

# Selectone

## OPERATING INSTRUCTIONS CTCSS Encoder/Decoder Model ST-101

### GENERAL

The ST-101 is a unique miniature CTCSS Encoder/Decoder designed for land mobile tone squelch applications. Compact size, continuously tunable frequency adjustment, and convenient mounting techniques permit easy field installation in almost any portable, mobile, or base station radio. The ST-101 is fully compatible with all major CTCSS systems, including Motorola "Private Line", General Electric "Channel Guard", and RCA "Quiet Channel".

Because of our comprehensive warranty policy, you should probably not have to consider any field repair; however, if repair is unavoidable, all parts are clearly labeled on our diagram and should be generally available through component distributors.

Application notes are available for over 100 different radio models. These notes provide mounting details, connection points, and radio modifications required (if any). If you would like application details for a specific radio, please call us TOLL FREE at (800) 227-0376, or in California call (415) 887-1950. Together we may be able to save you some time and money.

### OPERATING SPECIFICATIONS

OPERATING VOLTAGE:	5.5Vdc to 30Vdc (reverse polarity protected)
OPERATING CURRENT:	Less than 7mA (12Vdc Supply); less than 3mA with regulator removed
FREQUENCY RANGE:	67.0 Hz to 250.3 Hz
OPERATING TEMPERATURE RANGE:	Exceeds EIA spec. (-30° C to +60° C)
FREQUENCY STABILITY:	Exceeds EIA spec. (less than $\pm .5\%$ ); Typically less than $\pm .2\%$
ENCODE OUTPUT LEVEL:	Adjustable 0 to nominally 1 Vrms (with supply greater than 10.5Vdc); greater than 1 Vrms (with regulator removed & supply greater than 10Vdc)
ENCODE OUTPUT LEVEL STABILITY:	Less than $\pm 1$ dB change 67.0Hz to 250.3Hz
ENCODE SINE WAVE OUTPUT PURITY:	Less than 1% distortion (THD)
DECODER INPUT LEVEL:	20mVrms to 2Vrms
DECODER INPUT IMPEDANCE:	Greater than 50K
HI PASS FILTER:	Standard; May be muted by decode output
DECODER ACTIVATE:	Field Selectable hook switch and/or PTT
DECODER OUTPUT:	Open collector sink 80mA to (-) supply or source (+) voltage. Four possible output conditions or HP filter muting.
INTERFACE:	18" Flying Leads
SIZE:	1.75"L x 1.0"W x .38"H (4.45cm x 2.54cm x .97cm)
MOUNTING:	Double-sided pressure sensitive tape

### INSTALLATION

We have attempted to configure the ST-101 to require minimum installation effort for most radios. We recommend that you take advantage of the radio manufacturer's CTCSS connection points whenever possible.

**(+) Supply (red):** Connect to system (+) supply +10.5 Vdc to +30 Vdc. The ST-101 regulator is effective above 10.5Vdc. To lower the current and voltage requirement for use in portables, cut the leads of VRI as near the case as possible. Bend the lead of VRI nearest the anode lead of CR4 to touch, and solder. Cut off the remaining leads near the board. The ST-101 will now operate +5.5Vdc to +16 Vdc at low current (less than 3mA); however, polarity protection is removed. A regulated supply voltage is recommended for operation at less than 10.5Vdc and all low current applications.

**(-) Supply (black):** Connect to system (-) supply (ground).

**Tone Output (white/green):** Connections should be similar to Figure A or B. RA may be required to avoid circuit loading by the low output impedance of the ST-101. For your convenience, three common values for RA have been supplied with a section of heat shrinkable tube.

**Tone Input (green):** Jumpered to hi pass filter input by Ju 1. Connect directly to FM receiver detector audio output. Breaking the audio at this point will allow insertion of the hi pass filter. The Hi Pass Filter input lead will not be required and may be removed.

**Hi Pass Filter Input (blue):** Jumpered to tone input by Ju 1. For applications where breaking the audio path at the detector output is inconvenient, cut Ju 1. Hi pass filter input audio now may be taken at the most convenient point. Note: will not work in hi level audio stage (speaker lead).

