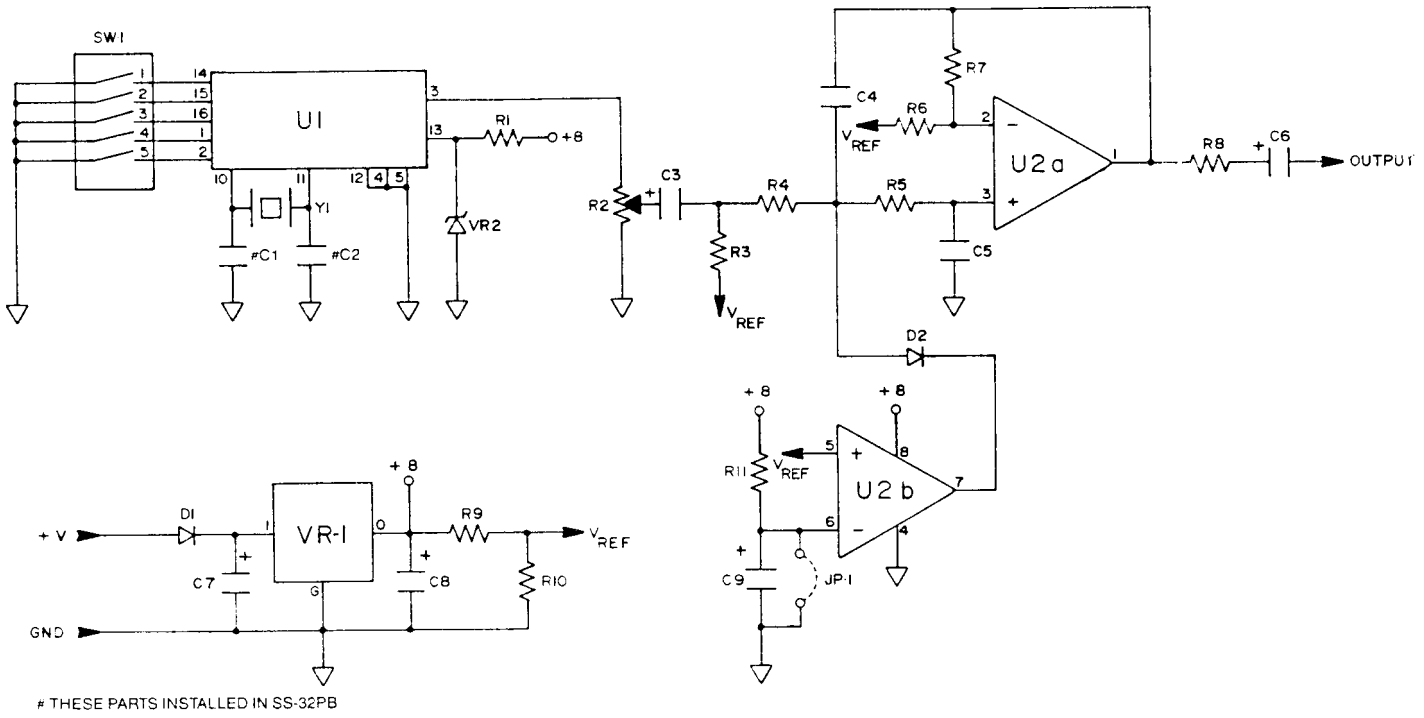
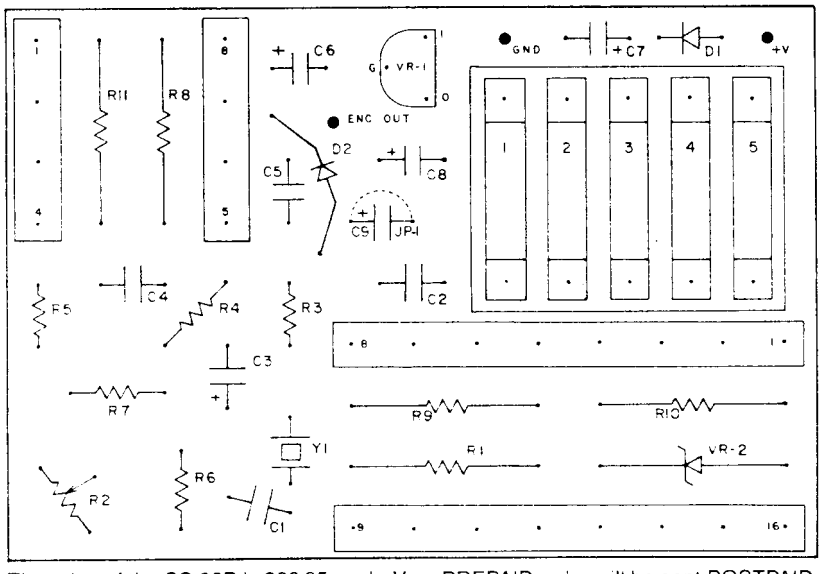
SS-32P INSTRUCTION SHEET



