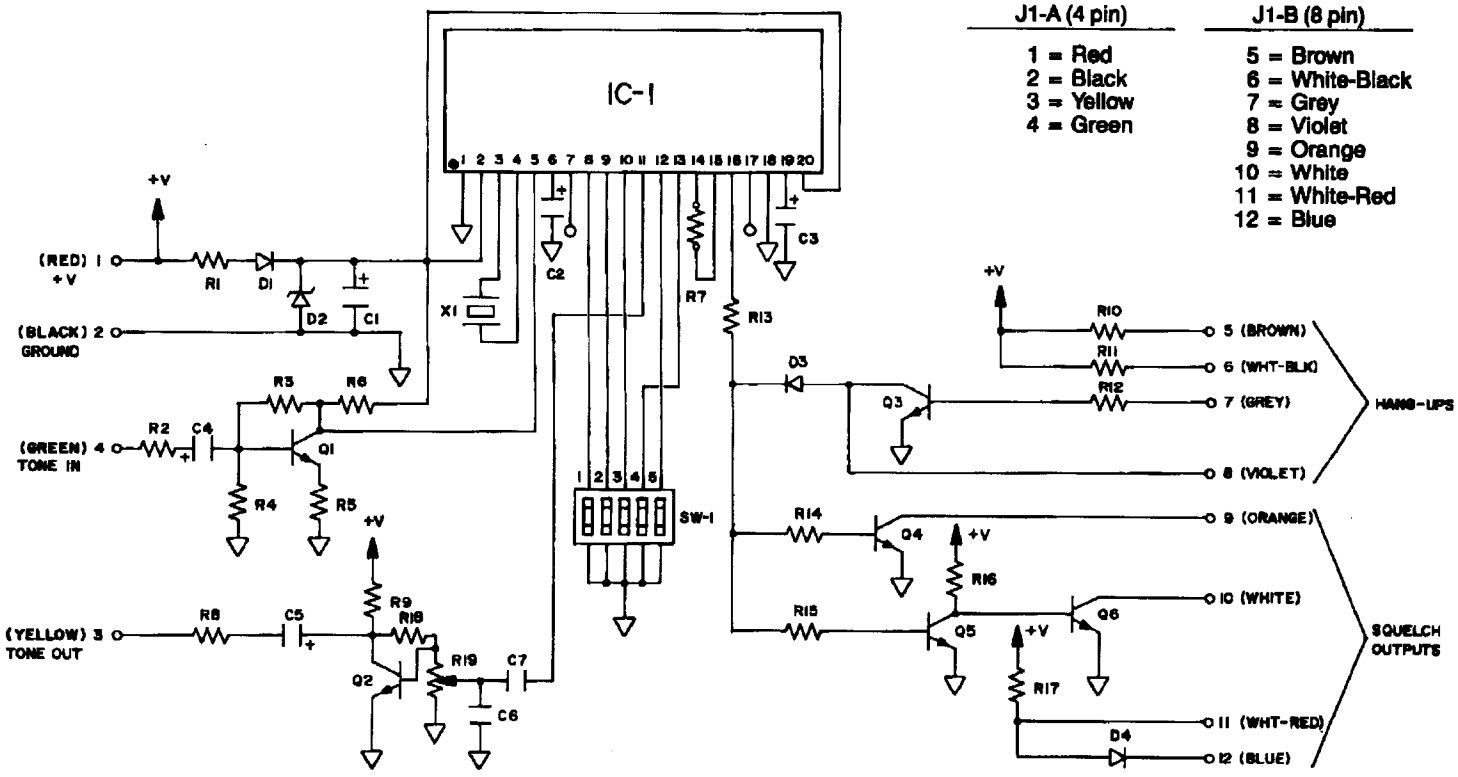
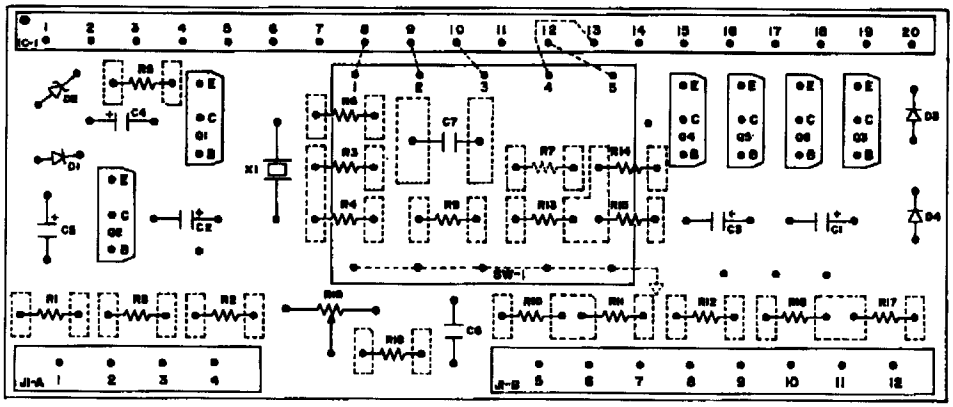
TS-32HB INSTRUCTION SHEET



