adjustment

The output level of the C1116 module is set by RV1. RV1 is normally set to midway for the KL CTCSS option.

Tone Selection

The C1116 module may be coded to any of the frequencies shown in the table by solder bridging the positions denoted by Y,X,8,4,2,1. The (O) means DO NOT SOLDER.

Tone Number	EIA Code	Frequency (in Hz)		Y	X	8	4	2	1
						Code			
1.	A1	67.0		0	O	O	O	O	O
2.		69.4	#	O	X	O	4	2	1
3.	B1	71.9		Y	O	O	O	O	O
4.	C1	74.4		O	O	O	O	O	1
5.	A2	77.0		Y	X	O	O	O	O
6.	C2	79.7		O	O	O	O	2	O
7.	B2	82.5		Y	O	O	O	O	1
8.	C3	85.4		O	O	O	O	2	1
9.	A3	88.5		Y	X	O	O	O	1
10.	C4	91.5		O	O.	O	4	O	O
11.	B3	94.8		Y	O	O	O	2	O
12.		97.4	*	O	O	O	4	O	1
13.	A4	100.0		Y	X	O	O	2	O
14.	B4	103.5		Y	O	O	O	2	1
15.	A5	107.2		Y	X	O	O	2	1
16.	B5	110.9		Y	O	O	4	O	O
17.	A6	114.8		Y	X	O	4	O	O
18.	B6	118.8		Y	O	O	4	O	1
19.	A7	123.0		Y	X	O	4	O	1
20.	B7	127.3		Y	O	O	4	2	O
21.	A8	131.8		Y	X	O	4	2	O
22.	B8	136.5		Y	O	O	4	2	1
23.	A9	141.3		Y	X	O	4	2	1
24.	B9	146.2		Y	O	8	O	O	O
25.	A10	151.4		Y	X	8	O	O	O
26.	B10	156.7		Y	O	8	O	O	1
27.		159.8	*	O	X	O	4	2	O
28.	A11	162.2		Y	X	8	O	O	1
29.		165.5	*	O	X	O	4	2	1

Tone Number	EIA Code	Frequency (in Hz)	Y	X	8	4	2	1
					Code			
30.	B11	167.9	Y	O	8	O	2	O
31.		171.3 *	O	X	O	4	O	O
32.	A12	173.8	Y	X	8	O	2	O
33.		177.3 *	O	X	O	O	2	1
34.	B12	179.9	Y	O	8	O	2	1
35.		183.5 *	O	X	O	O	2	O
36.	A13	186.2	Y	X	8	O	2	1
37.		189.9 *	O	X	O	O	O	1
38.	B13	192.8	Y	O	8	4	O	O
39.		196.6 *	O	X	O	O	O	O
40.		199.5 *	O	O	8	4	2	1
41.	A14	203.5	Y	X	8	4	O	O
42.		206.5 *	O	O	8	4	2	O
43.	B14	210.7	Y	O	8	4	O	1
44.	A15	218.1	Y	X	8	4	O	1
45.	B15	225.7	Y	O	8	4	2	O
46.		229.1 *	O	O	8	4	O	1
47.	A16	233.6	Y	X	8	4	2	O
48.	B16	241.8	Y	O	8	4	2	1
49.	A17	250.3	Y	X	8	4	2	1
50.		254.1 *	O	O	8	4	O	O

Solder bridges are Y,X,8,4,2,1.
O = no connection.

Notes: 1. Tone marked "#" is not defined by the EIA but is commonly used.

2. Tones marked "*" are not defined by the EIA but are sometimes used.

3. Any other binary combinations will result in transparent operation, i.e. the module will not encode and the decode output will be active.

C1116 Pinout Description

Pin 1 (Blue) tone output - connects to transmitter audio stages after microphone clipper/filter stages and just prior to the modulator.

Pin 2 (Black) common - connect to radio OV (ground).

Pin 3 (Red) supply input - connect to radio +ve supply.

Pin 4 (Green) PTT INPUT - connects directly to PTT. When PTT INPUT is grounded (by the PTT switch) the C1116 goes into the encode mode, and PTT OUTPUT (see pin 8) goes active as a result if PTT is not inhibited by the BUSY input.