MODEL SS-32P PROGRAMMABLE CTCSS TONE ENCODER

FIGURE 2



The price of the SS-32P is $28.95 each. 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.

PARTS LIST SS-32P AND SS-32PB * = PARTS OR VALUES IN SS-32PB

REF. DESIG.	CSI NO.	DESCRIPTION	PRICE
R1	06-4318	430 1/8 W 5% Carbon Film Resistor	.22 ea.
R8	06-1028	1k 1/8 W 5% Carbon Film Resistor	.22 ea.
R9, 10	06-1038	10k 1/8 W 5% Carbon Film Resistor	.22 ea.
R4, 5	06-3938	39k 1/8 W 5% Carbon Film Resistor	.22 ea.
R4a, 5a	*06-1158	110k 1/8 W 5% Carbon Film Resistor	.22 ea.
R3	06-1058	100k 1/8 W 5% Carbon Film Resistor	.22 ea.
R6, 7	06-1548	150k 1/8 W 5% Carbon Film Resistor	.22 ea.
R11	*06-6848	680k 1/8 W 5% Carbon Film Resistor	.22 ea.
R2	18-5020	5k Mepco Potentiometer	1.39 ea.
C2	21-1800	18pF 5% Mono Ceramic capacitor	.21 ea.
C1	21-4710	470 pF 10% Mono Ceramic capacitor	.29 ea.
C4a, 5a	*21-4710	470 pF 10% Mono Ceramic capacitor	.29 ea.
C4, 5	21-1030	.01 µF Mono ceramic capacitor	.14 ea.
C3a	*21-1040	.1 µF 10% Mono Ceramic capacitor	.34 ea.
C3, 7, 8	19-1050	1 µF 10% tantalum electrolytic cap.	.21 ea.
C9	*19-1050	1 µF 10% tantalum electrolytic cap.	.21 ea.
C6	23-1000	10 µF 20% aluminum electrolytic cap.	.30 ea.
Y1	48-3276	32.768 kHz crystal	.60 ea.
Y1a	*48-1000	1 MHz crystal	7.50 ea.
D1, 2	48-4148	1N4148 75 PRV 100 mA Silicon diode	.15 ea.
VR2	48-5231	1N5231B 5.1 V 400 mW Zener diode	.20 ea.
VR1	48-3636	78L08 8V 100 mA Voltage Regulator	1.00 ea.
U2	51-0062	TL062 BIFET dual op-amp	2.20 ea.
U1	51-0110	IC 110 Programmable Encoder/Decoder	18.00 ea.
SW1	40-1005	5 pole DIP switch	2.45 ea.
2 ea.	09-4504	4 pin SIP socket	.35 ea.
2 ea.	09-4508	8 pin SIP socket	.18 ea.
3 ea.	05-1007	Bead chassis pin R50-1	.01 ea.
1 ea.	84-1041	P.C.B. SS-32P	5.00 ea.
2 ea.	75-1002	Double sided tape square	.05 ea.
1 ea.	30-7035	Jumper wire	.03 ea.
1 ea.	SSP-1KW KIT	Wire kit	.50 ea.

COMMUNICATIONS SPECIALISTS, INC.
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Entire U.S.A. 1-800-854-0547

DESCRIPTION:

The Communications Specialists model SS-32P is a new concept in programmable CTCSS tone encoders. Any 32 tones between 67 Hz and 250 Hz (± .01 Hz) can be factory programmed into the SS-32P. Once the unit is programmed, the tones contained in memory are user selected by means of a 5 pole DIP switch. The tone output is a low distortion sine wave, with a variable amplitude of 0 to 5 volts p-p. The output impedance is nominally 1k ohm.