DIP SWITCH PROGRAMMING
(FOR CTCSS PRODUCTS)

#	FREQ.	CODE	SWITCH NUMBER* 6	4	3	2	1
1	67.0	XZ	0	0	0	0	0
2	71.9	XA	0	0	0	0	1
3	74.4	WA	0	0	0	1	0
4	77.0	XB	0	0	0	1	1
5	79.7	SP	0	0	1	0	0
6	82.5	YZ	0	0	1	0	1
7	85.4	YA	0	0	1	1	0
8	88.5	YB	0	0	1	1	1
9	91.5	ZZ	0	1	0	0	0
10	94.8	ZA	0	1	0	0	1
11	97.4	ZB	0	1	0	1	0
12	100.0	1Z	0	1	0	1	1
13	103.5	1A	0	1	1	0	0
14	107.2	1B	0	1	1	0	1
15	110.9	2Z	0	1	1	1	0
16	114.8	2A	0	1	1	1	1
17	118.8	2B	1	0	0	0	0
18	123.0	3Z	1	0	0	0	1
19	127.3	3A	1	0	0	1	0
20	131.8	3B	1	0	0	1	1
21	136.5	4Z	1	0	1	0	0
22	141.3	4A	1	0	1	0	1
23	146.2	4B	1	0	1	1	0
24	151.4	5Z	1	0	1	1	1
25	156.7	5A	1	1	0	0	0
26	162.2	5B	1	1	0	0	1
27	167.9	6Z	1	1	0	1	0
28	173.8	6A	1	1	0	1	1
29	179.9	6B	1	1	1	0	0
30	186.2	7Z	1	1	1	0	1
31	192.8	7A	1	1	1	1	0
32	203.5	M1	1	1	1	1	1

*CLOSED = 0 (ON)
OPEN = 1 (OFF)



COMMUNICATIONS SPECIALISTS, INC.
426 West Taft Avenue • Orange, CA 92665-4296
Local (714) 998-3021 • FAX (714) 974-3420
Entire U.S.A. 1-800-854-0547

TS-32HB PARTS LIST

DESIG.	CSI NO.	DESCRIPTION	PRICE
R5	06-1006	10 ohm chip resistor RM10	.23 ea.
R1	06-4716	470 ohm chip resistor RM10	.23 ea.
R9	06-2726	2.7K chip resistor RM10	.23 ea.
R6	06-3326	3.3K chip resistor RM10	.23 ea.
R8	06-6826	6.8K chip resistor RM10	.23 ea.
R10,11,12,13 14,15,16,17	06-1036	10K chip resistor RM10	.23 ea.
R2,4	06-3336	33K chip resistor RM10	.23 ea.
R3	06-1046	100K chip resistor RM10	.23 ea.
R18	06-2746	270K chip resistor RM10	.23 ea.
R19	18-1044	100K potentiometer	1.35 ea.
C6	21-1040	.1μf-X7R mono capacitor	.34 ea.
C7	21-1041	.1μf-X7R mono chip capacitor	.54 ea.
C4,5	19-1050	1μf-20V 10% tant. capacitor	.21 ea.
C1,2,3	23-1000	10μf-16v (3x5) al. elect. capacitor	.15 ea.
X1	48-1000	1 MHz crystal	7.50 ea.
Q1,2,3,4,5,6	48-2785	2SC2785 NPN silicon transistor	.30 ea.
D1,3,4	48-4148	1N4148 silicon diodes	.15 ea.
D2	48-5242	1N5242B 12V zener diode	.18 ea.
1C-1	51-1219	TS-32HB hybrid	40.00 ea.
J1-A	09-8706	4 pin socket	.14 ea.
J1-B	09-8704	8 pin socket	.26 ea.
SW-1	40-1010	5 position mini dip switch	2.58 ea.
1 ea.	84-1021	TS-32HB printed circuit board	2.54 ea.
1 ea.	01-1024	12 wire assy. with 4 & 8 pin plugs	3.00 ea.
2 ea.	75-1002	Double sided tape	.05 ea.
2 ea.	54-1002	"A" frequency labels	.10 ea.