Pin 5 (Pink) BUSY/MONITOR - input. This input is used to control either the channel monitor function or is used to provide the carrier detect (busy) input for Tx lockout operation.

a)   Monitor Operation

Bridge "M" and not "B". This input is used to monitor the radio channel by bypassing the C1116's audio mute circuit. To place the radio in the 'QUIET' state, the monitor input must be connected to common (ground). This input may be connected to a microphone hang-up bracket switch, so that when the microphone is removed, the audio filter muting is disabled and any traffic on the channel may be heard.

Notes: 1.   Optionally the phase of this input may be changed. Refer to the section called PHASE.

2.   To enable CTCSS decoding, the monitor input must be connected to ground.

b)   Tx Lockout Operation

Bridge "B" and not "M". In this mode the PTT OUTPUT will not go active in response to a PTT INPUT if the BUSY input is active. However if the BUSY input is active and a correct CTCSS tone is decoded the PTT OUTPUT will be allowed.

Note: 1.   The MONITOR input must be disabled when used in the Tx lockout mode. To achieve this place a solder bridge between FSEL "4" and "PHASE".

Pin 6 (Brown) Audio Output - Audio is only present here if the MONITOR INPUT is active or if the correct CTCSS TONE is detected. Pin 6 and Pin 7 (SIGNAL INPUT) together provide the audio path to the loudspeaker amplifier. The CTCSS tone is attenuated by the AUDIO HIGH PASS FILTER ON THE C1116.

Pin 7 (White) Signal Input - Connects to the discriminator output.

The AUDIO FILTER input also connects to this point.

Pin 8 (Yellow) PTT OUTPUT - This output is an open collector output and connects directly to PTT.

Pin 9 (Orange) Decode Output - This output controls the radio's mute circuitry/squelch gate. Note that the phase of this output may be changed by bridging "D" or "E" as follows:

i)   Bridge "E" (Default condition) to provide an Open Collector Transistor output which is LOW in the NO DECODE state.

ii)   Bridge "E" (Default condition) and cut the emitter lead of Q2 at cutpoint "A" on PCB to provide a Voltage Source output which is HIGH in the NO DECODE state.

iii)   Bridge "D" and CUT TRACK at cutpoint "Z" to provide an Open Collector output which is "ON" in the DECODE state. This state is used for the KL CTCSS option.

iv)   Bridge "D" and CUT TRACK at cutpoint "Z" and CUT TRACK from the emitter lead of Q2 at cutpoint "A" on the P.C.B. to provide a Voltage Source output which is HIGH in the DECODE state.

Note: On some C1116 boards point "C" is not a bridge point and the track has been cut so that high pass filter is not disabled.

Pin 10 (Grey) Beep Out - This is an A.C. coupled output which is connected to the input stage of the radio's audio amplifier stage to provide an audible alert on "BUSY" or "TIME OUT" conditions.

Time Out Timer (Not used on KL)

A transmitter time out function is available on the C1116 provided that the PTT line is interrupted and fed through the C1116 to the radio circuitry. A beep tone will sound at the end of the selected period.

To select this function, place a solder bridge between the solder strip labelled "TOT" and one of the solder lands labelled 0 to 5. Select the time required from the table below:

FSEL0 =	OFF	FSEL3	=	60 Seconds
FSEL1 =	15 Seconds	FSEL4	=	2 Minutes
FSEL3 =	30 Seconds	FSEL5	=	4 Minutes

Reverse Phase Keying (RPK or RTB)

Reverse phase keying is normally enabled on the C1116 module. The following choices are made available via solder bridging at the time of installation:

No connection   RPK enabled without beep
Solder bridge   "N"   RPK enabled with beep

Solder bridge   "F"   RPK disable

The BEEP referred to above is a short tone generated by the C1116 module when it stops decoding (when a phase reversal is encountered) in place of the normal squelch tail as a positive indication of the end of an "over".

