SS-32SMP INSTRUCTION SHEET

NOTE: There are NO stops on the output level Pot R4

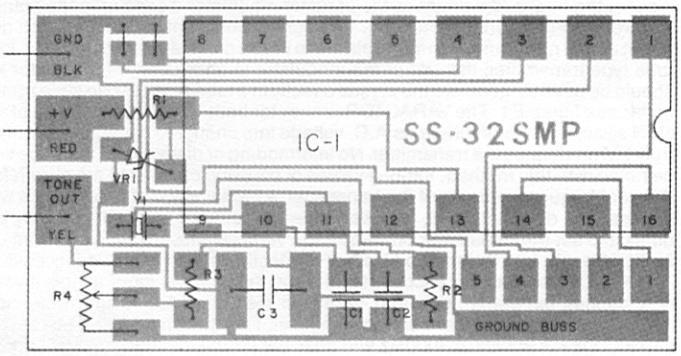


FIGURE 1

DESCRIPTION:

The Communications Specialists model SS-32SMP is a new concept in programmable CTCSS tone encoders. Any 32 tones between 67 Hz and 255 Hz (± .01 Hz) can be factory programmed into the SS-32SMP. Once the unit is programmed, the tones contained in memory are user selected by means of pads on the PCB. The tone output is a low distortion sine wave, with a variable amplitude of 0 to 2 volts p-p. The size is .53 x 1.00 x .16″

MOUNTING

Mount the unit with the double-sided tape supplied. If the unit is mounted with silicon seal, the warranty will be void unless it is all confined to the bottom of the PCB. Glue or other adhesives are not recommended.

POWER HOOK-UP

Hook + V (red) on the circuit board to a KEYED source of + 6 to + 15 VDC @ 3-14 ma. regulated if possible. Hook GND (black) on the PCB to chassis ground in negative ground systems. If positive ground operation is required, interchange GND and + V connections. If polarity is reversed to the unit, IC-1 will be damaged. Be careful of a radio which has multiple grounds, such as a chassis ground and a true vehicle ground. A GE Mastr Pro is a good example. The same holds true of the Motorola HT-200/PT-200 series portables

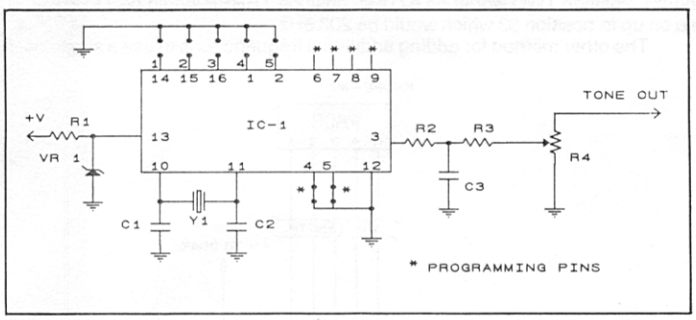
PROGRAMMING

This programmable line of products uses solder bridges from the pads (figure 1) to the Ground Buss to select the frequency desired. When the jumpers are in place, the binary code that is presented to IC-1 internally selects which one of the 32 frequencies is to be generated by the encoder. SS-32SMP is programmed by jumpering from Programming Pads 5, 4, 3, 2, & 1 to the Ground Buss (see figure 1) to select the frequency desired. For instance, if 1Z (100.0Hz) is desired, the code required is located on the Programming Chart and the jumpers are added accordingly. For example, the code for 1Z is "01011", thus pads 5 and 3 are grounded to the Ground Buss and 4, 2 and 1 are left unconnected. Special frequencies from 1Hz to 255Hz can be programmed at the factory at no additional charge. Frequencies from 256Hz to 7800Hz can be supplied by changing the crystal to 1MHz at a slight additional charge.