NOTE: If a high-pass filter is needed, order our HP-1B Hybrid High-Pass Filter for $8.95 ea.

The price of the TS-32HBH (1.5" x .65" x .65") OR TS-32HBL (1.5" x 1.2" x .4") is $64.95 ea. Both are identical except for form factor. Your PREPAID order will be sent POSTPAID by AIRMAIL OR UPS BLUE-LABEL the same day it is received. California residents add 6% sales tax or supply resale card with order.

MOUNTING

Mount the unit with the double-sided tape supplied. Do not mount with silicon seal or other type glues as this will void the warranty.

PROGRAMMING

This programmable line of products uses a five position DIP switch to select the frequency desired. When the switches are in any particular position, this binary code tells the integrated circuit on which one of the coded tones the system will operate. For instance, if 1Z (100.0Hz.) is desired, the code required is located on the instruction sheet and the switches are programmed accordingly. For example, the code for a 1Z is "11010," thus switch #1 is turned OFF (corresponding to a "1"), switch #2 is turned OFF, switch #3 is turned ON (corresponding to a "0"), switch #4 is OFF, and switch #5 is turned ON. By selecting the variable combinations of switch positions, all 32 tones can be accessed. Special tones are available also by using a different frequency crystal.

POWER HOOK-UP

Hook +V (Red wire-Pin 1) to a source of unswitched +6 to +17VDC, well filtered and regulated if possible. A battery is of course excellent. Hook GROUND (Black wire-Pin 2) to chassis ground in negative ground systems. If positive ground operation is required as in Motorola HT-200/PT-200 series portables, interchange GROUND and +V connections. If polarity is inadvertently reversed to the unit, transistors Q2,3,4, or 5 may be damaged.

DECODER TONE INPUT

Hook TONE IN (Green wire-Pin4) directly to the discriminator of the receiver forward of any metering resistance going to the discriminator jack. This must also be a point that is not switched off or grounded when the squelch is muted. DO NOT USE the speaker output as the frequency response is attenuated below 300Hz and provides insufficient tone for decoding. A minimum of 6mv is required.

TONE ENCODER OUTPUT

Hook the TONE OUT (Yellow wire-Pin 3) to the transmitter tone encoder input point which is usually just prior to the modulator stage.

Typical connections would be to the center of the deviation control, to the input of the final audio driver, to the varactor modulator diodes or to the manufacturer's normal connection point. This connection point varies with each different model radio, and you must determine which provides the best results. A varactor kit may be used to modulate the crystal directly, see figure E1. The VARACTOR (transistor base to collector junction of an NPN silicon transistor) changes A.C. voltage into changing capacitance which truly FM modulates the transmitter. No intermoding or distortion of the voice will be noted with this method. Various values of coupling capacitors are shown for different frequency ranges of the transmitter. A higher value of capacitance will increase the deviation level, however if the capacitance is too high, it may be difficult to set the transmitter on frequency. Varactor Kits are available from us for $3.00 each. Use this method if other connection points prove unsuccessful.

DO NOT connect the encoder tone to the microphone input as this invariably causes excessive tone and harmonic distortion due to the frequency response of the transmitter's speech amplifier. The speech amplifier has a typical response of 300Hz to 3000Hz and does not permit the fundamental tone to be transmitted. This is the usual cause of a distorted tone output as monitored on a deviation scope.