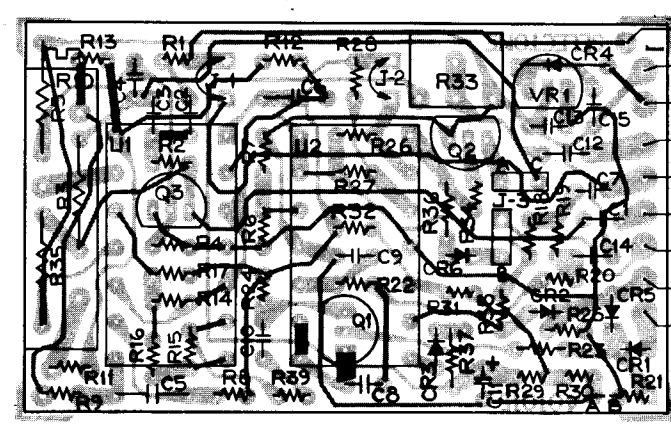
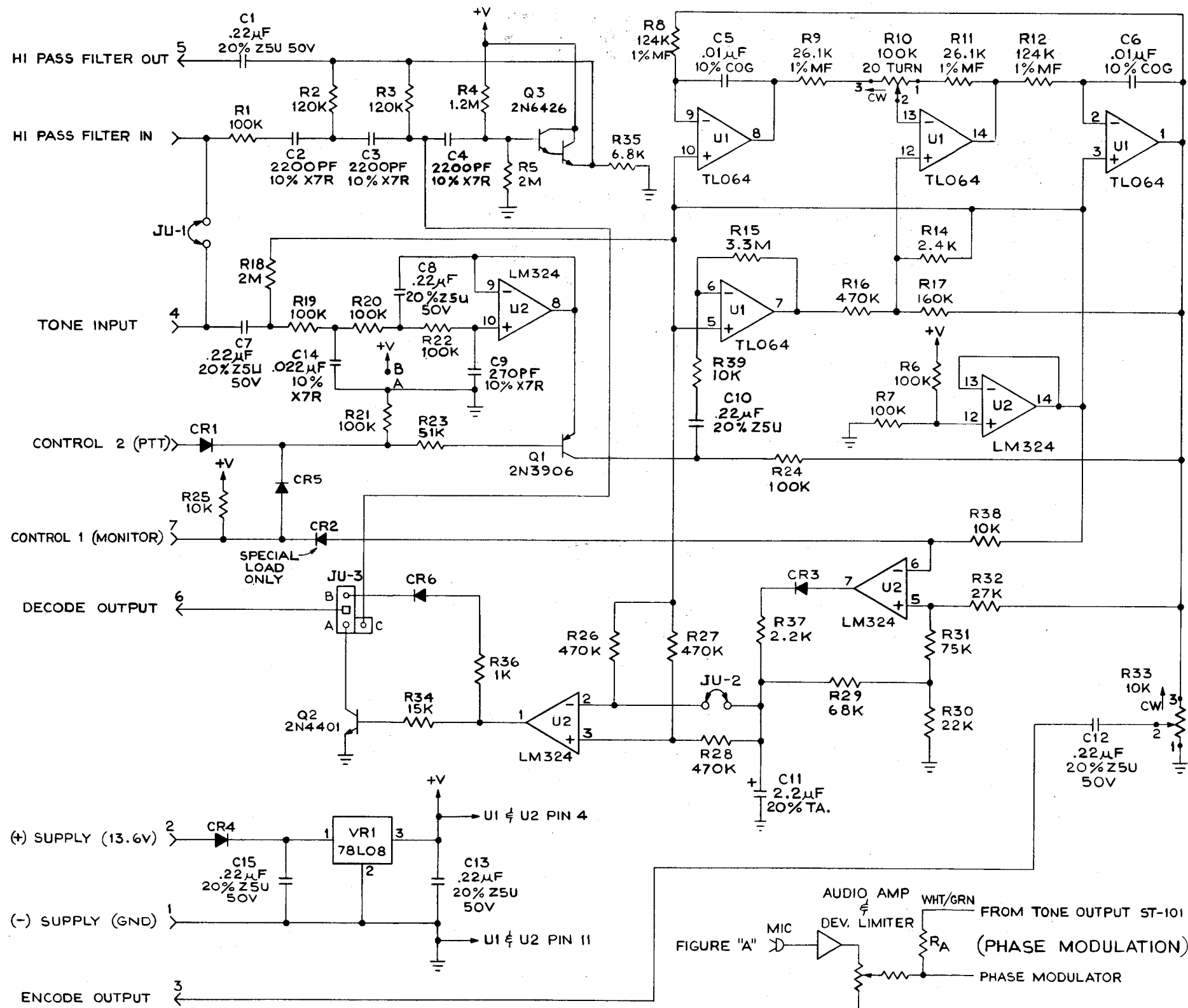
**Hi Pass Filter Output (white/blue):** Buffered audio from hi pass filter input with CTCSS audio component removed. Connect with hi pass filter in series with audio path.

