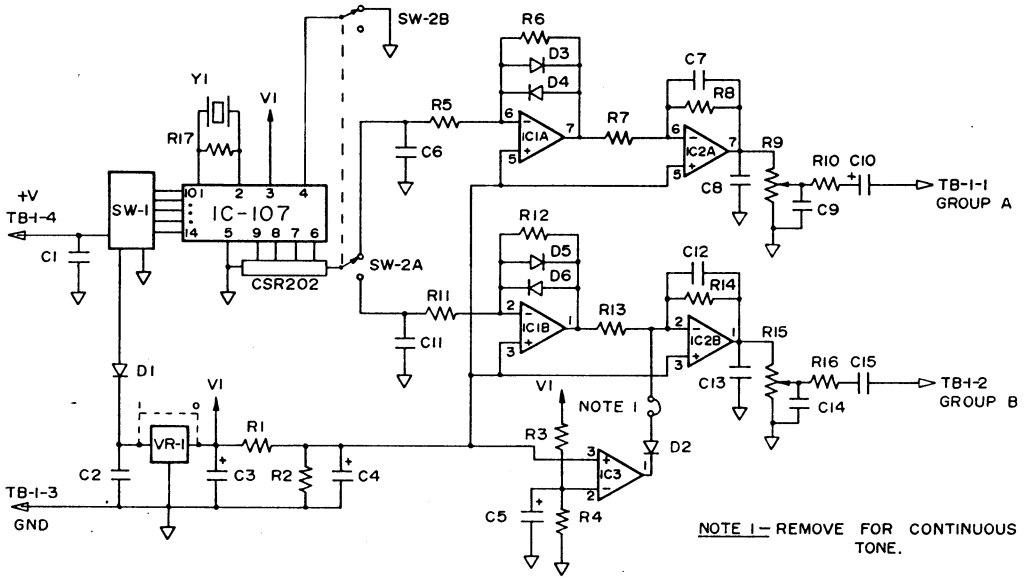
TE-64 INSTRUCTION SHEET

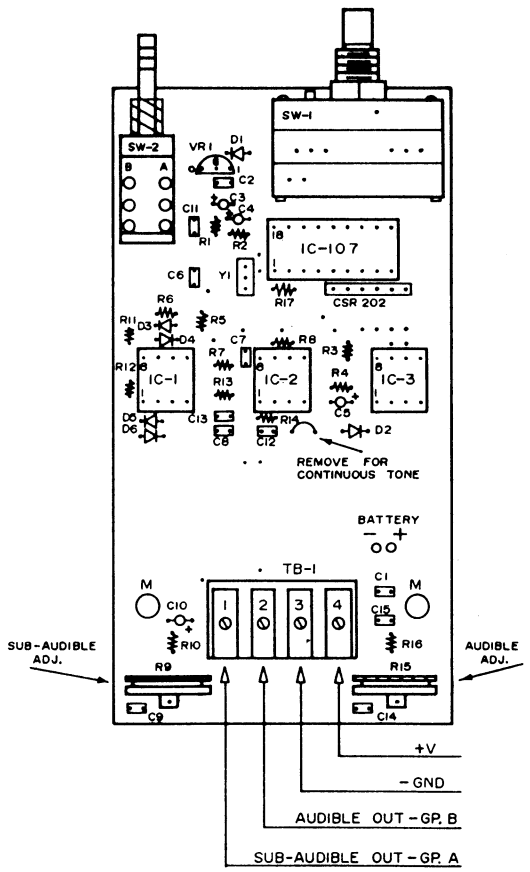
INTRODUCTION

The TE-64 is a Universal Encoder capable of encoding 64 different tones. This consists of the 32 standard sub-audible tones, plus an additional 32 audible tones including standard Burst Tones, Test Tones, and Touch Tones. Frequency selection is accomplished by a front panel mounted 33 Position switch. Output tones are accessible through the back panel, and connections are made to an internal terminal block. Two level adjust pots are provided to independently vary the output amplitude of each group, since the outputs typically will not be connected to the same point. Outputs may however be connected together for connections to a modulation input on an RF signal generator for testing. In addition, provisions are incorporated so the TE-64 may be operated off of an internal 9V transistor battery for portable use.