Phase

The active phase of the MONITOR INPUT, PTT INPUT, and BUSY INPUT may be altered during installation. The options are tabulated below:

PHASE CONNECTED TO	0	1	2	3	4
MONITOR ACTIVE STATE	LO	LO	HI	HI	LO
PTT INPUT ACTIVE STATE	HI	LO	HI	LO	LO
BUSY INPUT ACTIVE STATE	LO	LO	HI	HI	HI

Choose the active phases required for the current application and place a solder bridge between the solder strip labelled "PHASE" and the function select lines labelled 0 to 4.

The C1116 defaults to the active input states denoted by column 4 above for use with Option 5.

C1000 CTCSS Encoder Programming

Programming Chart

Number	Frequency (Hz)	8	4	Programme Inputs 2	1	X	Y
1.	C 67.8	-	-	-	-	-	-
2.	B 71.9	-	-	-	-	-	Y
3.	C 74.4	-	-	-	1	-	-
4.	A 77.0	-	-	-	-	X	Y
5.	C 79.7	-	-	2	-	-	-
6.	B 82.5	-	-	-	1	-	Y
7.	C 85.4	-	-	2	1	-	-
8.	A 88.5	-	-	-	1	X	Y
9.	C 91.5	-	4	-	-	-	-
10.	B 94.8	-	-	2	-	-	Y
11.	C 97.4	Not available					
12.	A 100.0	-	-	2	-	X	Y
13.	B 103.5	-	-	2	1	-	Y
14.	A 107.2	-	-	2	1	X	Y
15.	B 110.9	-	4	-	-	-	Y
16.	A 114.8	-	4	-	-	X	Y
17.	B 118.8	-	4	-	1	-	Y
18.	A 123.0	-	4	-	1	X	Y
19.	B 127.3	-	4	2	-	-	0
20.	A 131.8	-	4	2	-	X	Y
21.	B 136.5	-	4	2	1	-	Y
22.	A 141.3	-	4	2	1	X	Y
23.	B 146.2	8	-	-	-	-	Y
24.	A 151.4	8	-	-	-	X	Y
25.	B 156.7	8	-	-	1	-	Y
26.	A 162.2	8	-	-	1	X	Y
27.	B 167.9	8	-	2	-	-	Y
28.	A 173.8	8	-	2	-	X	Y
29.	B 179.9	8	-	2	1	-	Y
30.	A 186.2	8	-	2	1	X	Y
31.	B 192.8	8	4	-	-	-	Y
32.	A 203.5	8	4	-	-	X	Y
33.	B 210.7	8	4	-	1	-	Y
34.	A 218.1	8	4	-	1	X	Y
35.	B 225.7	8	4	2	-	-	Y
36.	A 233.6	8	4	2	-	X	Y
37.	B 241.8	8	4	2	1	-	Y
38.	A 250.3	8	4	2	1	X	Y

Tone Frequency Selection

The C1000 may be coded to any one of the 37 tone frequencies by following the PROGRAMMING CHART and placing a small solder bridge on the required PCB lands labelled 8 4 2 1 X Y.

Place solder bridge where indicated by 8 4 2 1 X Y. "-" means leave open circuit.

Care must be taken to ensure good clean solder joints and that invalid codes are not selected.

4.5.4 Installation

Remove the cover off the receiver module. Ensure that JMP 101 is installed within the receiver module and that all jumpers links and dip switches are configured as required. Refer section 4.5.1 for configuration. Invert the CTCSS PCB and install it into the corresponding sockets on the receiver PCB. Affix mounting screws and replace receiver cover.

Adjust RV1 for 500 Hz deviation when the KL is transmitting the encoded CTCSS tone.

4.5.5 Setting the CTCSS Frequency on the ST-146

The Selectone ST-146 CTCSS tone decoder is used in place of the Sigtec C1116 CTCSS tone decoder as a second source supply. Alternatively the ST-146 may also be set to non standard frequencies if required. Refer to section 4.5.3 for the standard tone list.

The ST-146 is also compatible with any systems using standard EIA CTCSS frequencies. Output connections for the ST146 are described overleaf.