PROGRAMMING CHART FOR CTCSS PRODUCTS GROUP A

#	FREQ.	CODE	PAD NUMBER 5	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

0 = SHORTED TO GROUND BUSS
1 = N/C



SS-32SMP PARTS LIST

REF.	CSI NO.	DESCRIPTION	PRICE
R1	06-4716	470 ohm 5% chip resistor 0805	.10 ea.
R2	06-3326	3.3k 5% chip resistor 0805	.10 ea.
R3	06-6826	6.8K 5% chip resistor 0805	.10 ea.
R4	18-1046	100k Hybrid potentiometer	.47 ea.
C1	22-4710	470pf NPO mono chip cap. 0805	.25 ea.
C2	22-1800	18pf NPO mono chip cap. 0805	.20 ea.
C3	22-3340	.33uf-Z5U mono chip cap.	.50 ea.
VR1	48-5231A	5.1v 5% chip zener diode	.24 ea.
Y1	48-3270	32.768kc miniature crystal	.75 ea.
IC-1	51-0110	iC-110 Programmable Enc/Dec	18.00 ea.
1ea	84-1042	SS-32SMP printed circuit board	1.97 ea.
12″	30-7025	28AWG PVC Black wire	.10 ft.
12″	30-7026	28AWG PVC Red wire	.10 ft.
12″	30-7028	28AWG PVC Yellow wire	.10 ft.
2ea	54-1002	Group A Frequency Selection Stickers	.10 ea.
1ea	75-1004	Thin double sided tape square	.06 ea.
1ea	75-1002	Regular double sided tape square	.07 ea.
1ea	56-1001	CSI Tuning Tool	.20 ea.

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PROCEDURE FOR CONNECTING SUB-AUDIBLE ENCODER TONE TO TRANSMITTER

The encoder tone output is typically connected 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. In a tube type transmitter, the grid of the modulator is often used, or a varactor kit should be used to modulate the crystal directly in a tube type or solid state transmitter, 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 .33uf to 1uf 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 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.

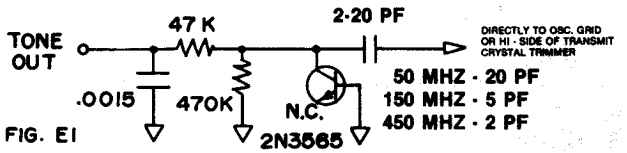


FIG. E1

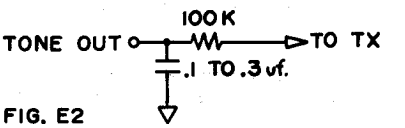


FIG. E2

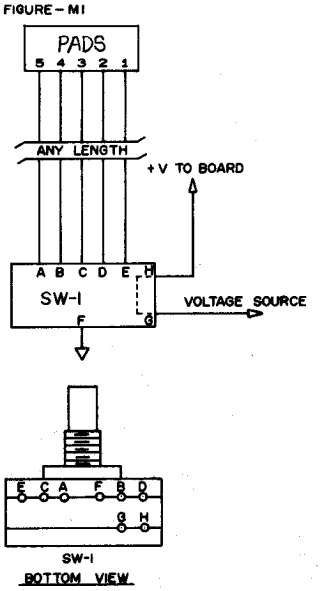
MULTI-TONE APPLICATIONS

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 to pads 1-5 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, position THREE would be 71.9Hz, and so on up to position 33 which would be 203.5Hz.

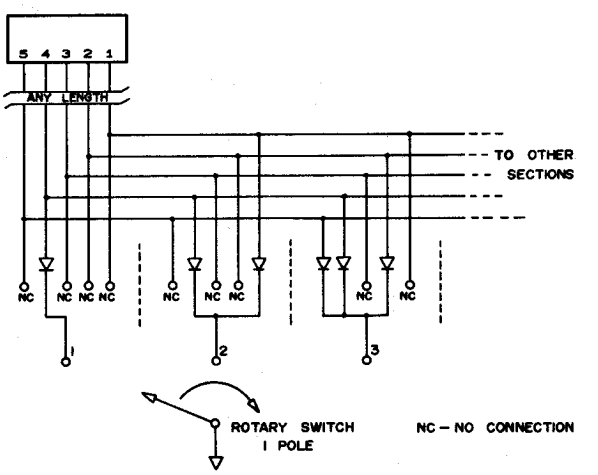
The other method for adding additional frequencies is to use a single pole rotary switch with as many positions as the number of different frequencies required. Using this method, a diode for line isolation must be used in each leg of the program code which requires a "0" or a ground for programming (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 4 and 1, 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



Switch
40-1007
$14.95 each

FIGURE – M2



PLEASE NOTE:

The SS-32SMP has a unique feature in that ANY of the 32 internal positions may be programmed at the factory for ANY frequency desired. This means that if only six tones or less are required in a particular radio system, a single pole six position switch may be used with NO isolation diodes needed. The six position switch is simply connected to pads 1-5 (the sixth position is left open) with the switch common grounded. The six desired frequencies are programmed at the factory into positions 31, 30, 28, 24, 16 and 32. As the switch is rotated, the tones in each position will be generated.

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.