FREQUENCY SELECTION:

The following instructions refer to Figure 1: Position the SS-32P so that the numbers on the DIP switch are readable, with number 1 in the left-hand corner. Notice the word "open" at the bottom center of the switch. When any switch is pushed down in the direction of the word open, a logical "1" is read at that switch. If a switch is depressed in a direction toward the numbers, a logical zero is generated. The setting of switches 1 to 5 are given in the tone location table Figure 1. Tones in the SS-32P can be selected by completing the following steps: 1) Locate the frequency to be encoded in the "Frequency" column, Figure 1. For custom tones use the custom tone location table supplied. 2) Find the digital code in the "Switch Setting" column that corresponds to the selected frequency. 3) Set switches 1 to 5 to match the digital code.

POWER REQUIREMENTS:

The SS-32P will operate from a D.C. power supply of between 11 and 25 volts at 12 mA. Operation on voltages lower than 11 volts can be accomplished by jumpering the series protection diode D1, and voltage regulator VR1 out of the circuit. An appropriate series resistor can be installed in the A + line to allow the SS-32P to work on voltages greater than 25 volts. **Caution, use the plug-on wires, supplied, for all connections. Avoid soldering directly to the P.C.B. If possible, use keyed voltage supplied only when the transmitter is on.**

APPLICATION PRACTICES:

The microphone preamplifier stages in most radio transceivers have poor low frequency response. CTCSS tone encoders work best, therefore, if they are coupled to a point in the audio chain which is after the microphone preamplifier stage. Choose an injection point as close to the modulator as possible. The fewer stages between the encoder and modulator, the less distortion and limiting will degrade the transmitted tone. The SS-32P has a low output impedance and care should be taken to avoid loading high Z circuits. Use series isolation resistors in the range of 22k to 100k ohms when driving vacuum tube grid circuits. Whenever electronic devices are operated in R.F. environments, conducted and radiated interference are always possible. Hence, proper grounding and decoupling techniques should be used when installing tone encoders in radio transmitters. Keep wires short and away from R.F. power circuits. When necessary, use low value (100 pF to .001 μF) bypass capacitors at A + and audio output terminals.

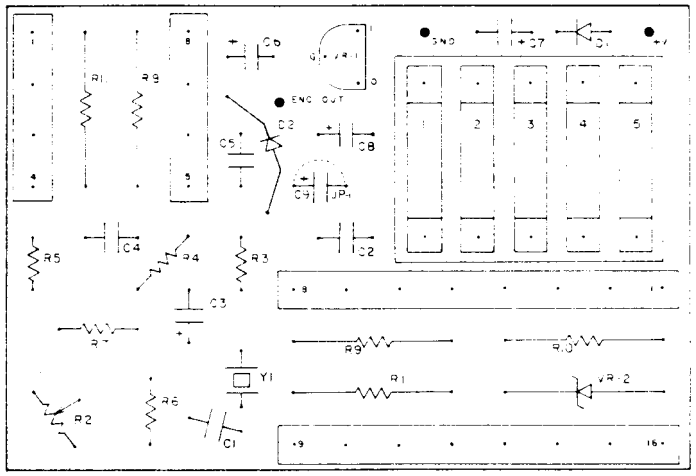
MOUNTING:

Please use the supplied double-sided foam tape squares to mount the SS-32P. Avoid the use of silicone rubber or glue.

BURST TONE:

The SS-32PB is the Tone Burst version of the SS-32P. The SS-32PB can be factory programmed with any 32 tones between 250 Hz and 3kHz (± .2 Hz). R11 can be varied for different burst times. The burst duration is set to a nominal 400 ms, with R11 = 680k. The burst time will increase 10% with each standard 5% value increase of R11. Conversely, the burst time will decrease 10% with each corresponding standard 5% value decrease of R11. For example, if R11 were changed from 680k to 750k, the burst time would go from 400 ms to 440 ms. Decreasing R11 from 680k to 620k would change the burst time from 400 ms to 360 ms.

FIGURE 2



CONTINUOUS TONE:

The SS-32PB can be configured to output continuous tone by either installing JP-1 or removing D2.

CONNECTING THE SS-32PB:

See Figure 2. Since the SS-32PB is designed to generate a "BURST" whenever power is first applied, it is necessary to connect the A + to a voltage that is switched on in transmit and off in receive. Because Burst tones are audible tones, the microphone preamplifier stages in radios are a suitable place to inject the SS-32P audio output. If the microphone input is selected as the injection point, a series isolation resistor may be required to keep the microphone from being loaded by the encoder. For low impedance circuits, choose a resistor between 1k and 10k ohms. Use 22k to 100k ohms for high impedance microphone inputs.