The output of our encoder is low Z, so it is capable of driving low Z loads. If you are driving a high Z load such as 100K deviation pot, then a series isolation resistor should be used so the encoder will not load down the normal voice modulation. This resistor value must be determined experimentally, but a 100K resistor would be a good starting point. This value could change from 10K to 1 meg depending on the radio used. If the tone output of the encoder is connected to a point in the transmitter where DC Bias is present, a .33µf to 1µf (non-polar) capacitor may have to be added in series with the encoder to keep this Bias from being upset.

If tone distortion continues to be a problem, then a capacitor can be placed on the tone output to provide additional filtering where required, see figure E2. This is most noticeable in phase modulators since the frequency response seems to be quite poor at the low end of the audio range. If you are using a a deviation scope, then little spikes will be riding on the sine wave output, and this will sound like a buzz. The additional filtering will cure the problem. True FM modulators do not have this problem and are very easy to work with and interface very well with sub-audible encoders. These modulators can be identified quite easily since the audio is fed into a varactor which is often connected in parallel with the crystal. If the purity of the encoder output is in question, look at the output of the encoder with an oscilloscope.

Most UHF transmitters interface quite well with sub-audible encoders. This is primarily due to the high multiplication factor from the modulator to the final amplifier stage. Because of the lower number of multiplication stages in low band transmitters, sufficient deviation level can sometimes be difficult to obtain.

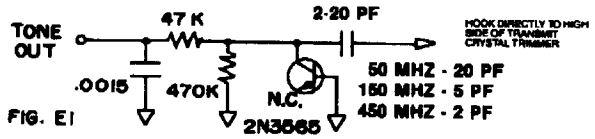


FIG. E1

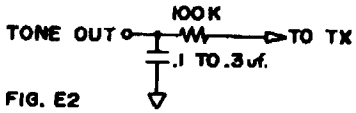


FIG. E2

RF INTERFERENCE

Although our encoders are not susceptible to RF, care must be taken when locating the unit, and how the wires are routed. In most cases of RF interference it has been found that the RF is coupled into the leads of the encoder and then fed back into the radio itself where the RF upsets the bias conditions in the transmitter. This causes distortion and other unusual effects. But under these conditions it will be noted that the encoder is still working properly. This is most common in portable hand held radios, since often the circuitry is compromised slightly to achieve the small size required. Often a small by-pass capacitor such as a 100pf on the radio's circuit board works quite well. Also, keeping all leads as short as possible or re-routing the wires helps.

HANG-UP

The TS-32HB has a universal hang-up circuit which can be configured to work with any unit it must be installed in. The four hang-up pins (5,6,7,8) are independent of the four squelch gating pins. Simply decide which one of the four hook-ups below you need and wire accordingly. Use an ohm meter for pulls to and from ground or a voltmeter for pulls to and from supply to find out which of the four hook-ups your particular CTCSS monitor switch supplies.

1. PULL TO GROUND TO MONITOR — Hook (Brown wire-Pin 5) to (Grey wire-Pin 7) and switch both these to ground to monitor. Also jumper (White/Black wire-Pin 6) to (Violet wire-Pin 8).
2. PULL AWAY FROM GROUND TO MONITOR — Hook (White/Black wire-Pin 6) to (Violet wire-Pin 8) and switch both these away from ground to monitor.
3. PULL TO SUPPLY (+V) TO MONITOR — Switch (Violet wire-Pin 8) to supply to monitor.
4. PULL AWAY FROM SUPPLY (+V) TO MONITOR — Switch (Grey wire-Pin 7) away from supply to monitor. Also jumper (White/Black wire-Pin 6) to (Violet wire-Pin 8).

NOTE: Any wires not used in your selected hook-up can be taped back or cut off as they are not needed.