PARTS LIST

R1 -	10K	1/8 watt	5%	carbon	film	resistor	$.31 ea.
R2 -	9.1K	"	"	"	"	"	.31 ea.
R3 -	470K	"	"	"	"	"	.31 ea.
R4 -	1Meg	"	"	"	"	"	.31 ea.
R5 -	68K	"	"	"	"	"	.31 ea.
R6 -	22K	"	"	"	"	"	.31 ea.
R7 -	47K	"	"	"	"	"	.31 ea.
R8 -	270K	"	"	"	"	"	.31 ea.
R9 -	5K	CTS potentiometer (upright)					.60 ea.
R10 -	1.2K	1/8 watt	5%	carbon	film	resistor	.31 ea.
R11 -	68K	"	"	"	"	"	.31 ea.
R12 -	22K	"	"	"	"	"	.31 ea.
R13 -	47K	"	"	"	"	"	.31 ea.
R14 -	270K	"	"	"	"	"	.31 ea.
R15 -	5K	CTS potentiometer (upright)					.60 ea.
R16 -	1.2K	1/8 watt	5%	carbon	film	resistor	.31 ea.
R17 -	10Meg	"	"	"	"	"	.31 ea.
C1 -	.22uf	50v	CW15	ceramic			2.25 ea.
C2 -	.033 uf	"	"				1.75 ea.
C3 -	1uf	35v	tantalum				1.05 ea.
C4 -	1uf	"	"				1.05 ea.
C5 -	1uf	"	"				1.05 ea.
C6 -	.01uf	50v	CW15	ceramic			1.50 ea.
C7 -	1500pf	"	"	"			1.25 ea.
C8 -	220pf	"	"	"			1.00 ea.
C9 -	220pf	"	"	"			1.00 ea.
C10 -	1uf	35v	tantalum				1.05 ea.
C11 -	470pf	50v	CW15	ceramic			1.00 ea.
C12 -	220pf	"	"	"			1.00 ea.
C13 -	220pf	"	"	"			1.00 ea.
C14 -	220pf	"	"	"			1.00 ea.
C15 -	.22uf	"	"	"			2.25 ea.
D1 -	1N4148	silicon	diode				.15 ea.
D2 -	1N4148	"	"				.15 ea.
D3 -	1N4148	"	"				.15 ea.
D4 -	1N4148	"	"				.15 ea.
D5 -	1N4148	"	"				.15 ea.
D6 -	1N4148	"	"				.15 ea.
Y1 -	1.000 Mhz crystal						7.50 ea.
VR-1 -	78L08A	regulator					1.00 ea.
IC1 -	TL062						2.20 ea.
IC2 -	TL062						2.20 ea.
IC3 -	TL062						2.20 ea.
TB-1-	Terminal block, 4 position						1.90 ea.
SW-1 -	33 position binary switch						9.95 ea.
SW-2 -	Push-on, push-off switch, with button						2.10 ea.
IC-107 -	Com-Spec microcircuit						17.50 ea.
CSR202-	Resistor network						2.30 ea.
3 -	8 pin IC sockets						.39 ea.
1 -	18 pin IC socket						.69 ea.
1 -	PC board						10.00 ea.
1 -	Plastic case, 2 pieces with screws						7.50 ea.
1 -	Front panel, with label, punched						2.00 ea.
1 -	Rear panel, punched						1.50 ea.
1 -	Mounting bracket						2.25 ea.
2 -	Knurled knobs						.60 ea.
2 -	PCB mounting screws						.05 ea.
	Knob assembly						1.90 ea.



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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 +30.0V. Use a regulated voltage if it is conveniently available. However, with voltages below 9.0VDC, place a wire jumper across the regulator (VR-1) on the circuit board. See the circuit board pictorial for the placement of the jumper. 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 30VDC. To determine the approximate value of the resistor (in Kohms) use the following formula: R = (V - 22) / 8. 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, return mike hang-up to +V instead of ground on decode models.
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.

When operating in the tone burst mode, keyed voltage must be used to power the unit. The internal timing circuitry requires keyed voltage to provide the proper tone burst length. Resistor R3 (470K) may be changed to change the burst tone length. Increase the value 1K of resistance for each ms. of tone length needed. About 1 meg is required for each second of timing. If continuous voltage is used no tone will be transmitted. **Keyed voltage should be used** whenever possible as this will disable the TE-64 when not transmitting.

Internal provisions are made in the TE-64 so that it may be powered by a 9V transistor battery. It should be noted that since continuous voltage is applied, tone burst operation is not possible. Observe Note 1 on Schematic and remove jumper if internal battery is to be used. The battery may be mounted inside the case, and a battery clip should be used for connection. This clip should be connected to the power as indicated on the pictorial diagram. **Be sure** to turn the TE-64 OFF when not in use.

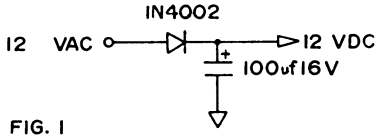

FIG. 1

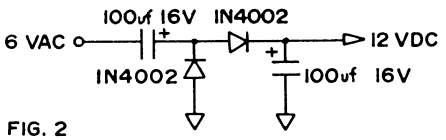

FIG. 2

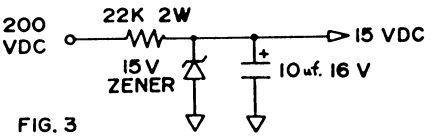

FIG. 3

PROCEDURE FOR CONNECTING SUB-AUDIBLE ENCODER TONE TO TRANSMITTER

The encoder tone output is typically connected just prior to the 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 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. Insufficient level output should never be a problem. However, 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 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.

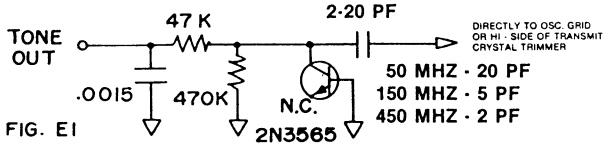

FIG. E1

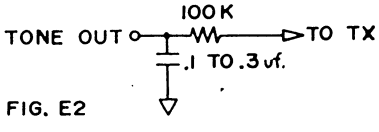

FIG. E2

PROCEDURE FOR CONNECTING AUDIBLE ENCODER TONE TO TRANSMITTER

Audible tone can be connected directly to the microphone input. When driving a high impedance load, a series isolation resistor will be required so the voice modulation will not be affected. If insufficient level seems to be a problem, then inject the tone at the input of the next amplifier stage in the transmitter. Be sure to use a series resistor if modulation level is reduced. If continuous tone is required when encoding from Group B, then remove the circuit board jumper as shown on the pictorial.

RF INTERFERENCE

Although our encoders are not susceptable 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. in the radio's circuit board works quite well. Also, keeping all leads as short as possible or re-routing the wires helps.