**Decode Output (white/orange):** Requires application consideration. Five output conditions are possible with single output lead:

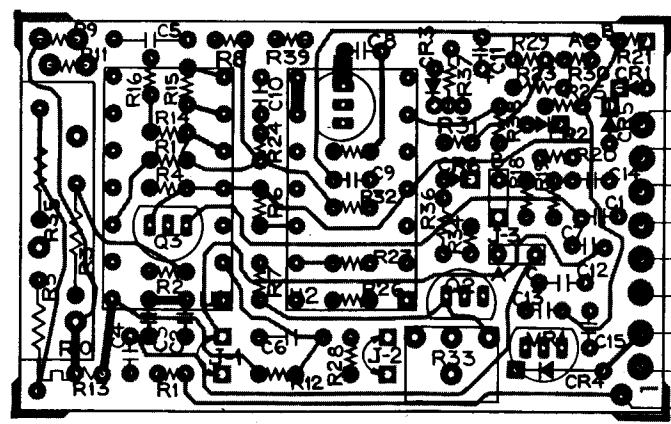
1. **JU3 center to "A":** Provides open collector output 80mA at up to 40Vdc. Saturated to (-) supply until decode or monitor.
2. **JU3 center to "B":** Sources (+) voltage until decode or monitor.
3. **JU3 "A" to "C":** Mutes H.P. filter until decode or monitor.
4. **JU2 cut; JU3 center to "A":** Provides open collector 80mA at up to 40Vdc. Saturated during decode or monitor.
5. **JU2 cut; JU3 center to "B":** Sources (+) voltage during decode or monitor.

**Control 1— Monitor (Brown):** Primary control of encode/decode functions and decode output state. Connect to (-) supply through monitor or hookswitch to mute the radio with tone squelch. Open from ground to encode and monitor.

**Control 2—PTT (Yellow):** Secondary control of encode/decode functions. Overrides control 1 when connected to (+) voltage, causing encode and monitor. Connect to transmit keyed (+) voltage to encode. This lead may be cut off and eliminated if a mic hookswitch is used.



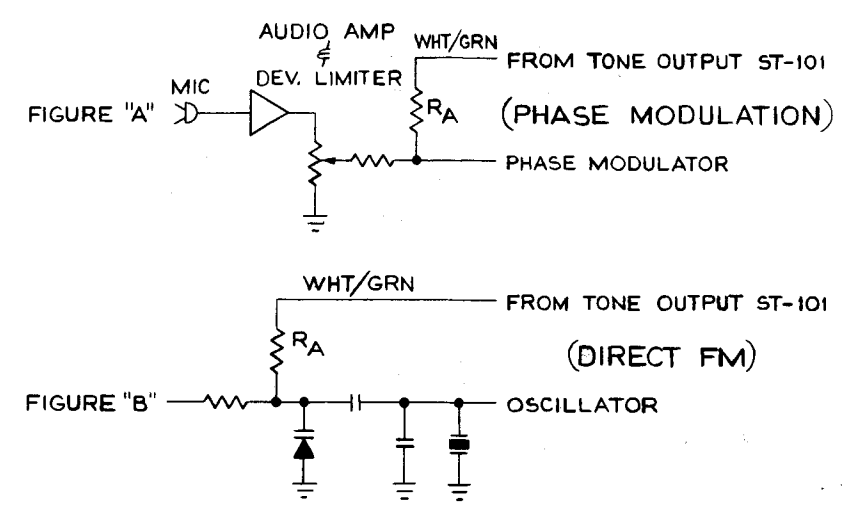
SOLDER SIDE



COMPONENT SIDE

NOTES: UNLESS OTHERWISE INDICATED;

1. ALL RESISTORS ARE 1/8W, ± 5%
2. ALL DIODES ARE IN914



DRAWN	DAN ALVAREZ	DATE	5/10/81	<b>Selectone</b>			
CHECKED	JFO	DATE	12/81				
ENGR		DATE		ASSEMBLY & SCHEMATIC			
MFG		DATE		ENCODER/DECODER			
FIRST USED (NEXT ASSY)				MODEL ST-101			
SHEET	1	TOT SMT	1	SIZE	D	DWG NO.	401016

# MOUNTING

Use of a double-sided adhesive pad eliminates hardware requirements. Mount the ST-101 on a clean, dry surface oriented to allow future adjustments should they be necessary. Press firmly after mounting to insure good contact of adhesive. Do not touch the adhesive or attempt to reposition the unit after mounting.