RECEIVER MUTING (SQUELCH GATING)

The TS-32HB squelch outputs are also universal in nature and may be configured to work in any type unit. The four squelch pins (9,10,11,12) are independent of the four hang-up pins. Simply decide which one of the four hook-ups below you need and wire accordingly. The normal connection point is to the collector or base of the squelch switch transistor. Where this point is not easily identified, the following procedure can be used. Use a clip lead to ground with a 100 ohm resistor in series. Probe around the receiver with the squelch open to locate a point that will mute the receiver audio when the resistor is connected to that point. This point may be in the squelch circuitry or possibly in the audio stages. When an IC is used for the audio section, often one pin on the IC will mute the audio. Use hook-up #2 if such a point is found. If the above method is unsuccessful, use a clip lead to +V with a 10k resistor in series. Probe around the receiver with the squelch open to locate a point that will mute the receiver audio when the resistor is connected to that point. Use hook-up #4 if such a point is found. Hook-up #1 can be used to pull a small DC relay (250 ohms or so) or LED call light to ground. If a relay is connected to (Orange wire-Pin 9) put a diode across the coil with the + end of the diode to supply. Hook-up #3 might be useful in unusual applications but is only capable of sourcing 1ma or so.

1. PULL TO GROUND UPON RECEIPT OF PROPER TONE — The (Orange wire-Pin 9) is pulled to ground upon receipt of the proper tone.
2. PULL AWAY FROM GROUND UPON RECEIPT OF PROPER TONE — The (White wire-Pin 10) is pulled away from ground upon receipt of the proper tone.
3. PULL TO SUPPLY (+V) UPON RECEIPT OF PROPER TONE — The (Blue wire-Pin 12) is pulled to supply (+V) upon receipt of the proper tone. Also jumper (White wire-Pin 10) to (White/Red wire-Pin 11).
4. PULL AWAY FROM SUPPLY (+V) UPON RECEIPT OF PROPER TONE — The (Blue wire-Pin 12) is pulled away from supply (+V) upon receipt of the proper tone. Also jumper (Orange wire-Pin 9) to (White/Red wire-Pin 11).

NOTE: Any wires not used in your selected hook-up can be taped back or cut off as they are not needed.

MULTI-TONE APPLICATIONS

By adding a little additional circuitry, our programmable line of products may be frequency programmed by remote means. Since these products all use DC signals for switching, any number of tones may be switched in or out without being concerned with additional lead length, or stray capacitance affecting the frequency. This is a typical problem associated with tunable or reed type units.

There are a number of ways of changing frequencies from a remote location. The easiest way is to use a 33 position binary switch (available from us) which connects on the circuit board. Thus all 32 tones may be accessed by rotating through all positions on the switch, with the first position on the switch being the off condition (see figure M1). When connections are made in this manner, position ONE will be the off condition, and the path from "G" to "H" will be open thereby removing power from the programmable board. Position TWO would be 67.0Hz (Group A), position THREE would be 71.9Hz, and so on up to position 33 which would be 203.5Hz.

The other method for adding additional frequencies is to use a single pole rotary switch with as many positions as the number of different frequencies required. Using this method, a diode for line isolation must be used in each leg of the program code which requires a "0" or a ground for programming (see figure M2). In this example, three frequencies are required to operate a three site repeater system. The sub-audible tones required to access all three sites are 5Z (151.4Hz), 4B (146.2Hz), and YZ (82.5Hz). The frequency code is located on the programming chart for each of the three frequencies and these codes are converted to the appropriate diode array for each frequency. For example, position number two on the rotary switch must be 146.2Hz. This corresponds to "10110" on the program chart. By looking at this code, it is determined that 2 diodes will be required on the locations containing a "0," and no connection is required in the locations containing a "1." Thus the lines from pads 8 and 13 are pulled to ground through the series diodes when the rotary switch is in position number two. This method works quite well where space is a factor, and is best when only a few frequencies are required.

FIGURE - M1

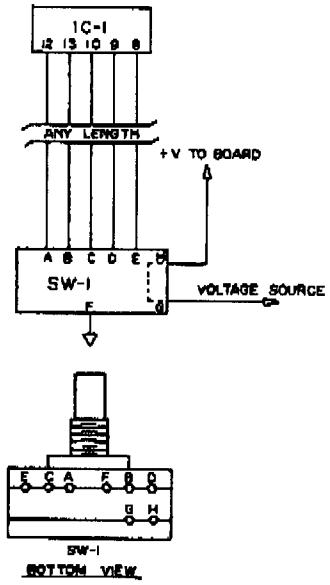


FIGURE - M2