Electrical Specifications:

Operating Voltage : 5.5V DC to 16V DC

Operating Current : Less than 5mA DC

Frequency Range : 67 to 250.3 Hz, continuously tunable

Temperature Range : -30°C to 60°C

Frequency Stability : Exceeds EIA RS220A (Less than U U ± 0.5%, typically less than ± 0.2%)

Encode Output Level : Less than 1% THD

Decoder Input Level: 10mV rms to 2V rms (Supply dependent)

Decoder Input Z : Greater than 100K

Hi-Pass Filter : May be muted by decode output

Decoder Activate : Field selectable (+) or (-) logic

Decoder Output : Open-collector sink to (-) Supply or source (+) voltage. Four possible output conditions or Hi-Pass filter muting.

Interface : 18" flying leads terminated at miniature low profile connector.

ST-146 Size : 1.68" L X 0.80" W X 0.20" H
4.27cm X 2.03cm X .51cm

Output Level Adjustment

The output level of the ST-146 module is set by R33. R33 is normally set to midway for the KL/KL Micro CTCSS option.

Decoder Frequency Adjustment

The ST-146 is continuously tunable over the standard CTCSS frequency range from 67 to 250.3Hz. To set the frequency, apply power, set R33 fully clockwise and connect the Tone Output lead (WHT/GRN) to your frequency measuring equipment. Adjust R10 for the desired CTCSS frequency. You may find the use of a lissajous figure with a known on-frequency reference the quickest set-up procedure, or as an alternate if a frequency counter is not available.

ST-146 Pinout Description

[9] Negative (-) Supply (BLACK): Connect to System [-] (Ground)

[3] Positive (+) Supply (RED): Connect to (+) Supply (5.5V DC to 16V DC)

[13] Tone Output (WHT/GRN): Connects to transmitter audio stages after microphone clipper and filter.

Three parrallel resistors (1K, 51K, & 150K) are in series with the ST-146 output circuit, and the 1K and 51K resistors may be eliminated from the circuit by removal of JU4 and JU5.

[12] Tone Input (GREEN): Jumpered to Hi-Pass Filter Input by JU1. Connect directly to the FM receiver detector audio output. Breaking the audio path at this point will allow insertion of the Hi-Pass Filter. If it is not practical to break the audio path at this point, refer to Hi-Pass Filter Input (BLUE).

[11] Hi-Pass Filter Input (BLUE): Use only when Tone input (Green) cannot be used for Hi-Pass Filter input. Remove JU1 for applications where breaking the audio path at the FM receiver detector is not practical. Hi-Pass Filter input audio should be taken at the most convenient point.

[1] Hi-Pass Filter Output (WHT/BLU): Connect to place the Hi-Pass Filer in series with receiver audio path.

[4] Decode (-) (WHT/ORG): For applications where the radio mute point must be held at Negative (-) Supply (Ground) during mute. Remove JU2 for applications requiring (-) Supply (Ground) during decode.

[5] Decode (+) (BLK/ORG): For applications where the radio mute point must be held Positive (+) during mute. Remove JU2 for applications requiring Positive (+) during decode. JU2 is removed for the KL Option 5.

[2] Hi-Pass Filter Mute (VIOLET): Connect to Decode (-) (WHT/ORG) if none of the above mute conditions apply.

[7] Monitor (Brown): Primary control of Decode Mute functions. Connect to Negative (-) Supply (Ground) through monitor/hookswitch to mute the radio. Open from Negative (-) Supply (Ground) to monitor. If your monitor switch closes to Negative (-) Supply (Ground) to monitor, connect MONITOR directly to Negative (-) Supply (Ground) and refer to MONITOR for switch hook-up.

[8] Monitor (BLK/BRN): If your monitor switch closes to Negative (-) Supply (Ground) to monitor, then MONITOR (Brown) must be connected to Negative (-) Supply, and connect this lead (BRN/BLK) to your Monitor hookswitch.

[10] Encode Enable (BLK/YEL): For applications with PTT closure to Negative (-) Supply (Ground) during transmit. Connect to PTT.

[6] Encode Enable (Yellow): For applications where a keyed Positive (+) is available during transmit.

4.6   REAR DISABLE DISPLAY SWITCH (Standard KL only)

The normally internal located JMP10 programmable link used to disable the display and normally located inside the KL LEDs is now located at the rear panel of the KL. Disabling the display will reduce the receive current by approximately 140mA with this option.