FIGURE 1

GROUP A TONE LOCATION TABLE

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

0 = ON = CLOSED = GND

1 = OFF = OPEN

GROUP B TONE LOCATION TABLE

LOCATION	SWITCH SETTING SWITCH NUMBER 1 2 3 4 5	FREQUENCY
1	0 0 0 0 0	600.0
2	1 0 0 0 0	1000.0
3	0 1 0 0 0	1500.0
4	1 1 0 0 0	1600.0
5	0 0 1 0 0	1650.0
6	1 0 1 0 0	1700.0
7	0 1 1 0 0	1750.0
8	1 1 1 0 0	697.0
9	0 0 0 1 0	1800.0
10	1 0 0 1 0	1850.0
11	0 1 0 1 0	1900.0
12	1 1 0 1 0	770.0
13	0 0 1 1 0	1950.0
14	1 0 1 1 0	852.0
15	0 1 1 1 0	941.0
16	1 1 1 1 0	2000.0
17	0 0 0 0 1	2100.0
18	1 0 0 0 1	2150.0
19	0 1 0 0 1	2200.0
20	1 1 0 0 1	2250.0
21	0 0 1 0 1	2300.0
22	1 0 1 0 1	2350.0
23	0 1 1 0 1	2400.0
24	1 1 1 0 1	1209.0
25	0 0 0 1 1	2450.0
26	1 0 0 1 1	2500.0
27	0 1 0 1 1	2550.0
28	1 1 0 1 1	1336.0
29	0 0 1 1 1	2175.0
30	1 0 1 1 1	1477.0
31	0 1 1 1 1	1633.0
32	1 1 1 1 1	2805.0

0 = ON = CLOSED = GND

1 = OFF = OPEN

GENERAL INFORMATION ON CTCSS ENCODER HOOK-UP

POWER AND GROUND CONNECTIONS

The ground connection is typically very straight forward. The main ground foil on the printed circuit foil works well, or a connection to the chassis. 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 power connection can be any unregulated positive D.C. voltage from + 6.0 to + 25V. Use a regulated voltage if it is convenient. However, with voltages below 9.0VDC, remove VR-1, jumpering "1" to "0" on the PCB. Also jumper out diode D1. This allows the board to work better at low voltages since the regulator only operates above 9.0V. Higher voltage can also be used, however an external limiting resistor will be required so the input does not exceed 25VDC. A two watt resistor should be sufficient for voltages up to 200VDC. Refer to figures 1, 2, 3 for additional information. If polarity is reversed to the unit, it will not operate but will not be damaged. Use the following as a guide for obtaining proper operating voltage in different environments:

Mobiles, 12V negative ground — standard hook-up (see above).
Mobiles, 12V positive ground — reverse board + V and GND connections.
Mobiles, 6V pos. or neg. ground — use B + dropping method.
Bases — use appropriate figure 1, 2, 3.
Portables, 9V or less — by-pass regulator, VR-1.

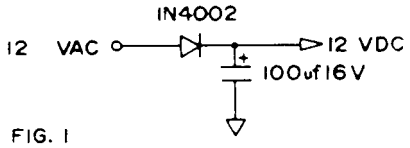


FIG. 1

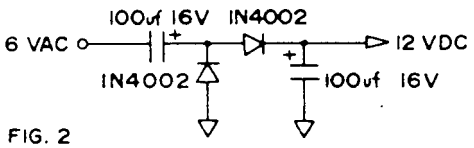


FIG. 2

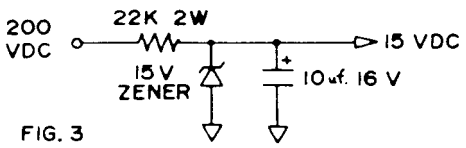


FIG. 3

PROCEDURE FOR CONNECTING SUB-AUDIBLE ENCODER TONE TO TRANSMITTER

The encoder tone output is typically connected just prior to the modular 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 truely 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.

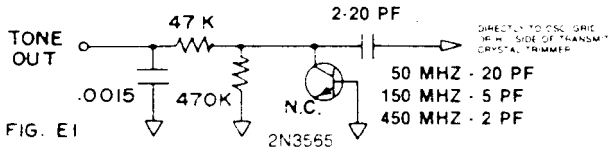


FIG. E1

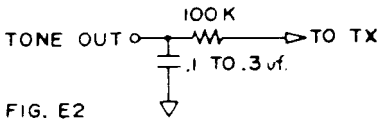


FIG. E2