The ST-101 has been designed for maximum immunity to RF interference; however, an effort should be made to locate the unit as far as possible from the radio's RF power stages. To further minimize RF problems, twist the power leads together and **maintain all leads at a minimum length.**

# ADJUSTMENTS

The ST-101 is continuously tunable over the standard CTCSS frequency range from 67HZ to 250.3HZ with a 20 turn pot. To set frequency, apply power and connect the white/green (tone output) lead to a frequency counter. Adjust R10 for the desired CTCSS frequency. You may find the use of a lissajous figure with a known frequency reference the quickest frequency set up procedure, or as an alternate if a counter is not available. The output level of the ST-101 is set with R33. Adjust R33 for approximately .75 khz deviation.

# WARRANTY POLICY

All standard Selectone products are guaranteed to meet or exceed published performance specifications and are warranted against defects in material and workmanship for a period of five years from date of purchase. Custom configurations and nonstandard systems are warranted for a period of one year.

If any standard Selectone product fails to operate within the first 90 days from the date of purchase, Selectone will immediately send a replacement unit postpaid via airmail or UPS Blue label (air), and will issue full credit upon the return of defective unit(s). For this special warranty replacement service, call the Selectone customer service department TOLL FREE at (800) 227-0376 (In California call (800) 421-5389).

After 90 days, this warranty is specifically limited to correction of the defects by factory repair or replacement of the faulty equipment or parts. Any unauthorized alteration or modification of the equipment or damage caused by external sources will void the warranty.

All warranty repairs must be performed at the Selectone factory in Hayward, California. No credit will be given for unauthorized repair work attempted by the customer.

Equipment for repair may be returned to the factory without prior written authorization; however, it is requested that a note be sent with the packing list briefly describing the nature of the defect.

# PARTS LIST

Schematic Reference	Description	Selectone Part No.
<b>CAPACITORS</b>		
C1, C7, C8, C10, C12	.22uf, 50V, 20%, Z5U, Ceramic	5-17-422
C13, C15		
C2, C3, C4	2200pf, 50V, 10%, X7R Ceramic	5-14-222
C5, C6	.01uf, 50V, 10%, COG, Ceramic	5-11-310
C9	270pf, 50V, 10%, X7R, Ceramic	5-14-127
C11	2.2uf, 16V, 20% Tantalum	5-47-522
C14	.022uf, 50V, 10%, X7R, Ceramic	5-14-022
<b>DIODES</b>		
CR1-CR6	IN914	6-51-914
<b>INTEGRATED CIRCUITS</b>		
IC1	TLO64CN Op Amp, Texas Instruments	6-31-064
IC2	LM324 Op Amp, RCA	6-31-324
VR1	MC78L08cp Regulator Motorola	6-32-808
<b>RESISTORS</b>		
<b>Note:</b> Unless otherwise indicated, all resistors are 1/8 watt, 5%, Carbon Film.		
R1, R6, R7, R21, R24	100K	7-11-410
R2, R3	120K	7-11-412
R4	1.2 Meg	7-11-512
R5, R18	2 Meg	7-11-520
R8, R12	124K, RN55D, 1%, Metal Film	7-33-124
R9, R11	26.1K, RN55D, 1%, Metal Film	7-32-261
R10	100K, 20 Turn Pot, Spectrol 43P104	7-65-410
R14	2.4K	7-11-224
R15	3.3 Meg	7-11-533
R16, R26, R27, R28	470K	7-11-447
R17	160K	7-11-416
R19, R20, R22	100K	7-11-410
R23	51K	7-11-351
R25, R38 R39	10K	7-11-310
R29	68K	7-11-368
R30	22K	7-11-322
R31	75K	7-11-375
R32	27K	7-11-327
R33	10K Single Turn Pot, CII RGPO54	7-62-310
R34	15K	7-11-315
R35	6.8K	7-11-268
R36	1K	7-11-210
R37	2.2K	7-11-222
<b>TRANSISTORS</b>		
Q1	2N3906	6-53-906
Q2	2N4401	6-54-401
Q3	2N6426	6-54-426
<b>WIRE</b>		
<b>Note:</b> All wire type BU 24gu. 19/36 18" Long, stripped 3/8" x 3/16"		
—Supply	Black	8-11-000
Control 1 (Monitor)	Brown	8-11-011
+Supply	Red	8-11-022
Control 2 (PTT)	Yellow	8-11-044
Tone In	Green	8-11-055
Filler In	Blue	8-11-066
Decode Out	White/Orange	8-11-093
Tone Out	White/Green	8-11-095
Filter Out	White/Blue	8-11-096
<b>MISCELLANEOUS</b>		
—	I.C. Socket Strips, Augat 510-AG91D-7	8-21-107
—	P.C. Board ST-101	4-01-016
—	Adhesive Pad Scotch #4408	8-18-100

**CALL SELECTONE TOLL FREE  
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