OPTION 7

4.7.   KL SOFTWARE OPTIONS

4.7.1   Description

Special custom software options can be incorporated into the KL450/150/70 main microprocessor. This can include software controlled hardware such as:

a)   Channel display data.

b)   Channel programming data.

c)   Transmit limit timer.

d)   Press to talk delay time.

e)   Channel changing.

f)   Channel scanning and sequencing.

g)   Mute functions.

h)   PTT functions.

i)   External analog and digital processing including A to D conversion at the internal options connector.

Consult factory for any special software requirements or variations.

4.9 INCREASED BANDWIDTH 50Hz to 5KHz

Description

Several hardware modifications are made to the Tx unit of the KL 50 so as to provide an increased modulation bandwidth of 50Hz to 5KHz. This facility is used when a modem or ancillary device requires low group delay distortion and flat frequency response in the tranmitter section of the KL transceiver.

Technical Description

The Tx bandwidth is increased by providing a direct connection to the VCO in the Tx unit. The PLL filter frequency is also lowered by the addition of a 470R resistor and 22uF capacitor on TP401 of the Tx VCO. This step also extends the low frequency response of the VCO.

OPTION 18

4.10 FAST TX RISE TIME OF 5mS. CONTINUOUS VCO

Description

Several hardware modifications are performed to the transmitter section of the KL so as to provide an RF output rise time of less than 5mS from the onset of PTT. This facility is used when a modem is connected to the KL transceiver to provide a fast response.

Technical Description

The VCO is wired so that it is running continuously and the PLL is permanently locked in a stable state. The PTT line is now isolated from the synthesizer and has only to switch on the output buffer amplifier Q301 and Q302.

4.11   1600 Hz VOTING TONE GENERATOR

Description

The voting tone generator board fits into the PLL cavity of the receive module. The unit generates a tone when either the mute is closed or CTCSS is not decoded.

To use this option, the option 5 CTCSS decoder/encoder board must also be fitted.

Technical Description

The KL Option 19 Voting Tone Generator consists of 14 stage binary counter with an on chip oscillator (IC1) and a tracking digital low pass filter (IC2). The final output frequency is determined by the frequency of XTAL 1 as defined by the formula:-

XTAL1 (MHz) = frequency out required (KHz) x 4.096.

ICI divides the XTAL frequency by 4096 to pin 1 and feeds the square wave to the filter RF5609 (IC2) for filtering to a sine wave output at pin 2. The cut off frequency of the filter is set by the clock frequency at pin 3 of IC2.

The output tone is disabled when pin 12 of ICI goes high. The jumper JMP1 allows for the input control signal to be active high or low. With the jumper shorting pins 1 and 2 the tone will be disabled when there is a low signal on CNOP4-1.

Installation

There are 2 connectors for the KL OPTION 19. The 3 pin connector (CNOP3) has wires which connect to the option 5 board and CNOP4 has one wire which connects to the board in the receive module below the option 5 board.

All wires on CNOP3 are connected to IC2 on the option 5 board as detailed below

CNOP 3	IC2 on Option 5 Board
pin 1	pin 5
pin 2	pin 14
pin 3	pin 7

To connect CNOP4 the receive module should be removed from the transceiver. The wire which is connected to CNOP4 pin 1 should be connected to the hole in the receive board marked TP105, which is near FVR102. This wire should be routed along the left edge of the receive module so that it will not interfere with the installation of the option 5 board.

If an option 8 board is installed, pins 1 and 6 of IC 11 on that board must be linked together. If there is no option 8 board then jumper JP4 should be installed on the motherboard.

4.11.1 Alignment

After having aligned the receive VF levels, use RV1 on the option 19 board to set the required tone output level. With the radio set up with RF input but no deviation, so that the mute is open but no CTCSS is decoded, set the output tone to the required level (normally -10dBm).

OPTION 21

4.12 HIGH SPEED MODEM INTERFACE

This option entails minor modifications to both the transmit and receive circuitry of the UNI-LAB KL radio transceiver. Also added to the KL for Option 21 is a power regulator module. The circuit diagram and component layout of the power regulator (CD 197.2) are included in Sections 10 and 11 of this manual.

Users should also note that KL Option 18 - fast Tx rise time and continuous VCO - is an integral part of Option 21.

Technical Description

Wide band FSK input is located on connector CN304, pin 2 and provides a direct connection to the Tx VCO. The 47uF capacitor and 470R resistor connected to TP401, together with R317 (12K), lower the phase locked loop frequency to cater for low frequency modulation. Pin 7 of connector 305 is permanently grounded so that the VCO runs continuously to provide a fast Tx on-time.

In the KL receive section, C155A and C150A are changed to improve the low frequency response of the Rx demodulation.

4.13   DUAL CHANNEL INTERFACE

Description

Additional interfacing and several hardware modifications are performed to the Tx and Rx units of the KL to facilitate connection and interfacing to the DCM-1R.

Technical Description

The KL transmitter bandwidth is increased to 10KHz by providing a direct connection to the VCO in the Tx unit. The receiver bandwidth is also increased by providing a direct connection from the discriminator (pin 9 of IC107 in the receiver unit). The discriminator output is followed by a low pass filter to remove unwanted frequencies. Connections to the Rx and Tx units go directly to the rear of the KL which provides a direct connection to the DCM-1R.

Connections from KL to DCM-1

KL	DCM pin no
Tx mod wide band co-axial braid (Red RCA plug)	a6
Tx mod wide band co-axial centre (Red RCA plug)	c6
Rx mod wide band co-axial braid (Black RCA plug)	a8
Rx mod wide band co-axial centre (Black RCA plug)	c8

OPTION 23

4.14   DUAL TONE CTCSS ENCODE WITH OPTION 5

Description

This option allows the selection of two different CTCSS tones on a KL transceiver fitted with Option 5. The KL Option 5 MUST be fitted with a Sigtec C1000 encoder - the ST140 encoder is not suitable for this purpose.

Technical Description

One of the CTCSS tones is 67Hz and the other is programmable, via diodes. It is used for a continuous link but the tones can be changed over for mobile reception, allowing 'mobiles' using a different tone to receive the link transmitter.

In the standby state, the transmitter is operating all the time with a CTCSS tone of 67Hz. When the PTT is activated, the tone changes to the second frequency, factory set to 173.8 Hz.

Caution should be taken by the user as the KL transmitter is on continuously with this option.

4.15   DUAL CTCSS DECODER

Description

This second CTCSS tone decoder fits into the PLL cavity of the receive module. When used with an Option 5 CTCSS decoder/encoder board, this unit will allow a second CTCSS frequency to be decoded.   The outputs from both boards are connected as a logic OR function

To use this option, the Option 5 CTCSS decoder/encoder board must be fitted.

Technical Description

This board may be fitted with either a Selectone ST-146 or a Sigtec C1116 decoder/encoder. This is connected in parallel with the encoder/decoder on the Option 5 board and will, consequently, operate in the same manner, which is dependant upon the setting of the Option 5 dip switch settings.

Descriptions of both Sigtec and Selectone units can be found in the Option 5 information.

Installation

The Option 24 board is installed in the PLL cavity of the receive module.

A 9 pin plug is used to connect to CN1 on the Option 24 board. The wires from this plug are soldered to the solder side of CN109 on the Option 5 board.

The pins are connected as shown below

CN1 (Option 24)	CN109 (Option 5)
1	N/C
2	2
3	3
4	4
5	5
6	6
7	7
8	N/C
9	9

Alignment

To align the ST-146 decoder it must be switched by the Option 5 dip switches to encode mode i.e. turn switches 6 and 8 on SW1 (option 5) on.

The frequency can be measured at Pin 1 of CN1.

To align the C1116 decoder refer to the information in the Option 5 section.

4.16   12.5 KHZ CHANNEL SPACING

Description

This option provides narrow band filtering in the KL-450 Rx UHF main unit, along with a high stability crystal in its oscillator unit. It involves the substitution of CF101 by a CFG 455G filter, XF101 by 21P08C filters and TXCO by a GFS210X crystal.

After fitting at the UNI-LAB factory, the KL Rx IF strip is re-aligned, ensuring that deviation is reduced to 2.5KHz.